

CHAPTER

# 4

## SPELLING ACQUISITION IN ENGLISH

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Having been given the opportunity to write a short chapter about spelling acquisition in English, we are pleased to report that this task is now near to impossible. The reason we are happy is that, in the past, the field of spelling suffered from a dearth of research. There was much more work on the acquisition of reading and word recognition than on the acquisition of writing and spelling. However, the body of research on spelling in English-speaking children is now so large that it would be foolish to presume to do it justice within a single chapter. Given this limitation, we chose three main topics for discussion. These are the use of letter names as an entry into the writing system, young children's knowledge of the orthographic patterns of their language, and children's use of morphological strategies to guide their spelling. We chose these three topics because each plays a major role in existing theories of spelling development. We review experimental evidence to suggest that young spellers have more knowledge in each of these areas than portrayed by existing theories. Children's knowledge, we argue, provides a foundation for the development of spelling skills.

To accomplish our goal, it is first necessary to review what the existing theories have to say about spelling development. Current research on the topics of letter-name spellings, knowledge of orthography, and morphological knowledge is then discussed. In the final section, we address the implications of the findings for views of spelling development.

## THEORIES OF SPELLING DEVELOPMENT

Henderson (1985) outlined five stages of spelling development. The first stage, *preliterate writing*, begins almost as soon as a child starts to make marks with a crayon or pencil. A child's "writing" at this stage may resemble scribbles more than writing. The child understands that writing is different from drawing but not that writing represents speech. When children do begin to realize that writing is a way to communicate speech and that letters symbolize the sounds in words, they are considered to be entering the second stage of spelling development. This second stage is called *letter-name spelling*. Gradually, the child has become aware of sounds and of the letters used to represent them. The child has also learned the names of the letters of the alphabet. Often a child will write a letter to represent the sounds of the letter's name. For example, the words *mess* and *help* may be spelled MS and HLP, respectively, with the letters *s* and *l* standing for their names, /es/ and /el/. (Throughout this chapter, we use capital letters to refer to children's spellings of words or nonwords.) Children do not represent in their spellings sounds that they have difficulty accessing as separate units, such as the /m/ and /n/ in the words *bump* and *want*. For the child, the sound of the vowel plus the /m/ or /n/ appears to be one. Because children do not yet know all of the conventions of the writing system, their spellings contain these apparently odd errors. Henderson stated that children use a phonetic or sound-based strategy to spell words that they do not know throughout the first and second spelling stages and into the third stage, called the *within-word pattern stage*.

By the time children reach the within-word pattern stage, they have begun to learn words by sight through their reading. Basically, the term *sight words* refers to an acquired pool of memorized spellings. According to Henderson (1985), children usually spell sight words correctly once they have acquired these words. Not until a considerable number of sight words are learned do they begin to influence children's spellings of novel words. As children's writing starts to change as a result of this influence, children are considered to be entering the within-word pattern stage. This stage is marked by the correct spelling of short vowels, the use of silent markers such as final *e* for long vowels, and the correct spelling of clusters such as *st*, *dr*, and *tr*. The letters *m* and *n* that were previously missing in words such as *bump* and *want* now appear. Children's knowledge of sight words helps them to realize that writing does not always involve a one-to-one matching of sound to letters. Children begin to use frequent letter patterns that correspond to sequences of sounds, for example the *-ight* pattern found in *light*, *might*, and *fight*.

After children have begun to learn patterns in conventional spelling and start to use them in their own spellings, they become able to understand

how meaning relations among words are marked in print. Before this, according to Henderson (1985), children's spelling is based on sounds. For instance, letter-name spellers represent the past tense ending *-ed* with either *d*, *t* or *id* according to its sound, as in PED for *pinned*, STAPT for *stepped*, and PLATID for *planted*. During the initial part of the within-word period, children still choose different patterns depending on the morpheme's phonetic form. Later, children come to understand that the past tense ending has a consistent spelling. "From the third grade on, ... the role of meaning becomes rapidly more conspicuous" (Henderson, p. 63).

The use of double consonants to mark a short vowel characterizes Henderson's (1985) fourth stage, called the *syllable juncture stage*. Children who are making rapid progress in learning to spell may reach this point during the middle years of elementary school; other children do not reach this stage until later. Children now learn that the presence versus the absence of a double consonant marks the difference between the first vowels of words such as *little* and *title*. Other learning at this stage includes the understanding of when and when not to double consonants with the addition of suffixes such as *-ed* and *-ing*.

The last stage in Henderson's (1985) outline of spelling development is called *derivational principles*. This stage may begin as early as the late elementary grades for children who are progressing quickly; it begins later for other children and continues throughout a writer's lifetime. As the title of this stage implies, the spelling relations among words in terms of roots, origins, and meanings are further explored. Knowledge of the meaning connections among words such as *confide*, *confident*, and *confidential* aids the speller. These words have similar spelling patterns even though their sounds vary slightly.

