Disentangling the effects of stress on neural components underlying the experience of empathy

Tomova, L. 1*, Majdandzik, J. 1,5, Hummer, A. 2, Heinrichs, M. 3,4, Windischberger, C. 2, Lamm, C. 1

1 Social, Cognitive and Affective Neuroscience Unit, Department of Basic Psychological Research and Research Methods, University of Vienna; 2 MR Center of Excellence, Center for Medical Physics and Biomedical Engineering, Medical University of Vienna; 3 Department of Psychology, Laboratory for Biological and Personality Psychology, University of Freiburg, Germany; 4 Freiburg Brain Imaging Center, University Medical Center, University of Freiburg, Germany; 5 Institute of Normal and Pathological Physiology, Slovak Academy of Sciences, Bratislava, Slovakia

*Correspondence at: livia.tomova@univie.ac.at

Background: Stress is omnipresent in modern life - both at the workplace and in private. Although there is extensive research on the effects of stress on isolated individuals, little is known on how stress affects social cognition.

Methods: We used fMRI to assess effects of stress on neural correlates underlying empathy for pain paradigm. Participants (N=75) were randomly assigned to a stress and a control group. Psychosocial stress was experimentally induced in the stress group using a well-established stress paradigm (i.e. Montreal Imaging Stress Test, MIST) while the control group underwent a non-stressful control condition.

Results: When watching painful situations of others, stressed participants showed increased activation in brain areas associated with the “empathy for pain network” – such as bilateral anterior insula (AI) and anterior midcingulate cortex (aMCC). However, during situations which were actually not painful for the other but required cognitive reappraisal, stressed participants showed again similar responses while control participants showed stronger connectivity between aMCC and temporoparietal junction and prefrontal cortex - indicating the engagement of stronger emotion regulation and inhibitory processes.

Conclusions: Our results imply that while stress intensifies emotion sharing, this comes at the cost of reducing the ability to flexibly regulate this affective response.