The language bases of reading comprehension: insights for assessment and instruction

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Talk overview

What is (reading) comprehension?

Learning to read: should we keep things simple?
  • How word reading and listening comprehension contribute to reading comprehension between 6 to 9 years

The dimensionality of language
  • The oral language skills that support text comprehension

Pressure points in reading comprehension
  • The contributions of different language skills and cognitive resources to reading comprehension outcomes
Molly was carrying the glass of juice. She tripped on the step. Her eyes filled with tears. "Don't worry, darling" said Mum, and went to fetch the mop.
Summary: what is (reading) comprehension

Comprehension draws on different levels of language:

• word meanings are retrieved,
• sentence meanings are constructed,
• and beyond the word- and sentence-level, the discourse-level message is extracted.

Beyond decoding, the same language skills that support reading comprehension also support listening comprehension.
Text comprehension

Comprehension is an INTEGRATIVE process: information from different sentences is combined.

Comprehension is a CONSTRUCTIVE process: explicit information in a sentence or sentences is supplemented by world knowledge stored in long-term memory.

Comprehension is dependent on CONTEXT: interpretation (of words, phrases, and actions) does not occur in isolation.
Text comprehension

The product of skilled comprehension is an accurate, coherent and integrated memory-based representation of the meaning of the text – a Mental Model or a Situation Model.

(Johnson-Laird, 1983; Kintsch, 1998)
The Simple View of Reading (Gough & Tunmer, 1986; Hoover & Gough, 1990) describes reading comprehension as the product of word reading and listening comprehension and the relative contribution of each to reading comprehension across development.
The Simple View: change over time

The relative balance between word recognition skills and listening comprehension should change over time

• Confirmation for broad developmental change:
  – longitudinal study sampling in grades 2, 4, and 8 (Catts et al, 2005)
  – meta-analysis (Garcia & Cain, 2014)

• No developmental studies of consecutive grades to pinpoint this shift

• Contribution of word reading and listening comprehension to reading comprehension varies by measure (Keenan et al., 2008; Nation & Snowling, 1997)
The Simple View: the role of fluency

- Fluent word recognition enables rapid access to meaning-based representations of written words such that greater cognitive resources are available for comprehension processes.

- Accuracy may be a sufficient indicator in the early years, when word recognition is slow and more error prone, but fluency may be more important later on (Kershaw & Schatschneider, 2012 vs Høien-Tengesdal & Høien, 2012).

- Do accuracy and fluency make separable contributions? (Silverman et al., 2013 vs Adlof et al., 2006)
The Simple View: developmental study

- **Change over time:** Does the simple view adequately capture change over time as children acquire word recognition skills?

- **The role of reading fluency:** Is word recognition fluency separate from accuracy? What is its role in the prediction of reading comprehension?

Participants

<table>
<thead>
<tr>
<th>Grade</th>
<th>Age (years, months)</th>
<th>% female</th>
<th>% English home lang.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 1</td>
<td>6,06</td>
<td>57</td>
<td>78</td>
</tr>
<tr>
<td>N=125</td>
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<td></td>
</tr>
<tr>
<td>Grade 2</td>
<td>7,06</td>
<td>48</td>
<td>86</td>
</tr>
<tr>
<td>N=123</td>
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<tr>
<td>Grade 3</td>
<td>8,06</td>
<td>54</td>
<td>77</td>
</tr>
<tr>
<td>N=123</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Methods and measures

• **Participants:** Children aged 6-7, 7-8, and 8-9 years

• **Multiple assessments of key skills:**
  – Word recognition
  – Listening comprehension
  – Reading comprehension

Word recognition

Each child completed two measures of word/nonword reading accuracy (number correct), two measures of speeded isolated word/nonword reading, one measure of fluency for connected prose.

<table>
<thead>
<tr>
<th>Age</th>
<th>WJ word ID</th>
<th>WJ word attack</th>
<th>TOWRE sight word</th>
<th>TOWRE non-words</th>
<th>FAIR</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>7 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>8 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<td>✔</td>
</tr>
</tbody>
</table>

# Listening comprehension

Three measures: passages followed by open-ended questions

<table>
<thead>
<tr>
<th>Age</th>
<th>CELF USP</th>
<th>LCM open-ended</th>
<th>TNL open-ended</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>7 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
<tr>
<td>8 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>

Reading comprehension

Three measures: passages followed by multiple-choice questions, open-ended questions, cloze procedure

<table>
<thead>
<tr>
<th>Age</th>
<th>Gates multiple-choice</th>
<th>RCM open-ended</th>
<th>WJ cloze</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 years</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>7 years</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>8 years</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Change over time

A shift around grade 2 (7 - 8 years) in the relative contributions of word recognition and listening comprehension

The role of fluency

The influence of accuracy decreases over time and the influence of fluency increases

Word Accuracy

Word Fluency

Listening Comp.

Reading Comp.