A very similar sequence for spelling development has been outlined by Gentry (1982), who analyzed the spellings of a precocious youngster who began to write at home without formal instruction (Bissex, 1980). Gentry's depiction begins with the *precommunicative stage*, when the child has no knowledge of letter-sound correspondence. During this stage, spellings are random letter strings that may include numbers or letter-like marks. Next, the child begins to understand that letters are used to represent sounds. However, spellings start out as incomplete phonetic representations of words. The letter-name strategy mentioned earlier is the hallmark of this second stage, which Gentry called the *semiphonetic stage*. "Where possible the speller represents words, sounds, or syllables with letters that match their letter names (e.g., R [are]; U [you]; LEFT [elephant]) instead of representing the vowel and consonant sounds separately" (p. 194). Once children can symbolize the entire sound structure of words in their spellings, they are considered to have reached the *phonetic stage*. All of the surface sound features of words are now represented in spellings. However, "letters are assigned

strictly on the basis of sound, without regard for acceptable English letter sequence or other conventions of English orthography" (p. 195). The fourth stage, called the *transitional stage*, starts when children become more aware of conventional spellings. Children now employ visual and morphological information in their spelling rather than depend wholly on sound, as they did earlier. Gentry's last stage is simply called the *correct stage*. Knowledge of the orthographic system and of basic rules is firm. A writer will continue to master uncommon and irregular forms and so errors will occur, but the majority of spellings will be correct.

Ehri (1986) outlined three stages describing the development of orthographic knowledge: the *semiphonetic*, *phonetic*, and *morphemic* stages. The characteristics of these stages are very similar to the semiphonetic, phonetic, and transitional stages described by Gentry (1982). Ehri did not include the period before actual alphabetic writing as the initial stage of spelling development, in contrast to Gentry's first precommunicative stage. Although Ehri acknowledged that very young children have some primitive notions about writing, she preferred to begin her description at the point at which children are attempting to write words. Another difference between the stages outlined by Ehri and by Gentry is that Ehri did not include a final stage characterized by correct spelling. She argued that a number of regularities are learned during the morphemic stage, leading to the correct spellings of many words. This learning process is part of the morphemic stage, which continues throughout the writer's lifetime.

These three descriptions of spelling development (Ehri, 1986; Gentry, 1982; Henderson, 1985) share some important characteristics. All depict beginning spellers as focused on representing speech sounds in their spellings. Common phoneme-grapheme mappings and letter names are believed to guide a child's use of letters and letter sequences at this time. Knowledge about the variety of letter sequences that are possible in English and about when each one should be used develops only after children have established a corpus of sight words. The understanding of meaning relations among words and the use of this knowledge to guide spelling is also a late development. Thus, the theories portray spelling development as a sequence of stages that involve the ability to use different types of information. Young spellers are limited to a few sources of information, namely sounds and letter names. As children progress through the stages, they gain the ability to use other types of information, including orthographic regularities and morphological relations among words.

We argue that the existing theories underestimate young children's abilities. Although phonology and letter names play important roles in early spelling, young children also have some budding knowledge about the orthographic regularities of the written language and about the role of morphology in spelling. Children begin to use this knowledge earlier than they

are given credit for in the existing theories. In addition, we argue that theories of spelling development need to pay more attention to the interactions among various sources of knowledge. For example, we suggest that children's tendency to make use of letter names is affected by the phonological structure of the letter names themselves. To exemplify these notions, let us begin by examining how children use their knowledge of letter names to guide their spellings.

## LETTER NAMES AND SPELLING

Middle-class North American children typically learn to recite the alphabet (often by singing the alphabet song) and to name many of the letters well before they begin formal schooling. Parents, children's television programs, and preschools are just some of the sources from which children acquire this information. In one study (Mason, 1980), almost two thirds of 4-year-olds were said by their parents to "very often" recite the alphabet without error. Over half of the children were said to recognize more than 20 letters of the alphabet by name. In another study, which assessed acquisition of alphabet skills directly rather than rely on parental report, children could recite or sing five or more letters of the alphabet by age 4 and were almost perfect by age 5 (Worden & Boettcher, 1990). Shown uppercase letters and asked to name them, 4-year-olds were correct on about 14 of the 26 letters. Five-year-olds were correct on about 22 letters. Children's knowledge of the sounds of letters was not as good as their knowledge of the names. Four-year-olds could provide the sounds for about 6 letters of the 26 and 5-year-olds for 8.

Given that children enter school with a good deal of knowledge about letter names, what role, if any, does this knowledge play in learning to write and read? One might argue that letter-name knowledge cannot directly benefit spelling or reading because written letters symbolize phonemes and not the letters' names. After all, *bat* is pronounced /bæt/ rather than /biæti/. However, most English letter names contain the phoneme that is commonly represented by the letter. For instance, *b* has the name /bi/; this letter typically symbolizes the phoneme /b/, which is the first sound of its name. Durrell (1980), Ehri (1983, 1986), and others argued that letter-name knowledge plays an important role in the early acquisition of literacy. In fact, the theories of spelling development that we have discussed depict beginners as relying so heavily on a letter-name strategy that they spell a phoneme or sequence of phonemes that matches a letter name with the corresponding letter whenever it is possible to do so (Ehri, 1986; Gentry, 1982; Henderson, 1985). However, recent evidence suggests that such letter-name spellings may not be as widespread as previously thought. Children's tendency

to use letter names as a guide to spelling appears to be influenced by the phonological properties of the letter names themselves.

