EXAMINING VISUAL PERCEPTUAL PROCESSING IN CHILDREN IN TYPICAL AND ATYPICAL DEVELOPMENT (CEREBRAL PALSY)

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PhD Student

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A little about me…

- Neuropsychologist
- Work with children with CP since 2006
  - Consultations
  - Cognitive assessment
  - Collaborations with schools

- Made my thesis after my working days for 6 years
- Now full time work on my thesis thanks to a grant

AIMS (1)

- Creation of a battery of tests for the assessment of visual perceptual and visual spatial processes, specifically design for children with Cerebral Palsy

→Easy to respond

→No time limit for item presentation

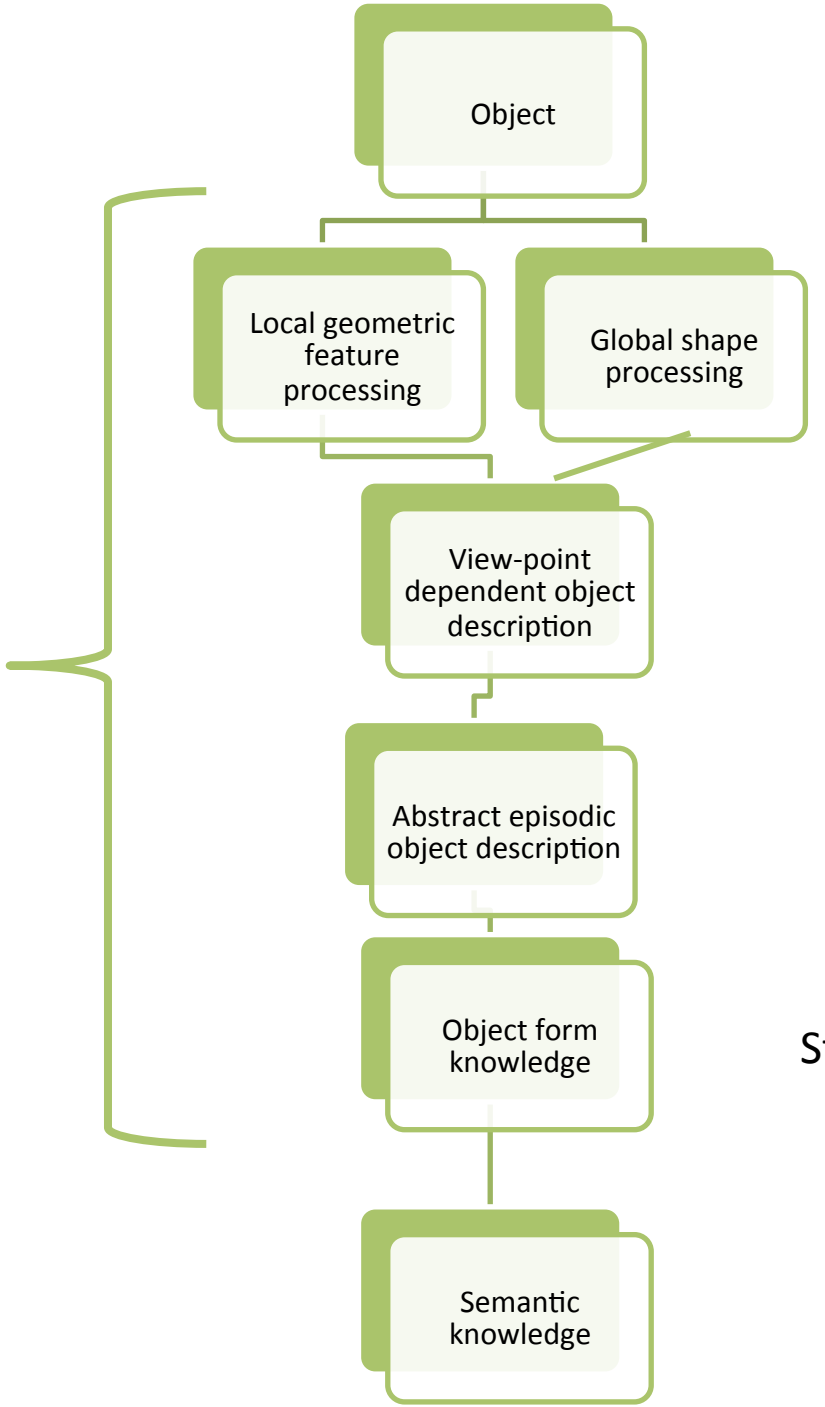
→Limited involvement of language

AIMS (2)

- Assessment of children with Cerebral Palsy and of typically developing children to:
  - Specify the developmental trajectories in CP and TD children
  - Compare the performance profiles

- CP n=108
- TD children n=215
- TD adults=20

PRE-SEMANTIC PROCESSING
OF VISUAL OBJECT RECOGNITION



Early analysis

Intermediate analysis

Late analysis

Structural representations

Humphreys and Riddoch model (1987)

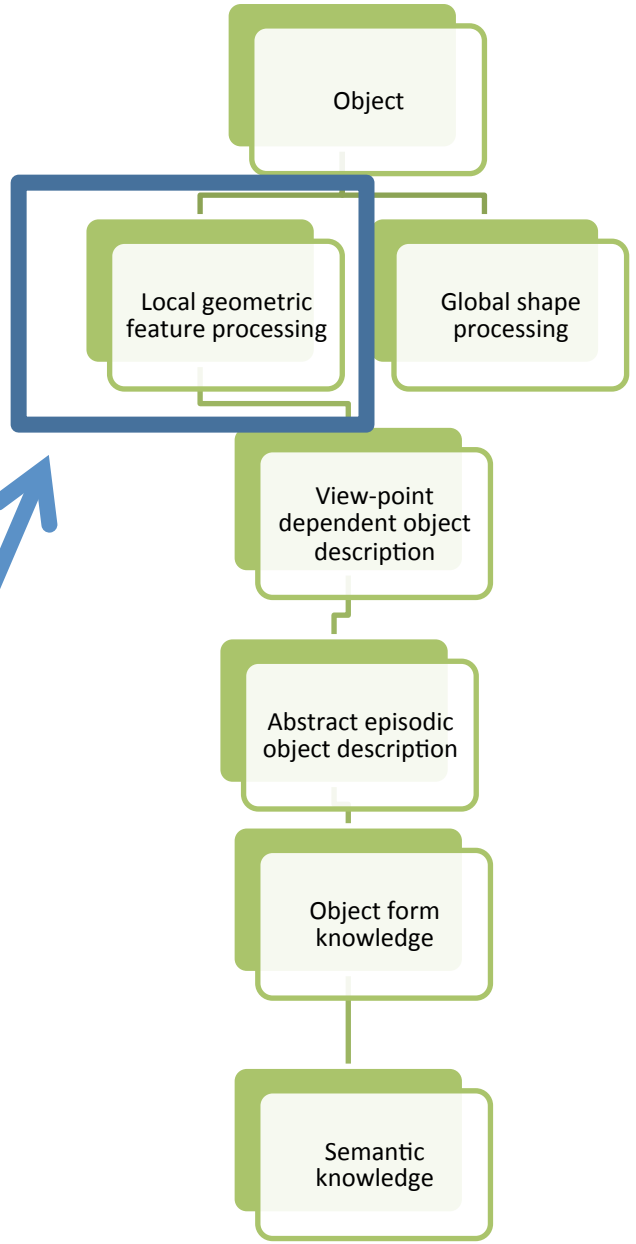
Creation of the tests

- ***Based on the BORB (1993)*** standardise in adults

- ***Early analysis*** :

basic components of pictures

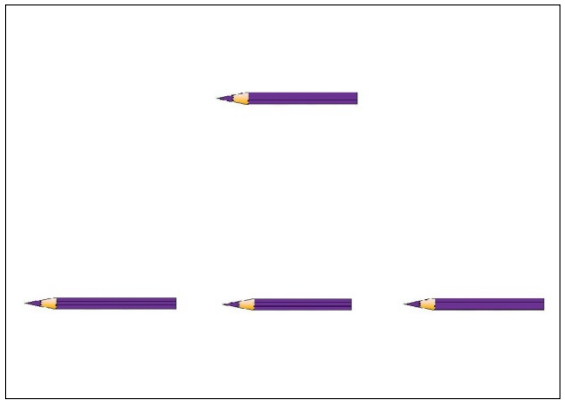
- length
- surface
- orientation
- position



