

# Morphology and the Common Core Building Students' Understanding of the Written Word

by Peter N. Bowers and Gina Cooke

As stated by Rayner, Foorman, Perfetti, Pesetsky, and Seidenberg (2001, p. 34), becoming literate means “learning how to use the conventional forms of printed language to obtain meaning from words.” It logically follows that “*the child learning how to read needs to learn how his or her writing system works* [emphasis added]” (Rayner et al., 2001, p. 34). Similarly, the CCSS emphasize the need to foster “students’ understanding and working knowledge of . . . basic conventions of the English writing system” (p. 15). The text of the CCSS fails, however, to provide sufficient information about these basic conventions. Specifically, because morphology—the underlying meaning structure of words—is foundational to the English writing system, teachers and students who do not understand it are not fully equipped to make sense of how the writing system works. Consistent with recent instructional research (e.g., Bowers, Kirby, & Deacon, 2010; Goodwin & Ahn, 2010), the CCSS target certain aspects of morphology, but their brief references are insufficient to elucidate the fundamental role that morphology plays in making sense of print.

English is a morphophonemic language in which the pronunciation of morphemes (bases and affixes) regularly shifts across words (Venezky, 1999). As Pinker (1999) noted, this is why “English words notoriously do not always reflect their sounds [in writing]; often they reflect morphological structure instead” (p. 45). More than four decades ago Venezky explained, “the simple fact is that the present orthography is not merely a letter-to-sound system riddled with imperfections, but instead, a more complex and more regular relationship wherein phoneme and morpheme share leading roles” (1967, p. 77).

While it thus makes sense to include morphology in literacy instruction, educational research has been slow to examine the practices and effects of morphological instruction. Recent meta-analyses of morphological instruction, however, show benefits in literacy outcomes, especially for less able and younger students (see Table 1).

***. . . because morphology—the underlying meaning structure of words—is foundational to the English writing system, teachers and students who do not understand it are not fully equipped to make sense of how the writing system works.***

It is important to note that the CCSS explicitly prescribe learning goals rather than the means to achieve those goals. “Teachers are thus free to provide students with whatever tools and knowledge their professional judgment and experience identify as most helpful for meeting the goals” (p. 4). Similarly, although the CCSS explicitly detail the importance of teaching certain aspects of English morphology, they do not offer a

*Continued on page 32*

**TABLE 1. Findings from Published Meta-Analyses on Morphological Intervention Studies**

Authors	Number of studies in meta-analysis	Findings regarding morphological instruction
Reed (2008) <sup>a</sup>	7	<ul style="list-style-type: none"> <li>• Positive effects overall</li> <li>• Strongest effects for less able</li> </ul>
Bowers, Kirby, & Deacon (2010) <sup>b</sup>	22	<ul style="list-style-type: none"> <li>• Positive effects overall</li> <li>• Largest effects for less able</li> <li>• Effects for pre-school to grade 2 <math>\geq</math> grades 3–8</li> </ul>
Goodwin & Ahn (2010) <sup>b</sup>	17	<ul style="list-style-type: none"> <li>• Significant effects for less able</li> </ul>
Carlisle (2010) <sup>a</sup>	16	<ul style="list-style-type: none"> <li>• Positive effects overall even with youngest students</li> </ul>

Note: <sup>a</sup>Systematic reviews that did not calculate and average effect sizes of instruction; <sup>b</sup>statistical meta-analyses which calculated average effect sizes of control and experimental groups.

basic understanding of how morphology works or how it might be taught. Although we have ample evidence that morphological instruction is beneficial (see Table 1), we do not yet have research that tells us how best to design such instruction (Bowers, Kirby, & Deacon, 2010; Carlisle, 2010).

The purpose of this article, then, is to fill in gaps in the CCSS about morphology and English spelling to arm educators with the means to meet the goals of CCSS. To this end, we offer two sources of practical guidance for those seeking to develop effective morphological instruction and interventions. First, is a description of the basic principles by which morphology operates in English. Second, investigations of these spelling conventions are provided as “worked examples” (Schnotz & Kürschner, 2007) to illustrate how this content, new to many educators, can be presented from the very beginning of formal literacy instruction. In particular, these examples (including video links) highlight the process of “morphological problem solving” (Anglin, 1993, p. 5) with the aid of two linguistic tools: the morphological matrix ([www.realspelling.com](http://www.realspelling.com)) and the word sum. To our knowledge, Henry (2003/2010) and Bowers and Kirby (2010) are the only research-based references specifically addressing both of these linguistic tools for classroom instruction. The instructional examples are presented for descriptive, not prescriptive, purposes. They illustrate ways that this linguistic content is currently being presented to children of a wide range of grade levels, abilities, and native languages. Teachers, curriculum developers, and researchers are invited to draw from these examples of linguistically rigorous instruction as they design their own means to the instructional goal of understanding how the writing system works.

