

THE DOUBLE VISION DILEMMA

Solving The Binocular Vision Pandemic



Tod R Davis, OD, FCOVD
Developmental Optometrist

WELCOME !!
THANK YOU FOR BEING HERE

***15 % or more
of the
population
cannot view
3-D***



AGENDA



What is **VISION**? Basic information from medicine, neuroscience, and optometry.

How **VISION** develops and clinical significance

The **impact of VISION** deficits on our *families*, society.

Convergence Insufficiency: signs and symptoms, diagnosis, and treatment.

Dedication to A M Skeffington, OD FAAO

First Director of Education, AOA

Developed model of vision as dual spatial information processing system (anticipated “Magno / Parvocellular”)

Established OEP 1928. Largest CE provider in US excluding optometry schools. Large growth recently.



What is Vision?



Let's Ask The Experts

What is Vision?

VISION IS MORE THAN “20/20”

“20/20” clarity at **20 feet**

BUT most classroom learning occurs at about **20 inches**.

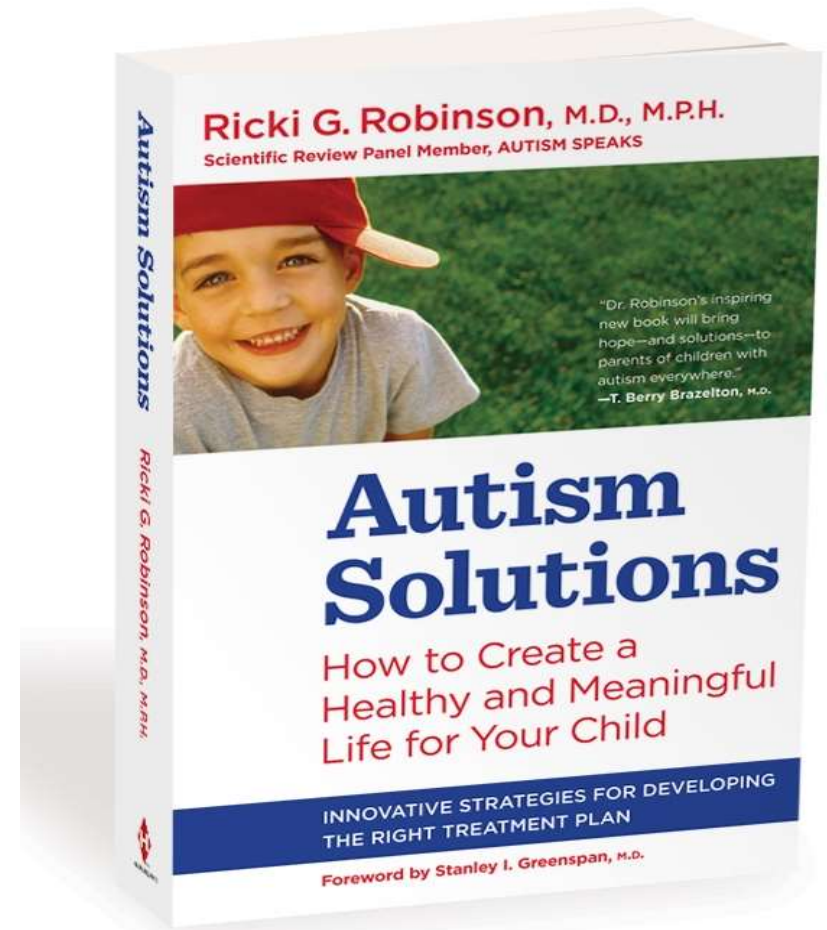


What is Vision?

"*Sight* is what our eyes see.

Vision is what our mind *understands* what we see."

Ricki G. Robinson, MD, MPH,
Clinical Professor of Pediatrics, USC



What is Vision?



“Vision is the primary medium of thought.”

Rudolph Arnheim, PhD

Psychology of Art, Harvard University

Visual Thinking, p. 18

What is Vision?



**“It is a terrible thing to see
and have no VISION”**

Helen Keller

1880 - 1968

What Is Vision?

Vision Is Our **Dominant** Sense

“The brain receives about **3 million** bits of information every moment, & **2 million** of these process vision”.

V. S. Ramachandran MD, PhD



What Is Vision?

*“Vision is the key to a
child’s whole development...”*

Vision: It’s Development in Infant and Child

By Arnold Gesell, M.D.



What Is Vision?

**“ When we open our eyes each morning,
it is upon a world**

***we have spent a lifetime
learning to see.”***

An Anthropologist on Mars,

Oliver Sachs, MD



Vision Development

“Acquiring a functional visual system
is a *developmental* process.”

Autism Solutions

Ricki G. Robinson, MD, MPH,
Clinical Professor of Pediatrics USC (CA)



Vision Development

Developmental

Vision Clinical Model

We regard

*developmental
immaturity (delay)*

as the basis of *most*
vision problems.

(non-pathological)



Vision Development



**Developmental
Vision Clinical Model**
Evaluating and treating the
visual system based on
*predictable developmental
sequences.*

Vision Development

Developmental Sequence

From Primitive Reflexes

To Gross Motor Skills

To Oculomotor Skills



Vision Development



Full development of fine motor including oculomotor control occurs after and depends on *coordinated gross motor skills.*

And

Full development of gross motor skills depends on earlier *primitive reflex integration.*

Vision Development



Binocular vision is a fine motor control system similar to eye-hand and speech.

Speech problems strongly associated with oculomotor control problems.

Parallels Between Auditory
& Visual Processing

Leonard J. Press, OD

Vision Development



Later voluntary movement (Gross & Fine Motor) depends on *involuntary movements of* **PRIMITIVE (EARLY) REFLEXES.**

PRIMITIVE REFLEXES develop in utero, are directed from the brain stem, and are integrated from 6 months to 3 years.

Vision Development



The Origin Of Intelligence In The Child, Piaget (1953)

Highlighted importance of primitive reflexes in both motor and *cognitive* development

Vision Development

Effects Of Replicating Primary-reflex Movements On Specific Reading Difficulties In Children:

LANCET Vol.355, Issue 9203, 2/2000 Pages 537 - 541

Children with specific reading difficulties have problems that extend beyond..underlying language-related deficits.

We investigated the role of **persistent primary reflexes** in disrupting..reading skills.



