

The social brain in adolescence

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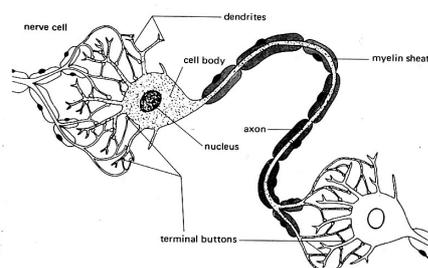


Outline

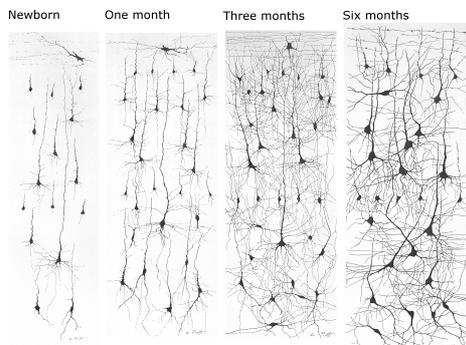
- Brain development
- The social brain
- Development of the social brain in adolescence

How does the human brain develop?

Synaptic reorganisation



Synaptogenesis in the human cortex



Synaptogenesis is followed by synaptic pruning

Synapses that are used are strengthened
 Synapses that are not used are pruned back

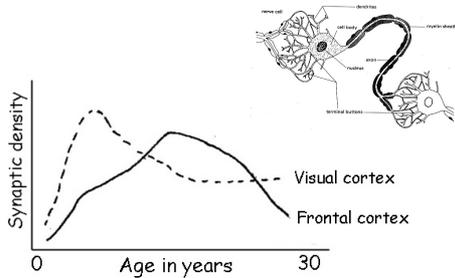
Fine-tunes brain tissue according to the species-specific environment

Learning the sounds of one's language

These processes are over mostly by the third year of life in the visual cortex of animals (e.g. monkeys).

... what about the human brain?
 ... and other brain areas?

Synaptic reorganisation continues for decades in human prefrontal cortex



Prefrontal cortex is involved in:

- Self-regulation and self-control
- Planning
- Inhibiting inappropriate actions
- Problem solving
- Multi-tasking
- Decision making
- Self awareness
- Social interaction

... continue to change during adolescence

The adolescent brain – a long history

"I would there were no age between ten and three-and-twenty, or that youth would sleep out the rest; for there is nothing in the between but getting wenches with child, wronging the ancients, stealing, fighting."

Shakespeare, *The Winter's Tale*, III.iii

- Adolescence is associated with heightened self-consciousness, risk taking and peer influence
- Psychiatric conditions often have their onset in adolescence

Magnetic Resonance Imaging (MRI)



Grey matter and white matter in prefrontal cortex develop throughout adolescence and beyond

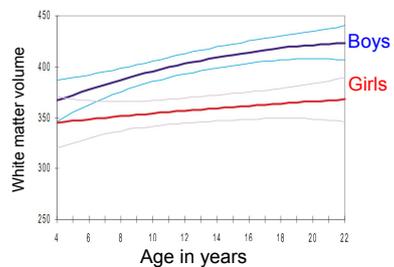
White matter comprises long fibres that carry signals between brain regions

Grey matter contains brain cells and connections

Increases for many decades

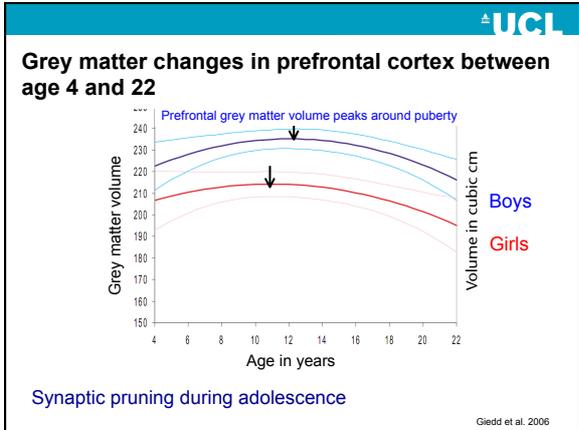
Increases until puberty then decreases during adolescence

