Learning difficulties in oral and written language in children with SLI

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http://www.psy.ox.ac.uk/oscci/

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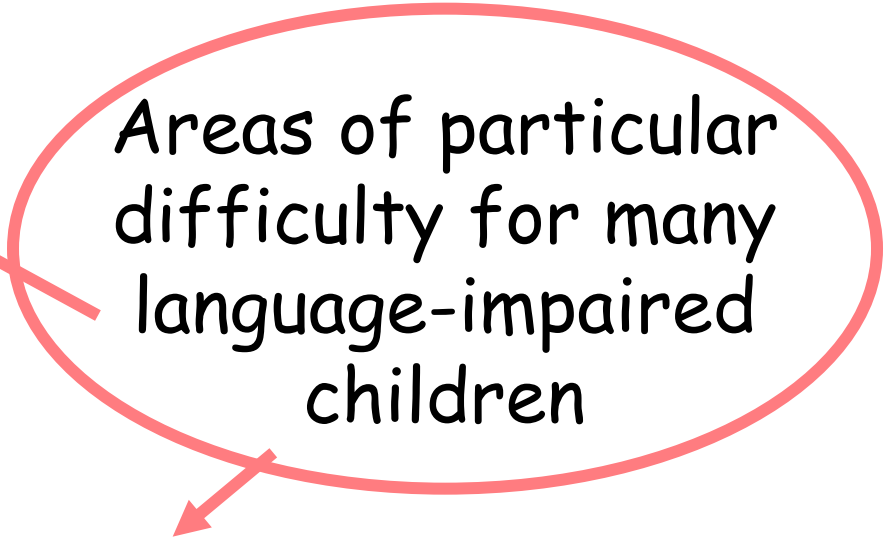
Specific language impairment (SLI)

- Language does not follow normal developmental course
- Normal development in other areas
- Not due to hearing loss, physical abnormality, acquired brain damage

Aspects of language structure

- Phonology
  - speech sounds
- Syntax
  - word order
  - grammatical morphology



Grammatical tense/agreement: an area of especial difficulty

- Omission of 3rd person singular
  - e.g. Every day my brother walk to school
  - He like chocolate
- Omission of past tense -ed
  - e.g. Yesterday I walk to school

Specific reading disability (SRD) (developmental dyslexia)

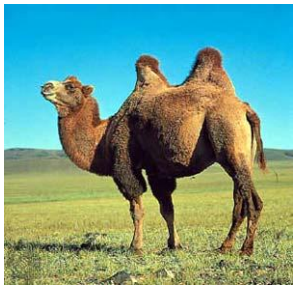
- Unusual difficulty in learning to read
- Not due to hearing loss, physical abnormality, acquired brain damage, or lack of opportunity
- Normal intellectual development

Cognitive neuroscience approach

Specify underlying nature of impairment in terms of model of normal function, using evidence from

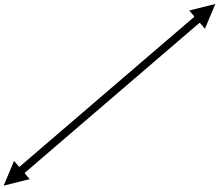
- Pattern of difficulties
- Tasks beyond those used to define disorder

Decomposing the task of learning to read



Animal
Lives in desert
Has hump(s)
etc.

lexical representation



/'kaml/

phonological representation

Decomposing the task of learning to read

Animal
Lives in desert
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lexical representation

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phonological representation

CAMEL

orthographic representation

Decomposing the task of learning to read

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CAMEL

orthographic representation

"Indirect" route to word reading

Convert letters into sounds to achieve pronunciation

CAMEL

/k/+/a/+/m/+/ɛ/+/l/

/kamɛl/

Two routes to word reading

Animal
Lives in desert
Has hump(s)
etc.

lexical representation

Direct route

Indirect route

/'kaml/

CAMEL

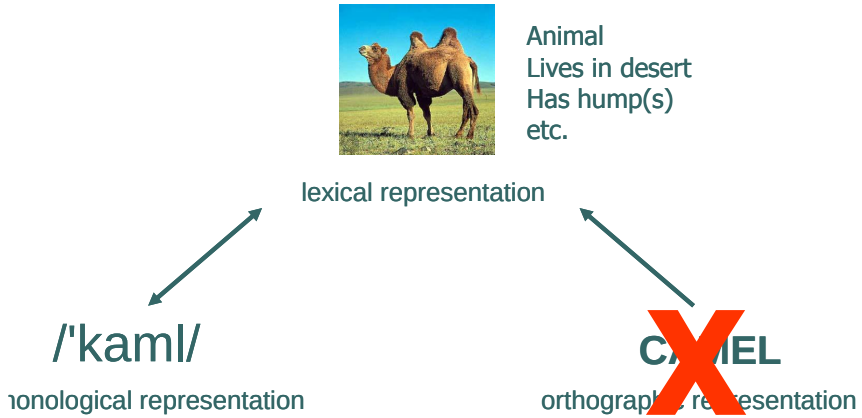
phonological representation

orthographic representation

Coltheart, M. (2005). Modeling reading: the dual route approach. In M. J. Snowling & C. Hulme (Eds.), *The science of reading: a handbook* (pp. 6-23). Oxford: Blackwell.

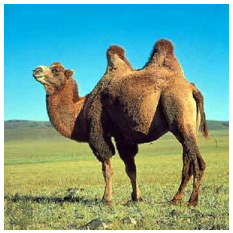
Which aspects are impaired in developmental dyslexia?

- Common belief that dyslexia is a visual disorder – problems with reversing b/d



Singleton, C., & Henderson, L.-M. (2007). Computerized screening for visual stress in children with dyslexia. *Dyslexia, 13*, 130-151.

Problems with mappings between orthography and lexicon



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lexical representation

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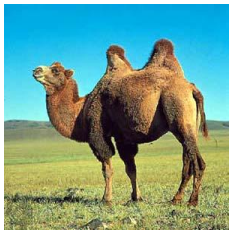
Surface dyslexia:

Key symptom – difficulties in reading irregular words, e.g. YACHT

Problems with mappings between orthography and phonology



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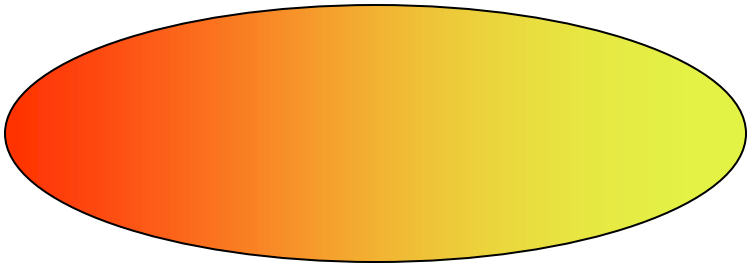
CAMEL

orthographic representation

Phonological dyslexia:

Key symptom – difficulties in reading nonwords, e.g. ZUG

“Phonological awareness”: ability to identify individual speech sounds in syllables

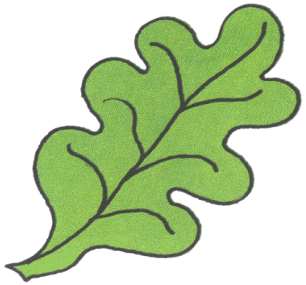
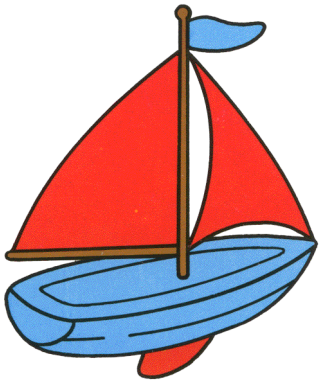


p i n

Phonological awareness task

(Introducing monster): This is ‘Bill’.
He likes things that sound like the first sound of his name. Which do you think he will choose?
The cake, the jug, the leaf or the boat?

