Control of Morphological Forms in Writing

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Abstract

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Morphological awareness has been found to be related to reading skills, including comprehension, vocabulary, and word-reading. However, not much is known about how morphological awareness might contribute to writing skills beyond spelling. This exploratory study looks at how morphological awareness as measured by total morphological changes made in a sentence combining task is related to performance on an essay task (essay quality), as well as on reading comprehension, for fifth and eighth graders (n = 149). Multiple linear regressions with sequential predictor entry were conducted to test the research questions. Total morphological changes were found to be uniquely predictive of both essay quality and passage comprehension, after accounting for other measures of writing. The results suggest that morphological awareness may be an important skill to learn—not only for reading, but perhaps for writing as well.

Introduction

When Huckleberry Finn found himself caught in a pickle, Mark Twain wrote that "it warn't no time to be sentimentering" (Twain, 2003, p. 73). Time would be better spent searching for the lost boat so that Huck and Jim could escape the gang of murderers. Now technically, "sentimentering" is not a real word in the English language. But, given the structure of the word and the context in which it is found, a reader might guess that "sentimentering" might mean "to be sentimental or emotional about something". How odd would it have been, however, had our narrator—whose broken English gives *Adventures of Huckleberry Finn* its unique voice and nuanced meaning—decided to say instead that "there was no time for sentimentality"? The choices that Twain made in crafting the words and syntax of his narrator are what make Huck Finn and his cast of characters come alive in readers' minds. Those choices were intentional; "sentimentering" is used as a tool to help the reader feel what Twain wants them to feel. That is not to say that writers should always make up new words to express their ideas—rather, knowing that some words might be more effective at times than others is a necessary skill for a writer to have. Writing is a craft, and words are the tools we use to craft meaning.

In the process of making meaning through writing, writers must juggle many different demands simultaneously. Especially important to keep in mind are purpose and audience. Who we write for and why greatly impacts the choices that we make as we go through the writing process. This is not only true for writing—any act of language requires choices and awareness of audience and purpose. For example, children might use different language with their friends than they do with their family, which might be different from the language that they are expected to use at school (Schleppegrell, 2012). In each situation, choices are made about how language is used to create meaning, whether those choices are consciously or unconsciously made. To make

those choices, it's important to be aware on some level of language as a tool. Language is not just the way we talk to each other—it is also a system that we can manipulate, reflect upon, and make choices about to better communicate what we intend.

This ability to reflect upon language as an object of thought is often referred to as metalinguistic awareness. It is a metacognitive process that allows us to think about and manipulate the structural features of language (Tumner & Bowey, 1984). Tunmer and Bowey (1984) argue that metalinguistic awareness is a necessary component of being a skilled reader. They suggest that the four different types of metalinguistic awareness (specifically phonological, word, form, and pragmatic awareness) have varying levels of importance in the reading process at different stages of reading development. While metalinguistic awareness is often referred to in reference to reading, it is relevant to all forms of literacy. As children have more and more experience with both oral and written language, their awareness of the different features of language also develops. Gombert (1992, as cited in Myhill, 2012), in reference to oral language, argues that there are three stages of development in metalinguistic awareness. At first, knowledge of language is implicit and unconscious. Then, a transition is made into the conscious and intentional manipulation of language. Lastly, this manipulation becomes automated, and typically occurs without conscious awareness.

From Gombert's conceptualization of metalinguistic awareness, it is important to note that there are many different ways in which we can be and are consciously aware of language. And when we become aware of the patterns and rules within any language, we can be more intentional in language processing and production. One type of metalinguistic awareness that has been shown to significantly contribute to literacy is morphological awareness, which relates to Tumner and Bowey's (1984) *word awareness*. Morphological awareness can be defined as a

"conscious awareness of the morphemic structure of words and [the] ability to reflect on and manipulate that structure" (Carlisle, 1995, p. 194). Morphology gives us insight into the structure of English words, which are made up of morphemes, the smallest meaningful unit of language. For example, the word *cars* is made up of two morphemes: *car*, signifying the object, and *s*, signifying plurality. When the spelling of an English word does not clearly reflect its proper pronunciation, it is often because the word's morphemic structure is being maintained. Take, for example, the words *sign* and *signature* (Nagy & Scott, 2000). The spelling of *sign* makes sense when the semantic connection is found between *sign* and *signature* within their morphemic structure. Morphology gives us insight into both the orthographic and semantic properties of English words. It is thought that awareness of the morphology of a word could provide assistance in recognizing relationships between English words—a skill that could prove very helpful given how many words there are in the English language.

In their 1984 study, Nagy and Anderson discerned that there are 88,533 distinct word families in printed school English, defining word families as "group[s] of morphologically related words" (Nagy & Anderson, 1984, pg. 315). They did this by analyzing Carroll, Davies, and Richman's (1971) *American Heritage Word Frequency Book* for grades 3 through 9, which compiles words of running text from over a thousand items of published materials (textbooks, workbooks, kits, novels, poetry, general nonfiction, encyclopedias and magazines) used in schools. With the possibility of encountering so many words in texts, it is important that students have a way to broaden their vocabulary knowledge by developing tools and strategies with which they can demystify the unfamiliar words that they encounter, as well as identify the patterns that English words follow. When students encounter an unfamiliar word, the thought is that they will use their knowledge of the morphology of a word and the context in which it is found to infer the

word's meaning. This ability is important, because morphologically complex words are characteristic of academic writing (Nagy & Townsend, 2012). As students grow older, they can expect to encounter increasingly more morphologically complex words. Not only that—as a student's ideas become more complex, they may need more complex words in their lexicon to express those ideas. If a student cannot see the patterns of structure within and between words, they will need to learn more individual, distinct words (e.g., learning *form*, *formation*, and *forming* as separate, unrelated words) in order to be a successful reader and writer.

