Independent Junior Research Group
Neurocognition of Decision Making

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Decision Making in Social Contexts

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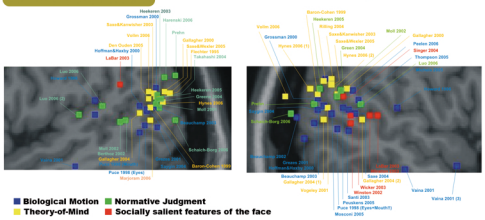
Sociotopy of Superior Temporal Sulcus (STS)

Aims

Fig. 1: Meta-Analysis



Numerous studies on social cognition using diverse paradigms found the STS to be responsive to social cognitive tasks, such as Biological Motion (BM), Theory-of-Mind (ToM), and Normative Judgment (NJ) (Fig. 1).

Functions attributed to the STS range from the perception and representation of socially relevant stimuli (Allison et al., 2000) to the detection and analysis of goals and outcomes of behavior (Frith & Frith, 1999).

A conception, which reconciles the opposing perspectives, is that the activity in the STS-region elicited by different social cognitive tasks can be explained in terms of a shared intention reading process (Gallagher et al., 2000).

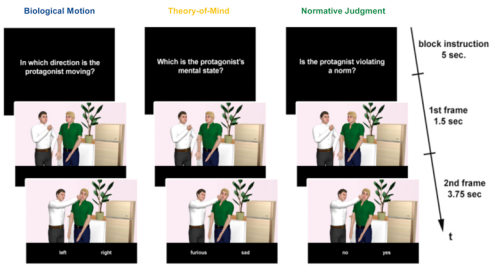
However, it is yet unclear whether the activity in the STS-region produced by different tasks actually falls into the same location, which would be expected, if the tasks shared a common process.

Consequently, to further the understanding of the function of the STS, we investigated how three aspects of social decision-making, namely biological motion, theory-of-mind, and moral judgment are represented in this region, combining the three tasks in a single experiment using the same material.

Methods

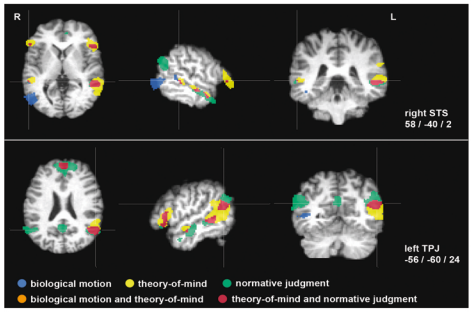
We developed a new set of animated stimuli depicting two people in a social interaction (Fig. 2). Participants were asked to make judgments about either a person's movements, or mental states, or norm-conformity of behavior. Importantly, the picture stimulus was kept constant for these three tasks, only instructions and response pairs were manipulated.

Fig. 2: Stimulus Material



Results

Fig. 3: Overlay of contrast maps for the three tasks



In the STS-region Biological Motion activated the right superior temporal sulcus (STS), Theory-of-Mind the STS bilaterally and the left temporo-parietal-junction (TPJ), and Normative Judgment the STS and TPJ both bilaterally (Fig. 3).

A considerable overlap was observed for Theory-of-Mind and Normative Judgment in both the left STS and left TPJ.

Cognitive and Emotional Empathy in Autism Spectrum Conditions

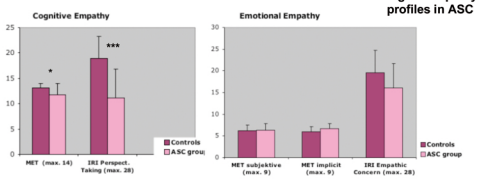
Aims

Autism spectrum conditions (ASC) are listed in the DSM-IV as neurodevelopmental disorders and are associated with impairments in social interaction and repetitive and restricted patterns of behavior. Despite a lack of systematic research, individuals with ASC have consistently been cited to lack empathy.

According to recent conceptions, empathy entails cognitive components (theory of mind, Baron-Cohen et al., 2004) and emotional components (empathic concern, Davis, 1980), where those components can been seen as different, yet related.

In order to measure the different components of empathy simultaneously and ecologically more valid than questionnaires, we developed a new measure, the Multifaceted Empathy Test (MET; Dziobek et al., 2007).

Fig. 1: Empathy profiles in ASC



Although individuals with ASC scored lower on cognitive empathy, they were not impaired on the MET's emotional empathy scales, which was corroborated by the IRI. In a next step, we aimed at identifying the brain correlates of empathic functioning

Methods

Fig. 2: MET MRI adaptation

20 individuals with ASC and 20 matched controls were contrasted on cognitive and emotional empathy using an fMRI adaptation of the MET; Fig.2).