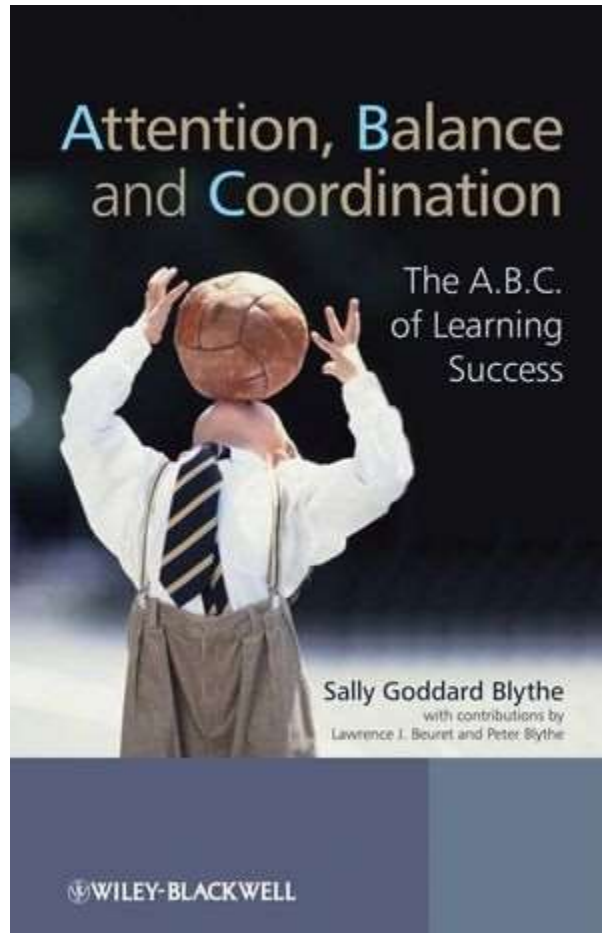
Vision Development

**Prevalence Of Persistent
Primary (Primitive) Reflexes
And Motor Problems In
Children With Reading
Difficulties.**

Dyslexia 10/4:316-338



Vision Development



“The first ABC a child learns is the *ABC of the body*, the foundation on which *cognitive learning* is built and the *mode through which it is expressed*.”

ABC, Goddard Blythe, page 4

Vision Development

Do 'Clumsy' Children Have Visual Deficits

Behavioural Brain Research 139 (2003) 123/129

The most striking finding ..the group of clumsy children diagnosed solely on the basis of motor difficulties, *were significantly less sensitive...on all three tasks of visual sensitivity.*

These results support the existence of generalised visual anomalies associated with impairments of cerebellar function.



Vision Development

Developmental Sequence



From MOUTH

to HANDS

to OCULO-MOTOR

CONTROL

Vision Development

Cognitive And Motor Development

Is Underpinned By

**Visual Processing & Fine Manual
Control**

In Typically Developing Children 4–11 Yrs

Deborah Ely Budding, Ph.D.

American Board of Pediatric Neuropsychology

©2011 The British Psychological Society 31 MAR 2011

Vision Development

CHILD'S DRAWINGS PREDICT LATER INTELLIGENCE

**7,752 pairs of twins drew
a picture of a child, scored
by the number of body
features (Draw-A-Child test)**



There exists a moderately strong link between higher drawing scores and later intelligence test results.

Vision Development

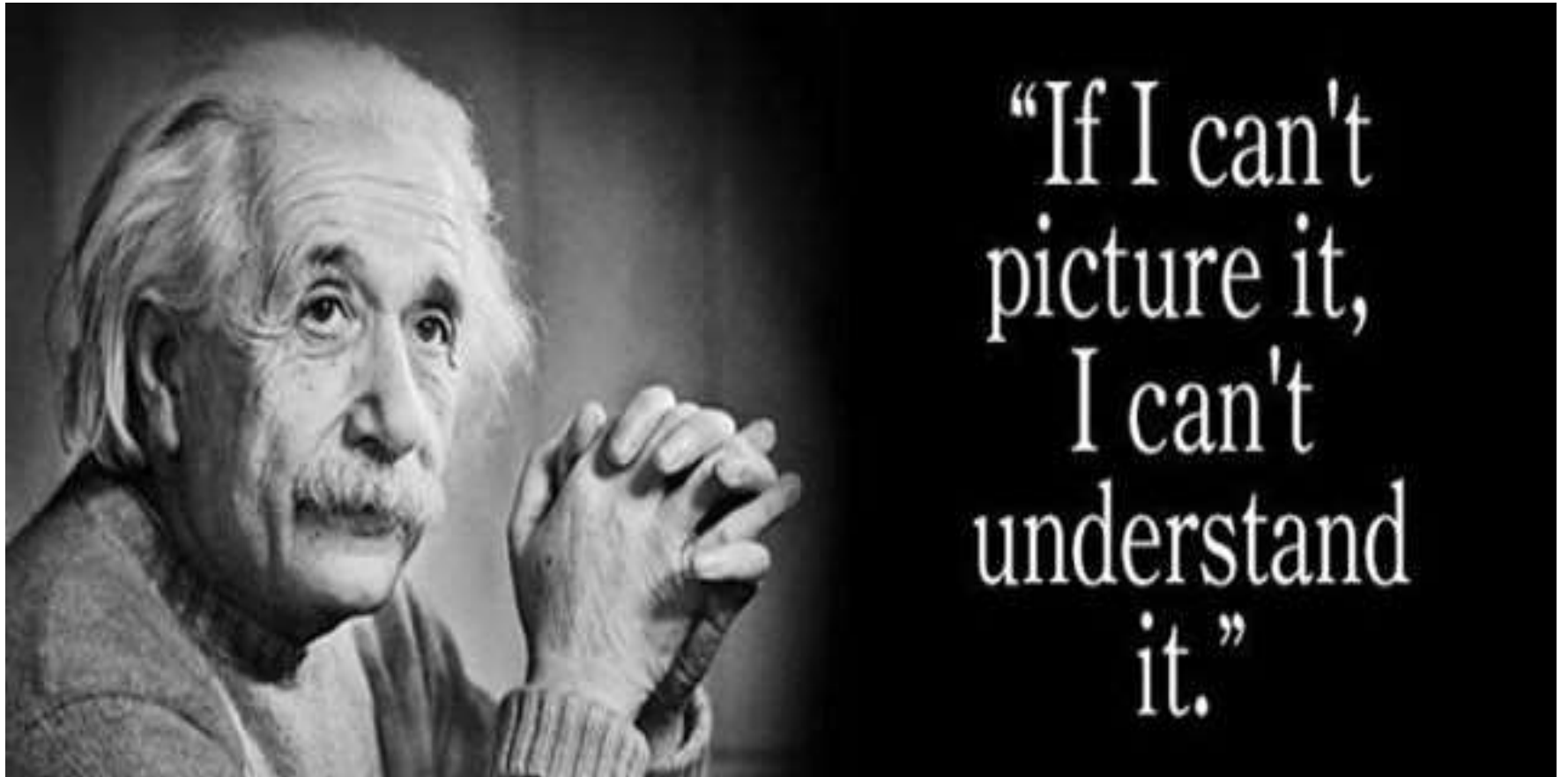
*“Vision is the brain’s way
of touching the world”*

Merleau-Ponty, 1964

Concepts of reach, grasp, and release.



