



# Assessment of Visual Functioning for Development and Learning

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[www.lea-test.fi](http://www.lea-test.fi)

# Transdisciplinary Assessment

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Involves numerous specialists in:

- medicine, in hospitals and locally
- early intervention team(s)
- social services
- education, local school, resource centres
  
- FAMILY of the infant(s) – child(ren) or
- FAMILIES of the infant(s) – child(ren)

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Problem areas: communication, coordination, early detection

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# Screening

among healthy infants and children

# Visual communication

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Eye contact, copying of expressions  
At 6 weeks, 8 weeks at the latest

# Communication – at 8 weeks

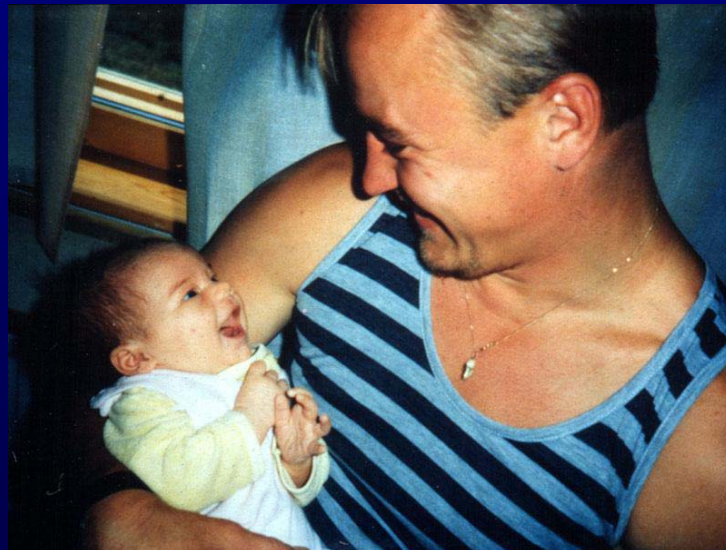
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# Recommended follow-up

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- Birth: structure of the eyes, red reflex, strabismus
- 6 – 8 weeks: good eye contact
- 12 weeks – 4th month: - active visual communication, hands found



# Eye contact and social smile

are important to the baby and the parents

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If a 4-month-old baby refuses visual communication



Insufficient accommodation?  
Mirror neuron system?



# Accommodation

eye contact and social smile

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Weak accommodation can be compensated with "reading glasses".

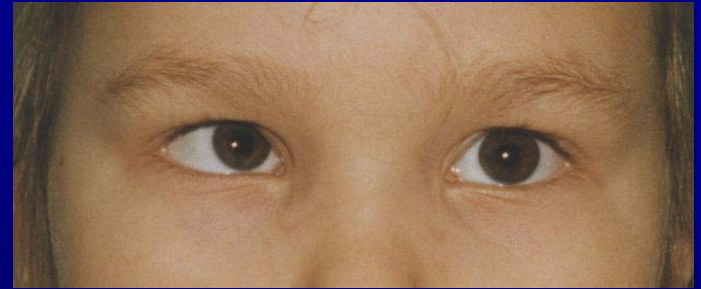
# Penalisation+bifocal

Amblyopia did not develop, binocularity remained

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Late development of accommodation may lead to esotropia, which requires glasses with special structure: bifocal for the left eye and near correction for the right eye = "penalisation".



At school age esotropia is corrected with progressive glasses, no surgery was needed in this case.

# Recommended follow-up

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- Birth: structure of the eyes, red reflex, strabismus
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  - baby follows hand movements of children and adults
  - fixation, following movements, convergence

Vision in motor development

# At the Art Museum Pori, Finland

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Infant artists  
using  
Mirror neuron functions

Photo: Päivi Setälä



# Recommended follow-up

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- Birth: structure of the eyes, red reflex, strabismus – all nine contacts
- 6 – 8 weeks: **good eye contact**
- 12 weeks – 4th month: - **active visual communication, hands found**
  - baby **follows hand movements** of children and adults
  - **fixation, following movements, convergence**
- 7- 8 months: pincer grasp, **face recognition**, Hirschberg
- 18 months: **face recognition**, Hirschberg, cover test (H+c)
- 3<sup>rd</sup> year: (H+c), near vision acuity; **unusual behaviours**

# Infants at risk

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Whenever there is a deviation  
from normal interaction / communication  
infant's visual and auditory functions  
need to be carefully assessed without delay.

