

# Functional Vision: What it means for the Child with Cerebral Palsy

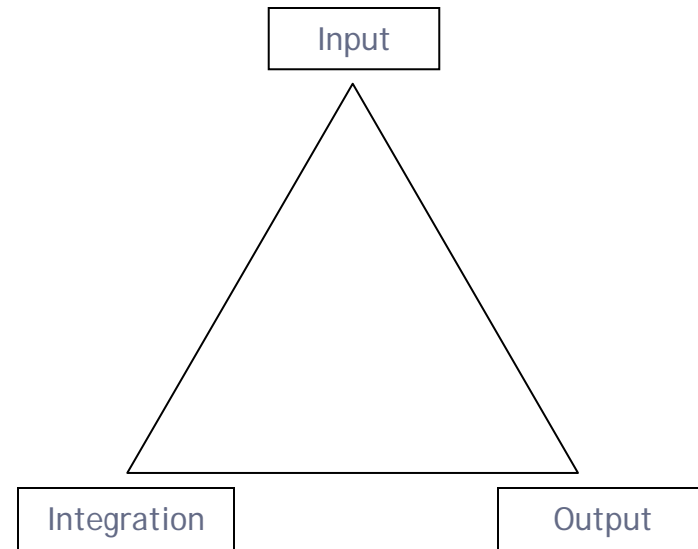


MICHAEL ZOST, O.D., FCOVD, FAAO  
APRIL 9, 2010

# What is the importance of vision?

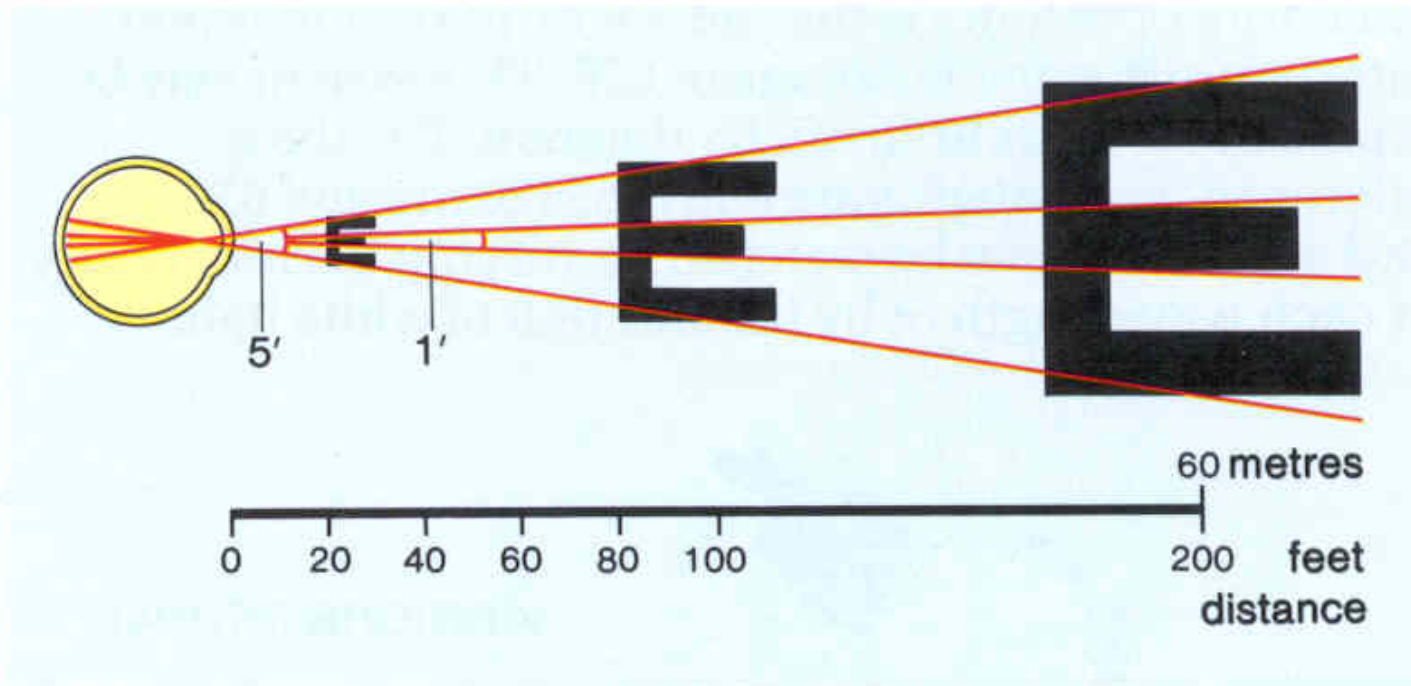


- 80% or what we learn is do to the use of vision
- The Triad - input, integration, output