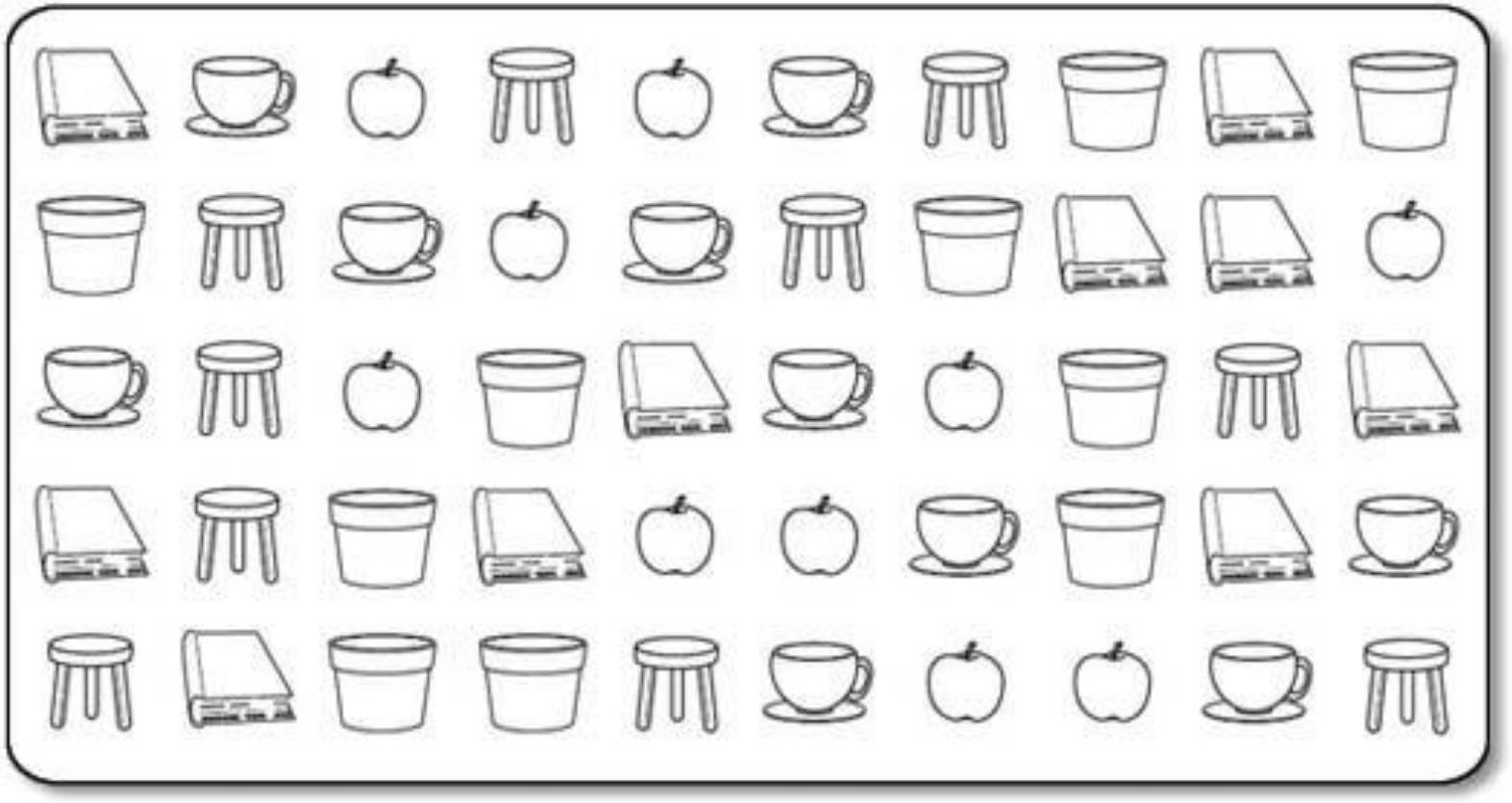


Oral language deficits in dyslexics:Poor phonological processing

- Phonological awareness deficits
- Poor at nonword repetition
- Slow at naming familiar items

Example of rapid naming task



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lexical representation

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phonological representation

CAMEL

orthographic representation

Ricketts, J., Bishop, D. V. M., Pimperton, H., & Nation, K. (2011). The role of self-teaching in learning orthographic and semantic aspects of new words.

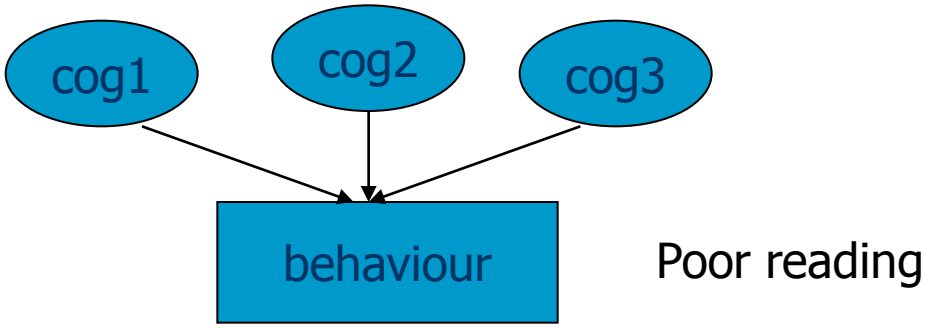
Scientific Studies of Reading, 15, 47-70.

Learning new words

Vindy thinks the best animal is the lork. She likes the lork because it runs around a lot. Vindy goes to the zoo. She goes to see the lork first. The lork gets fed at noon.

