Imaging the mind

Neurocognitive research in Salzburg...

Understanding the human mind and its disorders is the focus at the Center for Neurocognitive Research. For example, how do we understand the intentions of other people? Why do children have difficulties in learning to read? What is the basis for insomnia and disorders of consciousness? These are exemplary research questions that concern the center's interdisciplinary team of cognitive scientists, psychologists, medical scientists, linguists and biologists. To answer these questions, the center's researchers rely on cognitive analysis, behavioural studies and observations of the human brain in action. Functional imaging, for example, allows us to infer which regions of the brain are activated during specific mental activities. Electroencephalography, as another example, can tell us when specific information is processed or memories are retrieved. In sum, cognitive analysis and neurocognitive methods tell us about the how, when and where of mental processes in our brain. And this information, in turn, allows the center's researchers to draw inferences on our concepts of the human mind and its disorders.

A unique configuration in Austria

The Center for Neurocognitive Research is unique in its kind in Austria – for three reasons. First is human resources: the center comprises several internationally renowned researchers who are leading in their respective fields. In the Center for Neurocognitive Research, these researchers from the University of Salzburg and the Christian Doppler Hospital pool their different perspectives on a common topic, the human mind. Specific recruitment on all levels has helped to strengthen this interdisciplinary team since the center's foundation in 2004.

A second aspect is that the Center for Neurocognitive Research offers a broad methodological spectrum. The center successfully attracted a competitive grant to realise its own, research-dedicated 3T magnetic resonance tomograph (MRT). Further available methods are electroencephalography (EEG), transcranial magnetic stimulation (TMS), eye tracking, as well as a laboratory for sleep and consciousness research.

Last but not least, the Center for Neurocognitive Research provides excellent opportunities for the training of young researchers. In addition to positions for young scientists in stand-alone projects, the center was recently granted a doctoral programme by the Austrian Science Foundation. This doctoral programme acknowledges the center's status as a center of excellence and ensures its continuity and impact, allowing the research training of internationally recruited PhD students. The doctoral programme gives young researchers access to cutting-edge methodology.

Hiring now

At the Center for Neurocognitive Research we believe that an understanding of the human mind is a prerequisite to understand its disorders. A correct diagnosis and treatment of children with dyslexia, for example, requires an understanding of how reading is mastered by unimpaired children. A valid diagnosis of the disorders of consciousness, as another example, demands knowledge about neural correlates of consciousness in healthy persons. Specific competence on the human mind and its disorders has been established in Salzburg and is handed down to new generations of young researchers. We are hiring PhD students now. Please do not hesitate to contact astrid.sattler@sbg.ac.at for further information on our doctoral programme.

UNIVERSITÄT SALZBURG

Professor Florian Hutzler
Head of Center

Center for Neurocognitive Research
and Department of Psychology
University of Salzburg
Hellbrunnerstr 34
A-5020 Salzburg
Austria

Tel: +43 662 8044 5114
Fax: +43 662 8044 5126

florian.hutzler@sbg.ac.at
www.uni-salzburg.at/psychologie

An empirical state of mind?

Professor Florian Hutzler, of the University of Salzburg's Center for Neurocognitive Research, looks at the connection between the brain and concepts of the human mind...

Common among cognitive scientists is that our concepts about the human mind have to be rooted in empirical evidence. But since the human mind eludes itself from direct observation, this can prove problematic. At the beginning of the last century, researchers relied strongly on the method of introspection, that is the self-observation of their mental processes. Unfortunately, self-observation (aside from being susceptible to confabulation) has its limitations since not all processes are consciously accessible. In particular, the early and fast aspects of our mental processes are those that we are not aware of.

Thus, cognitive scientists decided to rely on what is measurable. 'Measurable' equalled 'observable' for a long time, and therefore, researchers registered mainly reaction times and error rates. Dyslexic children, for example, exhibit prolonged reading times and an increased number of reading errors. Observable behaviour, however, marks the end product of complex mental processes. To answer the question, for example, of which aspect of the reading process might be impaired in dyslexic children, researchers have to resort to clever experimental designs that reveal more about the mental process that determines the observable behaviour. The evidence that dyslexic children have more problems when reading certain kinds of words than others can tell us more about their reading deficiency.

Does 'measurable' equate to 'observable'?

When we accept that not all that is 'measurable' also has to be 'observable', methodological pragmatism (that is, choosing the method that is most suitable to provide the necessary kind of evidence) points us to neurocognitive methods. For example, the recording of the electrical activity of firing neurons (ie. electroencephalography) can tell us with a time resolution of milliseconds when specific characteristics of a written word are available to a reader. Obviously, the information about the time course of information processing is extremely helpful when trying to characterise the temporal characteristics of the underlying mental processes.

Functional imaging, on the other hand, helps us to learn which brain regions are activated during a specific mental process. Information about the involvement of specific brain regions is particularly relevant when we have a priori knowledge, where the activation of a brain region is indicative of the presence of a specific kind of cognitive process. We might have, for example, the (unproven) theoretical assumption that the recognition of a specific group of written words results in a conflict in our mental lexicon. Functional imaging can reveal the neurophysiological correlates of such a conflict, putting the theorising about processes involved in word recognition on a firmer footing.

Neurocognitive evidence can help to further refine scientific concepts of the mind

A complement, not a substitute

So, what is a cognitive scientist's interest in the human brain? Observations of behaviour can tell us a lot about how the human mind works. But it is the human brain where the neurophysiological correlates of our mind are measurable. Thus, neurocognitive evidence can help us to further refine and validate our concepts of the human mind. Neurocognitive methods are no substitute for the observation of behaviour, but they are a most welcome complementary source of evidence in an ongoing quest to understand the human mind and its disorders.

Professor Florian Hutzler
Head for Center of Neurocognitive Research and the Department of Psychology
University of Salzburg
Tel: +43 662 8044 5114
florian.hutzler@sbg.ac.at
www.uni-salzburg.at/psychologie