

Specific learning difficulties: the role of the optometrist

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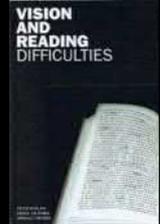
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 - Lecture content always my own
- i.O.O. Sales Ltd
 - Markets IFS orthoptic exercises, which the speaker designed, and for which he receives a small royalty
 - Community optometric practice in Brentwood, Essex



www.aop.org.uk/ot/vision-and-reading-difficulties-book

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THE INSTITUTE OF OPTOMETRY

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INTRODUCTION

CONVENTIONAL OPTOMETRIC CORRELATES

MAGNO (TRANSIENT) VISUAL DEFICIT

BEHAVIORAL OPTOMETRY

SENSORY VISUAL STRESS (SVS)

CONCLUSIONS

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Overview of LD & SpLD

- Profound learning disabilities (PLD):** usually low IQ & disabilities in several academic areas
 - e.g., Down syndrome, cerebral palsy
 - a.k.a., Intellectual impairment (Shute, 1991)
- Specific learning difficulties (SpLD):** specific difficulties with certain activities. IQ may be normal
 - e.g., dyslexia, dyspraxia
- Problems with classification
 - e.g., autism
 - In USA, LD=SpLD

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Background

- Polarised views on vision & dyslexia

Zealots middle view Deniers

Visual factors cause dyslexia Vision irrelevant to dyslexia
maybe visual problems can co-occur with dyslexia

Visual stress major cause of RD Visual stress does not exist
maybe sensory visual stress can co-occur with dyslexia

- Evans et al. (1994)
 - Dyslexic children are significantly more likely to report text transient blurring (26% of 9%) & doubling (23% of 7%)
 - N.B., most dyslexics don't have visual symptoms
 - Study concluded that visual factors are "not a major cause of the dyslexia"
- Eliminating any visual symptoms is likely to be helpful

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Role of visual factors in dyslexia

- Dyslexia is a learning difficulty that primarily affects the skills involved in accurate and fluent word reading and spelling (Rose, 2009)
- Characteristic features of dyslexia are difficulties in phonological awareness, verbal memory & verbal processing speed (Rose, 2009)
- Visual problems are not "the cause" of dyslexia
- The term "visual dyslexia" is a misnomer
- Visual problems may contribute to reading difficulties
 - In these cases visual treatments may help

optoms do not treat dyslexia



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Optometric correlates of reading difficulties: binocular instability

SYMPTOMS: blur, double vision, visual perceptual distortions, eye strain & headaches

Evans et al. (1994) *Ophthal. Physiol. Opt.* 14, 5-19.

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Optometric correlates of reading difficulties: binocular instability

SYMPTOMS: blur, double vision, visual perceptual distortions, eye strain & headaches

SIGNS: low fusional reserves, unstable heterophoria

Evans et al. (1994) *Ophthal. Physiol. Opt.* 14, 5-19.

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Optometric correlates of reading difficulties: binocular instability

SYMPTOMS: blur, double vision, visual perceptual distortions, eye strain & headaches

SIGNS: low fusional reserves, unstable phoria relieved by monocular occlusion

PREVALENCE: circa 15% in dyslexia; c.f., 5% good readers (so, not found in 85% of dyslexics)

TREATMENT: does not always require treatment
fusional reserve exercises
refractive correction

EVIDENCE: moderate for correlate; weak for cause

Evans et al. (1994) *Ophthal. Physiol. Opt.* 14, 5-19.

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Do eye exercises improve fusional reserves?

Scheiman & Gwiazda (2011), Cochrane review (only 1 modest RCT)

1a. Systematic review of homogenous RCTs
 1b. Individual RCT with good CI

2a. Systematic review of homogenous cohort studies
 2b. Individual cohort study

3a. Systematic review of case control studies
 3b. Individual case control study

4. Case series
 5. Expert opinion

EBP is "the integration of best research evidence with clinical expertise and patient values." (Sackett, 2000)

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Do base in prisms work? – depends on test used

Evans (2007): **yes**
 Scheiman & Gwiazda (2011): **no**
Conc: controversial

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 1b. Individual RCT with good CI

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Magno & parvo sub-systems (Transient and sustained)

