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This paper was originally presented in 1985 at a meeting on 'Paper versus screen'. Although most computers still had green screens with 25 lines of text to view, the Apple Mac had been launched the year before. And although the World Wide Web was still some years off, the concept of hypertext was already established and was heralded by many as the future of instructional text.

I put the case for paper, while the other speakers enthused about a hypertext future on screen. I wasn't so counter-cultural as to deny the benefits of this, but I argued that we shouldn't throw the baby out with the bath water – that we should recognise how paper documents work so we retain the good things while claiming the amazing promise of digital documents.

At the time I was frustrated that paper was being caricatured as a completely linear experience. Although these quotations are from several years later, they are typical of what was being said about hypertext in 1985:

"Unlike the static form of the book, a hypertext can be composed, and read, non-sequentially." (Landow & Delany 1991: 9)

"Text is typically presented in linear form, in which there is a single way to progress through the text, starting at the beginning and reading to the end." (Foltz 1996: 109)

Since that time there have been quite a number of much deeper studies of this issue, notably Andrew Dillon's excellent 'Designing Usable Electronic Text' (1994) and Abigail Sellen & Richard Harper's seminal 'The Myth of the Paperless Office' (2002). And I recently returned to it in my 2012 paper 'Graphic literacies for a digital age: the survival of layout'.

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At present it is possible to be very optimistic about the future of electronic publishing: with better screens, cheaper memory and faster processors it will be possible eventually to engineer out many, perhaps all, of the ergonomic problems which we can now perceive. Engineering the solution, though, depends on perceiving the problem. In this short paper I wish to call attention to some aspects of studying long passages of continuous prose: an activity that forms the core of much of the learning that takes place in higher education.

Reading a text on a very basic word-processor is not unlike reading a scroll-you can simply go forward or backwards. Scrolls have not been

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widely used since they were supplanted by the bound codex in about the fourth century AD. The codex format made every page of the book equally and instantly accessible, with no need to search through in a sequential fashion. Most other innovations in book design since that time have had the same goal – to make information more accessible. We can list page numbers, title pages, headings, contents lists, indexes, glossaries, abstracts and summaries. Successful and lasting developments in electronic text will have to perform at least as well as the codex; they will therefore extend this trend towards accessibility.

This is already happening: for example, the term ‘hypertext’ has been coined to describe a dynamic text which offers alternative pathways, rapid links between concepts, and the ability for users to add comments or modify the text (Nelson, 1974; Weyer, 1982). Several implementations of the concept are now being developed (for example, Brown, 1984), and the forthcoming introduction of the CD-ROM, storing large amounts of pictures, text and sound in a marketable format, will accelerate the process.

Before we opt too enthusiastically for this ultimate accessibility, though, it is worth considering some features of conventional printed books which we tend to take for granted, but risk losing if we don’t take care to build them in to electronic alternatives.

The permanence of printed text

One rather obvious feature of books is that every time we look at a particular book it is exactly the same as before. Because we have been able to take the stability of text for granted, very little research has specifically addressed it. However, there is some empirical evidence to confirm the intuition reported by many readers that they can remember or find ideas by their location on the page (Rothkopf, 1971).

Reading researchers, such as Thomas (1976) and Pugh (1979), have reported that readers employing active reading strategies are more effective than those who read through in a linear even manner. Active reading strategies include initial browsing and skimming to preview the text, frequent looks-back, and re-reading. They help readers to build a cognitive map of the text as a physical object in which headings, illustrations and other features act as landmarks. At first sight, dynamic texts would seem to help readers to employ such active strategies. But it is possible that this process relies on the text remaining stable so that readers can retrace their path or locate ideas which at first seemed irrelevant but now need more attention. This may be made more difficult if a computer is constantly trying to second-guess their intentions and monitor their progress, if the act of reading has itself changed the text by expanding the sections selected

for attention, or if there is in fact no permanent text but a series of frames accessed in the dynamic way envisaged by Nelson.

The length of printed texts

Texts which contain arguments to be studied, rather than simply facts to be referred to, can rarely be taken in at one sitting. In fact, the sheer length and complexity of text is one of ways in which literacy revolutionised society – it allowed writers to develop arguments which are beyond the attention span of listeners. The amount of information to view at any one time may also have an effect on our ability to understand complex arguments. More than four times as many words are displayed on even a small format double page spread than on a typical 25 line screen display of the present day.

