



THE UNIVERSITY *of York*

# Dyslexia and Language Impairment: Risk and Protective Factors

Maggie Snowling  
University of York

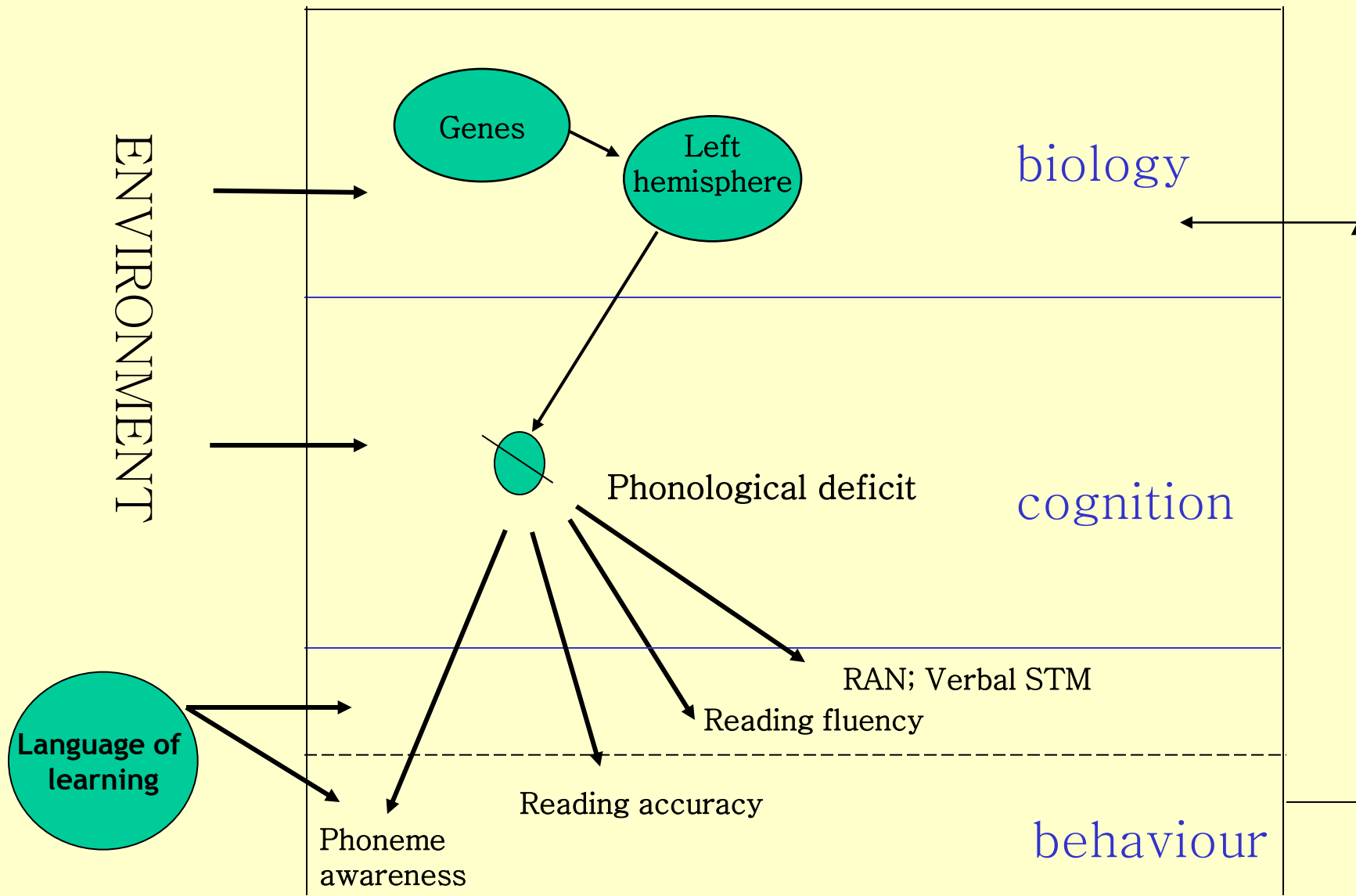
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wellcome trust



The  
Nuffield  
Foundation



*after Morton & Frith, 1995*

# Developmental Disorders of Language, Learning and Cognition

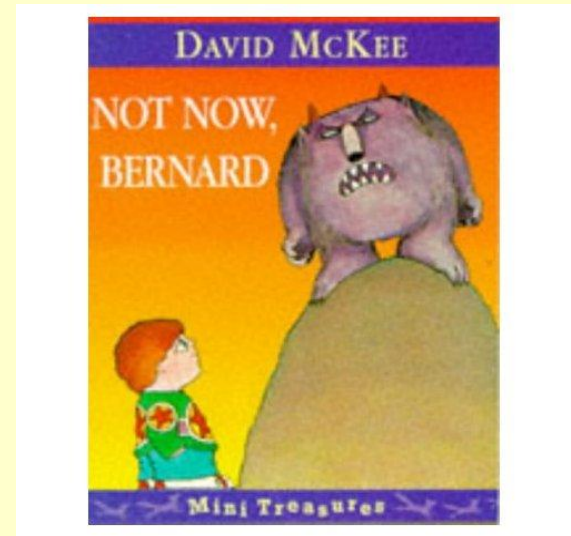
*Charles Hulme and Margaret J. Snowling*



**Growing recognition of co-morbidity and continuities between dyslexia and other learning disorders**

# Specific Language Impairment

Characterized by significant language delay in the preschool years, **poor lexical learning (vocabulary)** and persistent difficulties with **grammar** despite normal non-verbal ability

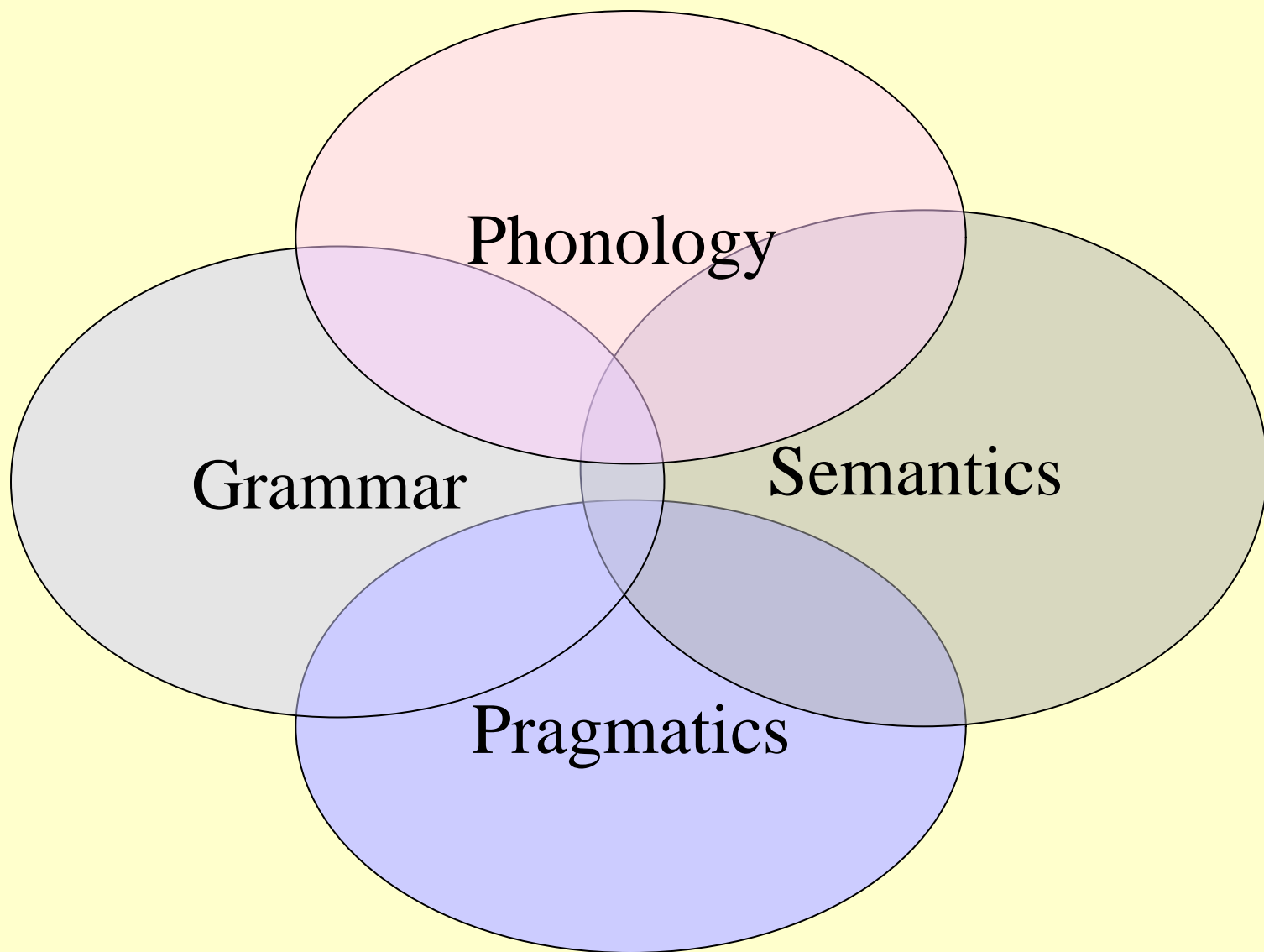


and, when 'dad was reading the newspaper, Bernard bite- the monster bite.....that dad 'leg but the- but dad never took any notice