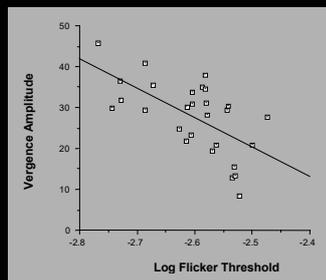
magno system is predominantly	parvo system is predominantly
rapid	slow
low acuity	high acuity
low contrast	high contrast
colour insensitive	colour sensitive

Dyslexia is correlated with a deficit of the magno-cellular visual sub-system

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Dyslexia: linking the visual deficits (a)

- Magno visual deficit is correlated with binocular instability (Evans et al., 1996)

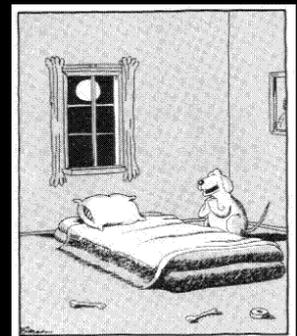


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Dyslexia: linking the visual deficits (b)

- BUT, magno system is not colour-specific
- Magno deficit is not directly related to the benefit from coloured filters

- Evans et al., 1994
- Evans et al., 1995
- Simmers et al., 2001
- White et al., 2006
- Conlon et al., 2009



"... And please let Mom, Dad, Rex, Ginger, Tucker, me, and all the rest of the family see color."

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Behavioral optometry

- Detailed symptomatology recommended
- Holistic approach
- Good orthoptic assessment & treatment
- Eye movement assessment & treatment
- Perceptual-motor and gross co-ordination exercises
- "learning lenses"
- Photo-syntonic Weak evidence

Jennings (2000)

Barrett (2008)

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Behavioral optometry

- As many therapies as there are practitioners
- "no randomised controlled trials" (Jennings, 2000)
- "a large majority of behavioral management therapies are not evidence-based" (Barrett, 2008)
- Doubt is not a pleasant condition, but certainty is an absurd one (Voltaire)



Voltaire: "Practical therapeutics is the art of keeping the patient entertained until nature effects a cure"

"I do not agree with what you have to say, but I'll defend to the death your right to say it."

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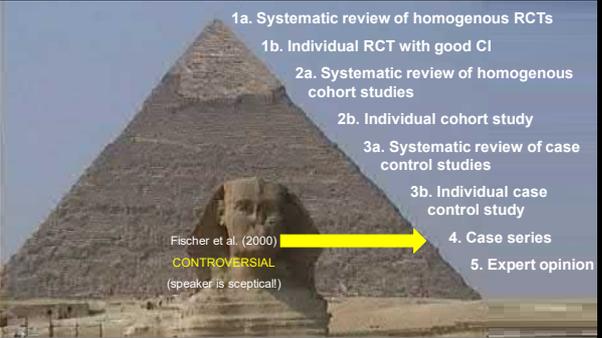
"Tracking" & dyslexia

- Saccades are not unique to reading
- Most studies have not found a saccadic eye movement deficit in dyslexia
 - Dyslexia influences saccades: "search for meaning"
 - ADD influences saccades
- The DEM test does not measure eye movements (Ayton et al., 2009; Webber et al., 2011)
 - Poor DEM scores do not mean that reading difficulties result from poor eye movements (Medland et al 2010)
- Treatments based on training saccadic or pursuit eye movements are controversial
- The DDAT has not been validated by masked controlled trials (PubMed search 15-Oct-06)
 - "Reynolds et al. (2003) provides no evidence that DDAT is an effective form of treatment" Snowling & Hulme (2003)



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Is vision therapy for saccades effective?



- 1a. Systematic review of homogenous RCTs
 - 1b. Individual RCT with good CI
- 2a. Systematic review of homogenous cohort studies
 - 2b. Individual cohort study
- 3a. Systematic review of case control studies
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Fischer et al. (2000) → 4. Case series

CONTROVERSIAL
(speaker is sceptical)

