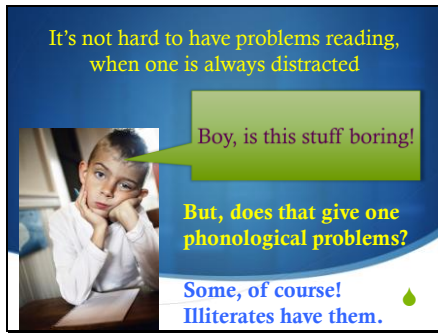


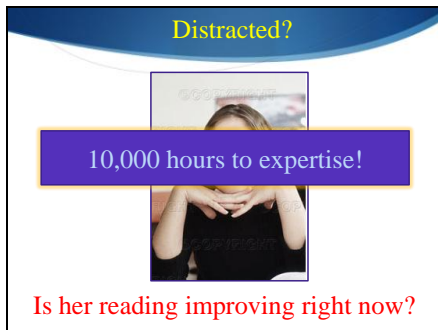
Slide 4



Slide 5




Slide 6



Slide 7

It's not hard to get irritable, tired and distracted when trying to read "Chinese"



好一朵美丽的茉莉花
好一朵美丽的茉莉花
芬芳洁白人人爱
让我来将你摘下
送给别人家
茉莉花呀茉莉花

But, does that make you hyperactive and impulsive?

Maybe some, if one gets frustrated enough.

Slide 8

HOWEVER...

- ◆ Whereas dyslexia occurs in about 5-10%
- ◆ And ADHD occurs in about 5-10%
- ◆ And random occurrence predicts 0.25-1%
- ◆ Comorbidity has been reported to occur in 10-92% (92%???) – **10-368 times predicted!**

Slide 9

HOW TO EXPLAIN THIS?

- ◆ Dyslexia & ADHD have a common cause*
- ◆ ADHD causes Dyslexia
- ◆ Dyslexia causes ADHD
- ◆ **ADHD + RD, but not Dyslexia**
- ◆ Dyslexia + AttD, but not ADHD
- ◆ *Namely genetic – Implied preferred explanation


Slide 10

Maybe also true for comorbidities with other disorders...ADHD are bad in math too!

- ◆ Attention Deficit Disorder c/s Hyperactivity
- ◆ Developmental Social Disorders (ASD)
- ◆ Developmental Dyslexia (RD)
- ◆ Developmental Prosopagnosia
- ◆ Developmental Dyscalculia
- ◆ Developmental Gerstmann Syndrome
- ◆ Developmental Apraxia/Dyspraxia
- ◆ Specific Language Impairment

Slide 11

Some clinical observations
ADHD



Slide 12


ADHD

- ◆ Difficulty attending and concentrating
- ◆ Difficulty shifting attention
- ◆ Forgetfulness
- ◆ Hyperactivity
- ◆ Impulsivity
- ◆ Executive dysfunction
- ◆ Reading difficulties

Slide 13

Concentrating


- ◆ Easily distractible – start all over again
- ◆ Poor listener – interpersonal problems
- ◆ Forgetful – “I forget what I wanted to say”
- ◆ Leaves work unfinished – switches
- ◆ Takes longer to complete tasks
- ◆ “Say that again?”



Slide 14

Shifting Attention

- ◆ “I was so into the show, I missed my class”
- ◆ “I didn’t hear my mother calling me”
- ◆ “My two-page paper ended up 15 pages long”



Slide 15

Forgetfulness


- ◆ “I don’t remember her telling me to...”
- ◆ “I forgot what I went to get upstairs”
- ◆ “I don’t remember anything I read”
- ◆ “Where was I?”
- ◆ “Who are you?”



