The edges of words

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Where does a word *start* and where does it *end*, what are its boundaries, its limits, where and what are its *edges*?

One might most readily — at the outset — construe this question as relating to the *meaning* of words. From this viewpoint, the 'edges' of words may refer to points at which the meaning of a term shades off or 'falls off' (those places at which we would write, utter, or use a word tentatively, with hesitation, unsure of the soundness or correctness with which we do so) or, especially, as concerning the *connotations* of words. And, indeed, even a brief consideration indicates that there are many points of connection between the notion of connotations and the 'edges' of words — many apt conjoinings are possible. For instance, we may see connotation as relating to those aspects or qualities that 'give the edge' to a particular word, giving the word priority or preference over another word which, although it may be quite close in meaning, yet subtly fails or falls short relative to the preferred word. Connotations may also be seen as at 'the edge' of words because they are most likely to be in contact with, or near, other words and other ideas and notions; here connotations are those relations, attributes, and intimations which, through nearness in time, place, or other modes of association, come to adhere to a word. This sense of the connotative meaning of words as growing outward through associations is most acutely and one might say *accumulatively connoted* by Roland Barthes.[1] In addition, and from a somewhat broader perspective, connotation may itself be considered peripheral (and thus on the edge) of the science of language. Beatriz Garza-Cuarón (1991) in her extended study *Connotation and Meaning* refers repeatedly to this not-at-the-center treatment of connotation: 'In linguistics, the problem of connotation presents itself only on the periphery of theories of meaning. … Linguists find connotation, like any other peripheral phenomenon, most difficult to study and to schematise …' (Garza-Cuarón 1991: 3) and, elsewhere, 'there is a tendency to base the analysis of meaning on the nucleus of the subject. In other

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words, only terms that can function as nuclei of the subject — nouns or nominalised forms — are used in a description of meaning' (Garza-Cuarón 1991: 122).[2]

Yet, plentiful and inviting as these many possible directions are, my focus here — 'on the edges of words' — will not be on connotation, nor (in the first place) on meaning. Once conceived, the notion of the edges of words simply would not itself 'stay put' with this first (possibly more obvious) nucleus of meaning.[3] The edges pulled outward — the question of where, and what, are the edges of a word seemed to demand (or recruited into itself) considerations of the physical form of words: *visually* — their orthography, their appearance and placement on the page (how Does the use of the Uppercase versus lowercase letter Format affect how you read, Perceive and process a word?), and also *auditorily*, and *temporally*, as a word 'unfolds' over (in) time as it is spoken and perceived and apprehended in a listener's mind. The notion of 'the edges of words' provokes multiple questions concerning the effects and role of a word's *physical* beginnings and endings: a word's placement within a sentence or in a line of verse (The first and last words of a sentence or line have different edges than those embedded in the middle of the sentence.), and in relation to adjacent (preceding and following) words and punctuation. For example, what should we (or can we) make of Emily Dickinson's extensive use of the dash? How do dashes — those straight, horizontally elongated adjoiners of the edges of one word or set of words with another — work? Or commas, and colons, and hyphens? Also, given that words that are heard (perceived through sound) can neither be heard, nor comprehended, 'all at once' — what effect does this have on the process of understanding the word? Have some of these aspects regarding the concrete, embodied physical edges of words — like those of connotation — *also* been neglected?

Thus here I concentrate on (one might better say: circumnavigate or circumambulate) the *physical* edges of words, where those edges may assume multiple modes: written, visual, auditory, articulatory, temporal. More specifically, although I will draw on literature and poetry as sources of examples, I will chiefly draw on empirical research, particularly in cognitive psychology, cognitive neuropsychology, and related fields, relating to how we perceive, comprehend, and produce the beginnings and endings of words. (The 'top' and 'bottom' edges of visual word forms and associated graphic symbols, such as commas and ellipses, will also be considered.) Within this notion of the physical edges of words, I roam rather freely (and not necessarily exhaustively) but especially attempt to consider aspects which may have been relatively less often given direct treatment in domains outside of psychology.

The edges of spoken versus written words: Temporality, spatiality, and the eye

At least initially, there appears to be a marked contrast between the readiness, clarity, and assurance with which we may identify those units that we refer to as 'words' in their *written* or *printed* form — as visuo-spatial 'entities' — compared with how readily we may do so for their *spoken* or *auditory* manifestations. In written form, the edges of a word — where it begins, and where it leaves off — seem to be relatively clearly signaled: words on a page are stationary and, at least in English and European languages, are spatially distinct units, set apart from one another by fairly uniform spaces, and (typically) neatly aligned in larger arrays of lines, paragraphs, sections, pages. …

By contrast, although, under normal (non-noisy) circumstances, we usually experience little difficulty in understanding *spoken* words, we nonetheless seem to know, from various experiences such as exposure to speech in an unknown language or attempts to verbally communicate under noisy conditions, of the possible sources of difficulty in perceiving and identifying the beginning and endings of words in *auditory* form. Thus, we are not likely to be surprised at the enumeration of several sources of variation that may contribute to the difficulty of auditory segmentation, such as co-articulation (the influence of adjacent, preceding or following, speech sounds on how we articulate a given portion of a word, including a word beginning or word ending), or contextual determinates of pronunciation. (An especially telling example [Kennedy 1984] is how we say the initial portion of the words *photograph* versus *photography* — words that differ in only one ending letter):

> The acoustic properties of the basic, linguistically defined speech unit, the phoneme, vary across speakers, speaking rates, and phoneme contexts. The speech signal, produced by fluent speakers, is nearly devoid of any segmentation clues and the temporal structuring of speech provides little, if any, information pertaining to word onsets and offsets. Furthermore, listeners must be able to understand spoken language under a wide range of signal presentation rates as the speaker, rather than the listener, controls the rate of signal presentation. (Inhoff and Connine 1995: 73)

Yet, the sharpness of this distinction between written and spoken formats may derive from a subtle difference in focus. In the case of the spoken word, given our difficulty in pointing to a *physical entity* alone (we generally have nothing concrete to point to that corresponds to the spoken word, unless we have audio-recording equipment and also a means of visualizing speech sounds), we tend to focus on the perceptual *processes* of articulation and hearing. In the written case, the apparent 'clarity of separateness' of the visual printed word is also, in fact, quite deceptive, focused as it is, on words on the *page*, but not yet as perceived, or comprehended, by a *reader*. The actual process of reading, and especially the eye movements and associated perceptual and cognitive processes involved in reading, introduces several sources of spatial and temporal variability: variable movements in space ('saccades'), more or less prolonged pauses ('fixations'), and more or less extensive forward and backward looks.

Many of these factors are attributable to the structure of the retina, particularly the restriction of high-acuity vision to a small region of the fovea and adjacent parafovea:

> The visual signal, in the form of letter and word sequences, is projected onto a retinal structure with vast differences in visual acuity. High-acuity vision is confined to a small concentric area that is projected onto the fovea and adjacent parafovea. At a typical eye text distance of approximately 40 cm and a font size of 10 characters per inch, approximately 3 to 5 horizontal character spaces to the right and left of a fixated character space, and adjacent character spaces on lines above or below the fixated character space, are projected onto the fovea and adjacent parafovea. Within this range, fine grained letter discrimination is possible as needed; for instance, when *house* is to be distinguished from *horse*. However, even within this area, there is a distinct center-to-periphery acuity gradient, with highest acuity for the directly fixated letter. (Inhoff and Connine 1995: 74)

To acquire detailed visual information concerning text — individual words, letters, spaces, punctuation — that is situated beyond the fovea and near fovea, the reader must move his or her eyes. Rather than a strictly linear, regular, and orderly progression across the page, the visual process of reading is comprised of multiple and variable periods of rapid movement (saccades), interspersed with (more or less long) periods of comparative stability or fixation. The saccades may be longer or shorter, terminating at more or less ideal locations within a word (spaces are rarely fixated), and most often move forward, but occasionally return to earlier portions of the text.

The mechanisms controlling eye movements are essentially ballistic: the information determining where the eye will move must be available before the movement occurs (whether from the visual field, or from internal commands) because, while the eye is moving, the visual information is changing so rapidly that there is essentially no room for effective input at all. When combined with the limited resolution of the eye for stimuli beyond the point of current fixation, this leads to clear limits on the types of information that may guide eye movement. Empirical evidence points to a key role for the physical edges of words in providing such guidance (in part because letters bounded by spaces are more perceptible, e.g., Jacobs 1987):

> The most potent source of influence over the size and direction of eye movements is the physical length of words lying to the right of the currently fixated word. In normal careful reading the eyes tend to move slightly to the left of the centre of the next available word. Very few eye movements fall on the spaces between words. Some small words may be passed over without being inspected at all. … but … these word-skipping effects are relatively rare and are confined to a few, very frequent, short words (for example, the word *the*). We may conclude that if a text is unfamiliar, or is being read for the first time, the most significant source of control over the direction and extent of eye movements is the physical length of words yet to be read. (Kennedy 1984: 126–127)

Visual fixations in reading typically last about 250 ms; between fixations, saccades take on the order of 20–50 msec and, for English text, typically span some 8–9 characters, yet there is also considerable inter- and intra-individual variability. For example, within a given reader, individual fixations may last from less than 100 msec to over 500 msec and saccades may span from only 1 to as many as 15–20 characters (Rayner, Raney, and Pollatsek 1995) and, although most readers may fixate longer on end-of-sentence words, or on novel words, not all readers show these patterns (Just and Carpenter 1980). In even the most skillful of adult readers, looking back comprises between 10% and 15% of all eye movements. This looking back tends to be highly focused or direct, and is unlikely to be supported by visible features of the page (which are relatively few at fixation), so most likely derives from internally generated control. Fixations that are not 'optimal' (in the center of the word for short words and slightly left of center for long words) have a cost: non-optimally fixated words are named less quickly than optimally fixated words; also gaze durations may be shorter for optimal locations, and lead to fewer re-fixations (e.g., Rayner 1979; McConkie, Kerr, Reddix, Zola, and Jacobs 1989).

