Visual processing disability

Cerebral Visual Impairment CVI

How to diagnose the CVI?

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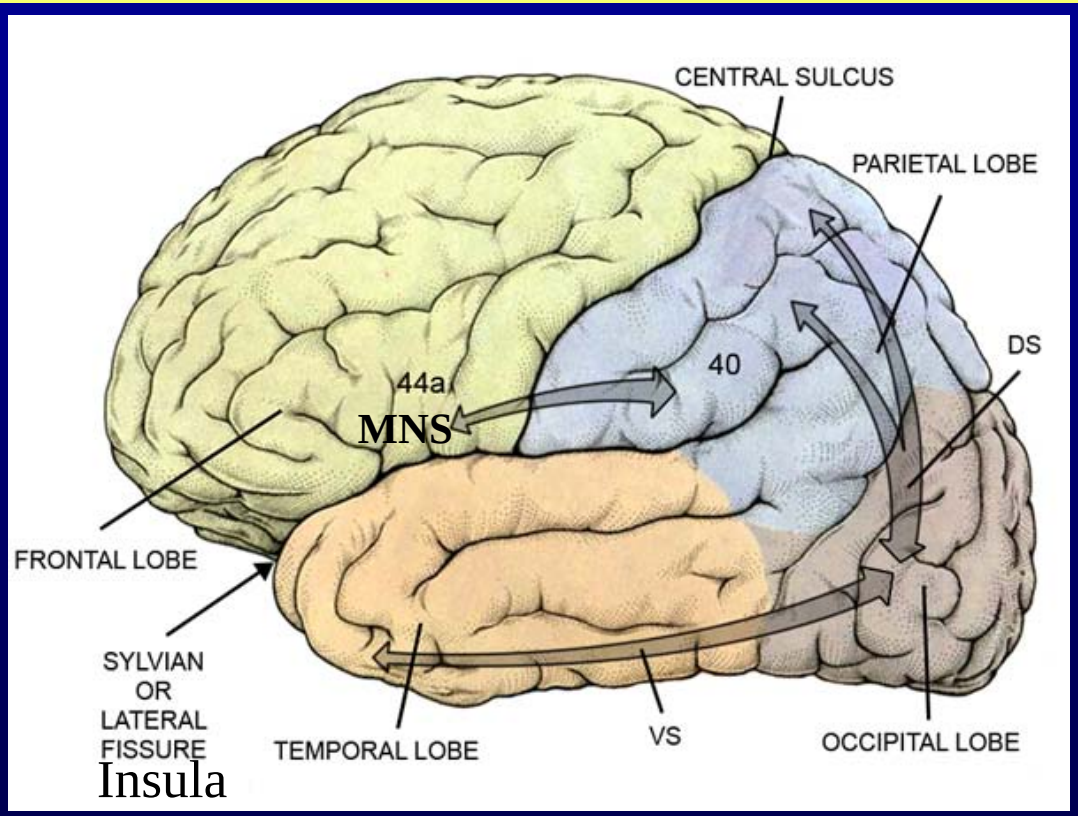
Processing problems

- Primary visual cortex (& V5):
  - coding direction and length of lines, colour, motion
- Ventral stream functions:
  - recognition: face, landmarks, objects, form
  - facial expressions, body language, pictures,
    object – background, surface qualities, textures
- Dorsal stream functions:
  - orientation in space, eye-hand coordination

Since the specific visual areas are more or less apart, a single visual function may be lost without loss of other visual functions.

Processing of visual information



Early processing in the occipital lobe:

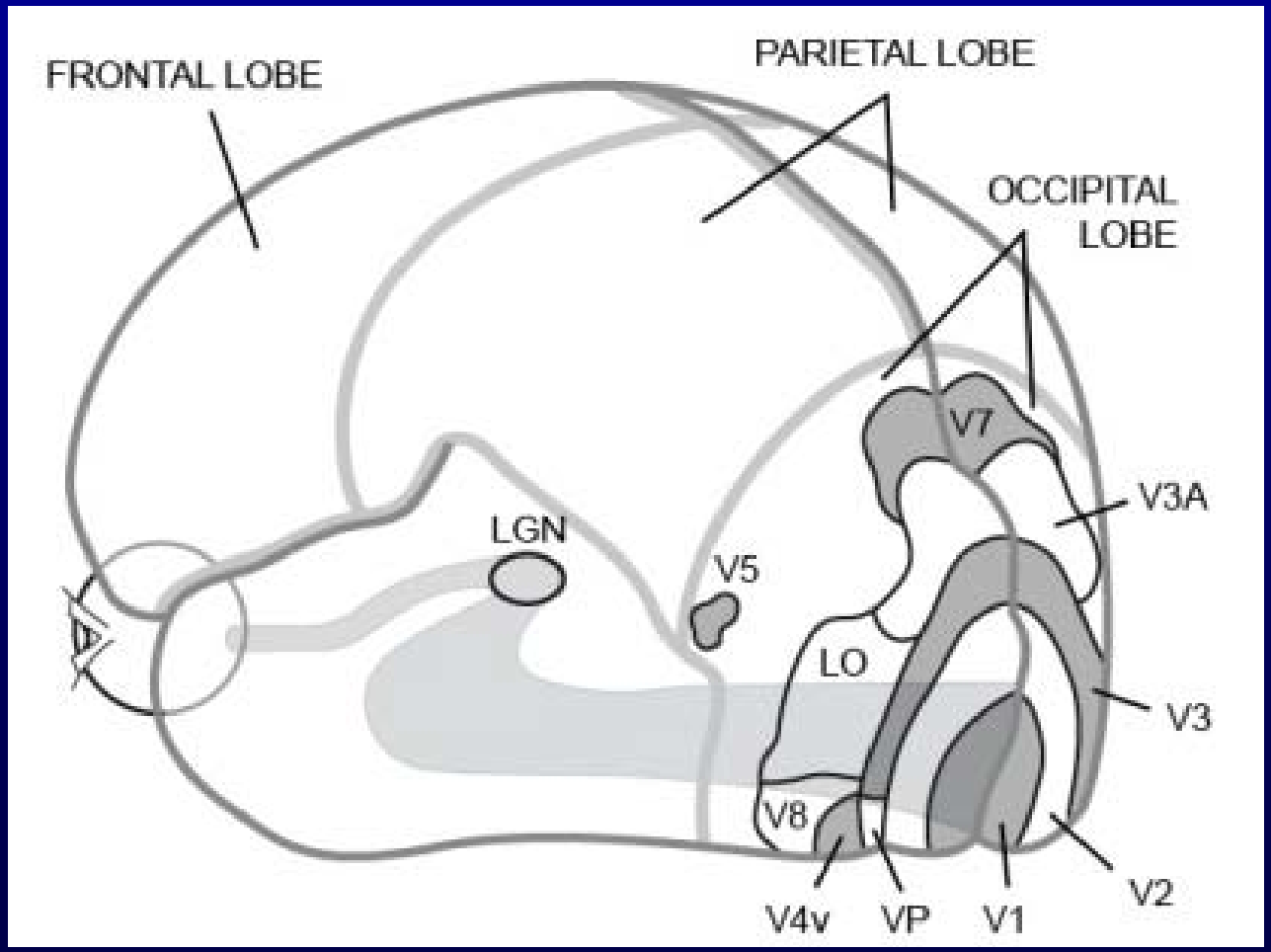
Ventral stream
Dorsal stream
Mirror neuron system

Assessment

for schools and for early intervention

- Oculomotor functions
- Quality of the image
- **Processing of the image**
  - ventral stream
  - dorsal stream

Retinocalcarine pathway



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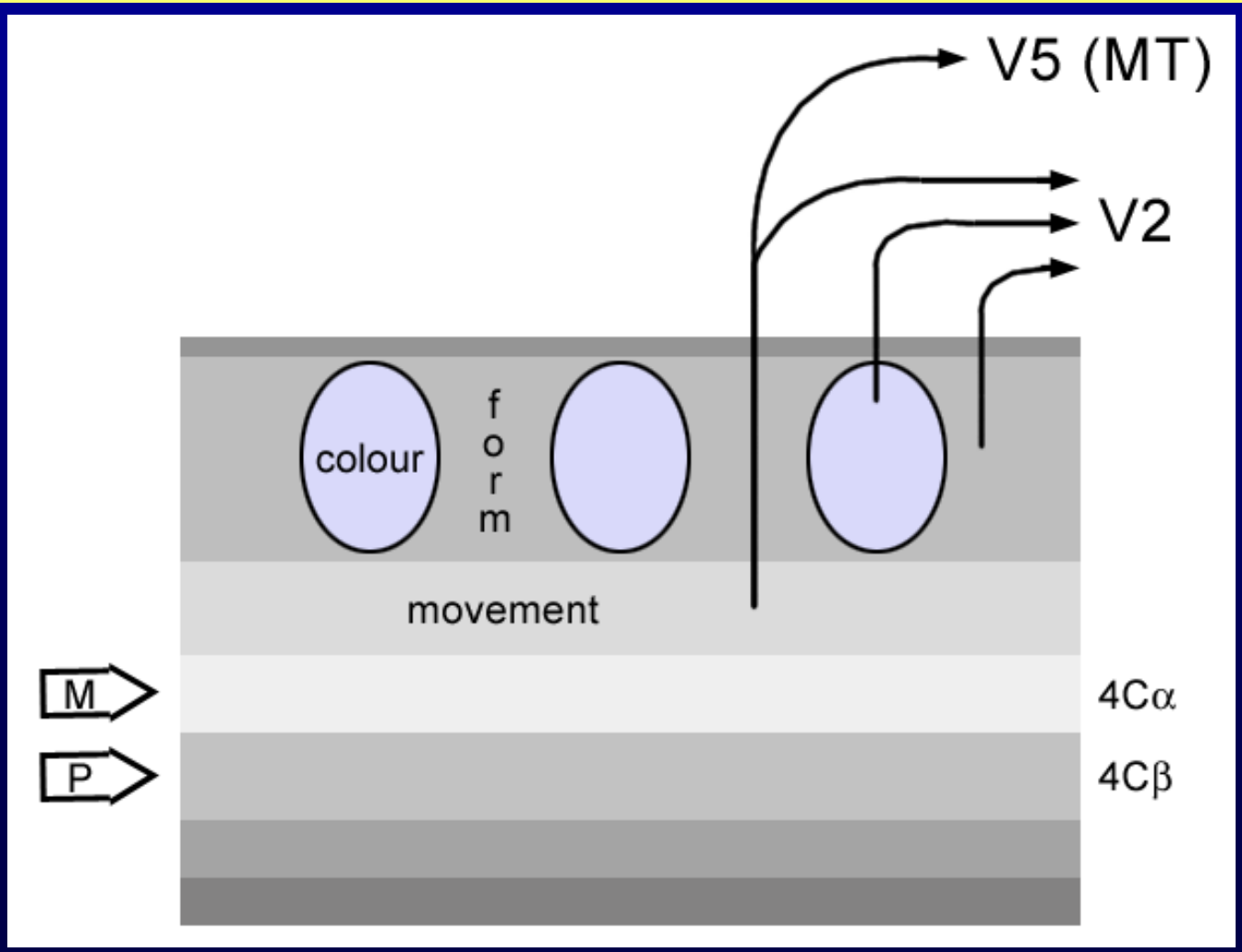
Lea Puzzle

magnetic puzzle pieces for children with limted hand functions

Primary visual cortex

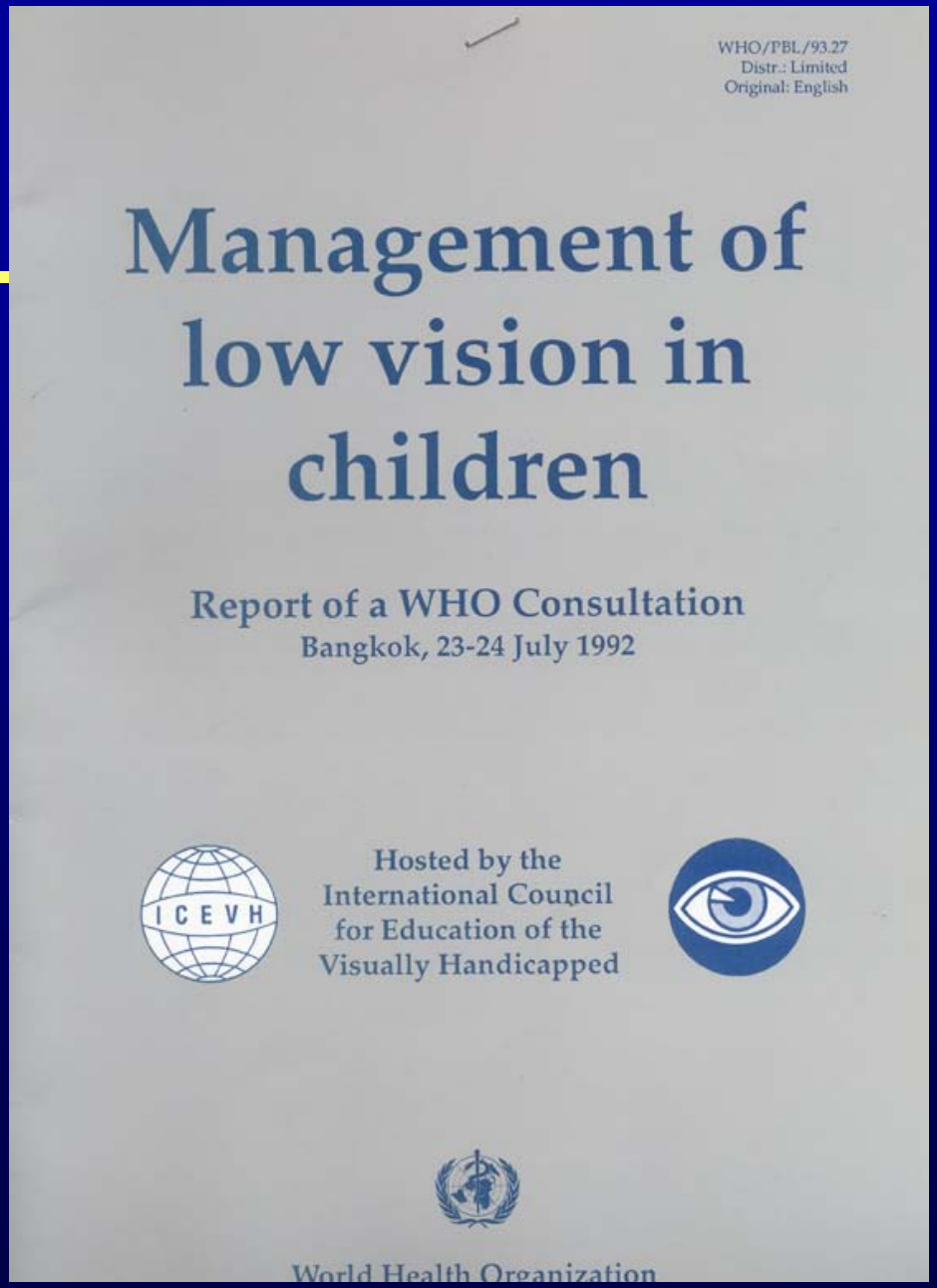


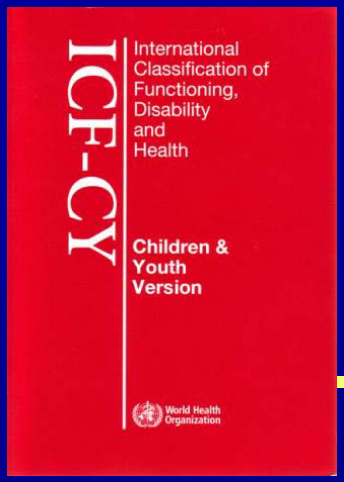
ICF-CY
Core domains

Main functional areas:

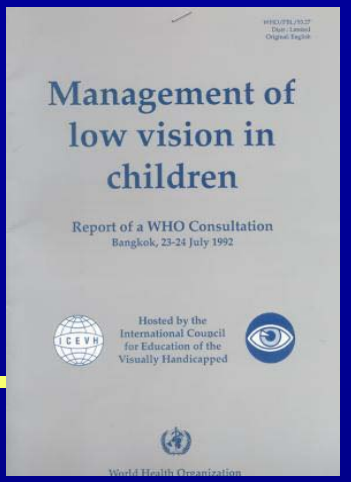
- Communication and interaction
- Orientation & moving
- Activities of daily living
- Sustained, demanding visual tasks like reading