Evidence to support this point comes from a series of experiments conducted by Treiman (1994). In the first experiment, first graders were asked to spell a series of monosyllables, each of which contained a sequence of phonemes that matched the name of an English consonant letter. Examples are /var/, which contains the name of the letter *r*, /vel/, which contains the name of the letter *l*, and /pem/ and /kef/, which contain the names of *m* and *f*. If children use a letter-name spelling strategy whenever it is possible to do so, as the theories of spelling development claim, they should spell these nonwords as VR, VL, PM, and KF. The first graders, who were tested in October and November, did make some of these consonant-consonant (CC) errors. However, the errors were by far most frequent for nonwords containing the name of *r*. For nonwords, such as /var/, 41% of the children's spellings were letter-name errors such as VR. The letter-name errors occurred less often for *l*, with a rate of 9% errors such as VL for /vel/. Vowel omissions in spellings of nonwords containing the names of *m*, *n*, *f*, and *s* were even less common, occurring between 2% and 4% of the time. It appears that some vowel-consonant (VC) letter-name sequences are more likely to be spelled as units than others.

Treiman's (1994) second experiment was designed to investigate these differences further. In addition to examining letters with VC names, the second study also included letters with consonant-vowel (CV) names. Children in preschool, kindergarten, and the very beginning of first grade were tested; these children were screened to ensure that they knew the names of the critical letters. The children were asked to spell syllables containing phoneme sequences that matched the names of English letters. The letters considered were *r*, *l*, *m*, *n*, *f*, *s*, *t*, *p*, and *k*. For example, /gar/ contains the letter name for *r*, or /ar/, /zef/ contains the letter name for *f*, or /ef/, and /tib/ contains the letter name for *t*, or /ti/. The kindergartners and first graders produced most CC spellings for syllables containing the name of *r*. Indeed, kindergartners made errors such as GR for /gar/ 61% of the time, and first graders did so 50% of the time. Syllables containing the letter name *l* were the next most likely to be spelled as CCs, with 41% such errors for kindergartners and 19% for first graders. CC spellings were less common for syllables that contained the names of the letters *m*, *n*, *f*, *s*, *t*, *p*, and *k*. However, children did produce more CC spellings for these syllables than for control syllables that did not contain letter-name sequences. Thus, although the kindergartners' and first graders' spellings were most influenced by their knowledge of letter names for *r* and, to a lesser extent, *l*, there was some effect for a broad range of other letters. (The preschoolers showed a different pattern of performance than the older children; their results are discussed further on.)

Two additional experiments reported by Treiman (1994), as well as data on first graders' spellings of real words reported by Treiman (1993), provide further evidence that letter-name spellings are not equally likely for all consonants. These errors are most common for *r*, next most common for *l*, and less frequent for other consonant letters. These differences speak against the idea that children use a letter-name spelling strategy whenever it is possible to do so.

Why are children more likely to spell /ar/ as *r* than to spell /el/ as *l* or /ti/ as *t*? The answer to this question, Treiman (1993, 1994) suggested, may lie in the phonological structure of the letters' names. In particular, some letter names may be easier for children to segment into phonemes than others. Children have particular difficulty dividing the sequence /ar/ into phonemes and so tend to spell this sequence as a single unit. The difficulty with /ar/ may reflect, in part, the special properties of postvocalic /r/. Evidence from speech errors and from the learning of games that divide spoken syllables in various ways suggests that a vowel and a following /r/ form an especially tight bond, stronger than that between a vowel and a following /l/ or between a vowel and another following consonant (Derwing & Nearey, 1991; Laubstein, 1987; but see Stemberger, 1983). Thus, based on the properties of the consonants in the VC letter names, the letter-name sequence /ar/ may be more cohesive than /el/. Both of these in turn may be more cohesive than sequences such as /es/ (Derwing & Nearey, 1991; Hindson & Byrne, 1997; Treiman, 1984; Treiman, Zukowski, & Richmond-Welty, 1995). A child attempting to spell the spoken syllable /gar/ may analyze it into /g/ and /ar/ and, being unable to segment the /ar/ further, may spell the syllable as GR.

So far, we have focused on the special properties of postvocalic /r/ that may make it hard for children to divide the letter name /ar/ into phonemes. However, the nature of the vowel may be important as well. The letter *r* is unusual in that the vowel phoneme in its name, /a/, occurs in no other English letter name. The lack of letter names such as /ap/ or /ag/ leaves children without a mate to compare with /ar/. In contrast, the repetition of vowel phonemes across other consonant letter names may help children to understand that the letters are used to represent the distinctive consonant phonemes rather than the repeated vowels. Thus, a child may come to realize that the letter names /bi/, /di/, /pi/, /ti/, and so on, share the vowel /i/ and that the letters *b*, *d*, *p*, and *t* symbolize the consonants that distinguish these letter names. The same may be true for the VC letter names /el/, /ef/, /em/, /en/, and /es/. How much of a contribution the uniqueness of the vowel in /ar/ among the letter names of English makes to children's use of *r* letter-name spellings remains to be investigated.