G1 (G2) G3

.64* (.47*) .21

.17 (.05) .30*

.24* (.57*) .61*

R² = .94; (.92); .88
CFI = .98; (.97); .97
SRMR = .05; (.06); .06
NFI = .96; (.95); .94
NNFI = .97; (.95); .95
The Simple View: summary

Change over time

- word recognition skills were critical to early reading comprehension outcomes, but listening comprehension had a significant influence from the earliest stages of reading development

Word recognition

- the best indicator was dependent on age: accuracy was sufficient in the early years, but fluency was more sensitive by 8 to 9 years

The Simple View: implications

Instructional perspective

• listening comprehension should not be ignored in early instruction: can be the vehicle for access to complex text and language

Assessment perspective

• listening comprehension should be assessed early to identify those at risk of specific reading comp. difficulties
• fluency/speed of word reading should be assessed to identify those at risk of reading comprehension problems that result from word recognition weaknesses

The dimensionality of language
The dimensionality of language

Language is typically viewed as a complex system consisting of several components:

- phonology, semantics, syntax/morphology, and pragmatics
- expressive vs receptive
- lower vs higher-level skills
Dimensions of language and reading comprehension

Young language learners:

- vocabulary, sentence memory (proxy for grammar), and inference making (higher-level) each explain unique variance in concurrent listening comprehension in 6-year-olds (Lepola et al., 2012)

Young readers:

- evidence for separability; lower- & higher-level skills predict unique variance in reading comprehension outcomes (Oakhill & Cain, 2012; Silva & Cain, in press)
Dimensionality: developmental study

• **Structure of language:** What is the dimensional structure of language ability in young children?

• **Change over time:** Does the dimensional structure change over time?
Dimensionality: models

Three factors

- Vocabulary
- Grammar
- Discourse

Two factors

- Lower-level language
- Higher-level language

Uni-dimensional

Language

LARRC (under review) Child Development
## Participants

<table>
<thead>
<tr>
<th>Grade</th>
<th>Age (years, months)</th>
<th>NV IQ (standardised score)</th>
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<tbody>
<tr>
<td>Pre-K</td>
<td>4,06</td>
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<tr>
<td>Kindergarten</td>
<td>5,06</td>
<td>101</td>
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<tr>
<td>Grade 1</td>
<td>6,06</td>
<td>106</td>
</tr>
<tr>
<td>Grade 2</td>
<td>7,06</td>
<td>109</td>
</tr>
<tr>
<td>Grade 3</td>
<td>8,06</td>
<td>109</td>
</tr>
</tbody>
</table>

LARRC (under review) Child Development
Each child completed two measures of receptive vocabulary and two of expressive vocabulary.

<table>
<thead>
<tr>
<th>Age</th>
<th>PPVT-R</th>
<th>EVT-E</th>
<th>CELF-R</th>
<th>CELF-E</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 years</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>5 years</td>
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<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>6 years</td>
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<tr>
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<td>✔</td>
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<tr>
<td>8 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
</tr>
</tbody>
</table>
Language measures: grammar

Each child completed 4 - 5 measures of receptive and expressive grammar, assessing a range of knowledge.

<table>
<thead>
<tr>
<th>Age</th>
<th>Morph Der</th>
<th>TROG</th>
<th>CELF word</th>
<th>CELF recall</th>
<th>TEGI past</th>
<th>TEGI 3rd</th>
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</thead>
<tbody>
<tr>
<td>4 years</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>5 years</td>
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<td>✔</td>
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<tr>
<td>8 years</td>
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</table>
## Language measures: higher-level

Each child completed measures to assess 3 higher-level skills: comprehension monitoring, inference, & knowledge of narrative structure.

<table>
<thead>
<tr>
<th>Age</th>
<th>CompM KVT</th>
<th>CompM DI</th>
<th>Inf BK</th>
<th>Inf Int</th>
<th>Narr PAT</th>
<th>Narr SAT</th>
</tr>
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<tbody>
<tr>
<td>4 years</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>5 years</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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<tr>
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<tr>
<td>8 years</td>
<td>✓</td>
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</table>

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Higher-level language: comprehension monitoring

Knowledge violations test: A man had three sons. The youngest was Jack. Every morning Jack chopped wood for his family. He always used a knife to chop the wood. Jack had to do it quickly on school days so he wouldn't be late for school.

Detecting inconsistencies: Last night Jill walked home through the park. There was no moonlight, so Jill could hardly see her way. Jill often takes this route home. She walked along a narrow path. The moon was so bright that it lit the way. Jill lives on the other side of the park.
Higher-order language: text structure

**Picture arrangement test:** arrange sequence of 3 to 5 pictures into a 'good story'.

**Sentence arrangement test:** arrange sequence of 6 to 12 sentences into a 'good story'.

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Billy, Susie, and their Mum had gone out for the day. Billy spent the morning building a sandcastle near the water. Mum sat on their large beach towel and read a book. Susie wanted to go for a swim. She put her feet in the sea but the water felt too cold. Susie went and sat down next to Mum, instead.

Background knowledge (link with BK to establish theme)
Q: Where were Billy and his family?

