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Metatext and the Evolution of Writing

Andrew Armour

With the art of writing the true reign of miracles for mankind commenced. It related, with a wondrous new contiguity and perpetual closeness, the past and distant with the present in time and place; all times and all places with this are actual here and now. All things were altered for men.

—Thomas Carlyle[1]

Writing is a language—or, in the view of conventional linguistics, an isomorph of language—that allows the dead to talk to the living.[2] Although it is true that some cultures have rich oral traditions, it requires writing for a culture to become a civilization. Writing enables the accumulation of the knowledge of a culture, thus allowing both continuity and progress. And as civilizations progress, so does writing.

Writing has evolved slowly over five thousand years, but in the last decade an abrupt change has taken place. The development of word processing and " desktop publishing " has created a climate of unprecedented freedom as regards the ways in which we handle words; and this freedom is due to the advent of the electronic manuscript. Writing can now exist on two different levels—one visible or " manifest ", and the other electronic or " latent " (sometimes referred to as " machine readable "). Text on the latent level, which shall here be called " metatext ", behaves in ways quite unlike conventional text, and its proximity to the cognitive processes that generate text makes it well suited as an intermediary between thought and print. Without doubt, the appearance of metatext is the most significant development in the evolution of writing since phonetization.

To put this new development into proper perspective, it is necessary to look at the past. A generalized model of the evolution of writing starts with the simple drawings—identifying-mnemonic devices—that convey universally understandable messages. Initially there is no reference to elements of speech. With time, however, the perceived connection between a particular device and the identified object grows stronger to the point where a correspondence develops between the device and the spoken word used to identify that object. This gives rise to logography, or word writing. Purely logographic systems would appear to be impossibly difficult, as was discovered by Sequoyah, the Indian credited with the invention of the Cherokee script in 1821. The impracticality of using a separate sign for each word in a language is evident when one considers that even a " concise " English dictionary contains about 75,000 entries. This problem is circumvented by developing a hybrid system in which signs express syllables as well as words, thus keeping the total number of signs within manageable limits; the Chinese still employ one such logosyllabic system. Assigning a phonetic value to a sign—the rebus principle—constitutes the most significant step in the development of writing.

The next step is to dispose of the word signs and create a syllabary. After abandoning logographs, this is in fact what Sequoyah did; his 86-symbol syllabary was so successful it was used for newspapers and official documents. Of more significance to Western civilization is the ancient syllabary known as " West Semitic ", from which the Greeks created their alphabet. This development—normally considered the final stage in the evolution of a writing system—involves adding vowel signs that effectively demote the syllabic signs to simple consonantal signs. In the 2,800 years since the development of the Greek alphabet, many other alphabets have appeared, but no reforms have taken place in the basic principles of writing.

Despite the continued and successful use of logosyllabic and syllabic systems in the twentieth century, alphabetography is thought to be the most advanced writing system invented by man. It is clear, for instance, that an alphabet would have been well suited for writing Japanese, but now such factors as the preponderance of homophones make its adoption difficult to the point of impossibility. Furthermore, a culture rarely seems to be sufficiently motivated to remodel its own writing system—Turkey and Korea being notable exceptions. Innovative developments are typically made by " outsiders " who borrow and then refine, unhindered by the pressure of vested interests. The transition from logography via syllabography to alphabetography may seem obvious, but so far there has been no evidence of sudden breakthroughs. The evolutionary path is seemingly fixed and unidirectional.

Evolution implies progress, but progress invariably causes problems. If one focuses on the smallest linguistic element of expression in writing, it is clear that the evolutionary trend is towards units of decreasing size: from word, to syllable, to phoneme. There is thus a corresponding decrease in the number of signs that must be memorized by a writer or reader. This would seem to be an advantage, but it can actually hinder comprehension: the fewer the signs, the less the information that each carries, and the greater their frequency in any document. Without the addition of metagraphic devices—such as punctuation marks, capital initial letters, and italics—the words in an alphabetographic text are much harder to pick out than those in a logosyllabic text. Thus a reduced set of symbols requires an increased set of metagraphic devices; and the trend is for such devices to multiply, adding greater complexity to a writing system that was intended to be simple. Yuen Ren Chao very tentatively suggests about 170 symbols for an ideal writing system —a golden mean between the roman alphabet and the number of Chinese characters in normal use.[3)]

Predicting the future development of writing systems accurately is far more difficult than deciphering those of the past. Since an alphabet expresses single sounds, or phonemes, it would seem to be the practical terminus of writing's evolution. But it is clearly not ideal, as can be seen from our increasingly complex metagraphy. Fortunately, however, technology has provided a way in which writing may continue to evolve, but in an entirely new direction. Unlike previous developments, this "lateral" evolution has occurred very suddenly, so suddenly that we are forced to redefine what we mean by "writing".

