Brass Article Summation:

Week 4 article:

By Team Awesome

Main Arguments:

- Predicting and interpreting other agents' actions is an important component in both the Adaptive and Action Understanding models of Cognition

- The main debate is over the functional *mechanisms* and neural *circuits* involved in action understanding

Unique focus/finding of this study

Focus: Context and novelty

- Participants were to view unusual actions in implausible versus plausible contexts

Main Finding:

- Action understanding in novel situations is primarily mediated by an inferential interpretive system rather than the mirror system

Experiment

Previous studies:

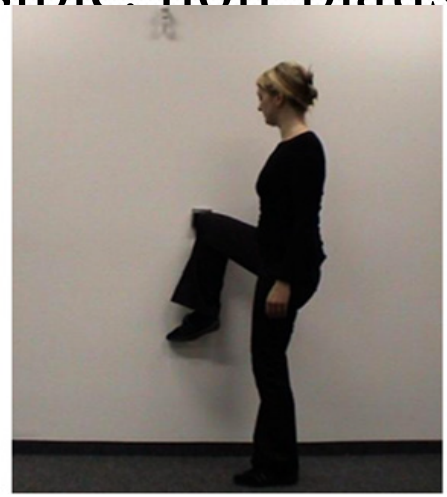
- Contextual effects on inferential processes involved in action understanding have been successfully demonstrated in preverbal infants.

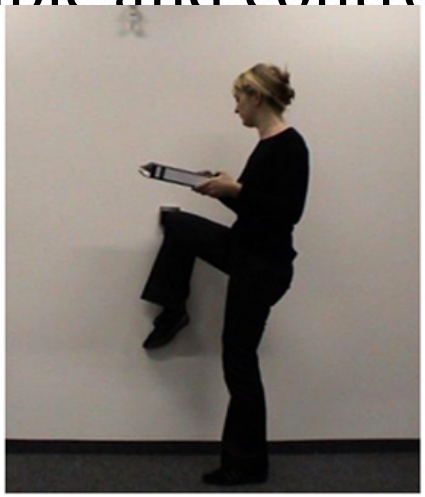
Here:

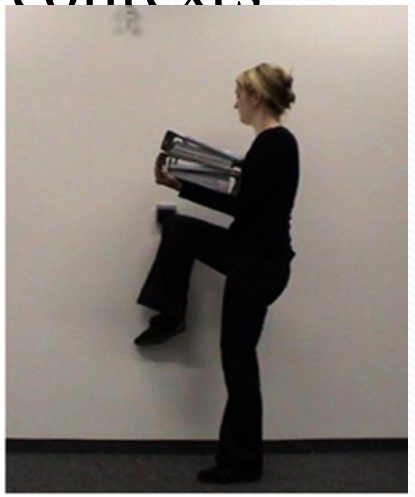
- They tested adults to see if mirroring or inferential reasoning was needed in novel constraints (plausible, non-plausible and no restraint conditions)

