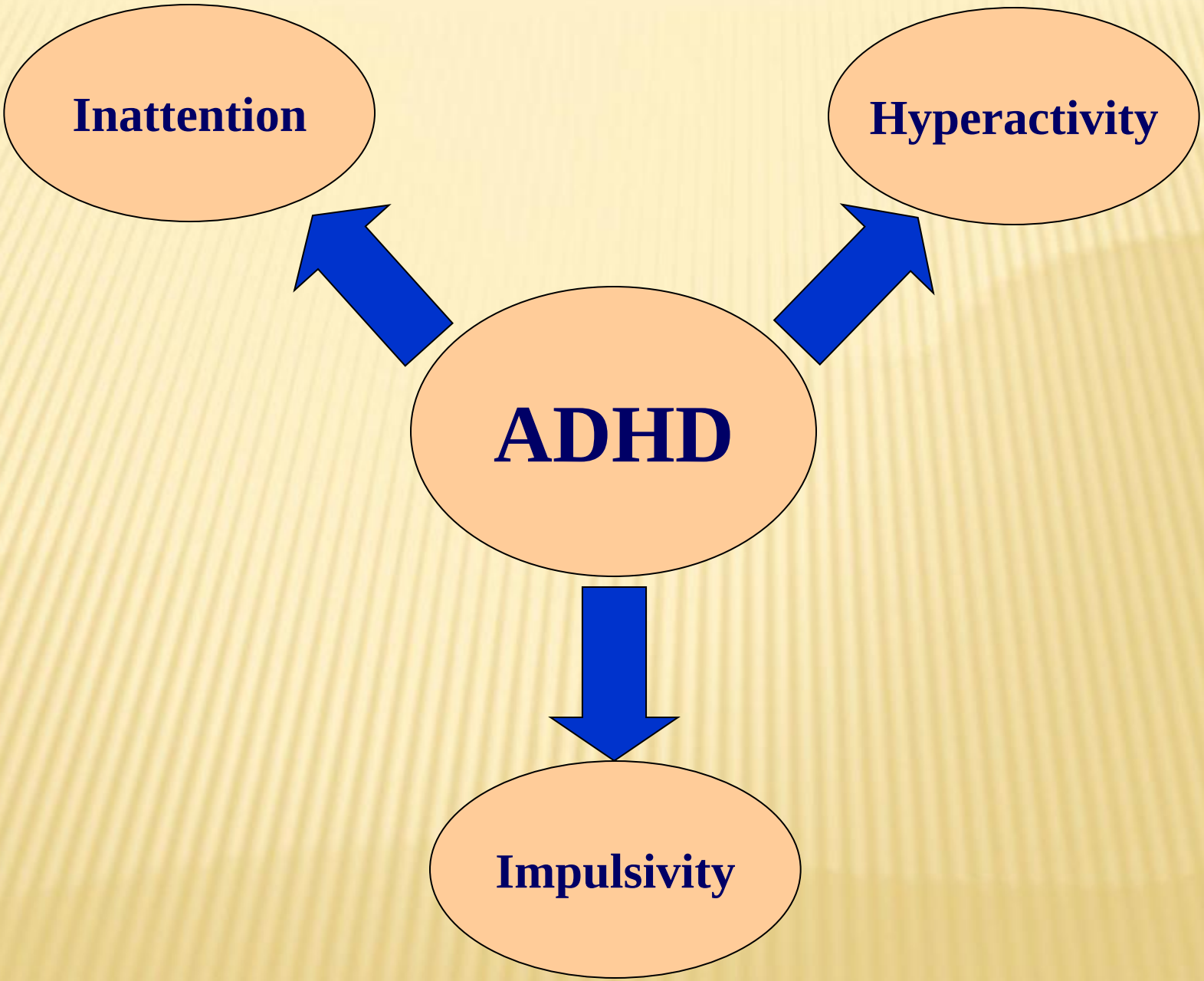
ADHD SYMPTOMS


Inattention
Hyperactivity
ADHD
Impulsivity

THE EXISTENCE OF A SPECIFIC DISORDER

- Debates
- The complications due to the drug treatment

DSM-5

- Confirms the previous criteria
- Underlines the neurodevelopmental problem
- Emphasizes the life span perspective

- A. A persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development, as characterized by (1) and/or (2):
- 1. Inattention: Six (or more) of the following symptoms have persisted for at least 6 months to a degree that is inconsistent with developmental level and that negatively impacts directly on social and academic/occupational activities:
- Note: The symptoms are not solely a manifestation of oppositional behavior, defiance, hostility, or failure to understand tasks or instructions. For older adolescents and adults (age 17 and older), at least five symptoms are required.
- a. Often fails to give close attention to details or makes careless mistakes in schoolwork, at work, or during other activities (e.g., overlooks or misses details, work is inaccurate).
- b. Often has difficulty sustaining attention in tasks or play activities (e.g., has difficulty remaining focused during lectures, conversations, or lengthy reading).
- c. Often does not seem to listen when spoken to directly (e.g., mind seems elsewhere, even in the absence of any obvious distraction).
- d. Often does not follow through on instructions and fails to finish schoolwork, chores, or duties in the workplace (e.g., starts tasks but quickly loses focus and is easily sidetracked).
- e. Often has difficulty organizing tasks and activities (e.g., difficulty managing sequential tasks; difficulty keeping materials and belongings in order; messy, disorganized work; has poor time management; fails to meet deadlines).
- f. Often avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort (e.g., schoolwork or homework; for older adolescents and adults, preparing reports, completing forms, reviewing lengthy papers).
- g. Often loses things necessary for tasks or activities (e.g., school materials, pencils, books, tools, wallets, keys, papenwork, eyeglasses, mobile telephones).
- h. Is often easily distracted by extraneous stimuli (for older adolescents and adults, may include unrelated thoughts).
- i. Is often forgetful in daily activities (e.g., doing chores, running errands; for older adolescents and adults, returning calls, paying bills, keeping appointments).

- 2. Hyperactivity and impuisivity: Six (or more) of the following symptoms have persisted
- for at least 6 months to a degree that is inconsistent with developmental level
- and that negatively impacts directly on social and academic/occupational activities:
- Note: The symptoms are not solely a manifestation of oppositional behavior, defiance,
- hostility, or a failure to understand tasks or instructions. For older adolescents
- and adults (age 17 and older), at least five symptoms are required.
- a. Often fidgets with or taps hands or feet or squirms in seat.
- b. Often leaves seat in situations when remaining seated is expected (e.g., leaves
- his or her place in the classroom, in the office or other workplace, or in other
- situations that require remaining in place).
- c. Often runs about or climbs in situations where it is inappropriate. (Note: In adolescents
- or adults, may be limited to feeling restless.)
- d. Often unable to play or engage in leisure activities quietly.
- e. Is often “on the go,” acting as if “driven by a motor” (e.g., is unable to be or uncomfortable
- being still for extended time, as in restaurants, meetings; may be
- experienced by others as being restless or difficult to keep up with).
- f. Often talks excessively.
- g. Often blurts out an answer before a question has been completed (e.g., completes
- people’s sentences; cannot wait for turn in conversation).
- h. Often has difficulty waiting his or her turn (e.g., while waiting in line).
- i. Often interrupts or intrudes on others (e.g., butts into conversations, games, or
- activities; may start using other people’s things without asking or receiving permission;
- for adolescents and adults, may intrude into or take over what other

- B. Several inattentive or hyperactive-impulsive symptoms were present prior to age
- 12 years.
- C. Several inattentive or hyperactive-impulsive symptoms are present in two or more settings
- (e.g., at home, school, or work; with friends or relatives; in other activities).
- D. There is clear evidence that the symptoms interfere with, or reduce the quality of, social,
- academic, or occupational functioning.
- E. The symptoms do not occur exclusively during the course of schizophrenia or another
- psychotic disorder and are not better explained by another mental disorder (e.g., mood
- disorder, anxiety disorder, dissociative disorder, personality disorder, substance intoxication
- or withdrawal).

- ***Specify*** **whether:**
- **314.01 (F90.2) Combined presentation: If both Criterion A1 (inattention) and Criterion**
- **A2 (hyperactivity-impulsivity) are met for the past 6 months.**
- **314.00 (F90.0) Predominantly inattentive presentation: If Criterion A1 (inattention)**
- **is met but Criterion A2 (hyperactivity-impulsivity) is not met for the past 6 months.**
- **314.01 (F90.1) Predominantly hyperactive/impulsive presentation: If Criterion A2 (hyperactivity-**
- **impulsivity) is met and Criterion A1 (inattention) is not met for the past 6 months**

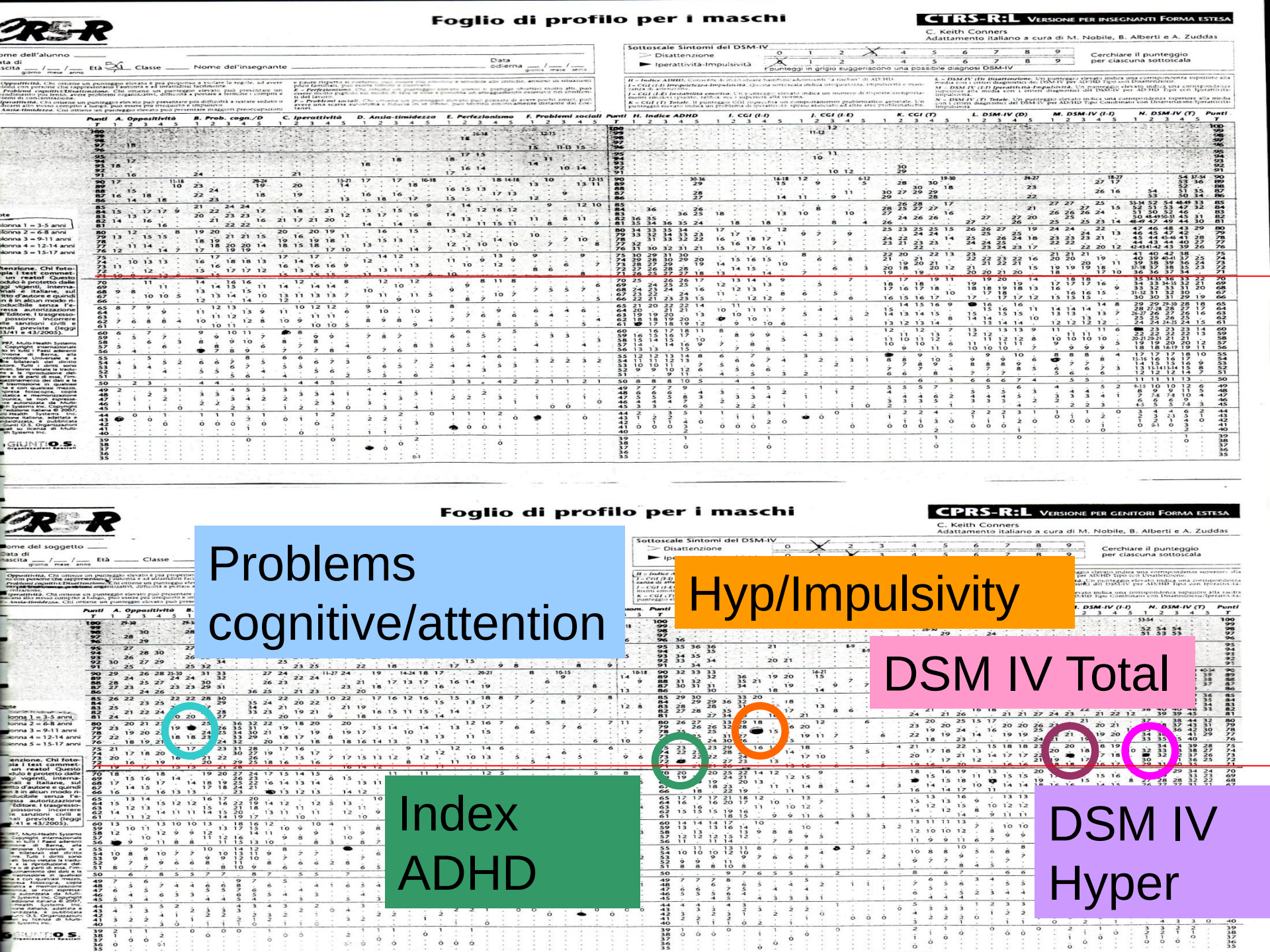
ATTENTION TO THE ADULT

- ADHD begins in childhood. The requirement that several symptoms be present before
- age 12 years conveys the importance of a substantial clinical presentation during childhood.
- At the same time, an earlier age at onset is not specified because of difficulties in establishing
- precise childhood onset retrospectively. Adult recall of childhood symptoms
- tends to be unreliable, and it is beneficial to obtain ancillary information.
- Manifestations of the disorder must be present in more than one setting

- Associated features may include low frustration tolerance, irritability, or mood lability.
- Even in the absence of a specific learning disorder, academic or work performance is often impaired.
- Inattentive behavior is associated with various underlying cognitive processes, and individuals
- with ADHD may exhibit cognitive problems on tests of attention, executive
- function, or memory, although these tests are not sufficiently sensitive or specific to serve as diagnostic
- indices. By early adulthood, ADHD is associated with an increased risk of suicide attempt,
- primarily when comorbid with mood, conduct, or substance use disorders.
- No biological marker is diagnostic for ADHD.

DIAGNOSIS

- BASIC
- Semistructured interview
- Rating scales
- CLINICAL ELEMENTS
- Neuropsychological assessment


Foglio di profilo per i maschi
CTRS-R:L Versione per insegnanti Forma estesa
C. Keith Conners
Adattamento italiano a cura di M. Nobile, B. Alberti e A. Zuddas
Foglio di profilo per i maschi
CPRS-R:L Versione per genitori Forma estesa
C. Keith Conners
Adattamento italiano a cura di M. Nobile, B. Alberti e A. Zuddas
Problems cognitive/attention
Hyp/Impulsivity
DSM IV Total
Index ADHD
DSM IV Hyper

Scala SDAG

Scala diretta ai genitori per l'individuazione di comportamenti di disattenzione e iperattivita' del bambino (1995)

Istruzioni
Il genitore deve valutare, per ciascuno dei comportamenti elencanti qui sotto, la *frequenza* con cui essi compaiono. Si raccomanda di procedere con ordine e di rispondere per tutti i comportamenti, anche se per alcuni casi ci si sente molto incerti. Per esprimere la valutazione della frequenza, barrare la casella relativa.

Nome del bambino		Data			
Comportamenti	**Mai**	**Qualche volta**	**Abbastanza spesso**	**Molto spesso**
1. Incontra difficoltà nell'esecuzione di attività che richiedono una certa cura.	0	1	2	3
2. Spesso a tavola o alla scrivania, durante lo svolgimento dei compiti, si agita con le mani (ad esempio, giocherellando con gli oggetti che gli sono vicini o afferrando le cose in modo maldestro), o con i piedi, o si dimena sulla sedia.	0	1	2	3
3. Incontra difficoltà nel mantenere l'attenzione sui compiti o sui giochi in cui è impegnato, interrompendosi ripetutamente o passando di frequente ad attività differenti.	0	1	2	3
4. Non riesce a stare seduto quando le circostanze lo richiedono.	0	1	2	3
5. Quando gli si parla non sembra ascoltare.	0	1	2	3
6. Manifesta una irrequietudine interna, correndo o arrampicandosi dappertutto.	0	1	2	3
7. Non esegue ciò che gli viene richiesto o fatica a portarlo a compimento.	0	1	2	3
8. Incontra difficoltà a impegnarsi in attività o in giochi tranquilli.	0	1	2	3
9. Incontra difficoltà a organizzarsi nei compiti e nelle sue attività.	0	1	2	3
10. Si muove continuamente come se avesse l'«argento vivo» addosso.	0	1	2	3
11. Evita o è poco disposto a impegnarsi in attività che richiedono uno sforzo continuato.	0	1	2	3
12. Non riesce a stare in silenzio; parla eccessivamente.	0	1	2	3
13. Non tiene in ordine le sue cose e di conseguenza le perde.	0	1	2	3
14. Spesso risponde precipitosamente.	0	1	2	3
15. Viene distratto facilmente da stimoli esterni.	0	1	2	3
16. Non riesce a rispettare il proprio turno.	0	1	2	3
17. Trascura o dimentica le incombenze o i compiti di ogni giorno.	0	1	2	3
18. Spesso interrompe o si comporta in modo invadente con altre persone (fratelli, genitori, amici) impegnate in un gioco o in una conversazione.	0	1	2	3
			Totale	

Scala SDAI

Scala per l'individuazione dei comportamenti di disattenzione e iperattivita' (1994)

Istruzioni
L'insegnante deve valutare, per ciascuno dei comportamenti elencati qui sotto, la *frequenza* con cui essi compaiono. Si raccomanda di procedere con ordine e di rispondere per tutti i comportamenti, anche se per alcuni casi ci si sente molto incerti. Per esprimere la valutazione della frequenza, barrare la casella relativa.

Nome del bambino		Data			
Comportamenti	**Mai**	**Qualche volta**	**Abbastanza spesso**	**Molto spesso**
1. Incontra difficoltà a concentrare l'attenzione sui dettagli o compie errori di negligenza.	0	1	2	3
2. Spesso si agita con le mani o i piedi o si dimena sulla sedia.	0	1	2	3
3. Incontra difficoltà nel mantenere l'attenzione sui compiti o sui giochi in cui è impegnato.	0	1	2	3
4. Non riesce a stare seduto.	0	1	2	3
5. Quando gli si parla non sembra ascoltare.	0	1	2	3
6. Manifesta una irrequietudine interna, correndo o arrampicandosi dappertutto.	0	1	2	3
7. Pur avendo capito le istruzioni e non avendo intenzioni oppositive, non segue le istruzioni ricevute o fatica a portarle a compimento.	0	1	2	3
8. Incontra difficoltà a impegnarsi in giochi o attività tranquille.	0	1	2	3
9. Incontra difficoltà a organizzarsi nei compiti e nelle sue attività.	0	1	2	3
10. È in movimento continuo come se avesse dentro un motorino che non si ferma.	0	1	2	3
11. Evita o è poco disposto a impegnarsi in attività che richiedono un impegno continuato.	0	1	2	3
12. Parla eccessivamente.	0	1	2	3
13. Perde oggetti necessari per le attività che deve svolgere.	0	1	2	3
14. Risponde precipitosamente prima ancora che la domanda sia stata interamente formulata.	0	1	2	3
15. Viene distratto facilmente da stimoli esterni.	0	1	2	3
16. Incontra difficoltà ad aspettare il suo turno.	0	1	2	3
17. Tende a dimenticarsi di fare le cose.	0	1	2	3
18. Spesso interrompe o si comporta in modo invadente con altre persone impegnate in un gioco o in una conversazione.	0	1	2	3
			Totale	

ATTENTION DEFICIT HYPERACTIVITY DISORDER (ADHD)

- Studies found that the 3- 5% of school population shows ADHD
- According to literature, ADHD children have problems in several Executive Functions (such as planning, working memory, inhibition etc.)

