Advanced Social Cognitive Psychology PS1064

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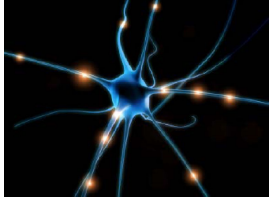

Topic 1 Readings

Step 1:

- Eysenck M., & Keane M. (2010). *Psychology: A student's handbook* (6th ed.). Hove: Psychology Press. Chpt. 2 – 4 (focus on 2 and 4; 3 dealt with separately as topic on object/face perception/recognition)
- Gilhooly, K., Lyddy, F., Pollick, F. (2014) Cognitive Psychology. Chpt. 8
- Smith E., & Kosslyn S, (2006). Cognitive Psychology: Mind and Brain. London: Pearson. Chpt. 2, 11 (esp. parts 3 and 4)

Step 2:

Baron-Cohen et al. (1985) Does the autistic child have a theory of mind? Cognition. 21: 37-46

Blake R & Shiffrar M (2007) Perception of Human Motion. *Annual Review of Psychology*

Cattaneo et al (2007) Impairment of action chains in autism and its possible role in intention understanding. PNAS 104(45): 17825-17830

Fadiga et al (1995) Motor facilitation during action observation: a magnetic stimulation study. *J Neurophysiology 73: 2608-2611*

Gillihan SJ & Martha J. Farah MJ (2005) Is Self Special? *Psychological Bulletin*, 131, 76–97. 2)

Readings

Hadjikhani et al. (2006) Anatomical differences in the mirror neuron system and social cognition network in autism. Cerebral cortex. 16(9):1276-1282

Iacoboni (2006) Failure to deactivate in autism: the co-constitution of self and other. Trends in Cognitive Sciences. 10(10): 431-433

Pulvermüller et al. (2014) Motor cognition–motor semantics: Action perception theory of cognition and communication. Neuropsychologia, 55, 71-84

Ramachandran VS & Oberman LM (2006) Broken mirrors: a theory of autism. Scientific American, November, 39-45.

Southgate V. & Hamilton A (2008) Unbroken mirrors: challenging a theory of Autism. Trends in Cog. Science (Unbroken mirrors: challenging a theory of Autism)

Uddin et al. (2007) The self and social cognition: the role of cortical midline structures and mirror neurons. Trends in Cognitive Science 11(4): 153-157

Key Concepts

https://pixabay.com/illustrations/brain-wave-awareness-compassion-4372151/

High Level Social Cognition/ Function

Theory of Mind & Intentional Stance

Gaze

Low Level Sensory and Motor Cognition/Functions

Visual Perception

Object/Face

Motor/Mental Simulation

Imitation

Biological Motion

Motor Cognition

- Motor cognition is mental processing in which the motor system draws on stored information to plan and produce our own actions, as well as to anticipate, predict and interpret the actions of others
- Distinct form of cognition
- May use mental imagery

https://pixabay.com/illustrations/machine-mechanical-eye-blue-look-1776925/

Motor Cognition

- Action is a series of goal-directed movements (voluntary displacement of body part in physical space)
- Perception-Action cycle: mental plans designed to achieve a goal through action
  - Perceptual and motor aspects

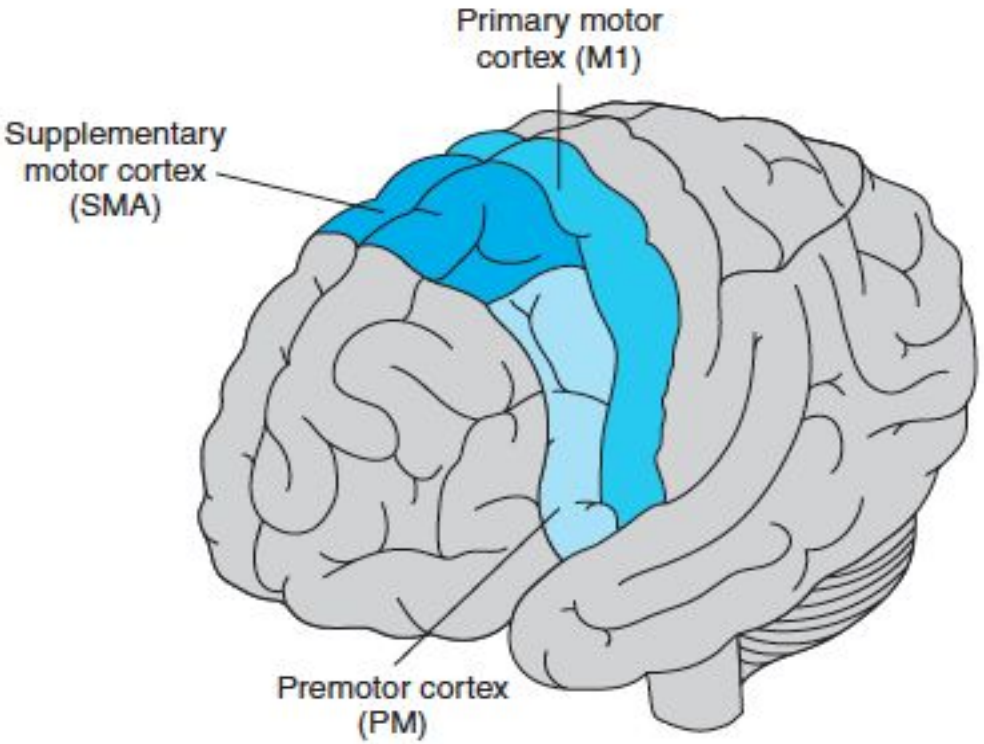

FIGURE 11–1 Key cortical motor areas

Three brain areas used in motor control and motor cognition.

(Figure based on http://www.brainconnection.com/med/medart/1/motor-cortex.jpg showing only primary motor cortex (M1), premotor cortex (PM) and supplementary motor cortex (SMA).)

Mental Imagery and Simulation

- One way we reason is to form and transform mental images of possible actions and ‘observe’ the consequence of them
- Neural mechanisms common to perception and imagery (Kosslyn et al. 2006)
- Motor imagery and performance enhancement (e.g. Feltz & Landers, 1983)

Motor Priming

- Priming – performance facilitation as a result of a previous process.
- Motor Priming: watching a movement or an action facilitates making a similar motor response oneself

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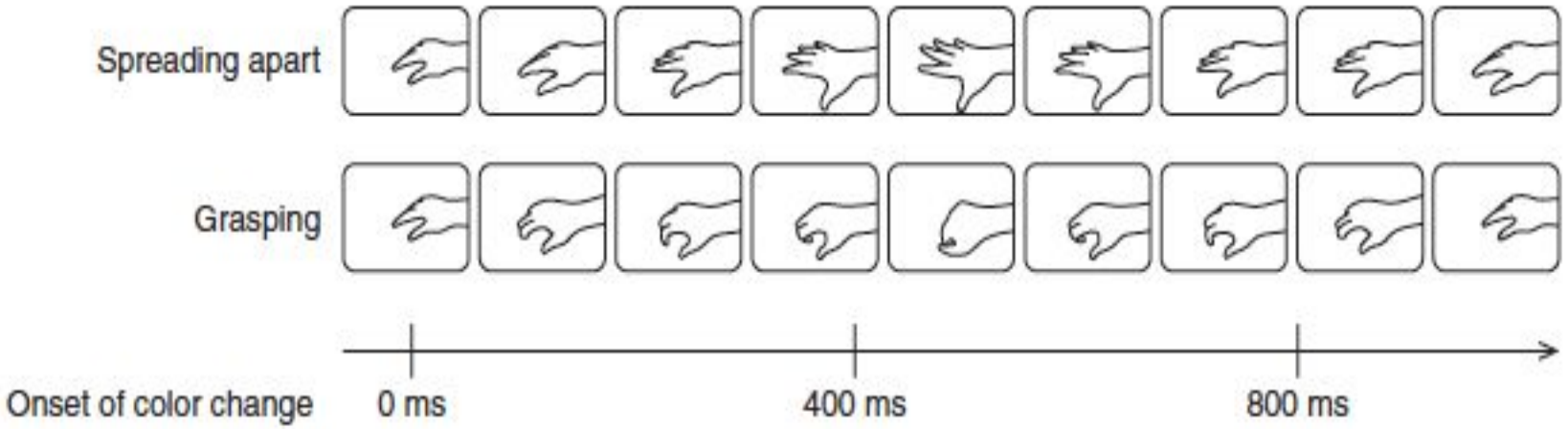


FIGURE 11–2 Hand position research

Sturmer, Aschersleben, and Prinz (2000) showed participants these hand positions. The color changed to red or blue, which cued the participants to grasp or to spread their own hand. The participants responded more quickly when the position of the stimulus hand matched the required response.

(Sturmer, B., Aschersleben, G. & Prinz, W. (2000). Correspondence effects with manual gestures and postures: A study of imitation. *Journal of Experimental Psychology: Human Perception and Performance, 26,* 1746–1759.)

Motor Programs

- Representation of a sequence of movements planned in advance of actual performance
- Motor Anticipation
  - Planning processes: used to create mental simulations
  - Response Initiation processes
  - Massive inhibition at spinal level to prevent premature triggering of action
- Readiness Potential -> SMA
- Voluntary Action -> Prefrontal/SMA/Parietal/Thalamus/Cerebellum

Imitation

FIGURE 11–5 The power of imitation

Even newborns can imitate facial expressions.