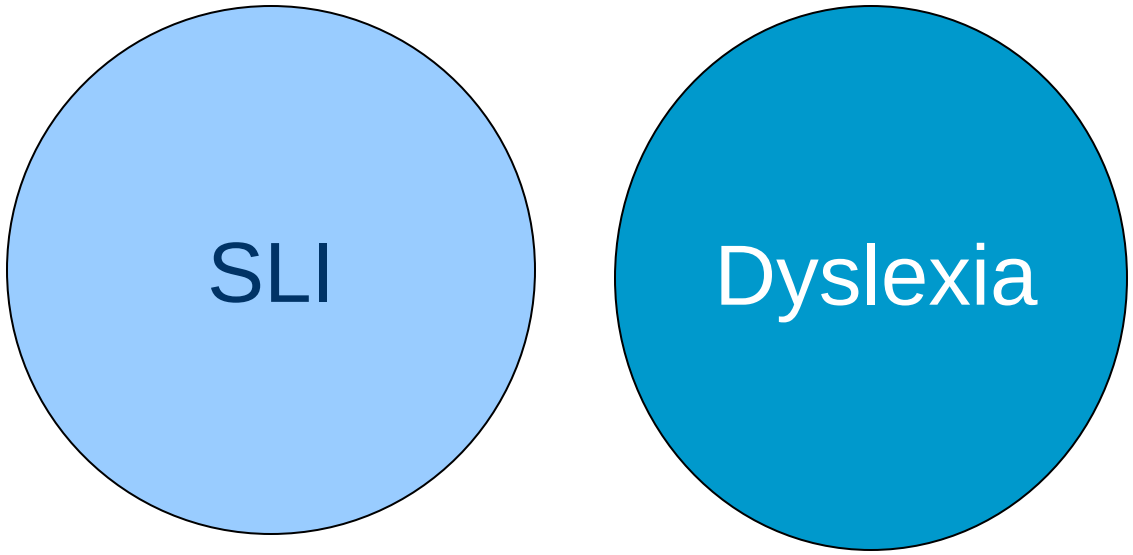
Cognitive analysis: insights

- Same behaviour can be caused by different underlying problems



- Developmental dyslexia usually a language problem rather than visual disorder

Traditionally, considered as separate disorders



Studied by speech and language therapists

Studied by educators/ psychologists

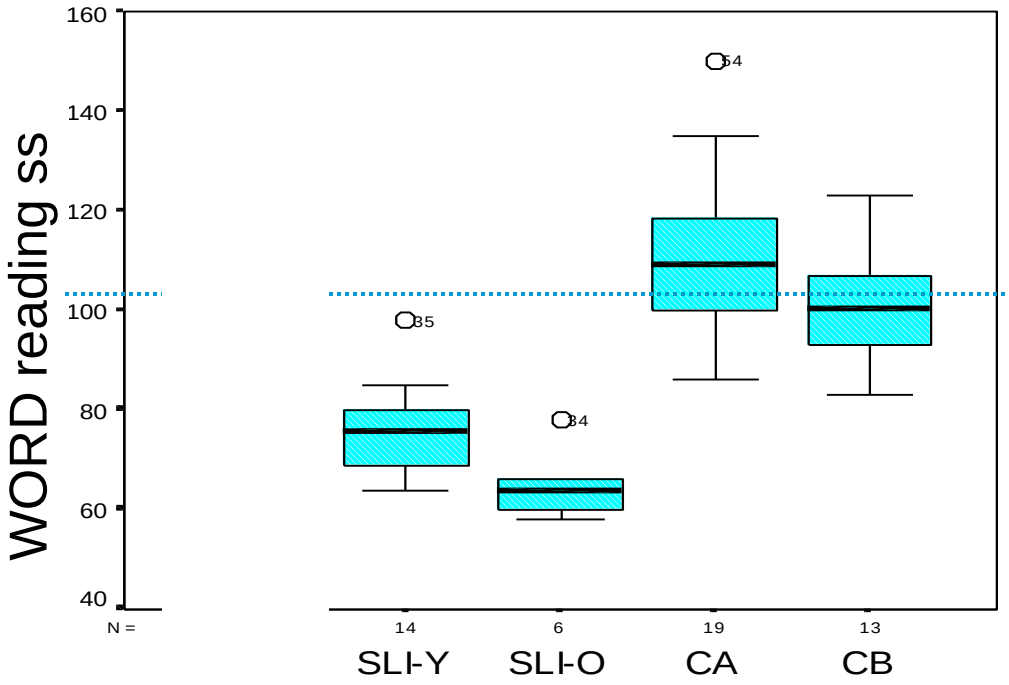
Association between SLI and poor literacy skills

data from Briscoe et al, 2001

CA and CB: control

HI: hearing impaired

SLI-Y and SLI-O:
older and younger SLI



Association between dyslexia and oral language impairment

- Language delay more frequent in dyslexic than controls (e.g. Naidoo, 1972)
- McArthur et al (2000): 61/110 children with specific reading disability scored more than 1 SD below average on CELF-R

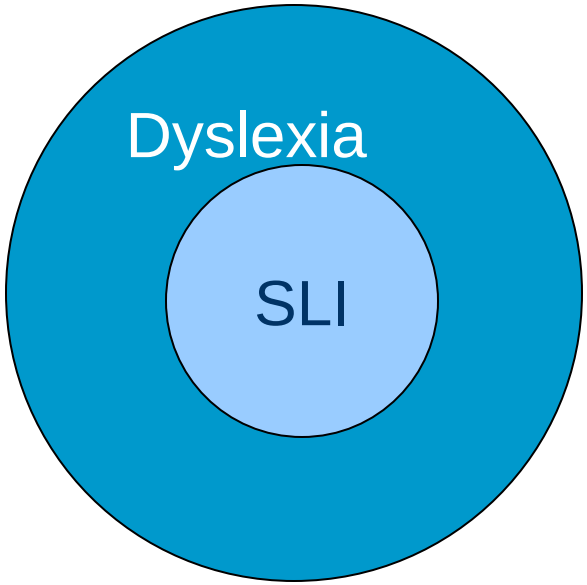
High-risk studies

Gallagher et al, 2000; Lyytinen et al, 2001

- Children of dyslexic parents tend to have slower language development than controls

