

# 1

## The Interface of Lexical Competence and Knowledge of Written Words

Edmund H. Henderson  
*University of Virginia*

In this chapter I will relate research about spoken and written language to the teaching of reading and writing. My intention is to provide a background for and a prelude to the particular studies and essays that will comprise the successive chapters in this volume. To accomplish this aim it will be necessary to sketch in a wonderfully broad and complex terrain of scholarship, a playing field upon which some of the finest scholars of our century have labored. As for the whole of this work let it be said at the outset that I agree with Huey (1908/1968) on two points. We still may hope at best for penultimate knowledge of our topic (p. 6). Nonetheless, we are "working toward daylight" (p. 102).

How should we tackle a topic this complex? One feels like the first designer of the parachute pack. One knows how it should look in the end, but facing thousands of square feet of silk, where does one make the first fold? My scheme will be to declare at the outset what I conceive to be the delimiting parameters of reading and writing. Both I think are incredibly complex but only subtly cognitive behaviors. My position is that while we may have learned something about reading behavior and its neural architecture, we are light years away from understanding comprehension as a psychological construct. We should take our guidance for exercising the latter from philosophers and poets.

Second, in this chapter I intend to draw upon my reading and thought about the origins of spoken and written language as these have been dealt with over recent years and with the history of written English. With some notable exceptions (Horn, 1957; Venezky, 1967, for example), this rich source has been largely neglected since Huey's very interesting accounting in 1908. I will argue in fact that these evolutionary events provide a powerful source of understanding about when and how children learn to read and write.

Thirdly, I will be concerned with the experimental research in verbal learning that has enjoyed such a bloom over the past two decades. These scholars rose to Huey's challenge like knights, and while their particular quest is not mine, I hope to show that their work and ours begins to show an interesting convergence.

In the main I am inclined to embrace Fodor's (1983) concept of the modularity of language as a "faculty"—innate, mandatory, encapsulated, domain-specific, and of shallow output. I am encouraged to find that Stanovich (1988) seems to concur on this point, for I believe that most of the verbal learning and eye movement research of recent years tends to illuminate this aspect of the reading process. Indeed I was tempted to subtitle this chapter "Teaching the lexicon to read and spell."

In the fourth section of this chapter I will describe the educational/developmental model that my students and I have followed as we have tried to map, in pupil behaviors, the benchmarks that children reach and the progressions that they follow as they advance toward a mature level of literacy. My focus will be on knowledge of word rather than on text comprehension, the rationale for which I will present shortly. In this section also I will show where our perspective tends to support or to contradict some of the experimental work. For example, I will suggest where phoneme segmentation does in fact lie in the progression of written language acquisition, and I will consider the role of rhyme production and recognition as an aspect of phonological awareness.

This chapter will end with a brief sketch about implications for teaching. A fuller treatment of this topic will conclude the volume.

### THE LIMITS OF READING AND WRITING

Put baldly my belief is that the work of Lenneberg (1967) and the standard theory of Noam Chomsky (1968) provide a sound and continuingly sound conceptualization of language and of written language acquisition. I mean no silliness by writing this, for I know full well what a battering Chomsky's ideas have suffered since they changed the face of American psychology in the 1960s. What I insist, however, is that the very simple properties that he first ascribed to language are correct in terms of what we know physiologically, and that they also make good sense psychologically, given the limits of our vision in that discipline. To be sure, the related notion of innateness and the Language Acquisition Device is not useful (nor is it in fact necessary to the model). Neither is it necessary to reject the general model because a particular set of transformational schemes fails the test of "psychological reality." Certainly language is acquired and this occurs only interactively in a sociocultural setting (Bruner, 1983). To say that language is thus "learned" seems quite reasonable.

On the other hand, language, in the rich form that we know it, is species-specific. (Let's have no "monkey business" about that!) Language is physio-

logically lateralized, neurologically incredibly rich in connectivity, and phenomenally so robust that the Lenneberg notion of "resonance" becomes attractive indeed, even if it too is nonexplanatory.

Some years ago my colleague Professor James Deese invited my student, Mary Abouzeid (see this volume), to review the literature through 1985 in order to determine "what was left" of Lenneberg's theories after a decade. One hundred and seventy entries later, her conclusion was "everything!" Of course there is one exception that she noted. Later work (Geschwind, 1979) reported strong evidence that the to-be-dominant hemisphere is determined *in utero* and is thus probably genetically fixed. This fact does not deny, however, the initial plasticity of the brain through which language can develop at need in either hemisphere or its inability to do so past pubescence.

The basic point that I wish to make is that language is a specialized neurophysiological function. It is one that calls on auditory, articulatory, motor competencies and, in the case of writing, highly specialized visual competencies. These conjoin in ways that are far from fully understood, to realize oral language apprehension and production as well as reading and writing. At the base there is an intricately connected lexical and syntactical focus. Broca's and Wernicke's areas operate, perhaps like filters, to realize language. Between the predication of the speaker and the apprehension of the listener a generative system may intercede.

And where is thought in all this? Well, for one thing thought is not lateralized. Language serves thought and because it can function autonomously, tacitly, automatically, it can both nourish thought and express the predication of the thinker. But the thinking part is always prior to and well after any discrete language event itself.

The temporal relationships of language and thought are well illustrated by Eric Brown, who was a student and protégé of Lenneberg (Brown, 1981). In Brown's model, one second of reading is mapped on a flowchart, the nodes of which have (at least in the initial phases) determined neurological counterparts and for which the temporal flow of information is documented. The arousal mechanism that will determine the next fixation is in operation well before the first categorical scan operates on the iconic store of the letters fixed upon (Rayner & Pollatsek, 1989). In Brown's model there are many shortcuts; so the whole possible operation need not be carried through. This allows for that familiar "uh huh" that one almost senses as one reads. Linguistic knowledge in a state of automaticity makes for greater reading speed. In contrast, the beginning reader or faltering mature reader may have to maintain conditions by actually reading aloud in order to hold information in place over time. A major point to be made, however, is that there is not time to guess. Only when reading stops may one do conscious guessing. And so it is in my opinion that reading is a psycholinguistic knowledge game and not a guessing game at all. We will return to these ideas later on when we consider different models of the reading process.

I am well aware that my position on this matter may offend devotees of the whole language movement, but I hope it will not, and I think it should not. I do see word knowledge as a separate entity and as the central feature of reading. If the verbal percept were nourished by context, as I once thought to be likely, then I should think differently. But the data show us that the two are independent. A careful rereading of Huey will show, I think, that he would not have been surprised by this turn of events. In discussing the "word effect," he concluded that words were not perceived by letter but by words and phrases: "The simple fact is that words . . . are thrown outward, projected upon a page . . . somewhat as a lantern might throw them outward upon a screen" (Huey, 1908/1968, p. 106). Repeatedly he used the "lantern slide" metaphor:

For our purposes here consciousness may best be thought of as in the brain, totally in the dark as to physical environment, constructing even its light as well as its forms and meanings according to the excitations that come in to it and their relations to those that have previously come in. I raise here no question of idealism, and there need be no discussion of metaphysics.

Of course the whole matter could be stated equally well in terms of James' radical empiricism, without affecting the argument here. I have come to consider the doctrine of James to be nearer the truth. However, my thought about perception in reading is doubtless more intelligible as stated in terms of my working hypothesis of plain dualism. (Huey, 1908/1968, p. 106 and footnote 2)

Many students of reading, myself included, interpreted these conclusions to mean that the total mental set and intellectual history of the reader bore upon the percept at every fixation. And we did so despite Huey's remarks about the limitations of attention during so brief an exposure period. The key to it lies in the phrase "excitations that come into it." The referent for that must be word, phrase, syntactic group, or some other lexical marker. It cannot be yesterday's lunch or any other equipotential notion. Moreover if belief overrides the stimulus, then reading has ceased and something akin to writing or guessing or plain self-deception has taken over. \*

Both the work of Perfetti (1985) and Vellutino (1979) support this general position. Specifically, Perfetti shows that increased automaticity of word response affects comprehension positively but the inverse does not. Vellutino's work makes it entirely clear that dyslexia is not an intellectual failure or a peripheral failure in or among the modalities but a language failure that diminishes or decimates the learner's ability to identify words (Vellutino, 1979; Vellutino & Scanlon, 1987).

What then may be said about the recent and continuing heavy emphasis upon research in reading comprehension (e.g., Anderson et al., *Becoming a Nation of Readers*, 1985)? Certainly if children can read we want them to read freely and to think responsibly about what they read. These are sociocultural and philosophical

matters about which we feel deeply. As such they are germane to education; in a sense they must be held the major goal of education in a democratic society.

Thus it is that purposeful reading, the quest for information, ideas, comforts, and challenges will inevitably be the motivating force of reading and writing without which no practical skillfulness would be likely to emerge. But on equal balance stands the fact that no reading occurs—purposeful or purposeless—unless a successful integration is achieved between the oral lexicon and its graphic representations—*words*.

In general, I am suspicious of most psychological models of the thinking process as they relate to reading. Again I believe that philosophers, literary critics, semanticists, thoughtful teachers are better guides, than the numerous scaffolds, schemata, maps, and metaphorical architectures that have emerged in such abundance in recent years. Pedagogically the problem is that these superstructures divert the child's and the teacher's minds from the issues given, and instead set him or her to thinking about thinking, which patently is not the way to do it. Beginning with Ausubel's organizers (1960) and ending perhaps with Bruner's scaffolds (1960), there comes to be the false notion that there is such a thing—like a pep pill—called "preteaching" that makes teaching possible. Obviously, if we had that "trick" we wouldn't have to teach at all.

