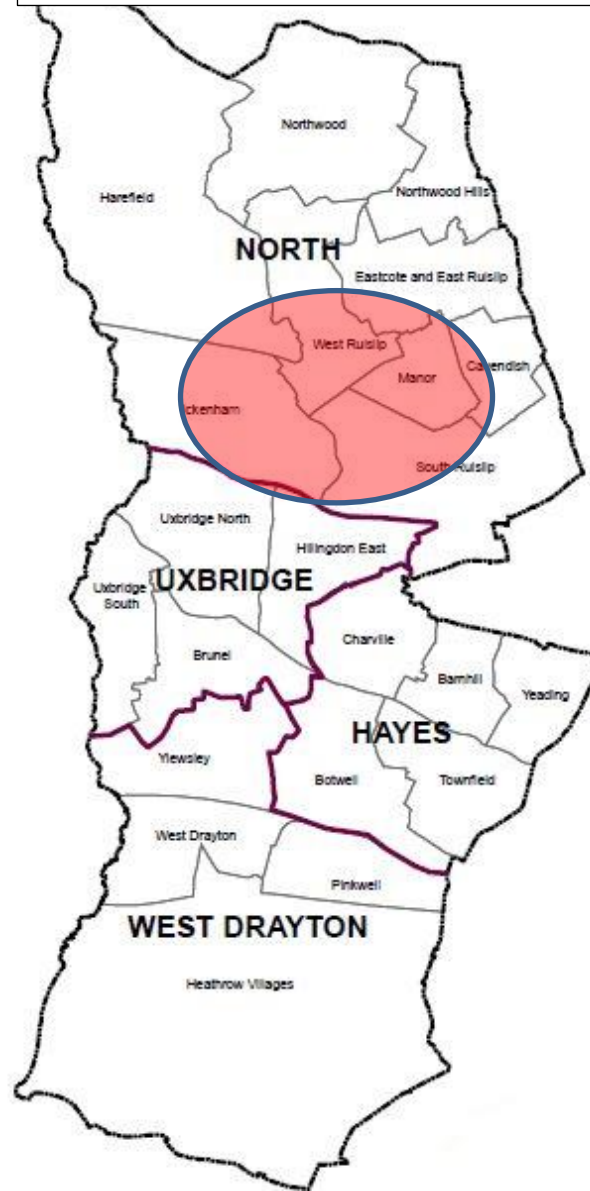


Whole-school approach to neuroscience

Dr Martina Lecky, Headteacher of Ruislip High School

London Borough of Hillingdon



Ruislip High School

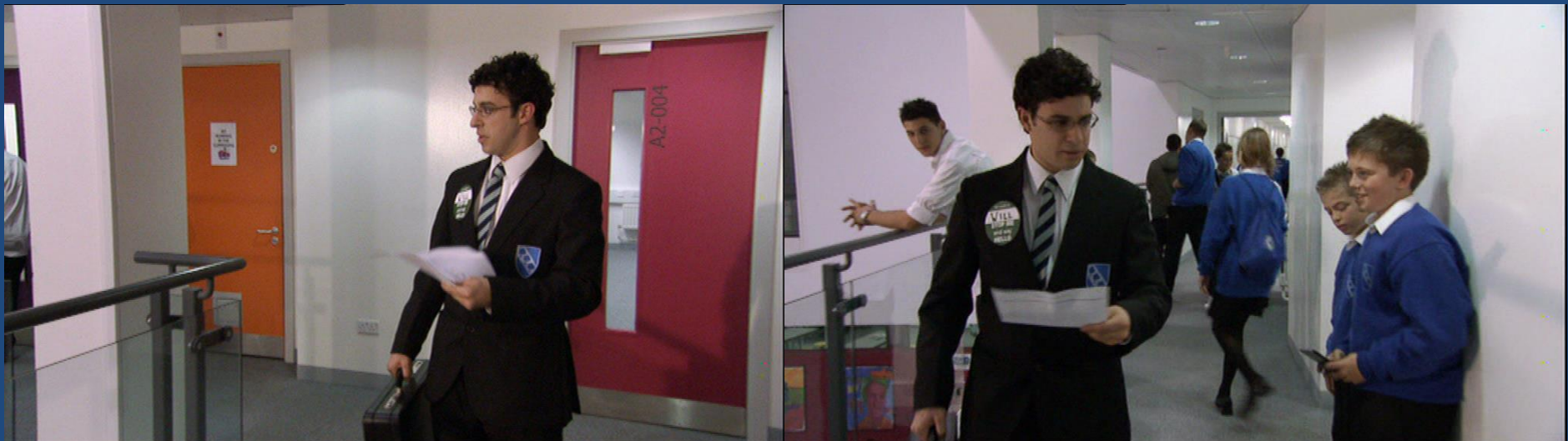


Opened in 2006

School demographics

- Number of students: 1,091
- Number of girls: 49%
- Students eligible for FSM: 8% (% of disadvantaged students is 21%)
- % of ethnic minorities: 39%
- % of pupils with a SEN statement or EHC plan: 1.4%
- School deprivation indicator: 0.14 (national 0.20)

When considering the teenage brain, it's no coincidence that Channel 4's *The Inbetweeners* was filmed at Ruislip High.



Promotion of the discourse

- Students' awareness of neuroscience
- Values of effective teaching and learning
- Neuroscience reading group and conference
- Neuroscience of trust – occupational psychology


Promotion of the discourse

- **Students' awareness of neuroscience**
- Values of effective teaching and learning
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David Eagleman

THE BRAIN
WITH DAVID EAGLEMAN
What is Reality?

6 x 60'
STARTS
THURSDAY
21st JAN



9PM
ON
BBC FOUR

"Utterly enthralling" - The Guardian
"An Exceptional Mind-Bending Series" - The Times Saturday Review
"Mind-Blowing" - TV Times
"Fascinating and enthralling" - Sunday Times

