7

Analyzing the Reading Process: Use and Uses of Meaning

Obviously the recognition of a printed pattern is not an end in itself for the reader. Where does meaning enter in? For skilled readers it seems that meaning, too, is largely the product of effortless and automated activities. Moreover, the nature of the relationships between orthographic and semantic processing also holds a number of implications with respect to the skills that young readers must develop.

The Relationship between Meaning and Orthography

Figure 7.1 shows the relation between the readers' knowledge and processing of orthography, word meaning, and the broader context in which a word occurs.[1] The ellipse labeled "Orthographic processor" contains all of the individual letter recognition units and the associative linkages between them. Note that the Orthographic processor is the only one that receives input directly from the printed page: The first important point of the figure is that, when reading, it is visual, orthographic processing that comes first and that causes the system to kick in.

The second important aspect of this figure is that between the Orthographic and Meaning processors, there are arrows leading in both directions. As the visual image of a string begins to take form, it sends excitatory signals to units representing word meanings. And as the visual information begins to resolve itself and settle in on fewer and fewer meaning candidates, they reciprocally send excitation back to the letter patterns they require.

1. Seidenberg and McClelland (1989).

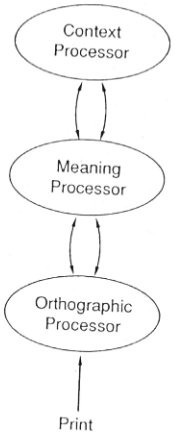

Figure 7.1
The relation of the Orthographic processor to the meaning and context processor.

The third important aspect of this figure is that the Meaning processor is connected in both directions to the Context processor. These connections serve to facilitate the perception of contextually appropriate words and to select a contextually appropriate interpretation of words whose meanings are ambiguous or diffuse. Let us consider each of these phenomena in turn: first, contextual facilitation and then meaning selection.

The Context Processor

The Context processor is in charge of constructing a coherent, ongoing interpretation of the text. As it does so, it sends excitation to units in the Meaning processor according to their compatibility with its expectations; this process is symbolized by the arrow leading from the Context processor to the Meaning processor in Figure 7.1. Within the Meaning processor, such contextual priming produces a boost in the excitation levels of all units that are compatible with the reader's ongoing interpretation of the text.

Contextual Facilitation and Word Recognition

The exact amount of excitation that the Context processor will contribute to any given meaning unit depends on exactly how predictable it is. If the context is only weakly predictive of the

word to follow, then its energy will be dispersed across as many units in the Meaning processor. If the context is strongly predictive of the word to follow, that word's meaning should receive a strong and focused boost in excitation.

In effect, such boosts in the excitation of a meaning give it a head start toward reaching consciousness. To the extent that a meaning is already turned on, it needs less input from the letter recognition network to become fully active. In keeping with this, predictive context speeds people's ability to decide whether any given string of letters is or is not a word. The more highly predictive the context is, the more it does so.[2]

The Context processor is also responsible for selecting among alternate meanings of a word. This is important not just for blatantly ambiguous words (such as soccer *ball* versus inaugural *ball*) but to a lesser extent for almost any word. For example, the word *Wyoming* brings different images to mind, depending on whether the surrounding topic is national parks or national elections. The Context processor's job is to pick out and emphasize those aspects of a word's meaning that are most important to its evolving interpretation of the text.[3]

Yet even while the Context processor facilitates the reader's awareness of appropriate words and meanings, it does not prevent excitation of inappropriate ones. Given a sentence such as

John saw several spiders, roaches, and *bugs*.

people very briefly show signs (albeit not conscious awareness) of having interpreted the last word to mean both insects and spying devices.[4]

The brevity of this phenomenon shows that the Context processor is quick to settle the issue. On the other hand, its very existence demonstrates that, among skilled readers, the contributions, even of relatively strong context, are not preemptive—even at the level of meaning selection. In particular, this example demonstrates that contextual selection cannot overcome orthographic information; it is not even strong enough to prevent the incoming orthographic information from turning on each of its own appropriate meanings.

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2. For a review, see Fischler and Bloom (1979).

3. Sanford and Garrod (1981) is an excellent book on the ways in which readers' understanding of larger context influences their interpretation of individual words.