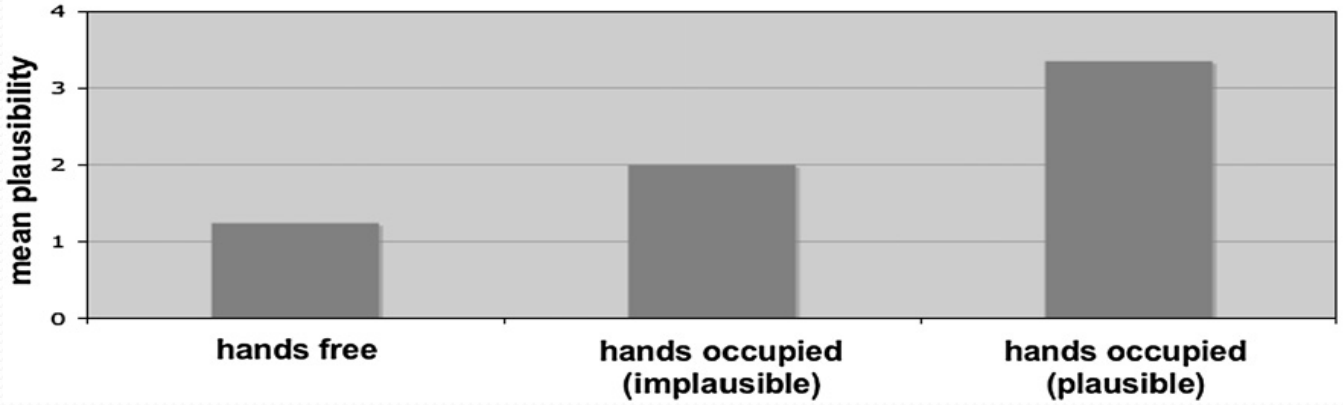
Within the experiment

Plausible, non-plausible and control contexts









Experiment Continued:

Overview:

- In order to demonstrate that the inferential network is more strongly involved in action understanding than the mirror system, region by condition interactions were carried out
- Regions: STS, pSTS, or aFMC
- Condition: hands free, hands partially occupied, and hands fully occupied

Other conditions

- Opening a door
- Switching on a Light
- Operating an elevator
- Closing a drawer
- Closing a cabinet door
- Adjusting a pinboard
- Moving aside a chair
- Moving a file in a shelf
- Closing a box
- Moving aside a package

Experimental Conditions

- Sixteen Participants: 8 male & 8 female
- Participants were inside an MRI scanner
- Each clip about 7 seconds long
- Each clip was presented 4 times
- 120 experimental clips
  - (ten situations x three conditions x four repetitions)

Results:

For unusual/implausible action vs plausible action:

- There were strong and reliable activations along the STS and a less reliable activation in the aFMC
- A significant interaction was found when comparing the STS with the IFG (reference point)
- However, no differential activation in the mirror system (inferior frontal cortex or inferior parietal cortex) was observed

Adaptive/ Motor-Simulation Model

It has been proposed:

- Premotor mirror-neuron areas are sensitive to context effects, such as situation clues/constraints, on intention recognition

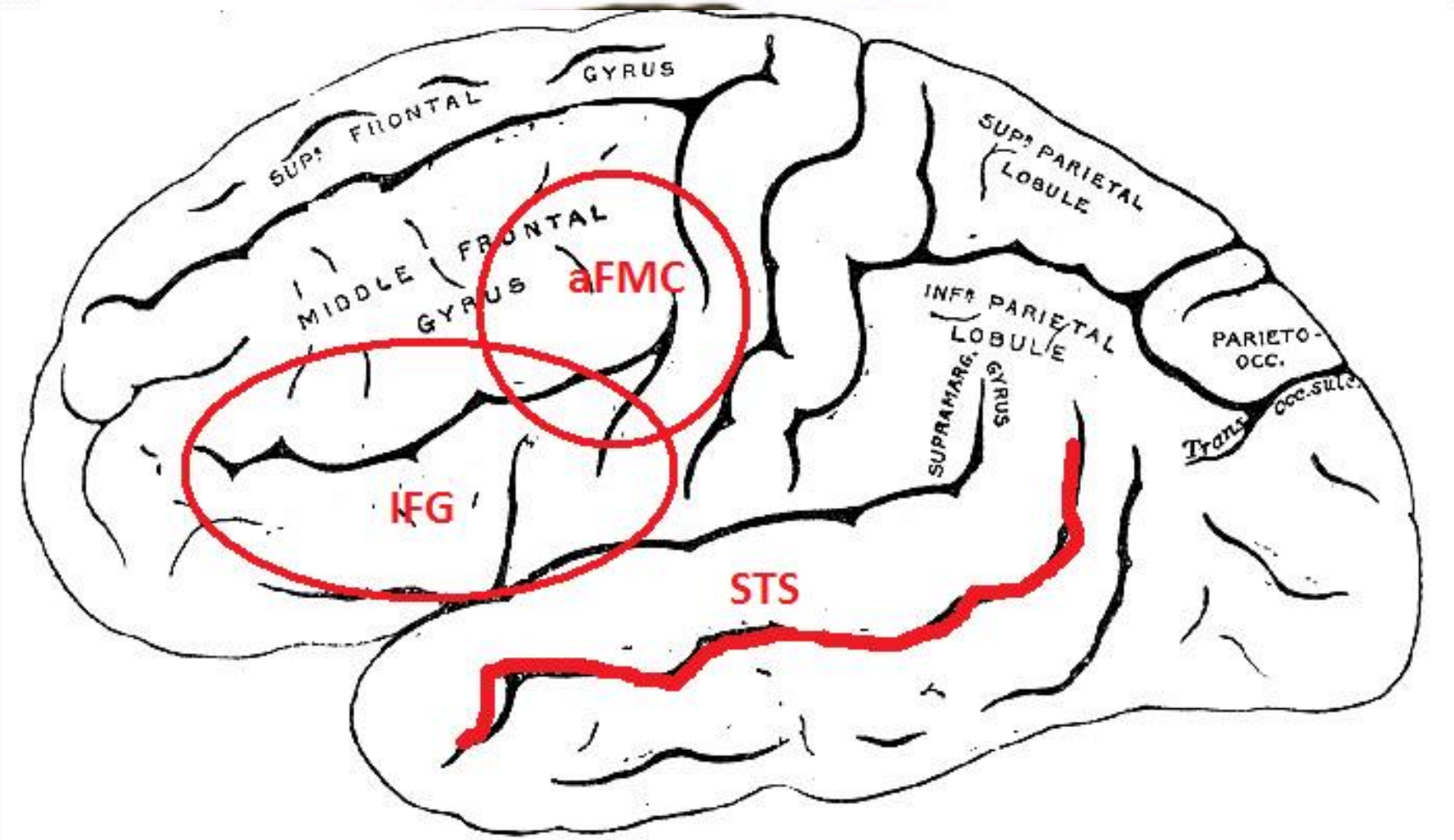
- They are also involved in understanding the 'global' intentions of others" (why the do an action)

