

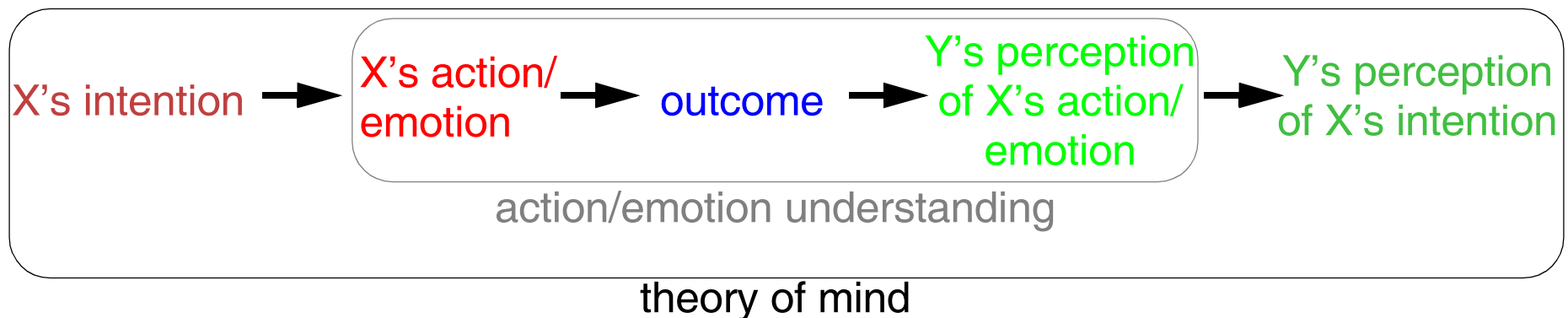
Action and Emotion Understanding

How do we grasp what other people are doing and feeling?

Why does it seem so intuitive?

Why do you have a visceral reaction when you see a wound or someone in a physically uncomfortable situation?

Understanding others' actions/emotions is crucial for social interaction.



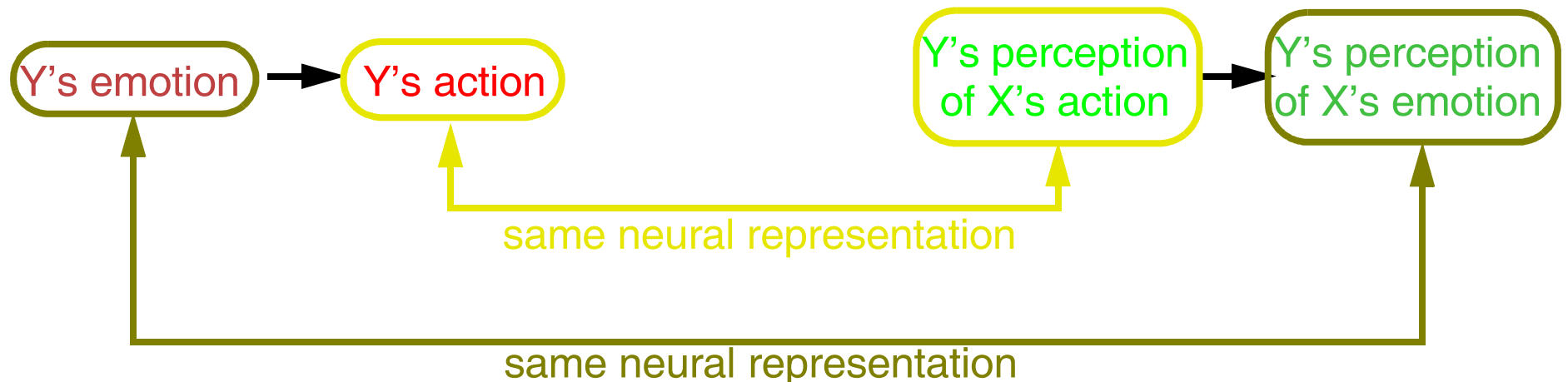
First vs. Third Person

Human actions and emotions are special: they can be experienced from first or third person.