From Bishop, 1997

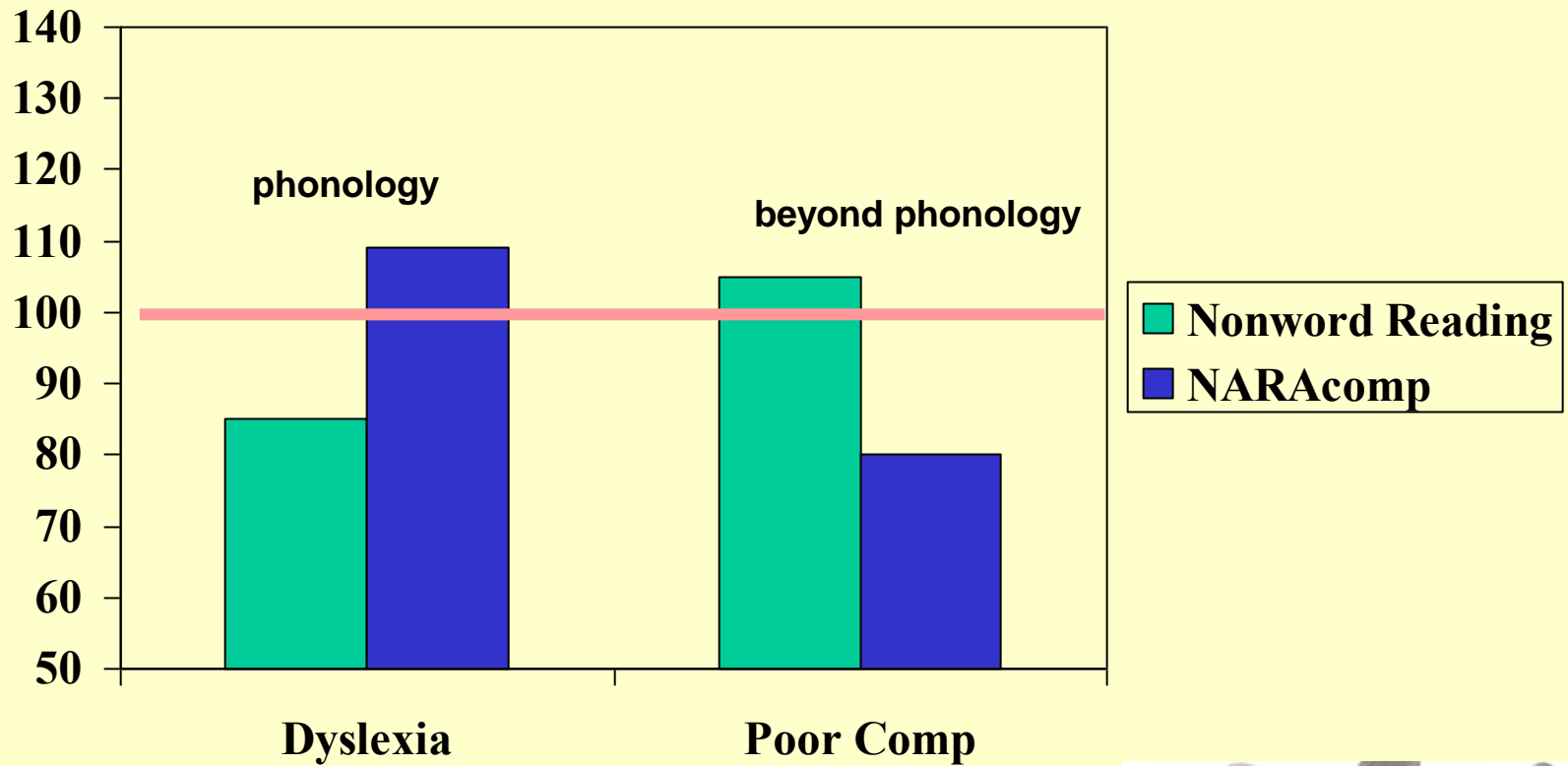
# Plan of talk

- Relationships between different language skills and component reading skills
- Relationship between dyslexia and LI in cross sectional and family risk studies
- Reframe 'dyslexia' in dimensional terms and risk [and protective] factors
- Implications for intervention



# Two Distinct Forms of RD

## Dyslexia vs Poor Comprehender



Learning to decode depends  
on phonological skills:

Phoneme awareness

Phonological memory

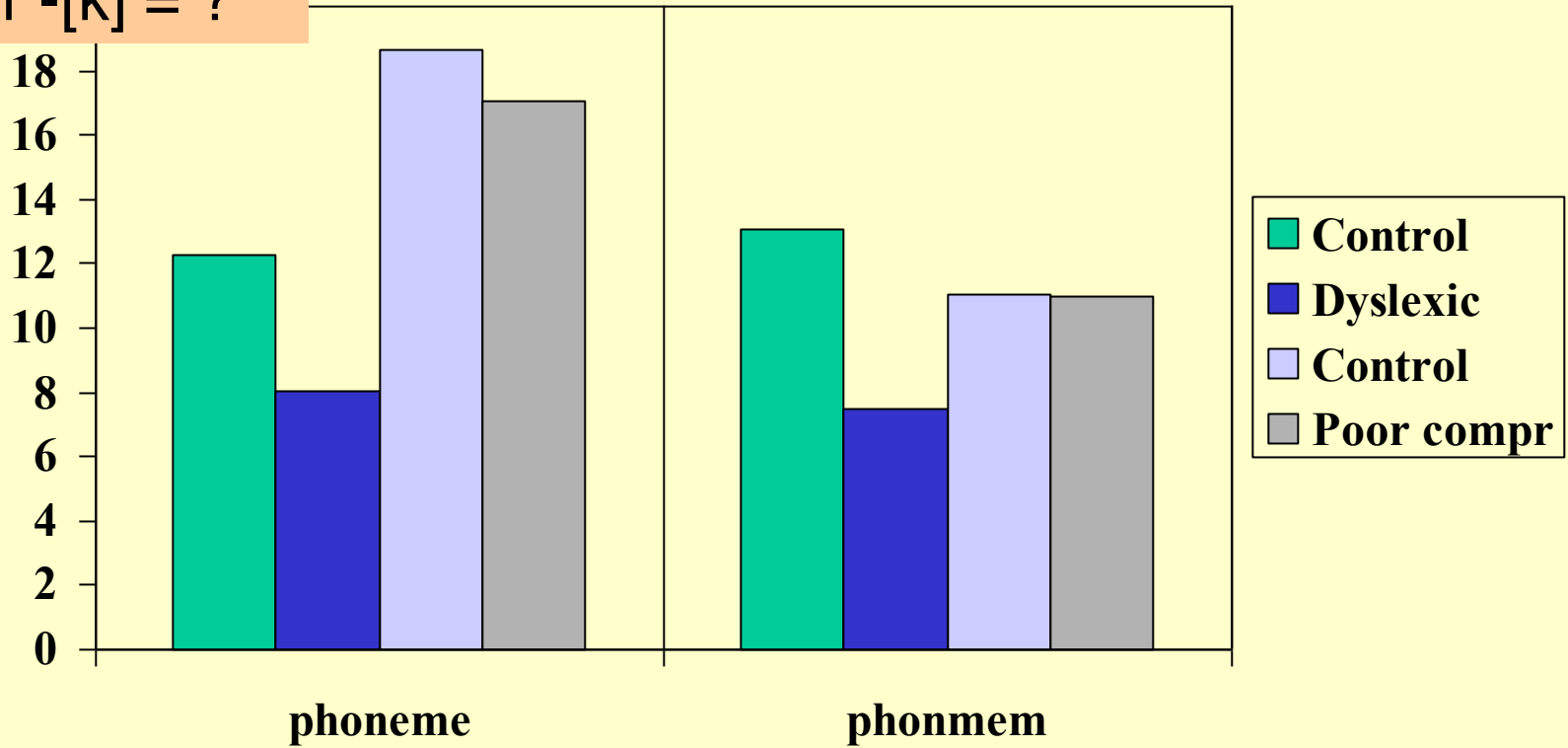
Phonological representations

# Phonological Skills: Dyslexia vs Poor Comprehender

## Phoneme Deletion

“bice” - [b] = ?

“cleaf” - [k] = ?



