



CENTRE FOR
NEUROREHABILITATION

Rehabilitating Alexia: Practice-based therapy apps and aids for people with acquired alexia

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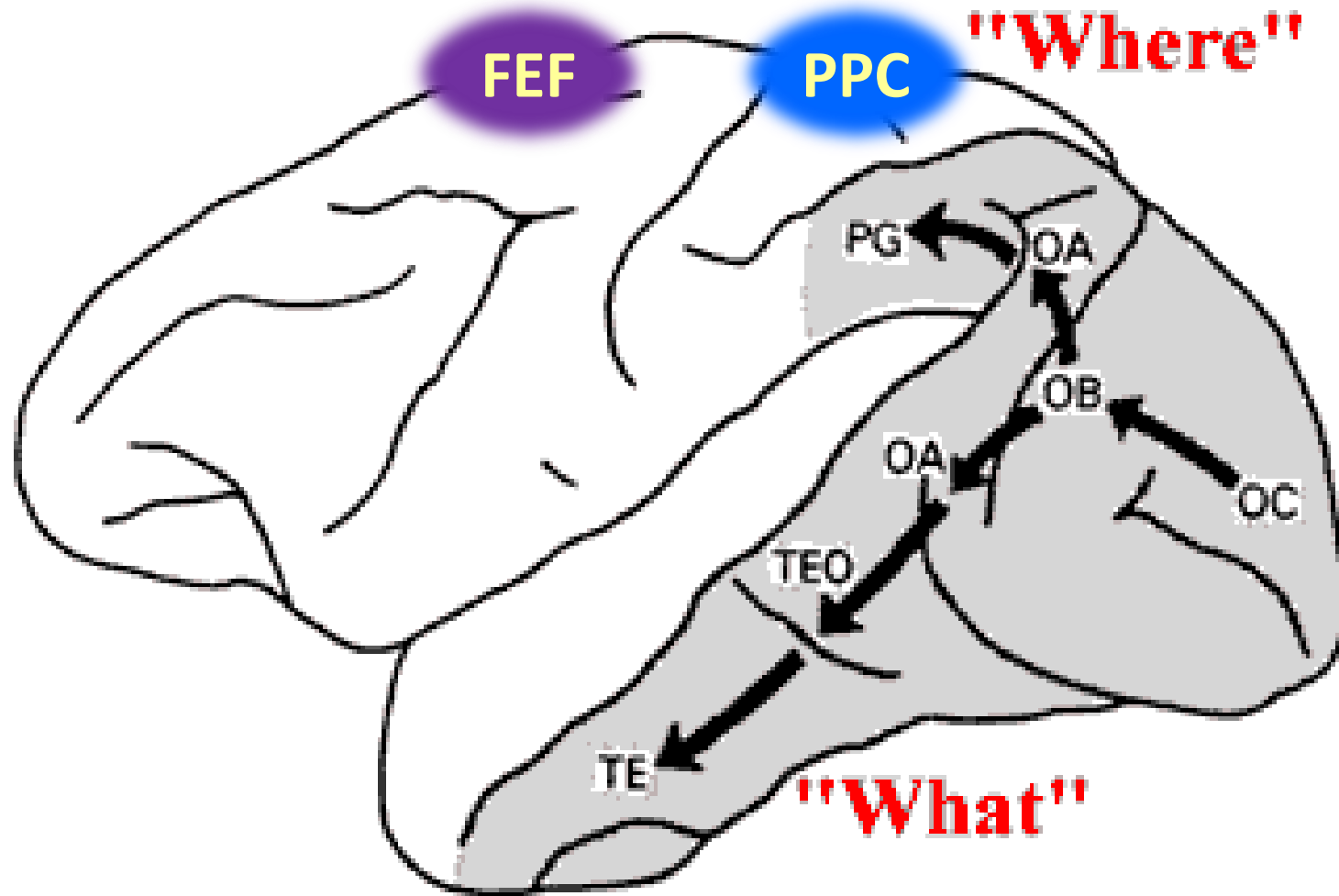
National Hospital for Neurology & Neurosurgery



Overview

- Anatomical basis of reading
- Difference between neurotherapeutics and aids
- Four main types of acquired alexia and app-based therapy/aids
 - Hemianopic alexia
 - Neglect dyslexia
 - Pure alexia (other language functions largely intact)
 - Central alexia (part of an aphasic syndrome)

Key brain regions involved in teading



Neurotherapeutics vs. Aids

Distinguish between

Neurotherapeutic

Aid



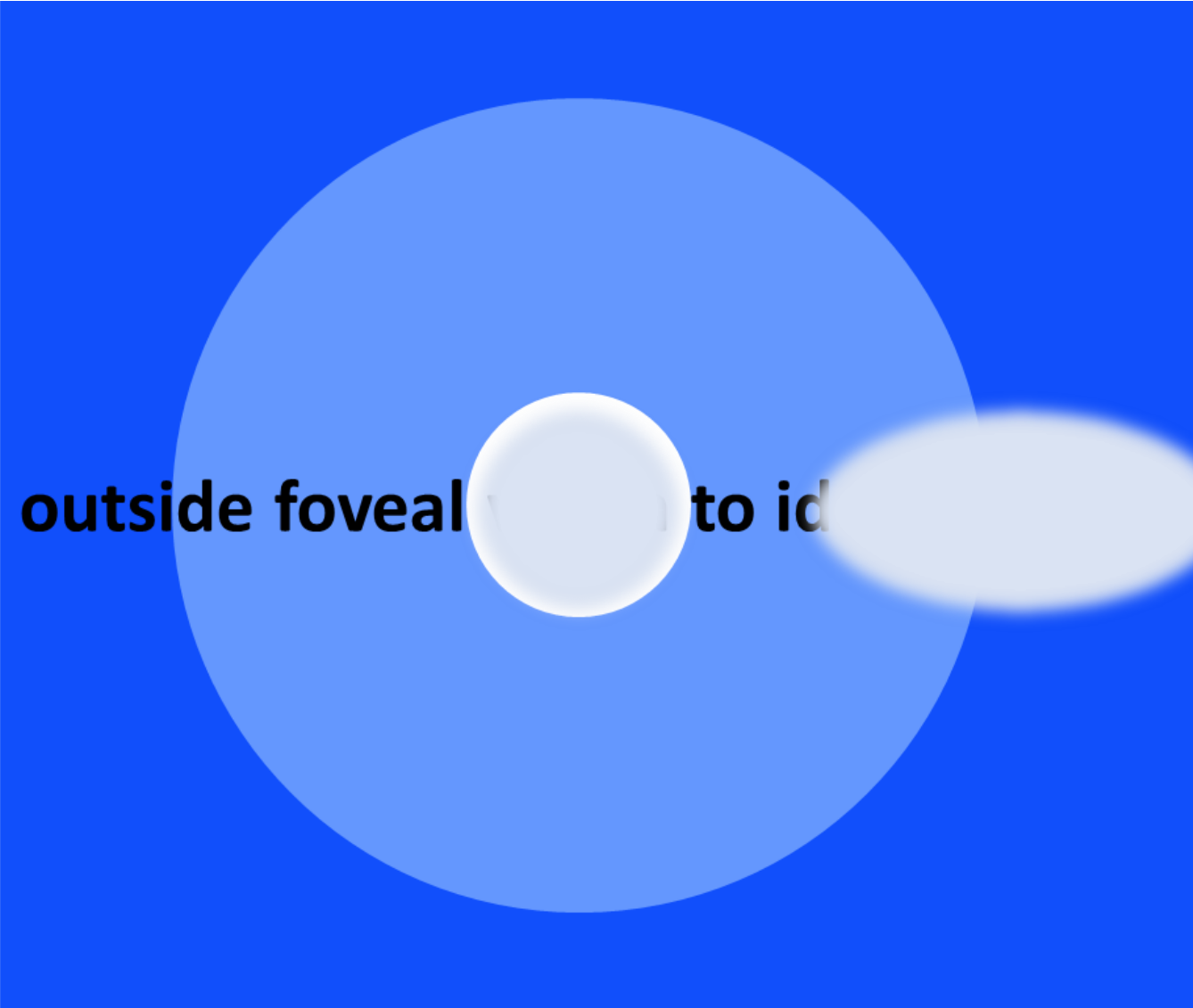
Lasting change



Plasticity



How do we read text?



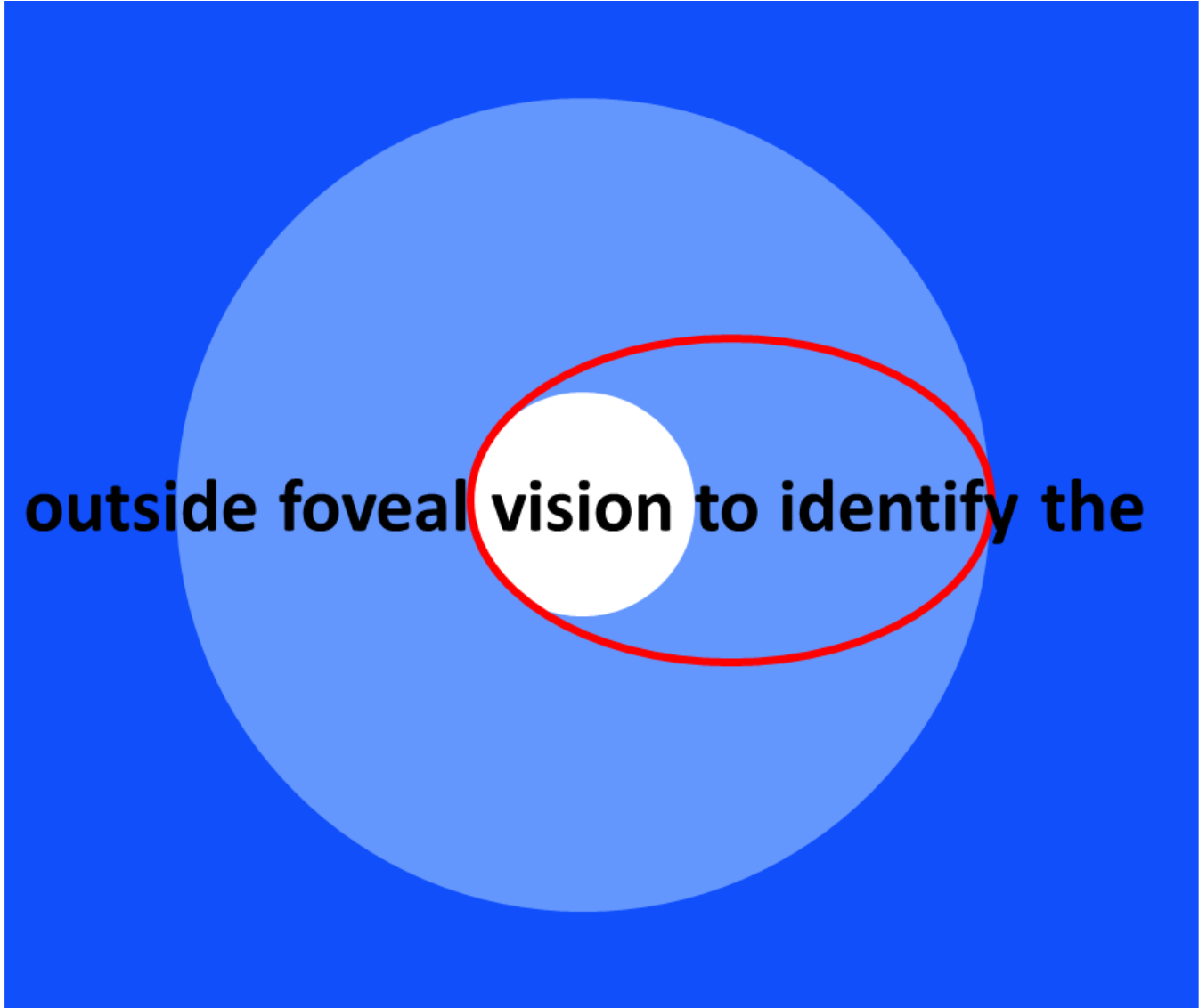
The diagram illustrates the visual field during reading. It features a large blue square background. In the center is a small white circle, representing the fovea. Surrounding this is a larger, light blue circle, representing the foveal region. The text 'outside foveal' is positioned to the left of the fovea, and 'to id' is positioned to the right. A horizontal, light blue oval shape extends from the fovea towards the right, representing the area of visual attention or the 'spotlight' of reading.