vs., e.g., ball dropping, water flowing

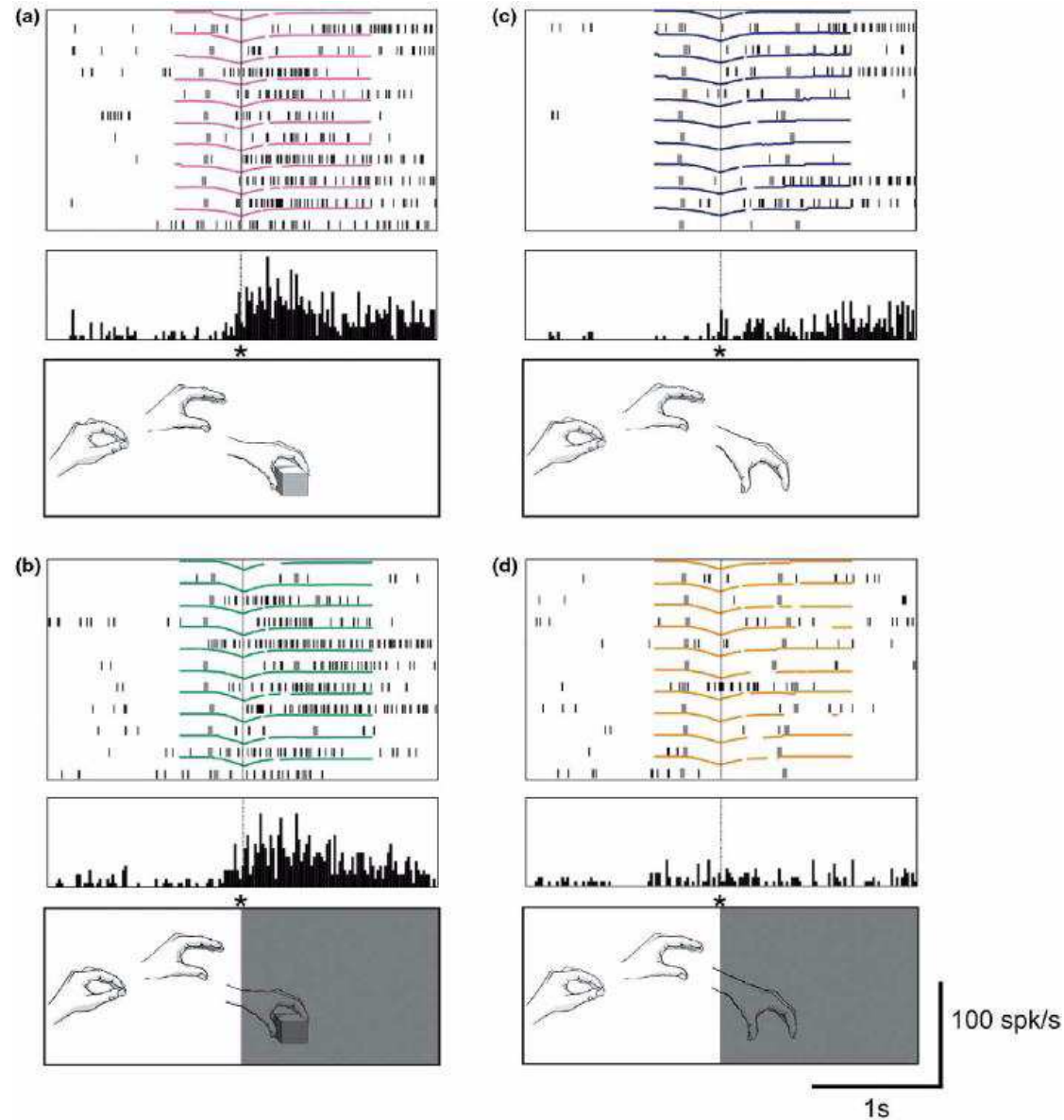
Maybe some animal actions/emotions are special in the same way to the extent that the animal is endowed with a similar brain-body system?