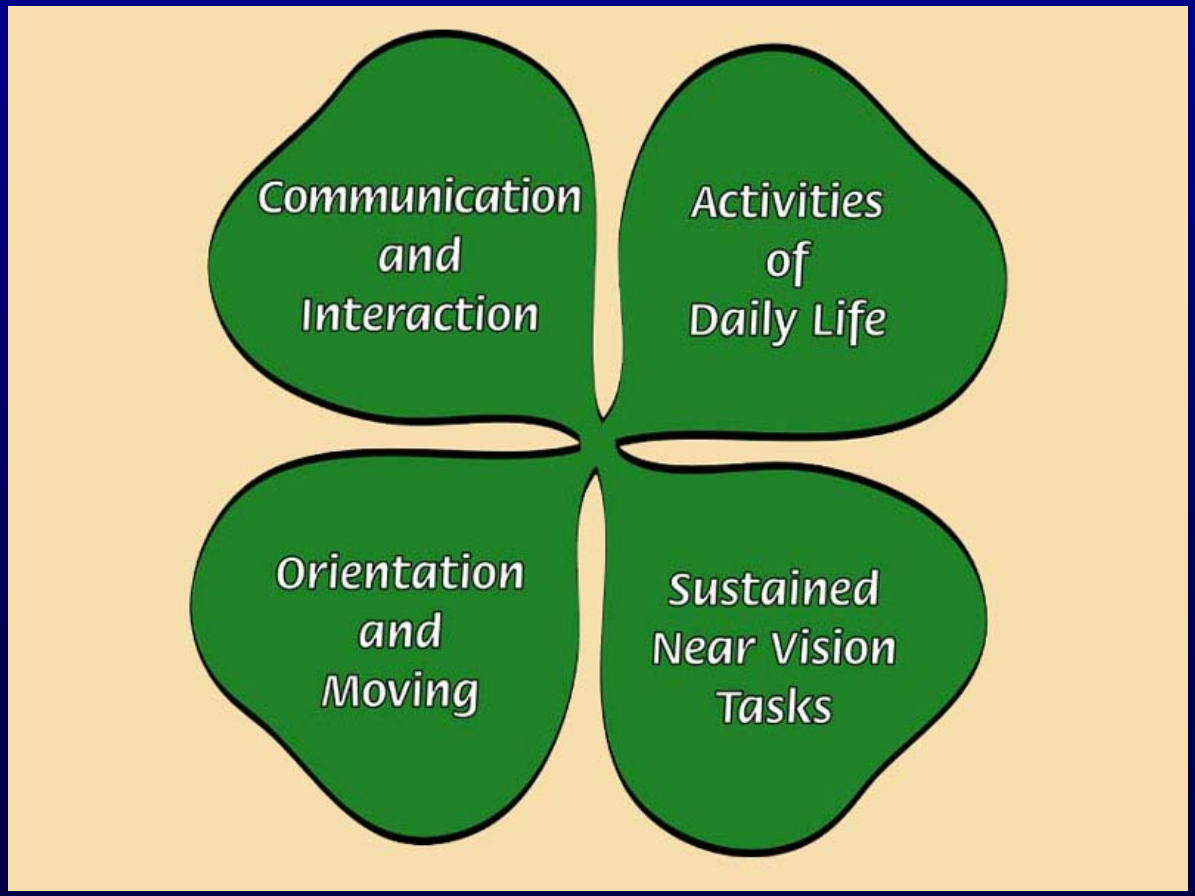
WHO 1993





Four-leafed clover of Visual Functioning





Ventral Stream

Inferotemporal Networks

Details in pictures, Noticing errors and missing details
Perception of textures and surface qualities

Recognition of familiar and unfamiliar faces
Facial expressions, Body language

Landmarks, Concrete objects, Pictures of concrete objects

Abstract pictures of objects of different categories

Abstract forms (letters, numbers)
Reading words and lines of texts, Optimal reading strategy

Comparison with pictures in memory, ‘Reading’ series of pictures

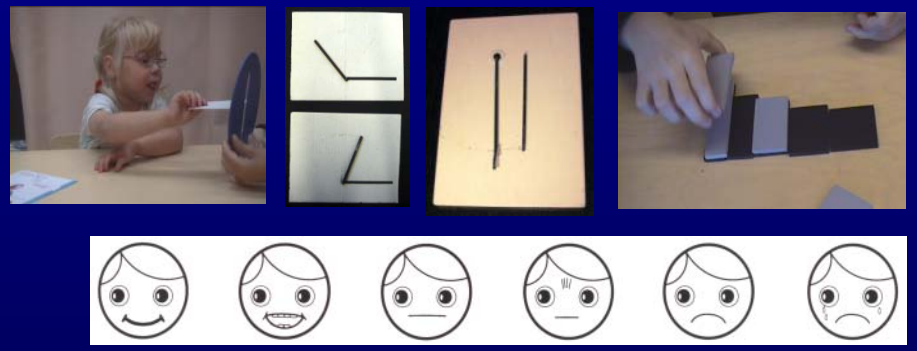
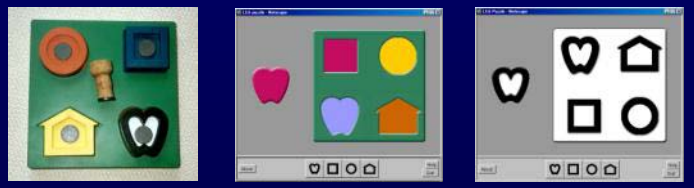
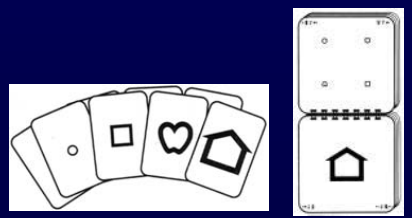
Visual problems in copying pictures from blackboard and/or at near

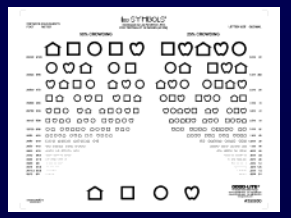
Crowding effect, Scanning lines of text

Cognitive vision test

- Hiding Heidi for communication
- LEA-Mailbox
- LEA-Rectangles
- Face pictures
- Heidi Expressions
- LEA Puzzle
- Crowding effekt
- Reading tests

- OBSERVATIONS
- Neuropsychological consultation



Dorsal Stream/ Parietal Networks

Awareness of surrounding space, directions and distances in space

Body awareness

Perception of near and far space

Orientation in space, map based, Memorising routes

Motion perception, Depth perception, Simultaneous perception

Eye-hand coordination, Grasping and throwing objects

Drawing, free hand, visual imagination

Copying from near/ from blackboard, motor planning and execution

Mathematics, Visual attention

Visual processing and its problems

VENTRAL STREAM

Direction and length of lines and objects
Object-background
Crowding – increased crowding X

RECOGNITION FUNCTIONS:
Concrete objects
Pictures of concrete objects
Visual closure – Filling in
Order of 3-4 pictures
Copying basic drawings, lines, cross, angle X
used for planning motor functions
Perception of textures, surface qualities Y

Reading as a visual task
Recognition of letters and words
Saccades in reading, reading without saccades

Recognition of numbers and numerals

Recognition of landmarks Y

Recognition of facial features Y
Recognition of facial expressions Y

Perception/recognition of body language Y

5

DORSAL STREAM

Awareness of space Y
Map based orientation in space Y
Orientation based on routes Y

Visual imagination
Mathematical abstract space x Y

Detection and discrimination of motion Y

Perception of distances and depth Y

Simultan perception, - agnosia y

Neglect X

Eye-hand- co-ordination
Copying from near space, from far Y
Use of egocentric near space
Use of allocentric space Y

Integration problems, sensory, sensomotor X

Hypersensitivity to noise, visual, auditory Y
Inhibitory functions, their insufficiencies Y

11

CASE	N	I	P
OCULAR MOTOR FUNCTIONS			
A Fixation			
B Following movements			
C Saccades			
D Nystagmus			
E Strabismus			
F Accommodation			
G Convergence			
CLINICAL FINDINGS, sensory			
H Binocularity			
I Visual Acuity			
J Grating Acuity			
K Contrast sensitivity, optotype, grating			
L Colour Vision			
M Adaptation speed, observation			
N Photophobia			
O Visual field, central scotoma?			
P Visual field, peripheral			
Q Motion perception, Pepi-test			
R Biological motion, Walking Man			
S Refraction			
T Correction of refractive errors			

EARLY PROCESSING				
V Length of lines				
W Orientation of lines				
X Objects/figures on a patterned background				
Y Textures and surface qualities				

DORSAL STREAM				
A Perception of near and far space				
B Observation of surrounding				
C Orientation in space, map based				
D Route based orientation				
E Simultaneous perception				
F Eye-hand coordination				
G Length of lines				
H Direction of lines				
I LEA-Puzzle				
J Grasping and throwing objects				
K Drawing, free hand				
L Copying from blackboard				
M Spatial problems in mathematics				
N Spatial problems in reading				

OTHER PROFILES AVAILABLE				
A Developmental level				
B Motor Functions				

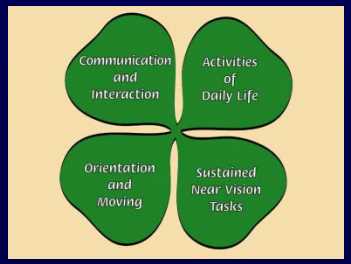
VENTRAL STREAM	N	I	P
A Lenght of lines, purely visual test			
B Direction of lines, purely visual test			
C Recognition of details			
D Noticing missing details in pictures			
E Recognition of faces			
F Interpretation of facial expressions			
G Reading body language			
H Landmarks			
I Concrete objects			
J Pictures of concrete objects			
K Abstract pictures of objects of different categ			
L Abstract forms (Roman letters, numbers)			
M Reading words, characters			
N Cartoons			
O Visual problems in copying pictures			
P Increased crowding effect			
Q Recognition problems n math tasks			

MIRROR NEURON SYSTEM				
A Early communication and interaction				
B Interpretation of emotions and intentions				
C Observation and copying of movements				
D Effect of image quality, motion perception				
E Effect of image quality, contrast sensitivity				
F				
G				

OTHER COMMON PROBLEMS				
M Integration of sensory information				
N Visual and auditory overload				
O Specific memory problems				
P Head control				
Q Body control				
R Hand functions				
S Moving				
T Hearing				
U Executive functions				
V Other				
W Use of devices at school, KG, work				
X Use of devices at home				
Y Services of educational resource centre				
Z Vision services as medical care				

MAIN FUNCTIONAL AREAS				
A Communication				
B Orientation and moving				
C Activities of daily living				
D Demanding vision tasks				

PROFOUND loss of function in __visual funcitions
IMPAIRED but useful visual functions in __
NORMAL visual function in __ functions



CASE		N	I	P
OCULAR MOTOR FUNCTIONS				
A Fixation				
B Following movements				
C Saccades				
D Nystagmus				
E Strabismus				
F Accommodation				
G Convergence				
CLINICAL FINDINGS, sensory				
H Binocularity				
I Visual Acuity				
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O Visual field, central scotoma?				
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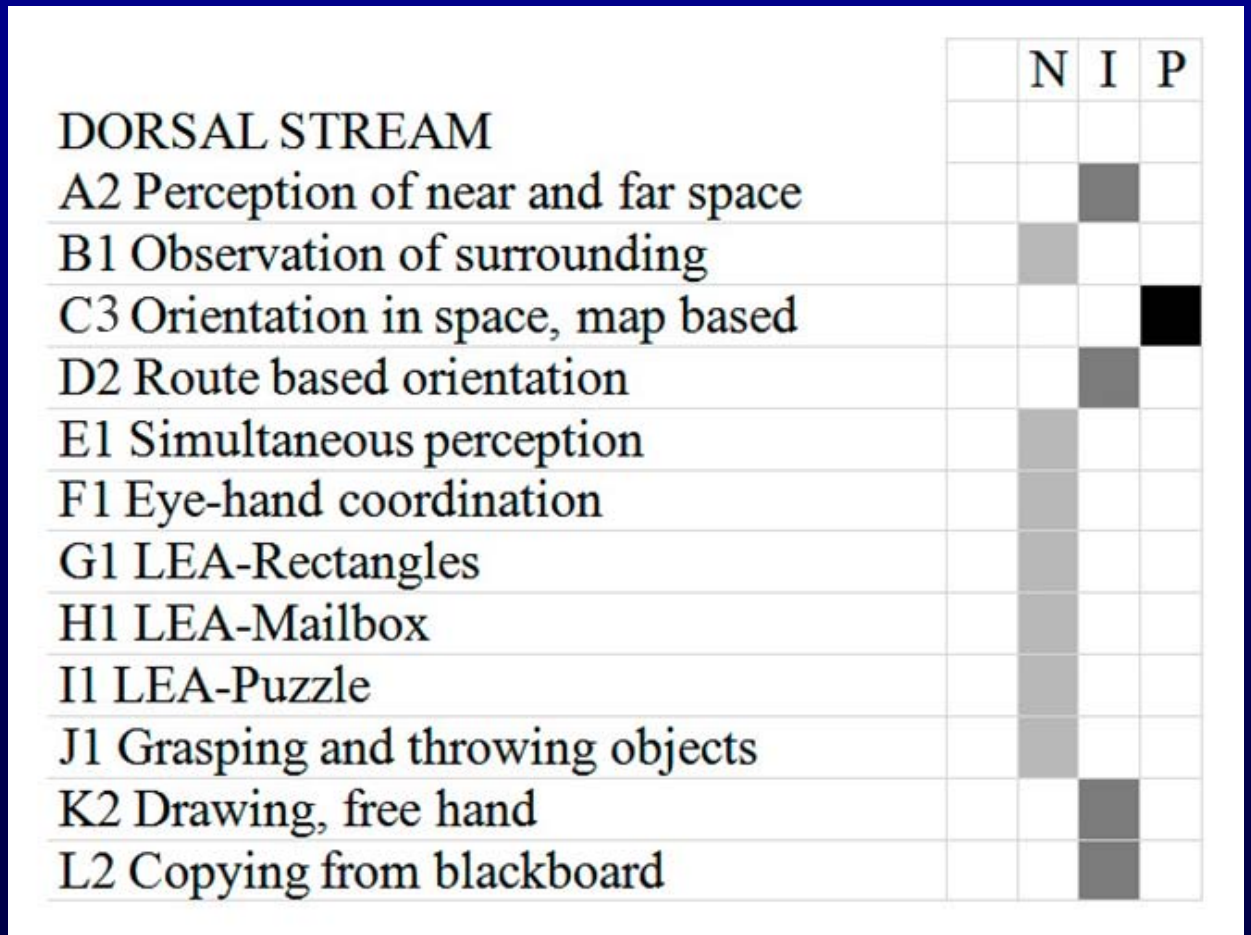
R Biological motion, Walking Man				
S Refraction				
T Correction of refractive errors				
EARLY PROCESSING				
V Length of lines				
W Orientation of lines				
X Objects/figures on a patterned background				
Y Textures and surface qualities				

		N	I	P
VENTRAL STREAM				
A Lenght of lines, purely visual test				
B Direction of lines, purely visual test				
C Recognition of details				
D Noticing missing details in pictures				
E Recognition of faces				
F Interpretation of facial expressions				
G Reading body language				
H Landmarks				
I Concrete objects				
J Pictures of concrete objects				
K Abstract pictures of objects of different categ				
L Abstract forms (Roman letters, numbers)				
M Reading words, characters				
N Cartoons				
O Visual problems in copying pictures				
P Increased crowding effect				
Q Recognition problems n math tasks				
MIRROR NEURON SYSTEM				
A Early communication and interaction				
B Interpretation of emotions and intentions				
C Observation and copying of movements				
D Effect of image quality, motion perception				
E Effect of image quality, contrast sensitivity				
F				
G				

Profile of visual Functioning

For IEP/ILP 2004, Learning strategies to be trained

N= normal (1), I= impaired but useful (2), P=profound VI or blindness (3)



