Word Morphology and its Role in Reading Development and Reading Disabilities

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Faculty of Education
Department of Psychology
Centre for Neuroscience Studies
Queen’s University
Thank you to …

<table>
<thead>
<tr>
<th>Students, past and present</th>
<th>Colleagues</th>
<th>Sources of Funding</th>
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<tr>
<td><strong>Education</strong></td>
<td><strong>Queen’s</strong></td>
<td>Social Sciences and Humanities Research Council</td>
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<tr>
<td>Peter Bowers</td>
<td>Douglas Munoz</td>
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<tr>
<td>Miao Li</td>
<td>Lesly Wade-Woolley</td>
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<tr>
<td>Barbara Mendes</td>
<td><strong>Alberta</strong></td>
<td>Canadian Language and Literacy Research Network</td>
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<td>Cara Metzger</td>
<td>George Georgiou</td>
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<td>Jeff MacCormack</td>
<td>Rauno Parrila</td>
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<td>Sana Tibi</td>
<td>Tomohiro Inoue</td>
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<td>Bozena White</td>
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<td>Laura Steacy</td>
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<td>Kelly Geier</td>
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<td>Hengameh Hassan-Yari</td>
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<tr>
<td>Noor Al Dahhan</td>
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</table>

**Elsewhere**
- Kate Cain (Lancaster)
- Donald Compton (Vanderbilt)
- Hélène Deacon (Dalhousie)
- Alain Desrochers (Ottawa)
- Michael Lawson (Flinders)
- Timothy Papadopoulos (Cyprus)
- Xiuli Tong (Hong Kong)
The Message

1. Morphology is exciting and important for reading
2. Morphology works because it helps integrate (bind) letters, sounds, and meaning
3. Morphology is important for struggling readers

Morphology describes how words are composed of morphemes, the smallest units of meaning

Prefix + Base + Suffix or Base + Base

Examples: walked = walk + ed (an inflection)  
design = de + sign (a derivation)  
deadline = dead + line (a compound)

Morphological awareness is sensitivity to morphemes and ability to manipulate them
Outline

1. How reading works

2. How morphology contributes

3. The promise of morphology for struggling readers
How reading works: 1. The Simple View of Reading

Gough & Tunmer, 1986

Both decoding and language comprehension are needed
How reading works: 2. The Simple View of Reading plus Fluency

Adequate speed of word reading is essential
How reading works: 3. The Not-So-Simple View of Reading

Vocabulary, Morphology
Prior knowledge
Inferencing

Phonological awareness
Naming speed
Orthographic knowledge
Morphological awareness
Phonics knowledge

Listening comprehension

Decoding

Fluency

Orientation
Purpose

Reading Comprehension

Strategies
How reading works: 3 The Not-So-Simple View of Reading

- Vocabulary, Morphology
- Prior knowledge
- Inferencing

- Phonological awareness
- Naming speed
- Orthographic knowledge
- Morphological awareness
- Phonics knowledge

- Listening comprehension

- Decoding

- Fluency

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How reading works: 3 The Not-So-Simple View of Reading

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- Decoding
- Fluency
- Strategies

- Orientation
- Purpose

Meaning path
Decoding path
Speed path
Deep path
Home literacy environment, emergent literacy skills, and reading skills (Inoue, Georgiou, Parrila & Kirby, 2018)

* $p < .05$. ** $p < .01$. *** $p < .001$
What is reading?

Semantics
(meaning)

Orthography
(spelling, letters)

Phonology
(sounds)
How to teach reading?

Perhaps everything is needed for English.

Whole Language

Semantics

Orthography

Whole Word

Phonology

Phonics
The Reading Network (Left hemisphere)

- Two pathways:
  - Dorsal: Spelling to Sound to Meaning, for sounding out
  - Ventral: Spelling to Meaning to Sound, for whole word recognition
  - Developing automaticity and integration

For more on the Reading Network, see:


So what about Morphology?