outside foveal to id

Eye movements limit reading speed



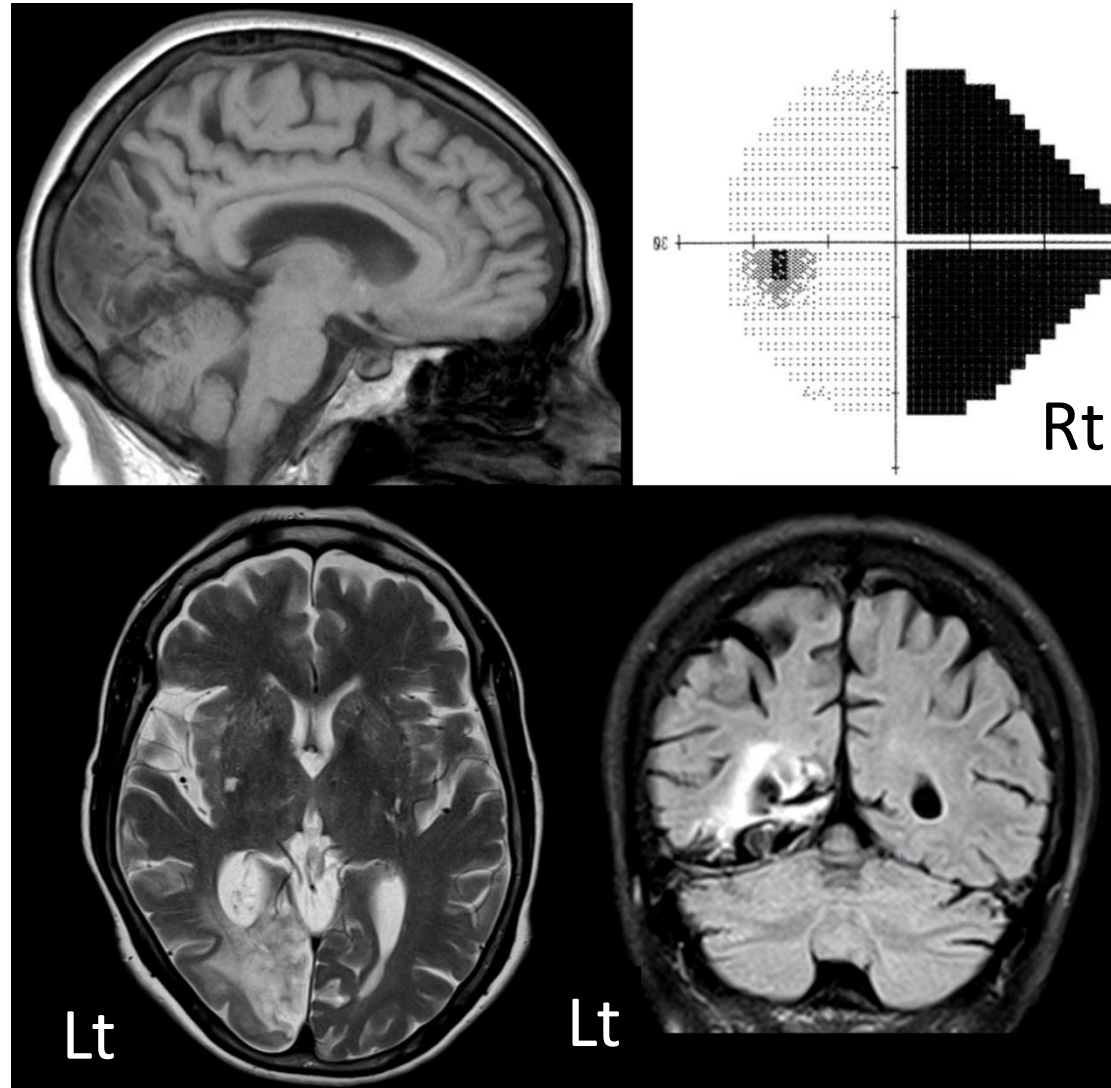
Word form identification and visuo-motor programming



The diagram illustrates visual fields with three concentric circles. The innermost circle is white and represents the foveal vision. The middle circle is light blue and represents the peripheral vision. The outermost circle is dark blue and represents the far peripheral vision. A red oval is drawn around the white circle, and the text "outside foveal vision to identify the" is written across it.

outside foveal vision to identify the

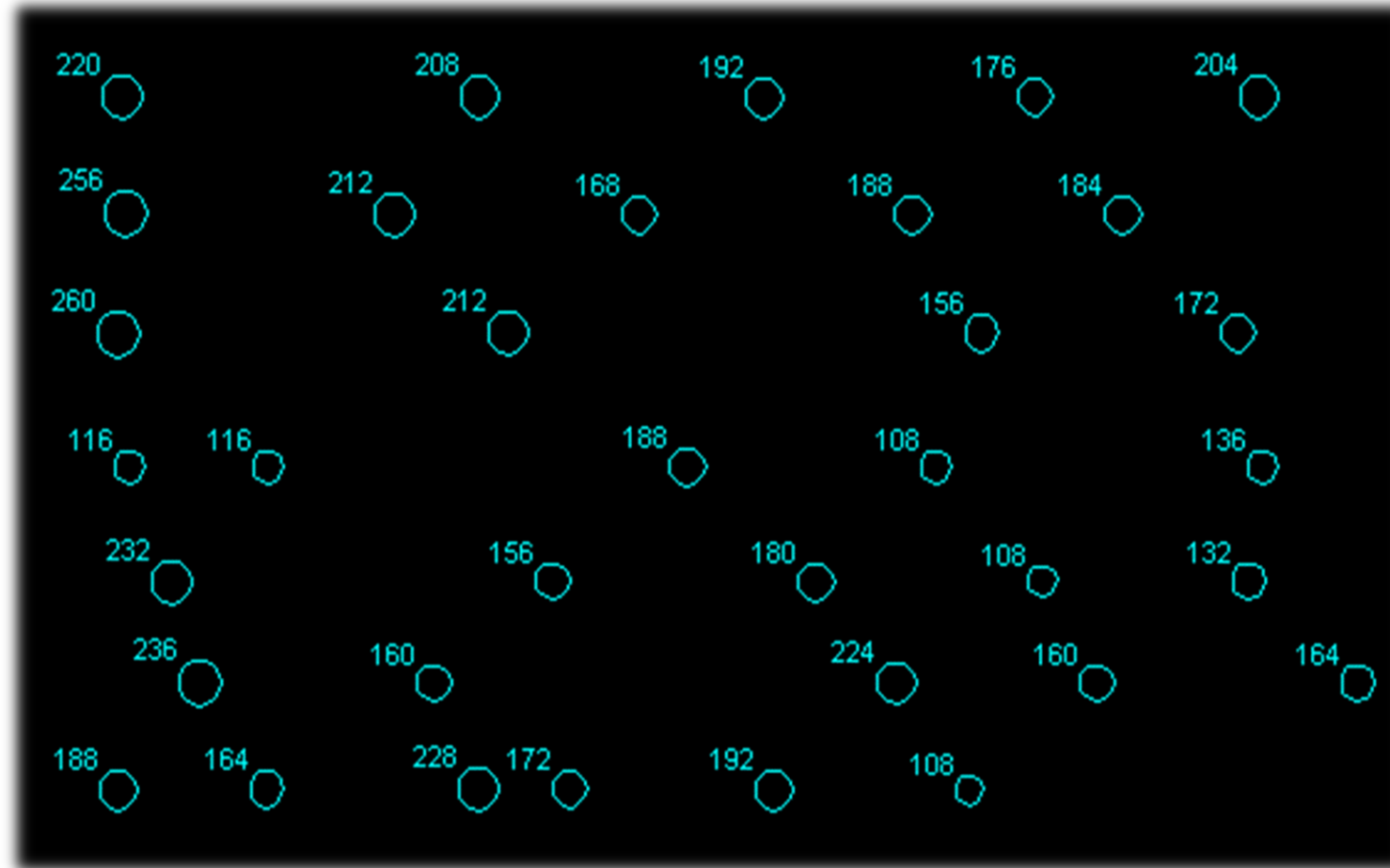
Hemianopia is caused by damage to the occipital cortex or its inputs



Eye movements when text reading

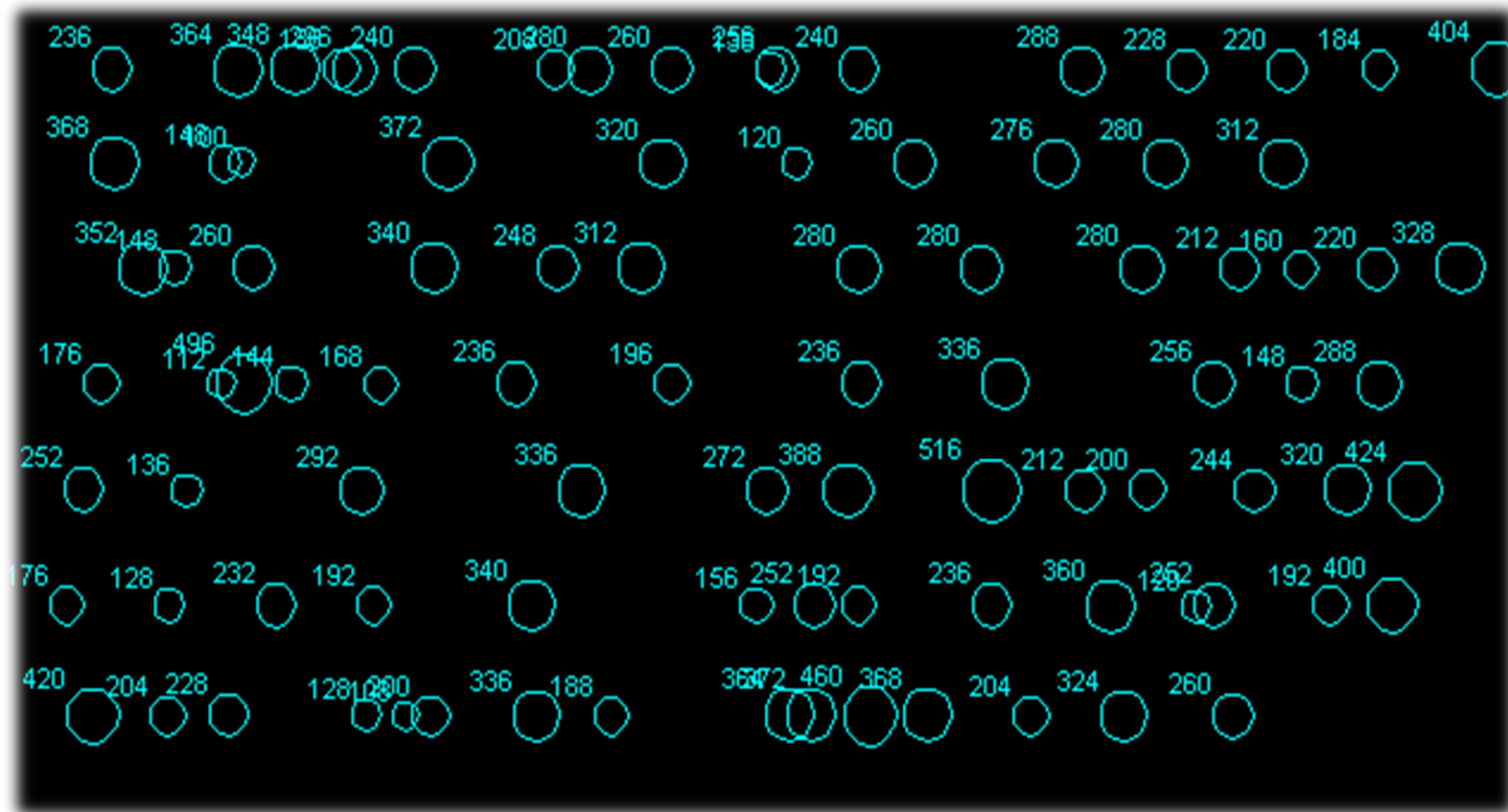
Passenger Paul Lynch stunned airport security staff when he proved his identity by showing them the cover of a Guinness Book of Records. Paul did not have any photo ID with him when he checked in at Stansted for a no-frills GO flight to Edinburgh.

Eye movements when text reading



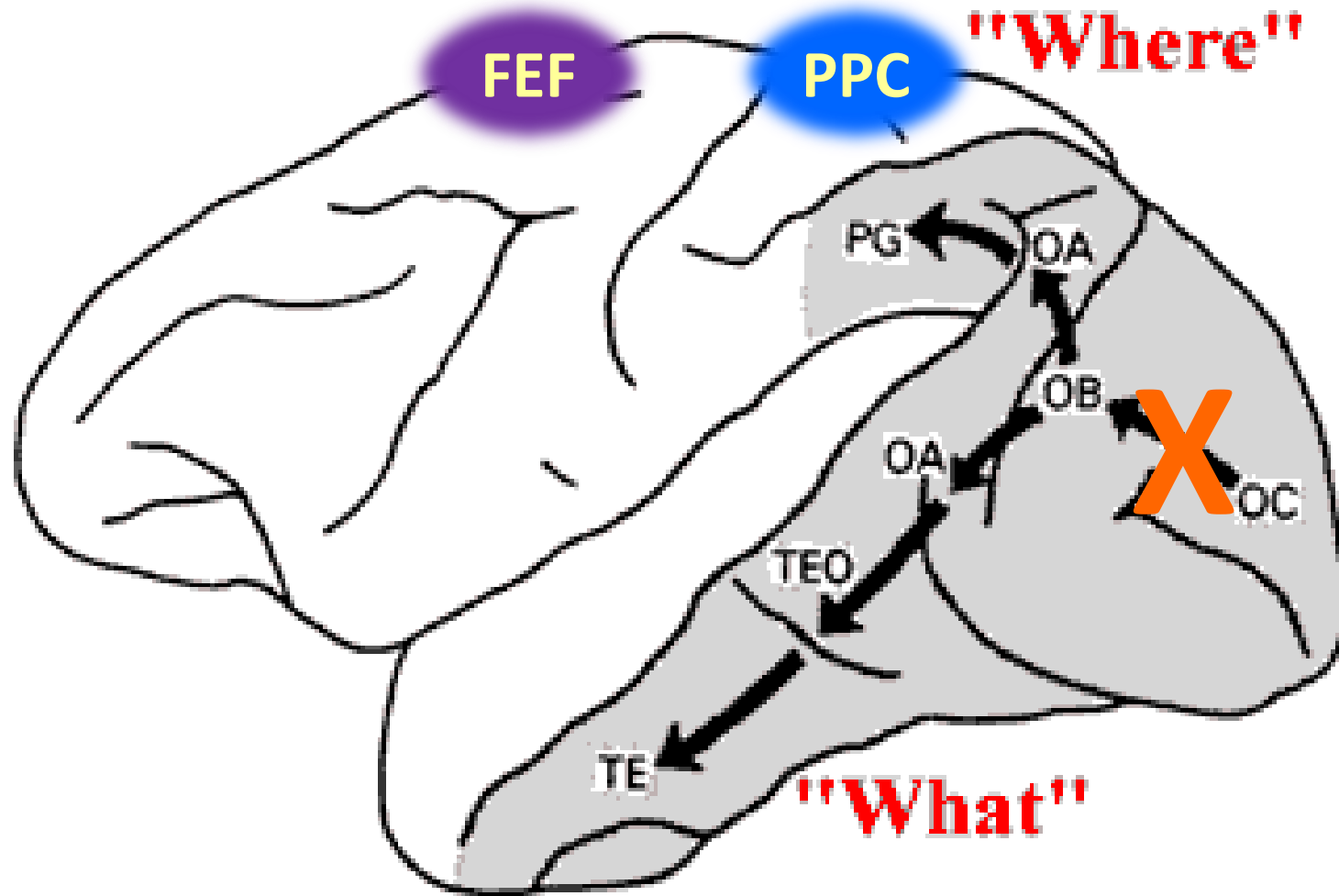
Normal text reading fixations: 36 fixations 45 words, ratio = 0.8

Eye movements: hemianopic alexia



Hemianopic alexia: 93 fixations 45 words, ratio = 2.1

Hemianopic Alexia: affects co-ordination of “where”



www.readright.ucl.ac.uk

Read-Right - Hemianopic Alexia Therapy

UCL Queen Square Institute of Neurology

[Help](#)



Welcome To Read-Right

Get Started

Read-Right is a therapy which can help to improve reading speeds in patients with Hemianopic Alexia.