(From "Imitation of Facial and Manual Gestures by Human Neonates," by A. N. Meltzoff and M. K. Moore, 1977, *Science, 198,* pp. 75–78. Reprinted with permission.)

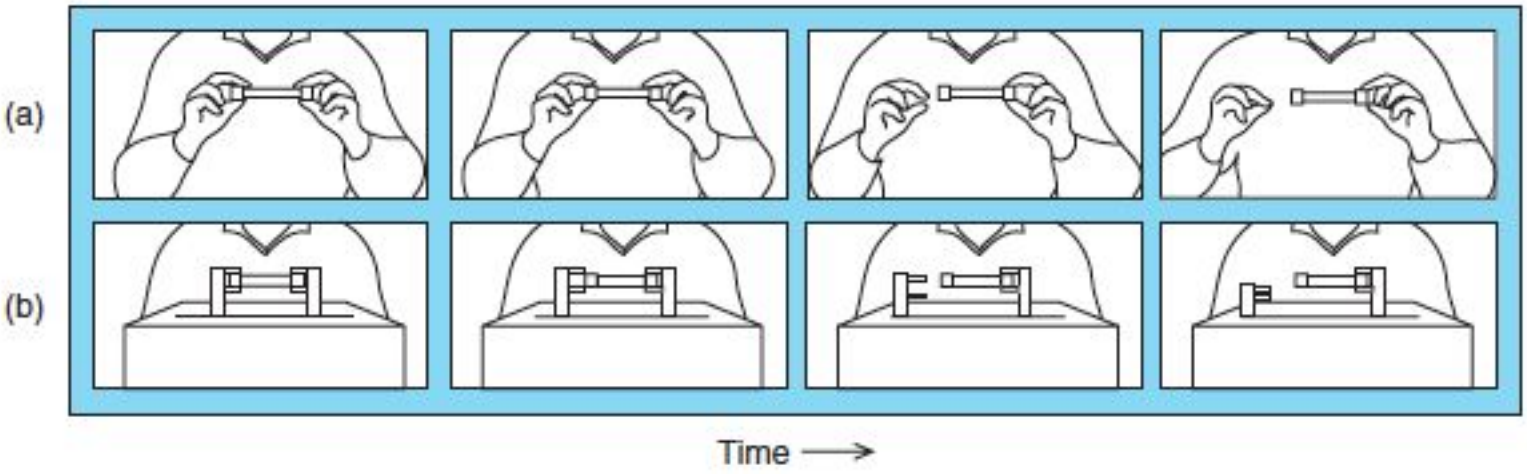


FIGURE 11–6 What—or whom—do we imitate?

Eighteen-month-old children watched either (a) a human actor or (b) a mechanical device attempting to pull apart a dumbbell. All the children watched with interest, but only the children who watched the human actor imitated the action.

(Andrew N. Meltzoff, Understanding the Intentions of Others: Re-Enactment of Intended Acts by 18-month-old children. *Developmental Psychology,* 1995, vol. 31, no. 5, fig. 2, p. 844. Copyright © 1995 American Psychological Association. Reprinted by permission.)

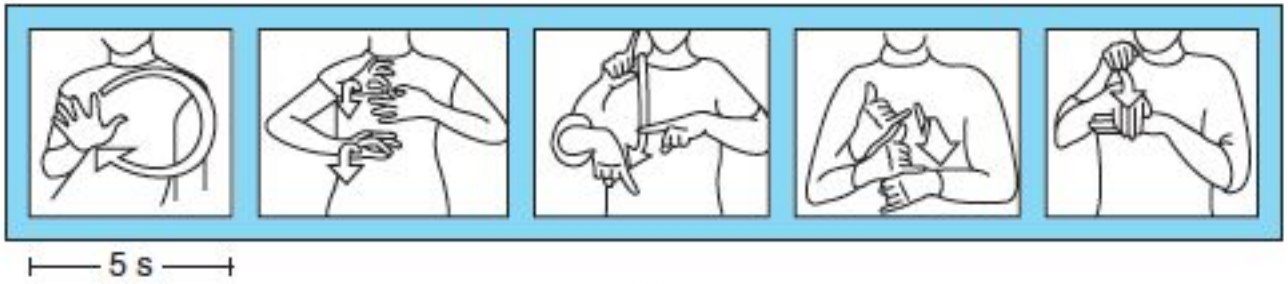


FIGURE 11–7 The power of intention

(a) Participants were shown a human model performing these actions, each for 5 seconds. (b) When they observed the actions for later imitation, as compared with passively observing the same actions, additional brain activation was detected in the supplementary motor area (SMA), the middle frontal gyrus, the premotor cortex, the anterior cingulate gyrus, and superior and inferior parietal cortices in both hemispheres. ("L" and "R" stand for left and right hemispheres.) Thus, the intention to imitate has a top-down effect on the information processing recruited when we observe actions.

(Decety, J., Grezes, J., Costes, N., Perani, D., Jeannerod, M., Procyk, E., Grassi, F. and Fazio, F. 1997. Brain activity during observation of actions. Influence of action content and subject's strategy. *Brain, 120,* 1763–1777. Reprinted with permission of Oxford University Press.)

Imitation and gestures

- Better memory for meaningful gestures (Rumiati & Tessari, 2002)

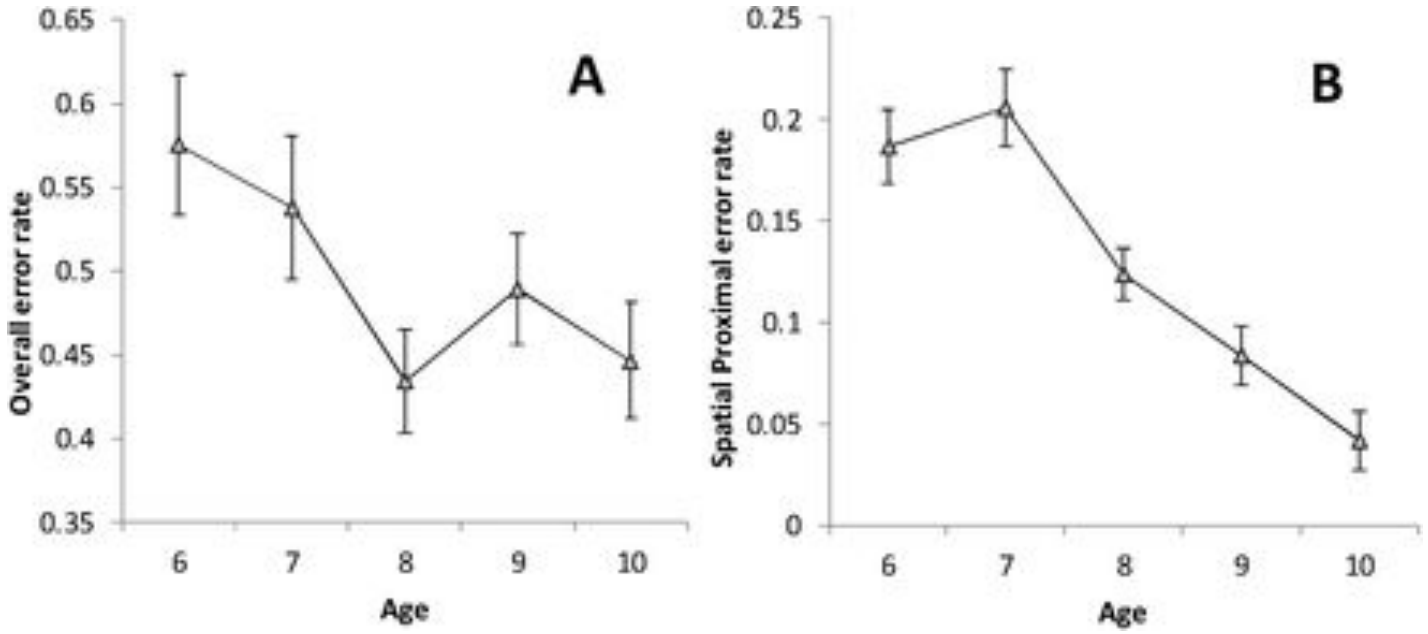
Rumiati, R., & Tessari, A. (2002). Imitation of novel and well-known actions. *Experimental Brain Research*, *142*(3), 425-433.Imitation of novel and well-known actions: the role of short-term memory

- Use Goal (end point: left premotor) and Means (how to achieve goal: medial prefrontal) – appear to be partially dissociable
- If the model had her hands occupied with the blanket, infants were able to reason that the strange head action was necessitated by her constraints and, because the infants' own hands were free, the headaction was not necessary for them; not see same for ASD

14 months old +

Imitation and gestures

Participants imitated meaningless actions as if they were in front of a mirror. Actions varied across three levels of complexity (movements of a single limb, of arm and leg of the same body side, or of arm and leg of opposite sides).
Age was important factor in predicting frequency of error categories: “side” errors (movement imitated with the left instead of the right limb or vice-versa) paradoxically increased with age (from 9 years), but their sensitivity to complexity decreased with age, enhancement of Working Memory (WM) and body knowledge with age.



Ottoboni, G., Toraldo, A., Proietti, R., Cangelosi, A., & Tessari, A. (2022). Paradoxical decrease of imitation performance with age in children. *bioRxiv.*

What is Social Cognition?