Mirror neurons: a direct link between the first- and third-person experiences



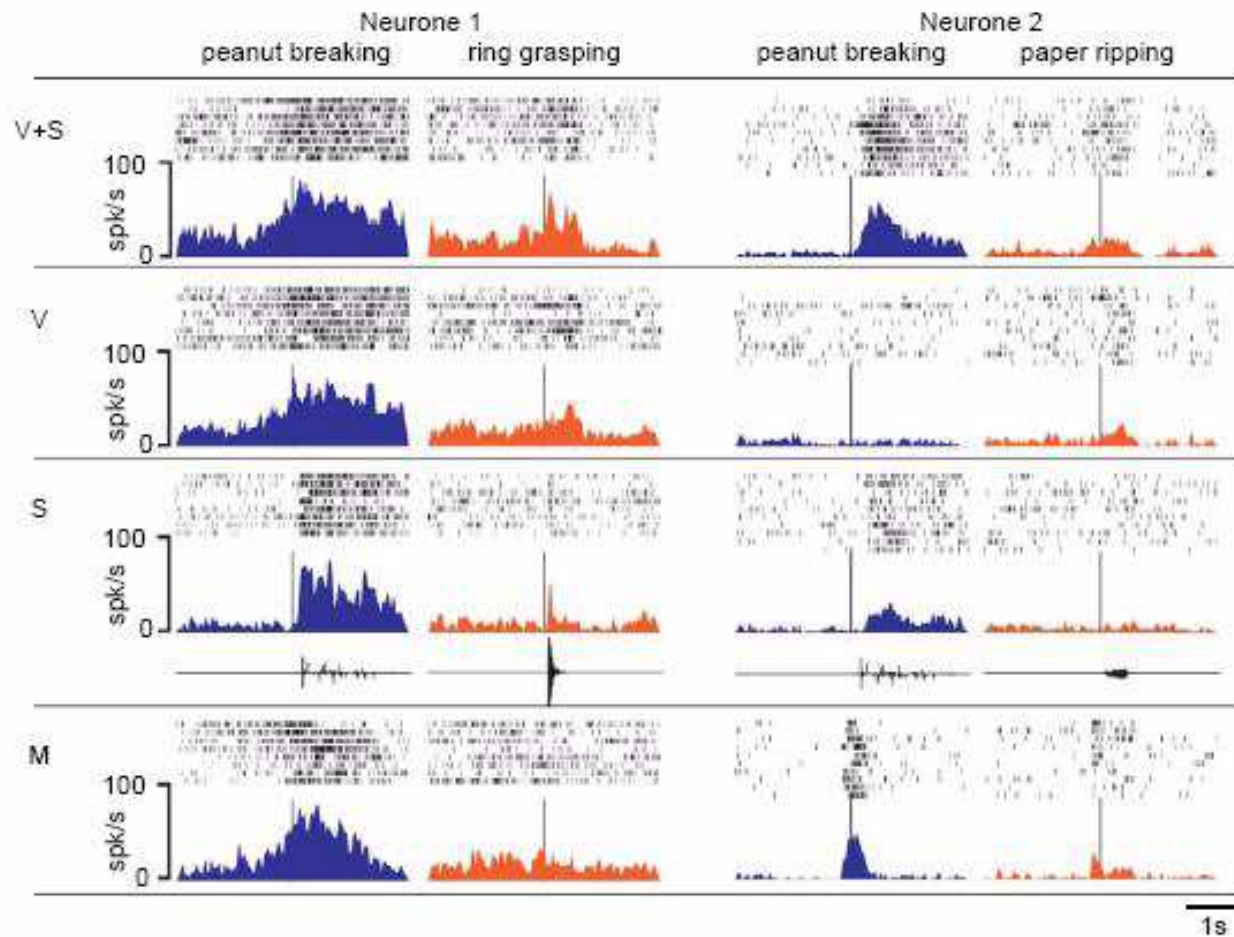
Mirror neurons integrate motor, memory, and visual representations.

>50% of neurons responses sensitive to memory.



Mirror neurons integrate motor, visual, and auditory representations.

15% of neurons responsive to vision+sound were responsive to sound alone.



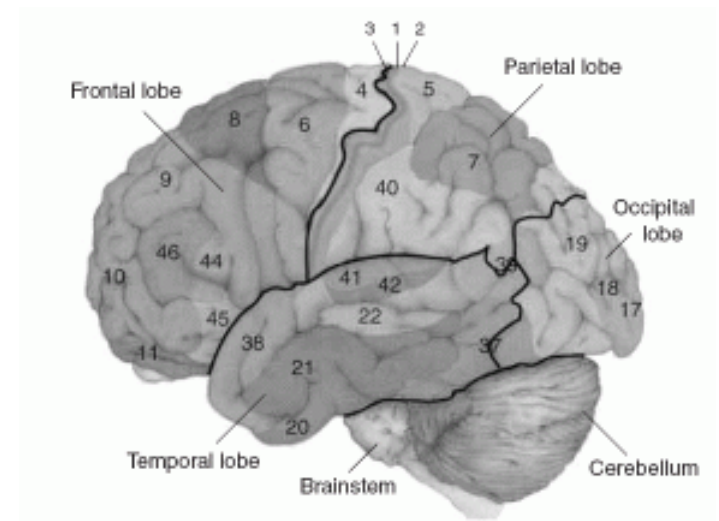
Seeing/hearing someone performing an action triggers the same motor circuits involved in performing the action.

