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Research Report

Empathy, culture and brain – proposal for a large-scaled cross-cultural study

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Abstract *Our brains and minds are shaped by the experiences we make in the context of the culture in which we develop and live. Although psychologists have provided abundant evidence for the diversity of human cognition and behaviour across cultures, the question of whether the neural correlates of human cognition are also culture-dependent is often not taken into account by neuroscientists. This paper presents the current knowledge concerning the influence of culture on empathy as the basic emotion of the "social brain", and a proposal for a cross-cultural neuroimaging study on this issue.*

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INTRODUCTION While psychologists have shown abundant evidence for diversity of human cognition and behavior across cultures, current neuroimaging research still neglects the potential cultural sensitivity of the underlying neural correlates only targeting general neural mechanisms of human cognition. To resolve this discrepancy between psychology and neuroscience, neuroimaging studies need to take into account the cultural diversity of human cognition and behaviour. Cultural differences seem to modulate many neural activities at multiple-level functions. Transcultural neuroimaging research will provide a novel approach to distinguish culture-independent and culture-sensitive neural mechanisms of human cognition and behaviour. To collect data on this new and important issue, Georg Northoff, Research Unit Director at the Institute of Mental Health Research of the University of Ottawa and Thomas Stompe, head of the Vienna Research Group on Transcultural Psychiatry, have considered to organize a serial of large-scaled cross-cultural studies on basic human cognitive and affective functions. As a first step healthy subjects from different countries, ethnicities and cultures should be included in order to collect basic data on these issues. These data should provide a baseline of knowledge for the studies on various groups of mentally ill patients. The first topic under study will be empathy, followed by self-processing and Theory of Mind.

EMPATHY Several authors have tried to define empathy in order to conceptualize our intuitive understanding of this term (Scheler, 2008; Goldman, 1993; Thompson, 2001; Batson, 1991). In conclusion empathy has the following extension:

- Empathy literally means the power of understanding things outside ourselves (after the Greek *empatheia*).
- Empathy is the ability to experience and understand what others feel without confusion between oneself and others.

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- Empathy is a complex form of psychological inference in which observation, memory, knowledge, and reasoning are combined to yield insights into the thoughts and feelings of others.
- Empathy is an affective response more appropriate to someone else's situation than to one's own. It is an other-oriented emotional response congruent with the other's perceived welfare.
- Empathy is an affective response that stems from the apprehension or comprehension of another's emotional state or condition, and which is similar to what the other person is feeling or would be expected to feel in the given situation.

Empathy refers to the mental process of understanding and sharing others' emotion and provides a proximate mechanism of altruistic behaviours and is strongly modulated by cognitive and social factors.

EMPATHY AND NEUROSCIENCE Two decades ago, cognitive neuroscience research focused mainly on the neural underpinnings of perception, attention, memory, language and emotion and did not compare different cultural groups. In the 1990s, cognitive neuroscience research extended into the field of social cognition, targeting the neural correlates of interpersonal and social behaviours (e.g. Eslinger, 1998). This led to an outburst of papers on social neuroscience or social cognitive neuroscience since the last ten years (e.g. Gu *et al*, 2010; Mason & Bartal, 2010; Krämer *et al*, 2010; Derntl *et al*, 2010; Lamm *et al*, 2010; Betti *et al*, 2009; Singer *et al*, 2009; Xu *et al*, 2009; Zaki *et al*, 2009; Akitsuki & Decety, 2009; Shamay-Tsoory *et al*, 2009; Nummenmaa *et al*, 2009; Hein & Singer, 2008; Preston *et al*, 2007; Lamm *et al*, 2007 a; 2007b; Singer, 2007; Morrison *et al*, 2007; Keysers & Gazzola, 2006; Decety & Lamm, 2006; de Vignemont & Singer, 2006; Singer *et al*, 2006; Jackson *et al*, 2005; Decety & Jackson, 2004; Leslie *et al*, 2004; Singer *et al*, 2004; Meltzoff & Decety, 2003). This new field of research mainly combines cognitive-neuroscientific and socio-psychological methods.

Recent neuroimaging studies have systematically examined the neural basis of empathy for pain (e.g. Betti *et al*, 2009; Xu *et al*, 2009; Akitsuki *et al*, 2009; Lamm *et al*, 2007a; Morrison *et al*, 2007; Jackson *et al*, 2005; Singer *et al*, 2004). It has been shown that perception of painful compared to non-painful stimulation applied to others generates increased activation in the insula and anterior cingulated cortex (ACC) and the somatosensory cortex. The ACC activity correlates with subjective estimation of the intensity of others' pain. A recent ERP study showed that the frontal neural activity automatically differentiates between painful and nonpainful stimuli as early as 140 ms after sensory stimulation. A long-latency empathic response occurs after 380 ms over the central-parietal regions and is modulated by task demands. Moreover, the ERP amplitudes at 140-180 ms correlate with subjective feelings of both perceived pain and of self-unpleasantness. The brain imaging findings suggest shared representation of one's own emotional experience and others' emotional states in terms of both neural structures and temporal dynamic of neural activity, and provide objective measurement of empathic responses to perceived pain. Recent neuroimaging research also showed evidence that empathic neural responses are strongly influenced by features of painful stimuli and contexts in which painful stimuli are perceived. For example, fMRI research yielded that the ACC activity associated with empathy for pain depends on contextual reality of stimuli and the early neural activity linked to empathy for pain is reduced when the reality of painful stimuli is restrected by presenting painful stimulations in cartoon form. Empathic neural responses also depend on subjective attitudes toward a target person suffering from painful stimuli; the activity in the insula related to empathy decreases when watching confederates who played unfairly receiving pain compared to confederates who played fairly. Observation of body parts being penetrated by needles induces increased activity in the ACC and insula in the control group but not in physicians who practice acupuncture, suggesting a strong influence of personal experiences on empathic neural responses.