blink
FILMS

Hindu



Atheist



Scientologist



Christian



Muslim



Jewish



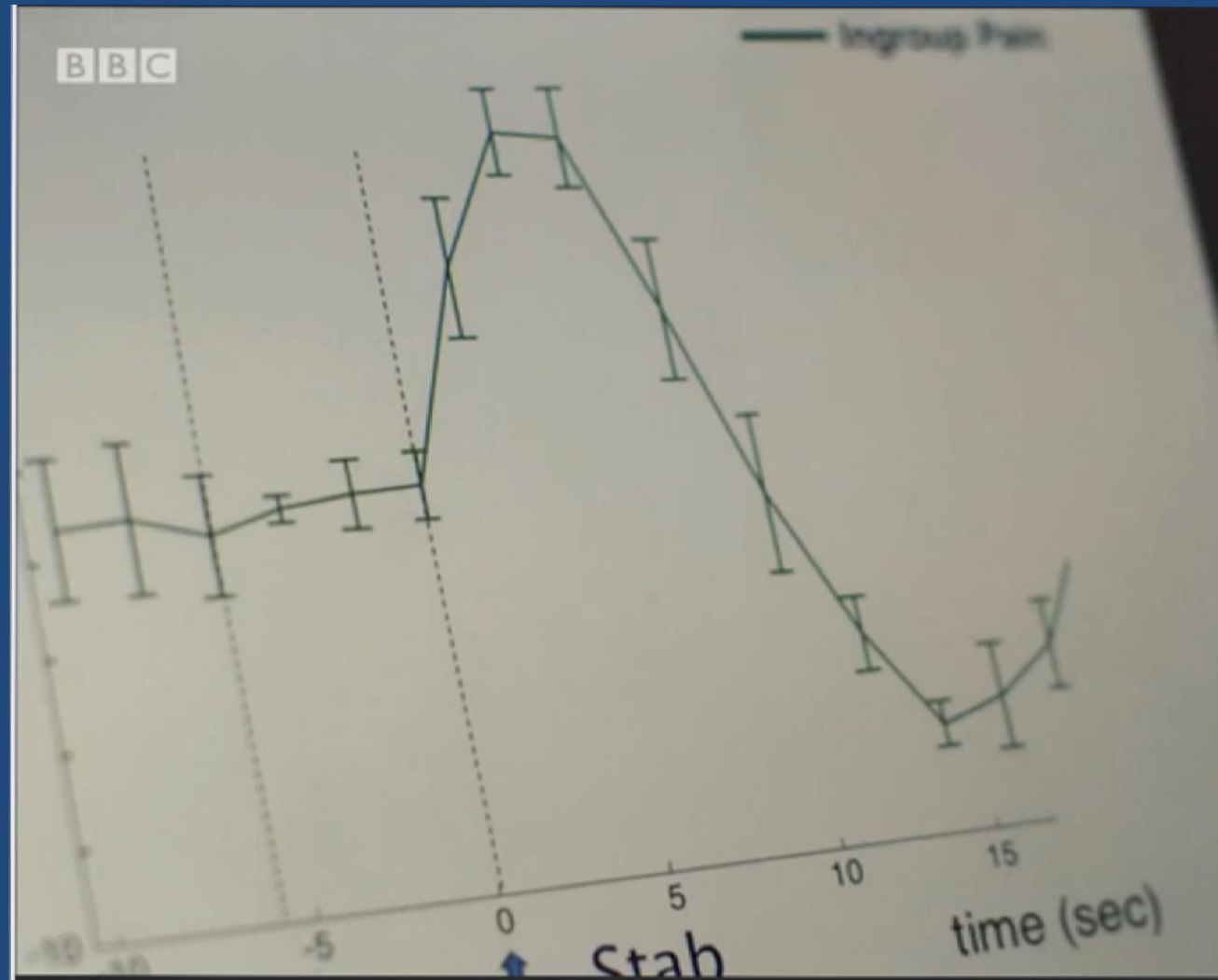
In versus out group



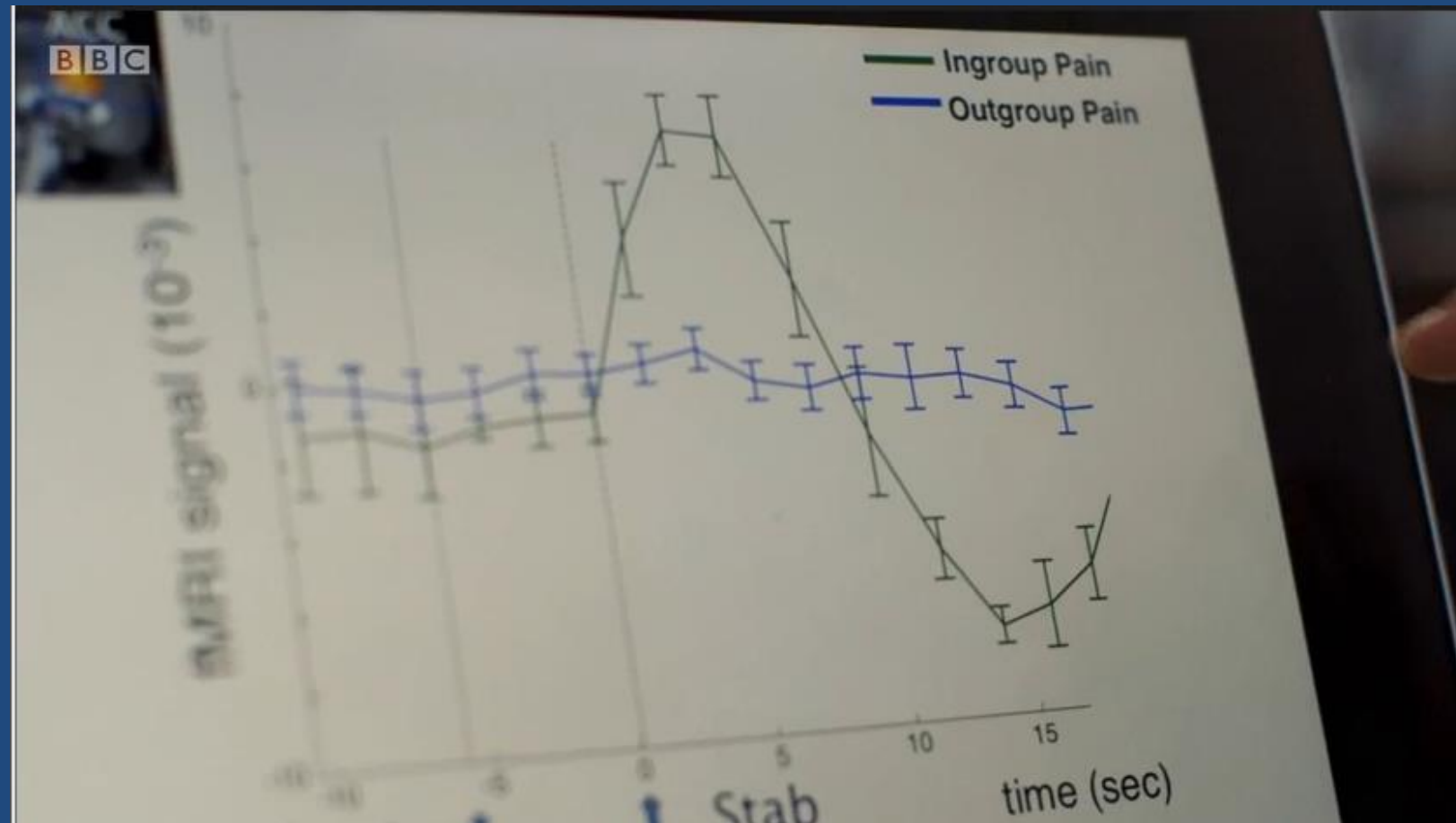
In group



In-group pain levels



Out-group pain levels



Division by group

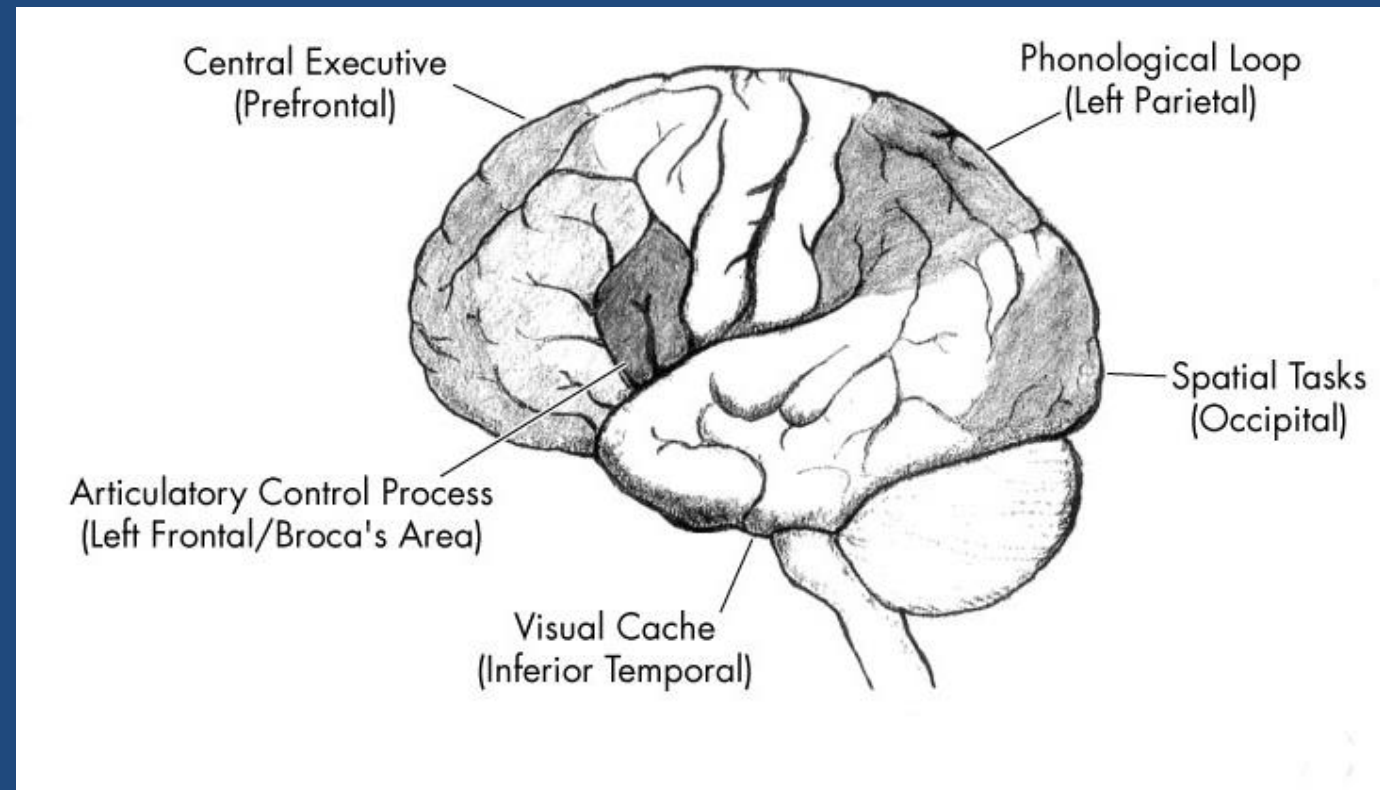
There should be no
'in groups' and 'out groups'