Learning to spell depends on  
phonological skills:

Phonological representations

Phoneme segmentation

Phonological memory

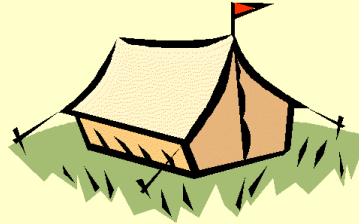
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tghlml



dog  
bog  
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doe

cup  
cop  
kup

tet  
tent  
ten

buk  
bok  
book

hat  
hrt  
hart

# Spelling to dictation

“**Dorothy** was looking **closely** into the face of the **scarecrow**. She was **surprised** to see one of the eyes wink at her”

## TD

- Dorofy was looking **cloly** into the face of the **scrow** she was **sprised** to see one of the eyses wink at her

## DYS

- **dought** was look **consly** in to the face of the **starrow** she was **sowl**t to see one of the eye winck at her

## SLI

- **balfiy** was locin down into the fisr of ure **sear** she was **spad** too see one of the isr wick at hrr

# Use of context in reading depends on grammatical skills

Dyslexia = normal sentence context  
effect

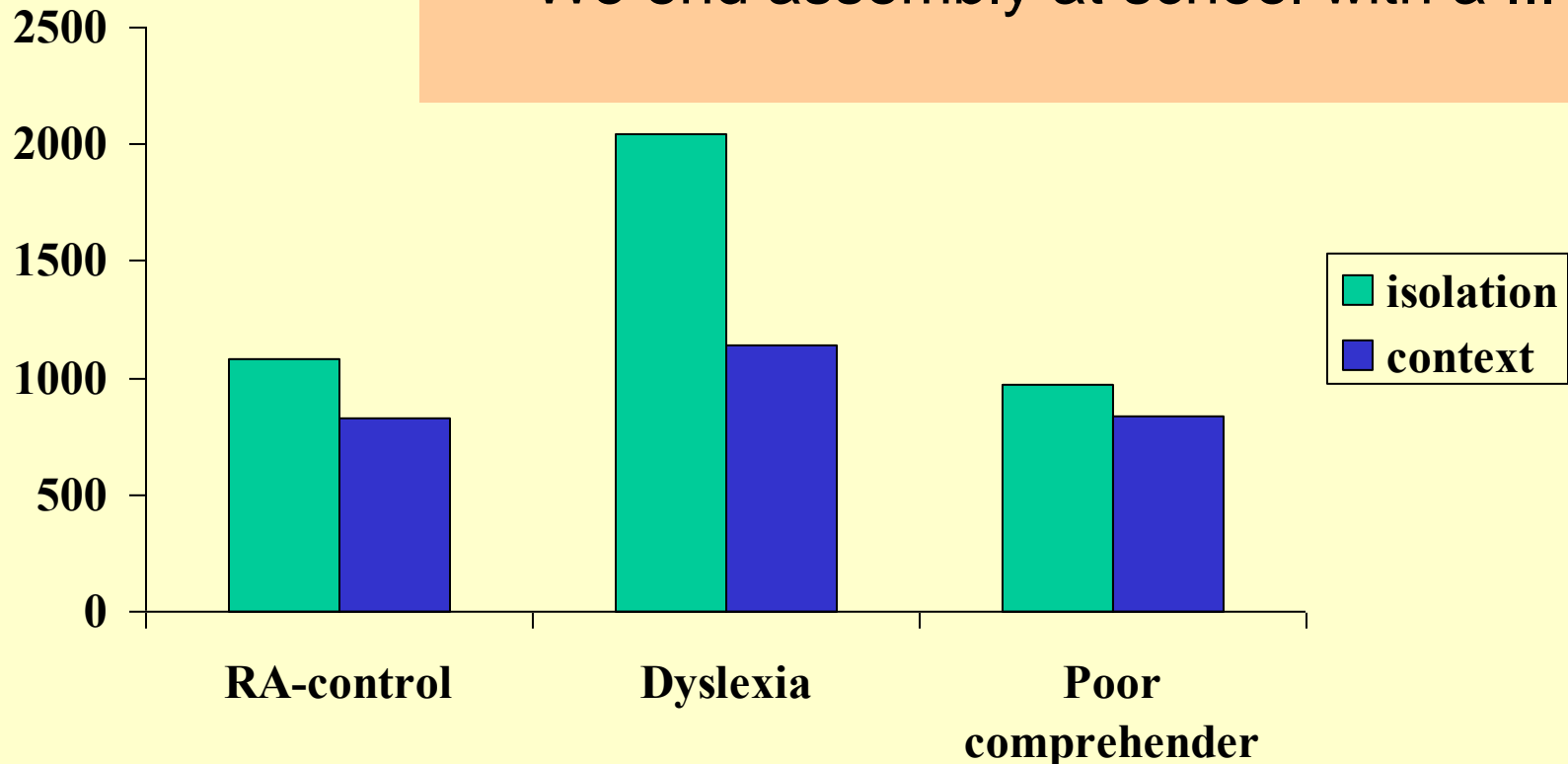
Poor comprehender = reduced context  
effect

# Contextual Facilitation: Dyslexia vs Poor Comprehender

Low constraining contexts

I went shopping with my mother and my..

We end assembly at school with a ...



# Text comprehension requires inferencing skills

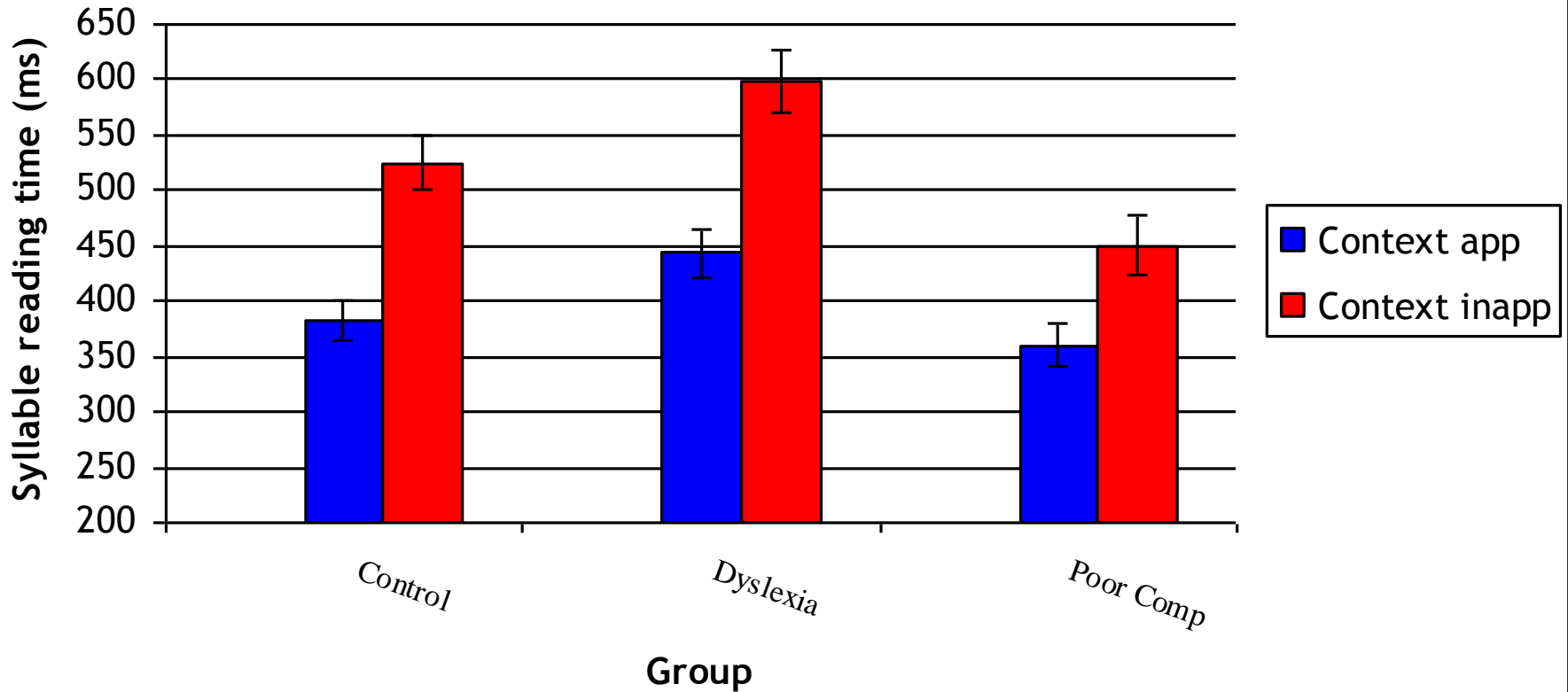
Dyslexia = automatic on-line  
inferencing

Poor comprehender = fewer on-line  
inferences

Holly was on a school trip. Her class were going to the zoo as part of 'wild week'. They saw elephants, monkeys, zebras and tigers. Holly wanted to see the lions most of all. She could see them, but they were all asleep. "Wake up!" shouted Holly. Suddenly, one of the lions jumped up and ran towards her. The lion ran up to the fence where Holly stood and made a huge roar! **Holly had never been so scared.** She ran away fast. "He didn't want to be woken up!" said her teacher

Holly was on a school trip. Her class were going to the zoo as part of 'wild week'. They saw elephants, monkeys, zebras and tigers. Holly wanted to see the lions most of all. She could see them, but they were all asleep. "Wake up!" shouted Holly. Suddenly, one of the lions jumped up and ran towards her. The lion ran up to the fence where Holly stood and made a huge roar! **Holly had never been so happy.** She ran away fast. "He didn't want to be woken up!" said her teacher