10.2 TC		N	I	P
CLINICAL FINDINGS, ocular motor funct				
A1 Fixation				
B1 Following movements				
C1 Saccades				
D1 Nystagmus				
E3 Strabismus				
F2 Accommodation				
CLINICAL FINDINGS, sensory				
G2 Binocularity				
H1 Visual Acuity				
I1 Grating Acuity				
J1 Contrast sensitivity, optotype				
K Contrast sensitivity, grating				
L1 Colour Vision				
M4 Adaptation speed	4			
N2 Photophobia				
O1 Visual field, central				
P1 Visual field, peripheral				
Q2 Motion perception, high speed				
R1 Biological motion				
S Depth perception				
T5 Vernier acuity				
U5 Other				
EARLY PROCESSING				
V1 Length of lines,				
W1 Orientation of lines,				
X2 Objects/figures on patterned background				
Y Visual closure				
Z2 Textures and surface qualities				
AA1 Short time memory, if text is large				
DORSAL STREAM				
A2 Perception of near and far space				
B1 Observation of surrounding				
C2 Orientation in space, map based				
D2 Route based orientation				
E1 Simultaneous perception				
F1 Eye-hand coordination				
G1 LEA-Rectangles				
H1 LEA-Mailbox				
I1 LEA-Puzzle				
J1 Grasping and throwing objects				
K2 Drawing, free hand				
L2 Copying from blackboard				

	N	I	P
VENTRAL STREAM			
A1 LEA-Rectangles, purely visual part of the test			
B1 LEA-Mailbox, purely visual part of the test			
C1 Recognition of details			
D1 Noticing errors and missing details in pictures			
E3 Recognition of faces			
F2 Interpretation of facial expressions			
G2 Reading body language			
H2 Landmarks			
I1 Concrete objects			
J1 Pictures of concrete objects			
K1 Abstract pictures, objects of diff. categories			
L1 Abstract forms (Roman letters, numbers)			
M1 Sequencing non-sense words			
N1 Comparison with pictures in memory			
O1 Funny pictures			
P1 Pictures of different activities, occupations			
R1 Reading series of pictures			
S1 Visual problems in copying pictures			
T2 Increased crowding effect			
U1 Recognition in mathematical tasks,			
V1 Memory functions			
W2 Spatial problems			
X5 Other			
OTHER COMMON PROBLEMS			
M1 Integration of sensory information			
N2 Visual and auditory overload			
O1 Specific memory problems			
P1 Head control			
Q1 Body control			
R2 Hand functions			
S2 Moving			
T1 Hearing			
U2 Executive functions			
V5 Other			
W1 Use of devices, categories decided locally			

Early Diagnose

Strategies planned

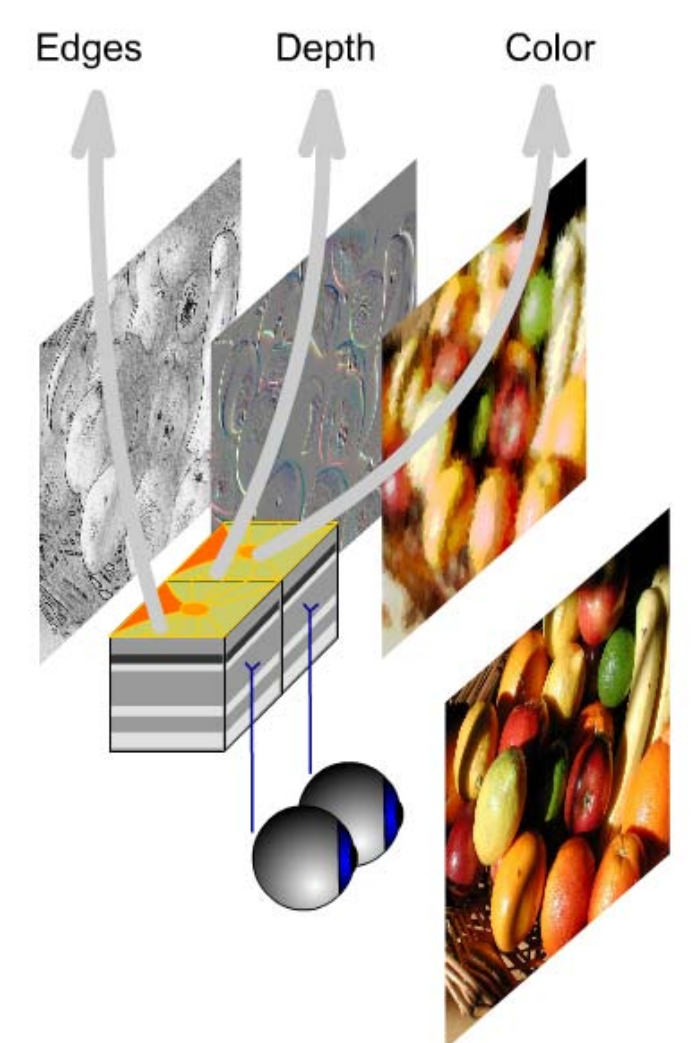
Early processing

Primary visual cortex, V1

Decoding – encoding:
- contrast edges
- lines, length, direction
- binocular fusion > stereo depth
- movement, also directly to V5

- ”filling-in” of scotomas

- short time memory



Mailbox Game

Mailbox Game – Orientation of lines

in eye-hand coordination

Direction of lines

Eye-hand coordination

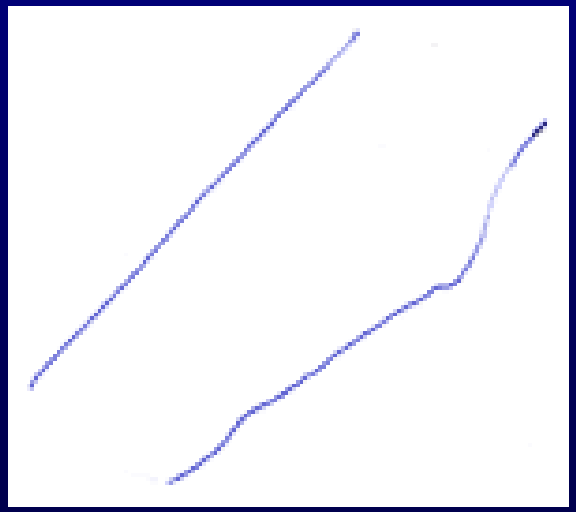
Copying

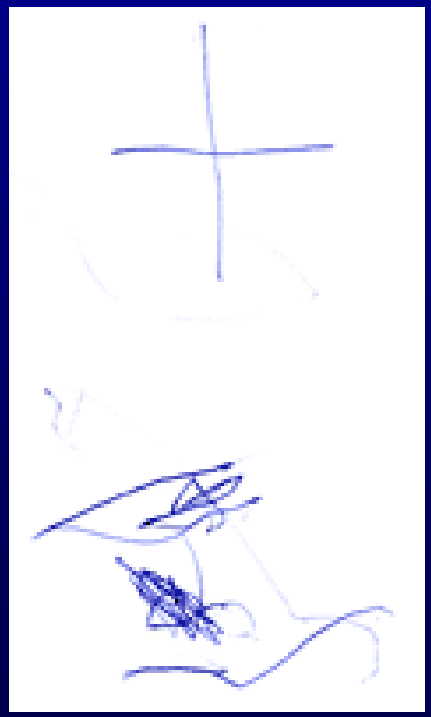
- Copying a parallell lines
  - drawing lines when the child watches
- Copying an angle
- Copying a cross
- Copying more complex pictures
- Naming geometric forms - language