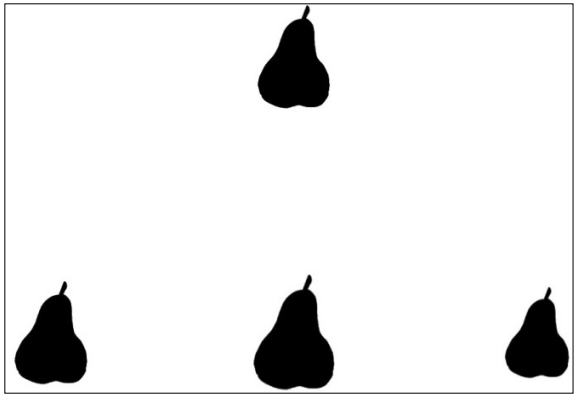
Early Analysis

Four subtests :

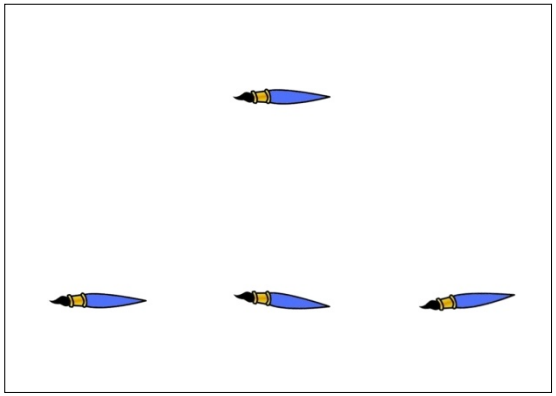
Length



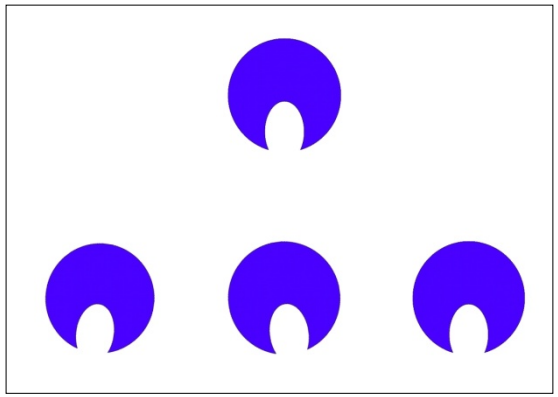
Surface



Orientation



Position

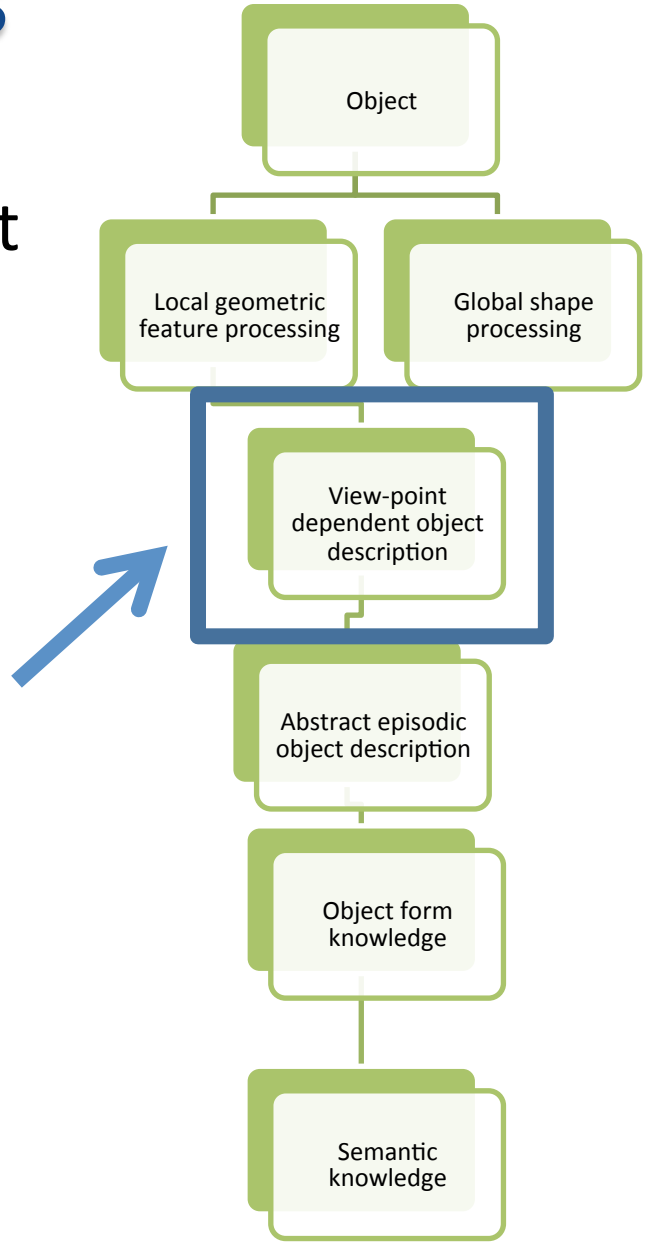


Creation of the tests

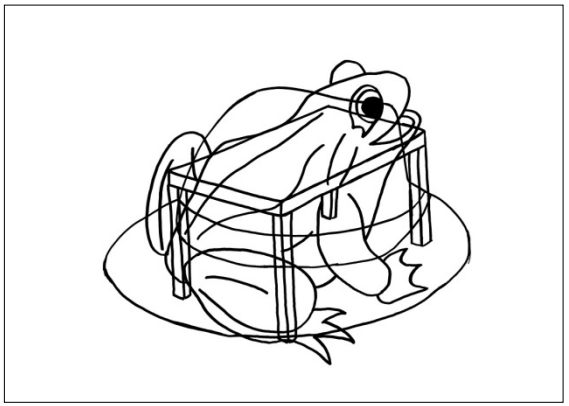
- ***Intermediate analysis***:

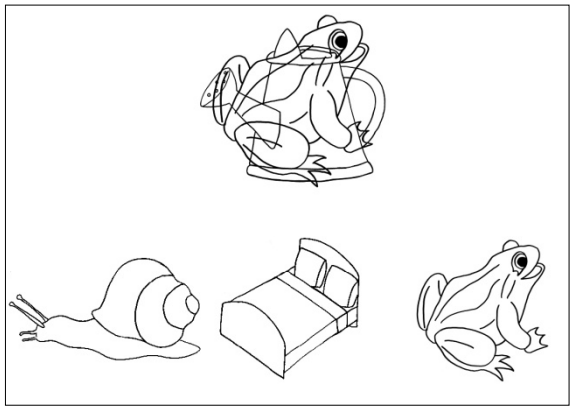
construction of a view-dependent representation of an object

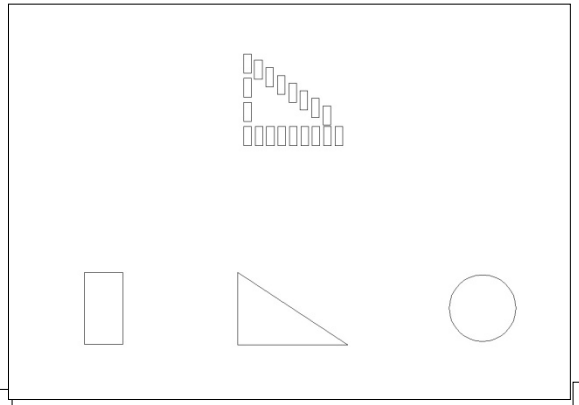
- visual closure
- figure-ground discrimination
- local-global processing

