

# Prosodic Sensitivity and Morphological Awareness in Children's Reading

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## 1 Abstract

This study examined the complex relationship between prosodic sensitivity, morphological awareness, and reading ability in children in grades 3, 5, and 7. Using a task adapted from Carlisle (1988), we measured children's productive performance of morphological derivations of differing phonological complexity: no phonological change, phonemic change, stress change, and both phonemic and stress change. Children perform significantly worse on both types of derivations that involved stress changes. In addition, prosodic sensitivity and morphological awareness are significant predictors of reading ability, with awareness of stress-shifting morphological awareness of particular importance.

## 2 Introduction

Prosodic sensitivity is the awareness of the linguistic stress and intonation patterns of a language. Stress is of particular importance to English; its perception can be influenced by a syllable's length, loudness, and pitch, which across multiple syllables creates a stress pattern, the alternation of strong and weak syllables. Current concepts of phonological awareness deal with segmental changes, but prosody is considered suprasegmental, as it carries information across multiple segments (onsets, rimes, and phonemes). There are two varieties of stress in English: metrical stress (stress pattern across an entire phrase or sentence) and lexical stress (stress pattern of a single word) (see Table 1).

Term	Example / Definition
Metrical Stress	DOC-tors use pe-ni-ci-llin. Doc-tors use pe-ni-CI-llin.
Lexical Stress	DEsert, deSSERT; REcord (N), reCORD (V)

Table 1. Examples of metrical and lexical stress.

One possible connection between prosody and reading may be through morphology. Some studies have investigated whether children who differ in language and literacy abilities also differ in their ability to productively use different classes of derivational morphemes. Carlisle (1988) studied the ability of children in grades 4, 6, and 8 to orally produce and spell the root and derived forms of words with derivational suffixes. Across the ages studied, children more often orally produced and correctly spelled words which underwent transparent (neutral) changes than words that underwent orthographically and/or phonologically opaque (shift) changes.

In the majority of tasks investigating children's knowledge of shifting and neutral derivational morphology, however, phonologically shifting morphemes are not differentiated between (1) strictly phonemic shifts (e.g. heal, health), (2) phonemic plus stress shifts (e.g. electric, electricity), and (3) strictly stress shifts (e.g. equal, equality). When these categories are combined we cannot determine whether the three types of morphological changes are differentially challenging for children.

Jarmulowicz (2006) provides some insight into this issue. Children aged 7, 8, and 9 were asked to create derived forms of English stems with derivational stress-neutral affixes (e.g.

"Put -ous on the end of poison") and performed at ceiling levels. However, the older children had far greater pronunciation accuracy when creating derived forms with stress-shifting affixes (e.g. "Put -ity on the end of active") than younger children. Thus, children do have difficulty with specifically stress-shifting derivations, rather than solely broad phonological changes. In a follow up study, Jarmulowicz, Hay, Taran, and Ethington (2008) found that children's ability on this test predicted decoding skill, which in turn predicted reading comprehension.

## 3 Research Questions

1. Are all derivational phonological changes of equal difficulty for children?
2. Are prosodic sensitivity and morphological awareness significant predictors of reading ability? If children had found one type of derivation particularly difficult to produce, then does this type have a particularly important relationship to reading?

## 4 Method

104 students (Grade 3, n=44; Grade 5, n=26; Grade 7, n=34) from schools in Eastern Ontario who were fluent speakers of English participated. Figure 1 shows the measures used.

Prosody Composite	Morphological Awareness
Stress Contour Discrimination Stress Contour Matching	MA Task (derivations)
Control Measures	Reading Composite
General Language Ability Nonverbal Intelligence Working Memory Phonological Awareness	GORT (Rate, accuracy, comprehension) TOWRE (Words & nonWords) Word ID

Figure 1. Control measures, reading measures, and measures of prosodic sensitivity and morphological awareness.

Two tasks were used to measure children's Prosodic Sensitivity, the Stress Contour Discrimination and the Stress Contour Matching task. In the first task, adapted from Wood and Terrell (1998), children were asked to discriminate between sentences' metrical stress contours (see Figure 2).

