

How Plain Language Fails to Improve Organizational Communication

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Abstract:

Long used in technical communication, readability formulas have been circulated widely in management communication through publications like the SEC's *Plain English Handbook*. However, readability formulas actually only measure what were previously the only visible and quantifiable aspects of documents that contributed to their readability. As extensive cognitive neuroscience research has revealed, readability formulas fail to account for the interaction between written documents and readers' cognitive processes. This article addresses the contrast between readability formulas and the characteristics of written documents that actually make for efficient reading. Using neuroimaging studies of the reading mind, this article maps out the cognitive reading process and leverages this research to establish guidelines for writing documents, which readers can read quickly and efficiently.

In one form or another, plain language laws have existed for more than forty years. Beginning in 1964, as part of the Civil Rights Act, plain language laws eventually covered scores of common documents, from insurance policies to rental agreements. In 1996, the Securities and Exchange Commission (SEC) started a Plain English Pilot program, encouraging companies to use readable English in disclosure documents for investors, an initiative that quickly attracted the participation of Bell Atlantic and NYNEX. Less than a year later, the SEC rolled out its *Plain English Handbook* for creating clear SEC disclosure documents (Smith, 1998). By June 1998, the plain language initiative was, if not law, then at least required in documents and applications distributed by all federal agencies. Four years later, the Sarbanes-Oxley Act would make plain language laws an integral aspect of disclosures and corporate accountability (Sarbanes-Oxley, 2002).

In some instances, organizations enjoyed immediate benefits from adopting plain language initiatives. When the U.S. Department of Veterans Affairs tested plain language form letters, the VA support center reduced calls from an average of 1.5 per letter to fewer than .3—changes which saved the department an estimated \$40,000 each year for the single letter (Egan, 1995). Similarly, Fed-Ex enjoyed a savings of more than \$400,000 during the first year it revised its ground-operation manuals to reflect plain language guidelines (DuBay, 2004). Undoubtedly, plain language guidelines have helped make readable many financial prospectuses and, most recently, even the more recherché special publications issued by the IRS, including publications that formerly relied heavily on legal language and such difficult-to-interpret features as triple negatives.

At first glance, plain language guidelines seem to be the remedy for the problems with poorly written documents that continue to plague organizations. In 2005, Fortune 500 companies alone spent an estimated \$3 billion on instruction in written communication for employees, a response to still-greater costs of poorly written memos and other documents (O'Neil, 2005). Badly written documents diminish productivity (U.S. Bureau of Labor Statistics, 2005), hinder communication between organizations (Sauer, 1993; Winsor, 1993), lead to lawsuits (McCord, 1991; DuBay, 2004), strategic and tactical errors (Blundell, 1980), and, ultimately to the failure of complex systems, evidenced by the history of miscommunication between NASA and engineers at Morton Thiokol that led to the Challenger disaster (Winsor, 1993). Plain language guidelines seem to promise to make most written communication immediately intelligible and to considerably reduce both the costs of training employees to write well and of poor writing itself.

But the answer is, unfortunately, not that simple. While plain language guidelines have certainly tamed the thickets of prose that distinguish many investment prospectuses and government publications, these guidelines work best in instructions or documents that provide answers to Frequently Asked Questions. The instructional steps or question-and-answer format make for short paragraphs that address a single, clear-cut topic, which also makes unproblematic the relationships between sentences and the organizational structure of the paragraph itself. For more complex forms of communication, plain language guidelines can potentially worsen the readability of written documents, even if organizations faithfully implement the guidelines issued by the federal government itself

(Federal Aviation Administration, 2005) or the SEC's more fully-fledged handbook (Smith, 1998).

This article examines the three signal reasons why plain language guidelines, while sufficient for consumer-oriented documents, fail to foster effective writing within and between organizations. First, the guidelines themselves evolved from readability formulas, one of the mainstays of technical writing and also a central feature built into many software style checkers. As we'll see below, these formulas are themselves highly problematic, based on assumptions about readability that are, at best, empirically unproven and, at worst, challenged by more recent studies on reading. Second, plain language guidelines focus almost entirely on a single textual level, the lexical, which limits its scope to word choice. The guidelines touch briefly on the second level, syntactic, involving sentence structure, but completely ignore the third and most complex textual level, which relies on organization, propositions, and schemas. And, finally, these guidelines, like virtually every article on written communication, ignore a substantial and significant body of neuroscience research on the way our minds process written language.

