Representing and Interpreting Literature by Computer

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It is clear that the advent of computers has so far had almost no impact on the mainstream activities of producing, reading, or studying literary texts. This may be about to change. The prophecy that computing will transform the nature of literary studies is certainly one that we have heard before, but the widespread use of powerful personal computers in the last few years and the increasing role played by the electronic 'freeway', as it has been called (networks between institutions and between countries), now makes such a forecast seem to carry more weight.[1] Advocates of these technologies have recently begun to put a new and powerful argument: computer technology for modelling, representing, or creating texts is emerging that will allow us to bring these processes a major step nearer to the activities of actual readers; this in turn will revolutionize understanding of the nature of textuality itself. If this is true, the forthcoming shift in the domain of the literary will be on a tectonic scale, analogous to that brought about in the visual arts by the invention of photography and film.

Two significant developments that underlie this scenario are first, access by computer to large *corpora* of literary texts together with techniques for examining them (generally called text analysis); and second, the building of hypertext and hypermedia systems. First of all I will describe some of the advantages of these two technologies and assess some arguments that have been made recently for their theoretical importance.

Important though these developments are, I will suggest that in the immediate future they are likely to remain of interest to only a minority of scholars and readers. This is not only because, as everyone knows, literary scholars have been slow to pick up and use computers for anything other than word processing. A more important reason is that scholars, with few exceptions, have traditionally been uninterested in how actual readers come to understand literary texts (the reader response debate of the last fifteen years has been conducted almost entirely around putative readers, not real ones). Thus, since we lack firm information about the reading process itself, we cannot expect to build computer-based systems that will genuinely

[1] See Robert L. Oakman's dispassionate preface to *Computer Methods for Literary Research* (Athens: University of Georgia Press, 1984).

enhance the reading process. Some scholars have predicted that the computer will bring about changes in reading itself, making possible a type of interaction with text that the printed book inhibits. While this may be true, it is perhaps imprudent to speculate about changes in such a fundamental human activity as reading when we know so little about how we have accommodated to conventional printed materials over the last several hundred years. The advantages of book technology, which have made the medium so successful, cannot be dismissed so readily. Moreover, the computer technologies that I will be describing are poorly developed and even more poorly distributed. They are still a long way from growing into a David ready to overthrow the Goliath of the book industry. In the last part of this paper I will mention the broader context within which literary computing is situated, and offer an assessment of its future possibilities.

Text analysis

With each year that passes more texts are becoming available to the scholarly community in machine readable form. For instance, English literature texts are now being commercially distributed: Chadwyck-Healey (of Cambridge) will shortly be completing a comprehensive data base of English poetry, while Oxford University Press offers single texts or collections of texts by a single author, such as Jane Austen.[2] Also, text archives in several different countries distribute texts in various (mainly European) languages. Users of such texts, however, are still confined largely to a small and specialized research community, with the technical skills to make use of electronic text. The notable absence so far of computer-assisted research in the leading scholarly journals is one sign that the field is still marginal.[3] As I will suggest, there are reasons for this that go beyond mere Luddism, although this too has played a part in slowing the emergence of the field into the mainstream.

First, no one can yet advise readers that their primary reading activities can take place on a computer. Computers small enough to hold as comfortably as a book, and with screens as clear and versatile as conventional print, are probably imminent, but the number of texts available in electronic form is still small in comparison with the range of texts that is read in (say) a typical English studies curriculum at school or university. Moreover, while arguments over copyright continue unresolved, publishers are not releasing recent texts in computer readable form. The number of new texts being published in conventional form thus continues to far outstrip the number being encoded for reading by computer. The process of scanning an existing printed text electronically and proof-reading it (since no scanning process is

[2] See *TLS*, 30 April 1993, p. 7.

[3] An important account of this problem is provided by Rosanne G. Potter, 'Literary Criticism and Literary Computing: The Difficulties of a Synthesis', *Computers and the Humanities*, 22 (1988), 91–97.

perfect) is also very expensive: the labour involved in producing an acceptable computer-readable version of an average novel runs to well over one hundred hours. While some of the canonical texts, from Shakespeare to Virginia Woolf, are gradually becoming available in electronic versions, the same is not true of the secondary literature. Critical books and journals are still confined to book form, with the exception of a few electronic journals (which, however, are new journals, not electronic versions of established journals such as *ELH* or *Critical Inquiry*). This drag on development, represented by the conservatism of publishers and the restrictions of copyright, shows no sign of diminishing.