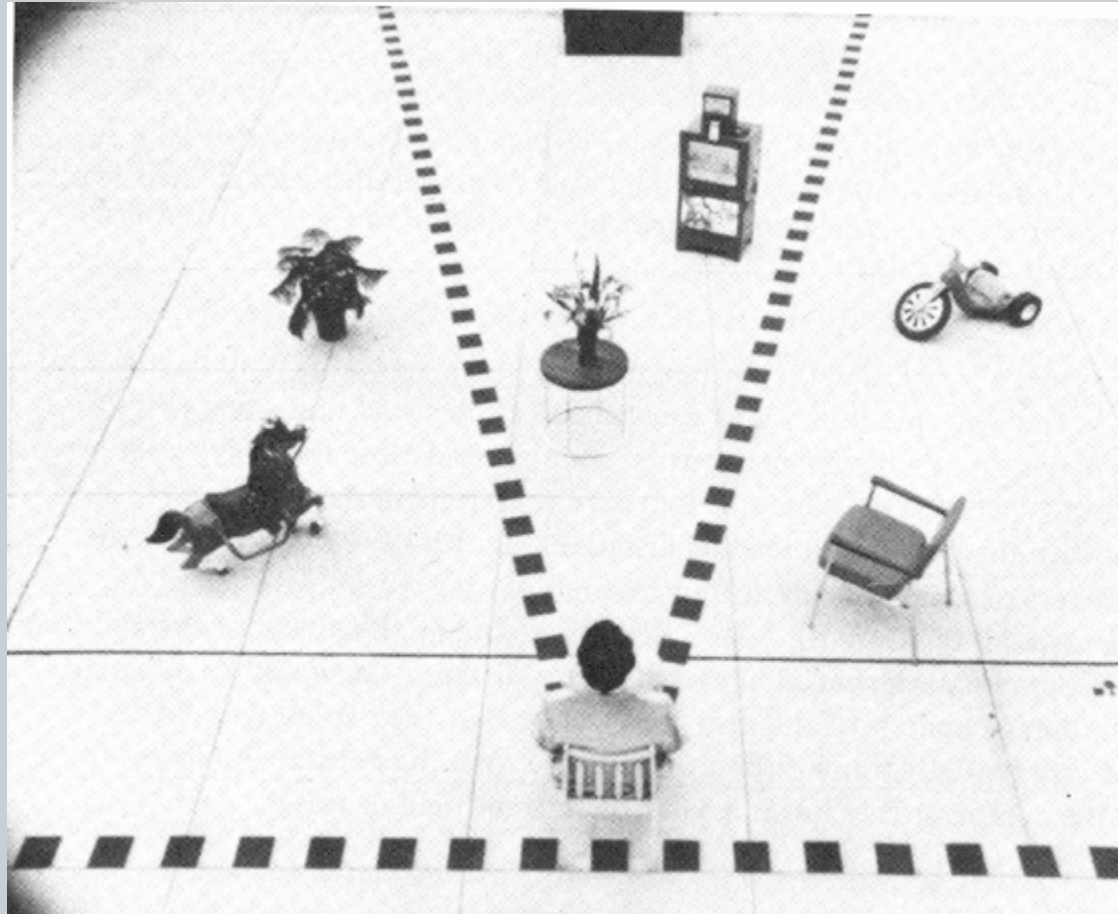


# What is Visual Acuity?

- 20/20 - What does that mean?



# What is Peripheral Vision?



# Critical Visual Skills for Learning

5

- Eye Alignment or Aiming
- Eye Coordination or Teaming
- Eye Tracking or Scanning - Saccades, Pursuits
- Focusing - Stamina, flexibility, accuracy
- Depth Perception
- Color Vision

# Visual Perceptual Skills



- Visual discrimination
- Visual spatial relations
- Form constancy
- Figure ground
- Visual closure
- Laterality and directionality
- Visual memory and sequential memory

# These abilities can be compromised if:

7

- Vision is not clear
  - The eyes don't align properly
  - The eyes don't sustain or change focus easily
  - The eyes don't coordinate and track smoothly
  - These can all alter depth perception
- 
- Bottom line: These make the intake of information less reliable, therefore can negatively influence interpretation

# We Need to Rule Out:



- Long standing vs. acquired disorders
  - Long standing (Children & Adults)
    - ✦ Developmental Delays
    - ✦ Neurological Consequences - CP, brain injury
    - ✦ Dyslexia
    - ✦ ADD / ADHD
    - ✦ Slow learner
    - ✦ Reading difficulties
    - ✦ Uncorrected visual skills problems

# Long standing vs. acquired disorders

- Acquired

- Sensory and perceptual functions
- Learning and memory
- Language skills
- Visuo-spatial and manipulo-spatial skills

- Planning ability and judgement
- Initiating and performing goal-oriented activities
- Speed and efficiency of information processing
- Response time

## Visual deficits may be clouded by:

- Unresolved medical issues, cognitive and memory issues, emotional instability, and social functioning
  - ✦ These can continue even after participation in a rehabilitative program

# What Visual Skills Are Seen with CP



- Eye Alignment
  - Eso or Exo phoria or tropia
- Accommodation or Focusing
  - Fatigue and instability
- Eye Movements / Tracking
  - Jerky and Choppy Movements
- Eye Coordination
  - Limited range of eye teaming
- These are due to poor muscle control
- Caused “Vision-Related” Learning Problems
- Not Vision Disabilities

## Each vision condition has a medical code:

12

- Esotropia/phoria: 378.00-378.45
- Exotropia/phoria: 378.00-378.45
- Hypertropia: 378.31
- Divergence Anomalies: 378.85
- Convergence Insufficiency: 378.83
- Convergence Excess: 378.84
- Accommodative disorders: 367.50-367.53
- Saccadic Eye Movements: 379.58
- Pursuit Eye Movements: 379.57

# Signs & Symptoms



## OF VISION-RELATED LEARNING PROBLEMS

# Signs & Symptoms

14

- **Close working distance**
  - Closer than indicated by the student's "Harmon" distance
  - Counter-intuitive to efficient focusing
  - Habitual

