

Background

Introduction

Previous meta-analyses literature (Di Martino et al., 2009; Philip et al., 2012) provided evidence of the abnormal activation in specific brain regions related to the social cognition processing in ASD, including the superior temporal gyrus (STG), superior frontal gyrus (SFG) and posterior cingulate (PC). Meanwhile, the middle frontal gyrus (MFG) has been found to be a relatively under-activated region in ASD (see Fig. 1).

The functional connectivity (FC) in the ASD brain also gained increasing interest of researchers over the past decade. The default mode network (DMN) (Washington et al., 2014) and frontal-parietal control network (FPC) (Just, Keller, Malave, Kana, & Varma, 2012), are proposed to be two networks associated with social-communicative functions in ASD.

Current Study

It is still unclear whether and how abnormal FC between different brain networks in ASD is associated with behavioral impairments.

Here, we investigated to which extent the FC between these brain regions relates to the social-communicative impairments in ASD by calculating both local and long-distance FC.

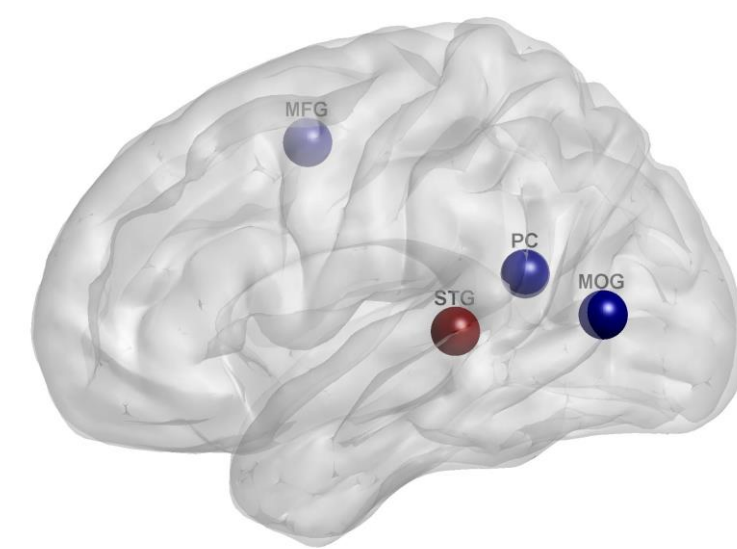


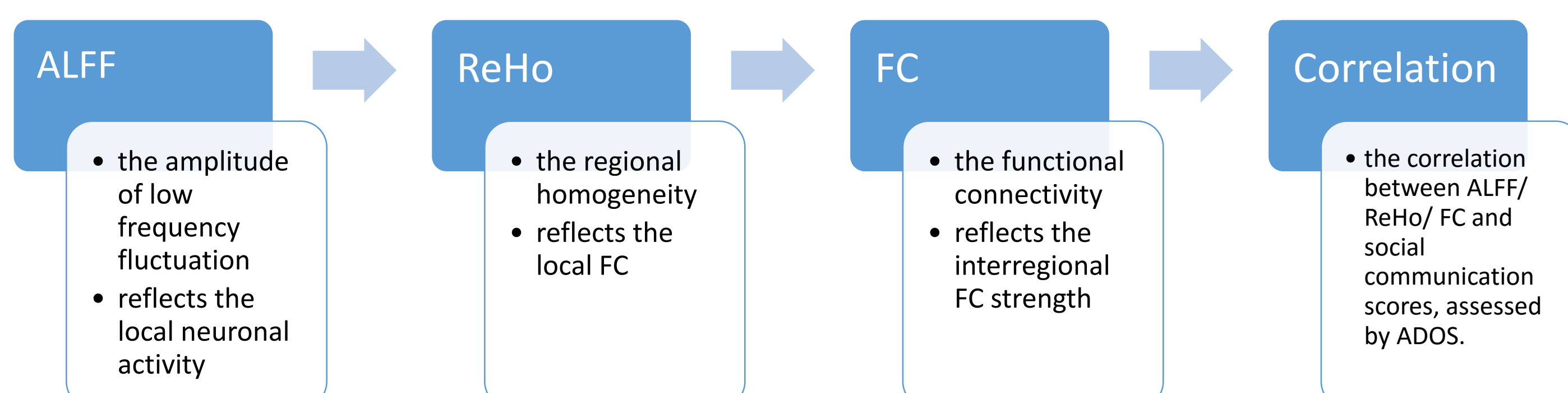
Fig.1 The location of some specific brain region

Method

Participant

112 participants (56 per group) from The Autism Brain Imaging Data Exchange (ABIDE) were selected with strict criteria (e.g., matched age, gender and IQ).