**Eye contact, eye movements, expressions**

**Train** health care nurses, therapists, paediatricians

# Infant groups at risk

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- small prematurely born infants
- intellectual disability
- hearing impairment
- motor problems, hypotonia
- twins
- certain syndromes, Down
- after accidents, infections

Start early intervention even when no eye disease is present, **train vision** as a part of infant's early general intervention.

# Accommodation

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# Compensating accommodation

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# Watching simple pictures

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# Early Intervention

should start EARLY

It should start already during the first assessment.



# First days and weeks

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- First child
- Parents had no experience of blindness
- Treatment of the disease in the eyes
- Immediate contact with early intervention
- Assessment of vision
- Assessment of general functioning
- Assessment of the needs of the family

Early intervention should start as an integral part of treatment, at birth if visual impairment is noticed during the first day.

**First information is a part of early intervention.**

# What if an infant is functionally blind?

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Congenital glaucoma

Cloudy corneas, flat anterior chambers

**"Developmental emergency"** Patricia Sonksen



Corneal transplants, activation of use of vision during 10 weeks of clear cornea + support to motor development >> normal development

# Transdisciplinary Assessment

of infants and children with or without multiple impairments

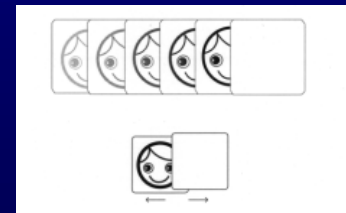
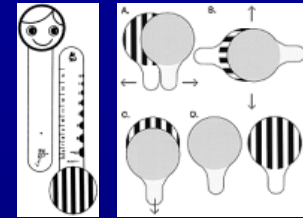
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- family of the child
- obstetrician, neonatologist, ICU
- paediatric neurologist: neurologic dg
- early intervention team
- paediatrician, health care nurse
- ophthalmologist: anatomy, diseases,
- optometrist: functional diagnosis, glasses
- teachers, therapists: observations, re-testing
- genetic diagnostic team
- audiologist, ENT-specialist
- (neuro)psychologist: specific tests

# Clinical examination

and a few clinical tests prepare for the assessment of visual functioning

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Hiding Heidi test

Pepi-test

Few tests to measure visual functions



# Hiding Heidi

low contrast pictures for assessment of communication distance

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age 3 months



Facial expressions are fast moving low contrast shadows on the face.

Copying smiling face = the infant must have seen the smile to copy it.

In a few seconds we have observed key brain functions for visual communication.

# Before the assessment of visual functioning

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Clinical examination:

- structure of the eyes
- structure of the visual pathways
- refractive errors
- spectacles, under- or overcorrections
- ocular motor functions
- accommodation

The above functions are assessed and reported by ophthalmologists.

The infant should have proper glasses fitted by an optometrist.

**Assessment is a part of Early Intervention.**

# Communication

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## Training of Baby Tadoma



Early interaction uses smell,  
body contact, voice,  
eye contact, facial xpressions

# Figure-in-motion, Pepi-test

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Near correction, head support



Pepi-test, copy from [www.lea-test.fi](http://www.lea-test.fi)

Never mention what you saw moving on the screen!!  
You can ask "Should I play it again?"

# Low tonus and poor head control

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Include vision as an integral part in the early general intervention.  
Strong visual stimuli activate motor control. **Avoid passive stimulation!**

# Constricted visual field

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Large illuminated ball used by the child's own therapist.

# Assessment >> Early Intervention

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1. Normal hand
2. Spastic hand

Awareness of hands

⇒ Fixation



# Eye contact

when reading lenses give a clear image on the retina

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Have several pairs of plus lenses from +4 to +10 in soft frames for trial.

# Visually active infant

ten weeks later: improved visual and motor functions

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Use favourite toys to entice movements.



Right eye's Grating Acuity less than in the left eye  
>> training as a part of physiotherapy.

# Play situation as training

orientation in space, listening skills, object permanence

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Light coloured surfaces rough,  
dark surfaces smooth >> visual  
and touch information coincide.



Resonance board, plastic waste  
basket, metal washing basin, big  
ball and mirror as playthings.



”Little room” for awareness  
of small spaces;  
tactile, auditory, haptic  
information in exploration  
of toys hanging on rubber  
band.

# Vision loss

often affects development of following areas of functioning:

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- communication
- interaction
- motor development
- spatial concepts
- orientation in space
- object permanence
- language

Support of all these functions should be included in the functions of each day day – several times so that the infant experiences activities in all functional areas like a sighted baby, preferably also as many.