To summarize this section, my view of reading is both a broad one as regards comprehension and a narrow one as regards the fundamental mystery of written word identification. I am reminded of some lines of the poet T. S. Eliot (also less fashionable today than he was in my youth). They come from *Burnt Norton*, the first of the "Four Quartets":

. . . After the Kingfisher's wing  
Answered light to light, and is silent, the light is still  
At the still point of the turning world.

Eliot's Kingfisher, of course, is language, wholly independent, reflecting thought and bonded to it in the universe of being. So do poets often forecast the cutting edge of science.

#### THE MILLENNIUM AND LONG AGO

Some years ago an anthropologist friend of mine, Frederick Richardson, counseled thus: "Don't say when language began because you will soon find that it began very much earlier!" Accordingly I will merely say that current evidence suggests that humankind existed a million or so years ago, perhaps even two, on the eastern edge of the Olduvai Gorge in Africa. It also is clear that these people used chipped tools, among them missiles that were thrown to moving targets.

Our inference is that just as shooting and throwing require the simultaneous exercise of purpose and execution, then we may suppose that these early people enjoyed a lateralized brain structure and that this laterality included the first elements of language. Physically rather weak but agile and gifted in brain-weight ratio, such creatures enjoyed the possibility of cooperative action. Both this state and tool making (a projection outward from the mind) required *name*. "Don't hand me the rock; hand me the missile." Not, "go there and go there," but "Michael, go there; and Frank, go there."

In this coalescence of hand-eye motor competence governed by a purposeful mind one sees the emergence of *self* and *other* and the inevitable march from Eden where self-reliance alone can sustain those who live beyond their ecological niche. Thus what little we know and can surmise suggests forcibly that language is deeply embedded in the human system, unique to the system and an interactive product of that system.

In the mid-1970s a conference was held in New York City on the topic "Origins of Language." It was the first such conference held in a hundred years, the question having been outlawed heretofore as manifestly speculative and thus unscientific. Modern technology now offers a renewal of such inquiry. Philip Lieberman's account (1975) of the allied research in acoustics of human speech (Haskins laboratories) with the reconstruction and dating of bone fragments has made possible convincing evidence about the nature of the changing characteristics of human speech.

To produce the multiple vowels of modern speech one requires precisely the laryngeal and supralaryngeal chambers of *Homo sapiens*—a so-called "two-tubed system." Very early hominids, including Neanderthal, had but a single-tube laryngeal construction as does, incidentally, the newborn infant. Acoustically this condition limited such creatures to a single vowel and to language production that was linearly articulated and thus vastly slower and more limited than the compressed and versatile syllables achieved by modern man.

Lieberman's account (1975) reports that a skull fragment carbon-dated at about 70,000 B.C. could be reconstructed to show a modern, two-tubed laryngeal capacity. And, quite as Professor Richardson had warned, a newspaper account of February, 1988, has reported the claim of far earlier remains with this same configuration. Without doubt we are descended from this line of hominid.

By 50,000 B.C. the Neanderthal species was extinct. It was the frailer but fast-talking candidate who survived. Nor can one doubt that the interaction of brain, hand, and speech was idle over the millennia. Lieberman points out that the first manufacture of flaked tools is coincident with the establishment of our fast-talking ancestor, and that this invention has in it logical properties that are prerequisites for a modern generative grammar. The general date of 50,000 B.C. has, as Lieberman also notes, long been recognized as a period of cultural "bloom." And that is what one should expect from the unleashing of such new

intellectual and linguistic power. These speculations gain some power by the manner in which they fit contemporary theories of language-mind relationships.

One final surprise remains. Marshack (1972), using an electron microscope to study the decorative marks upon bone tools of this period, discovered in them an unanticipated order. He concluded at last that these must represent the earliest moon calendars. If these findings hold, here is the beginning of human use of graphics. We may judge therefore that written languages are not the recent artifact that was once supposed, but that they have emerged instead over a period of thousands of years.

I agree with Gelb (1963) and DeFrancis (1989) that a distinction must be made between count markings or pictographs and a true written language. The latter requires some balance between sound and meaning representation so that a speaker of the language may access a novel text. The earliest hieroglyphics served to remind the reader of what he or she knew but resisted tenaciously access by the uninformed. The same was probably true of earliest Chinese. Each script became a true written language as sound clues were combined into the text. Chinese makes use of a common character as a phonetic marker conveying the notion "sounds like, rhymes with" or something similar. The Egyptians similarly adopted syllabary symbols in conjunction with contentive characters, much as the Japanese did many centuries later in order to achieve an optimal balance of sound and symbol representation for their language.

This necessary homeostasis between sound and meaning appears to shift from language to language and for particular languages over time. And doubtless it is this capacity to vary that allows the man-made artifact, writing, to maintain consonance with the organic properties of spoken language. An appreciation of both the long evolution of written language and its absolutely necessary responsive facility allows one to have great confidence in the probability that most children can learn to read and write. Written languages are never overwhelming in the demand that they place on memory.

I was able to realize a fresh sense of the common characteristic of beginning reading recently when a student of mine, Zhenming Li, presented our Test of Early Word Knowledge to a five and a half year-old Chinese boy in his native language. While he would not "invent" characters as an English spelling child might invent spellings from letters, when the examiner wrote some characters to label his picture, he criticized several of her strokes. She had to explain "In fast writing we do it *this way* . . . rather than like this . . ." "Oh," he said, fully satisfied.

After memorizing a short Chinese poem, the child was shown the work in written Chinese. The examiner demonstrated reading by pointing to each character as she recited the verse. The child was then able to do the same with far greater ease than would have been the case in English, for in Chinese one word was also one syllable.

After several practice sessions, the child was shown characters from the poem in isolation, and he was able to identify them readily. Thus in Chinese, character recognition actually proceeded faster than it typically does in English. And so it is that a written language that looks so complex to us works quite well for the spoken language to which it was formed.

And, over all, the child's intense curiosity and willingness, his readiness to dare and not to dare, his satisfaction in achievement were simply indistinguishable from that of any advantaged child in any culture anywhere beginning to learn to read. I think it therefore a serious error of judgment to suppose that the alphabetic system is infallibly better than Far Eastern systems.

The invention of the alphabet by the Greeks was born of necessity. The syllabaries of the Middle East fit those syllabically simple languages admirably. Syllabaries could not, however, accommodate to Greek which, like English, is syllabically complex. If a language is composed of only simple, closed syllables, such as *cat*, or only open syllables, such as *Toyota*, than a limited number of syllable symbols will provide a perfect rendering. If, however, there are a vast number of syllable combinations, the syllabary would overwhelm memory, and thus it could not serve as a record of that language.

Some unknown ancient Greek who was literate in the Near Eastern languages, must have pondered upon this misfit and in doing so discovered the vowel and the phoneme segments of words. Unlike syllables, phonemes are quite limited in all languages and thus may be used in letter groups to represent words of one or more complex syllables. It is thus we surmise that alphabetic language was discovered. We will argue later that children follow a very similar path as they begin to access written English. We also find it somewhat ironic to think that what required 50,000 years to develop is today impatiently required of every child between the age of 6 and 7. We should have greater faith in children and the language they are to learn. Each is a product of a vast history and the chance of accommodation between the young speaker and his or her written language is enormous. We need merely to know what the learner presently knows and then help him or her on the way. Today we have both the knowledge and the skill to do just that.

## THE STORY OF ENGLISH

If English were a relatively simple language like German, French, Italian, and Spanish, its story would be less interesting and less important for teachers and researchers to understand. But English is complex. It is a hybrid—a buffeted mixture of languages that has in the course of history found its own peculiar phonological characteristics. The written language has accommodated to this novel blend. To be sure, humans devised this system—some with simple, indeed, child-like intuition; others with scholarly conviction and others still in

ignorance but with an empirical marketplace motivation. All, however, danced to a deeper drum than they supposed. Written languages *must* serve spoken languages by achieving an optimal tradeoff between meaning and sound representation. Alphabets do of course serve potentially as a near-perfect sound representation. But as a language like English begins to borrow masses of vocabulary from here and from there, then strict sound representation by letter will inevitably decimate semantic regularities needed for efficient reading. That is what happened to English spelling and that is why it has not been corrected to a more orderly phonemic "code."

What then is the Story of English? The language had its formal beginning when the island of Briton was invaded and settled by three low German tribes, the Angles, Saxons, and Jutes. When, after a colonial period of some 400 years, the Roman legions were withdrawn, the Celtic people were driven to the West and North or brutally slaughtered by these invaders. The shadowy figures of King Arthur, Lancelot, and Guinevere were in fact leaders of those Romanized Britons who stemmed for a brief time the oncoming age of pagan ignorance and darkness.

Having burned the cities and spurned the highways of civilized Briton, the invaders settled into seven uneasy kingdoms, each vying for supremacy. Into this civil vacuum soon flowed the Christian teaching of missionaries from old centers in the North and from the powerful Church of Rome. With these came also literacy. By 600 A.D. Christianized Northumbria became the dominant kingdom and monasteries there became renowned in Northern Europe for the production of books. While these works were composed in Latin, English too began to be used, spelled out with the Roman alphabet.

Next came the surging tide of Vikings spilling over the waterways of Europe, first as capricious marauders and at last as settlers of northern France and eastern England. In France they adopted the language of the country, but in England their Danish tongue blended nicely with that of Northumbria. Thus we have today old English *skirt* and Danish *skirt*: old English *ship* and Danish *skipper*.

The pagan ax-wielding Danes threatened for a time to master all of England. They were stopped by that most remarkable of medieval rulers, the Saxon king, Alfred the Great. From early defeat and flight he battled back until the tide was firmly turned. From this vantage point, his heirs eventually united England under Saxon rule. Alfred had the distinction of being literate. (Charlemagne, we are told, could read but not write.) Alfred did both and what is more he wrote in English as well as Latin. He founded a school for princes at his palace (certainly the first English public school). When settlement was reached with the Danes, he commissioned religious works to be written in English for those people who had suffered so long under godless rule.