Substantial insight regarding the nature of what is 'seen' and 'used' during ongoing reading has been obtained through what has been called the 'moving window' paradigm. In this paradigm (e.g., McConkie and Rayne 1975, 1976; Rayner, Well, and Pollatsek 1980), text at the center of the reader's current fixation is displayed normally, but text at nearer or farther distances from fixation is altered or mutilated so that this not-currently focused text is replaced — in synchrony with the reader's eye movements — by 'nonsense' text, or other letters. Consider, for example, the following five lines of text:

(1) Graphology means personality diagnosis from hand writing. This is a
(2) Cnojkaiaxp wsorc jsncaroilfp bloqraele tnaw kori mnlflrz. Ykle le o
(3) Cnojkaiaz*y means personality diagnosis from hand w*nlflrz. Ykle le o
(4) Cnojkaiaxp wsorc jsncaroi*ity diagnosis from hand w*nlflrz. Ykle le o
(5) Cnojkaiaz*y means personality diagn*aele tnaw kori mnlflrz. Ykle le o

Experiments using the moving window technique have shown that the *perceptual span* in reading — the region on the printed page from which useful information is acquired during any one visual fixation — is markedly *asymmetric*, typically extending considerably farther to the right (up to a maximum of about 15 characters) than to the left (typically a maximum of about only 4 characters, and confined to the currently fixated word). Thus, assuming that the participant's center of fixation was on the letter '*d*' in the word *diagnosis*, the typical 'perceptual span' in reading is that shown by the italicized portion of the fourth of the above sentences (from McConkie and Rayner 1976: 366), which show (1) the original text, (2) the altered or mutilated line that would be displayed at a point when the region of text was completely beyond the (moving) perceptual span of the reader, (3) a centered window (assuming the 'd' of diagnosis as the center point), (4) a right-shifted window, and (5) a left-shifted window. (In this instance the letters of the text not within the window were replaced with letters that were visually similar to the original letters, using empirical evidence from studies of visual 'confusability' [Bouma 1971]).

This direction of asymmetry is found for readers of English text. Subsequent research has demonstrated that readers of Hebrew, when reading *English*, show a similar right-shifted asymmetry but, when reading Hebrew — a language read primarily from right to left — show asymmetry in the opposite direction (i.e., toward the left, Pollatsek, Bolozky, Well, and Rayner 1981), as also do readers of English who are (experimentally) required to read from right to left. These observations suggest that the asymmetry is not a general effect of reading in a particular direction, nor an outcome of differences in hemispheric specialization of the brain for language processing, but rather reflects directionality regarding where the eyes will next fixate; this, in turn, may relate to covert shifts of attention in the corresponding direction (see Henderson and Ferreira 1990, for review). The magnitude of the window — some 15 to 20 characters — also implies that the region of text from which effective information is acquired during any one fixation will usually contain only on the order of three or four words — rarely sentences, and often not even complete phrases.

On most visual fixations readers typically identify the word they are currently fixating, and also extract some information regarding the word to the right — a 'parafoveal preview' that may help to shorten the fixation time later accorded it. Extraction of the initial and ending letters, and information about word length, may prove especially facilitatory because, taken together, this information may greatly reduce the number of possible candidates for a word. For example, based on an examination of all words comprised of 4 to 13 letters in the Kucera and Francis (1970) word frequency norms, O'Regan (1979: 502; cf. Inhoff and Connine 1995) found that 'knowledge of a word's first and last letters and its length decreases the number of possible choices to less than 19 words 75% of the time'.

An experimental manipulation of parafoveally previewed information reported by Briihl and Inhoff (1995) yielded outcomes consistent with O'Regan's observations. Parafoveal preview information was manipulated using the 'moving window' or eye-movement contingent display technique such that — prior to their fixation — parafoveal words were shown with varying portions of the pretarget word replaced by the letter 'x', thereby allowing preview of only the initial letters of the word (thuxxxx), the exterior letters (thxxxxr), the initial bigram (thxxxxx), the two exterior letters (txxxxxr), or the initial letter only (txxxxxx); a length-matched series comprised entirely of x's (xxxxxxx) provided only letter length information with no other preview information, and the intact word itself (*thunder*) provided full preview information. When the full intact target word (thunder) was subsequently fixated during reading of the target sentence, preview benefits were observed for previews to the exterior and beginning letters (initial letters were especially important) but not for the (less salient) center letters; however, the largest benefit occurred for the full preview condition, involving all letters. This suggests that there may be 'a spatio-temporal gradient in the acquisition of parafoveal information, with the acquisition of salient exterior letters preceding and constraining the encoding of nonsalient center letters' (Inhoff and Connine 1995: 83; also see Balota and Rayner 1983). Yet preview benefits are not always or uniformly obtained. For example, Henderson and Ferreira (1990) found a parafoveal preview benefit only when the preceding (foveated) word was easily recognized and easily integrated into the syntax of the sentence; preview benefits were not found for foveated words that were of low frequency or that were syntactically difficult.

Fixation duration and the length of saccades appear to be computed somewhat independently, with saccades determined by word length information acquired parafoveally, and fixation duration especially influenced by the ease or difficulty associated with processing the fixated word(s). For example, fixation times on high frequency words are briefer than for low frequency words even when the length of the words is controlled. This, too, underscores the importance of the real (actual) edges of words, because it points to a relatively short *eye-mind span* during reading (Just and Carpenter 1980, 1992): if there was a considerable delay between what the eye *yields* and what the mind *returns*, then frequency effects should not be observed for the word itself, but for a later word (if at all).

Some other (written) word edges ...

Inaudible but visible endings

Apart from the explicitly labelled 'silent *e*' that voicelessly closes many words (*quite*, *alike*, *before*, *same* ...), there are many other mute letters in English: the letter 'b', for example, in *plumb*, *bomb*, *climb*, *dumb*; the letter 'k', as in *knight*, and *knife* (the latter both begins and ends with silent letters), and the letter 'g', as in *gnaw* and *gnome* (yet another instance of a bipartite silence, ghostly before and after). Also, a word that I still recall entirely and utterly eluded me in an oral spelling test in grade-school, *bouquet* ... (Today, for you, a bouquet of mute but lovely letters ...).

Although advocates of simplified spelling would propose elimination of these silent letters so as to increase spelling-to-sound correspondence, such simplifications might also bear unexpected disadvantages; for instance, with regularized spelling, some homophones, such as *sight/site/cite*, or *aisle/I'll/isle* would become homographs: not only similar in sound, but also spelled identically. Simplified spelling might also reduce the visual similarity between pairs of words that are similar in meaning (e.g., bomb, bombard) — a form of visual similarity that, because it reflects similar morphemic structures — may enhance access to meaning (Underwood and Batt 1996).

Silent letters were here designated 'inaudible but visible endings'. Yet, in some respects, silent letters might more aptly be characterized as both inaudible and (also) *less visible* than their vocalized peers. Corcoran

(1967) found that participants who were asked to mark texts wherever the letter 'e' had been deleted were nearly three times more likely to overlook such deletions if the letter was normally silent than if the letter would be pronounced. Similar findings were reported by Corcoran and Weening (1968) who observed a higher probability of detection for the omitted letter 'k' when it was pronounced [*(k)eeping*, *(k)icks*, and *(k)itchen*, no failures to detect reported] than when it was silent [*(k)nitting*, *(k)nack*, and *(k)nots*, a total of 6 failures to detect the missing letter, despite an overall tendency to most often successfully detect missing letters at the beginning of words]. Thus, silent letters could become *invisible* — through their actual omission or disappearance from a text — with greater impunity to detection than if the letter had been pronounced. Corcoran (1966) also found that participants who were asked to cross-off or 'cancel' all instances of the letter 'e' in a passage were more likely to leave silent letters uncancelled. Taken together, these findings point to an interaction of the visual processes involved in reading and the phonological or acoustic nature of the words that are read, and suggest that where a word begins or terminates in its auditory form may (perhaps subtly) influence how it is processed in visual form.

The edges of words and uppercase/lowercase letters

Not all languages or scripts have two cases. What difference does it make that some scripts, such as English, have these protrusions, ju*tt*ings upwar*d*, and danglings below
beneath
under
down
dee*p*?

What differences arise (or befall) from these ascending and descending letters (like ladders)? In English, I now mentally count:

— 7 letters that are ascenders: b d f h k 1 t (or 9, if one counts the dots for i and j).[4]

— 5 (or 6) that are descenders: f (in writing but not printing), g, j, p, q, y.

Thus, out of 26 letters, nearly one half of the letters climb or plummet away from their horizontal textual center:

peaches, pears, plums, apples, oranges, grapes, orange, fruit, juice

Reading these words now, was your eye drawn down, then up, down, down, up … now ascending, now descending from the middle, or central, 'register line' (Elkins 1999)? Counting the number of ascending or descending letters has been used by memory researchers as a 'shallow' or 'surface' encoding task (Craik and Lockhart 1972). Participants who are asked to indicate the number of letters (if any) that extend above or below 'the' line in a set of words, when later unexpectedly asked to recall or recognize the items typically show less accurate memory for the items that were thus encoded than if they had processed the word 'deeply', for meaning rather than surface appearance (as, for instance, by indicating how pleasant peaches are). However, contrariwise, it might also be noted that studies (beginning as early as the 1920s) that have compared how quickly text is read, or searched, when the text is entirely set in uppercase letters, or is set entirely in lowercase letters, have typically found a speed advantage for lowercase letters. For example, using a relatively prolonged reading task (up to 30 minutes), Tinker (1955) found that reading times for entirely uppercase text were some 10 to 14% slower than for lowercase text — a substantial difference that prompted Tinker (1955: 444) to observe that 'few typographical variations in printing practice produce differences as large as this'. This lowercase advantage has been attributed to the presence of word-shape cues that somehow facilitate reading for lowercase words but not uppercase. (An alternative account localizes the effect more narrowly to letter shape rather than to word shape. See Healy and Cunningham 1992, for review and discussion, and also for evidence suggesting that localization to the word (or perhaps syllable) level may nonetheless be appropriate). Eye movement data (Tinker and Paterson 1939) suggest that, in reading texts set entirely in uppercase letters, participants have briefer pause durations between fixations than for lowercase text, but require more fixations, and read fewer words per fixation — thus yielding slower overall reading times.

