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Vision impairment and the city

Focus on Cerebral Visual Impairment

Professor John Ravenscroft
MHSES

Mobilities, Land use, and Transport (MLT) Network

Future Cities



We use Vision for: Access to Information

Distant
Near

Visual guidance of movement

Upper limbs: to reach and pick up something

Lower limbs: to walk with

Social Interaction

Can you see someone in a group?

Can you recognize a face?

Can you see the language within
facial expression

Implications
for
Learning,
Mobility,
& Transport



The Effects of Childhood Visual Impairment

- It can impact upon a child's development, education, employment and emotional and social prospects
- It has wide ranging effects upon the immediate family
- Far reaching effects throughout life
- Consideration of “VI years”
- Creates financial implications for society, impacting upon the provision of educational, social and health services as well as city development and mobility



What recent research tells us (1)

- Teoh, Lucinda J., et al. "Visual impairment, severe visual impairment, and blindness in children in Britain (BCVIS2): a national observational study." *The Lancet Child & Adolescent Health* 5.3 (2021): 190-200. ((N=788))
- Incidence of visual disability in the first year of life **was 5·19 per 10 000** children (95% CI 4·71–5·72), almost ten times higher than among 1-to-4-year-olds and between 20 times and 100 times higher than in older age groups.
- The overall cumulative incidence (or lifetime risk) of visual impairment, severe visual impairment, or blindness was **10·03 per 10 000** children (9·35–10·76).
- Incidence rates were higher for those from any ethnic minority group, the lowest quintile of socioeconomic status, and those born preterm or with low birthweight. 345 (44%) of 784 children had a single affected anatomical site.
- **Disorders of the brain and visual pathways affected 378 (48%) of 784 children.**



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So what are our representations of Children with visual impairment

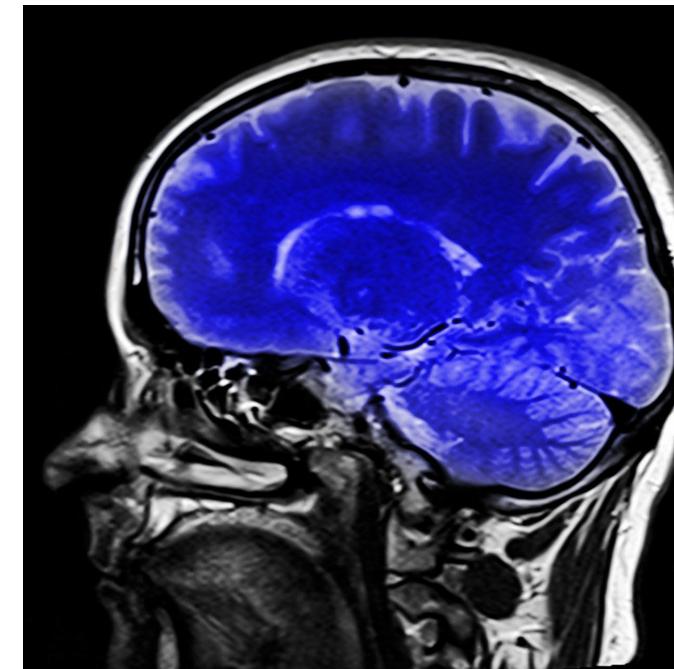


Misrepresentation:

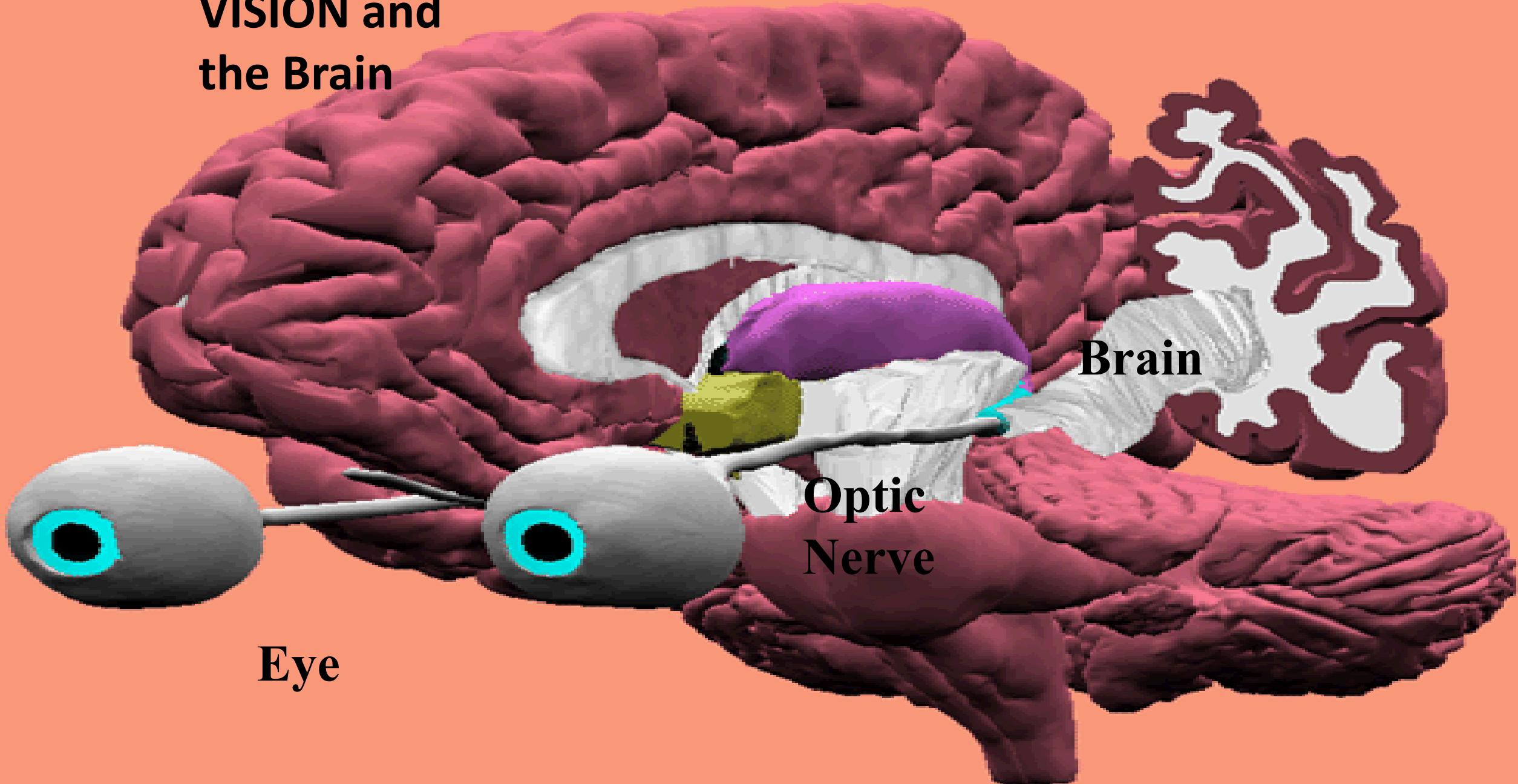
Ocular (VI) (eyes)