Given a suitable portable computer, and well-designed software, there is no intrinsic reason why our main reading activities should not take place on a screen rather than a book, once more electronic versions of books come onto the market. This issue is peripheral, however, to the implications of literary computing for the discipline. The gap between physically reproducing the text stream on a screen and employing the computer to represent the reading process in any meaningful way that would enhance it is, at the present time, considerable, and not to be underestimated. The main use for computer texts, therefore, is for research. But here, a major difficulty presents itself, which has both practical and conceptual implications.

First, the software resources for studying computer text remain relatively primitive: the gap is still immense between what readers can do effortlessly, and what a computer can do. Scholars interested in calling on a computer to aid their research are limited to a very narrow range of possible operations, and such operations still fall largely outside the mainstream work of literary scholarship. Moreover, each research study must, more or less, create its own tools from the resources available. Although some tools for text analysis are becoming standard and more readily available,[4] there are severe limits on what can be achieved with purely 'off the shelf' products. Many scholars thus spend time either writing special computer programs to perform a particular analysis, or creating specially encoded electronic versions of the texts they wish to study (or both), so that a particular range of textual features can be isolated for examination. The nature of such research means that almost no existing software or standard encoding will be adequate to support a serious study, nor could it be adequate until major developments take place in our understanding of reading and how to represent its component processes on a computer. It takes a particular type of dedication to undertake such research, since results are neither gained quickly, nor are they often readily communicable to the wider scholarly community, where understanding is rarely found of such domains as computational linguistics

[4] Perhaps the most notable current example is TACT, a text analysis package developed at the University of Toronto which now distributed by the Modern Language Association of America. For a view of its capabilities see *A Tact Exemplar*, ed. by T. Russon Wooldridge (Toronto: Centre for Computing in the Humanities, University of Toronto, 1991).

or statistics (the two most frequent underpinnings of such study) and where the major journals are inhospitable to the alien discourse of this type of research.

Willie Van Peer has pointed to a basic problem with the present state of text analysis methods, which deal largely in counting words.[5] The quantification offered by text analysis enables only relatively primitive methods of examination. The frequencies of words, collocations, or particular stylistic features, tell us rather little about the literary qualities of a text, since these aspects of a text find their meaning only within the larger and constantly shifting context constituted by the reading process. Text as object (a pattern of words) is a quite different entity from text as communication (a reader's interaction with a text). As Van Peer remarks, 'in the very act of transforming textual qualities into counts, their essentially process-like character is irretrievably lost'. Or, as he puts it more generally, by confining attention to what can be counted, 'the processes of meaning constitution have been eliminated before the analysis is undertaken' (p. 302). The role of figurative language in literature provides a central example. No known computer algorithm is yet capable of identifying whether a word is being used metaphorically or literally (or ironically, or within a pun). But computer-based methods that cannot take account of the multivalent meanings of words do away with one of the basic characteristics of the literariness of the texts being studied. Thus, Van Peer points out, the easier it is to represent a given feature on a computer, the less relevance it has to what makes a text literary (pp. 304–05). While it is possible to encode a text such that figurative usage is identified, and can be made the basis of a computer analysis, this is merely to transfer a standard tool of scholarship from paper to screen, with (one would hope) gains in speed and accuracy: the method, however, is still not computational, in any substantive sense. The role of figurative language in the production of meaning has not been represented by the computer.

This is not to argue that computer methods of analysis have no place: a number of interesting studies could be cited to show the opposite, from Oakman's analysis of Carlyle's prose style to Burrows's study of the idiolects of the characters in Jane Austens's novels.[6] The issue is rather, that no paradigm shift (to use that much overworked concept) in our theoretical understanding has been effected by our use of computer methods in literary scholarship. Nor is it likely to occur until a much more refined and accurate understanding of human cognitive processes is available, and of the process of literary reading in particular. Claims that a new electronic world is

[5] Willie Van Peer, 'Quantitative Studies of Literature: A Critique and an Outlook', *Computers and the Humanities*, 23 (1989), 301–07.