Results

A conjunction analysis revealed that both groups activated similar distinct networks for cognitive and emotional empathy (Fig. 3).

When contrasting cognitive empathy between groups, the individuals with ASC showed more activation in an emotional network encompassing the right amygdala, anterior insula, and orbitofrontal cortex (Fig. 4).

Potential explanations for this effect include an inability of the ASC group to down regulate emotions during cognitive empathy processes. Alternatively, the activation might reflect aversion by higher demands on deep-level processing of faces (i.e. analysis of the eye region).

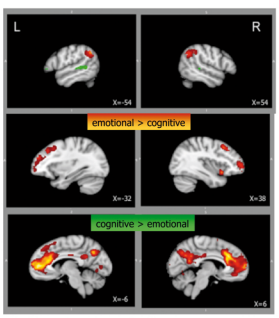


Fig. 3: conjunction analysis

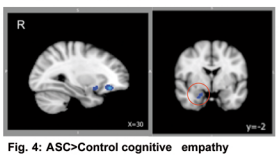


Fig. 4: ASC>Control cognitive empathy

Social Cognition Intervention Study

Aims

Social cognitive difficulties are central to ASC. However, only a limited amount of intervention tools exist targeting social cognitive (dys)functions. We developed a computer-based intervention tool, the Social Cognition Training Tool (SCOTT) that uses lifelike video-based stimuli and virtual reality environments (Fig. 1). The central aim of the study is to document brain and behavioral changes after a 12-week intervention program with the SCOTT in adults with ASC (Fig. 2).

Fig. 1: SCOTT example item

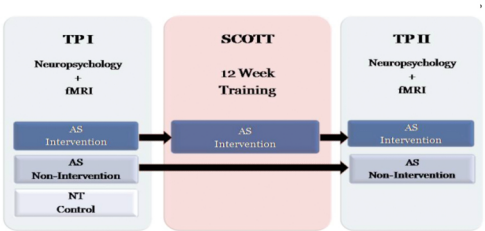


Fig. 2: Study design

Methods

Treatment success will be assessed at close and distant behavioral generalization levels. In addition, more objective correlates of improved social cognition will be obtained by measuring brain volumes (amygdala, fusiform gyrus, cortical thickness; Fig. 3 and Fig. 4) and function (real life social interaction test (MASC; Dziobek et al., 2006; Fig. 5)) that have proven sensitive in ASC in previous studies of our group.

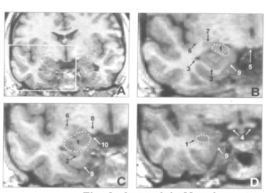


Fig. 3: Amygdala Morphometry

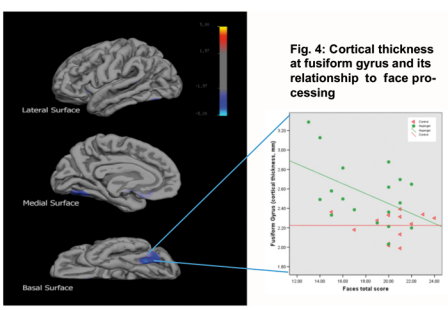


Fig. 4: Cortical thickness at fusiform gyrus and its relationship to face processing

Results

We have acquired preliminary neuropsychological and neuroimaging data for time point 1 (TP1, pre-intervention) in a group of 20 individuals with ASC and 20 controls . Compared to the control group, individuals with ASC showed deficits in all tests of social cognition (emotion recognition, face identity processing, theory of mind).

Fig. 5: MASC fMRI adaptation

Results of the fMRI study using the MASC showed that under those more naturalistic conditions both groups activated a network composed of superior temporal sulcus, temporal poles and medial prefrontal cortex that has also been identified by previous theory of mind studies using non-lifelike stimuli (Fig. 6).

Interestingly, when subjects were compared on the free viewing condition of the movie paradigm (i.e., no specific tasks instructions are provided) the ASC group exhibited activation in the amygdala bilaterally, while the control group did not (Fig. 7). Left Amygdala activation covaried systematically with emotion regulation.

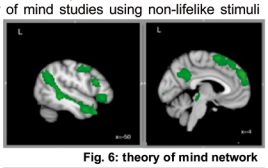


Fig. 6: theory of mind network

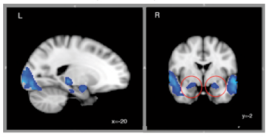


Fig. 7: free viewing amygdala activation in ASC group