Cerebral (VI) (brain)

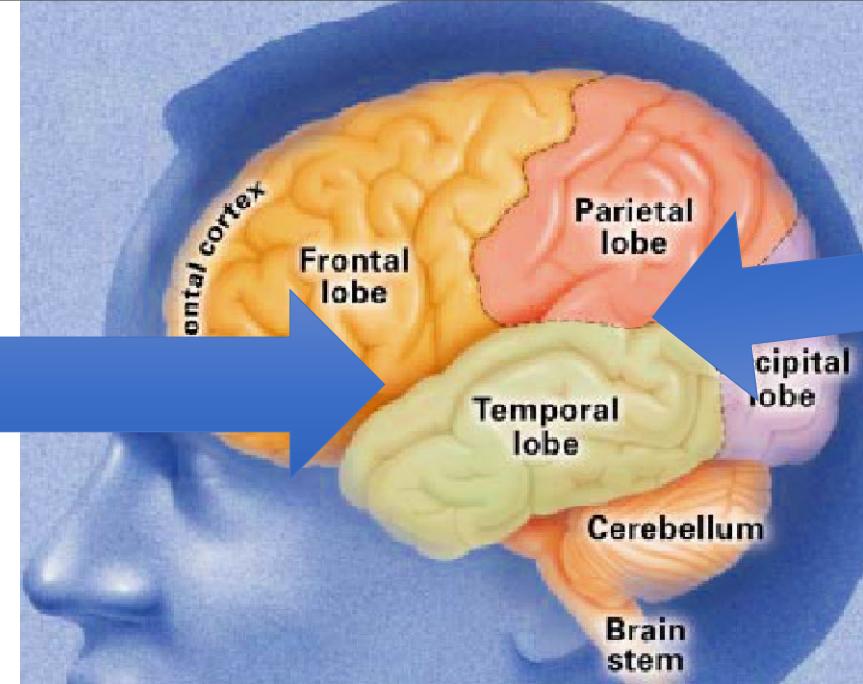


VISION and the Brain

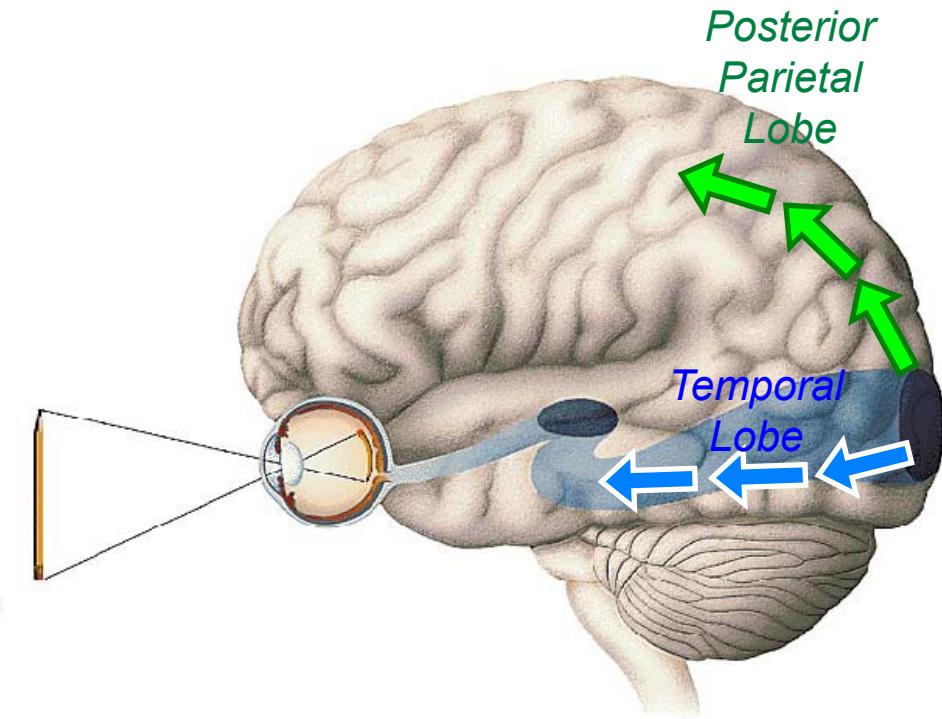
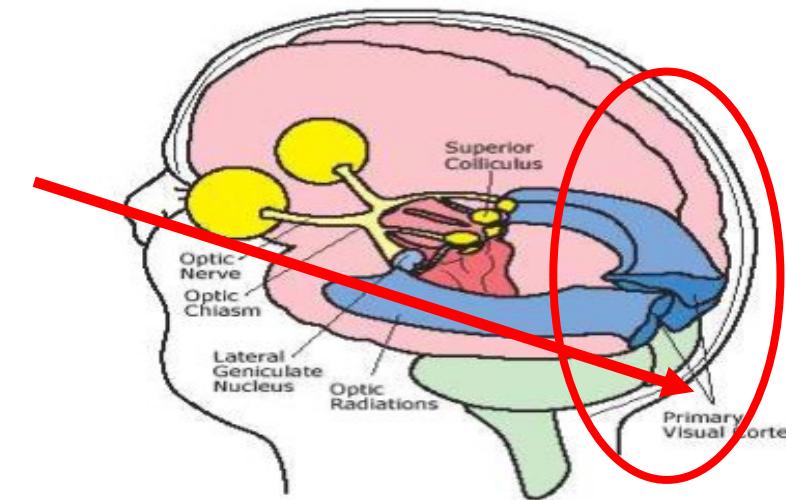
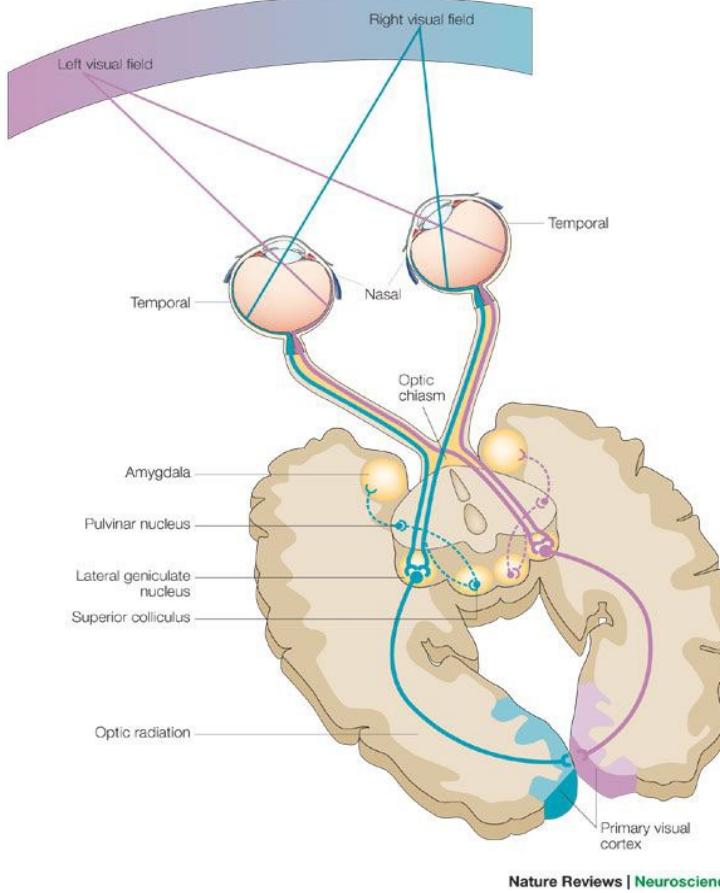