Vision Development



“If I can't
picture it,
I can't
understand
it.”

Vision Development

Developmental Sequence



From **NEAR SPACE**

to **FAR SPACE**

And The Effects Of

Crowding

Vision Development

Developmental Sequence

Body position or
“orientation” to
judging distances.
“Depth perception”



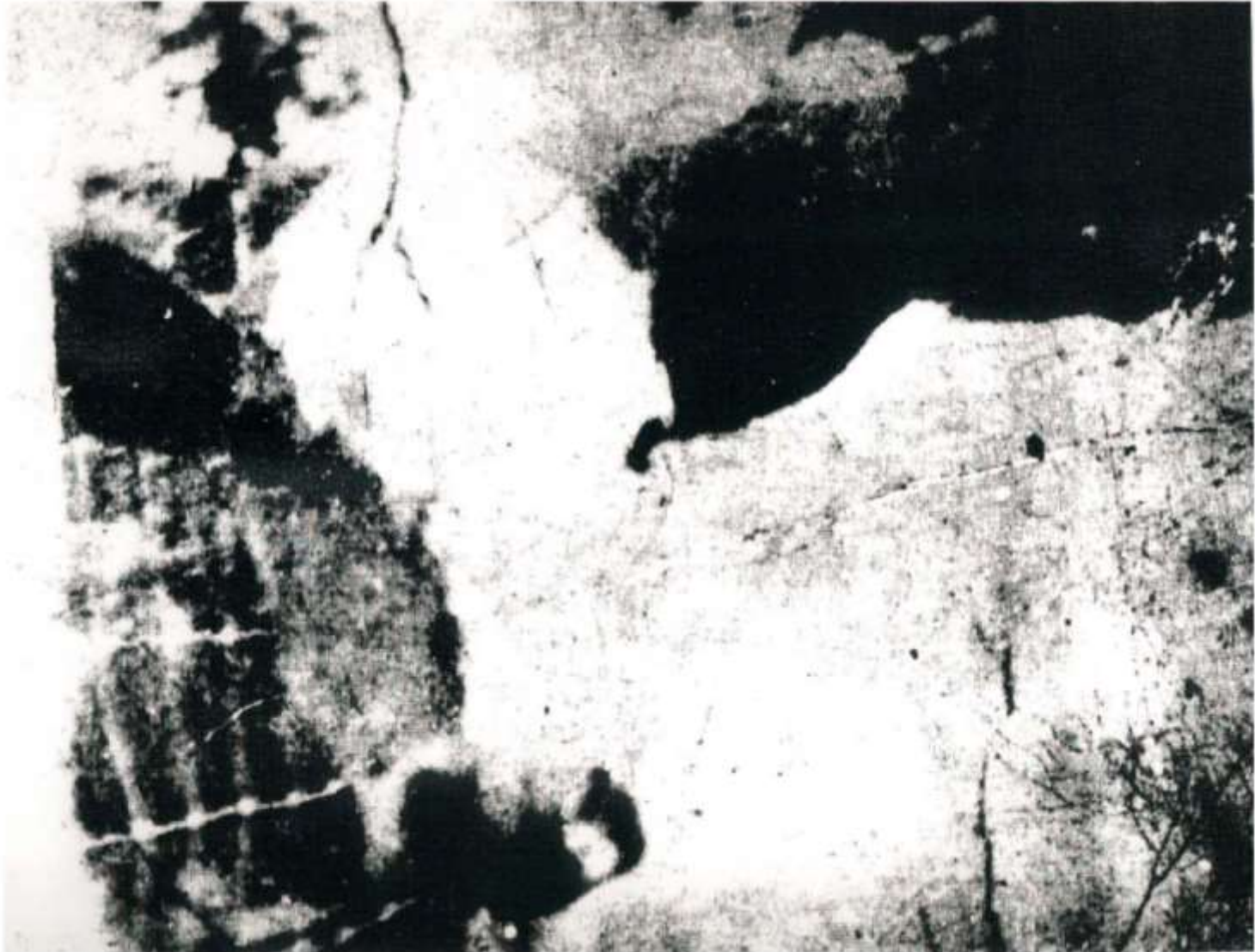
Vision Development

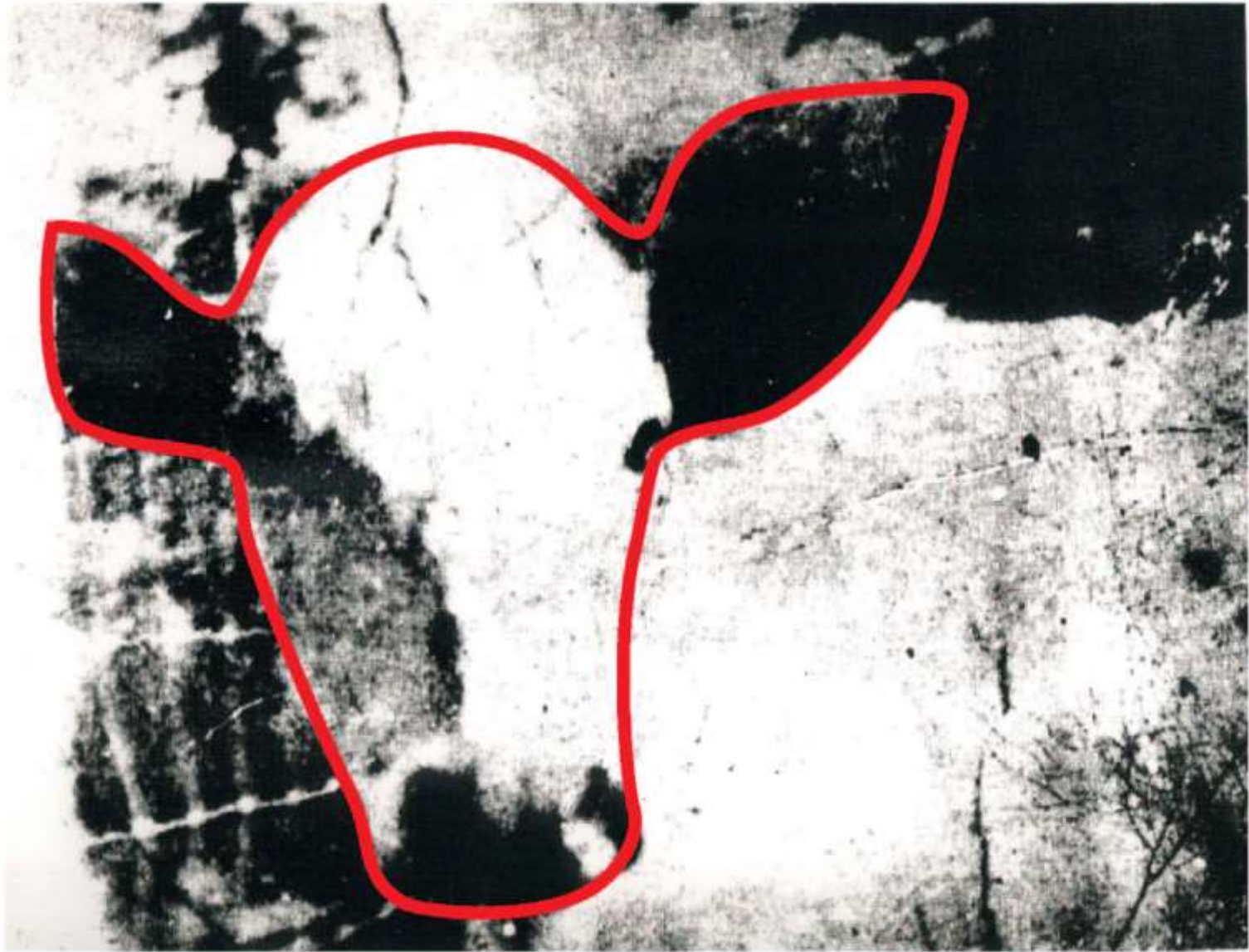
Developmental Sequence

Relating An Object To
Surrounding Objects
“Spatial Relationships”
Or “3-D”



What is this?





Moo!

What Causes Vision Problems?

BIRTH HISTORY:

Pregnancy and/or birth complications

Prematurity (< 36 wks)

Birth weight (< 5 lbs)

Adoption



What Causes Vision Problems?

MEDICAL HISTORY:

Trauma, especially head injuries

Genetic problems

Serious illnesses

including *persistent*
ear infections



What Causes vision problems?

DEVELOPMENTAL HISTORY:



Poor crawling / creeping

Late or early walking

Difficulty learning to run
or ride a bike

What Causes Vision Problems?



Stress from *Long-term near work*, including computers and devices.
