Stress Research Institute

Stockholm University

Effects of sleep deprivation on emotional contagion measured by self-reports and EMG during fMRI scanning

Gustav Nilsonne, Sandra Tamm, Paolo d'Onofrio, Johanna Schwarz, Göran Kecklund, Mats Lekander, Torbjörn Åkerstedt, Håkan Fischer

Conclusions

These findings provide proof of principle for the detection of facial mimicry by EMG during fMRI scanning. Participant self-reports indicated that sleep deprivation induced a shift from feeling happy towards feeling more angry. EMG results were partly consistent with such a shift.

Background

Mimicry of observed emotional expressions occurs spontaneously and automatically and can be measured using electromyography (EMG). We hypothesized that partial sleep deprivation (PSD) would cause deceased emotional contagion, measured by EMG and self-reports, during a functional magnetic resonance imaging (fMRI) experiment.

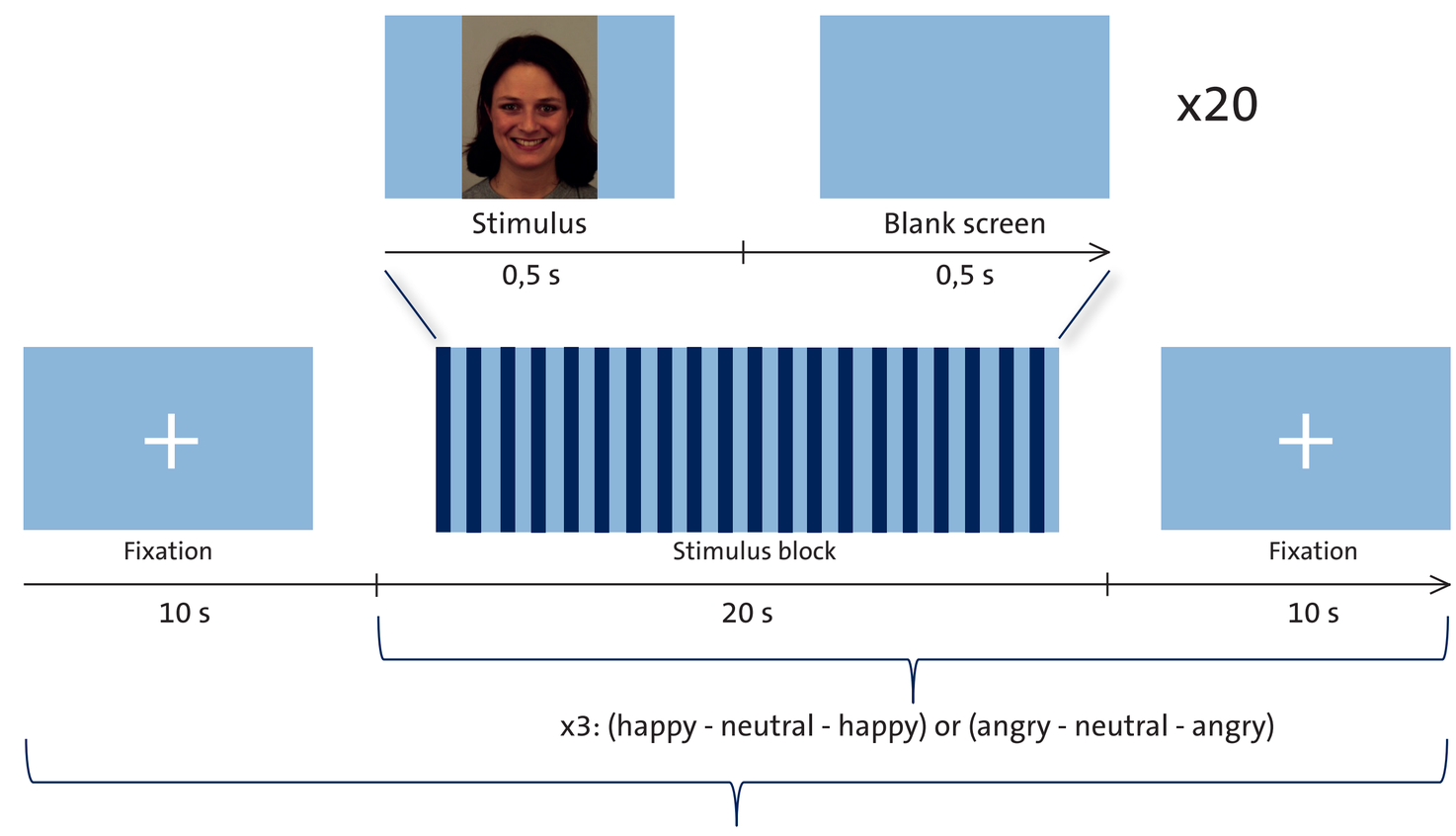
Methods

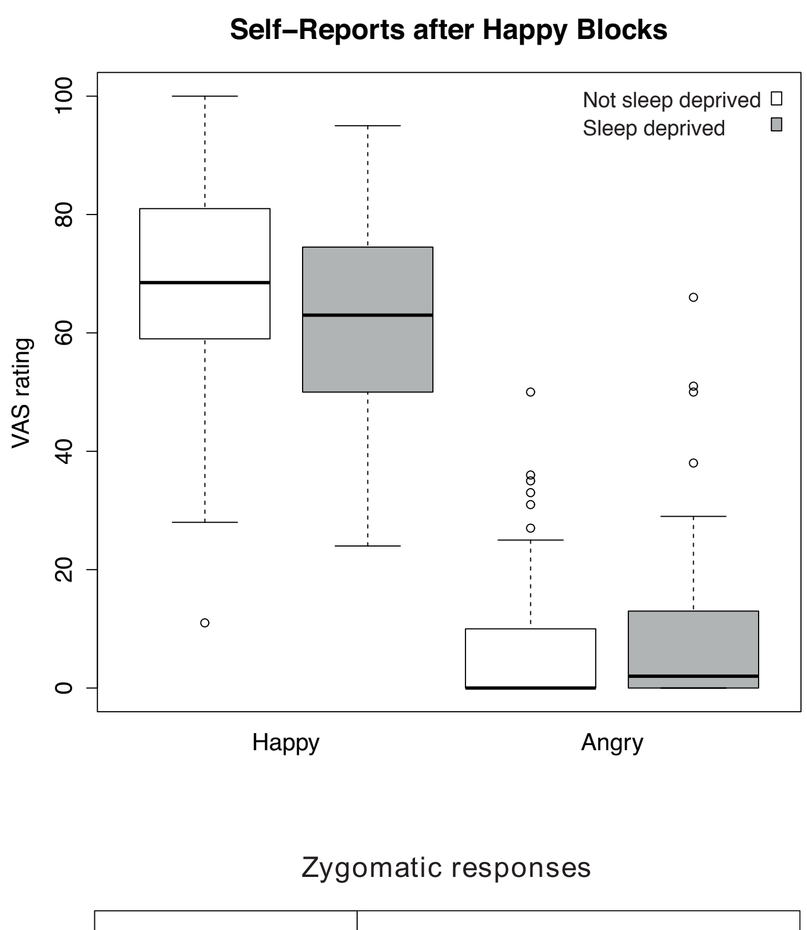
23 healthy volunteers underwent EMG recordings during fMRI scanning. PSD was induced by allowing subjects 3 h sleep at night, and was carried out in a cross-over design with a full night of sleep in the other condition. Subjects were shown happy, angry, or neutral facial expressions from the Karolinska Directed Emotional Faces (KDEF) stimulus set. Pictures were presented in a block design showing 20 consecutive faces with the same expression for 0.5 s each with an interval of 0.5 s. Four blocks were shown of each emotion. EMG was recorded using pregelled circular 1 cm-diameter radiotranslucent electrodes on 3.8 cm circular vinyl backing. Radiotranslucent clip leads were connected through a patch panel connector to Biopac EMG amplifiers in the control room. To remove scanner noise, EMG signals were processed according to a procedure proposed by Heller et al (NeuroImage 2011). A comb band stop filter with a base frequency corresponding to the number of slices/TR was used. Furthermore, a 30-300 Hz band pass filter was applied to exclude electrical activity not originating in muscle, and a 49-51 Hz band stop filter was used to remove line frequency noise. Average rectified EMG signal was calculated for bins of 1 s during each block. A mixed effects model was fitted with condition as random variable and subject as fixed variable.

