



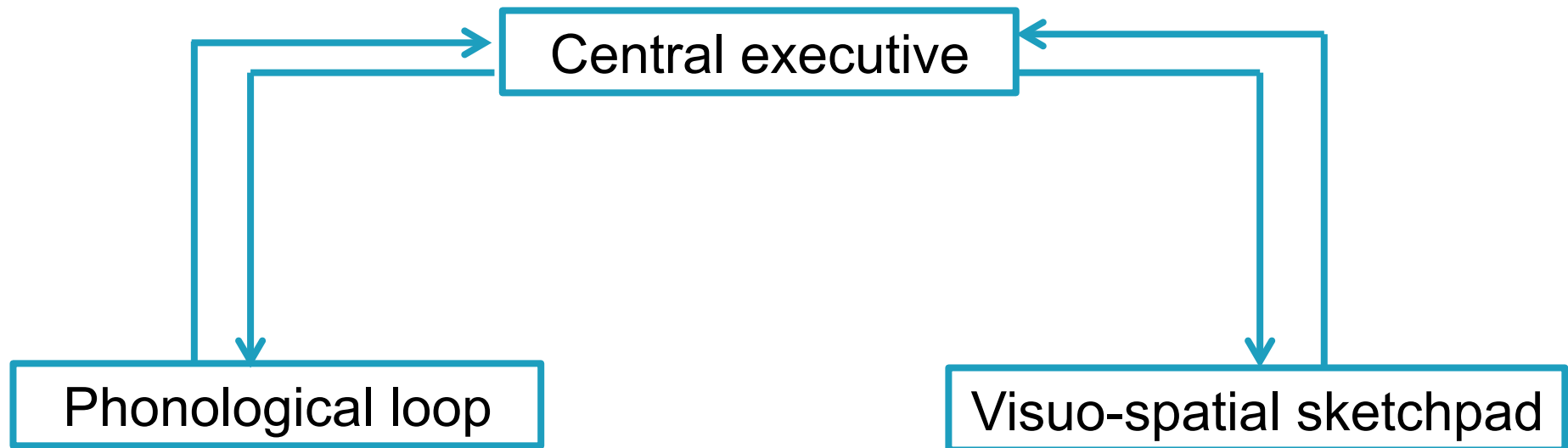
Structure of executive functions (EF) and risk profiles for EF-quality in preschool children

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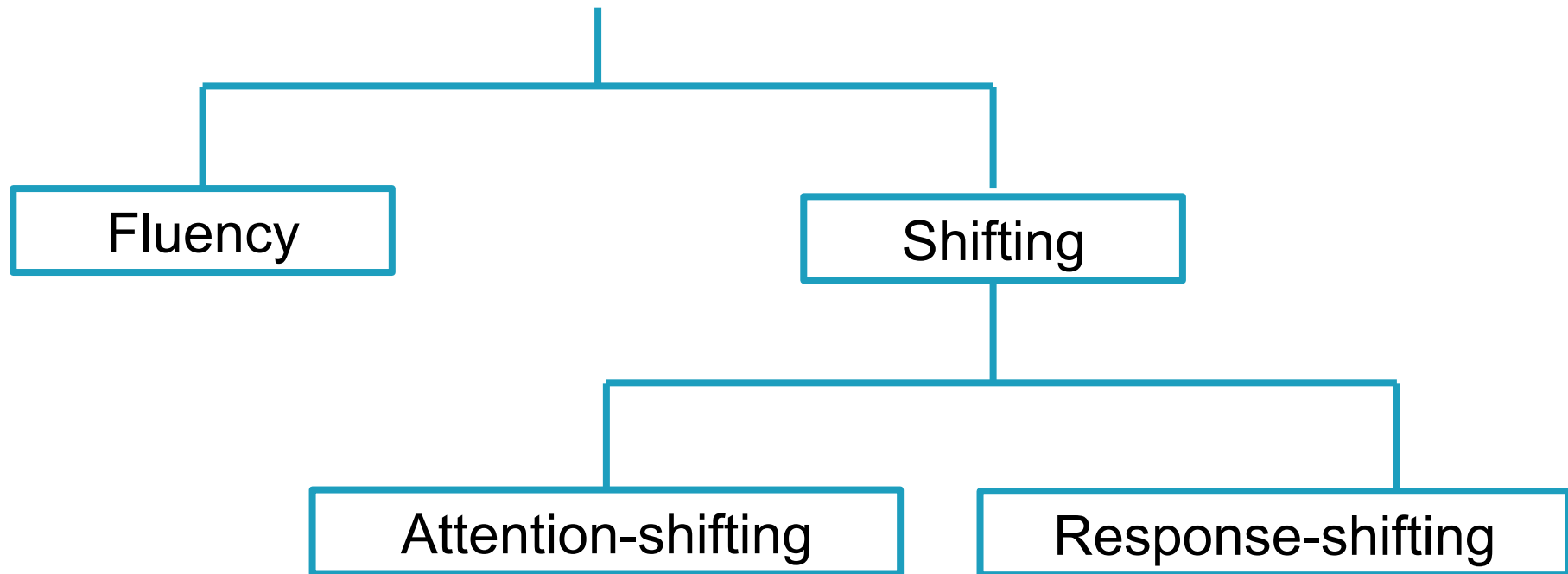
1. Introduction

