

# Neural correlates of compassion attitude toward sad, neutral and one's own faces.

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## INTRODUCTION

Compassion is a fundamental human quality that allow to respond with caring to the suffering of others, whereas self-compassion (SC) refers to ability to having an accepting and caring attitude towards oneself.

Previous studies established that compassionate attitude towards other people's sad faces modulate activities of midbrain-ventral striatum region network (Kim et al., 2009). There is lack of studies investigating neural basis of self-compassion, however.

## OBJECTIVES

Here, we present the preliminary results of the fMRI study aiming at evaluation of the neural nature of compassion directed to own faces (*self-compassion*) as well as to neutral expressions of other people in healthy individuals.

We hypothesized that compassionate attitude would recruit brain areas implicated in theory of mind (ToM), such as medial and inferior frontal cortex, whereas self-compassion would activate regions involved in awareness and emotional processing. Additionally, we expected that viewing participants own faces would modulate the midline cortical regions implicated in self-referential processes.

## METHODS

### Subjects

20 healthy subjects (9 females; age  $M = 31.24$ ,  $SD = 6.8$ ) without history of current or previous psychiatric and neurological disorders were recruited.

Mental status and psychiatric history was determined using the Mini International Psychiatric Interview (MINI, Sheehan et al., 1998).

Self-compassion was measured with short version of Self Compassion Scale (Neff, 2003).

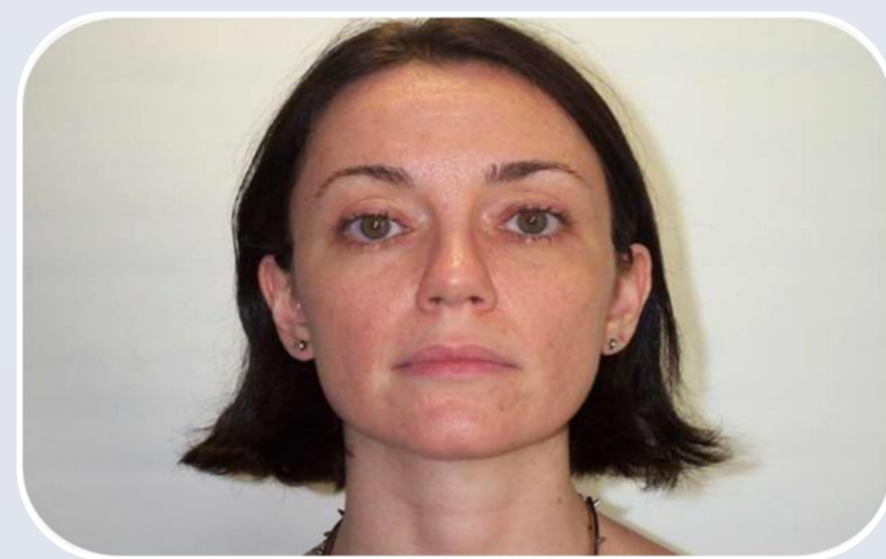
### Stimuli and Design

The pictures displaying participant own face, 18 neutral (9F) and 18 sad faces (9F) from NimStim sets were selected.