Slide 16

Hyperactivity


- ◆ Off the wall
- ◆ "My mind goes a thousand miles an hour"
- ◆ Fidgety
- ◆ Restless



Slide 17

Impulsivity

- ◆ "I didn't need it; why did I buy it?"
- ◆ "I thought I could make it across the street"
- ◆ Blurts out answers
- ◆ Interrupts



Slide 18

Stroop-3: "I hate this test"

red	white	green	brown
green	red	brown	white
white	brown	green	red
red	white	green	brown
brown	green	white	red
white	brown	red	green
green	white	brown	red
red	brown	green	white

Slide 19

Executive Function


- ◆ "I can't plan for anything"
- ◆ "I put my shoes on before my socks"
- ◆ "There is no order in my head"



Slide 20


Reading Difficulties

- ◆ "I read a sentence over and over again"
- ◆ "I don't remember what I read"
- ◆ Careless errors
- ◆ "I get to the bottom of the page and I have just gone through the motions"
- ◆ "I hate to read; I have read very little"



Slide 21

Some Clinical Observations
Dyslexia



Slide 22

Dyslexia

- ◆ Difficulty attending task dependent – reading
- ◆ Hyperactivity – no
- ◆ Impulsivity – no; Stroop-3 is easy
- ◆ Executive dysfunction – task dependent
- ◆ Reading difficulties – of course

Slide 23

Reading Difficulty

- ◆ Reading slow and laborious
- ◆ Trouble decoding words
- ◆ Concentration to get clues without reading
- ◆ Guessing
- ◆ Tiring
- ◆ Looking for excuses to stop

Slide 24

If dyslexia & ADHD are co-morbid...

- ◆ Why are the affected not all of these?
 - ◆ Hyperactive
 - ◆ Dysexecutive
 - ◆ Inattentive for everything
 - ◆ Impulsive
 - ◆ Phonologically impaired
 - ◆ Forgetful
 - ◆ Annoying

Slide 25

Because the comorbidity is grossly overestimated

Slide 26

Literature

- ◆ Reading predicts for inattention and *vice versa*, but inattention's predicting for reading is much stronger.
- ◆ Inattention is a stronger predictor for reading than hyperactivity and impulsivity.
- ◆ RD > non-RD for "symptoms" of ADHD, but mostly inattention, not hyperactivity and impulsivity
- ◆ Studies overestimate co-morbidity (Semrud-Clikeman *et al.*)

Slide 27

Literature

- ◆ Children with ADHD c/s RD have more hyperactivity and antisocial behaviors than RD alone but not than ADHD alone
- ◆ EEG of ADHD s. RD and ADHD c. RD differ, but are both more like the EEG in pure ADHD than pure RD
- ◆ Performance lapses in ADHD inversely correlate with reading fluency
- ◆ Dyslexia pure → phonological and time perception problems;
ADHD pure → executive functions and time perception problems;
RD+ADHD → time perception problems, executive functions and phonological problems. But... (Snowling's group)

Slide 28

Literature

- ◆ **Interesting:** Both RD and ADHD have problems at the orthographic and phonological levels, and RD is worse than ADHD and than RD+ADHD. You'd think that the opposite should be true! Hypothesis: RD pure has more dyslexics than RD+ADHD
- ◆ **Possible resolution:** Willcutt *et al.*, 2010: RD and ADHD differ fundamentally from one another. The only factor they share is slow processing speed, which the authors attribute to genetics, but...
- ◆ Attention/hyperactivity/impulsivity link up to a marker on chromosome 6p, and so does dyslexia, but there is no overlap between them

Slide 29

Literature

- ◆ No evidence that ADHD/RD display non-random mating, but the authors suggest a genetic overlap. Gene by environment interactions influencing reading disability and the inattentive symptom dimension of attention deficit/hyperactivity disorder. **But, can we say that this is dyslexia/ADHD comorbidity?**
- ◆ ADHD+RD: Gene overlap: 2.5 with an ADHD sample (16p, 17q, $\pm 10q$) and 1.0 for RD (2p). **So, there are sites for ADHD+RD and sites for RD alone, but no sites for ADHD alone.**

Slide 30

In Conclusion

- ◆ Clinical observations support the notion that ADHD is accompanied by reading difficulties that attentionally based, and
- ◆ Dyslexia is accompanied by task specific attention problems without hyperactivity and impulsivity
- ◆ The overlap of symptoms is too small to call it ADHD+Dyslexia comorbidity. It is instead ADHD+RD and RD+AttD, and these can be genotypically linked
- ◆ Dyslexia+ADHD must occur together occasionally, but no evidence has been shown to me that says that such overlap is not purely random

Slide 31