English is thus the first of the common or vulgar European languages to have been committed to writing. By the end of the 10th century this literary tradition was fully established. One can scarcely doubt that this early foundation provided

a resistance to change when Norman French became the language of law and court.

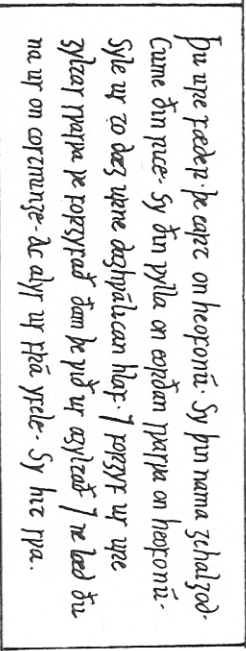
A few lines from the Lord's Prayer composed by Abbot Aelfric in 990 A.D. show the principal characteristics of Saxon English (see Fig. 1.1).

Old English was German, much of which remains in the function words of modern English. It was an inflected language like Latin, nouns and adjectives agreeing in case as well as verb forms for tense. It was spelled alphabetically with remarkable regularity. Both of these latter characteristics have changed in the modern version. Inflections have largely eroded away and spelling has become the least regular of any Western language.

What happened to this elegant, simple, and true Old English? I think it worth noting that this fine written language was not the product of linguists. It was formed instead by sensible Latin-literate individuals who applied their knowledge to set down the language they spoke. I believe that the same empirical forces have directed the evolution of modern written English. I think modern English is not only spelled as it should be but as it must be to fulfill its linguistic mission. I will argue further that English is no more difficult to learn than any other written language. But English did suffer a sea change in the year 1066! Harold, whose claim to the English throne was modest though real, fought and defeated the Danish claimant Tostig. Then he quickly marched south to ward off William of Normandy. The Battle of Hastings is English and linguistic history. Late in the day Harold was slain by an arrow in his eye; England became a bilingual nation for the next 400 years.

William the Conqueror, William the First of England, was illegitimate and a rough-neck, Danish-descended Norman prince. He was also a bright and skilled leader. He commanded the support of the Pope and brought with him to England nobles of the emerging European feudal system. His invasion of England, quite unlike that of the Saxons before him, was an invasion of the top—crudely similar to a leveraged buyout in the corporate world today.

Linguistically, the reign of the Norman and the Plantagenet kings led to a



*Ʒu ure fæder þe eart on heofonū. Sy þu nama gchadgod.  
Cume ðin rice- Sy ðin willa on eorðan Ʒerpa on heofonū.  
Syle ur to dag ure daghālican hwar- Ʒ þergyr ur ure  
Sylear Ʒwara þe fergyrædð ðam þe Ʒið ur egrædð Ʒe leað ðu  
na ur on eortmurg- ac alyr ur fēa. yrde- Sy hit Ʒra.*

FIG. 1.1. Lord's Prayer by Abbot Aelfric circa 990. From Scragg (1974).

curious battle of tongues. Old English had already begun to erode inflections probably as a consequence of the need to blend the various German dialects and these with the once-removed Danish. At the risk of anthropomorphism, we might describe English then as a firmly founded but flexibly disposed vehicle. And as English was soon the nonliterate language of the lower class of England, its capacity for change was that much more enhanced.

Norman French was the language of court, law, literature, warfare, and romance, but, at the cutting edge of enterprise, English and French collided. One might dine on *pork* but what was eaten came from that animal called a *pig*. And so it was that the vocabulary of France invaded English but English remained itself. As the years passed the dialect of Paris became the French standard and that spoken by English peers became rustic and unfashionable by comparison. And so it was that Norman French, despite its early strong literary traditions, gradually became a dying language.

Middle English, as this new language is termed, contained a heavy infusion of French vocabulary, but its structure was still English. Inflections, much eroded, still remained and pronunciation varied curiously and musically between the French and German style. The French nasals remained in place and the final stressed syllables: *dance* = *dans*; *association* = *associaasion*. This was the language of Chaucer and it was this in its London dialect that was set in print and spelling by Caxton's press. By 1415, Henry V, Shakespeare's glamorous victor at Agincourt, cheered his troops forward and wrote his dispatches in a new form of English.

Middle English is a delightful language to listen to. And we must be grateful to those linguists who have made it possible for us today to achieve so near a rendering of it. Chaucer's *Canterbury Tales* presents a pageant worth visiting in the original, as contemporary as *Ms* magazine and as incisive as Jonathan Swift.

Within a hundred years of Chaucer's death, Middle English changed abruptly to Modern English. French pronunciations disappeared; accents moved to the front, /dāns/ became /dans/, *Robert* became *Robert*. And the long vowels of English shifted. Probably the phonological pressures of blending two disparate languages forced this unique linguistic event, which is named by linguists the Great Vowel Shift. Howsoever it transpired, English, already set in print, changed radically, though consistently, in pronunciation. The broad *a* of /māk/*make* became the single-syllable glided *a*, /māk/ (*make*).<sup>1</sup> The pronunciation of *fine* moved from /fēna/ to the modern long *i* glide. Altogether it was a turbulent dislocation of speech quite as dramatic as a tectonic shift in the surface of the earth and equally irreparable.

<sup>1</sup>Editors' note: Following Cummings (1988), throughout this volume we have used the Merriam-Webster system for noting sounds because this system is more accessible than others. We refer readers to *American English Spelling* for a fuller discussion of the merits of different systems of phonetic notation. Cummings' book has become an important reference.

Young modern English emerged at the peak of the Renaissance when the ancient classical cultures were rediscovered. This was a time when all educated persons read Latin and most read Greek as well. Queen Elizabeth I was master of both. Modern science then began its first forward thrust and new-world discoveries suddenly placed London at the center of the mercantile West. For the English language these events had a dramatic effect. The rush of new ideas and travel led to a wholesale borrowing of classical terms from Latin and Greek. Thus having borrowed from Church Latin, Danish and Norman French, English added a further vocabulary to cover the sciences and humanities: Saxon *shirt* and Danish *skirt*; Saxon *pig* and Norman *pork*; Saxon *forgetfulness* and Greek *amnesia*, *mnemonic*, and *amnesia*; Saxon *misfit* and Latin *incompatible*; Saxon *throw away* and *put it to them*, Latin *dispose* and *impose*—*imposition*, *deposition*, *composition*.

Early in the period, a writer complained that rusty English lacked the terms for thinking. Soon there were terms for every nuance and more to spare. This was the grand instrument that Shakespeare played to the everlasting glory of our language.

So evolved English, a language that today is read and written by more than half the literate population of the world (Taylor, 1981). Its hybrid nature and lack of inflections fit it well, according to Baugh (1957), for this international role. But again and again linguists agree that English is inordinately difficult to learn to spell. Indeed the cry for spelling reform has pierced the air continually for the past 500 years. And even those who argue that reform is not possible, authors such as Johnson, Webster, Mulcaster (in Scragg, 1974) and Bradley (1918) regret the difficulty that English spelling places on teachers, children and foreign speakers who must learn to write it.

Accordingly, it may seem brash to assert that English poses no greater difficulty for young learners than does any other language, but such is the argument I will attempt here to defend. I will suggest that it is not possible to reform English spelling to a fully or even nearly regular letter-sound relationship. I will argue that English spelling as it stands, though imperfect, is in Noam Chomsky's terms, nearly optimal. I will show that children as they learn to spell English penetrate layers of orthographic invariance that parallel exactly the evolutionary characteristics of modern English spelling. I will argue further that every learner of every written language, regardless of its surface regularity or lack of it, must penetrate that language to a depth at which an optimal balance of sound and meaning cues is achieved. Such a command in my judgment is indispensable for true reading and writing fluency and underpins the interesting findings of W. S. Gray's *UNESCO* study (1956).

I am convinced and should like to convince you that the earliest forms of correctness or incorrectness in spelling, for those who enjoy a regular versus an irregular orthography, are of no real consequence. All will require about 12 schoolyears to master the full system and each deserves our informed under-

standing of students' efforts to do so. The long-enduring and still-continuing frustration with English spelling reflects in my judgment not a fault of the system but fault in our understanding of it. The high level of failure among English spellers (about 50% by present statistics), is a result not of a flaw in our language but a failure in our ability to teach it sensibly.<sup>2</sup>

### An Argument for English Spelling

An argument for the optimality of our present system of English spelling should perhaps begin by recognizing that after 500 years no proposal for reform has won acceptance. At first glance this outcome seems ridiculous. When the Saxons decided to write early English in Roman alphabets, they did so with due care and high degree of regularity. To be sure, they represented the voiced and unvoiced *the* as in *than* and *thing* willy-nilly with either *eth* (ð) or *thorn* (þ). But for the most part there was one letter for one phoneme and the long and short vowels were paired logically by place of articulation. Thus /e/ was matched with /i/, each being spelled with the letter *i* as in /feyns/ and /fin/ (Modern English *fine* and *fin*), whereas today pairing of long *i* /i:/ with short *i* /i/ is counterintuitive, the result, of course, of the Great Vowel Shift of the 16th century.

Well then, why don't we do what the Saxons did? Take the language as it stands and respell it to an alphabet, possibly a somewhat augmented alphabet? Is there some conspiracy by the older generation and perhaps the publishers that prevents this? I for one thought there was years ago, and I think George Bernard Shaw and Theodore Roosevelt thought so, too. I think now, however, that the problem runs deeper than the venal crimes of laziness and greed. English spelled phonetically could not be learned or read, nor could it be coordinated with those languages from which it is derived through 1,500 years of borrowing.