[Sign in with Google](#)

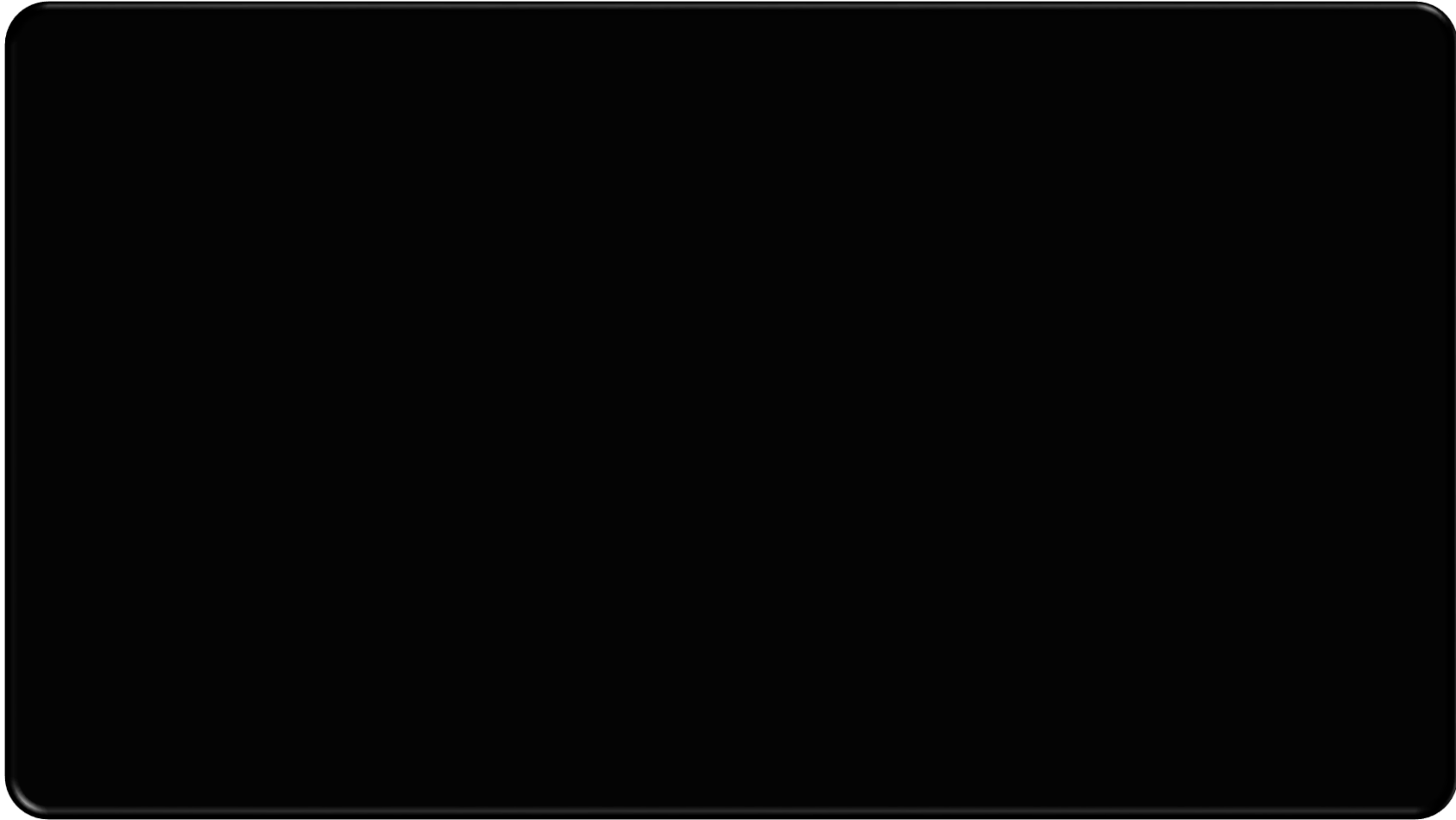
Find Out More

[+ What is Read-Right?](#)

[+ What is hemianopic alexia \(HA\)?](#)

[+ Does Read-Right work?](#)

R-R: induces small-field optokinetic nystagmus



Text reading test (1^o outcome)

**Read-Right Hemianopic Alexia Therapy**
UCL Institute of Neurology | UCL Multimedia

Passage 1 of 3

Before you start, make sure you see the whole red frame.

Click the button below when you are ready to read the passage.

Click the button again when you have finished reading.

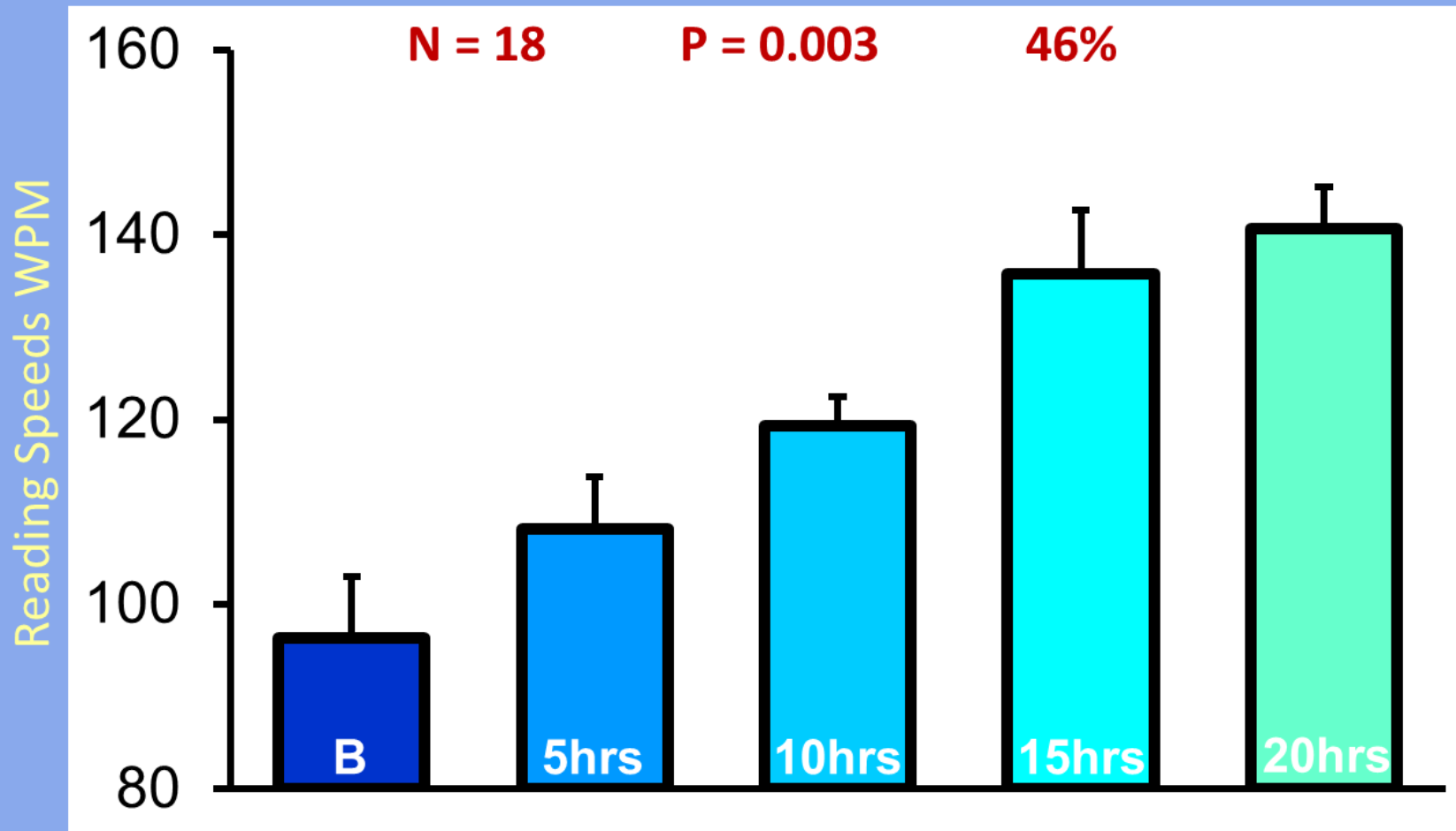


The number of drivers caught by speed cameras has topped a million for the first time. Much of the money generated will be spent on more speed traps. The news will outrage drivers who claim cameras are used to raise cash and not as a deterrent to improve safety.



R-R: dose effect n=33

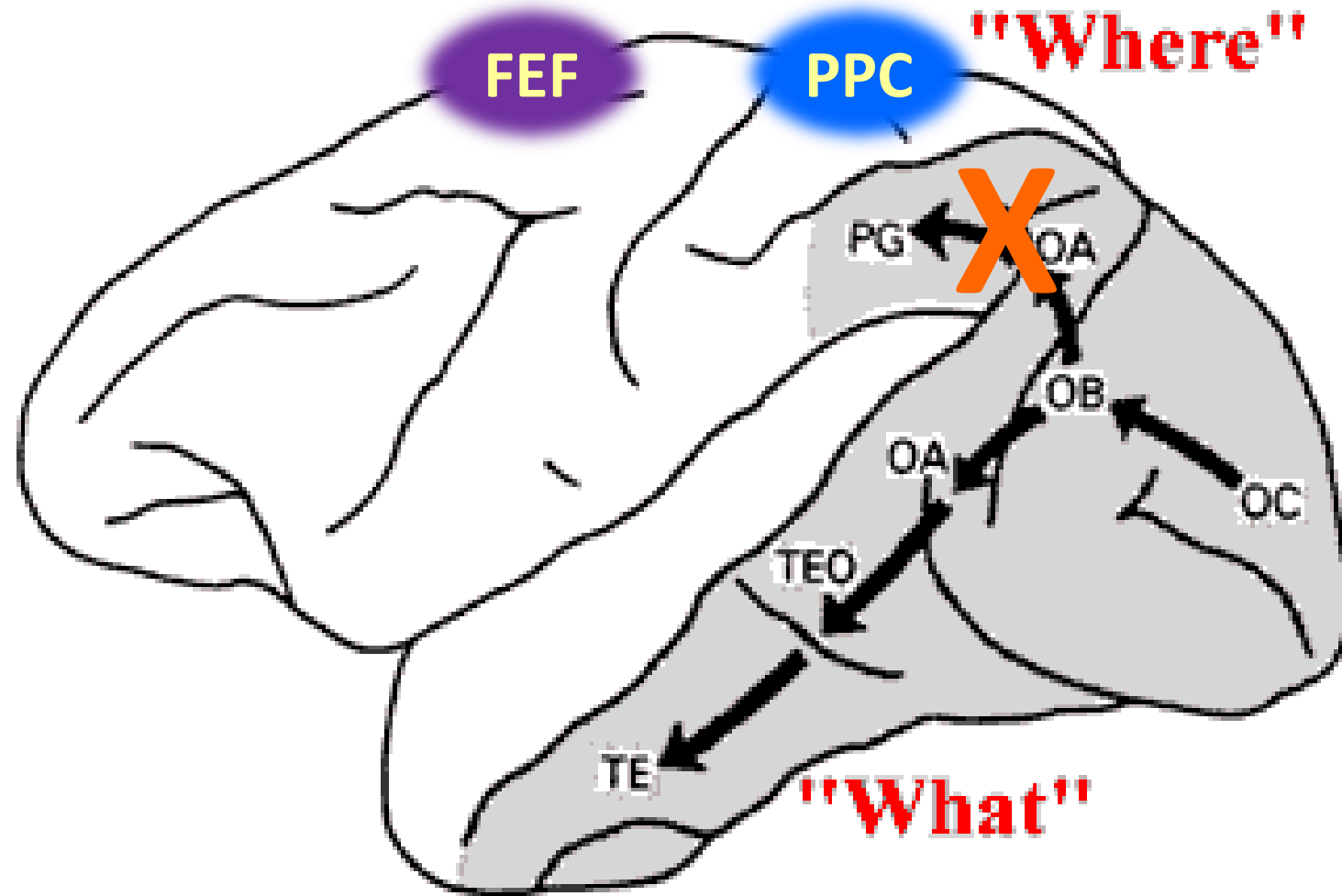
Normal reading speed (38 age-matched controls) = 302 wpm [80] SD



Ong (2012)