Alterations of the original word shapes, through, for example, SyStEmAtIcAlLy or pseudo-RAndoMLY aLtErNaTiNg the lettercase, or omitting the spaces between words, or filling + the + spaces + with + other + characters, also have been found to lead to decreased reading speed among adult readers relative to that observed for normal text (e.g., Fisher 1975; Smith 1969; Smith, Lott, and Cronnell 1969; Spragins, Lefton, and Fisher 1976). (Differences in the size of the letters may play an especially important role in the disruption associated with alternating case: Smith et al. [1969] found no decrement in reading search times for words that alternated in letter case but were held constant in size.) Typographical errors, or misspellings, may also be more readily detected if the error alters the shape of the word (Haber and Schindler 1981; Healy and Cunningham 1992; Monk and Hulme 1983), although the magnitude of this difference is especially marked only for extremely frequent words, and may disappear for less frequent words. Additionally, there is considerable evidence that alterations of words or nonwords in peripheral or parafoveal vision that use substituted letters that *preserve* the overall shape of the word (its pattern of ascenders, descenders, and small letters as, for example, in the substitutions of *chart*, *chovt*, or *ekovf* for the word *chest*) result in less disruption of reading performance, as shown in subsequent fixation durations on the (now-intact) target word, than does the substitution of letters that alter the shape of the word (e.g., Rayner 1975; Rayner, McConkie, and Ehrlich 1978). On the other hand, although adults may be able to use word-shape cues to facilitate reading, word-shape cues are not necessarily the *most* helpful cues that may be used; for example, individual letters such as the beginning and ending letters of a word, may prove a more effective cue (Williams, Blumberg, and Williams 1970). Additionally, the evidence pointing to word-shape use by children who are beginning readers is less strong than for competent adult readers (Marchbanks and Levin 1965; Williams et al. 1970; see Feitelson and Razel 1984, for review).

These findings clearly implicate the 'edging-shapes' of printed words in how we process written text. However, as noted by Healy and Cunningham (1992), many critical questions remain unanswered. For example, given that some features beyond individual letters and possibly relating to overall word shape, or syllable shape, appear to contribute to word processing, at what point do they do so? During initial lexical access? During a later stage of processing, such as verification, where an earlier and less refined perceptual representation of the stimulus is consciously evaluated against a more refined representation to determine if it is sufficiently similar to a particular word (e.g., Papp, Newsome, McDonald, and Schvaneveldt 1982)? Or at a 'postperceptual cognitive-memorial stage' (Johnson 1981)? If the latter, I only somewhat sheepishly wonder: Should one always write one's love letters in lowercase?

Vertical textual neighbors

Apart from aspects of the text itself (i.e., the letters themselves) that dangle below or protrude above the central line of text, and also apart from punctuation (discussed below), one might also wonder about the words of *text* that are above and below a given — currently fixated — line: Given the concentric shape of the fovea and parafovea, do the lines immediately above and below a given line of text influence processing?

Perhaps the earliest evidence regarding this question was presented by Ulric Neisser in a conference on attention, in 1969. Neisser (cited in Willows and MacKinnon 1973) presented participants with a story that was typed in red; interposed between the (red) lines of the story, however, were black lines containing irrelevant text. Participants, who were asked to read the red story aloud and to ignore the black words, reported very little knowledge concerning what was presented in the black lines and even failed to recall words that were presented repeatedly, across three pages of text, in every one of the to-be-ignored lines. Yet — paralleling findings earlier reported by Moray (1959) using a 'selective listening' rather than 'selective reading' procedure — if the participant's own name appeared in the to-be-ignored lines, then almost two-thirds of the participants noticed it the first time that it appeared.

Does this imply that, as we read, we are (possibly quite without awareness) reading (or *re-reading*) several lines of text concurrently? For example, even though Neisser's readers showed little knowledge — as assessed by self-report — of the irrelevant text, might it nonetheless have been processed by them but (because it was of little interest, or for any of a host of other reasons) was thereafter accorded little further attention (unlike the participant's own name), and was thus also quickly (and possibly irremediably) forgotten? What if the 'black' lines contained text that was not irrelevant but highly relevant to the story? Consider the following initial portion of a passage, where you have been instructed to read (out loud) only the odd-numbered lines (shown here in regular type face), but to ignore the even-numbered lines (shown here in italics; in the original experiment, the two types of lines were shown in different colors):

> One morning a big poster outside of Oak
> *xxxxx a rummage sale folding tables*
> School told people about a basement bargain
> *xxxxx volunteers new textbooks volunteers*
> sale. Inside were long counters, on which
> *xxxx folding tables new textbooks a rum-*
> things collected by the children were displayed.

Using text passages such as this, Willows and MacKinnon (1973) found that participants (sixth-grade boys) who were asked to read such interleaved text showed no differences in oral reading errors, and no difference in reading time, compared to control participants who were not exposed to the irrelevant text; however, participants exposed to the irrelevant lines were significantly more likely, on a subsequent multiple-choice reading comprehension test, to choose lure or distractor 'answers' that had appeared in the irrelevant lines than were the control participants (e.g., selecting 'a rummage sale' in response to the question, 'What was going on in the basement of Oak School?' or selecting 'volunteers' in response to the question, 'Who had collected the things for the sale?'). A similar outcome was observed for undergraduates, and for undergraduates reading text passages where only the initial portion of each irrelevant line was set off in a different color (i.e., each irrelevant line of text was preceded by five red *x*'s). Further, when asked directly to report any of the words they remembered from the irrelevant text these readers — like those of Neisser — were most often unable to do so.

However, the use of eye-fixation records illuminates — and extends — these findings. Using eye-fixation records, Inhoff and Briihl (1991) found that these semantic effects of the text's 'vertical neighbors' entirely resulted from occasional (and presumably inadvertent) fixations on the to-be-disregarded lines; when fixations to the unattended text were excluded, there was no evidence that participants were acquiring semantic information from the unattended text. These analyses also provided evidence that most fixations on the irrelevant lines were, indeed, inadvertent inasmuch as these fixations were briefer than those for relevant lines, were generally immediately 'corrected', and did not appear to substantially disrupt either the immediately preceding or directly following fixations to the relevant text.

On the one hand, these outcomes appear to point to the need to attentionally process text (however briefly, and however free of any deliberate or conscious intent) in order for that text to have 'semantic consequences'. Yet, on the other hand, these outcomes raise a more puzzling question: given how readily semantic information may be extracted from (brief and inadvertent) fixations outside the current line of text, how is it that we, as readers, are as 'selective' (at least on the line-by-line level!) as we are? Here Inhoff and Briihl (1991; also see Inhoff and Connine 1995 for further review) point to several of the spatial factors — the precise way words appear on the page — and also accompanying eye movements, that have already been considered above:

> During reading, global spatial cues such as line assignment can be used to discriminate to-be-attended from to-be-neglected text. Given that relatively detailed spatial information (e.g., word length) can be gleaned up to 20 character spaces into the periphery … , readers may use spatial information to focus attention on a selected line of text prior to the parafoveal and foveal processing of the line's constituent words. This spatial preprocessing may serve a dual function: to insure the acquisition of semantic information from words occupying attended lines and to exclude the acquisition of semantic information from irrelevant words occupying flanking lines. (1991: 293)

Punctuation 1 — commas, colons, and semi-colons

In each of these three instances (commas, colons, semi-colons), one function of the mark (one wants to say one *intention* of the mark, giving it signifying power rather than only *use* power), is to indicate a place of pausing and (especially) of separation or segmentation of one linguistic unit from a subsequent unit.[5] Yet even if the comma, colon, or semi-colon marks a boundary point for a set of words rather than a single word, the mark itself draws near but *one* word (the last of the phrase), and so approaches its closing edge. In the typographical and cursive conventions of English, the comma, colon, or semi-colon does not (as one might imagine it could, and perhaps as it does in other scripts or languages) fall neatly *between* the phrases it separates, at the halfway or midpoint between them. Rather, it stays more nearly-by the earlier of the phrases, nearer to one particular word (or word ending) than any other word. This seems entirely fitting: if one thinks of the punctuation mark as designating a pause, then placement of the mark such that it follows very closely upon the earlier phrase, and is then itself followed by a space, eloquently provides *two* graphic indicants to segmentation rather than one; the unequally allocated space in a sense fulfills or *embodies* (with its emptiness) the designated pause.

Punctuation 2 — punctuation versus lineation

Thus, in the latter instance, punctuation and spaces agree, or cohere, together aiding the reader. However, there are also instances, particularly in poetry, where punctuation and spaces do not entirely co-occur or agree. In particular, many lines of verse may end without any punctuation — and thus may prompt questions regarding the relative weightings to be assigned to the line break or lineation (here seen as defined by space) *versus* punctuation (or punctuation combined with a line break). How should (or is) the unpunctuated line to be treated?

Although some writers have emphasized the central role of lineation in poetry as determining when pauses will occur (e.g., Hartman 1980; Turner and Pöppel 1983), empirical findings point to punctuation as the more potent causal player (O'Connell 1982). Dillon (1976: 7) analyzed the readings given by experienced teachers of literature of a passage from Milton's *Paradise Lost* (II, 604–628) and concluded that 'overwhelmingly, substantial pauses occur at points in the text(s) where marks of punctuation occur and the longest pauses at the heaviest marks of punctuation (; and .).' However, Dillon also noted that 'readers aim for at least one pause per line, usually line-final, but also line-medial' — though whether these aims can be attained may also depend on the nature of the line (pauses might be 'blocked' in the case of sequences of simple-sentence elements that resist intruding pauses).

