Morphological Awareness: A Key to Understanding Poor Reading Comprehension in English

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This longitudinal study examined the performance of poor comprehenders on several reading-related abilities in the late elementary school years. We identified 3 groups of readers in Grade 5 who were matched on word reading accuracy and speed, nonverbal cognitive ability, and age: unexpected poor comprehenders, expected average comprehenders, and unexpected good comprehenders. We compared these groups in Grade 5 and, retrospectively, in Grade 3. The 3 groups performed similarly on phonological awareness, naming speed, and orthographic processing tasks but differed in morphological awareness, even when vocabulary was controlled statistically. Unexpected poor comprehenders performed more poorly than expected average comprehenders in morphological derivation at Grade 5 but not in Grade 3; in contrast, expected average comprehenders performed more poorly than unexpected good comprehenders at Grade 3, but these groups did not differ in Grade 5. Our findings suggest that poor morphological awareness contributes to reading comprehension difficulties and that children with different reading comprehension profiles may learn morphology at different rates.

Keywords: unexpected poor comprehenders, morphological awareness, derivational morphology, inflectional morphology, reading comprehension

Recent research has identified children with late-emerging reading disabilities, specifically children who do not show identifiable deficits until Grade 4 or 5 (Leach, Scarborough, & Rescorla, 2003). These children with late-emerging reading disabilities demonstrate weakness in either word-level reading or text comprehension, or both (Compton, Fuchs, Fuchs, Ellemor, & Gilbert, 2008; Leach et al., 2003; Lipka, Lesaux, & Sichel, 2006). In this study, we focused on a specific subgroup of children with late-emerging reading disabilities: unexpected poor comprehenders.

Unexpected poor comprehenders are children who have developed word reading skills that are adequate for their age but who are less competent in comprehending text. We know remarkably little about poor comprehenders, for whom difficulties lie specifically with reading comprehension as compared with dyslexics, for whom difficulties lie specifically at the word level (e.g., Nation, 2005). As an example, difficulties in reading comprehension are typically not identified until after Grade 3, and even at this point, poor comprehenders are substantially underrepresented for testing and treatment (e.g., Leach et al., 2003). Clearly, more needs to be understood about this group of children with reading difficulties. In this study we examined whether unexpected poor comprehenders demonstrate a specific weakness in a skill known to be implicated in reading comprehension in typical readers: morphological awareness.

Morphological awareness refers to individuals’ “conscious awareness of the morphemic structure of words and their ability to reflect on and manipulate that structure” (Carlisle, 1995, p. 194). For example, the word cats is composed of two morphemes: the base cat and the plural marker –s. There is evidence that kindergartners and first graders demonstrate the ability to use inflectional morphemes (Berko, 1958; Carlisle, 1995) and simple transparent derived forms correctly (Carlisle, 1995; Jones, 1991). Inflections include case marking and number and person agreement.

This term poor comprehenders has been used in British research on reading comprehension difficulty to describe children who can understand some of what they have read but not as much as good comprehenders (for a review, see Cain & Oakhill, 2007). Here we use the term unexpected poor comprehenders to clarify that their weakness in reading comprehension is relative to what one would predict from their word reading skills and general ability.

The term poor comprehenders has been used in British research on reading comprehension difficulty to describe children who can understand some of what they have read but not as much as good comprehenders (for a review, see Cain & Oakhill, 2007). Here we use the term unexpected poor comprehenders to clarify that their weakness in reading comprehension is relative to what one would predict from their word reading skills and general ability.

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ment, in which the meaning of the base word remains constant across inflected forms (e.g., execute, executing, executed). Derivations, on the other hand, usually change syntactic class of the base word (as in the change from the verb execute to the nouns executive or execution) and often bring about substantial changes in meaning.

Morphological awareness has been found to be related to word reading (e.g., Carlisle, 1995; Roman, Kirby, Parrila, Wade-Woolley, & Deacon, 2009) and, of note for the current study, reading comprehension (e.g., Carlisle, 2000; Deacon & Kirby, 2004; Kirby et al., in press; Nagy, Berninger, & Abbott, 2006). For example, Deacon and Kirby (2004) showed that performance on an inflectional morphological awareness task at Grade 2 contributed uniquely to reading comprehension at both Grades 4 and 5 after controlling for prior reading ability, verbal and nonverbal ability, and phonological awareness. Nagy et al. (2006) reported similar findings; morphological awareness, indexed by both derivational and inflectional tasks, accounted for unique variance in reading comprehension in children in Grades 4–9, over and above vocabulary. Kieffer and Lesaux (2008) recently showed that knowledge of derivational morphology makes a unique contribution to reading comprehension. In their study, performance on a derivational morphological awareness task contributed to English reading comprehension among upper elementary Spanish-speaking English language learners. This contribution remained even after controlling for word reading, vocabulary, and phonological awareness. A similar finding was recently demonstrated in native English-speaking children (Kirby et al., in press).

These findings support a link between morphological awareness and children’s success in reading comprehension. Moreover, there is empirical evidence demonstrating that the role of morphological awareness in children’s reading development increases in later elementary grades because of an increasing number of complex words to which they are exposed in written text (Wolter, Wood, & D’zatko, 2009). Almost half these words are derived forms (e.g., Nagy & Anderson, 1984). The meanings of morphologically complex words are often indicated by the internal constituents of the word. For example, the meaning of the word displeasure is roughly signaled by the combination of the derivational prefix dis-, meaning “to negate”; the base please, meaning “the feeling of being pleased”; and the suffix -ure, which denotes a quality. It seems likely that an awareness of morphemic structure of words could guide children’s understanding of novel morphological complex words in text. This might, in turn, facilitate text comprehension. It is possible, therefore, that children with weak morphological awareness may not be able to process the morphemic structure of morphologically complex words efficiently, and as a result, reading comprehension difficulties may arise. Identifying the specific domains of the poor comprehenders’ difficulties would provide foundational knowledge for the development of targeted interventions to remediate these difficulties.