# Signs & Symptoms

15

- **Headaches**
  - Dull achy pain, frontal or temporal in nature
  - Occur after reading or some type of near work
  - Not generally relieved with pain medication
  - Not related to allergies or sinus issues
  - Will not wake up with a vision-related headache

# Signs & Symptoms

16

- **Blurry vision**
  - Far - could be nearsightedness or a focusing problem
  - Near - could be farsightedness or a focusing problem
  - Both near and far - could be astigmatism or a focusing problem
- **Balanced and Mobility Issues**
  - Dependent on Severity of Case

# Signs & Symptoms

17

- **Diplopia**
  - Two images either side by side, above one another or split diagonally
  - Can happen when looking far and or near
  - Can be constant or intermittent frequency
  - Can occur more later in the day or with fatigue
  - Will not be present if one eye is closed

# Signs & Symptoms

18

- **Text moving or jumping**
  - Skipping words
  - Skipping lines
  - Re-reading sentences
  - Poor comprehension
  - Excessive head movement when reading
  - Using a finger or ruler to assist pacing

# Signs & Symptoms

19

- **Avoidance of near work**
  - If vision isn't reliable, why use it?
    - ✦ Use what is reliable - auditory or tactual
  - Students that do poorly in reading, spelling
- **Postural Skews**
  - Leaning forwards, backwards, or to one side

# Signs & Symptoms

20

- Lesser seen symptoms
  - Excessive blinking - may be the student is trying to refocus for blurry vision
  - Rubbing eyes after reading - may be the student is rubbing due to eyestrain or rub away the blur
  - Closing one eye to improve vision
    - ✦ May indicate something is interfering with binocularity

# Signs & Symptoms

21

- Lesser seen symptoms
  - Reversing letters or words
  - Difficulty sequencing or recalling numbers or words
  - Difficulty with fine-motor tasks, such as handwriting

**Anatomy of:**

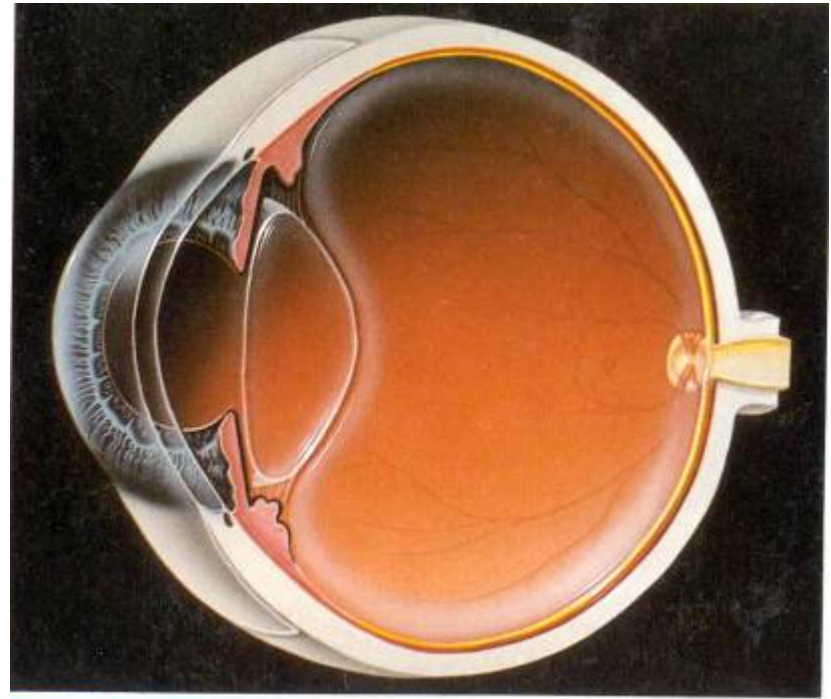


**VISION-RELATED LEARNING PROBLEMS**

# Input Factors

23

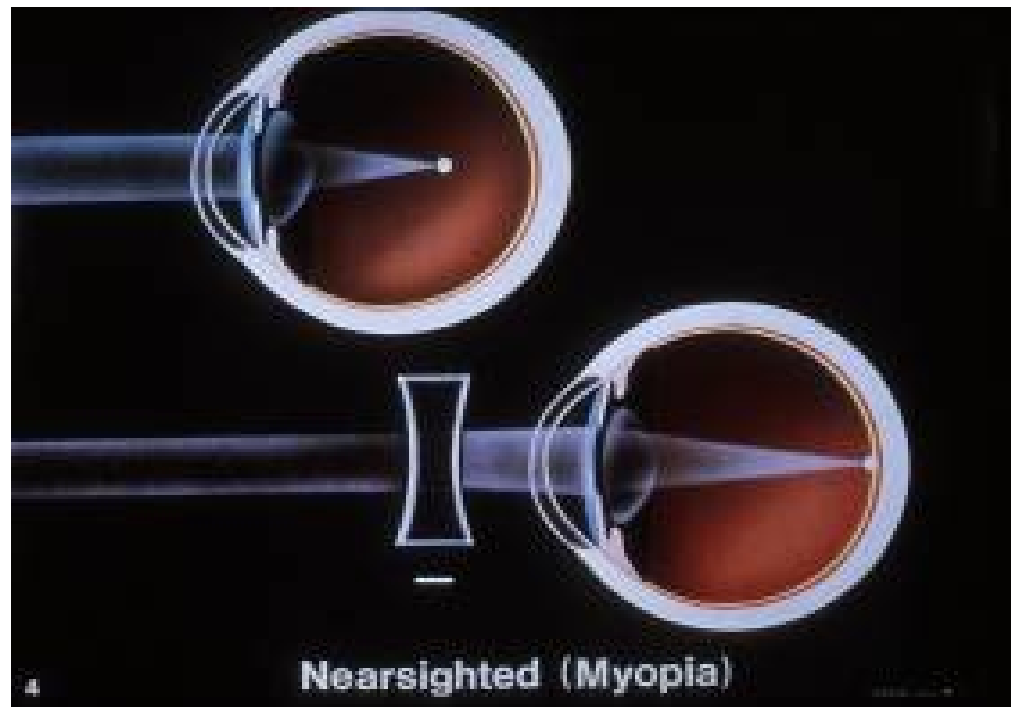
- A normal healthy eye
  - Clear media
  - Intact retina
  - Healthy optic nerve