Van De Water and O'Connell (1985) analyzed nine poems of Seamus Heaney, read by the poet in April of 1984 at Loyola University of Chicago,[6] and assessed when pauses occurred relative to both line endings and punctuation. Pauses (defined as periods of silence lasting 130 msec or more) occurred at nearly 99% of the punctuated positions in the printed corpus (53% at commas, 39% at periods). Pauses also occurred at most of the stanzas, including *all* of the punctuated stanzas, and 47% of the unpunctuated stanzas. Pauses likewise occurred at *all* punctuated line endings, but at only about 50% of the unpunctuated line-ends (excluding stanzas and final lines). Both the factor of punctuation (punctuated or unpunctuated) and the factor of position (stanza, line-end, midline) were significant in determining pause duration. However, the duration of pauses at punctuated positions was significantly greater than at unpunctuated positions. The mean duration of pauses across the six possible combinations of punctuation and position followed the pattern of punctuated stanza > punctuated line-end > punctuated midline > unpunctuated stanza > unpunctuated line-end > unpunctuated midline, with mean pause durations of 1,571 > 1,032 > 650 > 621 > 431 > 278 msec. Across the entire corpus, nearly 92% of the pause time occurred at punctuated positions. Similar outcomes were found by O'Connell in an earlier unpublished study (cited in Van De Water and O'Connell 1985) involving a large number of oral poetic performances by authors, actors, and adult readers, and also by O'Connell (1982). Based on findings with multiple readers, as well as an earlier study of e. e. cummings reading his own work (percentage of pauses at punctuated line, punctuated mid-line, unpunctuated line-end, and unpunctuated mid-line of, respectively, 100, 90, 19, and 19), O'Connell (1982: 388) characterized the emphasis accorded the poetic line in literary criticism and psycholinguistics, 'to the thorough neglect of punctuation', as 'inordinate', and 'a distortion of the factors operatively relevant for performance.'

Punctuation 3 — weighting the waiting (and an intriguing case study)

Not all punctuation marks were created equal: some 'should' have more weight, demand more conformity, more pronounced pausing, or more stringent paying of appropriate respects, than others (Nunberg 1990). But do they (actually) do so? Fayol and Abdi (1988, cited in Fayol 1997) asked 36 students to evaluate twelve punctuation marks, indicating on a subjective scale the strength of the link or separation of the linguistic units associated with each mark, ranging from 0 (indicative of a very strong link between the units) to 7 (indicative of a very weak link). The outcomes showed that the weakest links (or, conversely, the greatest breaks) were thought to be designated by the 'section sign' (§), followed by the period (or 'full-stop'). The next strongest links (of approximately similar link strength) were judged to be for the question mark and exclamation mark, followed by the semicolon, colon, and dash (all relatively similar to one another) and, finally, the comma (least strong). Fayol (1997) then plotted these outcomes against the actual pause times that were found — in an entirely independent study — to be associated with various forms of punctuation in English sermons that were broadcast on the radio and that were read by the sermon-writers themselves (Van De Water and O'Connell 1986). The profile of pause times across the various punctuation marks (e.g., longer for periods than for commas, intermediate for other forms of punctuation) was remarkably parallel to that obtained for the subjective ratings in the study of Fayol and Abdi, suggesting at least some degree of convergence between individual's explicit, subjective perceptions of punctuation weightings and the translation of such perceptions into performance.

And an intriguing case study …

Whereas many words are symbols that refer to given external entities, whether concrete (desk, sun, heart) or abstract (charity, playfulness, hope), some symbols, such as those designating arithmetic operations (plus or $+$, minus or $-$, divide or $\div$, etc.) do not refer to external entities. Rather, they define a relationship between other symbols that belong to a different class of symbols, and which do have specific referents (Laiacona and Lunghi 1997). For instance, shown:

$$2+11=?$$

one is asked to assess a particular type of relation (addition) between the specific referents (2 and 11), and to supply an answer in terms of another relation (equality). Laiacona and Lunghi (1997) report the case of a patient with amnestic aphasia who showed particularly pronounced impairment in the use of these *relational symbols* — when presented in *graphic* rather than verbal code, or requiring a mapping between auditory, or verbal written and *graphic* code. The patient, E. B., showed almost intact comprehension and production of numbers, and calculational processing (slightly impaired) but was especially impaired in using operational signs. Compared with two aphasic controls matched on age, education, and type and severity of aphasia, E. B. showed marked impairment in tasks requiring a yes/no decision of whether a given symbol from among various sorts of symbols was or was not a mathematical sign (58% compared with 100% for the two aphasic controls), and also showed impaired performance when asked to identify (by pointing to one of four operational signs) what operation should be performed when given an auditory or verbal written description (e.g., 'three plus seven'), or to 'fill in' an appropriate sign (e.g., 5 … 2 = 10), or to write to dictation. (E. B. could copy symbols with 100% accuracy, indicating that the origins of his difficulties were not in the analysis of visual stimuli.) Most intriguingly, when given a similar range of tasks for *punctuation marks*, E. B. also showed somewhat impaired performance (albeit less so than for arithmetic operations). For example, E. B. correctly selected 25 out of 28 punctuation marks embedded in a larger set of symbols (e.g., operational signs, punctuation marks, letters, digits, and geometric shapes; 89% correct, compared with 100% by the two aphasic controls) and correctly wrote 68% of punctuation marks to dictation (compared with 100% and 92% by the aphasic controls); E. B. was also impaired at judging whether written punctuation marks were adequate to the meaning conveyed by the prosody of sentences (read by the examiner), and at 'filling in' appropriate punctuation marks as conveyed by sentence prosody. By contrast, E. B. performed well on other (non-relational) symbol tasks, where the symbols carried only 'ideographic' notation (e.g., naming the countries associated with flags or identifying symbols of important political parties). Although these findings, from a single case, should be treated cautiously, they nonetheless are suggestive of the possibly distinctive role assumed by punctuation, indicating as they do, relations between 'words as words' rather than words as referents or pointers to an 'extra-textual' world.

Punctuation 4 — extending to ellipses and dashes

Ellipses … those fine series of three neatly and nearly spaced dots … also edge upon words. By definition, an *ellipsis* or *ellipse* is an omission from a sentence of words 'needed to complete construction or sense' or the 'omission of a sentence at the end of a paragraph' — thus literally an *edging out* of words — as well as the (visually apparent) 'set of three dots, etc. indicating such omission'. Walt Whitman, in what he later termed the 'Preface', and also throughout 'Leaves of Grass', uses ellipses in many ways … abounding in elliptical liberality. (The dash is also often used.) In the 'Preface', it seems that ellipses sometimes serve as the breathing space where commas elsewise may have been. But here, and in ‘Leaves of Grass’, these seem to be, not *omissions*, edgings out but, rather, perhaps — a lull, or a caress, of earlier words with later words:

Loafe with me on the grass. … loose the stop from your
throat,
Not words, not music or rhyme I want. … not custom or
lecture, not even the best,
Only the lull I like, the hum of your valved voice. (Whitman 1982: 30)

[… the hum of the places between …]

Ellipses bear affinities with *dashes*: The prolific use of dashes in Emily Dickinson — What functions do these serve? Is there some role for uncertainty as to the *direction* of the dash? Does it face both forward and backward? Does it deny (or at least fail to claim knowledge of) the ordering or sequencing of words, of a (necessary, enforced, inevitable) temporal hierarchy? Does it allow multiple meaning spaces to emerge, to co-occur? Sundry and shifting attentional grounds? Just as Dickinson rejected the construal of life as a journey, preferring life as a voyage (Freeman 1995), might she have wanted her poems to assume a less-linear form, with multiple options for venturing not only forward (as on a journey with a known goal) but also pausing, and returning, and not necessarily hurrying forward, as in a voyage? The connotative and denotative senses of *dash* also bear reflection: as a mark upon the page, a dash is ‘a hasty pen-stroke’ (should not one add ‘*key* stroke’?), a ‘horizontal stroke in writing or printing to mark a break in sense’ and ‘(in pairs) a parenthesis, omitted letters or words, etc.’. But the term *dash* may also be used as a verb with regard to writing, to ‘write down or throw off rapidly (letter, composition, sketch)’ and other senses of the word abound in direct and indirect intimations of collision, of striking, of edges that meet edges — just as do the words that precipitate and ensue. As a verb, dash may be to ‘shatter; knock, drive, throw, or thrust’, to ‘fling, drive, splash against’ and to ‘fall, move, throw oneself, with violence; come into collision against’. And, as a noun (perhaps most provoking), it may refer to the ‘sound of water striking or struck’.

In the poem ‘The Botticellian Trees’, by William Carlos Williams, there is, after line 21, a dash followed by an extended ellipsis. O’Connell (1984: 390) found that all readers of this poem noticeably paused here, with one of the readers showing the longest pause (2,680 msec) found across any of the readings of two experiments. Yet — ‘paradoxically, these longest pauses … involve no sentence break, but only a transition from main to subordinate clause’. …

Punctuation 5 — reflecting pause

What are the limits to which you will allow ('your') punctuation to be changed? I say to you, 'I'll change no words … only punctuation'. Can you agree? Paul Bruthiaux (1993: 28), speaking of medieval scholastics: 'punctuation was often added to manuscripts by ecclesiastical correctors in an attempt to clarify semantic relations and thus ensure that doctrinal points would not be misconstrued by readers'. In visually demarcating clauses, words, phrases: does punctuation 'make meaning edges' as well as (in addition to) visual edges, temporal edges, prosodic edges (I but ask — I do not insist; I — but ask — I do not — insist; I (but ask) … I do (not) insist …).