Indeed, poor comprehenders’ weakness in morphological awareness has been demonstrated in two studies by Nation and colleagues (Nation, Clarke, Marshall, & Durand, 2004; Nation, Snowling, and Clarke, 2005). In one, Nation et al. (2005) found that 8-year-old poor comprehenders with average-for-age nonword reading scores had difficulties with specific aspects of past tense production. The poor comprehenders did not differ from controls in their ability to inflect either novel verbs (“Today I ____ over the bump”) or regular real verbs, but they made significantly more mistakes in inflecting irregular real verbs (such as to ring with the past tense rang). The authors argued that this specific weakness for irregular verb forms arose from the poor comprehenders’ weak verbal-semantic skills. Poor comprehenders also have difficulties with the elicitation of regular and irregular past tense verbs (Nation et al., 2004).

Findings from studies by Nation et al. (2004, 2005, 2005) reinforce our hypothesis that unexpected poor comprehenders’ weak text comprehension skills are due, at least in part, to weak morphological skills. This is consistent with previous research showing that poor comprehenders lack some of the skills that aid the acquisition of other aspects of language, such as vocabulary knowledge (e.g., Cain, Oakhill, & Elbro, 2003; Cain, Oakhill, & Lemmon, 2004). In this study, we conducted a concurrent and retrospective analysis of morphological skills in children identified with unexpectedly poor comprehension in the fifth grade to examine three primary research questions.

First, we asked whether poor comprehenders’ weaknesses are specific to morphological awareness. To answer this question, we compared performance on multiple measures of morphological awareness and three other reading-related skills—phonological awareness, orthographic processing, and naming speed—in three groups of readers: unexpected poor comprehenders, expected average comprehenders, and unexpected good comprehenders (the specification of the three groups are detailed in the Method section). Each of these has been shown to be related to word reading ability (Adams, 1990; Kirby et al., in press; Roman et al., 2009; Wolf & Bowers, 1999). We predicted that the unexpected poor comprehenders would show a specific difficulty on the morphological awareness tasks.

Second, we asked whether any weakness that emerges in morphological awareness is evident for both derivational and inflectional forms. By including measures of both inflectional and derivational morphology, our study extends previous research (e.g., Nation et al., 2004, 2005) to a more broadly defined morphological awareness construct. We predicted that unexpected poor comprehenders’ weaknesses would emerge most clearly with derivational forms for two reasons. First, there are far more derivations than inflections to learn, and derivations generally involve relatively more complex formations (Carlisle, 2003; Marslen-Wilson, 2001). Certainly, knowledge of derivational morphology increases rapidly during the latter half of the elementary school years (e.g., Anglin, 1993; Carlisle, 2003). Nagy and colleagues (Nagy & Anderson, 1984; Nagy, Osborn, Winsor, & O’Flahavan, 1993) estimated that 40% of unfamiliar words that average Grade 5 students encounter in text are derived from more frequent words. Thus, an increase in morphological knowledge specifically in the derivational domain could be important for subsequent reading comprehension performance. Second, derivational morphological awareness plays an important role in reading comprehension in the upper elementary school years (e.g., Kieffer & Lesaux, 2008; Tyler & Nagy, 1990).

We tested the importance of morphological weakness rigorously by controlling for differences in vocabulary knowledge between our groups, given that there are likely vocabulary differences between unexpected poor comprehenders and good comprehenders (e.g., Nation, Snowling, & Clarke, 2007).

Third, we evaluated when an apparent weakness in morphological awareness might emerge. There is some evidence that the role
of morphological awareness in reading comprehension becomes increasingly prominent in the late elementary school years (Carlisle, 2000; Deacon & Kirby, 2004; Kieffer & Lesaux, 2008). An increasing correlation between morphological and comprehension skills would suggest that the differences between our three levels of comprehenders would emerge more prominently across time. Specifically, the unexpected poor comprehenders may differ more from readers with other comprehension profiles in later rather than in earlier grades. To address this, we compared the three groups of children identified at Grade 5 in their performance at Grades 3 (retroactive comparisons) and 5 (concurrent at the point of identification).

Method

Participants

The participants comprised three groups of children categorized on the basis of fifth-grade reading achievement with a comprehensive regression technique. The three groups were selected from a longitudinal sample of 132 English-speaking children (63 boys, 69 girls) followed from Grade 3 to Grade 5. This longitudinal sample was recruited from Canadian urban and suburban schools in St. Albert, Alberta (n = 59; from eight classrooms in three schools), and Kingston, Ontario (n = 73; from eight different classrooms in six schools), during the fall of 2005. St. Albert is a middle-class community outside a major city (Edmonton), and Kingston is a small city in which the schools selected represented a broad range of socioeconomic status. In order for us to obtain as broad a sample as possible, the only inclusion criteria were that parents signed a consent form, children assented to participation, and all children were able to understand instructions (as demonstrated by ability to complete practice items).