We have seen that first graders and kindergartners sometimes symbolize a difficult-to-segment sequence such as /ar/ or /el/ with the letter that has



this name, producing errors such as CR for *car* and HLP for *help*. Additional evidence points to letter-name effects in even younger children. Consider the results for the preschoolers in the second experiment by Treiman (1994), in which children attempted to spell syllables such as /gar/, /zɛf/ and /tib/. A number of the preschoolers originally screened did not know the names of all of the critical consonant letters and so did not participate in the spelling test. Those who knew the letter names, however, made some intriguing errors. Unlike the kindergartners and first graders, these preschoolers produced many single-letter spellings. The single letter that they used was often the consonant letter suggested by the letter-name sequence in the spoken syllable. For example, the preschoolers often spelled /gar/ as R, /zɛf/ as F, and /tib/ as T. These errors are interesting because children generally have more success spelling initial consonants than final ones (Stage & Wagner, 1992; Treiman, 1993; Treiman, Berch, & Weatherston, 1993). Letter-name knowledge is apparently potent enough to override this tendency, making preschoolers more likely to spell /gar/ as R, the final letter, than as G, the initial letter. Thus, children who have a strong knowledge of letter names before they begin formal schooling may be able to take advantage of this knowledge to produce sound-based spellings. A child who spells /gar/ as R is demonstrating a knowledge that the spelling of a word is not arbitrary—that the letters in a spelling have some connection to a word's sound. A child may be able to spell /gar/ as R based on the overall similarity in sound between /gar/ and /ar/; the child need not be able to divide the spoken syllable /gar/ into smaller units of sound (see Treiman & Breaux, 1982). Although spellings like R for /gar/ appear very primitive, the children who produce these spellings may be able to appreciate that certain aspects of conventional spelling, such as the *r* in *car* or the *p* in *pizza*, make sense given the sounds in words. In this way, letter-name knowledge may help children take their first steps toward understanding that writing is connected to speech.

The names of letters may also help children to discover and remember the sounds that letters make, at least for those letters whose names suggest their sounds. Evidence to support this claim comes from a study by Treiman, Weatherston, and Berch (1994, Exp. 2). These researchers asked preschoolers and kindergartners to supply the first letters of syllables such as /ba/, /la/, and /ga/ and, in another condition, the last letters of syllables such as /ab/, /al/, and /ag/. Children were simply asked to say the first or last letters of the spoken syllables; they were not asked to write them. Knowledge of letter names could help children to remember the link between /b/ and *b* and the link between /l/ and *l*. This is because /b/ is found in the name of *b* and /l/ is found in the name of *l*. Letter names could not help children with the mapping between /g/ and *g* because the name of the letter *g* does not contain the phoneme /g/. Children indeed performed better in the supply-the-first-

letter task on syllables for which letter-name knowledge could help them (e.g., /ba/, /la/) than on syllables for which letter-name knowledge would be useless or even misleading (e.g., /ga/). Similarly, performance in the supply-the-last-letter task was better for syllables such as /ab/ and /al/ than for syllables such as /ag/. An additional finding is that performance was better with letters like *b*, where the phoneme that the letter symbolizes is at the beginning of a CV letter name, than with letters like *l*, where the phoneme that the letter symbolizes is at the end of a VC letter name. This difference may arise because /b/ is in the salient onset position of the CV letter name /bi/. Children's ability to divide the letter name into its onset and rime (Bowey & Francis, 1991; Kirtley, Bryant, Maclean, & Bradley, 1989; Treiman, 1985, 1992) helps them access the /b/ in the syllable /bi/. In contrast, the /l/ of /el/ is in a less salient position in the spoken syllable and is more difficult to separate from the vowel.

Thus, the phonological properties of a letter's name that make it easier or harder to segment into phonemes seem to have at least two effects. First, these properties influence children's tendency to use the letter to spell the sequence of phonemes in its name. Second, they affect children's ability to use the letter's name as a clue to its sound. As an example, the name of *b*, /bi/, is relatively easy for children to divide into phonemes. Its segmentability means that errors like BT for *beat* will be uncommon but that children will be able to use *b*'s name to remember its sound. The name of /l/, /el/, is harder to break apart. Hence, children will make a fair number of errors like BL for *bell* and will have more trouble using the letter's name as a clue to its sound.

Children's tendency to use letter names to discover the letters' sounds sometimes leads them astray. Consider the letter *w*, which is used in English to spell the phoneme /w/. However, the name of *w* ("doubleyou") does not contain /w/. The letter name that contains the /w/ phoneme is instead the name of *y*, /wai/. Not surprisingly, the kindergartners tested by Treiman, Weatherston, and Berch (1994) sometimes said that *y* makes the sound /wə/. Also, they sometimes misspelled words with initial /w/ with *y*, as in YAT for *wet* or YRM for *warm*. These errors were nearly absent by the spring of first grade (see also Read, 1975; Treiman, 1993). Thus, young children who can divide spoken syllables into onsets and rimes may analyze the CV name of *y* into /w/ and /ai/. They may conclude that *y* should be used to spell /w/ just as other letters with CV names, such as *b* and *k*, are used to spell the first phonemes of their names. As children learn the spellings of common words such as *went* and *will*, in which /w/ is spelled with *w*, or as they are taught that *w* makes the sound /w/, they abandon their early belief that *y* corresponds to /w/.

Exposure to print may thus be one factor that leads to the eventual disappearance of errors such as YAT for *wet* and CR for *car*. Children see

that words beginning with /w/ generally start with *w* rather than *y*. They observe that printed words almost always contain a vowel. Indeed, first graders' knowledge that printed words must include vowels leads them to sometimes produce spellings such as GRE for the nonword /gar/ (Treiman, 1994). A child's belief that /ar/ is an indivisible phonological unit suggests that the rime be spelled with single *r*; the child's orthographic knowledge suggests that the word contain a vowel. The child may solve this conflict by placing an *e*, which occurs as a "silent" letter at the ends of words such as *came* and *give*, at the end of the spelling. Thus, even in the early stages of spelling development, children may notice what words look like and may use this information when constructing their own spellings. In the next section, we focus more directly on children's orthographic knowledge.

