Dyslexia and Language Impairment: Risk and Protective Factors

Maggie Snowling
University of York
http://www.york.ac.uk/res/crl/

Growing recognition of comorbidity 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

after Morton & Frith, 1995
Learning to decode depends on phonological skills:

- Phoneme awareness
- Phonological memory
- Phonological representations

Learning to spell depends on phonological skills:

- Phonological representations
- Phoneme segmentation
- Phonological memory
Dorothy was looking closely into the face of the scarecrow. She was surprised to see one of the eyes wink at her.

Use of context in reading depends on grammatical skills

Dyslexia = normal sentence context effect
Poor comprehender = reduced context effect
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.
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

Two Distinct Forms of RD
Dyslexia vs Poor Comprehender

Dyslexia and Language Impairment

Becky Larkin & Maggie Snowling

What is the relationship between dyslexia and SLI?

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

Characteristics of family-risk sample

- Two ‘sorts’ of phonological deficit in pre-school
  - Poor phonology + delayed language (P-/L-)
  - Poor phonology + normal language (P-/L+)

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

Language and Phonology

Expressive language

Nonword repetition

Age 4

Age 6

Literacy Skills in Adolescence

At-risk ‘normal’ readers show weak exception word reading, spelling and reading fluency relative to controls.

Broader phenotype of dyslexia

Two risk factors

One risk factor
### Frequency of ADHD in ‘at-risk’ families

<table>
<thead>
<tr>
<th></th>
<th>Attention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyslexia</td>
<td>55%</td>
</tr>
<tr>
<td>No-dyslexia</td>
<td>64%</td>
</tr>
</tbody>
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- Implies there is a genetic basis to the comorbidity of dyslexia and ADHD
- In line with parental reports of ‘educational concerns’ in relation to the broader phenotype

*Snowling, 2008*

### 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-)

### Dimensions, Risk, and Dyslexia Phenyotypes 1

- 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 2

- Phonological dyslexia
- Dyslexia
- SLI-dyslexia

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)

Bowyer-Crane, Snowling, Duff, Fieldsend, Carroll, Miles, Götz, & Hulme (2008)

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)

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

- LK
- EWR
- SPELL after
- SPELL AFTER
- PROSE
- Read comp

Segment/Blend
What causes reading gains?

Chi sq  = .86, df. 1 NS; CFI 1.0; RMSEA  0.00 (0-.208)

Literacy outcome is entirely mediated by these two variables . Dropping direct effect of group has no effect on fit

Indicators of model

R² for Literacy 67% ; Total indirect effects on Literacy  4.0%; Indirect effect Grp->Seg/Bl3-> Lit 2.4%; Indirect effect Grp->LK3-> Lit 0.2%. Both indirect effects are reliable

Putting it All Together: Standardized solution

What causes reading gains?
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

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

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