• There are **bases** and **affixes**

• English uses three kinds of morphology:
  • Inflections ( plurals, verb tenses, etc.)
    • English has very few compared to languages such as French
  • Derivations (adding prefixes and suffixes to make new words, for example **un + help + ful**)
  • Compounds (book + shelf) (two bases)

• Remarkably, outside of Linguistics classrooms, morphology is seldom taught systematically
Morphology

English is fundamentally Morpho-phonemic

English orthography “is not merely a letter-to-sound system riddled with imperfections, but instead, a more complex and more regular relationship wherein phoneme and morpheme share leading roles” (Venezky, 1967, p. 77)

English spelling pays some attention to phonology, but more to morphology (why is there a “g” in sign?)

Morphology is a key to learning vocabulary, and vocabulary is key for language. We know about 50,000 distinct words by age 20, so we learned 2500 per year, or 7 per day. How?

Children should learn how their language works.
Where is morphology?

Morphology binds semantics, orthography, and phonology.
How do we measure morphological knowledge or awareness?

• Some examples:
  
  • Word Analogy: \textbf{walk} is to \textbf{walker} as \textbf{think} is to ____________
  
  • Composition: (farm) My uncle is a ____________
  
  • Decomposition: (driver) Children are too young to ____________
  
  • Pseudoword derivation: The teacher said she was too ____________.
    
    A. sigglition.   B. siggly    C. siggling   D. sigglize
  
  • Base Identification: What is the main part of these words?
    
    A. Teacher   B. Unhelpful,   C. Construction,   D. Business
Morphological knowledge predicts reading ability

Grade 3: After controlling verbal and nonverbal IQ, and phonological awareness (Kirby, et al., 2012)

Other studies show the same, with other predictors controlled, in many languages, e.g., Arabic (Tibi & Kirby, 2014), French (Kirby, Desrochers, & Thompson, 2010)

True for adults too (Kotzer, Heggie & Kirby, 2019)
Morphological awareness is often the strongest predictor

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Word Reading</th>
<th>Reading Comprehension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verbal IQ (vocabulary)</td>
<td>.05</td>
<td>.31***</td>
</tr>
<tr>
<td>Nonverbal IQ (Matrices)</td>
<td>.09</td>
<td>.02</td>
</tr>
<tr>
<td>Phonological awareness</td>
<td>.28***</td>
<td>.02</td>
</tr>
<tr>
<td>Naming speed</td>
<td>.18**</td>
<td>.15*</td>
</tr>
<tr>
<td>Orthographic processing</td>
<td>.22**</td>
<td>.19**</td>
</tr>
<tr>
<td><strong>Morphological awareness</strong></td>
<td><strong>.30</strong>*</td>
<td><strong>.37</strong>*</td>
</tr>
<tr>
<td>% accounted for</td>
<td>59%</td>
<td>61%</td>
</tr>
</tbody>
</table>

Kirby, Deacon, Parrila, etc, in preparation)
Poor Morphological Awareness characterizes unexpected poor comprehenders

- “unexpected poor comprehenders” are students with adequate word reading ability but poor reading comprehension

- Grade 5 poor comprehenders performed worse on morphology tasks (derivation) in grade 3 than average readers (Tong, Deacon, Kirby, Cain, & Parrila, 2011)

- In Chinese ESL students, poor and average comprehenders performed worse in morphology than good comprehenders (Li & Kirby, 2014)
Morphological instruction improves reading

Meta-analyses (e.g., Bowers, Kirby & Deacon, 2010) have shown that morphological instruction (compared to regular class instruction)

- Improves reading, spelling, vocabulary
- Is more effective for younger children
- Is more effective for less able children
- Medium effect sizes

Effect sizes: 0.2 = small  
0.5 = medium  
0.8 = large
Morphology and reading


Including a chapter by Kirby & Bowers,
The effects of morphological instruction on vocabulary learning, reading, and spelling.
Effect sizes of Morphological instruction (from Bowers, Kirby, & Deacon, 2010)