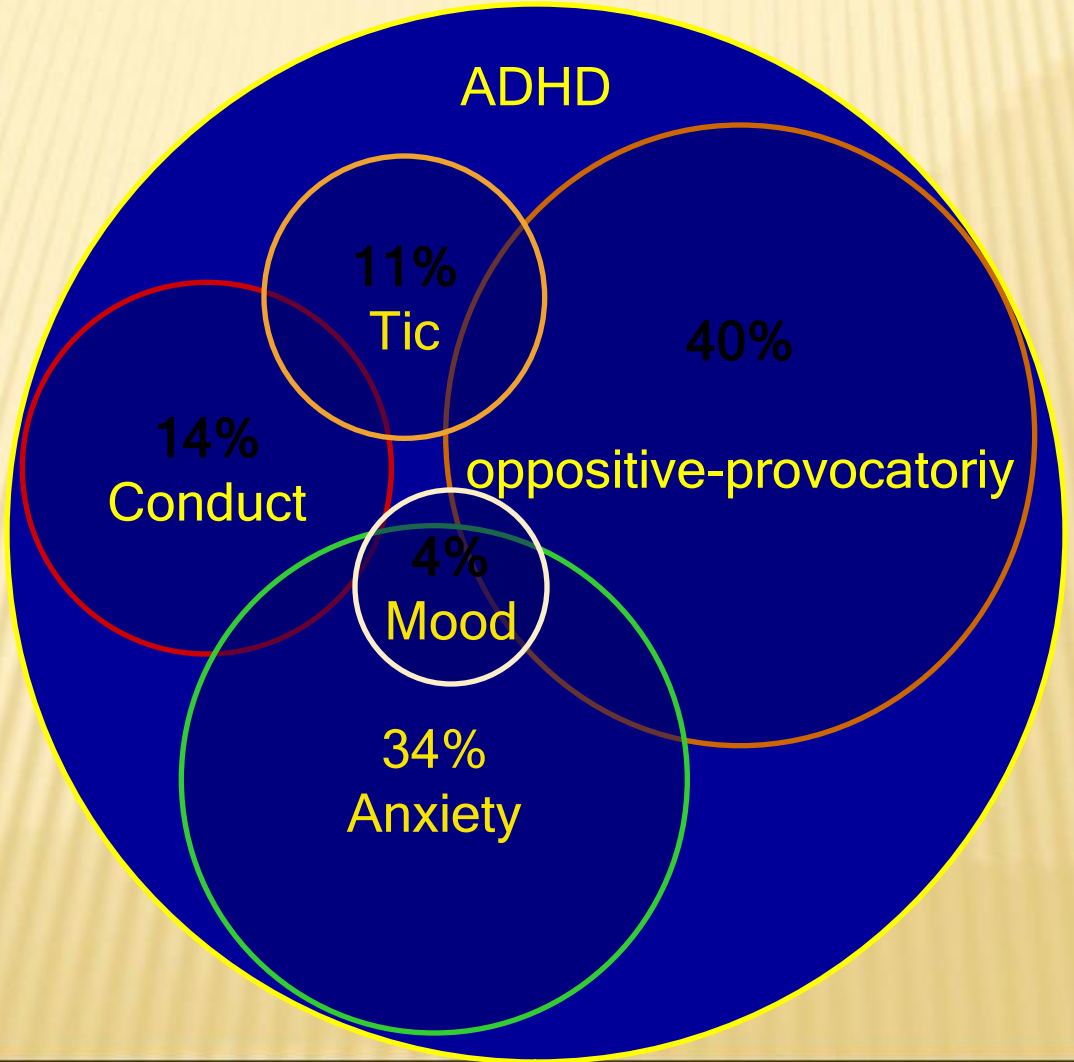
INTRODUCTION

- One of the most important secondary effects of ADHD is the presence of academic difficulties in a variety of learning areas
- The emphasis has been on the most basic skills such as reading, arithmetic, problem solving
- Few studies have explored the relationship between ADHD and writing skills

COMORBIDITÀ

STUDY MTA: COMORBIDITY

THE MTA COOPERATIVE GROUP (1999). A 14-MONTH RANDOMIZED CLINICAL TRIAL OF TREATMENT STRATEGIES FOR ATTENTION-DEFICIT/HYPERACTIVITY DISORDER. THE MTA COOPERATIVE GROUP MULTIMODAL TREATMENT STUDY OF CHILDREN WITH ADHD. *ARCH GEN PSYCHIATRY*; 56: 1073-86.



Outline

I Single Deficit Models of ADHD

- A. Executive Inhibition
- B. State Regulation
- C. Delay Aversion

II Why Single Deficit Models Fail

- A. Review of Executive Inhibition Model: Inhibition deficit is associated, coheritable, but not pervasive in ADHD
- B. Tests of Motivational Effects
  1. Motivational Inhibition Tasks
  2. Manipulating Incentives on the Stop Task
  3. Delay Aversion
  4. Orbital Frontal Tasks: Object Reversal and Gambling

III What is the Multiple Deficit Model?

IV Multiple Deficit Model Applied to Comorbidity of ADHD and RD

- A. ADHD and RD have a genetic overlap
- B. ADHD and RD have a cognitive overlap

V. Conclusions

Cognitive Mechanisms in ADHD

Distinctive cognitive Profile — Douglas (1988)

Impairments in vigilance, systematic search, motor inhibition, tasks without extrinsic rewards.

Not impaired on basic verbal and nonverbal memory tasks.

Executive Deficits — Pennington & Ozonoff (1996)

Consistent for MFFT errors and Motor Inhibition Tasks, like Go No-Go, Stopping.

Not consistent for WCST, Fluency tasks

Executive Inhibition Hypothesis

Key Idea: The PFC-mediated process of voluntary motor inhibition is impaired in ADHD.

Marker task: Stopping task (e.g. Logan, Cowan & Davis, 1984)

Fundamental Questions:

1) Inhibition deficits are found in other disorders.

2) If someone fails to inhibit, is it because top-down control is too weak, or because bottom-up impulses are too strong, or both?

Prova **CP1**

Cognome e Nome		Data	

Cerca la sequenza di lettere FZB. Ogni volta che la incontri barrala.

Esempio:

B G A F Z A P R S F Z B I C Q A

B W O Y F Z O U F R B F Z B K T E I P D

A M Q X L F Z A Q Z A F U J F Z B J R S

V I P N T G F Z B W C H N R K F Z Q F R

D F Z B Z C A U F Z B N L Y M F Z X A S

W N F K F Z H D O V F E O B X F Z B L J

E H E P I A H Y A W F Z Y W B O G M D P

F Z B F Z Q I V X M L F Z G P O R Q F U

G Z C F O F Z B V F C F Z H V O S F Z B

G J D Z B U X L F Z B D G M R V I K A N

A W F Z E S M A G H F Z B Y J S P L X U

D X A F Z B K F I O F Z X C H W D J F Z

W T Y E P M G F Z B I N Z B L F J F Z B

T M U R K L T F Z A C F R F Z B C J P Y

E F Z B K H D S P Z L F Z S K V U F P Z

E I F Z B I P O F M Z R F Z B L B X N U

Prova **CP2**

Cognome e Nome		Data	

Cerca la sequenza di lettere FZB. Ogni volta che la incontri barrala.

A Q X F Z B I S D F Z F O T W L Q V F Z M B L V P I F Z B H

D O G K W R E F Z B N H S O J T X A F Y Q U F Z B N W F Z C

L R F Z P I F Z B T J X D F O M K S F Z V X D Z P G O Q W G

U C F Z U K B F Z B V S F N C B X N A F Z B G F Y N O P T O

M V E S C B E K F Z Q Y E F Z B A D J D H A G L H T U L K R

F Z B R J W F H L Q A O Z F F Z G Z F Z J V F Z B S P W A U

D S I T X N X A F Z B Q I B I H F Q C O S H U Z F O M F Z O

P D V X F Z B D M K F U E T G R L K F Z B N A S H J F Z J S

A F Z B F Z P M C U O F Z B L Z G S H J T B F G B F Z B V K

M F Z U L A X F Z B Z X F Q D F Z E F A K J C L F Z B M D I

Prova **CP3**

Cognome e Nome		Data	

Cerca la sequenza di lettere FZB. Ogni volta che la incontri barrala.

VFZOHNIKLFZDSFEJSFZBGAYQCBFWQRFZBTEJZSPXDZTAFZBEWUDGLFZBFPFZ

FZBKGLRFZKMBXIOWFZBHYJFZBPCYFATSAFZWVIFEHOXQDFZGLSCAGNHNGSOC

FZYLFJDBFZBZHBVFZWFEIJSWEQUFZBXUFWRSDVLFZBRPBTRVAFZMKTYFZBAQ

XSXCGUVNFZBCIKFZVFOTPDFZBFUDFZYLSHGPHFZBUHOFZJLIRFQZTNAIGMKG

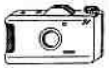
YJGSKYFZBOBSOSEWXNSKFZBPQPCQIBCVFZFTWMJAFDHFZBOFZOUXDEWFZBPI

Scheda di registrazione

Prova **MF**

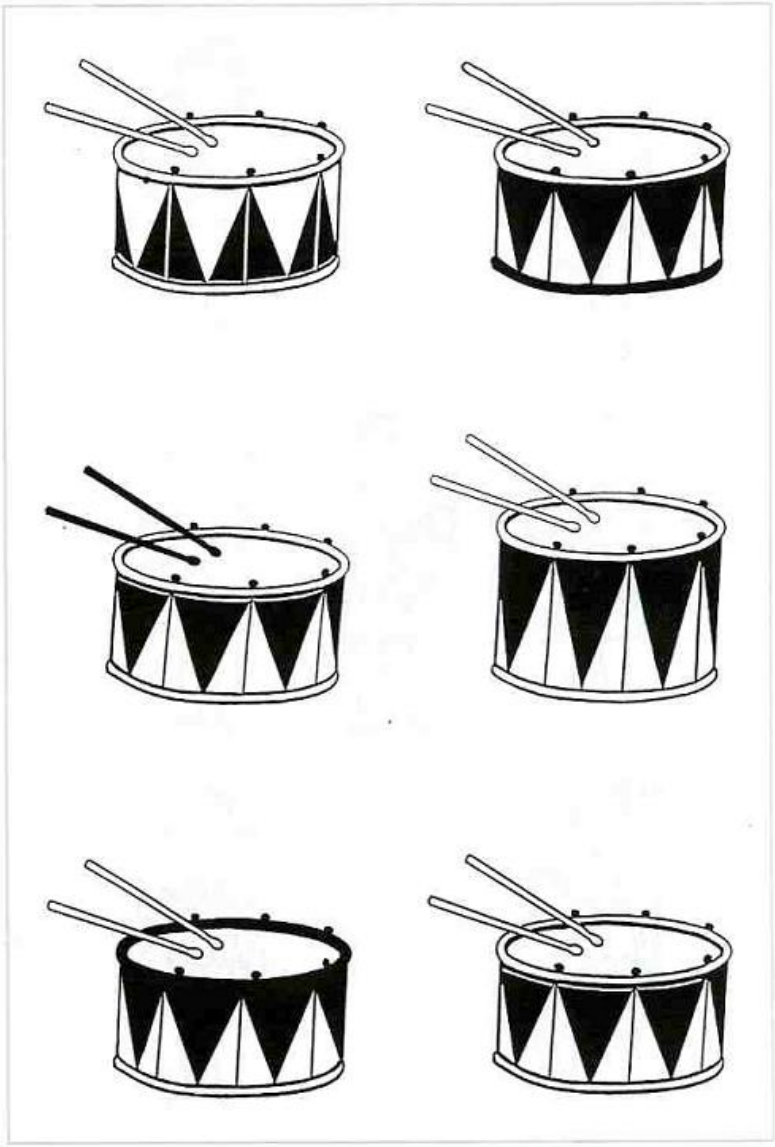
Cognome e Nome		Data	

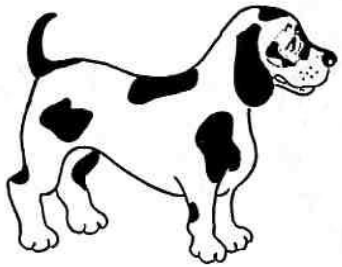
SCHEDA	TEMPO DI RISPOSTA	SCELTA EFFETTUATA
schede di esempio — Vaso di fiori 		1 2 3 5 4 6
schede di esempio — Pacco 		1 2 3 5 4 6
1. Annaffiatoio 		1 2 3 5 4 6
2. Gelato 		1 2 3 5 4 6
3. Pinza 		1 2 3 5 4 6
4. Martello 		1 2 3 5 4 6
5. Vaso 		1 2 3 5 4 6
6. Tamburo 		1 2 3 5 4 6
7. Bambina con bambola 		1 2 3 5 4 6
8. Cane 		1 2 3 5 4 6

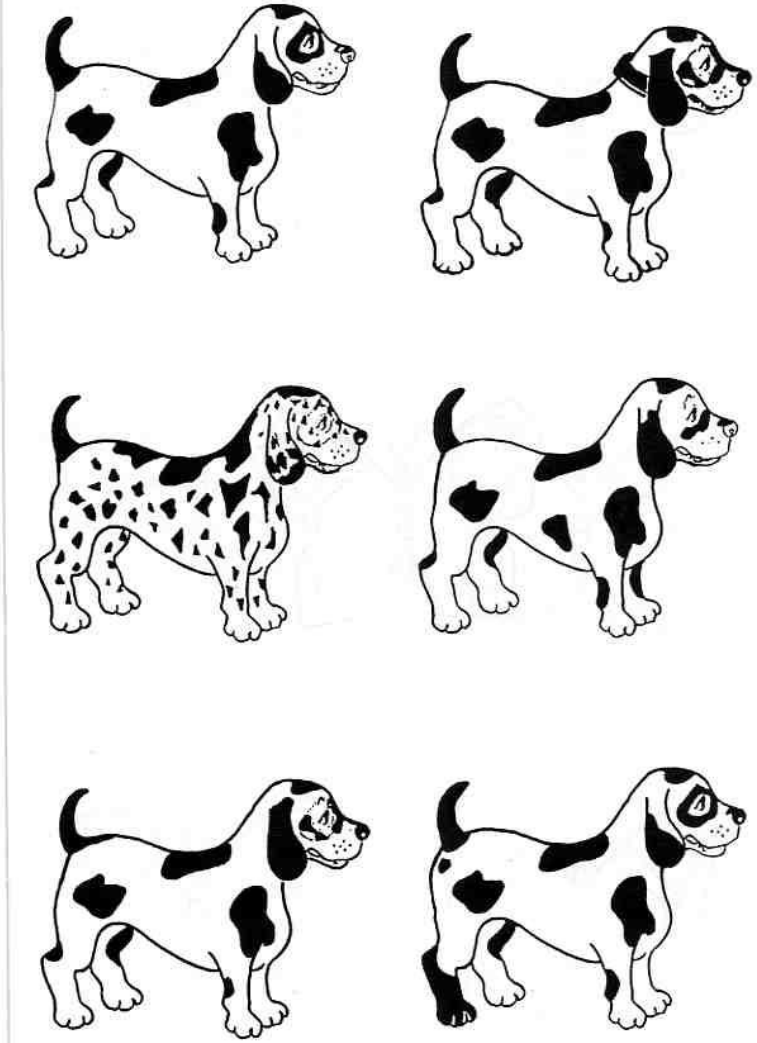
SCHEDA	TEMPO DI RISPOSTA	SCELTA EFFETTUATA
9. Farfalla 		1 2 3 5 4 6
10. Scarpa 		1 2 3 5 4 6
11. Maglietta 		1 2 3 5 4 6
12. Gabbia 		1 2 3 5 4 6
13. Calciatore 		1 2 3 5 4 6
14. Cow-boy 		1 2 3 5 4 6
15. Vespa 		1 2 3 5 4 6
16. Casa 		1 2 3 5 4 6
17. Palazzo 		1 2 3 5 4 6
18. Pagliaccio 		1 2 3 5 4 6
19. Automobile 		1 2 3 5 4 6
20. Macchina fotografica 		1 2 3 5 4 6

Prova MF *6a*

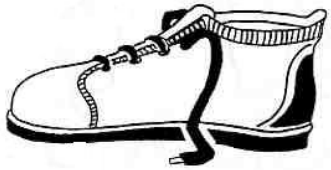
Prova MF *6b*



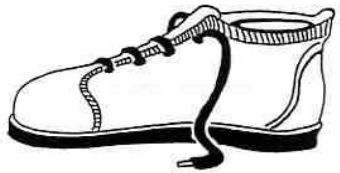


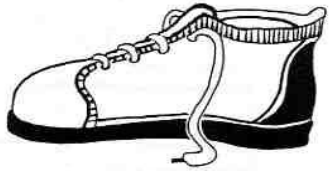


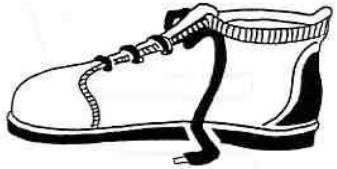
Prova MF *10a*



Prova MF *10b*



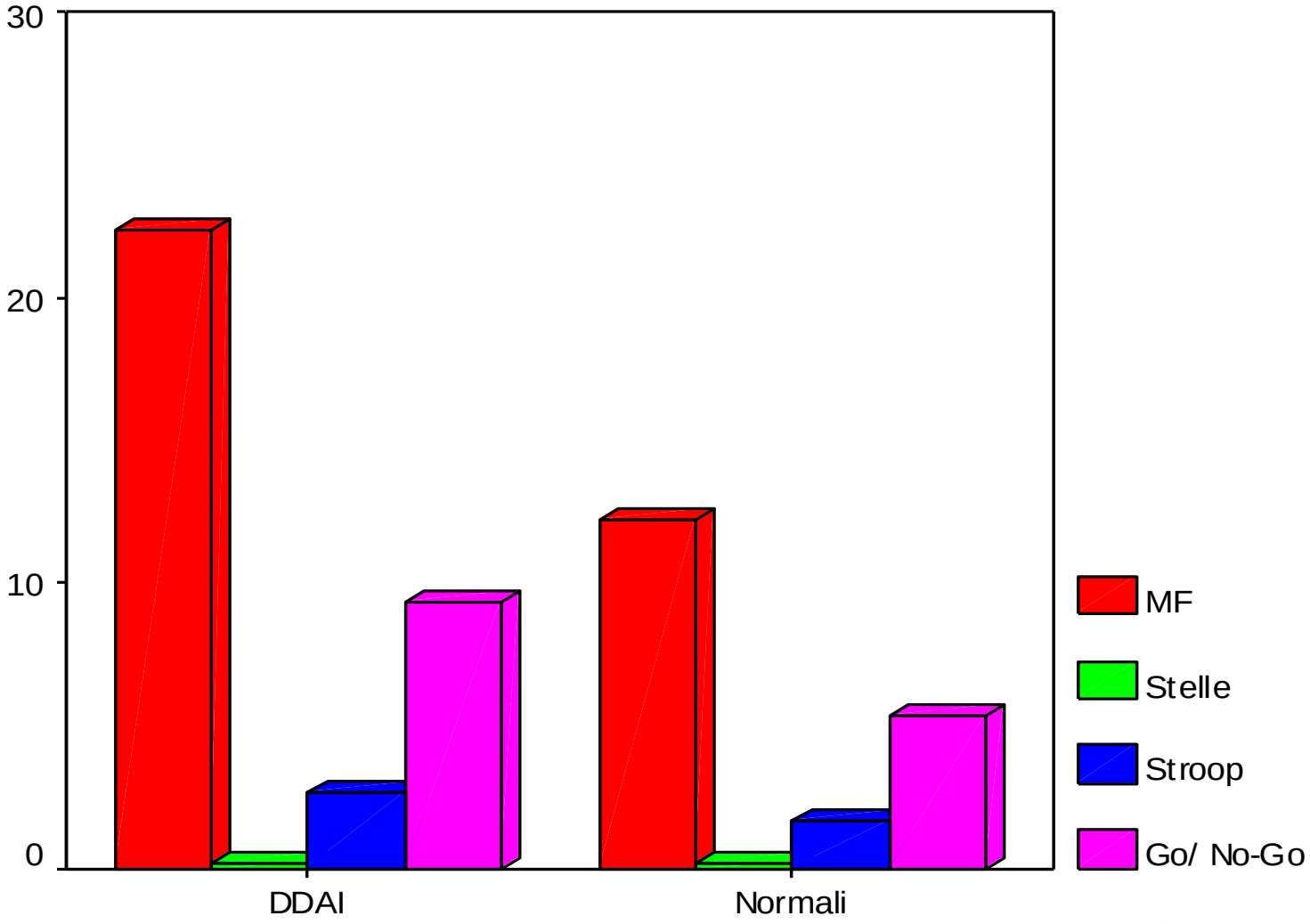


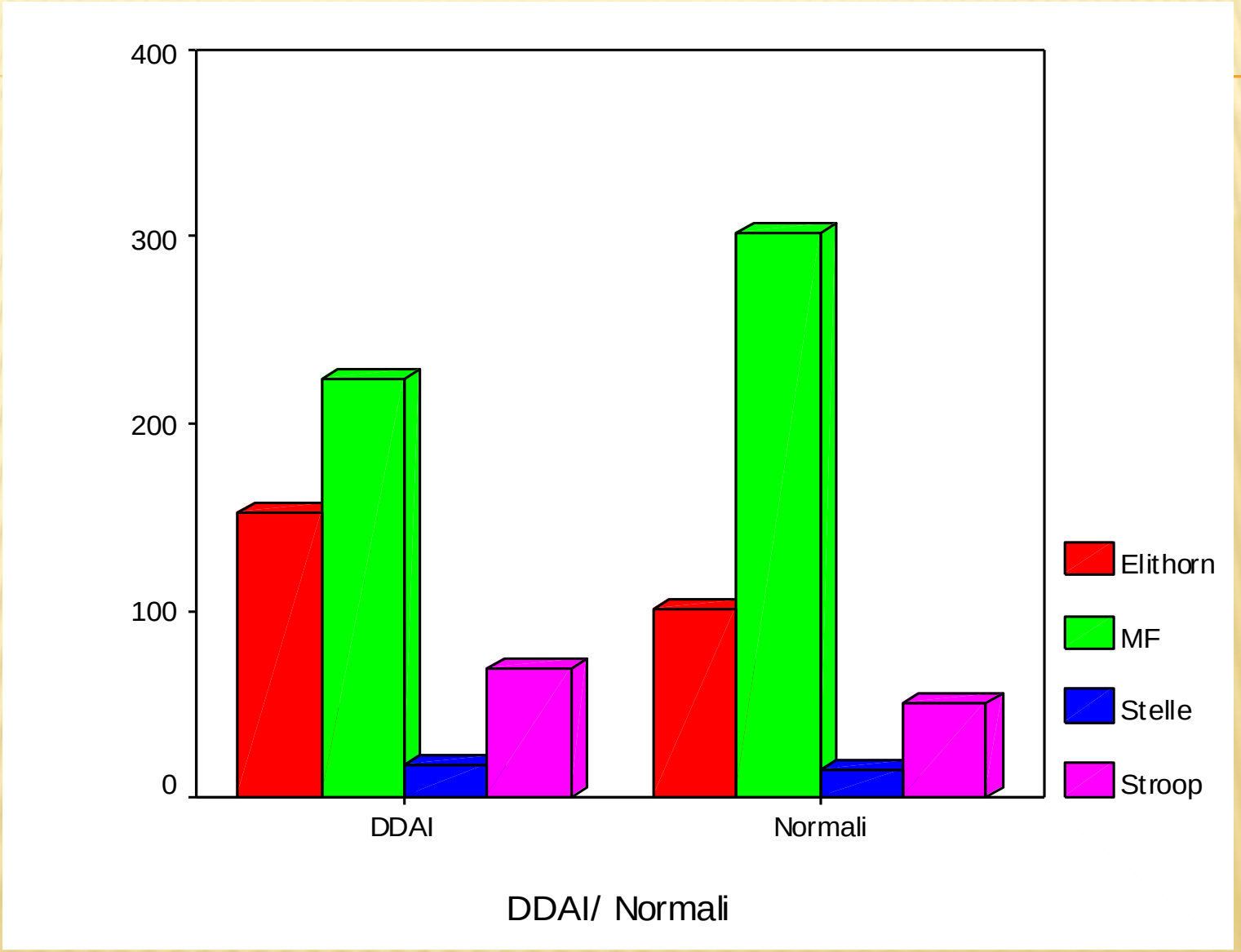


STROOP

GREEN

GREEN


30
20
10
0
DDAI
Normali
MF
Stelle
Stroop
Go/ No-Go
DDAI/ Normali


400
300
200
100
0
DDAI
Normali
Elithorn
MF
Stelle
Stroop
DDAI/ Normali

State Regulation Models of ADHD

Sergeant & van der Meere (1990)
Douglas (1989)

Key Idea: In contrast to executive inhibition model, holds that core problem is in maintaining optimal state for task. For instance, state variability can lessen inhibition deficits.