We are one community



Neuroscience and Memory

- Braver et al. (1997) gave their participants tasks that involved the central executive while they were having a brain scan.
- The researchers found greater activity in the prefrontal cortex area of the brain.
- The activity in this area increased as the activity became harder.



Memory experiments

- Peterson and Peterson (1959): Duration experiment
- Jacobs and Miller (1954): Capacity, Digit Span
- Craik and Tulving(1975): Levels of processing

Peterson & Peterson's (1959) technique

- You will show a **CPW** (a consonant trigram (three letters that pronounce, e.g. A D Q))
- Immediately afterwards you must count backwards from the number **130** (0, 117, 114, 111, 108, 105, 102, 99, 96, 93, 90, 87, 84, 81, 78, 75, 72, 69, 66, 63, 60, 57, 54, 51, 48, 45, 42, 39, 36, 33, 30, 27, 24, 21, 18, 15, 12, 9, 6, 3, 0) You will be asked to recall the letters after **18** and **21** seconds

You should do this until instructed to stop and
Write down letters!

Capacity
Digit Span
Jacobs and Miller (1954)

Digit Span: The capacity of short-term memory (STM)

- Joseph Jacobs (1887) developed a technique to measure digit span.
- This is a way of assessing how much information your STM can hold.
- The researcher gives 4 digits and then the participant is asked to recall these in the correct order out loud.
- If this is correct the researcher reads out 5 digits, and so on until the participant can't recall the order correctly.

E.g. 2, 4, 8, 1

4, 5, 2, 4, 2

5, 7, 3, 1, 5, 6

3, 9, 3, 6, 3, 8, 3

3.141592653

↑
MARCH

↑
14th

↑
2015

↑
9:26 a.m. or p.m.

↑
53 seconds

Levels of processing: Craik and Tulving (1975)

- Shallow
- Deep
- Participants were asked questions about 60 nouns

150 Vocabulary Words

for early childhood or special education

glad	repair	extremely	throat
speak	tardy	hilarious	sip
weep	clever	ingredients	grin
infant	jet	recipe	lie
autumn	ill	intelligent	cheat
purchase	thief	scream	spill
fall	wealthy	aisle	wing
dresser	plenty	cashier	type
community	globe	wallet	sunset
barber	author	menu	suitcase
blame	bashful	envelope	practice
borrow	clutter	chef	lock
character	award	round	ship
disagree	marvelous	pond	gift
produce	cautious	few	simple
imagine	brain	slip	road
agree	brave	price	tale
dust	calf	destroy	pair
shade	calm	underground	rush
often	career	remote	horrible
similar	chew	cushion	cheap
terrify	search	helmet	relax
gigantic	shiver	stir	dive
celebration	tiny	afraid	shovel
freezing	greedy	adult	guess
hurry	instrument	bank	flame
jog	leap	beg	perfect
island	dangerous	broom	race
frown	evening	cave	chill
bored	finally	chat	beach
awful	collect	choke	share
exhausted	crowd	cute	damp
annoy	curious	exercise	smooth
applaud	whisper	lady	
giggle	worry	nap	
neighbor	angry	rake	
melt	bridge	wheel	
parade	delicious	uniform	
litter	disappointed	thin	

Types of questions to assess levels of processing

- Gold

- Does this begin with the letter G?

- Silver

- Is this a precious metal?

150 Vocabulary Words

for early childhood or special education

glad	repair	extremely	throat
speak	tardy	hilarious	slip
weep	clever	ingredients	grin
infant	jet	recipe	lie
autumn	ill	intelligent	cheat
purchase	thief	scream	spill
fall	wealthy	aisle	wing
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community	globe	wallet	sunset
barber	author	menu	suitcase
blame	bashful	envelope	practice
borrow	clutter	chef	lock
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produce	cautious	few	simple
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shade	calm	underground	rush
often	career	remote	horrible
similar	chew	cushion	cheap
terrify	search	helmet	relax
gigantic	shiver	stir	dive
celebration	tiny	afraid	shovel
freezing	greedy	adult	guess
hurry	instrument	bank	flame
jog	leap	beg	perfect
island	dangerous	broom	race
frown	evening	cave	chill
bored	finally	chat	beach
awful	collect	choke	share
exhausted	crowd	cute	damp
annoy	curious	exercise	smooth
applaud	whisper	lady	
giggle	worry	nap	
neighbor	angry	rake	
melt	bridge	wheel	
parade	delicious	uniform	
litter	disappointed	thin	

Craik & Tulving found that participants were better able to recall words which had been processed more deeply; this is processing semantically, which supported the level of processing theory.

Sleep and memory

- Research explains the way in which deep sleep (also called slow-wave sleep) may be promoting the consolidation of recent memories.
- Traces of episodic memory acquired during wakefulness and initially stored in the hippocampus are progressively transferred to the cortex as long-term memory during sleep.

- Reference: Y. Wei, G. P. Krishnan, M. Bazhenov. **Synaptic Mechanisms of Memory Consolidation during Sleep Slow Oscillations.** *Journal of Neuroscience*, 2016; 36 (15): 4231



Student Conference

Learnus

Understanding Learning



Neuroscience

FREE Presentation for Hillingdon Sixth Form students
Ideal for students studying Biology, Chemistry, Physics and for Psychology

Wednesday 1st February, 2017

at Ruislip High School

from 3:30pm – 4:30pm

Jeremy Dudman-Jones
Assistant Headteacher, Greenford High School
Member of the Learnus Council

Learnus is delighted to be able to offer a free one-hour workshop (forty-five minutes and fifteen minutes Q&A session) to give sixth form students an insight into contemporary brain related research, focussing on brain plasticity, brain maturation and exploring the potential pitfalls of neuromyths.

Students will leave the presentation with a greater awareness of the nature of neuroscience and its relevance or application as well as considerable neurological changes that occur during teenage years.



