CHAPTER 10

On the Relations between Learning to Spell and Learning to Read

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The study of spelling is oddly neglected by researchers in the cognitive sciences who devote themselves to reading. Experimentation and theories concerning printed word recognition continue to proliferate. Spelling, by contrast, has received short shrift, at least until fairly recently. It is apparent that in our preoccupation with reading, we have tended to downgrade spelling, passing it by as though it were a low-level skill learned chiefly by rote. However, a look beneath the surface at children's spellings quickly convinces one that the common assumption is false. The ability to spell is an achievement no less deserving of well- directed study than the ability to read. Yet spelling and reading are not quite opposite sides of a coin. Though each is party to a common code, the two skills are not identical. In view of this, it is important to discover how development of the ability to spell words is phased with development of skill in reading them, and to discover how each activity may influence the other. Thus, this chapter is concerned with the relationship between reading and writing.

It is appropriate to begin by asking what information an alphabetic orthography provides for a writer and reader, and to briefly review the possible reasons why beginners often find it difficult to understand the principle of alphabetic writing and to grasp how spellings represent linguistic structure. In this connection, would an orthography best suited for learning to spell differ from an orthography best suited for learning to read? The second section discusses how spelling and reading are interleaved in a child newly introduced to the orthography of English. Here, one central question is precedence: Does the ability to read words precede the ability to spell them, or, alternatively, might some children be ready to apply the alphabetic principle in writing before they can do so in reading? A related question is strategy. Do children sometimes approach the two tasks in very different ways? Finally, the last section discusses how analysis of children's spellings may illuminate aspects of orthographic learning that are not readily accessible in the study of reading.

How writers and readers are equipped to cope with the information provided by an alphabetic system

Writing differs from natural and conventional signs in that it represents linguistic units, not meanings directly (DeFrancis, 1989; Mattingly, this volume). The question of how the

orthography maps the language is centrally relevant to the course of acquisition of reading and spelling. All forms of writing permit the reader to recover the individual words of a linguistic message. Given that representation of words is the essence of writing, it is important to appreciate that words are phonological structures. To apprehend a word, whether in speech or in print, is thus to apprehend (among other things) its phonology. But in the manner of doing this, A. M. Liberman (1989; this volume) notes that there is a fundamental difference between speech on the one hand and reading and writing on the other. For a speaker or listener who knows a language, the language apparatus produces and retrieves phonological structures by means of processes that function automatically below the conscious level. Thus, Liberman notes that to utter a word one does not need to know how the word is spelled, or even that it can be spelled. The speech apparatus that forms part of the species-specific biological specialization for language "spells" the word for the speaker (that is, it identifies and orders the segments). In contrast, writing a word, or reading one, brings to the fore the need for some *explicit* understanding of the word's internal structure. Since in an alphabetic system, it is primarily phonemes that are mapped, those who succeed in mastering the system would therefore need to grasp the phonemic principle and be able to analyze words as sequences of phonemes.

The need that alphabetic orthographies present for conscious apprehension of phonemic structure poses special difficulties for a beginner (see Gleitman & Rozin, 1977; I. Y. Liberman, 1973; Liberman, Shankweiler, Fischer, & Carter, 1974). The nub of the problem is this: phonemes are an abstraction from speech, they are not speech sounds as such. Hence, the nature of the relation between alphabetic writing and speech is necessarily indirect and, as we now know, often proves difficult for a child or a beginner of any age to apprehend. In order to understand why this is so it will pay us to dwell for a moment on the ways in which it is misleading to suppose that an alphabetic orthography represents speech sounds (see Liberman, Rubin, Duques, & Carlisle, 1985; Liberman et al., 1974).

First, the letters do not stand for segments that are acoustically isolable in the speech signal. So, for example, one does not find consonants and vowels neatly segmented in a spectrogram in correspondence with the way they are represented in print. Instead phonemes are co-articulated, thus overlappingly produced, in syllable- sized bundles. Accordingly, apprehension of the separate existences of phonemes and their serial order requires that one adopt an analytic stance that differs from the stance we ordinarily adopt in speech communications, in which the attention is directed to the content of an utterance, not to its phonological form. In view of this, it is not surprising to discover that preschool children have difficulty in segmenting spoken words by phoneme (see Liberman et al., 1989; Morais, 1991 for reviews).