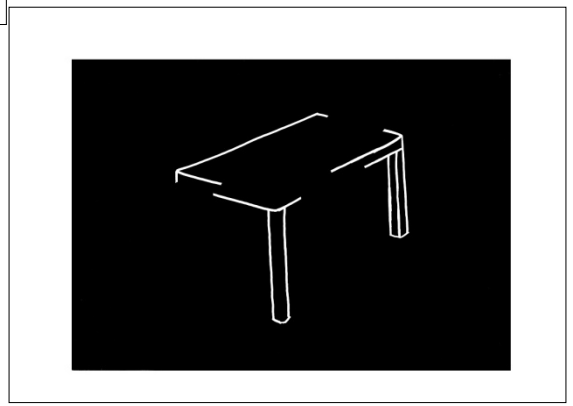


Intermediate Analysis







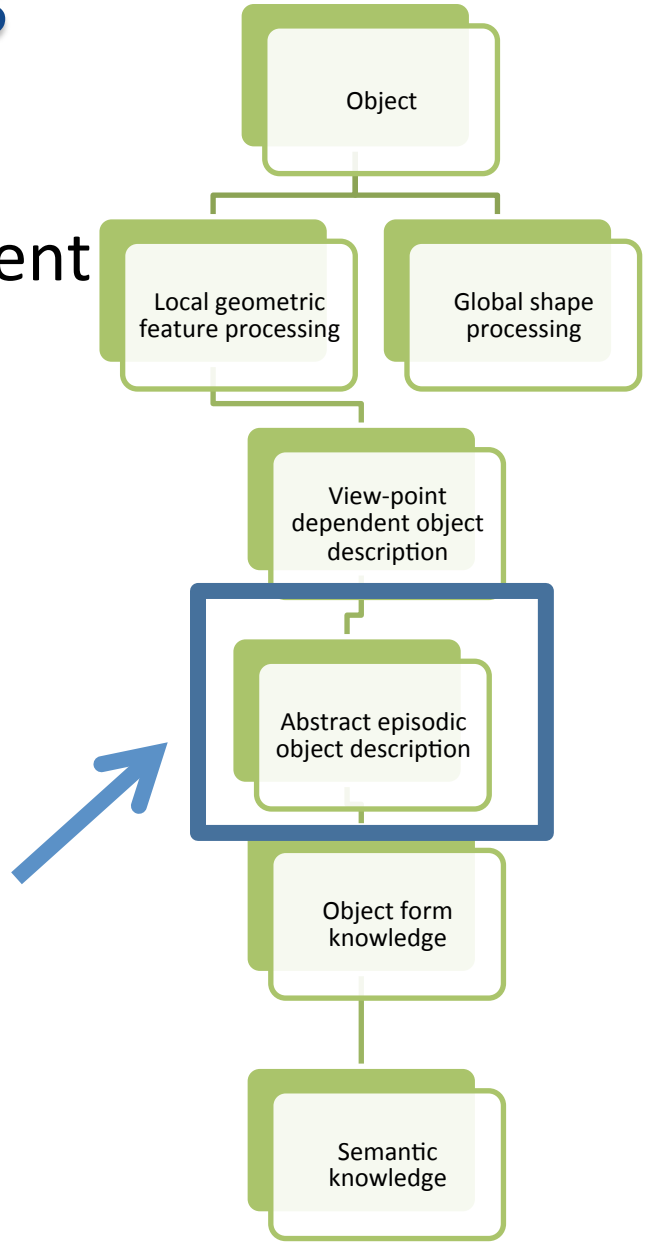


Creation of the tests

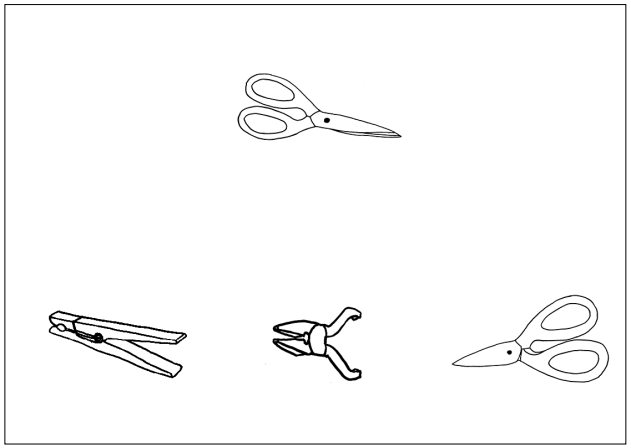
- ***Late analysis***:

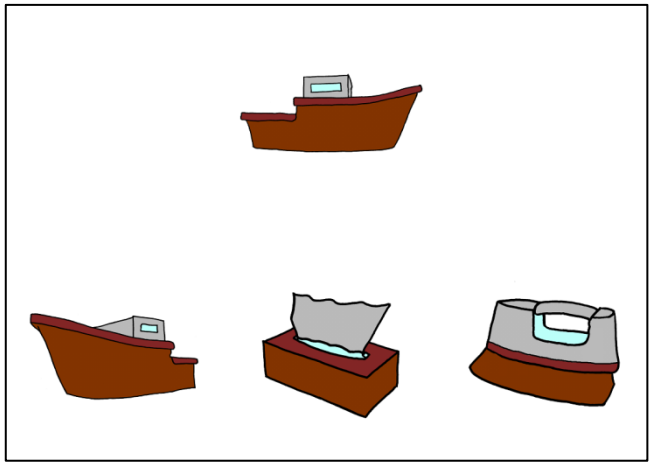
construction of a view-independent representation of the object

- object constancy



Late Analysis

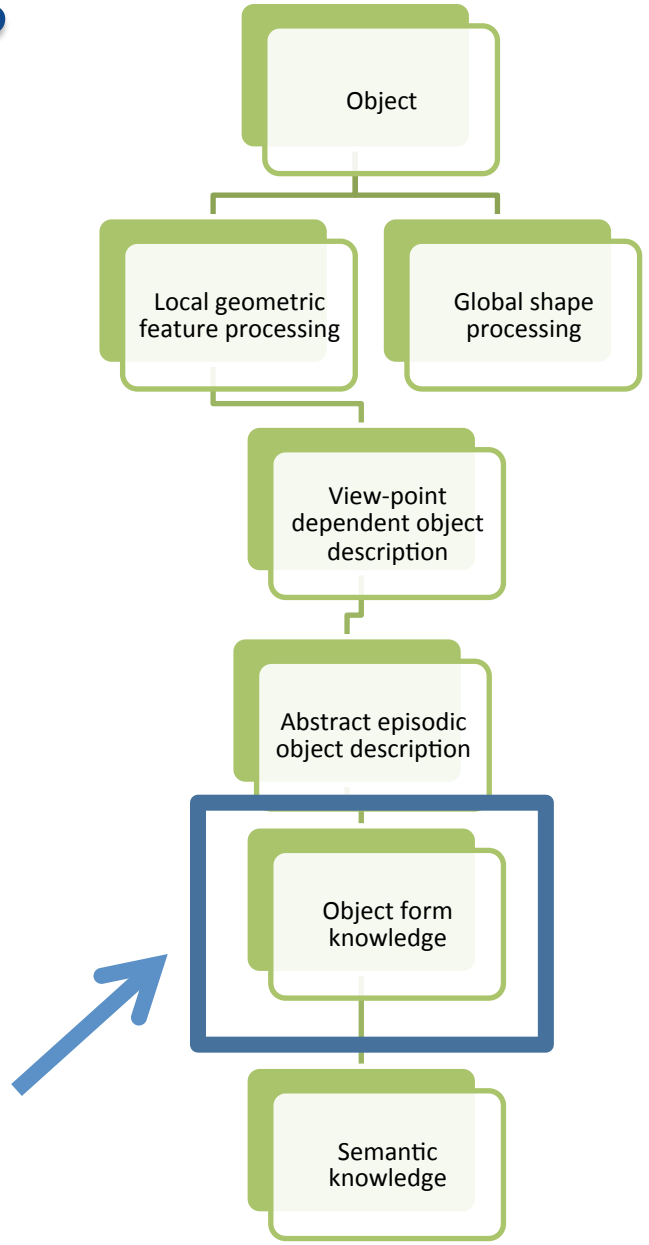




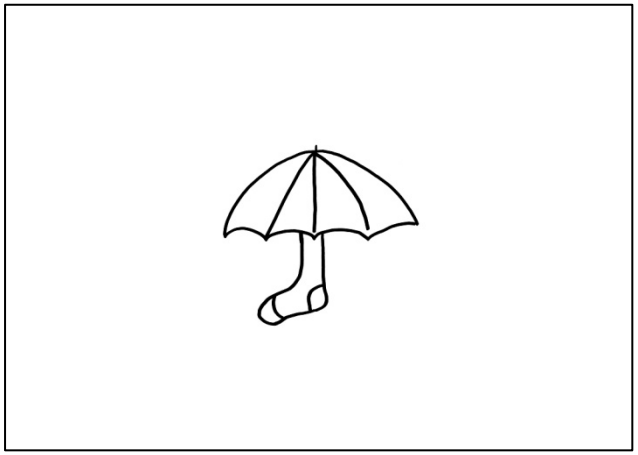
Creation of the tests

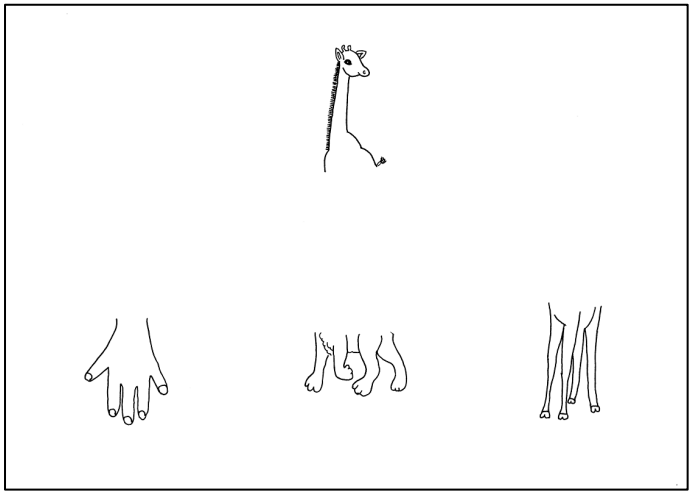
- ***Structural representations***:

stored knowledge on physical characteristics of objects

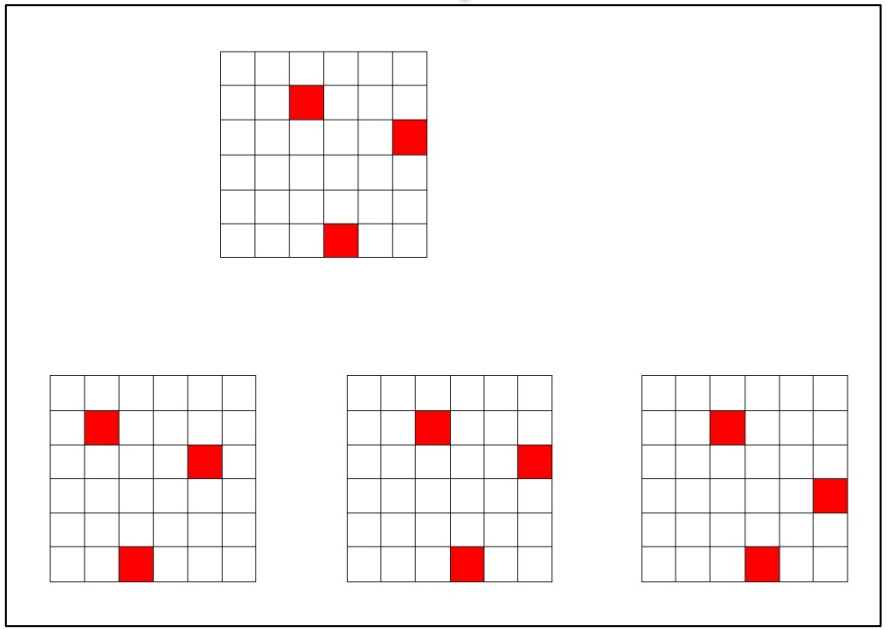


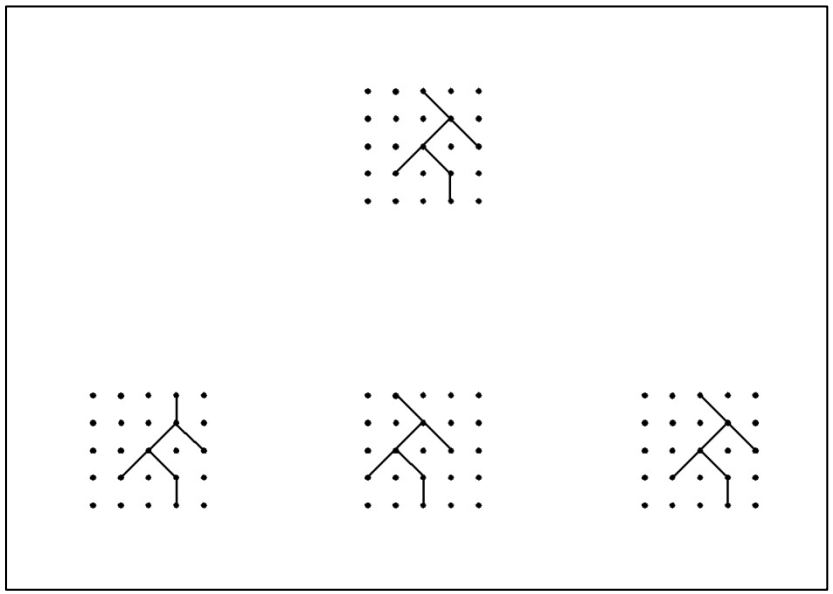
Structural representations





Creation of the tests: visual spatial





First step: validation of the battery

- 179 TD children
- Task sensitivity: task selection
- Internal consistency of each test
- Convergent validity
- Theoretical validity with an exploratory factorial analysis

Theoretical validity

	Factor 1	Factor 2	Factor 3
Length	**.75**	.04	.03
Surface	**.75**	.30	.01
Orientation	**.72**	.34	.00
Position	**.57**	.42	-.09
Incomplete figures: silhouettes	.38	**.66**	.01
Hierarchical figures	-.01	**.76**	.02
Overlapping figures naming: complete	.32	**.71**	-.02
Object constancy: outlined drawings	.23	**.75**	.00
Object decision	.11	**.50**	.13
Object completion	.28	**.54**	-.14
Location in a box: grid	.07	-.07	**.90**
Location in a box: no grid	.11	-.05	**.87**
Distances: egocentric	.01	-.01	**.81**
Distances: allocentric	-.20	.13	**.65**

Theoretical validity

Grouping of view-dependent and view-independent representations, and structural representations stored in memory