A regression technique was employed to categorize Grade 5 children into three levels of comprehenders relative to their word reading skills: unexpected poor comprehenders, expected average comprehenders, and unexpected good comprehenders (White & Kirby, 2008). We first used a regression equation to predict reading comprehension scores from age, word reading accuracy, word reading speed, and nonverbal cognitive ability. Age, word reading accuracy, and word reading speed are established predictors of reading comprehension scores from age, nonverbal ability, word identification, and word reading fluency dimensions (see below for more details).

Table 1 reports the mean raw scores of performance of three groups of comprehenders on reading, verbal, and nonverbal measures. For the reading scores at Grade 5, for example, the mean raw scores of word reading accuracy for unexpected poor comprehenders, expected average comprehenders, and unexpected good comprehenders were equivalent to the mean score for 11 years 4 months of age (according to the Woodcock Reading Mastery Tests–Revised; Woodcock, 1998). In contrast, the mean raw scores of Grade 5 reading comprehension for unexpected poor comprehenders were equivalent to that for children 9 years 7 months of age, and those for expected average comprehenders and unexpected good comprehenders were equivalent to that for children 10 years 10 months of age and 14 years 5 months of age, respectively. These age equivalencies demonstrate the clear disparity between word reading and reading comprehension for our poor comprehenders.

As shown in Table 1, the three groups were similar in age, nonverbal ability, word reading accuracy, and word reading speed. Figure 1 displays the distribution of unexpected poor comprehenders (UPCs), expected average comprehenders (EACs), and unexpected good comprehenders (UGCs), as well as those who were not selected for analyses (NSC), in the regression predicting reading comprehension from age, nonverbal ability, word identification, and word reading efficiency.
Table 1

Means, Standard Deviations, and Comparisons of Unexpected Poor Comprehenders, Expected Average Comprehenders, and Unexpected Good Comprehenders on the Tests of Reading Comprehension, Age, Nonverbal Ability, and Word Identification and the Test of Word Reading Efficiency

<table>
<thead>
<tr>
<th>Measure</th>
<th>Unexpected poor comprehenders</th>
<th>Expected average comprehenders</th>
<th>Unexpected good comprehenders</th>
<th>F(2, 51)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Age (in months)</td>
<td>105.50</td>
<td>4.30</td>
<td>104.61</td>
<td>5.75</td>
</tr>
<tr>
<td>WASI block design</td>
<td>14.67</td>
<td>5.34</td>
<td>21.11</td>
<td>12.06</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>28.83</td>
<td>8.08</td>
<td>33.78</td>
<td>8.03</td>
</tr>
<tr>
<td>Word reading accuracy</td>
<td>66.39</td>
<td>9.90</td>
<td>65.61</td>
<td>8.14</td>
</tr>
<tr>
<td>Word reading speed</td>
<td>64.06</td>
<td>10.26</td>
<td>61.94</td>
<td>10.72</td>
</tr>
<tr>
<td>Reading comprehension</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word reading accuracy</td>
<td>77.00</td>
<td>10.12</td>
<td>76.56</td>
<td>7.29</td>
</tr>
<tr>
<td>Word reading speed</td>
<td>75.28</td>
<td>7.08</td>
<td>75.06</td>
<td>9.21</td>
</tr>
<tr>
<td>Reading comprehension</td>
<td>35.00</td>
<td>4.56</td>
<td>40.39</td>
<td>4.55</td>
</tr>
<tr>
<td>Group 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note. N = 18 for each group. WASI = Wechsler Abbreviated Scale of Intelligence. 
*p < .05. **p < .001.

Word reading efficiency. The Test of Word Reading Efficiency (Torgesen, Wagner, & Rashotte, 1999) consisted of 104 single words and assessed children’s ability to pronounce isolated words accurately and quickly. Children were asked to read as many of the words as quickly and as accurately as possible within 45 s. The split-half reliability is .93 (Torgesen et al., 1999).

Nonverbal ability. Block Design, a subtest of the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999), was used to measure children’s nonverbal abilities (Kaufman, 1979). Testing stopped when children failed three consecutive items. The split-half reliability of this subtest is .87 for children at age 8 (Wechsler, 1999).

Vocabulary knowledge. The Vocabulary subtest of the Wechsler Abbreviated Scale of Intelligence (Wechsler, 1999) consisted of 42 items and assessed children’s vocabulary knowledge. The children began the test with words, presented both orally and visually, that required oral definition. Testing stopped when children failed five consecutive items. The split-half reliability of this test is .85 for this age group (Wechsler, 1999).

Naming speed. Digit Naming and Letter Naming, adapted from the Rapid Automatized Naming and Rapid Alternating Stimulus test battery (Wolf & Denckla, 2005), were administered to measure children’s speed in naming visually presented numbers and letters, respectively. These tasks were adapted for presentation on a computer, and only one page of stimuli was shown for each task. In Digit Naming five digits were presented randomly 10 times in a display of five rows and 10 columns. The children were asked to name digits as fast as they were able while making as few mistakes as possible. Letter Naming was similar, with five letters presented randomly 10 times in a 5 × 10 array. The test–retest reliabilities of these two tests are .87, and .89, respectively (Wolf & Denckla, 2005).

Phonological awareness. Phonological awareness was measured with the Elision subtest of the Comprehensive Test of Phonological Processing (Wagner, Torgesen, & Rashotte, 1999);
the measure consisted of 29 items, six easier ones having been added to the test items. It was administered to children via a computer’s speaker. Children were asked to repeat the word first and then to say the word that would be left if a specific sound was taken away (e.g., “Say snail. Now say snail without saying /l/”; correct answer: sail). The reliability of this task is .79 in our participants’ age range (Wagner et al., 1999).