# Input Factors

24

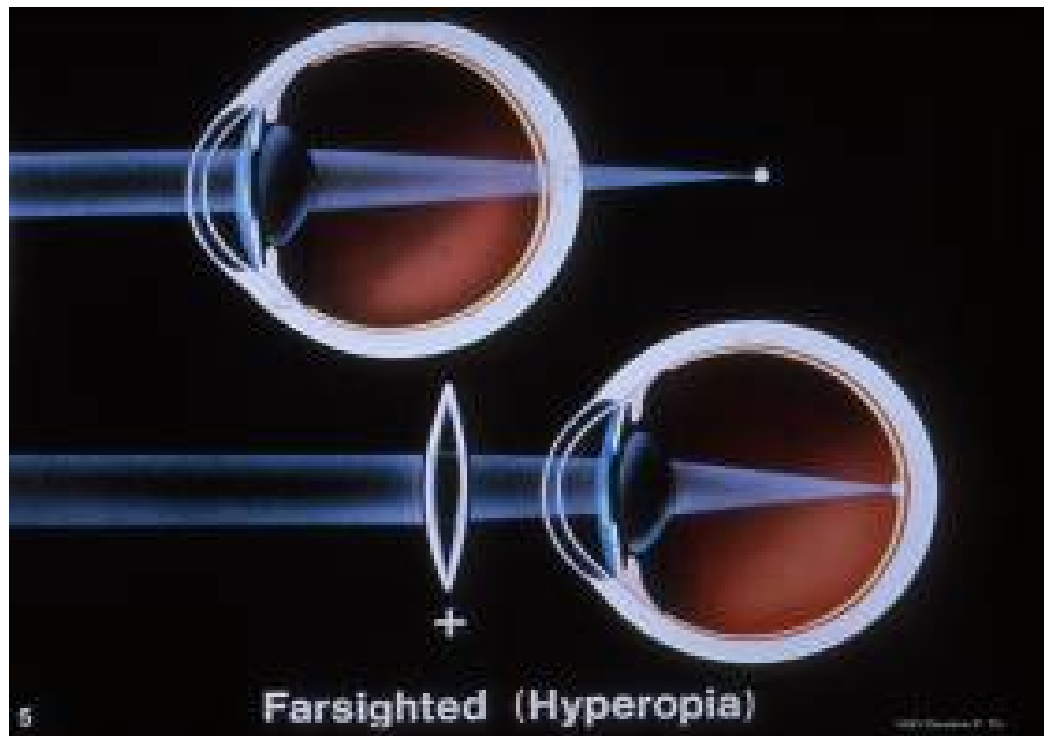
- Myopia



# Input Factors

25

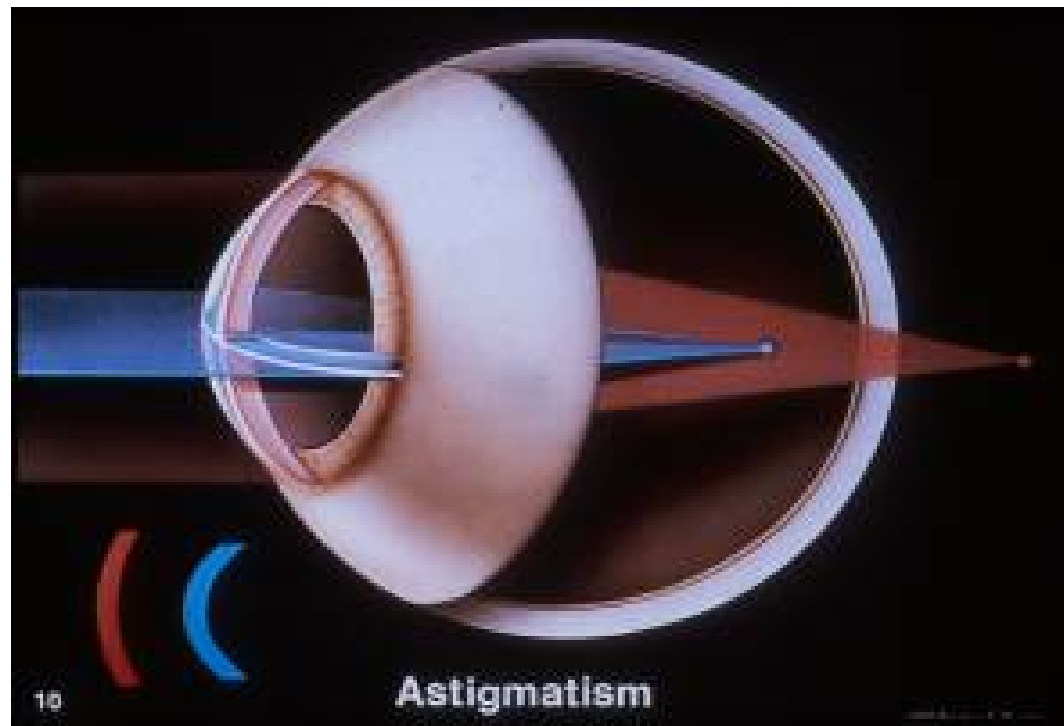
- Hyperopia



# Input Factors

26

- Astigmatism



# Input Factors

27

- Eye Misalignment

- Esotropia

- Exotropia

- Hypertropia

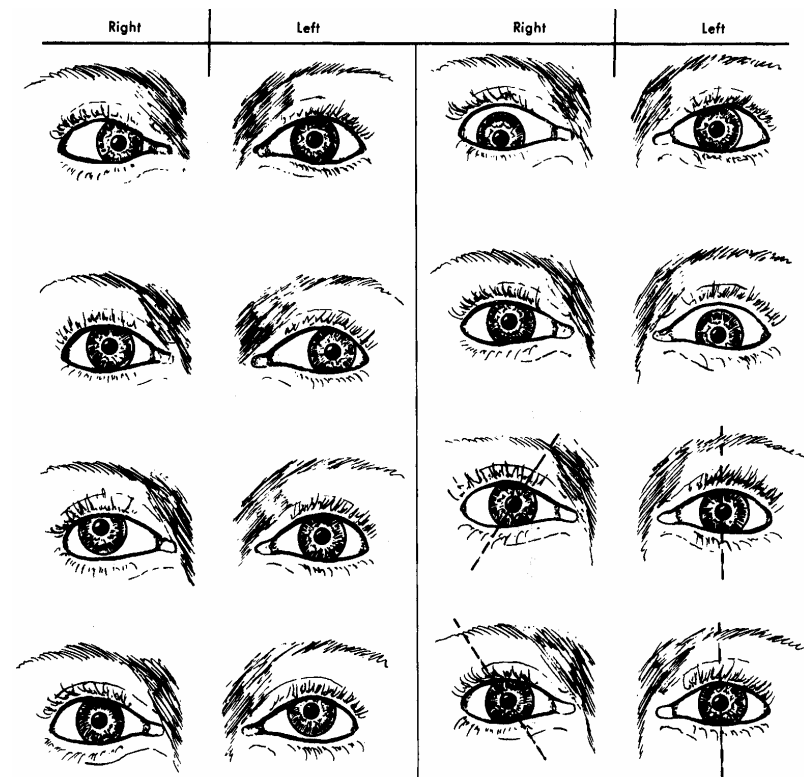