### Morphology: Form and Meaning

Morphology is the system by which a language combines morphemes (bases and affixes) to construct words. Every word in English is either a base or a base with one or more additional morphemes fixed to it. (See Table 2 for ways of revealing this structure, and for a description of our use of the terms *base* and *root* in this article.) The orthographic word sum is a tool that uses standard linguistic notation to reveal the underlying morphological elements in a word: for example, < un + help + ful > → < unhelpful >. On one side of the rewrite arrow, each morpheme is separated by a plus sign, and on the other, morphemes are rewritten in the conventional orthographic realization. Thus, a word sum allows us to see both a word’s underlying form and its surface realization. If a word is comprised only of a base, then its underlying form and surface realization are the same.

The base element carries the main kernel of meaning in a word, and words with a common base comprise a word family. Although a morpheme’s pronunciation may change depending on the word in which it surfaces, its orthography is conventionally consistent. For example, in *press* and *pressure*, <ss> represents different sounds, but the spelling remains the same. Morphemes integrate semantics, orthography, and phonology. Morphology can thus occupy a central place within the

“triangle model” of reading: it provides a juncture between forms and meanings of words (see Figure 1). Carol Chomsky (1970) located this juncture in abstract representations she called *lexical spellings*:

Lexical spellings represent the meaning-bearing items directly, without introducing phonetic detail irrelevant to their identification. Thus on the lexical level and in the orthography, words that are the same look the same. (C. Chomsky, 1970, p. 294)

So the lexical spelling <photograph> remains the same in *photography*, *photographic*, *photographed* even though the pronunciation of that lexical spelling changes.

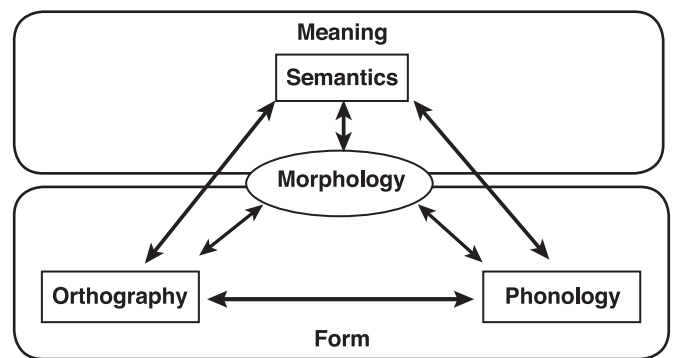


Figure 1. Morphology’s role within the “triangle model” of reading. The role of morphology illustrated by this model is described in Bowers & Kirby (2010) and Bowers, Kirby, & Deacon (2010). This figure was presented in Kirby, Bowers, & Deacon (2009, August).

### The Word Sum and Matrix

Teachers and students need to be equipped with reliable tools to investigate and make sense of the English writing system. The first column in Table 2 shows word sums for the word family with the base < please >. These are synthetic word sums in which the full form of each morpheme is to the left of the rewrite arrow and the surface orthographic realization is on the right. (This arrangement reverses in analytic words sums.)

The forward slash in the word sums in Table 2 marks the suffixing convention that a single, silent < e > at the end of a morpheme is replaced by a vowel suffix. A flowchart titled “The Big Suffix Checker” outlines the reliable suffixing conventions for single, silent < e > replacement, consonant doubling, and < y > / < i > changes ([www.realspelling.com](http://www.realspelling.com)). Watch a student using this tool at <http://youtu.be/myh7ULLvWWk>. An interactive suffix checker by Neil Ramsden reveals those same conventions and is available for free at [www.neilramden.co.uk/spelling/checker/index.html](http://www.neilramden.co.uk/spelling/checker/index.html)

**TABLE 2. Table of Relationships Between Word Sums, Surface Spellings and Pronunciations, and the Underlying Lexical Spelling of the Base in Members of the <please> Word Family**

Word sums for members of the <please> family	Surface spelling of base	Surface pronunciation of base	Underlying lexical spelling of base
please/ + ing → pleasing	pleas	/pli:z/	please
please/ + ant + ly → pleasantly	pleas	/plez/	please
un + please/ + ant + ness → unpleasantness	pleas	/plez/	please
please/ + ure/ + able → pleasurable	pleas	/pleʒ/	please
dis + please → displease	please	/pli:z/	please

Note: The terms *base* and *root* are both attested terms referring to the morpheme that carries the core meaning in a complex word. In this article we use the term *base* for this morphological concept and reserve *root* to refer only to etymological origins of words. We recommend this practice for terminological clarity. Without this precision, there are two attested correct answers to the question, “What is the *root* of the word < helpful >?” If *root* is used morphologically, the answer is < help > (where angle brackets indicate a spelled word rather than a pronounced one). If the term is used etymologically, the answer is “*helpan*,” the Old English word meaning *help*. Consistent with scientific practice, we can avoid using one term for two meanings or one meaning for two different terms by restricting the term *base* to the morphological domain and *root* to the etymological domain.