Compound words (and hyphens)

Blueberry, caretaker, copyright, nightmare, middleman, sandpaper, waterfall, daydream …

What of the hyphenation of words, their formation into compound words, or assimilation into single words: *black bird* or *blackbird*? *white cap* or *whitecap*? Might compound words have both *outer* and *inner* edges?

Using displays in which letters of the beginning and end of compound words were shown in different colors but the center letter itself was ambiguous — composed of an overlay of the beginning and ending letter colors — Prinzmetal (1990) and Prinzmetal, Hoffman, and Vest (1991), found that the perception of the letter color for the ambiguous middle letter was systematically biased such that it 'assumed' the color of the morpheme unit to which it 'belonged'. Thus, for example, the ambiguously colored fourth letter 'h' in the word *anthill* was more likely to be perceived as of the same color as the last three letters of 'ill', than of 'ant' (even though the bigram frequencies of letters at the division between the constituents were selected so as to bias responses in the opposite direction, pairing the 'h' with the 't' across, rather than within, the morphemes). This suggests an 'inner edge' to compound words — indeed, an 'acquired cognitive structure' (Prinzmetal 1990) sufficiently strong to influence color perception.

But not all compound words are similar: some have semantically transparent constituents (e.g., *teaspoon*, *houseboat*); others have opaque constituents (e.g., *buttercup*, *backgammon)*. Leonard Bloomfield (1933) observes that different languages have varying restrictions on what types of compound words may be formed (Finnish apparently has many compound words?), and notes two general ways in which compound words may be classified: according to the relation of the members to one another, or of the compound as a whole to its members. In English, with regard to the relation of the members of the compound to one another, we may have ‘syntactic compounds’ — that is, words that stand in the same grammatical relation to one another as in a phrase, as in *blackbird* (adjective with noun), verb with goal noun (*dreadnaught*), verb with adverb (*gadabout*), and past participle with adverb (*castaway*). In contrast, we may also have ‘asyntactic compounds’ where the placement of the constituent members does not correspond to or follow the syntax of the language, as in *doorknob*, *bedroom*, *salt-cellar* or, also, *frost-bitten*, *footsore*, *dry-clean*, *cry-baby*, and *driveway* (or, too, *mushroom*, *smokestack*, *zigzag*, *bittersweet* …). With regard to the relation of the compound as a whole to its members, Bloomfield distinguishes between compounds that are ‘endocentric’ in that the compounds have the same function as their head member: thus, *blackbird* is a kind of *bird*, and *door-knob* is a kind of *knob*; similarly, *bittersweet* is endocentric because the compound, like each of its members, is an adjective. By contrast, the head and components of ‘exocentric’ constructions do not agree in function this way, as in *turnkey*, or compounds comprised of an adjective with a noun head, as in *two-cent*, *half-mile*, and *apple-pie*. However, some combinations, as in *sure-footed*, *blue-eyed*, and *straight-backed* may be classified as endocentric because, for example, ‘footed’ is arguably an adjective just as ‘sure’ is. (Might one tend to treat compound words that derive from the same grammatical class as less ‘divided’ within themselves — possibly placing greater emphasis on the external edges than internal edges?).

That compound words may be treated differently in language processing is suggested by several further findings. Investigators using a task where participants are asked to judge if briefly presented verbal stimuli are words or nonwords (making a so-called ‘lexical decision’ regarding the word strings), but where the beginning and/or ending morpheme of the combination is a word (e.g., *sunkib* or *shipsnack*), have found longer nonword decision times for items containing embedded words than for items without any constituent words (Lima and Pollatsek 1983; Andrews 1986). There is also evidence that — for word-word compound words — the frequency of occurrence of the constituents may independently influence response times. For example, although the compound words *headstand* and *loincloth* are (according to written word frequency norms) equally frequent, the first constituent of the former (*head*) has a word frequency count that is considerably greater than that of the latter (*loin*) and lexical decision response times reflect this difference, being significantly slower for compounds with low-frequency components than for words with high components (Taft and Forster 1976; see Andrews 1986 for a replication of this finding but also for evidence that, contrary to the findings of Taft and Forster, response times may be influenced by the frequency of *both* the first and *second* constituents of the word). Intriguingly, Andrews (1986) also found evidence that the presence of compound words may itself alter participants' strategies of word access, encouraging the use of morphemic structure in processing words, such as suffixed words, that might otherwise not show effects of morphological structure.

Using a reading task where compound words were embedded in neutral sentences, Inhoff, Briihl, and Schwartz (1996) did not find differences in total gaze durations for compound words (e.g., *blueberry*), suffixed words (e.g., *ceaseless*), and monomorphemic targets (e.g., *arthritis*); however, the *first-fixation* durations for compound words were longer than for the other word types (an outcome usually taken to reflect greater difficulties in word recognition); first fixations for compounds also tended to be closer to the center of the word than for the other word types. (In general, the center letters of a word are the most likely, and the ending letters the least likely, 'recipients' of a fixation; during reading, any fixations near the center of words appear to be about equally effective, with a reading time cost — and intraword refixations — occurring only when fixations are at the very beginning or ending of long words; e.g., McConkie, Kerr, Reddix, Zola, and Jacobs 1989; Rayner 1979.) Using the same materials, but with an online naming task, Inhoff et al. (1996) found that the naming latencies for compound words were *shorter* than those for suffixed and control words; a further analysis including several factors that may have contributed to naming latencies such as the number of syllables, phonological regularity, and the number of 'morphemic access codes' (1 for control words, 2 for suffixed words, and 3 for compound words), showed that, even controlling for the other factors, the number of morphemic access codes was the best predictor of naming latency.

Further evidence that compound words may be treated differently in language processing is provided by a case study reported by Delazer and Semenza (1998), concerning an aphasic patient (M. B.) who showed naming difficulties that were almost exclusively confined to compound words. M. B. was a 35-year man who had suffered a left intraventricular hemorrhagic lesion and who showed average performance on tests of nonverbal intelligence, and mental calculations; his verbal and visual memory span were within normal limits; his speech comprehension was intact, and spontaneous speech was fluent, but with occasional word-finding difficulties that led to circumlocutions. On several tasks using monomorphemic words, M. B. made either no errors (four different tasks) or very few errors (a ‘confrontation naming’ task where he was to produce the names for colored photographs and made errors for 5% of the items). By contrast, on this same confrontation naming task where the depicted items were named with compound words, he made errors for 60% of the photographs; he also made many errors (52%) for compound words that he was asked to name from a description. His errors in repetition (22.5%), reading (22.5%), and writing to dictation (7.5%) were less frequent but still above those for monomorphemic words (0%). Most revealingly, M. B.’s naming errors all *themselves* had a compound structure and were ‘semantically adequate’ substitutions for the target that followed the word construction rules of his language (Italian). In about half of the cases, one part of the target appeared in the paraphasia, with the first and second components included equally often and nearly always maintaining their appropriate place within the compound. For example: for robin, or ‘pettirosso’ (an opaque target, ‘chest red’), he responded with the neologism ‘*beccorosso’ (beak red); likewise for porcupine, or ‘porcospino’ (a transparent target, ‘pig thorn’) he responded with the neologism ‘*ricciospini’ (hedgehog thorns). In additional tasks, M. B. read long low-frequency numbers correctly, and most often correctly defined transparent compounds (10/10 correct) and opaque compounds (8/10 correct); he also was able to accurately judge whether morphologically well-formed compound neologisms, intermixed with existing Italian compounds, were actual words (lexical decision task, 20/20). Taken together, these results suggest that M. B. has difficulty during the *retrieval* process for compound words; these results also imply that compound words are represented by *two* lexical items or lemmas, and that the components are separately processed (especially given M. B.’s errors involving the retrieval of one component and substitution of the second component). Additionally, however, the equivalent number of substitution errors for the first and second components implies that processing of the two components may not necessarily occur sequentially, or hierarchically (or that errors arose in processing after a stage when both components were partially accessed). Again: compound words may, indeed, have both inner and outer edges. …[7]

Margins and spaces

Whether typewritten, or written by hand, text usually does not uniformly or entirely ‘cover’ a page, there are spaces not only around words within lines, but also around particular letters (the space allotted first letters of first words at the beginning of first paragraphs — why are these called 'drop letters'?), or within sets of *lines* (the so-termed 'call outs' in popular print publications) and around *all of the lines* together: margins, top, bottom, right, left … (The notion of 'justified margins' — are these margins that are not unchastely penetrated by the edges of words? that are absolved because they are silent? silent so that they may be absolved? spaces that remain excusably pure of words?)

Where words are, and where they are not, is by no means entirely irrelevant to either reading, or writing. Thus one definition of reading, recently encountered, is that it is 'a translation of spatially presented lines and spaces into meaningful information' (Spragins, Lefton, and Fisher 1976). Similarly, James Elkins (1999) argues that some space between letters, and words, is one of some approximately ten 'traits of writing' that help to indicate that an artifact is (or might be) susceptible to 'reading'. Most centrally, Elkins (1999: 147) suggests that, in the 'most complete case', writing will have (1) 'disjoint signs', that is, signs that are not physically fused, and (2) 'a rationally comprehensible spacing between signs', as in the white spaces between words in typewritten or handwritten English, and the narrower spaces between letters within words.