# Effects of Text-level Context on Reading Time: Dyslexia vs PC



# Language Skills and Literacy Development

Literacy builds on a foundation of oral language skills

– Phonological skills

- Foundation for the creation of mappings between letters and speech sounds : decoding and spelling

– Language skills (beyond phonology)

- Grammar, vocabulary, syntax
- Required in order to read for meaning and for text comprehension

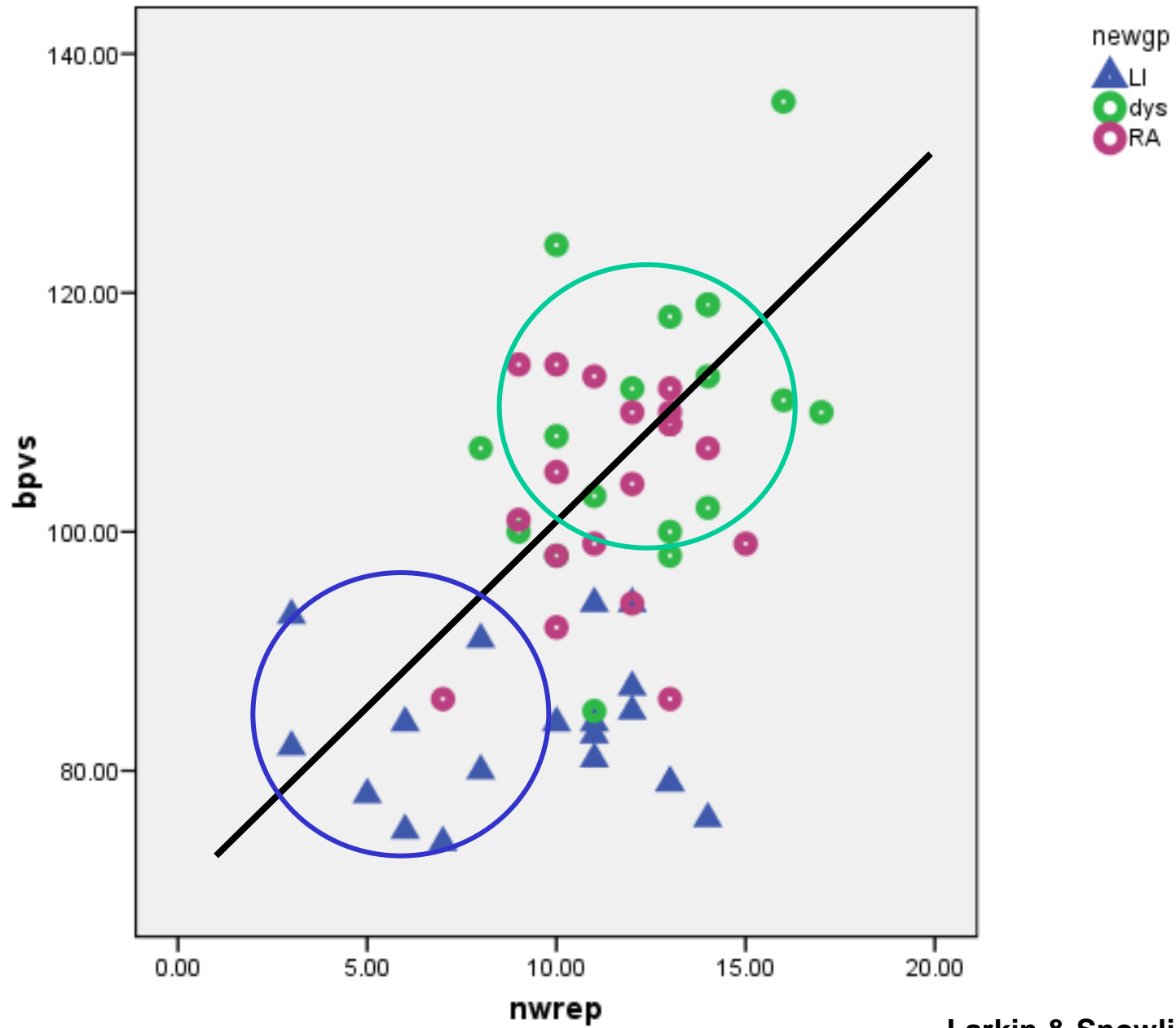


# What is the relationship between dyslexia and SLI?

- SLI = dyslexia + additional co-morbid impairments in grammar and vocabulary
- SLI = more severe form of dyslexia

# Participants

	<b>Dyslexia</b>	<b>LI</b>	<b>RA control</b>
<b>Age (yrs)</b>	<b>10.5</b>	<b>11.0</b>	<b>7.9</b>
<b>Reading (yrs)</b>	<b>8.3</b>	<b>8.4</b>	<b>7.8</b>
<b>Vocabulary (BPVS)</b>	<b>108.9</b>	<b>83.3</b>	<b>103.3</b>
<b>Grammar (Sentence Recall)</b>	<b>91.5</b>	<b>73.2</b>	<b>93.2</b>

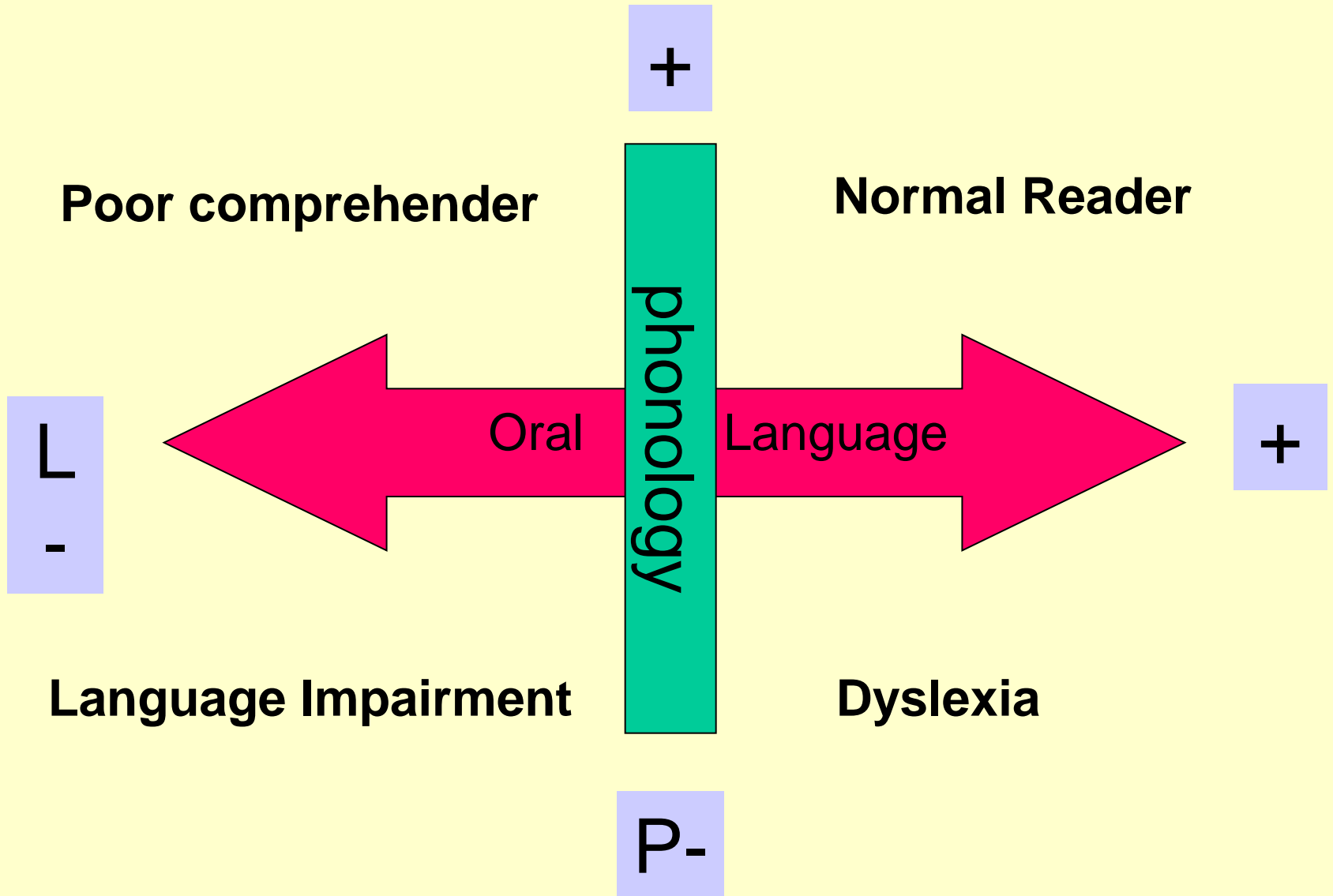


# Variants of LI

- Some children with SLI fall on a continuum of skills with dyslexia
  - Low PM and low vocabulary
  - ‘SLI-dyslexia subtype’
- Others show a discrepant profile
  - High PM and low vocabulary
  - ‘SLI-poor comprehender’ subtype
- Consistent with variations in language dimensions underpinning a spectrum of reading disorders (Bishop & Snowling, 2004)