When readers skim, scan or browse through a conventional text, they interact with a physical object. Activities such as flicking through pages or browsing can be done semi-consciously rather than in a deliberate articulated way. As Kerr (1986) has pointed out, electronic text does not allow you to stick a finger between two pages while examining a third. Further, electronic texts using menu or keyboard systems to access text frames require users to articulate their needs. We don't really know whether this articulation is likely to distract attention from the main task of thinking or learning about the text content. An intellectual construct has replaced the physical object.

The linearity and cohesion of printed text

Another feature of text we take for granted is its linearity. In spite of all our efforts to make text more accessible, we still expect authors to develop arguments in a logical way, establishing structures and developing evidence at the appropriate time. De Beaugrande (1984) has developed a theory of linear action to account for a wide range of techniques used by writers. He argues that the essential problem of writing is the transcription of ideas which are related in complex multi-dimensional ways into the linear form of language. For example, his 'look-back' principle accounts for such disparate techniques as pro-forms (for example, the replacement of a noun with a pronoun), parallel constructions, spatial metaphor, alliteration and rhyme – all of which refer readers back to or remind them of a prior text segment. If, as de Beaugrande suggests, so many of our familiar techniques of discourse relate to the linearity of language, we should approach alternatives to the traditional linear text with caution.

Because text has always been linear, most of our publicly agreed techniques for making texts cohere depend on this linearity. And the ability to

use cohesion cues (cf Halliday and Hasan, 1976) is crucial to reading comprehension. Skilled readers seek such cues, and may even invent them by inference if they are not present. A problem with dynamic texts may be that inappropriate juxtapositions are likely to occur which are unpredicted by the author. Misunderstandings and errors of this sort are not always easy to spot. In our own observations of reading strategy (Waller, in press) we have found that readers who move to the wrong column in multi-column pages are often able to read on and make a sort of sense without spotting their error. This is because a great deal of text comprehension is achieved through inference. Since readers naturally assume that adjacent discourse is connected, they can construct scenarios within which two unconnected passages or frames seem to make sense. McHoul (1982) has explored such inferencing in some detail.

The alternative to linear text would seem to be a frame-based system similar in form to the programmed learning texts of the 1960s. Each text frame would contain a fact, concept, narrative of explanation and would be accessed in an order determined by the user, by a tutor, by a computer program, but not necessarily by the author. In addition, glossary entries, cross-references or short definitions might be overlaid in separate screen windows. This sort of text is an attractive proposition for some writers since it seems to absolve them from the onerous task of constructing long coherent arguments. Glynn et al (1982) have reported evidence that writers freed of the constraints of good style and correct grammar are more creative since less cognitive capacity is taken up by the need to conform to stylistic standards.

On the other hand, those writers who prefer to ramble on may find themselves having to specify objectives and declare the structure of their material – in short, to implement the much-abused precepts of traditional educational technology. Explorations with a pre-release version of the Guide dynamic document system on the Apple Macintosh computer leads me to believe that a wide variety of techniques for organising and connecting text frames, yet to be identified and given names, are likely to emerge; and that writers will need to develop a new sort of sensitivity to readers' needs, incorporating some of the skills possessed at present by trained editors and typographic designers.

Conclusion

No revolution in communications media succeeds without a transitional period during which it simply imitates the old system. This gives time for the new system to become accepted and expressive techniques to evolve along with the ability of the audience to interpret them. For example, early printed books imitated manuscripts, and early cinema used fixed cameras

in imitation of the fixed viewpoint of the theatre-goer. Electronic screen-based texts intended for critical review or for study will have to be seen to be as good as books before they can demonstrate that they are better. Book emulators with double-page formats and realistic page-turning, such as those proposed by Benest (1985) and Burrill (1986), are an interesting move in that direction. And if effective techniques are to develop naturally in response to the needs of readers and the creative ideas of writers, electronic systems will have to be as open and 'programmable' as books currently are. There is nothing hard-wired about a blank sheet of paper.

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