Without some awareness of phonemic segmentation, it would be impossible for a beginning reader or writer to make sense of the match between the structure of the printed word and the structure of the spoken word. So, for example, writers and readers can take advantage of the fact that the printed word CLAP has four segments only if they are aware that the spoken word "clap" has four (phonemic) segments. Accordingly, in order to master an alphabetic system it is not enough to know the phonetic values of the letters. That knowledge, necessary though it is, is not sufficient. In order to fully grasp the alphabetic principle, it is necessary, in addition, to have the ability to decompose spoken words phonemically. Indeed, experience shows that there are many children who know letter-phoneme correspondences yet have poor word decoding skills (Liberman, 1971).

Considerable evidence now exists that children's skill in segmenting words phonemically and their progress in reading are, in fact, causally linked (e.g., Adams, 1990; Ball & Blachman, 1988; 1991; Bradley & Bryant, 1983; Byrne & Fielding-Barnsley, 1991; Goswami & Bryant, 1990; Lundberg, Frost, & Petersen, 1988). One would also expect to find that the same kind of relationship prevails between phoneme segmentation abilities and spelling. And, indeed, the data are consistent with that expectation. Studies by Zifcak (1984) and Liberman et al. (1985) have shown substantial correlations between performance on tests of phoneme segmentation of spoken words and the degree to which all the phonemes are represented in children's spellings. The findings of Rohl and Tunmer (1988) confirm this association. They compared matched groups of older poor spellers with younger normal ones and found that the poor spellers did significantly less well on a test of phoneme segmentation. (See also Bruck & Treiman, 1990; Juel, Griffith, & Gough, 1986, and Perin, 1983).

The complex relation between phonemic segments and the physical topography of speech is one sense in which alphabetic writing represents speech sounds only remotely. This, we have supposed, constitutes an obstacle for the beginning reader/writer to the extent that it makes the alphabetic principle difficult to grasp and difficult to apply. Two further sources of the abstractness of the orthography should also be mentioned, which may be especially relevant to the later stages of learning to read and to spell.

First, alphabetic orthographies are selective in regard to those aspects of phonological structure that receive explicit representation in the spellings of words (Klima, 1972; Liberman et al., 1985). No natural writing system incorporates the kind of phonetic detail that is captured in the special-purpose phonetic writing that linguists use. Much context-conditioned phonetic variation is ignored in conventional alphabetic writing,[1] in addition to the variation associated with dialect and idiolect. Hence, conventional writing does not aim to capture the phonetic surface of speech, but aims instead to create a more generally useful abstraction. It is enlightening to note, in this connection, that young children's "invented spellings"[2] often differ from the standard system in treating English writing as though it were more nearly phonetic than it is (Read, 1971; 1986).

A second source of abstractness stems from the fact that the spelling of English is more nearly morphophonemic than phonemic. English orthography gives greater weight to the morphological structure of words than is the case with some other alphabetic orthographies, for example, Italian (see Cossu, Shankweiler, Liberman, Katz & Tola, 1988) and Serbo-Croatian (see Ognjenović, Lukatela, Feldman, & Turvey, 1983). Examples of morphological penetration in the writing of English words are easy to find. A ubiquitous phenomenon is the consistent use of s to mark the plural morpheme, even in those words, like DOGS, in which the suffix is pronounced not [s], but [z]. The

[1]For example, it has often been noted that aspirate and inaspirate /p/, /t/ and /k/ are not distinguished in English spelling. In the word COCOA, for example, both the initial and medial consonant are spelled alike although phonetically and acoustically they are different.

[2]Often children who have had little or no formal instruction attempt to write words using the letters that they know, together with their their conceptions of the phonetic values of the letters and the segmental composition of the words they wish to write. This phenomenon has been studied extensively by Read (1986). The question of whether invented spellings can regularly be elicited from children with varied educational and family backgrounds was addressed by Zifcak (1981). In a study of 23 inner-city six year olds from blue-collar families, it was found that nearly all the children were willing to make up spellings for words though most had little knowledge of the standard orthography.

morphemic aspect of English writing appears also in spellings that distinguish words that are homophones, for example, CITE, SITE; RIGHT, WRITE.