Integrative (connecting propositions)
Q: Why did Susie not swim in the sea?
A unidimensional structure for language was apparent for 4 to 5 and 5 to 6-year-olds (PK & K):

- The 1-, 2-, and 3-factor models were all good fits to the data.....
- ...but, taken together, the fit indices identified the uni-dimensional model as the best fitting model for both age groups.
With increasing age, a multidimensional structure emerged:

• For Grades 1 & 2, the 2-factor model was a better fit than the 1-factor model and there was no difference between the 2- and 3-factor models.

• By Grade 3, the 3-factor model was the better fit.
Dimensionality: summary

Structure of language

- The dimensional structure of language appears to change across development

Dimensionality emerges with age

- Higher-level language skills, when included, form part of a unidimensional construct at 5 & 6 years
- A multi-dimensional structure emerges after 6 years, with two factors at 7 to 8 years and three factors by 8 to 9 years
Dimensionality: implications

Instructional perspective

• Language rich interactions important

Assessment perspective

• important not to rely on a single language measure, because all dimensions are important (if not separable)

  • fits with conclusion of National Early Literacy Panel (2008) - best prediction of reading comprehension evident when vocabulary, grammar, and discourse-level skills included in assessment

LARRC (under review) Child Development
Pressure points in the reading system

According to the Simple View of Reading, poor reading comprehension can arise from difficulties with word recognition, listening comprehension, or both.
Perfetti, Stafura, and Adlof (2013) proposed three possible “pressure points” in the reading system:

- Word-level processes, e.g., word recognition and meaning retrieval
- Higher-level comprehension processes, e.g., inference making, comprehension monitoring
- General cognitive abilities, e.g., poor working memory

When considered together several language skills together predict reading comprehension outcomes (Catts et al., 1999; Oakhill & Cain, 2012)
Pressure points: study questions

Individual pressure points: Do selected pressure points predict unique variance in children's reading comprehension level?

The relation with reading comprehension level: Does the importance of pressure points vary as a function of the level of children's reading comprehension skill?
Pressure points: study

- **Participants:** Children aged 7 to 9 years (US grades 2 and 3)

- **Multiple assessments of key skills:**
  - Word recognition: accuracy and fluency
  - Vocabulary: receptive and expressive
  - Grammar: receptive and expressive, word – (morphology) and sentence-level
  - Higher-level skills: comprehension monitoring, inference
  - Memory: storage and processing
Pressure points: results

Vocabulary and its relationship with reading comprehension

At the lower end of the comprehension distribution there is a stronger relationship between vocabulary and comprehension scores than at higher end

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Pressure points: results

Similar pattern for each construct: more predictive of reading comprehension at the lower end of the reading comprehension distribution

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Pressure points: results

Vocabulary and its unique relationship with reading comprehension

When controlling for other constructs, vocabulary predicted variance in reading comprehension across the distribution

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Pressure points: results

When controlling for other constructs, vocabulary, grammar, and higher-level language each predicted variance in reading comprehension across the distribution.

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Pressure points: summary

**Individual pressure points**

- Vocabulary, grammar, and higher-level language each uniquely accounted for variance in reading comprehension
  - Constructs are consistent with dimensionality findings
- Memory was not a strong predictor

**The relation with reading comprehension level**

- Word reading was only a unique predictor for poor readers
- Greater proportion of variance in reading comprehension accounted for in poor comprehenders (84%) than better comprehenders (53%)

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inference
enables integration of information into the mental model; essential for filling in missing details; supports vocabulary and knowledge acquisition

vocabulary & background knowledge
support comprehension in general and inference in particular; are learned from text; background knowledge can provide a framework for the mental model

grammar and cohesive ties
enables integration of meaning between clauses and sentences; key words signal text structure and inference

text structure
provides a framework for the mental model; can support inference making and learning from text

comprehension monitoring
enables the reader to identify when comprehension has failed, for example unknown vocabulary, an unresolved pronoun, or the need for an inference

Pressure points: implications

Instructional perspective

• A range of language skills contribute to reading comprehension outcomes

Assessment perspective

• Grammar was the most consistent predictor: should be included in language batteries, alongside vocabulary and higher-level skills to identify those with comprehension weaknesses
General conclusions

Learning to read: should we keep things simple?

• good reading comprehension is not simply the result of good word reading; good word reading skills and good listening comprehension skills are both necessary for good reading comprehension.

• listening comprehension has a critical influence on reading comprehension early in development.

• together, these findings suggest that literacy instruction should include rich oral language activities from the outset, while word reading is developing.
General conclusions

The dimensionality of language
- oral language skills are separable and measurable early on

Pressure points in reading comprehension
- reading comprehension determined by skills beyond the word- and sentence-level: higher-level language skills, such as inference and monitoring, are also important.

Together, these findings suggest that instruction or intervention needs to include multiple skills to support the construction of the meaning-based representation of the text; a focus on a single skill runs the risk of overlooking the contributions made by other aspects of language and will not result in effective curricula and robust interventions for young or struggling readers.