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Visual Stress = symptoms + benefit from colour

a.k.a. Scotopic Sensitivity syndrome, Irlen syndrome

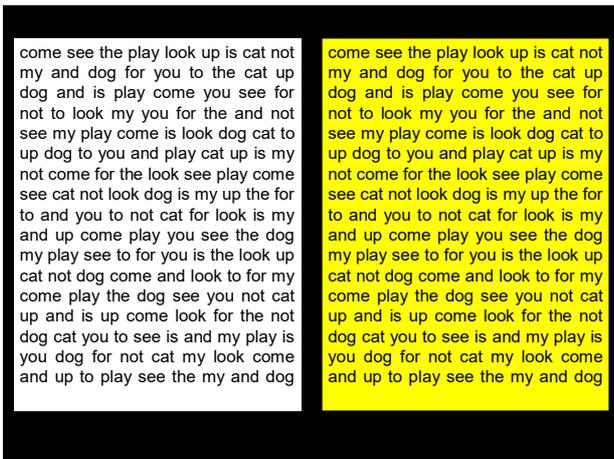
Meares-Irlen Syndrome / Sensory Visual Stress (SVS)



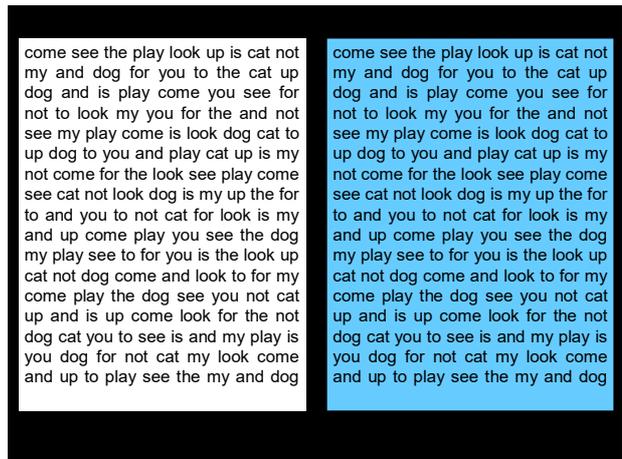
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come see the play look up is cat not my and dog for you to the cat up dog and is play come you see for not to look my you for the and not see my play come is look dog cat to up dog to you and play cat up is my not come for the look see play come see cat not look dog is my up the for to and you to not cat for look is my and up come play you see the dog my play see to for you is the look up cat not dog come and look to for my come play the dog see you not cat up and is up come look for the not dog cat you to see is and my play is you dog for not cat my look come and up to play see the my and dog

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Why might the tints help?

Successful treatment = Placebo only

OR

Placebo + Treatment effect

Evans & Drasdo (1991) Evans (1994) Wilkins & team

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The Intuitive Colorimeter

INTRODUCING THE REVOLUTIONARY INNOVATIVE COLORIMETER 'CURVE'

- large gamut
- colour change continuous
- hue, saturation, luminance varied independently
- eyes remain colour-adapted
- no coloured surfaces visible

Wilkins et al. (1992) Figures courtesy of Prof. Arnold Wilkins

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Precision Tinted Lenses (PTL)

7 dyes: 2⁵ levels of deposition

Wilkins et al. (1992) Figures courtesy of Prof. Arnold Wilkins

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Intuitive Overlays

NOTE: OVERLAY COLOUR DIFFERS FROM LENS COLOUR

Wilkins (1993) Figures courtesy of Prof. Arnold Wilkins

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Assessing optometric interventions Wilkins Rate of Reading Test

come see the play look up is cat not my and dog for you to
the cat up dog and is play come you see for not to look my
you for the and not see my play come is look dog cat to up
dog to you and play cat up is my not come for the look see
play come see cat not look dog is my up the for to and you
to not cat for look is my and up come play you see the dog
my play see to for you is the look up cat not dog come and
look to for my come play the dog see you not cat up and is
up come look for the not dog cat you to see is and my play
is you dog for not cat my look come and up to play see the



Wilkins et al. (1996) *Ophthalm. Physiol. Opt.* 16, 491-497

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Key research on sensory visual stress (SVS) with the "Intuitive" system

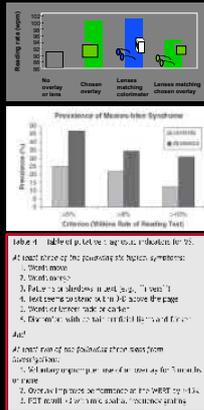
- PTL can alleviate symptoms when reading
Wilkins, Evans, Busby et al. (1994)
- Overlays associated with improved speed of reading
Wilkins et al., (1996); Bouldoukian, Wilkins, Evans (2002)
- Overlays may improve visual performance
Evans et al. (1994); Singleton & Henderson (2007); Allen et al. (2008)
- Binocular & accommodative anomalies need to be detected (Scheiman et al., 1990) but VS is an independent sensory dysfunction
Evans, Wilkins, Busby et al. (1995); Scott et al. (2002)
- The benefit from PTL is linked to pattern glare
Evans et al. (1994, 1996); Singleton & Henderson (2007); Allen et al. (2008)