Humans vs. Monkeys

fMRI studies reveal cortical network involved in action understanding.

anterior portion of inferior parietal lobe

posterior sector of inferior frontal gyrus and adjacent premotor cortex



Humans show activity for mimed actions (no object present).

Humans show activity for intransitive actions (e.g., waving, pointing)

What does this imply?

Perhaps human system has more abstract representations.

e.g., encoding goals not just physical actions

Emotion Understanding: Disgust

Insula

Activated by disgusting stimuli

Activated by sight of disgusted facial expressions of others

fMRI study

red: exposure to disgusting odorants

yellow: observation of facial expression of disgust

Patient NK

lesions in blue region -> selective impairment in recognizing disgust

reported reduced sensation of disgust



Emotion Understanding: Disgust

Patient B

Observed dramatic display of disgust: “...eating, and then regurgitating and spitting out food, accompanied by retching sounds and facial expressions of disgust...”

B reported that food was ‘delicious’

B ingests food indiscriminately, including inedible items and fails to experience disgust when presented with worms, etc.

B may know intellectually that you shouldn't eat worms.

Representation of disgust in insula is separate.

Seems that ability to act on knowledge depends on this representation.

Necessity of qualia?

Emotion Understanding: Empathy for Pain (Singer et al., 2004)

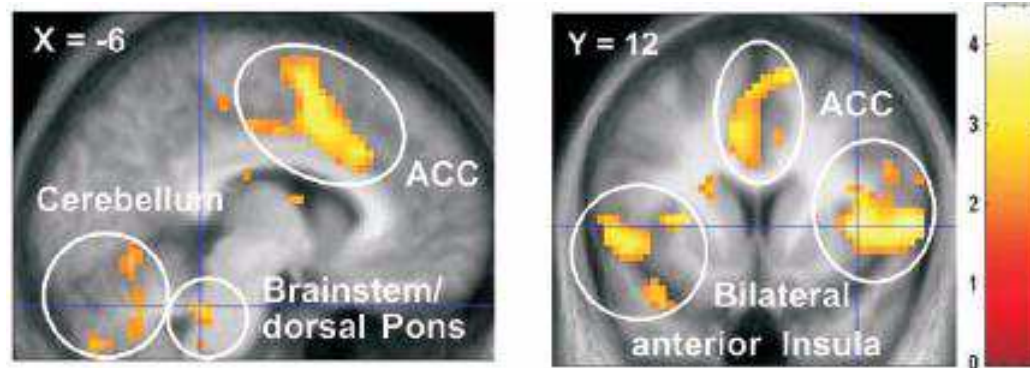
fMRI study

Participant in MRI machine.

Could view spouse's hand in mirror.

Participant would receive a signal indicating that either they or partner would receive a low (no pain) or high (pain) stimulation.

Anterior insula (AI) and anterior cingulate (ACC) activity obtained for both perception and observation.