Increase in white matter between childhood and adulthood



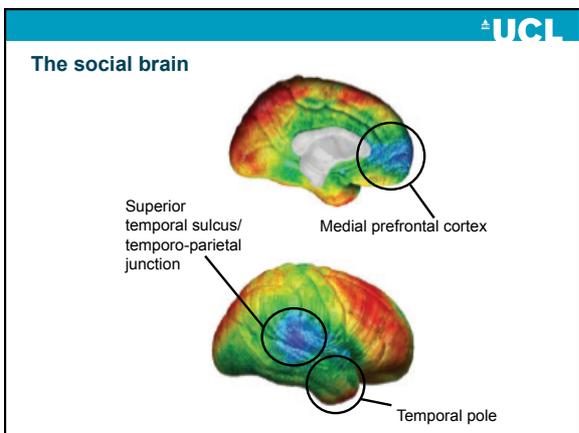
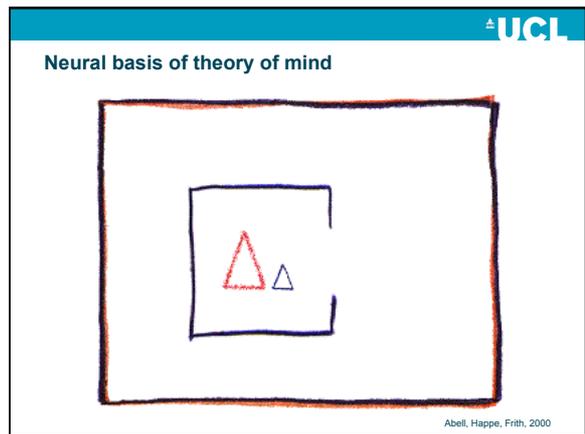
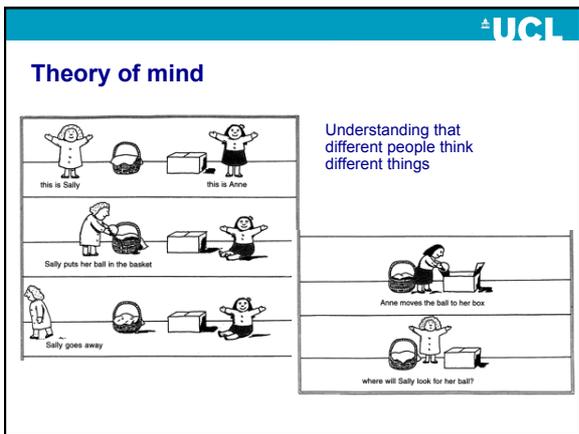
Myelination speeds up signalling between brain cells

Giedd et al. 2006



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The social brain



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Development of social emotion during adolescence

Participants

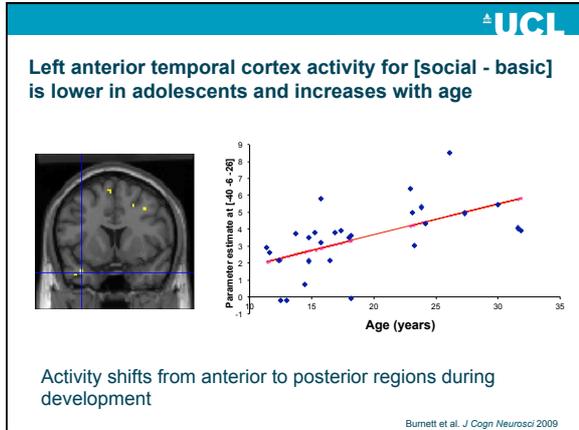
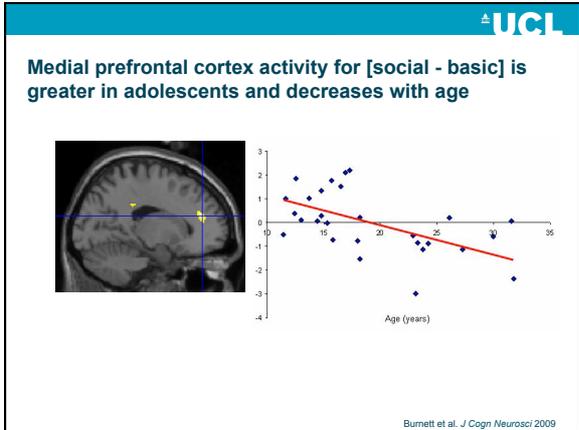
- 18 adolescents (all female; aged 11-17; IQ 115±7)
- 10 adults (all female; aged 21-37; IQ 111±14)

Conditions

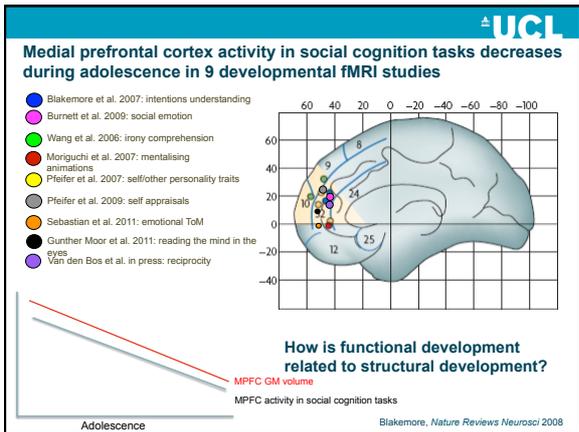
- Social emotions** require representation of others' mental states e.g. guilt, embarrassment
- Basic emotions** e.g. disgust, fear

Social emotion (guilt)

Burnett et al. J Cogn Neurosci 2009



Activity shifts from anterior to posterior regions during development



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Relationship between functional and structural development of stimulus-independent thought