- Social cognition is about **understanding other people** (Lieberman, 2007)

- Social cognition encompasses any cognitive process that involves conspecifics, either at a group level or on a on-to-one basis (Blakemore, 2004)

What is Social Cognition?

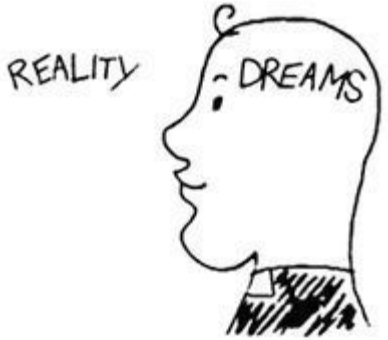
- Concept of Intentionality
  - Standard view of cognitive science is that mental states are intentional - they are about some state of affairs in the world
  - '*We found that the intentional in existence, the reference to something as an object, is a distinguishing characteristic of all mental phenomena*' (Brentano, 1874)

Theory of Mind (1)

- propositional reasoning about how minds work & about how social situations affect mental states in order to represent specific person's mental state
- 'empathy', 'taking the perspective of another'
  - children develop their everyday knowledge of the world by using the same cognitive devices that adults use in science (idea of the naive scientist)
  - children actively experiment with and explore the world, testing the predictions of the theory and gathering relevant evidence

Theory of Mind (2)

- Early in cognitive development (2-5 years) there are clear and consistent changes in the ways that children make inferences about the mental states of others (Gopnik, 1993)
  - 18 months - generate representations that are not given to them perceptually (goals and means)
  - 24 months - use language to refer to mental states
  - 36 months - distinguish between dreams & reality; distinguish own mentality from mentality of others; trouble understanding that beliefs can be false
  - 48 months - understand false beliefs & appearance reality contrasts



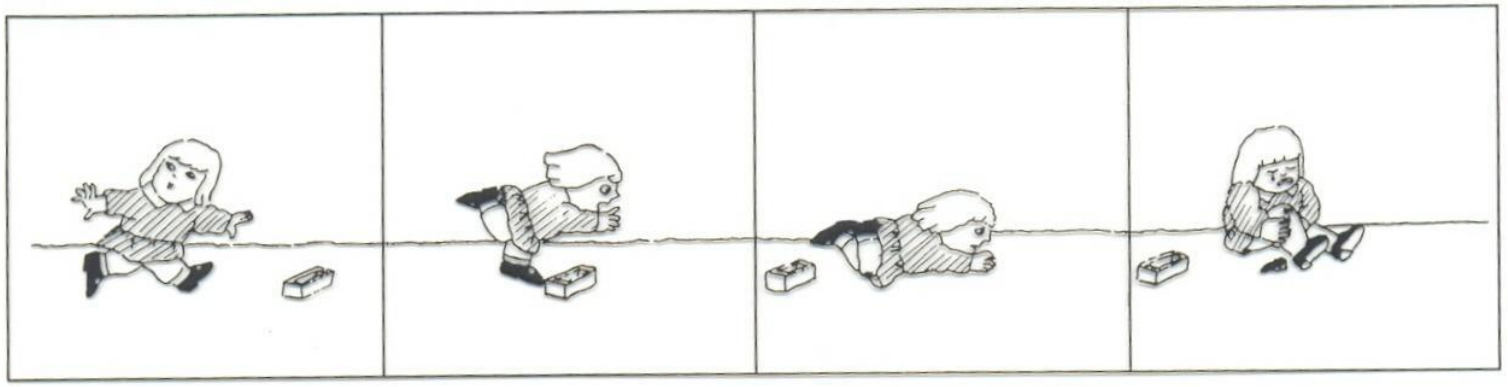
Gopnik, A. (1993). How we know our minds: The illusion of first-person knowledge of intentionality. *Behavioral and Brain sciences*, *16*(1), 1-14.

Theory of Mind - TOM (3)

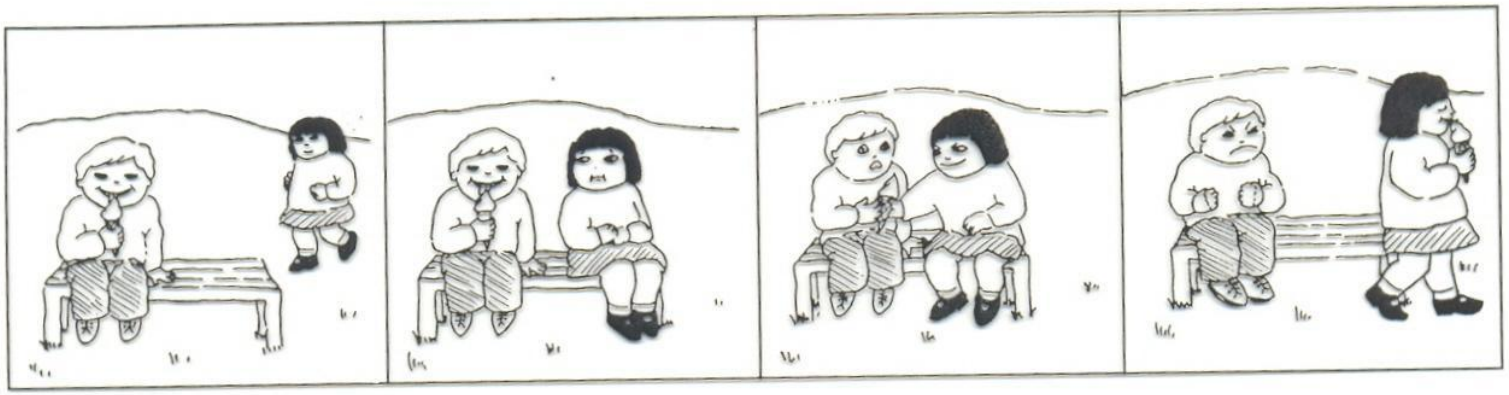
- Baron-Cohen on development of theory of mind: staged process; intentionality detector; eye direction detector; shared attention mechanism, theory of mind (4 years of age)

Development of TOM **(3)**

- Pretend play: 18-24 months
- Understand that ‘seeing leads to knowing’ 36-48 months
- Understanding that people can have both ‘true beliefs’ and ‘false beliefs’

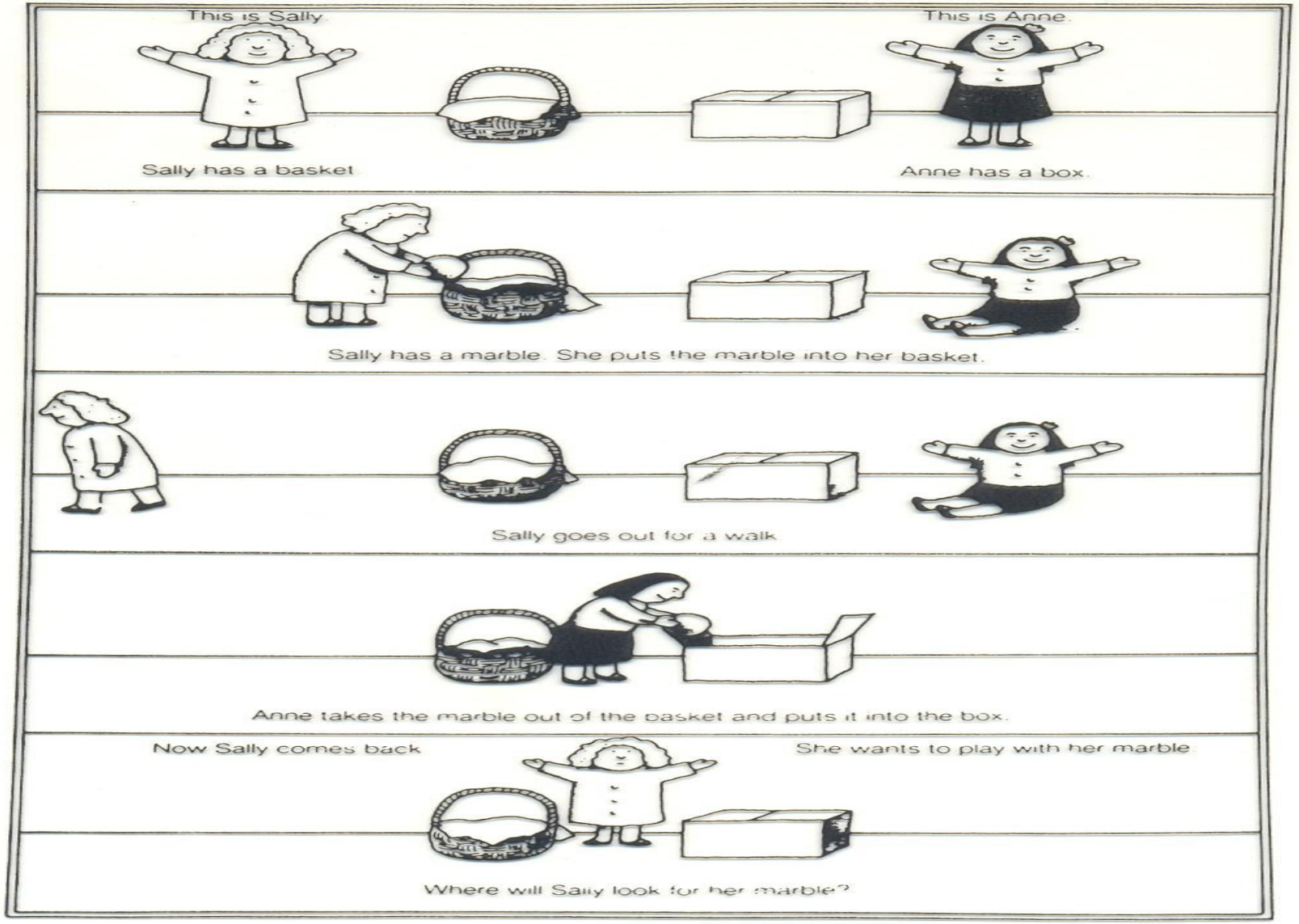


Understanding physical causes



Understanding desires and goals

False-belief task
'Sally-Anne test'



