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Representations of emotion from the face, body and voice in the brain, an fMRI decoding study

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Introduction

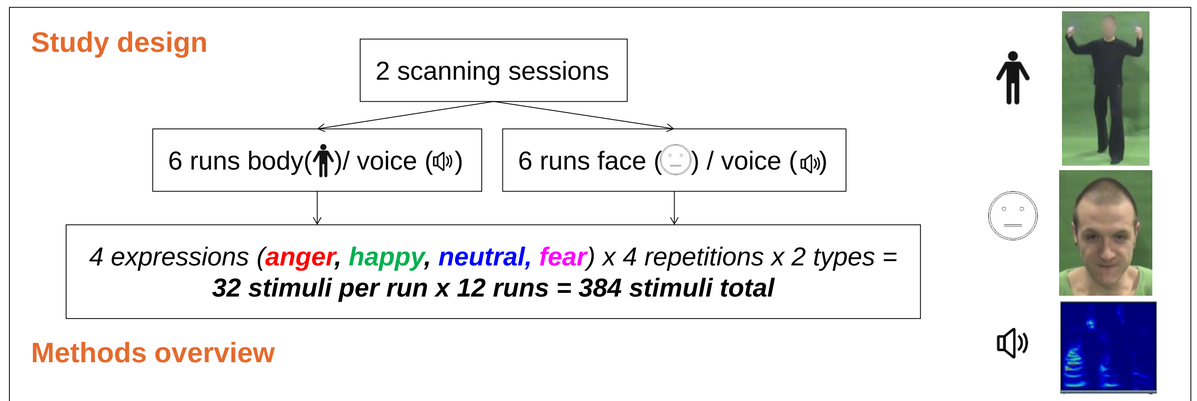
Whether we see an angry face, we hear voice shouting, or we watch threatening body movements, we conclude effortlessly that the person is angry. The traditional explanation is that the face, voice and body are equally fit to convey an abstract or amodal emotion content. In line with this view previous work has identified high-level brain areas where affective information converges and emotions are represented at an abstract, modality-independent level [1]. An alternative view, not starting from a categorical organization of basic emotion concepts, postulates that in the course of processing emotional expressions the sensory specificity of the signals is maintained.

Our study aimed to clarify whether the brain represents emotions as modality specific or modality-invariant using fMRI with affective stimuli in a passive viewing paradigm. We then perform multivariate pattern analysis to identify cortical regions containing representations of emotion independently of the explicit evaluation of emotion.