Spectrum of Reading Disorders (Bishop & Snowling, 2004)

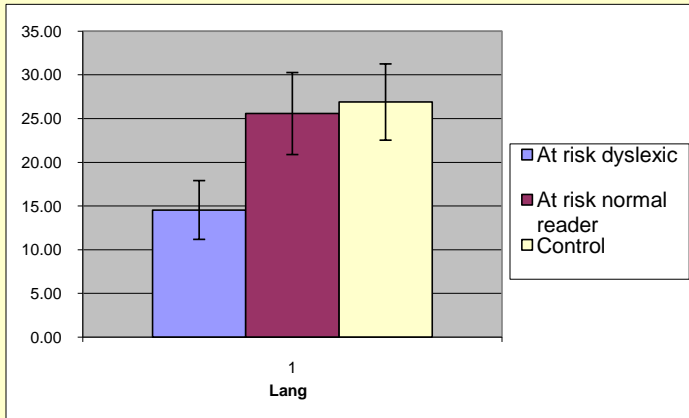


# Family-Risk Study

- Children with a parent with dyslexia
  - seen at 4, 6 and 8 years (Snowling, Gallagher & Frith, 2003)
  - follow up at 12-13 years (Snowling, Muter & Carroll, 2007)
- Controls from families with no history of dyslexia, similar SES
- >40% persistent literacy difficulties (dyslexia); compare with at-risk normal readers and controls

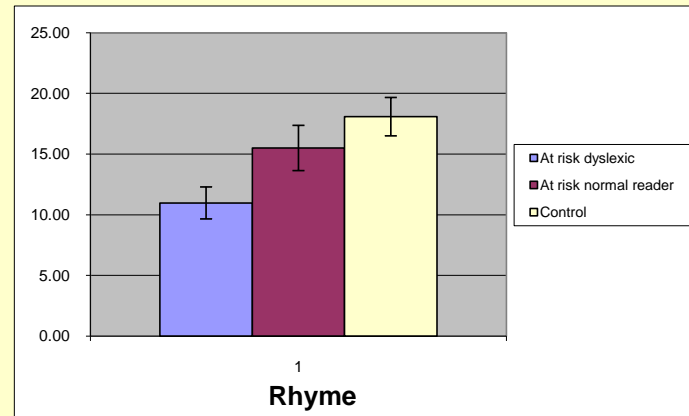


# Language and Phonology

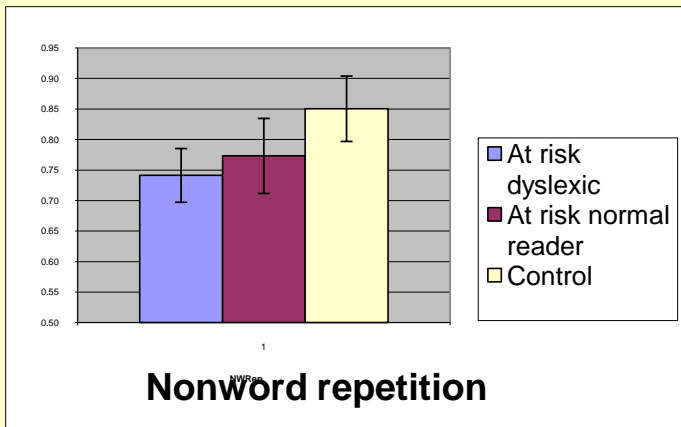


Expressive language

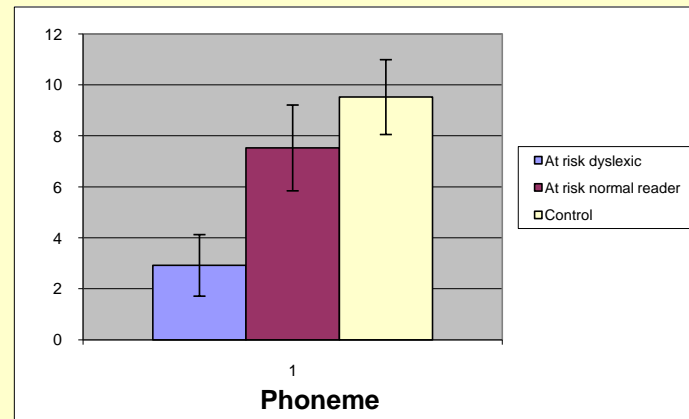
Age 4



Rhyme



Nonword repetition



Phoneme

Age 6

# Characteristics of family-risk sample

- Two 'sorts' of phonological deficit in pre-school

Two risk factors

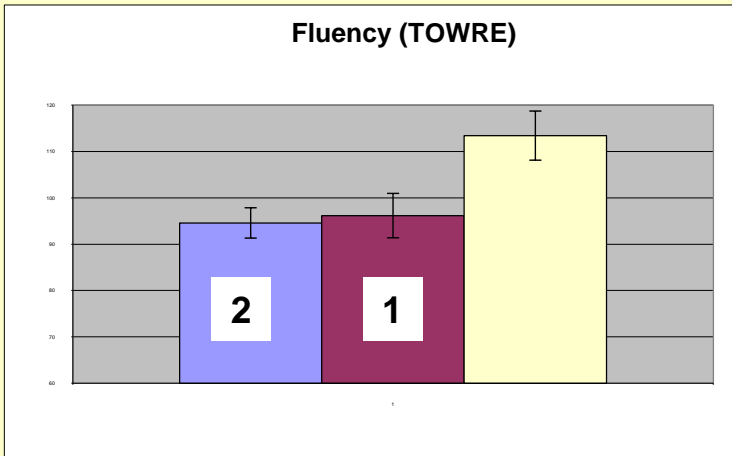
- Poor phonology + delayed language (P-/L-)
- Poor phonology + normal language (P-/L+)

One risk factor

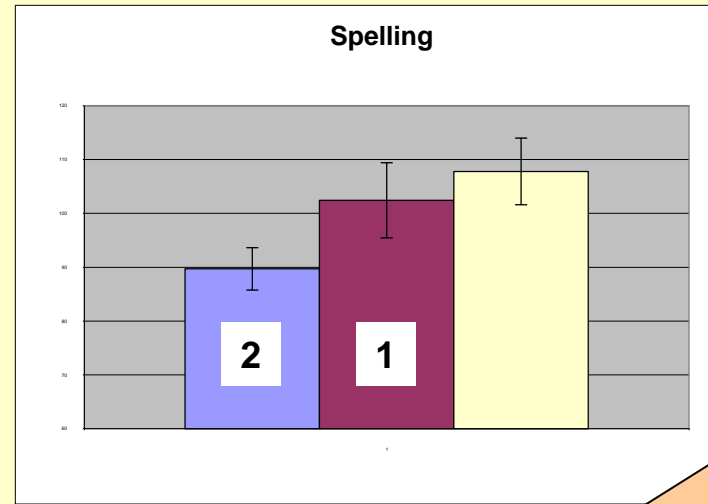
- Developmental consequences vary:
  - P-/L- fulfil criteria for dyslexia at 8 years
  - P-/L+ do not fulfil criteria for dyslexia

# Literacy Skills in Adolescence

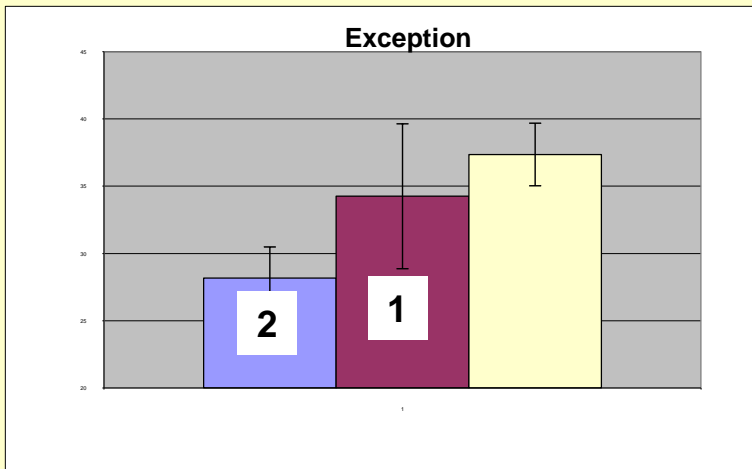
Fluency (TOWRE)



Spelling



Exception



At-risk 'normal' adolescents show weak spelling and word reading skills, relative to