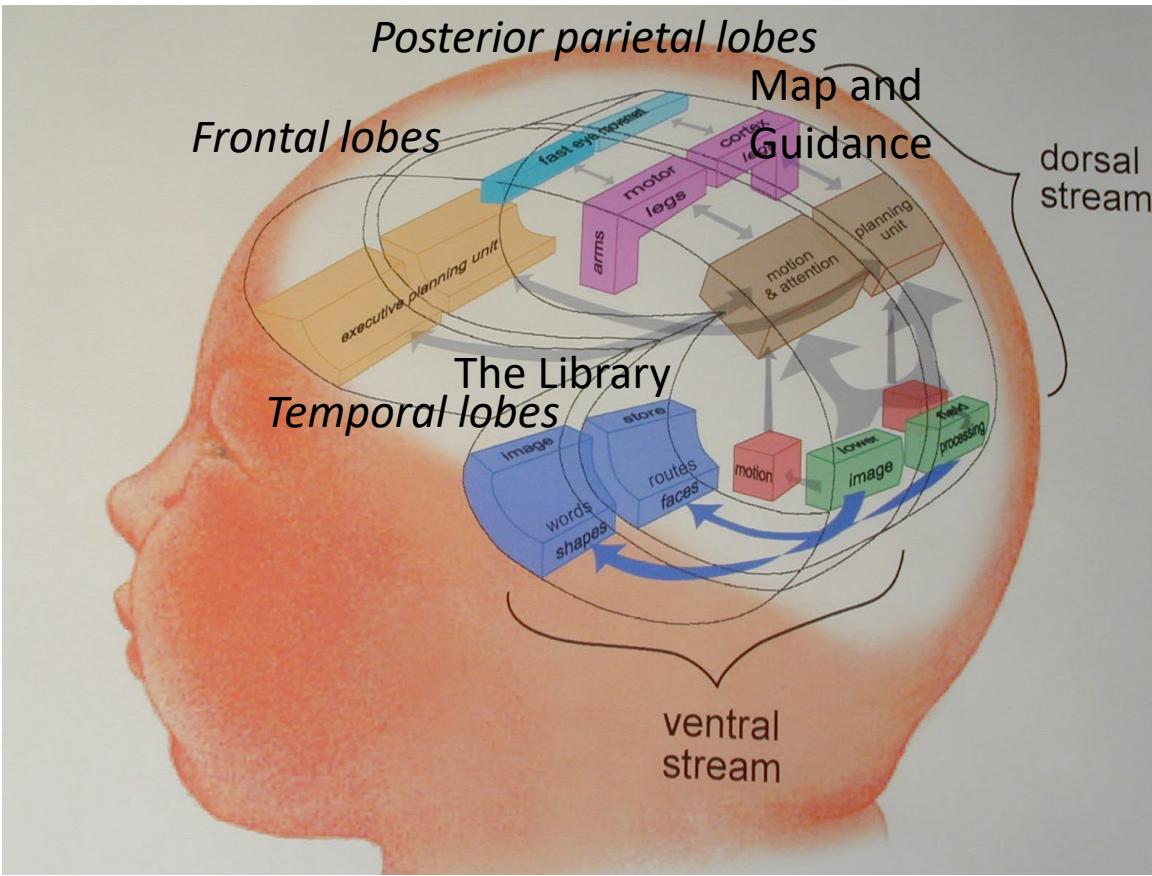


Vision Involves More Than The Eyes, and.....



Vision is Processed in Many
Parts of the Brain





Cerebral Visual Impairment(s)

Cerebral visual impairment is an umbrella term that describes deficiency in the functions of vision due to damage or malfunction of visual pathways and visual centers in the brain.