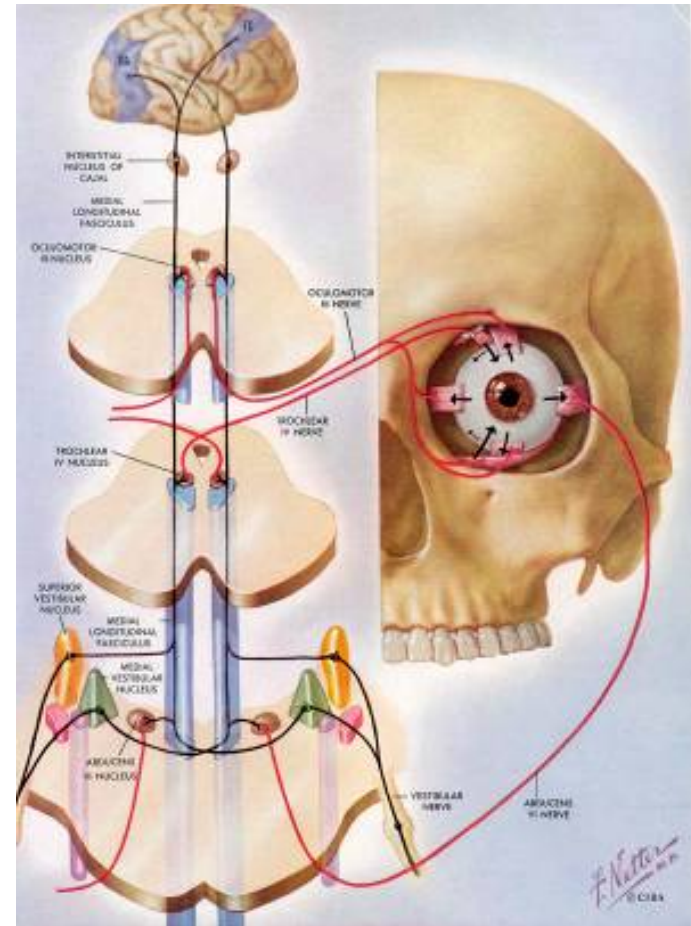
Fig 8-2. Classification by direction of deviation. A, Right esotropia. B, Left exotropia. C, Right hypertropia associated with small exotropia. D, Left hypertropia. E, Right hypotropia. F, Left hypotropia. G, Right incycloptropia. H, Right excycloptropia.



