True or False: the RTPJ responds to task-relevant beliefs

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Background

Neuroimaging experiments have identified several brain regions, including the right Temporo-Parietal junction (rTPJ), associated with reasoning about other people’s minds. A recent study (Sommer et al., 2007) have argued that rTPJ is involved only in reasoning about false beliefs. In this study we sought to provide evidence that rTPJ is involved in belief reasoning generally, rather than being specifically associated mental representations that contrast with reality.

Central Questions

Is rTPJ activation associated only with reasoning about false beliefs?

Can we observe rTPJ activation when the agent’s true belief is relevant to task performance?

Verbal Theory of Mind Experiment

“False Photograph”

Old maps of the islands near Titan are displayed in the Maritime museum. Erosion has since taken its toll, washing away all but the three largest islands.

Reality Question

Near Titan today there are three islands many islands

“False Belief”

Jenny put her chocolate away in the cupboard. Then she went outside. Alan moved the chocolate from the cupboard into the fridge. Half an hour later, Jenny came back in.

Representation Question

Jenny expects to find her chocolate in the cupboard fridge

False Belief > False Photograph

N=13 p<.001, k=10

Nonverbal Theory of Mind Experiment

Reality question

Where is the Dog Hiding?

rTPJ response

rTPJ percent signal change

Belief Only > True Belief:
T(13)=2.15, p=0.055

Belief Only > False Belief:
T(13)=4.34, p=0.0008

Conclusions

✦ rTPJ is reliably recruited by a nonverbal belief-attribution task

✦ Activation in the rTPJ is not specifically related to false beliefs

✦ rTPJ response is observed whenever representing beliefs of others is task-relevant, independent of the veracity of their contents.

rTPJ response in standard false belief tasks

In standard false belief tasks, rTPJ responds more to false belief trials. However, belief representation is unnecessary in standard true belief trials: the subject already knows where the girl will look for the dog.

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