Marker tasks: Reaction time (RT) and RT variability (SDRT)

Fundamental Questions:

1) Slower and more variable RTs are pervasive in developmental disabilities.

2) Neuroimaging studies of RT and SDRT implicate PFC.

LA VARIABILITÀ INTRAINDIVIDUALE

Varieties of Attention-Deficit/Hyperactivity Disorder-Related Intra-Individual Variability

F. Xavier Castellanos, Edmund J.S. Sonuga-Barke, Anouk Scheres, Adriana Di Martino, Christopher Hyde and Judith R. Walters (2005), *Biological Psychiatry 57*, 1416 –1423.

Intra-Subject Variability in Attention-Deficit Hyperactivity Disorder

Christoph Klein, Katharina Wendling, Paul Huettner, Hans Ruder and Martin Peper (2006), *Biological Psychiatry*, 60, 1088-1097.

Working memory, response inibition and within-subject variability in children with attention-deficit/hyperactivity disorder or reading disorder

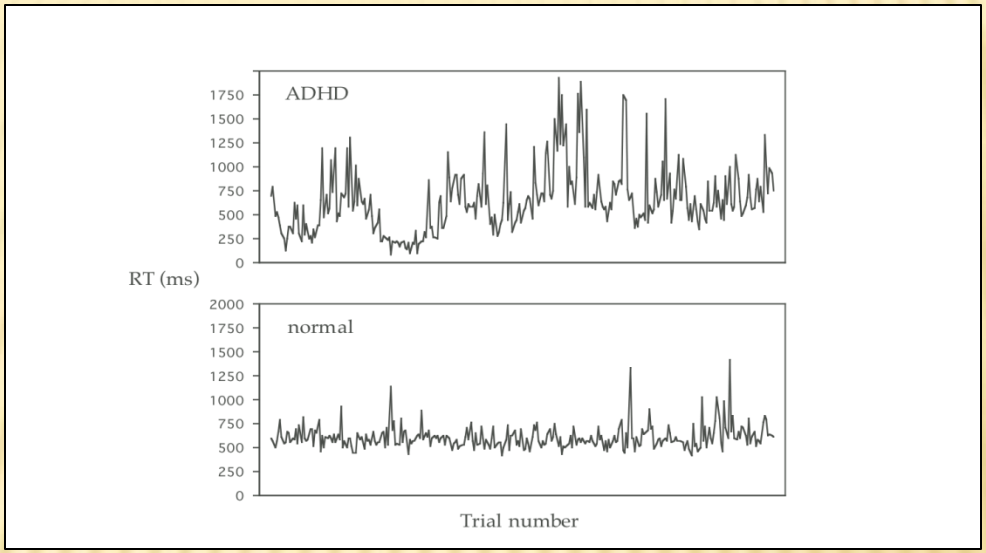
Van De Voorde,S., Roeyers,H., Vertè, S. e Wiersema,J.R., (2010), *Journal of clinical and experimental neuropsychology*, 32, 366-379.

. IIV

dispersion
(across-task intraindividual variability)

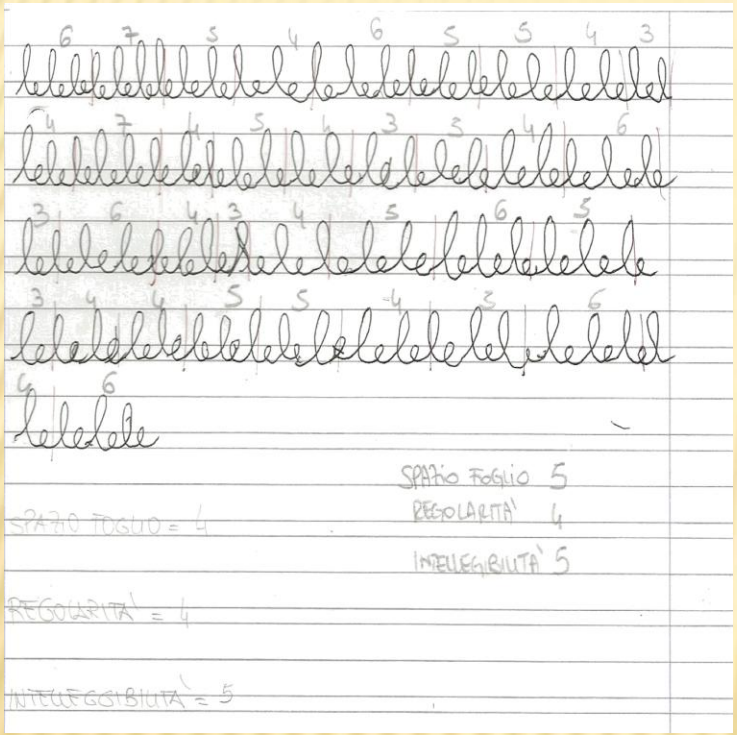
inconsistency
(within-task intraindividual variability)

Within task Variability

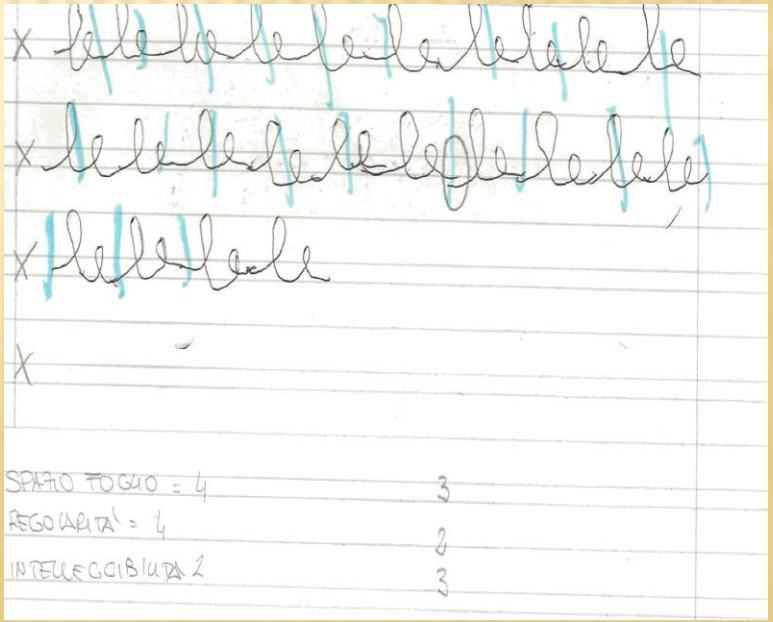


ADHD IIV handwriting

Controllo



ADHD



THE MARCHE STUDY

- **Sample:**

Gruppo	n°	età		Q.I.	
		M	DS	M	DS
ADHD	24	9,21	1,38	96,63	19,62
ADHD+DSA	6	10,67	1,36	98,5	7,31
Dislessici	16	9,33	1,39	103,87	6,81
Normodotati	33	9,79	1,57	107,45	12,53

- **Tasks:**

1. Stroop

(9 blocchi, ognuno da 24 item= 216; tempo tot:15 min.)

2. Handwriting

(tempo tot: 3 min/ 5 sec= 36 misure)

3. Simple RT

(5 blocchi, ognuno da 24 item = 120; tempo tot.: 10 min)

4. Updating

(12 liste, ciascuna di 8 parole; tempo tot: 15 min)

RESULTS

- **Prova di Stroop:** ANOVA 3 (Gruppo) X 3 (condizione sperimentale); V.D.: TR, accuratezza, indici di variabilità.

	TRmedio						n° errori					
	neutra		congruente		incongruente		neutra		congruente		incongruente	
	M	DS	M	DS	M	DS	M	DS	M	DS	M	DS
ADHD	1051,82	324,21	959,67	256,95	1321,32	431,1	1,04	0,20	0,26	0,09	1,61	0,15
Dislessici	1000,08	281,74	950,22	271,13	1271,84	364,72	0,56	0,24	0,13	0,11	2,00	0,18
Normodotati	813,6	220,93	790,21	212,12	1033,99	344,68	0,36	0,17	0,09	0,08	0,88	0,13

- effetto del Gruppo ($p<.01$)

- effetto del Gruppo ($p<.001$)

	ISD						CVI					
	neutra		congruente		incongruente		neutra		congruente		incongruente	
	M	DS	M	DS	M	DS	M	DS	M	DS	M	DS
ADHD	418,41	397,67	360,23	304,96	425,45	324,16	0,35	0,17	0,34	0,17	0,3	0,11
Dislessici	368,63	250,62	369,2	231,37	412,54	265,33	0,34	0,13	0,36	0,13	0,3	0,11
Normodotati	185,93	144,74	189,96	102,82	234,96	162,63	0,21	0,08	0,23	0,07	0,21	0,07

- effetto del Gruppo ($p<.01$);

- effetto del Gruppo ($p<.001$);

- effetto della Condizione ($p<.01$)

- **Handwriting: Mean number of letters written in 5 sec and variability coefficient**.

	M lettere scritte/5 s		CVI	
	M	DS	M	DS
ADHD	4,79	0,84	0,35	0,08
Dislessici	6,29	1,25	0,24	0,05
Normodotati	6,29	1,75	0,25	0,06

)

- **Simple reaction time**.

	ISD		CVI	
	M	DS	M	DS
ADHD	167,33	83,18	0,36	0,1
Dislessici	185,59	121,28	0,37	0,14
Normodotati	105,21	39,78	0,26	0,06

Delay Aversion (DA)

Sonuga-Barke (2005)
Sagvolden et al. (2004)

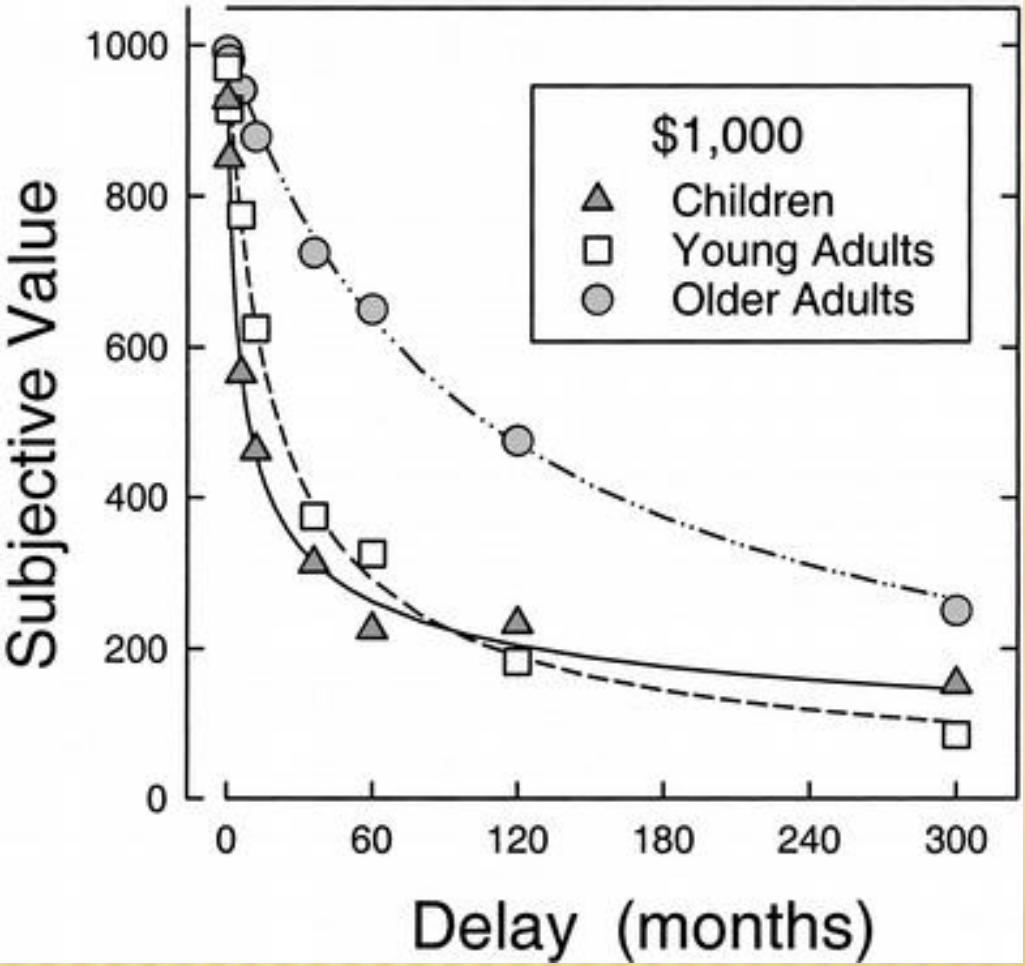
Key Idea: Prefer immediate small rewards to delayed larger rewards. Fall-off in reinforcement gradient is steep.

Related Constructs:
Delay of gratification (Mischel, et al. 1989)
Delay discounting (Green & Myerson, 2004)

Fundamental Questions:

1) Is DA more related to CD than ADHD?
2) How does DA deficit relate to state regulation and inhibition deficits?

Delay Discounting
(Green & Myerson, 2004)



THE EF THEORY ACCORDING TO PENNINGTON

The EF theory of ADHD

A core EF deficit is necessary and sufficient to cause ADHD (usually referring to the combined type)

FIVE CRITERIA THAT MUST BE MET FOR EF WEAKNESSES TO BE CONSIDERED THE CORE DEFICIT OF ADHD

I. Groups with ADHD must exhibit weaknesses on EF measures.

II. The group deficit must remain significant after controlling for IQ and symptoms of other disorders.

III. The group EF deficit must explain a large proportion of the variance in ADHD symptoms.

IV. EF weaknesses must be present in most individuals with ADHD, and absent in most individuals without ADHD.

V. EF weaknesses must be due to the same genes as ADHD.

META-ANALYSIS OF EF AND ADHD

(WILLCUTT, BRODSKY, ET AL., 2005; WILLCUTT, DOYLE, NIGG, FARAONE, & PENNINGTON, 2005)

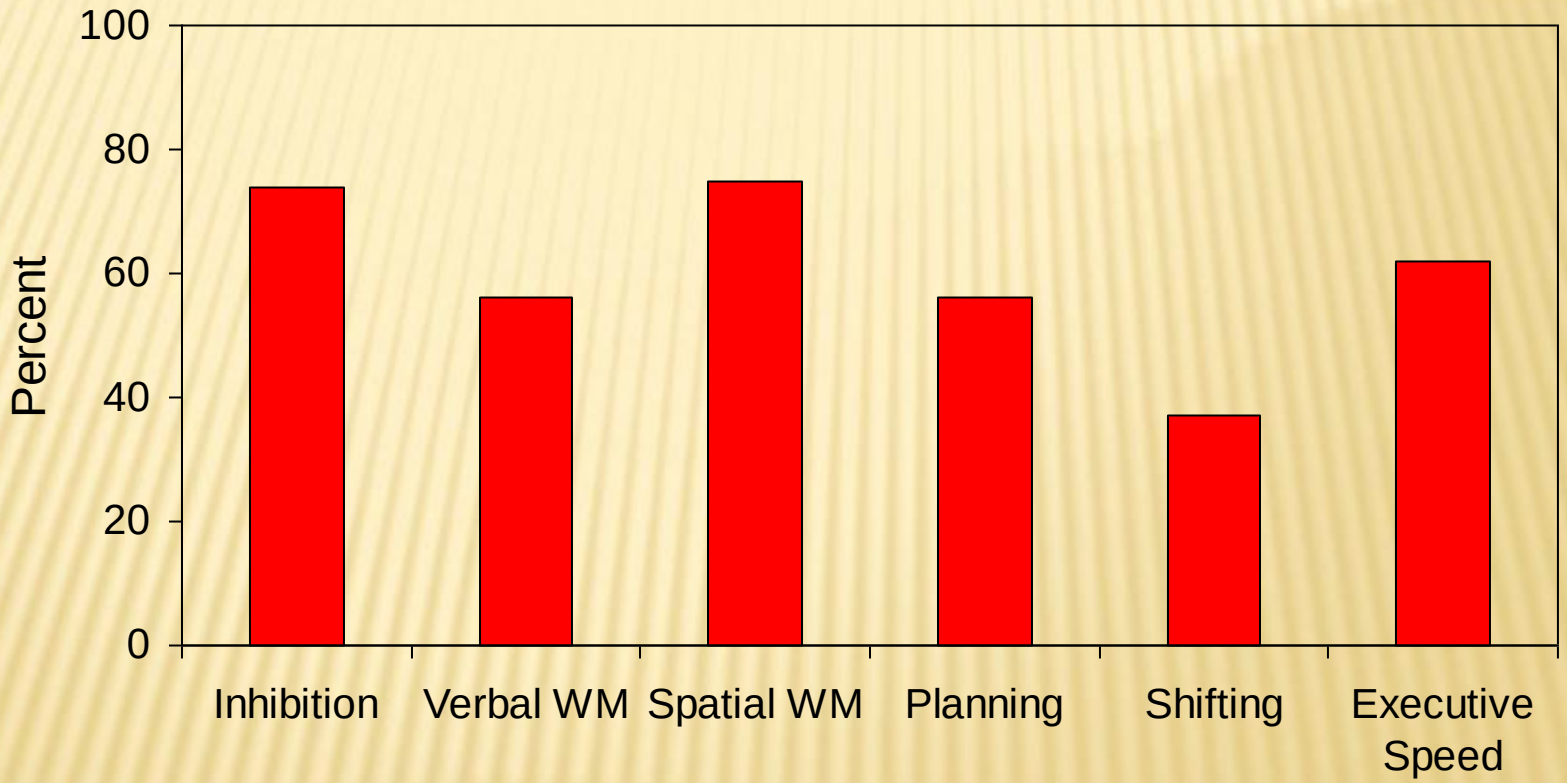
- One key measure of each core EF domain was identified
  - Inhibition: Stop-signal Reaction Time (25 studies)
  - Set shifting: Wisconsin Card Sort perseverative errors (25 studies)
  - Verbal working memory: sentence span (3 studies) and digits backward (6)
  - Planning: Tower of Hanoi / London (12 studies)
  - Interference Control: Clinical Stroop (9 studies)
  - Executive Processing Speed: Trailmaking Test Part B (13 studies)
- 100 new studies of EF measures have been published since the review by Pennington and Ozonoff (1996)
- 65 studies that administered at least one of these six measures were included (most studies combined type only)
- Total N = 3,374 with ADHD and 2,969 without ADHD

TESTING THE EF MODEL OF ADHD: FIVE CRITERIA FOR A CORE DEFICIT

Criterion	Result
I. ADHD must be associated with EF weaknesses.	