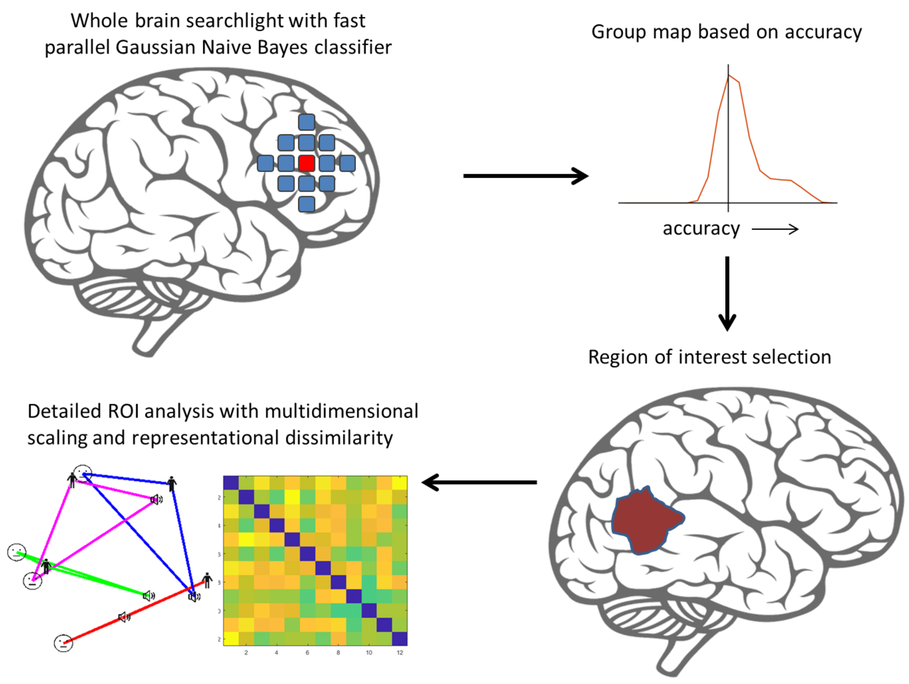
Methods

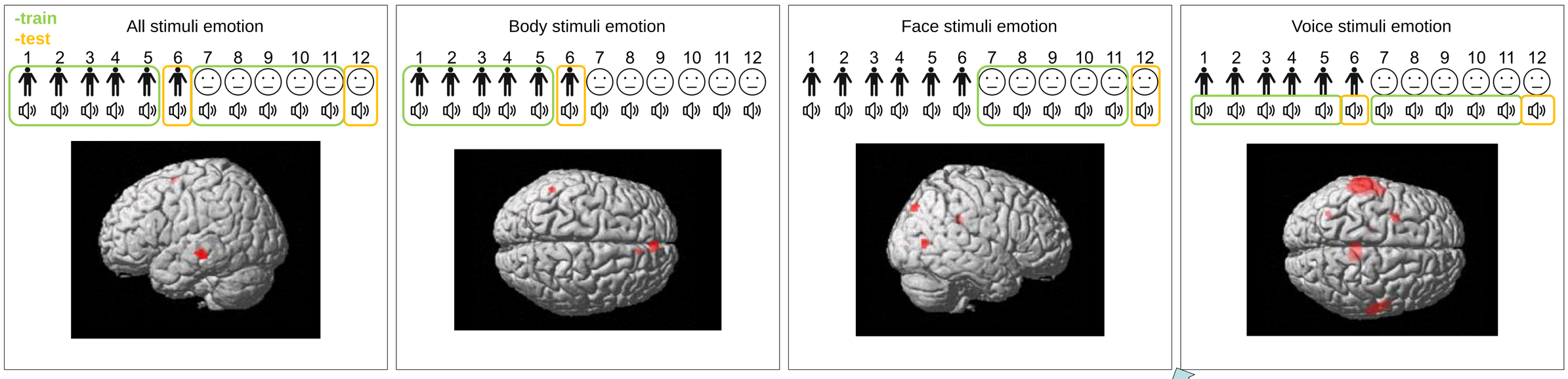
Each trial consisted of a 1s stimulus presentation of an emotion expression by the body / face / voice in a slow event related design. fMRI data was acquired at 3T (2x2x2mm, TR=3) in 13 subjects. Data was preprocessed with BrainVoyager and trial-wise beta values were extracted with custom MATLAB code. A classifier (searchlight Gaussian Naïve Bayes) was trained on (1) stimulus type, (2) emotion or (3) within modality emotion, and was tested with leave-one-run-out cross-validation. Decoding accuracies were tested at the group level by a 1-sample t-test against chance level.