Ironically, even as managers and pundits decry the state of writing in organizations and wonder what to do about it, neuroscience researchers have been prying open the black box of reading to reveal the cognitive processes every reader must complete to understand a single line of text. The fruits of this research are considerable—and the implications for improving organizational writing, if anything, even more striking, since this research collectively provides a map for the kinds of word choices, sentence structures, and organizational patterns that make for writing readers will read swiftly, process efficiently, and recall accurately.

READING AS A BLACK BOX

For decades, researchers in technical communication faced a singular challenge: how to define and quantify the features that made some documents significantly more readable than others. The challenge, however, lay not in the quantifying but in the invisibility of the reading process itself. Reading was what sociologists call a black box (Bijker, 1995), a process that remains a cipher, eluding researchers' best efforts to examine it. If we view written communication along the lines of Claude Shannon's communication model (Shannon, 1949), the sender, receiver, and most of the messages are identifiable entities. However, the factors that distinguish signal from noise are destined to remain obscure as long as we treat the channel—written language—as transparent. But, unlike other modes of communication like the telephone or television, the way the message is conveyed by language is integral to our reception of it. When we leave voicemail for a colleague, we can remain blissfully ignorant of the machinations of the analog or digital processes that translate our voices into packets of data—the comprehensibility of our messages has nothing to do with our knowledge of how telephones work, provided we avoid using gestures in lieu of words. Unfortunately, the same fails to hold true for written communication in virtually any form. To ensure a message's accurate transmission, we need to know how the channel works. This vital part of the communication process, however, remained perversely invisible to researchers until the 1980s, the decade that ushered in intensive research into the cognitive processes involved in reading.

Readability Formulas: Accounting for Taste

Readability formulas evolved on a top-down basis, rising from researchers' need to account for the reasons why the likes of *People Magazine* are easily read by adults with an eighth-grade education, while even seasoned PhDs struggle with the most elementary passages of, say, the California Penal Code Section 631a¹. The differences, researchers noticed, seemed to lie not in the complexity of the subject matter but in the manner of its expression—specifically, in the lengths of sentences. The longer the sentence, they theorized, the more difficult the task of reading. Certainly, lengthy sentences, as we'll see below, pose considerable demands on readers, substantially increasing the amount of cognitive processing involved in comprehending text. But sentence length is far from the lone determinant of readability. Despite this fact, the simplest readability formulas rely primarily on the lengths of sentences, edicts that were made concrete in the most common software style checkers (MacDonald, Frase, Gingrich, & Keenan, 1982) and which survive today in Microsoft Word's and Corel WordPerfect's style and grammar checkers (Sydes & Hartley, 1997). More nuanced and complex readability formulas add the familiarity of terms or even the number of syllables in words to sentence length as determinants of readability. Not coincidentally, word and sentence lengths are perhaps the only two aspects of written texts capable of being easily quantified. Researchers who plugged these two features into increasingly complex readability formulas like the Flesch and Fog indices were dealing with the most tangible features of texts. For example, Flesch's Reading Ease score counted average lengths of sentences by dividing the number of words by the number of sentences in a document

and subtracting from that product the number of syllables in sentences divided by the number of words:

$$\text{Score} = 206.835 - (1.015 \times \text{Average Sentence Length}) - (84.6 \times \text{Average Syllables per Word}).$$

Flesch then correlated the resulting score to reading grades and to the estimated percentage of the US adult population capable of reading at those grade levels. A score of 0-30 designated a document readable only by college graduates, while a score in the 90-100 range was readable by a fifth grader, and, by extension, readable by over 93% of American adults, by Flesch's reckoning (Flesch, 1974). While Flesch's formulas tend to be widely invoked by teachers of technical writing, Gunning's later Fog Index (Gunning & Kallan, 1994) is simpler and, as a result, more commonly used:

$$\text{Grade Level} = .4 (\text{average sentence length} + \text{hard words of more than two syllables}).$$