Neuroscience lecture



Students commented afterwards:

- *The lecture was very engaging. I was particularly interested in the part about the development of neurons as you grow older.*
- *The delivery was exciting and engaging. Very good audience interaction. The topics discussed were relevant to topics for the new psychology A Level specification.*
- *Inspirational and insightful!*
- *The speaker had great interactions with students which made the lecture really interesting.*
- *The speaker used great analogies to make it easy to understand.*

Randomised rewards

- 'Keep it 100' club: raffle tickets
- 100% attendance and no warnings
- Head of Year raffles at termly celebration assemblies
- Westfield vouchers
- iPad (300 plus reward wheels)



Awareness of behaviour

- Risk seeking
- Sensation seeking
- Peer approval /heightened self-awareness

Risk-taking behaviour and consequences

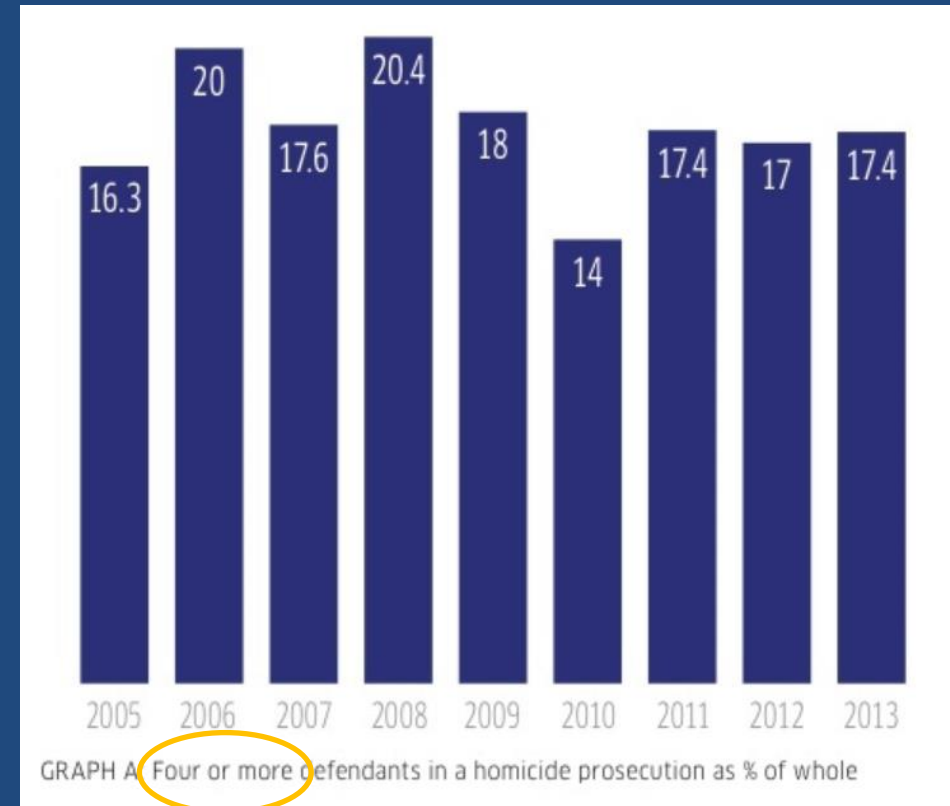
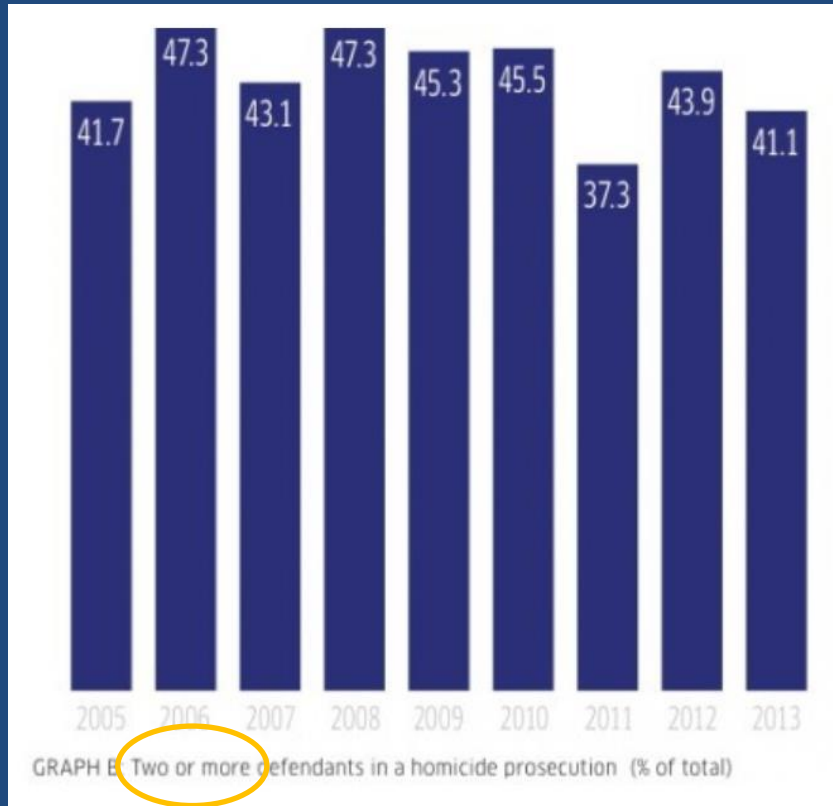
Joint Enterprise

- *The doctrine of common purpose, common design, joint enterprise, or joint criminal enterprise is a **common law legal doctrine** that imputes **criminal liability** to the participants in a criminal enterprise for all that results from that enterprise.*

Positive Behaviour Policy

- *Ruislip High School's Positive Behaviour Policy: The school takes the same position as the law in terms of individuals being collectively held responsible for an incident involving group behaviour which, in the context of a school, is deemed to be irresponsible and/or inappropriate; therefore, students must remove themselves from a situation rather than being spectators.*

