

Module:

Biological Foundations of Mental Health

Week 5:

Reward, emotion and action



Professor
Francesca Happé

Topic 1:

**Cerebral cortex and
mental health**

Part 3 of 3

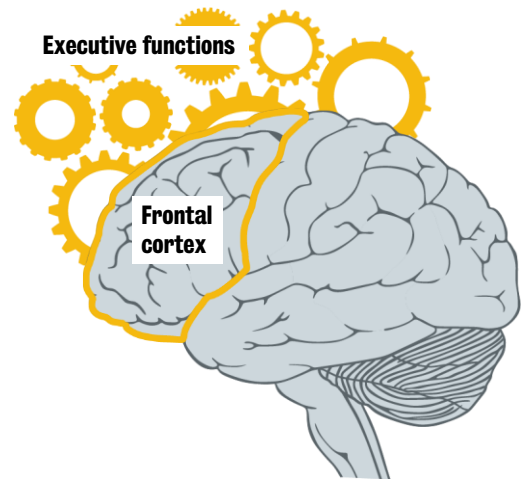
Part 3

Introduction to part 3

There are at least two sources of evidence:

Neuroimaging, e.g. fMRI

Neuropsychological studies of acquired brain damage to frontal lobes



Functional Magnetic Resonance Imaging (fMRI)

fMRI studies show how blood flow changes in the prefrontal regions of the brain when volunteers engage in cognitive tasks.



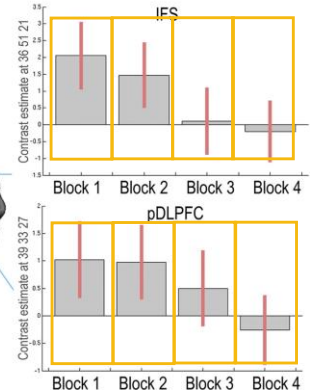
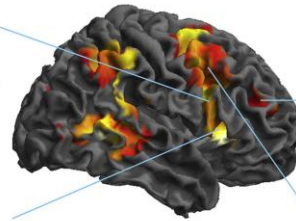
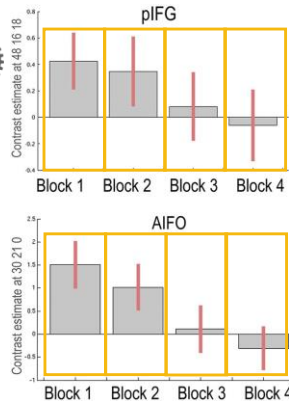
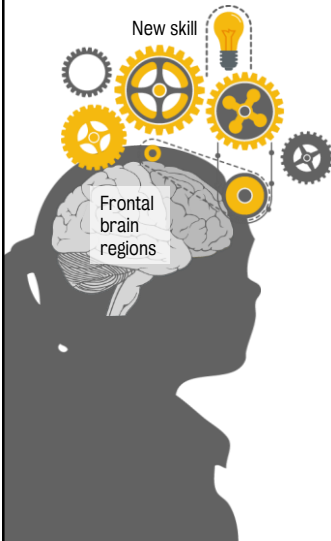
Activation in frontal regions is greatest for novel tasks and decreases with practice



Hampshire and colleagues (2016)

Findings:

Activation in the frontal regions decreases across the blocks of an inhibition task as the volunteers become more practised at the test.



Hampshire et al. (2016)

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Topic 1: Cerebral cortex and mental health

5 of 17

Cases of acquired frontal lobe damage



Another source of evidence for the role of the frontal regions of the brain in executive functions comes from **neuropsychological cases of acquired brain damage**.

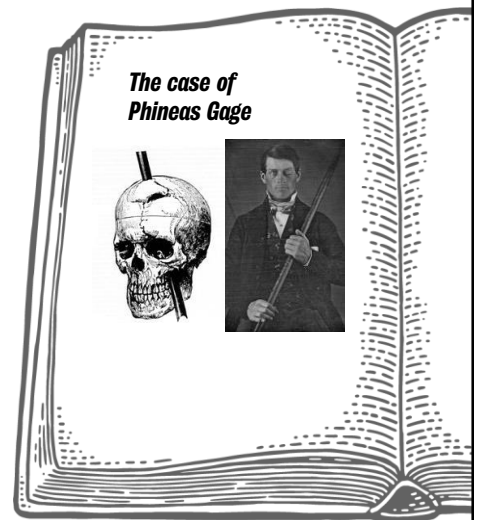
The case of Phineas Gage

"The damage to Gage's frontal cortex caused by the iron rod seems to have resulted in a loss of social inhibitions. The role of the frontal cortex in social cognition and decision making is now well-recognised; in the 19th century, however, neurologists were only just beginning to realise these connections. Gage's injuries provided some of the first evidence that the frontal cortex was involved in personality and behaviour."