The knowledge that spellings of some English words may sacrifice phonological transparency to capture morphological relationships brings into perspective certain seeming irregularities, as several writers have noted (Chomsky & Halle, 1968; Klima, 1972; Venezky, 1970). Homophone spellings are instances in which the two modes of representation, the phonemic and the morphemic, are partially in conflict (DeFrancis, 1989). In these spellings the principle of alphabetic writing is compromised to a degree, but it is not abandoned, since most letters are typically shared between words that have a common pronunciation. A lexical distinction in homophone pairs is ordinarily indicated by the change of only a letter or two. Thus, homophone spellings in English present an irregularity from a narrowly phonological standpoint, while nonetheless keeping the irregularity within circumscribed limits.

Such examples are telling. They led DeFrancis (1989) to make a novel and stimulating suggestion: that the needs of readers and writers may actually conflict to some degree. The convention of distinct spellings for homophones would benefit readers by removing lexical ambiguity in cases in which context does not immediately resolve the matter. Writers, on the other hand, would perhaps be better served by a system that minimizes inconsistencies in mapping the surface phonology. For writers, the presence of homophones which are distinguished by their spellings increases the arbitrariness of the orthography, and hence the burden on memory. Because it has to serve for both purposes, the standard system can be regarded as a compromise, in some instances favoring readers and in other instances favoring writers.

Scrutiny of the words that users of English find difficult to spell confirms that morphologically complex words are among those most often misspelled (Carlisle, 1987; Fischer, Shankweiler, & Liberman, 1985). Carlisle (1988) notes that in derived words the attachment of a suffix to the base may involve a simple addition resulting in no change in either pronunciation or spelling of the base (ENJOY, ENJOYMENT). Alternatively, the addition may result in a pronunciation change in the base (HEAL, HEALTH), a spelling change but not a pronunciation change (GLORY, GLORIOUS) or a case in which both spelling and pronunciation change (DEEP, DEPTH). Difficulties in spelling morphologically complex words appear to stem in part from their phonological complexity and irregular spellings. But they may also stem from failure to recognize and accurately partition derivationally related words. Carlisle (1988) tested school children aged 8 to 13 for morphological awareness. They were asked to respond orally with the appropriate derived form, given the base followed by a cueing sentence designed to prompt a derivative word (e.g., "Magic. The show was performed by a _____"). It was found that awareness of derivative relationships was very limited in the youngest children, especially in cases in which the base undergoes phonological change in the derived form (as in the above example). Moreover, the ability to produce derived forms has proven deficient in children and adults who are poor spellers (Carlisle, 1987; Rubin, 1988). All in all, the evidence supports the expectation that both phonologic and morphologic aspects of linguistic awareness are relevant to success in spelling and reading.

So far we have discussed the common basis of reading and writing, pointing first to the great divide that separates speech processes on the one hand from orthographic processes on the other. Then we proceeded to identify the factors that make learning an alphabetic system difficult. The idea was also introduced that reading and spelling may tax

orthographic knowledge in somewhat different ways. It is to these differences that we turn next.

Can children apply the alphabetic principle in spelling before they are able to apply it in reading?

The possibility that the needs of readers and writers may differ with respect to the kind of orthographic mapping that is easiest to learn raises the broader issue of the relation between learning to write and learning to read. Does one precede the other? Do children adopt different strategies for the one than for the other? To answer these questions we will want to examine what is known about how spelling articulates with reading in new learners.

As to the first question, one may wonder whether precedence is really an issue. Just as in primary language development, where it is often noted that children's perceptual skills run ahead of their skills in production, so in written language, too, it would seem commonsensical to suppose that a new learner's ability to read words would exceed the ability to spell them. Most users of English orthography have probably had the experience of being unsure how to spell some words that they recognize reliably in reading. Contributing to the difficulty is the fact that there is usually more than one way for a word to be spelled that would equivalently represent its phonological structure. (Consider, for example, "clene" and "cleen" as equivalent transcriptions of the word *clean*). The reader's task is to recognize the correspondence between a letter string that stands for a word (i.e., its morphophonological structure) and the corresponding word in the lexicon. It is not required that the reader know exactly how to spell a word in order to read it—only that the printed form (together with the context) should provide sufficient cues to prompt recognition of the represented word and not some other word. In contrast, the writer must generate the one (and ordinarily only one) spelling that corresponds to the conventional standard. So it is natural to assume that spelling words requires greater orthographic knowledge than reading them. We therefore might expect that a beginner would have the ability to read many words before necessarily being able to spell them correctly.