- Executive functions (EFs) = a set of cognitive processes implicated in the control of thoughts, emotions and behavior, needed to guide goal-directed behavior
- 3 core EFs: working memory,
 cognitive flexibility,
 inhibition

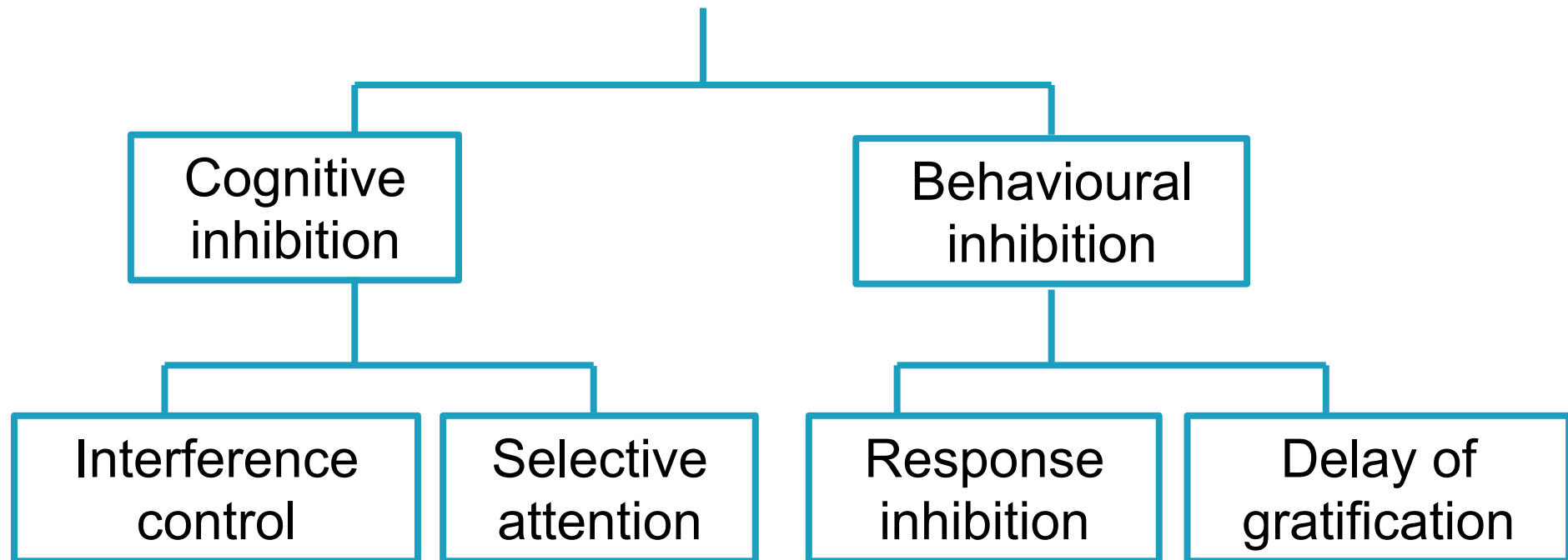
1. Introduction: working memory



1. Introduction: cognitive flexibility



1. Introduction: inhibition



Based on Diamond, 2013 and Bari & Robbins, 2003

1. Introduction

- Developmental perspective
 - EF-structure in 5-6 year old children?
 - Inconsistent results
 - Unitary construct: e.g. Wiebe et al., 2008; Hughes & Ensor, 2010
 - 2 factor-model: e.g. Miller et al., 2012; Usai et al., 2013; Van der Ven et al., 2013

1. Introduction