	Factor 1	F	
Length	**.75**		
Surface	**.75**	.30	.01
Orientation	**.72**	.34	.00
Position	**.57**	.42	-.09
Incomplete figures: silhouettes	.38	**.66**	.01
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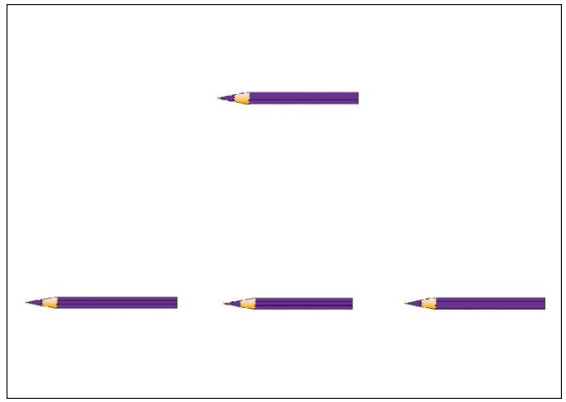
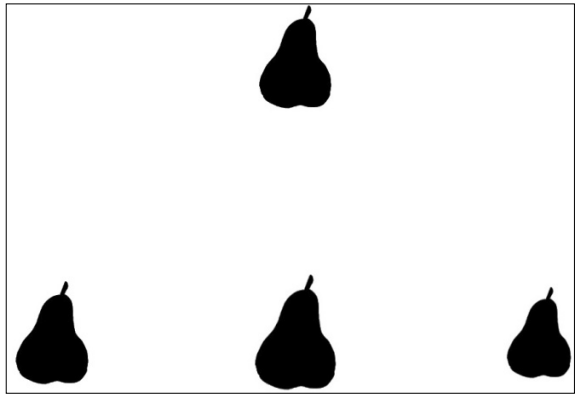
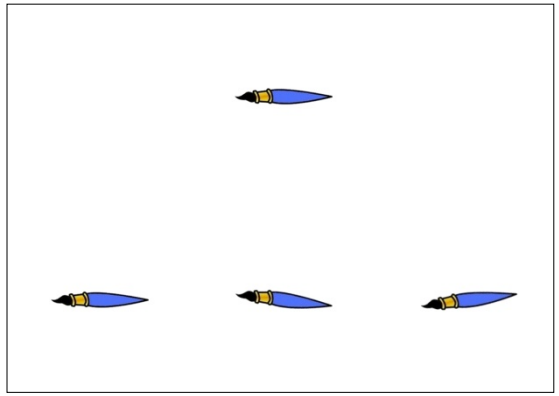
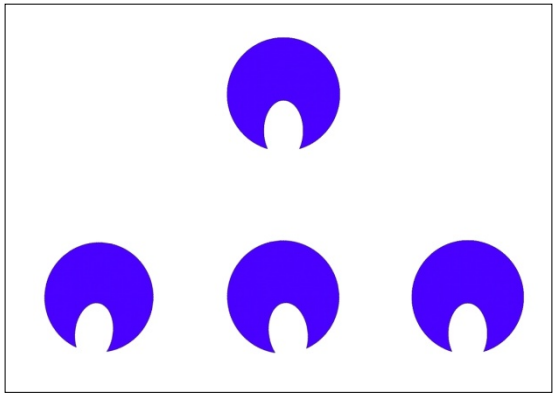
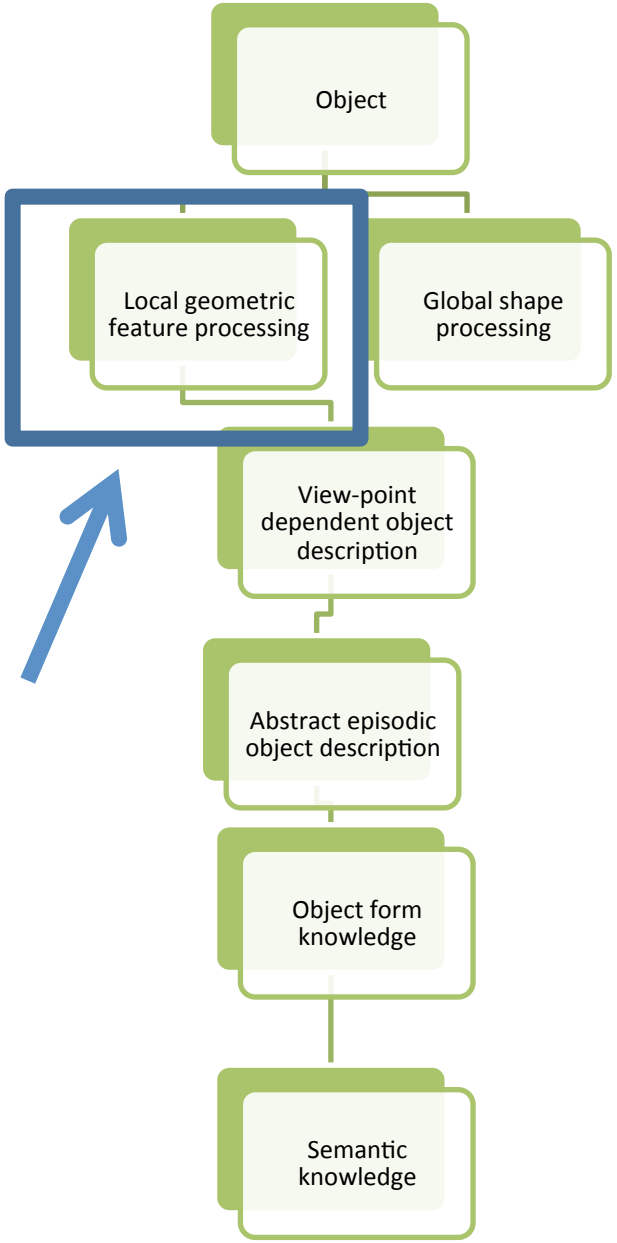
Early Analysis





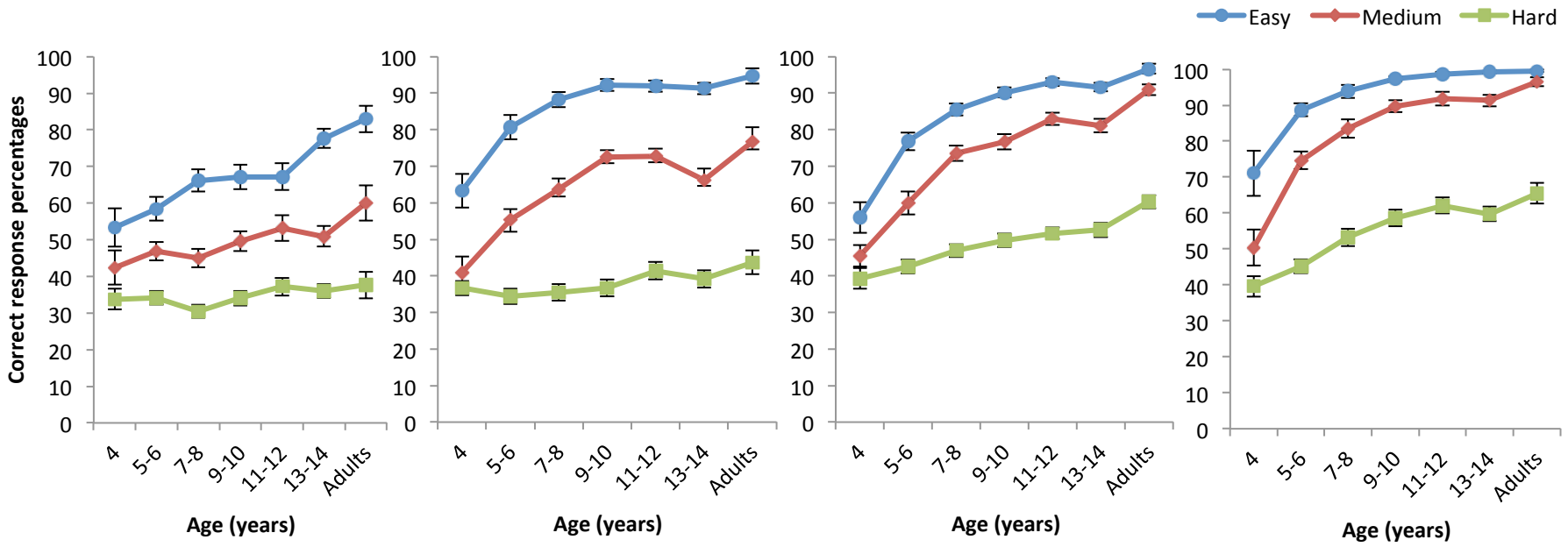






Study of developmental trajectories with
215 TD children
20 young adults

Early Analysis: TD children



Difficulty	Length	Surface	Orientation	Position
Easy	13-14	9-10	Adult	11-12
Medium	n s	9-10	Adult	13-14
Hard	Chance level	n s	Adult	13-14

Early Analysis: children with CP

- Sample:
  - 86 children with spastic CP (pre- or neonatal brain lesions, NO malformations, NO epileptic encephalopathy)
  - 86 TD children matched on chronological age
  - 86 TD children matched on non verbal mental age

Early Analysis: children with CP

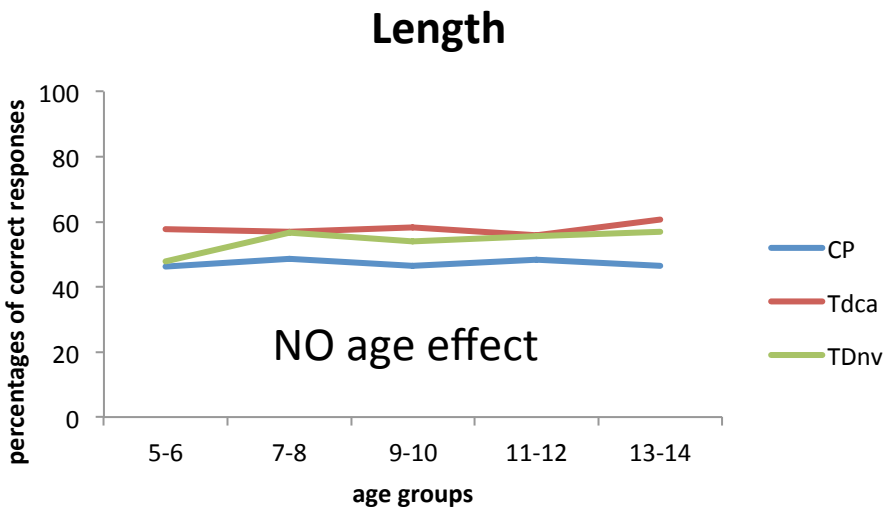
- Questions:
  - Same or different developmental trajectories in children with CP and in TD children?
  - Significant differences between children with CP and matched children on CA ? And/or on MA?
  - From what age these differences appear and are significant?