There is a growing body of evidence that morphological awareness plays an increasingly important role in reading as children develop (Berninger, Abbott, Nagy, & Carlisle, 2010; Green, McCutchen, Schwiebert, Quinlan, Eva-Wood, & Juelis, 2003; Singson, Mahony, & Mann, 2000). Performance on morphological awareness tasks positively predict reading comprehension (Carlisle, 2000; Kirby, Deacon, Bowers, Izenberg, Wade-Woolley, & Parrila, 2012; McCutchen & Logan, 2011; Nagy, Berninger, & Abbott, 2006), word reading (Kirby et al, 2012; McCutchen, Green & Abbott, 2008; Singson et al., 2000), and vocabulary (Carlisle, 2000; McCutchen & Logan, 2011; Nagy et al., 2006). Additionally, interventions in morphological instruction have positively impacted children's reading and writing improvement. Specifically, interventions teaching morphemes and morphological awareness have been associated with improvements in spelling (McCutchen, Stull, Herrera, Lotas, & Evans, in press; Nunes & Bryant, 2006), vocabulary (Nunes & Bryant, 2006), morphological analysis of unfamiliar words (Baumann, Edwards, Font, Tereshinski, Kame'enui, & Olejnik, 2002), and use of complex morphological forms in a sentence combining task (McCutchen et al., in press; see also Carlisle, McBride-Chang, Nagy, & Nunes, 2010 for a review).

What we don't know very much about, however, is how morphological awareness may be related to writing skills *beyond spelling*. Writing is a highly metalinguistic activity (Myhill, 2012), and yet little research has investigated the role that morphological awareness might play in more complex writing processes.

Cognitive Factors of Writing Production

Although there may only be a small amount of empirical research regarding the role that morphological awareness plays in writing, theoretical models of the writing process can help predict what that relationship might look like. Hayes and Flower (1980) offer a model of the writing process that consists of three main processes: planning, translating, and reviewing. Planning includes generating, organizing, and goal-setting, translating includes transforming ideas into language on a page, and reviewing includes reading and editing the text. Berninger and Swanson (1994) modified the model by describing the subcomponents of translating: text generation and transcription. Text generation involves "transforming ideas into language representations in working memory" while transcription involves the "translation of those representations into written symbols" (Berninger and Swanson, 1994, p. 58). Spelling, handwriting, and typing are all transcription processes. Text generation, however, has more to do with translating ideas from working memory into words, sentences, and discourses.

Working memory, the process of holding information in mind while carrying out operations with it, also seems to be a very important system in successful writing. Berninger and Swanson (1994) argue that working memory is needed to coordinate multiple simultaneous goals, including planning and generating content, finding language to express the content, organizing text, and monitoring what is being written (see also McCutchen, 1994). Berninger and Amtmann's (2003) proposed model for competing working memory resources illustrates how

working memory attention is regulated, depending on the demands of the task at hand. While composing, relevant information is selected and irrelevant information is inhibited, allowing attention to be switched depending on the need. The fluency or automaticity of skills that the writer has determines where attention is allotted during the writing process. For example, for young writers, more attention may be paid to transcription processes such as handwriting or spelling, and consequently, less attention will be available for other, higher-level processes, like crafting syntax and communicating nuanced meanings. When certain processes become automated, they no longer require the writer's direct attention.

Using these models of the writing process, we can make predictions about how morphological awareness may fit into the writing process. Writers have to juggle many different cognitive demands as they write. As Scardamalia (1981) notes, writers must deal with "handwriting or typing, spelling, punctuation, word choice, diction, textual connections, purpose, organization, clarity, rhythm, euphony, the possible reactions of possible readers, and so on" (p. 80). When one of these skills is mastered or when a writer becomes more fluent in a skill, cognitive resources can be focused on the skills or processes that demand more attention. If we have a limited working memory capacity, fluency in certain skills allow for those limited resources to be spent elsewhere—especially on higher-level functions. As McCutchen (2006) argues, working memory constraints may make it difficult for writers (especially young writers) to avoid simple grammatical errors or to pay attention to clear, crafted syntax. Struggling writers may have difficulty finding the right word to express their thoughts or finding a good way to structure their text. We already know that morphological awareness can help with certain reading skills; it is possible that improved fluency in intentional sentence structuring and diction may

lighten the cognitive load, allowing writers to focus more intently on other aspects of the writing process (Saddler& Graham, 2005).