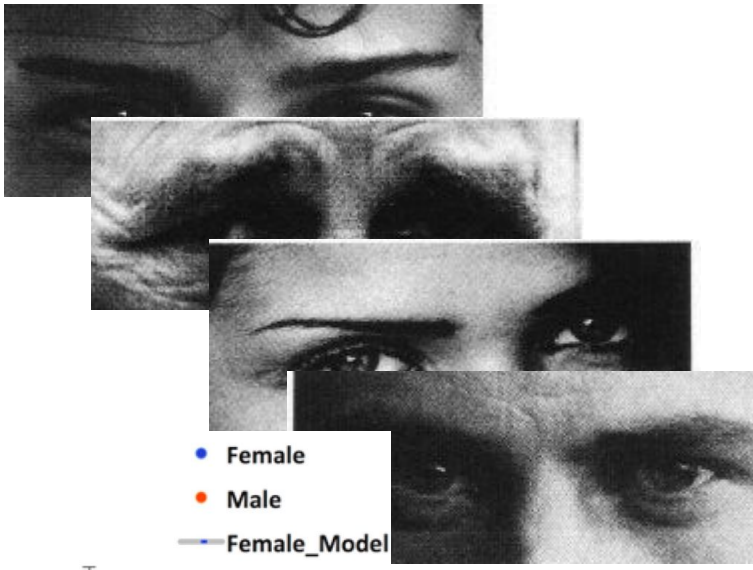
Baron-Cohen

‘Mind in Eyes’ test:

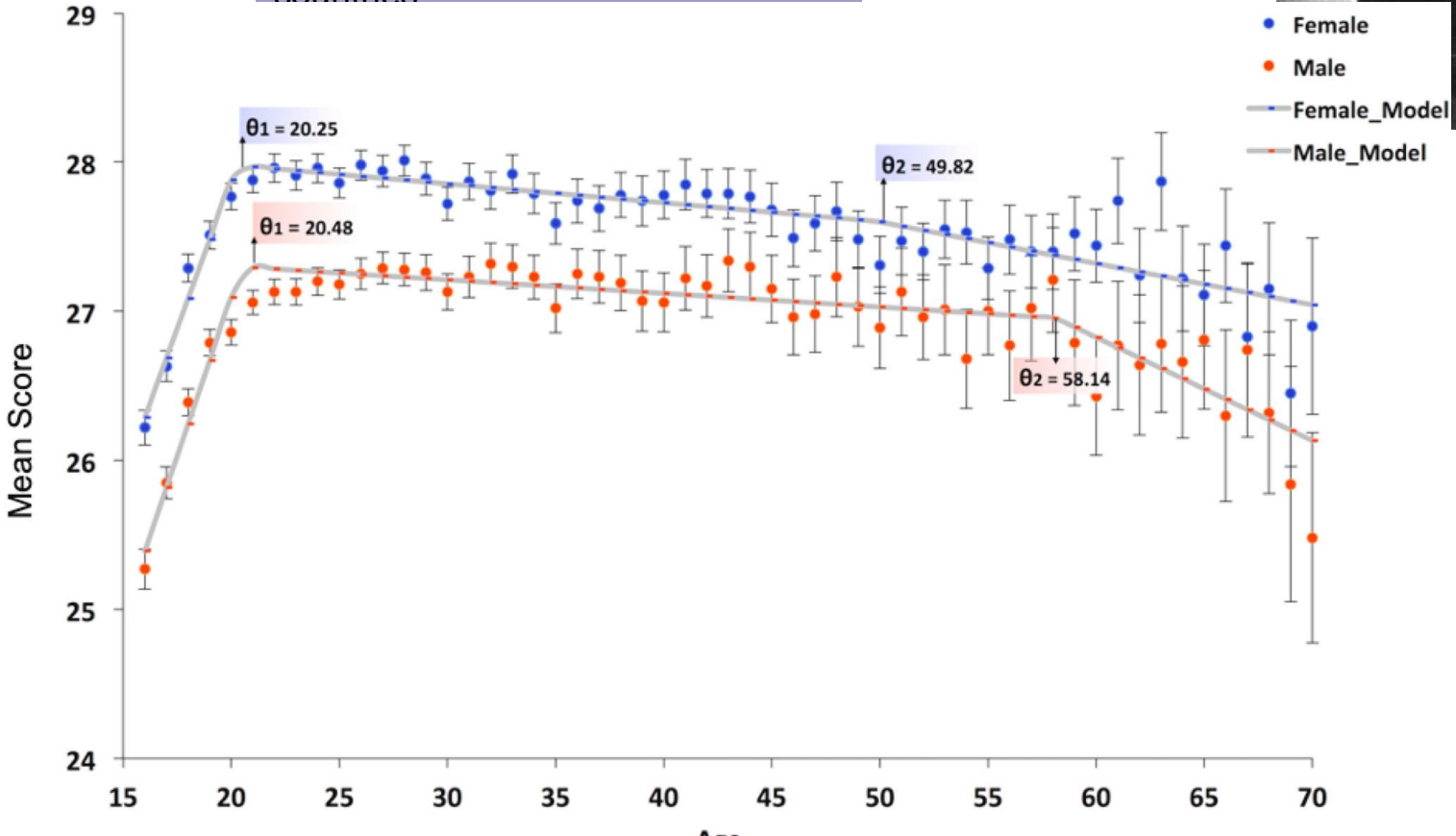
F > M > AS

practice jealous panicked arrogant hateful

Greenberg, D. M., Warrier, V., Abu-Akel, A., Allison, C., Gajos, K. Z., Reinecke, K., ... & Baron-Cohen, S. (2023). Sex and age differences in “theory of mind” across 57 countries using the English version of the “Reading the Mind in the Eyes” Test. *Proceedings of the National Academy of Sciences*, *120*(1), e2022385119.



Report female advantage across 57 countries



Mirror Neurons & Social Cognition (1)

- Fadiga et al. were studying the brain's motor cortex - area F5, associated with hand and mouth movements

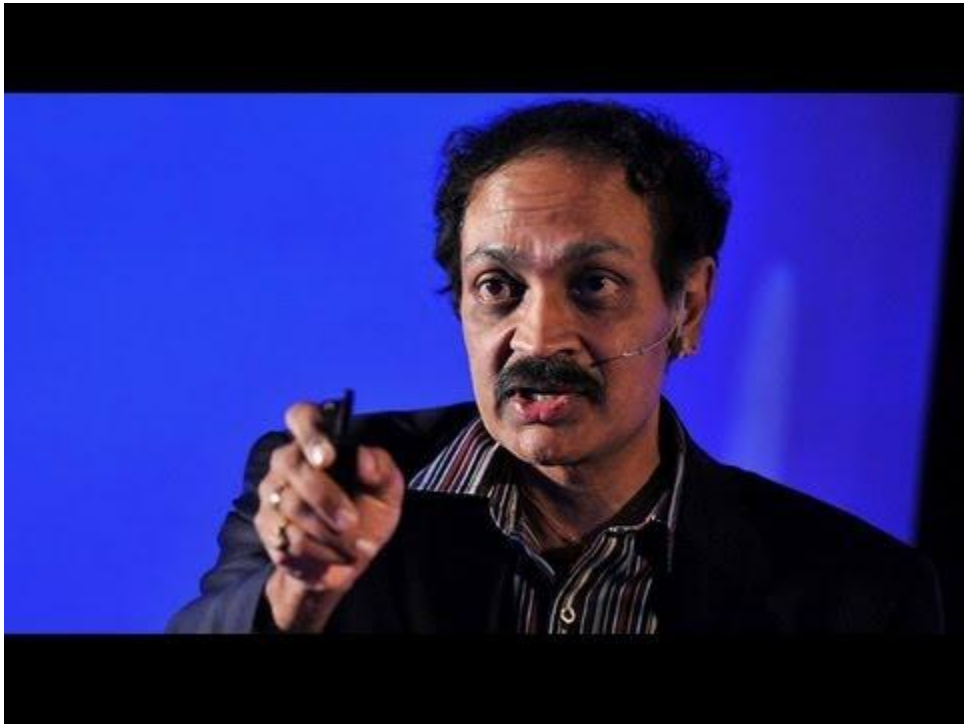
- 'then we began to notice something strange: when one of us grasped a piece of food, the monkey's neurons would fire in the same way as when the monkeys themselves grasped the food' (Rizzolatti, 2006: 56)

- these have become known as 'mirror neurons'

Mirror Neurons & Social Cognition (2)