As Charles Read showed with his doctoral thesis many years ago (1968), when children take up their pencils to write English sentences for the first time, their performance is almost identical to that of the early Saxon. They spell by letter-name. They extract the salient phoneme from each letter-name and apply it, or the nearest one to it, to each phoneme that they discern in a spoken word. The word *fin* is most often spelled FEN. The word *pen*, in Virginia spelled PEN, is in Boston spelled PAN. In short, children intuitively adopt a one-to-one phonemic match between letter-name and word as their strategy for spelling English. That they do so without being taught to do so is one of the mysteries of written language acquisition, but one that gains some credibility in light of the long history of graphic experience in human experience.

There are two difficulties with children's first effort to spell English. First

<sup>2</sup>The commonly accepted correlation between spelling achievement and reading and/or intelligence is about .30.

there is a heavy buildup of homographs; many different words are spelled the same. For example, by letter-name strategy *bed*, *bad*, *band*, *bend*, and *bayed* are all spelled BAD, while *bid*, *bead*, *beamed*, and *binned* are spelled BED. Secondly, adults have great difficulty reading what children write. Try these in isolation: DIGS, KATS, DAS, RIBN, RIBR, SOCEASON, SOSITE, SOSL, DSOSEAT = *dogs*, *cats*, *Dan's*, *dance*, *robin*, *robber*, *association*, *society*, *social dissociate*. These spellings are fairly close. One can get on to it after a bit, but usually it is woefully inefficient. In KANUDU, KUNADEAV, EL-EKRESHN, the country and the countrymen are disjointed and the agentive suffix *ian* is destroyed.

Many years ago the lexicographer Bradley (1918) presented a formidable defense of modern English spelling. He recognized that it was difficult to learn but he insisted that the form itself was both optimal and absolutely necessary. He used many of the same exemplars employed by Chomsky 50 years later in his psycholinguistic defense of the optimality of English spelling (Chomsky & Halle, 1968). And so it is that science did once again reinvent the humanistic wheel.

Today I think we can go both scholars one step forward. We will admit that modern English spelling is complex, and we will admit that children must learn its characteristics gradually over the years. But we will insist that its features are in the main logical, teachable, and learnable by all normal speakers of our language. English thus differs very little from modern Japanese, that highly efficient written language of one of the world's most literate cultures.

#### COGNITIVE RESEARCH IN READING 1969-1989

The past 20 years have seen a rejuvenation of a broadly cross-disciplinary effort in reading research. It has been a time like that earlier period, which began in the 1870s and closed with Huey's great summary of 1908. History has thus repeated itself in that many capable scholars have again addressed the "miracle" that is reading. And while mysteries still abound in this most complex subject, many solid findings have been made that are pertinent both for theory and educational practice.

The central feature of reading research in the early days was a description of the "word effect." It was shown that words could be identified as rapidly as individual letters and that words could be read at levels of illumination at which letters randomly displayed could not be read. The profound question was (and in some measure still is): What infuses the graphically represented *word* with an apprehensibility exceeding that of random graphic elements? Herein was no question of memory span and other simple explanations. More was got for less through word than otherwise.

Following Huey these questions fell dormant for nearly 70 years. Formal scientists in psychology moved to a behavioral model and eschewed questions of "mind." As we saw earlier, Huey himself gave a "mind" explanation of the "word" phenomenon but in the same breath denied it. Psychologists thereafter were no longer interested. And despite the formidable and clearly stated warnings of William James (1899/1958), educators followed the behavioral model down the dark streets of psychometrics and the blind alleys of programmed instruction.

The cognitive revolution in American psychology occurred when Noam Chomsky wrote a critique of B. F. Skinner's *Verbal Behavior* (1957). Piaget was rediscovered. A new view of language was espoused. And language acquisition was studied and interpreted anew. This latter work in language acquisition provided a model for our subsequent studies of spelling errors which we began in the mid-1960s. By 1969, the new developmental, psycholinguistic, and cognitive lines of research were firmly launched and it was then that Reicher (1969) and Wheeler (1970) reintroduced the great question "why is a word as easily named as a letter!"

Though researchers had not wrestled with this issue for years, educators had been much influenced by the general hunch that meaning infused word perception. Indeed, in the 1840s Horace Mann, impressed by the ease with which the word-picture association could be taught, championed what today we call the "whole-word" method. Interpretation of the "word effect" in Huey's day tended also to lend support to such an approach, though Huey himself urged a "combination method," in which words were learned as units but were also studied analytically for their sound (phonemic) elements. It will appear by the end of this volume that our pedagogical conclusions will tend to endorse Huey's conservative view, though I hope with something new and helpful added.

Of greater theoretical interest is the schism that occurred at this period between reading and the language arts. Prior to the mid-19th century beginning reading was taught *through* spelling. The so called alphabet approach consisted in naming the letters of "known" passages and reciting them thereafter word by word, for example, "o," "u," "r," "our," "f," "a," "r," "h," "e," "r," "father." This general system had endured for about 2,000 years. Thereafter, reading came to be taught in one set of lessons, and spelling and writing in another. That practice continues to this day.

The psychological side of the schism is the dictum that word recognition and word production are altogether different processes (Read, 1986). And, of course, they *are* different. By the end of this chapter, however, I will argue that they draw on a common body of knowledge, that they are mutually interactive and reinforcing and pedagogically should be taught together, not separately.

Researchers in the 1970s and 1980s have been able to bring to bear an incredibly more refined technology to their efforts than was possible a century



before. Instead of plastic caps attached to the cornea making tracings on smoked drums, light-sensitive, computer-driven apparatuses are able to measure eye movement and display content in milliseconds. Happily this machinery has largely confirmed early findings. The eyes do move in saccades. The time of fixation varies with age and text and on the average is about 250 milliseconds. Regressions occur, skipping occurs, but, in the main, readers read what is there; that is to say, they bring nearly all of the text under the area of clear vision (Rayner & Pollatsek, 1989).

What earlier research could not do was answer questions about *how* meaning presumably induced the word effect. Exposure time and illumination could be controlled but in general there was not a means to parse the period between onset of a word stimulus and a verbal report of this recognition. L. Henderson (1982) describes this change in research technique and its effects in excellent detail.

These technologies have allowed a variety of new questions to be asked. For example, given an average fixation of 250 milliseconds, what goes on during that span? How long is required for "pickup," how long for analysis? And what is the order of events in the interpretive stage? Is the grapheme translated to sound and thence to the "lexicon" or does it go directly from grapheme to lexicon and then to the place where speaking (oral reading) is planned? Are features examined in linear order or in parallel? Does the first information route to realize recognition win (the horse race theory) or is there a prescribed order of analysis?

The review of verbal learning research by L. Henderson gives a somewhat bewildering view of the state of that art. Nearly every issue is hotly contended, difficult to "adjudicate," and often still moot. Nonetheless there is some gradual concurrence. A few topics will be touched on informally.

### Feature Theory

L. Henderson (1982) has pointed out that most contemporary researchers rest their models of reading either explicitly or implicitly upon a feature theory of text perception. At its most primitive level, feature theory must entail the contrasts of intersect, slope, and curve; symmetry and closure. Gibson and Levin (1975) focused on this aspect of early graphic learning as did Smith (1971). But I think nothing could be more clear than that there are severe limitations to a simple feature theory of word identification. From the earliest research in reading a distinction has been found between form discrimination and word discrimination (Gates, 1936). The two are radically different. We do not recognize words the way we recognize faces; indeed the physiological correlates are different. To be sure, Benson (1984) attributes form recognition and character recognition to the right hemisphere, and even suggests that some form recognition is possible for English words. Nonetheless, I remain skeptical.

What else is there in alphabetic words that might contribute to their very

specialized accommodation to an oral lexicon? One candidate that I would put forward is "manner in which space is filled." This is an attribute common to all written languages. Another may be a dynamic relational capacity by which letter strings within words become phonological or semantic units. Studies by Spoehr and Smith (1975) and Invernizzi (1984, this volume) suggest the presence of such features.

These considerations lead me to doubt that there is such a thing ever as pure whole-word recognition or pure alphabetic recognition except in the case of some linguistic catastrophe. Our studies of orthographic features cast considerable doubt about the reality of there being "Chinese versus Phoenicians" (Baron & Strawson, 1976) or disphonetic versus dysideitic learners (Boder, 1973).

### What is the Lexicon?

The lexicon of human speech is our inner abstract dictionary store. When we are born, it is empty; when we are grown, it is full. When we propose to "say" something, words fly all in a rhythmically temporal string to serve our purpose. Words resonate to the meanings surrounding them in our experience and they realize in varied hierarchies of syntactical structure records and visions of our conceptual world. But of what are they made and how might a graphic symbol map to them?

My guess is that the lexicon is composed within a felt-like system of filters with semantic networks like a Chinese dictionary and phonological networks reflecting the rules and analogies of the orthographic system. But, of course, what I write is pure metaphor; the device is doubtless more subtle than that. Content words and function words appear physiologically routed through to Broca and Wernicke's areas differentially (Coltheart, Patterson, & Marshall 1980). Thus when we speak of the lexicon we speak of what we know only darkly. Nonetheless, it is a construct answered unflinchingly by language researchers.

### Word Identification

When it comes to word identification, current research has narrowed the field of possibilities encouragingly whether by manipulating word stimuli with modern tachistoscopic presentations, or by studying continuous reading under eye movement monitors, where the display may be changed at high speed and the perceptual window varied. The data show that words are held in iconic store for about 50 milliseconds. Thereafter analysis takes place (Rayner & Pollatsek, 1989; Smith, 1971). Reaction-time studies show that identification precedes report by a considerable amount. And the strong implication is that for the mature reader the written word maps directly to the lexicon.

