



# Cognitive Neuropsychology Centre

Department of Experimental Psychology

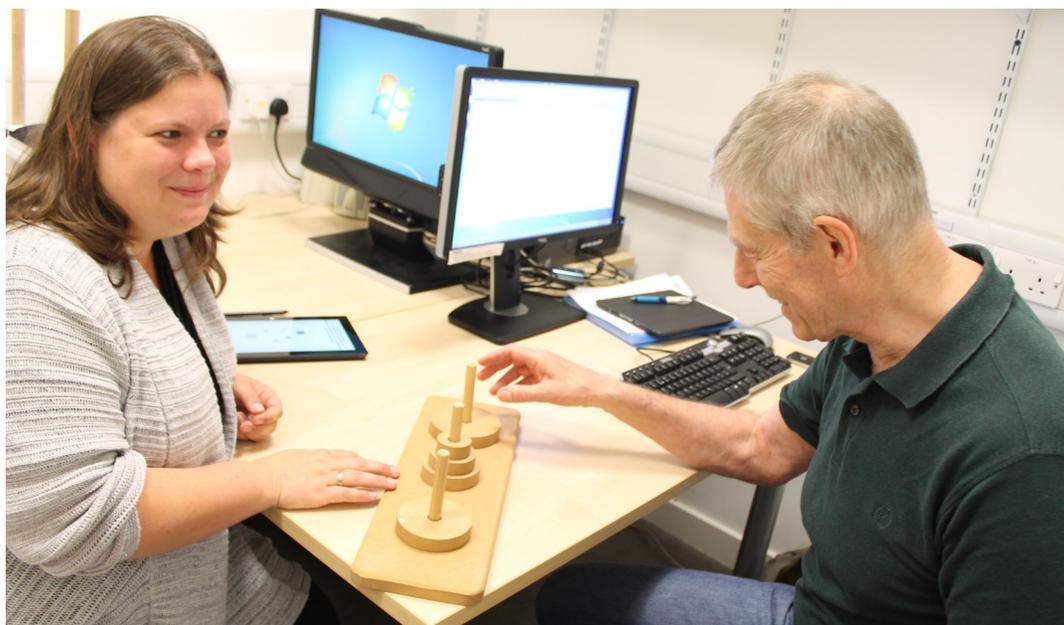
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## Welcome to the Cognitive Neuropsychology Centre

The Oxford Cognitive Neuropsychology Centre (CNC) provides facilities for the assessment and treatment of neurological patients (stroke, Parkinson's, MS, memory disorders).



The Cognitive Neuropsychology Centre was set up by the late Prof Humphreys as a flagship centre for Cognitive Neuropsychology Research as part of the NIHR Oxford Cognitive Health Clinical Research Facility. Today it covers research conducted by the Cognitive Neurology Research Group (led by Prof Masud Husain) and the Translational Neuropsychology Group (led by Dr Nele Demeyere).

The CNC has facilities for neuropsychological studies, brain stimulation (e.g., trans-cranial magnetic stimulation, trans-cranial direct current stimulation), and measuring upper limb and eye movements. Researchers in the group also support the clinical screening of stroke and dementia patients across the Oxford region as well as experimental medicine studies into novel rehabilitation techniques, memory and social cognition.

# Translational Neuropsychology Group

The Translational Neuropsychology Group, led by Dr Demeyere, received seed funding from the MRC Confidence in Concept fund to develop a new way of assessing mental capacity.

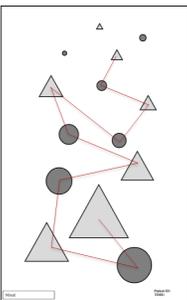


Figure 1 - Task assessing memory of a structured scene

According to The Mental Capacity Act (2005), mental capacity is to be assumed, unless there is a “disturbance in the mind or brain”. Therefore, all neurological patients (either with a brain injury, e.g. a stroke, or a degenerative condition) potentially qualify for the assessment of their ability to make decisions about medical and social care (e.g. discharge destinations) and their independence (e.g. financial independence). In order to be attributed mental capacity, the patient needs to be able to (i) understand information given, (ii) retain the information, (iii) weigh up the information, and (iv) communicate the decision made.

Despite the formal framework set out in the Mental Capacity Act, clinical practice does not have any standardized assessment tools designed specifically for mental capacity. Instead, mental capacity assessments are typically conducted with short, non-standardized and mostly non-structured.

The Oxford COMPetency ASSESSment, COMPASS, aims to standardize a clinical qualitative interview into a formal quantitative assessment to provide clinicians with an objective, standardized, quantified and graded mental capacity profile that will inform and guide situation-specific mental capacity judgments.



Executive function involves a set of mental processes that enables us to efficiently focus attention in order to achieve a goal and helps us to prepare meals, handle finances, drive. This project, investigated what pattern of brain damage caused by stroke leads to executive decline. Participants did the Trail Making Test– alternating between circles and triangles from large to small. The analysis revealed that stroke survivors with damage in the parietal lobe performed more poorly on this executive task.

Individualised Diagnostics and Rehabilitation for Attentional Disorders (INDIREA) runs throughout Europe (Magdeburg, Munich, Barcelona, Dublin and Copenhagen). Our very own students: Alex Luettich, Edwin Dalmaijer, Nir Shalev and Rachel King, have been heavily involved.