Poor nutrition including Vitamin D deficiencies



Kids Haven't Changed; Kindergarten Has

*New data support a return to “balance”
in kindergarten*

Harvard Education Letter. Vol 26, # 5
September/October 2010

Impact of Vision Problems "life-altering"



Impact of Vision Problems "life-altering"

3-D Movies
15% of population
can't view 3-D



www.3deyehealth.org

AOA site on 3-D

Impact of Vision Problems “life-altering”

*“25% of all school children in the U.S.
have a vision problem significant
enough to affect learning.”*

***Vision and Learning,
American Foundation
for Vision Awareness.***

June 1, 2002,

***Bureau of the Census,
Washington, DC.***

1992 – 112th edition



Impact of vision problems "life-altering"

Learning-Related Vision Problems Education and Evaluation

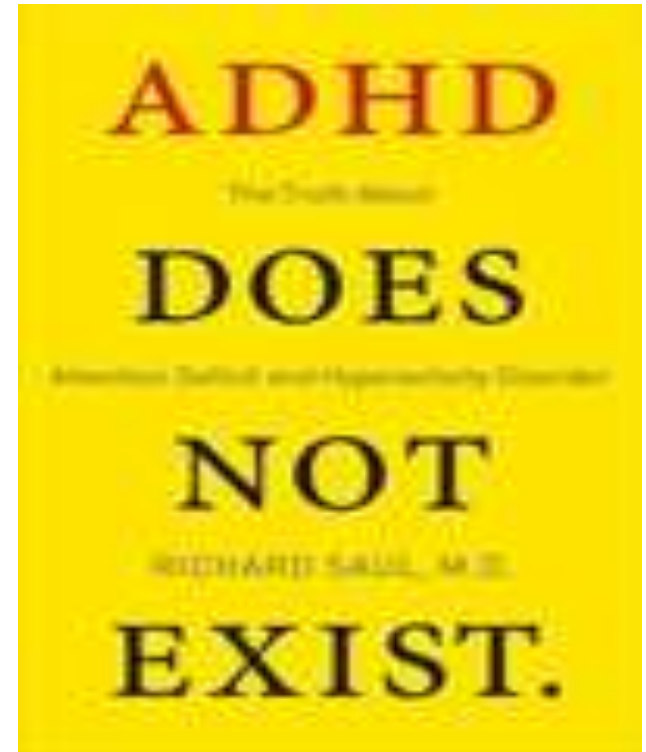
*National PTA resolution
June 1999*



Impact of Vision Problems "life-altering"

*"Problems related to vision
are among the most
overlooked explanations
for ADHD symptoms."*

Richard Saul, MD



Impact of Vision Problems “life-altering”