[6] Robert L. Oakman, 'Computers and Surface Structures in Prose Style: The Case of Carlyle', in *Computers in Literary and Linguistic Computing*, ed. by J. Hamesse and A. Zampolli (Paris and Genève: Champion-Slatkin, 1985) pp. 277–85; J. F. Burrows, *Computation into Criticism: A Study of Jane Austen's Novels and an Experiment in Method* (Oxford: Oxford University Press, 1987).

imminent, in which understanding of literature will be radically reconstituted, are thus almost certainly premature and, in the light of our present primitive technical capabilities, misleading: they underestimate the complexities of the reader's engagement with a literary text.[7]

Alternative models of what it means to read a literary text are abundant in the theoretical literature. The little empirical work that has taken place, however, suggests that a central characteristic of reading a poem or a novel is a transformation process, in which what the reader knows or feels undergoes a change in the course of reading.[8] This contrasts with other types of reading, from newspaper articles to instruction manuals, which generally appear to be cumulative, consisting of a process of conceptual model building.[9] The latter process can clearly be simulated more easily by computer: the typical hypertext system, which provides annotations and links to related documents, enables a reader to elaborate a view of a target domain in this way. Thus a literary text can be surrounded by various supporting contexts that will enhance a readers' knowledge and understanding of it, but this is not the same process as the encounter with the primary text.

The act of reading a literary text involves a different set of issues. There is a major indeterminacy in literary reading, springing from the reader's individual experiences and feelings (in addition to a rather sophisticated set of literary competencies for recognizing structures and genres special to literature): this makes the process impossible to simulate by any known computer method. While there is some evidence that various literary features, including stylistic variations and manipulations of plot in narratives, tend to constrain the reading process in ways that are partly predictable, no study has yet gathered systematic evidence to show what determines the interaction of readers with literary texts: the process is extremely complex, and we have hardly begun to ask what the major variables might be.[10] Thus, until we understand the reading process better, we can make little use of the computer as a facility for presenting or examining literary texts; and to treat such texts solely as information is to disregard the most significant feature that makes them literary.

Hypertext and postmodernism

Will the computer become the primary means of literary communication? Patrick Connor, one of a recent group of advocates of computer-based

[7] See, for example: Richard A. Lanham, 'The Electronic Word: Literary Study and the Digital Revolution', *New Literary History*, 20 (1989), 265–90.

[8] See my 'Beyond the Schema Given: Affective Comprehension of Literary Narratives', *Cognition and Emotion*, 3 (1989), 55–78.

[9] Gary M. Olson, Robert L. Mack, and Susan A. Duffy, 'Cognitive Aspects of Genre', *Poetics*, 10 (1981), 283–315.

[10] See my discussion in 'Beyond the Word: Reading the Computer', in *The Digital Word: Text-Based Computing in the Humanities*, ed. by George P. Landow and Paul Delany (Cambridge, MA: MIT Press, 1983), pp. 319–42.

literary systems, cites Genette: 'How will literature survive the development of other media of communication? [...] The day when the Book ceases to be the principal vehicle of knowledge, will not literature have changed its meaning once again?'[11] Genette's distinction as an analyst of narrative is unquestioned, but the assumptions that inform his work are typical, and prefigure more recent extensions of the claim for postmodern understanding to hypertext. As Cees Van Rees has pointed out,[12] Genette's account of the narrative structures he identifies takes for granted that a reader's response is determined by them.[13] Genette's question about the fate of 'the Book' raises the problem in its most general form. Since we know very little about the cultural ecology within which readers and books interact, including books as physical objects, we cannot intelligibly pose the question whether the demise of the book is imminent.

In Connor's paper, which begins with the quotation from Genette, he contrasts oral with literate culture, and proposes that the advent of hypertext points to a reinstatement of the textual system of orality. The integrity and self-sufficiency of the single text will no longer be privileged, as it has been in print culture. We will see the 'linguistic conception' of text peculiar to the book replaced by a 'semiological conception', similar to that which died out in the medieval period under the impact of print technology. Connor explains that the 'linguistic conception [...] minimalizes the extra-referential possibilities which characterize the semiotic conception of the text' (p. 10); it produces a 'rhetoric of linearity, as opposed to a rhetoric of association' (p. 11). In the semiotic conception, Connor envisages a reader reading non-sequentially: thus, he adds, hypertext is one means 'of reducing the writer's control over the reader' (p. 12), that is, freeing the reader from the constraints of linearity.