- 'I *predict that mirror neurons will do for psychology what DNA did for biology; they will provide a unifying framework and help explain a host of mental abilities that have hitherto remained mysterious and inaccessible to experiments*'

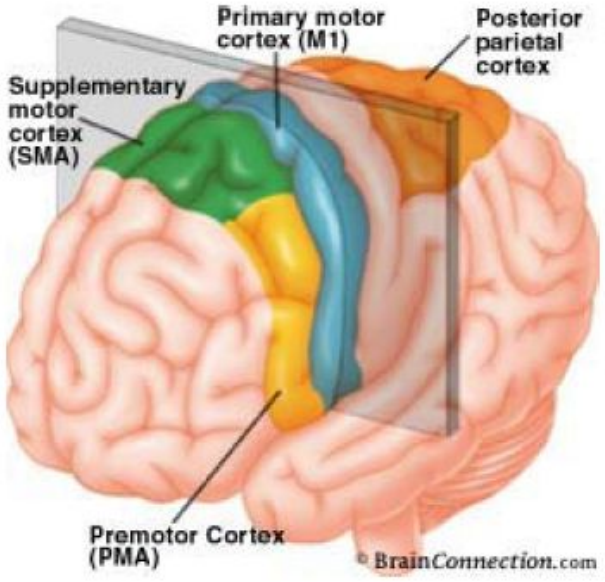
Ramachandran VS



Mirror Neurons (4)

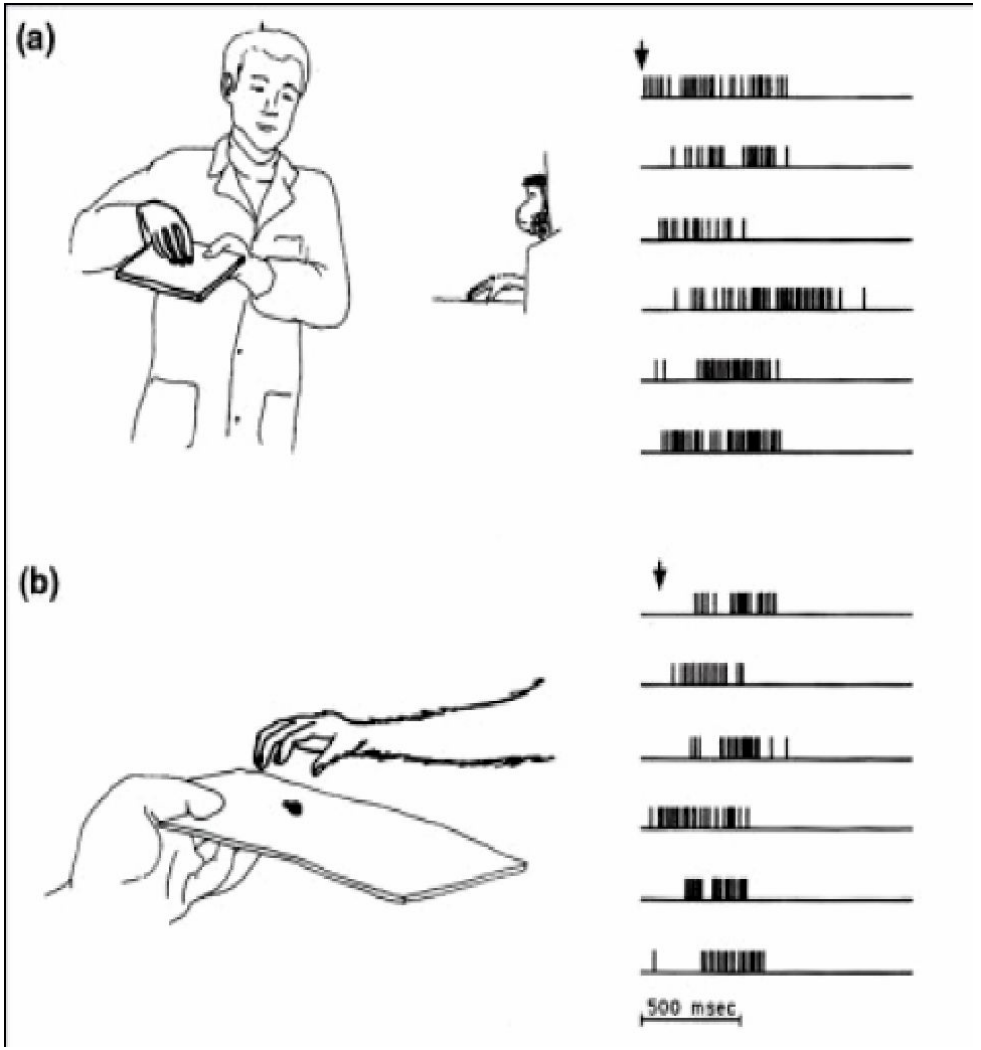
- Secondary Motor areas and posterior parietal cortex - planning of actions

- Primary Motor cortex - execution of actions



Mirror Neurons (5)

- Pre-motor and posterior parietal cortex neuron responses in the monkey
- (a) Observed action
- (b) Executed action
- Only when movement has a purpose (is an action); specific to action type (pick up or move a peanut); respond to implied actions



Relationship between ‘self’ and ‘others’ (6)

- ‘Most people are other people. Their thoughts are someone else’s, their lives a mimicry, their passions a quotation’

  - Oscar Wilde

- In cognitive neuroscience, this is referred to as ‘co-constitution of self and other’

Is Social Cognition special? (7)

- Are the general processes involved in perception, memory, attention sufficient to explain social cognition?

- Or are there separate, special processes?

- High-functioning autism, in which social processes are impaired, while other cognitive functions are intact, suggest this

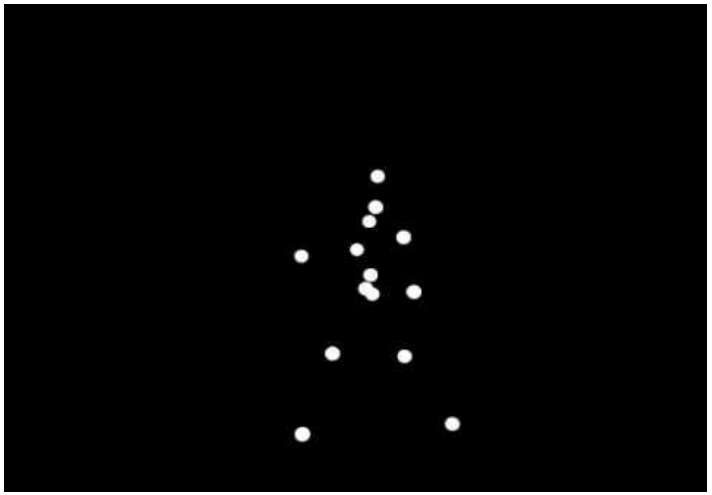
Are there special perceptual processes underlying social cognition (8)

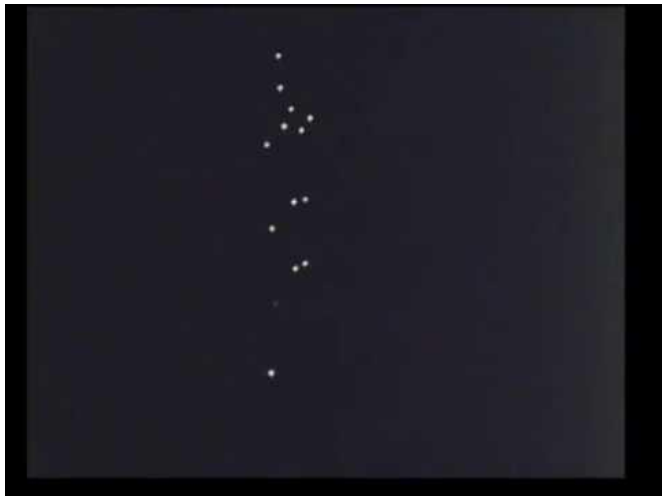
- Perception of action as a special type of perceptual processing

- Biological Motion Stimuli ('Point Light Displays') remove form and retain information about movement

Point Light Displays

- identify actions (walking, running, lifting)
- identify person (close friend, self) by gait alone
- identify properties of stimulus acted upon e.g., weight of lifted sand bags





Point Light Displays

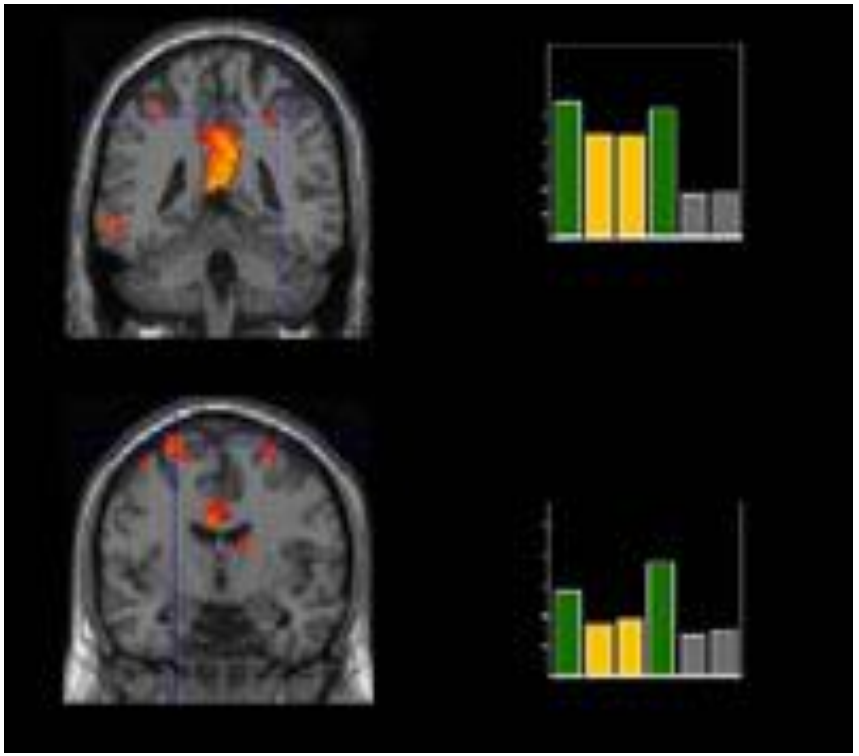
- As with faces, there is a well known 'inversion effect' in perceiving biological motion
- Dedicated region of brain (STS - 'superior temporal sulcus') for processing biological motion. Feeds into 'mirror neuron system'

Troje, N. F. and Westhoff, C. (2006) **Inversion effect in biological motion perception: Evidence for a "life detector"?** Current Biology 16:821-824.Troje, N. F.