# Leo Video

how to create play situations for motor and spatial experiences

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# Vision loss after the first year

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- Inherited diseases, retinal dystrophies and degenerations, optic nerve, brain disorders
- Brain damage related vision loss, late dg
- Infections and inflammations
- Accidents
- Non-accidental damage
- Numerous syndromes

Early intervention starts as a part of diagnostic work.

Information should be given early also to the school and resource centre.

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# Testing Vision

# Training for assessment

Learning the concept "same" with colours  
as preparation for the measurement of VA



with B & W forms



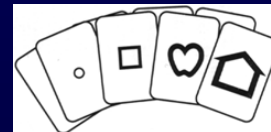
comparing concrete object  
with the picture of the object



$VA = m/M$



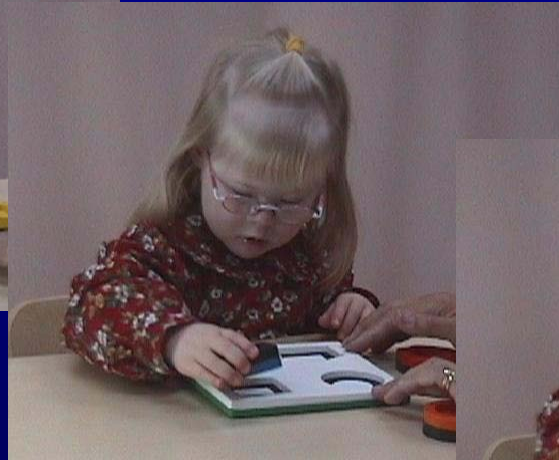
Playing Cards



# Learning to match forms

may require months of fun play situations

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Infants with Down syndrome should have their near correction at the age of a few WEEKS if the error is +6.0 as in this girl or a high minus.

# Transdisciplinary assessment

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The persons with the best communication test the different visual functions.  
Testing is often more successful in day care and at school.

# Assessment

for for early intervention and schools, 3 main areas

- 1. Ocularmotor functions  
repeat the test situations
- 2. Quality of the image:  
clinical tests, observations
- 3. Processing of the image
  - ventral stream
  - dorsal stream
  - mirror neuron system

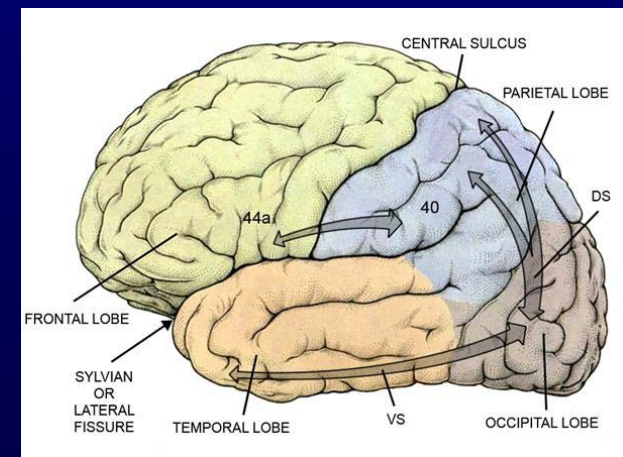
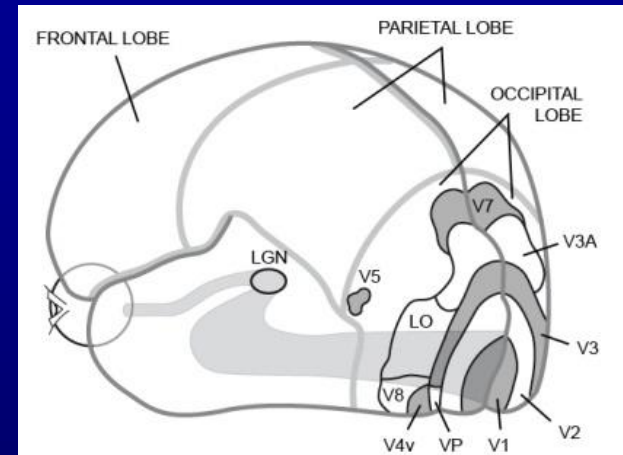
Early processing in the occipital lobe



Ventral stream

Dorsal stream

Mirror neuron system



# Clinical tests

results are important for EI and education

- Ocular motor functions, spectacles
- Grating acuity
- Optotype acuity
- Contrast sensitivity
- Visual field
- Colour vision
- Visual adaptation, filters
- **Motion perception**
- Fusion, stereo vision