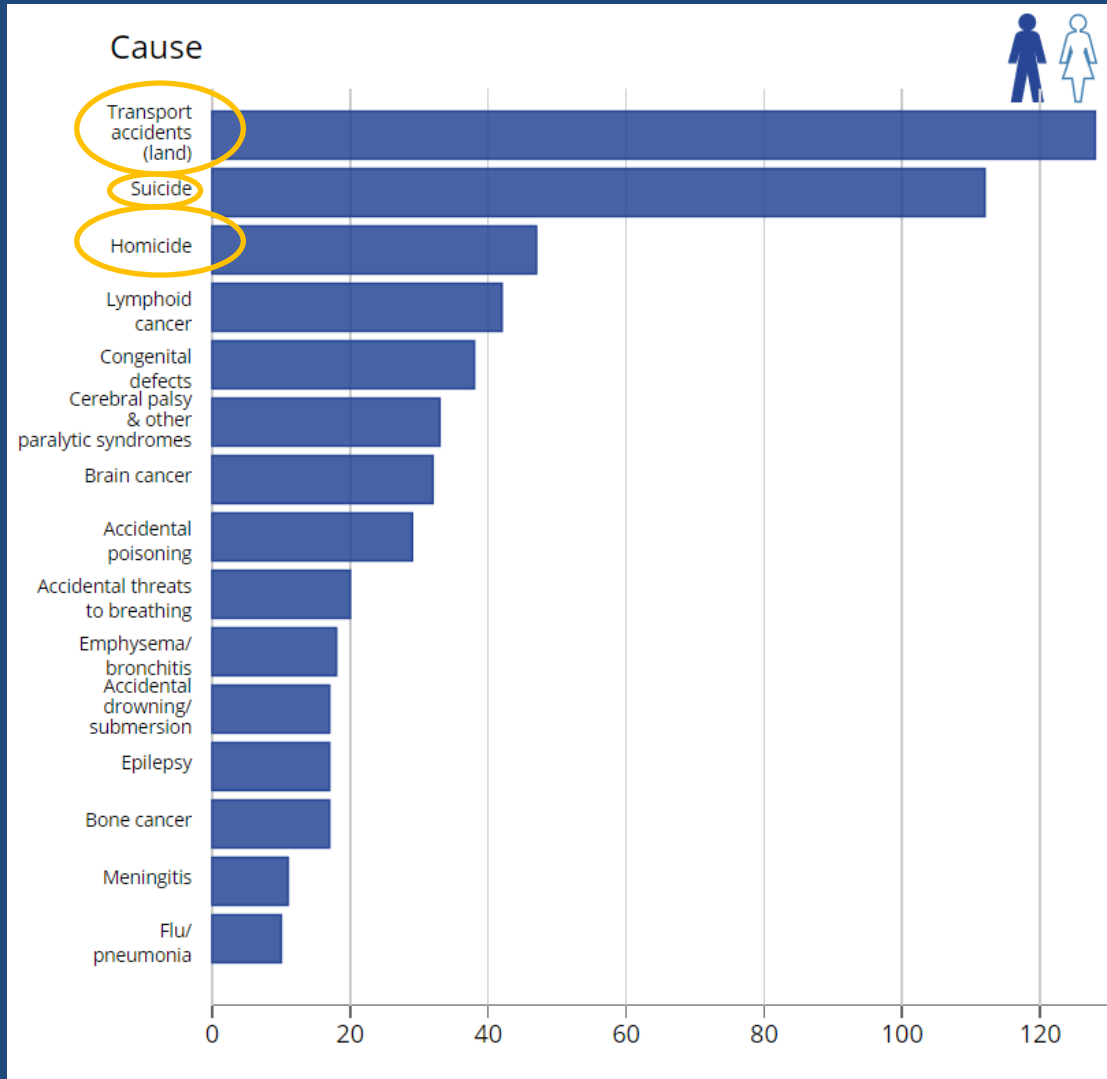
Joint enterprise and figures



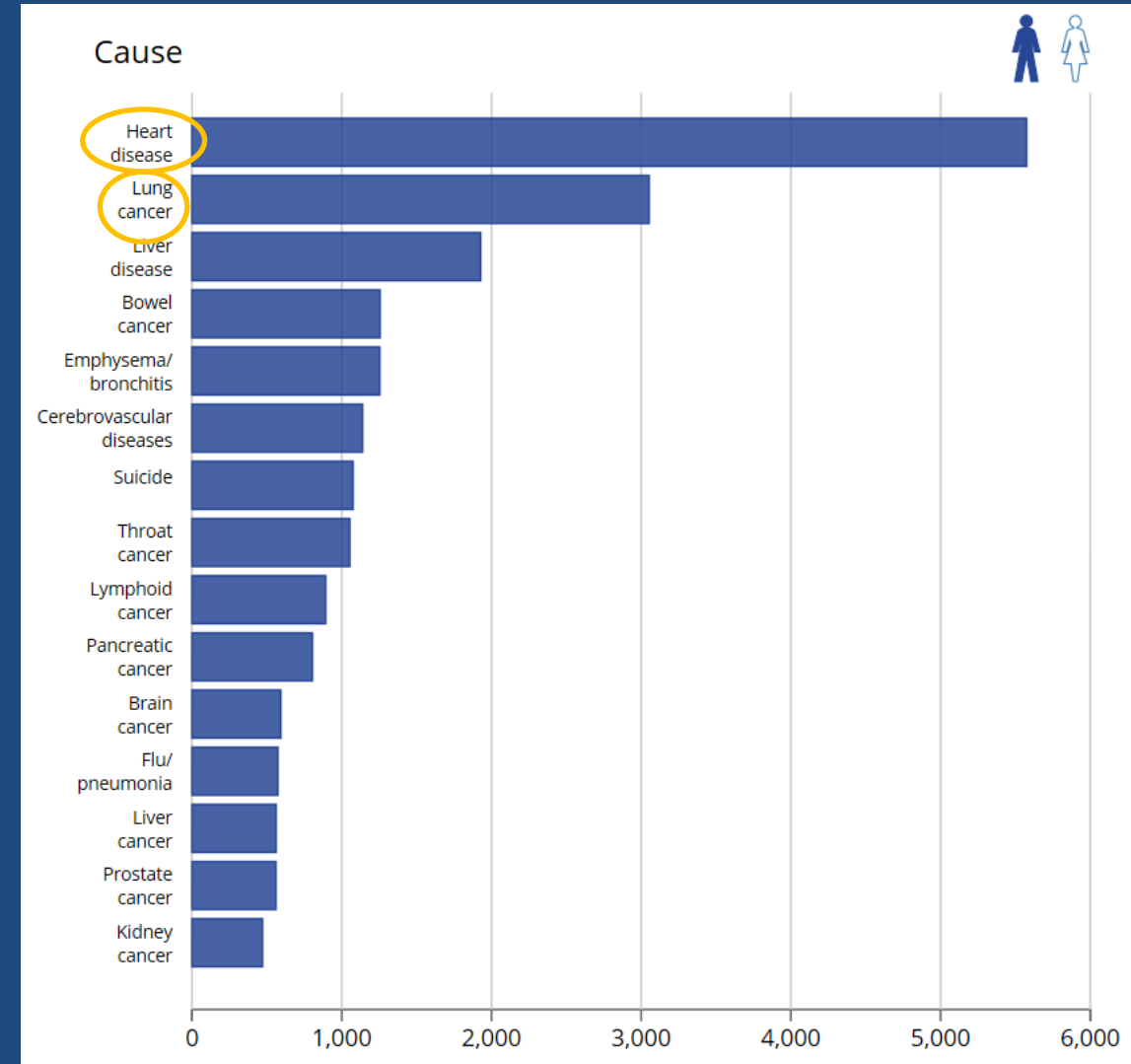
- *There is even less information on the age distribution of those convicted of joint enterprise offences, although it appears clear that a huge proportion of them are young.' House of Commons - Joint enterprise: follow-up - Justice Committee, December 2014;*
- 44% of all homicides involve two or more defendants;
- 20% of all homicides involve four or more defendants.
- <https://www.thebureauinvestigates.com/stories/2014-03-31/data-joint-enterprise-in-numbers>

