علوم‌شناختی

جلسه ۲۵ (ج)

علم اعصاب شناختی
ذهن‌خوانی

The Cognitive Neuroscience of Mindreading

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http://courses.fouladi.ir/cogsci

PART 3:
APPLICATIONS

Chapter 14:
Mindreading: Advanced Topics

Chapter 14.3:
The cognitive neuroscience of mindreading

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Aims

- Review neuroscientific support for existence of ToMM

- Review some evidence in support of simulation theory (perhaps)

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Imaging evidence for ToMM?

Looking for regions that

a)   show increased activation in tasks that require belief attribution

b)   increased activation not due to general task demands or non-belief processing

Neutral between false and true belief tasks Requires domain-specificity

Candidate brain regions

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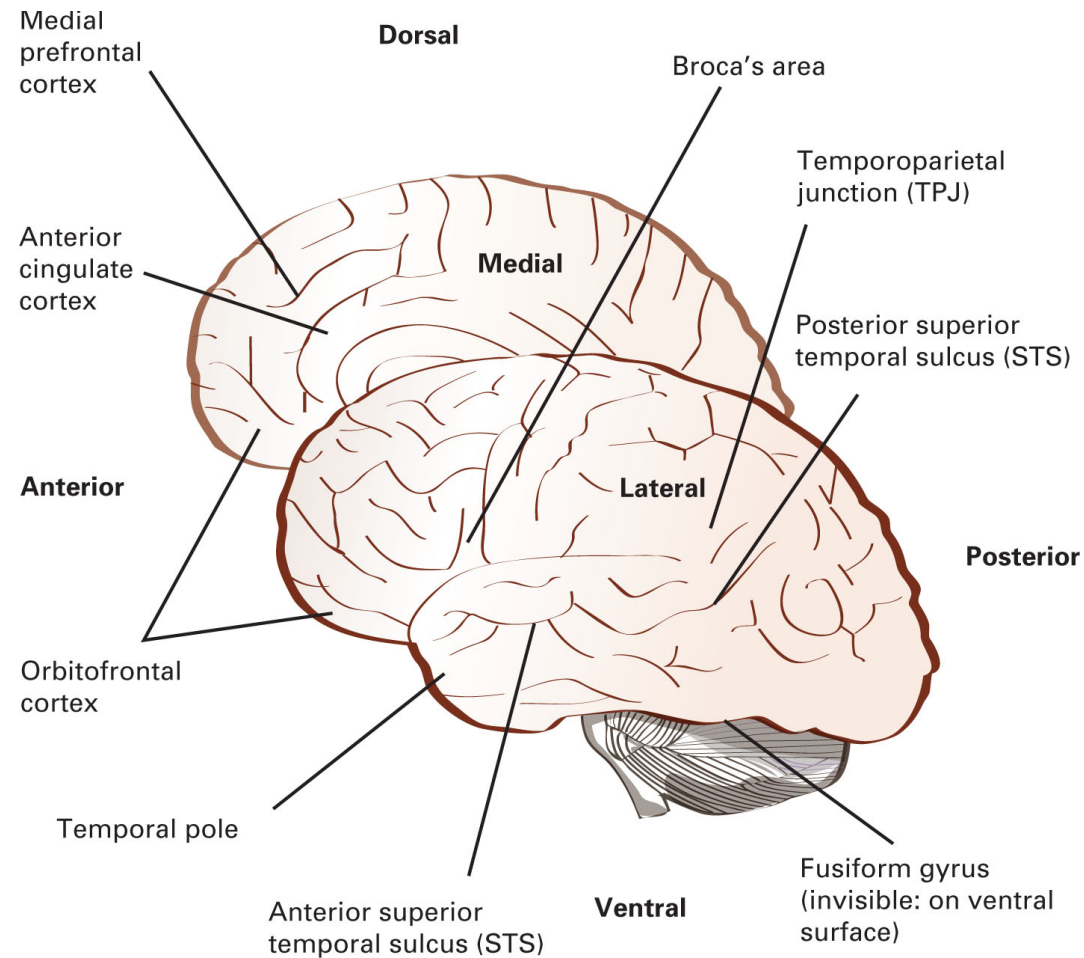
Saxe and Kanwisher

- Narrowed down on domain-specificity by ruling out two alternative explanations of activation in 3 candidate ToMM areas

- **Explanation 1** =
  domain-general reasoning about hidden causes

- **Explanation 2** =
  domain-general reasoning about representations

False photograph test

- Require reasoning about what is represented in photographs that differ from actual state of affairs