The most obvious problem with Gunning's Fog Index lies in its definition of difficulty by, again, the most observable and quantifiable elements in the sentence: lengths of words and sentences. However, the number of syllables in a word is not a reliable gauge of its difficulty. For example, *praxis* and *model* have the same number of syllables but few fifth graders would have a nodding acquaintance with *praxis*, for all its two-syllable length. These rough gauges are suitable as a quick-and-dirty means of assessing the grade levels required for readers to comprehend a text, and educators have relied on them for sorting reading materials into grade-appropriate categories (DuBay, 2004). But, as guidelines for writers aiming to produce easily readable documents, readability formulas are highly inaccurate, accounting for only a fraction of the features of texts readers must

process to comprehend their contents. In fact, followed faithfully, the writing guidelines that have evolved directly from readability formulas advocate practices that lead to less-than-stellar writing. Since readability guidelines fix the optimal sentence length between 17 and 24 words, writers adhering faithfully to these guidelines can churn out sentences of nearly uniform length and rhythm, leading to monotonous and even soporific writing (Sides, 1981).

The Three Stages of Reading

Unfortunately for readability formulas, as a communication channel, writing is a veritable iceberg: word and sentence lengths are only the top-most, visible layer of a considerable process that remains beneath the surface. During the 1980s and 1990s, the burgeoning field of Artificial Intelligence (AI) led researchers to scrutinize the cognitive processes involved in reading, initially as part of an effort to build a computer capable of, among other things, reading written text. While this effort yielded mixed results, AI brought unprecedented focus to the act of reading, leading researchers to study the different phases of reading by testing readers' reactions, recall, and reaction times to individual words, sentences, and paragraphs.

Reading, these studies revealed, consists of at least three distinct phases of cognitive processing. The first level, lexical processing, begins when readers recognize individual words and assign them a fixed meaning based on familiarity with the word from prior encounters. Using eye movements called *saccades*, scientists have tracked the length of time our eyes stop or fixate on individual words and linked it with EEG activity, measuring the amount of brain activity or *cognitive load*, involved in identifying a word.

Skilled readers pause on words for as little as 300 milliseconds, a mere fraction of the blink of an eye (Posner & Pavese, 1998; Perfetti, 1999). But the speed of our eye movements depends entirely on the context surrounding the word. The more specific the context, the more constraint those surroundings put on the individual word, and the fewer meanings we're likely to attach to it (Huckin, 1983; Perfetti, 1999). Since most languages tend to assign multiple meanings to a single word, even the meanings of individual words are never completely certain. But readers can identify word meanings more readily based on their function and position within the sentence structure. For example, many words in English boast multiple functions as different parts of speech: *writing* can act as a noun, verb, or even an adjective, as in *I'm writing* [verb] *this writing* [noun] *on a writing* [adjective] *tablet* or *The rebel* [noun] *rebels* [verb] *by giving a rebel* [adjective] *yell*. By identifying whether *rebel* is a noun or a verb, readers make the meaning of the word more recognizable, as well as more determinate.

This interdependence between the meanings of words and their positions in sentence structure inextricably links the first and second levels (Michael, Keller, Carpenter & Just, 2001). Readers make sense of words during the second, or syntactic, phase of processing the same way they make recognize words on the page, by using surrounding words to anticipate how the sentence will structurally play out (Perfetti, 1999). We tend to anticipate what we're most likely to see in the context, so readers of English expect to see the main noun of any sentence before they encounter its main verb. Moreover, readers expect to see the verb relatively early in the sentence, since verbs in English tend to occur soon after the subject, rather than toward the ends of sentences (Pinker, 1994; McWhorter, 2001). For the average sentence in standard written English,

the default mode is *subject-verb-object*, usually occurring in the early portion of the sentence, excepting rare constructions like the periodic sentence, where the verb appears toward the end of the sentence. For this reason, sentences that defy readers' standard expectations about sentence structure are difficult to process and frequently require re-readings (Norman, Kemper, Kynette, Cheung & Anagnopoulos, 1991). For example, a student in a post-graduate writing course I teach at Florida's College of Medicine submitted an article with a sentence that puzzled other members of class:

Thirteen of the 27 genes significantly up-regulated at short reperfusion but not at long reperfusion encode for known transcription factors or inflammatory cytokines, suggesting roles in gene transcription and regulation at this early reperfusion time point.