Orthographic processing. Word Chains, Word Likeness, and Orthographic Choice tasks were administered to assess children’s skills of orthographic processing in Grades 3 and 5.

Word Chains. Fifty words were presented on 11 lines without any spaces between words. Children were asked to indicate the missing spaces between the words by placing a slash between the words (e.g., boypenonlookname; correct answer: boy[pen/on/look/name] in 1 min. The total score of this task was the number of correct slashes minus the incorrect and omitted slashes up to the last response. The split-half reliability of this task is .84 and .91 in Grades 3 and 5 for the whole sample, respectively.

Word Likeness. Twenty-four pseudoword pairs were selected from previous studies (Siegel, Share, & Geva, 1995) to assess children’s awareness of conventional regularities of English orthography. Children were asked to look at the word pair (presented on a computer screen) and decide which pseudoword looked more like a real word (e.g., tolz or tolb; correct answer: tolb). The Cronbach’s alpha of this task is .66 and .64 for Grades 3 and 5, respectively.

Orthographic Choice. A 30-item computer-based task measured children’s ability to identify correctly spelled words. Each item consisted of a real word and its pseudohomophone (e.g., sleep and sleap) presented on a computer screen. Children were asked to indicate the correctly spelled words by pressing the corresponding key. The word pairs for this task were selected from a previous study (Olson, Forsberg, & Wise, 1994). The Cronbach’s alpha of this task is .74 and .59 for Grades 3 and 5, respectively.

Morphological awareness. Word Analogy and Sentence Completion tests were used to measure children’s morphological awareness.

Word Analogy. Word Analogy consisted of 10 inflectional and 10 derivational items following the form A: B: C: D (Kirby et al., in press; following on Nunes, Bryant, & Bindman, 1997). In each item a pair of words was presented orally to the child, followed by the first word of the second pair. The child was asked to say a fourth word that completed the pattern. An example of an inflection item is push: pushed; lose: (lost) (involving a change from present to past tense). An example of a derived item is paint to painter as bake is to (baker) (involving a transformation from verb to noun). The split-half reliabilities of the inflection and derivation items in Grade 3 are, respectively, .82 and .75; in Grade 5 they are .72 and .66.

Sentence Completion. In the Sentence Completion test, adapted from previous research (Carlisle, 1988), there were 40 items for Grade 3 and 20 items for Grade 5. The child’s task was to choose which of two words, presented both aurally and visually, better completed a sentence (e.g., “She was an excellent hockey ___” (player, playful)). It consisted of real words and pseudowords (20 items for each). Because of a potential ceiling effect for the real words, only the pseudowords were used in Grade 5. The Cronbach’s alpha reliability of this task is .72 in Grade 3 and .60 in Grade 5.

Procedure

All tasks were individually administered in a quiet room in the child’s school by trained research assistants. The tests were given in two 45-min sessions each year; this includes other tests that were part of the larger research project that are not included in this study.

Results

An examination of the normality and linearity of all the variables was performed first with the data for the total sample. Square root transformations (Tabachnick & Fidell, 2007) corrected significant positive skew for Grade 5 word identification and Test of Word Reading Efficiency, and word analogy inflection and derivation in Grades 3 and 5. Skew correction was demonstrated by the fact that all skewness and kurtosis statistics of all variables were far less than 2 times as large as the standard error of skewness and kurtosis (as recommended in Tabachnick & Fidell, 2007). All analyses were carried out with the transformed scores.

Do Unexpected Poor Comprehenders Have Specific Weaknesses in Morphological Awareness?

To answer our first research question, a series of multivariate analyses of variance (MANOVAs) was conducted to test for differences between the three groups in reading-related skills. These analyses were conducted for scores from both the time at which the children were identified in our analyses as members of the three groups (at Grade 5) and earlier in their reading careers (at Grade 3). Table 2 shows the raw scores for each group on each task of the three reading-related constructs: naming speed, phonological awareness, and orthographic processing. Scores for morphological awareness, again as raw scores, are shown in Table 3.

We first created composite scores for naming speed, phonological awareness, orthographic processing, and morphological awareness by averaging z scores for the different indices of each construct at each grade. For example, at Grade 3, naming speed was indexed by Digit Naming and Letter Naming, and orthographic processing by Word Chains, Word Likeness, and Orthographic Choice. The composite score of morphological awareness at Grade 3 was created by averaging z scores of Word Analogy (the total of inflection and derivation subtests) and Sentence Completion. The composite scores of these constructs in Grade 5 were calculated with the same procedure. We conducted four MANOVA analyses: one for each of phonological awareness, orthographic processing, naming speed, and morphological awareness. In each analysis, group was the between-subjects factor.

For phonological awareness, the three groups did not differ, \( \Lambda = .93, F(4, 100) = .91, p = .46 \). The second MANOVA with naming speed as the dependent variable also failed to reveal a significant effect of group, \( \Lambda = .95, F(4, 100) = 0.65, p = .63 \). The third MANOVA performed with the orthographic processing composites similarly revealed no significant group difference, \( \Lambda = .90, F(4, 100) = 1.41, p = .24 \).

