Stimulus intensity affects emotion regulation success and neural responses in subcortical and cortical regions

Carmen Morawetz[1], Stella Berboth[1,2], Christian Windischberger[1]

[1]Center for Medical Physics and Biomedical Engineering, Medical University of Vienna, Austria
[2] Charité Universitätsmedizin Berlin, Germany

Introduction

- Emotional experiences and their regulation differ widely across individuals, which might modulate activation in the emotion regulation (ER) network[1]
- ER success might vary as a function of perceived emotional intensity[2]
- Functional magnetic resonance imaging (fMRI) studies commonly use a correlational approach to relate brain activity of predefined regions-of-interest to individual differences in emotion processing[3]
- We used fMRI and whole-brain parametric regression analyses to examine how variability of stimulus features (valence and arousal) and ER ability (emotional state ratings, ESR) impact the ER network

Methods

- 28 participants (23 female, age: *M*=22.79 ± 3.14years)
- ER task (**Fig. 1**) with two conditions (**Decrease** or **Look**), 3 scanning sessions separated by 1 week, 240 trials; CMRR multiband EPI sequence at ultra-high field (7T)
- High and low arousing negative IAPS[4] and NAPS[5] images
- Stimuli were rated after scanning on arousal (1 calm to 9 exciting) and valence (1 negative to 9 positive)

Fig. 1: Emotion Regulation Task

Behavioral Results

- Our sample differs in arousal ratings from the norm[4,5] (**Fig. 2**)
- ESR correlate significantly higher with individual arousal and valence ratings compared to norm (**Fig. 3**)
- Individual arousal is significantly correlated with valence
- Participants felt significantly less negative after ER which was modulated by arousal (**Fig. 4**)

Behavioral Results

Fig. 2: Individual and norm arousal ratings illustrated for 20 stimuli

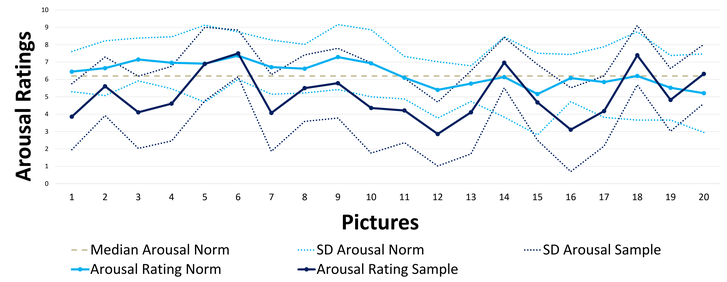


Fig. 3: Correlation between ESR and arousal and valence ratings (norm and individual)

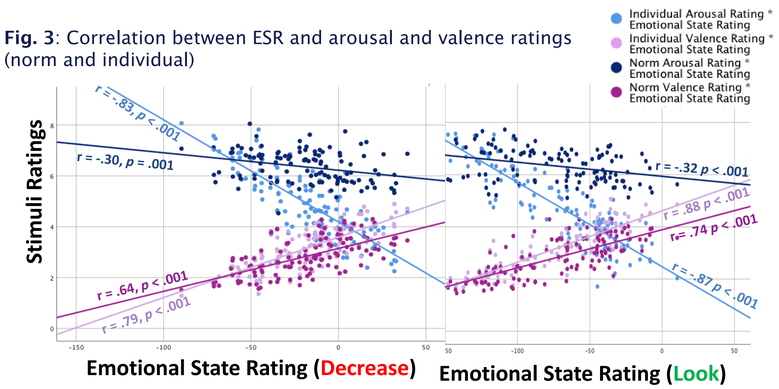
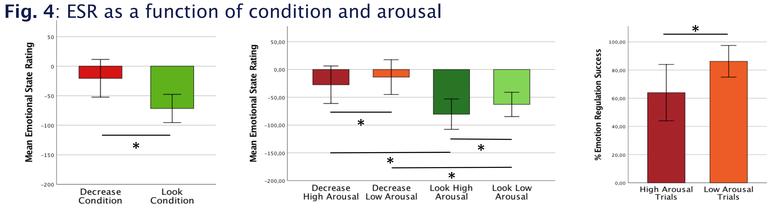


Fig. 4: ESR as a function of condition and arousal



fMRI Results

- Higher activity in subcortical regions is correlated positively with arousal and negatively with valence and ESR during **Decrease** and **Look** (**Fig. 5**)
- Higher activity in cortical and subcortical regions is correlated negatively with arousal (**Decrease** and **Look**) and positively with valence and ESR (**Look**, **Fig. 6**)

fMRI Results

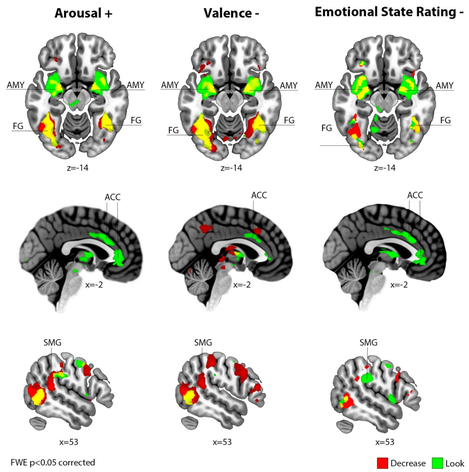


Fig. 5: Brain regions modulated by higher arousal ratings, lower valence ratings and lower ESR

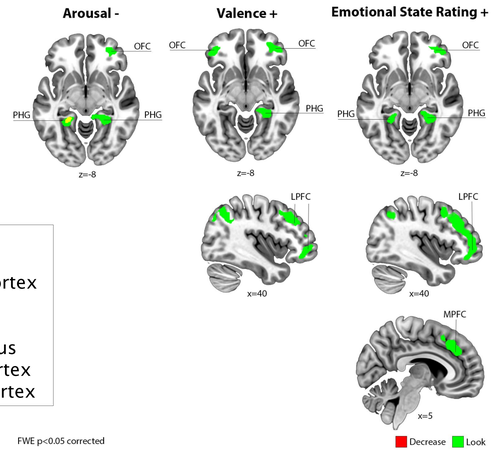


Fig. 6: Brain regions modulated by lower arousal ratings, higher valence ratings and higher ESR

AMY = Amygdala
FG = Fusiform Gyrus
ACC = Anterior Cingulate Cortex
SMG = Supramarginal Gyrus
OFC = Orbitofronal Cortex
PHG = Parahippocampal Gyrus
LPFC = Lateral Prefrontal Cortex
MPFC = Medial Prefrontal Cortex

Conclusions

Our findings indicate that stimulus features as well as ESR parametrically modulate activity in emotion generative and regulative brain regions including the amygdala and prefrontal cortex. Thus, it is important to integrate individual differences in emotion processing in fMRI studies investigating the neural basis of ER.

References
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Contact: carmen.morawetz@meduniwien.ac.at