The sentence required at least two re-readings because it played off expectations that the first likely culprit for the sentence's main verb would arrive early in the sentence, not far behind the sentence's subject. Instead, the sentence physically and literally led readers down the garden path—linguists' term for sentences that invite us to project onto them the wrong sentence structure. Members of the class batted onto *up-regulated* as the sentence's verb, a tactic that played out beautifully until the readers hit *encode*, the sentence's real main verb. But in this instance, the arrival of the real verb, *encode*, promptly destroyed that prediction and made a hash of readers' comprehension of the main part of the sentence: its subject and main verb. This development required them either to soldier on to the end of the sentence, attempting to make sense of it, and then to reread the sentence, or to begin the sentence over again with a different prediction of its

structure. The rereading and new prediction revealed that *up-regulated* was actually part of a modifier referring to *genes*—not a verb at all.

While not terribly common, garden path sentences reveal several key features of readers' word- and syntax-level processing. First, the meanings of words are closely linked with their situation within any sentence's structure. *Up-regulated* as a verb is a rather different animal than *up-regulated* the modifier, despite the verb's seemingly narrow and highly technical use in a paper on genes and lung transplants. Efficiency and clarity in writing, as in most forms of communication, result when writers and readers rely on the same sets of expectations. We process sentences most efficiently, requiring less brain activity and less time for reading, with only brief eye fixations, when the sentence conforms to our predictions, as when words that look like verbs, also act like them. Prediction is, after all, not only a key element in the process of reading but also a typically uni-directional affair. Readers must backtrack in sentences whenever their predictions about word meaning and sentence structure fail to play out. But reading, like prediction, should also be uni-directional. Reading requires a substantial cognitive load merely in completing the process of identifying, predicting, and confirming (Michael et al., 2001). Reading is only efficient when the process is forward-looking, not bogged down in backtracking, especially since the process also requires a further step, linked to word- and sentence-level predictions.

To actually comprehend, assimilate, and recall written language, readers rely on a further phrase in the reading process: inference building (Kintsch, 1992; Zwaan, Langston & Graesser, 1995). Words on the page, after all, act as signs, referring to something beyond mere text—and not simply the concrete objects or even abstractions

they represent but declarations, propositions, and complex arguments about ways of perceiving the world. To achieve this leap, the reading process must encompass inference processing to convert nouns and verbs into actions, abstractions, and theories. Consider, for example, the demands placed on us when we read even the short sentence, *Information wants to be free*. To make sense of this sentence, we have to envision a scenario, one that involves identifying exactly what *free* means: does it mean liberated, as in *free of boundaries*, or does it mean without cost, as in *free of charge*? If the sentence is embedded in a discussion of the information economy, both interpretations are likely to be true. But if we read this sentence embedded in a paragraph, as it originally appeared in Stewart Brand's *The Media Lab: Inventing the Future at MIT*, in a discussion involving the value and costs of information, then we fix on *free* as meaning *without cost*.

As even this simple example illustrates, all three phases of processing interact seamlessly. Once readers identify the words and their meanings, relative to their role in the sentence's structure, they have to confirm their accuracy by also measuring these identifications against the contents of their long-term memories (Just & Carpenter, 1987; Perfetti, 1999; Michael et al., 2001). Specifically, readers access long-term memories to verify what they read against what they know of the world. According to some theorists, we build inferences by drawing on our long-term memory to compare the sentences we read to what we know of the world around us, relying on as many as five categories to turn sentences into scenarios: time, space, actor, cause, and intention (Zwaan et al., 1995).