  -though few meet criteria for SLI

Continuum view



- Common core language deficit in SLI and dyslexia

- SLI is (a) more severe form and/or (b) earlier manifestation

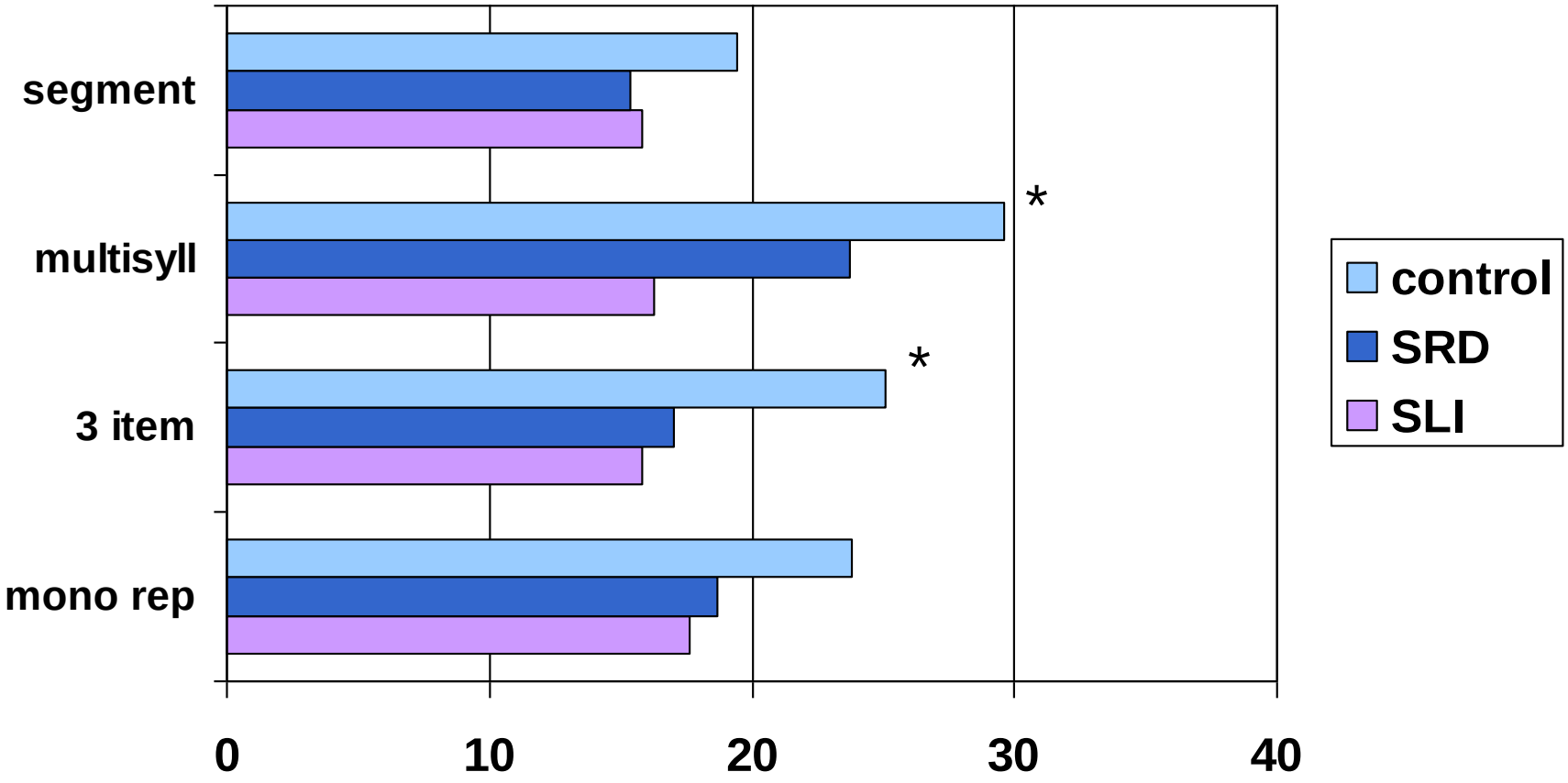
Alternative view...

- Similarities between dyslexia and SLI are superficial
- Different underlying cognitive deficits can lead to poor literacy

Cognitive processes

Is the nature of language/reading impairment the same in dyslexia and SLI?

Similar phonological deficits:
Kamhi et al, 1988



Literacy assessment

- Single word reading/spelling
- Nonword reading/spelling
- Passage reading:
  - accuracy
  - comprehension
  - (rate)

Neale Analysis

A robin hopped up to my window.

She made a nest in my garden.

I gave her some bread.

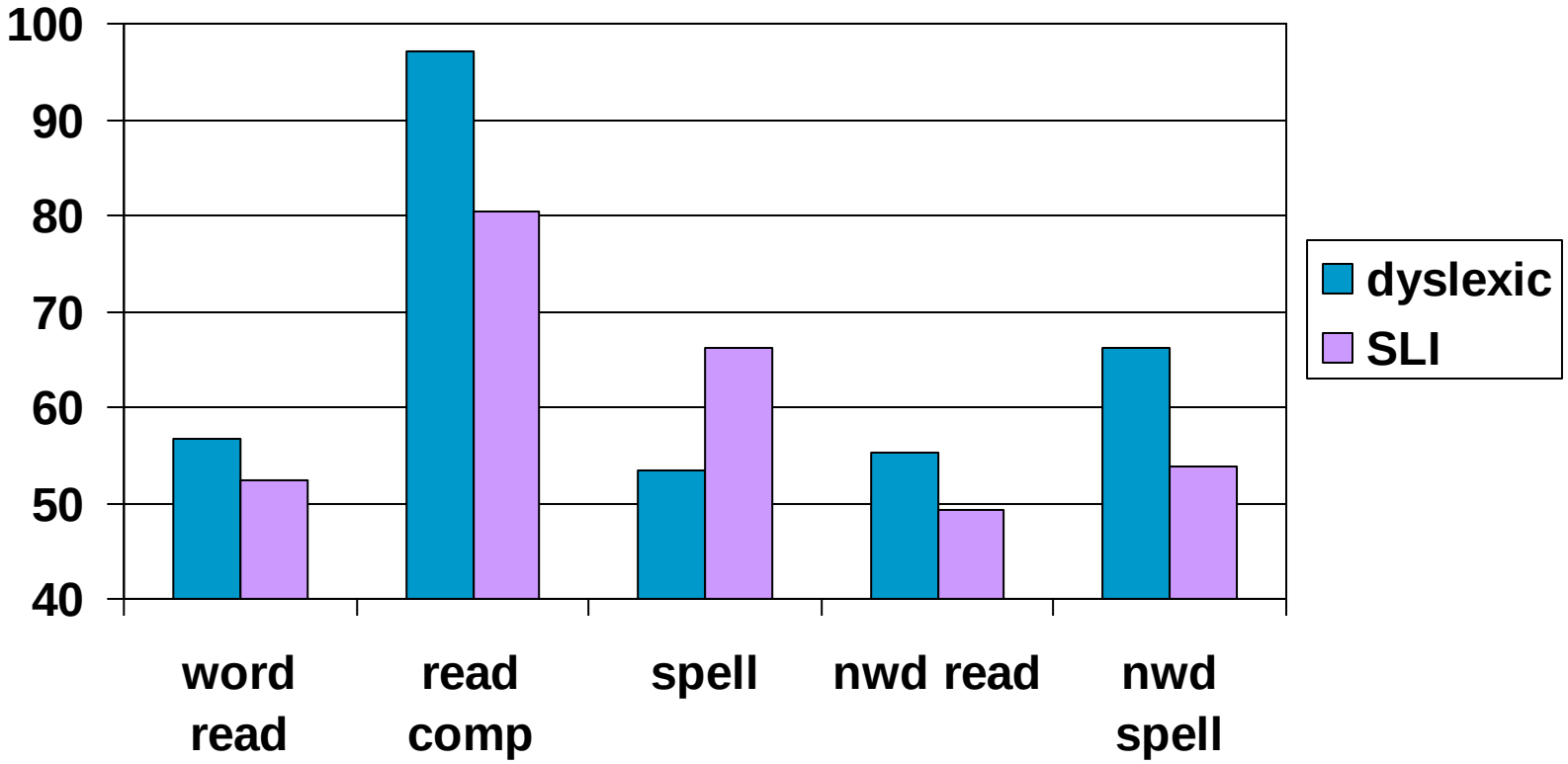
Now I look after her little birds.