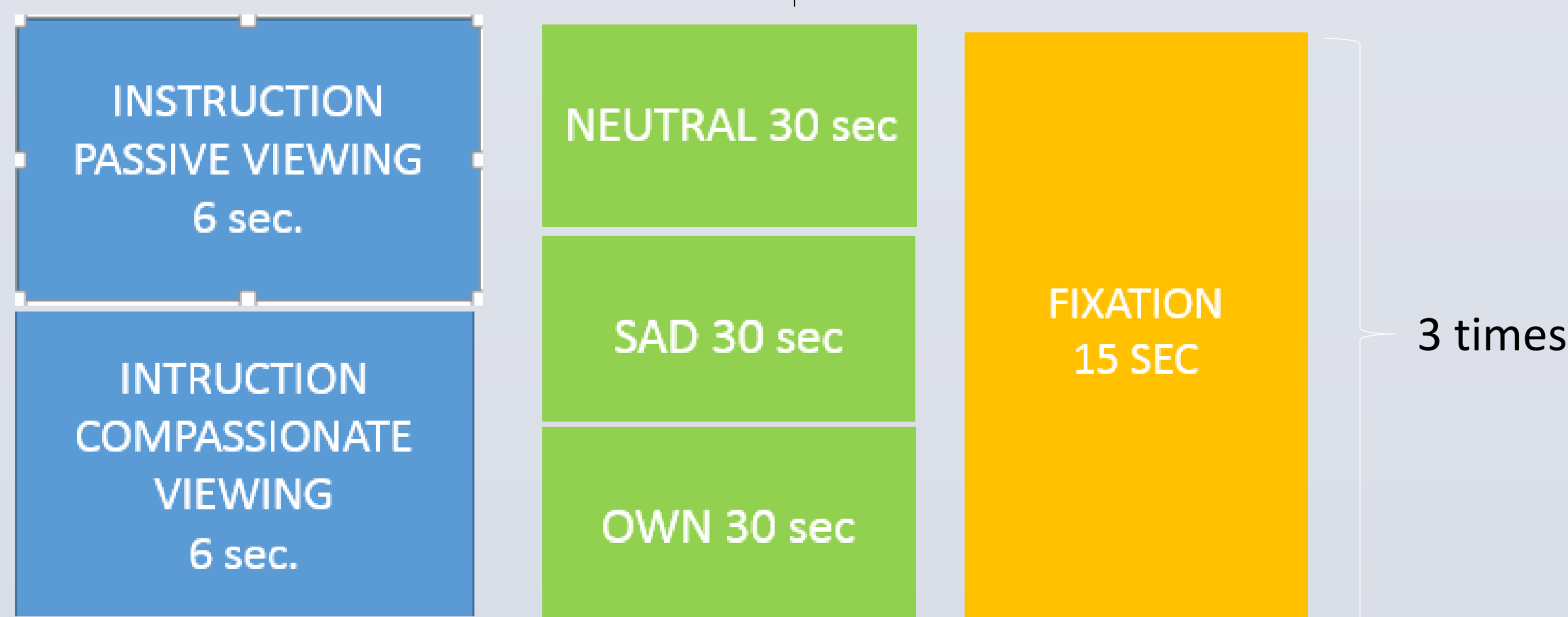
Design: 2 attitudes: compassion, passive\_view x 3 emotions: sad, own, neutral



(facial pict 1)



(facial pict 8)



### Procedure

Participants were asked to passively view or generate a compassionate attitude while viewing blocks of neutral faces (one block), sad faces (second block) and picture of their own face (third block) during fMRI scanning.

Compassionate instruction: „To view facial picture compassionately with a willingness to feel, share and understand the suffering of a person in the picture”.

fMRI in block design. Three blocks with 8 stimuli per block.

### Measures and Analyses

• Rating of the degree of how much they felt compassionate feeling toward pictures. fMRI:

- Siemens 3 T MRI whole body scanner (SIEMENS TRIO)
- T2\*-weighted single-shot gradient EPI sequence (TR: 2000 ms, TE: 30 ms, 90° flip angle, matrix: 64 X 64, voxel size: 3.5x3.5x3.5 mm), each EPI volume contained 35 axial slices acquired in interleaved order.

Data was analysed with SPM12 and xjview 8.12 (WFU PickAtlas). First-level individual whole brain contrasts were input into a second-level analysis using ANOVA factorial design - 2 attitude (compassion, passive view) x 3 face type (own, neutral, sad) creating a random effects model. ONLY contrasts with significant activations (on cluster FWE=0.05) were reported.