Mirror neurons as means to direct understanding of others? (9)

- Mirror neurons are said to underlie our understanding of actions, imitative behaviour, understanding other minds

Evidence for Mirror Neurons in Humans: Glaser's dance study



[NOVA | scienceNOW | Mirror Neurons: Ballet Dancer: QuickTime | PBS]

[NOVA | scienceNOW | Mirror Neurons: Capoeira Dancer: QuickTime | PBS]

[NOVA | scienceNOW | Mirror Neurons: Audio caption to "fMRI Results" image | PBS]

Glaser's dance study: fMRI

- 1) Non-dancers showed less activity than dancers to dance moves
- 2) Trained ballet dancers showed more activity to sight of ballet than capoeira moves
- 2) Trained capoeira experts showed more activity to sight of capoeira than ballet

Deficits in Social Cognition Autism Spectrum Disorders (10)

- Autism: Atypical social development & communication, strong obsessional interests from early age (by 3yrs)
- Asperger Syndrome: Variant of autism with normal to high IQ and speech developing on time 10:1 M:F ratio

A – Impairment of Social Interaction (Triad)

- Non-verbal behaviour (gaze, eye-contact)
- Failure to develop peer relations
- Lack of social or emotional reciprocity

B - Atypical Communication

- Delayed or no development of language
- Impaired conversation
- Repetitive use of language
- Lack of make-believe play, social imitation

C – Repetitive Behaviour

- Inflexible routines or rituals
- Repetitive motor mannerisms
- Preoccupation with parts of objects

DSM V ASD

A child must have persistent deficits in each of three areas of social communication and interaction (see A.1. through A.3. below) plus at least two of four types of restricted, repetitive behaviors (see B.1. through B.4. below).

1. Persistent deficits in social communication and social interaction across multiple contexts, as manifested by the following, currently or by history (examples are illustrative, not exhaustive; see text):
    1. Deficits in social-emotional reciprocity, ranging, for example, from abnormal social approach and failure of normal back-and-forth conversation; to reduced sharing of interests, emotions, or affect; to failure to initiate or respond to social interactions.
    2. Deficits in nonverbal communicative behaviors used for social interaction, ranging, for example, from poorly integrated verbal and nonverbal communication; to abnormalities in eye contact and body language or deficits in understanding and use of gestures; to a total lack of facial expressions and nonverbal communication.
    3. Deficits in developing, maintaining, and understand relationships, ranging, for example, from difficulties adjusting behavior to suit various social contexts; to difficulties in sharing imaginative play or in making friends; to absence of interest in peers.

Mind reading

- Making sense of and predicting another's feelings, thoughts and behaviours

- Inferring mental states from behaviour by employing a 'theory of mind'

https://pixabay.com/illustrations/brain-turn-on-education-read-book-770044/

Is Social Cognition special?

- Are there there separate, special processes dedicated to social cognition?

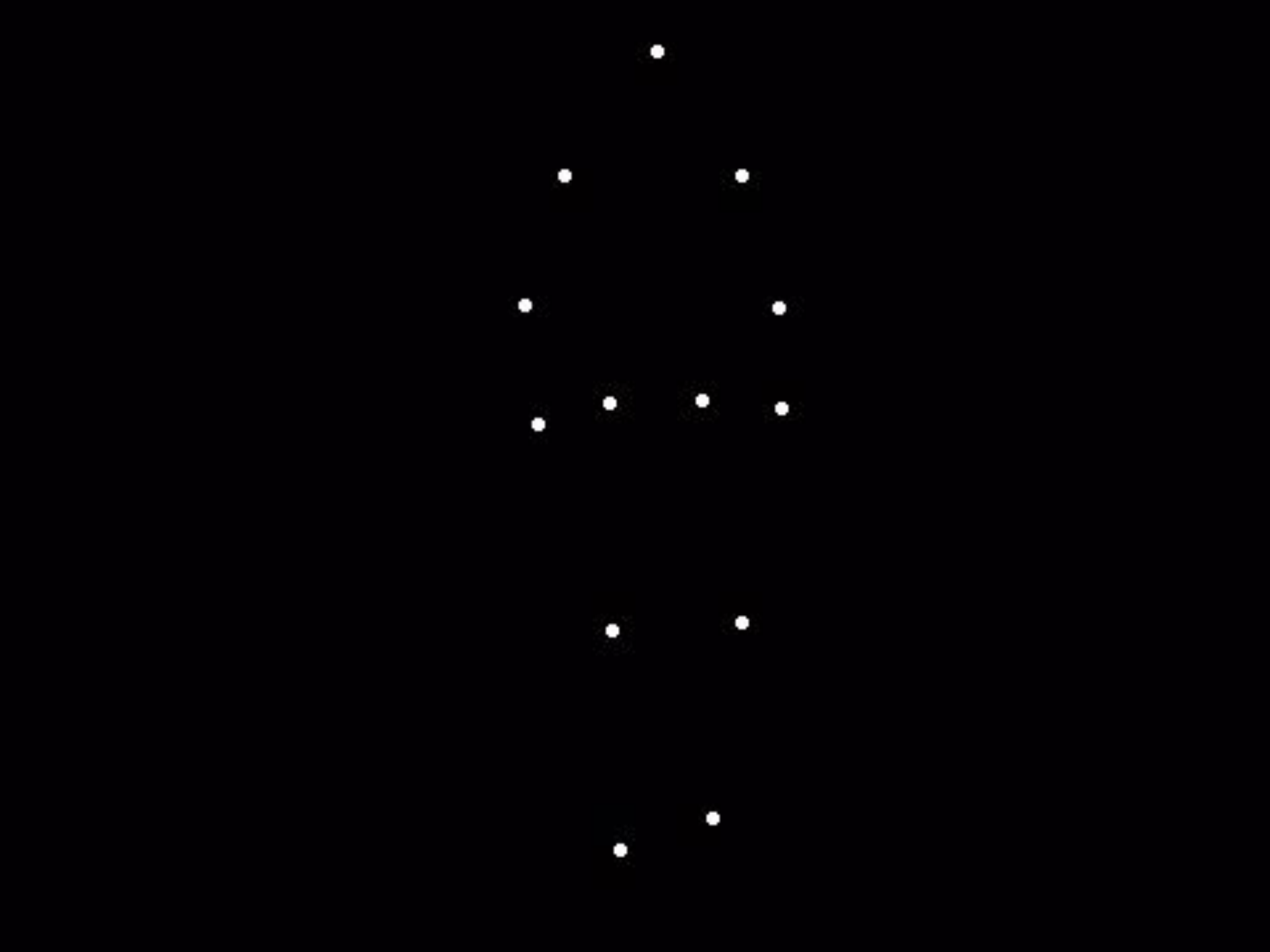
- Perception of faces, eyes, biological motion.