These conceptions of the printed text originate with the post-structuralist thinkers: Roland Barthes's often cited distinction of the *lisible* from the *scriptible* text (the 'readerly' and the 'writerly' text) provides a familiar way of understanding the distinction.[14] Hypertext is seen as a timely instantiation of the writerly text, in which meaning is visibly dispersed along the links across a constellation of texts, leaving the reader to construct meaning from the various available avenues. Unlike Barthes, who only claimed to distinguish two types of text, however, the proponents of hypertext see the book itself as a distortion of the true nature of textuality. As Connor remarks, 'the

[11] Patrick W. Connor, 'Hypertext in the Last Days of the Book', *Bulletin of the John Rylands University Library of Manchester*, 74 (1992), 7–24 (p. 7). The Genette quotation is from *Figures of Literary Discourse*, trans. by A. Sheridan (New York: Columbia University Press, 1982), p. 22.

[12] Cees J. Van Rees, 'Implicit Premises on Text and Reader in Genette's Study of Narrative Mood', *Poetics*, 14 (1985), 445–64.

[13] Apart from occasional brief, but illuminating hesitations, as, for example, in *Narrative Discourse*, trans. by J. E. Lewin (Oxford: Blackwell, 1980), p. 261, where the indeterminacy introduced by mentioning the reader's role suddenly undercuts his elaborate narratology and leads one to ask whether readers notice the structures Genette identifies.

[14] Roland Barthes, *S/Z*, trans. by R. Miller (London: Cape, 1975), p. 5.

text has been embodied in a book so that the physical constraints proper to objects are improperly transferred to the text itself' (p. 20). Hence hypertext, as the title of his article puts it, may signal 'the last days of the book'.

The potential advantages of hypertext as a pedagogical tool are undoubtedly considerable. The promoters of hypertext, however, overlook the inadequacy of the information on which their far-reaching claims are based. As a result, the issue of what constitutes literary reading is overlooked, and the real benefit to be gained from hypertext obscured. Reading a literary text is equated with reading about literary texts, to the disadvantage of both.

Several exemplary and well documented hypertext systems now exist, such as Perseus (for studying Greek culture) and Intermedia (to support English studies): both clearly serve important needs of students by encouraging a type of study that is both more efficient and more independent. But this use of computer technology, I will suggest, is not the radical shift that has been claimed. More hypertext systems will no doubt be created in the near future,[15] and students will be able to study literature more effectively as a result, from the ready availability of secondary texts and the maps of intertextual links that hypertext typically makes available. A rising tide, as the proverb puts it, raises all boats. But the boats, in this case, will be doing much what they did before. Whether sailing to the coast of Bohemia with Shakespeare, out into the storm with Shelley's Adonais, or to Byzantium with Yeats, we expect our students to acquire the contextual knowledge needed to understand these texts; hypertext systems enabling students to do this more rapidly and enjoyably will enhance the quality of learning. But this development does not amount to a new theory of reading.

Just as text analysis, as Van Peer shows, limits us to dealing with the physical elements of text (words and some of their elementary relationships), so hypertext is confined to what can be represented in verbal or graphical form; and this is, in the end, the least important dimension of the response to literature. It is what cannot be represented that invokes a reader's imaginative investment in a literary text. Henry James provided a particularly interesting statement of this view when he described his strategy in writing *The Turn of the Screw*. James insisted on not spelling out the details of the horrors he wished to evoke: 'Only make the reader's general vision of evil intense enough [...] and his own experience, his own imagination [...] will supply him quite sufficiently with all the particulars.'[16] Burke, it is worth noting, fought a comparable battle in the eighteenth century against the fashionable notion that the best poetry was like painting: verbal description, he claimed, raises stronger emotion than any painting, because it rouses the imagination to act.[17]

[15] See the examples described in a number of the chapters of *Hypermedia and Literary Studies*, ed. by Paul Delany and George P. Landow (Cambridge, MA: MIT Press, 1991). I am producing a hypertext package myself to support the study of Romantic literature.

[16] Henry James, *The Art of the Novel* (New York: Scribner, 1962), p. 176.

[17] Edmund Burke, *A Philosophical Enquiry into the Origin of our Ideas of the Sublime and Beautiful*, ed. by Adam Phillips (Oxford: Oxford University Press, 1990), pp. 55–56.

Hypertext representations of a literary text are perhaps rather likely to work against this imaginative mode of reading. Since the primary benefit of hypertext is intertextuality, various links to other texts and to graphics will continually tempt a hypertext reader to diverge from the main text to examine alternative pathways. The imaginative investment to which James alludes, the progressive development of a specific mood and a set of issues personal to some degree to the reader, will be aborted before it has properly taken hold: repeated digressions to linked texts will dissipate and undermine the reader's engagement with the primary text. Taken to its logical endpoint, the image of intertextuality offered by the advocates of postmodern hypertext suggests that a reader would never read a complete text at all, since all texts are merely dispersed fragments of a whole world of other texts whose relationships are more significant than any single text can be in itself.