Consider, for example, the inferences readers must make to comprehend this sentence:

The slackening of demand for business air travel, coupled with the rising costs of fuel, have put extraordinary demands on our company's finances. With regrets, we must begin staff reductions.

Nearly everyone reading these two sentences would automatically assume that the second sentence results from the conditions described in the first. While these two sentences have no linguistic or logical links that make explicit any causal relationship, readers almost invariably see a causal linkage. Readers assume that sentences that follow each other contain events that also follow each other, what cognitive psychologists dub *the iconicity assumption* (Fleischman, 1990), which involves our assuming that sentences represent events in a rough approximation of the way events occurred. Moreover psychology studies long ago established the centrality of cause and effect to human perception (Heider & Simmel, 1944; Michotte, 1963), observing the ability to detect cause and effect in infants as young as six months (Leslie and Keeble, 1987).

But even if someone had supplied instructions to us about time and space and intentions in asides as we read—like “Businesses tend to downsize when their finances begin to head south,”—we’d fail to grasp what the sentence meant unless we had some knowledge about the interaction between operating costs, industry trends, and a company’s ability to stay afloat financially. Even something as central to our perception as causation needs to be embedded in a context to be comprehensible. For this reason, readers need something cognitive psychologists call “schemas,” to comprehend just about anything they read (Schank & Abelson, 1977; Rumelhart, 1986).

Schemas: No Such Thing as an Immaculate Perception

Both syntactic and inferential levels of processing rely on frameworks for understanding, known to cognitive psychologists as *schemas*. Schemas are the building blocks of comprehension, patterns that enable us to make sense of what we see and hear, even directions on how we should act in specific situations. Significantly, schemas tend to be focused on default conditions—the standard configurations, features, and outcomes that tend to characterize an object or scenario. For all their helpfulness in enabling us to perceive the world, understand what we see, and act on it, schemas nevertheless remain fairly blunt instruments that require us to make inferences. In a sense, schemas act like inference-generators that establish our expectations for how a situation or transaction will play out (Rumelhart, 1986). Schemas lay out possibilities for actions and interpretations, and we make inferences about the way sentences will play out based on our understanding of the larger context (Schank & Abelson, 1977). But schemas also provide us with a feedback loop. We can also confirm the accuracy of the schema we've unconsciously chosen to guide our interpretation of an article in *The Harvard Business Review* by checking the way it fits with the local details we encounter at sentence level. Schemas can even intervene in our syntax-level processing, guiding us to glom onto the first suitable candidate for a verb—as in the *up-regulated* garden path sentence above—based on our experiences in previous encounters with millions of sentences (Kintsch, 1992). As a result, a familiar schema can speed our comprehension at all three levels of the reading process: word-, syntax-, and inference-processing.

Readability Outcomes, Not Formulas

After the heyday of AI drew to a close, the reading process was studied afresh by cognitive neuroscientists, this time using technology like electroencephalograms (EEGs) and functional MRI (fMRI) scans. Over the past fifteen years, researchers have wired test subjects' scalps for EEGs, capable of measuring the brain's responses to written text in microvolts, as well as in milliseconds (ms), necessary for capturing processes that can take as little as 200 ms (Posner & Pavese, 1998; Perfetti, 1999). More recently, researchers have measured blood flow in the brains of reading subjects with fMRI scans that provide better resolution of the reading brain than EEGs but which also lack the sensitivity to time notable in EEG studies (Smith, Jonides, Marshuetz & Koeppel, 1998; Friston, 1998; Perfetti, 1999).

Word choice and determinacy

Together, studies by Garnham, Oakhill, and Johnson-Laird (1982), Brown and Fish (1983), Kemper (1983), Zwaan (1996), and Just et al., (2004) reveal the reading brain tends to process certain classes of words, types of sentence structure, and even paragraph organization more rapidly and efficiently than others. On the lexical level, Brown and Hagoort (1993) discovered that unfamiliar words or words with multiple meanings considerably slowed cognitive processing. Conversely, the more constraint both context and sentence structure place on a word, the more efficiently readers processed the text by recognizing words more rapidly. Readers dealing with highly familiar words or words constrained in their meaning apparently proceeded directly to identifying and fixing the

word's meaning, eliminating the need for either semantic analysis or retrieval of memories of earlier occurrences of the word (Kutas and Van Petten, 1994; Perfetti, 1999).