Eye movements are, of course, also intimately constrained by the marginal edges:

> As we read, our eyes move left-to-right across each line of text. At the end of the line, we make a return sweep to the beginning of the next line. The last fixation on a line is typically about five or six characters from the end of the line, and the first fixation on the next line is typically five or six characters from the first letter in the line; thus, about 80% of the line generally falls within the extreme fixations. The first fixation of a line is usually a bit longer than other fixations, presumably because the reader has not had any preview of the word prior to fixating on it. On the other hand, the last fixation on the line is generally a bit shorter, presumably because the reader does not have to compute where to fixate next on the line nor engage in extensive parafoveal processing. (Rayner et al. 1995: 11)

Did you find yourself — notice yourself, observe yourself — mentally *following your eyes* just now? What effects may derive from extended quotations (such as this) which are set apart in this way from much of the remainder of the text, often with narrower text lines and wider margins? How does the actual (physical, visual) line length of text affect how we read and comprehend: the units of meaning, the pauses, the retracings?[8] What effect does the multi-columnar format of many scientific articles have on reading and understanding? Holding line length constant, are wider — more spacious — margins more inviting (preferable), to narrow, close ones? At what point do

wide margins
and
a narrow
textual
field
become uncomfortable
ineffective?
irritating?

And how much of this is learned, how much is simply a matter of what we are, or are not, accustomed to (in a given context)? Do the return sweeps become easier, more difficult for certain text field lengths?

Yet — although often 'sheepily' confined by margins at top and bottom, right and left — words may also, at times, seem to aggressively cut edges, thrusting themselves forward in solitary independence. Elkins provides a telling example, where words are far from flock-like:

> The Ogham script, which is the earliest surviving record of the Irish language, seems at first glance to be austerely nonpictorial … But it has a formal feature that is unique among all scripts and that makes it insidiously pictorial: It is inscribed along an edge or corner of a stone, so that a person reading it does not face a flat surface. … Some characters are etched to the right, others to the left. The effect, to my eyes, is an uncanny disorientation mingled with a faint sense of menace: It's always the edge (often fairly sharp) that faces me as I read. (Elkins 1999: 137)

Menace, sharpness, edges: one begins to think of words and swords (after all — I notice now with a sharp intake of breath — they differ only in one letter!). And, indeed, continuing to read (with Elkins) we see the association is not far-flung but very near the mark: Thus 'There is a suggestive parallel in Japanese sword-making, in which the handles are occasionally signed by their makers using a set of very simple linear marks that form a standard code …' and, too, 'Ogham stones are normally boundary markers, so who is to say that Ogham's linear character is not a figural property, an entirely appropriate, and pictorial, reminder of the danger of crossing boundary lines?' (Elkins 1999: 137–138)

Paragraphs and the edges of words

Did the opening 'paragraph' of this paper seem odd, lost, *adrift in space*? As if words in sentences needed neighboring shoulders on either side, or sought safety in numbers? Yves Bestgen (1998) notes that the term ‘paragraph’, which now refers to textual units, originally referred to a graphical symbol that marked the boundaries of units of text. Thus, the shouldering spaces of the paragraph (and possibly also the paragraph indentation) earlier also may have included an explicit graphic symbol that ‘edged’ each new paragraph.

More generally, Laurent Heurley (1997) observes that researchers have construed the paragraph as one of three types of linguistic units: orthographic, structural, or mixed. From an orthographic viewpoint, the paragraph is, indeed, critically defined (and delimited) by spaces: ‘Considered as an orthographic unit, a paragraph is a typographic visible suprasentential unit of which the boundaries are marked by paragraph breaks such as indentation, margin symbols, new lines, extra blank spaces or lines, and so on’ (Heurley 1997: 182). By contrast, from a structural viewpoint, the defining features of the paragraph are formal and semantic in nature, as in R. E. Longacre’s (1979) theory of the paragraph, typified by four characteristics: *closure* (an opening or setting sentence, and a closing sentence), *thematic unity* (each paragraph is constructed around a main topic), *hierarchical organization* (the opening sentence is often the statement of the main topic, and at the top of the hierarchical organization, with subsequent sentences situated at subordinate places), and *recursivity* (low level paragraphs may themselves combine to form higher level paragraphs). Proponents of the ‘mixed’ viewpoint (e.g., Christensen 1965: 156) characterize the paragraph as possessing both orthographic and structural or logical features (‘clearly it is both and the two jostle’).

Yet (setting the mixed viewpoint aside) the orthographic *versus* structural opposition may (sometimes) be ‘more neat than real’. Longacre (1979: 116, and cited in Heurley 1997: 185) also notes instances where formal, semantic considerations in the determination of paragraph placement may give way to largely *visual* or *aesthetic* considerations, as writers yield to their eye, and insert paragraph breaks because ‘it may be deemed inelegant or heavy to go along too far on a page or a series of pages without an indentation or section break’. Stark (1988: 276), makes a similar point, observing that early writers on the paragraph believed ‘a page of full print is intimidating’ and that paragraph cues may act ‘to alleviate this sensation’ by providing a form of visual landmark for the eyes.[9] Bond and Hayes (1984) likewise found that readers rely both on textual factors, such as topic shifts, and on paragraph length to determine paragraph locations. Additionally — the purported grammar of the paragraph notwithstanding — empirical studies that have examined where individuals place paragraphs in unmarked text show only modest levels of agreement with the paragraph segmentation used by the author. For instance, relatively low levels of paragraph segmentation agreement were obtained by Stark (1988), where only 53% of the author's breaks were also selected by more than 50% of the participants, and where levels of agreement tended to vary considerably across three different text passages. (Returning to the thought of 'shouldering sentences,' Stark found that, for one of the passages used — an expository essay, 'On comets', by Bertrand Russell — only 5% of participants opted to place a break such that an opening paragraph would be comprised of a single sentence — despite that being precisely where Russell had placed a break. Yet — on other occasions — participants were quite willing to designate both 'shorter than usual' paragraphs and 'longer than usual' paragraphs.)

One account of these comparatively low levels of agreement is that paragraphs have often been viewed from a *reader-centered* perspective, with segmentation cast as a communicative signal to the reader, intended to make text structure more apparent. However, paragraphs may clearly also derive from *writer-centered* interests (including the writer's knowledge, planning, and other constraints) that may — or may not — nicely map to those of readers, or to requirements concerning text structure (Heurley 1997).

Consistent with this possibility, experimental work conducted by Heurley and colleagues (see Heurley 1997) using both online measures (pause durations during writing) and offline analyses (text analyses) has clearly pointed to the effects of writing processes. For instance, in one experiment, participants were first asked either to draw, or to simply look at, an unfamiliar bidimensional geometric figure composed of five elementary drawn shapes; afterwards, they were asked to write a text explaining to a reader how the figure should be drawn. In general, the texts that resulted were composed of information blocks (e.g., details regarding the goal of the task, instructions, and results). Although these blocks were not consistently mirrored in paragraph breaks, the blocks were especially influential in the writing process itself: Pauses in writing were longest between information blocks (rather than at paragraphs), and revisions of the text either were confined to the information blocks (*all* of the revisions of 12 out of 16 writers respected these 'barriers') or (for the remaining writers), almost all across-block revisions tended to occur at transitional *between-block* points — directly after revision of one block, or prior to initiation of a new block. Based on these and other considerations, Heurley (1997) proposed that two terms should be used to refer to segmentation of texts: *paragraphs*, seen as visual text units that derive from a signalling process to the reader (including the writer as reader), essentially involving spatial separation (indentation, blank spaces, and/or extra lines), and with these 'orthographic' features used to identify those units, versus *information blocks*, seen as organized structural and semantic textual units deriving from the 'encoding' process (i.e., translation of propositions into clauses), and identified by thematic unity, hierarchical organization, and cohesive ties.

Coactivation of meanings consistent with physical form: The consorting of meaning and form

A key aspect of spoken word recognition concerns its temporal nature, such that the recognition and comprehension of a word occurs *across* and *within* time; the hearer often does not, at the outset of a word, have sufficient information (or prescience) to know what the word *will be*; this is a process that unfolds in or across time as the word is 'un-covered' or 'dis-closed' in full. Current models of speech recognition do not assume that the processing of a word is postponed (held in abeyance) until sufficient information is obtained to uniquely specify the word; rather, they propose that as the sound reveals itself, the cognitive processing of the recipient takes advantage of such information as is provided, even though it is indeterminate. These models assume that as the spoken stimulus is presented, words that are phonologically related or similar to the (as-yet-not-fully-specified) target word are also 'activated' or made more accessible. These other words — words that may comprise possible *solutions* to the question, 'what word *will* this be?' — are said to be part of the target word's phonological 'cohort' or 'neighborhood'. To the extent that this is so, such that, as a word unfolds, it heightens the *activation* of multiple possible candidates, two possibilities emerge: One possibility is that one may see the 'edge' of a word as itself multiple, perhaps as multiple nested or enclosed spaces, circling and grading inward (like the growth pattern of trees, seen when their trunk is cut in cross-section). Alternatively (or perhaps additionally) one may see the 'edge' of the word as not the beginning of the word, but count as the word's 'edge' that point at which the word becomes uniquely specified (as that word and no other) in the language. On this latter construal, different words may have differing 'edge-points', depending on the size of the word's phonological cohort.[10]

For example, according to a recent model termed the Neighborhood Activation Model or *NAM*, proposed by Luce and Pisoni (1998; also see Marslen-Wilson and Zwitserlood 1989) words in the mental lexicon are organized into 'similarity neighborhoods' where the neighborhoods consist of items that are phonologically similar to a specific target item; more specifically, the neighbors of a word are all those words that can be created by altering a single phoneme: adding, deleting, or substituting one phoneme. Thus, for the word *but* some of the neighbors include: *put*, *cut*, and *hut* (change only the initial phoneme), *bet*, *bat*, *bit*, and *boat* (change only the middle phoneme), and *buzz*, *bus*, *buck*, *bud*, and *bug* (change only the last phoneme). The model proposes that, when a target word (or, more correctly, a speech sound) is presented, the presentation results in a graded activation of acoustic-phonetic patterns, with greater activation for neighbors that are more phonologically similar to the target.