# Input Factors

29

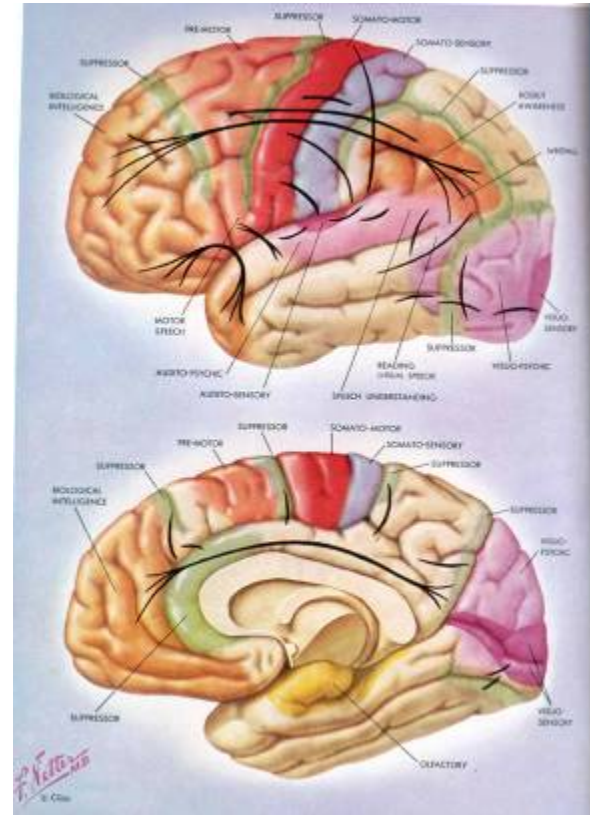
- Oculomotor Pathway
  - Saccades
  - Pursuits



# Integration Factors

30

- Visual Perceptual Areas
  - Laterality - Directionality
  - Visual Memory
  - Closure
  - Figure Ground
  - Visual-motor integration
  - Spatial Relations



# Common Vision-Related Learning Diagnoses



As seen with patients with  
normal acuity and peripheral  
vision

# Eye Alignment

32

- Esotropia or esophoria
  - The eyes over-converge
    - ✦ If an eye is turned in constantly (esotropia), the student is monocular
    - ✦ Sometimes small amounts of esophoria cause greater disruption to the use of vision than esotropia

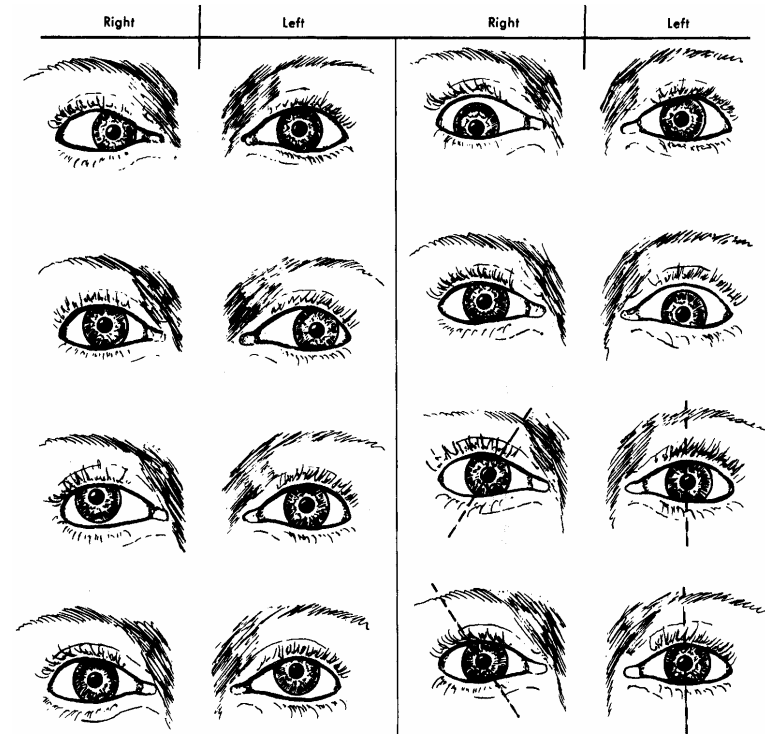


Fig 8-2. Classification by direction of deviation. A, Right esotropia. B, Left exotropia. C, Right hypertropia associated with small exotropia. D, Left hypertropia. E, Right hypotropia. F, Left hypotropia. G, Right incyclotropia. H, Right excyclotropia.

# Eye Alignment

33

- Exotropia or exophoria

- The eyes over-diverge

- ✦ If an eye is turned out constantly (exotropia), the student is monocular
- ✦ Sometimes small amounts of exophoria cause greater disruption to the use of vision than exotropia