EMPATHY, CULTURE AND NEUROSCIENCE Accumulating evidence has revealed that culture influences the neural mechanisms underlying both high-level social cognition and low-level perceptual/attentional processes. As cross-cultural psychology has shown accumulating evidence that social cognition and social behavior depend on the socio-cultural context to a high extent (Kitayama & Cohen, 2007), social neuroscientists have begun to consider cultural effects in the neural substrates of human cognition.

Researchers from all over the world, including the applicants of this project, have contributed to the emergence of cultural neuroscience (Han & Northoff, 2008; 2009; Chiao, 2009). Using neuroimaging techniques such as functional magnetic resonance imaging (fMRI) and event-related brain potentials (ERPs), researchers have measured neural activity in individuals either from different cultural groups employed in the same cognitive tasks or from the same group during priming with different cultural knowledge (Chiao *et al*, 2009; Harada *et al*, 2010; Chiao & Blizinsky, 2010; Bridge *et al*, 2010; Perrachione *et al*, 2010; Mathur *et al*, 2010). These findings provide the basis for investigations of differences in cognitive and neural mechanisms of empathy among people raised in different cultures. E.g. our recent researches have identified differences in neural representations of the self and close others between Euro-Americans and East-Asians (Han & Northoff, 2009). Other studies have shown evidence for cultural difference in neural substrates underlying cognitive functions such as attention and mental calculation (Kitayama *et al*, 2003; Duffy *et al*, 2009).

Though empathy facilitates altruistic behaviours, it may also mediate variations of such behaviours as a function of social contextual changes. For example, social psychologists have shown evidence for bystander apathy in specific situations, which illustrates the consequences of lacking empathy. In addition, as our age is characterized by distrust and violence between people of different cultures both inter and intra-nationally, it is an urgent issue to uncover the neural substrates underlying neurocognitive processes involved in generation and settlement of conflicts between different cultures and different social groups.

So far the neural mechanisms underlying bystanders' apathy remains widely unknown. There is only one study that has investigated the modulations of empathic neural responses by cultures and social relations (Mathur *et al*, 2010). The authors examined the neural basis of extraordinary empathy and altruistic motivation in African-American and Caucasian-American individuals. They found that empathy for ingroup members is neurally distinct from empathy for humankind in general. Usually people show greater response within anterior cingulate cortex and bilateral insula when observing the suffering of others, but African-American individuals additionally recruit medial prefrontal cortex when observing the suffering of members of their own social group. Moreover, neural activity within medial prefrontal cortex in response to pain expressed by ingroup relative to outgroup members predicted greater empathy and altruistic motivation for one's ingroup, suggesting that neurocognitive processes associated with self identity underlie extraordinary empathy and altruistic motivation for members of one's own social group.

PLANS FOR A NEUROIMAGING RESEARCH PROJECT ON CULTURE, BRAIN AN EMPATHY Increased understanding of inter-cultural differences in neurocognition such as empathy could be of great practical as well as scientific value. It is our obligation as scientists to apply our knowledge and methods to urgent social problems as well as to questions of scientific interest. The globalization of culture offers particularly valuable and perhaps unique opportunities for the investigation of the nature and extent of cultural differences in neurocognition.

Three factors create these opportunities. First, cultures that have differentiated over thousands of years to create what has been called cultural speciation still exist in pure enough form to make

differences in neurocognition evident. Second, there is now an international community of scientists with common equipment and methods for studying neurocognition. Third, there are first and second generation children of people who immigrated to one culture from another. It is possible in these individuals to compare environmental and genetic influences on cultural differences as the rearing culture is changing while the inherited genes are not.

The current joint research project aims to investigate the cognitive and neural mechanisms underlying the modulation of empathy by human social relations and cultural backgrounds. Neural activity in association with empathy should be recorded from different cultural groups using brain imaging techniques such as functional MRI and event related brain potentials. We will examine how the cognitive and emotional components of empathy are modulated by social in-group/out-group relationship and whether such modulation of empathy depends on participants' cultural backgrounds and attitudes toward in-group/out-group members. We will also explore priming procedures that may change empathic neural responses to in-group/out-group members.
Every participating centre shall investigate 15 healthy native people and 15 members of a distinct minority. The association between culture and empathy will be analyzed with categorical and dimensional approaches.
We want to invite the members of the World Association of Cultural Psychiatry (WACP), the Transcultural Psychiatric Section of World Psychiatric Association (WPA-TPS) and other interested parties to participate in this study. Those who are interested are asked to contact Georg Northoff (Georg.Northoff@rohcg.on.ca) or Thomas Stompe (thomas.stompe@meduniwien.ac.at) for further information.

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