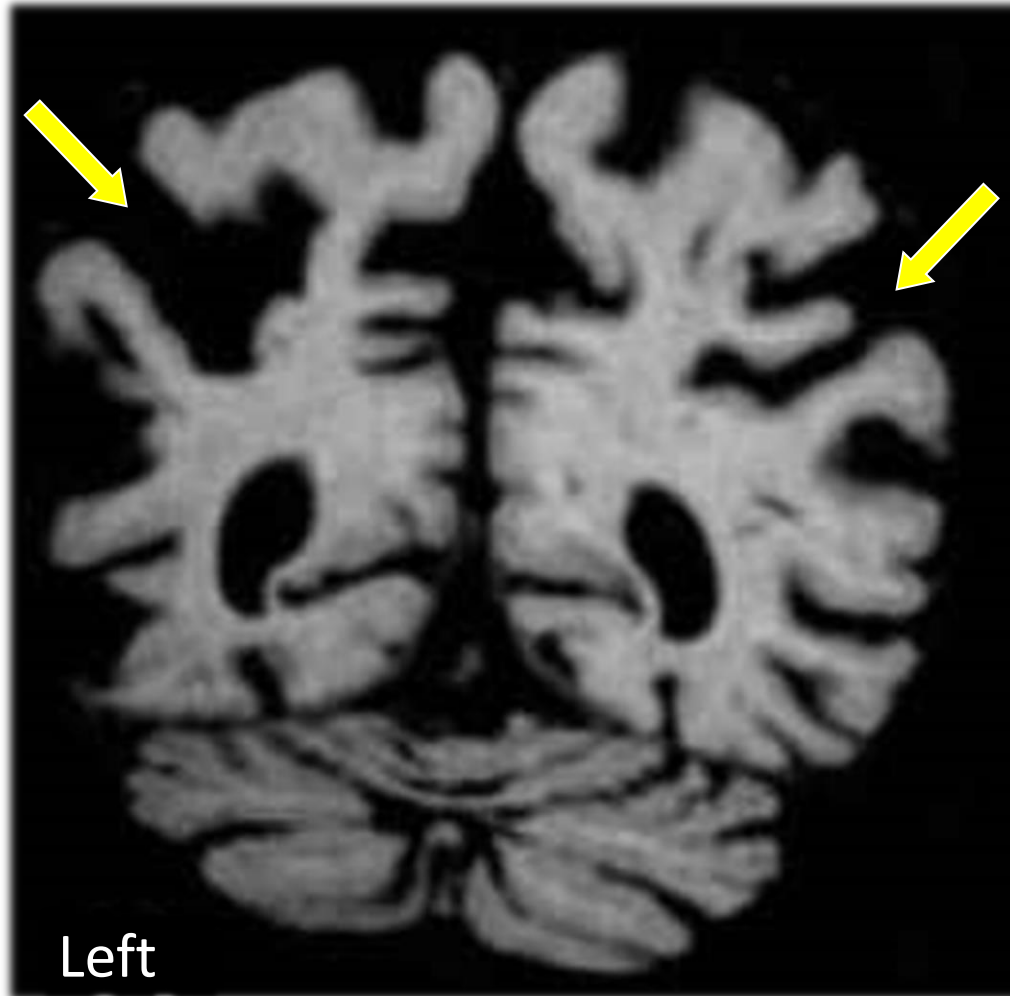
Bars = within-subject SEM

Neglect Dyslexia: affects “where”



Patient with Posterior Cortical Atrophy (PCA)

Damage to the dorsal “where” stream



PCA: getting lost on the page

1. tAD

The most outspoken judge on the US Supreme Court has defended the use of some physical interrogation techniques. The judge told the BBC that "smacking someone in the face" could be justified if there was an imminent threat.

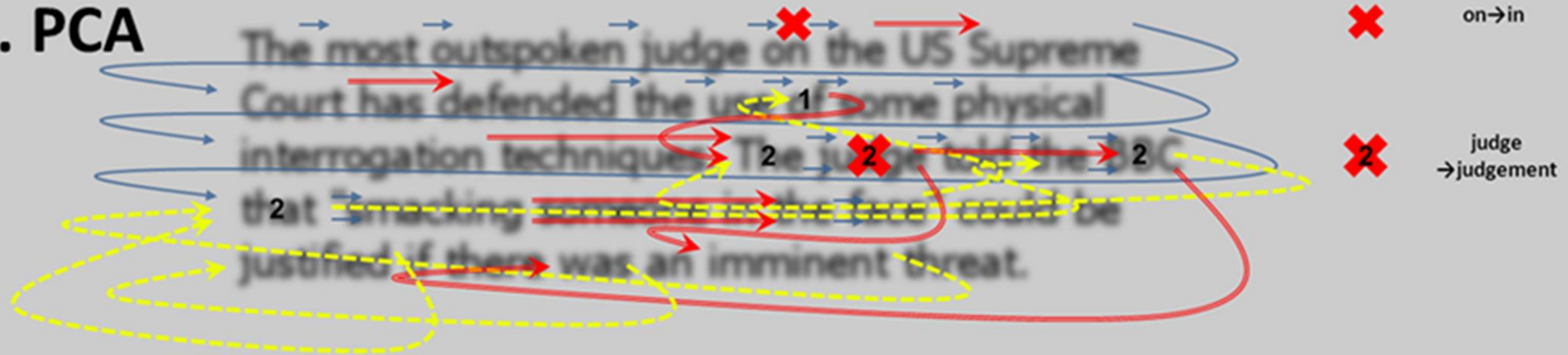
"You can't come in smugly and with great self-

"The most outspoken judge on the US Supreme Court has defended the use of some physical interrogation techniques. The judge told the BBC that "smacking someone in the face" could be justified if there was an imminent threat. You can't..."

tAD = typical Alzheimer's Disease patient, control

PCA: getting lost on the page

2. PCA



"The most outspoken judge in the Supreme Court defended the use of some -- physical interrogation. The judge told the BBC that "smacking the face" of the- judgement BBC the judge imminent that the BBC was- justified that- smacking the face.."

Normal

Premature

Backward

PCA: getting lost on the page

3. PCA

The most outspoken judge on the US Supreme Court has defended the use of some physical interrogation techniques. The judge told the BBC that "smacking someone in the face could be justified if there was an imminent threat."

"You can't come in smugly and with great self-satisfaction and say 'Oh it's torture, and therefore it's no good'," he said in a rare interview. He also accused Europe of being self-righteous over the death penalty.

In the interview with the Law in Action programme on BBC Radio 4, he said it was "extraordinary" to assume that the ban on "cruel and unusual punishment" also applied to "so-called" torture.

✗ threat → treaty

Normal

Premature

Backward

"The most outspoken judge in- the- Supreme Court has defended- Supreme----- the most- the BBC could be in the face could threat imminent treaty- with great self--- cruel- so cruel so Action--- Europe self- being- applied so- punishment Radio 4.."

Read Clear: a digital reading aid

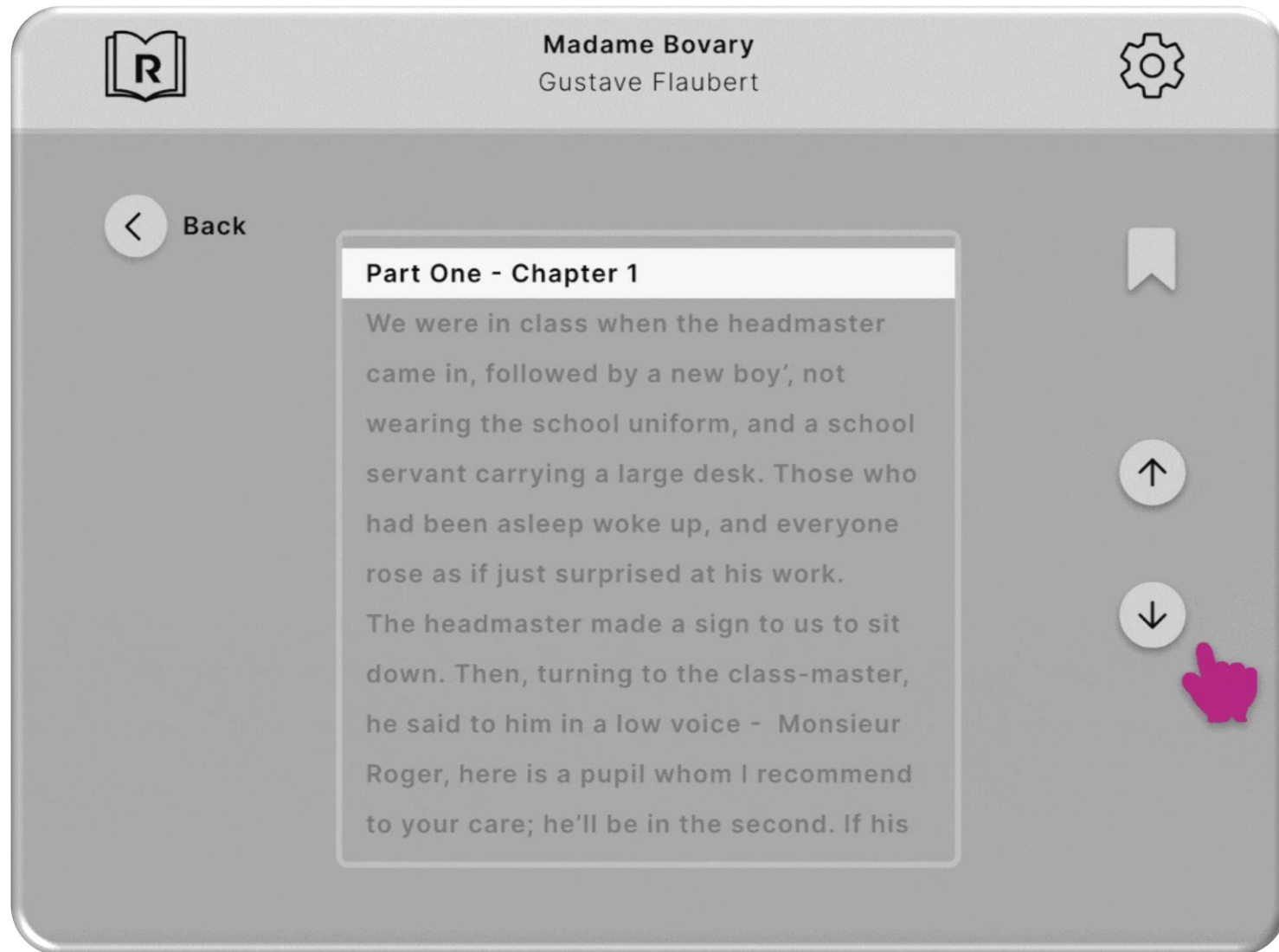


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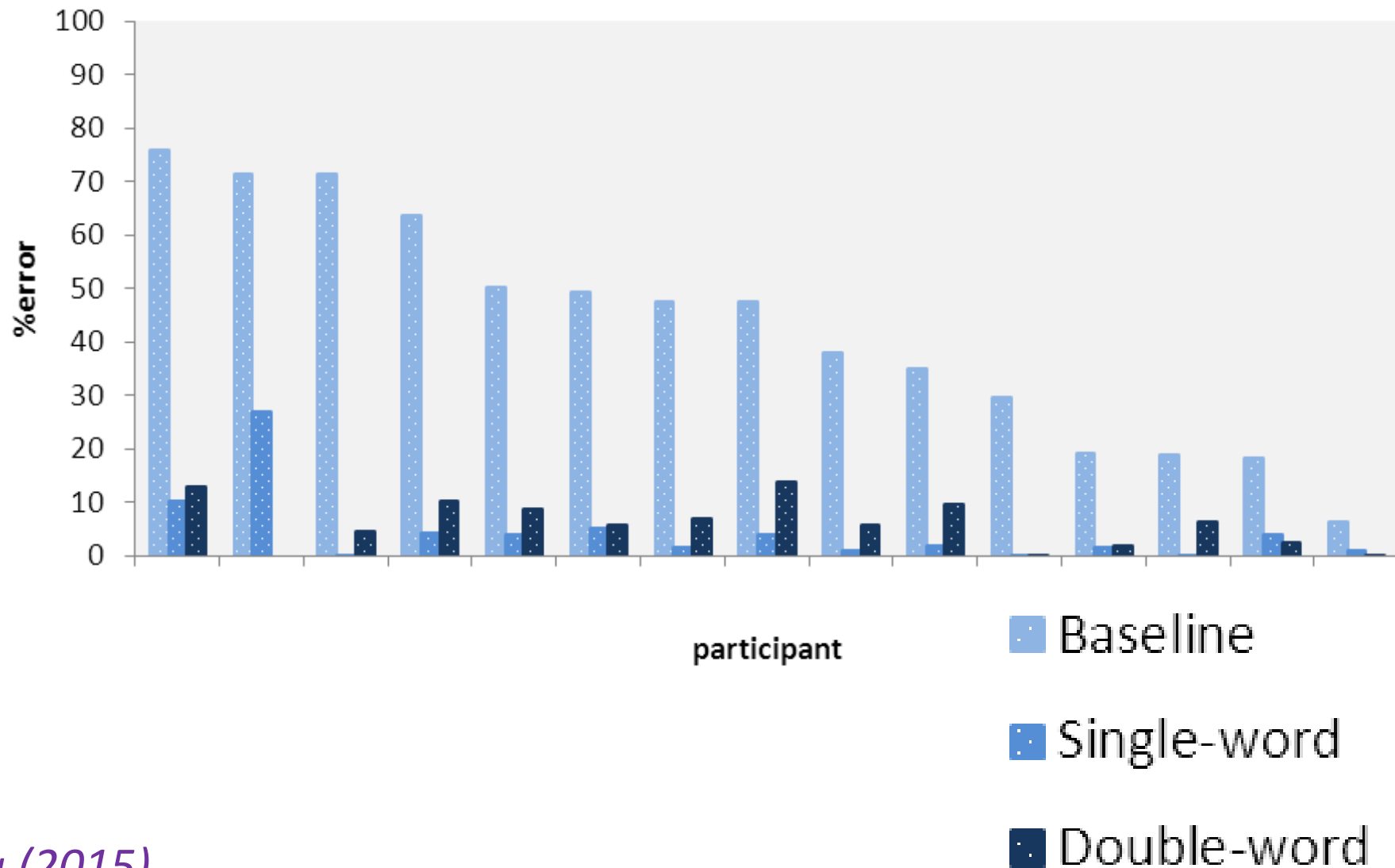
**A digital reading aid
for people with
neurological
visual impairment**