In contrast, the MANOVA conducted with the morphological awareness scores revealed a significant effect of group, \( \Lambda = .72, F(4, 100) = 4.43, p < .01, \eta^2_p = .15 \), with significant group differences at each grade, \( F(2, 51) = 6.18, p < .01, \eta^2_p = .20 \), and
Where and When Does Unexpected Poor Comprehenders’ Morphological Weakness Emerge?

To determine where and when poor comprehenders’ weakness in morphological awareness emerged, we conducted a 2 (grade: 3 vs. 5) \times 3 (group: unexpected poor and expected average comprehenders vs. unexpected good comprehenders) analysis of variance (with grade as a repeated measure) for each of the Word Analogy tasks (inflection and derivation). Due to the different number of Sentence Completion items administered in Grades 3 and 5, a one-way analysis of variance was conducted for Sentence Completion at each grade.

**Word Analogy.** There was a significant effect of grade in the analysis of Word Analogy inflection scores, with the Grade 3 children performing less well than the Grade 5 children, \(F(1, 51) = 4.38, p = .05, \eta^2_p = .15\), for Grades 3 and 5, respectively.

**Table 2**

*Means, Standard Deviations, and Comparisons of Unexpected Poor Comprehenders, Expected Average Comprehenders, and Unexpected Good Comprehenders on the Tests of Naming Speed, Phonological Awareness, and Orthographic Processing Skills*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Grade 3</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unexpected poor comprehenders</td>
<td>Expected average comprehenders</td>
</tr>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td><strong>Naming speed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Digit Naming</td>
<td>28.80</td>
<td>4.64</td>
</tr>
<tr>
<td>Letter Naming</td>
<td>28.01</td>
<td>7.04</td>
</tr>
<tr>
<td><strong>Phonological awareness</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CTOPP Elision</td>
<td>22.06</td>
<td>5.14</td>
</tr>
<tr>
<td>Grade 5</td>
<td>25.06</td>
<td>3.44</td>
</tr>
<tr>
<td><strong>Orthographic processing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word Chains</td>
<td>26.56</td>
<td>8.89</td>
</tr>
<tr>
<td>Orthographic Choice</td>
<td>29.11</td>
<td>1.37</td>
</tr>
<tr>
<td>Grade 5</td>
<td>40.78</td>
<td>8.07</td>
</tr>
<tr>
<td>Orthographic Choice</td>
<td>21.17</td>
<td>2.12</td>
</tr>
<tr>
<td>Orthographic Choice</td>
<td>29.11</td>
<td>0.76</td>
</tr>
</tbody>
</table>

Note. CTOPP = Comprehensive Test of Phonological Processing.

\(F(2, 51) = 4.38, p < .05, \eta^2_p = .15\), for Grades 3 and 5, respectively.

**Where and When Does Unexpected Poor Comprehenders’ Morphological Weakness Emerge?**

To determine where and when poor comprehenders’ weakness in morphological awareness emerged, we conducted a 2 (grade: 3 vs. 5) \times 3 (group: unexpected poor and expected average comprehenders vs. unexpected good comprehenders) analysis of variance (with grade as a repeated measure) for each of the Word Analogy tasks (inflection and derivation). Due to the different number of Sentence Completion items administered in Grades 3 and 5, a one-way analysis of variance was conducted for Sentence Completion at each grade.

**Word Analogy.** There was a significant effect of grade in the analysis of Word Analogy inflection scores, with the Grade 3 children performing less well than the Grade 5 children, \(F(1, 51) = 37.49, p < .001, \eta^2_p = .42\). However, there was no significant effect for group, \(F(2, 51) = 2.10, p = .13\), nor was there a significant effect for group interaction, \(F(2, 51) = 1.49, p = .24\).

**Table 3**

*Means, Standard Deviations, and Comparisons of Unexpected Poor Comprehenders, Expected Average Comprehenders, and Unexpected Good Comprehenders on the Tests of Morphological Awareness*

<table>
<thead>
<tr>
<th>Measure</th>
<th>Grade 3</th>
<th>Grade 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unexpected poor comprehenders</td>
<td>Expected average comprehenders</td>
</tr>
<tr>
<td></td>
<td>(M)</td>
<td>(SD)</td>
</tr>
<tr>
<td>Word Analogy–Inflection (10)</td>
<td>6.17</td>
<td>2.33</td>
</tr>
<tr>
<td>Word Analogy–Derivation (10)</td>
<td>5.17</td>
<td>1.95</td>
</tr>
<tr>
<td>Sentence Completion (40)</td>
<td>33.28</td>
<td>4.21</td>
</tr>
<tr>
<td>Grade 5</td>
<td>7.67</td>
<td>2.45</td>
</tr>
<tr>
<td>Word Analogy–Derivation (10)</td>
<td>6.11</td>
<td>1.88</td>
</tr>
<tr>
<td>Sentence Completion (20)</td>
<td>15.06</td>
<td>2.53</td>
</tr>
</tbody>
</table>

Note. Maximum possible score per measure is given in parentheses. UPC = unexpected poor comprehenders; EAC = expected average comprehenders; UGC = unexpected good comprehenders.