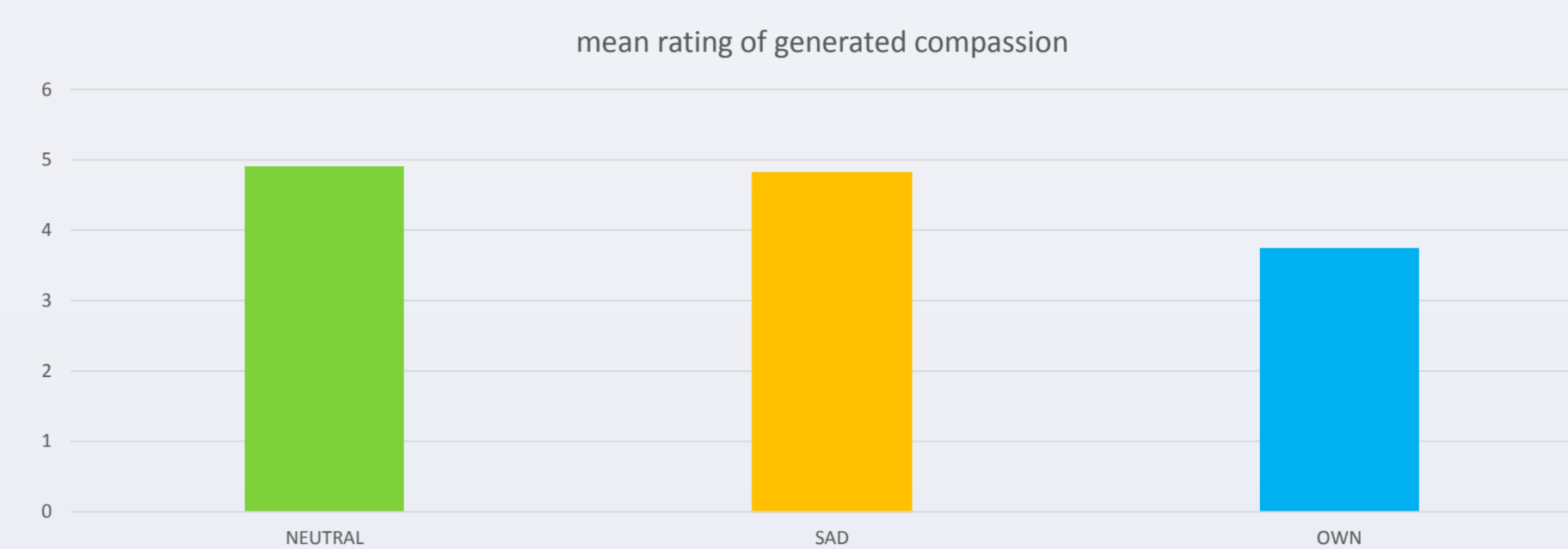
Preprocessing: realignment, DARTEL\_normalised, smoothed (6x6x6[mm])

## RESULTS

### Behavioral Results

Results of behavioral ratings of generated compassion showed the main effect of emotion ( $F(2,38)=3.25$ ,  $p=.05$ ).

Participants felt more compassion to neutral faces than to their own faces on the trend level ( $M_{neu}=4.92$ ,  $SD=2.02$ ,  $M_{own}=3.75$ ,  $SD=3.14$ ,  $p=.1$ ).