PERCENTAGE OF STUDIES FINDING A SIGNIFICANT DIFFERENCE BETWEEN ADHD AND CONTROL GROUPS

(AFTER WILLCUTT ET AL., 2005)



TESTING THE EF MODEL OF ADHD: CRITERIA FOR A CORE DEFICIT

Criterion	Result
I. ADHD must be associated with EF weaknesses.	Supported

TESTING THE EF MODEL OF ADHD: CRITERIA FOR A CORE DEFICIT

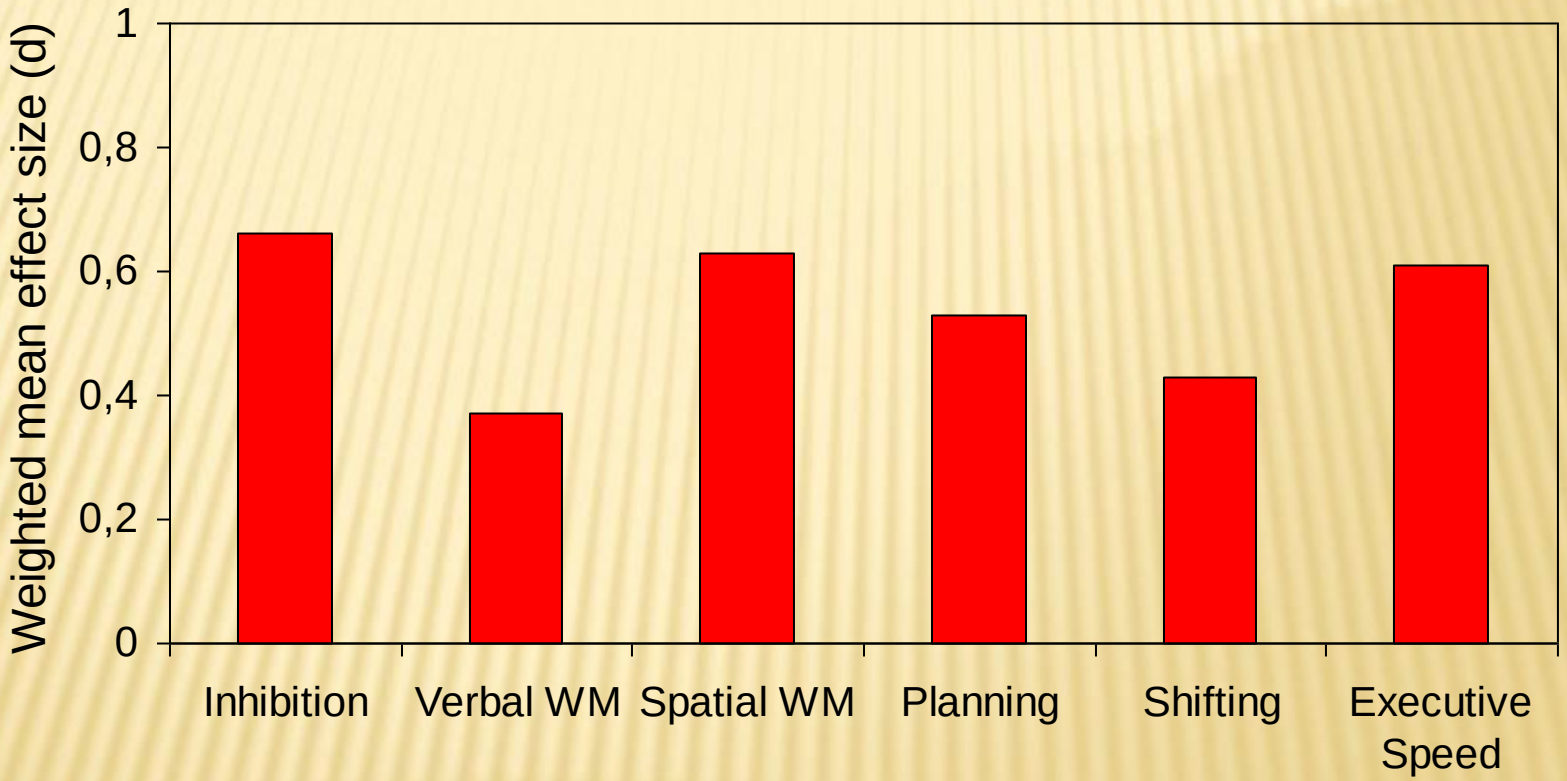
Criterion	Result
I. ADHD must be associated with EF weaknesses.	Supported
II. EF weaknesses must not be explained by group differences in IQ or comorbid symptoms.	Supported

TESTING THE EF MODEL OF ADHD: CRITERIA FOR A CORE DEFICIT

Criterion	Result
I. ADHD must be associated with EF weaknesses.	Supported
II. EF weaknesses must not be explained by group differences in IQ or comorbid symptoms.	Supported
III. The EF deficit must be large enough to be a core deficit.	

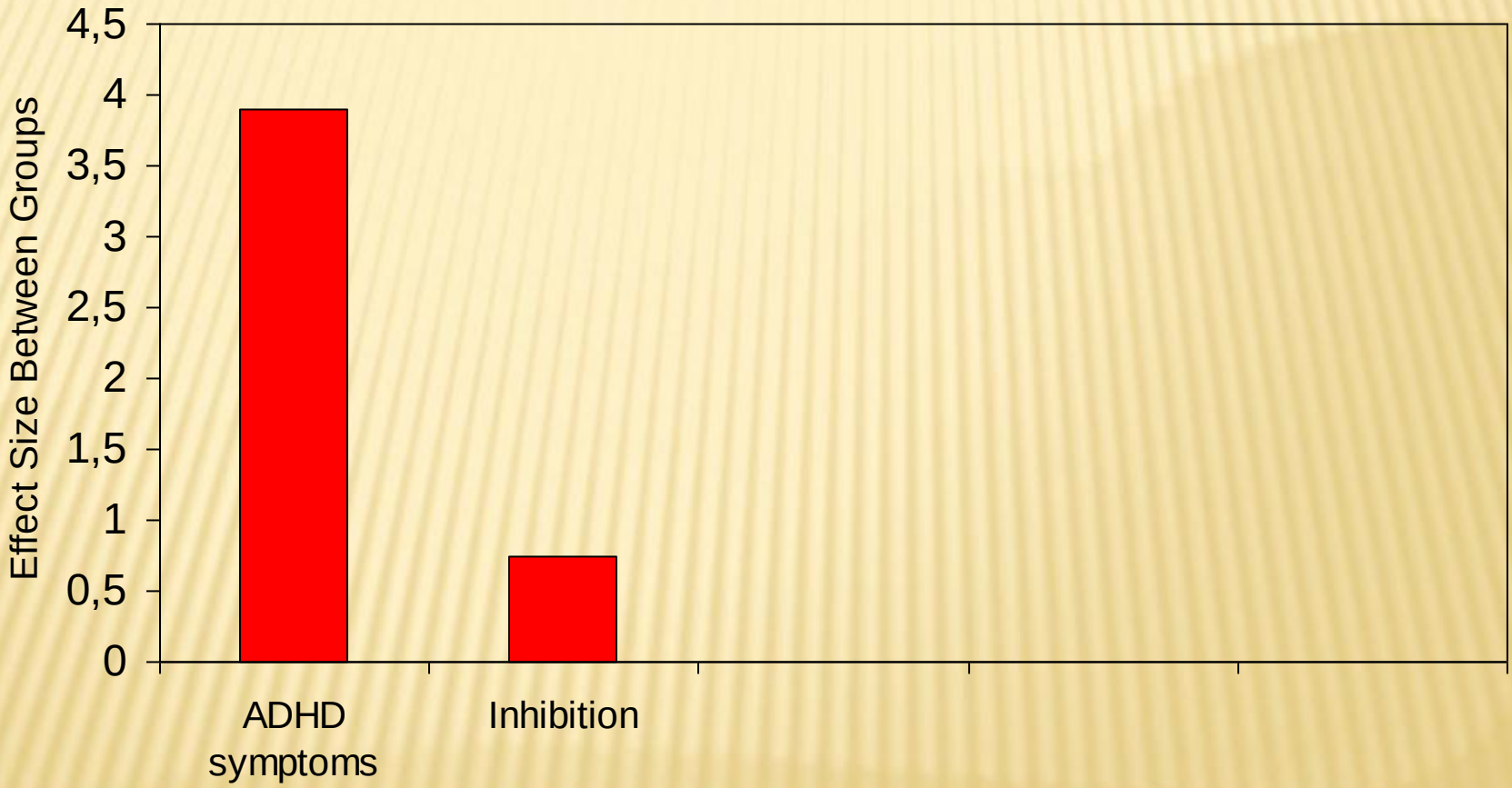
MEAN EFFECT SIZE OF THE GROUP DIFFERENCE ON EACH EF MEASURE

(AFTER WILLCUTT ET AL., 2005)



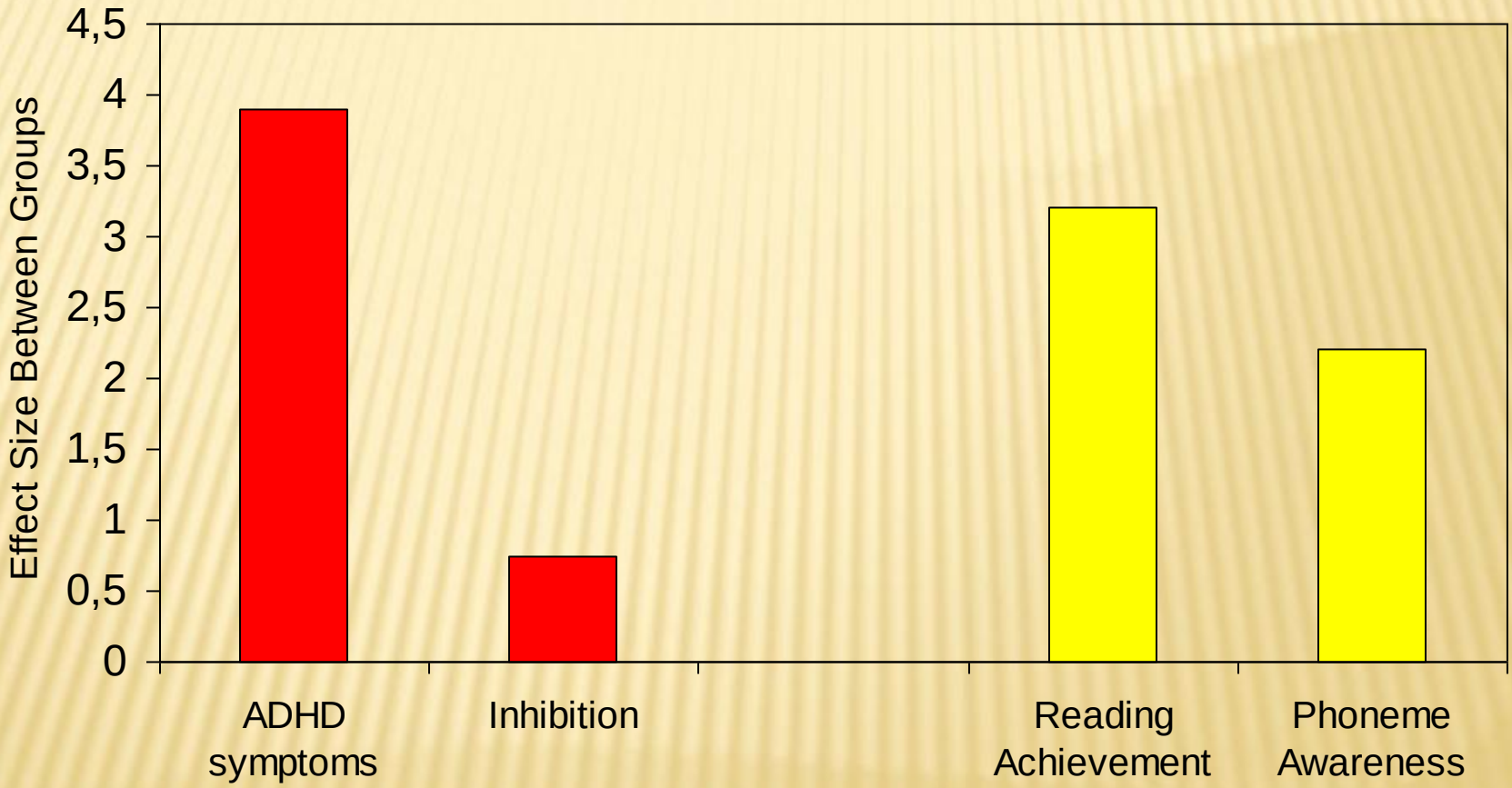
COMPARISON OF THE EFFECT SIZES FOR THE HYPOTHESIZED "CORE DEFICIT" IN READING DISABILITY AND ADHD

(WILLCUTT ET AL., 2001[28])



COMPARISON OF THE EFFECT SIZES FOR THE HYPOTHESIZED "CORE DEFICIT" IN READING DISABILITY AND ADHD

(WILLCUTT ET AL., 2001)



TESTING THE EF MODEL OF ADHD: CRITERIA FOR A CORE DEFICIT

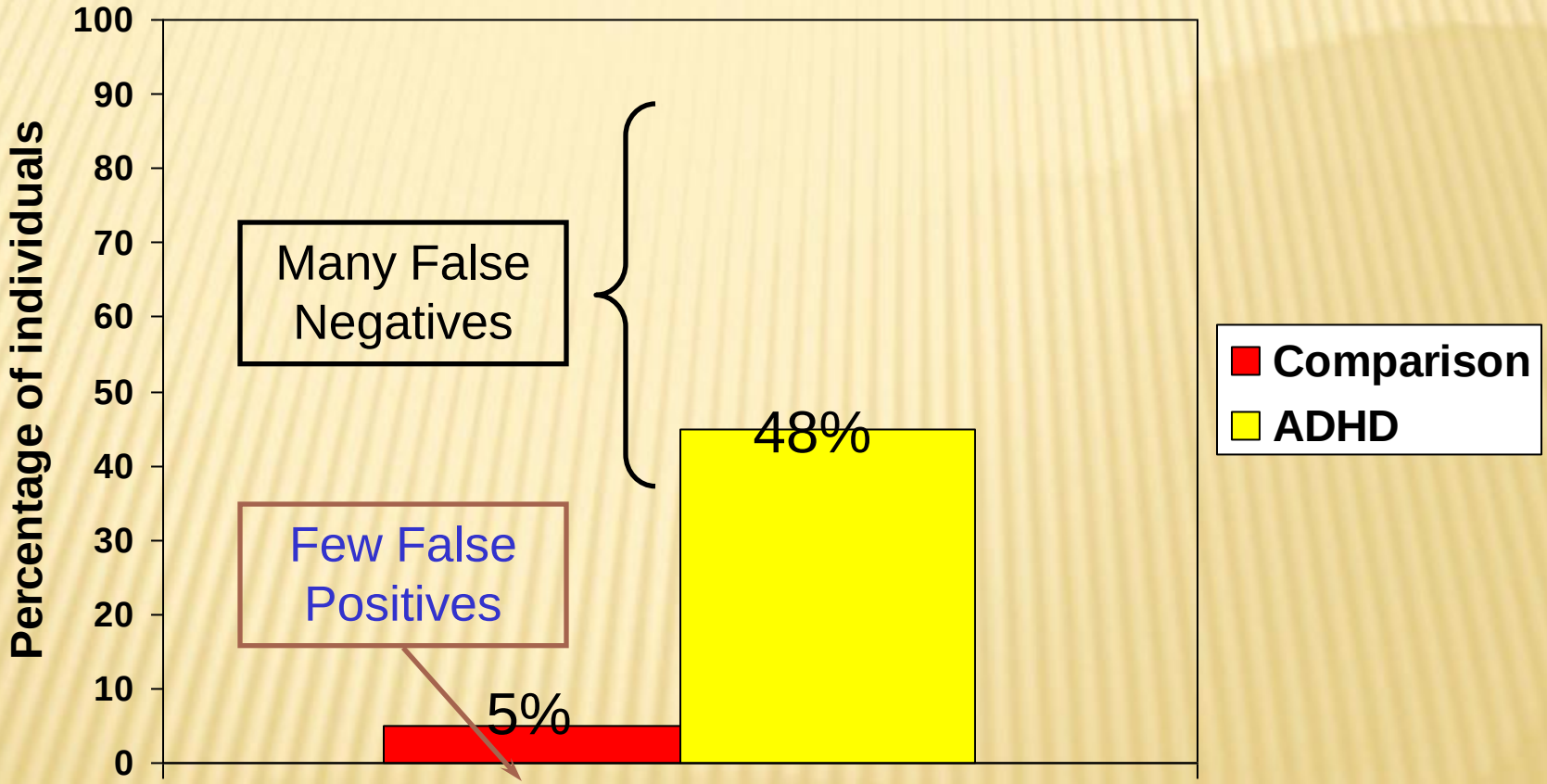
Criterion	Result
I. ADHD must be associated with EF weaknesses.	Supported
II. EF weaknesses must not be explained by group differences in IQ or comorbid symptoms.	Supported
III. The EF deficit must be large enough to be a core deficit.	Not Supported

TESTING THE EF MODEL OF ADHD: CRITERIA FOR A CORE DEFICIT

Criterion	Result
I. ADHD must be associated with EF weaknesses.	Supported
II. EF weaknesses must not be explained by group differences in IQ or comorbid symptoms.	Supported
III. The EF deficit must be large enough to be a core deficit.	Not Supported
IV. EF deficits must be present in most individuals with ADHD and absent in most individuals without ADHD.	