cortex or its inputs

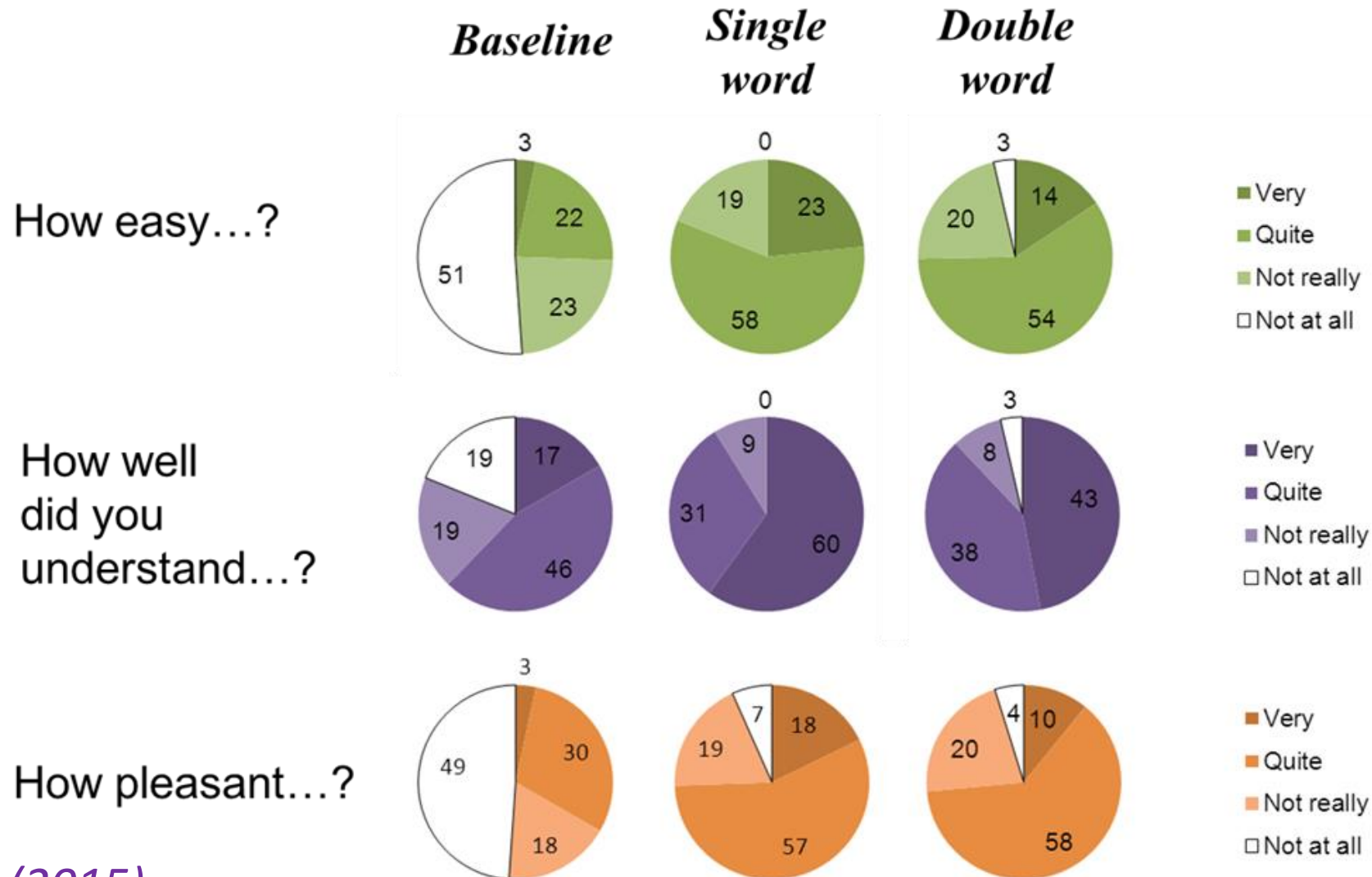


Read-Clear: within-subject analysis



Yong (2015)

Read-Clear: within-subject analysis

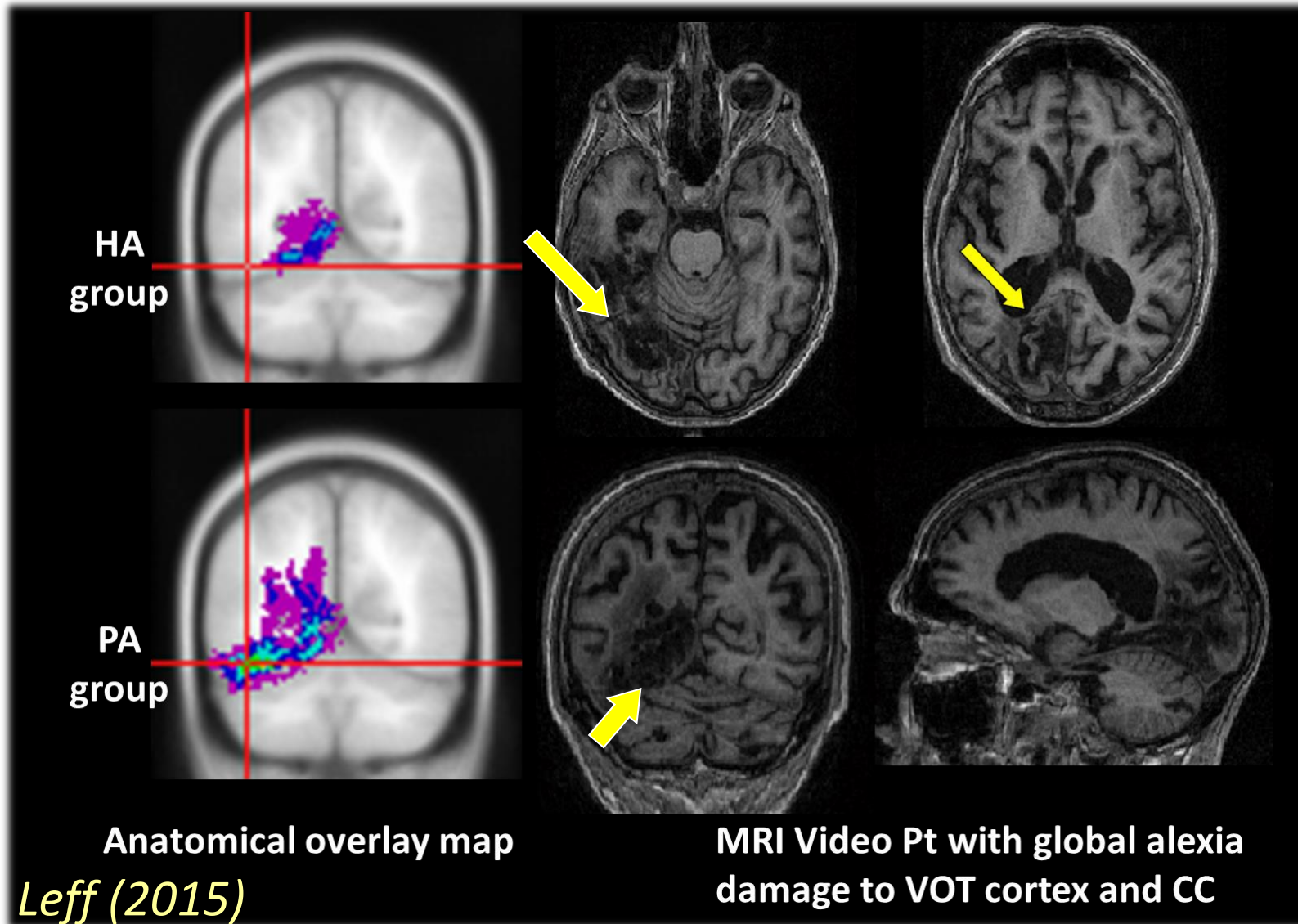


Yong (2015)

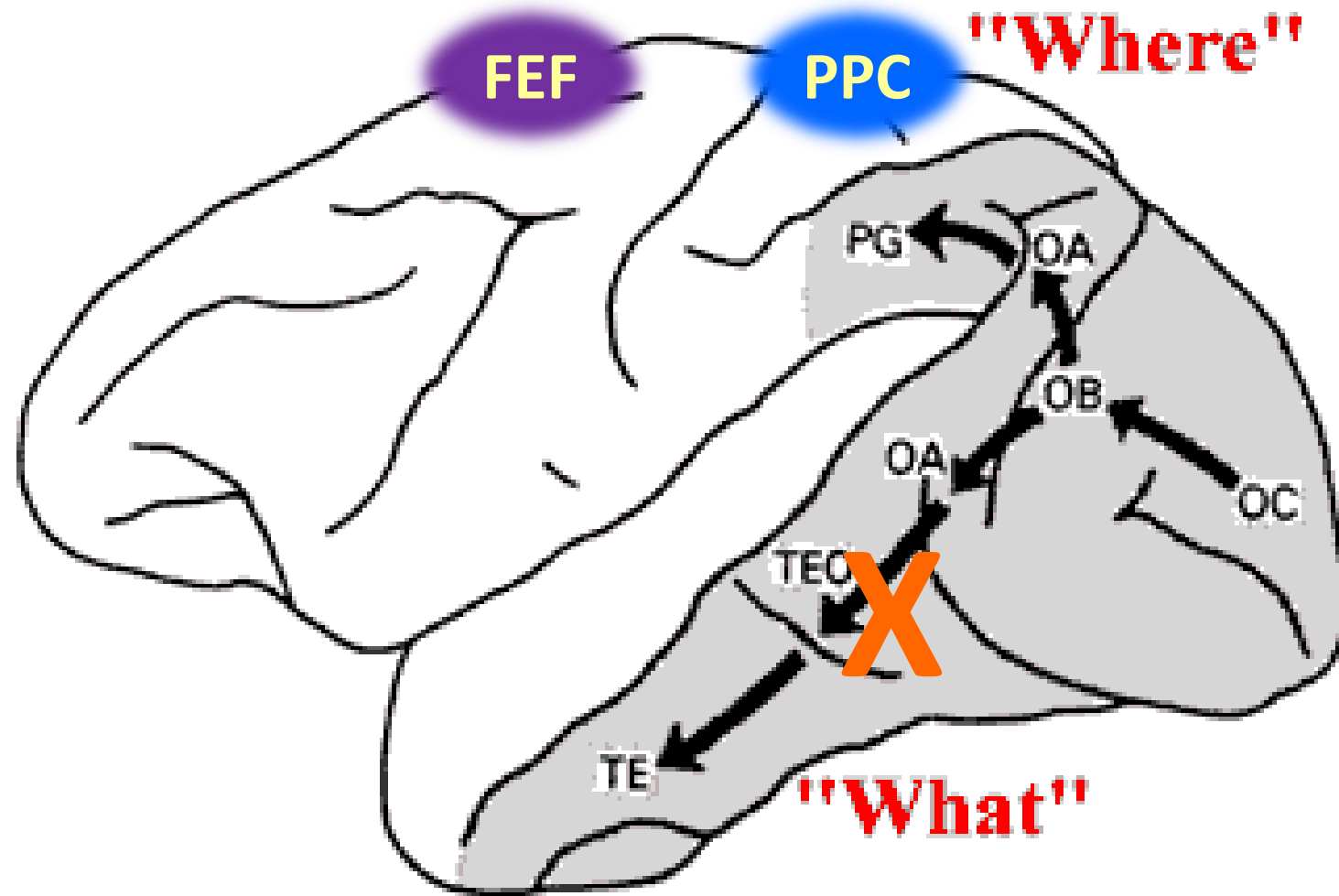
Pure Alexia: patients can't read what they have written