*Does Context Influence Speed of Word Identification?* Familiar text is read more readily than unfamiliar, coherent text is read more readily than incoherent (though the latter is more troublesome for the weak reader than the strong; Coltheart et al., 1980). In this sense, context makes a difference.

But as regards reading, the raw, automated language act itself, it appears that context has little effect. There simply is not enough time. Plans for successive eye movement are triggered before a present percept is fully analyzed. Comprehension follows magnetically behind these events, much as the voice trails the eye in oral reading.

Of course it is true that semantic categories facilitate recognition. The various priming studies show this. Thus *nurse* is identified tachistoscopically more rapidly if it is preceded by *doctor* versus *boor* (Balota, 1983; Marcel, 1983). So one must suppose that facilitation of this sort does influence the word-identification act in continuous reading. But such subliminal effects are not a conscious guessing game as implied by Goodman (1976) and Smith (1971). Verbal learning research of the past 20 years has made it altogether clear that reading is a knowledge game not a guessing game. And the knowledge that is crucial is knowledge of words.

*Mature Readers.* What then are the characteristics of the mature reader? Certainly he or she is driven by world knowledge, individual purposes, and perhaps the inspiration and demands of one's professors. He or she is oriented by knowledge of texts in general and the selected text in particular. And he or she may or may not be skillful in carving out parts to read and setting appropriate levels of understanding and recitation. Finally this student may or may not have good control of attention and the self-discipline to persist. All of these matters may be considered "top-down" operations that will influence the final product: comprehension to a predetermined standard.

Once the plan is set, however, and once reading begins, the operation is largely "bottom-up" from icon to lexicon to subliminal speech in most cases, and the mystical flow of comprehension. Fixations average 250 milliseconds, most words are perused, and a steady rate of 250 or 350 words per minute is typically accomplished. Should comprehension flag, reading should stop. Then conscious control directs a rereading and reflection until a new start is made. Put simply, cognitive research has shown that while thought motivates reading, reading itself is a relatively continuous language act that human beings learn to do.

I agree, as stated earlier, with Stanovich (1988) that reading and writing are modular events (Fodor, 1983). And herein lies the pedagogical paradox. What we know how to do, that is to read, is an encapsulated set of behaviors veiled from direct observation. Thus it is altogether impossible to tell a child who does not know how to read how to do it. "Look at the word and remember it," we say,

but that is twaddle. "Sound the letters and blend them into words," we say, and that is equally twaddle. It is no wonder that methodologists argue so hotly for their beliefs, for as we well know there is no war more terrible than a holy war.

#### EYE TO THOUGHT

What is the route from graphic symbol to the thought? In essence this asks for a model of the reading process like that of Eric Brown (1981) referred to earlier. Rayner and Pollatsek (1989) discuss three contenders: that of Goodman, a relatively pure "top-down" model, that of Just and Carpenter (1987), a much-revised interactive model, and their own primarily bottom-up model. They are forthright in declaring that none is above reproach, but I think they would agree that some are more fanciful than others. To the best of my knowledge, assertions about thought and how it "does things" are impossible in a scientific discipline for the very simple reason that we can neither measure nor define what we are dealing with. Therefore, influences drawn from the universe of the infinitely lateral cognitive domain are unmanageable (Fodor, 1983). Put simply, "top-down" models may be good philosophically and good pedagogically but they lack scientific conviction.

When, on the other hand, one designs a model that comports with what we do know of neural architecture as did Eric Brown's and reflects what can be measured directly in behaviors, then one may have some confidence in the design or model that emerges. Thus it was that Gough's early and vigorously bottom-up design (1972) impressed many serious scholars (as it did also outrage many dreamers). It was this work in conjunction with the new eye-movement data (Wildman & Kling, 1979) that led me to abandon the belief that reading is thinking and embrace the belief that reading is reading, that is, identifying written words so that they may map language.

Altogether, I am inclined to prefer that model proposed by Rayner and Pollatsek. And I take as a positive strength their self-criticism that they are vague "about the higher order processes" (Rayner & Pollatsek, 1989, p. 471). If Fodor is right, as I believe him to be, the language faculty is *shallow*. It contains a lexicon to be sure and that must entail a limited syntactical and semantic network. Such a storehouse would be subject to priming effects as when *doctor* facilitates recognition of *nurse* whereas *duck* does not. But there is not room or need here for the stately progress of conscious thought.

As the diagram in Fig. 1.2 shows, the Rayner and Pollatsek model posits parallel processing (Rayner & Pollatsek, 1989, p. 473). Both parafoveal and foveal information are accounted for and are coordinated with differing possibilities to trigger the next saccade. There are variable routes to the lexicon, both direct and indirect, and these may account for differing behaviors with highly

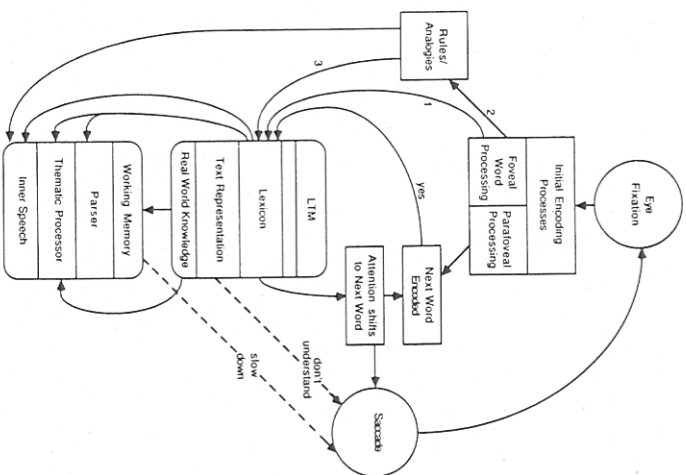


FIG. 1.2. Rayner and Pollatsek's (1989) model of reading.

frequent words versus rare words and nonce words. The model is heavy where research data are heavy and tentative where they are not. That, in my judgment, is as it should be.

Both reading and writing by the fully literate adult are wonderfully automated and habitual behaviors. Something of this is seen in McCloskey's data from the spelling of three stroke victims (1989). Letter omissions and substitutions occur in his data but of particular interest are the doublet errors (the terms these *geminis*), for example, *dress, broccoli*. What happens to these is quite like a glitch on a television screen. There may be a gap as with *dress* for *dress* or these may be a dislocation forward or back such that *broccoli* might come out *broccoli* or *broccoli*. McCloskey claims that his findings are largely unrelated to phonology but represent a misfiring in an essentially "dumb" routine.

What I found particularly interesting in these data was the fact that there were almost no initial errors or ending errors (the /s/ of *dress* is represented) and that there were no unallowable letter combinations made. The doublets are, in greatest proportion, silent letter markers. They are the last to be mastered by the

learner and not surprisingly subject first to a glitch. Thus I conclude that while the routine described by McCloskey may be "dumb," a great deal of "smarts" (albeit often tacit smarts) are required to build that automated structure. This observation leads me now to consider how reading and spelling are learned.

## LEARNING TO READ AND SPELL

### Spelling and Reading Development

I will turn now to our own studies of children's invented spellings and show first how these converge with the literature of phonological awareness and reading development (Ehri & Wilce, 1979, 1981; Maclean, Bryant, & Bradley, 1987; Stanovich, 1980; Stuart & Coltheart, 1989; Vellutino, 1979, for example). I have written earlier that I am in substantial agreement with Stanovich that Fodor's (1983) modular concept of language is a sound one. It seems to me that learning to read and write does entail the "education" of precisely such encapsulated faculties for visual perception and language. While much of this process is tacit and unavailable to direct examination, children's behaviors allow strong inferences about what, at least in part, is going on. One important source of this information is children's early writing attempts and their errors in spelling when analyzed for consistency and change by feature and word environment.

Current research persuades me that mature reading is primarily a bottom-up process. Yet there is much room to argue for top-down processes within the language faculty. I should take the priming effects to be among these and I believe this view is consistent with Rayner's outlook. Fodor suggests it explicitly (1983, p. 77). With regard to learning to read, moreover, there is much room for top-down activities and indeed they appear indispensable. This is to say children must learn what books are and what they do. They must discover text and letters. These are concrete things in the environment and they must be sorted out.

Children must also in some measure gain an awareness of their spoken language as an event in time and space that can be examined. Herein is the territory known as phonological awareness, a phenomenon that has been shown beyond doubt to be the single most powerful predictor of reading success, at least for learning an alphabetic language (Lundberg, 1985; Maclean et al., 1987; Treiman & Baron, 1981; Tunmer & Nesdale, 1985; Vellutino, 1987).

I find it interesting that among these studies one of the earliest and most powerful phonological awareness prediction variables is recognition and production of rhyme (Bradley & Bryant, 1985; Lundberg, Wall, & Olofsson, 1980; Stuart & Coltheart, 1989). There is, I think, reason for that.

Speakers in nonliterate cultures have no concept of word (Malinowski, 1952). This is the course of "word magic" and the mysterious quality that surrounds a

personal name. Illiterate members of a literate alphabetic culture have no phoneme awareness (Morais, Cary, Alegria, & Bertelson, 1979). And, as Read et al. (1986) have recently shown, older literate Chinese cannot segment by phonemes but younger Chinese taught briefly with the Roman alphabet, *phinyin*, do have phoneme awareness.