PERCENTAGE OF INDIVIDUALS WITH SCORES ABOVE THE 95TH PERCENTILE ON THE RESPONSE INHIBITION FACTOR

(AFTER NIGG, WILLCUTT, ET AL., IN PRESS[12])



TESTING THE EF MODEL OF ADHD: CRITERIA FOR A CORE DEFICIT

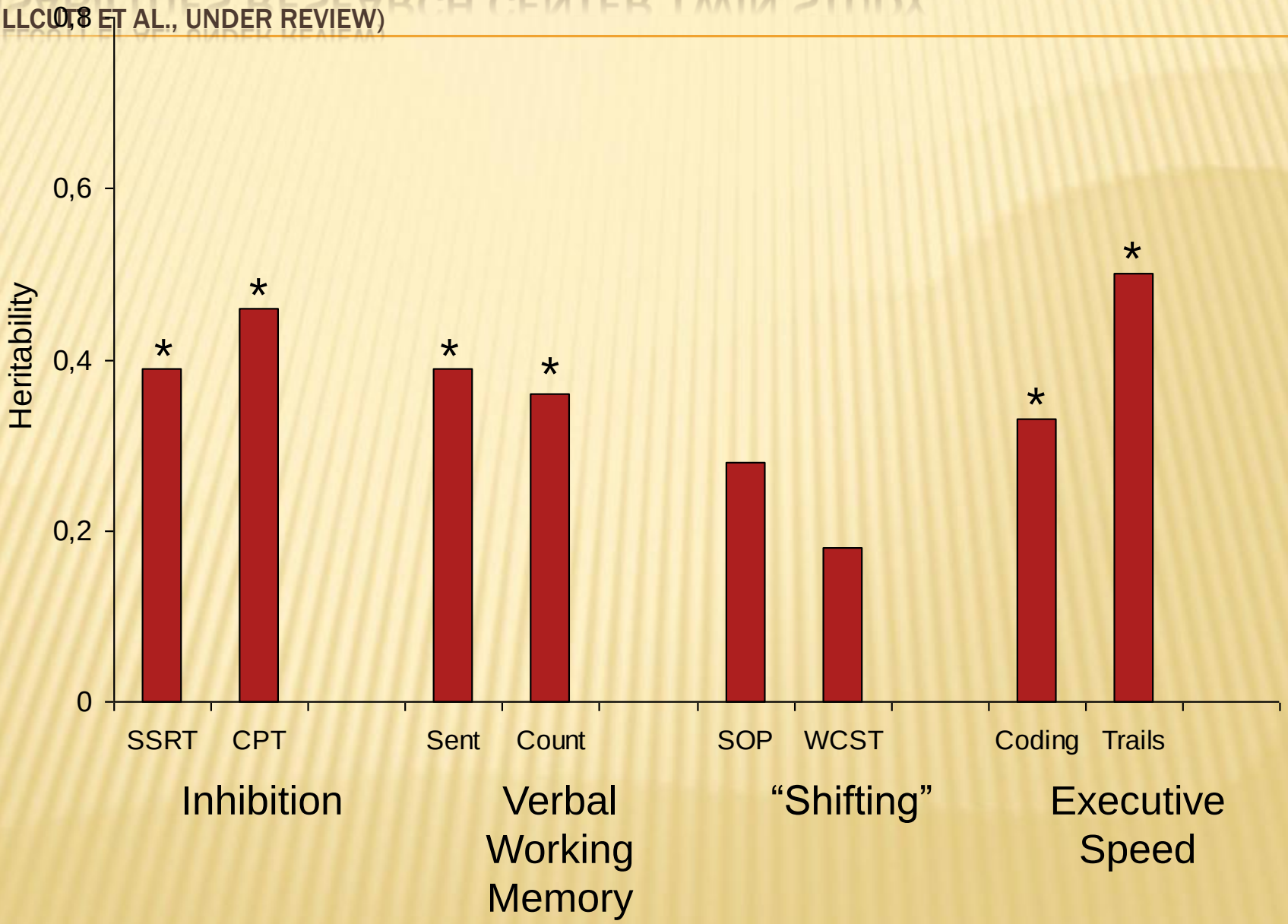
Criterion	Result
I. ADHD must be associated with EF weaknesses.	Supported
II. EF weaknesses must not be explained by group differences in IQ or comorbid symptoms.	Supported
III. The EF deficit must be large enough to be a core deficit.	Not Supported
IV. EF deficits must be present in most with ADHD and absent in most without ADHD.	Not supported Supported

TESTING THE EF MODEL OF ADHD: CRITERIA FOR A CORE DEFICIT

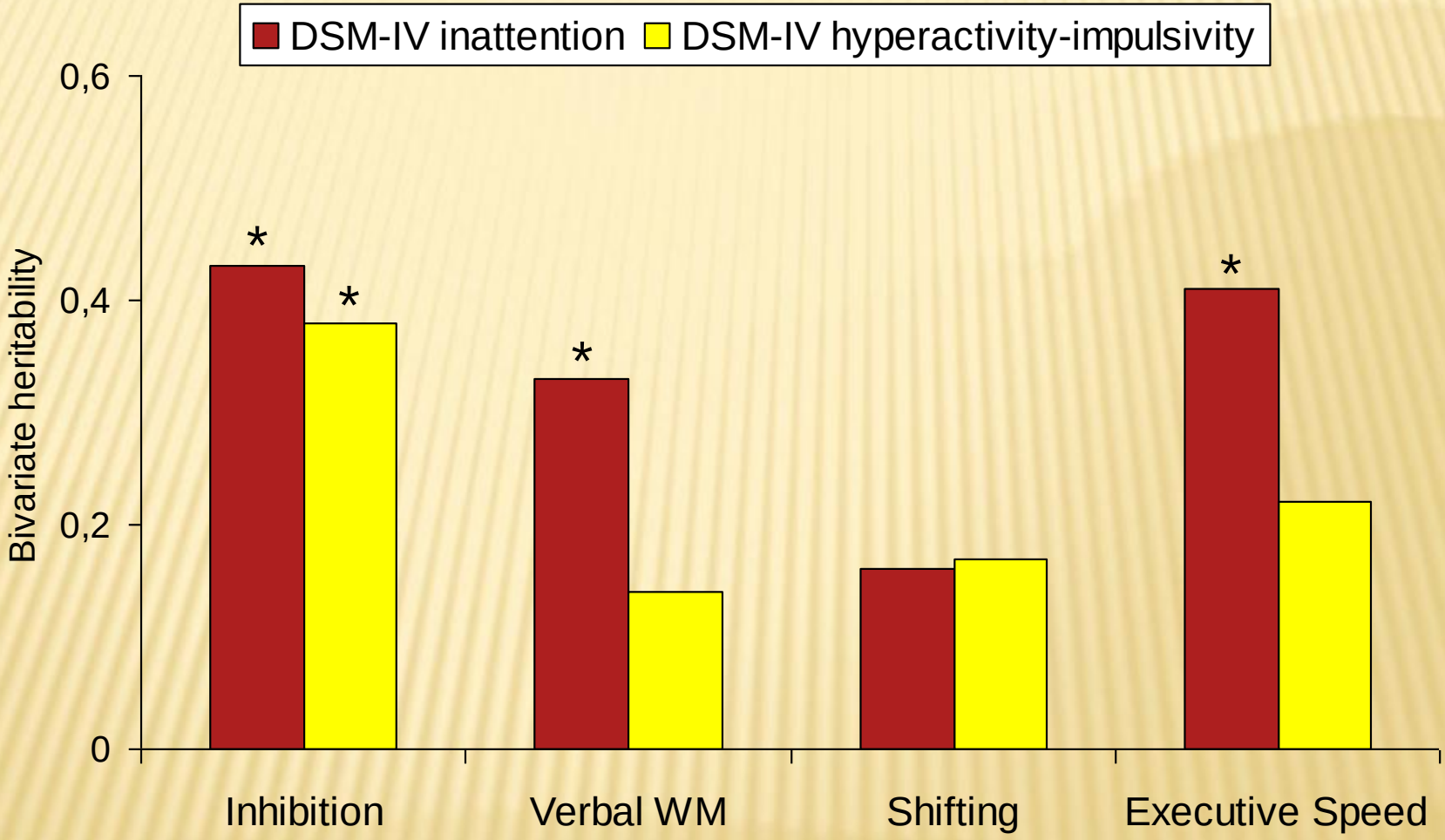
Criterion	Result
I. ADHD must be associated with EF weaknesses.	Supported
II. EF weaknesses must not be explained by group differences in IQ or comorbid symptoms.	Supported
III. The EF deficit must be large enough to be a core deficit.	Not Supported
IV. EF deficits must be present in most with ADHD and absent in most without ADHD.	Not supported Supported
V. EF deficits must be co-heritable with ADHD	

HERITABILITY OF EF DEFICITS IN THE COLORADO LEARNING DISABILITIES RESEARCH CENTER TWIN STUDY

(WILLCUTT ET AL., UNDER REVIEW)



BIVARIATE HERITABILITY OF ADHD SYMPTOMS AND EF FACTOR SCORES



TESTING THE EF MODEL OF ADHD: CRITERIA FOR A CORE DEFICIT

Criterion	Result
I. ADHD must be associated with EF weaknesses.	Supported
II. EF weaknesses must not be explained by group differences in IQ or comorbid symptoms.	Supported
III. The EF deficit must be large enough to be a core deficit.	Not Supported
IV. EF deficits must be present in most with ADHD and absent in most without ADHD.	Not supported Supported
V. EF deficits must be co-heritable with ADHD	Supported, but small common genetic effect

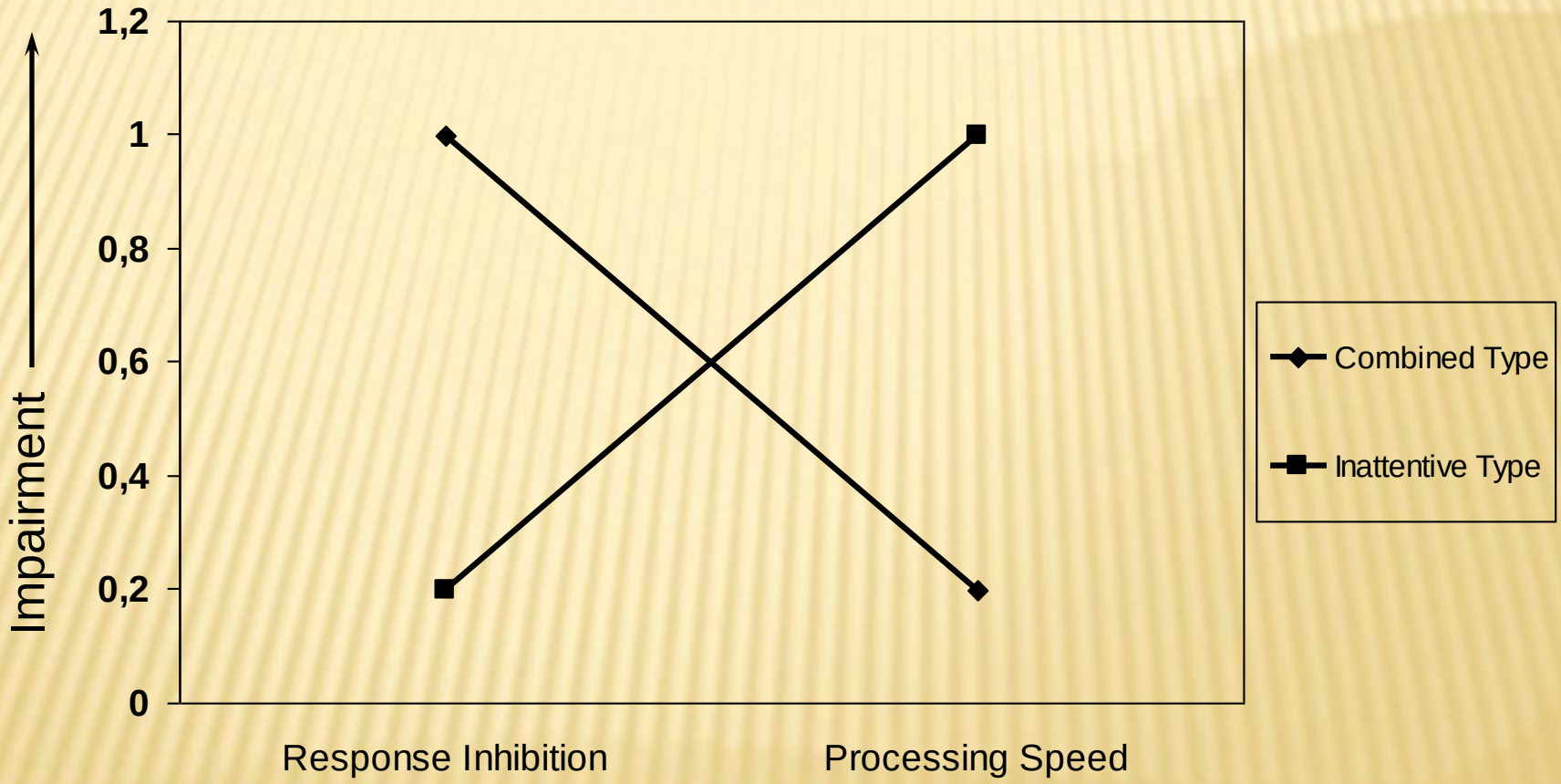
HOMEWORK

- 1 Propose reasons of why ADHD children typically pesent serious school difficulties
- 2 Discuss the issue of single vs multiple deficit hypotheses of developmental disorders

WHY DIDN'T WE FIND A CORE EF DEFICIT?

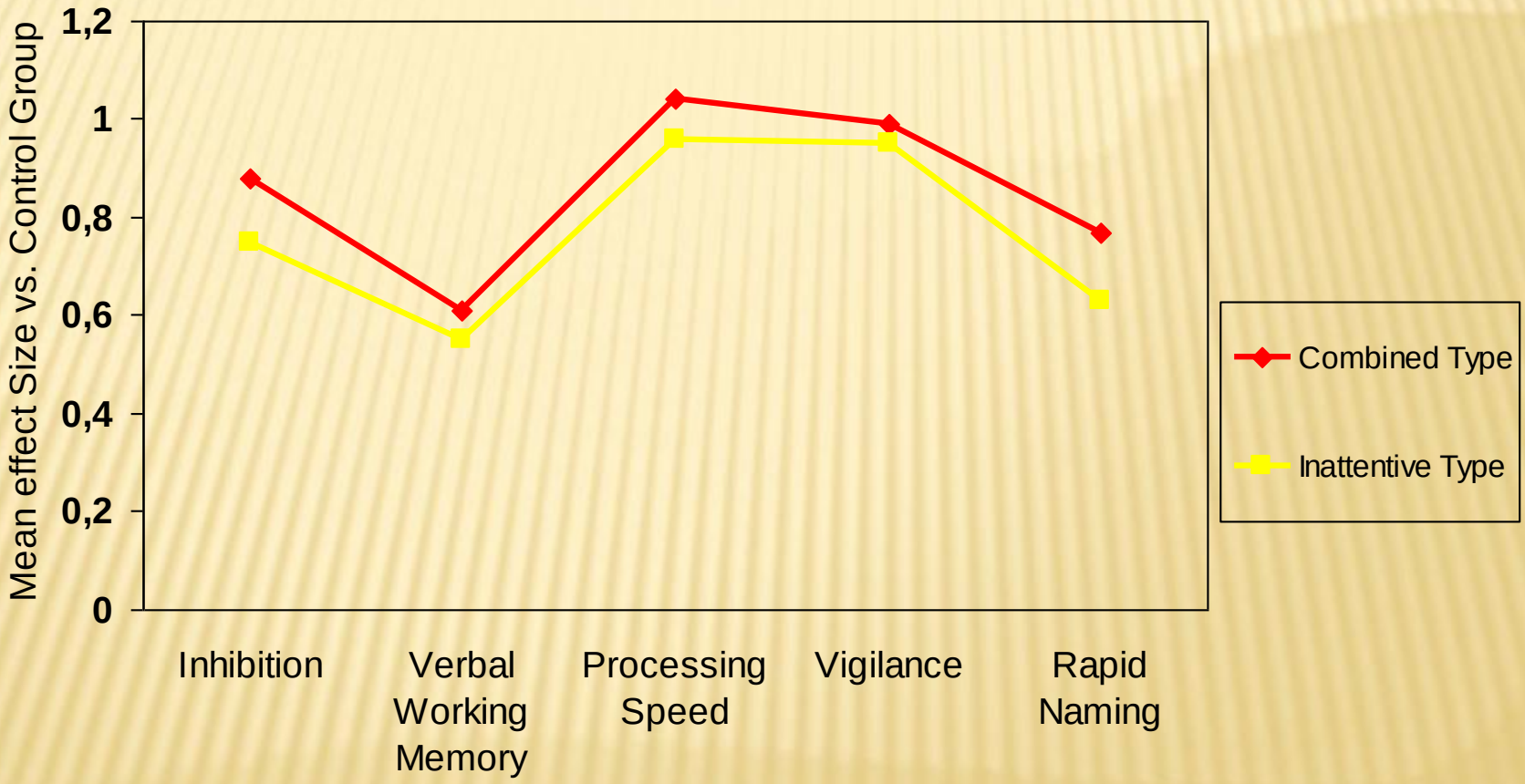
Did diagnostic heterogeneity attenuate the effect?

PREDICTED DOUBLE DISSOCIATION BETWEEN THE COMBINED AND INATTENTIVE SUBTYPES



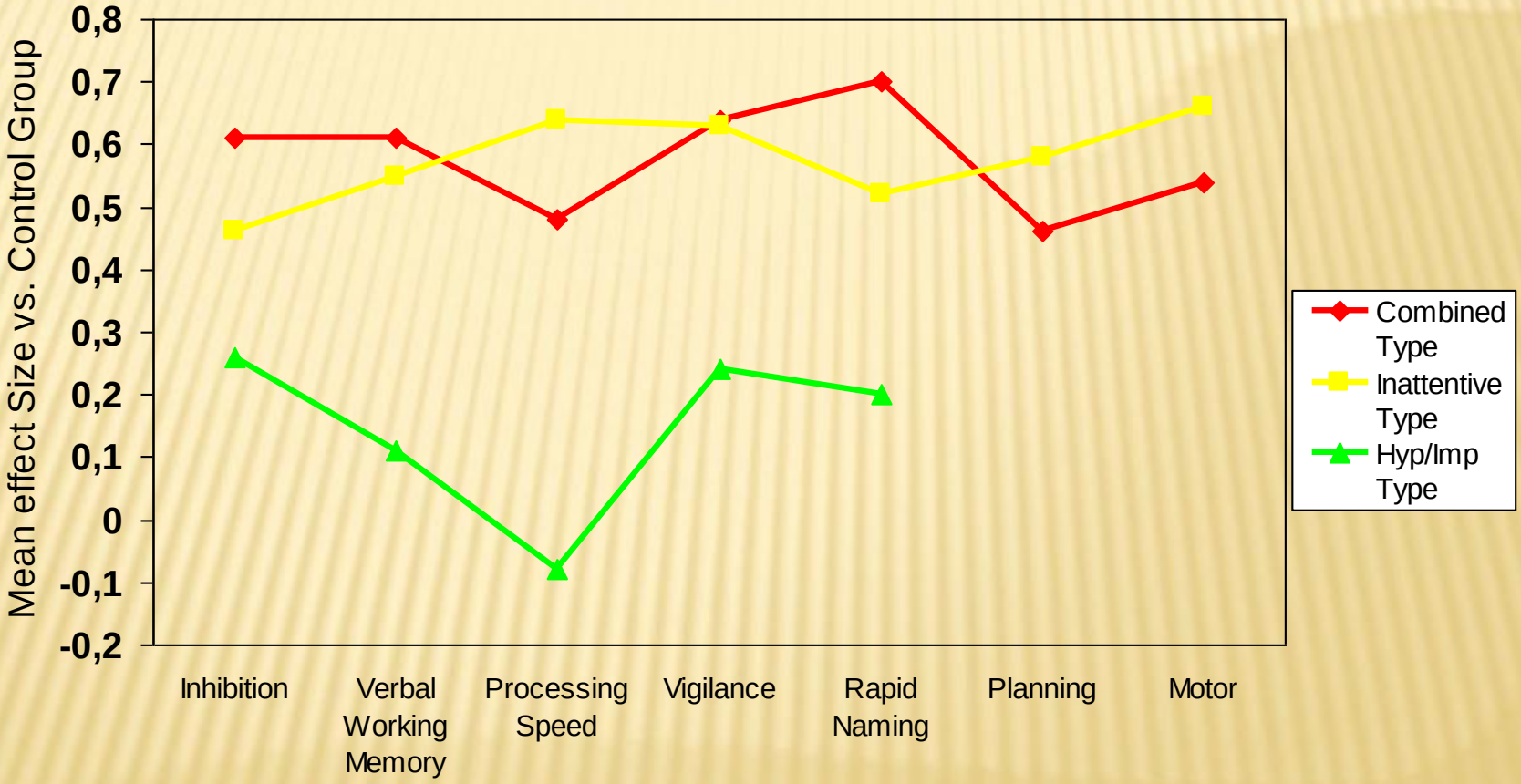
PERFORMANCE OF THE DSM-IV INATTENTIVE AND COMBINED TYPES ON MEASURES OF NEUROPSYCHOLOGICAL FUNCTIONING

(AFTER CHHABILDAS ET AL., 2001[1]; WILLCUTT ET AL., IN PRESS[30])



META-ANALYSIS OF PERFORMANCE OF THE DSM-IV SUBTYPES ON MEASURES OF NEUROPSYCHOLOGICAL FUNCTIONING

(10 STUDIES; WILLCUTT ET AL., UNDER REVIEW[25])

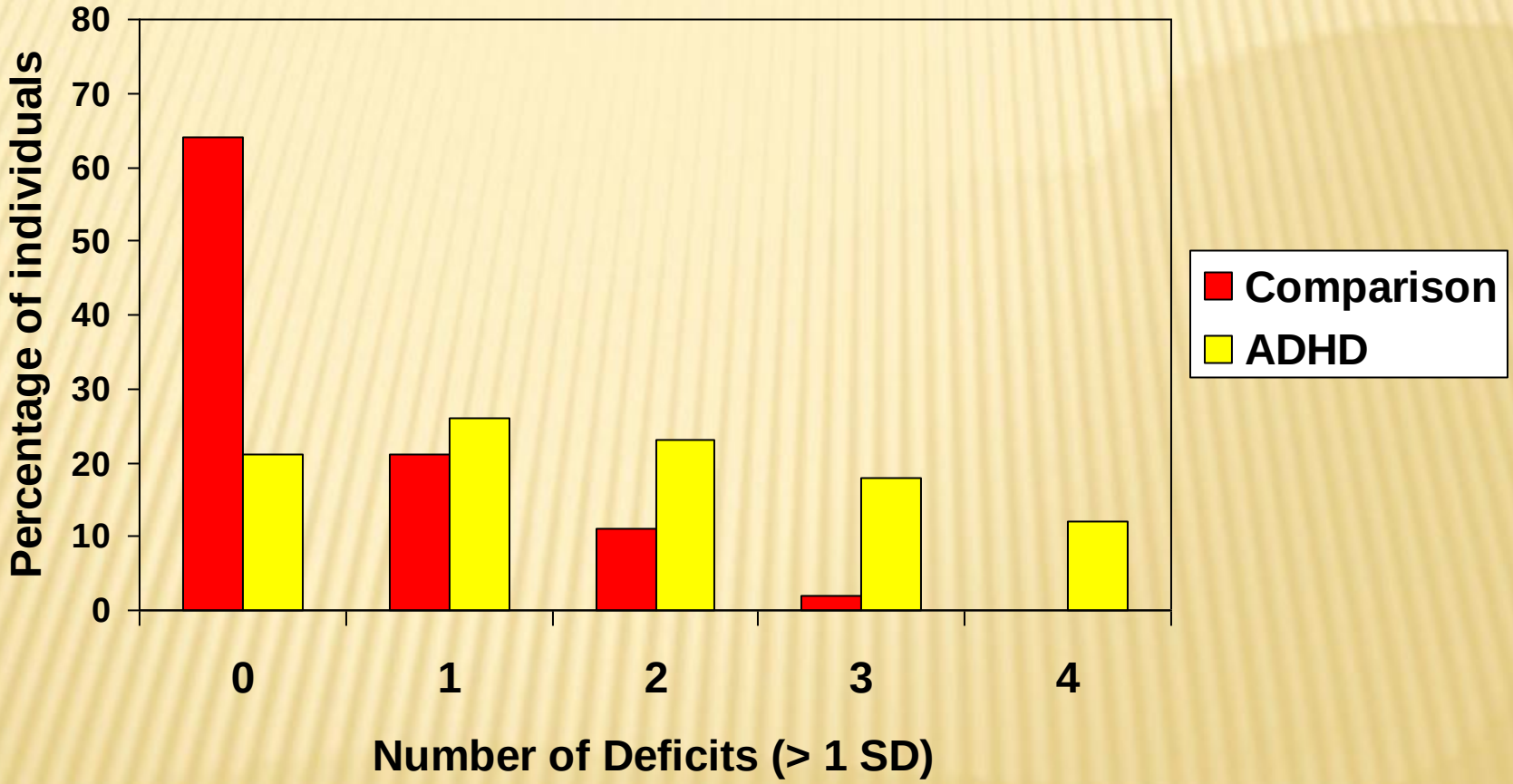


A PARADIGM SHIFT: THE NEED FOR A MULTIFACTORIAL MODEL

- ADHD is not attributable to a single core deficit in EF or anything else.
- EF deficits are one important part of a model that includes several other weaknesses.
- Other possible weaknesses:
  - Delay Aversion: hypersensitivity to delay expressed as behaviors devoted to minimizing the experience of delay (Sonuga-Barke, 2003)
  - Arousal ("state") regulation: fluctuations in arousal/activation lead to suboptimal performance (Sergeant et al., 2003)
  - Cognitive Speed
    - Naming speed (Rucklidge & Tannock, 2002)
    - Processing speed (Willcutt et al., in press)
  - Temporal processing
    - Durations > 2 seconds (Barkley et al., 2001)
    - Durations < 1 second (Castellanos & Tannock)
- Some weaknesses may be shared with comorbid disorders and some may be specific to ADHD.