Sample question:

1. Where was the little boy standing when he saw the robin?

SLI vs dyslexic 15-yr-olds

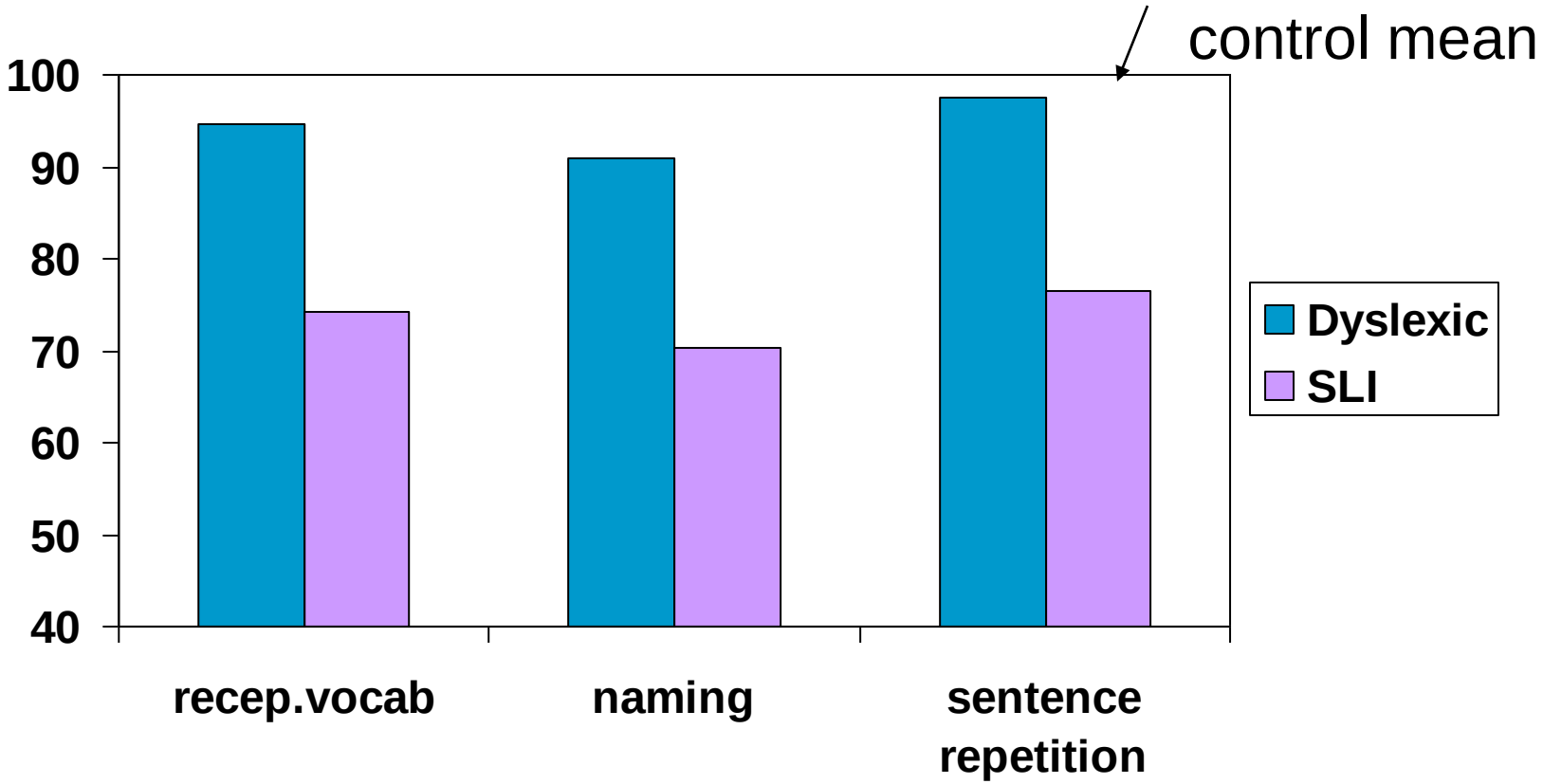
Goulandris et al, 2000



groups equivalent, except on reading comprehension

Oral language skills in dyslexics

Goulandris et al, 2000



Dyslexics did not differ from age-matched controls

Summary: Differences between SLI and dyslexia

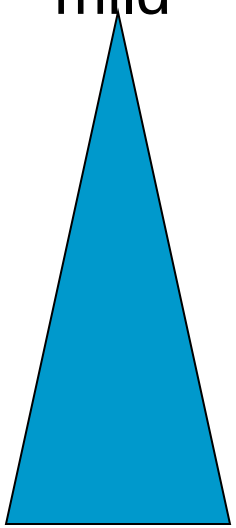
Dyslexia

- Problems with phonological processing and verbal memory
- Vocabulary, syntax, and general listening comprehension relatively intact
- Reading: decoding poor, comprehension OK

SLI

- Poor syntax, vocabulary and phonological short-term memory
- Problems with reading comprehension as well as decoding

Is the difference just in severity?