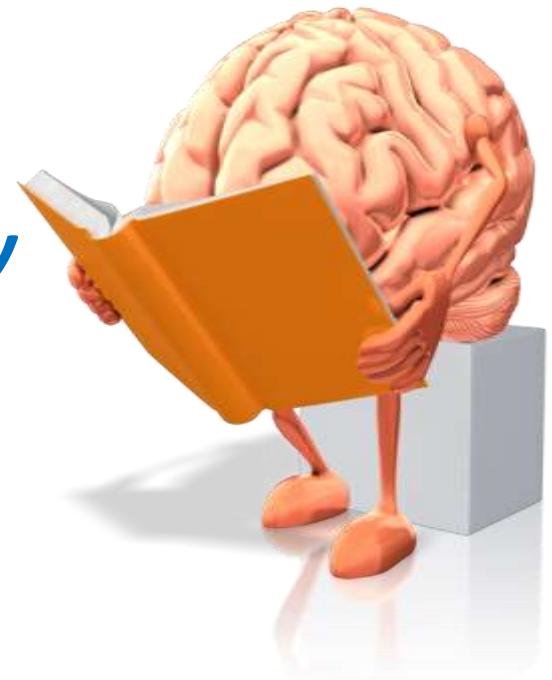
Developmental Dyslexia And Vision

JOURNAL OF CLINICAL OPHTHALMOLOGY

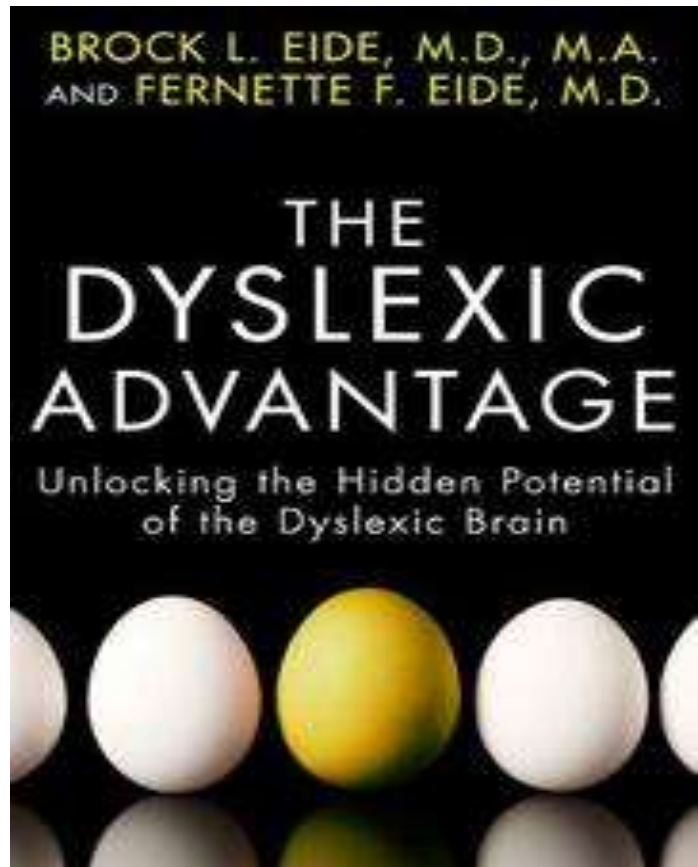
14 May 2013

“Dyslexia...represents a significant public health problem. *Its etiology is unknown.*

Numerous scientific studies have documented *the presence of eye movement anomalies and deficits of visual perception...in dyslexics.*”



Impact of Vision Problems “life-altering”



“**V**isual treatments can enhance..reading development for people with severe eye movement control problems.

The appropriate specialist....
is a **developmental**
optometrist.”

The Dyslexic Advantage, Pg 180

Brock Eide, MD

Impact of vision problems "life-altering"

Mental Illness In Young Adults Who Had Strabismus As Children

Children with exotropia
strabismus, *3.1 times chance*
of mental health problems
as adults.

Journal of Pediatrics

2008 Nov. 122 (5): 1033-1038



Impact of Vision Problems "life-altering"

Early Visual Indicators Of Autism

*Oculomotor abnormalities may play a role...**at the root of** impairments in later developing functional systems, ultimately resulting in socio-communicative deficits.*

Eye Movement and Abnormalities in Autism?

Laurie A. Brenner Æ Katherine C. Turner Æ Ralph-Axel Müller

J Autism Dev Disord (2007) 37:1289–1309

Autistic Group



Control Group



Convergence Insufficiency

Inability to *converge*
both eyes accurately
and sustain for
near work.



Convergence Insufficiency

CITT Convergence Insufficiency Treatment Trial



Massive research effort > 10 years

6.1 million funded by NEI

Multicenter; Mayo, Bascom Palmer, and 6 Optometry colleges.

Masked, placebo-controlled, randomized clinical trial of eligible children 9 to 18 years of age.

Archives Ophthalmology VOL 123, 1/2005

Convergence Insufficiency

INCIDENCE

About **8%** of population, or **1 in 12**

Affects over **21 million** in US alone

More common than **glaucoma** in children
Glaucoma in children 1 in 43,575

More common than **amblyopia** in children
Amblyopia in children 1 in 50

Symptoms/Signs of CI

Research found that children with CI reported the following symptoms “fairly often” or “always” while reading or doing close work.

Loss Of Place	50%
Loss Of Concentration	45%
Words Blurring	36%
Double Vision	32%
Headache	32%
Eyes Feel Sore	21%

Symptoms/Signs of CI



Performance-related symptoms such as *loss of place, loss of concentration* occur more often than eye-related symptoms such as *headache, sore eyes*

Symptoms/Signs of CI



Second most common symptom was loss of concentration, almost 50% reported this symptom fairly often or always.

Strong connection with ADHD-like symptoms.

Symptoms/Signs of CI

The Relationship between Convergence Insufficiency (CI) and ADHD

David B. Granet, MD FACS
FAAO FAAP,
Cintia F. Gomi, MD,
Ricardo Ventura, MD, and
Andrea Miller-Scholte, CO
Ratner Children's Eye Center,
Department of Ophthalmology,
University of California, San
Diego, CA, USA

*3-fold incidence of ADHD
with presence of
convergence insufficiency*

Symptoms/Signs of CI

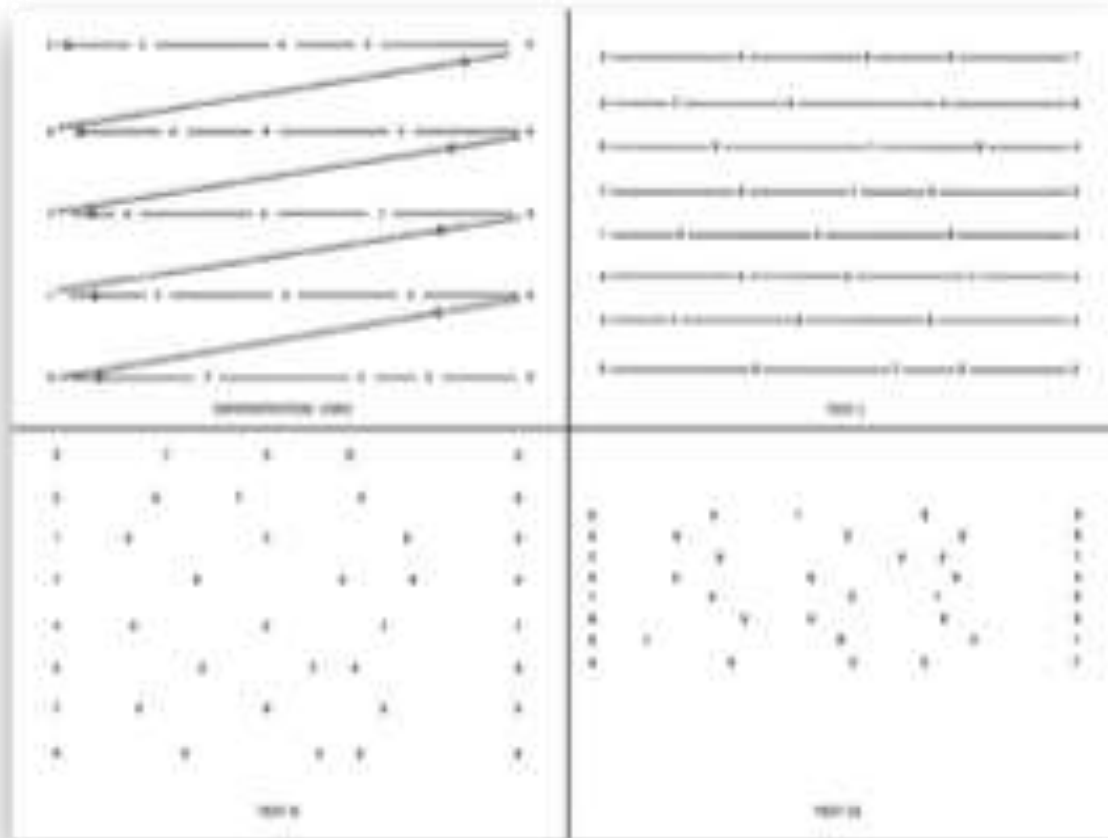
Skips lines
Uses finger
past 2nd grade.