4. Seidenberg, Tanenhaus, Leiman, and Bienkowski (1982).

For skillful readers, then, the implication is that context can respond to orthographic information; it can speed and assist its interpretation; but it cannot overcome it. Consistent with this, study after study has shown that context significantly affects the speed or accuracy with which skilled readers can perceive familiar words only when the experimenter has done something to slow or disrupt the orthographic processing of the word. This can be accomplished in either of two ways: (1) by reducing the contrast or by adding or subtracting bits of visual information so as to make the letters harder to see or (2) by choosing words whose orthography is unusually difficult.[5]

The fact that contextual cues prove especially helpful for orthographically difficult words is not only consistent with our analysis of how the system ought to work but is quite comforting. The implication is that by its very design, the Context processor gives us decoding assistance when we need it most. And in keeping with this, a number of investigators have shown that context exerts a much stronger effect on word identification performance of younger and less skilled readers.[6]

The capacity of the Context processor to help readers across orthographic difficulties must be of tremendous everyday significance to the young reader.[7] As it helps to reduce the time and effort that they must invest in orthographically difficult words, it must significantly increase their capacity for comprehending the text.

Contextual Facilitation and Comprehension

In essence, text comprehension is a hierarchically layered process. At the bottom level, the reader must retrieve the meaning of each individual word encountered. When the spelling of the word is only marginally familiar, contextual excitation can sometimes significantly assist this process. First, where a spelling pattern is only partially processed, contextual excitation can augment orthographic excitation so as to select the intended word from any competitors. Second, where orthographic processing is laborious or uncertain, indirect excitation, originating in the Context processor, can help to speed its progress.

5. For a review, see Stanovich (1980).

6. For reviews, see Perfetti (1985); Stanovich (1980).

7. On the other hand, overreliance on contextual clues should be a source of concern rather than pride for the educator for it is a strong sign that the reader's orthographic knowledge and skills have not been properly developed.

At the next level of text interpretation, readers must collapse the meanings of the individual words they have read into a composite interpretation. They must, in other words, periodically interrupt their word-by-word progress through the text to interpret the collective significance of the chain of words they have been reading. Skillful performance at this level depends on two factors: (1) the ability to recognize the opportunities at which recoding is most appropriate and (2) the ease and speed with which the individual words are recognized.

In general, for skillful readers, these interpretive pauses regularly occur at major syntactic boundaries.[8] As this effectively ensures the internal coherence of the string of words to be recoded, it is extremely important.

More specifically, the skillful reader's selection of recoding opportunities reflects a trade-off between the importance of the syntactic boundary and the length or difficulty of the phrase or clause that it bounds. Where there is a choice, major boundaries are preferable because they allow the reader to put together a more significant fraction of the sentence at once. However, when the number or difficulty of the words (or concepts) between major boundaries is high, skillful readers recode at earlier and more subtle junctures. Otherwise, their capacity for the remembering the uncollapsed string of words might be exceeded. As a consequence, some of the information to be put together would be lost, and comprehension would suffer.

Note that if readers try to recode at a syntactically inappropriate point in the sentence, they find themselves in the position of trying to interpret a syntactically anomalous set of words. In this case, too, comprehension must suffer.

Research confirms that the syntactic sensitivities of younger and less skilled readers are quite undeveloped and provides evidence that this may significantly contribute to their comprehension difficulties.[9] However, the second factor—the time and effort which readers must invest in recognizing the individual words of the syntactic unit—looks to be at least as important.[10]

The greater the time and effort that a reader must invest in each individual word, the slimmer the likelihood that preceding words of the phrase will be remembered when it is time to put them all together. Yet word recognition difficulties are ubiquitous

8. Kleiman (1975).

9. Adams (1980); Huggins and Adams (1980).

10. Perfetti (1985); Perfetti and Lesgold (1977).

for younger and less skilled readers. There must be some relief from this bind, or comprehension would be a rare event.

One way of circumventing decoding problems is to skip over difficult words. Although this is a common strategy even among better readers,[11] its drawbacks with respect to preserving the meaning of a text are obvious, especially in the extreme. The other source of relief is to be gained from the Context processor. For the reader with marginal word recognition skills, the speed and facilitation that the Context processor lends to the decoding process could well make the difference between comprehension and word calling.

At the third level of the comprehension process, readers must combine their understanding of the just-interpreted phrase or clause with their overall interpretation of the text so as to revise and update their understanding of what the text means and where it is going. At this step, the reader's working materials are no longer locally defined. Full understanding may require retrieval of particular facts or events presented many pages earlier in the text. It may also require consideration of knowledge and construction of argument that are entirely extraneous to the text. And it certainly requires the critical and inferential activities necessary for putting such information together.