Morphological Awareness and Writing

Research on morphological awareness and writing thus far has investigated the use of different types of morphological changes in spontaneous writing. Children develop inflectional morphology knowledge (tense or plurality markers; for example, *walk* to *walked* and *bird* to *birds*) early on, having learned most inflectional affixes by ages six to eight (Menyuk, 1988). Children's use of inflectional forms in writing generally precedes their use of derivational forms (Green et al., 2003). Derivational forms are used to change grammatical function (manipulating suffixes that mark word-level grammar; for example, *happy* to *happiness* or *brief* to *brevity*). Knowledge and use of derivational morphology begins to develop later than that of inflectional morphology; we see it typically beginning in the middle elementary years and continuing to develop throughout the middle school years and beyond (Berninger et al., 2010; Green et al., 2003; Tyler & Nagy, 1989; Kirby et al., 2012). In a test of spontaneous use of derivational morphology in written narratives, Green et al. (2003) found that, for 3rd and 4th graders, morphological accuracy predicted more variance in the students' spelling scores than it did in measures of reading (vocabulary and comprehension). The same study found that both 3rd and 4th grade students used inflectional morphology more often and more accurately in their spontaneous writing than derivational morphology (Green et al., 2003). This study replicated findings from Carlisle (1996), who found that, with students from 2nd through 4th grade, derivational morphology was found more commonly in the spontaneous writing of older children than that of younger children.

In addition to types of morphological forms, there are also different types of morphological knowledge, as defined by Tyler and Nagy (1989). By the later years of elementary schooling, children generally have acquired *relational* knowledge of morphology (recognizing relatedness by assessing morphological structure; for example, *birth* and *birthday* are related) and *syntactic* knowledge of morphology (knowing that derivational suffixes can signify the grammatical category of a word). What they might have not mastered at this age, however, is what Tyler and Nagy call *distributional* knowledge of morphology, which is knowing which affixes can be correctly applied to which words in the English language. For example, the suffix *–ty* can be added to the base word *wit* to make the word *witty*, but cannot be added to the base word *pit* to make *pitty*. Although it can often appear to be random, the English language is governed by patterns and rules. When children make distributional errors by creating words like *flavory* or *inkish*, it provides us with evidence that "acquisition of a morphological process as a combinatory, rule-governed process is taking place" (Tyler & Nagy, 1989, p. 659). Indeed, similar to the invented spelling that children use when the English spelling is not available to them, children (and adults) also invent morphology (Stull, 2010). In a study using a morphological sentence combining task, Stull (2010) found that higher skilled elementary readers were significantly more likely to use invented morphology compared to lower skilled readers. This suggests that both morphological and decoding skills might be necessary before a student can make these distributional errors, or "invented morphology."

In the present study, a morphological sentence combining task was used as a predictor of essay quality. Sentence combining tasks measure sentence-level skills, testing a student's ability to condense text into more complicated syntax. The syntax that children encounter and write becomes increasingly complex as they grow older (Hunt, 1970), and complex syntax is common

of academic language (Nagy & Townsend, 2012). Younger children often write by stringing together independent clauses (Hunt, 1970; Crowhurst, 1983), while older children tend to use more clausal subordination, packing more information into fewer words. More mature writers are able to reduce independent clauses into dependent clauses and clauses into words and phrases. This is where knowledge of the morphological structure of words may help. Morphological awareness introduces a word-level element to this sentence-level text generation exercise. As students attempt to reduce sentences, clauses and phrases, word-level manipulation could help them be more successful.

One way writers can condense information is by nominalizing verbs and adjectives, which turns what might have been an entire sentence into a phrase. For example, we can reduce "*the sky looked like ink*" into "*the inkiness of the sky*", turning a complete sentence into a noun phrase. Derivational morphological awareness might help a writer change verbs and adjectives into nouns by manipulating their suffixes (Berninger, Nagy, & Beers, 2011). In their 2011 study, Berninger et al. found that word level-skills (morphological awareness for first grade and spelling for second through fourth grade) explained unique variance in a sentence combining task. They argue that morphemes serve as a "bridge across the word- and syntax- levels for relating word-level suffixes marking grammatical function to sentence syntax (Berninger et al., 2011, p. 162). It is possible that word-level manipulation skills and awareness provide assistance in the sentence-level manipulation of text. This is one way in which morphological awareness might be related to more complex writing skills.

Secondly, morphological awareness may help writers to more effectively manipulate written language to achieve their rhetorical goals. Choosing the right words and the right order to put them in can help a writer communicate more clearly to their audience (Myhill, 2012), and

being able to effectively manipulate language at the word-level may help them do that (Berninger et al., 2011). For example, writing "*the sky that looked like ink*" may not be as effective as writing "*the inky sky*". The second phrase allows for smoother syntax, better sentence construction, and more nuanced meaning (McCutchen et al., in press). It's difficult to find just the right word to use when writing—with all of the demands we must juggle while writing, attempting to recall just the right word to express the right thought might sometimes be too difficult. Perhaps insight into the structure of English words, and practice manipulating them, could prove helpful in accessing and choosing the right word to use in each sentence. Berman (2009) argues that complex syntax might not necessarily be inaccessible to younger children, it might just be that their lexicon is not large enough to support more complex sentence structures. If a student can manipulate the words that they already know and use daily by altering suffixes, they may be better capable of expressing themselves more exactly and meaningfully.

Morphological awareness plays a role at the word-level of syntax (Berninger et al., 2011) and performance on morphological awareness tasks positively uniquely predicts performance on morphological sentence combining tasks (McCutchen, 2011b). This gives us reason to believe that measures of morphological awareness in writing tasks might be positively related to other measures of translation. As already mentioned, morphological awareness is also known to be related to spelling (Deacon, Kirby & Casselman-Bell, 2009; Green et al., 2003; Nunes, Bryant, & Bindman, 1997). Additionally, interventions with morphological awareness training have shown a positive association with improvements in spelling (Berninger et al., 2008; McCutchen et al., in press; Nunes & Bryant, 2006). Morphological awareness has also been shown to uniquely predict control of morphological forms in a short writing task, after controlling for other reading skills: McCutchen (2011) found that performance on a syntactic-morphological awareness task

(Singson et al., 2000) uniquely predicted success using morphological forms in a morphological sentence combining task.