### ORTHOGRAPHIC KNOWLEDGE

By orthographic knowledge, we mean children's understanding of the conventions used in the writing system of their language. Proficient writers possess a good deal of information about the orthography, including knowledge about the spacing of words, the orientation of writing, acceptable and unacceptable letter sequences, and the variety of ways in which certain phonemes may be represented, depending on such factors as their position in a word. It is widely held that individuals develop orthographic knowledge based on their experiences with the printed language. This knowledge, in addition to phonology, then influences spelling.

The theories of spelling development we have described (Ehri, 1986; Gentry, 1982; Henderson, 1985) maintain that orthographic knowledge does not begin to affect a child's spelling until the child has accumulated a considerable number of words that are recognized by sight. These theorists describe orthographic knowledge as the learning of complex sequences such as the *-ight* of words such as *light* and learning when to double consonants in polysyllabic words. Very likely, knowledge of complex orthographic patterns such as these does develop late relative to other spelling skills. However, the theories fail to account for the possibility that young children possess knowledge about simpler conventions of the orthography.

Treiman (1993) examined early spellings for evidence of adherence to relatively simple orthographic conventions. She looked at the writings produced over the course of the school year by first graders. These first graders were in a curriculum in which they were encouraged to write but their spelling was not corrected. The children tended to produce spellings that were consistent with the regularities of the English writing system. For instance, vowels and consonants that are more likely to occur as doublets in English, such as *e* and *l*, were more likely to occur as doublets in the

children's writing than letters that infrequently or never double, such as *u* and *h*. Another example of children's adherence to orthographic patterns involves *ck*. The *ck* spelling never occurs at the beginning of a word in written English; initial /k/ is instead spelled with *c* or *k*. The children in Treiman's study did use *ck* but rarely at the beginning of a word. These and other examples suggest that beginning spellers develop a sensitivity to simple orthographic patterns earlier than expected given current models of spelling development.

Treiman's (1993) evidence of orthographic knowledge came from the writings that first graders produced as part of their everyday classwork. Treiman also experimentally investigated children's knowledge of orthography by devising an *orthographic constraints* test. This test included 16 pairs of nonwords. Each pair tested a constraint or regularity of the English writing system. One nonword in a pair conformed to the regular pattern; the other word did not. However, both nonwords were pronounceable. For example, one pair was *ckun* and *nuck*. Children were to choose which item looked more like a real word. If children make their judgments on the basis of sound only, both items would be equally likely to be chosen. However, if children consider orthographic acceptability in making their judgments, the item that conformed to the orthographic constraint should be chosen more often. Treiman found that middle-class kindergartners (tested in May), first graders (tested in March), and second graders (tested in May) all chose the conforming item significantly more than 50% of the time. The percentages of correct responses were 56% for kindergartners, 62% for first graders, and 83% for second graders. The above-chance performance of kindergartners and first graders supports the idea that knowledge of orthography begins to emerge earlier than previously thought.

Treiman's (1993) orthographic constraints test contained 16 pairs of nonwords testing a variety of different constraints. Knowledge of no one constraint was explored in detail. Some further studies, however, specifically investigated children's knowledge of double consonants and vowels (Cassar & Treiman, in press). The first study focused on consonants. In English, consonant doublets may occur in the middle or at the end of a word but not at the beginning. In addition, medial doublets normally follow short vowels in polysyllabic words, as in *latter*. Single consonants normally follow long vowels, as in *later*. Pairs of nonwords were designed to test children's knowledge of these conventions. In pairs that tested knowledge of position, one nonword contained an initial doublet and the other nonword contained a final doublet. An example is *nnus* and *nuss*. If children know where consonant doublets may occur, they should judge that *nuss* is more likely to be a word than *nnus*. In pairs that examined the phonetic environment for doubling, one nonword contained a medial single consonant, as in *salip*, and the other contained a medial doublet, as in *sallip*. Cassar and Treiman asked

whether participants listening to pronunciations for the nonwords chose *salip* for a pronunciation with "long a" or /e/ in the first syllable and *sallip* for a pronunciation with "short a" or /æ/.

The participants in Cassar and Treiman's (in press) first study were children in kindergarten, first, second, third, sixth, and ninth grades as well as college undergraduates. One group at each grade level was assigned to an auditory condition in which they chose which spelling looked best for the word they heard. The other group was assigned to a visual condition in which they viewed pairs of spellings and chose the one they thought looked more like a real word. For the pairs that tested knowledge of position (e.g., *nuss* and *nnus*), even kindergartners tested in the first semester of the school year picked the final doublet spellings significantly more often than chance. Not until sixth grade and above did children evidence knowledge of the correspondence between short vowels and spellings with medial doublets. That is, only the older children were able to reliably choose *sallip* for the pronunciation /s'ælip/ and *salip* for the pronunciation /s'elip/. These latter results agree with Henderson's (1985) claim that knowledge about the complex pattern of short vowel plus double consonant in two-syllable words develops later than the first few years of elementary school. However, young children's above-chance performance on the test of knowledge about the positions of consonant doublets suggests that some types of orthographic knowledge emerge much earlier in the course of spelling acquisition. This finding fits with Treiman's (1993) observation that the first graders in her study did not often make errors such as BBAL for *ball*. It appears that beginning spellers not only represent speech sounds when they write but that they also attempt to honor the kinds of letter sequences to which they have been exposed.

