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Affiliate Lab Interview

Glyn Humphreys

Glyn Humphreys, Professor of Cognitive Psychology at the University of Birmingham and Scientific Director of the Birmingham University Imaging Center, focuses on the cognitive neuroscience of vision, attention and action. His work uses fMRI techniques, lesion research and robotics to improve the lives of stroke patients. Recently, his lab became an affiliate of the Center for Cognitive and Social Neuroscience.

University of Birmingham campus.

OUR CURRENT EFFORTS ARE PART OF A NEW INITIATIVE TO TWIN THE UNIVERSITIES OF BIRMINGHAM AND CHICAGO.

GLYN HUMPHREYS

How did you come to be involved with John Cacioppo and the Center for Cognitive and Social Neuroscience (CCSN)? How does your lab and work fit in with the work done by the CCSN?

Our current efforts are part of a new initiative to twin the Universities of Birmingham and Chicago. My particular work has a neuropsychological focus (working with individuals with cognitive impairments) which provides a nice complement to work on social cognition at the University of Chicago. Our recent conference in Chicago (March 4 and 5, 2010) brought together research groups from the two institutions to discuss potential joint projects in the area of cognitive neuroscience. We had a fruitful, interactive meeting and came forward with at least ten potential joint projects that we will be taking forward—everything from joint grant applications to graduate student exchanges.

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GLYN HUMPHREYS

How does social neuroscience relate to your work?

We are looking at the losses of social processes in individuals with specific brain lesions, and also using functional imaging to generate converging evidence on the role of different brain areas in social cognition—this adds value to the CCSN's work on physiological changes related to social cognition, stress and so forth.

You have developed a stroke lesion database- what is it, and how is it used?

The database is a collection of information from stroke patients—it contains data about the location and extent of their brain lesions as well as their behavioral symptoms. It is used first to provide a pool of participants for ongoing studies and secondly, to look at the relations between the brain lesion and the behavioral symptoms. You need large groups to look at common lesion overlap, and having multiple measures of cognition is good. It allows you to control for effects of one factor (e.g. memory loss) on others (e.g. attention). The database currently consists of 800 patients.

It is frequently used by visitors to our lab or as part of our collaborations with other centers. Using a database of this size helps to overcome some of the deficiencies of working with only a small group or individual patients. With smaller sample groups, it is more difficult to make definitive conclusions about issues like lesion-symptom relations, since precise localization of function can differ across individuals. This database gives us large samples and therefore more power for analyses of lesion-symptom mapping.

What advantage does stroke research that incorporates brain imaging and lesion data have over other means of studying and rehabilitating stroke patients?

The problems patients have (e.g., loss of speech) will depend on where and how big their lesion is —this is what we are analyzing when we look at lesion-symptom mapping. By incorporating brain imaging, we begin to understand the neural basis of recovery of function as something that cannot be understood with behavioral methods. In doing so, we can better target tasks at relevant brain areas to show behavioral change.

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Affiliate Lab Interview *Continued*

ABOVE: Glyn Humphreys.

RIGHT: Humphreys at his fMRI unit.

Do brain lesions heal and change over time?

The factors affecting a patient's performance can change over time. Initially, there can be brain swelling which disrupts function, but which decreases over time. There can also be learning-dependent changes. Indeed, this is what we try to encourage in rehabilitation. Because of these changes, it is very important to chart when tests and scans are being done in relation to other work with a patient—it really requires coordinated research.

You have also done extensive work in using robotics to improve the lives of stroke patients. How can robots help stroke patients?

Robotics could improve the lives of stroke patients in at least two ways. Intelligent robotics can take over or support some functions that are difficult. If a robot learns that a person can't attend properly to one field of vision, it can regularly check on one side of space for them. For example, agnosia is sometimes associated with brain injury. Agnosia, broadly defined, is a loss of ability to recognize objects, people, sounds, shapes, or smells even though the sensory systems are intact. For these patients, a robot could be able to recognize the unfamiliar object for the patient. Another possibility relates to training. We could use a virtual reality system so that the patient feels the unrecognized object when they look at it— since tactile recognition is spared, we could try to use the intact modality to help improve the impaired one (in this case, vision).

INTELLIGENT ROBOTICS CAN TAKE OVER OR SUPPORT SOME FUNCTIONS THAT ARE DIFFICULT IN STROKE PATIENTS... ROBOTS CAN ALSO BE USED IN REHABILITATION DIRECTLY TO INCREASE FEEDBACK.

GLYN HUMPHREYS

The robots can also be used in rehabilitation directly to increase feedback. For example, if a patient can't move his or her arm voluntarily, a robot can help them with tasks. Robotics can also be used for visual detection. Imagine having a visual detection device that responds to a looming stimulus on a patient's impaired side — a signal that can indicate and help avert an impending collision.

With regard to neuroprothestics (devices that could substitute a failing cognitive or sensory function, like cochlear implants do for hearing)—at present, the neuroprothestics systems are some ways away from giving a patient accurate online control of, for example, a robotic arm, but these are early days and rapid progress is being made.

What is your current research focus? What are the next steps for your work?

In social cognition, we are looking at whether certain lesions make it difficult to see someone else's point of view. We are investigating whether or not this can affect how well people interact when they do joint tasks together. We are also developing a social screening test to let us look at which lesions cause problems in social cognition.

We are making substantial advances in understanding the neurophysiological basis of perspective-taking. Until recently, people talked about Theory of Mind as if it were a single module. I think it is clear now that it has several components, perspective taking being one of them, and we are now just starting to look at how perspective taking itself is composed. Is it automatic? Can it be cued?

WE ARE LOOKING AT EFFECTS OF NEURO-REHABILITATION, INCLUDING VIDEO GAME PLAYING AND USING DIRECT BRAIN STIMULATION TO IMPROVE ATTENTION.

GLYN HUMPHREYS

How long does it take to switch perspectives? Answering these and other questions can be aided by investigating brain lesions across patients.

We have learned a lot about neuroplasticity in recent years—some have even called recent times a "revolution in neuroplasticity"— how does your work relate to our understanding of neuroplasticity across the lifespan?

We are looking at effects of neurorehabilitation, including, for example, video game playing and using direct brain stimulation (via transcranial magnetic stimulation) to improve attention. This all depends on the plasticity of the brain across the lifespan, which we are trying to encourage through training and intervention procedures. ■

RECENT PUBLICATIONS BY GLYN HUMPHREYS

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