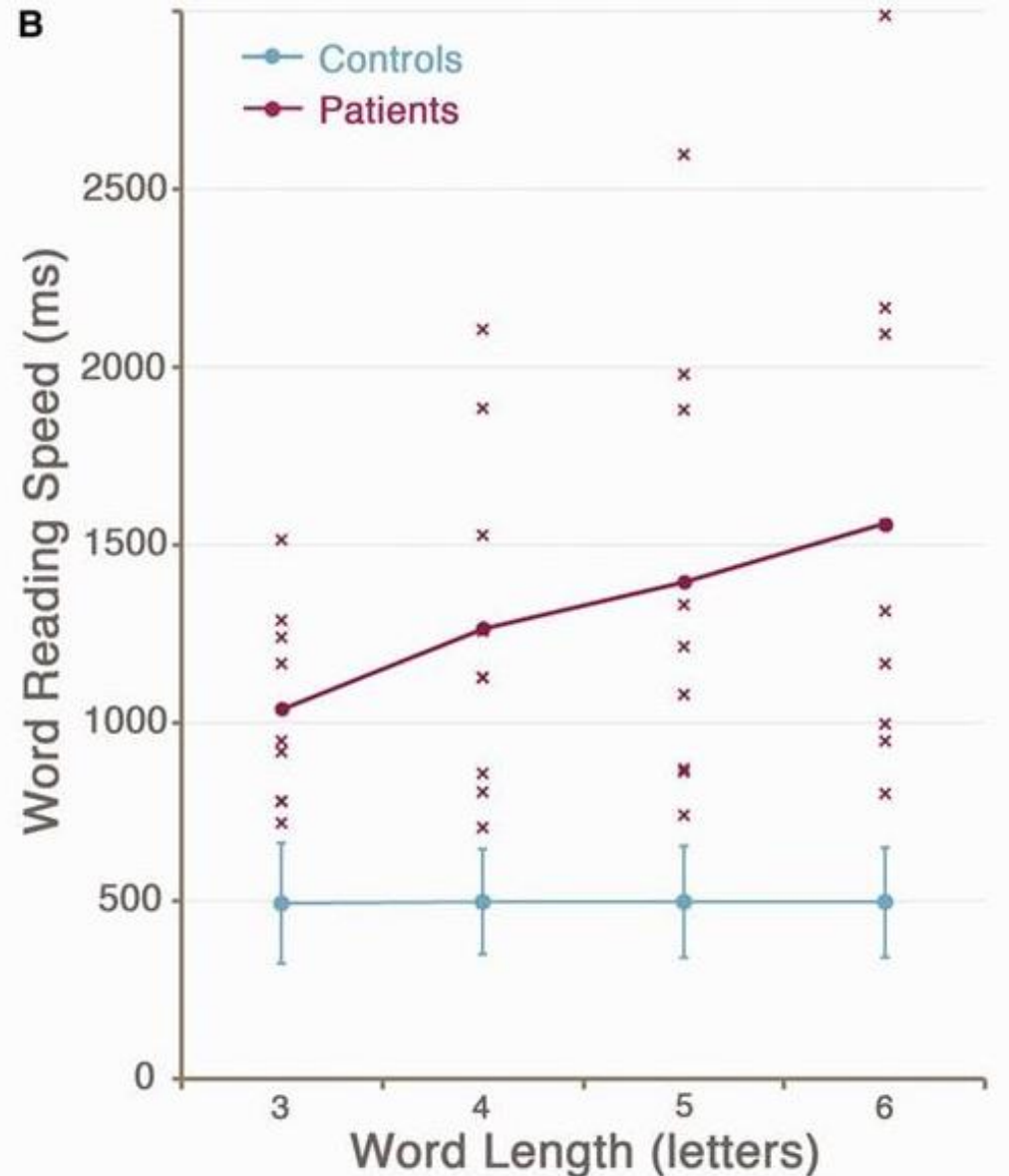
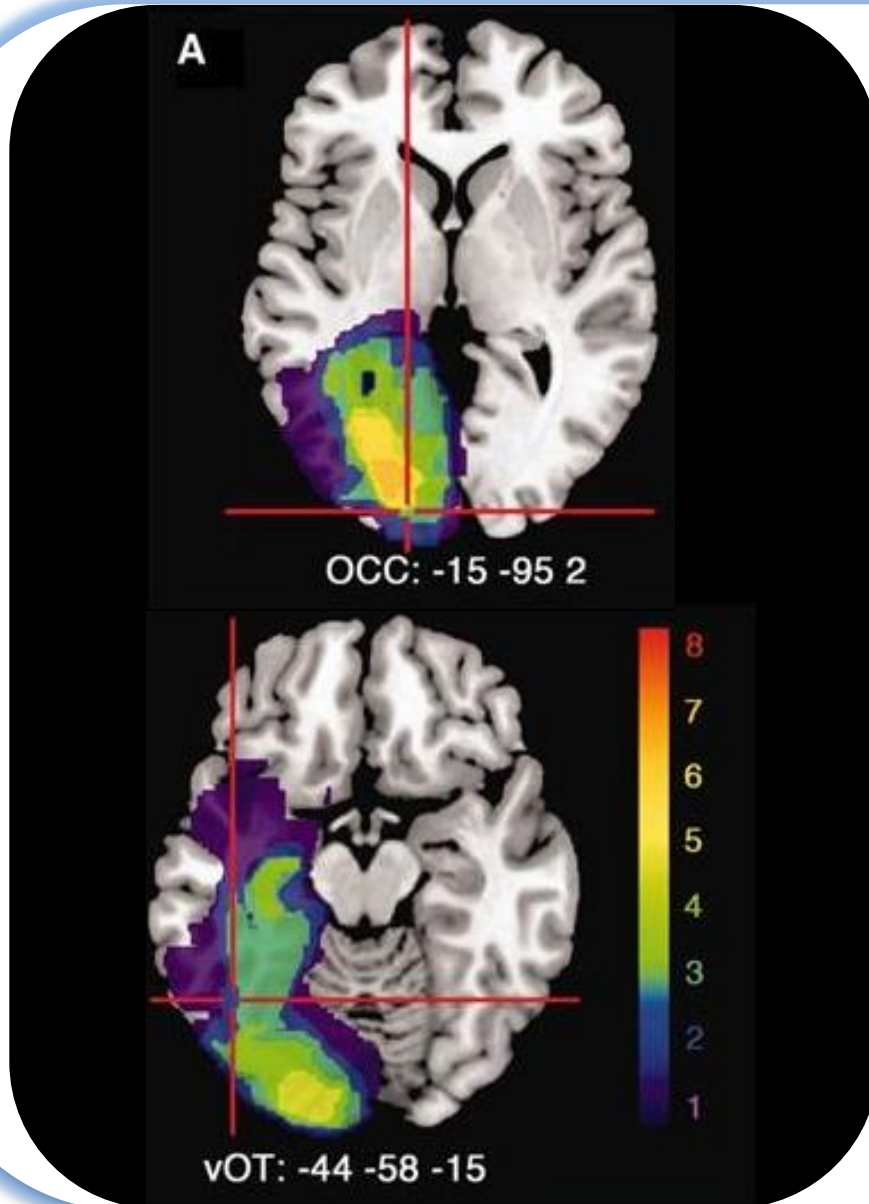
Anatomical locus of pure and hemianopic alexia



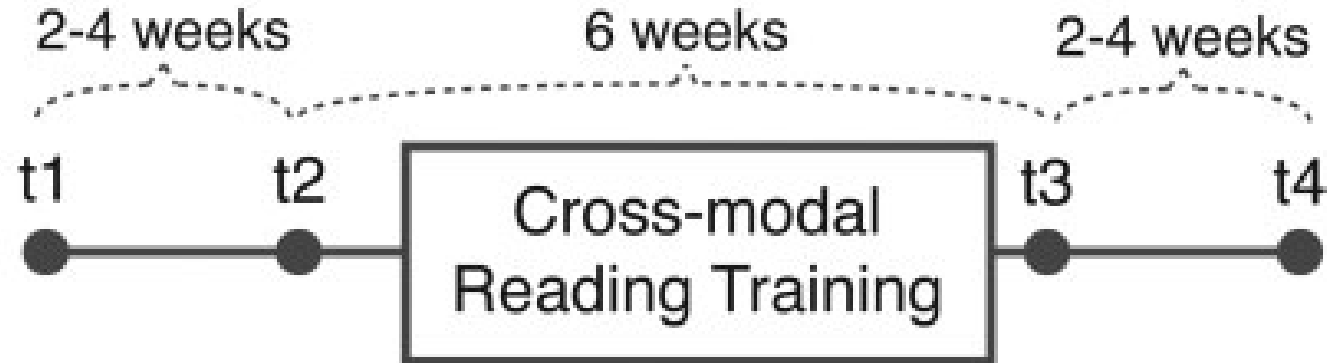
Pure Alexia: affects “what” pathway



Rehabilitation of people with Pure Alexia

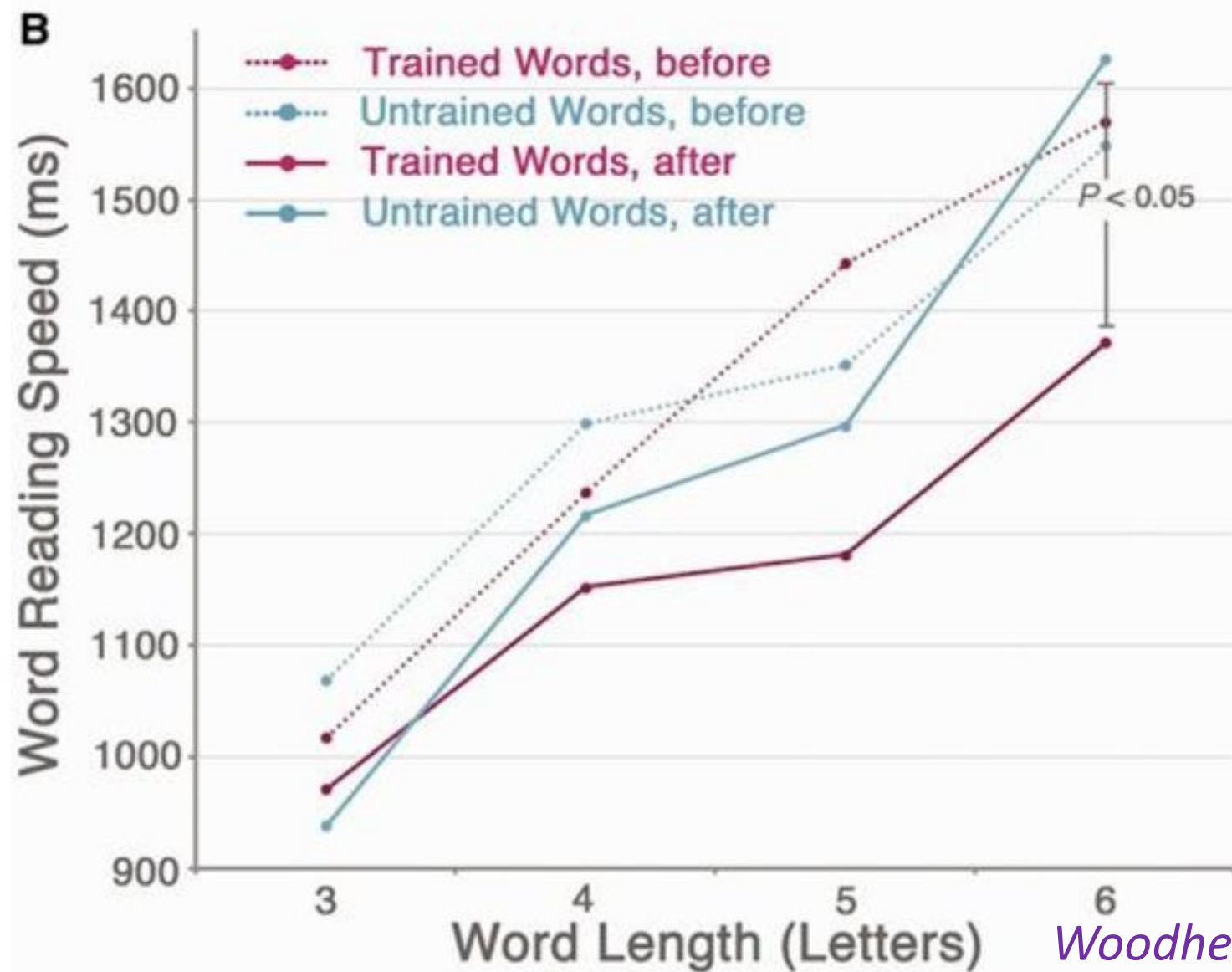


Rehabilitation of people with Pure Alexia



Patients	Reading tests:	☒	☒	☒	☒
	MRI scan:	☒			
Controls	Reading tests:	☒	☒		
	MRI scan:	☒			

Rehabilitation of people with Pure Alexia



Woodhead (2018)