Where does such a view of the literary text originate? Aside from the example provided by postmodern critical theory (and Saussure's linguistic model is ultimately at the back of this conception), George Landow's account is one of several discussions showing that the conceptual model for hypertext also stems from that of 'information'.[18] It derives, in other words, from the so-called cognitive revolution in psychology, which was in turn inspired largely by computing; this has given birth to the notion of 'information technology' and 'information processing'. How does this bear on the reader of literature? Landow provides a typical account: a competent reader of *Paradise Lost*, he says, is able to call to mind numerous echoes of other writers, from Homer, through the Bible, to Spenser. The texts of all these authors could be available as specific references through hypertext linkings from a main text of Milton's poem; hypertext can provide any number of such non-linear pathways to supplement the reading of a primary text. All of Landow's examples concern information in this sense: he refers to annotating literary texts, or to a proposed hypertext corpus of scholarly articles about James Joyce (p. 135). The importance of making the links that Landow indicates cannot be underestimated in literary education; but it is the priority that a hypertext system places upon them in Landow's account that is misleading. In the process of pursuing such links, what is most distinctive to the reading of a literary text disappears.

Landow, whose recent book on hypertext bears the subtitle *The Convergence of Contemporary Critical Theory and Technology*, aligns his arguments about hypertext with a line of critical thinking about textuality from Derrida to Hillis Miller. Miller, for example, speaking in 1990, referred to the replacement of the book by 'the new multilinear multimedia hypertext that is rapidly becoming the characteristic mode of expression both in culture and

[18] 'Changing Texts, Changing Readers: Hypertext in Literary Education, Criticism, and Scholarship', in *Reorientations: Critical Theories and Pedagogies*, ed. by Bruce Henricksen and Thaïs Morgan (Urbana and Chicago: University of Illinois Press, 1990), pp. 133–61.

in the study of cultural forms'.[19] As an account of that part of culture represented by books, which are still being produced on a scale far outweighing multimedia products, Miller's remark is not only far from the truth; it overlooks the nature of literary reading.

Hypertext appears to be most successful when used pedagogically as an aid to study, although since very few systems have been developed little empirical evidence for their effectiveness is available. The main instantiation of hypertext discussed by Landow, the Intermedia system that he helped to pioneer, involves a course in which students study the critical and historical context of authors such as Pope and Dickens through hypertext. Hypertext, in its ability to contextualize literature, is a remarkable and important tool, and the experience of teachers such as Landow who have observed students' responses to it is highly encouraging. As another witness remarks, speaking of his experience of helping to produce the hypertext system for Greek culture called Perseus, students 'ultimately learn what kinds of questions particular hypertexts can and cannot support, but their initial response is striking: they become more demanding and intellectually more aggressive'.[20] The critical attention of students, in other words, is both sharpened and focused by the kind of resource that a well-designed hypertext offers. In the case of Intermedia, this means that student readers build their own personal system of annotations and references around a primary text, by making use of those already provided by the authors of the system, or by writing their own.

By extending the model of hypertext to all types of text, however, Landow conflates the processes of literary and non-literary reading, to the disadvantage of the former. Literary texts are not information; and hypertext is not a medium in which the experience central to reading literary texts will be fundamentally reshaped for the reader. A critical apparatus such as Intermedia presupposes that a student has read the Pope poem or the Dickens novel before embarking on its study. The proponents of hypertext leave unclear what distinction, if any, they see between the primary act of reading a literary text and rereading it for analysis and study: rereading, or the comparative and analytic work of studying a text, employs a substantially different set of cognitive functions from those implicated in the act of reading.[21]

Hypertext, as Landow's work over a number of years demonstrates, offers exemplary conditions for studying literary texts, that is, for productive rereading; but hypertext does not speak to the direct interaction between the

[19] Cited in George P. Landow, *Hyptertext: The Convergence of Contemporary Critical Theory and Technology* (Baltimore and London: John Hopkins University Press, 1992), p. 28.
[20] Gregory Crane, 'Composing Culture: The Authority of an Electronic Text', *Current Anthropology*, 32 (1991), 293–311 (p. 294).
[21] See my chapter, 'Rethinking English Studies: The Role of the Computer', in *Humanities and the Computer: New Directions*, ed. by David S. Miall (Oxford: Oxford University Press, 1990), pp. 49–59 (p. 52).