*a Maximum possible score. b Equal sign indicates nonsignificant difference, and less-than symbol indicates \(p < .05\) or less.
significant interaction between grade and group, $F(2, 51) = 1.56$, $p = .22$. The analysis of the Word Analogy derivation scores revealed a different pattern. There were significant effects of grade, $F(1, 51) = 37.22, p < .001$, $\eta^2_g = .43$, and group, $F(2, 51) = 9.15, p < .001$, $\eta^2_g = .26$, qualified by a significant interaction between grade and group, $F(2, 51) = 3.72, p < .05$, $\eta^2_g = .13$. Simple main-effects analyses were conducted at each grade to examine the interaction. At Grade 3, the three groups differed significantly in morphological derivation, $F(2, 51) = 5.95, p < .01$, $\eta^2_g = .19$, with least significant difference (LSD) pairwise comparisons showing that scores for both unexpected poor comprehenders and expected average comprehenders were lower than those for the unexpected good comprehenders ($ps < .01$). There was no significant difference between unexpected poor comprehenders and expected average comprehenders ($p = .89$).

At Grade 5, the three groups also differed, $F(2, 51) = 9.08, p < .001$, $\eta^2_g = .26$, and pairwise comparisons indicated that unexpected poor comprehenders performed significantly less well than both expected average comprehenders ($p < .01$) and unexpected good comprehenders ($p < .001$). This time there was no statistically significant difference between expected average comprehenders and unexpected good comprehenders ($p = .34$).

**Sentence Completion.** The analysis of scores for Grade 3 revealed no significant effect of group, $F(1, 51) = 1.77, p = .18$, $\eta^2_g = .07$. The analysis of Grade 5 children’s scores revealed a trend toward a difference between the groups, $F(2, 51) = 2.66, p = .08$, $\eta^2_g = .10$. The LSD pairwise comparisons indicated only that unexpected poor comprehenders differed from unexpected good comprehenders ($p < .05$). No differences were found either between expected average comprehenders and unexpected poor comprehenders ($p = .42$) or between the unexpected poor comprehenders and expected average comprehenders ($p = .15$).

**Follow-Up Analyses to Control for Vocabulary Differences**

To examine whether group differences in performance in morphological derivation remained after controlling for vocabulary differences, we conducted analyses of covariance, with Grade 3 vocabulary knowledge as a covariate, and the dependent variables were Grade 3 and 5 Word Analogy (derivation score only) and Grade 5 Sentence Completion.

The covariate vocabulary was not significantly associated with the Grade 3 derivation score ($p = .46$), and after adjustment for the covariate, the groups still differed on Grade 3 Word Analogy derivation score, $F(2, 50) = 4.50, p < .01$, $\eta^2_g = .15$. The LSD pairwise comparison showed that unexpected poor comprehenders and expected average comprehenders performed less well than the unexpected good comprehenders ($ps < .05$). There was no significant difference between unexpected poor comprehenders and expected average comprehenders ($p = .96$).

The significant group difference in Word Analogy derivation scores at Grade 5 persisted after adjustment for the covariate, $F(2, 50) = 4.76, p < .05$, $\eta^2_g = .16$, even though the effect of vocabulary was significant, $F(1, 50) = 7.91, p < .01$, $\eta^2_g = .14$. The LSD pairwise comparisons indicated again that the unexpected poor comprehenders performed worse than both the expected average comprehenders ($p < .05$) and the unexpected good comprehenders ($p < .01$), who did not differ ($p = .61$). Thus the pattern of results is the same whether or not vocabulary is controlled.

The analysis of Grade 5 Sentence Completion showed that the group effect was not significant, $F(2, 50) = 0.99, p = .38$, after adjustment for the covariate. However, there is a trend for the significance of the covariate vocabulary, $F(1, 50) = 3.67, p = .06$, $\eta^2_g = .07$.

**Discussion**

The findings reported here provide answers to each of three questions raised about unexpected poor comprehenders and extend previous research on the key factors that are associated with reading comprehension difficulties. First, in line with Nation et al. (2004, 2005), we demonstrated that children with unexpectedly poor reading comprehension have specific difficulties with morphological awareness in the presence of good phonological awareness skills; however, for the first time, we also demonstrated that they also have adequate orthographic and naming speed skills.

Second, our findings suggest that, at least for the unexpected poor comprehenders identified at Grade 5, morphological weaknesses appear to be specific to derivational morphology. Our analyses indicate that differences between the three groups are apparent specifically on performance on the derivational subtask of word analogy, at both Grades 3 and 5, and even after controlling Grade 3 vocabulary. Third, we found that differences in morphological awareness emerged during the course of development. That is, unexpected poor comprehenders had poorer scores than expected average comprehenders on the morphological derivation tasks in Grade 5, but there were no differences between these two groups in Grade 3. We discuss our findings in relation to their implications for our understanding of reading comprehension difficulties and how they arise.

Unexpected poor comprehenders showed some competence with inflected words, but they were weaker in derived words. This may be explained by the difference between morphological inflection and derivation. Morphologically derived words make up 40% of unfamiliar words children encounter in text in their late elementary school years (Nagy & Anderson, 1984; Nagy et al., 1993). Research with typically developing readers has found that inflected words are easier to learn than derived ones (Carlisle, 1995). This may be because the morphological changes of derived words are less predictable and reliable, compared with inflected words, which might hinder unexpected poor comprehenders’ progress in learning derived forms. These findings are also in line with prior research showing the unique contribution of morphological derivation to reading comprehension in typically developing English readers (e.g., Kieffer & Lesaux, 2008; Kirby et al., in press; Tyler & Nagy, 1990). The findings of our study reported here further demonstrated that weak morphological derivation abilities were a factor that accounted for reading comprehension difficulties experienced by unexpected poor comprehenders.