Nonetheless, questions about precedence in the development of reading and writing have arisen repeatedly. Some writers have suggested that, contrary to the view that reading is easier, children may indeed be ready to write words, in some fashion, before they are able to use the alphabetic principle productively in reading. Montessori (1964) expressed this view, and it has more recently been articulated by several prominent researchers. In part, these claims are based on experiences with preschool children who were already writing using their own invented spellings. Carol Chomsky (1971; 1979) stressed that many young writers do this at a time when they cannot read, and, indeed, may show little interest in reading what they have written. Others who have proposed a lack of coordination between spelling and reading in children's acquisition of literacy are Bradley and Bryant (1979), Frith (1980), and Goswami and Bryant (1990).

In order to discuss the question of precedence we must first consider how we are going to define spelling and reading. By spelling, do we mean spelling a word according to conventional spelling? To adopt that criterion would ignore the phenomenon of children's invented spelling. That would seem unwise since it is well-established that some children are able to write more or less phonologically before they know standard spellings (Read, 1971; 1986). It would be appropriate for some purposes to credit a child for spelling a

word if the spelling the child produces approximates the word closely enough that it can be read as the intended word.

The criterion of reading is in one sense less problematical, but in another sense it is more so. For someone to be said to have read a word, that word, and not some other word (or nonword) must have been produced in response to the printed form. It is also relevant to ask how the response was arrived at. Words written in an alphabetic system can be approached in a phonologically analytic fashion or, alternatively, they can be learned and remembered holistically (i.e., as though they were logographs). As Gough and Hillinger (1980) stress, the difficulty with the logographic strategy is that it is self-limiting because it does not enable a reader to read new words. Moreover, as the vocabulary grows and the number of visually similar words increases, the memory burden becomes severe and the logographic strategy becomes progressively more inaccurate. Should we therefore consider someone a reader if she can identify high frequency words, but cannot read low frequency words or nonwords? There is some consensus that we should not (e.g., Adams, 1990; Gleitman & Rozin, 1977; Gough & Hillinger, 1980; Liberman & Shankweiler, 1979). The possibility of reading new words, not previously encountered in print, is a special advantage conferred by an alphabetic system. It is reasonable to suppose that someone who has mastered the system will possess that ability.

However, in the view of some students of reading, most children when they begin to read, and perhaps for a considerable time afterward, read logographically, and only later learn to exploit the alphabetic principle (Bradley & Bryant, 1979; Byrne, 1992; Gough & Hillinger, 1980). Given the absence of agreement as to what is to be taken as sufficient evidence of reading ability, the question of whether spelling or reading comes first is less the issue than whether children initially employ discrepant strategies for reading and writing.

The strategy question is brought into focus by Goswami and Bryant (1990). As noted above, they suppose that the child's initial strategy in reading (the default strategy) is to approach alphabetically written words as though they were logographs. They contend that children tend to do this even when they have had instruction designed to promote phonemic awareness. Reading analytically might require more advanced word analysis skills than are available to most beginning readers. Writing, on the other hand, forces the child to think in terms of segments. The process of alphabetic writing is by its nature segmental and sequential: The writer forms one letter at a time and must order the letters according to some plan. Thus, Goswami and Bryant suppose that children's initial approaches to writing would tend to be phonologically analytic. Goswami and Bryant (1990) find it paradoxical that children's newly found phonological awareness, which most often is introduced in the context of instruction in reading, has an immediate effect on their spelling, but not on their reading. "So at first there is a discrepancy and a separation between children's reading and spelling. It is still not clear why children are so willing to break up words into phonemes when they write, and yet are so reluctant to think in terms of phonemes when they read (p. 148)."