However, what we don't know is whether production of derivational morphemes in these sentence combining tasks predicts scores in longer, more authentic writing tasks. If morphological awareness uniquely predicts control of morphological forms in shorter writing tasks, does it also predict unique variance in longer writing tasks? From what we know about the role that morphological awareness plays in successful reading, we might hypothesize that morphological awareness plays a role in producing, rather than just comprehending (i.e., reading), language.

Additionally, because morphological awareness is a literacy skill, not just a reading skill, this study will also explore whether morphological awareness in a writing task is uniquely predictive of reading comprehension. Metalinguistic awareness is important in both reading and writing, and so it is possible that not only do reading morphological awareness tasks predict comprehension, but that morphological awareness as measured in spontaneous writing is also uniquely predictive of comprehension. Other studies predicting comprehension have used somewhat constrained morphological awareness measures that have students produce a morphologically derived word, whether it is in a word analogy task (Nunes, Bryant & Bindman, 1997; Kirby et al., 2012), in a task that asks students to derive or decompose words to fit in a syntactic context (Carlisle, 2000), or in a forced-choice task (Singson et al., 2000). Few studies (if any) have looked at the relationship between morphological awareness as measured in spontaneous use in a writing task with passage reading comprehension. Reading and writing are not separate skills—practice in producing academic language might contribute to gains in comprehension (Nagy and Townsend, 2012). Word-level manipulations access both semantic

and syntactic skills, and both essay quality and passage reading comprehension (a cloze task) draw on these skills for successful performance.

The Present Study

Research Questions and Hypotheses

The present study is an exploratory study that investigates whether performance on a morphological sentence combining task is uniquely predictive of different literacy tasks, both reading and writing. Additionally, the present study extends prior research by using a writing task outcome measuring more complex skills than spelling. Do total morphological derivational changes (both correct and incorrect, that is "invented" forms) in a sentence combining task predict essay quality over and above other measures of translating? I hypothesize that students who make more derivational morphological changes in a sentence combining task will also have higher content and organizational quality scores on a standardized scoring of their essays.

Secondly, using those same predictors, does morphological derivational change (in a sentence combining task) uniquely predict passage reading comprehension, after controlling for other measures of writing? I believe that students who make more morphological changes in the sentence combining task will also score higher on passage reading comprehension, and that total morphological change will account for unique variance in the outcome even after accounting for the other predictors.

Method

Participants

Data from 149 fifth and eighth grade students (5^{th} grade, n=74, 8^{th} grade, n=75) from two K-8 schools in the Pacific Northwest were selected from a broader sample of subjects who participated in a larger study. Data were gathered from subjects in 8 different classrooms: four

eighth grade classrooms and four fifth grade classrooms. There were 71 boys and 78 girls participating. The mean age of the fifth grade participants was approximately 10 years, 10 months, and the mean age of the eighth grade participants at the time of testing was approximately 13 years, 8 months. No data were collected on SES. The subject sample (from self-report) was 71.10% White/European American, 12.10% Asian, 7.40% more than one race, 4.0% Native American/Alaska Native, 2.70% Black/African American, 1.30% Pacific Islanders, and 1.40% other. Most students (90.60%) are native English speakers (9.40% spoke one or more languages other than English at home).

Measures

Four research assistants were trained in the administration and scoring of tests. Testing was administered between November and January. Students were tested in both group and individual testing sessions at their schools. Four measures of transcription and text generation were used, tasks in which students transform ideas into language representations (text generation), and then to transform those representations into written symbols (transcription).

Writing Fluency. The Writing Fluency task from *Woodcock Johnson III Tests of Achievement* (Woodcock, McGrew, & Mather, 2001) was used to measure writing speed and accuracy. Students must access both syntactic and semantic knowledge to quickly form sentences within a 7-minute time period. This measure was included as a predictor to account for the ease and speed with which a student can write syntactically and semantically correct sentences, or how fluent they are in generating text and transcribing it on the page. It is also a measure of handwriting fluency (transcription), in that students who can write quicker will score more points on the task. Students could receive a total of 40 possible points. The test manual

reports a reliability of .81 for 10-year-olds, .79 for 11-year olds, .81 for 13-year olds, and .82 for 14-year-olds in the norming samples.

Spelling. A portion of the spelling test from the *WIAT III Wechsler Individual Achievement Test, Third Edition* (Pearson, 2010) was included as a measure of spelling (transcription). Students could receive a total of 35 possible points. Students were asked to write isolated words, after those words were read to them singularly and as used in a sentence. The WIAT III reports reliability between .87 and .96.

Standardized Sentence Combining. A standardized sentence combining task was included as a predictor. This sentence combining task comes from the *WIAT III Wechsler Individual Achievement Test, Third Edition* (Pearson, 2010), and it measures written syntactic maturity. This task invites clausal coordination and subordination rather than morphological changes to words to form more complex noun or verb phrases. This task was included in the models as a comparison to the more morphologically-oriented sentence combining task (described below), in an effort to isolate the morphological component of combining sentences. Students could receive a total of 25 possible points. The Technical Report for the WIAT III subtest components (2010) reports a reliability of .79 for 5^{th} grade and .84 for 8^{th} grade.