Length & parallel lines

Angle & cross

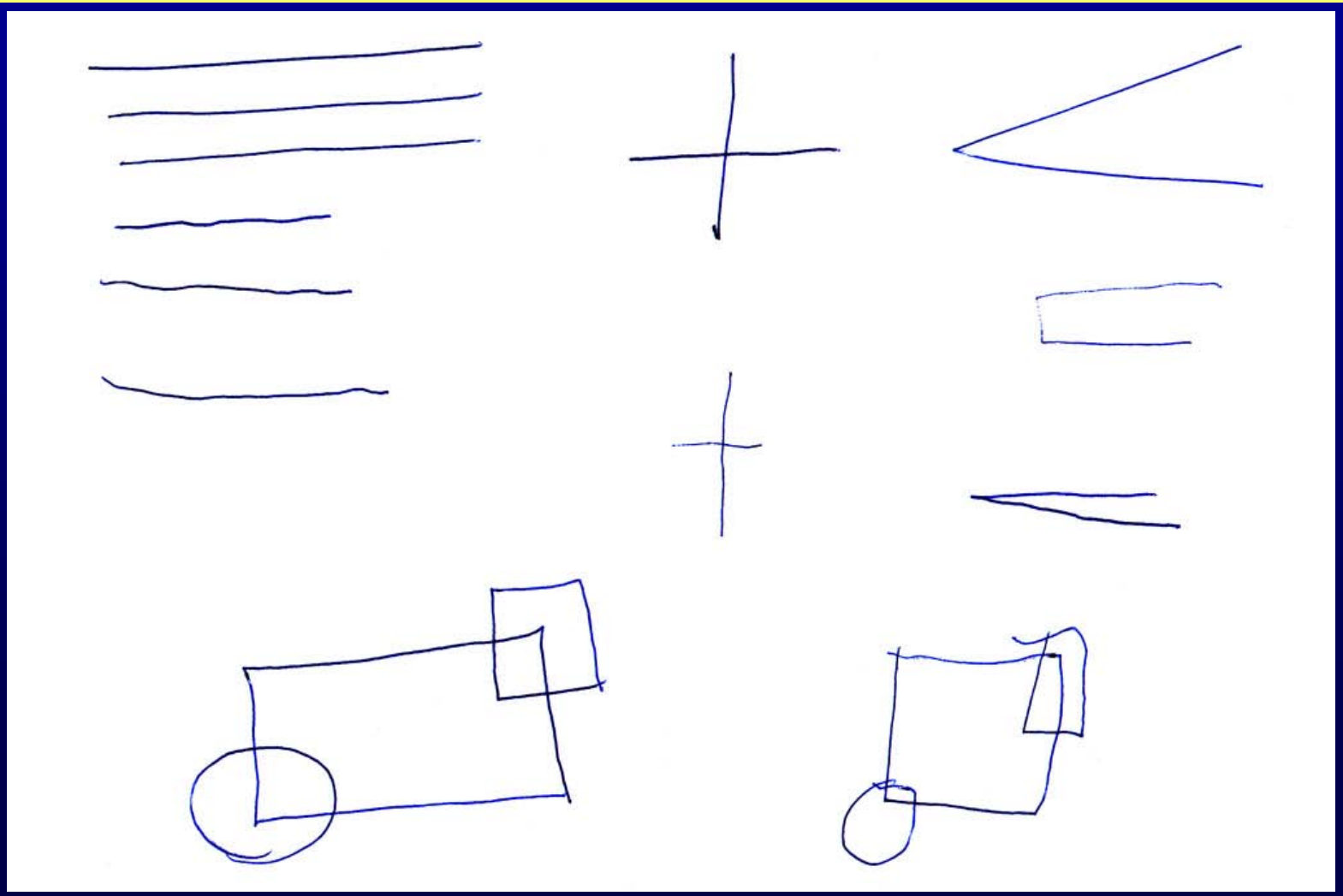
Parallel v. crossing lines



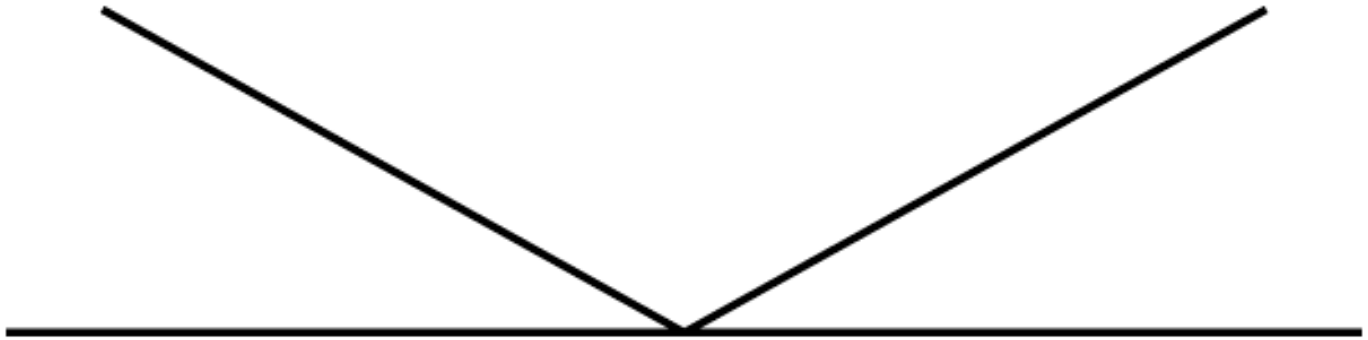


Difficulties with angles

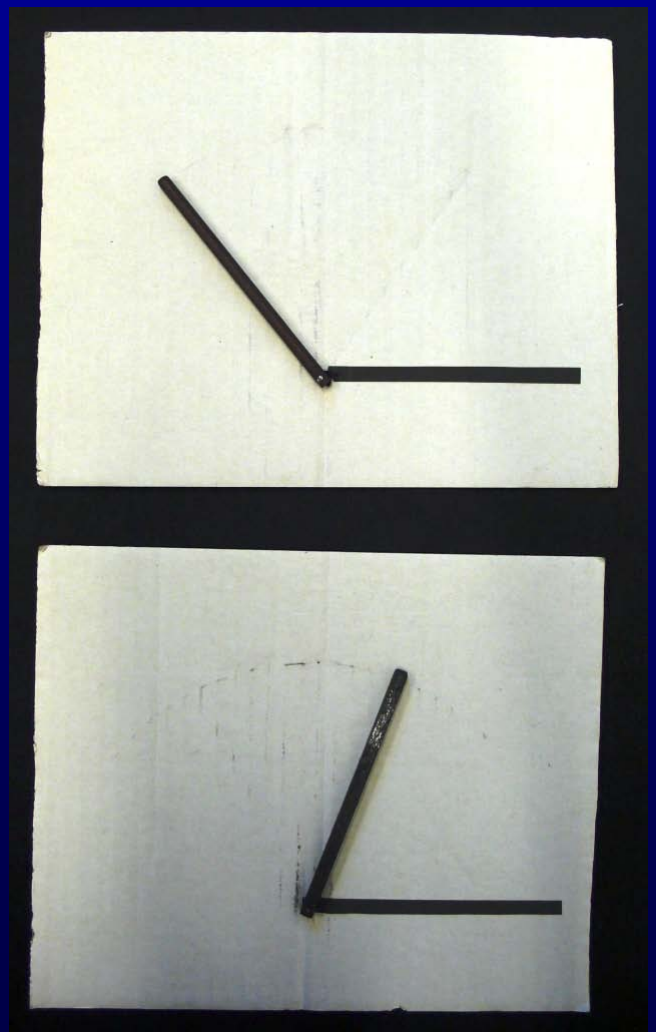
Copying tasks

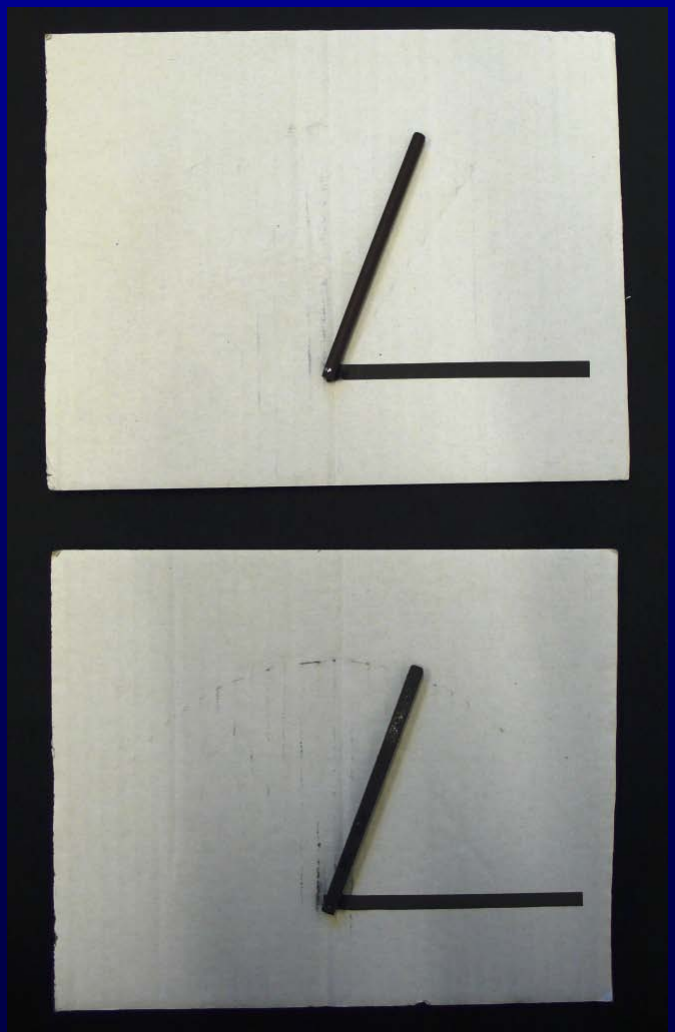


Direction of lines



Angles





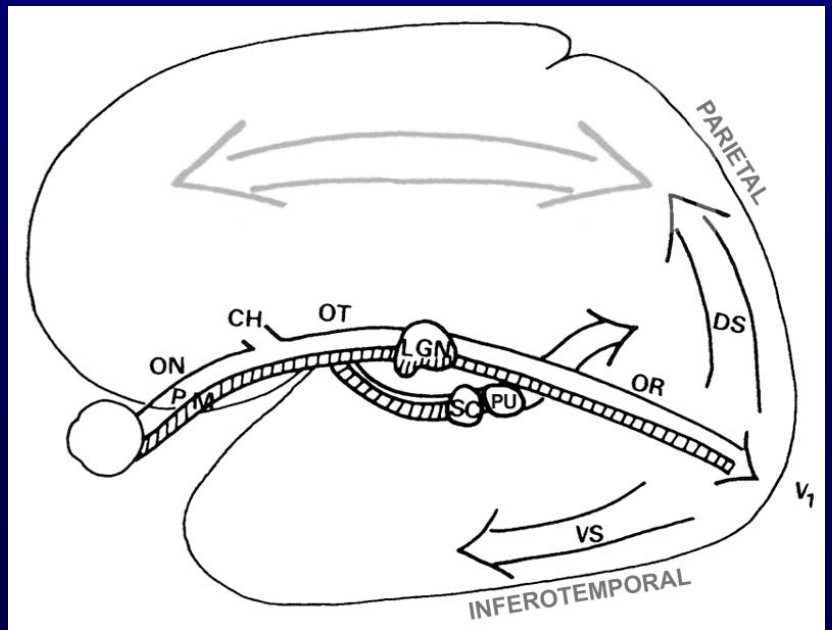
Orientation of lines

Orientation of Lines

- Information for hand movements and orientation in space in the **dorsal information stream** (vision for action)

  is combined with

- recognition functions and perception of orientation of lines in the **ventral information stream**

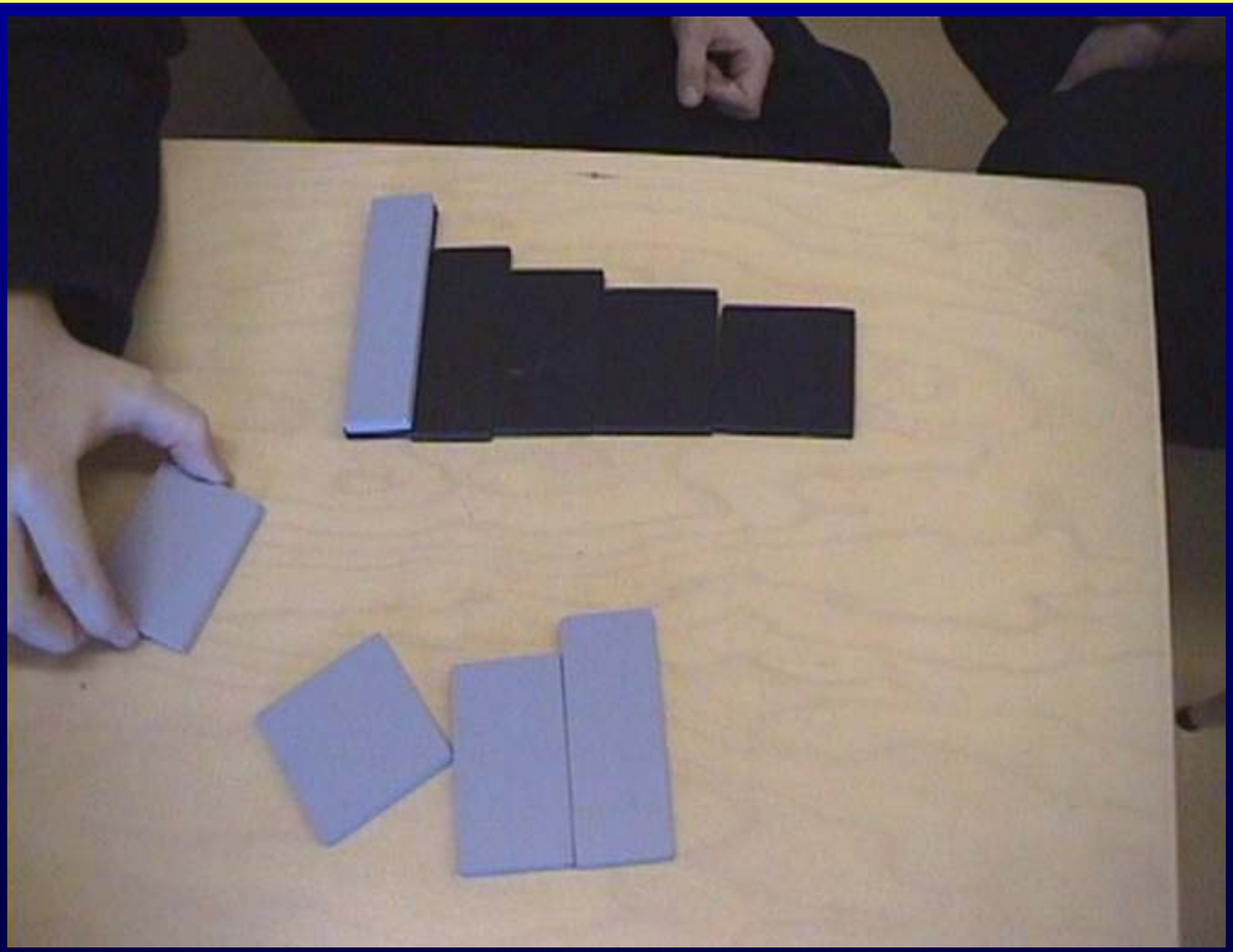


Purely visual task

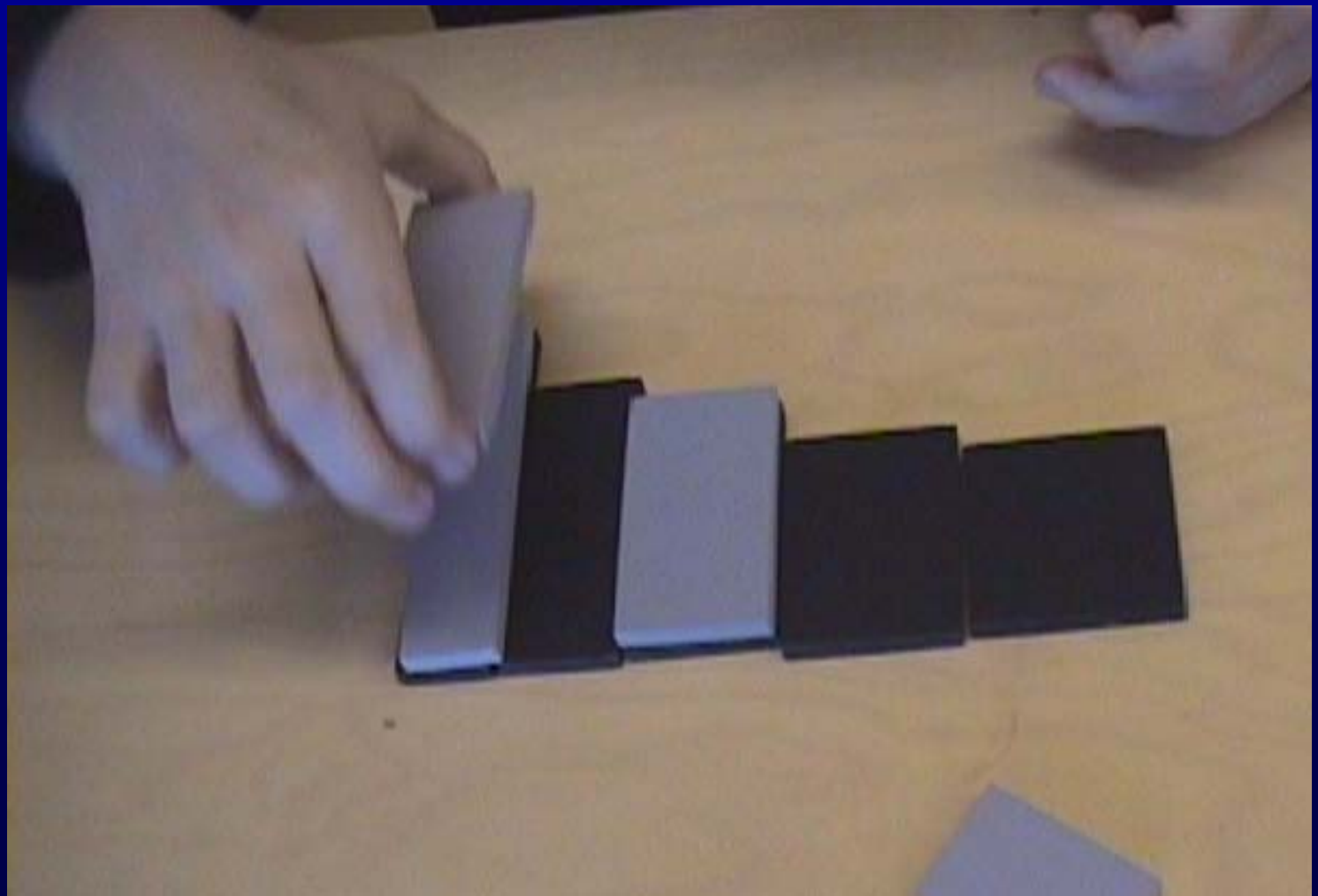
ventral stream function

LEA Rectangles Game

LEA Rectangles Game



Rectangles Game



Increased space between rectangles

Lea Rectangles - Game

Colour matching OK

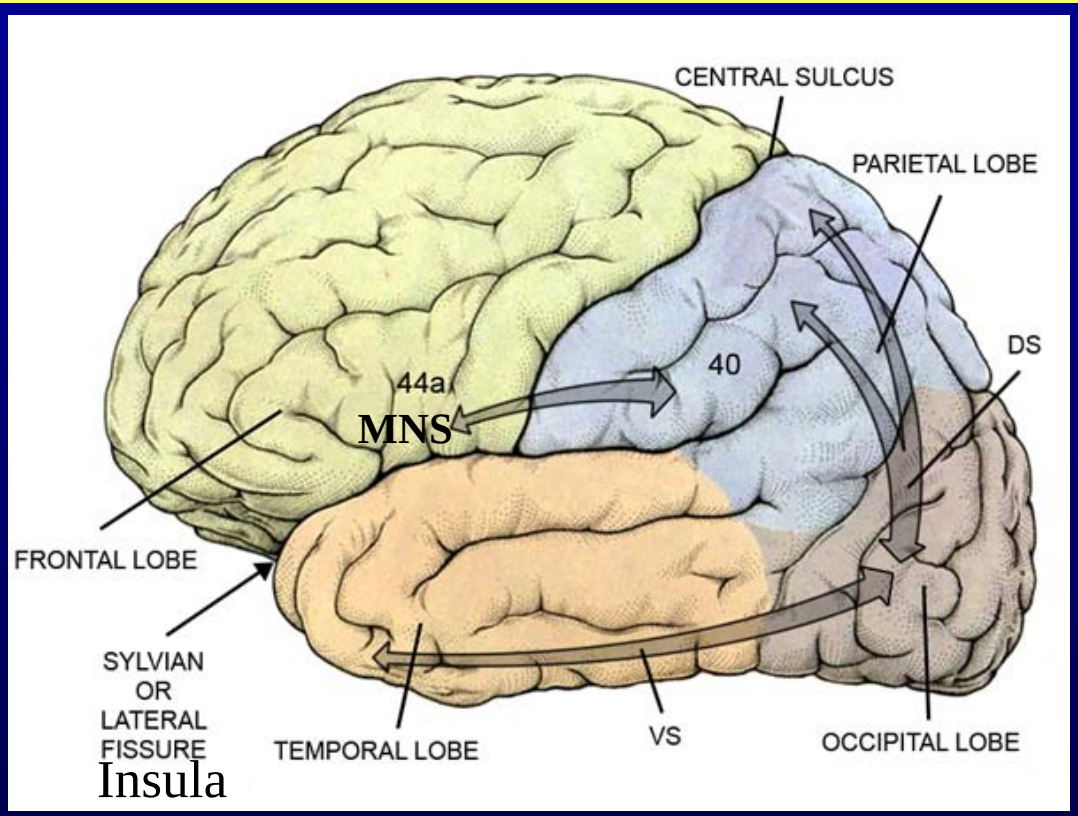
Black&white not perceived

or not remembered?

Cognitive Vision Tests

- Orientation of lines, LEA-mailbox
- Length of lines, LEA-Rectangles, Effron
- Photographs of faces
- Heidi Expressions, photos etc.
- LEA Puzzle, Form and Colour
- VA tests, Crowding effect
- Motion Perception, LEA Gratings, ball games

Processing of visual information

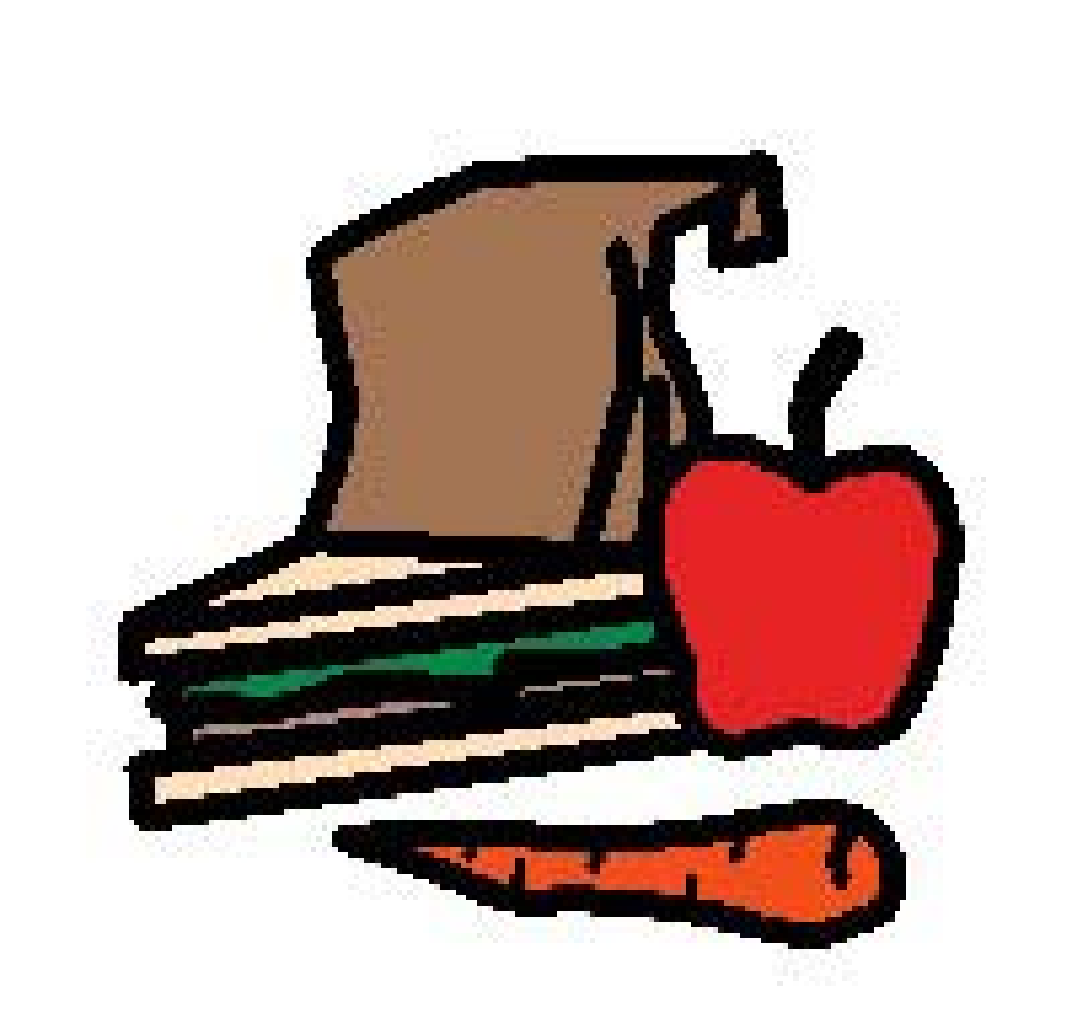


Early processing in the occipital lobe:

Ventral stream
Dorsal stream
Mirror neuron system

Puzzels

Picture perception



Picture communication

How does the child

- see the picture?
- blurred? uncorrected refractive errors?
- colours?
- details?
- matching

Picture communication

Does the child

- see the picture?
- blurred? uncorrected refractive errors?
- colours?
- details in the picture?
- **see the picture as a representation of the object in the picture?**




Picture communication

Does the child

- see the picture?
- blurred? uncorrected refractive errors?
- colours?
- details in the picture?
- see the picture as a representation of the object in the picture?
- **have picture comprehension?**

Picture communication

Does the child

- see the picture?
- blurred? uncorrected refractive errors?
- colours?
- details in the picture?
- see the picture as a representation of the object in the picture?
- have picture comprehension?
- **see a blob of colours as a signal of an activity?**

Text size and spacing

for the best reading speed and duration

car Daddy school mine yesterday, 12 point

car Daddy school mine yesterday

car Daddy school mine yesterday, 2 point extra spacing

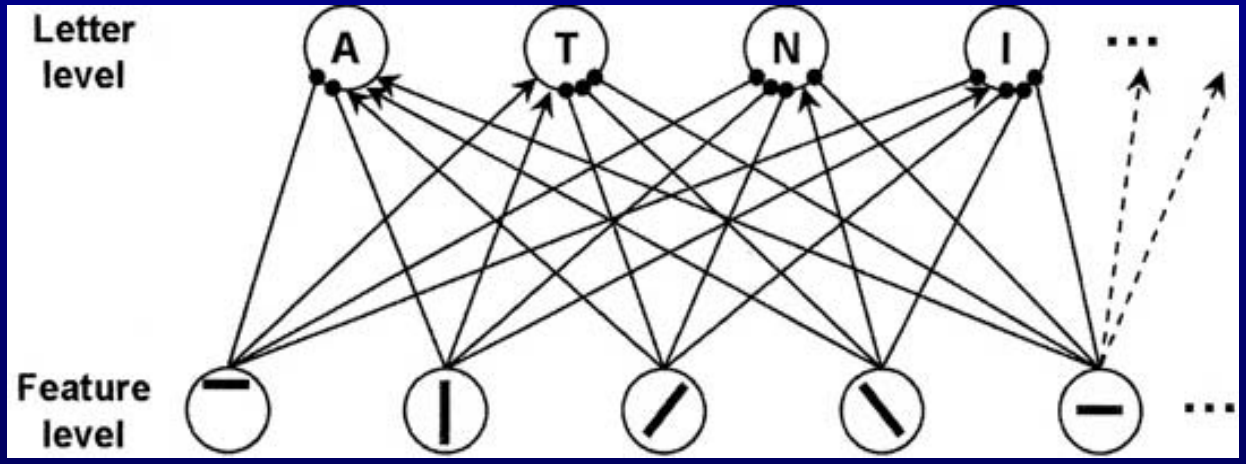
car Daddy school mine yesterday

car Daddy school mine yesterday, 18 point

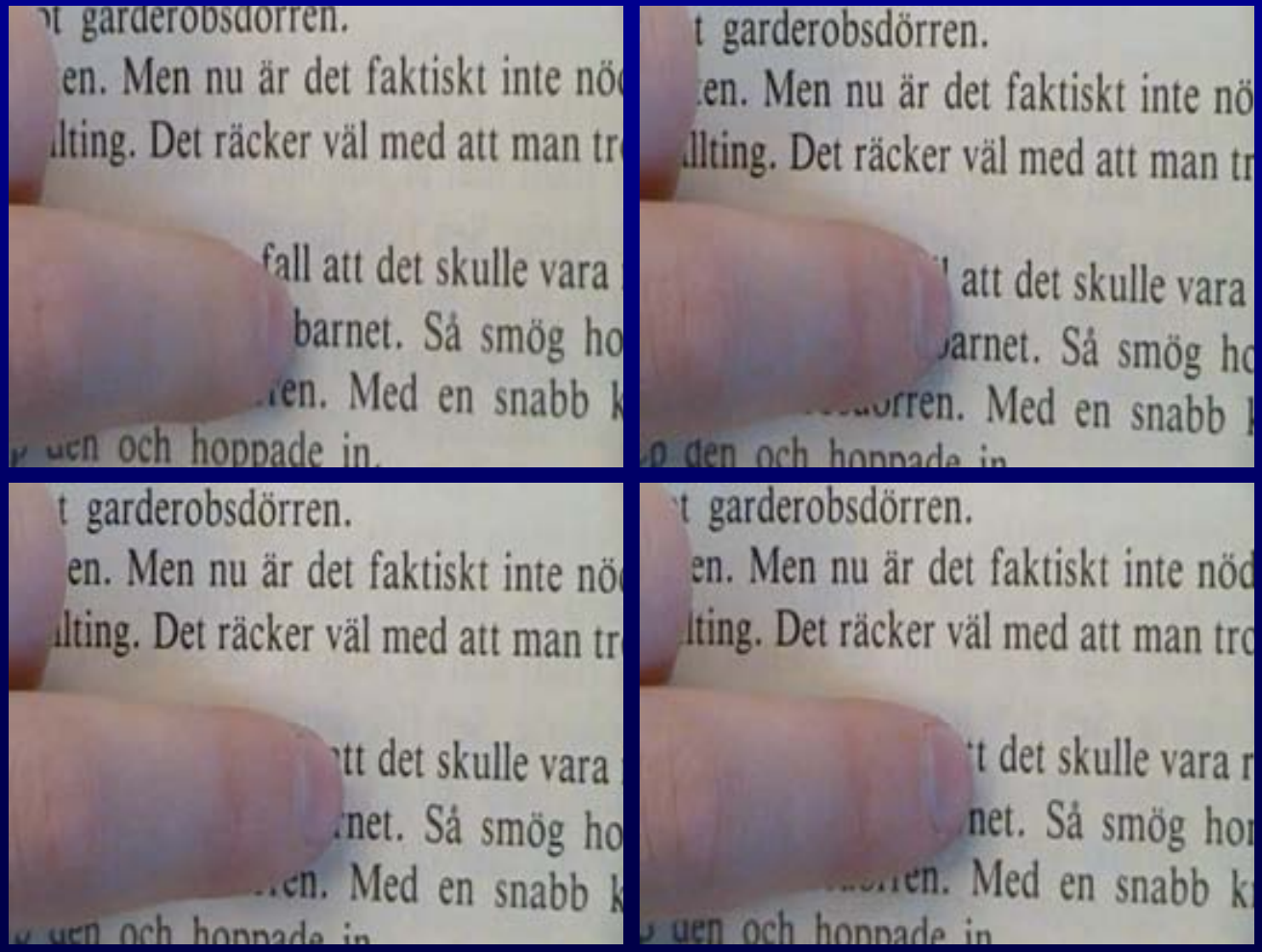
car Daddy school yesterday, 28p, 0.3p ex

Daddy school yesterday,

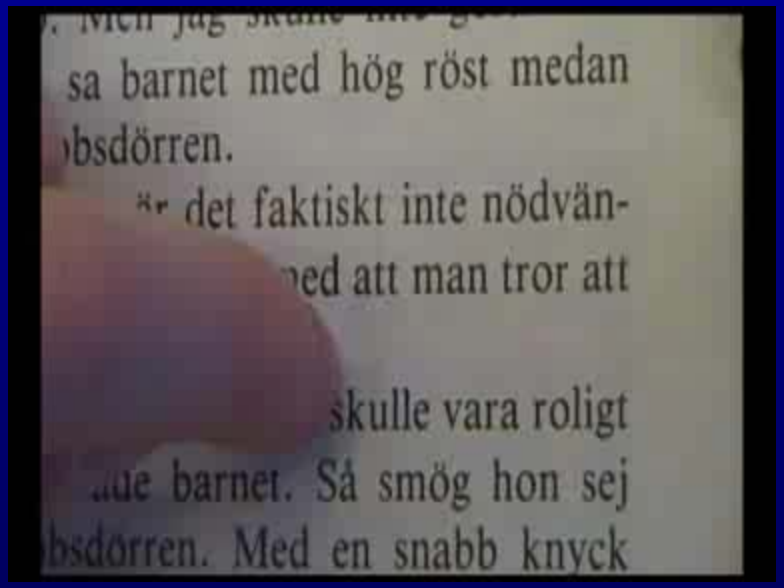
36point, 2p extra spacing

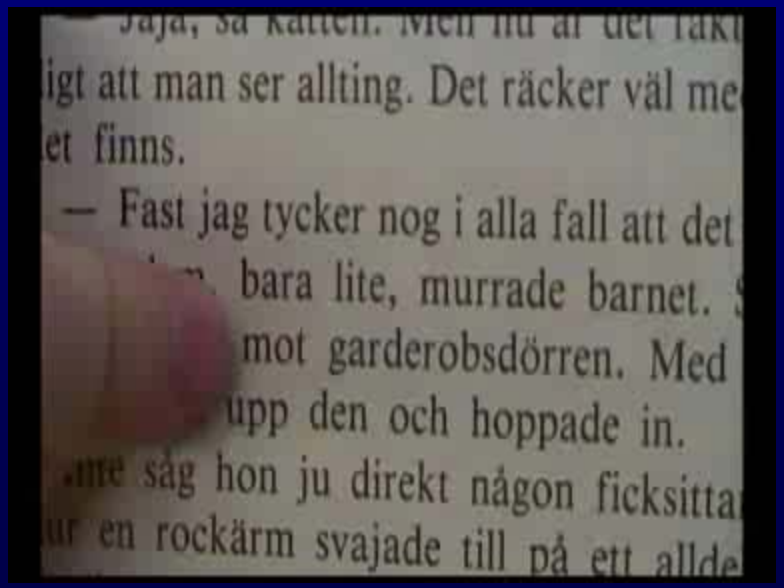

Letter level
A
T
N
I
...
Feature level
...

3 letters OK, more crowded



3 letters OK, more crowded





and in long words like
”garderobs-dörren”
he leaps over several letters
and says ”garderoben”

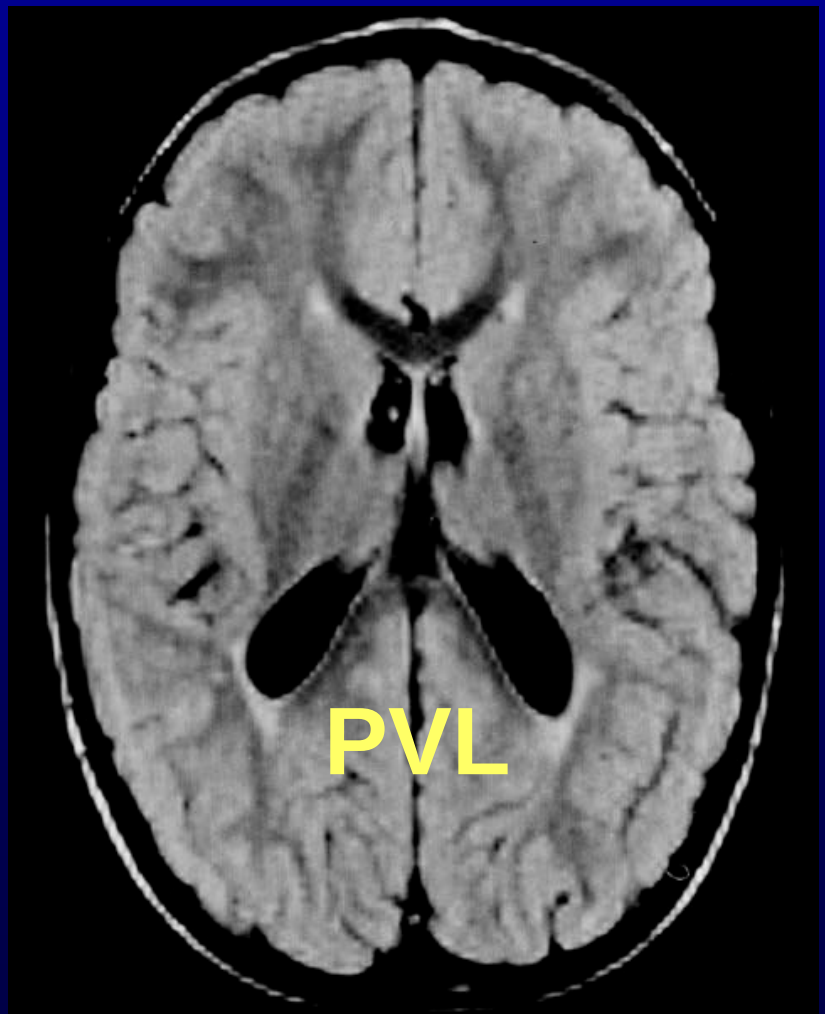
Pause 11.1.

afternoon

Periventrikuläre Leukomalazie

Außen herum - Ventrikel - weiß - Krankheit

- Premature birth, 1996
  25weeks + 6 days
- 520g >> 435g
- Dysplastic lungs
- Impaired swallowing
- Tube feeding, gastrostoma
- Mild CP, walking < 1km
- Diagnosis of visual problems and PVL at 2 years 9 months



Körperteile zu zeihnen

Visuo-motorische Pläne

Klettern

Feinmotorische Training

Fine motor training

Balls

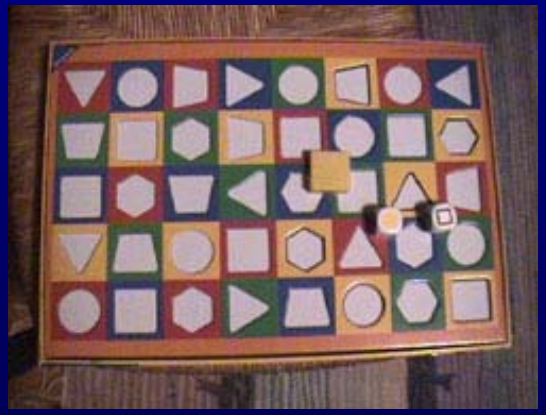
Rectangles – Mailbox
Heidi Expressions- Colorama

Testing early and higher visual processing

Colour & Form Training

Time for learning

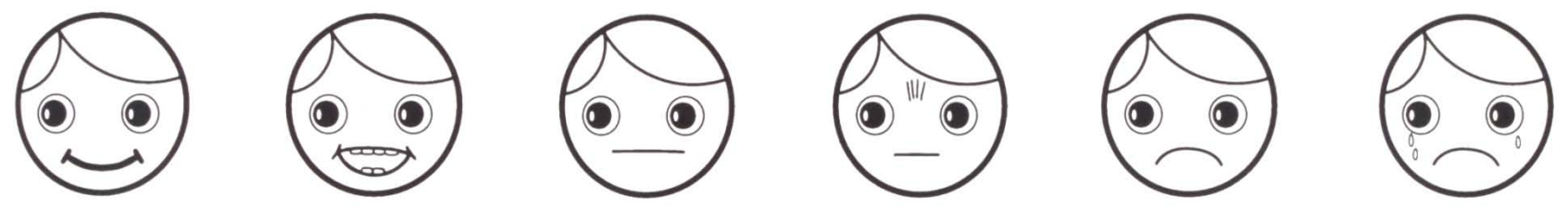
correct matching



PVL

No face recognition

Vision for communication



- Real life situations, drawing/making pictures
- Photographs, colour and B&W
- Videos, tactile exploration, magnifying mirror
- Intervener in communication situations