In addition to the word sum, the morphological matrix is another tool for representing the structure of morphological word families. The matrix shown in Figure 2 represents all the members of the < please > family that appear as word sums in Table 2. According to specified conventions, orthographic representations of morphemes are arranged into cells around the base that binds a morphological family, elegantly capturing the generative nature of morphology.

The word sum and the matrix target the only static feature of a word family: its underlying orthographic morphological structure, which corresponds closely to Chomsky’s concept of the lexical spelling. Along with the word sum, the matrix provides the opportunity to closely inspect the surface orthographic and phonological realizations in a specific word family and how they vary from the underlying forms. In this case we find three surface pronunciations of < please > (/pli:z/, /plez/, and /pleʒ/) and two surface orthographic representations (< please >, as in *displease*, and <pleas>, as in *pleasant*).

Teachers can take on the instructional role of “word scientist” with their students, investigating the morphological structure of words with word sums and matrices. Using the words < does > and < goes > can provide an effective starting point (see Figure 3). Through a guided scientific approach that Bowers & Kirby (2010) called “structured word inquiry” (p. 524), a teacher can ask questions about the structure of these words to construct the following word sums and matrices (see <http://youtu.be/ghhJfUblp70> for a video of this lesson in the classroom).

These “worked examples” (Schnotz & Kürschner, 2007) of how morphological word families are structured serve to reduce the working memory load required to make sense of words’ semantic, orthographic, and phonological interrelations. By targeting the spelled base in the word sums or matrix, we can discuss the changing pronunciations, from the /du:/ in

*Continued on page 34*

un dis	<b>please</b>	ing	
		ure	able
		ant	ly ness

Figure 2. A morphological matrix for the base element <please>. This matrix represents the five members of the morphological family shown by the word sums in Table 2 and it can be used to generate additional members of that family.

do + es → does  
do + ing → doing  
do + ne → done

<b>do</b>	es
	ing
	ne

go + es → goes  
go + ing → going  
go + ne → gone

<b>go</b>	es
	ing
	ne

Figure 3. Word sums and matrices for the <do> and <go> word families.

*do* and *doing* to the /dʌ/ in *does* and *done*. The teacher can ask students why they think the spelling of the base doesn't change even though the pronunciation does, inviting them to zero in on the consistent link between meaning and spelling.

Together with structured word inquiry, the word sum and matrix make sense of many basic orthographic features that are not typically featured in literacy instruction, including the following crucial points:

- Every written English word either *is* a base or *has* a base. A base carries the main meaning of any word in which it surfaces.
- A written morpheme can have multiple pronunciations across words.
- Words that share a common base comprise a morphological word family.

Each of these uncontroversial assertions about English spelling can be observed in the tables and figures above. Because any orthographic morphological word family can be represented by a matrix and analyzed with word sums, teachers and students can encounter these concepts over and over in the context of different word families.

The juxtaposition of the words < does > and < goes > in Figure 3 highlights the misunderstanding that comes when we attend only to surface sound-letter correspondences. Traditional literacy instruction characterizes *does* as irregular but treats *goes* as regular, even though both spellings conform completely to how phonology and morphology are represented in English spelling. These common words can thus be used as exemplars of how the whole writing system works, rather than as exceptions that can cause reading and spelling difficulties.

Just as letters are referred to by their names rather than by the sound(s) they can spell, we encourage teachers to model the practice that morphemes should never be named by their pronunciation, but instead by their underlying spelling. Just as letters can spell many sounds, a morpheme does not have a pronunciation until it surfaces in a word. According to this practice, the base < please > is named by spelling it out “p-l-ea-s-e” not the name of the word *please*. (This spelling out also signals the internal structure of the base. The letters of the < ea > digraph are stated together as recommended in Bowers and Kirby (2010). The < s > spells /z/ and the final < e > is a plural canceling marker (Venezky, 1999, p. 7).) This practice draws upon Chomsky's suggestion that it may be profitable to teach that a spelling like < natur > has no specific pronunciation until it surfaces in a word (e.g., *nature* or *natural*) (1970, p. 298).