One conspicuous sign of the new semantic territory occupied by writing is the frequency with which people now refer to computer disk drives "writing" and "reading" information (not always textual) that, being in electronic form, is not directly visible. The author, using a word processor, now "writes" with a keyboard, and the text is recorded in digital form. Although the author normally monitors the text on a screen, this is not theoretically necessary: the "writing" takes place on the latent level. The metatext is the author's "original", and it can only be viewed indirectly on a screen or on paper; this requires a transfer from the latent to the manifest level, in the same way that a latent image in photography must be developed to become visible. In practice, this means "printing" the text on a monitor or printing it out on paper; the former printout is ephemeral in nature, while the latter is as durable as more conventional manuscripts, typescripts and printed pages. The relationships between these two levels of writing, and between them and the author or reader deserve careful consideration.

What then is special about this metatext? How does it differ from the corresponding text on the manifest level?

First, metatext is binary and unidimensional, consisting of a string of ones and zeros. Manifest text, however, is two-dimensional (on occasion even three-dimensional). Although a text is conventionally thought of as being a string of characters and punctuation marks, when we open a book or journal we are confronted with formatted text over which our eyes are free to range. Efficient reading, in fact, involves scanning across lines of text rather than along them. Metatext, on the other hand, is strictly unidimensional and is directly "visible" only to a computer.

Secondly, metatext contains a mixture of familiar alphanumeric characters, special characters (such as $ and @) and operation characters (such as + and =), together with metagraphic "characters" that determine the appearance of the text when it is made manifest. These are all independent of each other, so that "A" has as much and as little in common with its allograph " a " as it does with " Z ". Also, the metagraphic characters—such as the carriage return (CR), line feed (LF), and form feed (FF)—are essentially no different from the alphanumerics. Even so-called graphic characters—representing lines, angles, solid blocks and shading—can now be found in metatext.

Thirdly, metatext is, like Morse, encoded. Any kind of encoding involves a convention, and the conventions for metatext are quite different to those for manifest text. These conventions are changing rapidly and becoming increasingly complex.

Probably the oldest convention still in use is that employed for telex: a primitive code known as the International Alphabet No. 2 (IA2) which enables representation of up to 52 alphanumeric characters and symbols plus a few basic metagraphic characters such as CR and LF. As on the first typewriters, minuscules are not available. The simplicity of this system would seem to represent a step backwards, away from increasing metagraphic complexity, but it should be remembered that this is in fact the starting point for a separate, lateral evolutionary path.

Some have questioned the necessity for a complex metagraphy and have tried to reverse the trend by proposing a single-case orthography. Although in some alphabets (such as the Irish) only size is used to indicate case, the idea of doing away with case altogether is about sixty years old; but, as Michael Twyman explains, it " proved to be only a passing fashion ".[4] The would-be reformers had underestimated the usefulness and attraction of a complex metagraphy—witness the recent fad for internal capitals, as in " WordStar ".

It was therefore only natural that both majuscules and minuscules were included in the International Alphabet No. 5 (IA5), ratified by the ISO (International Standards Organization) and CCITT (International Telegraph and Telephone Consultative Committee) in 1968. IA5 was developed from ASCII (the American Standard Code for Information Interchange), an encoding scheme introduced in 1963 which later became the *de facto* standard for microcomputer use.[5] In ASCII, each character is represented by one byte (8 bits), of which only seven bits are used, giving 128 possible bit patterns; the eighth bit remains available for non-specified uses, such as error control (parity). The first 32 combinations are codes that control the printing of text or the transmission of data; besides CR and LF, there are control characters that indicate the start and end of text, tabs, backspace and delete—even a "bell" (now a beep). IA5 differs from ASCII in that it omits certain symbols (including square and curly brackets, backslash, caret and the vertical line) to provide space for alphabet extensions and diacritical signs.