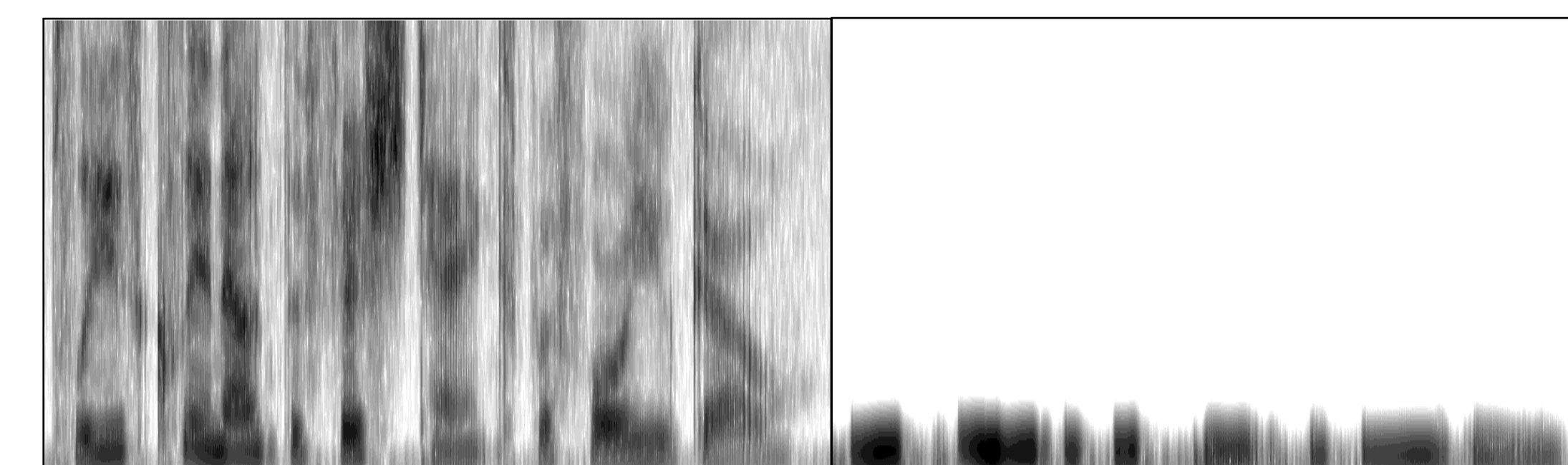


Figure 2. An example of the Stress Contour Discrimination task. Participants were asked to indicate whether two sentences were the same or different.

The second task used was Whalley and Hansen's (2006) DEEdee task, which measures prosodic sensitivity at the metrical level by using a reiterative speech technique (see Figure 3).

## Target: "Humpty Dumpty"

DEEdee DEEdee (HUMpty DUMpty)  
deeDEE deeDEE (the Llon KING)

Figure 3. Examples of the Stress Contour Matching, or DEEdee, task.

Morphological Awareness (MA) was tested with a task adapted from Carlisle (1988) in which children had to produce a derived form of a given root. In our version of the task, 44 items were divided into 4 categories of 11 words each and were matched for frequency: No Change, Phonemic Change, Stress Change, and Both Phonemic & Stress Change (see Table 2).

Table 2. Examples of each category (MA task modified from Carlisle, 1988)

Root	Carrier Sentence	Category
Danger	The steep cliff was very... (dangerous)	No
Discuss	We sat down to have a long... (discussion)	Phonemic
Equal	The teacher treats all her students with... (equality)	Lexical Stress
Magic	For my birthday, we hired a... (magician)	Both

## 5 Results

Question 1: Our data show that children experience different degrees of difficulty when producing words with the different derivation types. A 3 (Grade) x 4 (Derivation type) ANOVA was conducted (see Figures 4 and 5 for results).