Dr Zoe Woodhead

iReadMore

Word-reading therapy



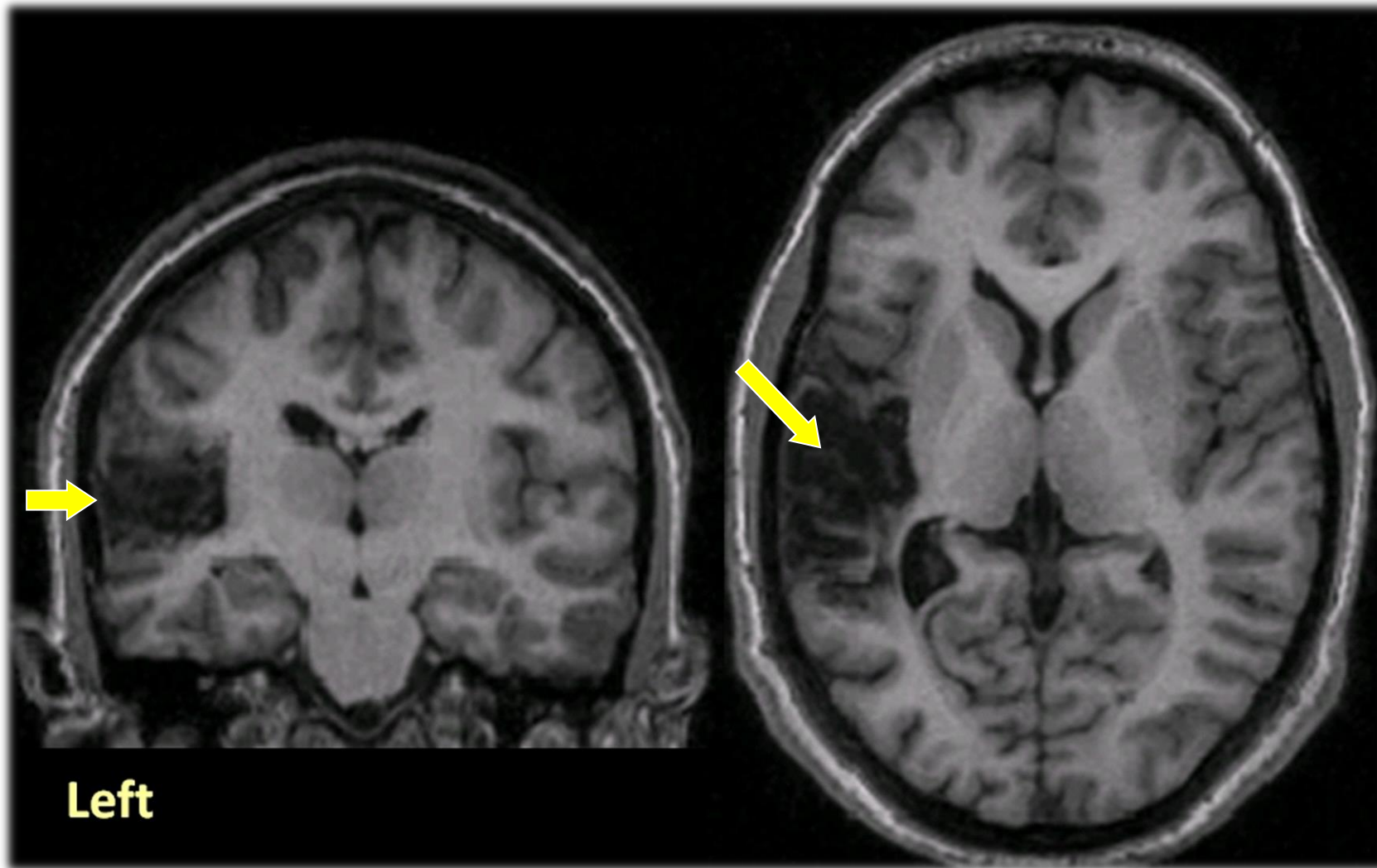
Dr Sheila Kerry

Word-reading therapy for stroke survivors with acquired reading problems

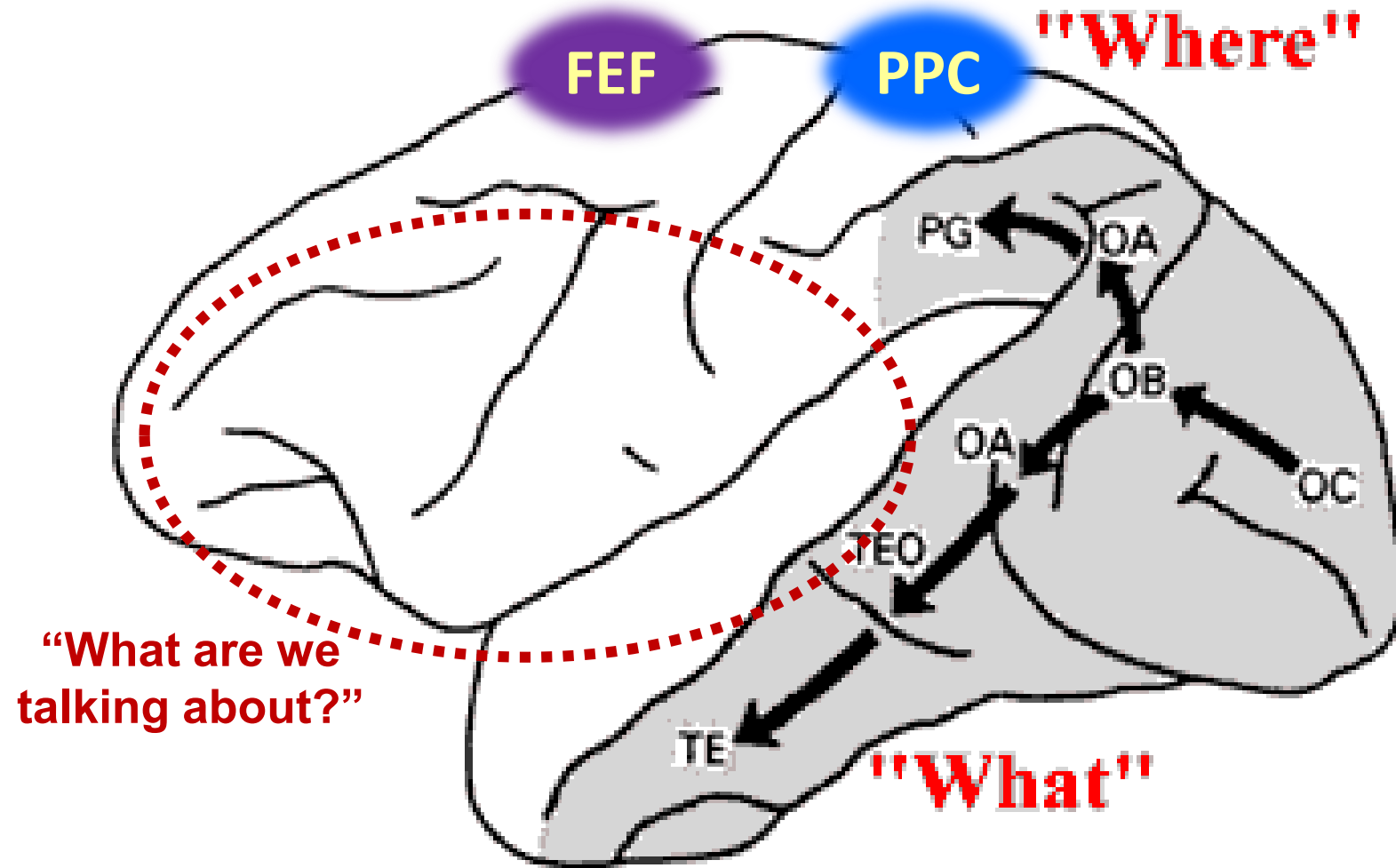
iReadMore: patients with central alexia



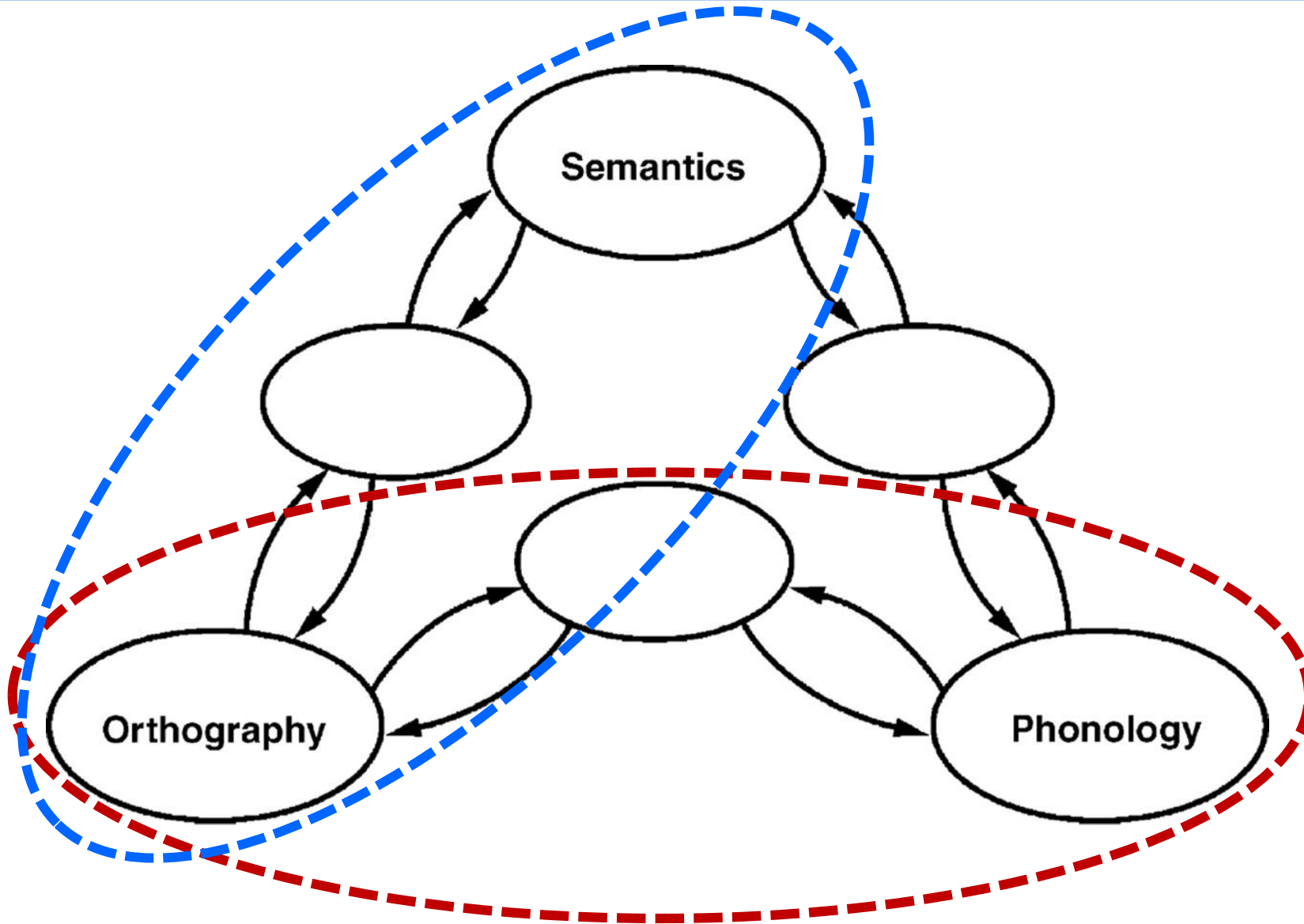
Central Alexia: generalized language problem



Central Alexia: affects “language” regions



iReadMore: based on triangle model of reading



- Computer based
- 2 x word lists of 500 words each (counterbalanced)
- Fast word presentation (500ms)
- Auditory-visual cross-modal pairs
- Training and testing phases
- Reward-driven
- Progressive difficulty
- >20 minutes training per day for 6 weeks

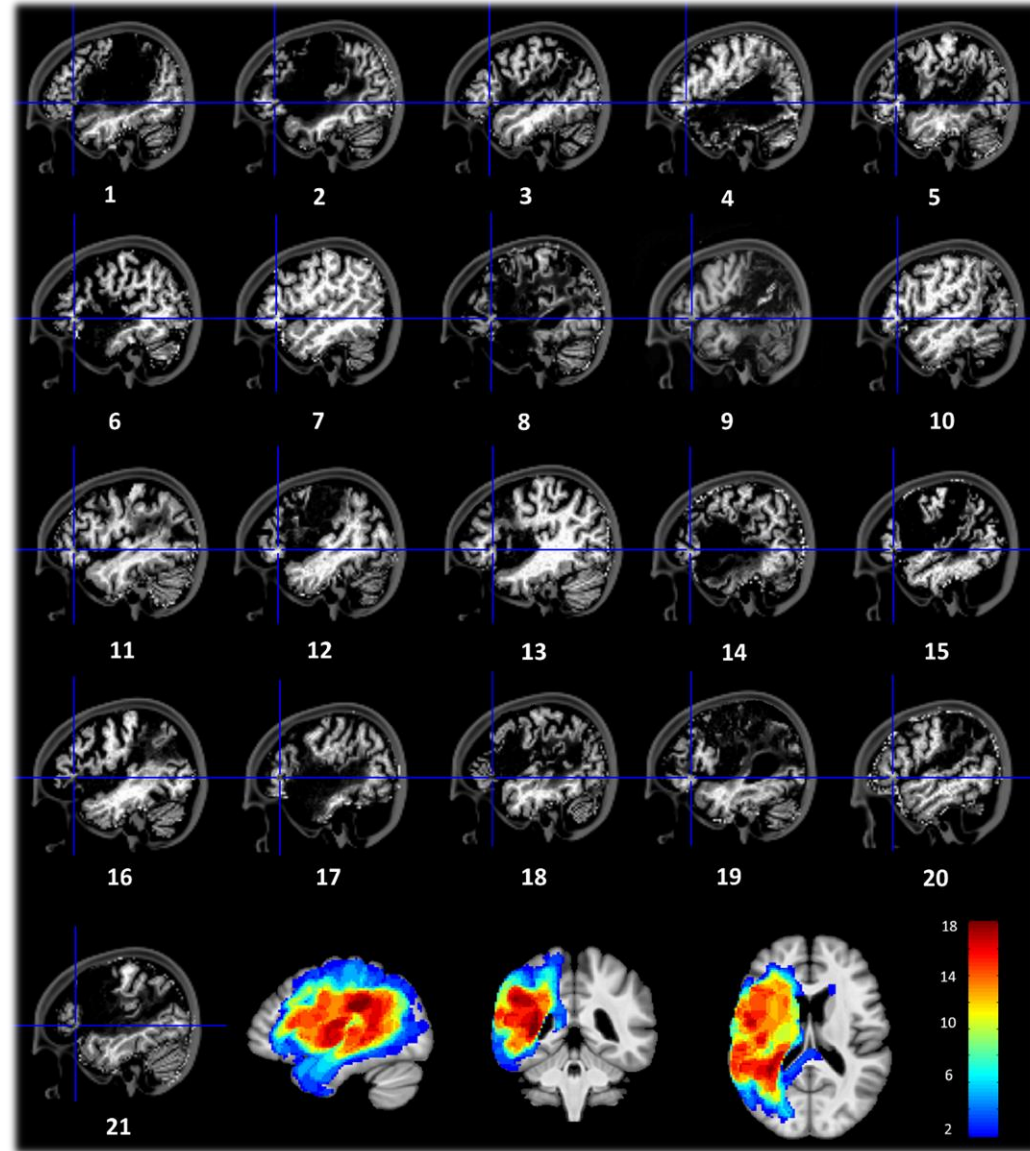
iReadMore: based on triangle model of reading



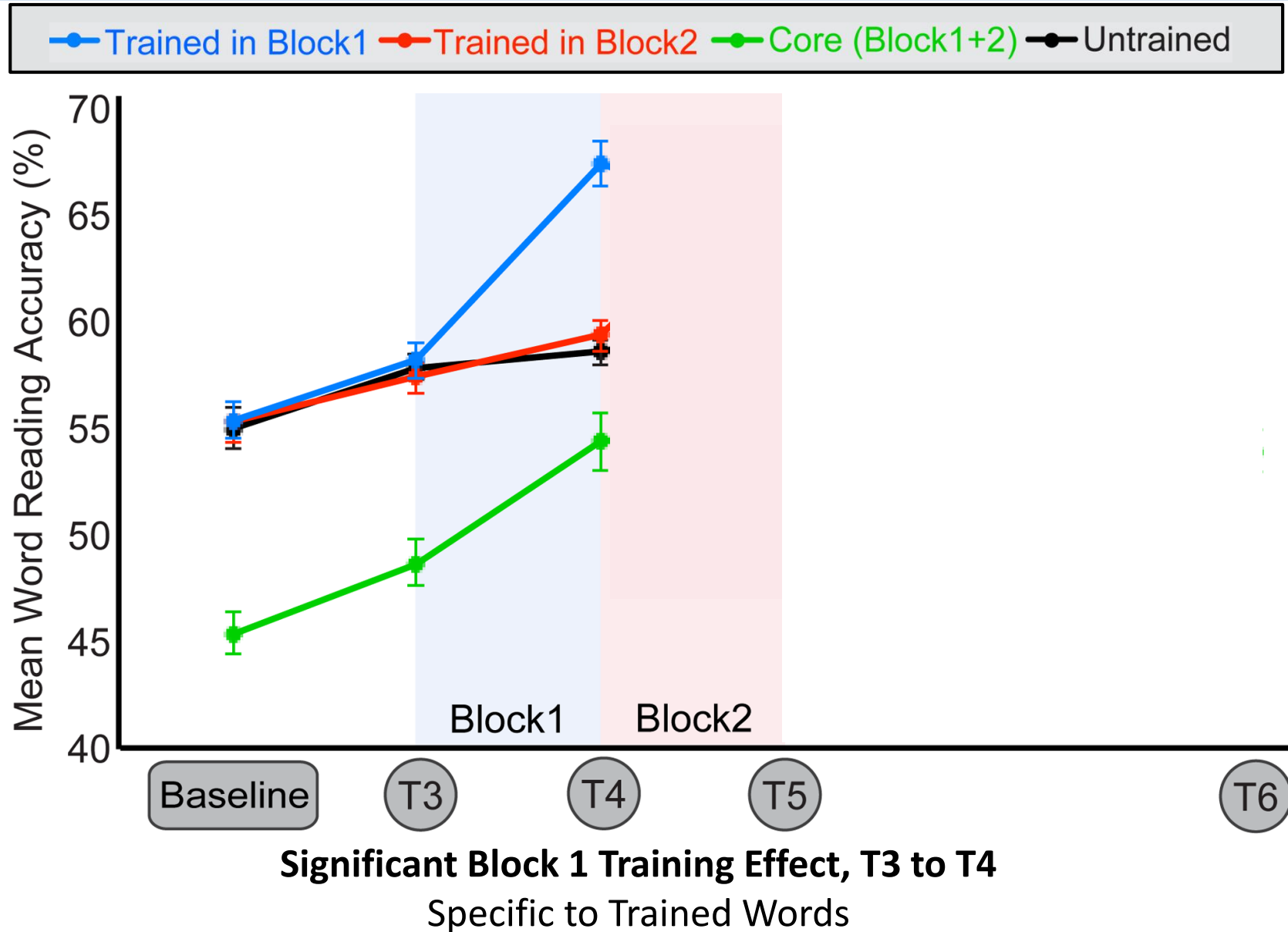
Langford (2022)

iReadMore for people with central alexia (n=21)