Morphological Sentence Combining. An experimenter-developed sentence-combining task was adapted from McCutchen and colleagues (2011) to assess the students' ability to derive morphologically-related words in order to successfully simplify many sentences into one. It was developed to test children's use of derivational morphology in response to the findings that students use derivational morphological forms far less often than inflectional forms in their writing (Green et al., 2003). Students are given 3-5 short sentences and asked to combine them into one longer sentence without losing the meaning of the original sentences and by trying not

to use the word “and”. There are many possible responses to each item, including many possible “correct” responses, yet the nature of the task compels the students to produce a morphological derivation of certain words. For example, given the three sentences:

The campers slept under the sky.

The sky looked like ink.

Their sleep was deep.

students may have answered with: “The campers slept *deeply* under the *inky* sky.” This task is different from other traditional morphological awareness measures because it invites students to produce morphological derivations in their writing without being specifically prompted to do so. Students are given one example, but not specifically told to change words in any way. Other tasks typically used in the research literature prompt students to choose an affixed word to fit a syntactic context, or to derive a morphological relative by adding an affix to a base word (Berninger, Abbott, Nagy & Carlisle., 2010). Because students were never specifically instructed to change word forms to combine sentences, this task may be more reflective of the students’ spontaneous writing skills.

Sentence combining tasks are used to teach students how to make their sentences more syntactically complex and to produce sentences that more closely convey the writer’s message (Saddler & Graham, 2005, p. 44). This task adds a morphology component to sentence combining. It not only measures a student’s ability to manipulate sentences into denser syntax, it compels them to derive morphologically complex words to make that syntax denser. For example, a student may have answered with, “*The campers slept in a deep sleep under a sky that looked like ink*.” While this sentence is grammatically correct, it is less elegant and it takes more clauses to convey the meaning than the sentence, “*The campers slept deeply under the inky sky*.”

Whereas the first example uses two clauses and two prepositional phrases to convey the meaning of the sentence, the second example uses only one clause and one prepositional phrase. It is also arguably easier to read, with smoother syntax and more succinct meaning.

Students were given six different items on this task, and performance was measured using three criteria. Students were given 1 or 0 points for whether there was a derivational morphological change, whether the morphological change was a real English word that made sense in the sentence, and whether that word was spelled correctly. For the purpose of this study, the total derivational morphological changes from each item were totaled. This score accounts for all derivational morphological changes, whether they are correct or incorrect (i.e., invented). Spelling is not accounted for in this score. It is used to capture invented morphology as well as correct derivational changes, measuring whether the child knew that the grammatical category of the word needed to be changed, and that to do so, the suffix of the word needed to be manipulated. This taps into distributional knowledge of morphology, and was the only score used in analysis for this study.

The internal consistency (Cronbach's alpha) was calculated at .88 for total morphological changes. With a 30% sample used for double scoring, inter-rater reliability (Cronbach's alpha) among the two research team members who scored responses was .99 for total morphological changes. Because many possible answers could be accepted, there is no actual maximum number of points possible, although 16 points seems to be a reasonable estimate.

Essay. Students wrote a short essay to obtain a longer, more authentic sample of their writing. The prompt for the essay is from the *WIAT III Wechsler Individual Achievement Test, Third Edition* (Pearson, 2010). Students are asked: "Write about your favorite game and include at least three reasons why you like it." They are given 10 minutes to write by hand, and are

prompted to try to write an entire page. The standardized scoring of these essays produces three scores: Word Count, Content and Organization, and Grammar and Mechanics. For this study, only the Content and Organization score was used, because it was thought to be the most reflective of writing quality. This score reflected five criteria: introduction, conclusion, paragraphs, transitions, reasons, and elaborations. To score well on the essay, students must write a well thought-out essay. They must know to introduce the essay with a thesis. The scoring encourages a maximum of 5 paragraphs and the use of transition words to show relationships between ideas. Lastly, students are expected to include clear, identifiable reasons and elaborations supporting their thesis. The scoring system is such that it rewards those who write succinctly and plan out a traditionally organized essay. Students could receive a maximum of 20 points. The Technical Report for the WIAT III subtest components (2010) reports a reliability of .82 for 5^{th} grade and .75 for 8^{th} grade.

Passage Comprehension. The Passage Comprehension task from the *Woodcock Johnson III Tests of Achievement* (Woodcock, McGrew, & Mather, 2001) was used to measure the student's ability to read a passage and identify a missing key word that makes sense in the context of the passage. This requires them to understand both the syntactic structure and the meaning of the passage in order to orally provide a word that makes sense. Students could receive a maximum of 47 points. The test manual reports a reliability of .91 for 10-year-olds, .83 for 11-year-olds, .83 for 13-year-olds and .86 for 14-year-olds.

Data Analysis Plan

To test research questions, multiple linear regressions using sequential predictor entry were conducted on each of the two outcomes (passage reading comprehension and essay quality), with effect-coded classroom membership and age in Block 1, then Writing Fluency,

Spelling, and Sentence Combining in Block 2, and Total Changes (in morphological sentence combining task) in Block 3. Preliminary analyses showed no violations to linearity, homogeneity of variance, or to normality. However, because there were significant differences between classes on predictors and outcomes, Block 1 was used to control for the amount of variance in the outcomes associated with classroom membership (along with age). Student age (in months), as well as the literary predictors, were standardized into *z*-scores for ease of results interpretation.