Subject-verb-object syntax

Similarly, on the syntactic level, studies have suggested that readers rely on deeply embedded syntactic preferences (Ferreira and Clifton, 1986; Pinker, 1994; Britt, Perfetti, Garrod and Rayner, 1992; McWhorter, 2001.). Written English, with its subject-verb-object order, tends toward sentences that unfurl after the introduction of the main subject and verb, where readers accustomed to this default structure can more easily process embedded phrases and clauses. For this reason, readers of English also tend to struggle to process what linguists call *left-branching sentences*, sentences that load information before the subject or embed the subject in a series of phrases and clauses. Sentences like this example, which recently appeared in *The New Yorker*, tend to require rereading so readers can correctly identify the sentence's syntax to ensure they understand the propositions the sentence offers:

What those of us who know Agee's criticism almost by heart read over and over, however, is the reviews that appeared in The Nation (Denby, 2006).

In *The New Yorker* example, the sentence is complicated by the opening—where readers would expect to spot the grammatical subject—featuring two prepositional phrases and an adjective clause, all embedded in a lengthy noun clause acting as the sentence's true grammatical subject. Readers are likely to seize on *what* as the subject, waver over

assigning primary verb status to *know*, then revise that syntactic guess upon reaching *is*. This particular example is rescued from garden path-dom by the presence of *is*, immediately recognizable as one of those rare English words that always function as a verb. In this particular sentence, however, the presence of *is* seems anomalous, a mismatch with the subject, since the clause is both lengthy and detailed—suggesting a plural rather than singular subject—and remote from the verb, both conditions that make difficult recognizing the correct form of the verb as plural or singular.

In numerous EEG studies, reading subjects struggled with syntactic arrangements that made fixing lexical meaning difficult. Readers tend to process subject-verb-object sentences rapidly and efficiently, projecting that the subject will precede the verb and the object will follow it. In syntactically complex or anomalous sentences, however, reading slows down considerably and EEGs attest to increased activity until the readers detect the syntactic pattern (Hagoort, Brown & Groothusen, 1993). However, even when longer and more complex sentences unfold according to English's default subject-verb-object order, the greater the sentence complexity, the greater the activation detected by EEGs of the cortical areas involved in processing language (Just, Carpenter, Keller, Eddy, and Thulborn, 1996). Just and his colleagues (1996) attribute these results to the greater cognitive overhead involved in processing the sentence, requiring the activation of more neural tissue, fostering a higher intensity activity.

Causation and schemas

At the same time cognitive neuroscientists were gaining glimpses into what had been reading's black box, cognitive psychologists were discovering sentence-level features

that made for sentences capable of being read more quickly and recalled more accurately than control sentences. While researchers over forty years ago established the importance of causation in human perception (Michotte, 1963; Leslie and Keeble, 1987) studies have more recently attested to this tendency in readers interpreting sentences in terms of implicit causality (Brown and Fish, 1983). When readers encounter sentences where either overt or implicit causality is present, their reading times speed up, with processing speeded up still further by the presence of verbs that concretely attribute causality to a character in the sentence (Green & McKoon, 1995). Further, studies have repeatedly established that readers tend to rely on the iconicity assumption in processing sentences (Zwann et al., 1995). As a result, the more events in the written text obviously deviate in the order of telling from the chronological order of the events they represent, the more difficulty readers experience in comprehending the text. The more clearly the sentences indicate connections between elements in time, space, intention, or causation, the better readers' comprehension of the sentences (Zwann et al., 1995; Zwaan, 1996).