Data Analysis Procedure



Results

Result of ALFF (Local activity)

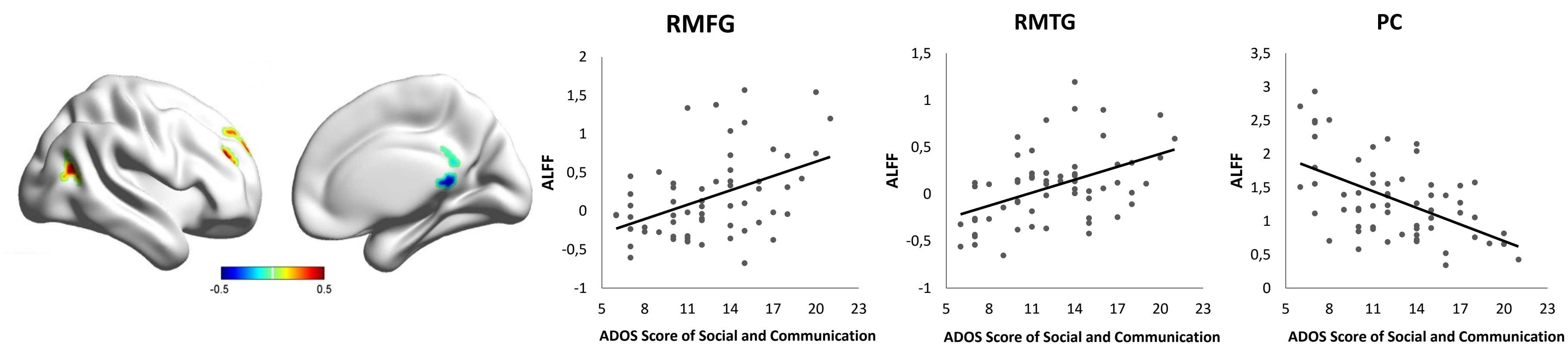


Fig. 1 The results of ALFF. The left brain map shows the brain regions with significant correlation between ALFF and the score of ADOS in ASD group. The correlation results are visualized on the right plot figures.

Result of ReHo (Local functional connectivity)

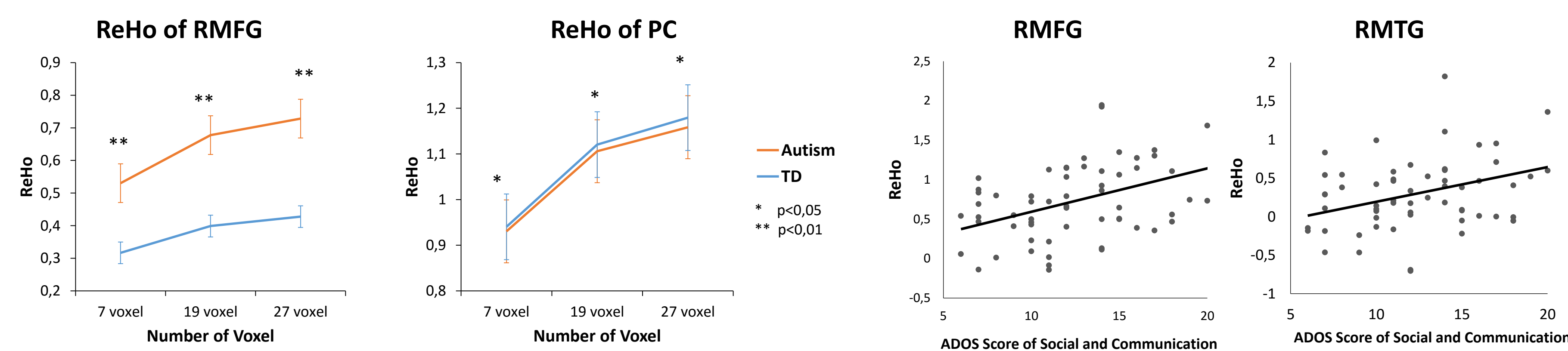


Fig. 2 The Results of ReHo. The left two figures show the difference between the ASD and control group. The right two figures show the correlation between ReHo and the Score of ADOS in ASD group.