### Student Learning through Teacher Learning

Even without addressing the basic facts of English, the CCSS offer an opportunity to bring more linguistic precision and understanding to classroom instruction. Current teacher training leaves many teachers with a very weak understanding of the linguistic principles that guide our writing system (Bos, Mather, Dickson, Podhajski, & Chard, 2001; Cunningham,

Perry, K. Stanovich, & P. Stanovich, 2004; Moats & Lyon, 1996; Moats & Foorman, 2003; Moats 2009). Morphology has traditionally been characterized as “advanced” literacy content. However, if we strive in literacy instruction to teach the most common and consistent patterns first, then, we must start with the foundational aspects of the English writing system set forth herein. To make sense of how letters and sounds work, we must address morphology from the beginning. This assertion based on linguistic understanding has now been corroborated by findings from morphological intervention studies (see Table 1). The linguistic tools of the word sum and matrix provide the means not only to introduce the workings of English spelling to children, but also to ensure that teachers themselves engage in a deepening understanding of the written word, thus creating a generative circle of learning.

In any scientific inquiry, we seek the deepest structures that account for the greatest number of examples; armed with this principle and with our linguistic tools, teachers and students can draw scientific conclusions about the written word from written words themselves. Rather than relying on answer sheets or specific references to present accurate morphological information, teachers and students can use these linguistic tools to interrogate language learning resources. From a scientific perspective, we should assume that any reference is fallible. For example, the Oxford English Dictionary lists < -tion > as a suffix, offering < relation > and < completion > as examples. With word sums, however, we can clearly see that the suffix must be < -ion >: < relate/ + ion > and < complete/ + ion >. Because teachers are presented with errors about morphology in teaching materials and other resources, it is critical that they have tools that allow them to draw scientifically based conclusions about the writing system regardless of the authority behind any reference they may use.

Bowers and Kirby (2010) made extensive use of matrices and word sums in their intervention study and found that the experimental group was significantly superior to the control group in vocabulary learning; improvements seen in the specific words presented in the study also extended to non-targeted words in the same word families. Teachers in English classrooms and clinics across the U.S., Canada, and abroad are currently using matrices and word sums to gather and analyze words and classify them into morphological word families, achieving both breadth and depth in the patterns they learn and study. Because of the attention garnered by the CCSS recommendations for English language arts, we submit that the matrix and the word sum deserve attention as important tools for “fostering students’ understanding and working knowledge of . . . basic conventions of the English writing system” (CCSS, p. 15).

When people first encounter the matrix and the word sum, we invite them to reflect upon whether these tools facilitate for them a deeper understanding of the relationships between spelling, pronunciation, and meaning. Do they feel better equipped, for example, to explain the spelling of *does* to a child in a new and logical way? Do they still think of \* < -tion > as a

suffix? We have observed many teachers engaging in scientific inquiry into the writing system with the aid of these linguistic tools. They report that their understanding of the conventions of written English and their confidence in teaching it continue to deepen. It is also common for students who investigate spellings with word sums and matrices to share with their teachers and peers their own discoveries about words and the writing system. For example, with the guidance of a tutor, word sums, and a matrix, one student ascertained that the base of < investigate > is < vestige >, denoting “trace, footprint” (see <http://realspellers.org/resources/matrices/446-investigate> for an account of this investigation). The tutor did not know this structure when they started; she and her student made this discovery together through scientific inquiry. By investigating English spelling with accurate information and tools, teachers and their students can learn to follow the traces or footprints left by the conventions of our writing system. The fact that the word sum and the matrix can make sense out of formerly problematic patterns in English indicates that these tools deserve the close attention of educators and researchers.