In our experience a number of things occur developmentally and experientially as children gradually access an alphabetic written language. Vocalized interaction begins extraordinarily early. My 4-month-old grandson talks to pictures of babies (and brightly colored catalogs) for extended periods. To be sure, his speech is not crystal clear, but I know talk when I hear it! From here on it's all down hill. Words will emerge, sentences will generate, grammar will differentiate and from it will emerge a talkative 4-year-old who draws people that look like tadpoles. And if all goes well, he will, by that time, be radically different from a child reared in a nonliterate culture. The reason is this: He will have been read to.

Reading nursery rhymes to children induces two awarenesses. First, the cadence of oral reading segments words in a manner that does not exist in the flow of oral language. Second, rhyme, alliteration, and word play focus attention upon the phonemic structures of words. Meaning is not an issue when a "dish runs away with the spoon." The focus is verbal segment and sound.

I would emphasize then that two different awarenesses are emerging at the same time. The one leads to the physical placement or bounds of the phoneme strings, the other awareness leads to the phonemic properties themselves. The former leads to the graphic word unit; the latter to the phonemic segments of spoken words. It is these that must become coordinate in ever more deeply nested communion as full literacy is attained.

Darrell Morris (1980; 1983; and this volume) has explored the early phases of this coordination when concept of written word is attained and phoneme segmentation is mastered. His data support a progressive and interactive advancement, which I hope will moot the strenuous causality argument between the whole-word and part-to-whole-word contenders (Liberman & Shankweiler, 1979; vs. Ehri & Wilce, 1981, for example). Perfetti's interactive position (1985) appears to be strongly supported. But do notice that to embrace this interactive model does not deny for an instant that phonological coding ability is causally related to reading success (Vellutino & Scanlon 1987). This is simply to insist that phonological awareness can only ripen in the context of *word*.

Children begin to scribble with interest at about a year and a half (Gibson & Levin, 1975). Thereafter they proceed in an orderly way through orchestrated scribbles to pictures; thence to letter-like scribbles and figures. Then, if a helpful adult or sibling is at hand, letters will be asked for and learned. Given adequate story and rhyme exposure, the developing child will then begin to represent words by simple initial consonants and this will soon be followed by the initial and final consonant (Gentry & Henderson, 1980; Henderson & Beers, 1980).

This same sequence has been noted by Stuart and Coltheart (1989), which they treat most interestingly. The saliency of the beginning and end is undeniable. If you watch a child pointing to the line "Sam Sam the Baker Man" while naming each word, he or she will eventually begin to point by syllables and so say "ker" while pointing to *man*. Then the day will arrive when *man* is rejected as *ker* and a self-correction is made. That self-correction is possible because at last the coordinate concepts of word and letter are achieved.

Stuart and Coltheart suggest that it is here that the alphabetic principle has been achieved. I agree with them fully. Children's theory of word at this point is that the initial and final consonants suffice; the vowel that is obvious may be ignored. And it is this theory that goes to print to be tested in the act of reading. Herein stands the exact intellectual posture necessary to enrich one's word knowledge. As the authors observe, NT is fine for *net* but it is equally good for *net*, *not*, *gnet*, *note*, and *newt*. Like the ancient Greeks, our questing children will need to find the vowel letters and use them if they are ever to read and write English. And they soon do.

Stuart and Coltheart's idea that young children bring to print an incomplete concept of word is precisely the argument advanced by Gill (1985, 1989, and this volume). The spelling of *not* as NT yields an attentional focus of the word *net* that is NEXT. Progress in learning to read is made when theory as reflected in spelling is found dissonant with reality. If *net* is not *net*, they why so!

It is this conception that leads me to feel that spelling, the alphabetic principle, and the orthographic features by pattern and meaning that flow from it, are the central core of literacy. Reading nourishes this gradually elaborating construct; writing automatizes it.

As children begin to identify words reliably in matching speech to print they spell syllabically; NT = net. When they can identify words automatically, they spell by letter-name. This is the plan discovered by Read (1971). They identify the vowels and they select letters strategically.

Thus they spell NOT for *note*, KAM for *came* and so on. Short vowels are spelled by place of articulation, paired as they logically should be and *were* before the Great Vowel Shift. FES spells *fish*, NAI spell *net*, PEK spells *pink* (the preconsantal consonant is regularly omitted).

I repeat this now well-known finding because Ehri has seemed to challenge it in a recent article (Ehri et al., 1988) and suggested that the phenomenon is motivated by dialect. An unpublished dissertation by Stever (1976, 1980) speaks to the dialect issue with some detail and this has been noted by Read (1986). But there is further reason why Ehri does not observe the "letter-name" effect in her data. Her subjects in Study One were first and second graders, in Study Two second graders, and in Study Three, kindergartners and three second graders. What is not answered is "Where were they developmentally as readers and writers?" The Letter Name stage is ephemeral; the tadpole soon has legs. It is

almost impossible to interpret such data unless one knows where children were and where they are headed in their knowledge of written words. Kindergartners, first- and second graders are apples, oranges, and potatoes.

It was quite the same issue that motivated a study by Barnes (1982) and by Invernizzi (1984, and this volume). Studying visual memory for silent letters, Ehri was surprised to find (for first and second graders) that silent letters were more salient than sounded letters. She replicated her work and confirmed it. We inferred from her data that most of the children in the two samples had passed the letter-name stage and were using silent vowel markers. We predicted that children at a true Letter Name stage would have little or no recall of silent letters. Those predictions are supported in both Barnes's and Invernizzi's findings.

The distinction among the stages pre-letter-name, letter-name, and within-word pattern (vowel marking) are interesting and important. But first, let me agree with Ehri that our original naming of these stages (Beers & Henderson, 1977) was misleading and ridiculous. I am not sure we have fully improved matters with our present labels, but I have good confidence in the data that support them nonetheless.

Children at a pre-letter-name stage spelling *nut* as N or NT are in the process of forming a stable concept of word. They are *not* able to acquire a stable sight reading vocabulary. Children at the Letter Name stage have acquired a concept of word: they can segment phonemes accurately (see Morris, this volume) and they begin to acquire a stable sight-reading vocabulary if they are supported in text and they "read" 20 to 25 minutes a day. Children who are well into the Within Word Pattern stage are able to read independently in texts at a "challenge level" of difficulty.

An examination of children's misspellings at the Within Word Pattern stage show them to be quite word-like. Most any adult can read their misspelled writing. We reasoned that this might reflect a lexicon sufficiently educated to the way of English orthography to identify words at a single fixation and thereby gain the lead time for fluent or naturally voiced oral reading. This was the hypothesis entertained by Bear (1982). Issues of prosody have continued to prove a lasting interest to Professor Bear and comprise his present contribution (see Bear, this volume).

Developmental stages on any dimension of human behavior are always proximate statements with gray areas between them. And they must always be recognized as task-specific. Stages of word knowledge are specific to alphabetic words. Their spelling characteristics may be found in illiterate and semilliterate adults as well as among children. Nonetheless, it is true that a significant relationship has been shown between within-word pattern achievement and the ability to decenter (C. Beers, 1980; Zutell, 1979). I have long felt that the early learned alphabetic concept involved a relatively simple linear match whereas the more complex task of letter by pattern by sound is analogous to the relational thinking required of Piaget's concrete operational thought. In this volume, Zutell

recounts his early explorations of this issue and relates further study that expanded this notion. His inquiry extends into the more recent investigations of the relationship between word knowledge and on-line reading fluency.

While much has been written about these early reading stages, considerably less attention has been given to the stages that follow vowel marking awareness. It was Schlagal who devised a "Qualitative Spelling Inventory," applied it to a school-wide assessment, and teased out the various features that change or grow richer in the context of the growing adult vocabulary (Schlagal, 1982, 1989). His chapter in this volume gives a nice picture of the ebb and flow of learning as the vocabulary grows more complex.

The Beers' research focuses on a particular aspect of the beginning awareness of syllable juncture: inflectional morphology. This development, first noted in Beers and Henderson (1977), builds upon within-word pattern knowledge. Although in the study reported here, subjects were surprisingly late in developing this knowledge, it is striking that they developed it nonetheless and in the sequence predicted by previous work.

Templeton also investigated advanced word knowledge in his dissertation (1976) and he has pursued this line through several additional studies (e.g., Templeton, 1983; Templeton 1989; Templeton & Scarborough-Franks, 1985). His focus has been the phenomena of vowel alternation and vowel reduction in words of common derivation. His investigations (this volume) speak both to some interesting linguistic hypotheses and equally provide some very practical implications for spelling and vocabulary learning.

A final word must be said about dyslexia and children who have difficulty learning to read. We submit that Vellutino's work is definitive and that it may be said with confidence that dyslexia is a linguistic problem, not a peripheral one. I have noted earlier that our study of spelling errors led us to be most suspicious of using error types as a means of diagnosis. When one studies the spelling errors thought to characterize the dysphonetic versus the dyslexic learner (Boder, for example) one finds two principal problems. First, many of the errors are taken from pupils spelling at a frustration level, a condition that Schlagal (1982 and this volume) has found to be uninterpretable. Second, many error candidates can be shown to be natural developmental errors and not deviant at all—FEGR (used by Frith, 1980) for *finger*, for example, shows the letter-name, short-vowel substitution E for I, omission of the nasal *n* and the *e* in the second syllable, all typical features of a beginning reader's letter-name spelling.

In fact, when normal and dyslexic children controlled for achievement level are compared feature by feature for spelling errors, no differences are found between them (Invernizzi & Worthy, 1989). What is different is speed of learning. The dyslexic children were 3 to 4 years behind the normal pace. In this volume Abouzaid reports some in-depth case studies of dyslexic children as they compare in word knowledge with normal children and one alexic child. Her findings support the new literature of reading disability.

## SUMMATION

What we have learned about reading and writing over the past 20 years has the potential to change the face of modern elementary education. We will discuss this contention in greater detail in our final chapter. At this point, however, I should like to adduce a few principles by way of summation.