It is interesting to note that on this latent level, characters can exist in a "pure", schematic form: 1000001 stands for not just a particular "A" but for every possible "A" (upper case, that is). Questions of size and shape are irrelevant to the latent character. Exploiting this property of metatext, Donald Knuth has developed a letterform-defining system called "Metafont" which can simulate a wide variety of typefaces (and even hybrid typefaces) by manipulating the values of certain external parameters governing the length and breadth of the strokes, angles of curvature, the presence or absence of serifs, and so on.[6)]

As more software engineers and innovators like Knuth become involved with metatext, standardization becomes more difficult. Despite its title, IA5 is far from being international; it lacks the necessary capacity, even if combined characters are considered "valid".[7)] Just restricting ourselves to roman alphabets, the need for many more than 128 combinations is clear: *The Chicago Manual of Style* lists 174 special characters required for setting text in Portuguese, Finnish, Turkish and other languages using the roman alphabet.[8)] Greater internationalization would require the inclusion of Cyrillic characters (for Russian and other Slavonic languages), Greek characters (including aspirates and accents), and Hebrew and Arabic characters. For Icelandic and Old English, the thorn, eth, wyn, and yogh are desirable, together with vowel ligatures. Even if one were to rely on transliteration for all other writing systems, this would still require far more combinations than Chao's golden mean of 170 symbols.

Fortunately, such expanded character sets are rapidly becoming available. Already many systems are using a full 8-bit code—referred to as an " extended character set "—that effectively doubles the number of combinations available with ASCII. Included in the ASCII extended character set are alphanumerics (such as ä), a few Greek characters (for scientific and mathematical use), mathematical and currency symbols, and graphic symbols (for creating boxes, shading, etc.). A rival scheme is the ANSI (American National Standards Institute) extended character set, but extended ASCII appears to be becoming the standard.

Further expansion requires either " shifting " (as on a typewriter) or the use of a 16-bit character set—that is, two 8-bit bytes (a unit known as a " word ") to code each character and symbol. Such a double-byte character set (DBCS) is currently used for Japanese *kanji*, and one may soon be introduced for English as well. Although the intention appears to be the creation of a DBCS for each " country ", a single DBCS could become a truly international standard. Metatext composed of double-byte " words " could accommodate 65,536 different characters. This would allow for extra punctuation symbols, italics and small capitals, mathematical and IPA symbols, *Fraktur* characters, and possibly all of the alphabets and syllabaries in use today—even the Devanagari script, which has almost 300 characters.

International alphabets may be devised by committees, but compliance is something that is effectively controlled by market forces. Although ASCII is commonly accepted, virtually no word processing programs create " pure ASCII " metatext. For example, some software publishers invent proprietary codes for such metagraphic devices as " soft hyphens " (hyphens that are only printed when at the end of a line) and " strikeout " (indicating that a portion of text will be printed with a line through it, signifying deletion). Since these decisions only affect the metatext, which is invisible, each software developer feels free to establish different conventions for metagraphic features. This creates problems of compatibility: text prepared with one program cannot normally be accepted by another, unless it is either " stripped " of special characters (in practice, becoming pure ASCII), or passed through a conversion program. Both methods can destroy important information (such as commands for underlining, italics or line spacing), since there is never complete equivalency between the metagraphic features offered by two different word processing programs. There is, it is true, a common IBM file format known as DCA (Document Content Architecture),[9] but in practice the formats of the leading word processors find wider acceptance. One way to minimize such compatibility problems, which multiply with the introduction of each new program, would be to include several more metagraphic characters in any future international alphabet.

The introduction of the " soft " concept—applied to hyphens, spaces, carriage returns, and even founts—signals the growing awareness of the latent level of writing. The term contrasts with the " hard " of hardware and hard copy (printout); " hard " denotes tangibility, and " copy " reflects the fact that the " original " is inherently latent. The third major difference between text on these two levels involves the degree of plasticity: a " hard ", manifest document resists manipulation, whereas a " soft ", latent document can be subjected to such transformations as editing, reformatting, sorting, merging, substitution, conversion, and translation. Except for translation, these operations are performed with great ease—hence the growing popularity of word processing.[10] Recent developments include ancillary software that can facilitate outlining (hierarchical organizing and manipulating of text blocks) and check for compliance with the conventions governing manifest text—spelling, style, punctuation and formatting. Words can be counted, tables of contents compiled, footnotes numbered and positioned with a minimum of effort. Some programs even allow people other than the author to add comments and corrections in different colours. Metatext is also amenable to statistical and other analyses. Machine translation, on the other hand, is still in its infancy and demands considerable advances in such fields as linguistics (particularly discourse analysis) and artificial intelligence: present-day translation systems leave much to be desired. The important point, however, is that the potential exists for adequate (if perhaps not optimum) translation. Moreover, metatext can be transformed in a multitude of other ways—it can even be compacted (" squeezed " or " crunched ") to aid storage and transmission. This plasticity is one of the most important features of metatext.