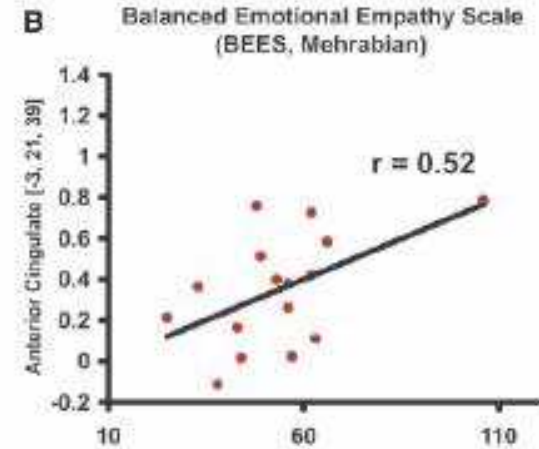
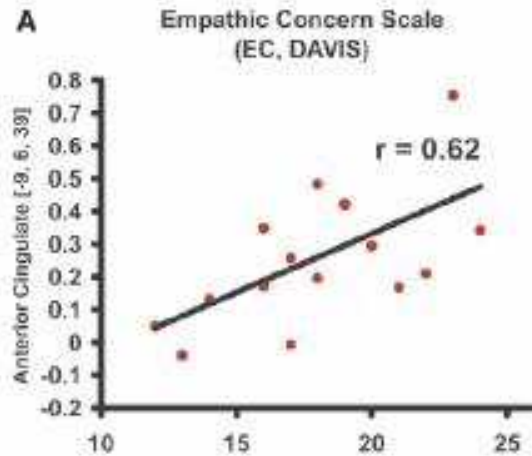


Empathy related activity (pain – no pain in spouse) correlates with behavioral measures of empathy.

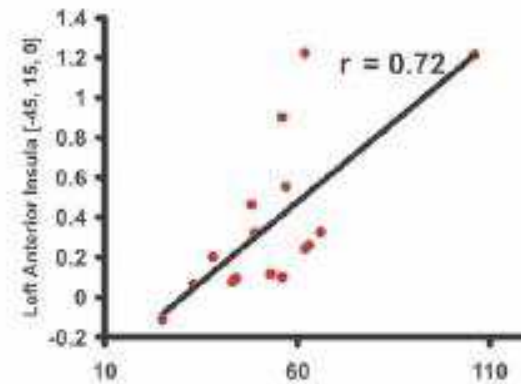
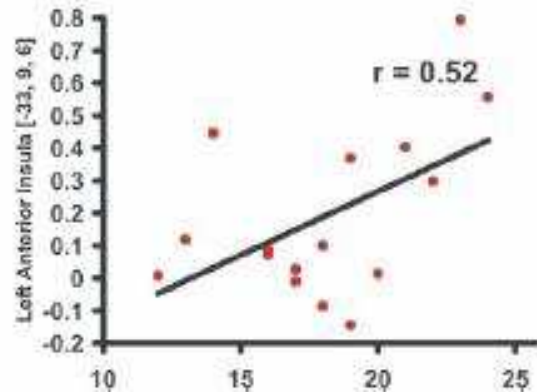
scale 1

scale 2

ACC



AI



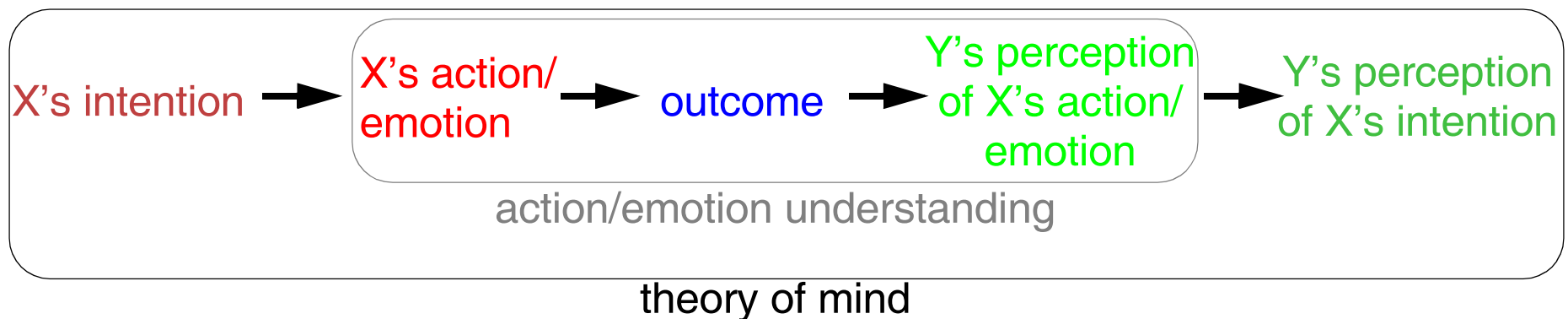
Is this where sociopaths come from?

Theory of Mind

Action understanding is about physical states.

Emotion understanding is a tiny step removed from physical states to mental states.