## Exercising Comprehension

While the nature of reading comprehension, listening comprehension, and thought seems not to answer well to scientific inquiry, that does not deny that readers think or that young readers need the guidance of mature adults. I take it as true that world knowledge, domain knowledge, and topic knowledge delimit what understanding a reader may construct from a text. I am confident that if such knowledge is requisite, the genre familiar, and the text coherent, reading will proceed more fluently than if it is not. Finally the reader's purpose and his or her ability to adjust that purpose to the social demands of the reading situation will also influence the efficiency of comprehension. These relationships have, I think, been understood for a very long while.

The task for a serious teacher is to see that the young reader indeed marshal attention to the text at hand, and exercise his or her capacities as vigorously as the occasion demands. It is also the teacher's responsibility to place the learner in a text that is suitable to his or her capacities. In such a setting, if pupils are exercised regularly, they will become more skilled both in reading and in comprehending texts.

Thus "teaching comprehension" must advance in the light of a skilled assessment of pupil's knowledge and text demand. The hope that there may be some shortcut to obviate this principle is unfounded and doomed to failure.

## Learning to Read

Learning to read involves the mapping of written words to the lexicon. Prerequisites for such learning begin at birth and evolve naturally as the child learns to speak. The potential for literacy is tapped just as soon as the child is immersed in a written-language environment and the physical attributes of written language are explored. This period of learning culminates when letter, word, and phoneme are coordinated in text. Thereafter and for a good number of years the nested features of English orthography may be assimilated as the grapheme-phoneme bond is automated for word recognition and production.

Research of the past two decades has once again placed spelling at the center of the reading/language arts curriculum. Many years ago Carol Chomsky asserted "Write first, read later" (1971). This year Stuart and Colheart (1989)

assert that an alphabetic spelling hypothesis is developmentally the first test of the textual waters. I believe them to be right.

The pedagogical implication of this view of emerging literacy is quite similar to that one must hold for language comprehension. The teacher's role must be to assess and challenge—to know what the child knows and motivate him or her to take the next step. Spelling and word study provide direct teaching of what to attend to in words. Reading provides the vocabulary (gradually advancing in complexity) to be examined. Writing (over and beyond the discipline of composition and rhetoric) provides the means to automatic and habituate word knowledge.

Our view of written-language acquisition makes the methodological squabbles of the past century seem petty indeed. Anything helpful must be welcomed, provided timing and pacing are matched to the children who are learning. This dictum holds for the gifted and less gifted, for rich and for poor, for normal and dyslexic.

Altogether it would seem that reading and writing instruction in the 21st century might be radically different and far more effective than that of the 20th. I feel confident that it will be.

## REFERENCES

- Anderson, R. C., et al. (1985). *Becoming a nation of readers: The report of the commission on reading*. Urbana, IL: Center for the Study of Reading.
- Ausubel, D. P. (1960). The use of advance organizers in the learning and retention of meaningful verbal materials. *Journal of Educational Psychology*, 51, 267-272.
- Balota, D. A. (1983). Automatic semantic activation and episodic memory and coding. *Journal of Verbal Learning and Verbal Behavior*, 22, 88-104.
- Barnes, W. G. W. (1982). *The developmental acquisition of silent letters and orthographic images in English spelling*. Unpublished doctoral dissertation, University of Virginia, Charlottesville.
- Baron, J., & Strawson, C. (1976). Orthographic and word-specific mechanisms in reading words aloud. *Journal of Experimental Psychology: Human Perception and Performance*, 2, 195-215.
- Baugh, A. C. (1957). *A History of the English Language* (2nd ed.). New York: Appleton-Century-Crofts.
- Beur, D. R. (1982). *Patterns of oral reading across stages of word knowledge*. Unpublished doctoral dissertation, University of Virginia, Charlottesville.
- Beers, C. S. (1980). The relationship of cognitive development to spelling and reading abilities. In J. Beers & E. Henderson, (Eds.), *Developmental and cognitive aspects of learning to spell: A reflection of word knowledge*. Newark, DE: International Reading Association.
- Beers, J. W., & Henderson, E. H. (1977). A study of developing orthographic concepts among first graders. *Research in the Teaching of English*, 3, 133-148.
- Benson, D. F. (1984). Alexia and the neural base of reading. *Annals of Dyslexia*, 34, 3-13.
- Boder, E. (1973). Developmental dyslexia: A developmental approach based on three atypical reading and spelling patterns. *Developmental Medicine and Child Neurology*, 15, 663-687.
- Bradley, H. (1918). On the relations between spoken and written language, with special reference to English. *Proceedings of the British Academy* (Vol. 6). London: Oxford University Press.

- Bradley, L., & Bryant, P. (1985). *Rhyme and reason in reading and spelling*. Ann Arbor: University of Michigan Press.
- Brown, E. R. (1981). A theory of reading. *Journal of Communication Disorders*, 14, 443-466.
- Bruner, J. (1960). *The process of education*. Cambridge, MA: Harvard University Press.
- Bruner, J. (1983). *Child's talk: Learning to use language*. New York: Norton.
- Chomsky, C. (1971). Write first, read later. *Childhood Education*, 47, 269-299.
- Chomsky, N. (1968). *Language and mind*. New York: Harcourt Brace & World.
- Chomsky, N. (1975). *Reflections on language*. New York: Random House.
- Chomsky, N., & Halle, M. (1968). *The sound pattern of English*. New York: Harper & Row.
- Coltheart, M., Paterson, K., & Marshall, J. C. (1980). *Deep dyslexia*. London: Routledge & Kegan Paul.
- Cummings, D. W. (1988). *American English spelling: An informal description*. Baltimore, MD: The John Hopkins University Press.
- DeFrancis, J. (1989). *Visible speech: The diverse oneness of writing systems*. Honolulu: University of Hawaii Press.
- Ehri, L. C., & Walce, L. S. (1979). The mnemonic value of orthography among beginning readers. *Journal of Educational Psychology*, 71, 26-40.
- Ehri, L. C., & Walce, L. S. (1981). Movement into reading: Is the first stage of printed word learning visual or phonetic? *Reading Research Quarterly*, 20, 163-179.
- Fodor, J. (1983). *Modularity of mind*. Cambridge, MA: MIT Press.
- Firth, U. (Ed.). (1980). *Cognitive processes in spelling*. New York: Academic Press.
- Gates, A. (1936). *A list of spelling difficulties in 3,876 words*. New York: Columbia University Press.
- Gelb, I. J. (1963). *A study of writing*. Chicago: University of Chicago Press.
- Gentry, J. R., & Henderson, E. H. (1980). Three steps to teaching beginning readers to spell. In E. H. Henderson & J. Beers (Eds.), *Developmental and cognitive aspects of learning to spell*. Newark, DE: International Reading Association.
- Geschwind, N. (1979). Asymmetries of the brain—New developments. *Bulletin of the Oron Society*, 69-73.
- Gibson, E. J., & Levin, H. (1975). *The psychology of reading*. Cambridge, MA: MIT Press.
- Gill, J. T. (1985). *Spelling and word recognition*. Unpublished doctoral dissertation, University of Virginia, Charlottesville.
- Gill, J. T. (1989). The relationship between word recognition and spelling in the primary grades. *Reading Psychology*, 10, 117-136.
- Goodman, K. (1976). Reading: A psycholinguistic guessing game. In H. Singer & R. B. Ruddell (Eds.), *Theoretical models and processes of reading*. Newark, DE: International Reading Association.
- Gough, P. B. (1972). One second of reading. In J. Kavanagh & I. Mattingly (Eds.), *Language by ear and by eye*. Cambridge, MA: MIT Press.
- Gray, W. S. (1956). *The teaching of reading and writing*. Paris: UNESCO.
- Henderson, E. H., & Beers, J. (Eds.). (1980). *Developmental and cognitive aspects of learning to spell: A reflection of word knowledge*. Newark, DE: International Reading Association.
- Henderson, L. (1982). *Orthography and word recognition in reading*. New York: Academic Press.
- Horn, T. D. (1957). Phonetics and spelling. *Elementary School Journal*, 57, 424-432.
- Huey, E. B. (1908/1968). *The psychology and pedagogy of reading*. New York: Macmillan.
- Invernizzi, M. (1984). *Memory for word elements in relation to stages of spelling power*. Unpublished doctoral dissertation, University of Virginia, Charlottesville.
- Invernizzi, M., & Worthy, J. (1989). Normal and disabled spellers on levels one through four: Implications for instruction. *Reading Psychology*, 10, 173-188.
- James, W. (1899/1958). *Talks to teachers on psychology and to students of some of life's ideals*. Reprinted. New York: Norton.
- Just, M. A., & Carpenter, P. (1987). *The psychology of reading and language comprehension*. New York, MA: Allyn & Bacon.
- Lemmerberg, E. (1967). *Biological foundations of language*. New York: Wiley.
- Lieberman, I. Y., & Shankweiler, D. (1979). Speech, the alphabet, and learning to read. In L. Resnick & P. Weaver (Eds.), *Theory and practice of early reading* (Vol. 2). Hillsdale, NJ: Lawrence Erlbaum Associates.
- Lieberman, P. (1975). *On the origins of language: An introduction to the evolution of human speech*. New York: Macmillan.
- Lundberg, I. (1985). Longitudinal studies of reading and reading difficulties in Sweden. In G. E. Mackinnon & T. G. Waller (Eds.), *Reading research: Advances in theory and practice* (Vol. 4). Orlando: Academic Press.
- Lundberg, I., Wall, S., & Olofsson, A. (1980). Reading and spelling skills in the first school years predicted from phonemic awareness skills in kindergarten. *Scandinavian Journal of Psychology*, 21, 158-173.
- Maclein, M., Bryant, P., & Bradley, L. (1987). Rhymes, nursery rhymes and reading in early childhood. *Merrill-Palmer Quarterly*, 33(3), 255-281.
- Malinowski, B. (1952). The problem of meaning in primitive languages. In C. K. Ogden & I. A. Richards (Eds.), *The meaning of meaning* (10th ed.). New York: Harcourt.
- Marcel, A. J. (1983). Conscious and unconscious perceptions: Experiments on visual masking. *Cognitive Psychology*, 15, 197-237.
- Marshall, A. (1972). *The roots of civilization: The cognitive beginnings of man's first art, symbol, and notation*. New York: McGraw-Hill.
- McCloskey, M. (1989). *Neuropsychological aspects of spelling*. Talk delivered at the University of Virginia, Charlottesville, February 10.
- Morris, T., Cary, L., Alegria, T., & Bertelson, P. (1979). Does awareness of speech as a sequence of phones arise spontaneously? *Cognition*, 7, 323-331.
- Morris, D. (1980). Beginning reader's concept of word. In E. Henderson & J. Beers (Eds.), *Developmental and cognitive aspects of learning to spell*. Newark, DE: International Reading Association.
- Morris, D. (1983). Concept of word and phonemic awareness in the beginning reader. *Research in the Teaching of English*, 17, 359-373.
- Perfetti, C. A. (1985). *Reading ability*. London and New York: Oxford University Press.
- Rayner, K., & Pollatsek, A. (1989). *The psychology of reading*. Englewood Cliffs, NJ: Prentice Hall.
- Read, C. (1971). Pre-school children's knowledge of English phonology. *Harvard Educational Review*, 41, 1-34.
- Read, C. (1986). *Children's creative spelling*. Boston: Routledge & Kegan Paul.
- Read, C., Zhang, Y., Nie, H., & Ding, B. (1986). The ability to manipulate sounds depends on knowing alphabetic transcription. *Cognition*, 24, 31-44.
- Reicher, G. M. (1969). Perceptual recognition as a function of meaningfulness of stimulus material. *Journal of Experimental Psychology*, 81, 275-280.
- Schlagel, R. C. (1982). *A qualitative inventory of word knowledge: A cross-sectional study of spelling, grade one to six*. Unpublished doctoral dissertation, University of Virginia, Charlottesville.
- Schlagel, R. C. (1989). Constancy and change in spelling development. *Reading Psychology*, 10, 207-232.
- Strang, D. G. (1974). *A history of English spelling*. New York: Barnes & Noble.
- Skinner, B. F. (1957). *Verbal behavior*. New York: Appleton-Century-Crofts.
- Smith, F. (1971). *Understanding reading: A psycholinguistic analysis of reading and learning to read*. New York: Holt, Rinehart, & Winston.
- Spoehr, K., & Smith, E. (1975). The role of orthographic and phonotactic rules in perceiving letter patterns. *Journal of Verbal Learning and Verbal Behavior*, 18, 21-39.