Having examined the differences between manifest and latent text, we should look at the relationship between them. An illustration of how complex the link can be is provided by interactive fiction, in which a unique manifest text is generated by the interaction of the reader with a highly complex metatext: in response to the reader's input, certain blocks of metatext, called " rooms ", are made manifest while others may never be uncovered. Each manifest text generated by " selective recall " of the encrypted metatext constitutes a narrative in which the reader is the protagonist—both in the fiction and in fact.[11] A similar manipulation of metatext is involved in computer-aided instruction (CAI).[12]

Interactive fiction and CAI are special cases, but metatext is only ever visible at one remove. As has been stated, latent text can be made manifest in two ways—either on a monitor (using screen founts) or on paper (using printer founts). In both cases interpretation is involved, and this interpretation is performed by something known as a " driver ". Thus, because any manifest document is the result of interpretation, neither the screen display nor the printed version are necessarily accurate representations of the latent original. Indeed, many word processing programs provide for " hidden " text—which is to say, metatext that can be seen on screen but not on paper; this is useful for making private memoranda.

Despite these differences, the durability and traditional appearance of hard copy mean that this is often treated as if it were the original; it is, after all, the one usually intended for consumption by others. Many writers still find it easier to mark corrections on the hard copy in preparation for later editing of the metatext, which is performed while looking at the monitor. It is usually desirable, therefore, that the two manifest versions of the metatext—one on the monitor and the other on paper—

should be similar in appearance, so that "what you see is what you get" (usually contracted to WYSIWYG).

Since attention is focused on the printed text, the programmer's quest for WYSIWYG usually involves modifying the monitor display of a text so as to make it resemble the printed version as closely as possible. As the quality of hardware improves, the possibility of achieving true WYSIWYG increases. But this is not necessarily as advantageous as it might seem. Perhaps an underlined or boldface word should appear so on screen as well as on paper; but is there any need for accurate leading, justification or proportional spacing? The answer depends on the application. When writing an academic paper, for instance, a simplified display is usually sufficient. Far removed from the WYSIWYG ideal is TREATISE, a "text-stream dissertation-formatting" program that makes use of special tags to control formatting, which is performed separately prior to producing the final output.[13] Such software is surprisingly versatile, especially if details of the major manuscript styles are programmed into it: the mere addition of a tag such as "@MLA@" could result in the text being entirely reformatted to conform to MLA style. If, however, the text is to form part of a newspaper, magazine or book, a closer approach to WYSIWYG may be extremely advantageous. This approach is illustrated by desktop publishing.

The term "desktop publishing" is still new and therefore highly ambiguous: "page making" is a more accurate and helpful term. Whatever the name, this software allows pages containing text, charts, diagrams, illustrations and even photographs to be composed, displayed and printed out. At present, emphasis is put on the layout rather than on the text, and thus the latter is often imported from a compatible word processing program. Naturally, the metatext created by a desktop publishing program differs considerably from ASCII. For instance, a string of bits may represent not merely a letter schema, but the actual fount and size to be used by the printer. Here too, conventions—"page-description" or "printer command" languages—are multiplying. In future, though, the advanced formatting features of desktop publishing software—which now include automatic hyphenation and kerning—will almost certainly be integrated with word processing software to give authors unprecedented control over both the content and appearance of their work, without outside intervention.

Printing of course represented a major change in the technology of writing, making texts available to large populations instead of just the privileged. Ironically, it also put control of texts into the hands of a few—the editors and printers, and sometimes the censors. As well as dictating the content and appearance of printed text, the decisions made by these people also influenced the ways in which we write—determining, for example, that the first person be represented with a capital " I " rather than " i ". Tom Carney argues that with the advent of the printing press, a process began by which the author became alienated from his work:

> This sundering of the writer and his or her . . . work was to grow more marked as the technology of printing became more elaborate. . . . It took the advent of desktop publishing in 1986 to give the writer back control. . . . [14]

With control, however, comes responsibility. Carney goes on to discuss the growing importance of what he terms " macro-punctuation ", or the formatting of text on a page by the author. " Formatting, at the level of the page, is becoming analogous to punctuation at the level of the sentence."[15] Punctuation was originally intended to facilitate reading aloud (the custom of reading silently to oneself is fairly modern), but by the end of the seventeenth century this elocutionary approach to punctuation gave way to the syntactical type of punctuation with which we are familiar. What Carney fails to see is that punctuation is just one aspect of metagraphy, that part of writing which continued to evolve after the invention of the Greek alphabet; just how far it has evolved is clear when we look at ancient texts consisting entirely of majuscules, with no word division and no punctuation marks. Now that the tools are available, it is the techniques of metagraphy that the writer must grasp in order to present his work to maximum advantage.