Bryant and his colleagues (see especially Bradley and Bryant, 1979) deserve much credit for grasping the need for a coordinated approach to the study of reading and spelling. They recognized that this undertaking would require testing children on reading and spelling the same words. It is well known that performance on reading and spelling tests are highly correlated, at least in older children and adults (Perfetti, 1985; Shankweiler & Liberman, 1972). Bradley and Bryant stressed that the correlation between

reading and spelling scores depends on the words chosen. They proposed that the words that children at the beginning stages find difficult to read are not always the words that are difficult to spell, and vice versa. Words that tended to be read correctly but misspelled were words whose spellings presented some irregularity, like EGG or LIGHT, whereas words spelled and not read tended to be regular words, like MAT and BUN (Bradley & Bryant, 1979).

The finding that the spell-only words and the read-only words did not overlap very much in the beginning would lend support to the hypothesis that children at this stage use different strategies for spelling and reading. The greater difficulty in spelling irregular words is what one would expect if the children were attempting to spell according to regular letter-to-phoneme correspondences. They would tend to regularize the irregular words and thus get them wrong. Moreover, the failure to read regular words suggests that the children were using some nonanalytic strategy for reading, responding perhaps to visual similarity. That would make them prone to miss easy words whenever their appearance is confusable with other words that look similar. If they were reading analytically they would read these words correctly. Thus, Bryant and his colleagues cite findings that seem to underscore the differences between early reading and spelling.

Should we, then, accept Goswami and Bryant's paradox and suppose that reading and writing are cognitively disjunct at the early stages, even in children who have received training in phonological awareness? We think not. First, as the succeeding section shows, some data (to which we turn next) point to concurrent development of reading and spelling skills. Secondly, it is too early to assess fully the impact on children's reading and spelling of the several experimental approaches to instruction in phonological awareness (e.g., Ball & Blachman, 1988; 1991; Blachman, 1991; Byrne & Fielding-Barnsley, 1991; in press). Therefore, we believe that the question must remain open.

A new research study, which coordinated the investigation of spelling and reading in six year olds (the subjects were selected only for age), does not find evidence that incompatible strategies are employed by beginners (Shankweiler, 1992). Unlike the Bradley and Bryant study, the test words in this experiment included no words with irregular spellings. The test words did contain phonological complexities, however. Each contained a consonant cluster at the beginning or the end.

There was a wide range in level of achievement within this group of six year olds. Nine of the 26 children were unable to read and spell more than one word correctly. The remaining 17 were able to read a mean of 70 percent of the words correctly but were able to correctly spell only 39 percent. These findings show that the spelling difficulties of beginners are not confined to irregular words.[3] Regularly spelled words can cause difficulty if they are phonologically complex, as when they contain consonant clusters. With the exception of one child, all read more words correctly than they were able to spell. Finally, analytic skill in reading, as indexed by ability to read nonwords, was almost perfectly correlated ($r = .93$) with spelling performance (on a variety of real words).[4] These data do not sit well with the conclusion that early reading and spelling are

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[3]These results are in full agreement in this respect with those of Treiman (1993), who carried out a comprehensive study of spelling in six year olds. The findings of both studies support the caveat that one should not be too quick to attribute children's spelling errors to the irregularities of English orthography.
[4]Spelling was correlated with reading real words, .91 and .81, respectively, based on two independent measures of reading.

cognitively dissociated. On the contrary, the findings lend support to the idea that skill in reading and spelling tend to develop concurrently over a wide range of individual differences in attainment.

It is notable that spelling accuracy consistently lagged somewhat behind reading. Only 6 percent of the words were spelled correctly and read incorrectly, whereas 37 percent were read and not spelled. Thus the children showed what might be expected to be true generally: that spelling the words would prove to be more difficult than reading them, if by reading we mean correct identification of individual words, and by spelling we mean spelling these words according to standard conventions.

Interpreting error patterns in spelling and reading

So far we have been comparing spelling and reading at a coarse level of analysis. To address more rigorously the question of whether new learners use similar or dissimilar strategies for spelling and reading we would wish to make a detailed comparison between the error pattern in spelling words and reading them. But, as it happens, this turns out to be a difficult thing to do.

Problems of comparability

Most of the published information on the correlations between reading and spelling scores is based simply on right/wrong scoring. This approach has the disadvantage of throwing away much of the potential information in the incorrect responses. It fails to distinguish reading errors that are near misses from errors that are wild guesses, and it does not distinguish misspellings that capture much of a word's phonological structure from those that capture little of it. If we give partial credit for wrong responses, we must create a scheme to evaluate the many possible ways of misspelling a word and assign relative weights to each.