- Contextual perspective
 - Demographic variables: family composition, socio-economic status, family health, cultural background
 - Relationships with EF have been found, but rather inconsistent
 - Familial variables: parenting
 - Warm and responsive parenting has been found to benefit EF-development
 - Relationship more pronounced for mothers

e.g. Cameron et al., 2012; Roskam et al., 2014

2. Research questions

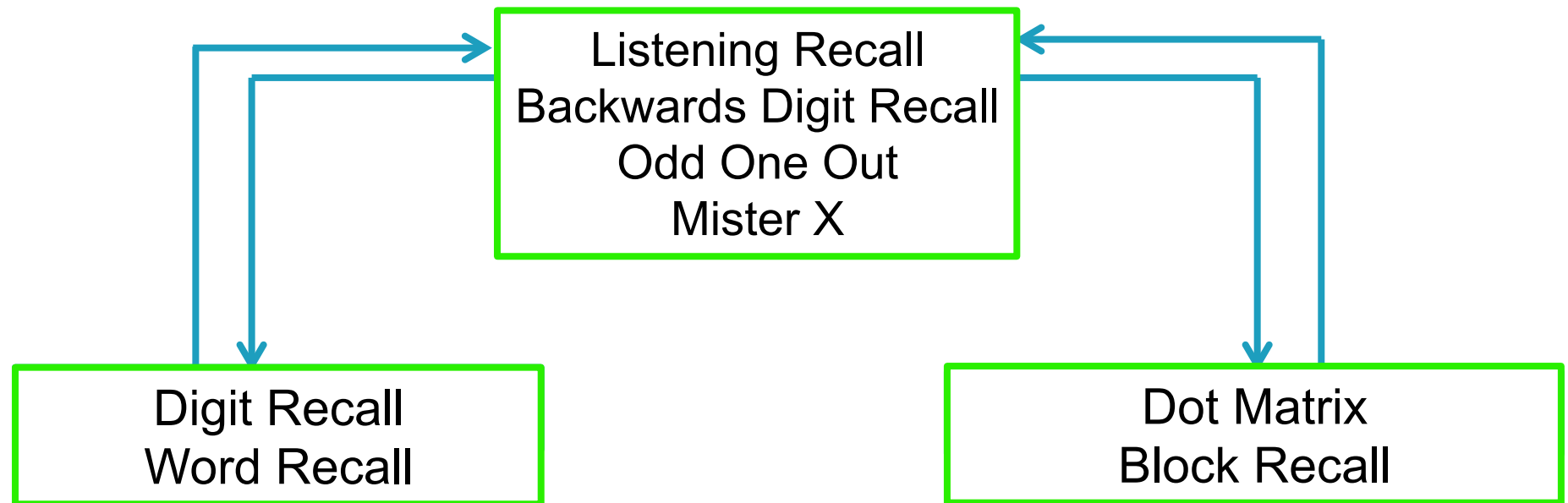
- What underlying structure best describes EF at the age of 6 when taking a broad range of EF-subcomponents into account?
- Do different EF-(risk)profiles exist at the age of 6?
- Are these profiles related to familial and demographic background variables?