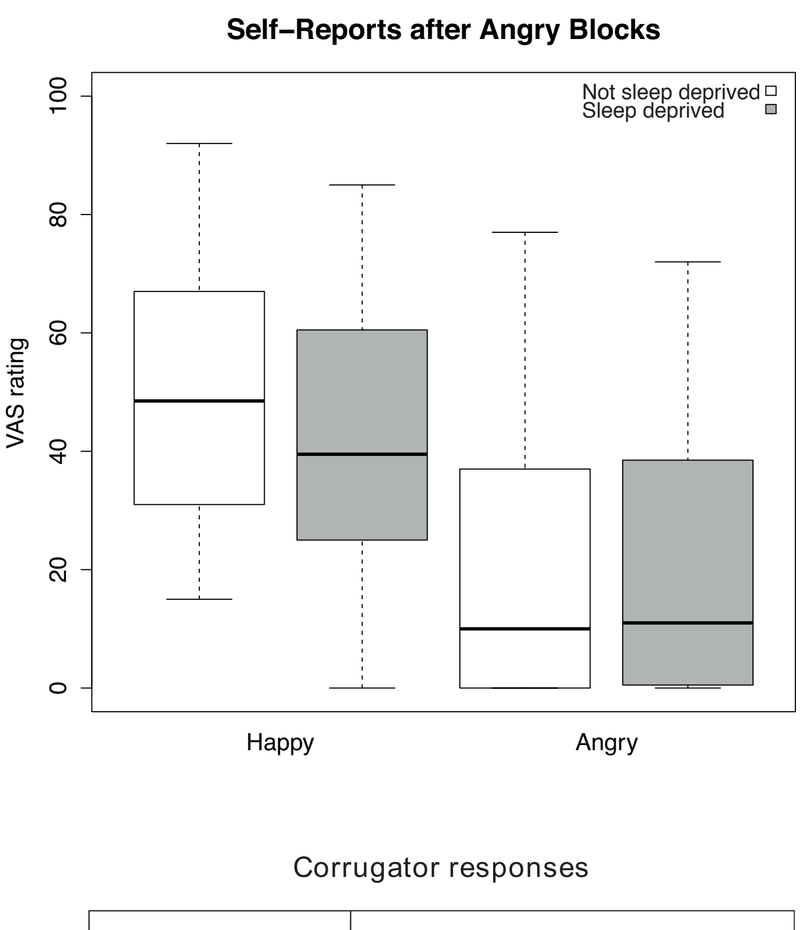
Results

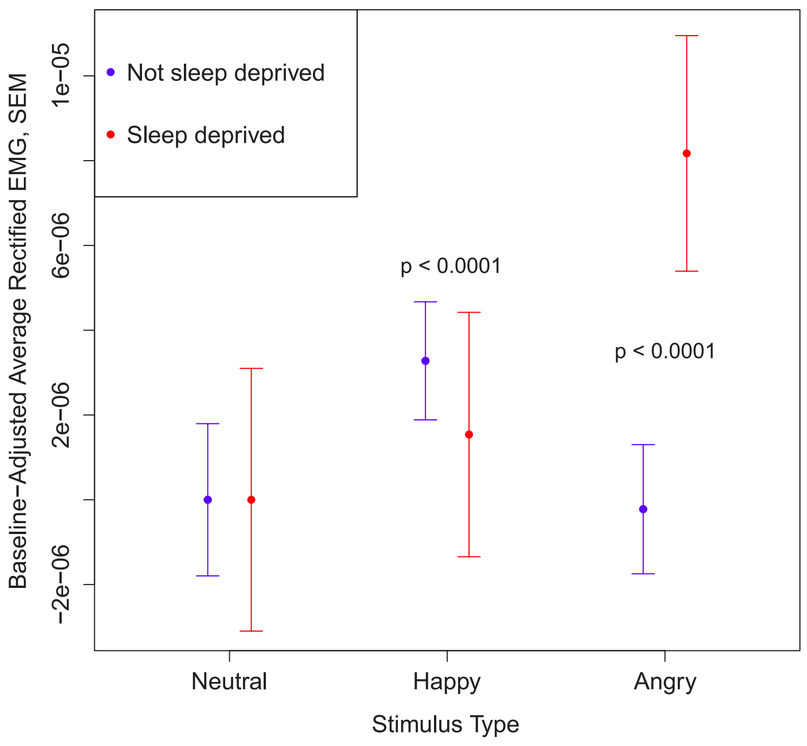
PSD caused participants to report feeling less happy and more angry. PSD caused lesser zygomatic activity to happy faces and greater activity to angry faces. PSD caused lesser corrugator avtivity to happy faces and greater activity to angry faces.

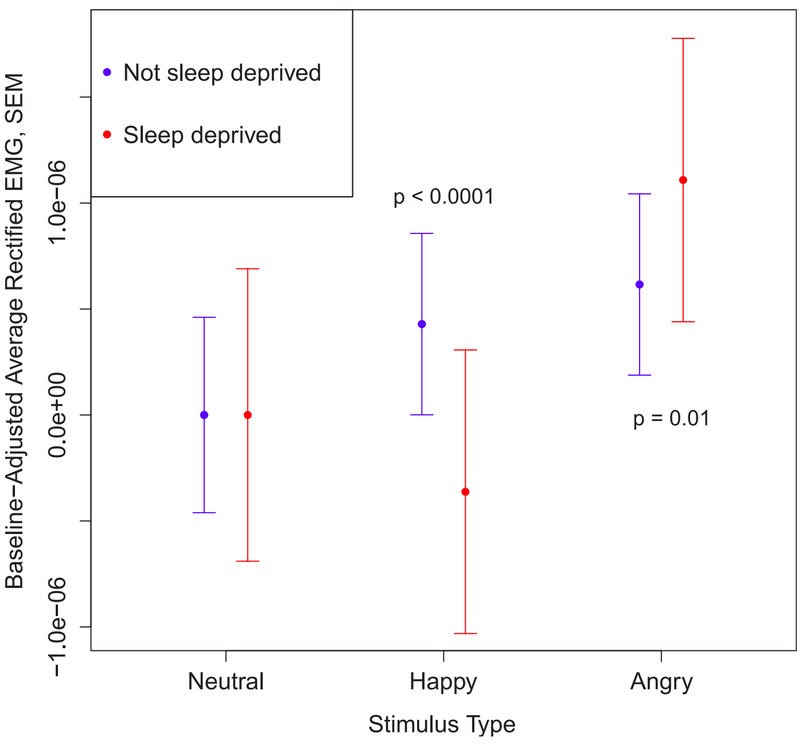
Experimental paradigm











Stress Research Institute is a knowledge centre in the area of stress and health. The Institute is part of the Faculty of Social Science, Stockholm University, Sweden and conducts basic and applied research on multidisciplinary and interdisciplinary methodological approaches.
E-mail info@stressforskning.su.se **Website** www.stressresearch.se

CONTACT
Gustav Nilsonne, Stress Research Institute, Stockholm, Sweden
E-mail gustav.nilsonne@stressforskning.su.se