Seminar

KIMMO ALHO

Erik Allardt Fellow, SCAS.
Professor of Psychology, University of Helsinki

Is the Human Brain Social?

Thursday, 13 November, 4:15 p.m.

In the Thunberg Lecture Hall
SCAS, Linneanum, Thunbergsvägen 2, Uppsala
www.swedishcollegium.se

SWEDISH
COLLEGIUM
for ADVANCED STUDY

ABOUT KIMMO ALHO

Kimmo Alho received his Ph.D. in Psychology at the University of Helsinki in 1987, after which he worked there as a Fellow of the Academy of Finland. He became Professor of Psychology at the University of Tampere in 1999 and at the University of Helsinki in 2000. Between September 2012 and July 2014, he worked as a Fellow at the Helsinki Collegium for Advanced Studies. He also holds the title of Docent of Cognitive Neuroscience at the University of Turku and has been several times a Visiting Fellow at the University of California, Davis, and Visiting Research Professor at the University of Barcelona. Between 1999 and 2006, he was Head of the Finnish Graduate School of Psychology and has since 2006 been Director of the Nordic–Baltic Doctoral Network in Psychology. He is a member of the Finnish Academy of Science and Letters and Academia Europaea.

Alho's research on human brain functions related to perception, memory and attention has resulted in over 150 articles in peer-reviewed scientific journals. In his research, he has applied electro- and magnetoencephalography, positron emission tomography, functional magnetic resonance imaging as well as psychophysical methods. In addition, he recently meta-analyzed results from over a hundred auditory brain imaging studies (Alho et al., 'Stimulus-dependent Activations and Attention-related Modulations in the Auditory Cortex: A Meta-analysis of fMRI Studies', *Hearing Research*, 2014, 307: 29–41). In his empirical research, he has mostly studied healthy adults but also neurological patients, healthy children and children with attention deficits. His current research at the University of Helsinki and Aalto University, supported by grants from the Academy of Finland, focuses on brain activity and cognitive performance during dual tasking and distraction in adults and in teenagers regarded as digital natives. At SCAS, he will work on a review and meta-analysis of brain imaging studies on social perception and cognition.

ABSTRACT

The complexity of human social behavior would not have been reached in human evolution without evolution of the human brain. Evolution of brain functions needed in social interaction, in turn, served survival of our ancestors in dangerous environments. Like in the brains of many other species, there are areas in the human brain that have a crucial role in perception of faces, voices, and actions of others. The mirroring system for action perception enables mimicking speech and usage of tools, two major components in human sociocultural evolution. However, it was necessary for this evolution that the emergence of mirroring system was paralleled by development of other brain functions, for example, those involved in controlling speech-organ and hand movements, social attention, and socially appropriate behavior, as well as those enabling maintaining social information in the working memory, encoding it to the long-term memory, and retrieving it when necessary. Modern brain research methods, functional magnetic resonance imaging (fMRI) in particular, have greatly helped us to understand these brain functions.

Temporal resolution of fMRI is, however, relatively low. Neural activity consuming oxygen in the brain has a millisecond-scale time course, but the resulting blood oxygenation level dependent (BOLD) signals measured with fMRI take seconds to develop. Spatial resolution of fMRI, in turn, is in the order of millimeters, but just 1 mm3 of brain tissue in the human cerebral cortex contains on average some 105 neurons and 108-109 synapses between neurons. Thus fMRI can give us information only at the macrolevel of brain areas. For statistical inference, fMRI data need to be averaged across human individuals despite the fact that the cerebral cortex shows great individual anatomical variation, as well as variation in mapping of brain functions to particular cortical structures. Moreover, activity and responsiveness of a brain area is affected by connections from other areas and may be increased

or decreased depending on participant's state of arousal or direction and amount of participant's attention, factors not always properly controlled in fMRI experiments. Taken all these methodological problems, it is rather surprising that fMRI research has been able to enhance our understanding of brain functions related to, for example, perception, memory, language, emotions, and cognitive control.

fMRI has many advantages: It is non-invasive, safe, relatively inexpensive, and quite easy to use. These are a few reasons why currently over 2000 fMRI studies on human brain functions are published every year. New fields of research have emerged, such as social neuroscience, neuroeconomics and neuroethics, and numerous scientific articles have reported brain activations associated with social perception, empathy, theory of mind, moral judgment etc. Also several meta-analyses pooling results from these studies have been performed already. However, it is not clear whether the observed brain activations are specifically related to the targeted psychological and social processes or more generally related to, for example, attention, emotion or memory functions triggered in socially relevant experimental conditions. One way to estimate this is to conduct meta-analyses comparing locations of brain activations reported in these social fMRI studies with results from fMRI studies on basic mental functions. Such meta-analyses elucidate relationship between brain and mind and reveal limits of fMRI, and brain research in general, in studying social cognition and behavior.