**Broader phenotype of dyslexia**

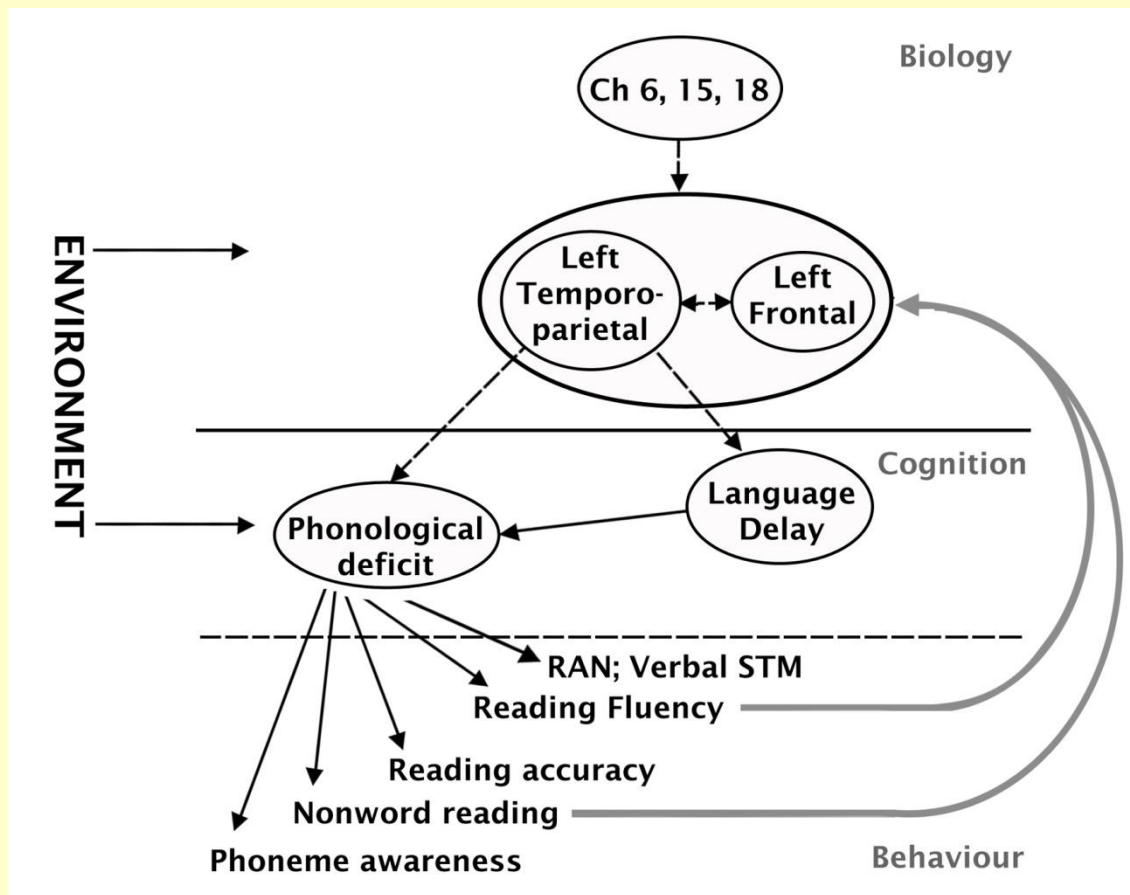
# Frequency of ADHD in 'at-risk' families

	Attention
Dyslexia	55%
No-dyslexia	64%

- Implies there is a genetic basis to the co-morbidity of dyslexia and ADHD
- In line with parental reports of 'educational concerns' in relation to the broader phenotype

# Summary: Family Risk Study

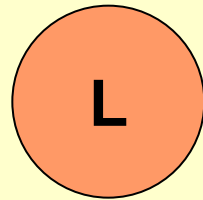
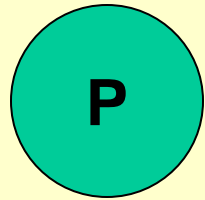
- Two risk factors for reading impairment (P; L)
- Affected and unaffected individuals display some of the same risk factors:
  - Poor phonology (P-)
  - Poor attention (A-)
- Children differ in their ability to compensate
  - Good language is a protective factor (L+)
- Children who have poor literacy through adolescence:
  - More likely to experience multiple deficits (P- / L- / A-)



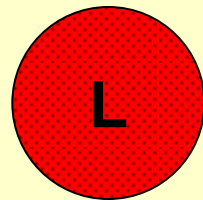
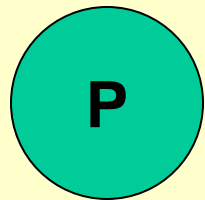
**Causal model of dyslexia (Hulme & Snowling, 2009)**

- Dyslexia is not as 'specific' or selective as once thought
- Two 'routes' to dyslexia:
  - Specific phonological deficits (PD)
  - Downstream effect of poor language mediated by PD
- Need to think of causes of disorders in a different way
- Dimensional view emphasizes continuous risk factors that may accumulate to lead to a 'diagnosis'

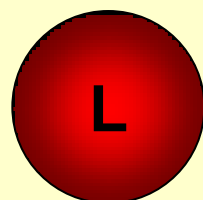
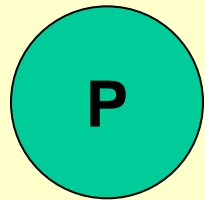
# Dimensions, Risk, and Dyslexia Phenotypes 1



**Broader Phenotype  
Dyslexia**



**Dyslexia**

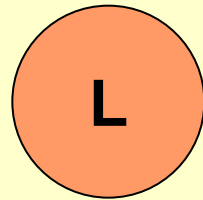
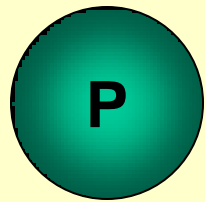


**SLI-dyslexia**

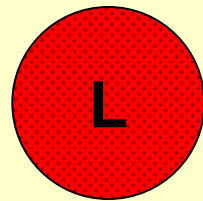
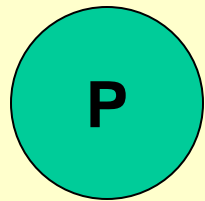
**Risk 1**

**Risk 2**

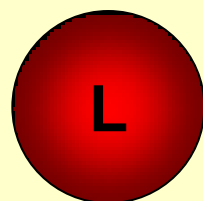
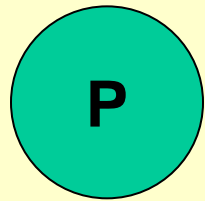
# Dimensions, Risk, and Dyslexia Phenotypes 2



**Phonological  
dyslexia**



**Dyslexia**

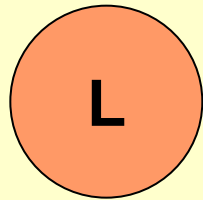
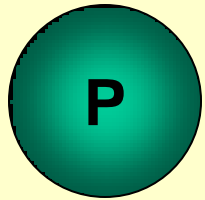


**SLI-dyslexia**

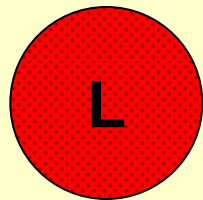
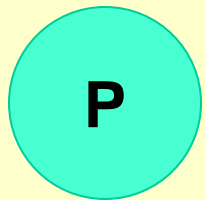
**Risk 1**

**Risk 2**

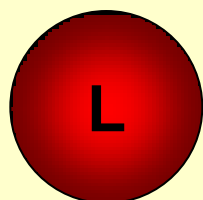
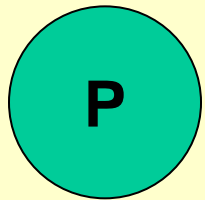
# Dimensions, Risk, and Dyslexia Phenotypes 3



**Phonological  
dyslexia**

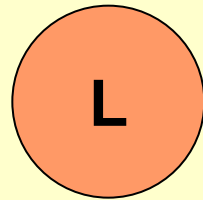
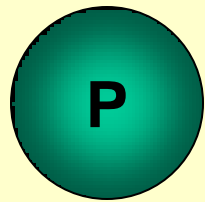


**Poor comprehender**

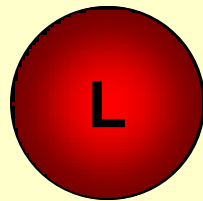
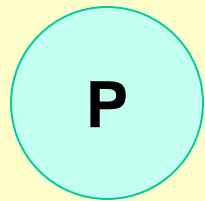


**SLI-dyslexia**

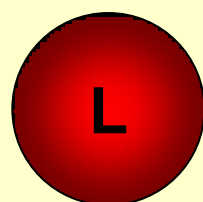
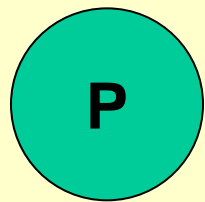
# Dimensions, Risk, and Dyslexia Phenotypes 4



**Phonological  
dyslexia**



**Hyperlexia**



**SLI-dyslexia**

# Implications For Intervention

- Dimensions represent important domains for development
- Children with **poor phonological skills** require intervention that includes training in phoneme awareness
- Children with **wider language difficulties** require intervention to foster reading comprehension

# Early Intervention at the Foundations of Reading

- To develop two theoretically motivated programmes of intervention for children who enter school with poor oral language development
- To compare the relative effects of a programme to promote phonological skills (P+R) with one to promote oral language (OL)

# Intervention Programs

## Phonology +Reading

- Letter-sound work
- Segmenting and blending
- Reading together and reading independently

## Language

- Speaking and listening
- Vocabulary training
- Narrative work (oral)

# P+R Session Outline

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## Group Session (30 minutes)