As an illustration of how we might proceed, we turn again to the research study last described (Shankweiler, 1992). In this study, reading was assessed by the Decoding Skills Test (DST, Richardson, & Di Benedetto, 1986). The test consists of 60 real words, chosen to give representation to the major spelling patterns of English, and, importantly, it also includes an equal number of matching nonwords, the latter formed by changing one to three letters in each of the corresponding words. For the purposes at hand, phonotactically legal nonwords constitute the best measure of reading for assessing the skills of the beginning readerbecause only these can provide a true measure of decoding skill. Because they are truly unfamiliar entities, nonwords test whether a reader's knowledge of the orthography is productive. As noted earlier, only that kind of knowledge enables someone to read new words not previously encountered in print (see Shankweiler, Crain, Brady, & Macaruso, 1992). Responses to the Decoding Skills Test were recorded on audiotape and transcribed in IPA phonemic symbols for later comparison with the spelling measures.

To gain a fine-grained measure of spelling for comparison with the reading error measures, the children's written spellings were scored phoneme by phoneme, using the following categories:

Correct spelling
Phonologically acceptable substitute (e.g., k for ck)
Phonologically unacceptable substitute (e.g., c for ch)
Phoneme not represented

When we try to compare the error pattern in reading and spelling, we encounter a further difficulty: Reading is a covert process that is assessed only by its effects. One cannot directly infer what goes on in the head when someone attempts to read a word. When we ask the child to read aloud unconnected words in list form, we encounter an obstacle: children are often unwilling to make their guesses public. Of course, a beginning reader who is stuck on a particular word may be entertaining a specific hypothesis about the word's identity, but in the absence of an overt response, we cannot discover the hypothesis and use it as a basis for inferring the source of the difficulty.

Writing, on the other hand, leaves a visible record of the writer's hypothesis about how to spell a word. The findings of the study we have been discussing bear this out. Many of the children declined the experimenter's invitation to guess at the words they were having difficulty in reading. Yet the same children produced a spelling for nearly every word they were asked to write. The upshot is that we have nearly a complete set of responses to the spelling test, but many gaps in the record occur on the corresponding items on the reading test. This yields an unsatisfactory data base for comparing the error pattern in spelling and reading. Thus, the kind of word-by-word comparison we would like to make may be unattainable.

Nonetheless, there is much to be gained by a linguistic analysis of children's spellings. Indeed, it is chiefly through their writing, and not through their reading, that children reveal their hypotheses about the infrastructure of words.

Children's conceptions of the infrastructure of words as revealed in their spellings

When encouraged to invent spellings for words, young children invent a system that is more compatible with their linguistic intuitions than the standard system. Whether the result corresponds to standard form is simply not a question that would occur to the child at this stage. In Carol Chomsky's words, creative spellers "appear to be more interested in the activity than the product (1979, p. 46)." There is evidence that children's invented spellings tend to be closer to the phonetic surface than the spellings of the standard system (Read, 1986). The standard system of English, as we noted, maps lexical items at a level that is highly abstract, both because the conventional system is morphophonemic, and because it tends not to transcribe phonetic detail that is predictable from general phonological rules.

In the comparative study of reading and writing in six year olds which we have discussed (Shankweiler, 1992), even the least-advanced beginners, who wrote only a single letter to represent an entire word, usually chose a consonant that could represent the first phoneme in the word. A child who does this is apparently aware that letters represent phonological entities even though she is not yet able to analyze the internal structure of the syllable. Altogether, first consonants were represented in 95% of cases. There was a strong tendency to omit the second segment of a consonant cluster: that is, the L in CL, the T in ST, the M in SM, the R in CR, and so forth. These were omitted in 56% of occurrences, yet when these consonants occurred alone in initial position, they were rarely omitted. Bruck and Treiman (1990) report the same trends, both in normal children and dyslexics. The tendency to omit the second segment from an initial cluster fits with Treiman's idea (1992) that children may initially use letters to represent syllable onsets and rimes rather than phonemes.[5]

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[5]The onset consists of the string of consonants preceding the vowel nucleus. When the onset consists of a single consonant, as in the example of CAR, Treiman (1985) showed that children may treat it as a segment

The ability to represent the second segment of initial consonant clusters was a very good predictor of overall spelling achievement. It was also a good predictor of the accuracy of word reading. Regression analysis showed that this part score accounted for 45 percent of the variance in either spelling or reading when a different set of words is tested, after age, vocabulary (Dunn, Dunn, & Whetton, 1982) and a measure of phonemic segmentation skill (Kirtley, 1989) had already been entered. Representation of the interior segment in final clusters does almost as well when entered in the regression. The results of fine scoring give further support to the view that reading and spelling skill are closely linked even in beginners.