reader and the literary text. Landow, like Connor and other proponents of hypertext, sees hypertext as a practical realization of the theory of intertextuality. Through hypertext, he claims, 'one gains an opening up, a freedom to create and perceive interconnections occurs'.[22] In this process, he notes elsewhere, 'links within and without a text [...] become equivalent, thus bringing texts closer together and blurring the boundaries among them'.[23] Overlooking the process of the reader's own construction of meaning from a text, however, this view of reading risks substituting a battery of intertextual links for those that readers form for themselves out of their own past experience (whether personal or literary). Readers inclined to form personal and intertextual contexts for themselves have no place in this scheme: Landow's theory of hypertext implies that readings of this kind are uninteresting or even irrelevant, an implication which can be found explicitly in the writings of other critics, such as Jonathan Culler.[24] In the perspective offered by Landow, the integrity and significance of the response to the single work of literature is replaced by a shift to the margins of the text, where endlessly permeable relationships to other texts and contexts are seen to disperse and intellectualize its values. As Landow claims, hypertext enormously speeds up the process of making links both within a text and between texts. But he concludes that this 'promises to change the way we read and write', and that with hypertext 'the distinction between intratextuality and intertextuality will become harder to maintain than it is with book technology'.[25]

The view that reading a literary text in book form imposes linearization, however, is an oversimplification of a highly complex process. Reading an information text, as a study by Olson, Mack, and Duffy shows,[26] is likely to take place in linear form: a reader elaborates concepts step by step from information that is successively encountered, and each concept is added to a conceptual model of the text that the reader progressively forms. Literary readers, on the other hand, frequently engage in anticipatory and retrospective acts of processing, even though the trajectory of reading appears to be linear. The devices of literary language and structure enable a reader to overcome precisely the limitations of linear presentation: forming a provisional interpretive schema, for example, then putting it on hold while other pathways are explored, only to be prompted later to return and revise it, or to create a new schema that serves to reinterpret all that has been read so far. Moreover, the feelings, images, ideas, and memories that a reader brings to a text to aid in its interpretation are not progressively absorbed or discarded: they remain active, informing the process of reading, and being in turn reshaped by the text. The views I am summarizing here are more or less

[22] 'Changing Texts', p. 150.
[23] *Hypertext*, p. 61.
[24] See, for example, Culler's casual dismissal of a psychology of reading in *The Pursuit of Signs* (London: Routledge & Kegan Paul, 1981), p. 129.
[25] 'Changing Texts', p. 154.
[26] See note 9.

commonplace in reader response discussions in the phenomenological tradition, such as Wolfgang Iser's, but empirical evidence for them is also beginning to accumulate.[27] Clearly, such a complex and individual process is already multilinear in ways that can never be replicated by a hypertext system; to endeavour to replicate them, even if it were possible, would be pointless, since each individual's reading of a given text will not only vary from those of other individuals, but will differ each time the same text is read.

The problem for reading raised by Landow's claims for hypertext can be exemplified in another way. For the student of anthropology a hypertext such as Perseus, as Crane's account shows, offers a decisive advantage over conventional book publication. 'The text of a printed ethnography,' Crane remarks, 'must evoke a visual and aural impression, and it forces the reader to fill in the cognitive gaps' (p. 296). But a hypertext offers not only intertextual linkages, but can also bring other sources of information to the student's workstation which would formerly have been out of reach: sound, graphics, and even video sequences, can be systematically interwoven with textual materials in such a way that the ethnographer's experience in the field, in coming to understand another culture, is brought much closer to the student. The conceptual input is surrounded with a sensory richness that no printed text can provide. What is appropriate for a scientific study such as ethnography, however, seems less appropriate in the case of literary education. It is central to the functions of a literary text that, to borrow Crane's words, it 'must evoke a visual and aural impression'; that is, it comes to life initially in a reader's images, memories, and feelings, enabling it to be situated in the reader's specific individual experiences. To substitute a hypertext array of links for this process, whether graphics, citations of other texts, or contextual information, is to disregard the reader's own constructive effort after meaning. Most readers have experienced a comparable phenomenon in watching a film made from a novel: when the text has been read first, the film's sound and images are almost always disappointing or puzzling, because they lack the personal relevance of those generated by the reader from his or her own experience while reading.