- spelling
- reading
- phonological awareness
- verbal short-term memory
- expressive phonology
- vocabulary
- expressive syntax
- language comprehension

Predicts a child who has impairment lower down the list will also have impairments higher on the list

“Poor comprehenders”

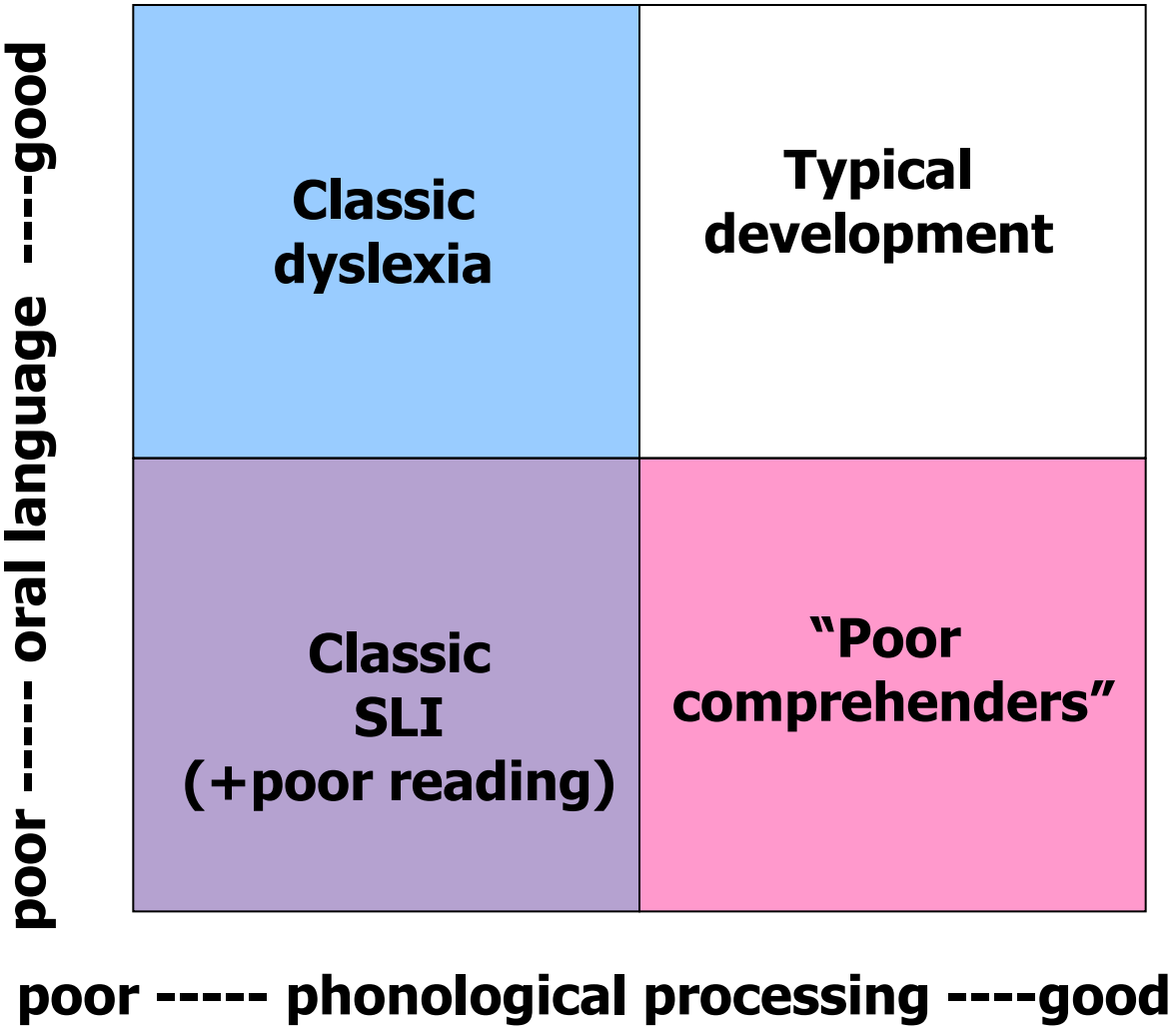
Nation, K., Clarke, P., Marshall, C. M., & Durand, M. (2004)

- Defined as those who do badly on tests of reading comprehension despite good reading accuracy

Do not fit ‘severity’ model: master reading accuracy despite weak oral language skills

- But good phonological skills

Bishop & Snowling, 2004



Etiology

Are same genes/environmental risk factors implicated in dyslexia and SLI?

What causes SLI?

- Family aggregation
- Twin studies

  – Both point to important effect of genes
  – Nonword repetition (measure of phonological short-term memory) is good marker of heritable phenotype

see Bishop 2002 for review

What causes reading disability?

"Since the first documented cases at the beginning of the last century, it has become increasingly apparent that the reading problems of people with dyslexia form part of a heritable neurobiological syndrome"

- Fisher, S. E., & DeFries, J. C. (2002). Developmental dyslexia: genetic dissection of a complex cognitive trait. *Nature Reviews, Neuroscience, 3*, 767-780.

What causes reading disability?

".. school effectiveness findings indicate that pupil achievements and behavior can be influenced (for the better or worse) by the overall characteristics of the school environment"

- Rutter, M., & Maughan, B. (2002). School effectiveness findings 1979-2002. *Journal of School Psychology, 40*, 451-475.

Twins as a tool for uncovering genetic and environmental influences

- Monozygotic (MZ) twins: genetically identical

- Dizygotic (DZ) twins: share 50% of polymorphic genes

- Twin-cotwin similarity could be due to shared genes or shared environments
- However, if genes are implicated expect more similarity for MZ than for DZ twins

2001 twin study

- Sample A: 86 pairs selected because one or both twins met criteria for Specific Language Impairment (SLI); aged 7 to 16 yr
- Sample B: general population sample of 100 twin pairs aged 7 to 13 yr
- All pairs same-sex

Bishop, D. V. M. (2001). *Journal of Child Psychology and Psychiatry, 42*, 189-198.

Results: sample A

SLI is highly heritable

- Children with SLI also tend to have literacy problems:

  specific reading disability in

  - 47% of children with SLI
  - 14% of unaffected

- Oral language and reading problems appear to have same genetic influences

Results: sample B

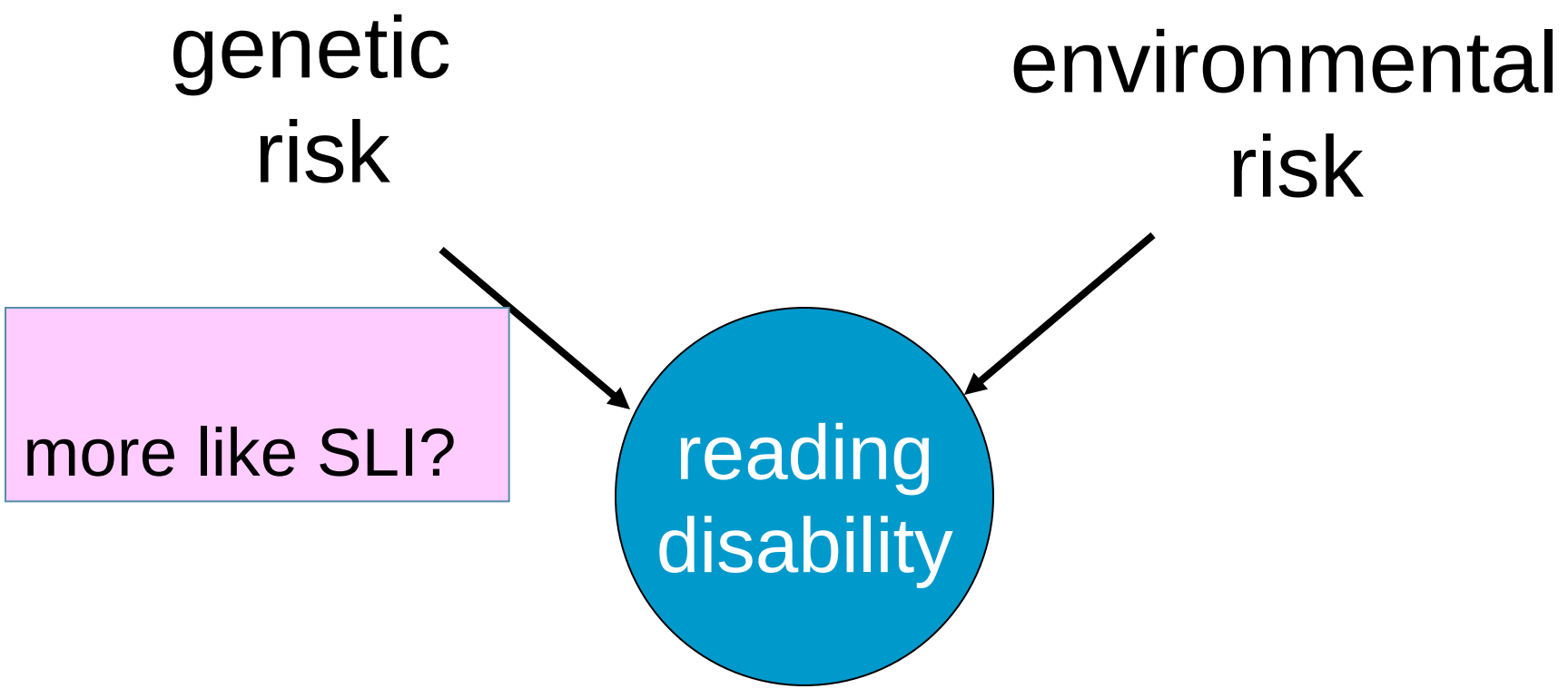
- General population sample
- High twin-twin correlations (r > .7) for reading ability in *both* MZ and DZ
- Suggests environmental rather than genetic influence is most important in determining reading ability

Results disagree with Colorado Twin Study

Sample selection

- wide range of social/educational backgrounds included; cf Colorado middle class sample
- Colorado sample used more extreme definition of reading impairment
- Maybe few true “dyslexics” in sample B

Can we distinguish genetic and environmental cases phenotypically?



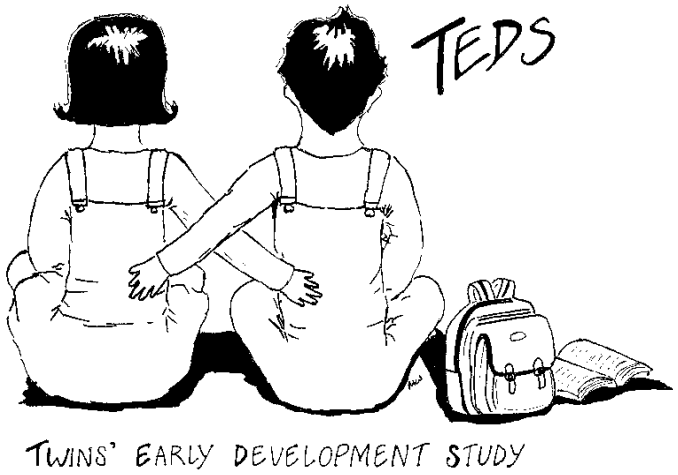
Children's Nonword Repetition Test (CNRep)

child listens to spoken nonwords and repeats, e.g.

- 2 syllables: hampent
- 3 syllables: dopelate
- 4 syllables: confrantually
- 5 syllables: pristoractional

Genetic analysis of sample B showed significant genetic effect on reading disability *only* for those with poor nonword repetition

Study of 6 yr old twins



twin testers:

Caroline Adams

Courtenay Norbury

Thanks to:

- Robert Plomin and staff at the Twins Early Development Study

Subset of TEDS sample, biased to include those with language difficulties

- 65 MZ and 67 DZ pairs with ‘low language’ on basis of parental report at 4 yr
- 37 MZ and 29 DZ control pairs (neither ‘low language’)

individual assessment included:

- Children’s Nonword Repetition Test (CNRep)
- Basic Reading (Wechsler Objective Reading Dimensions)