It is, in short, this third level of interpretation that we think of as true understanding. Interpretation at this level requires active attention and thought; it is not automatic. It will be only as fruitful as the discipline and effort that the reader invests in it, and the training of this discipline and effort is an area in which contemporary education in the United States clearly falls short.[12]

In view of the attentional requirements of comprehension, the immediate point is that the automatic facilitation that context imparts to word recognition may be critical. At least for marginal decoders, contextual facilitation may make the difference between whether or not they have sufficient resources to allow such comprehension to happen at all. Within the larger context of this book, the more important point is that the comprehension of a text, in its deepest and most productive sense, must be impeded unless and until the reader has mastered the knowledge and skills required for the automatic recognition of its words.

11. Freebody and Anderson (1983).

12. Chall (1983b); National Assessment of Educational Progress (1981a); National Commission on Excellence in Education (1983).

The Meaning Processor

The inner workings of the Meaning processor are similar in nature to those of the Orthographic processor. In particular, its units do not correspond to whole, familiar words. Instead, just as the spellings of familiar words are represented in the Orthographic processor as interassociated sets of letters, the meanings of familiar words are represented in the Meaning processor as interassociated sets of more primitive meaning elements.

For example, a person's understanding of the word *dog* would be represented neither by some self-contained "dog node" nor by any list of definitive properties but instead as the interassociated distribution of properties that collectively represent the person's total history, direct and vicarious, of experiences with dogs. Because the nature of these interconnected sets of meaning units holds implications for comprehension and vocabulary growth, it is worth examining in a little more detail.

Acquiring Concepts

Let us suppose that a child is encountering some particular thing, say a cat, for the first time.[13] As the cat is observed, the sets of meaning units representing its characteristics—its color, its fur, its voice, its tail, its shape and size, its behavior, its environment, and so on—become activated and interconnected in the child's Meaning processor. At that point, the child's concept of a cat will correspond precisely to that particular, interconnected constellation of meaning units. If the child is told that this creature is called a cat, the word *cat* will also correspond precisely to that particular, interconnected constellation of meaning units.

Now suppose that our child encounters another cat—and another, and another, and another. Whether these encounters involve the same cat in different situations or different cats in their own situations, none will be identical to that very first encounter.

To the extent that they are the same, they will activate overlapping sets of meaning units. Eventually, through their repeated and simultaneous activation, these overlapping sets of meaning units will become strongly interlinked, collectively representing the child's core concept of a cat. A creature that

13. This framework for concept acquisition is based most closely upon Hintzman (1986).

evokes their majority in proper configuration will be conceived as a cat; one that does not, will not.

To the extent that the cat encounters are different, they will activate different meaning units. Such dispersion of meaning serves to make the child's concept of a cat more flexible, to keep it from being tied to that first, unique image of a cat. It effectively broadens the child's understanding of what a cat can be like and can do.

Over time, as the child encounters more and more cats, there will also emerge subclusters of characteristics corresponding, for example, to barn cats and house cats, Siamese cats and Persian cats, stalking cats and curled-up cats. When the child sees a cat that matches one of these subclusters, it will evoke not only the general concept of a cat but also the entire subset of meaning units with which it is tightly connected, providing such responses as "better not pet a barn cat."

Acquiring the Meanings of New Words

Because of the direct connections between the Meaning processor and the Context and Orthographic processors, vocabulary acquisition can be seen to proceed in much the same way. Suppose that while reading a story, a child encounters a word that she or he has neither seen nor heard before. Because the meaning of the word is totally unknown, it has no established connections to the units in the Meaning processor. The associative pathways from the Orthographic processor to the Meaning processor ensure that it gets shipped up. Yet without a destination, its energy will diffuse, without constraint, around the meaning units.[14]

If the word had been presented in isolation, that might be the end of it. However, our imaginary child encountered this word while reading a meaningful text. As a consequence, the meaning units will not be homogeneously unprepared for its arrival. Those that are compatible with the ongoing interpretation of the text will have been excited already by the Context processor. Rather like radar, looking for a blip, the orthographic pattern will find these activated meaning units, and as their excitation intermingles, a bond will begin to form between them.[15]

The impact of such an incidental learning experience is expected to be small. Context is rarely pointed enough to predict the precise meaning of a word. The pattern of activation that it

14. See McClelland and Rumelhart (1986a).

15. McClelland and Rumelhart (1986a).

creates across the meaning units is likely to be quite diffuse. It is likely to miss some of the aspects of the word's meaning, and it is likely to include a number that belong only to the context and not to the word at all. Further, the more diffusely it is spread across meaning units, the weaker can be its contribution to any one. Thus, although our imaginary child will have learned something about this word through its accidental encounter, that something may well be too weak and too imprecise to be useful by itself.