Results

Table 1 presents means, standard deviations, and zero-order correlations for all variables in this study. All of the writing tasks were significantly and highly correlated with each other. For the Essay outcome, Writing Fluency had the highest correlation, followed by Spelling, Total Changes, and Sentence Combining. For Passage Comprehension, Spelling and Total Changes were equally highly correlated with the outcome, followed by Writing Fluency, and Sentence Combining. Not surprisingly, Total Changes (from the morphological sentence combining task) had a high, positive correlation with Sentence Combining. Finally, Spelling is also highly correlated with Writing Fluency and Total Changes.

Table 1. Descriptive Statistics and Zero-Order Correlations

	M	*SD*	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Essay	9.51	4.12	--													
2. Comprehension	32.99	4.15	.32***	--												
Block 1 Predictors																
3. Class 1	.14	.35	-.28***	-.13	--											
4. Class 2	.12	.33	-.19 *	-.04	.01	--										
5. Class 3	.17	.38	-.44***	-.08	.42***	.39***	--									
6. Class 4	.06	.24	-.37***	-.29***	.54***	.44***	.52***	--								
7. Class 5	.14	.35	-.11	.11 **	.45***	.40***	.42***	.54***	--							
8. Class 6	.11	.31	-.29***	.06 *	.48***	.42***	.46***	.57***	.48***	--						
9. Class 7	.14	.35	-.05	.09 **	.45***	.40***	.42***	.54***	.45***	.48***	--					
10. Age	147.30	17.83	.45***	.39***	-.51***	-.23 **	-.53***	-.43***	.02	-.06	.05	--				
Block 2 Predictors																
11. Writing Fluency	20.83	5.83	.51***	.54***	-.30***	.00	-.31***	-.27***	-.04	-.11	.08	.47***	--			
12. Spelling	20.76	7.91	.41***	.63***	-.31***	-.05	-.09	-.31***	.03	-.02	.11	.49***	.60***			
13. Sentence Combining	16.91	5.30	.35***	.53***	-.16 *	-.03	-.10	-.16 *	.04	-.06	.08	.29***	.52***	.51***	--	
Block 3 Predictors																
14. Total Changes	7.03	4.72	.40***	.63***	-.16 *	.09	-.11	-.11	.16 *	.12	.12	.37***	.50***	.60***	.58***	--

Note. $N = 149$.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Morphological Derivations and Essay Writing

For Essay, I was most interested in whether Total Morphological Changes uniquely predicted variance in a longer writing task after controlling for classroom membership, age, and the other writing predictors (see Table 2). The first block, which accounted for classroom membership and age, uniquely predicted 32% of the variance in Essay quality, $F(8, 140) = 8.26$, $p < .001$, $R^2_{\text{adjusted}} = .28$. In the second block, the set of typical writing predictors (Writing Fluency, Spelling, and Sentence Combining) uniquely predicted an additional 10% of the variance in Essay quality, $F(3, 137) = 7.51$, $p < .001$, $R^2_{\text{adjusted}} = .37$. Finally, the third block, which added Total Changes (in morphological sentence combining task), accounted for a significant, albeit small, amount of unique variance (2%) in Essay, $F(1, 136) = 4.35$, $p < .05$, $R^2_{\text{adjusted}} = .39$.

For brevity, the coefficients for the final regression results are interpreted here. The model estimate of the intercept showed that the mean estimate of Essay quality was 9.53 (SE = .30) for students with all other predictors held constant at average, which was significantly greater than zero, $t(136) = 31.98$, $p < .001$. Writing fluency had a unique positive effect on Essay quality (b=.88, SE=.38), $t(136) = 2.30$, $p < .05$. Specifically, there was an estimated mean increase of .88 points on Essay for every one standard deviation above average on Writing Fluency, holding all other predictors constant. Total Changes also had a unique positive effect on Essay quality($b = .80$, $SE = .39$), $t(136) = 2.09$, $p < .05$. Specifically, there was an estimated mean increase of .80 points on Essay quality for every one standard deviation increase on Total Changes, holding all other predictors constant. Approximate effect sizes were calculated by squaring the semi-partial correlations (sr^2) of each unique predictor of Essay quality. Effect sizes

were sr^2 = .02 for Writing Fluency, and .02 for Total Changes, when accounting for all other predictors. No other predictors accounted for unique variance in Essay quality.

Table 2. Sequential Regression Predicting Essay

	Model 1			Model 2			Model 3		
Fixed Effects	R^2_{change}	R^2_{total}	*Coeff*	R^2_{change}	R^2_{total}	*Coeff*	R^2_{change}	R^2_{total}	*Coeff*
Intercept (Mean)	.32 ***	.32 ***	9.44 ***	.10 ***	.42 ***	9.53 ***	.02 *	.44 ***	9.53 ***
Block 1									
Class 1			-.18			.97			1.35
Class 2			.00			.23			.31
Class 3			-2.21			-1.76			-1.35
Class 4			-2.20			-.79			-.60
Class 5			1.02			.33			-.10
Class 6			-1.59			-1.96			-2.44
Class 7			1.85			.53			.37
Age			.70			.63			.84
Block 2									
Writing Fluency						.94 *			.88 *
Spelling						.53			.24
Sentence Combining						.37			.09
Block 3									
Total Changes									.80 *