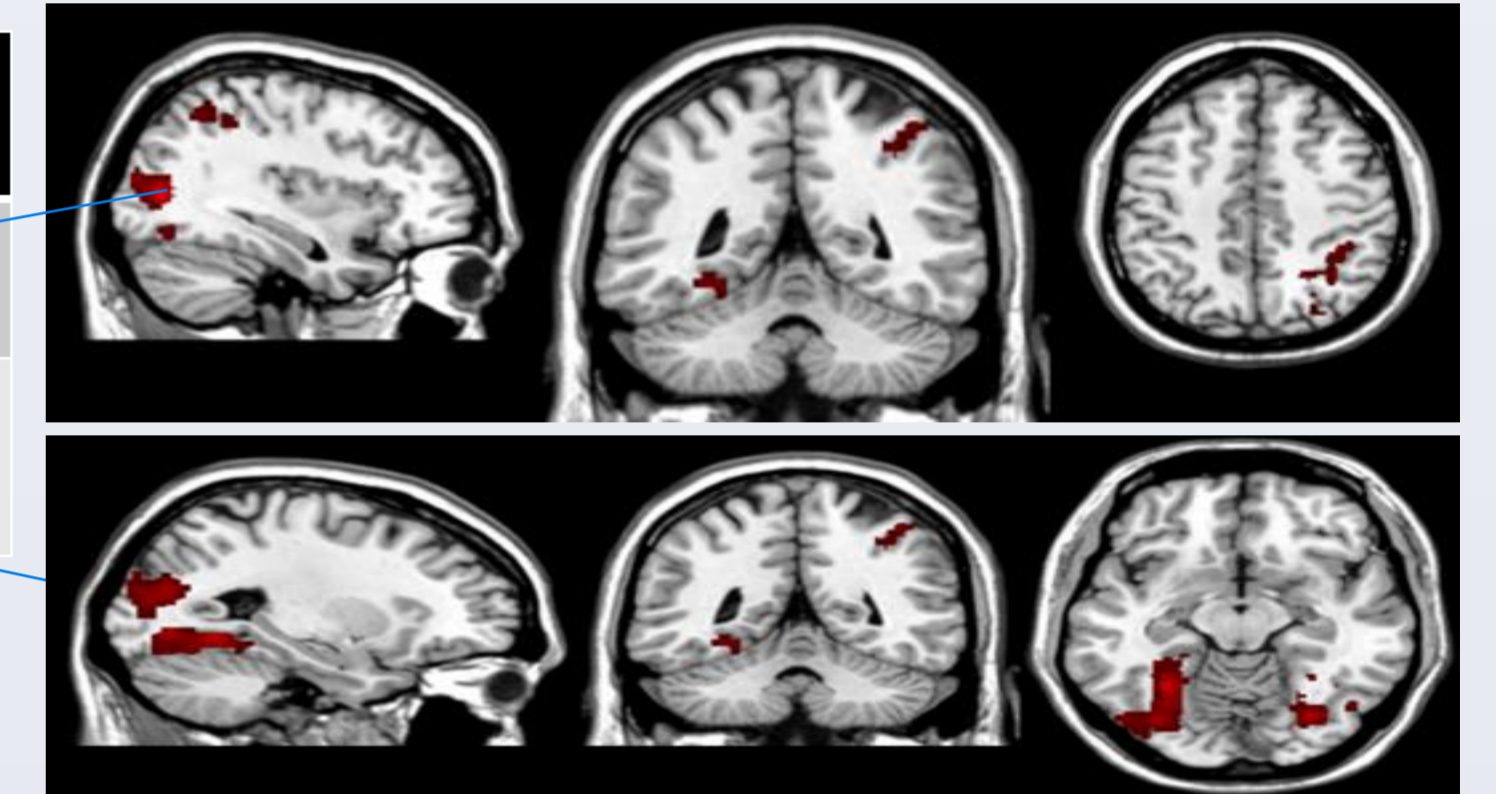


### Imaging Results

#### Main effect of compassion attitude

Table 1. Activated brain regions associated with main effect of compassionate attitude.

Brain region	x	y	z	F	k
Fusiform_L Parahippocampus	-32.0	-54.0	-10.0	37.50	488-108
Inf Parietal Lobule BA40	34.0	-58.0	50.0	17.86	150-60-24
Precuneus					