A final example of the misrepresentation of literary texts can be found in Landow's discussion of Walter J. Ong, who (echoing Plato's argument in the *Phaedrus*) suggested that a book cannot be refuted; its self-sufficiency, according to Ong, means that it still goes on saying the same thing after it has been criticized. 'This is one reason why "the book says" is popularly tantamount to "it is true".' But the same book sited within a hypertext system, adds Landow, linked to its critique, would seem part of an ongoing dialogue rather than 'the embodiment of one voice or thought that speaks

[27] Wolfgang Iser, *The Act of Reading: A Theory of Aesthetic Response* (London: Routledge & Kegan Paul, 1978). For empirical studies see David S. Miall, 'Beyond the Schema Given: Affective Comprehension of Literary Narratives', *Cognition and Emotion*, 3 (1989), 55–78; 'Readers' Responses to Narrative: Evaluating, Relating, Anticipating', *Poetics*, 19 (1990), 323–39; David S. Miall and Don Kuiken, 'Beyond Text Theory: Understanding Literary Response', *Discourse Processes* (in press).

unceasingly and authoritatively'.[28] While this may be an effective way of situating other kinds of texts, a literary text is not 'true' or capable of being 'falsified' in this sense. Nor is a literary text, because it is printed in a book, rendered 'univocal' in the way that Landow suggests.[29] The reading of literary texts, unlike most other types of text, is inherently dialogical: to the extent that reading draws upon a reader's imagery, for example, a text is drawing upon material available to the consciousness of the reader precisely because it represents some unresolved issue. Images in fantasy, daydreaming, or dreams, as research from Varendonck to Singer and States has shown, act as focal points for reflecting on current concerns with alternative possible outcomes, as yet unrealized.[30] Similar properties appear to inhere in active memories of experiences, or in feelings; thus any response of the literary reader that invokes images, memories, or feelings, is already problematized in ways unique to that reader. Understanding of the nature of reading, and of what is appropriate support for that activity in literary studies, must begin with this point. The proposed new world of hypertext, to the extent that it effaces such issues in favour of the intertextual agenda, will serve its readers poorly, and in the long term fail as a vehicle for learning.

I have suggested that it is an illusion to expect computers to bring about changes in how literary texts are represented or experienced. Computer methods are likely to be ineffective while we lack adequate knowledge of the processes involved in reading literary texts: much further empirical evidence of these processes is required before advances in computing will be possible. Computers may come to play a more significant role as tools in research and teaching, through the use of text analysis and hypertext, but neither method yet offers any central purchase on the process of reading itself. In the meantime, however, two other developments in computing should be mentioned that bear indirectly on the arguments about literary computing that I have presented so far.

First, a rapid increase in the global electronic network may be imminent. This will bring with it considerably expanded opportunities for literary engagement of a kind now rarely considered in university literature departments. In the United States the current vice-president, Al Gore, in one of the more innovative steps proposed by his administration, has announced the intention of creating 'information freeways': these are high capacity fibre-optic networks able to connect all computers. In the words of Benjamin Woolley, the vision is that of 'an information-age equivalent to the railroads and highways, that in their day introduced a technological unity to what

[28] 'Changing Texts', p. 155; the quotation from Walter J. Ong occurs in *Orality and Literacy* (London: Methuen, 1982), p. 79.
[29] *Hypertext*, p. 63.
[30] J. Varendonck, *The Psychology of Day-Dreams* (London: Kegan Paul, 1921); Jerome L. Singer, *Daydreaming and Fantasy* (Oxford: Oxford University Press, 1981); Bert O. States, *The Rhetoric of Dreams* (Ithaca and London: Cornell University Press, 1988).

remains a potentially fractured nation'.[31] This promises to democratize the communication process in revolutionary ways, allowing much greater participation, while largely eliminating the hierarchical relationship enshrined in conventional media. If the implications of this development are realized, computer networks will extend beyond the business and academic world into the homes of everyone who can afford to run a computer, radically changing the ways information and entertainment are delivered. The medium provided by such a network would, in that case, become the primary interface of computers and literature for the majority of people, for good or ill.