Action Understanding Model

Context clues are important in both models, they differ however in novel contexts because:

- There are no mirror properties in the AUM
- It involves inferential processing
- It centers around efficiency of an agents action to obtain a goal

Brain Map


SUP! FRONTAL GYRUS
MIDDLE FRONTAL GYRUS
aFMC
IFG
STS
SUP! PARIETAL LOBULE
INF! PARIETAL LOBULE
SUPRAMARG. GYRUS
PARIETO-OCC.
Trans.
OCC.SULC.

Areas in Detail

- STS (superior Temporal Sulcus): is involved in the perception of where others are gazing and is thus important in determining where others' emotions are being directed.

- aFMC (anterior frontonmedian cortex) is

mainly involved in evaluative judgments, supporting its role in self-referential processes and in the self-initiation of cognitive processes.

Why these regions matter:

The article makes note:

- The posterior STS and the aFMC have been previously related to perception of social stimuli, mentalizing, and action understanding

Questions:

- Based on the given area information:
- What does a high STS and low aFMC activation indicate?
- What does this contribute to the authors argument?

Reasoning for results:

Novelty

Identifying the goal of a familiar action observed in its stereotypic context:

- can be easily and automatically achieved by mapping it onto the corresponding motor representations already present in the observer's action schemes

Novelty significance continued:

- Inferring the purpose of an unusual action and the reason why it is performed in an implausible context necessitates a great deal of active inference

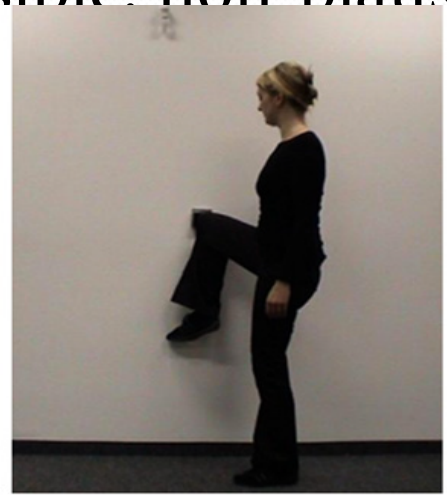
- This allows for evaluation of the efficiency of the action in relation to its situational constraints.