Priming, primacy and recency

Similarly, two well-established elements in working and long-term memory can also considerably boost the readability of any document. One important element, priming, involves initially exposing readers to words briefly then testing their recall of the words in later, more detailed reading (Park, Gabrieli, Reminger, Monti, Fleischman, Wilson, Tinklenberg & Yesavage, 1998; Wagner, Stebbins, Masciari, Flesichman & Gabrieli, 1998; Vernon & Usher, 2003). Researchers have discovered two especially significant features of priming. First, the effects of priming are equally strong for both normal

readers and for readers with damaged to the hippocampus and other structures involved in memory and recall, including amnesiacs and patients with Alzheimer's (Park, Gabrieli, Reminger, Monti, Fleischman, Wilson, Tinklenberg & Yesavage, 1998; Wagner, Stebbins, Masciari, Flesichman & Gabrieli, 1998). These studies and others (Basqué, Sáiz & Bowers, 2004) suggest that priming may affect both implicit and working memory. Second and perhaps more significantly, readers' recall of material in priming studies (Nicolas, 1998) existed independently of their comprehension of the text itself.

Surprisingly, given its prevalence in psychology studies of reading for over thirty years, priming has received little attention in studies of reading, cognition, and comprehension (see, for example, Huckin, 1983; Kintsch, 1992; Perfetti, 1999). Actually, the implications of the priming effect for reading are considerable, suggesting that the introduction of key words in a text at the outset of a paragraph will enhance readers' comprehension of the entire paragraph. Further, the repetition of key words central to a topic throughout a paragraph might easily also boost readers' sense of continuity between sentences, thus making more accessible the schemas necessary for comprehending the meaning of the paragraph (Rumelhart, 1986; Kintsch, 1992; Perfetti, 1999).

The second element in long-term and working memory involves primacy and recency. Studies in readers' recall of specific words in a text have long established that readers tend to display the most accurate and longest duration recall when readers remember items that occurred at the beginnings and the endings of sentences, lists, or paragraphs (Andre, 1975; Huang, 1986). In fact, Huang (1986) found an increased effect for primacy and recency when readers recalled nouns, rather than verbs or other parts of speech. Here, too, the implications for written communication are considerable, but only

a few scholars on writing (Williams, 1990) have incorporated them into principles for effective writing. However, the effects of priming, coupled with those of primacy and recency suggest enhanced recall for the contents at the beginnings of paragraphs, where writers should introduce the main premise for the paragraph, as well as its key terms. The recency effect also suggests that brief summaries, covering the salient points and terms in a paragraph, may work particularly well in assisting readers' comprehension and recall of particularly complex paragraphs. Furthermore, the principles of primacy and recency in recall also offer significant implications for the length of bulleted items or lists. As readers tend to retain a strong recall of only the first and last few items, writers should limit the lengths of lists to no more than seven items, as additional items will simply fall beneath readers' radar. Finally, writers can also take advantage of the unstressed areas in sentences and paragraphs to introduce details that they know will elicit negative reactions from their readers (Locker, 1999). For example, in negative letters, managers should situate the most negative elements in the second or later paragraphs, placing the unwelcome message, if possible, in a dependent clause in the middle of the paragraph.

Formulas vs. Outcomes

Given the complex and comprehensive scope of the data on the cognitive process of reading, we can only wonder that readability formulas, with their simplistic insistence on syllables and sentence length as the sole determinants of readability, hold any currency whatever. Actually, these formulas remain mainstays in books on business writing (Gunning & Kallan, 1994; Fugere, Hardaway & Warshawsky, 2005) and the central weapon in the arsenal of many writing consultants (DuBay, 2004). The reasons

for this anomaly—the co-existence of formulas that treat reading as an impenetrable black box with a plethora of neuroimaging studies on the reading brain—are many, including the tendency of scholars on writing to reproduce the tenets offered in earlier articles and textbooks (Knoblauch & Brannon, 1984), as well as the reluctance and, more commonly, the out-and-out inability of humanities scholars to read and understand clinical data.