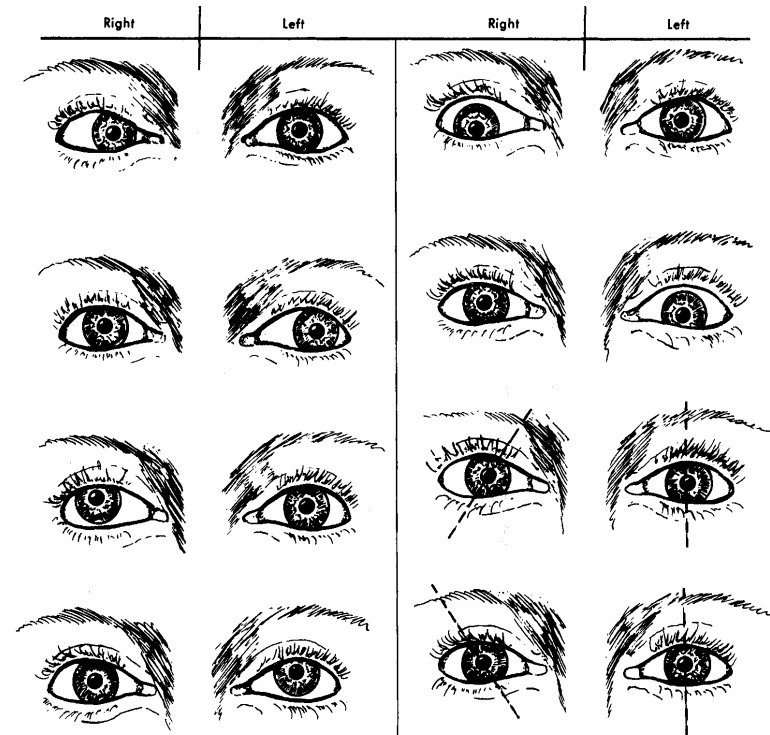


Fig 8-2. Classification by direction of deviation. A, Right esotropia. B, Left exotropia. C, Right hypertropia associated with small exotropia. D, Left hypertropia. E, Right hypotropia. F, Left hypotropia. G, Right incyclotropia. H, Right excyclotropia.

# Eye Alignment

34

- **Hypertropia or hyperphoria**
  - One eye aims higher, while the other aims lower
    - ✦ If an eye is turned up constantly (hypertropia), the student is monocular
    - ✦ Sometimes small amounts of hyperphoria cause greater disruption to the use of vision than hypertropia

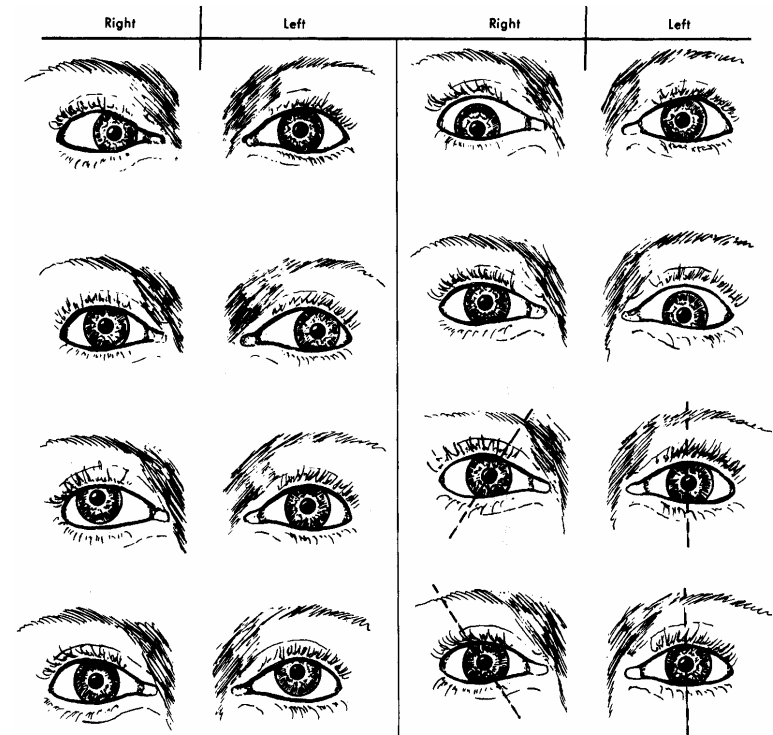


Fig 8-2. Classification by direction of deviation. A, Right esotropia. B, Left exotropia. C, Right hypertropia associated with small exotropia. D, Left hypertropia. E, Right hypotropia. F, Left hypotropia. G, Right incyclotropia. H, Right excyclotropia.

# Eye Alignment

35

- Eye Misalignment
  - Can lead to “suppression”
    - ✦ Of the input from one eye
    - ✦ This occurs at the level of the visual cortex and not the eye
    - ✦ Can affect depth perception
    - ✦ Usually doesn't affect peripheral vision

# Eye Coordination

36

- **Divergence**

- The eyes turn out when looking from near to far
- Divergence insufficiency - the eyes don't turn out enough
- Divergence excess - the eyes turn out too much

- **Convergence**

- The eyes turn in when looking from far to near
- Convergence insufficiency - the eyes don't turn in enough
- Convergence excess - the eyes turn in too much

# Eye Tracking

37

- **Saccadic Eye Movements**

- When looking from word to word
  - ✦ Undershooting
  - ✦ Overshooting
  - ✦ Re-reading

- **Pursuit Eye Movements**

- Following a moving object
- More related to athletic performance
- (ie. gym and recess)

# Focusing

38

- Also known as “Accommodation”
- Three aspects critical to focusing
  - Stamina
  - Flexibility
  - Accuracy

# Focusing

39

- Stamina - needed to hold focus at a particular distance for a length of time
- Flexibility - needed to quickly change focus from far to near or near to far
- Accuracy - needed to keep clarity constant and precise

# Focusing

40

- **Common Disorders:**
  - Accommodation Insufficiency - difficulty sustaining focus or using all of the focusing ability for one's age
  - Accommodation Infacility - difficulty changing focus quickly and easily
  - Accommodation Spasm - focusing has stiffened or locked up, (like getting a "Charlie-horse")