Classification of twin *pair* by CNRep

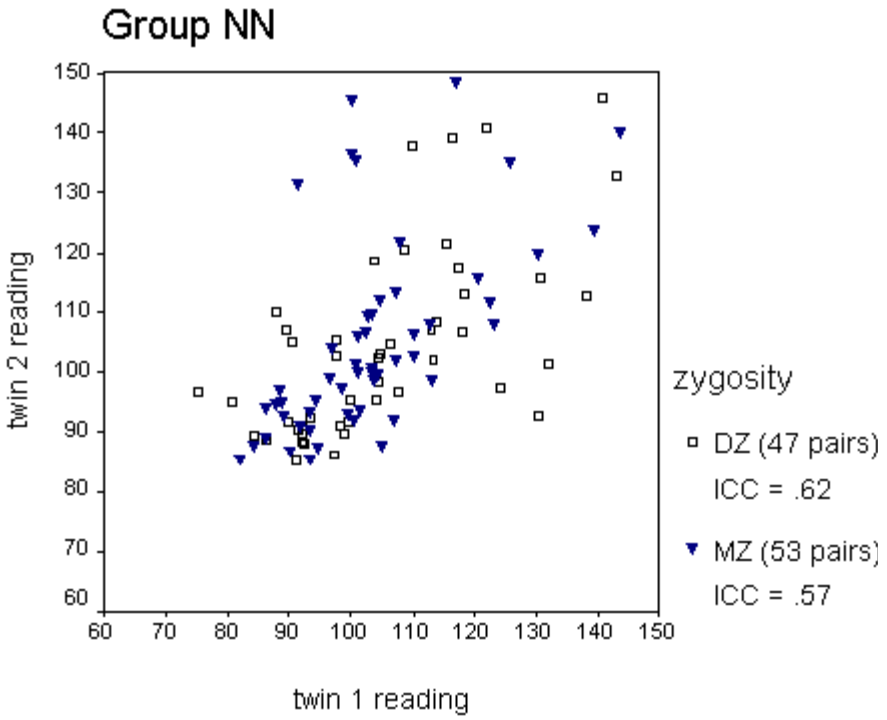
NN: both twins with CNRep above 84

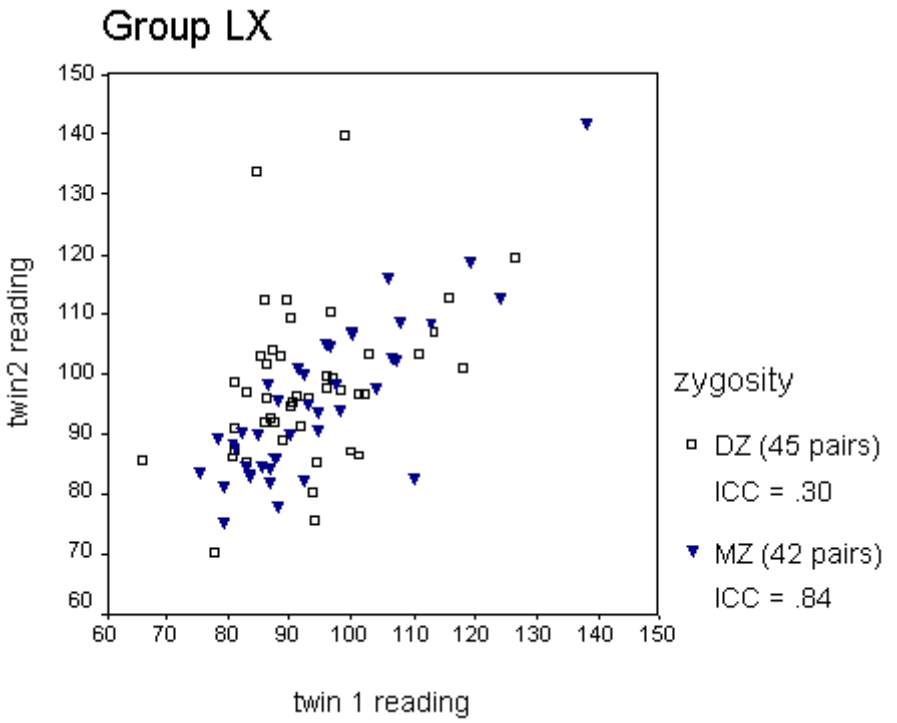
LX: one or both twins with CNRep < 85

NB twins with poor CNRep were more likely to have characteristics of SLI:

- Have had speech-language therapy
- Been identified as ‘low language’ by parents at 4 yr
- Have poor language test scores at 6 yr

Twin 1 vs. Twin 2: reading scores adjusted for age/PIQ





heritability: 0 (CI: 0 to .43)
sh.envmnt: .60 (CI: 21 to .71)

heritability: .79 (CI: .49 to .87)
sh.envmnt: 0 (CI: 0 to .43)

Conclusions from twin studies

2001 study suggested reading disability only heritable in children with low nonword repetition

2004 study: similar results in 6-year-olds across whole range of reading ability

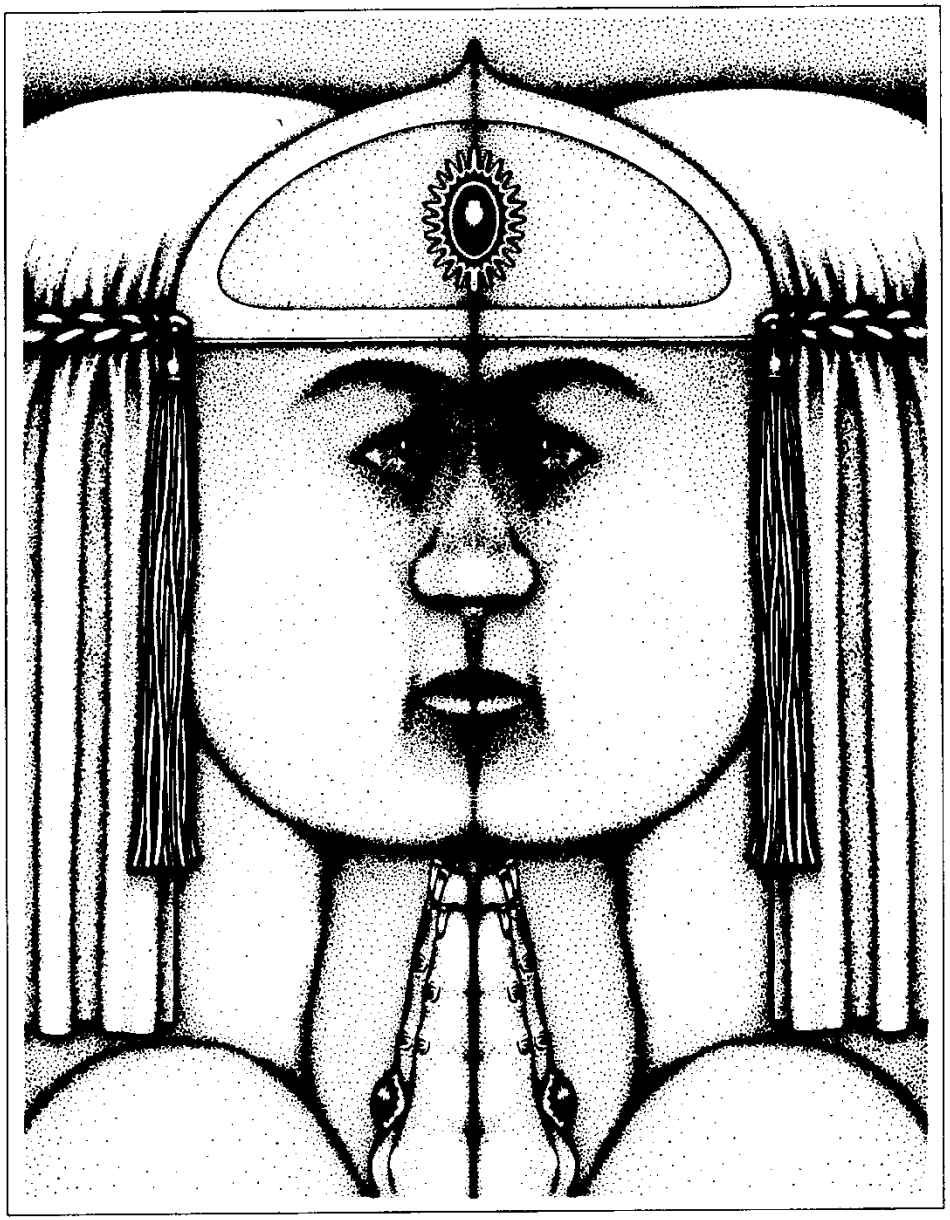
Bishop, D. V. M., Adams, C. V. & Norbury, C. F. (2004). *American Journal of Medical Genetics: Neuropsychiatric Genetics*.

Current classification

- Dyslexia – poor literacy
- SLI – poor oral language

A better classification?

- Categorise children according to underlying skills, i.e. whether they have:
  - Language comprehension problems
  - Phonological processing problems
- Reveals that many “dyslexic” do have oral language problems
- Many “SLI” have poor phonology



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