Some of the best evidence pointing to an increased level of activation for phonologically similar neighbors during speech comprehension derives from tests of memory where the items that are tested include not only the presented target items but also *phonological neighbors* of the target items — items that were not themselves presented but that, according to the cohort activation account, may have been 'implicitly activated' during the perception of the target words. The logic of these experiments is simple: if phonological neighbors are made comparatively more active than non-neighbors, and some of this relative difference in activation persists across time, then 'senses', or 'traces', or some form of representation from the earlier activation may make items that are, in fact, *new* (not previously presented in the experimental setting) *appear to be familiar* (or more familiar than items for which such implicit activation did not occur), leading to a higher frequency of false recognitions or misidentifications of these items.

Wallace, Stewart, and Malone (1995) used this approach but with an additional aspect that they hoped would provide further insight into these processes: they included phonological neighbors that would be 'disqualified' as possible target words early in the presentation of the target word, or late in the presentation. For example, if the target word was *DOMINEER*, a late-disqualified neighbor might be *DOMINOES* (here the phonological form of the two words diverges only late in the temporal processing stream, at the third syllable); by contrast, an early-disqualified neighbor for this same target might be *PIONEER* (here, the phonological form of the words diverges at the first syllable, or very early in the temporal processing stream). If increased false recognition of phonological neighbors occurs as a result of implicit activation of phonologically similar neighbors during the presentation of a word (or what Underwood 1965, termed 'implicit associative responses'), then it might be expected that words that offer a longer (more prolonged) opportunity for such activation might be associated with higher levels of false recognition than words that offer little opportunity for such activation.

The results of an experiment designed to test this were consistent with this prediction. The experiment involved a two-phase study-test paradigm in which subjects were first presented study words auditorily, and then were given an auditory recognition test for those items, together with new late-disqualified words, new early-disqualified words, and new *control* words (new items that were unlike those presented in the study phase). Participants more often falsely claimed to recognize late-disqualified lures than early disqualified lures or control words (the latter two did not differ from one another).

How much of this effect depends on *auditory* rather than *visual* presentation of the items? In a second experiment, Wallace et al. (1995) also included a visual presentation condition (in addition to auditory presentation); in this experiment, they did not find a similar effect to that of the previous experiment for once presented items, but replicated those findings for items that were presented *three* times, with both visual and auditory presentation yielding higher levels of false recognition for late-disqualified than for either early-disqualified or control items. Although cohort theory is closely tied to temporal processing (and thus might lead to the expectation that these effects would not be found for visually presented items), Wallace et al. (1995) suggest that the similarity of effects across auditory and visual presentations may have derived from re-coding of the visual representations into phonological representations, or possibly may have involved orthographic to lexical translation (Johnson and Pugh 1994). The observation of increased false alarms to late-disqualified words was also found in a further experiment (Wallace et al. 1995, Experiment 4) where the words were comprised of precisely the same syllables for each of the three conditions but were then spliced and presented together with different syllables (e.g., for the base word, CUE, the early disqualified word was RESCUE and the late disqualified word was CUPID). High levels of false recognition of phonologically related lure items have also been reported in studies of memory where word lists comprised of numerous phonologically related words are presented (Sommers and Lewis 1999; also cf. Schacter, Verfaellie, and Anes 1997).

The phenomenon of cohort activation raises several questions: does this occur for *all* words or are there exceptions — words that have unique beginnings from the very outset? Are there such words? How might 'early unique' words differ from other words that (as it were) *announce themselves as themselves* only rather less immediately and directly? To what extent do poets and other writers perhaps unwittingly, perhaps with some awareness of the *evocativeness* or suggestiveness of a word, exploit 'cohort activation' to achieve condensation and conflux of meaning — meaning engendered through means of which their readers, their listeners, are also only dimly or not at all aware? Do these possibilities point to a possible difference between reading and listening to poetry? Or to questions about the *optimal speed* or pace of reading certain poems? How do these possibilities fit with the realm of what has been considered 'connotation'? If (as many writers have done) we construe connotation as involving associated or secondary semantic meanings, acquired through experience, that come to 'adhere' to a word, it is possible that these forms of co-activation may be overlooked, elude, or slip through consideration.

Additional evidence for the coactivation of meanings consistent with physical form — and the consorting of meaning and form — might be derived from studies of alliteration.[11] One early psychologist who studied this form of 'formal recurrence' in speech was B. F. Skinner (1939, 1941). Based on an analysis of Shakespeare's sonnets, Skinner (1939) concluded that within-line alliteration did not occur at levels exceeding that expected by chance and, indeed, after correcting for instances where the same word or word stem was used in a line (as in, for example, 'Suns of the world may stain when heaven's sun staineth'.), alliteration appeared to be *less* likely to occur than might be expected by chance (defined as the frequency of the consonant in the entire sample). While acknowledging that corrections for these word repetitions 'probably go too far, since a repetition of the same word may in part exemplify an alliterative process' Skinner (1939: 191) nonetheless concluded that, so far as alliteration was concerned, 'Shakespeare might as well have drawn his words out of a hat', and that 'the thematic and semantic forces which are responsible for the emission of speech apparently function independently of this particular formal property'.

This provides a rather bleak vision of the likely role of alliteration, and seems at least *potentially* inconsistent with the notions of cohort models (although processes of editing and revision might clearly affect selection, depending on the perceived desirability or value accorded to alliteration). However, when Skinner considered another poet — specifically, the first 500 iambic pentameter lines of Swinburne's 'Atalanta in Calydon' — a rather different conclusion was reached: here Skinner (1941: 66) concluded that, 'Practically without exception, Swinburne has too many lines containing two, three, and four instances of the same consonant' (with 'too many' being beyond that expected by chance), and further noted that this phenomenon of 'the strengthening effect of the emission of a consonant' was greatest in the immediate vicinity of a word, and decreased to essentially zero at a distance of approximately four strong syllables (an 'alliterative span' of four strong syllables). However, not all consonants showed this effect: for example, considering cases of groups of three adjacent instances of the same initial consonant, the letters *f* and *h* showed especially pronounced divergences from the expected rate of occurrence (expected vs. observed values of 1 and 10, and 1 and 5 respectively); the letters *b*, *d*, *l*, *m*, and *s* showed more modest divergences (between 2 and 3 times the expected values), whereas the letters *g*, *th*, and *w* showed little divergence. Using a 'coefficient of alliteration' to compare poets and poems, Skinner (1941: 77) concluded that the coefficient obtained for Swinburne (0.226 — compared with .007 for Shakespeare's sonnets) was probably 'very near the upper limit to be found in poetry which is not deliberately constructed (say, for humorous effect) upon a principle of alliteration or where alliteration is not the chief poetic device, as in Anglo-Saxon poetry'. However, Skinner (1941: 78) also allowed for an extensive role for deliberate and quite-aware processes of selection — 'When alliteration is in fashion as an ornament, the poet may deliberately seek it out, presumably through a kind of controlled association practiced at various points in the composition, or through the use of such an artificial device as a word book' and, too, of *rejection*, discarding, avoiding, or eschewing possible candidates, such that 'where current taste is opposed to alliteration, instances which naturally arise from chance (as well as from formal strengthening) may be rejected'.

One last set of findings that may be considered with regard to the phonological beginnings and endings of words — including both alliteration and rhymes — pertains to the effects of these forms of structural or physical similarity on electrophysiological activity of the brain (as revealed by event-related brain potentials or ERPs), and particularly as related to other findings concerning how ERPs may reflect semantic or integrative processing. Recorded from electrodes placed on the surface of the scalp, ERPs consist of small fluctuations in the spontaneous electrical activity of the brain (electroencephalogram, or EEG) that are time-locked to a particular event, such as the onset of a particular word or other stimulus, and averaged over many trials. A very reliable and extensively investigated pattern found in ERP studies is a reduction in the magnitude of a particular 'component' or portion of the waveform for stimuli that semantically or contextually 'fit' with the context in some way. This component — known as the N400 because it is a negative-going wave that typically reaches its peak amplitude at approximately 400 msec post-stimulus onset — is, for example, larger (greater in amplitude) for words that are semantically *incongruent* or *unexpected* in the context of a sentence than for words that are semantically congruent or expected. More generally, semantic expectancy effects may be modulated by various factors, both automatic and under attentional control, that increase the activation of some semantic concepts relative to others. (Thus Kutas 1988: 205, lists 'lexical associations, the frequency of usage of a word in the language, grammatical, semantic, thematic, and pragmatic constraints, etc.' as possible contributors — under certain circumstances — to a word's semantic expectancy.)

While the N400 has most often been studied in connection with semantic processing, several investigators have used ERPs to examine the effects of alliteration and rhyming on this component. For example, using a rhyme-judgment task for pairs of words or nonwords, Rugg (1984a, 1984b) found that a negative wave, peaking at about 450 msec post-stimulus onset, was smaller in amplitude for words that rhymed than for words that did not share similar ending sounds. Using an auditory lexical decision task, Praamstra, Meyer, and Levelt (1994) also found that brain potentials were less negative for word pairs that *rhymed*, or word pairs that *alliterated* (sharing their first consonant and vowel) than for unrelated word pairs. There was also an intriguing divergence for these two forms of structural or formal similarity, such that rhyming word pairs showed reduced amplitude responses at a somewhat later point (450 to 700 msec post-stimulus onset) than did alliterative word pairs (250 to 450 msec post-stimulus onset). Using a judgment task wherein participants were asked to decide if spoken word pairs alliterated, McPherson and Ackerman (1999) also found that normal adolescent readers showed a priming effect in the N400 component, such that between 250 and 450 msec post-stimulus onset, ERPs were significantly less negative for alliterating than for nonalliterating targets.