3. Methods

- Sample:
 - 107 children tested, 90 children with full EF-data
 - 41 boys, 49 girls
 - Mean age: 5,87
 - Typically developing children
- Measurements:
 - EF: task battery
 - Demographic and familial variables: questionnaires

3. Methods: working memory

Automated working memory
assessment (Alloway, 2007)

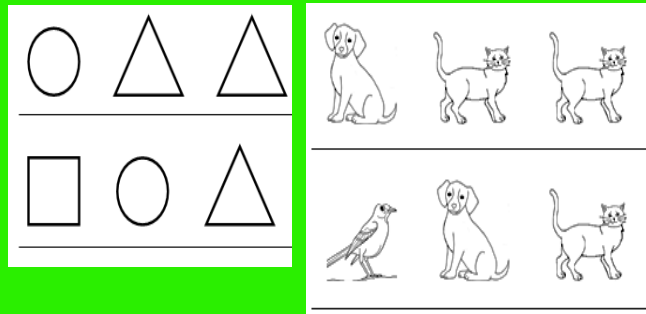


Outcome = number of correct trials

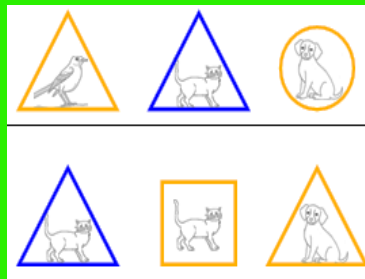
3. Methods: cognitive flexibility

Object Shifting task

Control conditions



Shifting condition



Outcome = difference in accuracy and reaction time

Verbal fluency task

Unusual uses task

Shifting

Outcome = number of words

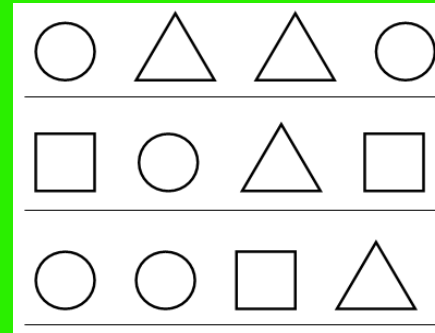
Attention-shifting

Response-shifting

3. Methods: Inhibition

Object inhibition task

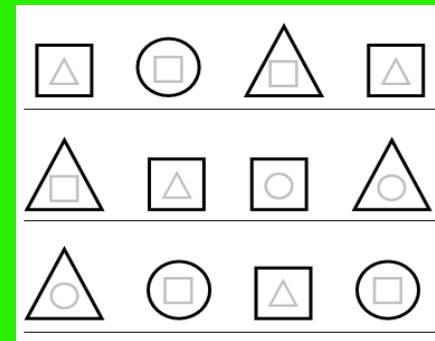
rol condition



Delay of gratification task

Small reward (1) now OR
Larger reward (2, 4 or 6) later

Inhibition condition



Outcome = number of
delayed rewards

control

att

and reaction time

Outcome = difference in accuracy and
reaction time

3. Methods: inhibition

- Strooplike Task (adaptation of the Day/Night Stroop)
 - Control and inhibition condition
 - Hot and cool condition
 - Outcome:
 - Difference between control and inhibition conditions
 - Difference between hot and cool condition
 - Accuracy and reaction time



3. Methods

- Demographic and familial variables: questionnaires
 - Background variables: self-constructed questionnaire (based on Rhoades et al., 2011)
 - Family composition (e.g. parental status, number of children)
 - Socio-economic background (e.g. parent education)
 - Family health (e.g. premature birth, parents psychological problems)
 - Cultural background (e.g. home language, sport activities)
 - The parenting style and dimensions questionnaire (Robinson et al., 1995)
 - Parental ADHD Rating Scale (DuPaul et al., 1998)
 - Parenting Stress Index (Abidin, 1995)

4. Results

Research question 1:

What underlying structure best describes EF at the age of 6 when taking a broad range of EF-subcomponents into account?

