Children's awareness of derivational morphology

Cross-language comparisons

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Psycholinguistic Grain Size theory

(Ziegler & Goswami, 2005)
How do children acquire sensitivity to morphological information in visual word recognition?

- Form-meaning co-activations (Schreuder & Baayen, 1995)
- Morphological awareness (Seymour, 1997; Rastle & Davis, 2008)
- Interaction between type frequency, meaning and compositionality (Reichle & Perfetti, 2003)
- Orthographic familiarity of letter sequences (Rastle & Davis, 2008)
Study 1

Morphological awareness in spoken language

Duncan, Casalis & Colé (2009)
Awareness of derivational morphology in spoken language

- marked growth between Grades 1 & 6 and continued improvement into adulthood
  - e.g. Derwing & Baker (1979)

- developmental trend for greater explicitness in knowledge about the definition of derivations
  - e.g. Anglin (1993)
Meta-linguistic development

- implicit phases are obligatory in typical language development
  - sufficient to produce accurate behavioral performance
  - limited flexibility to generalize to other situations

- explicit phases are optional and involve *meta-linguistic* control
  - requires presence of a demand for this type of conscious control in the external environment (e.g. learning to read)
Morphological awareness tasks

- **Judgement**
  - Do these words belong to the same family? …heat-heater?…ham-hammer?
  - Requires less explicit control

- **Production**
  - Someone who runs is a ……? (RUNNER)
  - Requires more explicit control

Carlisle (1995)
Why French and English?

- **Word Formation via Derivation**
  - farm $\rightarrow$ farmer
  - China $\rightarrow$ chinese
  - ferme $\rightarrow$ fermier
  - Chine $\rightarrow$ chinois

- **Word Formation via Compounding**
  - windscreen
  - pare-brise

### Diagram

- **ENGLISH**
  - Compounding
  - Derivation

- **FRENCH**
  - Compounding
  - Derivation
## Participants

<table>
<thead>
<tr>
<th>Language</th>
<th>Grade</th>
<th>N</th>
<th>Chronological Age</th>
<th>Receptive Vocabulary Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Grade 1</td>
<td>15</td>
<td>6;1</td>
<td>7;1</td>
</tr>
<tr>
<td></td>
<td>Grade 3</td>
<td>15</td>
<td>8;0</td>
<td>8;2</td>
</tr>
<tr>
<td>French</td>
<td>Grade 1</td>
<td>15</td>
<td>6;8</td>
<td>8;5</td>
</tr>
<tr>
<td></td>
<td>Grade 2</td>
<td>15</td>
<td>7;11</td>
<td>8;10</td>
</tr>
<tr>
<td></td>
<td>Grade 3</td>
<td>15</td>
<td>8;8</td>
<td>9;11</td>
</tr>
</tbody>
</table>

- Cross-linguistic difference in CA (p < .001) at grades 1 and 3
- VA relative to CA
  - No cross-linguistic effect in Grade 1
  - Cross-linguistic difference in Grade 3 (p < .05)
- No cross-linguistic difference in CA or VA for 8-year-olds
Judgement task
Do these words belong to the same family...heat-heater?

- Language: p < .05
- Grade: p < .05
- No interaction

% Accuracy

Grade 1  Grade 3

English  French

*
Judgement task
Do these words belong to the same family...heat-heater?

<table>
<thead>
<tr>
<th>Language</th>
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<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Grade 3</td>
<td>8;0</td>
</tr>
<tr>
<td>French</td>
<td>Grade 2</td>
<td>7;11</td>
</tr>
</tbody>
</table>

- Language: p < .08 mns
He knows how to zib
What do you call someone whose job is to zib?
This is a mot
What would you call a very tiny mot?
Morphological awareness task

- Someone who runs is a ......?
  - ...RUNNER

- Someone who needs is a ........?
  - ... NEEDER

- Someone who lums is a .....?
  - ...LUMMER

NOTE: Frequency of word root is matched between Real Word and Word Root conditions
No difference in the frequency of French and English roots or derivations
Word Root and Pseudoword Root conditions do not specify a suffix only a transformation
Production task