Training facial expressions

Drawing with the child

Magnifying mirror

Visuotactile pictures

Matching and recognition of pictures

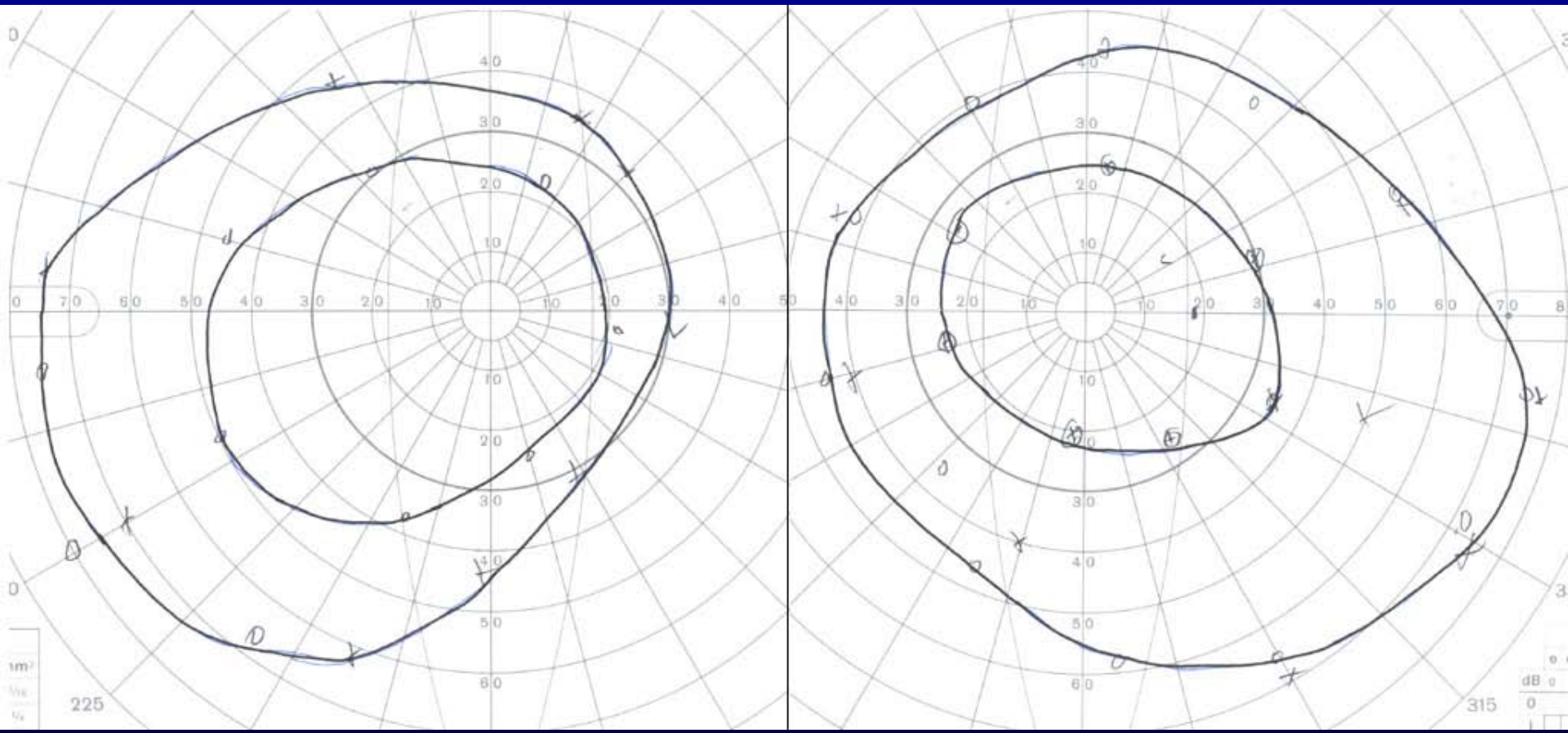
Recognition of faces

Re-cognition:

- facial features are seen well enough
- a template is formed in memory
- the face is seen again
- template is found and matched
- the name of the person is remembered
- in normal development infants recognise faces at the age of 6-8 months, latest at 10 months

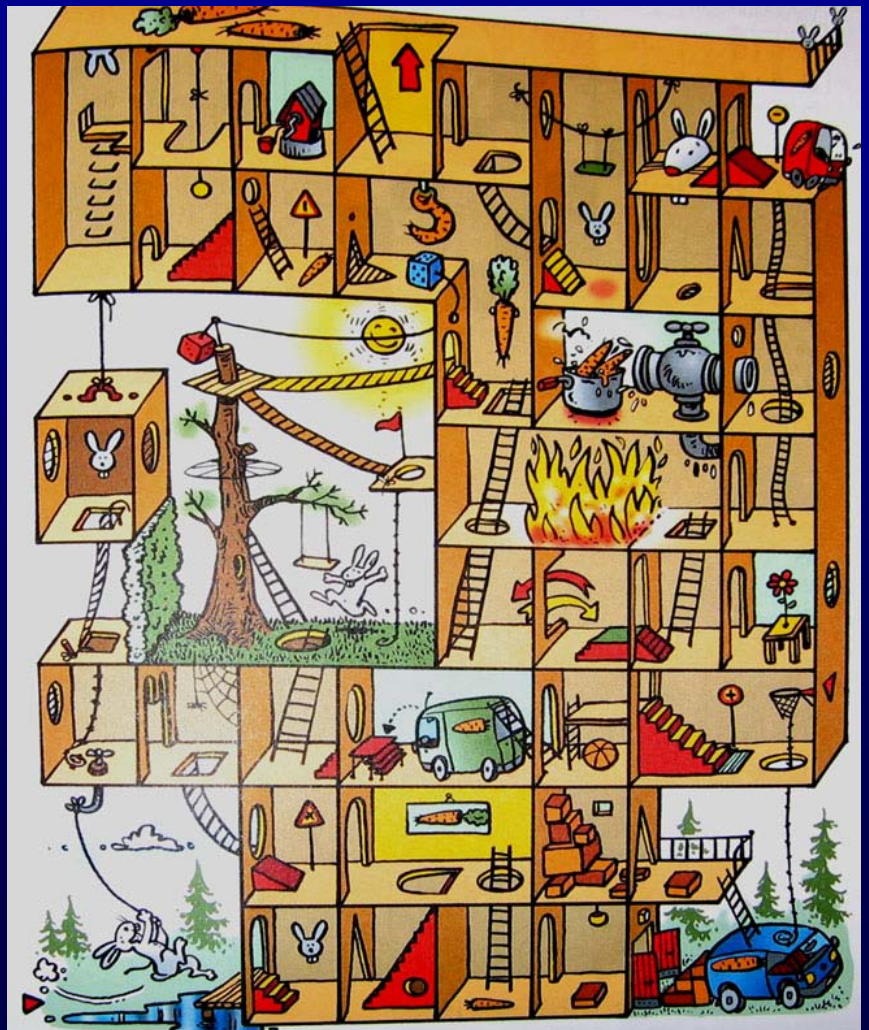
Finding the correct piece

CVI




5 6 9 2 1 3
3 5 8 9 0 6
2 7 4 9 1 9
8 9 6 0 5 6
1 6 9 3 3 5
2 3 6 9 8 4

Schoolbooks a problem



Spatial orientation

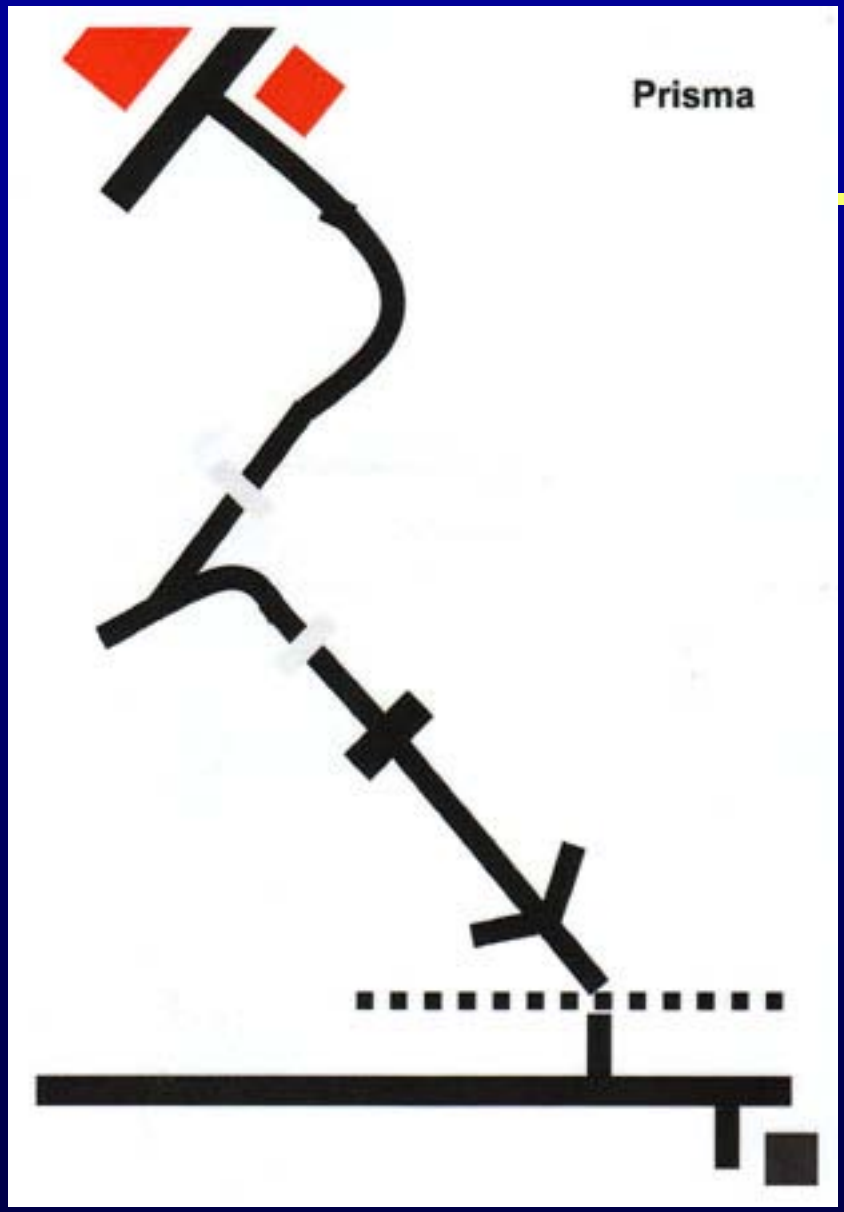
Hands are the ’second eyes’ of children with vision loss.

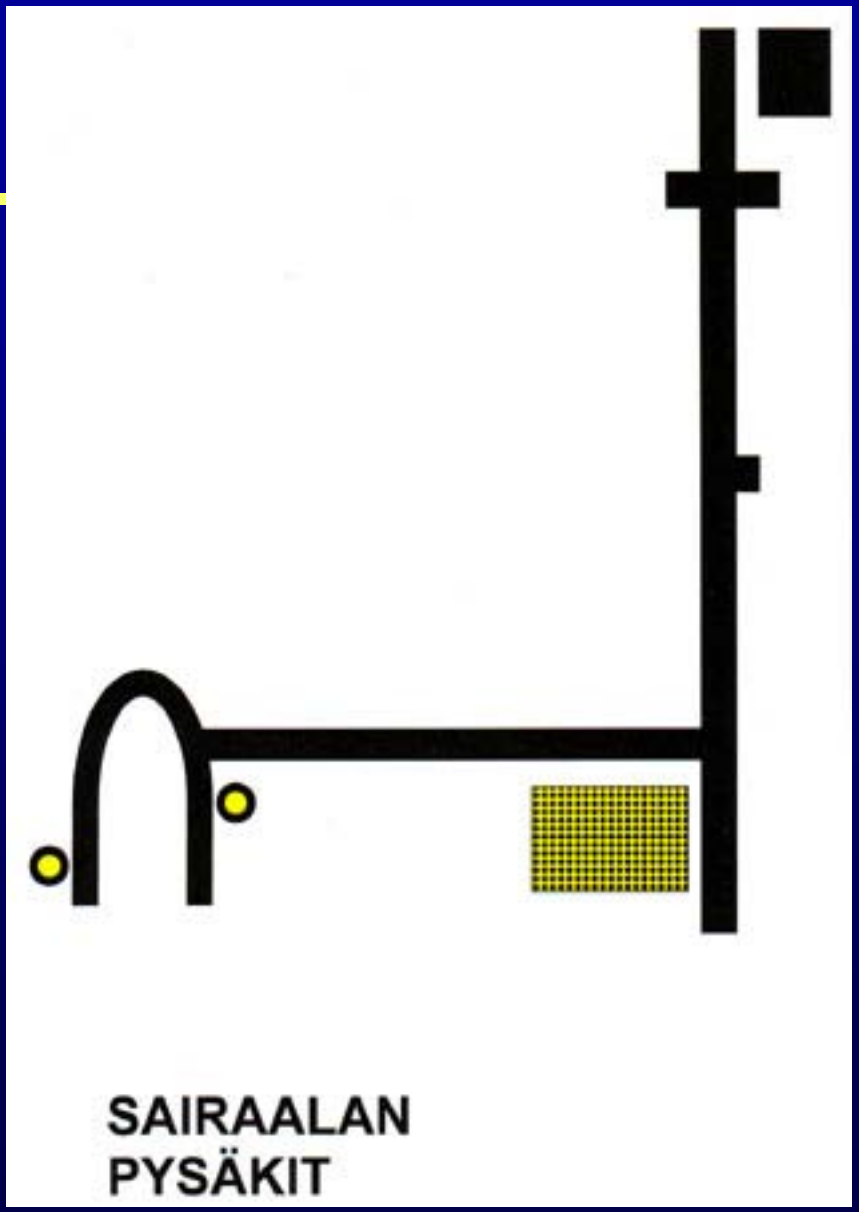
Visual processing disorder

- No face recognition
- Recognition of facial expressions weak
- Perception and recognition of many pictures good
- Perception of complex pictures difficult
- Perception of surface qualities fails > cane

Visual processing disorder

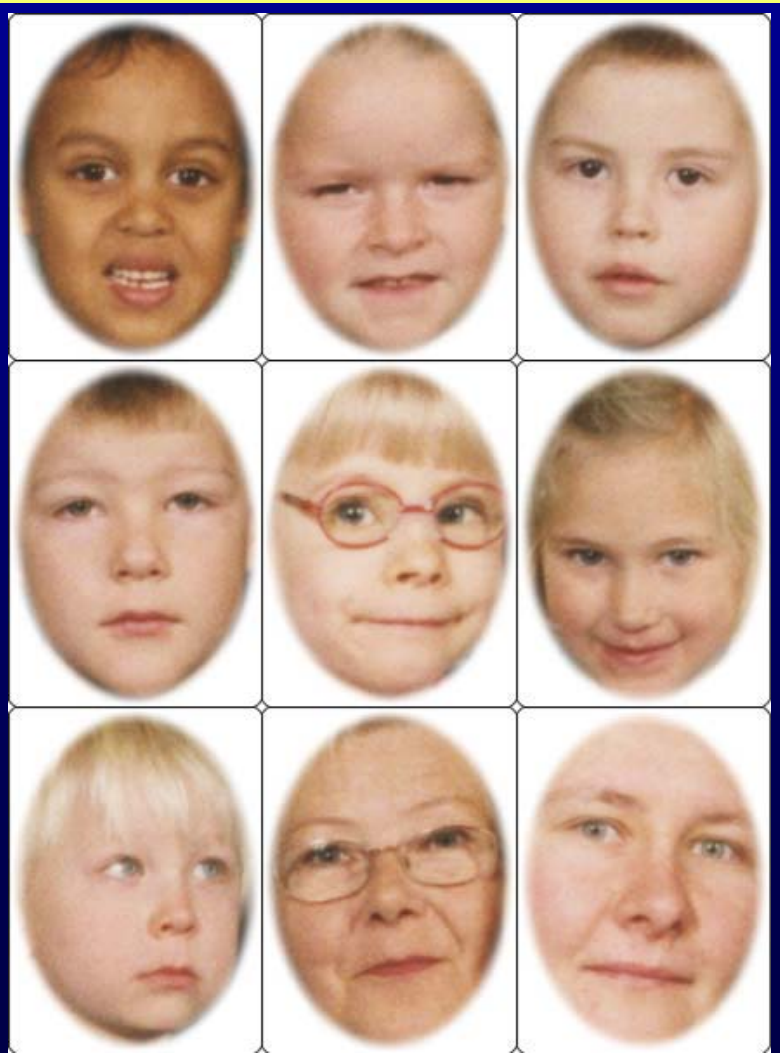
- No face recognition
- Recognition of facial expressions weak
- Perception and recognition of many pictures good
- Perception of complex pictures difficult
- Perception of surface qualities fails > cane
- In the egocentric small space, eye-hand coordination is under control. School bag is never correctly packed.