    - Character places object in one location and takes photograph

    - The object is moved/swapped while the photo is developed

    - Subject asked where the object is in the photo

- False photo tasks not correlated with false belief tasks in development

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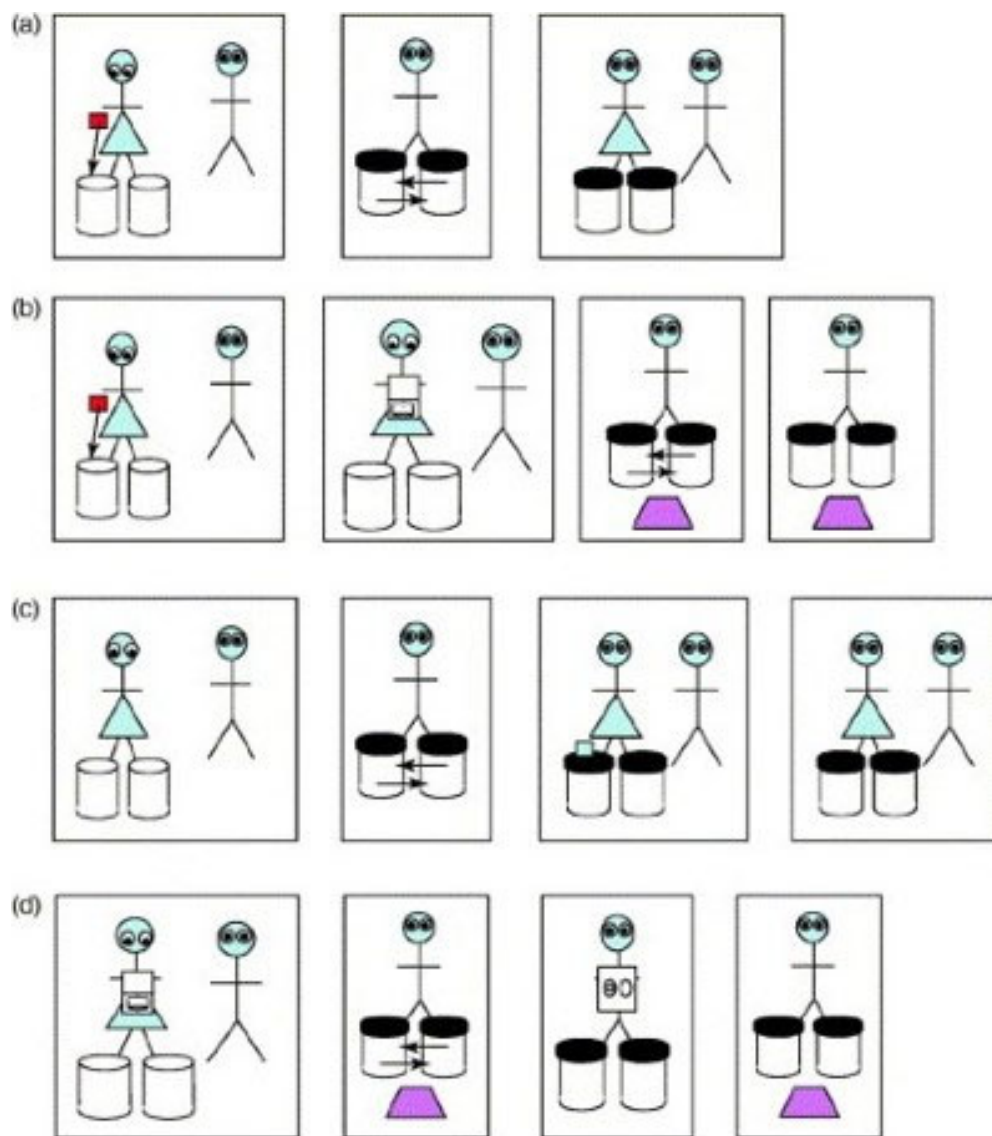
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Results and questions

- Three candidate regions showed activation in belief attribution tasks, but not in either false photograph tasks or mechanical inference tasks

  - MPFC
  - STS
  - TPJ

- Does this tell us anything about the TT/Simulation debate?
  - provides some evidence for metarepresentational areas (against radical simulationism)

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Perner's worry

- ## False photgraph tasks do not make the same conceptual demands as false belief tasks

  - ### False belief = misrepresentation of a current situation

  - ### False photograph = correct representation of an outdated situation

- ## False photograph tasks makes fewer executive demands

General problem

- Standard false belief and false photograph tasks fail to distinguish

  a) the need for participants to attribute a false belief

  b) the requirement that participants inhibit their own knowledge of how things actually are

- (b) is not specific to theory of mind tasks

- need to show that performance in false belief tasks depends upon (a) rather than (b)

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TRENDS in Cognitive Sciences