Symptoms/Signs of CI

King-Devick Test

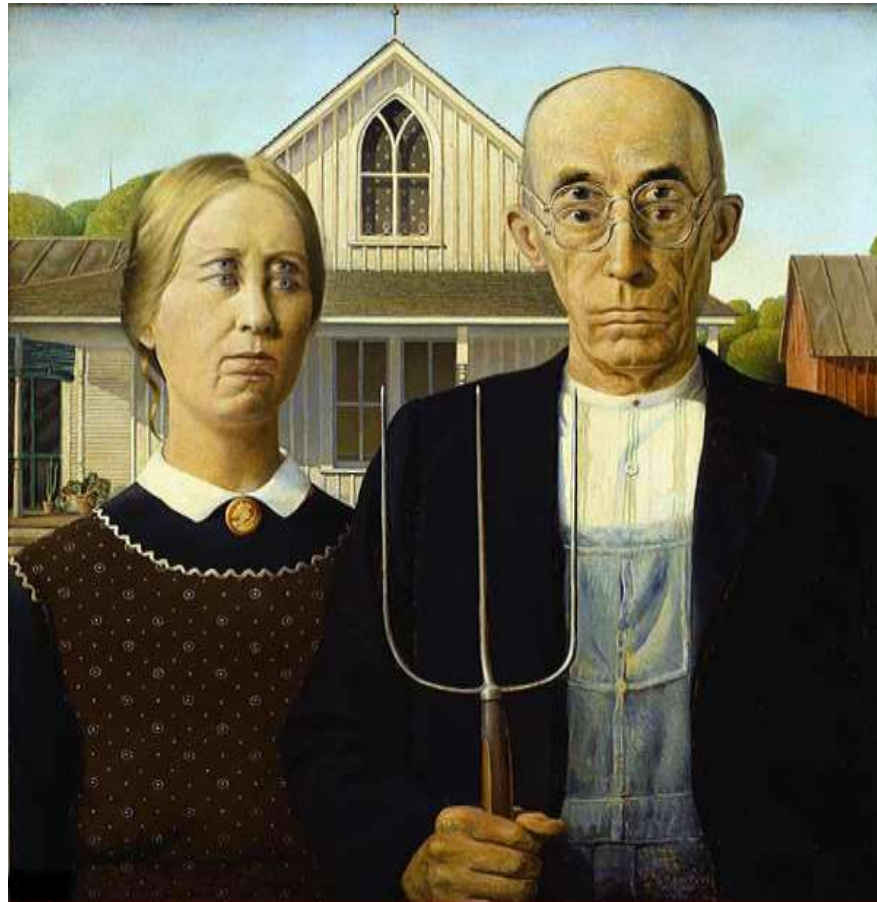
Evaluating Saccadic Eye Movements



Symptoms/Signs of CI

DOUBLE VISION

Words appear to run together, move.



Symptoms/Signs of CI

DOUBLE VISION

This is a demonstration of what it is like to see print the way someone with double vision would see it.

Symptoms/Signs of CI

**Not Autistic or Hyperactive. Just
Seeing Double at Times**

LAURA NOVAK

New York Times

September 11, 2007

Symptoms/Signs of CI



**Headaches,
especially after
near work.**

Symptoms/Signs of CI

Kids' eye problems often emerge in homework battle

Lauran Neergaard

The Associated Press Medical Writer

Diagnosing CI

Even though

CI affects many people of all ages

Impact on lives is extensive

Extensive research demonstrates that treatment is effective and permanent

Can cause behaviors that appear to be ADD/ADHD, reading and learning problems

Routinely missed in vision exams

Diagnosing CI

Why missed in routine exams ??

CI patients usually have 20/20.

CI patients rarely complain about their eyes to their parents or eye doctor.

Most CI patients have “quality of life” symptoms which are overlooked in routine exams.



Diagnosing CI

To minimize chair time:

1. 15–item checklist CI Symptom Survey CISS for *all* school-age children ***prior*** to your exam.
2. Measure Near Point Of Convergence (NPC) by you or tech ***Time: 1-2 minutes***
3. Assess vergence facility with a 3 BI / 12 BO prism flipper by you or tech ***Time: 1-2 minutes***

Diagnosing CI

Convergence Insufficiency Symptom Survey (CISS)



Validity and reliability of the revised convergence insufficiency symptom survey in children.

Optometry and Vision Science 2003; 80(12):832-838.

Borsting EJ, Rouse MW, Mitchell GL, et al and the CITT group.

Diagnosing CI

Convergence Insufficiency Symptom Survey (CISS)

Parent or adult patient reports frequency of symptoms, then totals score.

Children (< age 21)

total score = 16 or higher suggestive of CI

Adults total score = 21 or higher suggestive of CI

Diagnosing CI

Vergence Facility



Diagnosing CI

Vergence Facility

3 Base In / 12 Base Out prism flippers

(Call Bernell, approx. \$25.00)

Hold a 20/30 test card at 14 to 16 inches

**15 cycles per minute (one cycle is BI then BO),
*letters always clear and single.***

When CI present, BO more difficult:

blur, double vision, and/or facial stress.