TESTS REPEATED AT KG and SKOOL



# Use of tests

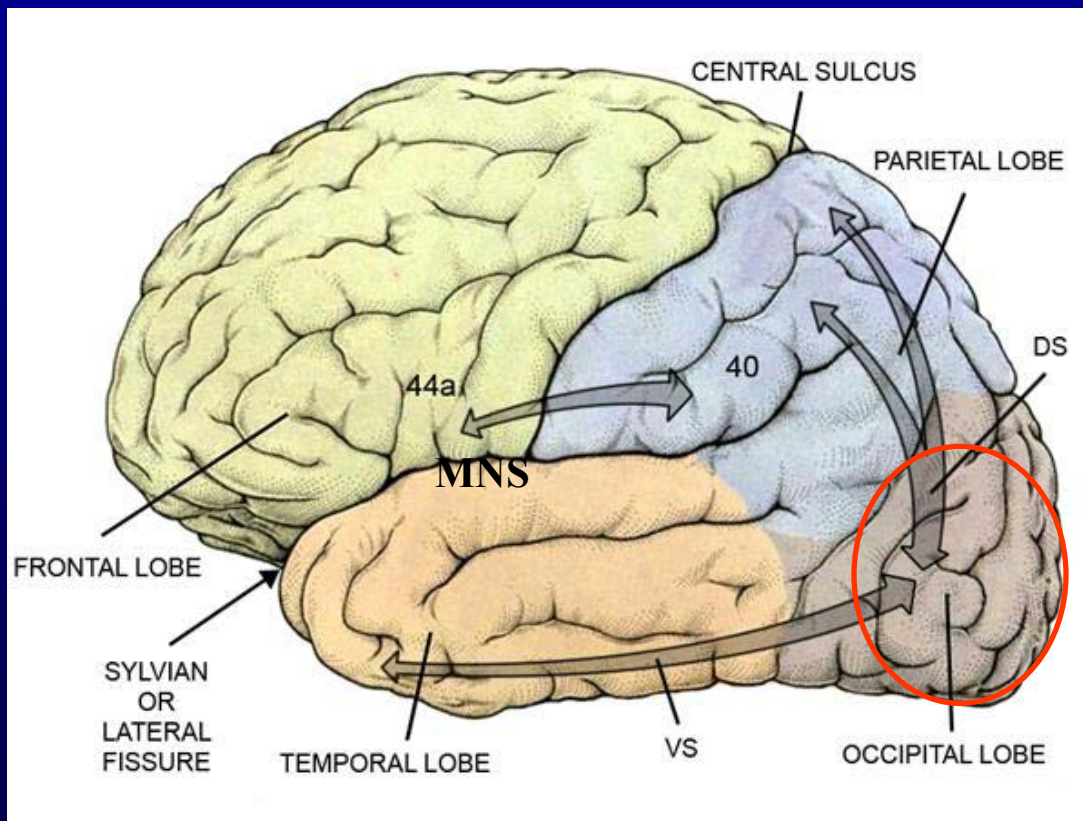
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Nearly all usual clinical tests  
can and should be used  
by teachers, therapists, nurses and psychologists,  
not only by neuropsychologists,  
ophthalmologists and optometrists.

**Test results become better understood**  
when the tests are used in play situations  
at kindergarten, at school or at home.  
Parents can also use many tests during play,  
especially the LEA Puzzle.

# Early processing in occipital lobe

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Early processing:

Coding of  
Colours

Contrast edges

Movement/ motion

Line directions & length

Stereovision

Object/ background

Figure/ ground

Visual closure, filling-in

Visual illusions

Short term memory

Tactile, haptic, and

Auditory space

Insula

# LEA Mailbox & Rectangles

## Colorama Game & Heidi Expressions

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# Assessment in day care

Vision for ..