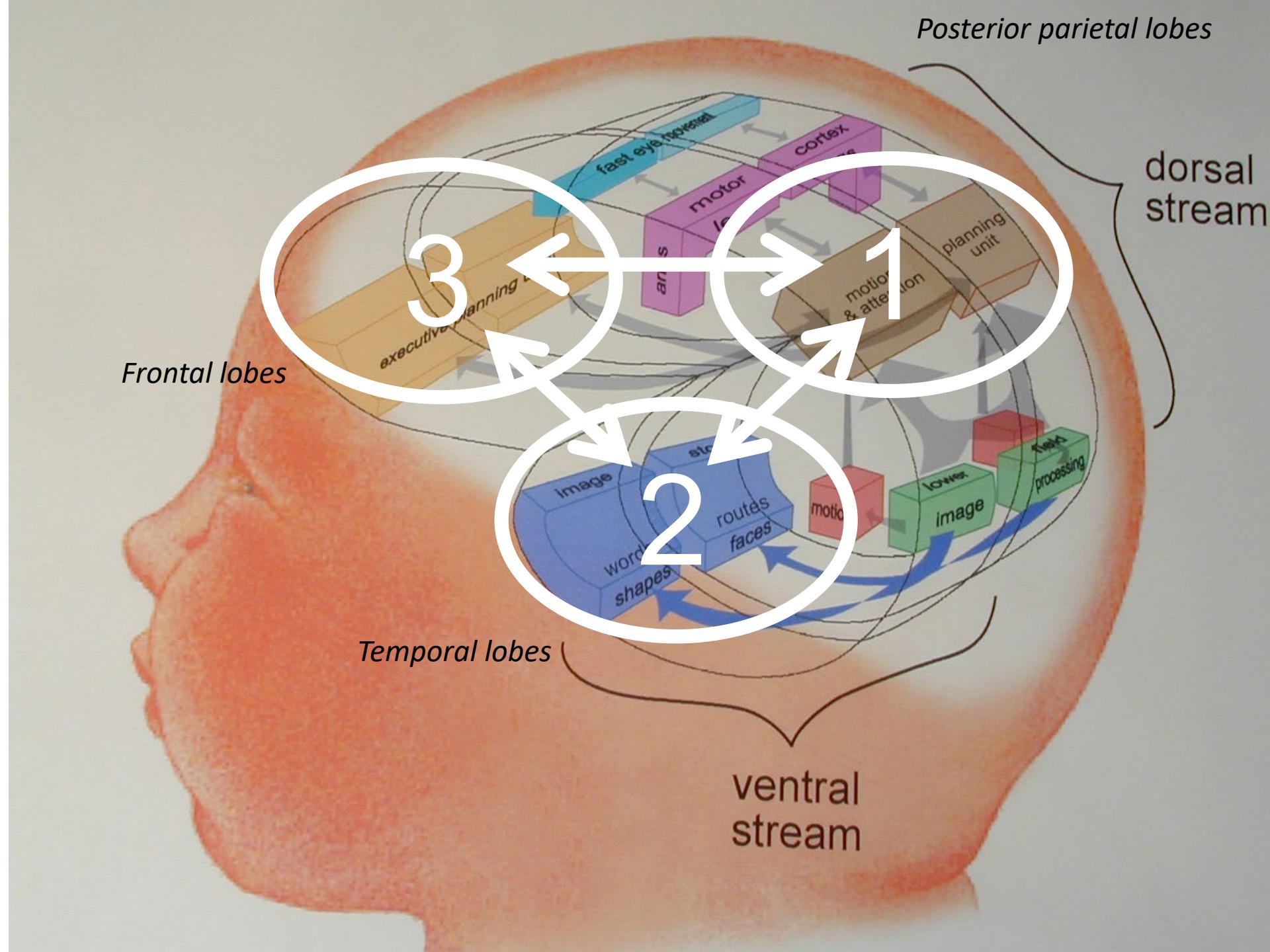
(Specifically those behind the lateral geniculate bodies), including the optic radiations, the occipital cortex and the visual associative areas, which may be accentuated by associated disorders of the control of eye movements).