Note. N=149, df for Model 1 = (8, 140), df for Model 2 = (3, 137), df for Model 3 = (1,136). Sentence Combining = WIAT III Standard Sentence Combining, Total Changes = Total derivational morphological changes (both correct and incorrect) from morphological sentence combining measure.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Morphological Derivations and Passage Comprehension

For Passage Comprehension, I again was most interested in whether total morphological changes uniquely predicted variance in reading comprehension after controlling for classroom membership, age, and other measures of writing (see Table 3.). In Block 1, classroom membership and age accounted for 29% of the variance in Passage Comprehension, $F(8,140)=7.04$, $p < .001$, $R^2_{adjusted}=.25$. Although age was not uniquely predictive of Passage Comprehension, one of the fifth grade classes was uniquely predictive of the outcome, as well as all of the eighth grade classes. In the second block, as in the previous analysis, Writing Fluency, Spelling, and Sentence Combining were entered. These predictors accounted for an additional significant amount of variance (25%) in Passage Comprehension, $F(3, 137) = 25.12$, $p < .001$, $R^2_{\text{adjusted}} = .50$. Finally, Total Changes was entered in the third block, accounting for a significant amount of variance (4%) in Passage Comprehension, $F(1, 136) = 14.00$, $p < .001$, $R^2_{\text{adjusted}} = .55$.

Again, for brevity, I describe the final model results for the coefficients here. The model estimate of the intercept showed that the mean estimate of Passage Comprehension scores was 32.68 points ($SE = .26$), which was significantly greater than zero, $t(136) =126.67$, $p < .001$. Writing fluency had a unique positive effect on Passage Comprehension scores ($b = .78$, $SE = .33$), $t(136) = 2.35$, $p < .05$. Specifically, there was an estimated mean increase of .78 points on Passage Comprehension for every one standard deviation increase on Writing Fluency, holding all other variables constant at average. Spelling also had a significant unique effect on Passage Comprehension ($b = .76$, $SE = .36$), $t(136) = 2.07$, $p < .05$, indicating that there was an estimated mean increase of .76 points on Passage Comprehension for every one standard deviation increase on Spelling, holding all other predictors constant. Lastly, Total Changes also had a unique positive effect on Passage Comprehension ($b = 1.25$, $SE = .33$), $t(136) = 3.74$, $p < .001$.

Specifically, there was an estimated mean increase of 1.25 points on Passage Comprehension for every one standard deviation increase on Total Changes, holding all other predictors constant. Again, approximate effect sizes were calculated by squaring the semi-partial correlations (sr^2) of each unique predictor of Passage Comprehension. Effect sizes were $sr^2 = .02$ for Writing Fluency, .01 for Spelling, and .04 for Total Changes, when accounting for all other predictors.

Table 3. Sequential Regression Predicting Passage Comprehension

	Model 1			Model 2			Model 3		
Fixed Effects	R^2_{change}	R^2_{total}	*Coeff*	R^2_{change}	R^2_{total}	*Coeff*	R^2_{change}	R^2_{total}	*Coeff*
Intercept (Mean)	.29 ***	.29 ***	32.48 ***	.25 ***	.54 ***	32.69 ***	.04 ***	.58 ***	32.68 ***
Block 1									
Class 1			-2.74			-.51			.08
Class 2			-1.43			-.73			-.61
Class 3			-.70			-.19			.44
Class 4			-6.48 ***			-3.92 **			-3.62 **
Class 5			3.36 *			1.98			1.33
Class 6			2.88 *			2.07			1.32
Class 7			3.15 *			.84			.59
Age			-.70			-.64			-.32
Block 2									
Writing Fluency						.87 *			.78 *
Spelling						1.21 **			.76 *
Sentence Combining						.97 **			.54
Block 3									
Total Changes									1.25 ***

Note. $N = 149$, *df for* Model 1 = (8, 140), *df for* Model 2 = (3, 137), *df for* Model 3 = (1,136). Sentence Combining = WIAT III Standard Sentence Combining, Total Changes = Total derivational morphological changes (both correct and incorrect) from morphological sentence combining measure.
* $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

Main Findings

The purpose of this study was to test whether morphologically deriving words (both correctly and incorrectly) to condense syntax in a sentence combining task was uniquely predictive of essay quality and reading comprehension. The answer is yes: the total morphological changes variable was uniquely predictive of both essay quality and passage comprehension, after accounting for other measures of transcription and text generation.

The first primary finding of this study is that both total morphological changes and writing fluency were uniquely predictive of the content and organization score of the students' essays, although the additional variance explained when total morphological changes was added into the model was only 2%. Interestingly, spelling and the standardized sentence combining measure were not uniquely predictive of essay quality when all other predictors were included in the model. It is likely that spelling may play a more important rule in the grammar and mechanics category of essay scoring. Sentence combining, while moderately correlated with essay quality (see Table 1), was understandably highly correlated with total morphological changes in our sentence combining task. However, even without total morphological changes in the model, standardized sentence combining was not uniquely predictive of essay quality. As mentioned earlier, the standardized sentence combining task invites more clausal coordination than morphological changes. This suggests that there may be something unique about the ability to recognize the need to change the grammatical category of a word in order to condense syntax in predicting essay content and organization scores.