Theory of mind is about understanding others' mental states.



Metaconsciousness?

Theory of Mind

Ability to attribute mental states to self and others

Ability to reason and predict behavior according to the attributed states

E.g., Why is John carrying umbrella?



E.g., Why is Kate carrying an umbrella?



Role of Theory of Mind

Necessary for ordinary social interaction

E.g., cooperation, lying, keeping secrets

Therefore important for communication and possibly the development of language skills

Key to introspective awareness?

Key to socially extended cognition?

Testing Theory of Mind

Tests that require ability to predict and explain actions based not one's own convictions and beliefs.

False belief tasks, i.e., understanding that another person may have a belief that is different from reality

Requires language skill; can't test before ~ age 3

Sally-Anne task

Sally has a box, Anne has a basket.

Sally puts marbles in her box, and then goes for a walk.

While she is out, naughty Anne moves the marbles from box to basket.

Sally comes back and wants to play with marble.

Where will she look for marble?

Smarties task

Tube candy shown to children.

What's in here? Smarties

Tube opened to reveal pencil.

“Your friend John is going to come in, and I'll show him the tube, and ask, ‘What's in here?’ What will John say?”

Three year olds have difficulty with these tasks.

Four year olds pass with no difficulty.

Theory of Others' Vs. Own Mind

Same cognitive mechanism involved in attributing mental states to others and to self?

Logical argument

Whether self or others, theory of mind involves second-order representations

First order: representations about physical states

e.g., apple is red

Second order: representations about mental states

e.g., Mary believes the apple is red

Data

“Little evidence in developmental literature to suggest that mental states are attributed to self before they are attributed to others.” (Frith & Happe, 1999)

Autism

Difficulty in conceptualizing mental states

Failure to attribute (false) beliefs to others

Failure is specific and not due a reduction in general cognitive abilities.

E.g., understanding of *deception* is impaired, but *sabotage* is not.

deception: manipulation of mental state to cause harm

sabotage: manipulation of physical state to cause harm

Autistic individuals appear to know little about their *own* minds: lack cognitive machinery to explicitly represent thoughts and feelings.

What Is It Like To Be Autistic?

First order representations

descriptions of objects and events

what it is and where it is

Not tagged for propositional attitude

whether they are a thought, ongoing experience, or memory

“People with autism can suddenly adopt another person’s suggestion that they had previously rejected, without acknowledgement of the reversal.

Unable to distinguish between their own willed and involuntary actions?

Box game

“Do you know or only guess what is in a box?”

Shown contents on some trials

No superiority in judging own knowledge vs. other’s knowledge

Target shooting

Children asked to name which of 4 targets they’d aim at

Experimenter controlled where shot landed.

After shooting, asked again which target they had meant to hit.

Autistic kids much less able to report original intention than age-matched controls.

Quotes

It confused me totally when someone said that he or she had seen something I had been doing in a different room . . . Not in my wildest fantasies could I imagine that that person had actually been there, in that room, then. It seemed as crazy as if someone had said that the same furniture was in all the rooms I was in, that the chairs and tables followed me wherever I went. (p. 64)

From Temple Grandin (1992)

As a child I was hyperactive, but I did not feel 'nervous' until I reached puberty . . . The feeling was like a constant feeling of stage fright all the time . . . I had a pounding heart, sweaty palms and restless movements. The 'nerves' were almost like hypersensitivity rather than anxiety. It was like my brain was running at 200 miles an hour, instead of 60 miles an hour . . . At a carnival I discovered that riding on the Rotor Ride provided temporary relief. Intense pressure and vestibular stimulation calmed my nerves. (p. 111)

I also had another problem . . . though it was a problem I never understood until I was an adult. I thought it was the same for everyone. I couldn't feel that I needed to go to the lavatory, so I had to think out when I needed to go. I didn't know other people had a signalling system that warned them at intervals before the need to go became urgent. I had no such system. I felt nothing, nothing, nothing . . . (p. 120)

Summary

Specific brain mechanisms have been identified that are involved in understanding observed emotions and actions.

Action/emotion understanding likely to be the basis for developing theory of mind.

Theory of self-mind goes hand in hand with theory of others' minds.

Deficits in theory of mind probably lead to a weaker form of consciousness.

Loss of metaconsciousness.