Dutton GN & Lueck AH. (2016). Impairment of vision due to damage to the brain in A.H. Lueck & G.N. Dutton (Eds). Vision and the Brain: Understanding Visual Impairment in children NY: AFB Press.

Boot, F. H., Pel, J. J., Van der Steen, J., Evenhuis, H. M. (2010). Cerebral visual impairment: Which perceptive visual dysfunctions can be expected in children with brain damage? A systematic review. *Res Devel Disabil* 31, 1149–1159 .

Fazzi, E., Bova, S., Giovenzana, A., Signorini, S., Uggetti, C., & Bianchi, P. (2009). Cognitive visual dysfunctions in preterm children with periventricular lekomalacia *Devel Med & Child Neurol*, 51, 974–981

Ortibus, E. L., De Cock, P. P., & Lagae, L. G. (2011). Visual perception in preterm children: What are we currently measuring? *Ped Neurol*, 45, 1–10.





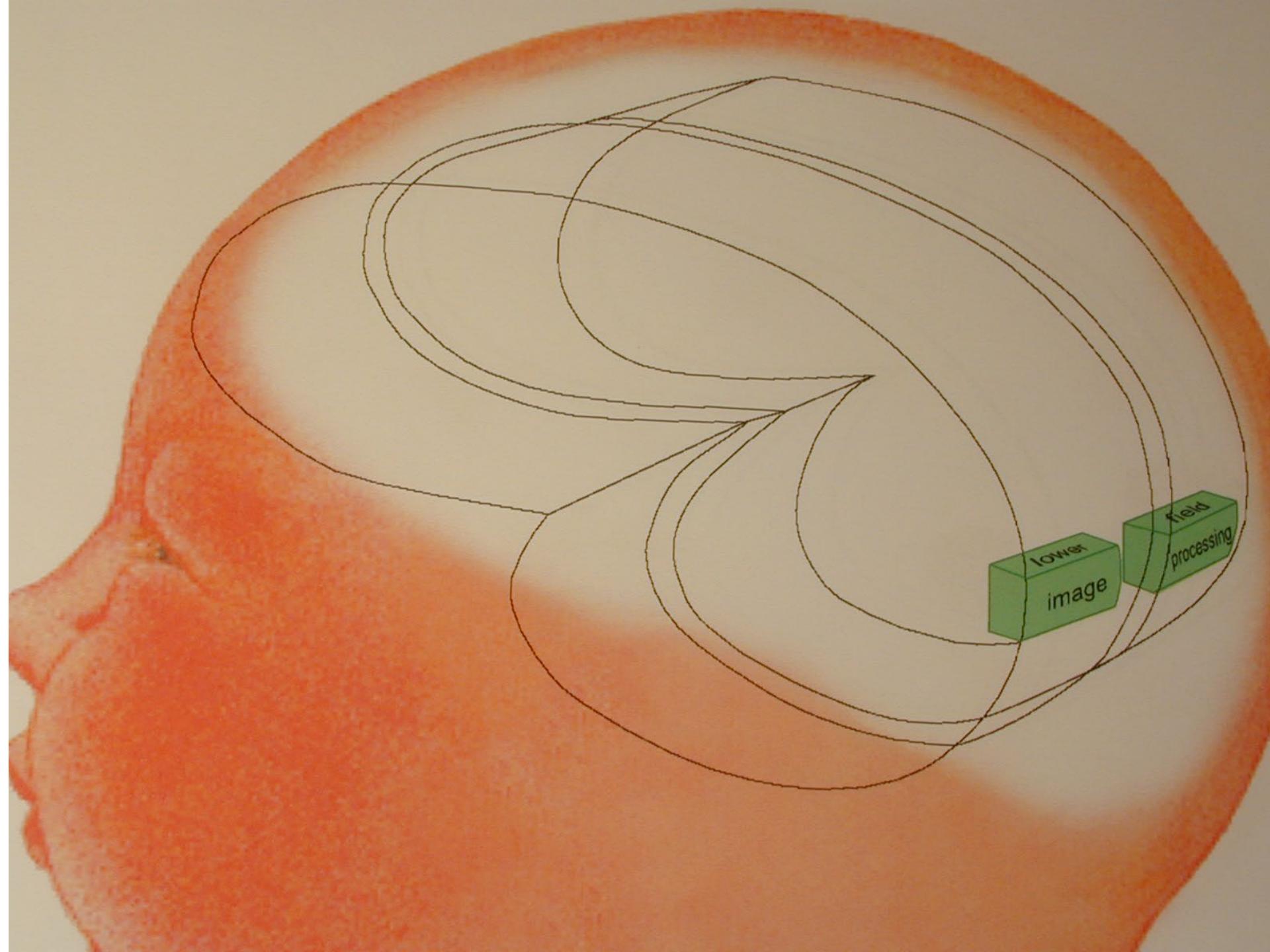
Now we have a seeing brain

- Cooperation of three areas of brain
 - 1 *Posterior parietal lobes: appraise overall visual scene*
 - 2 *Temporal lobes: recognise*
 - 3 *Frontal lobes: mediate choice*



What the Seeing Brain does

- Analysing the visual scene and giving attention
- Planning and bringing about visually guided movement
- Moving the map – neck and eye coordination
- Recognising what is seen
- Route finding
- Remembering what is seen and visual imagination
- Integrating of all these processes