- Perception of action (and perhaps perception of underlying intention) as a special type of perceptual processing

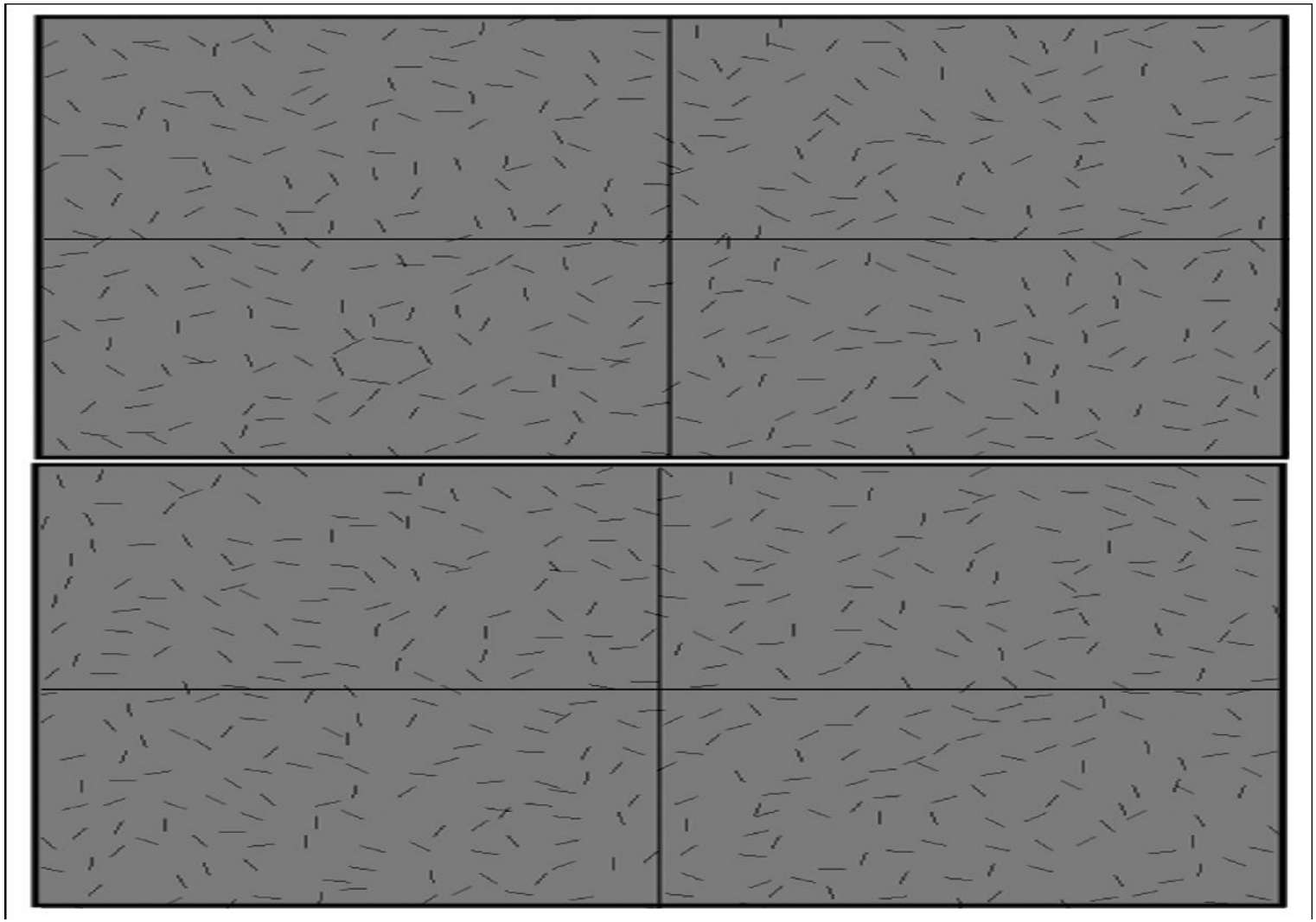
- Mirror neurons as neural substrate to understanding intentions

Blake et al (2003) Visual recognition of biological motion is impaired in children with autism

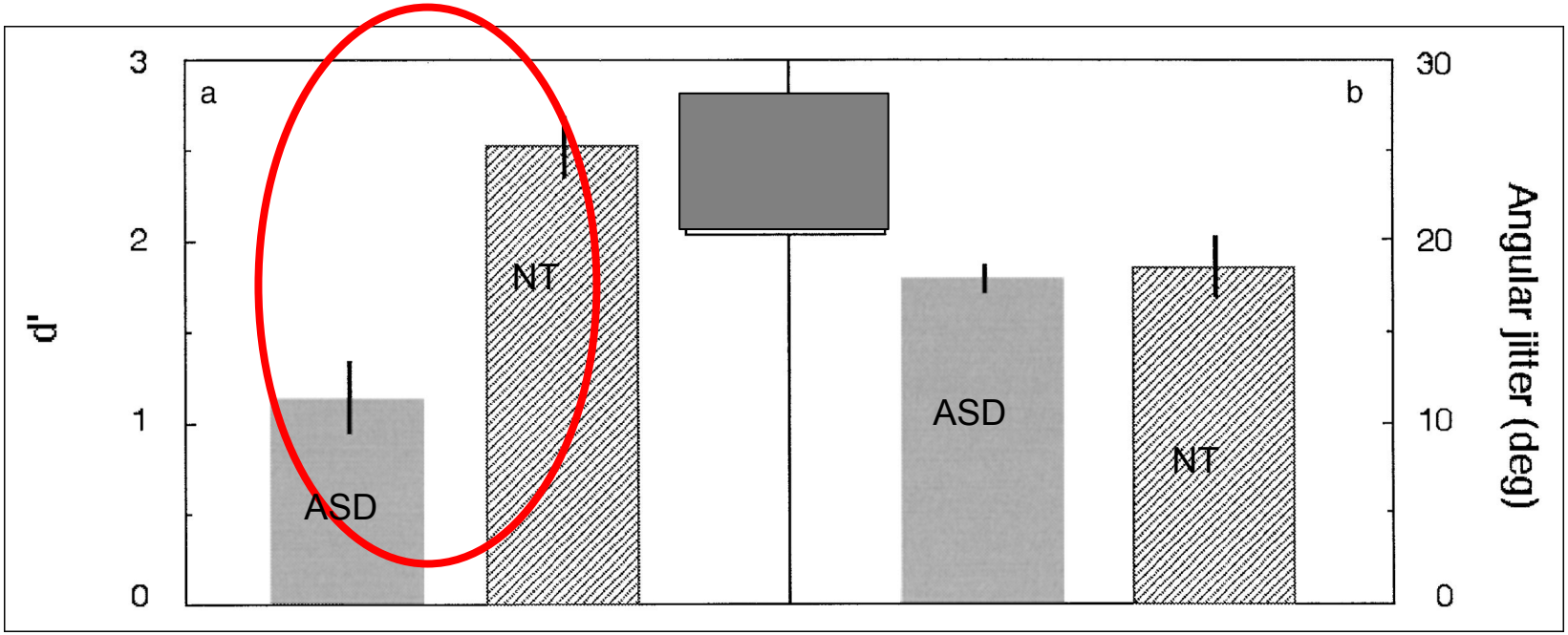
1) Biological motion task: Discriminate if point light pattern is ‘moving like person’ or not (actions: running, walking, kicking, throwing..).
2) Global-form task: Discriminate whether global form (circular contour) is present or not



Global-Form task



Blake et al (2003)



d' is measure of sensitivity

(a) Biological motion task

(b) Global for task

Blake et al (2003) Results

1) Children with ASD: 11 children (8-10yrs) differed in their ability to discriminate biological from non-biological motion from typically developing children

2) No difference on global-form task => differences are not dues to attention, motivation

1) Cells in region of superior temporal sulcus (STS) preferentially selection to biological motion

2) Cells is different regions of STS preferentially responsive to faces

3) Could ASD reflect deficits in STS?

4) Is ‘mirror neuron system’ faulty?

What are the functions of ‘mirror neurons’?

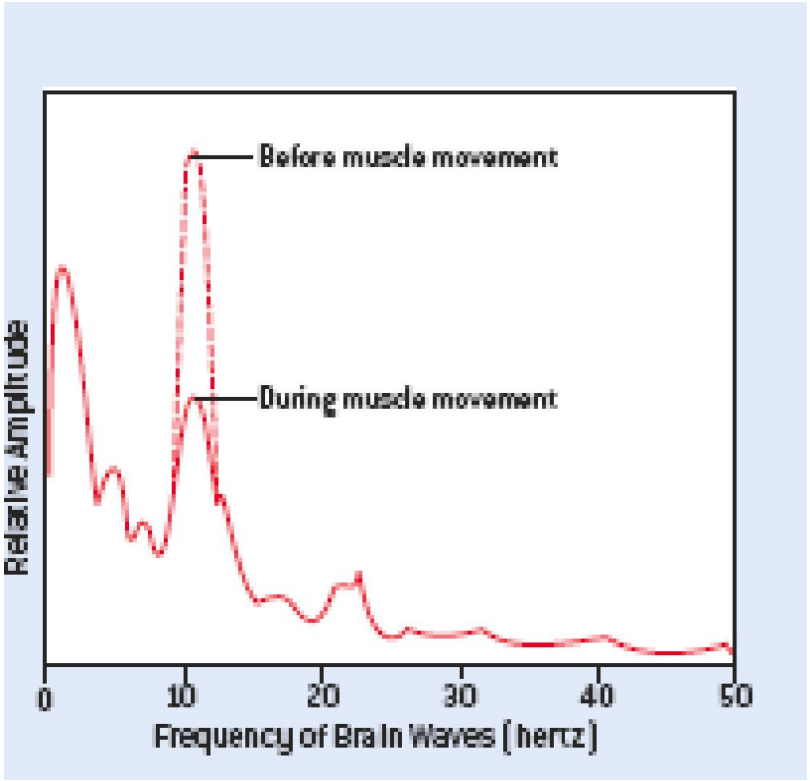
1) Understanding of actions
2) Empathy
3) Facilitate imitation?