For more information on the case of Phineas Gage, please see the Consolidation and Reflection section.

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BigPicture (2017); Costandi (2012); Harlow (1993, 1999); Van Horn et al. (2012)

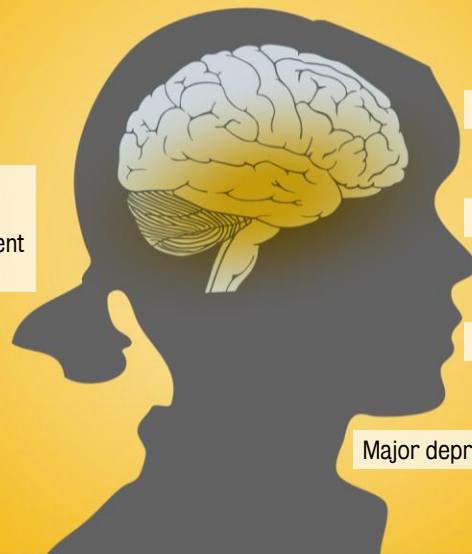
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6 of 17

Frontal association cortex implicated in many psychiatric and neurodevelopmental conditions

Several psychiatric and neurodevelopmental conditions are associated with an impairment in executive functions, such as:



Autism spectrum disorder (ASD)

Schizophrenia

Bipolar disorder

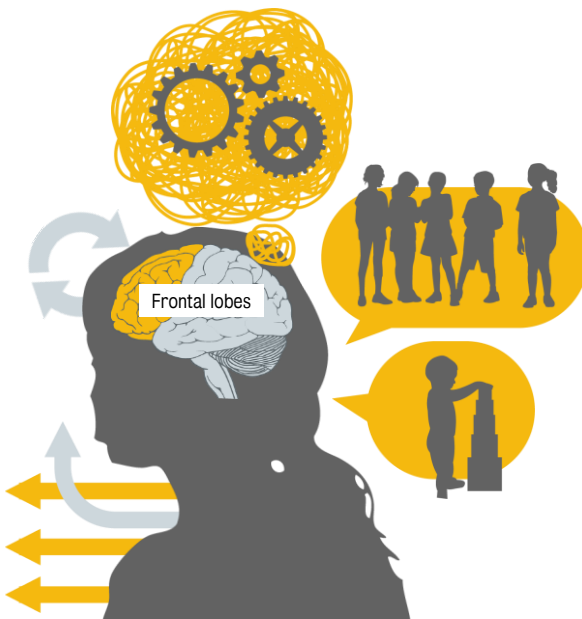
Major depression

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7 of 17

Autism Spectrum Disorder (ASD)



Autism spectrum disorder (ASD) is characterised by:

- impaired social and communicative development
- rigid and repetitive behaviours and interests
- poor performance on executive function tasks
- a dislike for change
- a preference for narrow routines and repetition

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8 of 17

Social and communication problems in ASD reflect impaired 'Theory of Mind'

'Theory of mind':

The ability to recognise others' thoughts, beliefs and desires, putting yourself in another person's shoes.

People with ASD tend to have difficulty understanding what others are thinking.



They often get confused by social situations and struggle with communication.

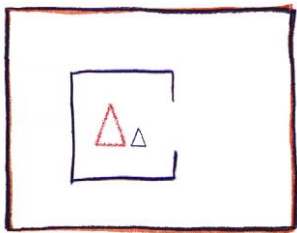


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9 of 17

A simple test of 'Theory of Mind': The Frith-Happé triangles animations



Hover over the video and press play to rewatch the first animation.

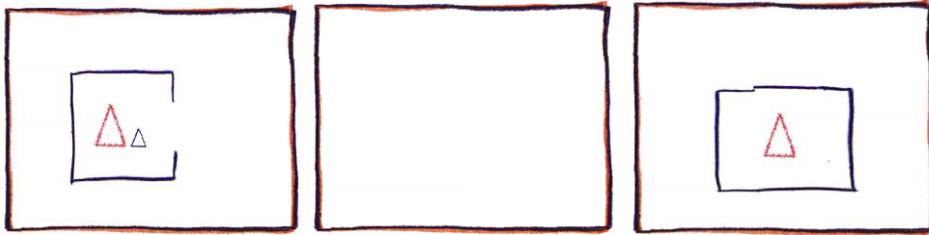
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10 of 17

A simple test of 'Theory of Mind': The Frith-Happé triangles animations



Hover over the videos and press play to rewatch the second and third animations.