Although alternative interpretations of these findings are possible (for example, they may reflect facilitated post-lexical integrative processing, or increased activation for phonologically related words), Praamstra et al. (1994: 215) concluded that the modulations that they observed for rhyming and alliterative words were modulations of the same underlying component, a negativity that they deemed 'similar enough to the "classical" N400 to be provisionally placed in the same category'. Furthermore, the observation of these effects across different tasks — those focused on the sounds of words, as in rhyming or alliteration judgment tasks, but also under conditions where participants' goals and attentional focus are not necessarily immediately or exclusively directed toward the sounds of the words, as in the lexical decision task requiring a judgment of whether the stimulus is or is not a word, suggests the *generality* of these effects and points to possible commonalities in how apparently 'formal aspects' and 'semantic aspects' of words are processed. (Note that, in each of these studies, the proportion of phonologically similar and dissimilar items was equal; however, participant's expectancy may have been for the rhyming or alliterative words, even in cases where this was not the direct task focus. Nonetheless the observed parallels for stimuli that are semantically congruent or expected and words that somehow 'fit' because of their formal features — the sound of the word beginnings and word endings — suggests that casting too large a gulf between these may lead to a failure to notice important ways in which their processing may be similar.) Further elucidation of the nature of these convergences remains an exciting area for empirical and theoretical endeavors.[12]

Invisible edges

The sign is that which is surpassed toward meaning, that which is neglected for the sake of meaning, that which is never apprehended for itself, that beyond which the look is perpetually directed. (Sartre 1956: 330 [*Being and Nothingness*]; cited in Anton 1998: 197)

Corey Anton, drawing on the work of Michael Polányi (1966), especially his concept of a *from pole* and a *to pole* — which was also developed and used by Drew Leder (1990) in *The Absent Body*, where 'each sense attends away *from* itself and out *to* the different profiles of the world' (Anton 1998: 197) — extends this notion from the lived body to the phenomena of *human symbolism*, arguing that speech too can be understood in these terms of 'from' and 'to': 'Speech is an intentional structure; we routinely and commonly attend not *to* speech but simply *from* it … we routinely listen *from* our speech *to* the thought so intended' (Anton 1998: 197).

Directing attention to the 'edges of words' may seem to undermine this transparency or *invisibility*, yielding a perceptual and attentional focus on the physical form of the word itself. Yet, although in some instances, such focus may be pathological and detrimental — an outcome of selective or attentional processes that fail in filtering and that interfere with meaningful processing — not all cases need be of this form and, as I hope the many examples detailed above have shown, attending to the *physical edges* of words may both implicitly and explicitly *form* and *inform* meaning. Although most often not within the focus of attention, the physical edges of words guide and influence processing — including processing for meaning — in multiple ways. Real (physical) word edges may affect the ease with which word identification occurs in reading as, for example, in the facilitative role of the varying 'edging shapes' of lowercase compared to uppercase letters, and the critical part played by the visual beginnings and endings of words in defining word length and achieving the processing benefits of parafoveal preview. Real (physical) edges of words may also more directly affect the ease with which access to meaning may be achieved, as in the presence of silent letters that continue to provide visual contact with morphemically related words and the 'inner and outer' edges of compound words. Conversely, visual word edges may also help to selectively *block* access to meaning, as in the possible role of textual lines and of parafoveal preview in selectively allowing acquisition of semantic information from currently attended lines, and diminishing the likelihood of acquisition of semantic information from immediately flanking textual lines. Likewise, the 'near-by visual and physical forms' that comprise punctuation, visually grouping themselves with words before rather than after pauses, may be likened to extended 'word edges' that help to guide where we pause and how long we pause, if at all — how we bridge from one word to the next. Likewise, too, for the concurrent activation of (at least initially possible) candidates generated — in and across time — in response to the not-always-immediately-answered and the more-or-less-temporally-extended question of 'what is *this* word that now is uncovering, unfolding before me?' These temporally extended processes of word perception may give rise to the activation of other words of which we may never be directly aware, but which may nonetheless bear 'traceable' (mnemonic) and possibly semantic effects, and may more or less strongly affect the sense of fluidity or flow of not only our words but also our thoughts: the sense of fittingness with which words, and the ideas and feelings to which they point, follow, continuing what was begun or suggested, more sharply defining what was already intimated, or fulfilling a thought.

Notes

1. For example, in *S/Z*, Barthes (1974 [1970]: 92–93) writes: 'The connotator refers not so much to a name as to a synonymic complex whose common nucleus we sense even while the discourse is leading us toward other possibilities, toward other related signifieds: thus, reading is absorbed in a kind of metonymic skid, each synonym adding to its neighbor some new trait, some new departure: the old man who was first connoted as *fragile* is soon said to be "*of glass*": an image containing signifieds of rigidity, immobility, and dry, cutting frangibility. This expansion is the very movement of meaning: the meaning skids, recovers itself, and advances simultaneously'.

2. Garza-Cuarón distinguishes and systematically analyzes no less than nine different groups of problems, each of which she divides into two fields, one side relating to one of the many different senses that have been given to the concept of *denotation*, problems which 'have always been taken into consideration in linguistics' (1991: 209) and the other side relating to one of the many different senses that have been given to the concept of *connotation*, which typically have not been taken into consideration. For the nine groups (each to a greater or lesser extent potentially seen as mapping to a *center* versus *edges*) see Garza-Cuarón 1991: 210.
3. A further, meaning-related interpretation of 'the edges of words' that might come to mind is with regard to what has been called the 'nextness' principle (Ochs 1979; cf. Fayol 1997), according to which — in the absence of evidence otherwise — two linguistic items that are near one another on the surface of a text or discourse are assumed to go together or to be strongly related to one another. Modulation and violations of the nextness principle may be signaled in multiple ways, including the use of connectives (e.g., coordinating and subordinating conjunctions, and relative pronouns; cf. Segal, Duchan, and Scott 1991) and the use of punctuation. Although I do not here consider connectives, because punctuation is often physically found at the 'edges of words' it is treated in some detail.
4. I subsequently discover that Bouma (1971) counted the letter 'j' only as a descender.
5. Nunberg (1990) defines a punctuation mark as any mark that serves to indicate the structural links between adjacent elements of a text.
6. The poems were from *Poems 1965–1975* (1980), *Fieldwork* (1979), and *Door Into the Dark* (1969) and included, 'Digging', 'Blackberry Picking', 'Personal Helicon', 'A Drink of Water', 'Sunlight', 'Bogland', 'Bog Queen', 'Punishment', and 'Oysters'.
7. See Libben (1998) for another example of an aphasic patient who, following a left temporal-parietal intracerebral hemorrhage, showed a pattern of misinterpreting compound words, tending to interpret semantically opaque compounds as though they were transparent — possibly as a result of a failure to inhibit meanings from constituent components at a conceptual level of representation.
8. Characterizing the return sweep of the eyes from the right-hand margin of a line of text to the left-hand side of the next line, Just and Carpenter (1980: 347) note that the return sweeps are 'often inaccurate', landing too far to the right, and often leading to a leftward saccade to the first word. Further, 'as a result of this error and recovery, the first word on a line eventually receives an increased gaze duration, relative to a line-medial word'.
9. The notion of paragraphs as possible visual landmarks is later taken up again by Stark (1988: 278) to contrast two ways paragraph cues may influence readers' comprehension: *nonsemantically*, as when paragraph cues may 'act as visual targets that are perceptible in peripheral vision and act to guide reading', or help to facilitate movement between parts of a text (either on initial reading or on re-reading or re-visiting a text) or *semantically*, as when paragraph markers may encourage readers to pause and integrate information before proceeding, or signal a textual discontinuity.
10. Marcus and Frauenfelder (1985: 164) define the 'uniqueness point' of a word as 'the point at which its initial sequence of phonemes is common to that word and no other' and cite considerable evidence indicating that the uniqueness point, determined in this manner, 'is a good predictor of the moment at which a word is recognized'. However, these researchers also question some of the assumptions made by, for example, the Cohort Model, regarding precisely *how* this real-time, on-line acoustic information is processed, particularly the simplifying assumption that these on-line phonetic decisions are made *categorically*, immediately activating appropriate, and deactivating

inappropriate, word candidates. Rather, given the often noisy and ambiguous nature of the speech signal, they propose a probabilistic rather than categorical process, according to which 'what should be decisive for word recognition is not the uniqueness point … but the moment at which the input matches one single lexical candidate better than all others by some criterion value'. More specifically, they argue that, 'At the uniqueness point the stimulus matches the correct candidate, but, by definition, deviates from the most closely competing candidates by precisely one phoneme. In order to allow for uncertainty in the perception of the input, the criterion amount of deviation required for recognition would need to be greater than this single phoneme, and the recognition point would thus be at some indeterminate moment *after* the uniqueness point' (1985: 164–165, original emphasis). However, based on an empirical analysis of 20,000 words of American English, they found an extremely close relation between the uniqueness point and the (more probabilistic) 'minimum deviation' point: not only was the uniqueness point that point at which a given stimulus word no longer matched any other word except the correct (target) word, but it was also the point at which (or very soon after which) many further (later or subsequent) phonemes in the word *likewise* failed to match those of any other word. Thus, the uniqueness point and the more probabilistic criterion yielded similar outcomes. Nonetheless, a few exceptions were also noted including, *aptitude* and *altitude*, *cancellation* and *consolation*, *figment* and *pigment*, *oasis* and *basis*, and *physician* and *position*.

11. Although the possibility that children may sometimes appear to 'select lexical items on the basis of their phonological similarity rather than on the basis of their appropriateness to the message conveyed' has been noted by a number of researchers, Ochs (1979: 73–74) also points to a possible role of similarity in sound in cuing word choice in the spontaneous speech of adults. For an extensive consideration of the role of rhyme, alliteration, and assonance in oral traditions see Rubin (1995).
12. One 'continuing question' concerns the conditions under which the often facilitative effects of formal similarity may, instead, lead to the opposite outcome, with too many or too strongly activated competitors initiating inhibitory processes that yield *decreased* rather than *increased* accessibility (see Colombo 1986; Praamstra et al. 1994 for review).

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