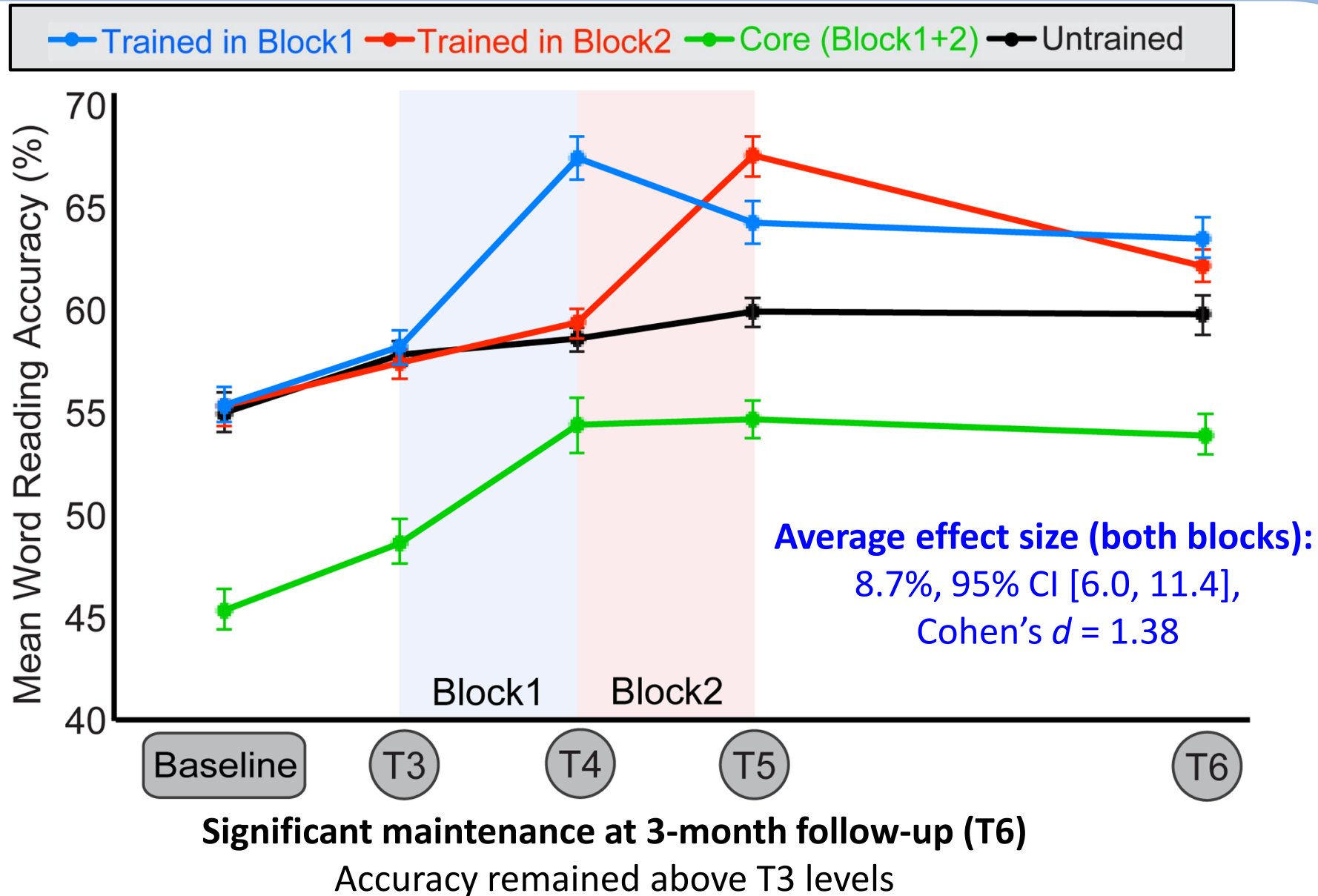
Recruited from PLORAS
Impaired speech output
(aphasic)
Impaired word reading
(alexia)
>1 year post stroke
(chronic)
Sparing of left IFG



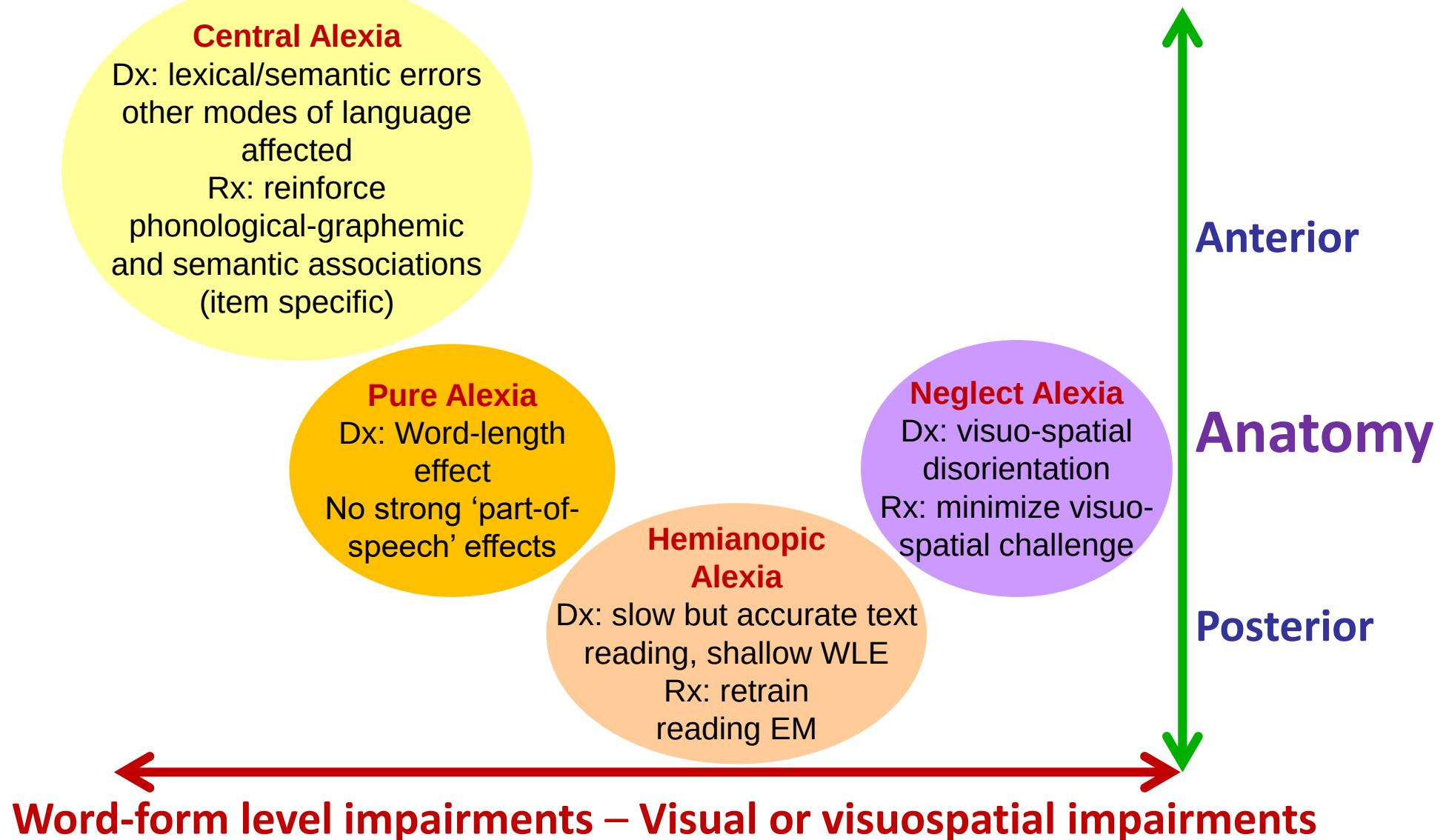
Results: Word Reading Accuracy (n=23)



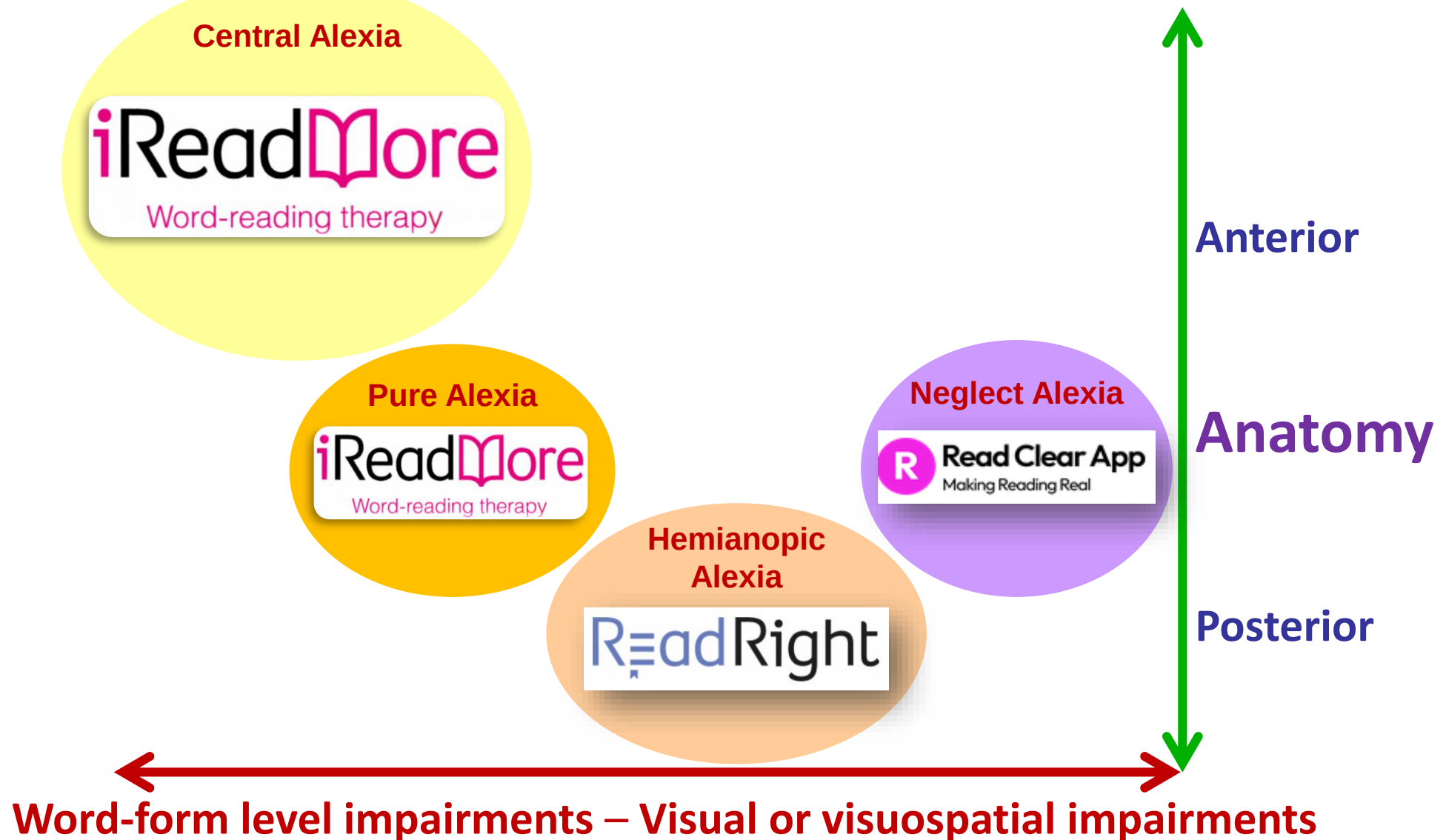
Results: Word Reading Accuracy (n=23)



2D map of the four alexias



Apps for the four alexias



Summary

- Four distinct acquired alexias
- Simple behavioural testing will distinguish them:
 - Visual or visuospatial impairments (?hemianopia, VSI)
 - Single word reading (?errors, if so which type ?WLE)
 - Text reading (slow but accurate = HA, lost on page = ND)
 - Other language functions (affected in CA)
- Therapy apps/aids for all four

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