Nir Shalev is studying individual's capacity to sustain their attention on a simple, repetitive, non-stimulating task over time. This skill is important for many everyday activities and is often impaired after brain injury.

Nir also uses a high-speed camera to monitor pupil size during the task, as changes in pupil dilation could be indicative of changes in level of attention.

Edwin Dalmaijer investigates whether a drug could help in neglect syndrome (failure to attend to one side of space).



In monkeys and young adults, the drug guanfacine has been shown to boost attention and short-term memory, but in Edwin's study the drug was mostly ineffective. This relatively inexpensive study was still useful in providing the groundwork for large-scale clinical trials.

# Cognitive Neurology Research Group

The Cognitive Neurology Group, led by Prof Husain (funded by The Wellcome Trust), investigates why people are inattentive, forget things quickly and why some people act impulsively while others just can't be bothered.

These problems can be particularly disabling in patients with neurological conditions such as Parkinson's or Alzheimer's disease, and we aim to better understand the underlying mechanisms to improve treatment.

Apathy or a lack of motivation is a very common disabling condition in Parkinson's disease (PD). Alterations in brain areas that process how much we value rewards may contribute to apathy. However, exactly how is poorly understood, limiting treatment options.



Drugs that stimulate dopamine receptors are crucial in improving the motor symptoms in PD (slowness, stiffness and tremor). However, much research in both animals and healthy humans has demonstrated that dopamine is also critical in motivation, and there are hints that it might also affect short-term memory.



Sanjay Manohar and Kinan Muhammed were able to objectively measure how much PD patients value rewards by recording the speed of eye movements and the change in pupil diameter for monetary incentives. Individual differences showed an association with motivation levels, providing a potential new detection and monitoring method for apathy and allowing us to understand its mechanisms in greater detail.



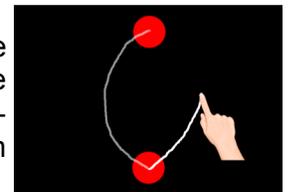
When testing PD patients ON and OFF their dopaminergic medication, they found that pupil dilatation in response to changes in motivation was reduced OFF medication, but it was restored when the patients had taken the dopaminergic medication.

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Yuen-Siang Ang looks at self-initiated option generation, an essential part in motivation and flexible decision-making..

He examined how dopamine levels influenced the ability to produce novel options. ON their dopaminergic medication, PD patients were quicker in generating lots of different options, but when OFF their medication they came up with options that were more novel/different from one another.



Sanjay's, Kinan's and Yuen's findings suggest that in addition to improving motor symptoms, dopamine may also be an effective treatment for apathy by increasing reward sensitivity and influencing the speed and novelty of option generation in PD patients.



Sean Fallon studies short-term memory in healthy and clinical populations. His recent results appear to

show that the dopaminergic medication used to treat Parkinson's disease only affects the aspect of short-term memory that allows us to resist distraction.



Matthew Apps looked at motivation and fatigue, and found that people with PD

are just as motivated to work as other people, but need to take longer rests to re-energise after long periods of work.

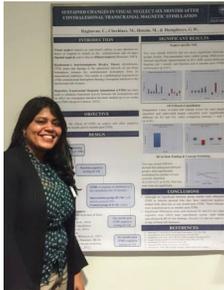


Campbell LeHeron demonstrated that PD patients with apathy weigh up reward and cost

information differently to those who do not have apathy, and seem to need greater "rewards" to overcome the costs of actions.

# Public Outreach Events and Conferences

Researchers from the Cognitive Neuropsychology Centre are heavily involved in a number of public outreach events across Oxfordshire, such as the Oxfordshire Science Festival and Brain FEST. In 2017, we will be attending Super Science *Saturday* (in the Natural History Museum, 11<sup>th</sup> March); *Living Well Oxford* (Templars Square Shopping Centre, 15<sup>th</sup>-21<sup>st</sup> May). We are also planning our second Stroke Awareness Day in spring. Come along!



Charu Raghavan presented her DPhil work on reducing visual neglect using TMS. Many stroke survivors gave up their time to help Charu in her project, which is an outcome of Prof Humphreys' vision and sustained efforts to improve quality of life in stroke patients. Charu found that TMS has potential to improve overall attention and performance in daily life.

Prof Audrey Bowen, Dr Terry Quinn and Dr Nele Demeyere discussing cognition at the UK Stroke Forum (November 2016). Dr Demeyere spoke about moving from paper to tablet-based assessment and the role of Dementia in stroke. The talk received great interest from stroke professionals.



Dr Kinan Muhammed was invited to give a TED x NHS talk on motivation and his research. The talk "Understanding motivation can make us healthier" can be found online: <https://player.vimeo.com/video/190485402>

## Social News



The Translational Neuropsychology Group's day out punting.



The Cognitive Neurology group's Christmas dinner 2016

New additions to the Cognitive Neurology lab:  
Leonardo Drew (l) and Claude Le-Heron (r) born in July and April 2016.

√ If you are interested in our work or would like to be a volunteer for our research—perhaps because you have had a stroke or because you would like to be part of our panel of control participants (for all ages!)



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