NUMBER OF NEUROCOGNITIVE DEFICITS EXHIBITED BY CHILDREN WITH AND WITHOUT ADHD

(DOMAINS ASSESSED: INHIBITION, SET SHIFTING, PROCESSING SPEED, VIGILANCE)

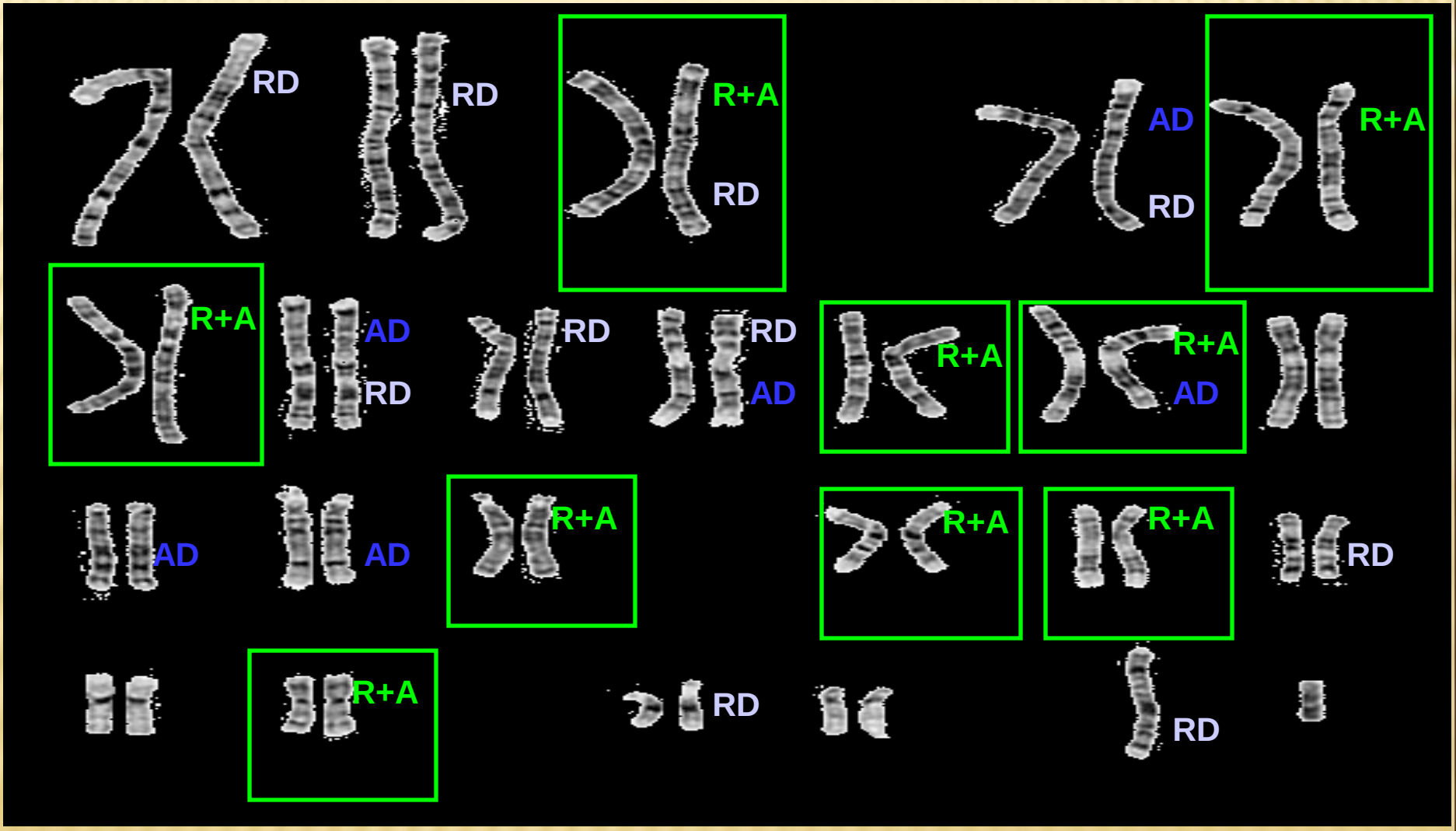


RD AND ADHD ARE COMORBID: WHY?

Rejected Hypotheses

- **Not a selection artifact: Comorbidity found in population samples (eg Willcutt & Pennington, 2000)**
- **Not a secondary phenocopy: Comorbid subjects have both EF and PA deficits (Willcutt et al, 2001), contrary to Pennington et al (1993)**
-

Possible Locations of Genes That Influence RD, ADHD, or both RD and ADHD



Measures

Latent Variable	Measures Used to Predict Latent Variable
Reading Ability	*Time limited word recognition task, PIAT Reading Recognition, & PIAT Spelling*
Inattention Symptoms	*Mother, Father, Teacher, & Examiner Ratings*
Hyperactive/Impulsive Symptoms	*Mother, Father, Teacher, & Examiner Ratings*
PA	*Phoneme Deletion (% correct, blocks 1 & 2), Pig Latin test, & the Lindamood Auditory Conceptualization task*
VR	*Information, Similarities, Vocabulary, & Comprehension from the WISC-R*
WM	*Nonword Repetition, Digit Span (Forward & Backward), Sentence Span & Counting Span*
Inhibition	*Gordon Diagnostic System commission errors (Vigilance & Distractibility), & Stop Signal Reaction Time from the Stop Task*
PS	*WISC-R Coding, WISC-III Symbol Search, Colorado Perceptual Speed Task,Identical Pictures, Trailmaking Test, Rapid Automatized Naming Task (Colors, Numbers, Letters, & Pictures) & Stroop Task (Word Naming & Color Naming)*

Note. For ADHD, mean severity ratings from each rater were used as the indicators. This strategy allows for more variance than the more typical strategy of defining ADHD using symptom counts.

Note. Errors from the same instrument (e.g., WISC Coding and Symbol Search) were allowed to correlate in both measurement models.

Results

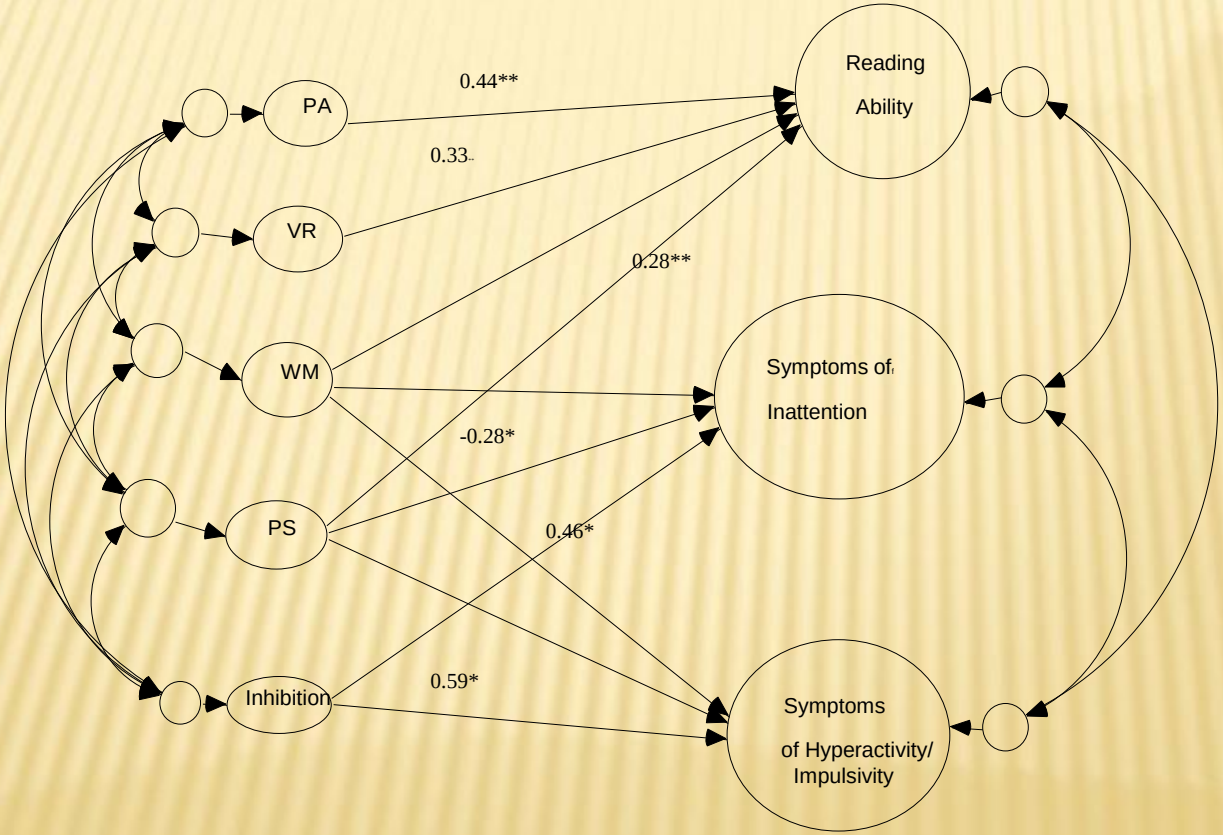
Measurement Model

The best fitting measurement model was one which created separate latent variables for the continuous symptoms of inattention and symptoms of hyperactivity/impulsivity ($\chi 2$ /df= 2.303, CFI= 0.986, RMSEA=0.045).

The measurement model for the latent variables of the the cognitive constructs was also a good fitting model ($\chi 2$ /df= 3.187, CFI= 0.915, RMSEA=0.059).

Full SEM Model

The full SEM model was also a good fit ($\chi 2$ /df= 2.63, CFI= 0.918, RMSEA=0.05



Predicting ADHD Symptoms (N=444)

	Adjusted R^2	R^2 Change	p
Processing Speed	.135	.137	.000
Inhibition	.174	.041	.000
SDRT	.187	.015	.006
Delay Aversion	.191	.006	<.10

Conclusions

1. No single cognitive deficit model of ADHD appears adequate.

2. DSM subtypes are not cognitively distinct, nor is pure Inattentive subtype.

3. Some combinations of executive and motivational deficits appear promising, but more work is needed.

4. A multiple cognitive deficit model helps explain ADHD's comorbidity with dyslexia.

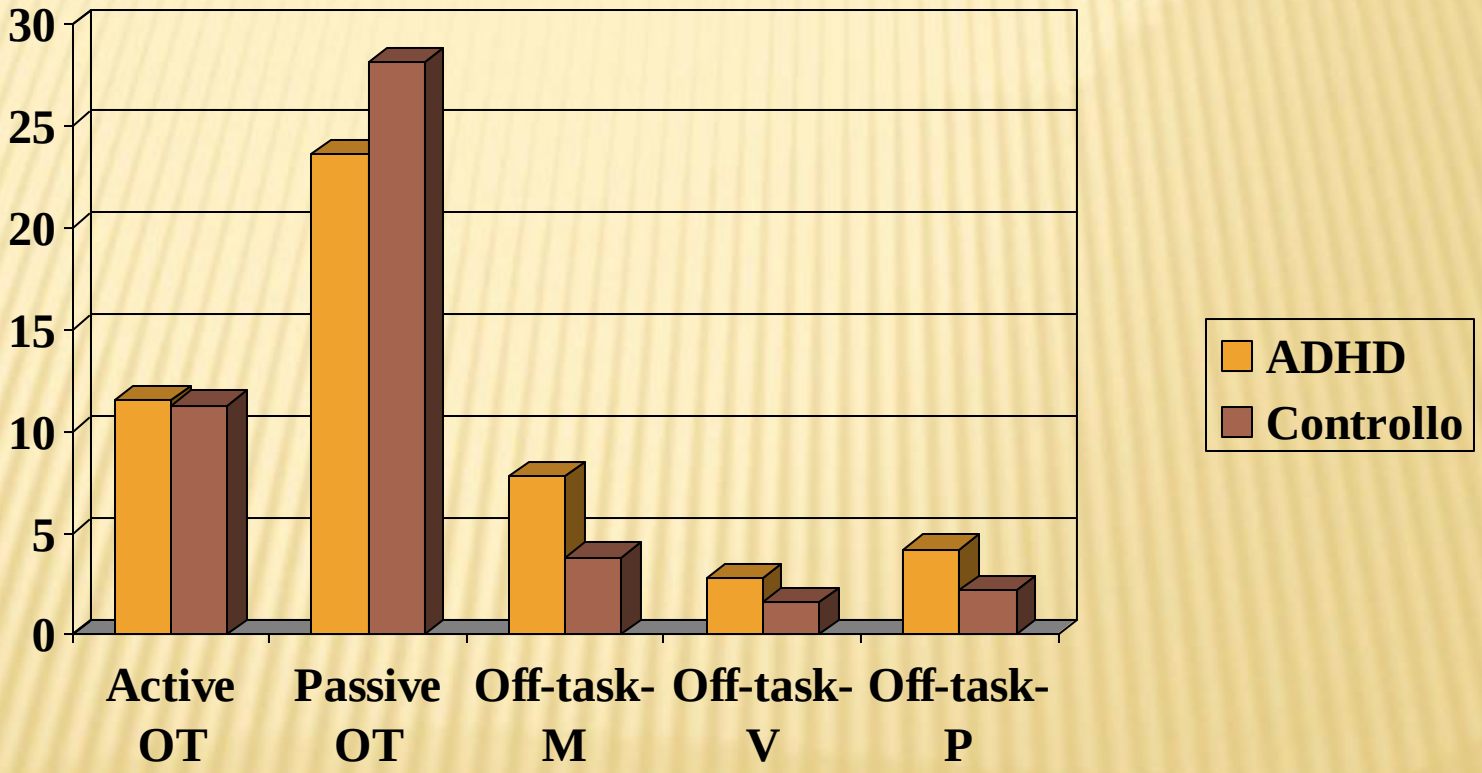
SCHOOL DIFFICULTIES IN ADHD?

- Disruptive behaviors
- Low effort/low attention
- Low accuracy
- Poor achievement
- Social problems

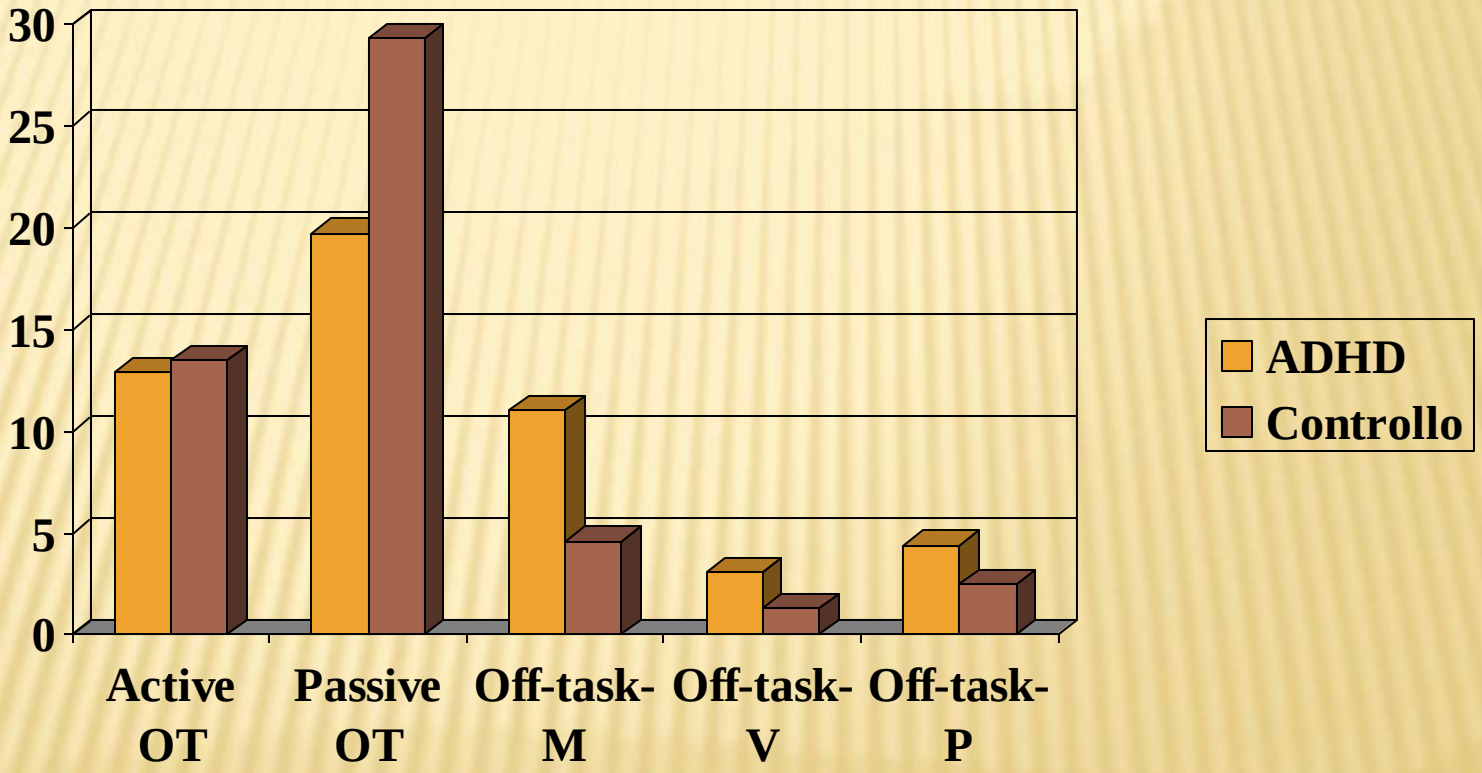
PROJECT PASS:

- Firts to fourth graders Palestinian
- N = 87 ADHD
- N = 38 controls

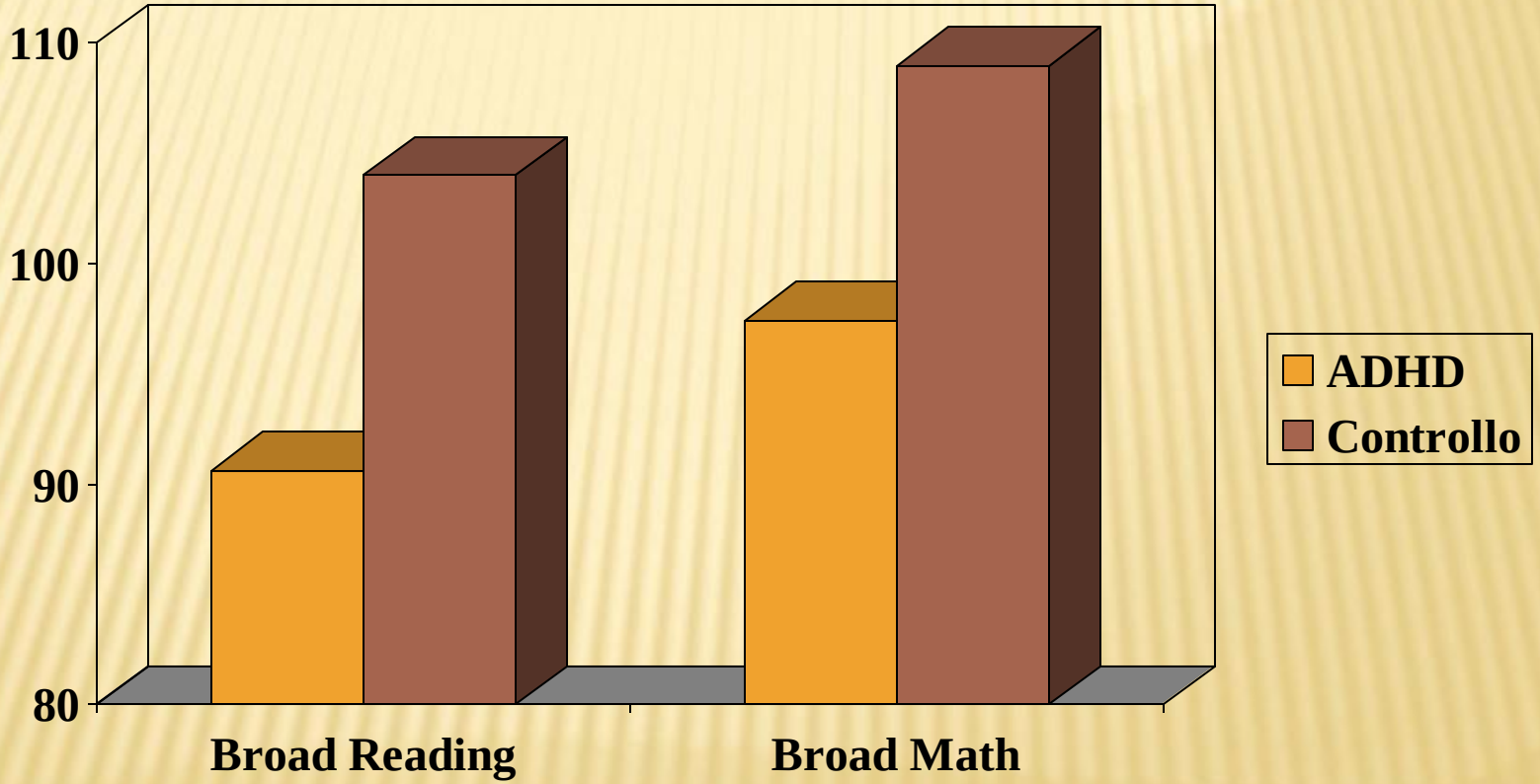
CHILDREN'S ON-TASK (OT) AND OFF-TASK BEHAVIORS DURING READING



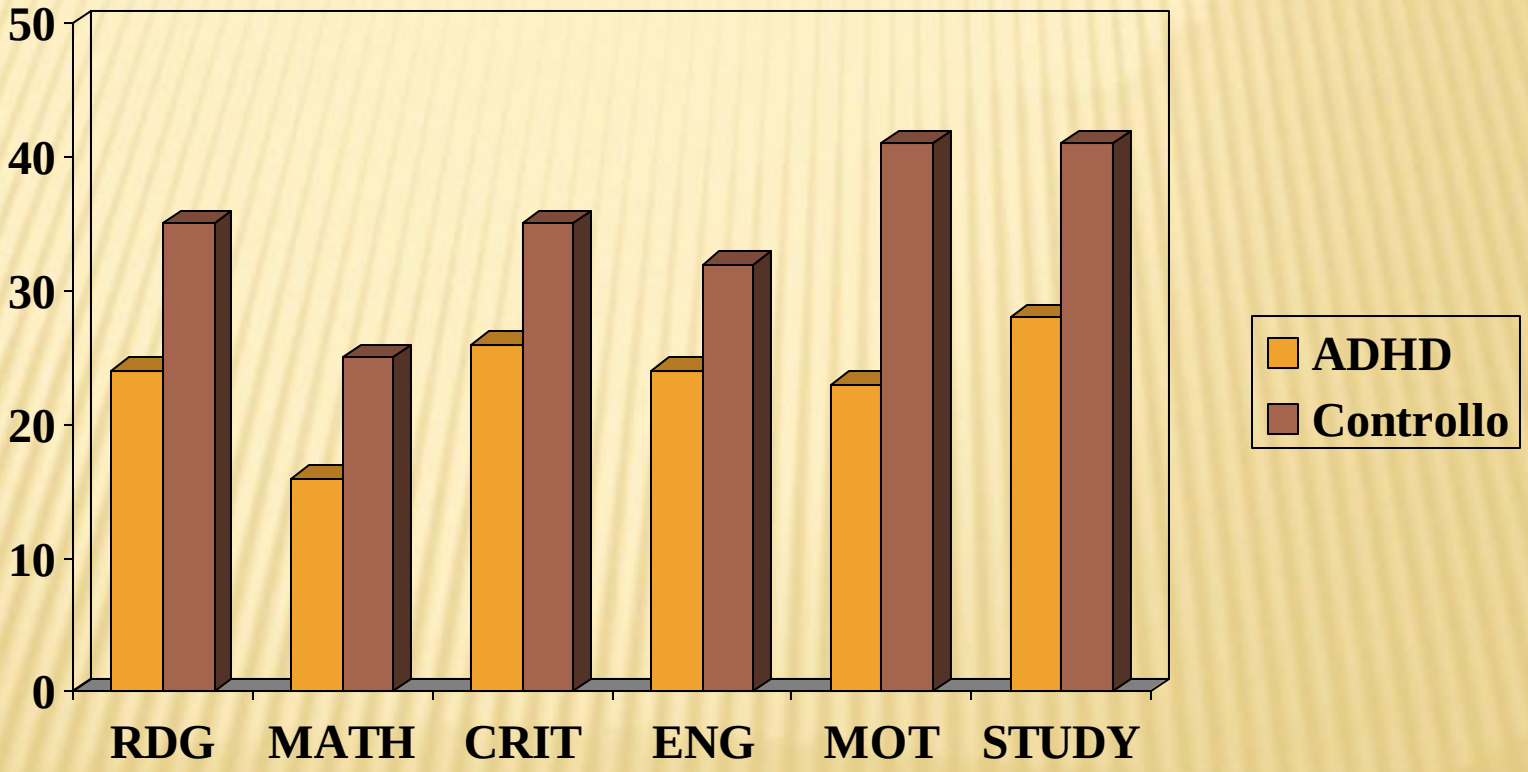
DURING MATH


30
25
20
15
10
5
0
Active OT
Passive OT
Off-task-M
Off-task-V
Off-task-P
ADHD
Controllo

PROJECT PASS: WJ-III ACHIEVEMENT TEST SCORES



TEACHERS ASSESSMENT



WRITING: PADOVA PROJECT

STUDY 1

Objective

Compare general writing skills of ADHD children and their peers

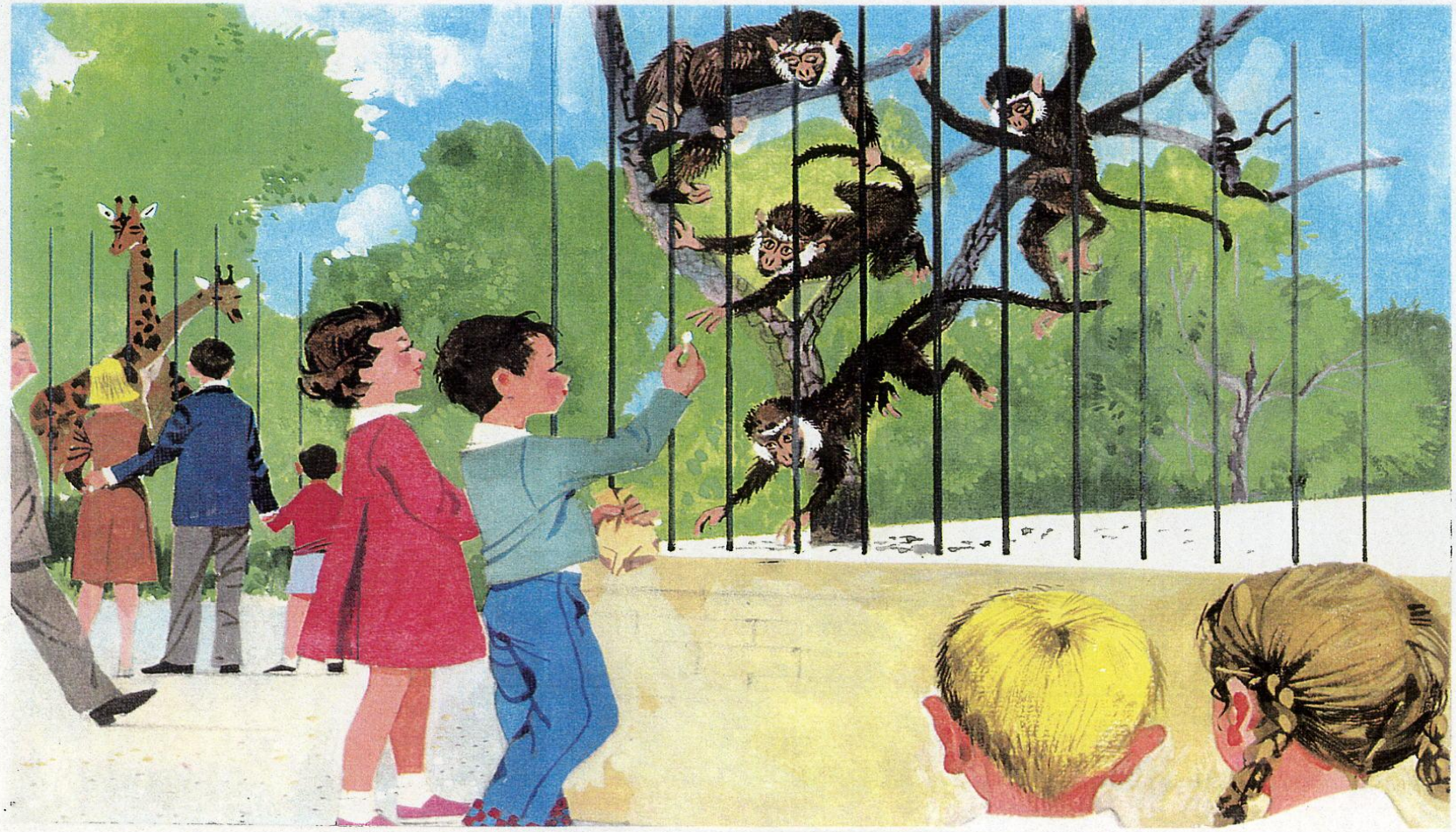
Participants

24 ADHD children and 24 controls (17 males and 7 females) of secondary school, matched for age, IQ, gender, social and cultural background, no children with other behavioural problems (ODD and/or CD)

Tasks

1) A speed of writing task
2) Expressive writing task: Description of an image

Imagine that you have been at the zoo and you have to describe the scene you see in the picture to some friends who were not there



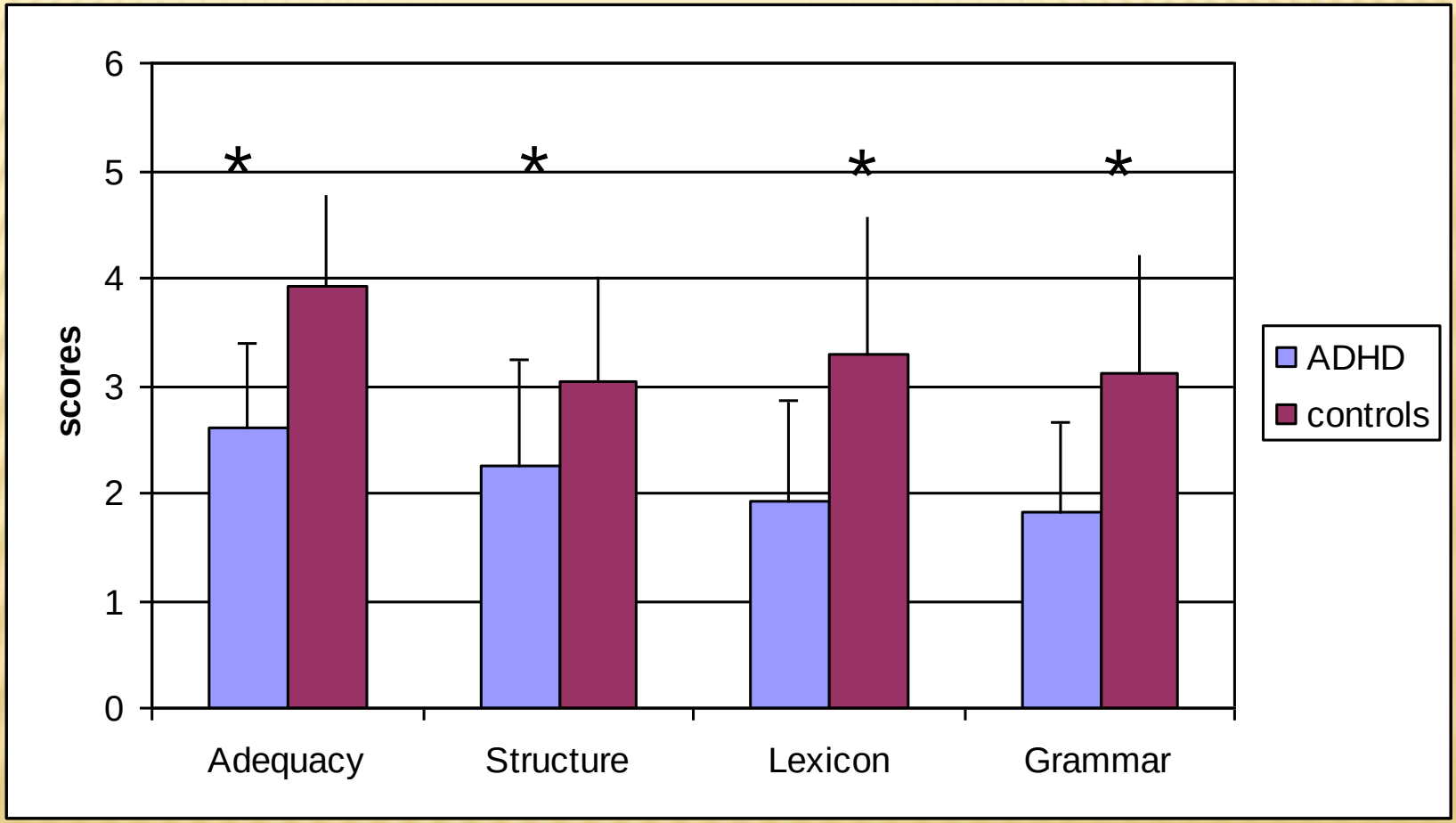
"Batteria per la valutazione delle competenze ortografiche nella scuola dell'obbligo" (Tressoldi & Cornoldi, 1991)

DEPENDENT VARIABLES

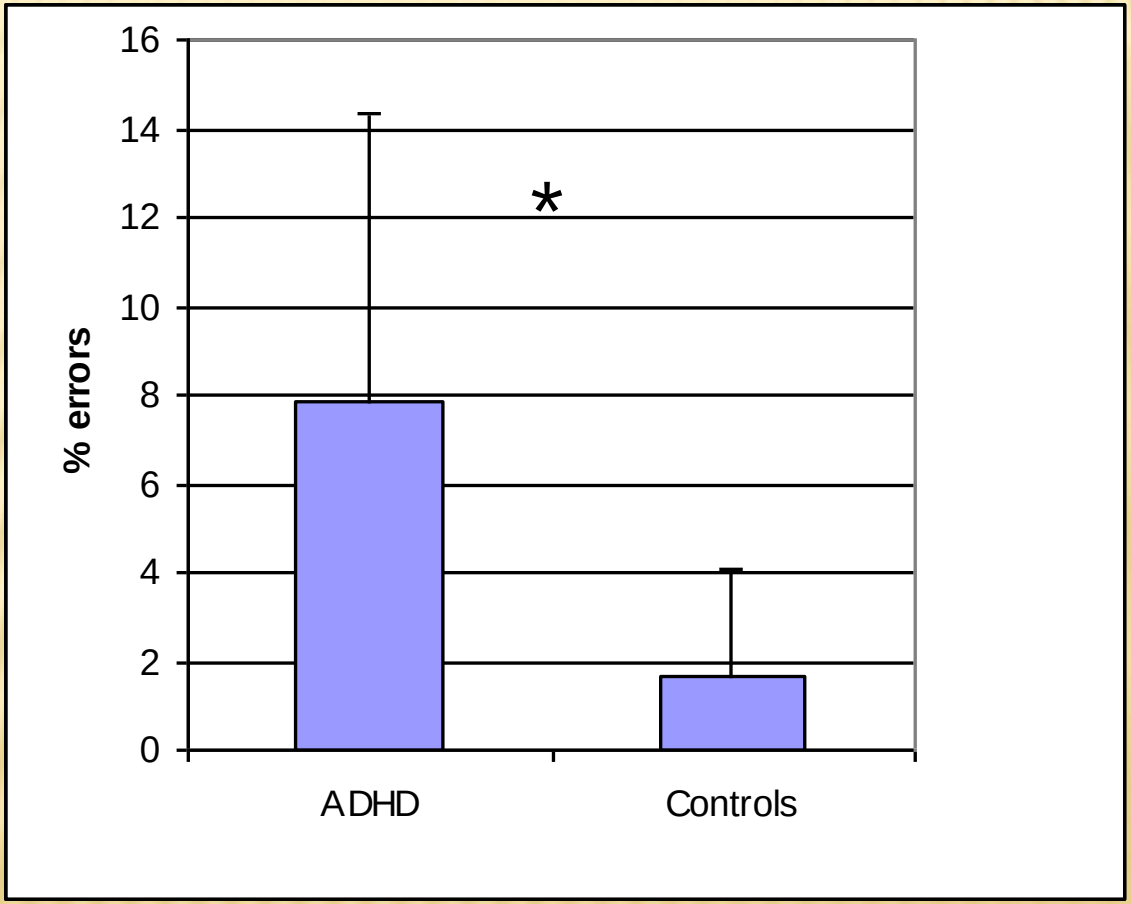
1) Variables related to the quality of the text (rated by two independent blind raters):
   - **Adequacy**, defined as the adequacy of the written text with respect to the task request
   - **Structure**, based on the organisation of the text
   - **Lexicon**, defined as the richness and adequacy of the used vocabulary
   - **Grammar**, concerning the correct use of punctuation and the tenses of verbs, correct concordance between gender and number of nouns, verbs and adjectives, appropriate syntactical organisation

2) Quantitative parameters:
   - The length of the essay (**total number of words**)
   - The **percentage of errors**

QUALITY OF THE TEXT: ADHD VS CONTROLS



PERCENTAGES OF ERRORS: ADHD VS CONTROLS



STUDY 2

Objective

- Examine whether children with ADHD had problems in expressive writing when their productions were prompted by detailed verbal instructions