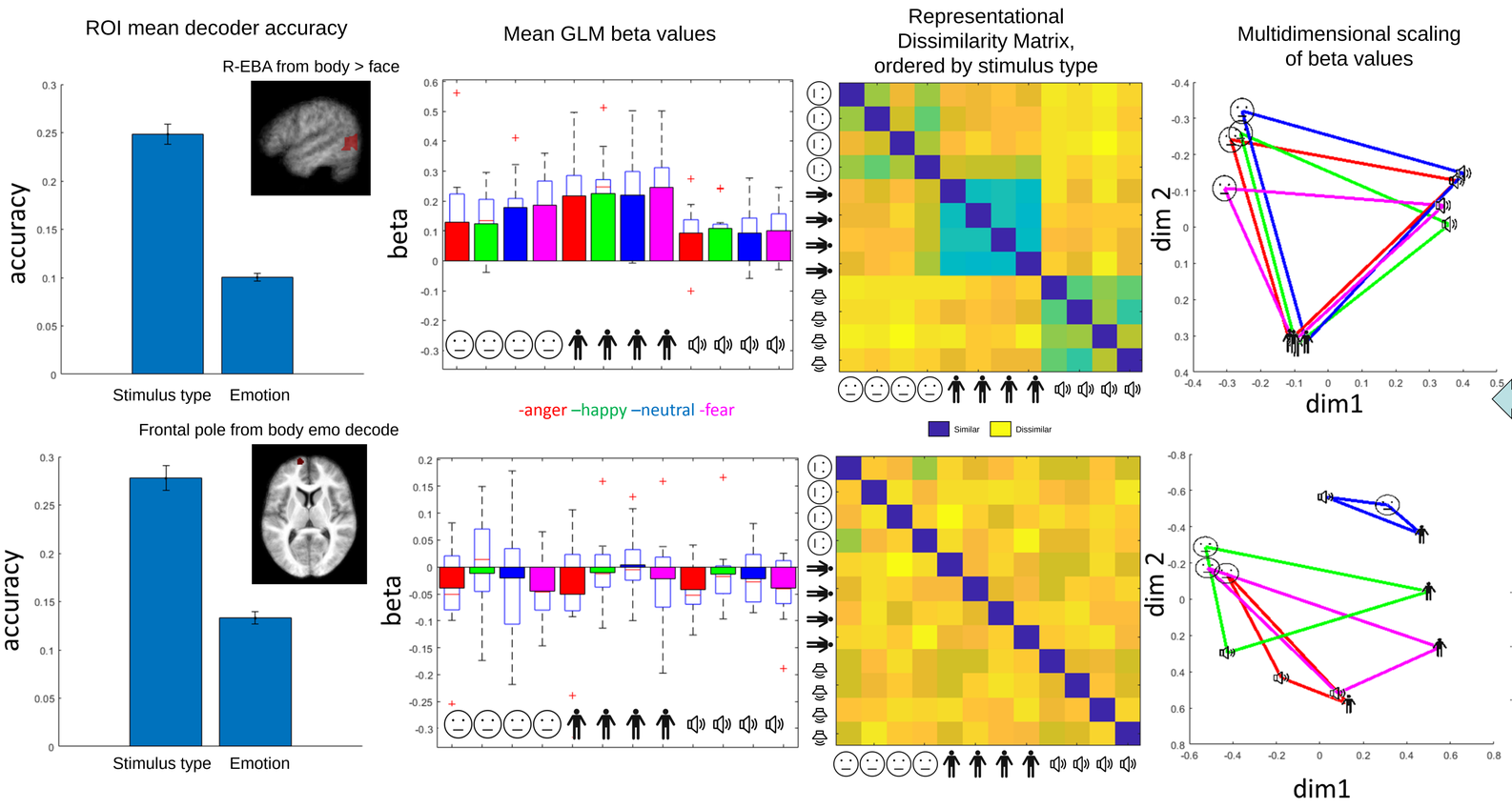
Study design



Methods overview







Results 1. Decoding of emotion trained on all stimuli types resulted in overall low accuracies (corrected for 25% chance level). Regions where emotion from the body could be decoded did not converge with regions where emotion from the face or voice could be decoded.

Results 2. A detailed analysis of ROIs revealed no regions that could be identified as truly amodal as multi-voxel response patterns for stimulus type were always highly dissimilar..

Discussion & Conclusion

We did not find support for amodal emotion representation defined as areas with voxel patterns where emotion could be decoded and having very similar voxel patterns for the different stimulus type. Instead we propose that emotional stimuli result in modality-emotion specific responses possibly reflecting an evolutionary and ecologically driven brain organization where each type of sensory expression has its own functionality.

References

[1] B de Gelder, Emotions and the Body, Oxford University Press, 2016; [2] M Peelen. et al., Journal of Neuroscience, 2010

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