## References

- Anglin, J. M. (1993). *Vocabulary development: A morphological analysis. (Monographs of the Society for Research in Child Development, 58)*. Chicago: University of Chicago Press.
- Bos, C., Mather, N., Dickson, S., Podhajski, B., & Chard, D. (2001). Perceptions and knowledge of preservice and inservice educators about early reading instruction. *Annals of Dyslexia, 51*, 97–120.
- Bowers, P. N., & Kirby, J. R. (2010). Effects of morphological instruction on vocabulary acquisition. *Reading and Writing: An Interdisciplinary Journal, 23*, 515–537.
- Bowers, P. N., Kirby, J. R., & Deacon, S. H. (2010). The effects of morphological instruction on literacy skills: A systematic review of the literature. *Review of Educational Research, 80*, 144–179.
- Carlisle, J. F. (2010). Effects of instruction in morphological awareness on literacy achievement: An integrative review. *Reading Research Quarterly, 45*, 464–487.
- Chomsky, C. (1970). Reading, writing, and phonology. *Harvard Educational Review, 40*, 287–309.
- Cunningham, A. E., Perry, K. E., Stanovich, K. E., & Stanovich, P. J. (2004). Disciplinary knowledge of K–3 teachers and their knowledge calibration in the domain of early literacy. *Annals of Dyslexia, 54*, 139–167.
- Goodwin, A. P., & Ahn, S. (2010). A meta-analysis of morphological interventions: Effects on literacy achievement of children with literacy difficulties. *Annals of Dyslexia, 60*, 183–208.
- Henry, M. K. (2003/2010). *Unlocking literacy: Effective decoding & spelling instruction*. Baltimore, MD: Brookes.
- Kirby, J. R., Bowers, P. N., & Deacon, S. H. (2009, August). Effects of instruction in morphology on reading. Paper presented at the biannual meeting of the European Association for Research in Learning and Instruction, Amsterdam, The Netherlands.
- Moats, L. C. (2009). Still wanted: Teachers with knowledge of language. *Journal of Learning Disabilities, 42*, 387–391.
- Moats, L. C., & Foorman, B. R. (2003). Measuring teachers’ content knowledge of language and reading. *Annals of Dyslexia, 53*, 23–45.
- Moats, L. C., & Lyon, G. R. (1996). Wanted: Teachers with knowledge of language. *Topics in Language Disorders, 16*, 73–86.
- Nunes, T., & Bryant, P. (2006). *Improving literacy by teaching morphemes*. New York, NY: Routledge.
- Pinker, S. (1999). *Words and rules*. New York, NY: Perennial.
- Rayner, K., Foorman, B. R., Perfetti, C., Pesetsky, D., & Seidenberg, M. S. (2001). How psychological science informs the teaching of reading. *American Psychological Society, 2*, 31–74.
- Reed, D. K. (2008). A synthesis of morphology interventions and effects on reading outcomes for students in grades K–12. *Learning Disabilities Research & Practice, 23*, 36–49.
- Schnotz, W., & Kürschner, C. (2007). A reconsideration of cognitive load theory. *Educational Psychology Review, 19*, 496–508.
- Venezky, R. (1967). English orthography: Its graphical structure and its relation to sound. *Reading Research Quarterly, 2*, 75–105.
- Venezky, R. (1999). *The American way of spelling*. New York, NY: Guilford Press.

**Peter N. Bowers**, a Ph.D. student at the faculty of Education at Queen’s University, is the founder of the WordWorks Literacy Centre, and he has taught elementary school for 10 years. His research and consulting work focuses on the effect of teaching how the English writing system works.

**Gina Cooke, M.A.**, is a linguist, Ph.D. student, and the author of LEX: Linguist~Educator Exchange. She has taught students about reading and writing from preschool to grad school and is continually captivated by the facts of the English writing system.

## In Memoriam



Lucia Rooney Karnes died on September 8, 2012 in Winston-Salem, North Carolina. Lucia served The Orton Society in many and varied positions of leadership, including several terms on the National Board of Directors and Vice President. She was Program Chair for the Winston-Salem IDA Conference and was the first Branch-in-Formation Chairman. In 1993, she received the Samuel T. Orton Award. Dr. Roger Saunders presented the award to her with this citation:

*Teacher of teachers, insightful, diagnostic psychologist, developer of programs in colleges, independent schools, and community clinics, Dr. Karnes has been a devoted member of The Orton Dyslexia Society with many leadership roles. Her enthusiasm and profound knowledge has influenced the lives of countless dyslexics and their families.*

Lucia was a graduate of Emory University in Atlanta, Georgia. She earned her Ph.D. in psychology from the University of North Carolina in Chapel Hill. She was a classroom teacher in various public and private schools. In 1950 to 1957, she was a language therapist at the Graylyn Bowman Gray School of Medicine under the direction of June Lyday Orton. From 1957 to 1962, she was a language therapist at the Orton Reading Center at Salem College. In 1972, as a Professor, Dr. Karnes established and directed the Center for Special Education at Salem College. In the following year, she established Camp Loquostee (love of learning in the Cherokee language), where for 16 years she served over 1,000 children with learning disabilities. She was a consultant and helped establish Orton-based programs at various independent schools, colleges, and community clinics. Dr. Karnes had an international presence, as well. In the 1970s and 1980s, she presented papers at various conferences in Europe and Australia.