Cassar and Treiman's (in press) second study further investigated children's knowledge of double consonants as well as double vowels. An attempt was also made to identify the spelling development of each child in terms of the stages outlined in the theories of spelling development. An examination of children's knowledge of doublets in relation to their level of spelling development was expected to yield insights into the types of information that children use when they are beginning to spell. As in the first study, an orthographic choice test employed pairs of nonwords. One nonword in each pair contained an acceptable vowel or consonant doublet; the other nonword contained an unacceptable doublet. The doublets occurred in the medial or final positions of the spellings, both of which are acceptable for doublets. Sample pairs are *noss* and *novv* and *geed* and *gaad*. If children know which letters are allowed to double, they should choose *noss* and *geed* as more word-like than *novv* and *gaad*.

To identify each child's level of spelling development, the child was asked to spell a list of common words such as *farm* and *people*. The spellings were

scored on the basis of features thought to predominate at particular stages of spelling development. Beginning spellers considered to be at the semi-phonetic and phonetic stages as described by Ehri (1986) and Gentry (1982), which correspond to the letter-name stage of Henderson (1985), were targeted in this study. According to the theories, these children focus only on sounds or phonetic mappings when they spell.

Kindergarten, first- and second-grade children were tested during February. First and second graders, but not kindergartners, chose spellings containing allowable doublets over spellings containing unallowable doublets. That is, they judged that *noss* and *geed* were more like real English words than *novv* and *gaad*. Importantly, children classified as phonetic spellers performed significantly better than chance on the orthographic choice test. Children at the semiphonetic level did not show above-chance levels of performance. These results suggest that children begin to learn about which letters may double in English earlier than previously thought. Gentry (1982) claimed that during the phonetic stage, letters are assigned strictly on the basis of sound, without regard for the conventions of English orthography. The results of Cassar and Treiman's (in press) study dispute this claim by showing that children whose spellings have many of the hallmarks of the phonetic or letter-name stage possess some knowledge of orthographic conventions. Children may begin to learn what words look like earlier than commonly believed. They use this knowledge, together with their knowledge of phonology and letter names, to construct spellings.

#### MORPHOLOGICAL KNOWLEDGE

The theories of spelling development we have reviewed depict the use of morphology to guide spelling as a late development. In fact, Henderson (1985) advised teachers that children need to be taught about the morphological relations among words. The relations to which Henderson referred are those such as the relation between *courage* and *courageous*. These connections may not be obvious to children, and so it may be best to point them out. However, not all morphological relations are this complex. Some, such as the relations between *rain* and *rained* or *bar* and *bars*, are simpler. Children can handle these kinds of morphological alternations in their speech from an early age (Berko, 1958). Hence, young children might take advantage of such relations in their spelling as well.

Consider the verb *wait*. By adding the suffix *-ed*, we create the past tense form *waited*. The addition of *-ed* also changes the pronunciation of the /t/ to a flap, a quick tap of the tongue against the top of the mouth. The flap of *waited*, which is voiced, is similar to /d/, which is also voiced. If young spellers use only sound-based information, they should spell the flap of *waited* with a *d*. However, if children understand the relation in meaning

between *wait* and *waited*, and if they realize that this relation is marked in spelling, they should use a *t* in *waited* based on the spelling of the stem. This was the reasoning behind two studies conducted by Treiman, Cassar, and Zukowski (1994).

The first study to be discussed (Treiman, Cassar, & Zukowski, 1994, Exp. 3) examined children's spellings of words containing flaps that were conventionally spelled with either *t* or *d*. The words contained either one or two morphemes. For instance, *duty* and *attic* are one-morpheme words with *t* flaps, and *waited* and *dirty* are two-morpheme words with *t* flaps. *Sturdy* and *louder* are examples of one- and two-morpheme words containing flaps that are conventionally spelled with *d*. If children use meaning relations among words to aid their spelling, they should do better on the flaps of the two-morpheme words (for which the stems can help them) than on the flaps of the one-morpheme words (for which there are no embedded morphemes that can aid performance). The results for first and second graders confirmed this hypothesis. These children were more likely to use *t* for two-morpheme words such as *dirty* than for one-morpheme words such as *duty*. The first graders, especially, often misspelled the flaps of both types of words as *d*, pointing to an influence of sound on spelling. However, the children were less likely to make this error for words like *dirty* than for words like *duty*. Children did not use morphological information to the full extent possible. Whereas they almost never misspelled the *t* of *dirt* with *d*, they sometimes misspelled the *t* of *dirty* in this manner. There is room for improvement in children's use of morphological relations among words to guide their spelling, but this strategy is by no means beyond their capabilities.

The youngest children in the study just described (Treiman, Cassar, & Zukowski, 1994, Exp. 3) were second-semester first graders. Another study (Treiman, Cassar, & Zukowski, 1994, Exp. 4) was designed to explore whether even younger children can also benefit from meaning relations when spelling. Kindergarten, first-, and second-grade children were tested twice during the school year, once in the fall and then again in the spring. As before, the stimuli included words with medial flaps that were conventionally spelled with either *t* or *d*. Of the words containing each type of flap, half contained a single morpheme and the other half contained two morphemes. Instead of spelling the whole words, as in the preceding study, children were asked to fill in the missing *t* or *d* in each word's spelling.