Diagnosing CI

Near Point Of Convergence



Present a penlight or transilluminator as a target at the patient's midline, slightly below eye level, about 1 ½ feet away.

Aim light at patient's forehead, not directly into patient's eyes.

Diagnosing CI

Near Point Of Convergence

“I am going to slowly move the penlight towards your face and tell me when you see two lights.”

While slowly moving the penlight inward, note when one eye turns out, the **convergence break point.**

The patient may not see 2 if suppression present, or has poor observation skills.

Diagnosing CI

Near Point Of Convergence

The penlight is now moved slowly away from the nose until convergence re-establishes, the ***convergence recovery point***. The patient may report seeing one light again.

Diagnosing CI

Nearpoint of Convergence: Test Procedure, Target Selection, and Normative Data

MITCHELL SCHEIMAN, OD, FAAO, MICHAEL GALLAWAY, OD, FAAO,
KELLY A. FRANTZ, OD, FAAO, ROBERT J. PETERS, OD, FAAO, STANLEY HATCH, OD, FAAO,
MADALYN CUFF, OD, and G. LYNN MITCHELL, MAS, FAAO

Optom Vis Sci 2003;80:214–225

Results

A clinical cutoff value of **5 cm (2")** for NPC
break and **7 cm (3 inches)** for NPC recovery
*with either an accommodative target or a penlight
with red and green glasses.*

Diagnosing CI

Near Point Of Convergence

Now hold a red lens over one of the patient's eyes, or have them put on red/green glasses.

Repeat the procedure, break/recovery points with the filter will be more receded compared to no filter ***if the patient's convergence is susceptible to fatigue.***

Diagnosing CI

Near Point Of Convergence

When break/recovery points are receded, and you suspect double vision, do not ask the child directly if they see double, they could tell you what they think you want to hear

Ask “how do you make words look OK again when they look funny or smeared?”

If the child sees double while reading, they will clearly state how they clear words by rubbing eyes, changing position of book, etc.

Communicating With Patients & Parents

Important to communicate the child's emotional struggle!

Show the double vision demo if child has diplopia.
Explain to the parent, “Can you imagine how hard it is to sit through school seeing like this?”

Allow the parent to feel the problem using 12 BO prism in front of parent's eye while looking at print, may need to rotate prism slightly to produce discomfort.

Discuss vision therapy referral.

Vision Therapy Referrals

“Finding a colleague in your area who specializes in (VT) is another important element Depending on your diagnosis, you will often need .. subspecialty care....for patients with binocular dysfunction. The majority of that care comes from ... dedicated binocular vision specialists.”



James Thimmons OD,
OPTOMETRY TIMES 12/2010

Vision Therapy Referrals

“When one looks at the services optometrists are uniquely qualified to render, ...it only makes sense to direct our patients...to those in the profession who have demonstrated the desire to help. In the case of vision therapy, there are evidence-based protocols to support referrals.”

Paul B. Freeman, O.D.

Editor, Optometry; Journal of AOA

7/2011



Managing Vision Problems By Developmental Optometrists

SPECIALIZED GLASSES

May include bifocals, prisms

More effective than
colored overlays



Managing Vision Problems By Developmental Optometrists

Optometric Vision Therapy



*In-office procedures to effectively
treat vision problems.*

Managing Vision Problems By Developmental Optometrists



It is **treatment of the visual brain** using proven **neuroscience techniques** such as feedback & visual awareness.

Where's The Research?

CITT RESULTS

In-office VT plus home treatment: *75 % reported fewer and less severe symptoms related to near work*

Home-based “vision activities” including pencil push-ups or computer-based programs:

no more effective than a placebo

Prism reading glasses alone:

no more effective than placebo

Subsequent research shows patients long-term success, thus *defining the cure* for CI with office VT.

Where's The Research?

Improvement in Academic Behaviors After Successful Treatment of Convergence Insufficiency

Optometry and Visual Science 2012 Jan;89(1):12-8

Borsting, Eric; Mitchell, G. Lynn; Kulp, Marjean Taylor; Scheiman, Mitchell; Amster, Deborah M.; Cotter, Susan; Coulter, Rachael A.; Fecho, Gregory; Gallaway, Michael F.; **Granet, David;** **Hertle, Richard;** Rodena, Jacqueline; Yamada, Tomohiko; the CITT Study Group

A successful or improved outcome after CI treatment was associated with reduced frequency of adverse academic behaviors and parental concern associated with reading and school work as reported by parents.

Where's The Research?

Behavioral and Emotional Problems Associated With CI in Children: An Open Trial Abstract

Objective: This study investigated behavioral and emotional characteristics of children with convergence insufficiency (CI), before and after treatment with office-based vergence accommodative therapy (OBVAT).

Conclusion: In an open trial, attention and internalizing problems improved significantly following treatment for CI.

Journal of Attention Disorders
Online publication Nov 22, 2013

Where's The Research?

The Incidence and Clinical Characteristics of Adult-Onset Convergence Insufficiency

Brian G Moheny, MD, et al, Mayo Clinic

OPHTHALMOLOGY Online 24 January 2015

"Patients with CI usually exhibit an exophoria at near and normal alignment at distance; however, they can also be orthophoric and occasionally even esophoric."

Quoted from Von Noorden GK et al.

Binocular Vision and Ocular Motility: Theory and Management of Strabismus. 6th ed. 502. St. Louis, MO, Mosby, 2002,

One of the most respected ophthalmologic sources on binocular vision

Where's The Research?

THE SYMPTOMATIC POST-LASIK PATIENT: DRY EYE OR BINOCULAR VISION ANOMALIES?

Amelia Nieto-Bona, Catalina Palomo-Alvarez, Jesus Carballo-Alvarez, M^a Cinta Puell-Marin
Poster at American Academy of Optometry 2006

CONCLUSIONS: **Symptoms** of dry eye were more frequent than binocular anomalies **symptoms** in post LASIK patients. However clinical procedures revealed that the percentage of patients with binocular (primarily CI) and accommodative anomalies was higher than that of patients with dry eye. Accommodative insufficiency (13.9%) and convergence insufficiency (11.1%) were the most prevalent anomalies.

Where's The Research?