- Exploratory factor analysis
- Promax rotation

4. Results

- EF-structure: working memory

EF-outcomes	Factor 1	Factor 2
	Verbal memory	Visuo-spatial memory
Word Recall	0.947	
Digit Recall	0.921	
Backwards Digit Recall	0.664	
Listening Recall	0.602	
Dot Matrix		0.760
Mister X		0.749
Odd One Out		0.709
Block Recall		0.647

4. Results

- EF-structure: cognitive flexibility

EF-outcomes	Factor 1	Factor 2
	Fluency	Shifting
Unusual Uses Task	0.731	
Verbal Fluency Animal	0.706	
Object Shifting Task (RT)	- 0.673	
Verbal Fluency F	0.526	
Knock and Tap 2		0.769
Knock and Tap 1		0.757
Objects Shifting Task (Acc)		- 0.689

4. Results

- EF-structure: inhibition

EF-outcomes	Factor 1	Factor 2	Factor 3	Factor 4
	Delay of gratification	Interference control (RT)	Interference control (ACC)	Selective attention
Delay of Gratification 2	0.898			
Delay of Gratification 4	0.793			
Delay of Gratification 6	0.672			
Stroop Like Task (RT)		0.810		
Objects Inhibition Task (RT)		-0.732		
Objects Inhibition Task (Acc)			0.712	
Stroop Like Task (Acc)			0.646	
Flanker Task (Acc)				0.756
Flanker Task (RT)				0.659

4. Results

Research question 2:

Do different EF-(risk)profiles exist at the age of 6?

- EF-(risk)profiles
 - Clustering with Latent Class Analysis (LCA)

4. Results

- EF-(risk)profiles: 2 groups

EF Factorscores	Cluster 1	Cluster 2	p
	High performers	Low performers	
Verbal Memory	0,3557	-0,5737	0,000*
Visual Memory	0,3700	-0,5121	0,000*
Fluency	0,2930	-0,4107	0,001*
Shifting	0,3383	-0,4581	0,003*
Delay of Gratification	0,4516	-0,7801	0,000*
Interference Control RT	0,1676	-0,2896	0,078
Interference Control ACC	-0,0641	0,1107	0,515
Selective Attention	0,2260	-0,3905	0,004*
Response Control	0,7954	0,7600	0,267

4. Results

Research question 3:

Are these profiles related to Demographic and familial background variables?

- Cluster – background variables
 - Crosstabs
 - T-test

4. Results

- Demographics: family structure

Family type	High EF	Low EF	P
Elementary family	90,0%	70,8%	0,036
Single parent or reconstituted family	10,0%	29,2%	

Number of children	High EF	Low EF	P
1 child	6,3%	29,2%	0,015
2 children	60,4%	33,3%	
+ 2 children	33,3%	37,5%	

4. Results

- Demographics: social economic status

Father education	High EF	Low EF	P
Secondary education	34,0%	66,7%	0,017
College or university degree	66,0%	33,3%	

Income	High EF	Low EF	P
	3,20	2,38	0,007

4. Results

- Demographics: family health

Smoking during pregnancy	High EF	Low EF	P
At least once	4,2%	21,7%	0,020

Chronicle illness in family	High EF	Low EF	P
Yes, 1 or more close relatives	31,9%	9,1%	0,040

- Parenting

Variable	High EF	Low EF	P
Verbal hostility father	9,098	7,529	0,004
Verbal hostility mother	9,447	8,476	0,066

5. Conclusions

- EF-structure:
 - In contrast to literature (e.g. Wiebe et al., 2008; Hughes & Ensor, 2010) differentiation in terms of subcomponents can be found when taking a broad perspective on EF
 - Careful selection of EF-tasks and EF-outcomes is important
 - Consistent with literature there is still room for further differentiation with age
- At 5-6 years of age only 2 EF-profiles could be found: low and high performers

5. Conclusions

- Contextual perspective: context matters
 - As expected: higher EF scores in elementary and high SES families... → stimulating environment (e.g. Sarsour et al., 2011)
 - ... and lower EF scores when mothers smoked during pregnancy → brain development? (e.g. Fitzpatrick et al., 2014)
 - Number of children in the family showed a complex relationship with EF
 - Stimulation vs. chaos (e.g. Brown et al., 2013)
 - More chronicle illness in families of children with higher EF
 - More independence expected?
 - Higher verbal hostility of parents with higher EF
 - Scale items

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