But think about what will happen when the child sees this word again. It will evoke the configuration of meaning units that it encountered before. In addition, it will meet the pattern of excitation set off by the new and different context in which it currently occurs. Where the meaning units of the earlier and current context overlap, their excitation will be mutually reinforced. They will therefore become more strongly bonded to each other and to the orthographic pattern of the word. As a consequence, they will also be the units that are most strongly evoked on the next encounter of the word.

Given a number of encounters with this word over a variety of different contexts, the units that context evokes most often will be those that belong to the meaning of the word itself. Beneath them will be subclusters of units that correspond to its frequent usages and connotations. Units that have been excited in only one or two contexts will become lost in the noise. In this way, the meaning of the word itself will eventually be learned well enough to contribute independently and appropriately to the meaning of a text, even if not to allow the child to generate a well-articulated definition.

Strategic Use of Context Should Be Taught

A caveat is in order. The kind of vocabulary acquisition I have described above is a bit slipshod. It is capable only of providing the word with the meaning anticipated by the immediately preceding context, and it requires only that the reader has looked carefully at the unknown word and has understood the context preceding it. Other than that, it is passive; it happens effortlessly and automatically.

If, in contrast, the reader takes the time and effort to analyze the contextual clues available, a far more precise and useful concept of the word may be established on its first encounter.[16]

16. More generally, productive learning depends on thinking as much as recognizing. The interplay between memory and thought will be discussed in chapter 9.

Such analysis may extend beyond the immediate context of the word. At best, readers will thoughtfully search for and interpret cues that precede the word more remotely. At best, they will additionally look for clues or definitions that might follow it. Although such methodical exploitation of context is not automatic, it can be taught, to the considerable benefit of the reader.[17]

Vocabulary Instruction

Intuitively, such incidental and incremental meaning acquisition should not be as efficient, word for word, as methodical vocabulary instruction. And, indeed, it is not.[18]

To gain an overview of the effectiveness of vocabulary instruction, Steven Stahl and Marilyn Fairbanks conducted a meta-analysis of relevant research published through April 1985.[19] Their study was addressed to three questions:

1. Does provision of vocabulary instruction generally result in an increase in students' word knowledge?

The answer to this question was a definite yes. Across studies, whether outcome tests measured children's knowledge of word definitions (e.g., through multiple-choice or short-answer items) or usages (e.g., through sentence anomaly or cloze tests), children who had received instruction on the tested words significantly outperformed those who had not. In addition, children who had received vocabulary instruction significantly (though, of course, less dramatically) outperformed the others on global vocabulary measures, such as standardized tests, indicating that vocabulary instruction effectively enhanced learning of words that were not explicitly taught as well.

2. Does vocabulary instruction result in any increase in students' reading comprehension?

Again the answer was yes. Instructed children demonstrated significantly better comprehension of passages containing taught words than uninstructed children. More concretely, the fiftieth-percentile-student in the instructed group was effectively advanced to the level of the eighty-third-percentile student in the uninstructed group. The instructed children also demonstrated slight but significant gains over their uninstructed peers on standardized measures of reading comprehension, corresponding to an advance from the fiftieth to the sixty-second percentile.

17. For a review of research on strategies for exploiting context, see Calfee and Drum (1986).

18. Nagy, Herman, and Anderson (1985); Stahl and Fairbanks (1986).

19. Stahl and Fairbanks (1986).

3. What kinds of vocabulary instruction are most effective?

Across studies, methods in which children were given both information about the words' definitions and examples of the words' usages in contexts resulted in the largest gains in both vocabulary and comprehension measures. Although methods providing repeated drill and practice on word definitions resulted in significant improvement on measures designed to assess children's specific knowledge of the words taught, it produced no reliable effect on the comprehension scores.

The limited effectiveness of having children learn the definitions of words deserves further consideration. After all, how many times did your parents say, "Look it up!" when you came to them with a vocabulary question?