(a) Reality known + false belief

(b) Reality known + false photograph

(c) Reality unknown + false belief

(d) Reality unknown + false photograph

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Studies on WBA

Patient with a right fronto-temporal lesion, often taken as an illustration of domain-specific theory of mind deficit

- Performed below chance on reality-known false belief tasks

- But <u>above</u> chance on reality-unknown false belief tasks

- Also generally poor performance on tasks requiring inhibition of his own perspective

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Studies

Apperly, Samson, Bickerton, and Humphreys 2006

- Tested 11 patients with lesions to brain areas implicated in theory of mind tasks

- Found strong correlation between performance on false belief tasks and performance on false photograph tasks [all reality unknown]

  - 3 passed both tests
  - 8 failed both tests

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Possible account

- Reject idea of domain-specific ToMM

- Performance on standard false belief tasks depends upon

   (a) General abilities to understand representation (exploited both in false belief and false photo tasks, when reality is unknown)

   (b) General ability to inhibit self-perspective (exploited in reality known belief and photo tasks)

Direct evidence for simulation?

Hypothesis of **co-opted mechanisms** – relevant data

- paired deficits following brain damage
- mirror neurons as examples of dual purpose systems that process both first-person and third-person information

Hypothesis of **analogical reasoning** - relevant data

- activation of specialized self-reflection areas during ToMM tasks
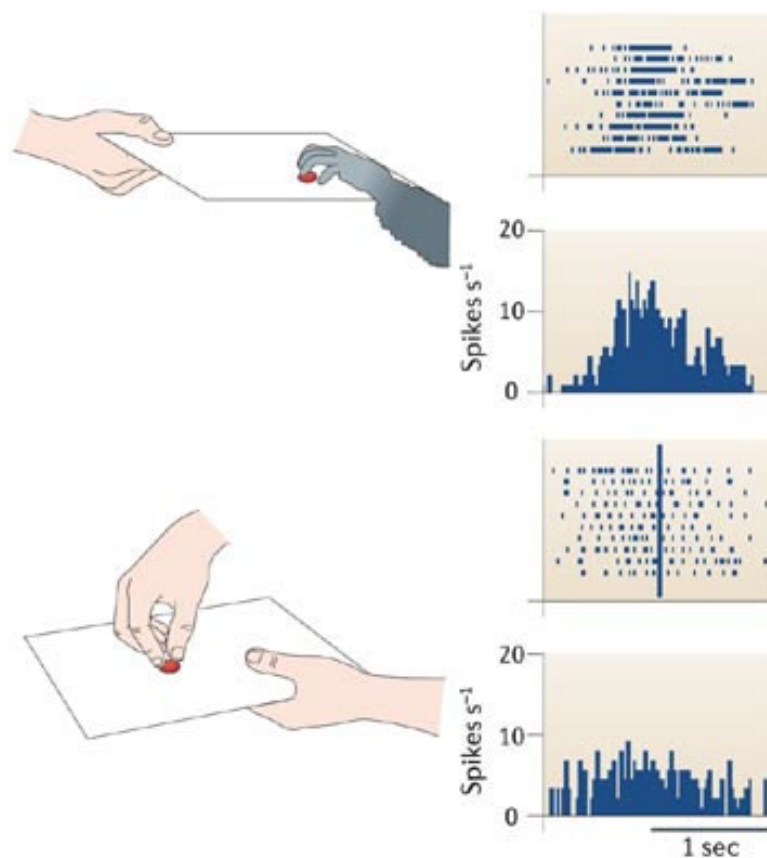
Paired deficits

Primarily relevant to <u>low-level mindreading</u>
(e.g. Baron-Cohen's emotion detector)

- SM (amygdala damage) - no experience of fear and severely impaired on recognizing facial expressions of fear

- Similar effects on disgust following damage to insula (patient NK)