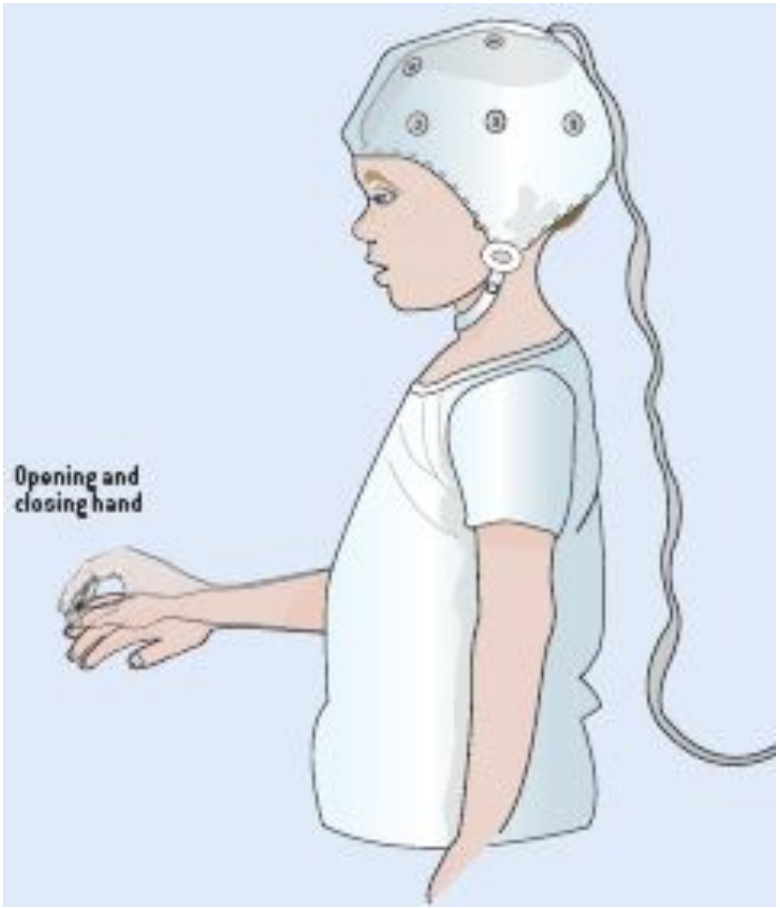
https://pixabay.com/illustrations/compassion-listening-sharing-857748/

Studying Mirror Neurons in Humans

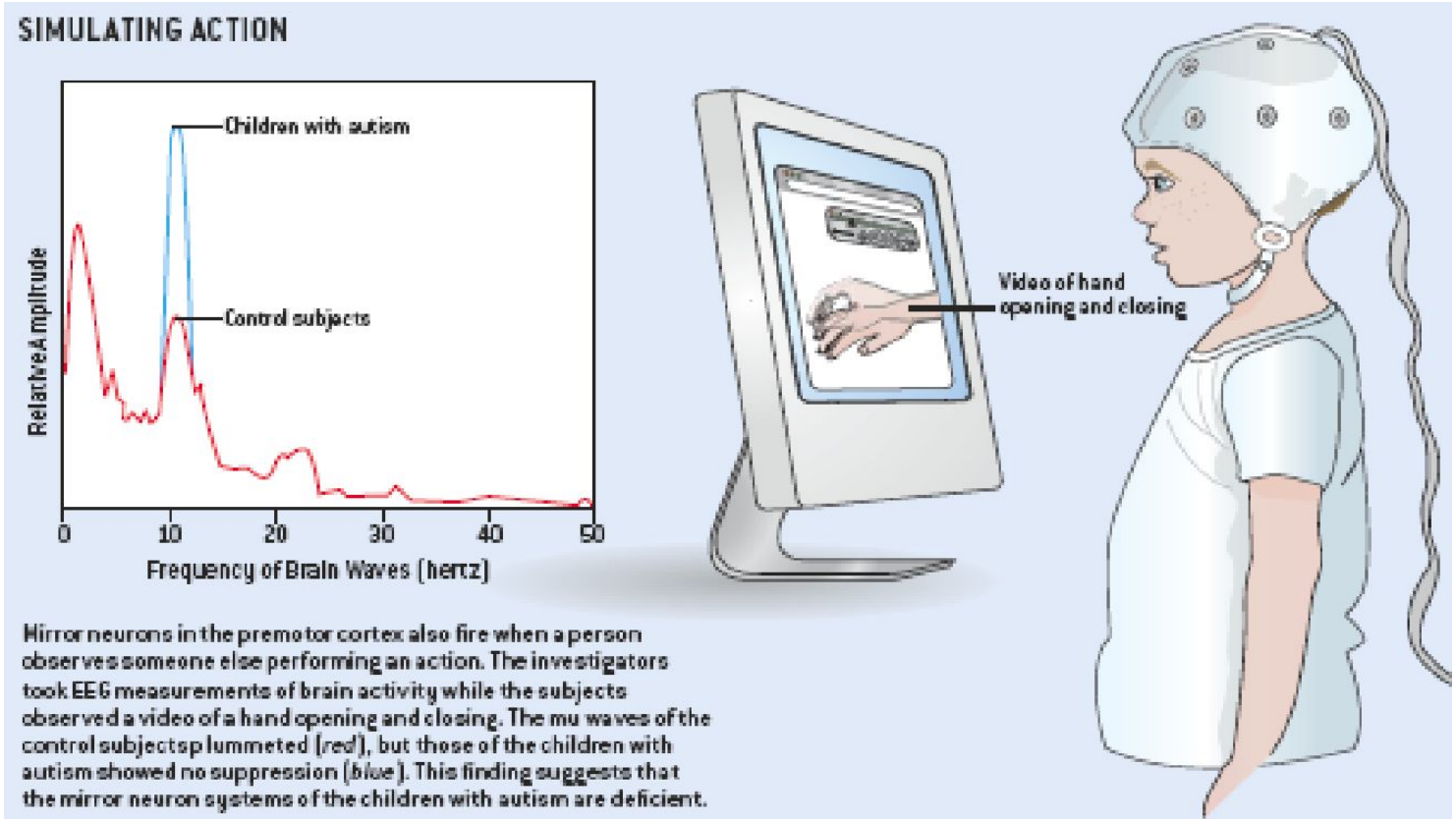
1) Component of EEG called mu wave (8-13Hz) known to be suppressed when person makes voluntary movement
2) mu waves are also suppressed when person observes same voluntary movement
3) Analogous to single cell recordings from mirror neurons in primates

Suppression of mu waves during action – open/close hand





Suppression of mu waves while observing action (BUT not in children with ASD)

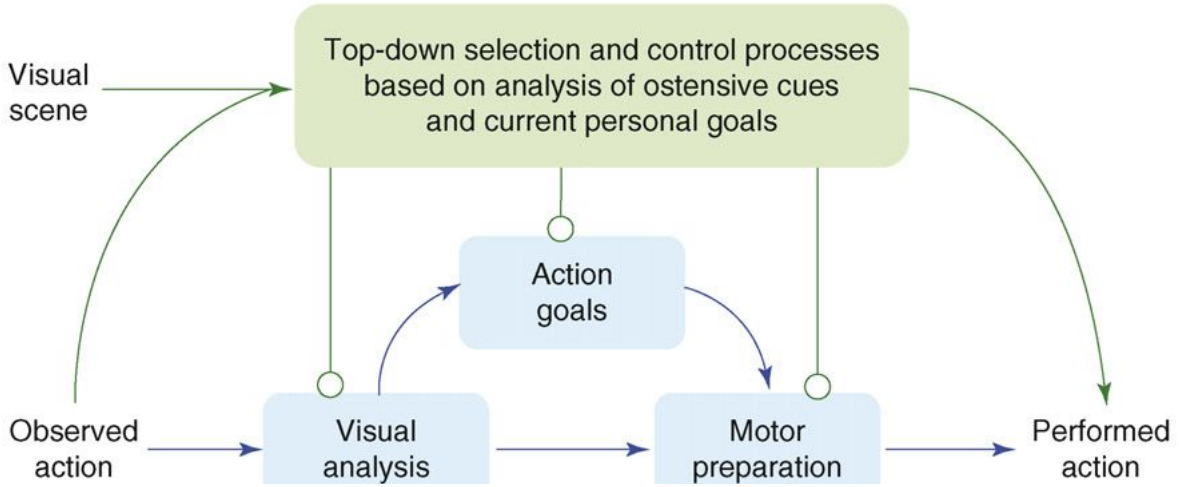


Oberman, L. M., Ramachandran, V. S., & Pineda, J. A. (2008). Modulation of mu suppression in children with autism spectrum disorders in response to familiar or unfamiliar stimuli: the mirror neuron hypothesis. *Neuropsychologia, 46*(5), 1558-1565.

- Children with ASD show little or no suppression of Mu when observing an unfamiliar person moving but show some Mu suppression when observing own behaviour or behaviour of family member
- Mu suppression in ASD and Schizophrenia spectrum disorder

Andreou, M., Skrimpa, V., & Peristeri, E. (2025). Neurological Underpinnings of Socio-Cognitive Dysfunction in Schizophrenia and Autism Spectrum Disorder: Evidence from “Broken” Mirror Neurons. *Applied Sciences*, *15*(12), 6629. Neurological Underpinnings of Socio-Cognitive Dysfunction in Schizophrenia and Autism Spectrum Disorder: Evidence from “Broken” Mirror Neurons

Challenges to the broken mirror theory



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Thinkpoint 1

What is the Mirror Neuron System? Does it explain the etiology, and development of childhood Autism Spectrum Disorder (ASD) and does it offer avenues for intervention?

LECTURE END