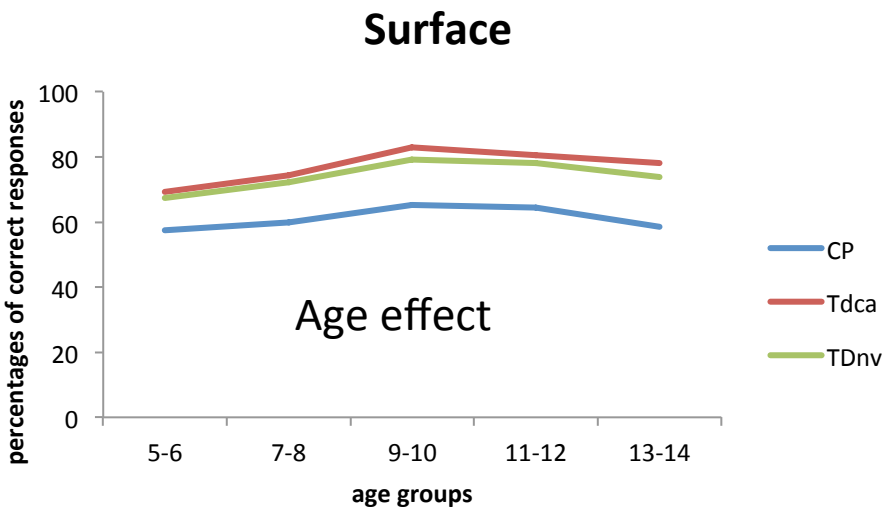
Early Analysis: children with CP

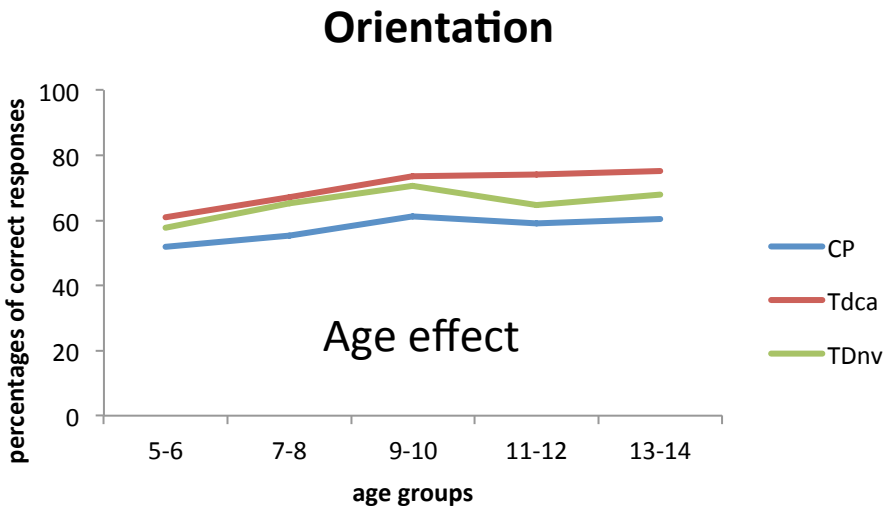
- Statistical analyses in progress…
- ANOVA made for this presentation
  BUT the condition of normality is not respected

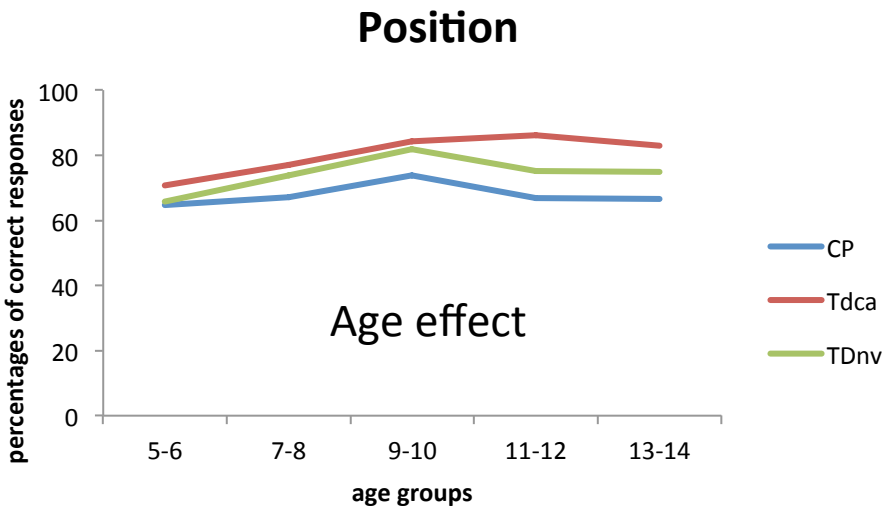
- SO we are searching a solution…
- Perhaps logistic regressions on probability of success