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Stimulus-independent thought in adolescence

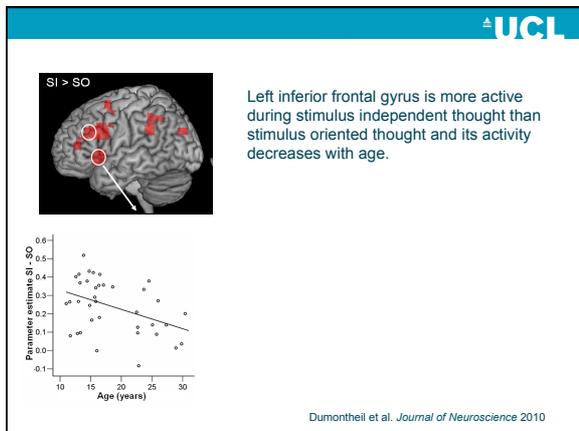
- 37 female participants (age 11 - 30 years), matched for IQ, SES
- Measured grey matter and white matter volumes (MRI)
- The Alphabet task (fMRI)

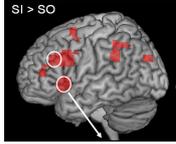
DOES THE LETTER CONTAIN A CURVE?

SO block SI block SO block ...

A B C D E F M Z F X T A E N O P Q R S ...

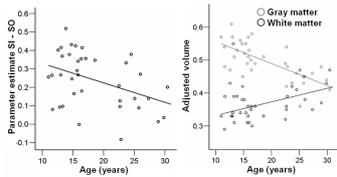
Dumontheil et al. *Journal of Neuroscience* 2010





Left inferior frontal gyrus grey matter volume decreases and white matter increases with age.

Decrease in activity in this region with age is not completely accounted for by change in structure and performance.

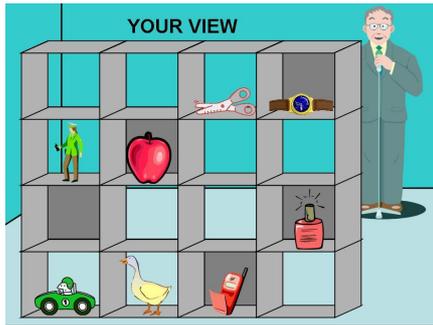


Strategy used to do the task changes with age

Dumontheil et al. *Journal of Neuroscience* 2010

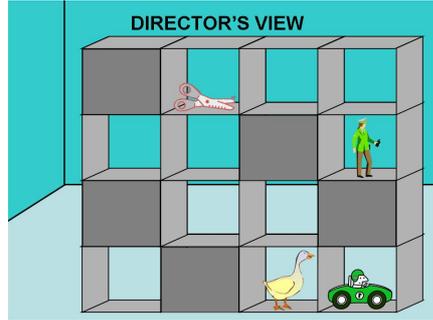
Behavioural consequences of social brain development?

Online mentalising task

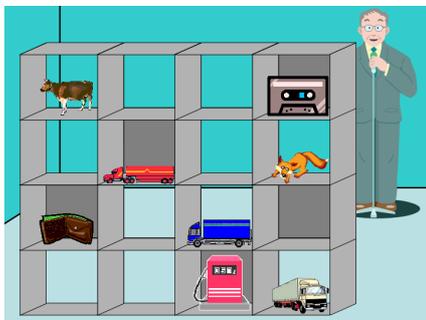


Keysar et al. 2000, Keysar et al. 2003, Apperly et al. 2010

DIRECTOR'S VIEW

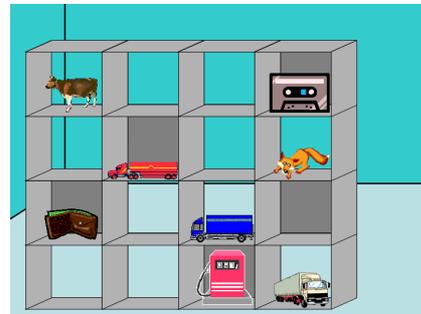


Director condition



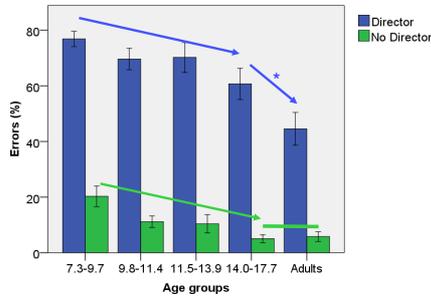
The director asks participant to "move the top truck right".

No director condition



Ignore the objects in slots with a grey background and "move the top truck right".

Percentage errors in Director and No-Director tasks



Dumontheil et al., *Developmental Science* 2010

Summary

- The social brain develops structurally and functionally during adolescence
- Effect of the environment on brain development during adolescence?
- Teaching and rehabilitation important and worthwhile – the brain seems to be particularly malleable during adolescence

Thanks

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Developmental Cognitive Neuroscience lab

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