In the morphological sentence combining task, students were not directly instructed to actually change any words in the sentence (although they were provided an example); as such,

their attempts to morphologically derive words could be somewhat reflective of their understanding of one way to combine sentences in an efficient and effective way. Many students' attempts to combine kernel sentences into one longer sentence resulted in run-ons (e.g., *Many campers slept under the ink colored sky, the campers were in a deep sleep*.), inappropriate causal relationships (e.g., *The motorcycle sputtered and backfired loudly which caused it to have dents*) or using synonyms to express the same idea (e.g., *The campers fell asleep in the dark sky*). Students who made morphological changes, even incorrect ones, seemed better able to avoid those problems and often to create more succinct sentences (e.g., *The students ate the steamy, flavory soup*). The fact that students were not specifically instructed to morphologically change words to combine sentences is also important in that it shows that this task may be more reflective of a child's spontaneous writing skills than previous tasks of morphological awareness.

In the 10 minutes spent writing their essays, students had to make many choices to be successful, including multiple paragraphs, transition words, and an introduction and conclusion—all of which all require planning ahead and organizing text. Additionally, it was less likely that a student would earn points in the standardized scoring scheme if they lost control of their sentences by rambling and writing run-on sentences. Succinct sentences, traditional paragraph structuring, and awareness of audience made for higher essay scores. It might be that students who show higher levels of morphological awareness in their spontaneous writing also show more control over the other choices that they make as they write.

This study's findings also show that the total morphological changes variable was also uniquely predictive of passage reading comprehension, after accounting for other measures of text translation. It is interesting to note that a writing measure of morphological awareness significantly predicted comprehension—a reading measure—over and above other measures of

writing. Moreover, the variance explained was 4%, in the range typically found with more explicit morphological awareness tasks (Carlisle, 2000). It is well known that reading and writing are intimately related, and as such, the finding that performance on a writing task predicts performance on a reading task is no great surprise. However, this result does reveal something unique about this particular sentence combining measure. Sentence combining, as mentioned earlier, is a method used to measure students' syntactic and semantic capabilities—can they successfully condense syntax while maintaining the meaning of the original sentences? Similarly, this passage reading comprehension task measures a student's ability to judge the syntactic and semantic elements of a passage to decide on a word that appropriately fits the context. The standardized sentence combining task no longer accounted for unique variance once the total morphological changes score was added into the model. This shows that morphological awareness, whether in producing or reading complex morphological forms, is related to how well we understand the structure and meaning of a text.

Limitations and Further Research

One obvious limitation of this study is the system through which longer writing samples were assessed. The genre of the essay prompt was an argumentative essay, which required students to provide a clear thesis supported by three reasons. This prompt elicits writing that is quite different from how a student might write for a persuasive, expository, or narrative text. Future research should extend the current study's results to these other genres. Secondly, the nature of the grading system for this essay was only one of many possibilities. The system for earning points is such that it rewards students who write a very traditionally-structured essay with concise wording and a formulaic structure. That being said, while the outcome used in this study was only one way to score for quality of writing, it is reflective of the way writing is

typically scored in high-stakes standardized testing, which would be of value to teachers and policy makers. Additionally, the Common Core Standards (2010) place considerable emphasis on argumentative writing for K-12 writers. Nevertheless, future research could extend this study's findings by using a more holistic analysis of student writing, (along with different genres of essays and a different measure of writing quality). This could include, for example, qualitative or quantitative analyses of syntactic maturity, spontaneous use of morphological derivations, or specific measures of sentence structure (see Myhill, 2008).

A third limitation of this study is the sample selection process. The sample of students who participated was drawn from intact classrooms in two schools, and thus, the results may be somewhat sample specific. Future research could be done on a broader sample to replicate the study's findings. In any case, classroom membership was controlled for in these statistical analyses (treating them as fixed effects).

The evidence presented here suggests that deriving complex morphological forms to combine sentence combining uniquely predicts variance in essay quality above other measures of text translation. Future research might use an experimental design to better explore a possible causal link between morphological awareness and writing quality. It would be worthwhile to explore this relationship; what, specifically, might morphological awareness contribute to writing? Is it related to meaningful sentence construction? To fluency of writing? Future research into the writing aspects of morphological awareness could tell us a lot more about its role in more aspects of literacy than just reading.

Writing is all about choices. Whether those choices are implicit or explicit, successful writers must constantly self-regulate, making word-level, sentence-level, and global decisions about the meaning they wish to communicate. Even if a writer has a lot to say about a subject, it

does not necessarily mean that they will be able to write about it well. Fluency, an understanding of how language works, and audience awareness are just a few of the skills a writer needs to communicate their ideas meaningfully and effectively. Students must deal with increasingly more complex words and sentence structures in both their reading and their writing as they grow older. In juggling so many different tasks in the process of writing, control in decision making seems a necessary skill to have. If a student has more control over even one of the many skills that they must have to write well, they will have more flexibility to focus attention on the other demands of the writing process.

In any literacy task, awareness (whether conscious or not) of how language works seems to be necessary in the process of making meaning. As this study shows, an awareness that a word-level change needed to be made to manipulate syntax at the sentence-level was positively uniquely predictive of both a longer writing task and a comprehension task. It may be that an awareness of words as one of the tools we use to make meaning empowers us both in reading and in writing tasks to understand the unique effect words can have on our understanding and how we can use words to make meaning.

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