It was notable that unexpected poor comprehenders’ competence with inflection was comparable to that of normally developing comprehenders in the present study. This is in contrast to the findings of Nation et al. (2004, 2005) showing the difference between poor comprehenders and control children in recalling grammatically complex sentences (Nation et al., 2004) and in generating irregular past tense forms (Nation et al., 2005).
are at least two important factors that may have contributed to this difference. One is the breadth and depth of the inflectional tasks in these two studies. It remains possible that poor comprehenders have a general competence with inflectional manipulations (as shown in our study) but that they have specific difficulties with regular and irregular past tense forms (as shown in Nation et al.’s studies). The second important factor is the difference in the samples, particularly in terms of age of identification. Nation et al.’s studies were of poor comprehenders identified at 8 years of age, whereas we identified poor comprehenders at 10 years of age. It is possible that poor comprehenders who are identified earlier in their reading careers have weaker inflectional skills than those identified later. New studies are needed to further investigate these differences.

Our study is the first to offer a developmental picture of the emergence of morphological difficulties in poor comprehenders, and this investigation revealed a potential difference in the rate of learning about morphology. Specifically, unexpected poor comprehenders’ performance on morphological derivation tasks at Grade 3 was indistinguishable (statistically) from that of expected average comprehenders; by Grade 5, unexpected poor comprehenders performed more poorly than expected average comprehenders. This finding implies that unexpected poor comprehenders began to lag behind the expected average comprehenders in derivational knowledge between Grades 3 and 5; during this same period expected average comprehenders caught up with the unexpected good comprehenders.

We see two plausible explanations for this pattern. First, both morphological awareness and reading comprehension might be influenced by a third factor. Unexpected poor comprehenders are poor at inferring the meaning of new words from context (Cain et al., 2004), at consolidating the meaning of newly acquired words (Ricketts, Bishop, & Nation, 2008), and in retaining information in working memory (Cain, 2006; Yuill, Oakhill, & Parkin, 1989). Their lower language skills in these domains, in spite of their adequate early morphological awareness skills, could lead to both poorer morphological awareness and poorer reading comprehension. Second, the relationship between morphological awareness and reading comprehension might be bidirectional, as has been suggested for the relationship between morphology and writing (Levin, Ravid, & Rapaport, 2001; Nunes et al., 1997). Children who have greater insight into the morphemic structure of words might be able to draw on this knowledge to better understand the meaning of written texts (Nagy, Berninger, Abbott, Vaughan, & Vermeulen, 2003). Similarly, children’s reading of texts for meaning might help to elucidate the meanings of morphologically complex words and reinforce children’s sensitivity to the internal morphemic structure of words. Children with lower reading comprehension skills, such as our unexpected poor comprehenders, might be less able to acquire the meanings of new morphologically complex words that they come across in texts. This possibility is supported by evidence that children identified as poor comprehenders at age 8 do not show the same rate of growth between 8 and 11 years in written or spoken vocabulary development as good comprehenders (Cain & Oakhill, in press). We would predict that such patterns and relationships would be increasingly important as morphologically complex words become more common in texts over the upper elementary school years (Anglin, 1993).

Theoretical Implications

The findings reported here are informative to two core models of reading comprehension, the lexical quality theory and the simple view of reading, neither of which explicitly addresses the role of morphological awareness in reading comprehension. According to lexical quality theory (Perfetti, 2007; Perfetti & Hart, 2002), children’s reading comprehension depends on the quality of their lexical representation of words, which is determined by the extent of the bonding of orthographic, phonological, and semantic components. Although this model does not specify the role of morphology in reading comprehension, morphology might be a core part of high-quality lexical representations (Bowers & Kirby, 2010; Bowers, Kirby, & Deacon, 2010). This is particularly the case given that morphology reflects the convergence of phonological and semantic information in the oral domain (see, e.g., Kuo & Anderson, 2006). Print-based morphological regularities incorporate orthography (Gonnerman, Seidenberg, & Andersen, 2007), thus reflecting all three dimensions (sound, meaning, and form) highlighted in this model. Therefore, the role of morphological awareness in reading comprehension might be explained within an extended version of lexical quality theory.

According to the simple view of reading (Gough & Tunmer, 1986; Hoover & Gough, 1990), reading comprehension is hypothesized to be the product of decoding and listening comprehension. Although the simple view does not explicitly specify the influence of morphology in reading comprehension, morphological awareness could be considered to be one part of listening comprehension. This would be one explanation for the difficulties in morphological awareness experienced by unexpected poor comprehenders with typical word reading skills. Alternatively, morphology, as both a parameter of semantic relationships between words and a predictor of word reading, might straddle the decoding and listening comprehension domains (Kirby & Savage, 2008). The placement of morphology in models of reading comprehension clearly needs reevaluation.

Methodological Implications

Beyond these theoretical contributions, the regression technique used to select subgroups of readers offers a novel solution to concerns about the identification of poor comprehenders. The majority of previous studies have selected poor comprehenders by identifying children with word reading scores above some cutoff score (such as an age-appropriate score) who also have reading comprehension scores below some cutoff score. Poor comprehenders are then matched with a comparison group on nonverbal ability (Nation & Snowling, 1999) or word reading and written vocabulary knowledge (Cain, 2006; Oakhill, 1982). These approaches have been useful in identifying children with a discrepancy between word reading and reading comprehension. There are two primary concerns, though, as to the appropriateness of groups identified in this manner.