In fact, a common vocabulary exercise in the classroom is to give children a list of words, ask them to look each up in the dictionary, and use it in a sentence. To get a closer look at the productivity of such instructions, George Miller and Patricia Gildea examined several thousand sentences written in response by fifth and sixth graders.[20] Examples of the sentences produced by the children follow in the column on the left. The dictionary definitions from which the children worked are given in the column on the right:

Student's Sentence	Dictionary Definition
Me and my parents correlate, because without them I wouldn't be here.	**correlate.** 1. be related one to the other: *The diameter and circumference of a circle correlate.* 2. put into relation . . . .
I was meticulous about falling off the cliff.	**meticulous.** very careful or too particular about small details.
The redress for getting well when you're sick is to stay in bed.	**redress.** 1. set right; repair; remedy: *King Arthur tried to redress wrongs in his kingdom.*

All things considered, one might conclude that the children used the definitions quite well; nevertheless, the sentences are peculiar. The productive understanding of a word requires much more than knowledge of its definition.

A study by McKeown, Beck, Omanson, and Pople is among those that have demonstrated that the number of times that children encounter a word is a strong predictor of how well they will learn it; this is consistent with the basic principle of associative learning.[21] But McKeown and company also found that the next

20. Miller and Gildea (1987).

21. McKeown, Beck, Omanson, and Pople (1985).

best predictor of learning was the richness and variety of meaningful contexts in which the words had been encountered and used. Of particular interest, rich and diverse experience with a word yielded a special advantage in the children's abilities to understand its connotations or submeanings in specific contexts and to exploit its extended meaning in the course of story comprehension. This is exactly as our portrayal of the Meaning processor would predict.

While affirming the value of classroom instruction in vocabulary, we must also recognize its limitations. By our best estimates, the growth in recognition vocabulary of the school age child typically exceeds 3,000 words per year, or more than 8 per day.[22] This order of growth cannot be ascribed to their classroom instruction, nor could it be attained through any feasible program of classroom instruction.

First, the amount of direct instruction prescribed in teachers' guides and curriculum materials is relatively small compared to this number. Examinations of basal reading series show that the number of word meanings to receive explicit instruction generally ranges between 200 and 500 per year.[23] Second, counting the number of vocabulary items listed in the basals greatly overestimates the number of new words that children are likely to learn through classroom instruction. It seems that the majority of the words listed for instruction by the basals are already familiar to most children.[24] Further it seems that teachers tend to spend very little time on direct vocabulary instruction in any case. Dolores Durkin observed that, of 4,469 minutes of reading instruction, only 19 were directed to vocabulary instruction.[25] Similarly, Roser and Juel found that the third-, fourth-, and fifth-grade teachers they observed spent an average of 1.67 minutes on vocabulary per reading lesson; most often they spent none at all.[26]

Not only does it seem that classroom vocabulary instruction is not the principal source of children's vocabulary growth, it also seems that even under the most supportive circumstances, it could

22. Miller and Gildea (1987); Nagy, and Anderson (1984); Nagy and Herman (1987).

23. Calfee and Drum (1986); Nagy and Herman (1986).

24. For example, in a study of third, fourth and fifth graders, Roser and Juel (1982) found that 72 percent of the "new" words that the basal listed for instruction were already known by students. Even among students in the lowest reading groups, 48 percent of the words were already known.

25. Durkin (1979).

26. Roser and Juel (1982).

not be. To gain more direct insight into this problem, Isabel Beck and her colleagues designed an intensive regimen of vocabulary instruction for fourth-grade children. The program was designed to teach the meanings of 104 words and took five months—seventy-five half-hour lessons—to complete.[27]

Children have been shown to learn well under this program, mastering about 80 percent of the trained words. But 80 percent of 104 words is only 81 words—a lot fewer than 3,000. Besides that, consider the amount of time it took. If this training were extended to a full year, one might expect the children to learn as many as 200 new words through it. Even if it were the only subject taught, all day long, every day, the total number of words that could be covered would barely exceed 3,000, and—especially under these circumstances—the total number of covered words that would be learned would surely be many fewer.

Importance of Learning New Words from Context

So how do children learn so many new words each year? Is it possible that they do so mostly on their own, from encountering the words in context? Thanks to work of William Nagy, Richard C. Anderson, and their colleagues, we can give this question a confident yes. Piece by piece, they have put this puzzle together, and here are the pieces[28]:

1. How many words of print do children read each year?

   A study of fifth graders indicated that the amount out-of-school reading ranged from practically none to nearly 6 million words per year, with half the children reading at least 650,000.[29] Adding in-school reading to this total, they conclude that the average fifth-grade student encounters more than 1 million running words of text a year.[30]

2. How many unknown words does a child encounter in a year?

27. Beck, Perfetti, and McKeown (1982); McKeown, Beck, Omanson, and Perfetti (1983).

28. Nagy, Herman, and Anderson's (1985) original study was smaller and its estimates less conservative than those provided in a more recent paper: Nagy, Anderson, and Herman (1987).