- Introduction  
(4 minutes)
- New letter introduction  
(8 minutes)
- Group book work  
(8 minutes)
- Segmentation or Blending  
(5 minutes)
- Plenary  
(5 minutes)

## Individual Session (20 minutes)

- Introduction  
(2 minutes)
  - Working with Sounds  
(3 minutes)
  - Sight word learning  
(5 minutes)
  - Reading Books –  
Running Record  
Introduce New Book  
(10 minutes)
-

# OL Session Outline

## Group Session (30 minutes)

- Introduction (5 minutes)
- New Vocabulary – Multi-Sensory Learning (5 minutes)
- Vocabulary Reinforcement (7 minutes)
- Speaking/Listening/Inferencing (10 minutes)
- Plenary/Best Listener (3 minutes)

## Individual Session (20 minutes)

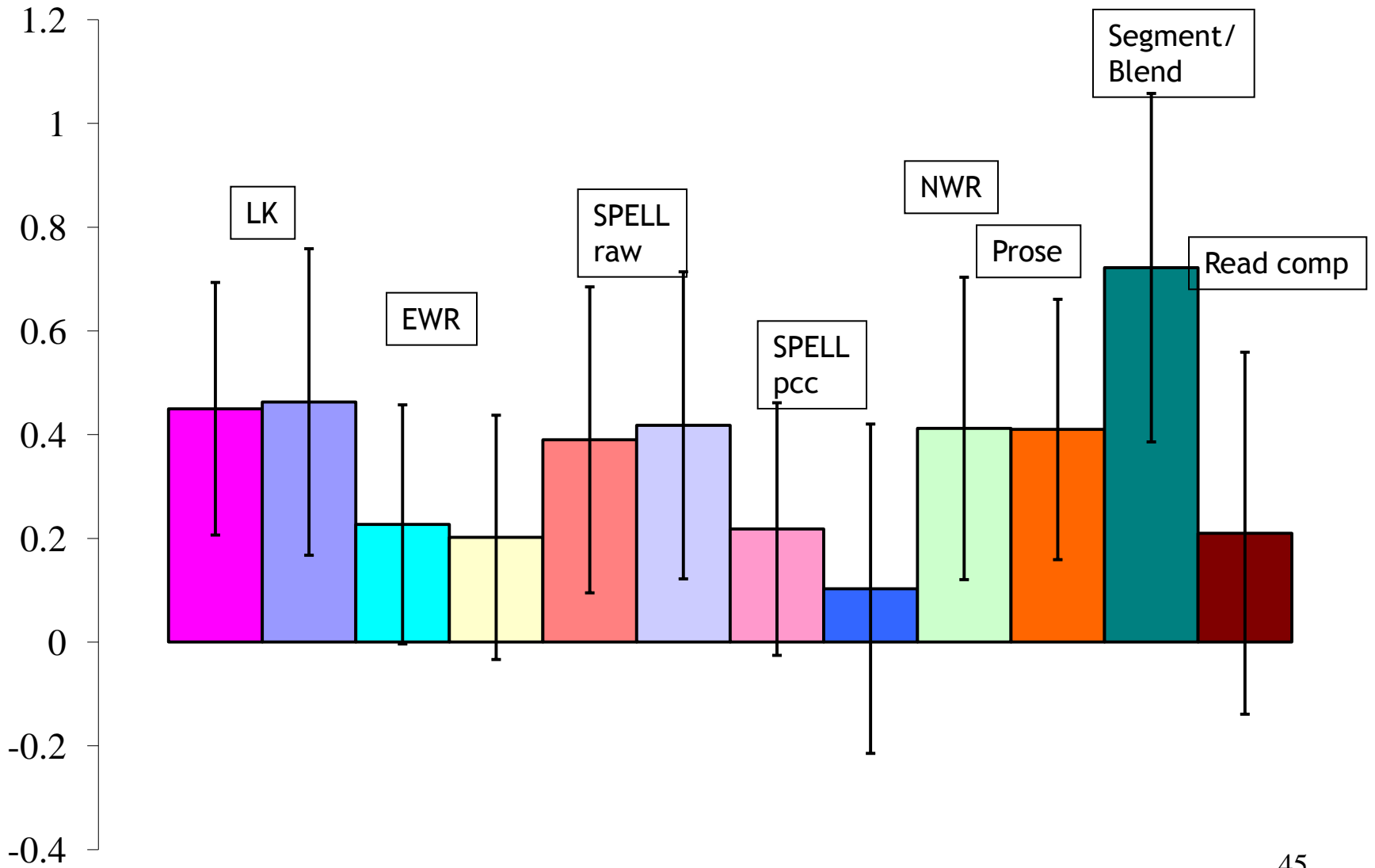
- Introduction (2 minutes)
- Vocabulary revision (5 minutes)
- Narrative task (5 minutes)
- Listening, Speaking and Inferencing (5 minutes)
- Plenary (3 minutes)

# Design of Study

- Evaluation of two 20-week programmes (P+R or OL) delivered by teaching assistants
- Randomised Controlled Trial (following the CONSORT guidelines)
- Investigators blind to group membership
- 4 test phases: pre-intervention (t1), mid-intervention (t2), post-intervention (t3), maintenance test (t4)
- Longer-term follow-up after one year (t5)

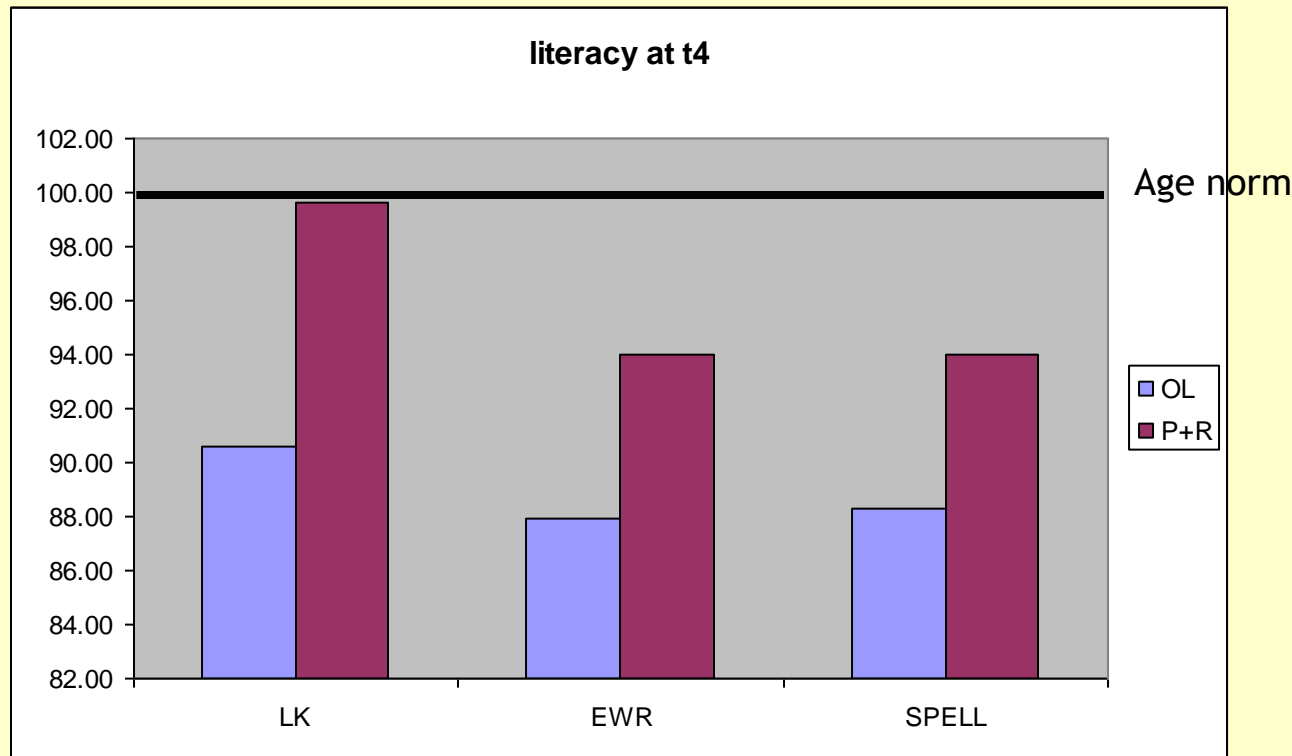
Test time	Phase		N	‘population sample’
t0	Screening in 23 schools			960
	Individual Assessments		200	10 children in 20 schools
t1	Interventions	20 weeks	152	8 children with lowest verbal composite; randomly allocated
t2			149	
t3			147	
t4	Maintenance	5 months +	142	706
t5	Follow up	1 year +	135	