Accidents

Leading causes of deaths registered in England and Wales, 2013, males aged 5-19

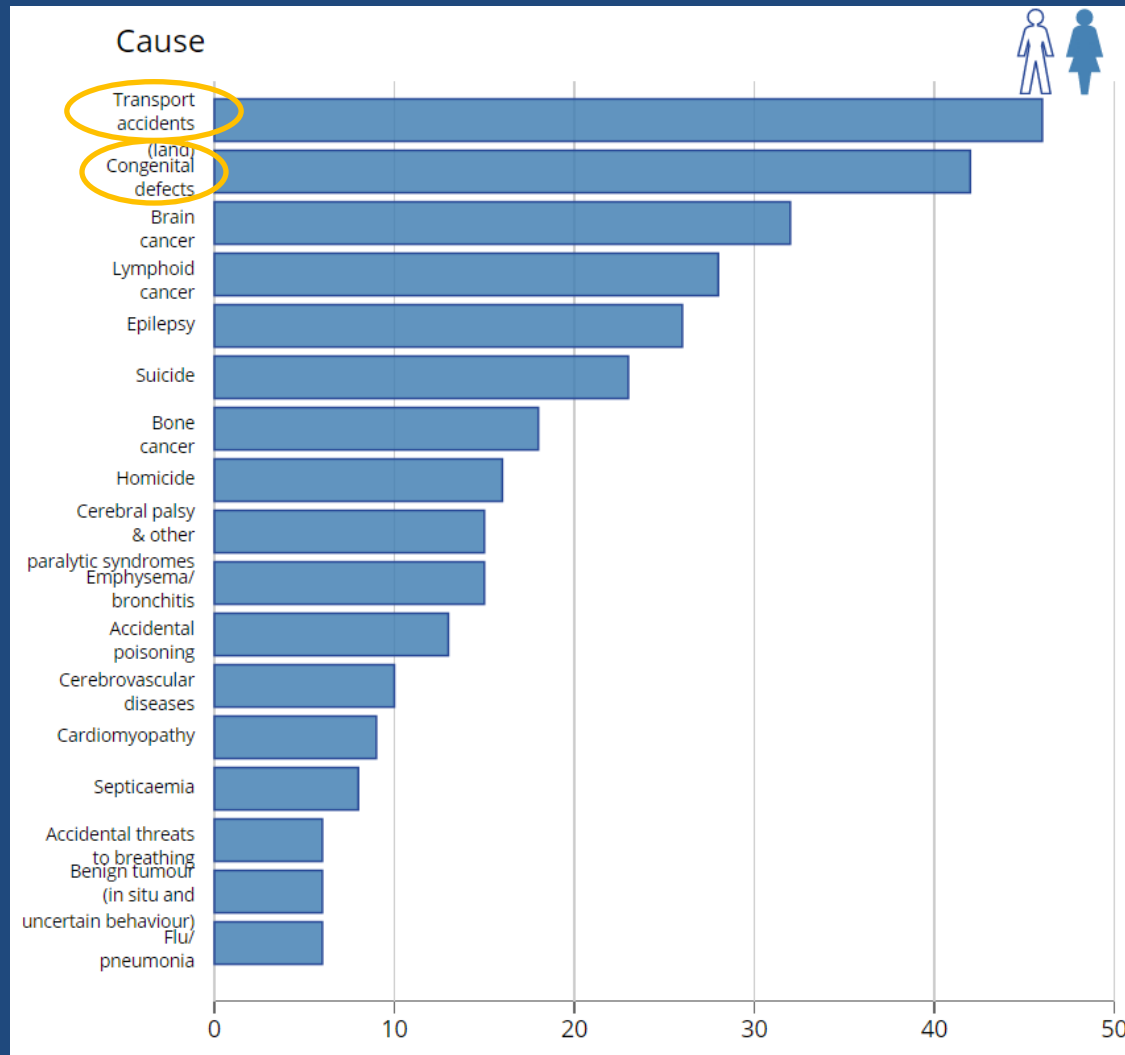


Leading causes of deaths registered in England and Wales, 2013, males aged 50-64

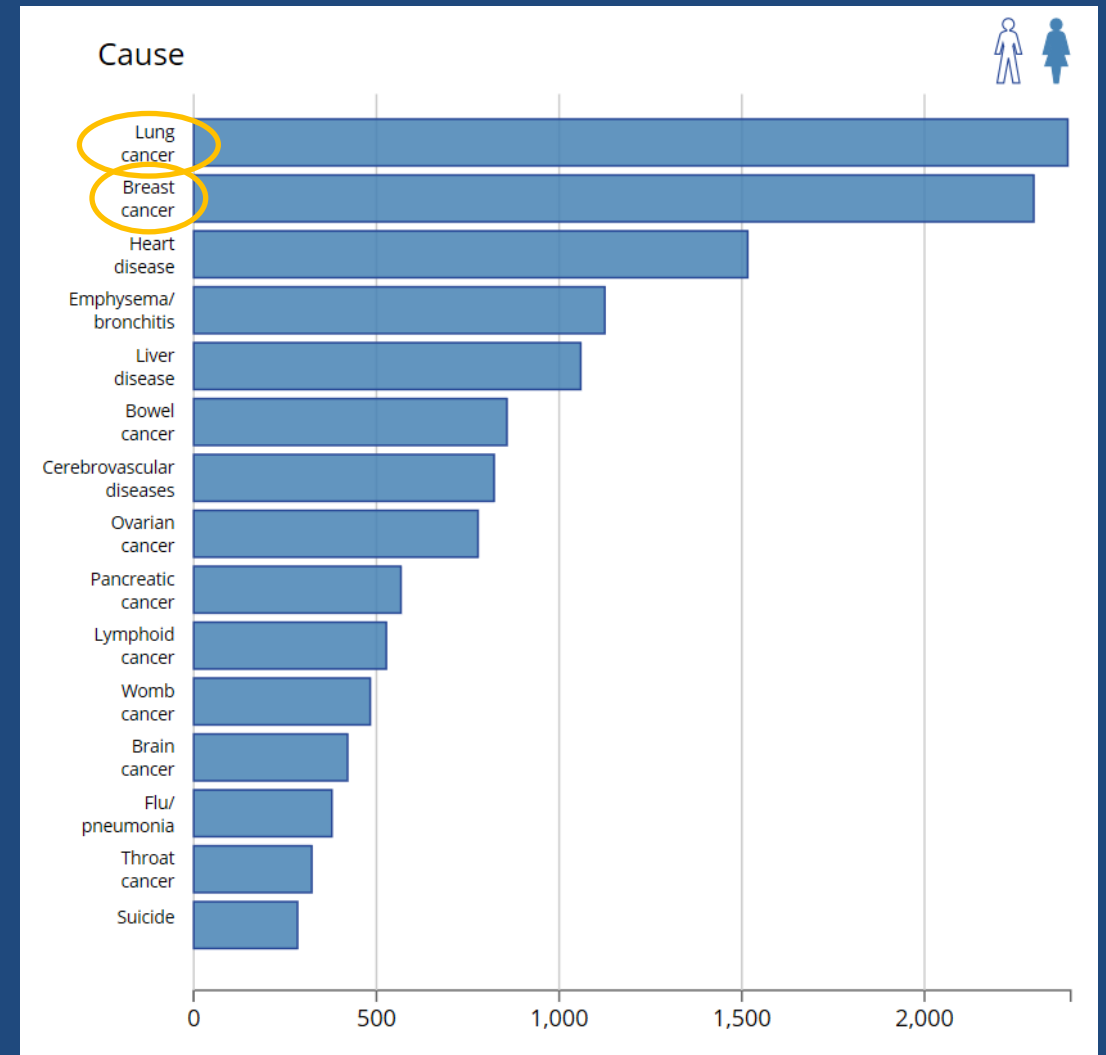


Accidents

Leading causes of deaths registered in England and Wales, 2013, females aged 5-19



Leading causes of deaths registered in England and Wales, 2013, females aged 50-64



Heightened self-awareness

The teenage brain and increased self-consciousness

- Somerville et al (2013). 'The medial prefrontal cortex and the emergence of self-conscious emotion in adolescence.' *Psychological Science*, 24 (8), 1554-62



- Participants sat on a stool in a shop window display with the curtain closed onto the street. They then surprised the participants by pulling back the curtain and exposing them to passers-by.
- The researcher measured their emotional response by GRS (galvanic skin response) as a useful proxy for anxiety.
- The results showed a significant difference in adults compared with teenagers with the latter group showing significantly higher levels of GRS.

The Brain, David Eagleman

- *'The answer involves an area of the brain called the medial prefrontal cortex (mPFC). This region becomes active when you think about your self – and especially the emotional significance of a situation to your self. Dr Leah Somerville and her colleagues at Harvard University found that as one grows from childhood to adolescence, the mPFC becomes more active in social situations, peaking at around fifteen years old. At this point, social situations carry a lot of emotional weight, resulting in a self-conscious stress response of high intensity. That is, in adolescence, thinking about one's self – so-called 'self evaluation' – is a high priority. In contrast, an adult brain has grown accustomed to a sense of self – like having broken in a new pair of shoes – and as a result an adult doesn't care as much about sitting in the shop window.'*

Promotion of the discourse

- Students' awareness of neuroscience
- Values of effective teaching and learning
- Neuroscience reading group and conference
- Neuroscience of trust – occupational psychology