29. Based on data collected by Fielding, Wilson, and Anderson (1987).

30. Nagy, Herman, and Anderson (1985). To this, Nagy, Anderson, and Herman (1987) add the observation that the ninetieth percentile student reads about 200 times more text per year than the tenth percentile student.

The average (fiftieth percentile) fifth grader is likely to encounter between 16,000 and 24,000 unknown words per year in the course of reading.[31]

3. What is the likelihood that the child will learn the meaning of an unknown word through a single encounter while reading meaningful text?

On immediate testing, there is a 20 percent chance that through a single encounter of a word in meaningful, grade-level text, the child will have acquired enough of its meaning to express a very vague aspect of its sense; there is a 10 percent chance that the child will have learned enough about it to express a fairly clear understanding of its meaning; and there is a 15 to 20 percent chance that the child will be able to pick out its meaning on a multiple-choice test.[32] When testing is delayed for about a week, multiple-choice performance falls to about 5 percent.[33]

4. What is the total number of new words that a child is expected to learn through independent reading?

If we use the most conservative estimates above, the answer is at least 5 percent (the likelihood of learning) of 16,000 to 24,000 (the number of unknown words encountered in a year), which equals 800 to 1,200 new words per year.

It is thus clear that learning from context is a very, very important component of vocabulary acquisition. But this means of learning is available only to the extent that children engage in meaningful reading and, even then, only insofar as they bother to process the spelling—the orthographic structure—of the unknown words they encounter. Where they skip over an unknown word without attending to it, and often readers do,[34] no learning can occur. Acquisition of the meaning of a word from context depends on the linkage of the contextually evoked meaning with the structural image of the word.

Meaningfulness and Orthographic Knowledge

While the acquisition of new vocabulary items depends on attending to orthography, it also happens that acquisition of new orthographic patterns is enhanced by attending to meaning. This is because the Meaning processor is directly linked to the Orthographic processor (figure 7.1).

In particular, when the Orthographic processor ships a meaningful spelling pattern to the Meaning processor, the Meaning processor returns excitatory feedback. The effect should be one of

31. Anderson and Freebody (1983).

32. Nagy, Herman, and Anderson (1985).

33. Nagy, Anderson, and Herman (1987).

34. Anderson and Freebody (1983).

adding reinforcement to the activated spelling pattern which should contribute to its consolidation. Whittlesea and Cantwell have shown that this is exactly what happens. When a pseudoword is given a meaningful definition, the perceptibility of its letters is significantly enhanced. Moreover, it remains so at least twenty-four hours later and whether or not its meaning can be remembered.[35]

Knowledge about Prefixes, Suffixes, and Word Stems

The direct linkage between the Orthographic and Meaning processors may also be responsible for skilled readers' perceptual sensitivity to the roots or meaning-bearing fragments of polysyllabic words and nonwords.[36] It moreover raises the prospect that it might be a good idea to teach students about the derivational morphologies of polysyllabic words—to teach them, for example, that such words as *adduce*, *educe*, *induce*, *produce*, *reduce*, and *seduce* are similarly spelled because they share a common meaning element: *duce*, "to lead."

By sharpening the connections leading from the Meaning to the Orthographic processor, such instruction might be expected to improve both spelling and visual word perception. Conversely, by refining the connections from the Orthographic to the Meaning processor, such instruction should strengthen students' vocabularies and refine their comprehension abilities.

In keeping with this, after giving seventh graders thirty ten-minute lessons on the derivational morphologies of words, Otterman found that they were more proficient with both the meanings and spellings of the studied items.[37] The students did not, on the other hand, demonstrate any significant improvement in their general vocabulary and comprehension scores or in their ability to interpret new derivationally complex words. Nor, by our analysis, could such improvement be expected unless, along with the word parts they had been taught, they were also trained in the strategies and discipline for inducing meaning from morphological components. Although the linking of particular orthographic patterns with particular meanings can be accomplished entirely through the mechanisms of the

35. Whittlesea and Cantwell (1987).

36. Although this sensitivity seems real, it is not very strong. Some of the papers that have addressed this issue are Fowler, Napps, and Feldman (1985); Manelis and Tharp (1977); Taft (1985); Tyler and Nagy (1987).

37. Otterman (1955, cited in Johnson and Bauman, 1984).

Orthographic and Meaning processors, making an independent habit of so doing requires additional and sophisticated cognitive control.