A great deal of study and experimentation is required.[16]

There are many technical topics related to the advent of metatext that need to be explored, but of more fundamental importance perhaps is the question of how an author relates to metatext.

Writing is not, and has never been, a process of producing hard copy of text that already exists inside the author's head. Ideas are far too disorganized and fluid, and this is reflected in the loose, unstructured nature of most speech. A spoken utterance is far more immediate than the written word. In contrast, manifest documents are highly organized and rigid. Writing is a maieutic process by which latent ideas are made tangible. Once organized and displayed in manifest form, these same ideas then resist change: some are carved in stone for centuries. Metatext, on the other hand, stands somewhere between the fluidity of the author's mind and the rigidity of the manifest text. It is at once organized and pliable, capable of being moulded and re-moulded, responding to every change of mind. The drawback, if there is one, is that the writer may find it difficult to stop making alterations since there is little to discourage him. Metatext is subject to a process of continuous improvement.

In conclusion, it can be said that metatext has qualities that make it an ideal, "soft" medium of communication in a technologically sophisticated society. It is serving to bring the author into closer contact with his work than has ever been possible. Since the invention of the Greek alphabet, writing evolved only in terms of metagraphy, an increasingly complex science that over the centuries had come to be monopolized by professionals—originally scribes, later publishers and printers. Now, however, the way is open for an entirely new relationship to develop between man and text. To suggest that metatext will lead to a new "reign of miracles" is somewhat hyperbolical, but Thomas Carlyle would surely have given it a warm welcome.

Notes

1) Thomas Carlyle, "Heroes and Hero-Worship", v, lecture in London, 19 May 1840.

2) In communications theory this is referred to as "time and space uncoupling". See Yuen Ren Chao, *Language and Symbolic Systems* (London: Cambridge University Press, 1968), p. 119.
3) Chao, p. 112.
4) Michael Twyman, *Printing 1770–1970* (London: Eyre & Spottiswoode, 1970) p. 83.
5) EBCDIC (Extended Binary Coded Decimal Interchange Code), an 8-bit alternative to ASCII, is rarely used for microcomputer applications.
6) For a critique of Knuth's work, see Douglas R. Hofstadter, *Metamagical Themas: Questing for the Essence of Mind and Pattern* (Harmondsworth, Middx.: Penguin, 1986), pp. 240–5.
7) Such combinations are produced by the somewhat clumsy process of "adding" the two components with a metagraphic character known as the backspace; thus, a+^ produces â.
8) *The Chicago Manual of Style*, 13th ed. (Chicago: University of Chicago Press, 1982), p. 254.
9) To be exact, there are two types of DCA files: Revisable-Form-Text and Final-Form-Text.
10) Although computers have traditionally been considered as "number crunchers"—useful for handling figures but unsuited for words—since 1980 word processing programs have come to account for the bulk of all personal computer applications. (The first complete version of *WordStar* was released by MicroPro in March 1980.)
11) See Andrew Armour, "Interactive Fiction: Literature in the Making", *Geibun-Kenkyu*, No. 48 (1986), pp. 1–14.
12) See Marvin Smith, "Computer-Assisted Language Learning—A Communicative Approach", *Journal of Audio-Visual Language Education / Kiyo*, No. 20 (1987), pp. 57–73.
13) Kate L. Turabian, *A Manual for Writers*, 5th ed. (Chicago: University of Chicago Press, 1987), pp. 235–6, 278–9.
14) Tom Carney, "The Impact of Word Processing on Authors and Their Books", *Research in Word Processing Newsletter*, 5, No. 4 (April 1987), p. 9.
15) Carney, p. 10.
16) Typical examples of poor "macro-punctuation" are the use of multiple founts on a page and the justification of non-proportional text with a short line measure and no word division, thus producing "rivers of white". It is to be hoped that, with advances in expert systems, future software will offer advice and warnings to the inexperienced.