Values of effective teaching and learning – the plasticity of the brain

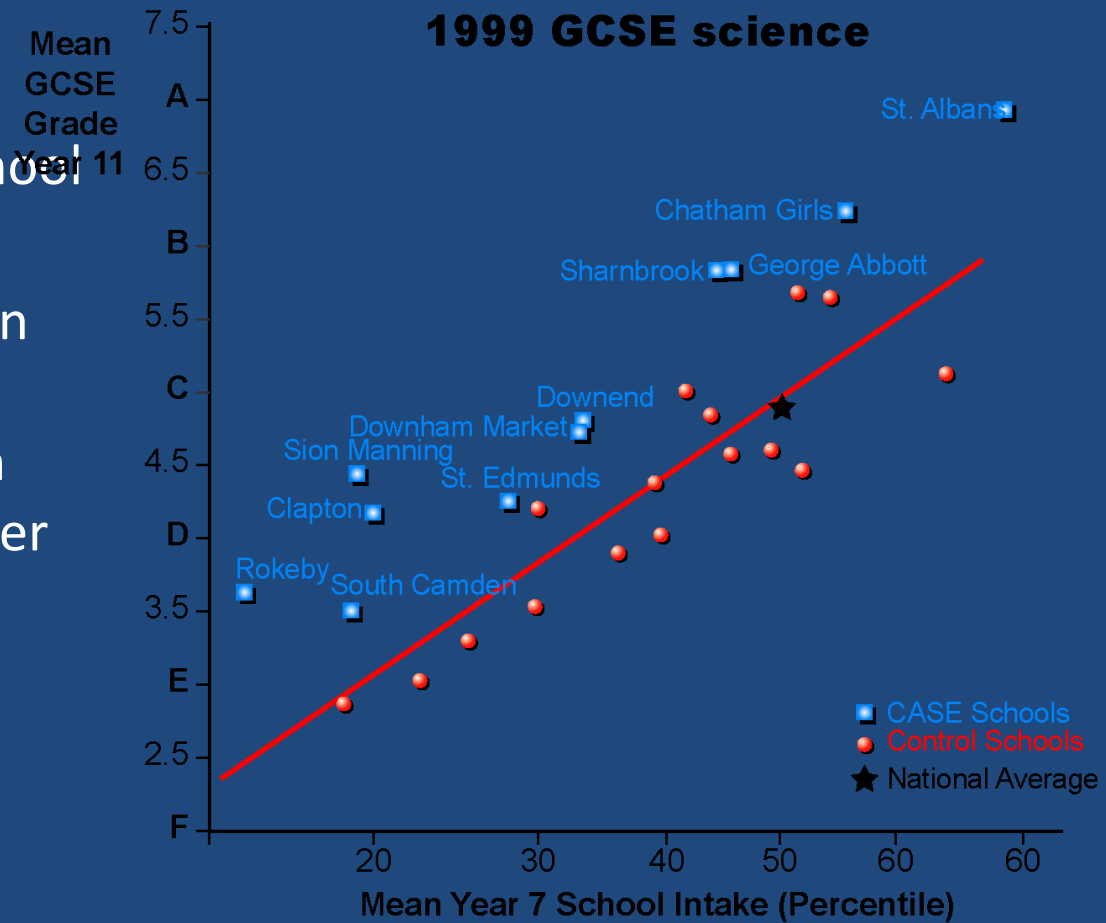
- Let's think lessons at KS1 – KS3 English, mathematics and science



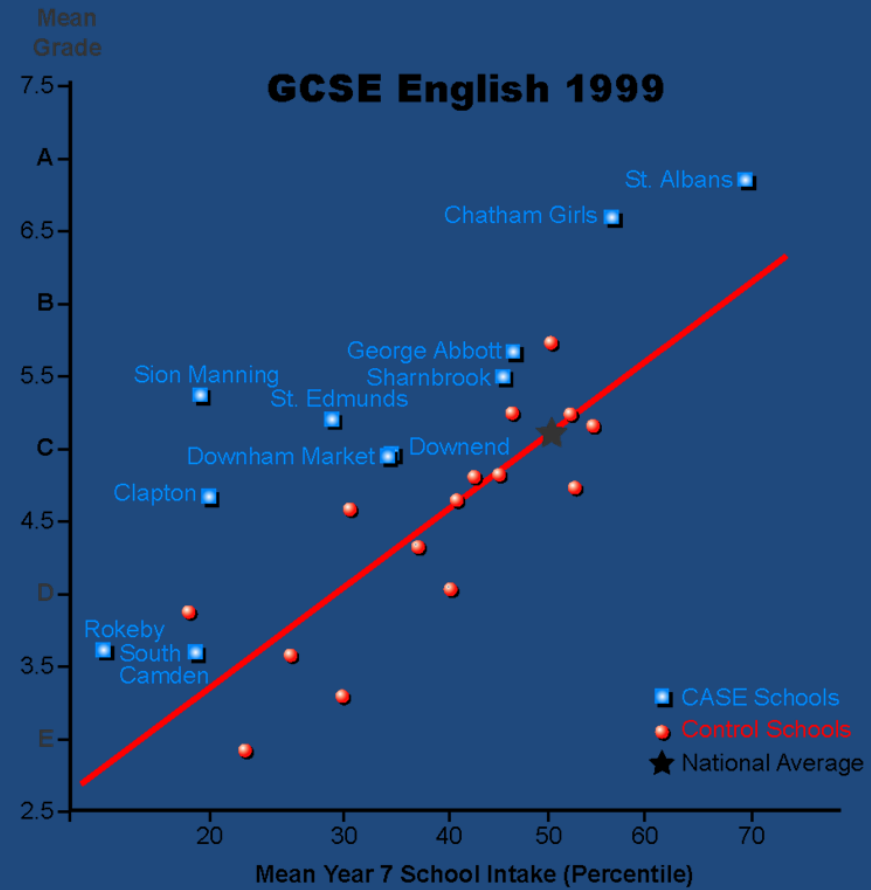
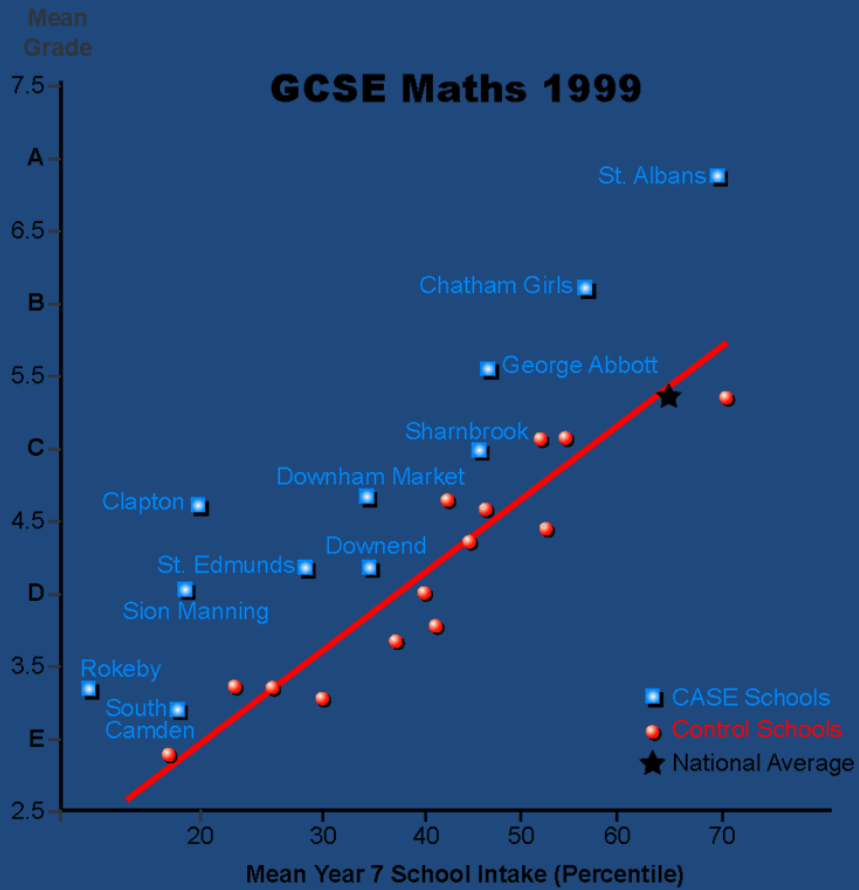
- Challenge –cognitive conflict
- Capacity of students' working memory
- Metacognition

Effects on GCSE: 'added value'

1. Find levels of cognitive development of all at school entry
2. Find relationship between non-CASE schools' entry level and GCSE grades on leaving school 5 years later
3. See by how much CASE schools' grades exceed these expectations



... and the transfer effect



Student quotes:

- *“We like it because you can use your imagination and there’s no set right or wrong answer.” Leah, 7D*
- *“Sometimes it’s really frustrating if you can’t put your hand up but you really want to answer.” Robert, 7D*
- *“We like discussing ideas and if you don’t know the answer, you can discuss it with your table and they can help you understand it.” Callum, 7D*
- *“I like let’s think lessons better than normal lessons because they let you properly interact with the class, and you can learn from other pupils.” Natasha, 7C*
- *“I find Let’s Think lessons challenging and they play with your mind but you enjoy learning amazing new words and facts about things you didn’t have a clue about before!” Annabelle, 7A*
- *“Let’s Think science lessons are phenomenal as they make you think about the stuff that’s around you.” Aamna, 7A*