Prisma


SAIRAALAN
PYSÄKIT


GPSmap 60Cx
GARMIN

Face recognition



435g premie
panic reactions
in sauna, reason?

Recognition of faces

Re-cognition:

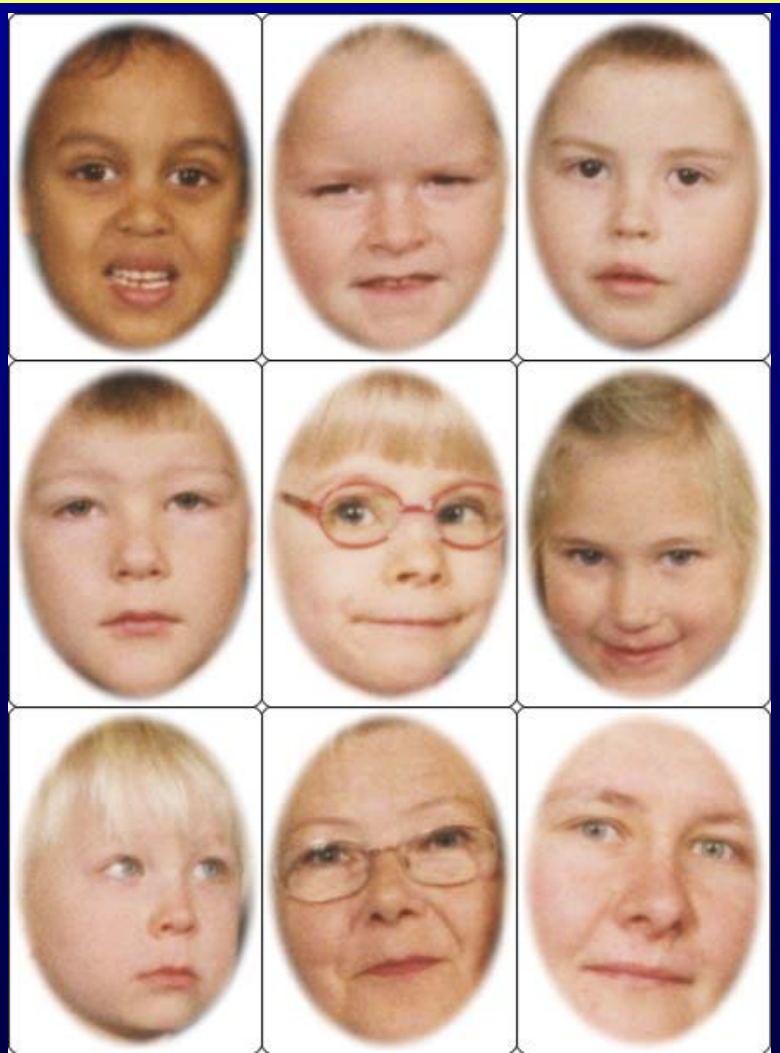
- facial features are seen well enough
- a template is formed in memory
- the face is seen again
- template is found and matched

- the name of the person is remembered

Matching pictures

Recognising pictures of faces

Face recognition



Strategies

Remembering

jewellry

clothing

way of moving

gestures

voice

smell

Asking ”What is your name?”

Other problems

Spatial concepts

- improved by early intensive training

Recognition of landmarks

Perception of surface qualities and depth, cane

Routes still not possible, on the 3rd grade

Hypersensitivity of mouth, poor swallowing reflex,

small ventricle (tube feeding 12>8 hours/day, 10-15dl),

constipation

Motor functions nearly normal.

Vision problems experienced most difficult.

Problems in orientation

- Major problems with directions ”up, down, right, left”, even ”here”.
- Does not recognise places, own door, day care rooms, yard.
- Does not perceive surface qualities, walks better with cane than without, also in stairs.
- Other ”non-visible” disorders, hypersensitive mouth, swallowing problems, constipation, malnutrition.
- Measured during therapies and day care.

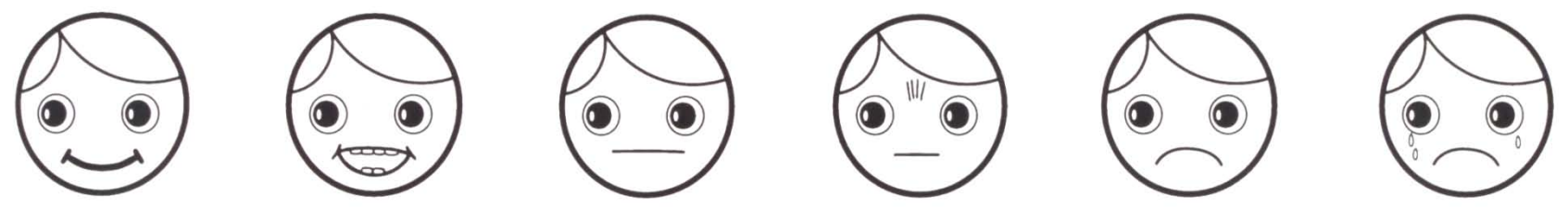
A sighted blind girl

- hypersensitive mouth, swallowing difficulties
- undernourishment
- bright, motor functions nearly normal
- clinical findings close to normal
- does not recognise faces, but expressions
- spatial awareness weak
- does not recognise landmarks
- does not see surface qualities – cane user

Cognitive Vision Tests

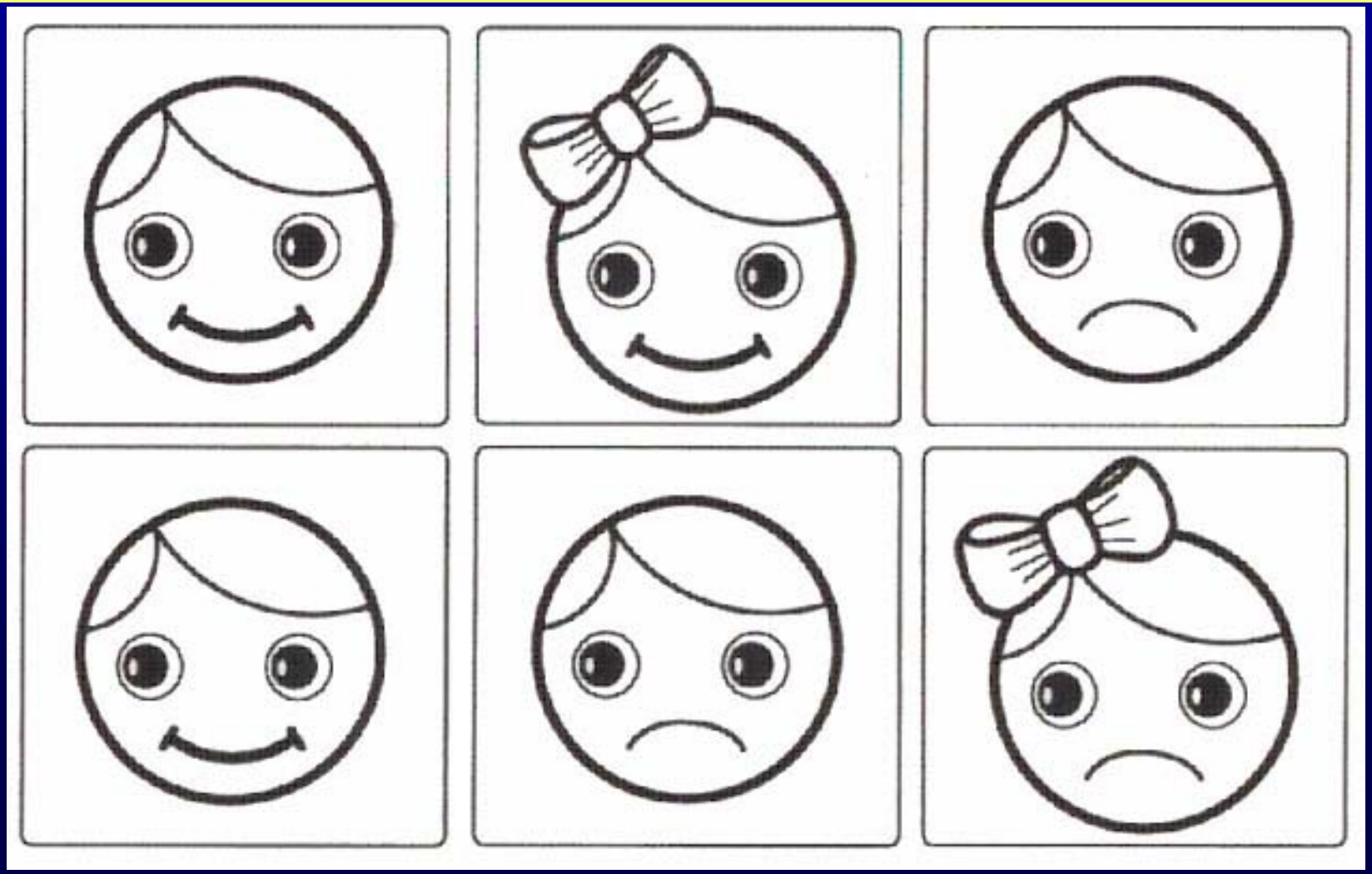
- Orientation of lines, LEA-mailbox
- Length of lines, LEA-Rectangles, Effron
- Photographs of faces
- **Heidi Expressions, photos etc.**
- LEA Puzzle, Form and Colour
- VA tests, Crowding effect
- Motion Perception, LEA Gratings, ball games

Vision for communication



- Real life situations, drawing/making pictures
- Photographs, colour and B&W
- Videos, tactile exploration, magnifying mirror
- **Intervener/ Interpreter**

Heidi expressions



Sensory integration

Often problematic:
the child can use
only one modality
at a time.

”Everything disappears”

Intermodal functions

- Congenital severe vision loss > competition between vision and tactile information > tactile info wins > no fusion of the two infos > alternating use of the two informations.

- Very late moving >> the child looks, takes a few steps, stops, looks, moves – functioning in sequencies

Table 2.

RECOGNITION and READING
Concrete objects
Landmarks
Faces, familiar and unfamiliar
Facial expressions, Body language
Pictures of concrete objects
Geometric forms
Letters
Numbers
Words
Crowding effect
Reading speed
Scanning lines of text
Efficiency of reading

PERCEPTION OF PICTURES
Length of lines
Orientation of lines
Details of pictures
Figure-ground
Visual closure
Noticing errors
Noticing missing details
Comparison with pictures in memory
'Reading' series of pictures
Visual problems in copying pictures
Geometric pictures depicting 3D forms

MATHEMATICS
Calculations, logical reasoning

AWARENESS OF AND ORIENTATION IN SPACE
Perception of one's body in space
Depth perception
Perception of near space and far space
Simultanagnosia
Perception of textures and surface qualities
Orientation in space
Memorising routes
Vision in traffic situations and in playgrounds

EYE-HAND COORDINATION
Grasping and throwing objects
Drawing, free hand
Copying, from near/ from blackboard
Copying, motor pl anning and execution

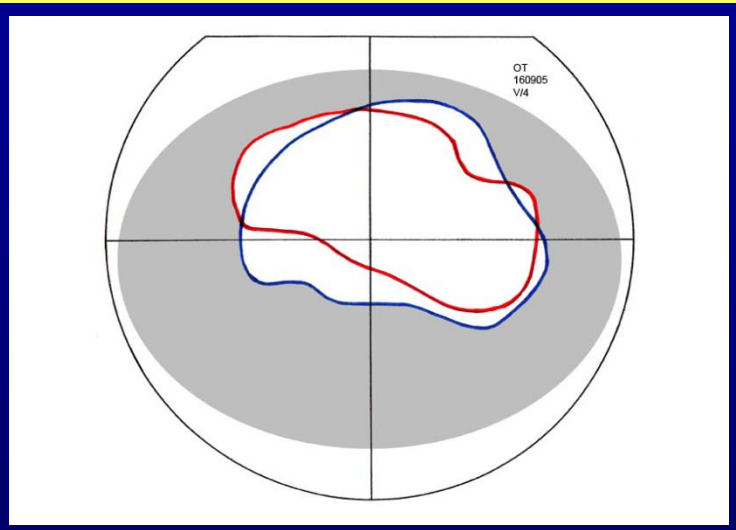
INTEGRATION PROBLEMS
Vision not used when listening or exploring
Vision not used when moving
Balance

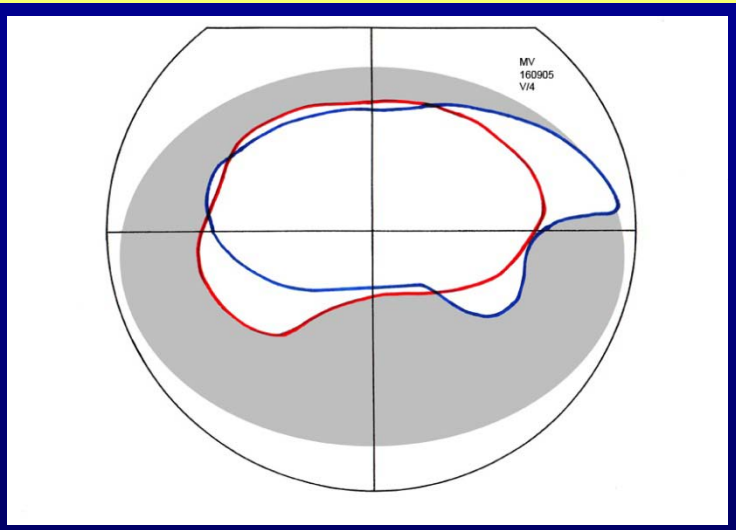
COMPENSATORY STRATEGIES
Auditory information
Tactile, kinaesthetic and haptic information
Memory, reasoning

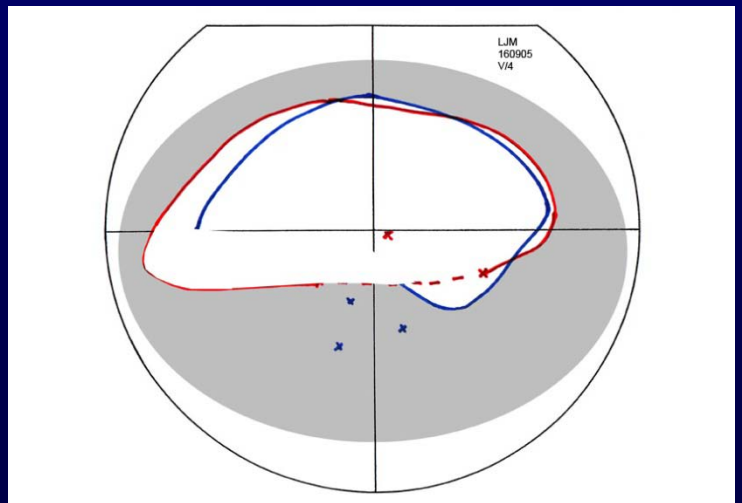
DISTURBING FACTORS
Environmental noise, visual and auditory
Balance problems and motor problems
Medications, epilepsy

