Unlocking the Secrets Of the Brain - University's Major Investment in Specialist Neuroscience Centre

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A pioneering new research centre which will use advanced techniques in computing and robotics to unlock the secrets of the brain is set to open at the University of Birmingham in 2010.

The centre for Computational Neuroscience and Cognitive Robotics (CN-CR) will discover more about how the brain learns, ages and recovers from severe injuries and degenerative or developmental neurological disorders. This will enable scientists to provide innovative treatment for the rehabilitation of patients and to help develop the next generation of intelligent robots.

The centre, which will be funded by a combination of strategic University investment and philanthropic contributions through the Circles of Influence campaign, will expand Birmingham's ground-breaking expertise in neuroscience and robotics to new areas, using robotics and computer science. New facilities will include additional laboratories and specialist equipment, while ten new posts will be created.

Researchers hope to develop new ways of reducing the effects of cognitive ageing and brain injury. This will include examining the effects of direct brain stimulation and immersive computer games on the recovery of attentional functions after stroke, developing on-line procedures for reading brain states and for controlling remote devices by brain command. The work will also explore the use of robotic devices to help interact with patients and guide rehabilitation.

Birmingham's research could have a major impact on patients' recovery. Each year in the UK there are about 250,000 cases of brain injury, such as stroke and head trauma and similar numbers of people who are diagnosed with degenerative change in disorders such as Alzheimer's or Parkinson's Disease.

Professor Glyn Humphreys, of the university's School of Psychology said:

"Current forms of treatment have relatively limited effects and there is a need for innovative developments. By linking our research in computational neuroscience and cognitive robotics to our work in cognitive ageing, we will be able to help patients.

"For example, stroke patients with the disorder visual neglect don't always notice things on the affected side of their body, and they often end up bumping into objects or failing to find what they are looking for. An assistive device that cues them to look to their bad side or that registers when an obstacle is approaching, would help patients become more independent.

"Similarly, both stroke patients and patients with dementia can get mixed up when they are carrying out everyday activities like making a cup of tea. Having an intelligent environment that cues the patients as to which objects to use next can be useful in retraining independent living activities.

"We can train computers to interpret brain activity to learn, such as whether someone wants to steer a wheelchair to the left or right. We will be developing techniques that use ongoing brain activity to enable computers to make actions and responses that patients may no longer be capable of making. We will also run projects to gauge how effective robots are in training and rehabilitation."

Researchers will use insights from studies of how the human brain works to provide new kinds of software for robots that will make them more intelligent. Robotics is an important industry and intelligent robotics has significant economic potential.

Jeremy Wyatt, of the School of Computer Science, said: "To help make robots in the future more intelligent we need to borrow ideas from the brain. Some of the most exciting work is now occurring at the interface between robotics and neuroscience. At the moment while robots are impressive mechanically, and in environments requiring precise control such as manufacturing, they are much less capable when confronted with the change, uncertainty and confusion that humans deal with effortlessly in our daily lives. Artificial intelligence will therefore benefit from a deeper understanding of the brain and robotics opens up exciting possibilities for treating damage to the brain."

The investment will make the university a centre of excellence in the cognitive neuroscience of perception, attention and action as well as in intelligent robotics. Neuroscience at Birmingham already has a number of key strengths, including functional MRI imaging which allows researchers to measure brain activity and to understand where in the brain particular processes happen. A new high-tech scanner at the heart of suite will open up the possibility of controlling computers using neural signals from the brain.

Professor Humphreys added: "These are exciting developments for the university and for the field of neuroscience and robotics. We are confident that the coming years will be full of breakthroughs as we finally begin to unlock the secrets of the brain."

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Notes to Editor

• Additional Funding bodies are: (BBSRC, EPSRC, ESRC, MRC), charities (Stroke Association, Wellcome Trust) and the EU

• Spanning the Colleges of Life and Environmental Sciences and Engineering and Physical Sciences the CNCR centre will be based in the university's Frankland Building, with new facilities to include MRI scanners, laboratories, robotics rehabilitation/training labs and EEG equipment.

• Key individual departments are at the forefront of international work, with Psychology and Sport and Exercise Sciences both positioned second in their units of assessment in the RAE 2008. In Psychology over 80% of activity was judged to be at an internationally excellent standard and 25% of activity was judged 'world leading', while teaching is also excellent with a score of 23 out of 24 in the QAA Quality Assessment Review of teaching.

Case Study

How music helps overcome the affects of a stroke

Neuroscientists at the University of Birmingham have discovered that music can decrease visual neglect, a serious clinical disorder affecting up to 60% of patients following a right hemisphere stroke.

Neglect occurs when the right paretial lobe of the brain is affected by a stroke, causing some patients to behave as if the left side of sensory space is nonexistent. In extreme cases, they may not eat the food on the left side of their plate, and if asked to draw a clock, their drawing might only show the numbers 12 and 1 to 6, the other half being distorted or left blank.

While factors that modulate awareness of the left side of the brain have been considered for the last 20 years, the potential role of an individual's emotional state in modulating this awareness has been overlooked. That was until a group of scientists at Birmingham's School of Psychology induced a positive response in patients with chronic visual neglect by allowing them to listen to their preferred music. Patients began to show enhanced visual awareness when tasks were performed under preferred

music conditions relative to when they were performed either with unpreferred music or in silence.

Further evidence of the improvement was gained when functional MRI data illustrated enhanced activity in the orbitofrontal cortex was associated with emotional responses as a result of tasks being performed while listening to their favourite music. The greater activity in the orbitofrontal cortex coincided with stronger connectivity from this region to parts of the brain affected by the stroke, enabling the affected areas to respond better to stimuli.

Professor Glyn Humphreys of the University commented, “These findings suggest that positive affect, generated by preferred music, can decrease visual neglect, suggesting that arousal and mood may modulate this problem. The power of arousal and mood can clearly be just as effective as medicine in the recovery process.”