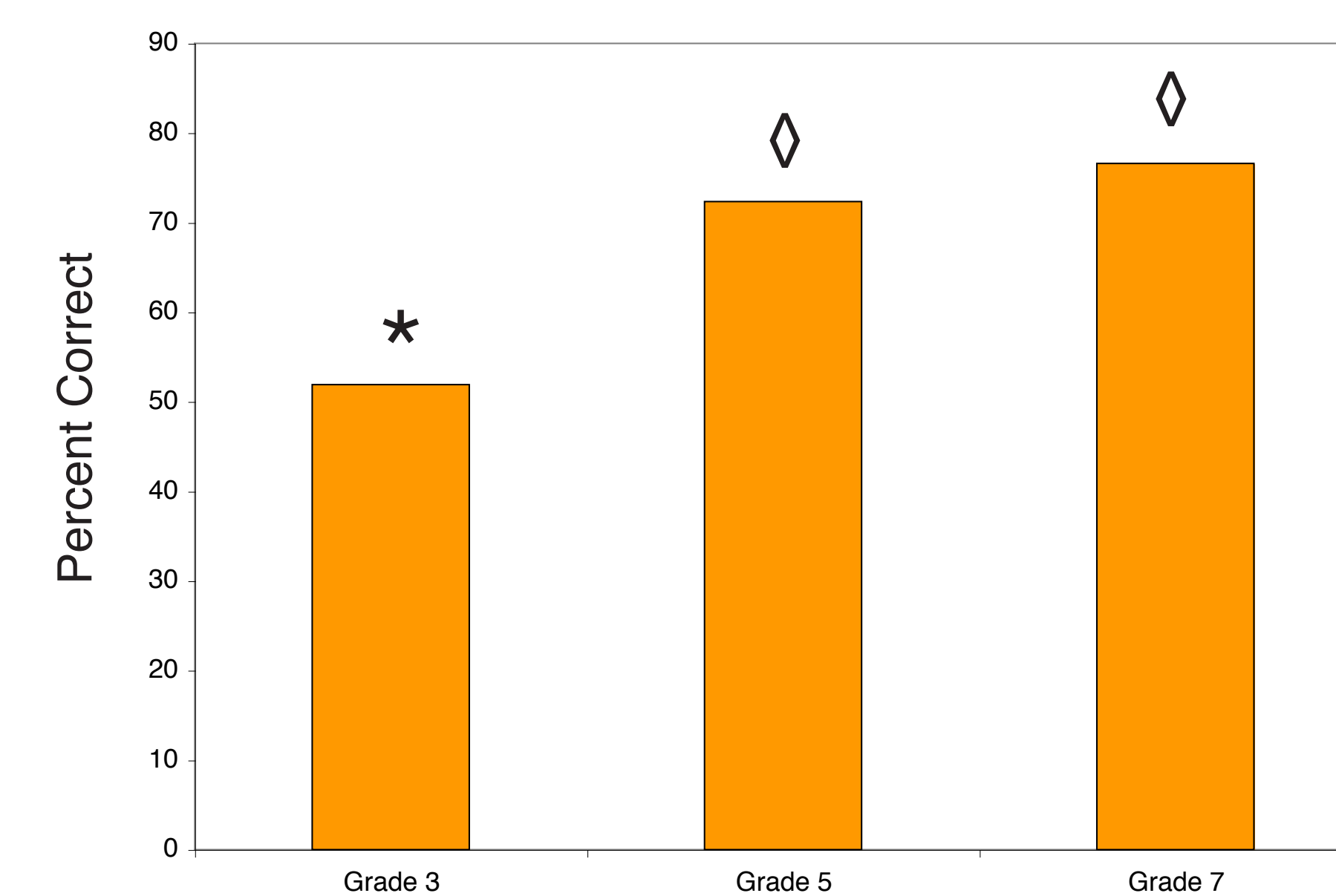


Figure 4. Main effect of grade: Grade 3 children performed significantly more poorly than Grades 5 and 7 children, who did not differ from each other. Asterisk indicates significant difference from diamonds.