<table>
<thead>
<tr>
<th>Outcome Variable</th>
<th>Sub-Lexical</th>
<th>Non-Morphological</th>
<th>Lexical</th>
<th>Supra Lexical (Comprehension)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Morphological</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>M vs. Control</td>
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<tr>
<td>(AT)</td>
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<td></td>
</tr>
<tr>
<td>All Readers (all effects)</td>
<td>0.65</td>
<td>0.34</td>
<td>0.41</td>
<td>0.28</td>
</tr>
<tr>
<td></td>
<td>(0.51)</td>
<td>(0.08)</td>
<td>(0.12)</td>
<td>(-0.08)</td>
</tr>
<tr>
<td>Less Able Readers</td>
<td>0.99</td>
<td>0.63</td>
<td>0.57</td>
<td>0.67</td>
</tr>
<tr>
<td></td>
<td>(1.25)</td>
<td>(0.25)</td>
<td>(0.24)</td>
<td>(0.39)</td>
</tr>
<tr>
<td>Younger (K - 2)</td>
<td>1.24</td>
<td>0.49</td>
<td>0.57</td>
<td>0.27</td>
</tr>
<tr>
<td></td>
<td>(1.25)</td>
<td>(-0.16)</td>
<td>(-0.07)</td>
<td>(-0.22)</td>
</tr>
<tr>
<td>Older (Gr 3 - 8)</td>
<td>0.62</td>
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<td>0.37</td>
<td>0.29</td>
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Note. M = Morphological instruction group, C = Control group, AT = Alternative Treatment Group.
Effect sizes of Morphological instruction (from Bowers, Kirby, & Deacon, 2010)

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Note. M = Morphological instruction group, C = Control group, AT = Alternative Treatment Group.

- Generally effective, compared to controls
- More effective for younger and less able
- Weaker compared to alternative treatments
Effect sizes at Lexical (word) level (Bowers, et al., 2010)

<table>
<thead>
<tr>
<th>Outcome (lexical level)</th>
<th>Reading</th>
<th>Spelling</th>
<th>Vocabulary</th>
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<tr>
<td>M vs. Control (AT)</td>
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### Effect sizes at Lexical (word) level

(Bowers, et al., 2010)

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Effective for word reading, spelling, and vocabulary. This may be the main locus of its effect.

You don’t have to choose between Morphology and AT, you can combine them.
<table>
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<tr>
<td></td>
<td>Literacy difficulties</td>
<td>All students</td>
</tr>
<tr>
<td>Phonological awareness</td>
<td>0.49</td>
<td>0.48</td>
</tr>
<tr>
<td>Morphological knowledge</td>
<td>0.40</td>
<td>0.44</td>
</tr>
<tr>
<td>Decoding</td>
<td>0.23</td>
<td>0.59</td>
</tr>
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# Effects sizes of morphological awareness instruction

(Goodwin & Ahn, 2010, 2013)

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- Generally effective
- Still effective for those with literacy difficulties
- Weaker for comprehension
Effects of Morphological Instruction

• Broadly effective
• Especially for younger (Lyster did it with pre-school children) or less able
• Whereas predictive studies showed the strongest effects on reading comprehension, instructional studies showed weaker effects on reading comprehension
  • Comprehension (and fluency) may come after practice and automaticity
• We know enough now to advocate morphological instruction be included in literacy programs
• But we need to know more about how best to teach it
How morphology contributes (A)

• Morphology is a part of lexical quality (Perfetti, 2007) and helps *bind* orthographic, phonological, and semantic representations (Bowers, et al., 2010; Kirby & Bowers, 2017, 2018)

• This is how it contributes to word reading
How morphology contributes (B)

• Deacon, Kieffer & Laroche, 2014:

  • Word reading partially mediates the effect of MA on reading comprehension

  Word reading

  Morphological awareness

  Reading comprehension
How morphology contributes (C)

- Levesque, Kieffer & Deacon, 2017:
  - MA contributes to word reading through M. Decoding
  - MA contributes to reading comprehension (a) directly, (b) through M. Decoding and word reading, and (c) through M. Analysis
Implications for instruction: General principles

• **Integrate** morphological instruction with other aspects of literacy (binding phonology, orthography, and semantics)
  • Reading, spelling, vocabulary
  • Teach how it applies (teach for transfer)

• Integrate morphological instruction with **content** learning, addressing key words and morphemes

• Teach **bases** and **affixes**; teach **bound bases**

• *Never too young* to start
  • Oral then written

• Use it with **struggling readers**

• Make use of errors (discovery → disco + very) to demonstrate how to test them

• **Problem solving**, not just rules and content
Implications for instruction: What can go wrong (grade 8)

• Displacement:
  • “dis means not and placement means to place something so displacement means to not place something”