Although network users may eventually be able to tap into hypertext systems, such as Intermedia, a more likely development lies in the extension of cultural forms already popular. It seems clear from the little research available on this issue, that the readership for fantasy and science fiction in the USA or Canada is already much more extensive than that for literary texts (conventionally defined).[32] Not only are computer-based forms of such fiction becoming widely available in new interactive forms, where the reader can participate actively in shaping the story, but network versions allowing for multiple participants are now emerging.[33] In terms of their potential for elaboration, and for a much increased payoff in suspense and personal engagement, networked interactive fiction games are a logical evolution both of current popular fiction and of arcade and video games. Their attractions will, of course, remove their participants yet further from the kind of engagement that has generally been considered appropriate for literary texts; as a result, literature, at least in North American culture, may be relegated to a status even more marginal than the one it occupies now. Thus the revolution in network communications will perhaps bring about changes in the status of literature more radical than anything that we can envisage emanating from literature departments.

A second important development lies in the constant evolution of computer technology itself. The rapid embracing of electronic media also means embracing rapid obsolescence. To move from book to electronic media is to invite ephemeral status: a text or hypertext created for today's machines will probably be unreadable in thirty years. Advocates of the bookless culture such as David Jay Bolter[34] are actually inviting the throw-away culture, unless the publishers and archivists of the future are prepared to continually

[31] Benjamin Woolley, 'Bill 'n Al's Modern Adventure', *Sight and Sound*, 3.2 (February 1993), 64.

[32] In Canada see Steven Tötösy de Zepetnek and Philip Kreisel, 'Urban English-Speaking Canadian Literary Readership: Results of a Pilot Study', *Poetics*, 21 (1992), 211–38; in the USA, see Nicholas Zill and Marianne Winglee, *Who Reads Literature? The Future of the United States as a Nation of Readers* (Cabin John, MD: Seven Locks Press, 1990), p. 30. Unpublished data collected by Don Kuiken and myself in Alberta yields figures similar to these studies.

[33] For a recent account of these developments, see Robert T. Kelley, 'A Maze of Twisty Little Passages, All Alike: Aesthetics and Teleology in Interactive Computer Fictional Environments', *Science-Fiction Studies*, 20.1 (March 1993), 52–68.

[34] See *Writing Space: The Computer, Hypertext, and the History of Writing* (Hillsdale, NJ: Lawrence Erlbaum, 1992).

copy or re-create our computer texts for each new generation of machines. While standards are now emerging for transmission of texts across machines, such as the Text Encoding Initiative,[35] the archiving of versions of texts and hypertexts in this form will incur a significant overhead in labour costs which the academic community will probably find it difficult to meet.[36]

In this context, producing hypertexts or other forms of computer media is a risky venture: although a common encoding format is also being considered for hypertext,[37] a program that does not make full use of the machine for which it is written will simply seem rather dull. If hypertext authors are caught between the Scylla of transportability and the Charibdis of attractiveness, it will come as no surprise to find authors opting for the latter: but each hypertext will thus remain an island, to borrow Jakob Nielsen's image.[38] Given both the current poor state of distribution for such materials, and the potential obsolescence of the machines that support them, the island is one that few readers are likely to visit, and which will soon disappear beneath the waves of a technical progress driven by considerations remote from the interests of literary students. While it is possible that the latest technical developments, such as CD–ROM, will provide a firm platform for the foreseeable future, the auguries are not promising: technical advances in computing currently enjoy a life cycle of ten years or less.

The promise of computers for literary studies can thus be given only cautious welcome. But this necessary caution signals a larger dilemma. A discipline that fails to profit from changes in technology, as Tom Corns and Margarette E. Smith pointed out several years ago, 'risks marginalisation as obscurantist'.[39] Yet to introduce current computing methods too rapidly to literary studies risks distorting the discipline and courting imminent obsolescence. Only history will tell which of these possible outcomes presents the greater danger, but for the moment a well-articulated ambivalence towards the promise of computers is perhaps the most rational position that we can adopt.

[35] Steven De Rose, 'Markup Systems in the Present', in *The Digital Word* pp. 119–35.
[36] For some timely warnings on these issues, see Frederick J. Stielow, 'Archival Theory and Preservation of Electronic Media: Opportunities and Standards Below the Cutting Edge', *American Archivist*, 55.2 (Spring 1992), 332–43.
[37] See De Rose, pp. 128–30, and B. Campbell and J. M. Goodman, 'HAM: A General Purpose Hypertext Abstract Machine', *Communications of the ACM*, 31 (1988), 856–61.
[38] Jakob Nielsen, *Hypertext and Hypermedia* (Boston: Academic Press, 1990), pp. 186–90.
[39] 'Literature', in *Information Technology in the Humanities: Tools, Techniques and Applications*, ed. by S. Rahtz (Chichester: Ellis Horwood, 1987), 104–15 (p. 115).