Thanks to CVI Scotland for use of Images:
<http://https://cviscotland.org/>



CVI Traps

If fails don't worry
the person will fall
into the moving
car



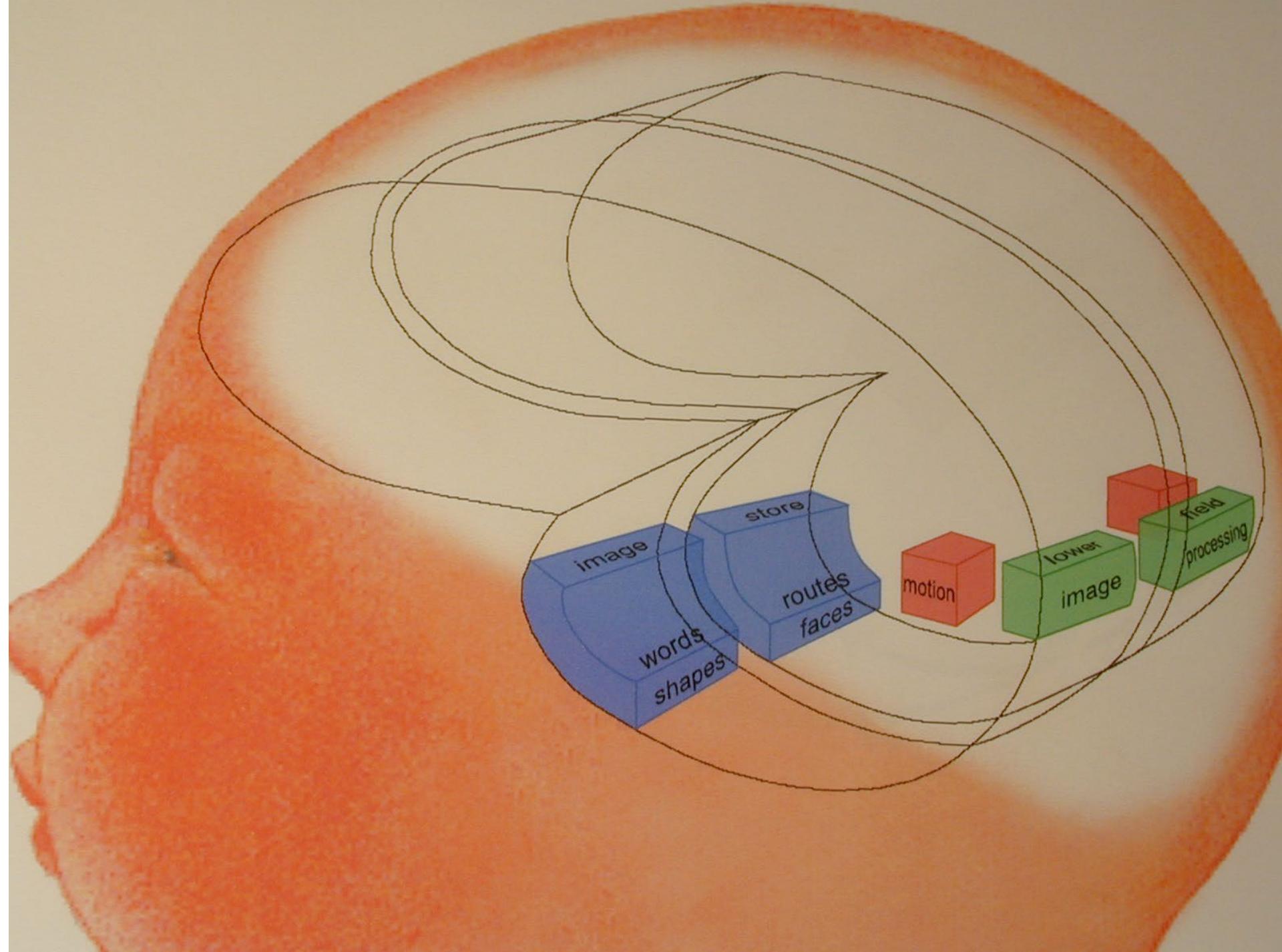
CVI Traps,
No real
contrast between road
and kerb