- Language by Condition by School Grade interaction: $p < .05$
  - French: School Grade (G3>G1), Condition (RW>WB>NWB) but no interaction
  - English: Condition by School Grade interaction (Grade 1: no differences; Grade 3: RW>NB=NWB)

**English**

- Real word: Grade 1 < Grade 3
- Word root: Grade 1 > Grade 3
- Pseudoword root: Grade 1 = Grade 3

**French**

- Real word: Grade 1 > Grade 3
- Word root: Grade 1 < Grade 3
- Pseudoword root: Grade 1 = Grade 3
Production task

<table>
<thead>
<tr>
<th>Language</th>
<th>Grade</th>
<th>Chronological Age</th>
</tr>
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<tbody>
<tr>
<td>English</td>
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<td>8;0</td>
</tr>
<tr>
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<td>Grade 2</td>
<td>7;11</td>
</tr>
</tbody>
</table>

Language by Condition interaction: $p < .001$
- Real words: cross-linguistic difference
- Word root: cross-linguistic difference
- Pseudoword root: no effect

% Accuracy

<table>
<thead>
<tr>
<th></th>
<th>English</th>
<th>French</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>real word</strong></td>
<td><img src="chart1.png" alt="Bar Chart" /></td>
<td><img src="chart2.png" alt="Bar Chart" /></td>
</tr>
<tr>
<td><strong>word root</strong></td>
<td><img src="chart3.png" alt="Bar Chart" /></td>
<td><img src="chart4.png" alt="Bar Chart" /></td>
</tr>
<tr>
<td><strong>pseudoword root</strong></td>
<td><img src="chart5.png" alt="Bar Chart" /></td>
<td><img src="chart6.png" alt="Bar Chart" /></td>
</tr>
</tbody>
</table>
Cross-language differences

- Derivation is more prevalent in French than in English
- Suffixes are unstressed in English
  - musical helpless
- Many English suffixes alter stress pattern of base
  - active → activity educate → education
    good → goodness judge → judgement
- Instruction about derivational affixes is introduced later in English than in French
Morphological awareness in spoken language further exploration

Duncan, Casalis & Quémart (in prep)
### Participants

#### English

<table>
<thead>
<tr>
<th></th>
<th>N</th>
<th>Chronological Age (years)</th>
<th>Reading Age (years)</th>
<th>WISC Vocab (raw)</th>
<th>Ravens Matrices (percentile)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 3</td>
<td>30</td>
<td>7.33 (0.37)</td>
<td>8.23 (0.98)</td>
<td>19.50 (4.07)</td>
<td>73 (29)</td>
</tr>
<tr>
<td>Grade 4</td>
<td>39</td>
<td>8.43 (0.46)</td>
<td>9.89 (1.62)</td>
<td>23.56 (5.18)</td>
<td>73 (26)</td>
</tr>
</tbody>
</table>

#### French

<table>
<thead>
<tr>
<th>Grade</th>
<th>CE2</th>
<th>Grade 3</th>
<th>16</th>
<th>8.84 (0.37)</th>
<th>9.30 (1.76)</th>
<th>18.94 (5.17)</th>
<th>66 (32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 4</td>
<td>CM1</td>
<td>30</td>
<td>9.91 (0.32)</td>
<td>9.98 (0.88)</td>
<td>20.13 (6.91)</td>
<td>62 (24)</td>
<td></td>
</tr>
</tbody>
</table>

- Cross-linguistic difference in CA (p < .001) at each grade
- RA relative to CA - advantage for English at both grades
- No difference in Ravens
Morphological Awareness

- Effects of Language, $p < .001$, Class, $p < .05$, and Language x Condition, $p < .05$
  - Language differences are stronger for RW and NWR than WR

**English**

**French**

[Bar charts showing accuracy for Real Words, Word Root, and Pseudoword Root for Grade 3 and Grade 4 in English and French.]
Distribution across suffixes English Grade 4

Real Words

Pseudoword Root
When you suggest something you make a…? (suggestion)
When you agree you make an…? (agreement)

Grades 3 & 4
Summary of findings

- Increasing levels of conscious control and generalisable knowledge about derivational morphology in early schooling

- Suffix-specific development under possible influence of
  - familiarity
  - phonological or semantic transparency/productivity

- Cross-language variation
  - morphological development is accelerated in French
  - derivational knowledge is more easily generalised in French
Study 2

Sensitivity to roots and suffixes in visual lexical decision

Casalis, Quémart & Duncan (2015)
Why French and English?