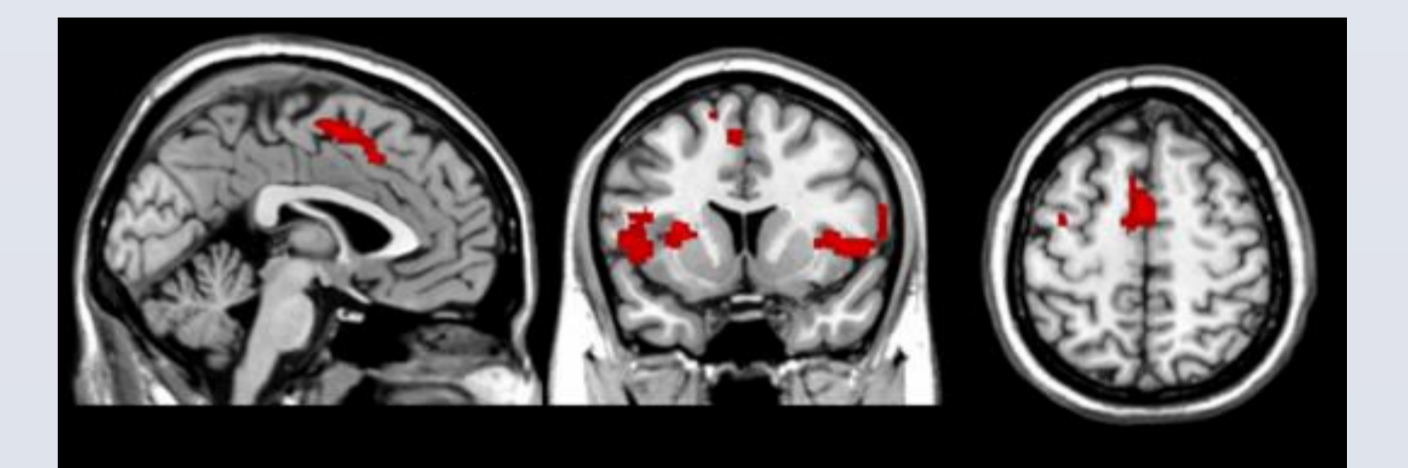
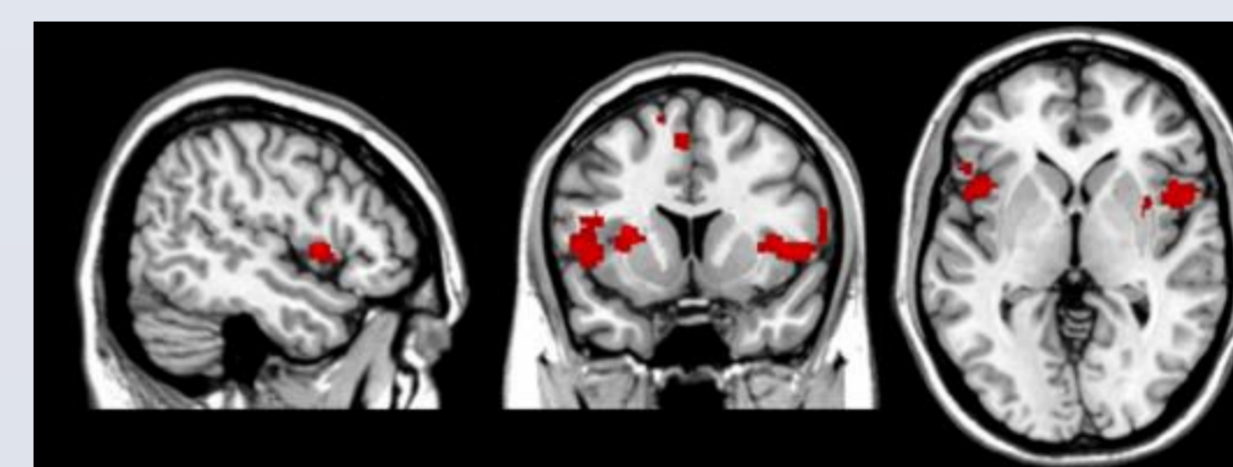
#### compassion x emotional face

Compassion attitude toward faces revealed an activation in R insula, putamen and orbitofrontal gyrus.



#### cmp\_neu-pv\_neu

When compassion to neutral faces we compared with passive viewing to neutral faces we found surplus of neural activity in right Insula, inferior, medial and superior frontal gyrus.



#### cmp\_own-cmp\_sad

An increase in neural activity in middle frontal gyrus (MPFC), L frontal sup. med. Gyrus, L cingulate and L ACC.



#### cmp\_sad covaried with cmp\_sad ratings

Compassion attitude toward sad faces correlated with behavioral ratings of compassion generated to sad faces in R insula, putamen and amygdala.

## CONCLUSIONS

- Naive to meditation and compassion practices participants tend to generate less compassion toward their own faces than to neutral faces of other people (note this was found on the trend level).
- Elicitation of compassion engage BA 40 and part of temporoparietal junction (TPJ) - areas involved in detecting another person's suffering expressions.
- Compassionate attitude activates also brain areas involved in theory of mind (ToM) and mirroring emotional experience: Inferior frontal gyrus (IFC) and insula.
- Elicitation of compassion might be related to appraisals of the relevance of the other to the self: we found recruitment of mid and ventral areas of the medial prefrontal cortex (mPFC)
- Self-compassion in contrast to compassion to sad faces activates middle frontal gyrus (MPFC), frontal sup. med. cortex and ACC - brain areas involved in self-awareness and default mode network.
- More studies, for example contrasting high and low compassionate subjects are needed.

## REFERENCES

Kim, J.W., Kim, S.E., Kim, J.J., Jeong, B., Park, C.H., Son, A. R., ... Ki, S. W. (2009). Compassionate attitude towards others' suffering activates the mesolimbic neural system. *Neuropsychologia*, 47 (10), 2073-81.

Neff, K. D. (2003). The development and validation of a scale to measure self-compassion. *Self and Identity*, 2, 223-250.

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