Mutual understanding measured as inter-subject correlation depends on the social relationship: A comparison between sisters, friends and acquaintances

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Introduction

Mutual understanding is a fundamental social skill. Here we studied whether similarity in brain activities might underlie this skill. We assumed that social closeness of people is reflected in how similarly they perceive the world. Therefore, our subjects were sisters, friends, and acquaintances. We hypothesized that when particularly sisters, but also friends, face the same difficult emotional situation, they also show highly correlated brain activity.

We used inter-subject correlation (ISC) as a method to evaluate similarity in brain activity when subjects were watching a feature movie (see Hasson et al., 2004; Jääskeläinen et al., 2008; Kauppi et al., 2010).

Methods

Subjects: fMRI – 29 subjects. All subjects were healthy females (mean age 26 years), and informed written consent was obtained before participation.

Imaging: Siemens 3T MRI, EPI sequence, TR 2s, 64x64 matrix, 3.4x3.4 mm resolution, 35 slices (4mm thickness, 1mm gap). 712 volumes were acquired.

Experimental design and analysis

A: Groups of subjects were either the same individual for two measurements, sisters, friends or acquaintances.
B: All subjects viewed a 25-minute version of the movie “My sister’s keeper” twice after being instructed to assume the movie protagonists to be sisters by birth or to assume that the younger sister was adopted as a newborn.
C: Temporal inter-subject correlation (ISC) matrices were calculated over subjects for each voxel.

Results

ISC shows clear differences for the perception of varying kinds of the movie protagonists

Higher ISC for genetic sisters (red-yellow) were found in the temporal and frontal cortex, higher ISC for adoptive siblings (blue) were found in two parietal and occipital areas.

ISC during perspective taking of the different protagonists

The brain activity ISC shows clear differences in dependence of which perspective was taken.

Conclusions

Subjects watching the same stimulus perceive the basic visual and auditory features of a movie in a similar way.

Subjects with a close social relationship as sisters, and friends in a lesser amount, are also more synchronized in higher cognitive functions or associative cortical areas.

Inter-subject correlation seems to be stronger if the subjects assume the movie protagonists to be genetic sisters, suggesting that the knowledge of a common genetic background between the movie protagonists induces higher synchronization among subjects.

Taking a specific perspective increases the ISC among participants, suggesting that having similar perspectives increases mutual understanding.

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