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Week 5 Reward, emotion and action

Topic 1: Cerebral cortex and mental health

11 of 17

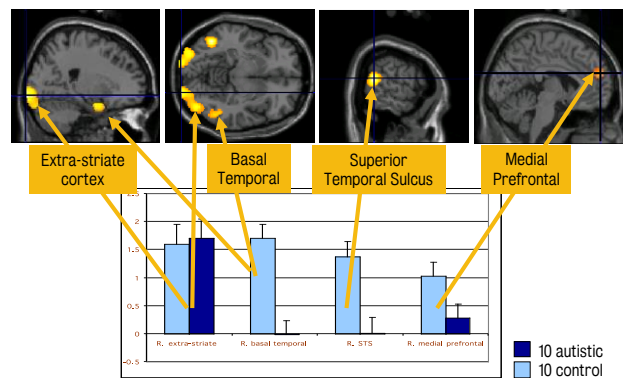
Theory of mind tasks

Blakemore and Decety, 2001



Castelli and colleagues, 2002

fMRI results during 'Theory of Mind' animations task



The Frith-Happé triangles animations

Blakemore & Decety (2001); Castelli et al. (2002)

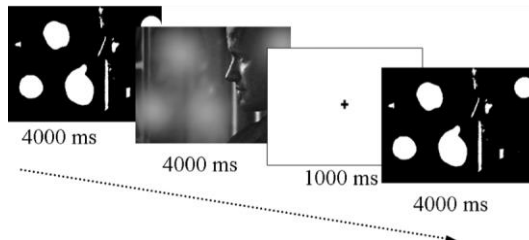
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Topic 1: Cerebral cortex and mental health

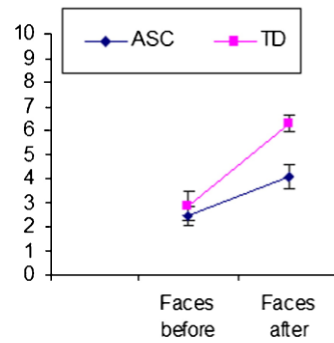
12 of 17

Reduced 'top-down' effects in ASD

Loth and colleagues, 2010



Brain scans suggest a reduced top-down effect in people with ASD.



ASC: Autism Spectrum Conditions

TD: Typically Developing adults

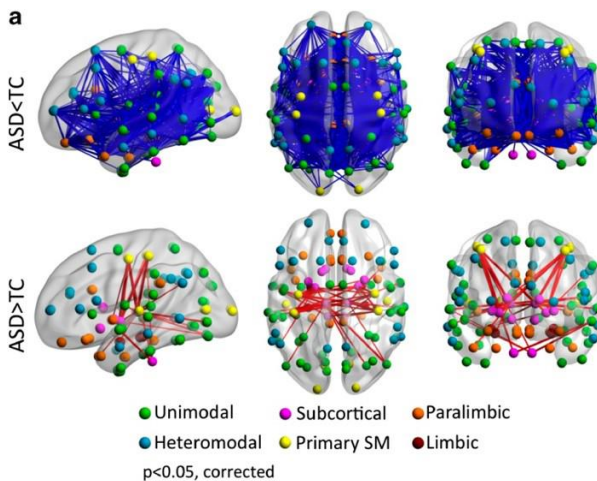
Loth et al. (2010)

Week 5 Reward, emotion and action

Topic 1: Cerebral cortex and mental health

13 of 17

Connectivity differences in ASD



b

Functional Divisions	Primary SM		Unimodal		Heteromodal		Paralimbic		Limbic		Subcortical	
ASD vs. TC	Hypo	Hyper	Hypo	Hyper	Hypo	Hyper	Hypo	Hyper	Hypo	Hyper	Hypo	Hyper
	n (%)		n (%)		n (%)		n (%)		n (%)		n (%)	
Primary SM	6 (13%)											
Unimodal	88 (20%)		276 (29%)									
Heteromodal	32 (13%)		166 (16%)		57 (21%)							
Paralimbic	34 (19%)		147 (19%)		104 (24%)		57 (37%)					
Limbic	7 (18%)		14 (8%)		7 (7%)		14 (19%)		1 (17%)			
Subcortical		20 (17%)		18 (3%)		1 (0%)	10 (5%)	1 (0%)		1 (2%)	2 (3%)	
Total	167 (16%)	20 (2%)	691 (18%)	18 (0%)	366 (15%)	1 (0%)	366 (20%)	1 (0%)	43 (11%)	1 (0%)	12 (1%)	41 (3%)



Take your time to study the images on the slide.

Click **Next** to continue

Ha et al. (2015)

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Topic 1: Cerebral cortex and mental health

14 of 17

Conclusion

We have looked at:

- the association cortex
- the role of the frontal lobes in executive functions
- acquired or developmental abnormalities in these regions and the consequent impairment in responding flexibly to novel situations
- the hypothesis on the importance of the frontal lobes in many psychiatric and neurodevelopmental disorders



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Attributions

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End of topic