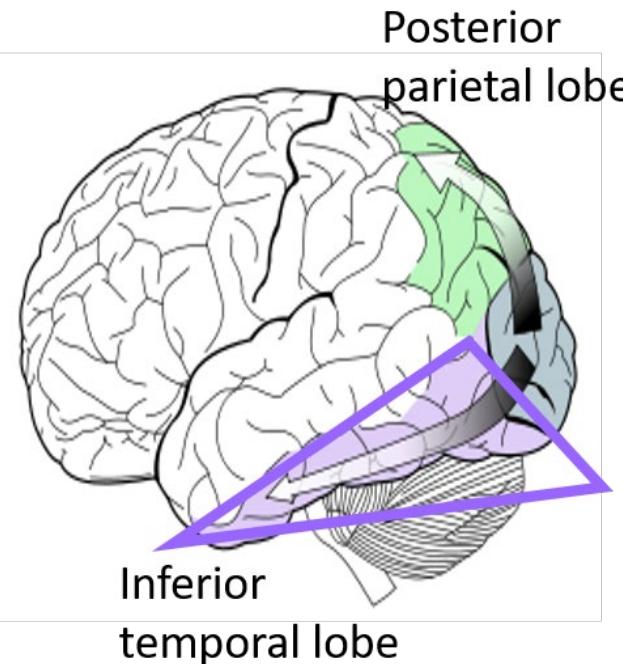
Who knows the height
of the Kerb



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The Ventral Pathways





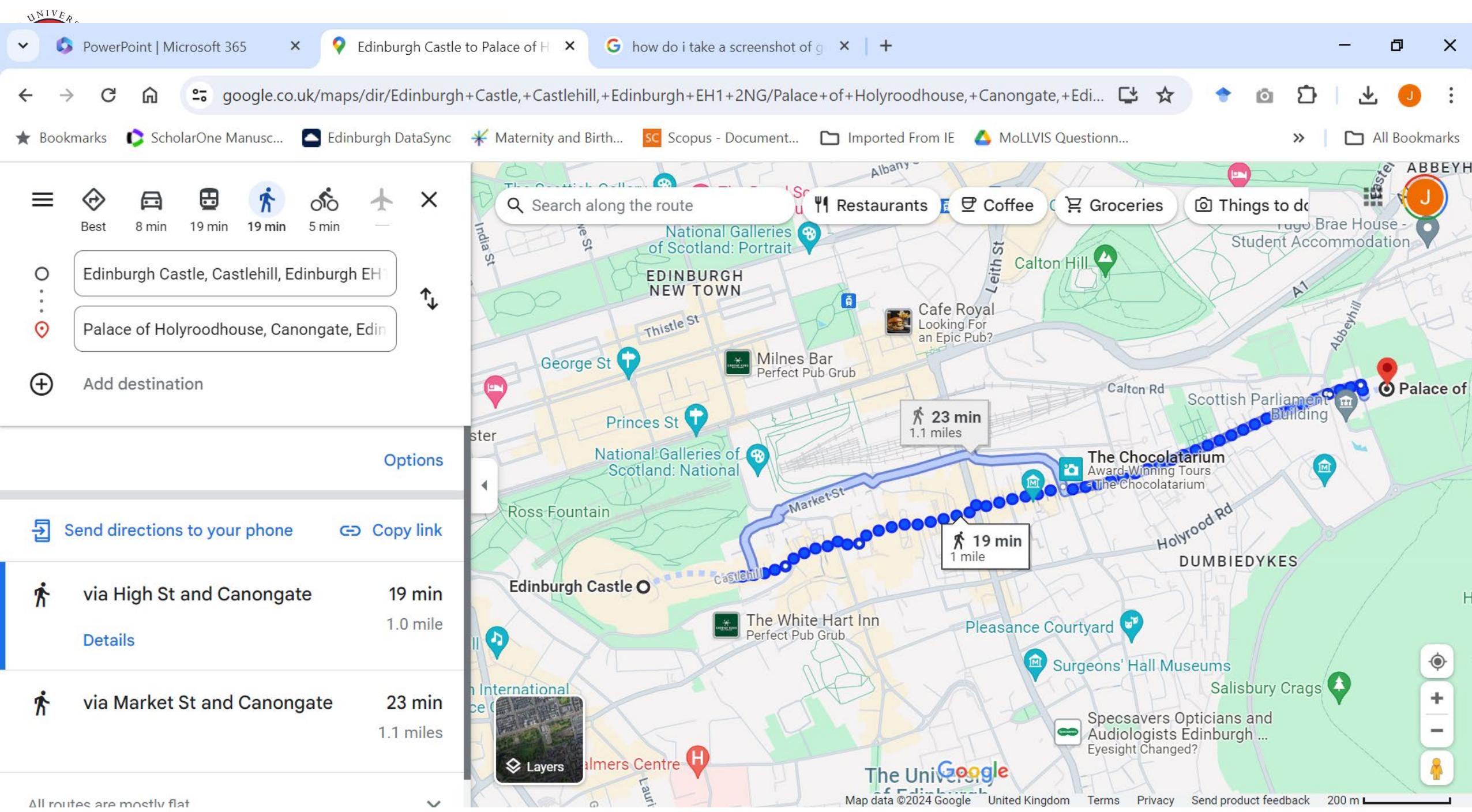
Ventral *What* Pathway

- Represents Colour
- Identifies Colour and Shapes
- Stores Visual Memory
- Visual “hard drive” for objects and faces performs visual comparisons.
- Requires Conscious awareness and has slower processing speed than the where pathway
- Helps in orientating between A+B



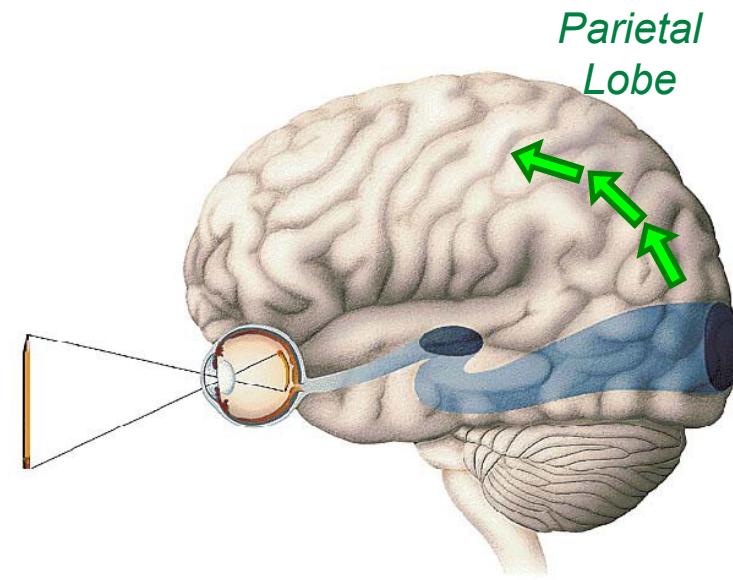
Difficulty with facial expressions





Dorsal Stream

- Occipital cortex to posterior parietal and frontal lobes
- Filtering out information from visual scene, giving selective attention to specific items
- Planning and execution movement within that scene