# Visual Perceptual Processing

41

- Difficulty recalling visual information
- Difficulty with sequencing visual information
- Difficulty noting differences or ranking the size, shape, position, etc. of visual information
- Difficulty with visual motor tasks - the eyes are guiding the hands
- Difficulty finding a key piece of information in an array

# Are these problems for real?



STATISTICS OF VISION-RELATED  
LEARNING PROBLEMS

# Statistics

43

- Accommodation:
  - Depending on the study: 10-80% of patients in the normal population may show some degree of focusing inefficiency (sustaining and flexibility)
- Convergence
  - 25% of the normal population exhibits either convergence insufficiency or excess
- Saccadic Eye Movements
  - 10-25% of normal kids exhibit deficient eye movement skills

# Statistics

- The percentages for vision-related learning problems are higher for students with learning disabilities or emotional disturbances than students with normal vision.
- As a side note:
  - The occurrence of eye disease in the normal population is only 3-5%

# Rehabilitation and Accommodations



For vision-related learning  
problems

# The Rehabilitation Process



To help the patient reach his or her potential as quickly as possible.

# Visual Hygiene - not just clean eyes

47

- Using the optimal working distance
- Proper illumination and minimization of glare
- Visual angle, work area ergonomics, posture
- Use of recommended eyewear
- Periodic breaks including visual relief
- Minimizing distractions and clutter

# The Optometrist's Role



Begins with a thorough  
assessment and accurate  
diagnosis

# An assessment should:

49

- First rule out the following as possible influences:
  - Acuity issues
  - Peripheral vision issues
  - Refractive errors
  - Ocular health issues

# An assessment should:

50

- Test for:
  - Eye alignment at far and near
  - Eye coordination at far and near
  - Eye tracking
  - Focusing stamina and flexibility
  - Check for suppression patterns
  - Screen for visual perceptual disorders if indicated or schedule for additional testing
- This should all be done prior to using dilating drops

## After the thorough assessment and accurate diagnosis:



- A well defined treatment plan should be presented to the parent and patient.
- This may include using spectacles, visual hygiene, vision therapy, and suggestions for classroom accommodations.

# Treatment guidelines:

52

- Prescription lenses:
  - Aid in binocularity by increasing clarity and equalizing the images seen between the two eyes
  - Helps make focusing easier
  - Can improve eye alignment
  - All the above can improve tracking (saccadic) eye movements
  - Improves a person's ability to gather visual information

# Treatment guidelines:

53

- Prescription Lenses:
  - Single vision or bifocals
  - Prisms
    - ✦ To correct eye alignment
    - ✦ To improve posture and head position
    - ✦ To assist in vision reorganization - yoked

# Treatment guidelines:

54

- Visual Hygiene
  - What is recommended in the classroom also needs to be carried through at home and vice versa
    - ✦ Slant board
    - ✦ Periodic Breaks
    - ✦ Limiting use of hand-held video games

# Treatment guidelines:

55

- Vision Therapy
  - Through the use of additional lenses and equipment, individuals can learn new strategies to use their vision more effectively
  - Focusing, eye coordination, eye movements, eye alignment, and vision perception can all be enhanced through a sequential program of learning new vision strategies

# Treatment guidelines:

56

- Vision Therapy
  - An average length of a program of vision therapy to address the most common focusing and eye coordination/teaming issues is 10-12 weeks
  - Programs running longer than this are poorly structured and only serve to misdirect the student and parent from obtaining needed support and tarnish the image of professional optometry

# Treatment guidelines:

57

- Are all vision therapy programs the same?
  - No
    - ✦ Doctor as therapist or technician-therapist
    - ✦ Costs
    - ✦ Office based vs. home-based
    - ✦ Frequency and length of sessions
    - ✦ Equipment - use of computers vs. not
    - ✦ See Clearly Method, versus other gimmicks

# Treatment guidelines:

58

- Can anyone else provide this service? i.e., Teachers?
  - No
    - ✦ Due to state laws, only optometrists or ophthalmologist are licensed to provide vision therapy services
    - ✦ Occupational therapists and orthoptists can provide some of these service, but only under the direct supervision of either an optometrist or ophthalmologist
    - ✦ Orthoptists are not recognized by insurance companies as certified to be reimbursed for vision therapy services

# Classroom Accommodations:

59

- I prefer to refer to them as “Suggestions”:
  - If spectacles are required, when?
  - Preferential seating
  - Lighting, glare minimization, and contrast
  - Ergonomics - slant desks, pencil grips
  - Periodic breaks or extended time for testing, allowing to write on a test booklet as opposed to using ScanTron forms

# Classroom Accommodations:

60

- **Note**

- Most of classroom accommodations do not need to be carried on throughout the student's academic career.
- They should apply only during the term of the therapy program. Accommodations should be re-determined periodically, especially after completion of the vision therapy program.

# Question!



When these problems are treated,  
does that mean the patient is  
cured?

# Answer



Yes and No.

Some problems can be fully addressed and corrected, while for others they may only be lessened and continue to have some level of influence on the child's performance.

What problems can not be directly  
treated by the Optometrist?



LEARNING DISABILITIES

READING DIFFICULTIES

DYSLEXIA

CLUMSINESS

MATH DIFFICULTIES

# Questions?

64



April 6, 2010



**Thank You for  
Your Time and  
Interest!**