Ultimately, writers in organizations need to focus on readability outcomes, rather than readability formulas. Readability outcomes, as demonstrated by over twenty-five years of studies of reading, include the speed with which readers can read sentences or documents, the efficiency of cortical activity, and the accuracy of recall. Speed almost invariably depends on readers' recognition of familiar words, words which have relatively fixed, determinate meaning. Speed and efficiency in reading also depend on the amount of cortical activation required to process sentences, which grows in relation both to length and complexity of sentences but also to the extent to which sentences deviate from the default subject-verb-object order of written English. Readers also process sentences swiftly and efficiently, and display better recall when sentences clearly flag relationships between elements, and when events in the text correspond to the chronological order of the events they represent. When events display causal relationships or activate schemas (Kintsch, 1992), reading times decrease, while recall increases in accuracy. By carefully assembling the disparate features of sentences and documents represented in dozens of studies of readers and texts, we can arrive at principles for writing clear and effective prose that reflect the types of words, sentence

structures, and paragraph organization that lead to written communication which readers process swiftly and efficiently, and which they also remember with relative ease.

Writing for Optimal Readability

Collectively, this body of research points toward a comprehensive set of guidelines for writing in management communication. Given what we now know about the act of reading, educators, managers, and editors are no longer restricted in their advice to matters of audience and context or to the old Keep It Simple credo, which might have some usefulness during the editing stage but which offers little in the way of tangible directives to employees struggling with a rough draft of a policy statement. Instead, writers can gain guidance on choosing words and structuring their sentences by relying on principles indicated by fifteen years of neurocognitive research on reading:

1. Prefer familiar to less commonly used words and concrete words to abstractions.
2. To aid in readers building inferences, use an actor or tangible object as your grammatical subject and use action, rather than passive, verbs.
3. To aid in readers identifying syntax, place your grammatical subject and verb as close to the beginnings of sentences as possible. If you need to modify a word, try to introduce phrases and clauses after the main verb.
4. Keep subjects and verbs as close together as possible.
5. Limit lists of words or bulleted items to no more than seven items.
6. Use transitions between sentences that make tangible the connections between sentences.

7. Avoid varying your word choice, particularly when using key terms in a paragraph. Instead, use key terms at the outset of sentences when possible, which will aid readers' comprehension of the text.
8. Introduce the primary topic in each paragraph at its outset, immediately enabling readers to access schemas that help them make sense of the paragraph.
9. Summarize the primary premise of complex paragraphs in a sentence at the end of the paragraph, where readers will recall its contents best and for the longest duration.
10. Place negative information in non-stressed positions in sentences and paragraphs, preferably in dependent clauses in the middle of a paragraph that follows the opening or later paragraphs.

These principles fail to exhaust the implications of the growing body of neurocognitive research on reading. However, these guidelines can help educators, managers, and employees take concrete, relatively simple steps to making written communication highly readable. After all, reading is no longer the black box it once was.

NOTES

1. Despite the establishment of plain language laws in California, many of the state's statutes and codes remain unreadable to all but lawyers. A typical example is California Penal Code, Chapter 1.5, Section 631(a):
Any person who, by means of any machine, instrument, or contrivance, or in any other manner, intentionally taps, or makes any unauthorized connection, whether physically, electrically, acoustically, inductively, or otherwise, with any telegraph or telephone wire, line, cable, or instrument, including the wire, line, cable, or instrument of any internal telephonic communication system, or who willfully and without the consent of all parties to the communication, or in any unauthorized manner, reads, or attempts to read, or to learn the contents or meaning of any

message, report, or communication while the same is in transit or passing over any wire, line, or cable, or is being sent from, or received at any place within this state; or who uses, or attempts to use, in any manner, or for any purpose, or to communicate in any way, any information so obtained, or who aids, agrees with, employs, or conspires with any person or persons to unlawfully do, or permit, or cause to be done any of the acts or things mentioned above in this section, is punishable by a fine not exceeding two thousand five hundred dollars (\$2,500), or by imprisonment in the county jail not exceeding one year, or by imprisonment in the state prison, or by both a fine and imprisonment in the county jail or in the state prison. If the person has previously been convicted of a violation of this section or Section 632, 632.5, 632.6, 632.7, or 636, he or she is punishable by a fine not exceeding ten thousand dollars (\$10,000), or by imprisonment in the county jail not exceeding one year, or by imprisonment in the state prison, or by both a fine and imprisonment in the county jail or in the state prison.

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