- Stanovich, K. E. (1980). Toward an interactive-compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly, 16*, 32-71.
- Stanovich, K. E. (1988). The right and wrong places to look for the cognitive locus of reading disability. *Annals of Dyslexia, 38*, 154-177.
- Sever, E. F. (1976). *Dialectal and socioeconomic factors affecting the spelling strategies of second grade students*. Unpublished doctoral dissertation, University of Virginia, Charlottesville.
- Sever, E. F. (1980). Dialect and spelling. In E. Henderson & J. Beers (Eds.), *Development and cognitive aspects of learning to spell: A reflection of word knowledge*. Newark, DE: International Reading Association.
- Stuart, M., & Coltheart, M. (1989). Does reading develop in a sequence of stages? *Cognition, 30*, 139-181.
- Taylor, I. (1981). Writing systems and reading. *Reading research: Advances in theory and practice 2, 2*, 1-51.
- Templeton, S. (1976). *An awareness of certain aspects of derivational morphology in phonology and orthography among sixth, eighth, and tenth graders*. Unpublished doctoral dissertation, University of Virginia, Charlottesville.
- Templeton, S. (1983). Using the spelling/meaning connection to develop word knowledge in older students. *Journal of Reading, 27*, 8-14.
- Templeton, S. (1989). Tact and explicit knowledge of derivational morphology: Foundations for a unified approach to spelling and vocabulary development in the intermediate grades and beyond. *Reading Psychology, 10*, 233-254.
- Templeton, S., & Scarborough-Franks, L. (1985). The spelling's the thing: Knowledge of derivational morphology in orthography and phonology among older students. *Applied Psycholinguistics, 6*, 371-390.
- Treiman, R., & Baron, J. (1981). Segmental analysis ability: Development and relation to reading ability. In T. G. Waller & G. E. Mackinnon (Eds.), *Reading research: Advances in theory and practice*. (Vol. 3). New York: Academic Press.
- Tunmer, W. E., & Nesdale, A. R. (1985). Phonemic segmentation skill and beginning reading. *Journal of Educational Psychology, 77*(4), 417-427.
- Vellutino, F. R. (1979). *Dyslexia: Theory and research*. Cambridge, MA: MIT Press.
- Vellutino, F. R., & Scantlon, D. M. (1987). Phonological coding, phonological awareness, and reading ability: Evidence from a longitudinal and experimental study. *Merrill-Palmer Quarterly, 2*(3), 75-105.
- Venezky, R. L. (1967). English orthography: Its graphical structure and its relation to sound. *Reading Research Quarterly, 1*, 59-85.
- Wheeler, D. D. (1970). Processes in word recognition. *Cognitive Psychology, 1*, 59-85.
- Wildman, D., & Kling, M. (1979). Semantic, syntactic, and spatial anticipation in reading. *Reading Research Quarterly, 14*, 128-164.
- Zatell, J. (1979). Spelling strategies of primary school children and their relationship to Piaget's concept of decentration. *Research in the Teaching of English, 13*, 69-80.

# 2

## Patterns of Orthographic Development into the Intermediate Grades

Robert C. Schlagal  
Spring Hill College

This study, like the others in this volume, is rooted in the clinical work, insight, and theoretical teaching of Edmund Henderson. When I first came to the McGuffey Reading Center, I was interested in reading from a literary point of view but wanted to learn more about its development and psychology. Rather than authoritative works and seminars, Henderson quickly directed me into clinical work. He assured me that if I devoted myself to teaching, observed closely, and puzzled over what I saw, comparing it with what authorities in various disciplines were saying, I would learn a lot. I followed that advice and spent a good deal of time in the diagnostic and teaching practice. And while I was deeply affected by the richness, utility, and theoretical implications of the knowledge I began to acquire, I made up my mind early to do a dissertation on metaphor comprehension.

I changed my mind rather suddenly several years later on a train ride from Virginia to Evanston, Illinois, and back. On the way up Henderson and I talked about metaphor and literature. On the way back we talked about orthography and children. What happened in between was interesting.

In Chicago, Henderson was featured in a colloquium, where he spoke opposite one of the more public names in the Whole Language movement. The two shared a great deal in common. Both believed in the critical importance of good literature and abundant, purposive reading and writing in the classroom; and both vigorously rejected the common classroom practice of drilling in meaningless and fragmented "subskills." Yet Henderson's work with struggling readers had persuaded him that reading was a lot less natural than learning to speak. He argued that in addition to sustained experience in interesting and well-constructed text, a great many children need skillful guidance in examining words.



# Contents

Copyright © 1992 by Lawrence Erlbaum Associates, Inc.  
All rights reserved. No part of this book may be reproduced in any form, by photostat, microform, retrieval system, or any other means, without the prior written permission of the publisher.

Lawrence Erlbaum Associates, Inc., Publishers  
365 Broadway  
Hillsdale, New Jersey 07642

## Library of Congress Cataloging-in-Publication Data

Development of orthographic knowledge and the foundations of literacy : a memorial festschrift for Edmund H. Henderson / edited by Shane Templeton, Donald R. Bear.  
p. cm.  
Includes bibliographical references and indexes.

ISBN 0-8058-0825-6

1. Word recognition. 2. Reading. 3. English language—Orthography and spelling. 4. Reading—Psychology of.  
I. Henderson, Edmund H. II. Templeton, Shane. III. Bear, Donald R.  
LB1050.44.D48 1992  
428.47:019—dc20

91-43929  
CIP

Printed in the United States of America  
10 9 8 7 6 5 4 3 2 1

10/22/92  
D.R.

<b>Foreword</b>	ix
<i>James Deese</i>	
1. <b>The Interface of Lexical Competence and Knowledge of Written Words</b>	1
<i>Edmund H. Henderson</i>	
2. <b>Patterns of Orthographic Development into the Intermediate Grades</b>	31
<i>Robert C. Schlagal</i>	
3. <b>Concept of Word: A Pivotal Understanding in the Learning-to-Read Process</b>	53
<i>Darrell Morris</i>	
4. <b>The Relationship Between Word Recognition and Spelling</b>	79
<i>J. Thomas Gill</i>	
5. <b>The Vowel and What Follows: A Phonological Frame of Orthographic Analysis</b>	105
<i>Marcia A. Invernizzi</i>	
6. <b>The Prosody of Oral Reading and Stages of Word Knowledge</b>	137
<i>Donald R. Bear</i>	
7. <b>The Developmental Acquisition of Silent Letters in Orthographic Images</b>	191
<i>William G. W. Barnes</i>	
8. <b>An Integrated View of Word Knowledge: Correlational Studies of the Relationships Among Spelling, Reading, and Conceptual Development</b>	213
<i>Jerry Zutell</i>	