Why are consonant clusters a special source of difficulty? Two possibilities might be considered, each related to the phonetic complexity of clusters. First, it is well known that clusters cause pronunciation difficulties for young children. Perhaps the spelling error signals a general tendency to simplify these consonant clusters - a failure to perceive and produce them as two phonemes. But there was no indication that this was the case. All the children could pronounce the cluster words without difficulty.

An alternative possibility is that the children had difficulty in conceptually breaking clusters apart and representing them as two phonemes. In that case, the difficulty in spelling could be seen as a problem in phonological awareness. So, also, could the problems in reading the cluster words. Reading analytically would require the reader to decompose the word into its constituent segments, and the presence of clusters would increase the difficulty of making this analysis.

Research conducted during the past two decades has shown that phonological awareness is not all of a piece. Full phoneme awareness is a late stage in a process of maturation and learning that takes years to complete (Bradley & Bryant, 1983; Liberman et al., 1974; Morais, Cary, Alegria, & Bertelson, 1979; Treiman & Zukowski, 1991). Although the order of acquisition is not completely settled, there is evidence that before they can segment by phoneme children are able to segment spoken words using larger sublexical units—onsets and rimes, and syllables, particularly stressed syllables that rhyme (Brady, Gipstein, & Fowler, 1992; Liberman et al., 1974; Treiman, 1992).

The role of literacy instruction in fostering the development of phonological awareness has been much discussed in the research literature (See chapters in Brady & Shankweiler, 1991, and in Gough, Ehri, & Treiman, 1992). In this connection, Treiman (1991) urges that an analysis of spelling is the best route by which to study those aspects of phonological awareness that depend on experience with reading and writing. We would tend to agree. This is not to say, however, that *writing, but not reading* would feed this development in young children. It is to be expected that a child's interest and curiosity about the one activity would encourage and nourish an interest in the other.[6]

To sum up, because reading and writing are secondary language functions derived from spoken language, they display a very different course of acquisition than speech itself: unlike speech, mastery of alphabetic writing requires facility in decomposing words into phonemes and morphemes. Since both reading and writing depend upon grasp of the alphabetic principle, it could be expected that both would develop concurrently, though spelling, being the more difficult, would progress more slowly. Several researchers,

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distinct from the remainder of the syllable, which corresponds to the rime. At the same time, they are unable to decompose the rime into separable components. An invented spelling, like CR for CAR or BL for BELL is consistent with such partial knowledge of the internal structure of the syllable.
[6]Adams (1990), Ehri (1989; Ehri & Wilce, 1987) and Treiman (in press) reach a similar conclusion.

however, have raised challenging questions about the order of precedence, suggesting that spelling, due to the inherently segmental nature of writing words alphabetically, emerges earlier than the ability to decode in reading. At present, the evidence is mixed. It is significant that recent research comparing children's reading and spelling errors indicates that in both spelling and reading, regularly spelled words present difficulties to beginners when the words contain phonologically-complex consonant clusters. Thus, beginners' difficulties in reading and spelling do not necessarily involve different kinds of words, as had been suggested earlier. This undercuts the claim of incompatible strategies.

Whether a child initially adopts a logographic or an analytic strategy for reading may depend in large part on the kind of pre-reading instruction the child was provided with. There is evidence that both phonological awareness and knowledge of letter-phoneme correspondences are important to promote grasp of the alphabetic principle, and are thus important to skill in spelling and decoding (Ball & Blachman, 1988; 1991; Bradley & Bryant, 1983; Byrne & Fielding-Barnsley, 1991; Gough, Juel & Griffith, 1992). Neither is sufficient alone. The phasing of these two necessary components of instruction may turn out to be critical in determining the child's initial approach to the orthography.

Acknowledgment

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