First, there are concerns as to the measure of reading employed in matching groups. Prior studies have typically measured word reading abilities in context (Cain, 2006; Oakhill, 1982). Better comprehenders might make greater use of context to read words accurately and may, therefore, obtain higher word reading scores than the poor comprehenders (Nation & Snowling, 1998). For this
reason, Nation and Snowling (1999) matched good and poor comprehenders on nonword reading, which assesses the skills that underlie reading of regular words. Notably, this creates groups that differ on measures of irregular word reading (Nation & Snowling, 1998). Our solution was to include a measure of reading of real words (both regular and irregular) in isolation to estimate real word reading while avoiding the inclusion of context that might inflate word reading scores. Additionally, fluency, in the form of word reading speed, might affect comprehension (e.g., Klauda & Guthrie, 2008), as might nonverbal ability. The regression technique offers a way to include multiple pieces of information that are available about the children of interest.

Second, the regression technique allows a distinction to be drawn between types of comparison groups. At least some of the children included in the comparison group in prior studies performed better on the reading comprehension measure than would be expected from their word reading scores (Cain et al., 2004; Nation & Snowling, 1998). Specifically, they appear to be unexpectedly good comprehenders, rather than average comprehenders. It seems important to specify how unexpectedly poor comprehenders diverge from average comprehenders, rather than from exceptionally good ones. Our regression approach distinguishes between unexpected good comprehenders and expected average comprehenders, a comparison that was useful in understanding the developmental trajectory in learning about derivational morphology.

Educational Implications

At the outset, we identified the educational importance of studying poor comprehenders. Clearly, we have much more to learn, but the findings presented here indicate that studies in the domain of morphology might be particularly informative. Our findings suggest that instruction about morphological forms, particularly derived ones, might be a key to the remediation of reading comprehension difficulties. Although we cannot make any causal assumptions about the direction of the relationship between morphological awareness and reading comprehension, there is empirical evidence that instruction on morphology can boost children’s reading comprehension (e.g., Nunes & Bryant, 2006; Reed, 2008; Stahl & Nagy, 2006), and a recent review (Bowers et al., 2010) found that such instruction was more effective for less able readers. Researchers clearly need to test empirically whether training in morphological awareness might be especially helpful in improving unexpected poor comprehenders’ reading comprehension. Such intervention studies would have important educational implications.

Limitations

Several limitations need to be noted. First, although there are clear advantages to our regression approach, a limitation of this study, as of other studies on poor comprehenders, is the small sample size. The occurrence rate of poor comprehenders in primary school is around 10% (Nation & Snowling, 1997), and our identification of 18 poor comprehenders among 132 children is roughly in line with this prevalence and with the proportion identified in other recent studies (Clarke et al., 2010; Nation et al., 2004; Ricketts et al., 2008). As in these other studies, the relatively small sample size may have prevented us from detecting more subtle differences in linguistic profile and developmental trajectory of unexpected poor comprehenders.

Another reason for caution in interpreting our findings is the use of a single measure of reading comprehension in this study. We used a standardized measure of reading comprehension: the Passage Comprehension subtest of the Woodcock Reading Mastery Tests–Revised. Using this reading comprehension test makes our sample comparable to the limited existing literature on poor comprehenders identified in a North American context (Catts et al., 2006). There are also certain limitations related to the Passage Comprehension test used in our study. The Woodcock Passage Comprehension is a cloze-format silent reading test, in which children are asked to provide missing words based on their understanding of passages. Word decoding and listening comprehension have been identified as two key subcomponent skills that account for individual variance in this test (a total of 61% of variance explained by two components; see Keenan, Betjemann, & Olson, 2008). As Keenan et al. (2008) noted, for younger and less skilled word decoders, performance on this test relies more on decoding and less on listening comprehension. For older and more accomplished word decoders, like those in our study, it taps less decoding and more listening comprehension, the latter of which likely reflects the true variance in reading comprehension that is not due to decoding ability. Accordingly, we believe that the Passage Comprehension scores of the participants in our study reflect more individual differences in comprehension per se rather than decoding. Further, our three groups were perfectly matched on word reading accuracy and word reading speed (see Table 1), further reducing the potential impact of single-word reading ability on our results. Nevertheless, it would be useful for future research to include multiple measures of reading comprehension (Swerling, 2004), particularly those that draw on listening comprehension to an even greater extent and that include other methods of measurement beyond the cloze format (such as the Gray Oral Reading Test; Keenan et al., 2008). Such a move would be important for research in both North America, where use of Passage Comprehension is dominant, and Britain, where the use of the Neale Analysis of Reading Ability–II (Neale, 1997) is common.

Another reason for caution in drawing conclusions is the limited number and the characteristics of the morphological awareness measures used. The differences we observed came from one mea-
Morphological awareness is a key to understanding specific difficulties with reading comprehension. This field of research would benefit from the development of standardized measures of morphological awareness with much higher levels of reliability.

In summary, this study identified morphological awareness as a factor distinguishing unexpected poor comprehenders from expected average comprehenders and unexpected good comprehenders. The groups performed remarkably similarly on phonological awareness, orthographic processing, and naming speed, as well as on word reading accuracy and fluency and nonverbal ability. Unexpected poor comprehenders demonstrated a weakness in morphological awareness that was specific to derivation rather than inflection, even with vocabulary controlled. There was evidence of a developmental difference in the rate of learning about morphology, with a difference between unexpected poor comprehenders and expected average comprehenders emerging between Grades 3 and 5. Together these findings underscore the hypothesis that morphological awareness is a key to understanding specific difficulties with reading comprehension.

References


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