- Word formation via derivation

- Orthographic depth
  - Inconsistency in the mappings between graphemes and phonemes

<table>
<thead>
<tr>
<th>ENGLISH</th>
<th>FRENCH</th>
</tr>
</thead>
<tbody>
<tr>
<td>less derivation</td>
<td>more derivation</td>
</tr>
<tr>
<td>more inconsistency</td>
<td>less inconsistency</td>
</tr>
</tbody>
</table>
## Participants

<table>
<thead>
<tr>
<th>Language</th>
<th>Grade</th>
<th>N</th>
<th>Chronological Age (years)</th>
<th>Reading Age (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>English</td>
<td>Grade 4</td>
<td>40</td>
<td>8.41 (7.58-9.25)</td>
<td>9.58 (6.50-14.00)</td>
</tr>
<tr>
<td>French</td>
<td>Grade 4</td>
<td>32</td>
<td>9.83 (9.33-10.58)</td>
<td>9.83 (8.50-11.83)</td>
</tr>
<tr>
<td>French</td>
<td>Grade 3</td>
<td>32</td>
<td>8.67 (7.58-9.25)</td>
<td>9.16 (7.67-10.91)</td>
</tr>
</tbody>
</table>

- No cross-linguistic difference in CA for ENGR4 vs FRGR3
- No cross-linguistic difference in RA for ENGR4 vs FRGR4
## Lexical decision stimuli

<table>
<thead>
<tr>
<th>Words</th>
<th>Word Root (R+)</th>
<th>Pseudo Root (R-)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Suffix (S+)</td>
<td>Pseudo-suffix (S-)</td>
</tr>
<tr>
<td>farmer</td>
<td>window</td>
<td>murder</td>
</tr>
</tbody>
</table>

### Pseudowords

- gifter
- puffow
- gopter
- ferbow

- **Matched for:**
  - Word frequency (real words, base words)
  - Length not matched except for R-S+ and R+S- bases (French words longer)
Lexical decision results

Words

**Lexical decision results**

<table>
<thead>
<tr>
<th></th>
<th>En Gr 4</th>
<th>Fr Gr 3</th>
<th>Fr Gr 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>farmer</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>window</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>murder</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>narrow</td>
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**Lexical decision results**

<table>
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<tbody>
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<tr>
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<td></td>
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<tr>
<td>narrow</td>
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</tbody>
</table>
Lexical decision results  Pseudowords

<table>
<thead>
<tr>
<th>Pseudoword</th>
<th>En Gr 4</th>
<th>Fr Gr 3</th>
<th>Fr Gr 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>gifter</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>puffow</td>
<td></td>
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<td></td>
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<tr>
<td>gooter</td>
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<tr>
<td>ferbow</td>
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Summary of findings

- Roots and suffixes appear to make letter strings more \textit{word-like} in lexical decision
  - Increased accuracy with words containing suffix (French)
  - Decreased accuracy with words containing neither (English)
  - Reduced accuracy with pseudowords containing both (French & English)

- Only the French children show any advantage for real derivations

- English and French very similar for pseudowords
Conclusions

The present study examined whether morphemic effects in lexical access are universal or whether such effects can be modulated by language specificities during development

• metalinguistic awareness of derivational morphology appears influenced by *availability* (suffix type frequency, productivity)

• *consistency* in grapheme-phoneme mapping does not appear to reduce the use of morphemes in reading

• evidence of strong sensitivity to semantics in visual word recognition during middle childhood
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