If young children's spelling is based only on sound, as the theories suggest, then children should spell the flaps of both one- and two-morpheme words with *d*. However, if children use morphology to supplement their performance, then they should perform better on the two-morpheme words than the one-morpheme words. This is what Treiman, Cassar, and Zukowski (1994, Exp. 4) found. Overall, children did better on *d* flap words than *t* flap words. Because flaps, being voiced, are closer in sound to /d/ than to /t/,

children tend to spell them with *d*. This leads to correct responses for *d* flap words but incorrect responses for *t* flap words. Importantly, the kindergartners and first graders performed significantly better on the flaps of the two-morpheme words than those of the one-morpheme words. (The second graders did not show a significant difference, probably due to their relatively high overall levels of performance.) Evidently, the children used their knowledge of the spellings of the stems to help spell the flaps in the two-morpheme words. For instance, the link in meaning between *float* and *float*ed suggested to children that the flap of *float*ed should be spelled with a *t*. Children were less likely to use a *t* in *float*ed than in *float*, showing that they did not use morphological information to the full extent of their ability. Nevertheless, these kindergartners and first graders could use meaning relations to guide their spelling even when so doing meant overriding sound.

Together, the results of the two studies with flaps (Treiman, Cassar, & Zukowski, 1994, Exps. 3 and 4) indicate that children as young as kindergarten age have some ability to use simple morphological relations among words to guide their spelling. This result speaks against the view that the use of morphological information in spelling is a late development. To determine whether children are affected by morphology more generally, Treiman and Cassar (1996) turned to the case of final consonant clusters. Children sometimes fail to spell the first consonants of final clusters, especially when these consonants are liquids (/r/ or /l/) or nasals (/m/, /n/, or /ŋ/) (Marcel, 1980; Read, 1975; Treiman, 1993; Treiman, Zukowski, & Richmond-Welty, 1995). For instance, first graders may spell *horse* as HOS or the nonword /vʌnt/ as VUT. If children have trouble including the *n* in one-morpheme words such as *brand*, they should also have problems with the *n* in two-morpheme words such as *rained* unless they use their knowledge of the stem, *rain*, to aid them. However, if children are able to use morphology, they should omit the first consonant of a final cluster less often in two-morpheme words than in one-morpheme words. Thus, the underlying logic of the experiments with final clusters was the same as in the flap studies described earlier.

The children in the experiments by Treiman and Cassar (1996) were asked to spell words with final consonant clusters, including one-morpheme words such as *brand* and two-morpheme words such as *rained*. The one- and two-morpheme words had the same final clusters in their spoken forms; for instance, *brand* and *rained* both end with /nd/. About a week after spelling the one- and two-morpheme words, the children were asked to spell the stems of the two-morpheme words (e.g., *rain*). The children's spellings of final cluster words were scored according to how they represented the final consonants. An A spelling was one that contained a reasonable representation of the first consonant in the cluster but not of the second consonant, as in RAN for *rained*. A B spelling represented only the second consonant, as in BRAD for *brand*. AB spellings symbolized both consonants in the final clus-



ter, as in RAND for *rained*. Given previous findings that children sometimes fail to spell the first consonants of final clusters, we expected to see a fair number of B spellings and fewer A spellings for the final cluster words. We asked whether B spellings would be less common for two-morpheme words than for one-morpheme words, suggesting that children benefited from the additional meaning information in the two-morpheme words.

In the first study by Treiman and Cassar (1996), children in first, second, and fourth grades were tested in March. Overall, children were more likely to omit the first consonant of a final cluster (B errors) than the second consonant of a final cluster (A errors). However, B errors were less frequent for two-morpheme words such as *rained* than for one-morpheme words such as *brand*. That is, children were less likely to spell *rained* as RAD than to spell *brand* as BRAD. Children apparently benefited from the stem *rain* when spelling the two-morpheme word *rained*. However, the first and second graders did not use their knowledge of the stem to the full extent possible because they left out the *n* of *rained* more often than the *n* of *rain*. Errors in which the final consonant of the cluster was omitted, or A errors, were more common for two-morpheme words than for one-morpheme words. That is, children misspelled *rained* as RAN more often than they misspelled *brand* as BRAN. In assembling the spelling of a two-morpheme word from the spellings of the component morphemes, children sometimes seemed to forget the second morpheme.

Our second study (Treiman & Cassar, 1996) included children in kindergarten as well as first grade. The kindergartners were tested once, late in the school year. The first graders were tested both in the fall and the spring. The children were asked to complete each word's spelling. For instance, *bra*\_\_\_\_\_ was printed on the test sheet and the children were told to finish this spelling for the word *brand*. As in the first study, omissions of the first consonant of the final cluster (B errors) were more common for one-morpheme words such as *brand* than for two-morpheme words such as *rained*. That children were more likely to omit the *n* of *brand* than the *n* of *rained* suggests that they derived some benefit from the stem *rain*. In contrast, omissions of the second consonant of the final cluster (A errors) were more common on two-morpheme words than on one-morpheme words. Children sometimes spelled *rained* without a final *d*, suggesting that they stopped writing after they had symbolized the first morpheme.