AGE x GROUP: NO interaction

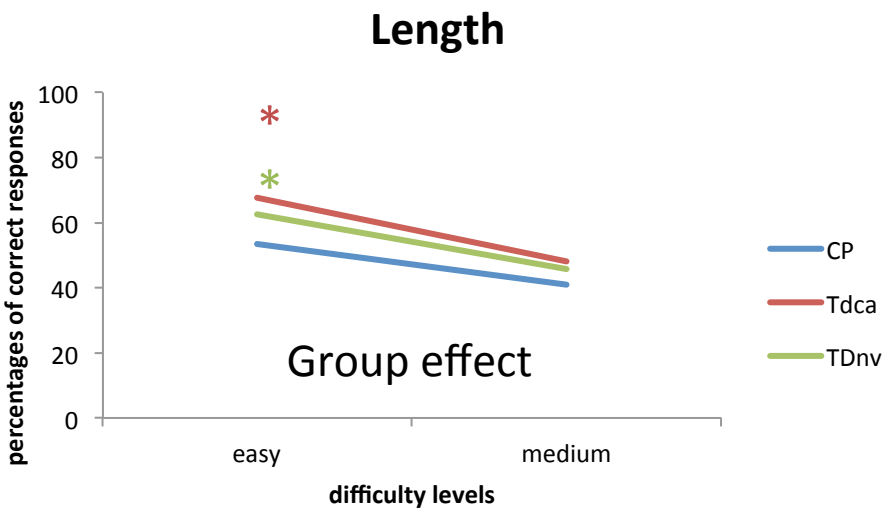


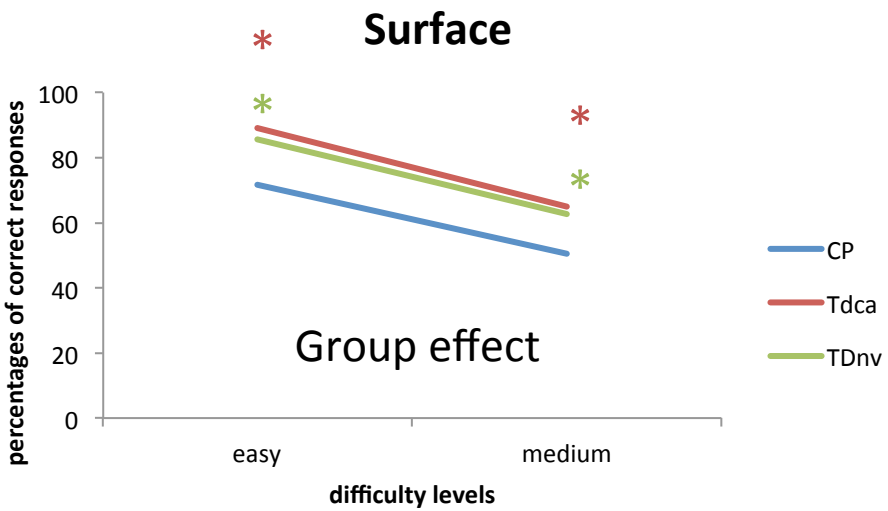


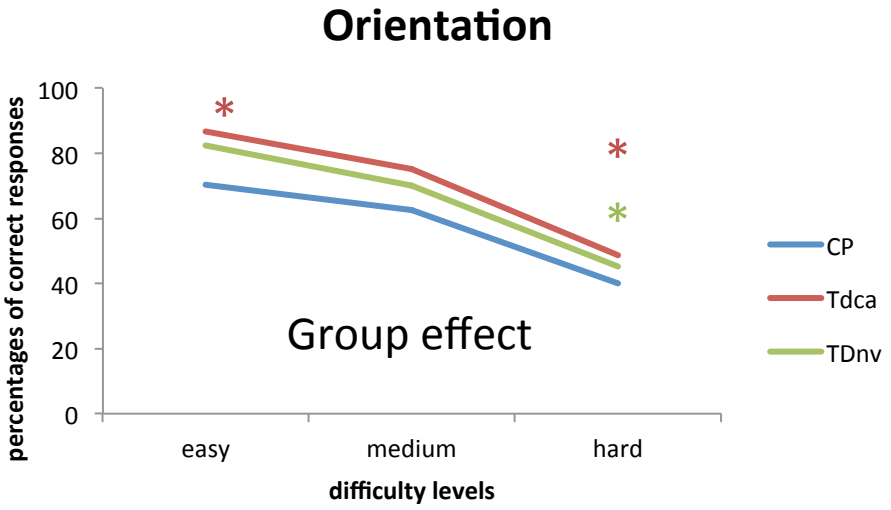


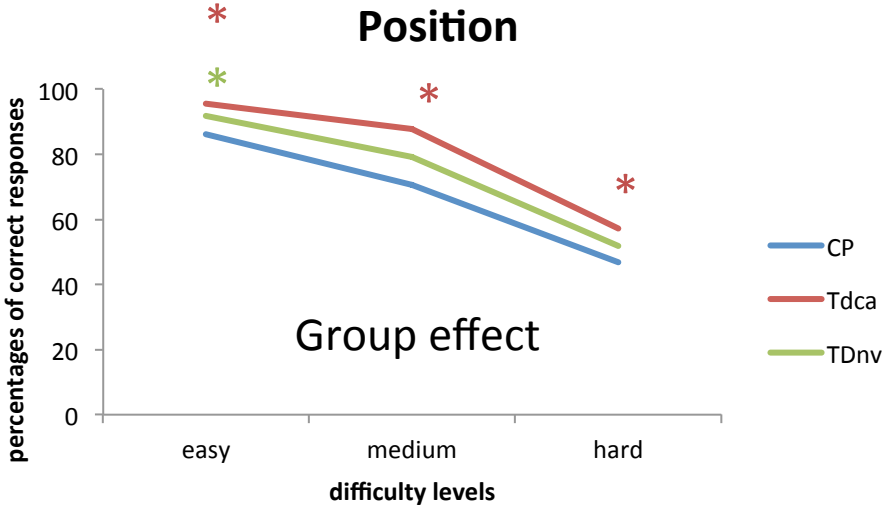


GROUP x DIFFICULTY: interactions

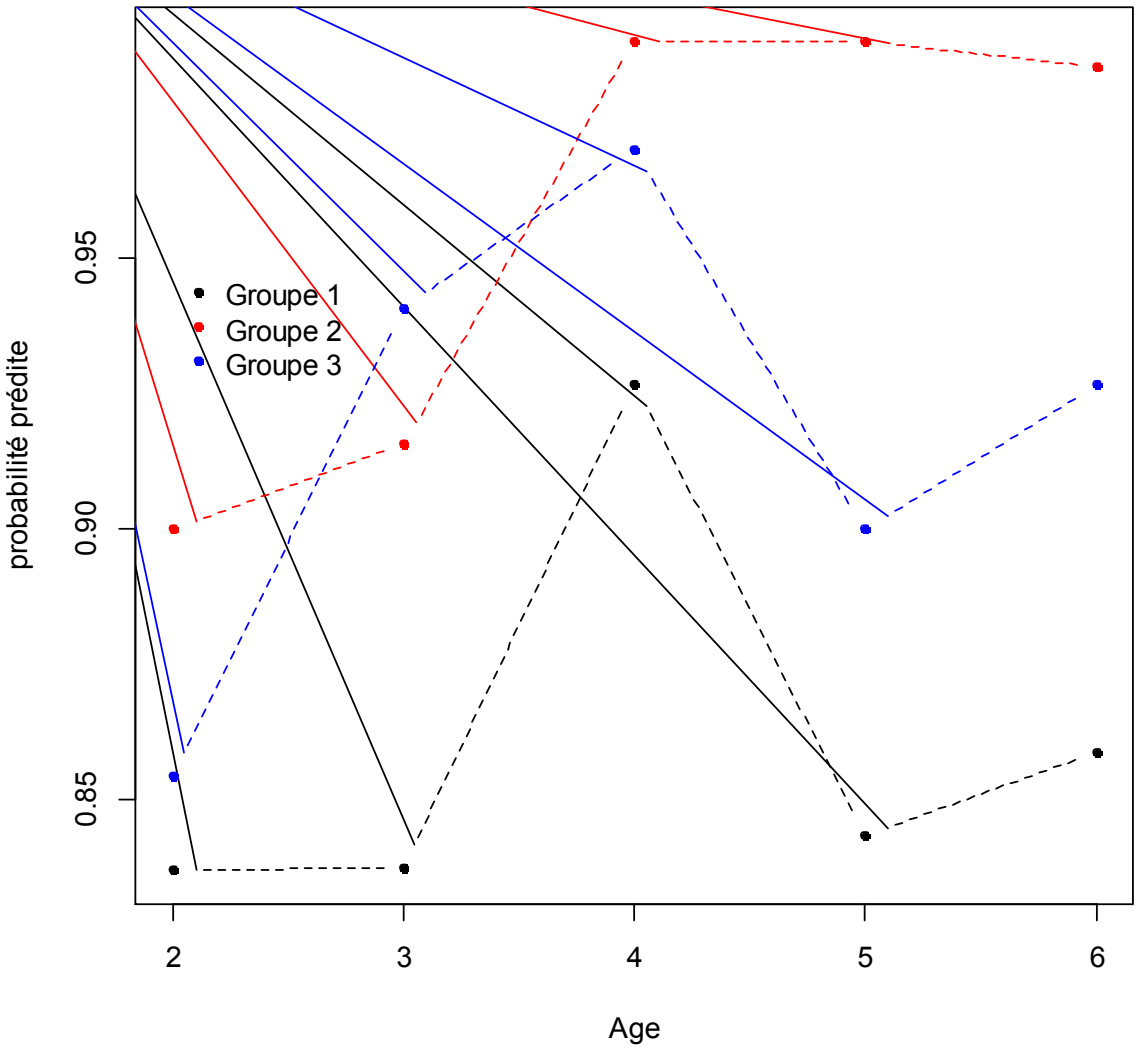








DIFFICULTY x AGE x GROUP

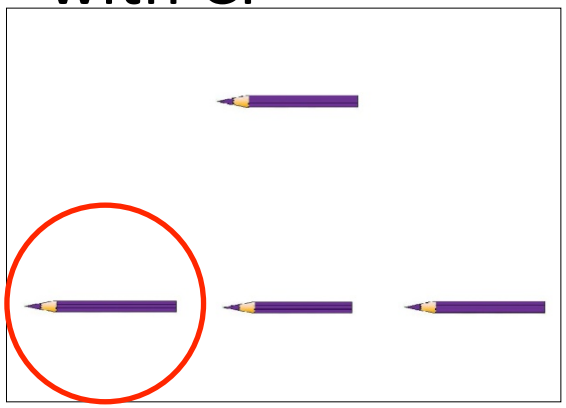


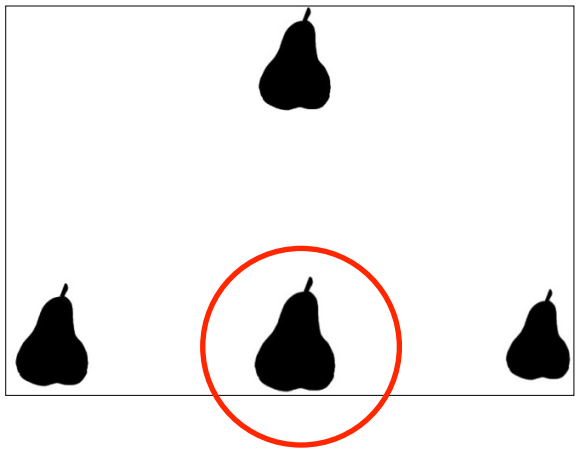
Early Analysis

- Overestimation index in Length and Surface subtests

→in errors, systematic choice of the tallest stimulus

- Present in all ages in TD children and children with CP



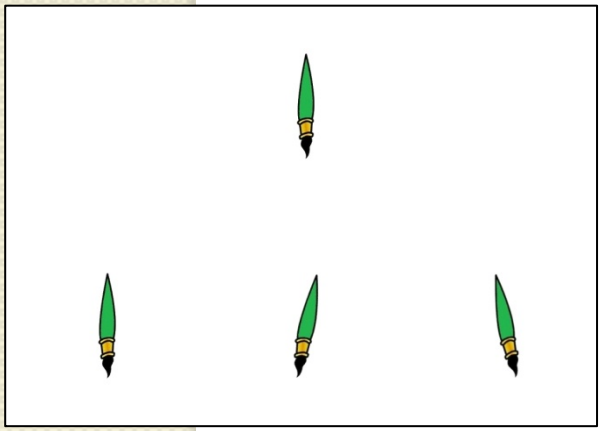


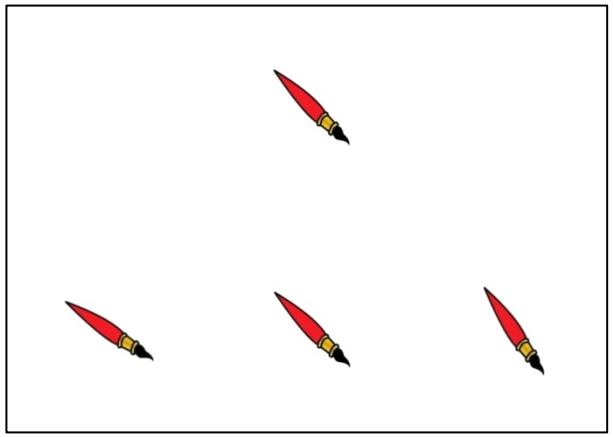
Early Analysis

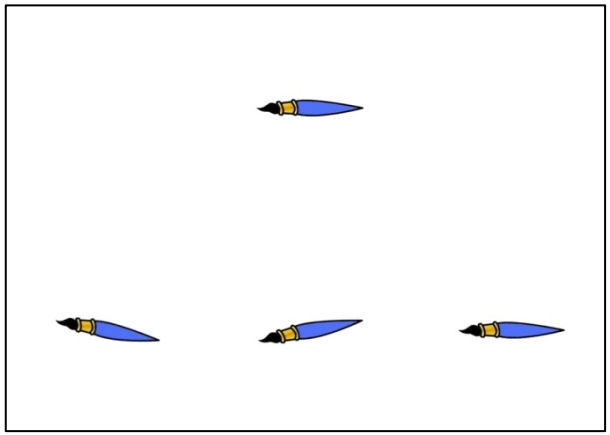
- Oblique effect in Orientation subtest

→horizontal and vertical lines are better succeed than oblique lines

- Present in all ages in TD children, and in adults.







In question: analysis of medical features of CP children

- Repercussions of
  - Type of motor disorder
  - Location of motor disorder
  - Birthweight
  - Gestational age
  - Epilepsy
  - Severity of cerebral palsy
  - Brain lesions
  - Ophthalmological disorders
  - Neurovisual disorders

on visual perceptual processes

		Number
Age-gender (male/female):	5-6 years	16-15
	7-8 years	8-11
	9-10 years	9-10
	11-12 years	14-4
	13-14 years	9-9
Schooling:	Traditional	59
	Specialized	37
	Adaptations	12
CP type:	Spasticity	86
	Athetosia	3
	Mixted form	16
Location of motor disorder:	Diplegia	21
	Right hemiplegia	31
	Left hemiplegia	28
	Quadriplegia	29
Gestational age:	≥37 weeks	50
	33-36 weeks	24
	28-32 weeks	26
	<28 weeks	8
GMFCS:	Level 1	57
	Level 2	26
	Level 3	12
	Level 4	13

		Number
Birth weight:	+2500g	50
	1500-2500g	32
	1000-1500g	20
	750-1000g	6
	<750g	0
[illegible]:	no information	19
	Right PVL	8
	Left PVL	9
	[illegible]	28
	[illegible]	9
	[illegible]	23
	[illegible]	4
	Stroke lesions	4
	No lesion	4
Ophtalmic disorders:	myopia	10
	Hypermetropia	23
	Strabismus	37
	Astigmatism	27
	Amblyopia	4
	Visual fields impairment	2
	Nystagmus	6
	No impairment	38
Epilepsy:	Yes	23
	No	85

Age effect was already assessed in each analysis level in previous papers

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		Number
Birth weight:	+2500g	50
	1500-2500g	32
	1000-1500g	20
	750-1000g	6
	<750g	0
Cerebral lesion:	no information	19
	Right PVL	8
	Left PVL	9
	Bilateral PVL	28
	PVL + cortical/subcortical lesions	9
	Hemorrhage	23
	Cortical lesions	4
	Nystagmus	[illegible]
	No impairment	38
Epilepsy:	Yes	23
	No	85

Schooling has an effect on intellectual quotients

BUT is it interesting to correlate schooling with visual-perceptual processing?

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	No lesion	4
Opht		
Epile		
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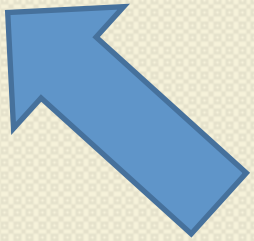

CP type has an effect on
intellectual quotients,
language,
memory,
visual spatial processing

Athetosia> mixed>spasticity