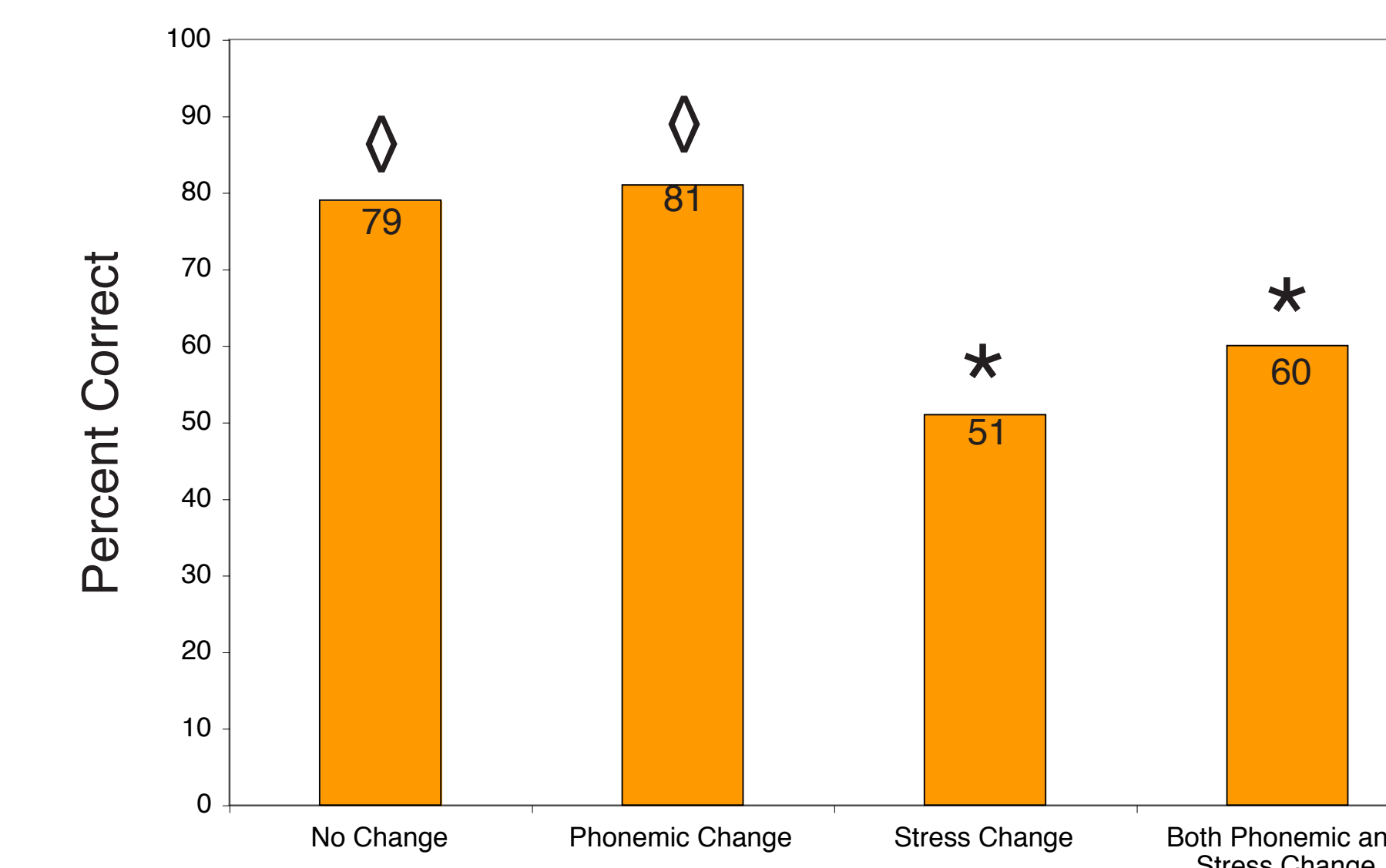


Figure 5. Main effect of derivation type (% correct). Asterisks indicate significant difference from diamonds.

Question 2: Prosodic sensitivity and morphological awareness showed a predictive relationship with reading ability. Four composite scores were created for use in subsequent analyses based on significant correlations within the variables: prosodic sensitivity, reading, stress-neutral morphological awareness, and stress-shifting morphological awareness.

Two hierarchical regression analyses were performed to answer our second question. In the first analysis, age, nonverbal intelligence, general language ability, working memory, and phonological awareness (step 1) served as controls, and prosodic sensitivity and morphological awareness were entered as the penultimate and ultimate steps, respectively (see Table 4).

Table 4. Hierarchical regression with reading as the dependent variable.

Step	R <sup>2</sup> change	F change (df1, df2)	Variable	Final β	t	p
1.	.59	27.77** (5, 97)	Age	.10	1.19	.24
			Nonverbal intelligence	.03	0.38	.71
			General language ability	.18	2.33	.02
			Working memory	.04	0.64	.52
2.	.03	8.52* (1, 96)	Prosodic sensitivity	.15	2.12	.04
			Phonological awareness	.14	1.94	.05
3.	.06	17.62** (1, 95)	Morphological awareness	.43	4.20	.00

Consistent with past studies, both prosodic sensitivity and morphological awareness are significant predictors of reading ability, even above the effects of phonological awareness. Prosodic sensitivity and phonological awareness have about an equal independent effect on reading ability, but morphological awareness is even more important, with a beta value nearly three times that of any of the other variables.