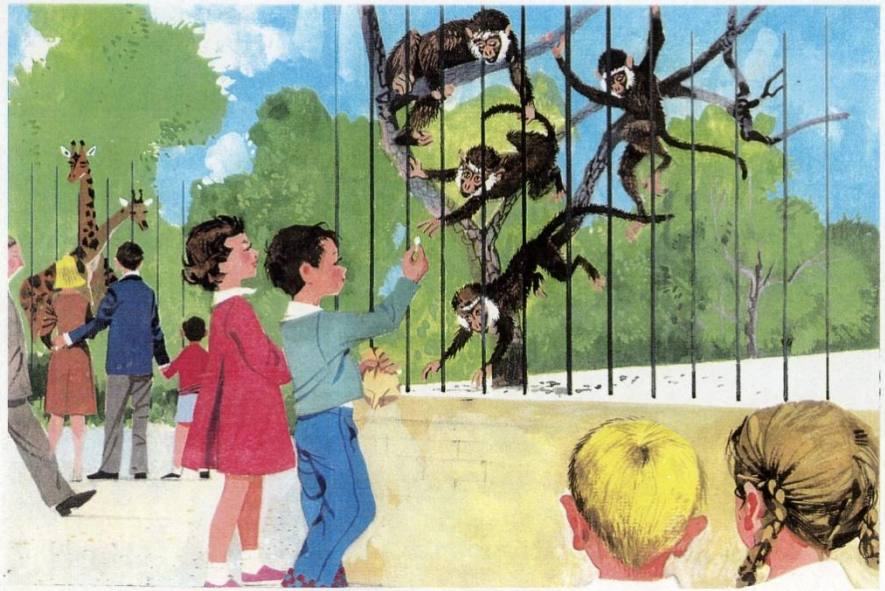
Participants

- 2 groups (ADHD and Controls) of 163 children of primary school (130 males and 33 females), matched for age, IQ, sex, social and cultural background, no children with ODD and CD, no children with reading or mathematical impairments

Tasks and procedure

- 2 description tasks, one with image (as in Study 1) and the other with verbal instructions
- Stimulus modality (verbal instructions vs. picture) and order of presentation of the situation (zoo with monkeys vs. zoo with parrots) were counterbalanced across participants

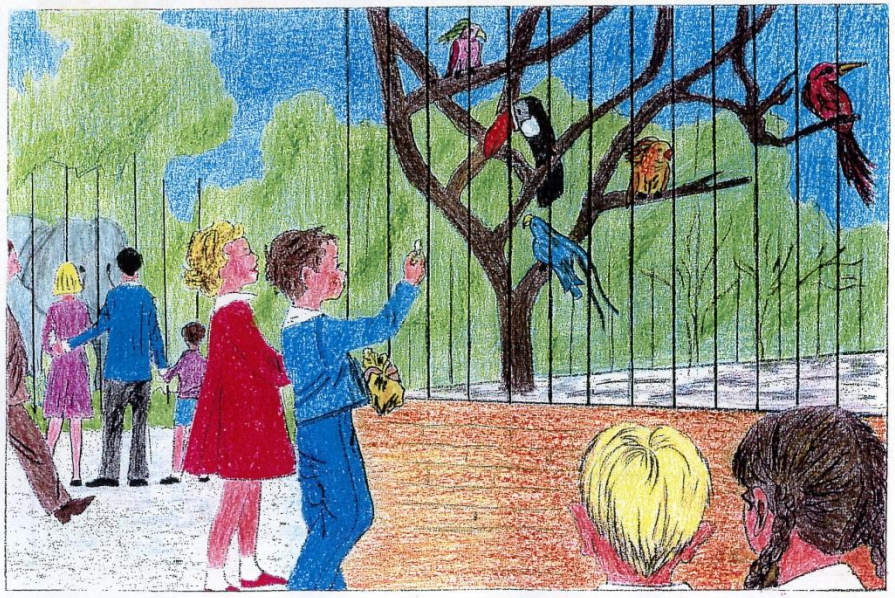
Immagina di essere stato allo zoo e di dover descrivere la scena che vedi nell'immagine a dei tuoi amici che non vi sono stati.



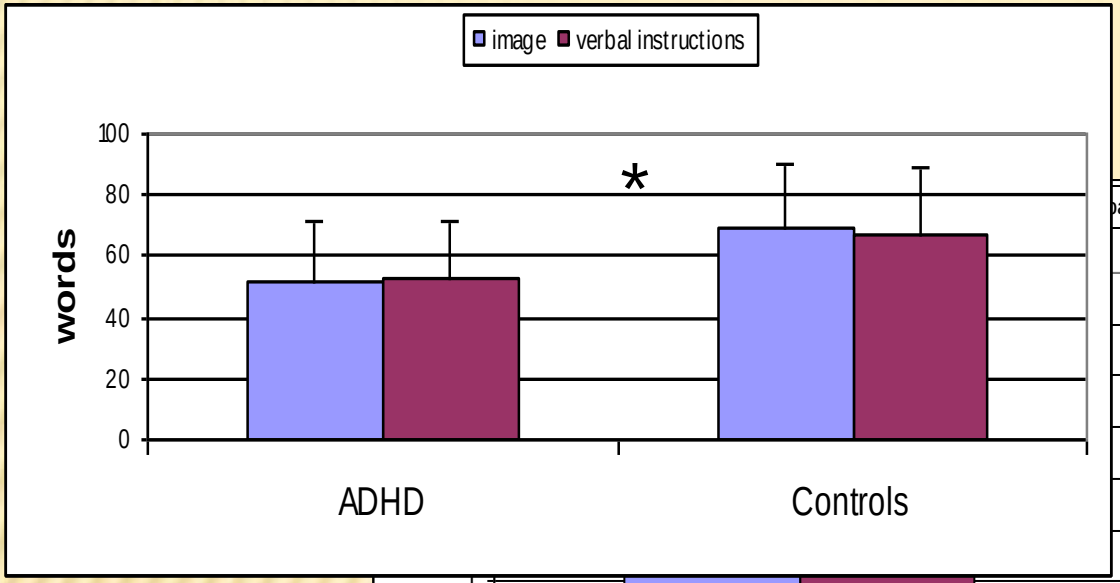
Try to image that you and another child have visited the zoo, where there were a lot of people and animals. At one point you stopped in front of a cage where there were many nice monkeys

Try to image that you and another child have visited the zoo, where there were a lot of people and animals. At one point you stopped in front of a cage where there were many parrots of different colours

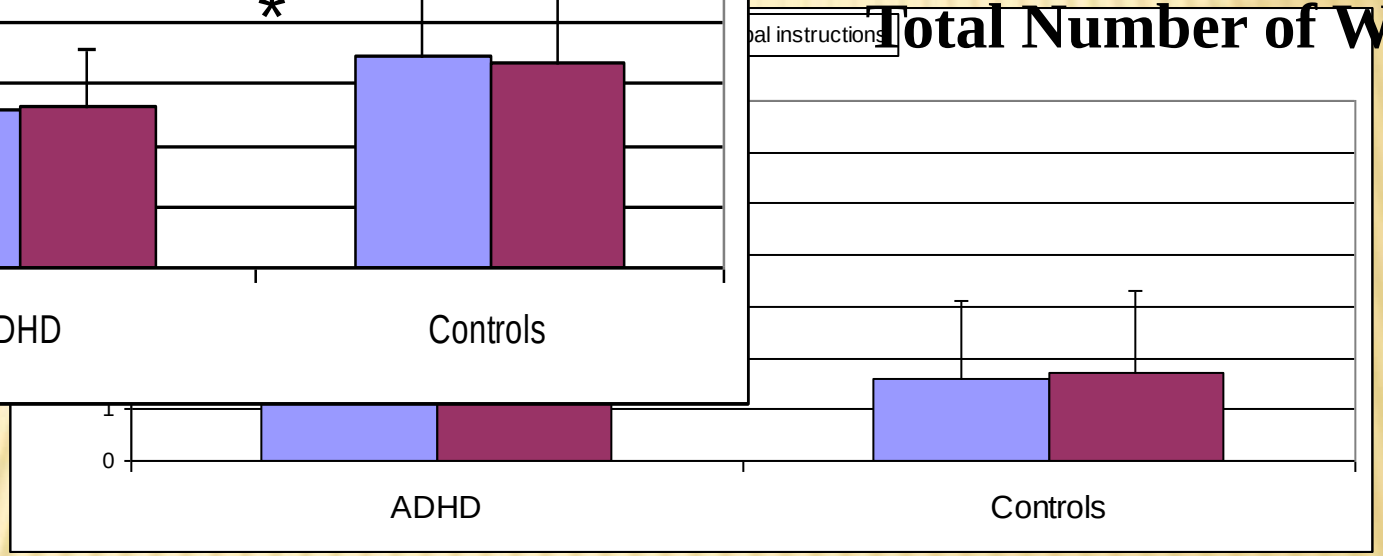
Immagina di essere stato allo zoo e di dover descrivere la scena che vedi nell'immagine a dei tuoi amici che non vi sono stati.



Text length and Percentages of Errors: ADHD vs Control



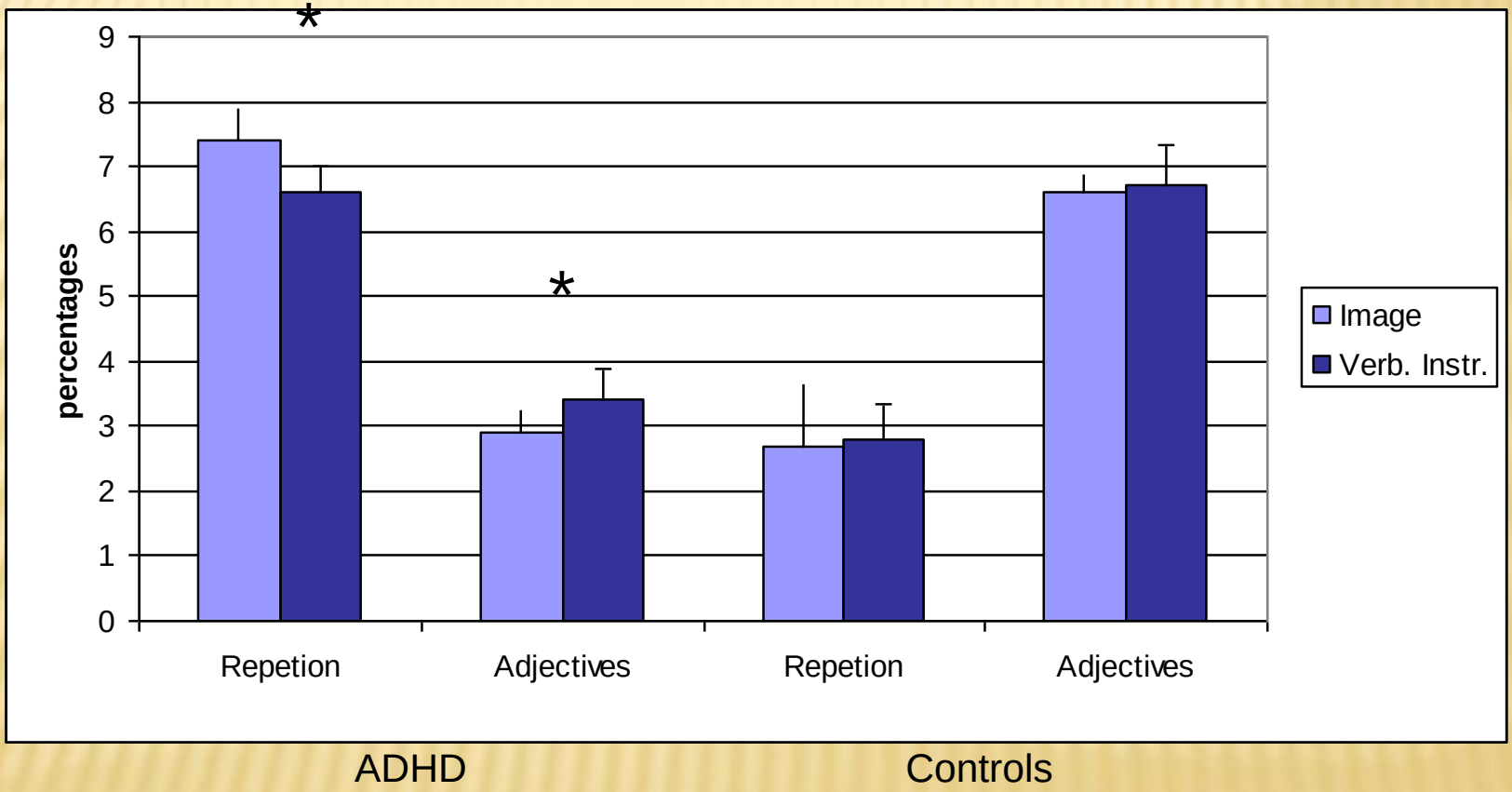
Total Number of Words



Total Errors

*

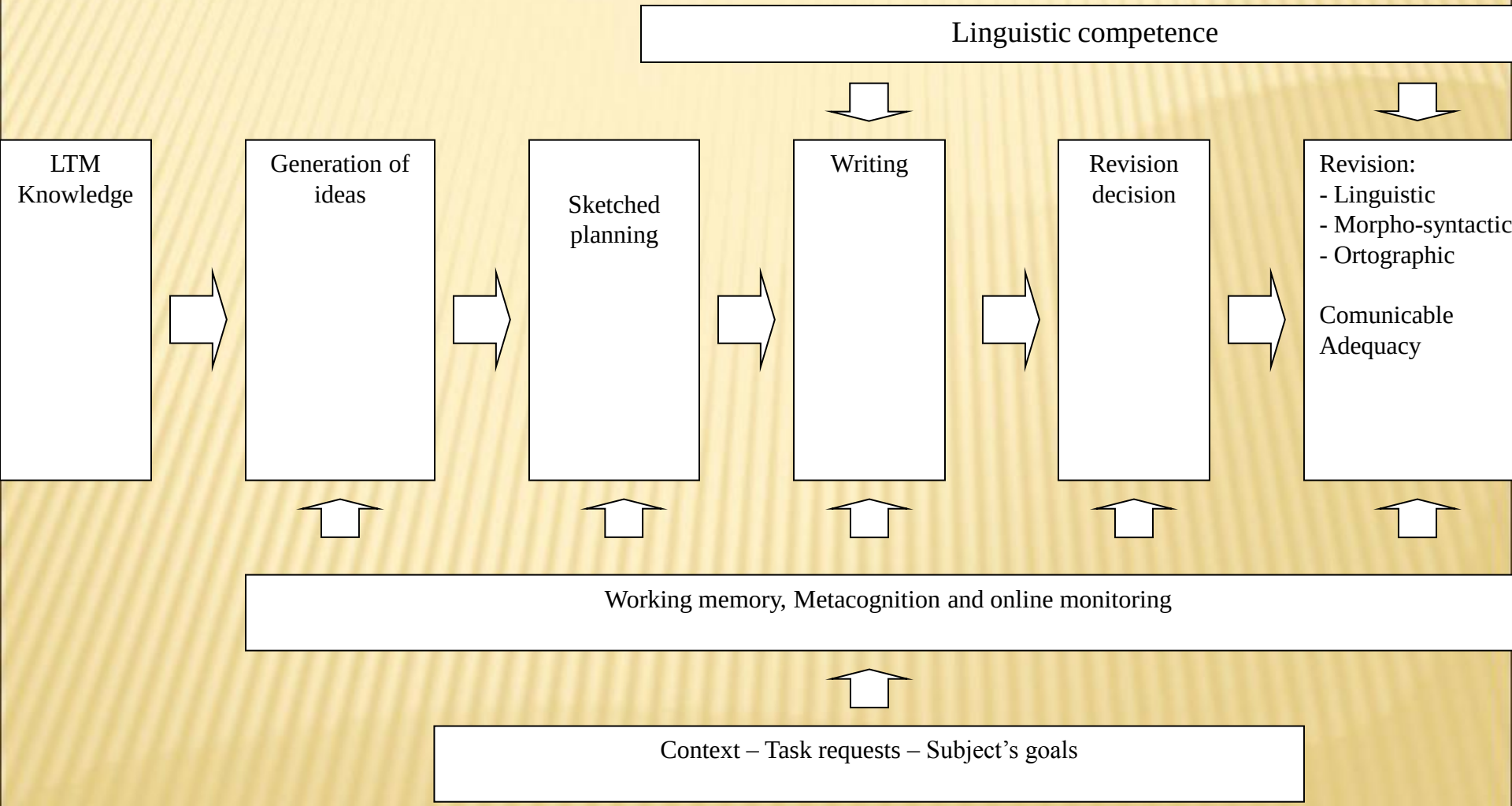
ADJECTIVES AND REPETITIONS: ADHD VS CONTROL

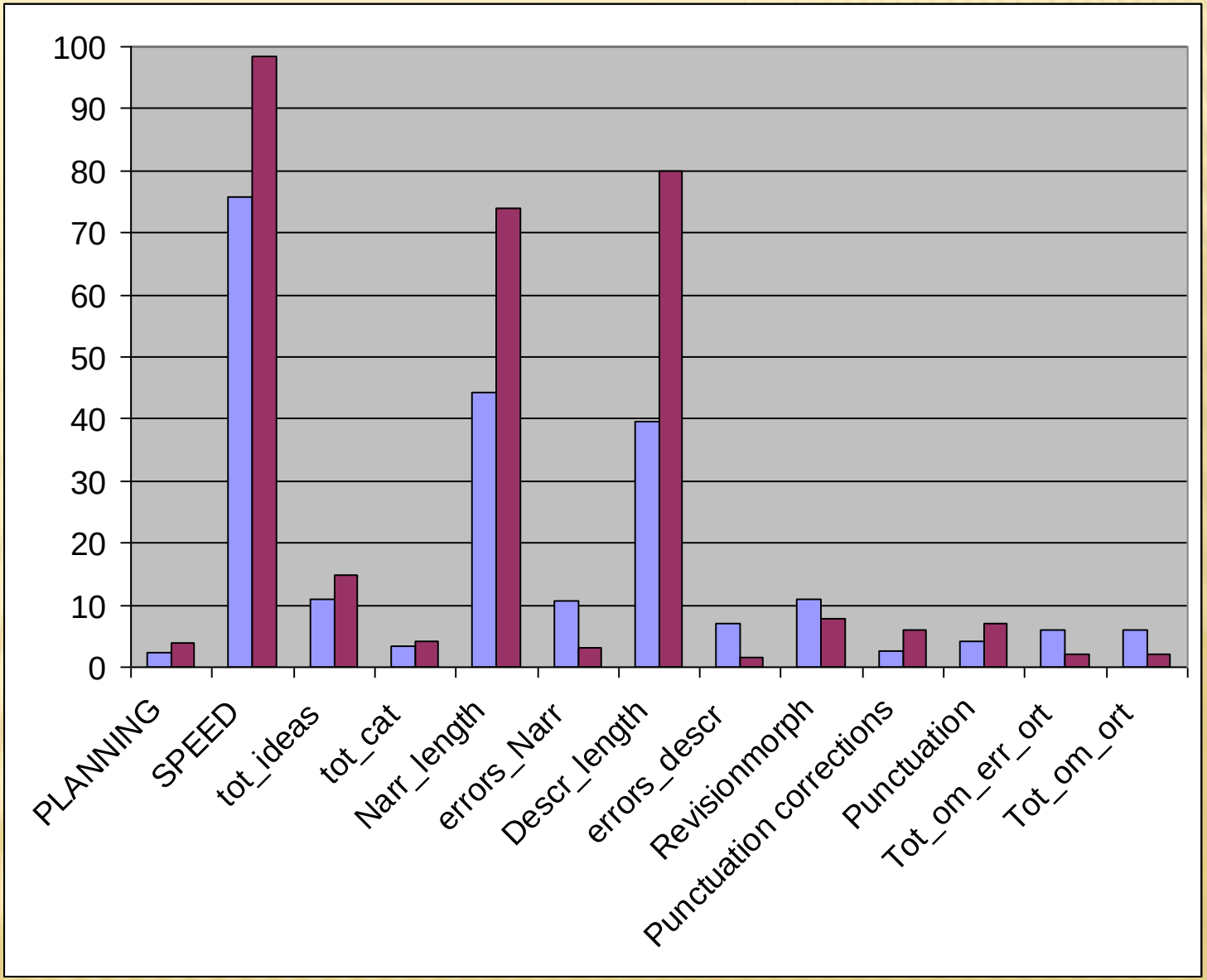


STUDY 2: CONCLUSION

- ADHD children wrote less and worse than controls
- ADHD children made more errors than controls
- Children of both groups did not take a great advantage from verbal instructions
- In the condition with verbal instructions, ADHD children improved the quality of their texts by increasing the number of adjectives and reducing the number of repetitions

A REVISED MODEL




100
90
80
70
60
50
40
30
20
10
0
PLANNING
SPEED
tot_ideas
tot_cat
Narr_length
errors_Narr
Descr_length
errors_descr
Revisionmorph
Punctuation corrections
Punctuation
Tot_om_err_ort
Tot_om_ort

SCHOOL INTERVENTION FORADHD

- Context and Antecedent manipulation
  - Emphasize rules
  - Make more explicit the instructions
  - Adapt the work load
  - Give the possibility of choosing
  - Favour peer tutoring and cooperative learning

SCHOOL INTERVENTION FORADHD (CONT.)

- Manipulation of consequences
  - Token
  - Verbal reinforcements
  - Esponse cost
  - Time Out
  - Self-management