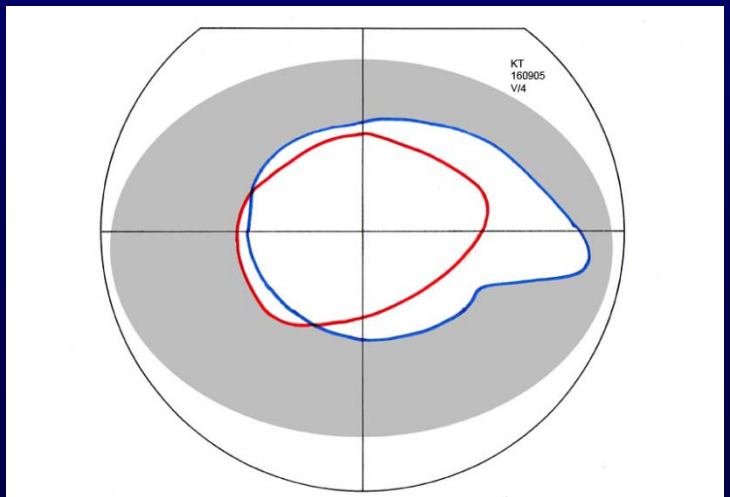
Visual field

typical findings in diplegic conditions



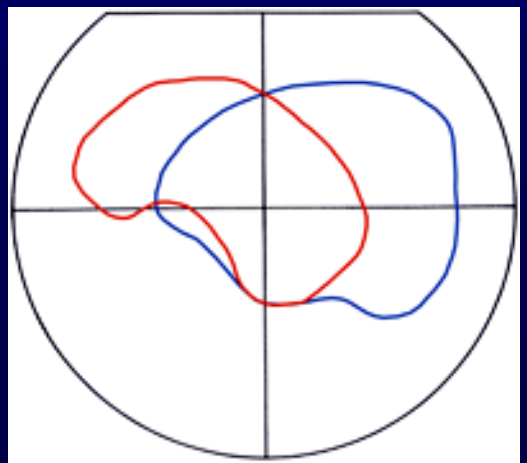




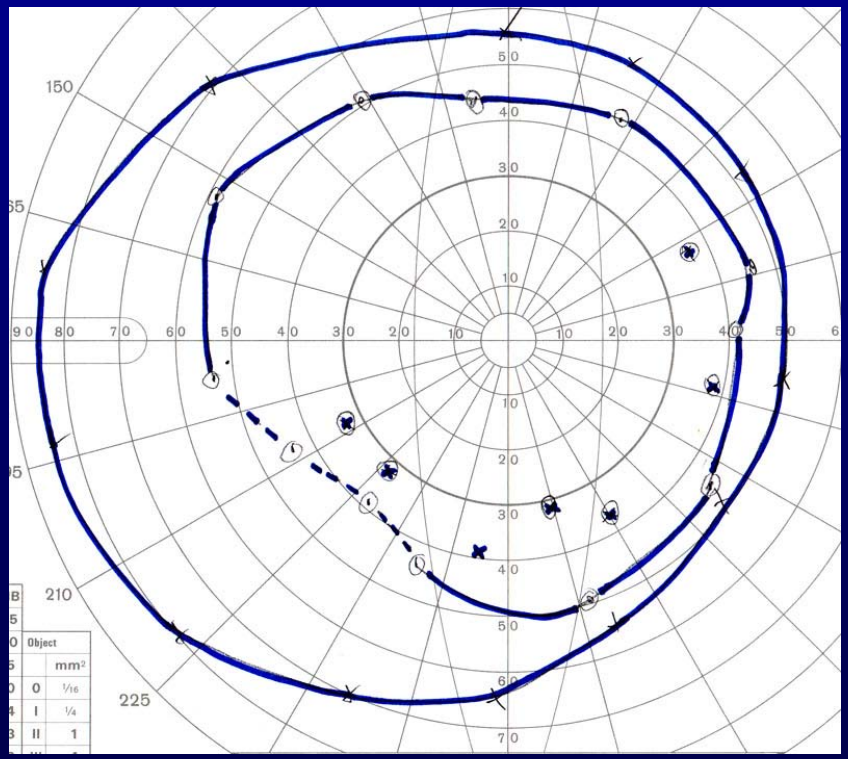


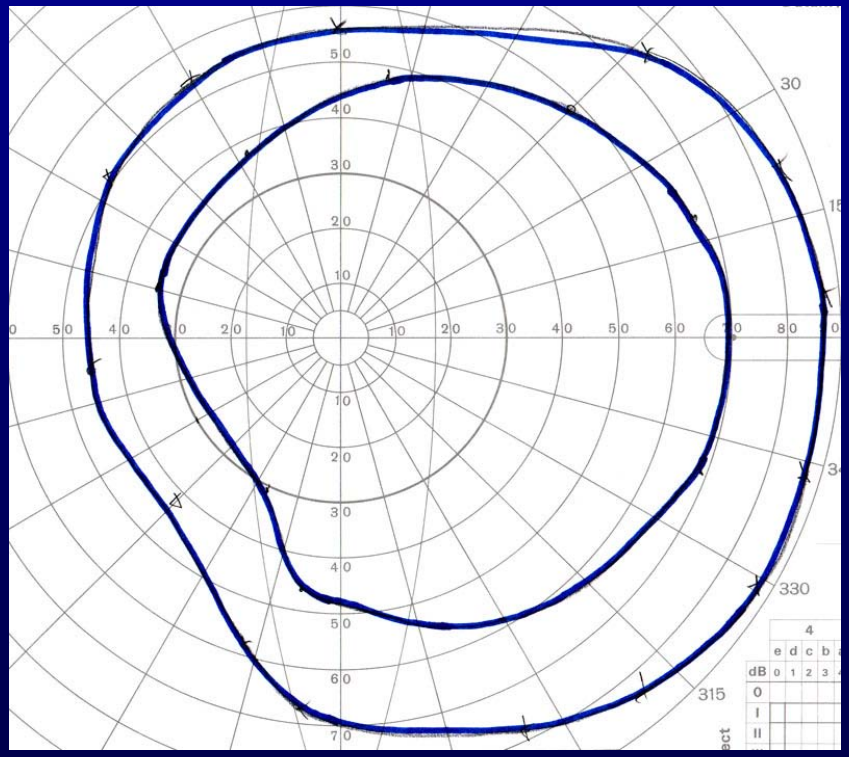
Spatial awareness

Orientation in environment



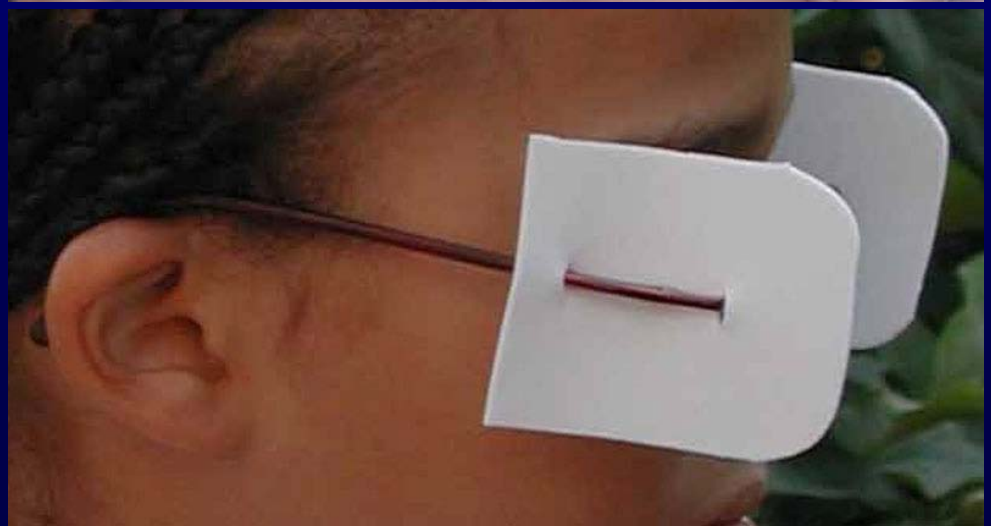
Improved visual fields





Environmental disturbance

Side shields



at the age of 7 years

- Poor motion perception confirmed
- Stress tolerance in use of vision low, peripheral visual noise highly disturbing > side shields >> **falling stopped**

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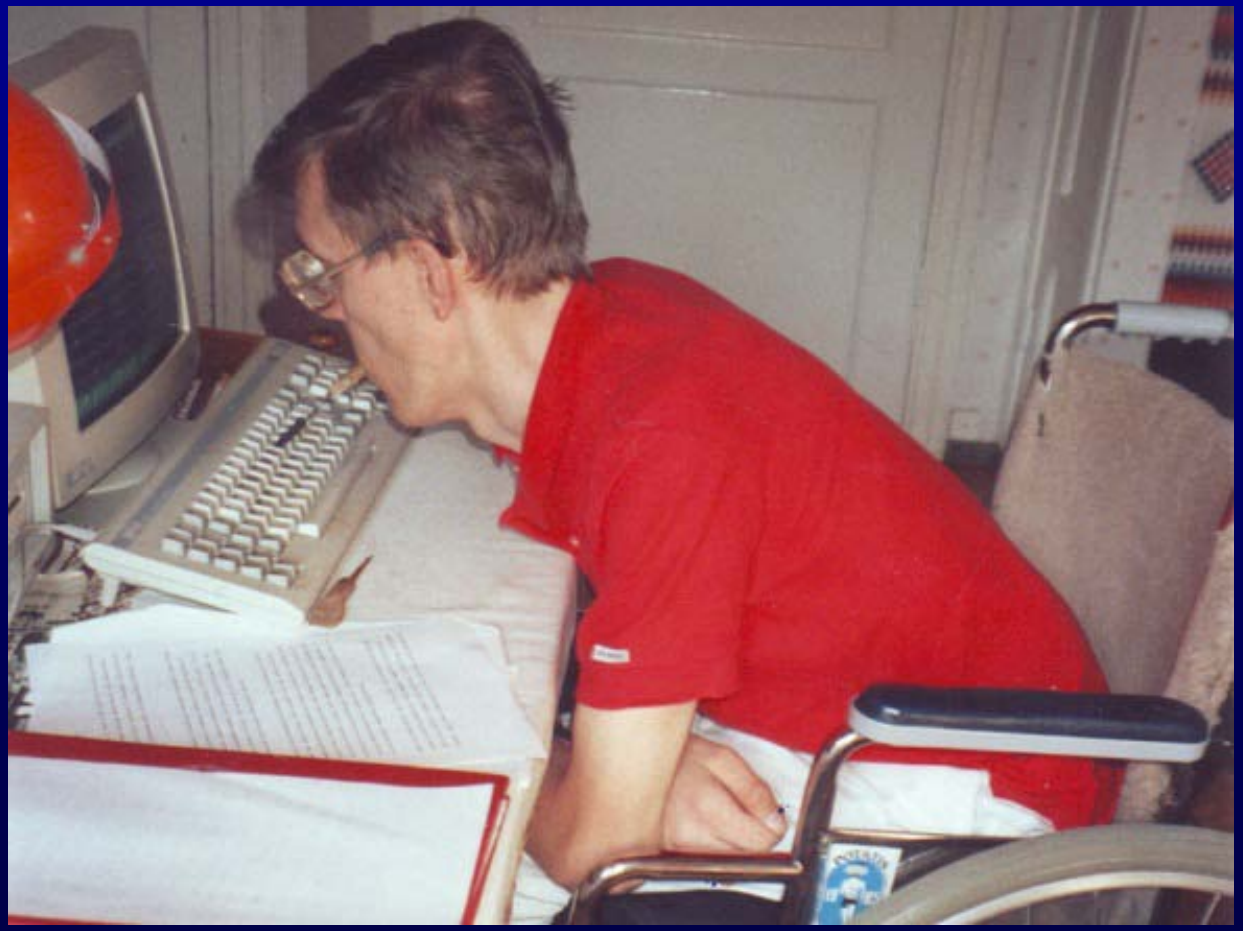
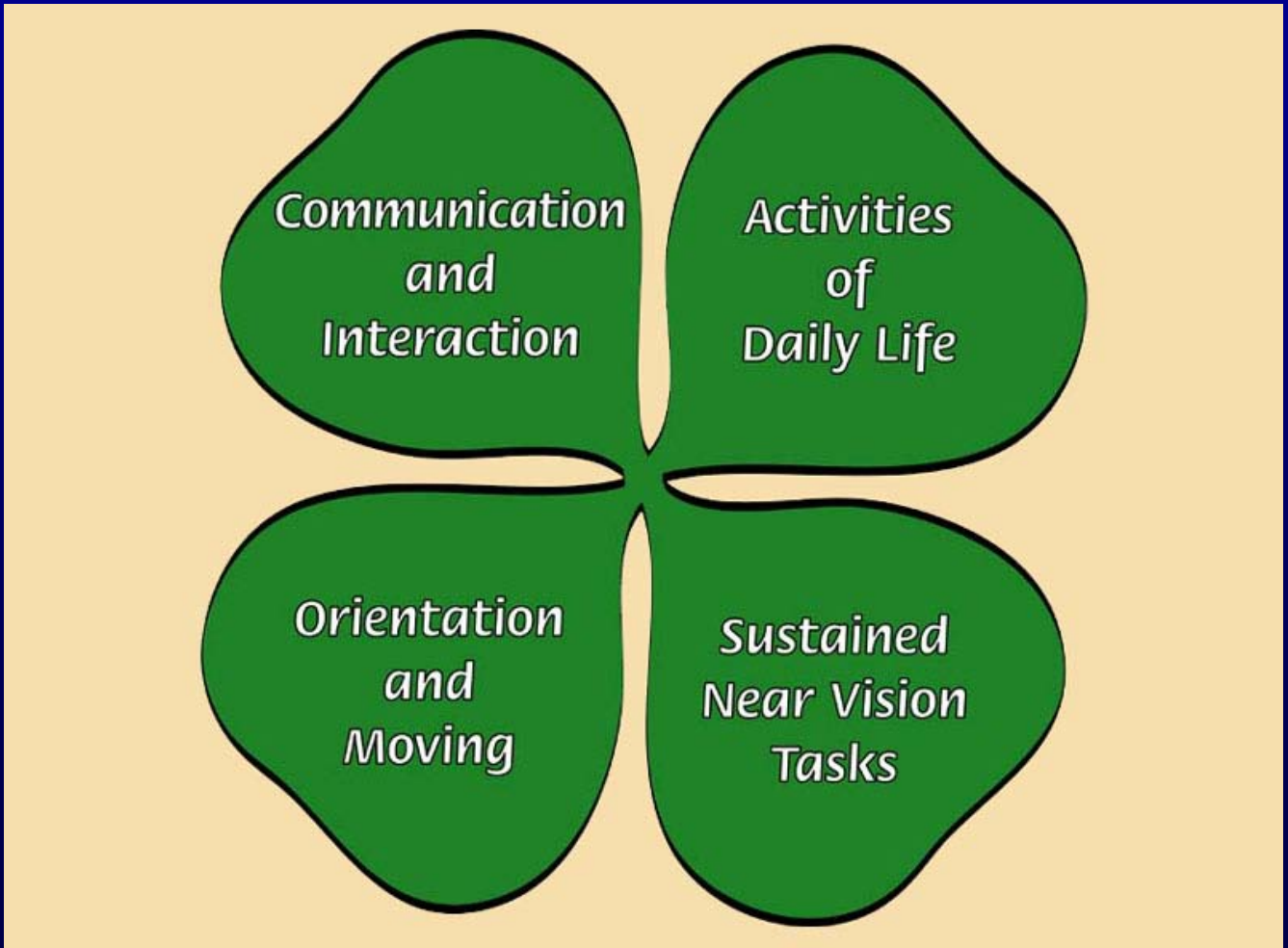


Assessment

for schools and for early intervention

- Oculomotor functions
- Quality of the image
- Processing of the image
  - ventral stream
  - dorsal stream
- Compensatory strategies

Four-leafed clover of Visual Functioning




Jablien
rolf


rukka
Thank you for your attention

End day 3


www.lea-test.fi