Given children's relatively poor performance with stress-shifting morphemes, we were interested in determining if their awareness of these derivation types is equally important in predicting reading skill than stress-neutral morphological awareness. To investigate this, a second hierarchical regression analyses was performed; steps 1 and 2 remained the same, with the stress-neutral and stress-shifting morphological awareness composite scores in step 3 (see Table 5).

Table 5. Hierarchical regression with reading as the dependent variable.

Step	R <sup>2</sup> change	F change (df1, df2)	Variable	Final β	t	p
1.	.59	27.77** (5, 97)	Age	.09	1.09	.28
			Nonverbal intelligence	.02	0.27	.79
			General language ability	.18	2.34	.02
			Working memory	.04	0.65	.52
2.	.03	8.52* (1, 96)	Prosodic sensitivity	.16	2.12	.03
			Phonological awareness	.14	1.98	.05
3.	.06	9.06** (2, 94)	Stress-neutral MA	.12	1.15	.25
			Stress-shifting MA	.33	3.04	.01

While stress-neutral morphological awareness did not significantly contribute to reading scores, stress-shifting morphological awareness did; indeed, it demonstrated the strongest relationship with reading, nearly twice that of the other predictors.

## 6 Discussion

Our study found that children find suprasegmental phonological derivations particularly challenging, but that ability in these derivation types are particularly important to reading ability for children at these developmental stages.

These results further refine Carlisle (1988)'s conclusion, suggesting that children's difficulty with phonologically shifting derivations lies primarily with shifts resulting in a changed lexical stress pattern, and that segmental phonemic shifts are no more difficult than neutral derivations. Also consistent with past findings contrasting stress-shifting and stress-neutral suffixation (e.g. Jarmulowicz, 2006), a developmental trend exists in this data, such that younger children have the most difficulty with stress-shifting derivation types. Growth in children's performance slows after Grade 5, suggesting that the middle elementary school years are the most important in developing understanding of the suffixes that drive such changes.

The amount of variance in reading ability accounted for by prosodic sensitivity and morphological awareness is consistent with past research (e.g. Whalley & Hansen, 2006; Deacon & Kirby, 2004). That prosodic sensitivity, a phonological skill, is predictive after having accounted for phonological awareness suggests that our current methods for tapping children's phonological abilities are insufficiently complex. Our results show that although prosodic sensitivity is phonological, it is not the same as phonological awareness (PA). As well, while there are prosodic elements in morphology, prosodic sensitivity is not the same as morphological awareness.

Given that English is morphophonologically complex and the fact that certain affixes drive phonological changes in morphological roots to varying degrees of complexity, children must have a good working knowledge of these interacting phonological (both segmental and suprasegmental) and morphological properties in order to master such a complex linguistic phenomenon.

## 7 References

- Carlisle, J. F. (1988). Knowledge of derivational morphology and spelling ability in fourth, sixth, and eighth graders. *Applied Psycholinguistics*, 9, 247-266.
- Deacon, S. H., & Kirby, J. R. (2004). Morphological awareness: Just "more phonological"? The roles of morphological and phonological awareness in reading development. *Applied Psycholinguistics*, 25, 223-238.
- Jarmulowicz, L. (2006). School-aged children's phonological production of derived English words. *Journal of Speech, Language, and Hearing Research*, 49, 294-308.
- Jarmulowicz, L., Hay, S. E., Taran, V. L., Ethington, C. A. (2008). Fitting derivational morphophonology into a developmental model of reading. *Reading and Writing*, 21(3), 275-297.
- Tyler, A., & Nagy, W. (1989). The acquisition of English derivational morphology. *Journal of Memory and Language*, 28, 649-667.
- Whalley, K., & Hansen, J. (2006). The role of prosodic sensitivity in children's reading development. *Journal of Research in Reading*, 29(3), 288-303.
- Windsor, J. (2000). The role of phonological opacity in reading achievement. *Journal of Speech, Language, and Hearing Research*, 42, 990-1002.
- Wood, C., & Terrell, C. (1998). Poor readers' ability to detect speech rhythm and perceive rapid speech. *British Journal of Developmental Psychology*, 16, 397-413.