• Depicted:
  • “not picted”
  • “when you get discluded”
  • “de + pict + ed to depict means to figure out something”

• Humanitarian:
  • “something that eats humans”
Implications for instruction: Tools

• Word matrices
• Word sums
• Structure test
• Meaning test
• Three orthographic change rules:
  • Silent –e: hope → hoping
  • Consonant doubling: hop → hopping, not hoping
  • y to i: carry → carriage, busy → business
Instruction: Word Matrix and Word Sums

Word sums:

- please/ + ing → pleasing
- please/ + ant + ly → pleasantly
- un + please/ + ant + ness → unpleasantness
- please/ + ure/ + able → pleasurable
- dis + please → displease
sense
“feel, perceive”

- ible
- ibly
- ibility
- ion
- ion
- or
- or
- ate

- ial
- ism
- ize
- ize
- ous
- or
- or
- ous
- ic

- al
- ly
- ity
- ed
- ing
- al
- ly
- ity
- es
Instruction: Structure and Meaning Tests

- Morphological hypothesis testing
- The **structure** test: the learner demonstrates that all of the hypothesized morphemes in a word sum are plausible morphemes in other words
- The **meaning** test: the learner shows that the base and the more complex word share a common meaning
  - if not transparent, can be explored in the words’ etymological origins

For more on instruction, see [www.wordworkskingston.com](http://www.wordworkskingston.com)
Future directions: Content area Vocabulary

- Grade 8 Science words:
- Unit on Fluids: Buoyancy, Viscosity, **Density**, Particle, Volume, Pressure, Hydraulic, Submarine, Hydrodynamics
- Teach about these words and their families, to increase lexical quality

- Perhaps also at University?

\[\text{dichlorodifluoromethane} = di+\text{chloro}+di+\text{fluoro}+\text{meth}+\text{ane}\]
May help in second language learning

An unfamiliar base in L2 may be more familiar in L1

Latin, am(are) "to love"
Key area: Morphology-oriented curriculum for the reading disabled

- Since Elbro & Arnbak (1996) there has been an argument that children with phonologically-based reading problems have a “relative advantage” in morphology
- Morphology could act as a mediating system, helping with the orthography → phonology link that is faulty
- Morphology would not replace phonology, but enhance it
- Such a curriculum needs to be developed and tested
The Message Again:
1. Morphology is exciting and important for reading
2. Morphology works because it helps integrate \textit{bind} letters, sounds, and meaning
3. Morphology is important for struggling readers

What’s next?
- Morphology in other languages
  - Arabic – has a nonlinear morphology (with Sana Tibi)
- Morphological instruction for struggling readers (with Jeff MacCormack and Peter Bowers)
  - Build on a relative strength
- Teachers’ knowledge of morphology
- Encourage integrated curriculum development
- ???
Thank You!

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References

Resources
[www.wordworkskingston.com](http://www.wordworkskingston.com)
[www.neilramsden.co.uk/spelling](http://www.neilramsden.co.uk/spelling)
[www.vocablog-plc.blogspot.com](http://www.vocablog-plc.blogspot.com)
[www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/WW_Morphology.pdf](http://www.edu.gov.on.ca/eng/literacynumeracy/inspire/research/WW_Morphology.pdf)
## Common affixes

<table>
<thead>
<tr>
<th>Prefixes</th>
<th>Vowel suffixes</th>
<th>Consonant suffixes</th>
</tr>
</thead>
<tbody>
<tr>
<td>a-, ad-, al-, be-, bi-, com-, contra-, de-, di-, dia-, dis-, en-, ex-, in-, inter-, intro-, mis-, non-, ob-, para-, per-, pre-, re-, se-, sub-, syn-, tele-, trans-, un-</td>
<td>-ability, -acle, -acy, -al, -ance, -ate, -ed, -eer, -ence, -er, -ery, -ian, -ibility, -icle, -ing, -ion, -ique, -ism, -ity, -ive, -ize, -or, -ory, -ous, -ule, -ure</td>
<td>-cy, -dom, -ful, -hood, -less, -let, -ling, -ly, -ment, -ness, -ry, -s, -ship, -some, -st, -th, -ty, -ware</td>
</tr>
</tbody>
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