In addition, a cautionary note is in order about teaching the derivational morphologies of words: The morphemic and syllabic structures of polysyllabic words rarely coincide. As an example, the syllabic segmentation of *information* is *in-for-ma-tion;* morphologically it is *in-form-ation.* Given that word recognition is driven by the Orthographic processor, one might expect readers to be more responsive to the syllabic structure of a word than to its morphology. Studies of skilled readers indicate that this is often the case.[38]

One wonders, moreover, whether our visual compulsion to syllabify is not partly responsible for the fact that we are not more sensitive to morphology.[39] Syllabic parsing, after all, disintegrates the *busy* in *business* and the *current* in *concurrent.* Though it might help us to see the *port* in *deport* or even *comportment,* it breaks it up in *importance* and *transportation;* though it might help us to see the *form* in *deform,* it hides it in *information, performance,* and *conformative;* and similarly for the *pos(e)* in *impose* and *repose* versus *position, positive,* and *imposter.*

Although teaching older readers about the roots and suffixes of morphologically complex words may be a worthwhile challenge, teaching beginning or less skilled readers about them may be a mistake. Juel and Roper/Schneider have demonstrated that the spelling patterns to which young children are asked to attend significantly influence the spelling patterns to which they respond during word perception.[40] More than that, children's word recognition facility is particularly influenced by their familiarity with "versatile" spelling patterns—ones that appear in a variety of words.[41] Where there is a difference, the syllabic segments of a polysyllabic word are, by their nature, orthographically more common or versatile than its morphological segments. To avoid conflicts with the goal of establishing solid sensitivity to frequent spelling patterns, instruction on morphology may best be postponed. The perceptibility of syllables is too important.

38. Goldblum and Frost (1988).
39. Kaye and Sternberg (1982).
40. Juel and Roper/Schneider (1985).
41. Juel (1983).

Instructional Implications

Several instructional themes follow from this discussion of meaning and orthography. The first is that reliance on context to the exclusion of orthography is a good strategy neither for reading nor for learning to read. For the skilled reader, meaning is effortlessly and automatically driven by orthographic processing. Unless young readers are encouraged to attend to the spelling patterns of words, they may not develop the orthographic knowledge on which this system depends.

To this end, it again seems that children should be encouraged not to skip over words that are difficult for them.[42] When they encounter a word that is hard to read, they should, of their own volition, take the time to study it. In addition to reflecting on its spelling, they should methodically consider its meaning, using not just the immediate drift of the context but also looking for definitions, paraphrases, and contrasts that follow or more remotely precede the word.

After they have worked over a new word, they should return to the beginning of the phrase and then the sentence to which it belongs, rereading the whole thing. This is not only valuable for purposes of reinforcing the orthographic structure and meaning of the new word: It is necessary for comprehension of the sentence. More generally, repeated reading of text is found to produce marked improvement in word recognition, fluency, and comprehension.[43]

An additional benefit of repeat readings may be toward the reader's appreciation of the syntax of the passage.[44] Because readers must interpretively collapse text at and only at syntactic boundaries, such sensitivity stands as a strong, if indirect, determinant of comprehension. Thus, when readers are asked to undertake repeat readings in unison with an expressive model (such as a professional reader on tape), marked improvements in their own phrasing are also found.[45] Before (or while) asking students to reread an important or difficult passage, we should not hesitate to read it aloud ourselves to them (or as they read silently) and with expression. Syntactic sensitivities can also be

42. Again, any child who has difficulty with more than a few words per paragraph should be given something easier to read.
43. Herman (1985); Samuels (1985); Taylor, Wade, and Yekovich (1985).
44. Carbo, M. (1978); Schreiber, R. (1980).
45. Carbo (1978).

strengthened by asking students to construct tables or flowcharts of the text—that is, by engaging them in tasks that inherently require thoughtfulness about the text at the level of propositional units and the relations between them.[46]

In this context, it is worth reflecting on the fact that readability or text difficulty is not a unary dimension: A text can be more or less difficult at the level of words, syntax, or concepts.[47] The aspects of a text that are best pushed beyond or kept within the students' level of mastery depend on the purpose for which the text is intended. If its purpose is to expand word recognition skills, then a larger proportion of new words can occur but its syntactic and conceptual structure should be entirely manageable. Similarly, if its purpose is to expand syntactic sensitivity, then the topic should be familiar and the vocabulary should be controlled. In contrast, if the purpose is to impart new concepts, grade-level control of syntax and vocabulary makes sense.

