

# Detection of facial mimicry by electromyography during fMRI scanning

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## Conclusions

These findings provide proof of principle for the detection of facial mimicry by EMG during fMRI scanning.

## Background

Mimicry of observed emotional expressions occurs automatically and can be measured using electromyography (EMG)<sup>1</sup>. MRI pulse sequences cause considerable noise in EMG recordings. We investigated whether facial mimicry can be measured by EMG during fMRI scanning. To the best of our knowledge, this has not been reported before.

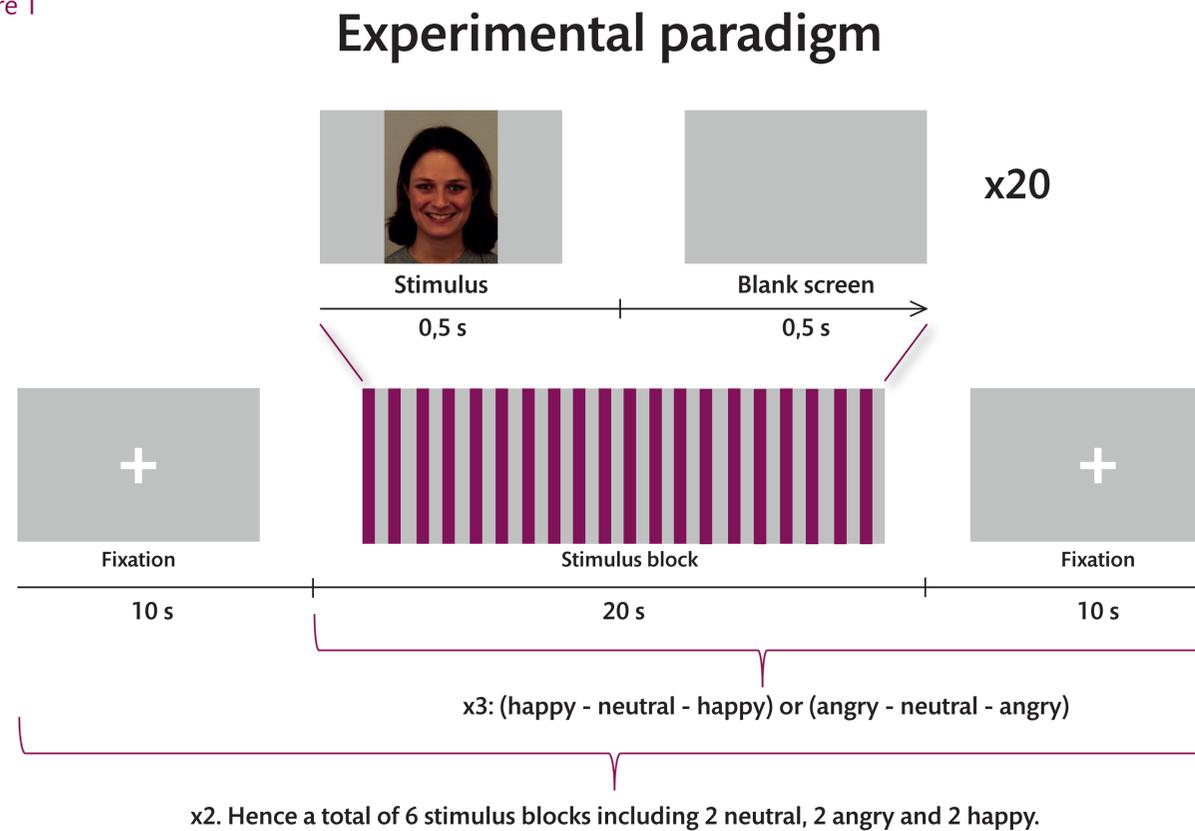
## Methods

11 healthy volunteers underwent EMG recordings during fMRI scanning. Subjects were shown happy, angry, or neutral facial expressions from the Karolinska Directed Emotional Faces (KDEF) stimulus set<sup>2</sup>. 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 (Fig. 1). Four blocks were shown of each emotion. EMG was recorded using pre-gelled 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<sup>3</sup>. 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

EMG activity from the superciliary corrugator muscle was greater when viewing angry faces than when viewing happy faces (Fig. 3,  $p < 0.01$ ). EMG activity from the major zygomatic muscle was not significantly greater when viewing happy faces than when viewing angry faces (Fig. 2).