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- Communication, eye contact, **Interaction**
- Hiding Heidi, Pepi-test
- Ocular motor functions:
- **Glasses?** Fitting, near correction?
- Grating acuity, visual acuity, near and distance
- Spatial concepts, body awareness, object permanence
- Language
- Exploration with all senses, concepts

# Assessment in day care, 2

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- Orientation in near and far space, cane
- Copying parallel lines, cross, circle
- Drawing a picture of himself, house
- Puzzles, noticing missing details in pictures
- Completing incomplete pictures
- Perception of complex pictures, scanning
- **Eye-hand coordination in detail**

# All infants with developmental delay

rare deletion in chromosome 2, other infants died before the age of 8 months

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When looking at the camera and my face he seemed to **fixate at the hair line.**

## Observations:

Moved rolling, explored the new place

Noticed the sound of the zipper of his mother's bag

Rolled to the bag and opened the zipper

Noticed gray rectangle on grey surface, contrast sensitivity

Good visual communication with his mother, tactile signs

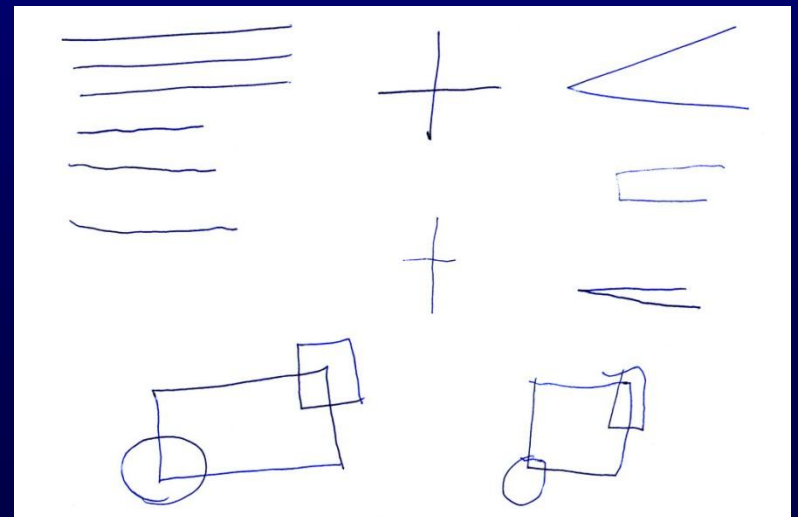
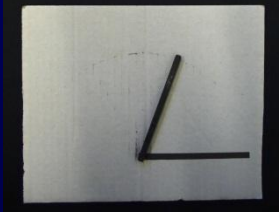
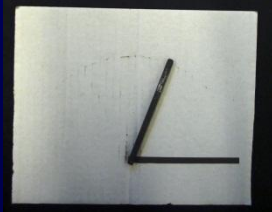
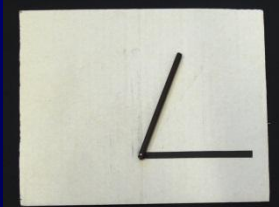
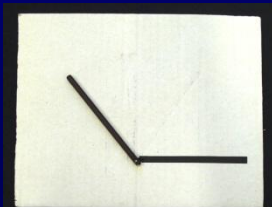
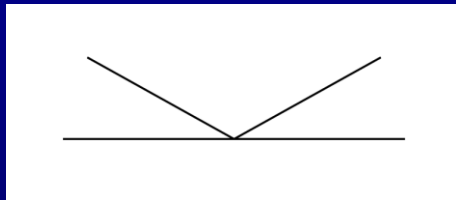


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# Assessment of vision for school

should answer even more questions  
related to the numerous functions  
in the parietal lobe (dorsal stream),  
in the temporal lobe (ventral stream),  
and the mirror neuron system.

# Direction of lines and geometric figures



# Dorsal Stream/ Parietal Networks

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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

# Ventral Stream

## Inferotemporal Networks, Recognition Functions

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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

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 Length 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				

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

PROFOUND loss of function in \_\_visual functions  
 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				
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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				

#### VENTRAL STREAM

A Length of lines, purely visual test				
B Direction of lines, purely visual test				
C Recognition of details				
D Noticing missing details in pictures				
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#### 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

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

	N	I	P
DORSAL STREAM			
A2 Perception of near and far space			
B1 Observation of surrounding			
C3 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			

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

# Opinion of the student

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- Which functional area is most important?  
In which function does (s)he not do well?  
(an open ended question)
- Which one of the four main visual functioning areas does (s)he value most? Why?
- Which one of them is most difficult? Why?
- Which one of them does (s)he have most/  
least interest in? Why?

# Participation

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- How does the student experience his/her participation in activities?
- How does (s)he experience daily communication at school, evening activities, camps, during trips.
- How does the student see **his/her** future?
- Family's experience/opinions.

# Environment

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- Attitudes and actions of people
- Physical structure of the environment
- Adaptations possible/ made
- Integration
- Inclusion
- "Least restrictive environment"





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