Within readability formulas, syntactic complexity is generally estimated by the number of words in a sentence.[48] Given text that has been written as clearly as possible, the average number of words per sentence provides a reasonable statistical index of its overall syntactic complexity. Among other things, it provides an estimate of the number of meaningful ideas that the reader must interrelate in interpreting the sentences.[49] Thus, proposition by proposition,

The dog chased the cat. The cat killed the rat. The rat ate the malt.

describes the situation in more digestible units than does

This is the dog that chased the cat that killed the rat that ate the malt.

But while the number of words between periods is a correlate of syntactic complexity, it is not its cause. To illustrate, we can significantly shorten our complex sentence as follows:

This is the malt the rat the cat the dog chased killed ate.

And, conversely, we can increase the comprehensibility of our simplest sentences by adding more words:

46. Sticht (1979).
47. See Klare (1984).
48. Klare, G. R. (1974–1975).
49. Kintsch and Keenan (1973).

First, a rat ate the malt. Then, a cat killed the rat. Then, this dog chased the cat.

The key to syntactic ease or complexity is not just the number of words or ideas in a sentence. It is also the transparency; it is the obviousness of the syntactic boundaries between clauses and phrases and the clarity of the meaningful relations between them.[50]

Turning from readability back to word meaning, it would seem that vocabulary instruction is generally a worthwhile endeavor. Although such instruction may produce relatively little direct increase in the children's vocabularies, it provides a general forum for experimenting with the uses of words and the ways in which their meanings differ. It supports the attitude that learning new words and being thoughtful about their meanings is worthwhile, and it sets up a context for discussing the larger meaning of the text.

In addition, explicit training on the strategic use of context for defining word meanings seems wholly warranted. Sometimes the meaning of a new word is inferable from or even explicitly provided by the text. However, theory indicates that neither the ability nor the tendency to exploit contextual clues that follow or more remotely precede a word can be automatic. By implication, the processes and benefits of using such information should be taught.

The idea of teaching students about the spellings and meanings of the roots and affixes of derivationally complex words seems promising but unproved. My own belief is that such knowledge is valuable on both orthographic and semantic dimensions. For example, once one sees that *concurrent* consists of "with" (*con-*) plus *current*, the word is no longer a spelling problem. I further sense that my appreciation of the meaning of such words changes qualitatively and profitably from appreciation of their derivations. Somehow, the insight that *fid* means "trust" or "faith" significantly alters and connects my understanding of words like *confidence*, *fidelity*, *fiduciary*, and *bona fide;* the discovery that *path* means "suffering" alters and connects my understanding of words like *sympathy*, *psychopath*, and *pathologist;* and so on. In reverse, I also find it quite helpful to look at morphology clues in inferring the meanings of new words. Yet it is also my impression that such insights are never automatic. The only way I seem to discover such relations is by consciously looking for them.

50. Huggins and Adams (1980).

Perhaps the objective of such lessons should be one of developing children's inclination to look for such relations as much as teaching them about any particular sets of words. In any case, when and if the worth or effectiveness of lessons on derivational morphology is firmly demonstrated (or otherwise accepted), there is reason to suspect that such training would be best postponed until later grades of schooling when the student's knowledge of frequent spelling patterns has been thoroughly established and automated. In an nutshell, it is less important for the orthographically inexperienced to be facile with the *form* in *information* than with either the *for* in *information, for, forty, forget,* and *misfortune* or the *ma* in *information, major, automation,* and *flammable.*

Finally, the most important point of this section is that meaningful experiences with words are important to the acquisition of their spelling, as well as their usage and interpretation. The best way to build children's visual vocabulary is to have them read meaningful words in meaningful contexts. The more meaningful reading that children do, the larger will be their repertoires of meanings, the greater their sensitivity to orthographic structure, and the stronger, better refined, and more productive will be their associations between words and meanings.

This book could not have been written without the unending support and encouragement of my husband, Milton B. Adams. I dedicate it to him and our children, John and Jocelyn, with all my love.

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Contents

Foreword by P. David Pearson v
Acknowledgments ix

PART I
Introduction 1

Chapter 1
Putting Word Recognition in Perspective 3

Chapter 2
Reading Words and Meaning: From an Age-Old Problem to a Contemporary Crisis 13

PART II
Why Phonics? 29

Chapter 3
Program Comparisons (And, by the Way, What Is Phonics?) 31

Chapter 4
Research on Prereaders 55

PART III
What Needs to Be Taught? Hints from Skilled Readers 93

Chapter 5
Outside-In Models of Reading: What Skilled Readers Look Like They Do 95

Chapter 6
Analyzing the Reading Process: Orthographic Processing 107