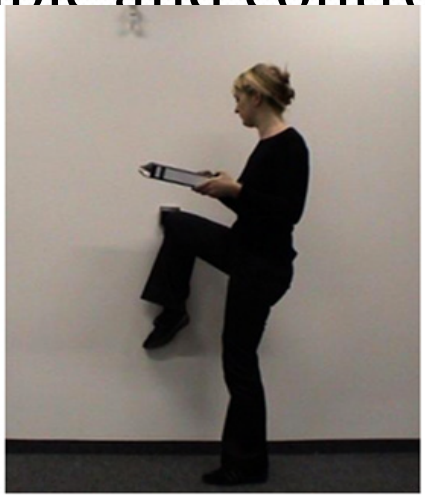
Ideas for the future…

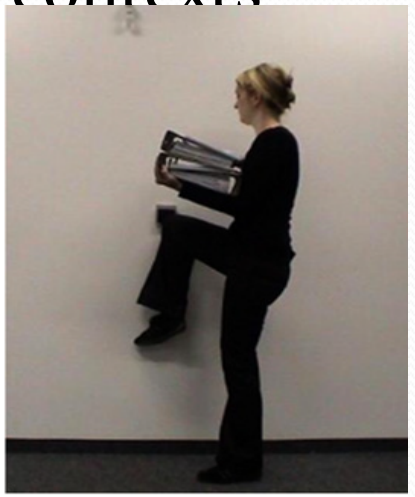
- Is the inferential process trainable?
- Do we still need to find the source of our logic?
- Where is the “logic” part of the brain?
- How do MN and the inferential circuit “know” what is novel and what is not?

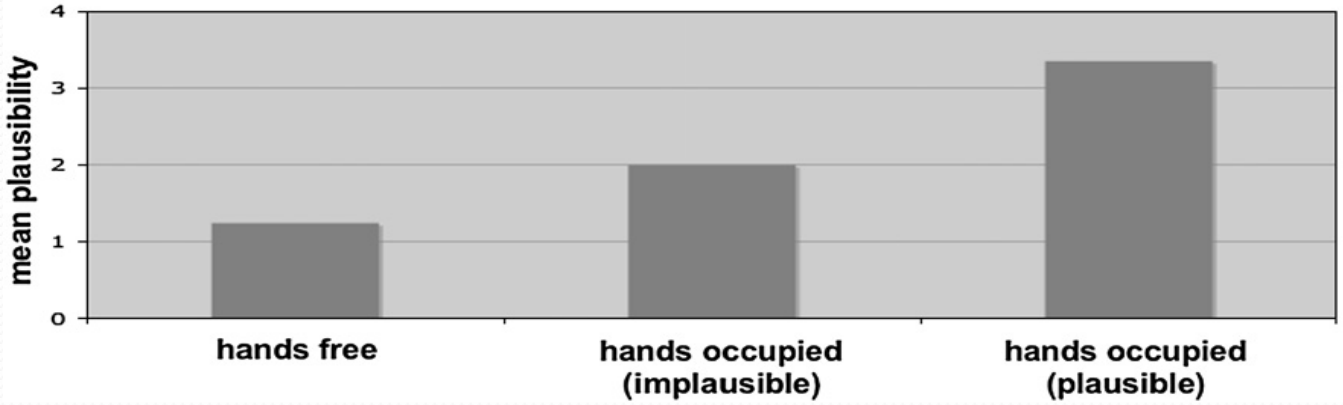
Within the experiment

Plausible, non-plausible and control contexts









Are we sure of the results?

- What role do mirror neurons actually play?
- Although mirror neurons showed no *differential* activation across experimental groups, there still was activation of mirror neurons across all three categories.
- We can indeed identify an inferential system, but can we really say there is no role played by the mirror neuron system?

- For sure mirror neurons are interesting, and an unexplored territory… but they can't do EVERYTHING we don't know in the brain!

Was it what we were looking for?

- Is inferential process and/or MN the last step of action understanding?
- They may be both involved
- There may be a higher level that coordinates both of them and makes us able to improve an observed task

What if…

- MN and inferential process are both necessary bases for understanding
- The understanding process involves a rational component analyzed by inferential process and an emotional one (empathy) operated by MN