		Number
Age-gender (male/female):	5-6 years	16-15
	7-8 years	8-11
	9-10 years	9-10
	11-12 years	14-4
	13-14 years	9-9
Schooling:	Traditional	59
	Specialized	37
CP type:		
Location of motor disord		
	Quadriplegia	29
Gestational age:	≥37 weeks	50
	33-36 weeks	24
	28-32 weeks	26
	<28 weeks	8
GMFCS:	Level 1	57
	Level 2	26
	Level 3	12
	Level 4	13

		Number
Birth weight:	+2500g	50
	1500-2500g	32
	1000-1500g	20
	750-1000g	6
	<750g	0
Cerebral lesion:	no information	19
	Right P	8
	Left P	9
	Bilate	28
	rtica rtical lesions	9
	Hemo nage	23
	Cortical lesions	4
	Stroke lesions	4
	No lesion	4
Ophtalmic disorders:	myopia	10
	Hypermetropia	23
	Strabismus	37
	Astigmatism	27
	Amblyopia	4
	Visual fields impairment	2
	Nystagmus	6
	No impairment	38
Epilepsy:	Yes	23
	No	85

Prematurity and low birth weight have a negative impact on

Attentional and executive processing
Visual spatial processing and praxis

		Number
Age-gender (male/female):	5-6 years	16-15
	7-8 years	8-11
	9-10 years	9-10
	11-12 years	14-4
	13-14 years	9-9
Schooling:	Traditional	59
	Specialized	37
	Adaptations	12
CP type:	Spasticity	86
	Athetosia	3
	Mixted form	16
Location of motor disorder:	Diplegia	21
	Right hemiplegia	31
	Left hemiplegia	28
	Quadriplegia	29
Gestational age:	≥37 weeks	0
	33-36 weeks	24
	28-32 weeks	26
	<28 weeks	8
GMFCS:	Level 1	57
	Level 2	26
	Level 3	12
	Level 4	13

		Number
Birth weight:	+2500g	50
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	Amblyopia	4
	Visual fields impairment	2
	Nystagmus	6
	No impairment	38
Epilepsy:	Yes	23
	No	85

GMFCS: classification of functional disorders

Levels 1-2: autonomous walk

Level 3: walk with help

Level 4: autonomous with a wheelchair

Influence on language and IQ

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	Left PVL	9
	Bilateral PVL	28
	PVL + cortical/subcortical lesions	9
	Hemorrhage	23
	Cortical lesions	4
	Stroke lesions	4
	No lesion	4
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	tism	27
	pia	4
	pairment	2
	mus	6
	rment	38
		23
	No	85

MRI: classification to be reviewed with a neurologist
Periventricular leucomalacia often associated with visual-spatial impairments
Cortical lesions often associated with multiple cognitive impairments and intellectual disability

Refractive errors are not associated with visual perceptual impairments

But neurovisual disorders are significantly correlated with visual perceptual impairments

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Sc		
CP		
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Epilepsy:	Yes	23
	No	85

The presence of Epilepsy
Influences on

IQ
Attentional and executive processing
Memory
language

Thinking about the best way to analyze my data…

- Percentages of correct responses
- Z-scores based on TD children matched on chronological age
- Z-scores based on TD children matched on non verbal mental age

- On global scores
- On specific scores: by difficulty level on each task

THANKS FOR YOUR ATTENTION