The results of the experiments with flaps and final clusters indicate that children's spelling can be influenced by morphology from an early age. This conclusion is different from that drawn by Treiman (1993) based on her naturalistic study of first graders' classroom writings. In that study, first graders' spellings were seemingly unaffected by morphology. For example, the children in Treiman's naturalistic study were not significantly more likely to include the *n* in a two-morpheme word such as *rained* than in a one-mor-

pHEME word such as *brand*. The different results in the two studies might reflect task differences. In Treiman's naturalistic study, children wrote words as part of texts that they produced during the classroom writing period. In the experiments described so far, children spelled or completed spellings for isolated words presented by an experimenter. Hoping that the different findings might be related to these task differences, we designed a third study using the same two-morpheme and one-morpheme words with final clusters.

Treiman and Cassar's (1996) third study included two groups of first-semester second graders. One group of children spelled the words using a whole word spelling task. The other group of children was asked to compose a sentence using each word and then to write out the entire sentence. If composing a sentence is more like the writing task in the Treiman (1993) study, then children in the sentence condition should produce similar types of spellings for the final consonant clusters in one- and two-morpheme words. However, this did not turn out to be the case. The children in the sentence condition, like those in the word condition, showed different patterns of performance on the one-morpheme and two-morpheme words. Omissions of the first consonant of the final cluster (B errors) were more common on one-morpheme words than two-morpheme words, and omissions of the second consonant of the cluster (A errors) were more common on two-morpheme words.

There are several plausible explanations for the failure of the sentence condition to replicate the results of Treiman (1993). The most obvious is that the sentence task did not duplicate the conditions of the naturalistic setting. In the experiment, the children were required to use a particular word to compose a complete idea. In the classroom, children wrote their ideas without restrictions as to word usage. In this situation, words may become part of the meaning of the message without having to be individually analyzed in terms of meaning. In contrast, a child who is required to use a specified word in a sentence may need to analyze the word's meaning to determine how it should be used. This may promote morphological analysis of the two-morpheme words. Of course, this explanation is conjecture without more evidence. The most striking and important finding from Treiman and Cassar's (1996) third experiment, as well as from the other experiments on flaps and final clusters, is that young children have some ability to use morphological strategies in spelling. In this way, children avoid errors that they would otherwise make if they were bound solely to a phonological spelling strategy.

## CONCLUSIONS

Existing theories of spelling development (Ehri, 1986; Gentry, 1982; Henderson, 1985) portray children as passing through a series of qualitatively different stages as they learn to spell. During an early period, children are

said to treat writing as a task of symbolizing the sounds in words. They progress through each word from left to right, using their knowledge of phoneme-grapheme correspondences and of letter names to represent the word's sounds. Only later, according to the theories, do children begin to symbolize a sound differently depending on its position or its context. Only later do children use morphological relations, symbolizing meaningful words instead of sounds.

The results that we have reviewed suggest that these views of spelling development are too limited. There is no doubt that young spellers rely on sound to a large degree, but this is not all that they do. For example, children often spell flaps as *d*, testifying to the importance of sound. However, children's knowledge of the relation in meaning between *dirty* and *dirt* makes them less likely to misspell the flap of *dirty* with a *d* than to misspell the flap of *duty* with a *d*. Children have some ability to divide *dirty* into *dirt* and *-y*, some notion that spelling represents meaning as well as sound. This is a long way from being able to retain the spelling of *courage* in *courageous*, but it is a start in that direction. Along with their attention to meaning, young children also attend to the kinds of letter sequences that make up words. Early on, they notice that English words may start but not end with capital letters and that words may end but not start with double consonants. They notice that letters such as *e* and *s* may double but that letters such as *a* and *v* rarely do. Children attempt to reproduce what they have observed, so even first graders do not usually produce such errors as BBAL for *ball* or HAAT for *hat*.

In our view, spelling involves an interaction among different sources of knowledge from the beginning. Although sound plays a central role in early spelling, young children also have other kinds of knowledge, including knowledge of morphological relations among words and information about the kinds of letter sequences that typically occur in print. Theories that treat learning to spell in terms of a sequence of stages that involve qualitatively different types of information are too simple. We must acknowledge that spellers, even young ones, are able to use various types of knowledge. We must learn more about how these different sources of information interact.

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## HOW LEARNING TO SPELL GERMAN DIFFERS FROM LEARNING TO SPELL ENGLISH

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Psychological research on the acquisition of spelling is quite anglo-centric due to the simple fact that the majority of findings come from children who learn to spell English. The present study questions some of the English conclusions by contrasting them with German findings. German offers an interesting test case for conclusions about the role of orthographic consistency and of phonology in the development of spelling because, due to the partly common roots of German and English, there are similarities with respect to phonology, although German is written in a more consistent manner than English.

The consistency with which phonemes map onto graphemes is of obvious importance for spelling both within and between writing systems. For example, Treiman (1993), in her landmark study on early spelling, concluded from the regularity effect observed in the spellings of her first-grade sample "that a writing system with one-to-one relations from phonemes to graphemes would be easier for children to learn than a writing system with one-to-many relations from phonemes to graphemes" (p. 59). German is certainly not a writing system with one-to-one relations from phonemes to graphemes. For nearly every phoneme there are at least two possible spellings. For example, /a:/ can be spelled as *a*, *aa*, and *ah*, and for /b/, as for most other consonants, possible spellings are *b* and *bb*. However, doubling of consonant letters only occurs after short vowels (e.g., *Sommer* [summer], *Butter* [butter]), and most of the different spellings for vowels have to do