Teacher quotes:

- *“I like the way students are ‘set free’ to some extent and discover things for themselves. Linked to this is the continual surprise I get at the level of mathematical thinking some of them use.”* Sue Davison
- *“Teaching CASE has improved my understanding of science education pedagogy and my teaching practice. Instead of wanting the correct answer I now want to know why they think their answer is correct and allows students to show if they really understand.”* Jon Prichard
- *“Let’s Think challenges students to think critically about texts and trains them in the practice of supporting their interpretations with evidence. The quick pace of the discussions means they become focused on reaching their conclusions without becoming distracted. Focusing on short stories means they also have experience in commenting on ‘whole texts’. I’ve found that teaching Let’s Think lessons has informed and improved the rest of my teaching: it’s made me reconsider my questioning, assess how I choose students for feedback and also how I respond to student opinion.”* Emma Kidd

Students' views

- <https://www.youtube.com/watch?v=FGb1L2aZqKY&feature=youtu.be&t=1m40s>

A teacher's view

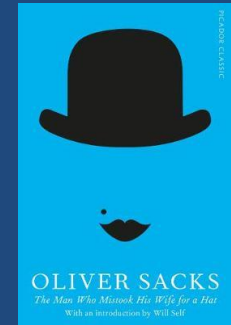
- <https://www.youtube.com/embed/ODjJibgftiw?autoplay=1&start=1&end=141>

Promotion of the discourse

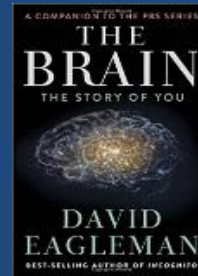
- Students' awareness of neuroscience
- Values of effective teaching and learning
- **Neuroscience reading group and conference**
- Neuroscience of trust – occupational psychology

Neuroscience reading group and conference

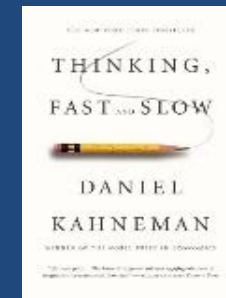
- The Man Who Mistook His Wife for a Hat: Oliver Sacks



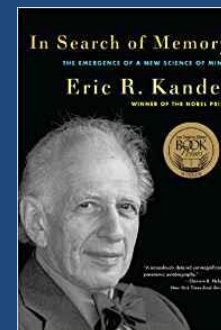
- The Brain: David Eagleman



- Thinking: Fast and Slow: Daniel Kahneman



- In Search of Memory: Eric Kandel



Conference

Ruislip
High
School

Learnus[®]
Unlocking Learning

Harrow Collegiate
Teaching School Alliance
(HCTSA)



"The Teenage Brain" Conference

Tuesday 10th October, 2017
at Ruislip High School
from 3:45pm – 6:00pm

Teenagers undergo significant neurological changes which impact their development and behaviour. This conference is ideal for educational practitioners interested in how to use evidence to inform policy and practice.



Professor Michael Thomas
Keynote Speaker



Jane Emerson
Access to the Curriculum:
SEN Workshop



Jonathan Hancock
Memory Workshop



Dr. Iroise Dumontheil
Mindfulness Workshop



Annie Brookman-Byrne
Educational Neuroscience
of the Adolescent Brain In
Mathematics and
Science Workshop



Jeremy Dudman-Jones
The Science of
Neuroscience Workshop

Conference programme

- **Programme**

- **3:15pm (no earlier):**

- Arrival to Ruislip High School and welcome

- **3:45pm - 4:45pm:**

- Keynote speaker, Professor Michael Thomas

- **5:00pm - 6:00pm:** Workshops

- **Adolescent Brain in mathematics and science**
- **Memory**
- **Mindfulness**
- **Science of neuroscience**
- **SEN**



Conference feedback

WWW

- Interesting, thought provoking or engaging
- Workshop leader
- Good practical ideas/techniques
- Keynote speaker
- Well organised

ebi

- More focused on practical teaching
- More interactive
- Tea/coffee
- Better time of day
- Better lighting (unable to see slides) and paper hand-outs
- Shorter workshops/attend more than one

Promotion of the discourse

- Students' awareness of neuroscience
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- Neuroscience reading group and conference
- **Neuroscience of trust – occupational psychology**

Neuroscience of trust – occupational psychology

Harvard
Business
Review



ORGANIZATIONAL CULTURE

The Neuroscience of Trust

by Paul J. Zak

- *‘My group then spent the next 10 years running additional experiments to identify the promoters and inhibitors of oxytocin. This research told us why trust varies across individuals and situations. For example, high stress is a potent oxytocin inhibitor. (Most people intuitively know this: When they are stressed out, they do not interact with others effectively.) We also discovered that oxytocin increases a person’s empathy, a useful trait for social creatures trying to work together. We were starting to develop insights that could be used to design high-trust cultures, but to confirm them, we had to get out of the lab.’
Paul Zak (2017)*

The Neuroscience of Trust

	low				high	Possible action
Recognise excellence	1	2	3	4	5	
Induce 'challenge stress'	1	2	3	4	5	
Give people discretion in how they do their work	1	2	3	4	5	
Enable job crafting	1	2	3	4	5	
Share information broadly	1	2	3	4	5	
Intentionally build relationships	1	2	3	4	5	
Facilitate whole-person growth	1	2	3	4	5	
Show vulnerability	1	2	3	4	5	

The background is a complex, abstract composition of numerous thin, overlapping lines that radiate from a central point at the bottom. These lines are rendered in a variety of colors, including shades of blue, green, yellow, orange, and red, creating a vibrant, multi-colored effect. The lines have a textured, almost metallic or crystalline appearance, with many small, rounded droplets or beads of liquid-like material clinging to their surfaces. The overall effect is one of dynamic energy and intricate detail.

Trust within the organisation



High challenge, low threat....

Creating safe spaces

The background of the slide is a close-up photograph of a wooden surface, showing a prominent knot in the center. The wood grain is a mix of golden-brown and dark brown tones. The text is overlaid on a semi-transparent dark blue horizontal band.

Linked to...

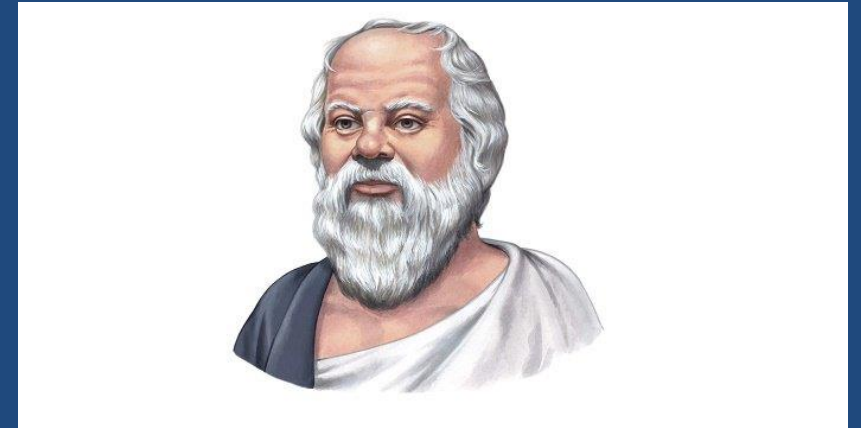
core purpose of the school and within teams

Promotion of the discourse

- Students' awareness of neuroscience
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- Neuroscience of trust – occupational psychology

Socrates

'The children now love luxury. They have bad manners, contempt for authority; they show disrespect for elders and love chatter in place of exercise.'



Questions

- Can you share good examples of how schools have promoted a discourse on neuroscience amongst staff and/or students?
- Do you feel there is an appetite in schools for staff to conduct action research on neuroscience?
- Are there specific topics staff are interested in conducting research?
- Teachers clearly require practical applications to empirical research; how can this be addressed by academies?