Study Results Indicate Testing Dry Eye Patients For Binocular Vision Disorders

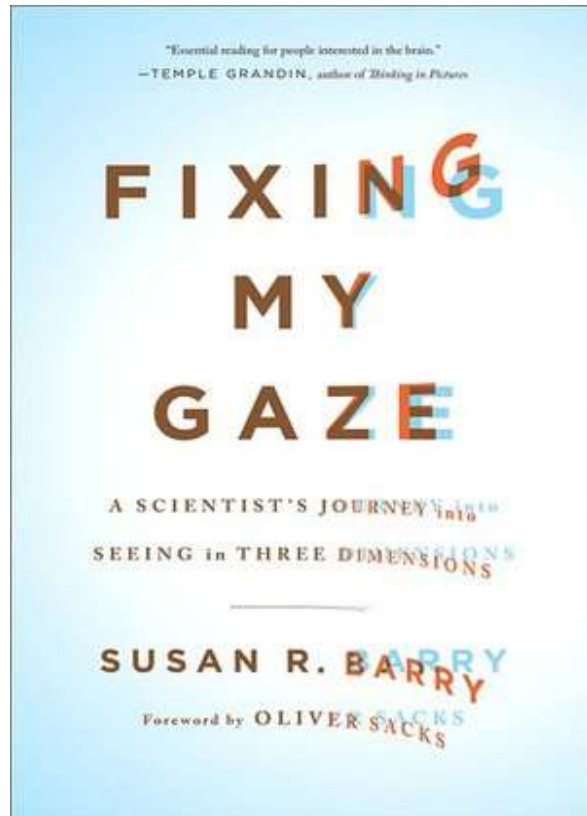
Association For Research In Vision and Ophthalmology

Erin M. Rueff, OD, et al, OSU School of Optometry

“The researchers found the subjects’ scores on the OCULAR SURFACE DISEASE INDEX (OSDI) and the CONVERGENCE INSUFFICIENCY SYMPTOM SURVEY (CISS) to be positively correlated”

“The results suggest that clinically we should be testing our dry eye patients for binocular vision disorders as well”

What Is Vision Therapy?



From 2-D to 3-D Sight: How A Scientist Learned to See

Review of FIXING MY GAZE

Scientific American

August 4, 2009

***Result of a primary care
optometrist referral to a VT OD***

What is vision therapy?



"Barry benefited from orthoptics — a hidden corner of restorative medicine.

With contrived ocular exercises, specially trained..optometrists treat patients whose eyes are cosmetically aligned but imperfectly foveated."

New England Journal of Medicine

Review of FIXING MY GAZE

July 2, 2009

What is vision therapy?

*“Several visual scientists have now demonstrated the reversibility of infantile loss of vision & stereopsis, **but blindness to these findings and under appreciation of the solutions offered by orthoptics still persist.**”*

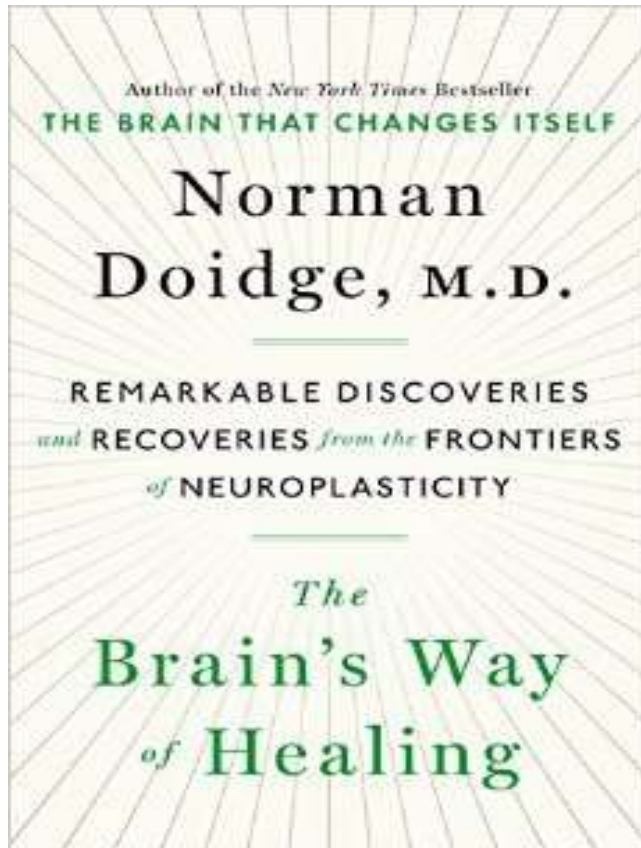


New England Journal Of Medicine

Review of FIXING MY GAZE

July 2, 2009

What Is Vision Therapy?



"Related to vision therapy is the relatively unknown field of behavioral optometry, which **for almost one hundred years** has understood that vision is a group of skills that can be trained. *The field relies on neuroplasticity.*"

What Is Vision Therapy?



The neurobiologist Dr. Susan Barry spent 50 years with 2-D vision...

With neuroplasticity-based training from her behavioral optometrist, Barry reawakened her visual cortex and finally experienced 3-D, as she described in Fixing My Gaze.”

What Is Vision Therapy?

Older Children Can Benefit From Treatment For Childhood's Most Common Eye Disorder

Results from a nationwide clinical trial...

Many children ***ages 7 through 17*** with **amblyopia (lazy eye)** may benefit from treatments that are more commonly used on younger children.

National Eye Institute April 11, 2005

What Is Vision Therapy?

“..poor visual-perceptual processing is one of the many characteristics of autism... Indeed, children with challenges in visual-spatial thinking are lost in space. *Optometrists can help both in diagnosis of ASD..as well as in treatment.*

Ricki G. Robinson, MD, MPH,
Clinical Professor of Pediatrics, USC

What Is Vision Therapy?

“The conclusions, particularly the failure to recommend optometric vision therapy for children likely to benefit, *are based on the exclusion of the most relevant data...*”

Joseph Manley, MD
Medical-legal Expert Witness

Commenting on
ACADEMY OF PEDIATRICS
Report On Learning Disabilities,
Dyslexia & Vision
March 1, 2011



What Is Vision Therapy?

“They fail to acknowledge abundant published and anecdotal evidence supporting..vision therapy.”

This...includes controlled trials, case reports, and consensus of experts – the same kinds of data that underpin the daily practice of medical professionals.”

Joseph Manley, MD



What Is Vision Therapy?

The Number of Placebo Controlled,
Double Blind, Prospective,
and Randomized
*Strabismus Surgery Outcome
Clinical Trials:*

None!



Dominick M. Maino, OD,
MEd, FAAO, FCOVD-A

Editor, *Optom Vis Dev* 2011;42(3):134-136.

**THANK YOU FOR YOUR
UNDIVIDED ATTENTION**



Tod R Davis, OD, FCOVD

Developmental Optometrist

www.virginiavisiontherapycenters.com

Springfield, Gainesville, Winchester, Fredericksburg

QUESTIONS?