- Anger – lowering dopamine levels with sulpiride can affect both levels of aggression and abilities to recognize anger from facial expression
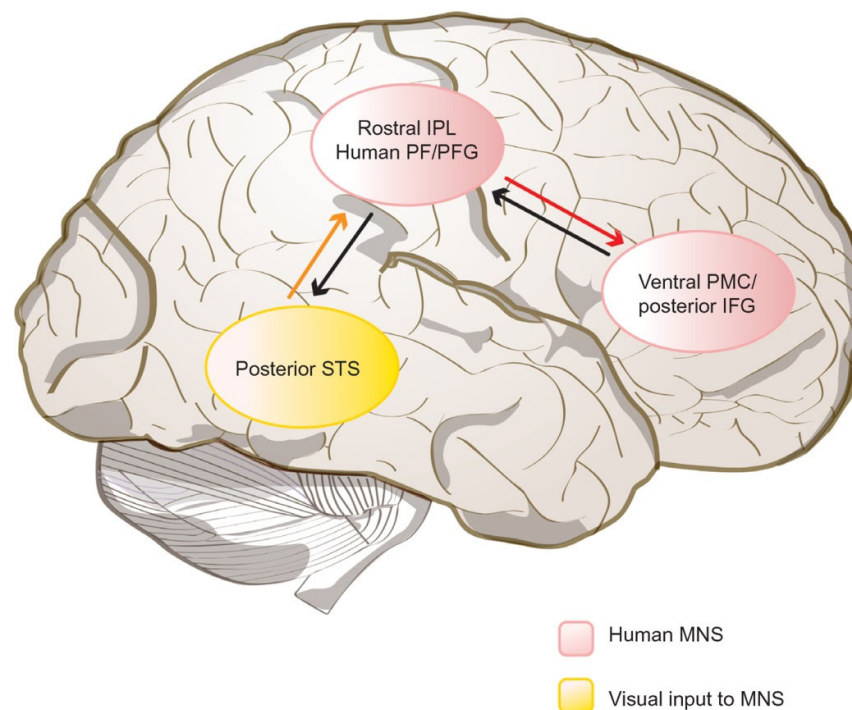
Problems

- Messy data – The consequences of amygdala damage are not as wide-ranging as ST require

    - SM's deficit in recognizing facial expressions can be removed by asking her to focus on the eye-region

    - Patients with amygdala damage are able to recognize fear from body posture

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Mirror neurons

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No evidence for mirror neurons in human brain - but some evidence for mirroring areas

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Assessing mirror neurons

- In monkey cortex the evidence primarily shows that neurons are responsive to goal-directed movements

  - But does this involve any form of mindreading?
  - Umiltá, Kohler et al. 2001

- Simulation requires more than "resonating"

Self-reflection and mindreading

Mitchell, Bannerjee and Macrae 2005

- Subjects scanned while answering questions about photographs of other people (some involving mindreading: others not)

- Subsequently asked how similar the person was to themselves

Principal results

- Activation in MPFC higher in mindreading versions of task

- Direct correlation between this activation and the subjects' similarity judgments

Saxe's objection

- The most the study can show is that there is a common neural basis for
  - Attributing character traits to others
  - Attributing character traits to oneself (assuming that this is where the similarity judgments come from)

- This is not a co-opted mechanism

- BUT: these experiments might still provide evidence of analogical reasoning, not of co-opted mechanism
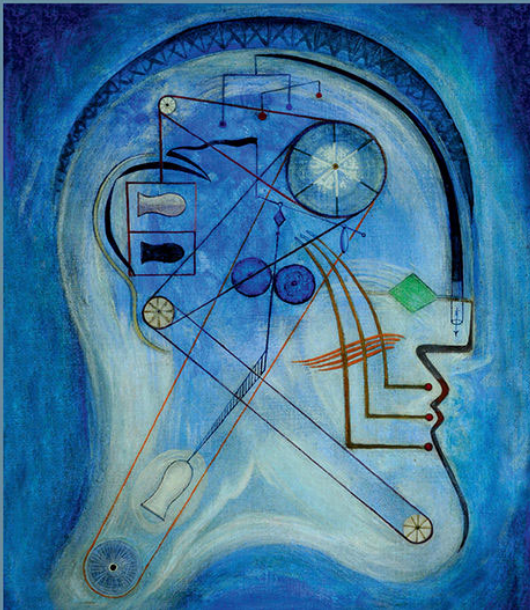
منبع اصلی

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3rd ed., Cambridge University Press, 2020.
Chapter 14 (Section 14.3)

José Luis Bermúdez

Cognitive Science

An Introduction to the Science of the Mind

Third Edition

CHAPTER FOURTEEN

Mindreading: Advanced Topics

Overview

Mindreading is the ability to understand other people's mental states. It is key to human social interaction. Chapter 13 introduced some prominent themes in the cognitive science of mindreading. We looked at Alan Leslie's influential idea that the roots of mindreading in early childhood lie in pretend play and other activities that involve *metarepresentation* (the ability to think about thinking, as opposed to just being able to think about objects in the world). We saw how this way of thinking about mindreading is supported by the best-known test of mindreading abilities – the *false belief task*, which tests for understanding of the basic fact that people can have mistaken beliefs about the world. And then we looked at Simon Baron-Cohen's longitudinal model of mindreading, which traces how understanding of belief and other complex psychological states emerges from such more primitive abilities, such as eye gaze tracking and emotion detection.

In this chapter we continue investigating mindreading. We will tackle some more advanced topics, starting in Section 14.1 with a problem that we encountered in the last chapter. Why does it take so long for children to pass the false belief task, if (as Leslie and other believe) they are

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