Impaired ability to handle complex visual scenes



A photograph of a busy urban street during the day. In the center, a white double-decker bus with "King's Head" and "Gateshead" written on its side is stopped at a red light. The street is filled with a dense crowd of people walking in both directions. To the right, there are several traffic lights, some showing red and others green. A red circular "No Entry" sign is mounted on a pole. In the background, there are buildings, trees, and more street signs. The overall atmosphere is one of a bustling city center.

iStock
Credit: georgeclerk

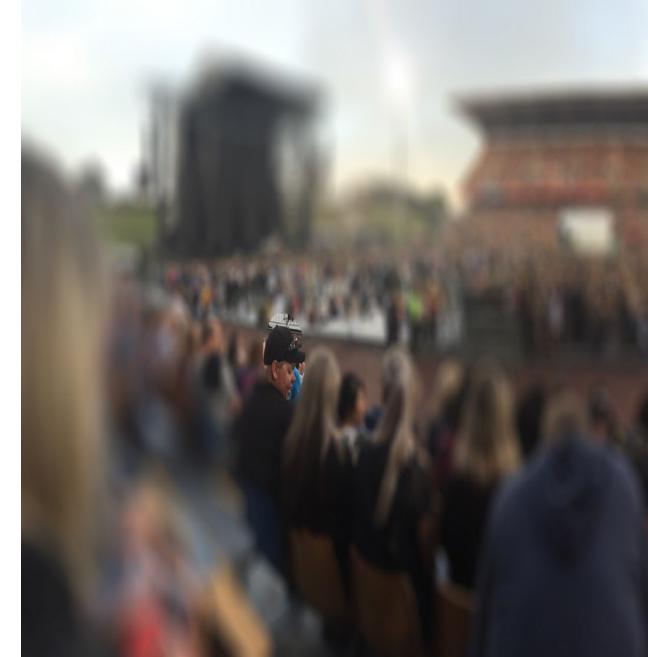






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Simultanagnosia



**A dramatically reduced visual
scene –
Significant Implications for learning**



Window

How much is visible to the person across their visual field



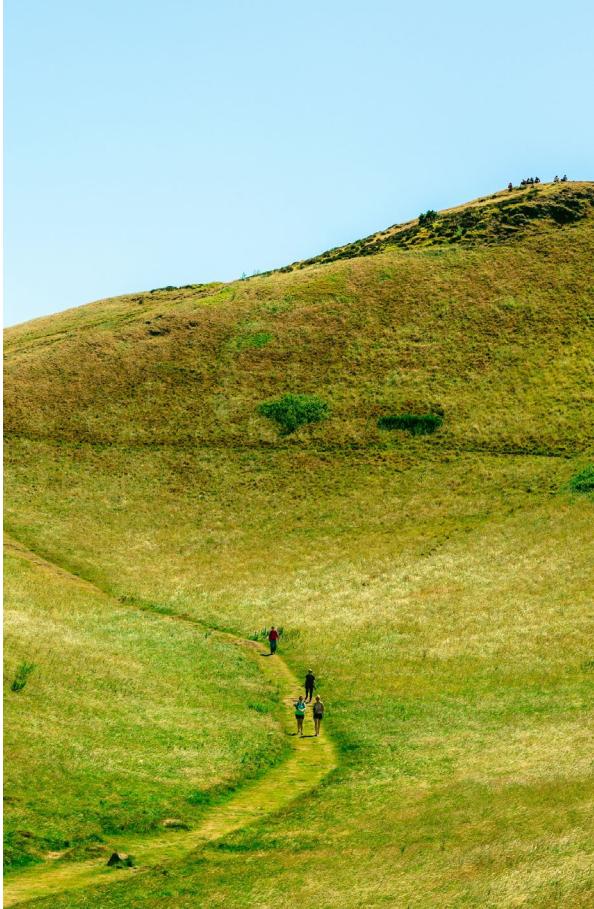
More to map and process, the
window gets smaller

Less to map and process, the
window gets bigger



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Edinburgh: Not all gloom and doom



Think of Transitions





Why this Matters

- 1) It is important to understand in any environment how do children with CVI perceive and experience their world with what is to them, normal vision.
- 2) We must not and should not transpose our visual experiences onto the child with CVI
- 3) We must understand what is accessible, perceivable, understandable, motivational, meaningful for each and every child.



- The built environment is no exception, think of the tension between space and clutter, between visual complexity and visual simplicity.
- What I haven't discussed is the impact of noise (or lack of it) on vision.
- The impact of movement for children with CVI



However,

- If we start to think of at least
 - Transitions
 - Moving from clutter to space then to space we are giving time for children with CVI to recover their vision.
 - Think of how people transition from pavement to road to kerb
 - Remove Lower Visual Field taps – high contrast (grey on grey not the solution)
 - Remove some of the visual stimuli that dominates the visual scene in Edinburgh
 - Don't fill up the empty space with Bunting, low level flags, shop A signs, Posters etc keep it empty
 - Or have CVI “maps” on how to get to A to B in a least cluttered environment



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And why is matters

- CVI is the most common form of childhood visual impairment in the UK.
- What we find is what is good for the child with CVI is also good for all.

Kong L, Fry M, Al-Samarraie M, Gilbert C, Steinkuller PG. An update on progress and the changing epidemiology of causes of childhood blindness worldwide. Journal of American Association for Pediatric Ophthalmology and Strabismus. 2012 Dec 1;16(6):501-7.

Philip SS, Dutton GN. Identifying and characterising cerebral visual impairment in children: a review. Clinical and Experimental Optometry. 2014; 97: 196-208



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Getting Back to Sooty.....





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Thank you

Contact:

john.ravenscroft@ed.ac.uk

Twitter (X) @johnnyravo