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Key research of VS with the "Intuitive" system (cont)

- >80% of people prescribed PTL report still using after one year
Evans, Patel, Wilkins et al. (1999)
- Lens colour is different to overlay colour
Lightstone, Lightstone, Wilkins (1999)
- VS appears to be about 2-3x more common in dyslexic children than non-dyslexic [c. 20% of dyslexics]
Kriss & Evans (2005); Evans & Allen (2016)
- Delphi study proposed diagnostic criteria
Evans, Allen, Wilkins (2017)



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Pitfalls in researching VS

- Research the target condition
 - Menacker et al (1993) & Henderson et al (2012) researched dyslexics
 - Mitchell et al (2008) did not study people with VS
 - Bouldoukian et al (2002) studied participants who "reported relief from overlays"
 - Ritchie et al (2011) used an Irlen diagnostic process which found VS in 77% of poor readers
- Prescribe colour individually, allowing for a degree of precision
 - Menacker et al (1993) & Ritchie et al (2011) used limited range of colours
 - Debate ongoing concerning precision (e.g., Suttle et al., 2017)
 - Clinically, precision varies but is required by some patients
- Use appropriate outcome measures
 - Ritchie et al (2011) used enlarged WRRRT text
- Systematic reviews with inappropriate selection criteria will reach negative conclusions (e.g., Griffiths et al., 2016;)
 - BUT: In part owing to these issues, VS is still **controversial**



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Conservative clinical practice

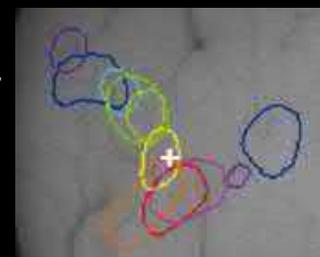
- Listen to symptoms but don't over-treat
 - This applies to SVS & conventional optometric anomalies
- Beware favourite colour & gender effects (Conway, Evans, Evans, Suttle, 2016)
- Solution for many is digital devices



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Representation of colour in macaque area V2

- Used optical recording & confirmed with electrode recording
- Identified "colour-preferring" modules
- Did not overlap with "orientation-preferring modules"
- Each contour illustrates the cortical region giving the maximal response to each tested colour
 - But different colours produce different response magnitudes



Xiao et al., 2003, *Nature*

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Pattern glare

High prevalence in high prevalence in

- Sensory visual stress
- Migraine
- Photosensitive epilepsy
- Allergy

DO NOT VIEW THIS IF YOU HAVE EPILEPSY OR MIGRAINE

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Sensory visual stress

PREVALENCE: uncertain, 20% of people with dyslexia

SYMPTOMS: eyestrain, headaches, visual perceptual distortions (text moves & blurs)

SIGNS: diagnosis of last resort – rule out other causes of symptoms
coloured overlays alleviate symptoms

TREATMENT: coloured filters or coloured background

EVIDENCE: debated & controversial

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Do individually prescribed filters help alleviate visual stress? – evidence too weak to be sure

1a. Systematic review of homogenous RCTs
1b. Individual RCT with good CI

2a. Systematic review of homogenous cohort studies, **conflicting evidence**
2b. Individual cohort study

3a. Systematic review of case control studies
3b. Individual case control study

4. Case series
5. Expert opinion

Griffiths et al (2016): **no**
Evans & Allen (2016): **yes**

WHY BOTHER?
estimated that 75% of schools test with coloured overlays, so optometrists encounter people wanting PTL

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Conclusions

- A minority of patients with reading difficulties report visual symptoms
 - Does text appear to move, blur, or cause headaches?
- If symptoms, suspect:
 - Sensory visual stress, binocular instability
 - Treatment may help symptoms but will not cure dyslexia
 - Need for more research
- People with reading difficulties & symptoms can be referred to interested eyecare practitioners via www.s4cjb.org

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