Result of FC (the whole brain functional connectivity)

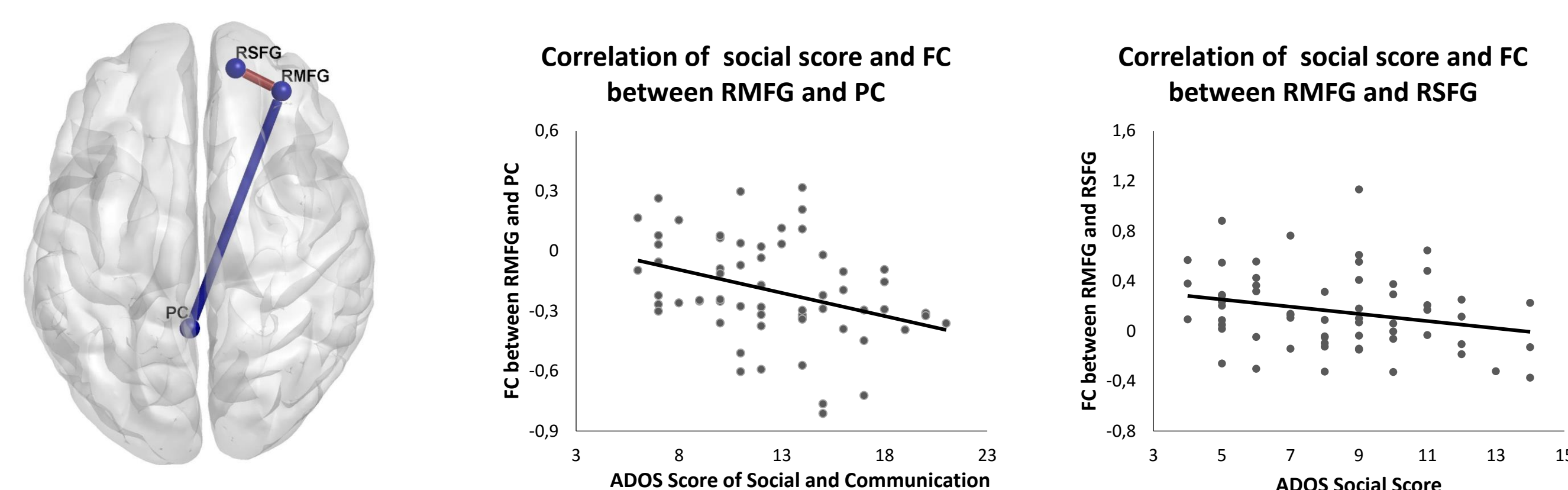


Fig. 3 The Results of Functional Connectivity.

The left brain map shows the brain connection between FC and the score of ADOS in ASD group. The right two figures show the correlation of FC and the score of ADOS between specific areas in ASD group.

Discussion

Main findings

- The results of ALFF suggested that the RMFG, RMTG and PC, regions that have been found in previous fMRI studies, are related to the social communication symptoms in ASD.
- The results of ReHo suggested that the short-distance functional signal transmission may be abnormal and less efficient for those brain regions in ASD compared to TD group.
- We further found that the FC between PC, RSFG (two key regions in the DMN) and the lateral RMFG (a key brain region in the control network) are associated with ASD's social impairment. This result suggested that the social communication impairment in ASD may be underlying the abnormality of inter-network signal exchanges, especially between DMN and FPC networks.

Summary

- Our findings support our hypothesis that abnormal inter-network FC was shown in the ASD group as compared to the TD group.
- Specifically, the abnormal social-communication functions in autism were highly related to the functional connectivity between the DMN and FPN, two key brain networks supporting social and communicative behaviors in typical populations.

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