# Relative Advantage of P+R Group in z-score units (95% CIs)

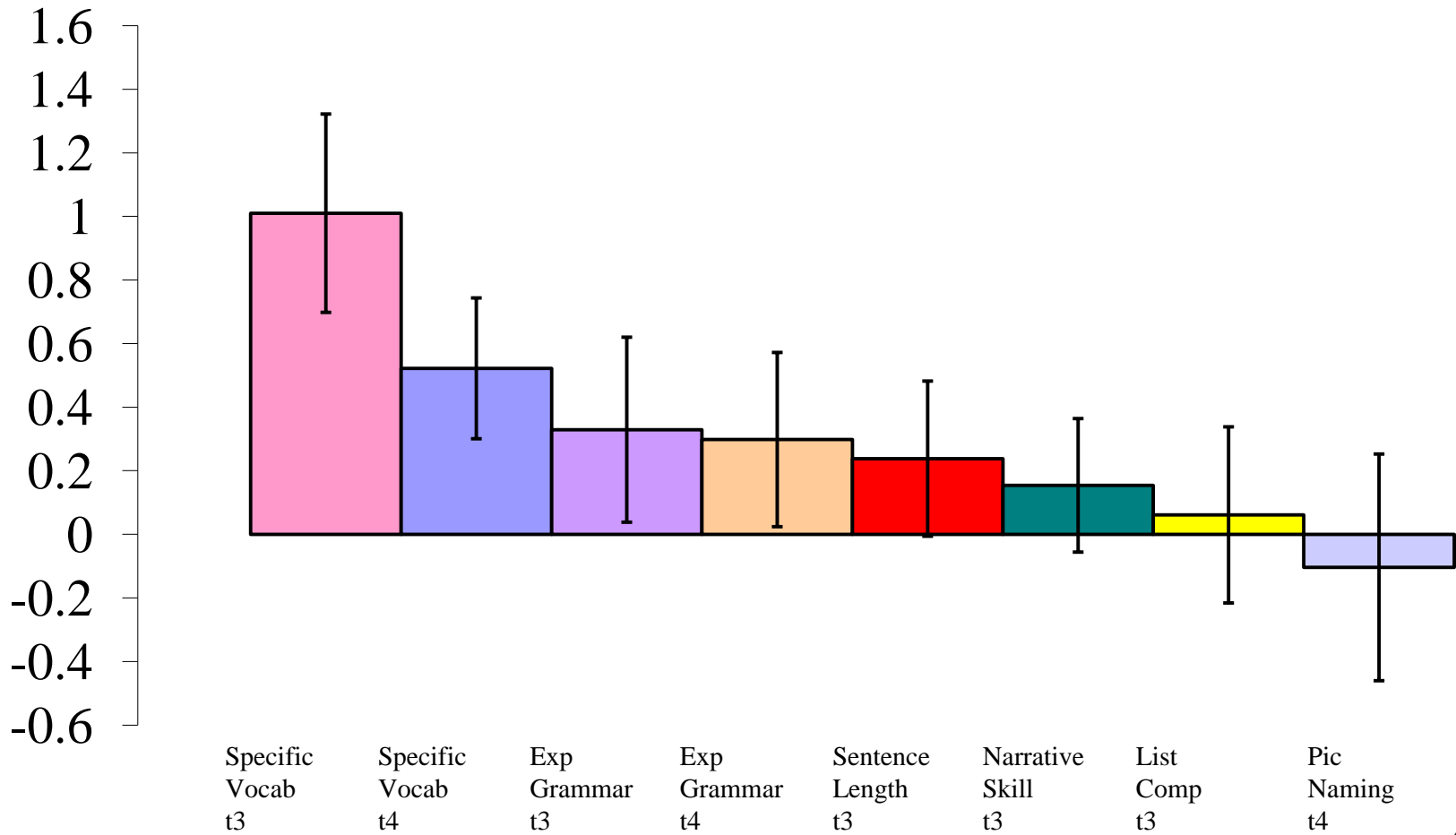


# Educational Impact of Interventions

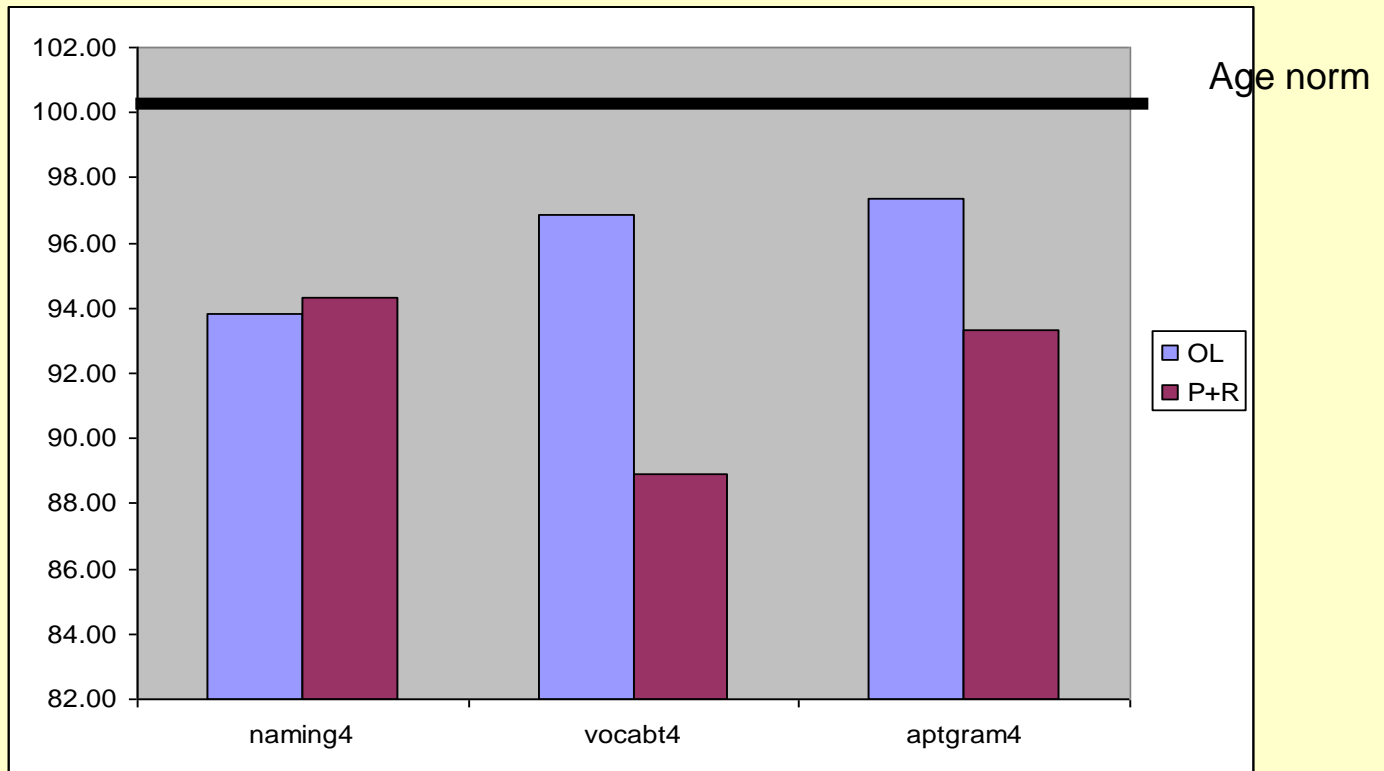
Literacy Scores standardized to those of Normative sample



# Relative Advantage of OL group in z-score units (95% CIs)



# Educational Impact of Interventions: Language Scores standardized to those of Normative sample



# Summary

- Both P+R and OL intervention programmes were effective in promoting basic skills that underlie reading comprehension
  - Vocabulary and grammatical skills fostered better by OL program
  - Word-level reading skills, phoneme awareness and spelling fostered better by P+R programme
- Effects maintained 5 months after intervention ceased.
- Gains in phoneme awareness and LK generalized to nonword reading at t4
- Reading skills brought to within the average range for children given the P+R programme at t4

# Conclusions 1

- Language and phonological skills – foundation of literacy development
- When one set of skills selectively impaired, ‘compensation’ is possible
- Intervention programmes targeted to improve language and/or phonological skills in ‘at risk’ children are effective
- For children with poor phonology in the context of poor language, response to intervention less good

# Conclusions 2

- Dimensional impairments interact during development to produce heterogeneity both within and between disorders
- Dyslexia is not a diagnostic ‘entity’ with clear-cut boundaries
  - Categories of developmental disorder are underpinned by dimensions and associated ‘risk factors’

# Developmental Disorders of Language, Learning and Cognition

Charles Hulme and Margaret J. Snowling



## Acknowledgements

- *Funders:* Wellcome Trust, Nuffield Foundation, MRC, ESRC, British Academy
- *CRL Research Group*
- *Schools:* Pupils, TAs and teachers
- All who provided assistance at various times



- *Dyslexia primarily affects the skills involved in accurate and fluent word reading and spelling .*
- *Characteristic features of dyslexia are difficulties in phonological awareness, verbal memory and verbal processing speed.*
- *Dyslexia occurs across the range of intellectual abilities.*
- *It is best thought of as a continuum, not a distinct category, and there are no clear cut-off points.*
- *Co-occurring difficulties may be seen in aspects of language, motor co-ordination, mental calculation, concentration and personal organisation, but these are not, by themselves, markers of dyslexia.*
- *A good indication of the severity and persistence of dyslexic difficulties can be gained by examining how the individual responds or has responded to well founded intervention .*