High BOLD stability of emotional faces processing network in ultra-high field fMRI data

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Background: Despite the contributions of numerous fMRI experiments on amygdala activity, some important questions regarding the reliability of these results remain unanswered, in particular intra- and intersession test-retest reliability, and reliability of condition dependent task-evoked brain responses. Here, we investigate response and habituation to emotional stimuli using an extended version of the well established emotion discrimination task (EDT) at ultra-high magnetic field (7 Tesla).

Methods: 14 volunteers (7f/7m, mean age: 25.3 ± 3.0 years) were examined with 7T fMRI using an extended version of the EDT, a paradigm known to stimulate brain regions associated with face recognition and processing. The standard EDT task requires subjects to match facial emotions while an object matching task is used as control condition. In this study, we added an implicit emotion discrimination task based on the instructions to match persons instead of emotions. Each task was repeated 18 times in total (2 sessions x 3 runs x 3 blocks). Data acquisition was performed on a SIEMENS Magnetom 7T scanner, using a 32-channel head coil with the CMRR multiband EPI sequence (TR=1.4s, TE=23ms, 78 slices with a spatial resolution of 1.5×1.5×1mm3). Analyses were conducted in SPM12.

Statistical parametric maps were calculated contrasting the explicit/implicit emotion discrimination task (eEDT/iEDT) versus the object discrimination task (ODT) and compared across runs and sessions. Habituation effects were analyzed by calculating t-contrasts comparing the first to the last run of each measurement session, as well as by performing t-tests on the calculated linear regression slopes on a single subject basis, using a p-value threshold of p<0.05. Connectivity is analyzed using Dynamic Causal Modeling.

Results: The group-level results for eEDT>ODT show activity in the well-known network engaged during facial emotion processing including bilateral amygdala, DLPFC and fusiform gyrus. Contrasting explicit vs. implicit facial emotion processing (eEDT>iEDT) reveals increased activation in DLPFC, insula and superior temporal gyrus. Activation levels remain stable across runs and sessions. No statistically significant habituation effects were found.

Conclusions: Here we showed that EDTs provide robust and reproducible activation results in the bilateral amygdala, DLPFC and fusiform gyrus across runs and sessions. These tasks thus seem perfectly suited to be used in large-scale and longitudinal studies. The results indicate reliable reproducibility for the applied emotion discrimination task using high SNR data from ultra-high field 7 Tesla fMRI.