Figure 1



## References

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2. Lundqvist D, Flykt A, Öhman A. The Karolinska Directed Emotional Faces-KDEF. CD-ROM from Department of Clinical Neuroscience, Psychology section, Karolinska Institutet, Stockholm, Sweden. ISBN 91-630-7164-9; 1998.
3. Heller AS, Greischar LL, Honor A, Anderle MJ, Davidson RJ. Simultaneous acquisition of corrugator electromyography and functional magnetic resonance imaging: A new method for objectively measuring affect and neural activity concurrently. *NeuroImage*. 2011 Oct 1;58(3):930–4.

Figure 2

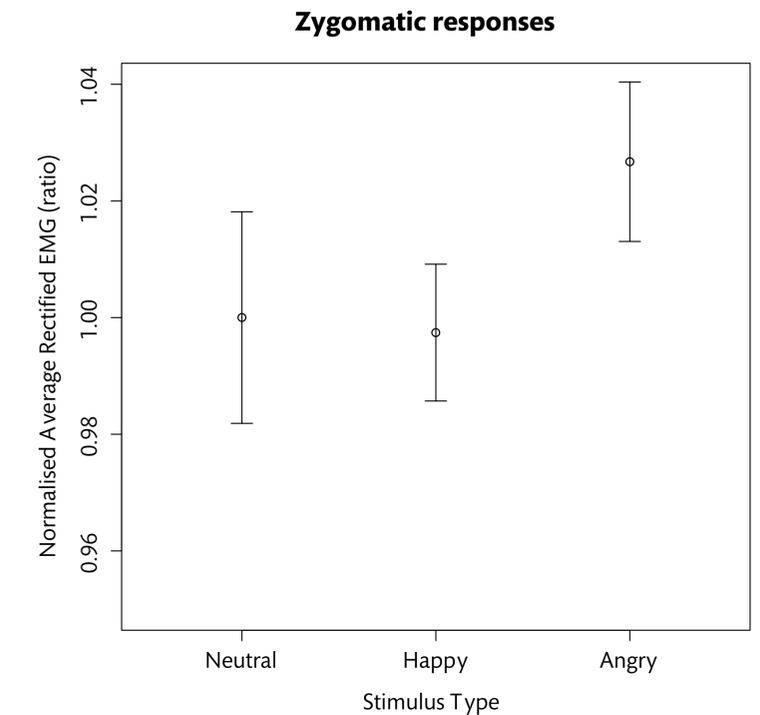
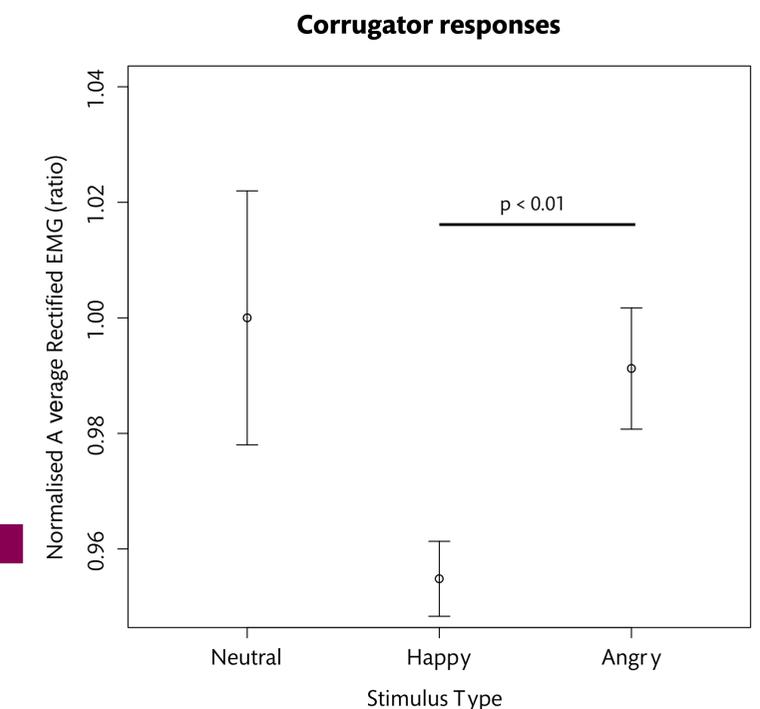


Figure 3



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