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ABSTRACT

Designed to help foster new research and facilitate a wider dissemination of research and ideas, this fifth volume in an ongoing series of working papers explores selected themes on the relationship between technology and literature. Three papers are presented which represent a sampling of the themes that could be pursued through literature in a variety of technology and society courses. The first paper, "Technology, Romanticism, and Blake" by Mark L. Greenberg, reviews romanticist William Blake's response to the impact of contemporary book printing technology on writing and artistic form. In the second paper, "Technology, Pynchon, and the Meaning of Death," Lance Schachterle explores novelist Thomas Pynchon's critique of technology and focuses on how the fear of death is routinized by technology. "Literature as Technology," by Joseph W. Slade, the third paper, notes the similarities between science and literature. Comments and responses to the three papers are offered by Edward J. Gallagher. He applies the notion of three levels of consciousness to the different approaches reflected in each of the papers and explains how they may be utilized in a course on literature and technology. (ML)

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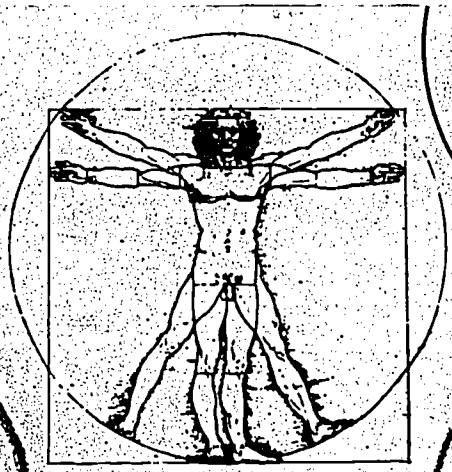
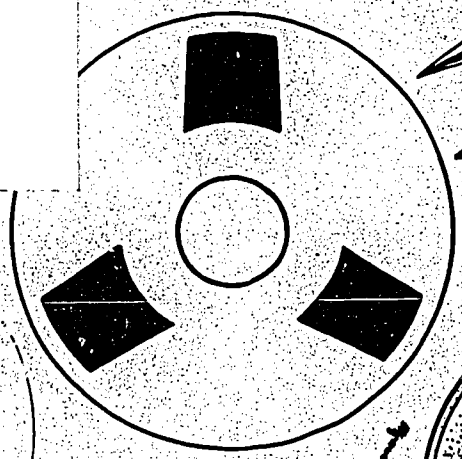
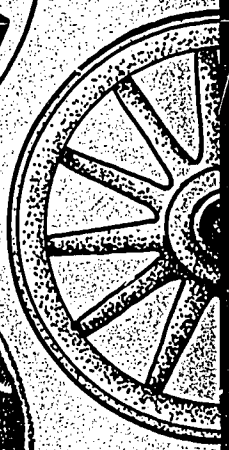
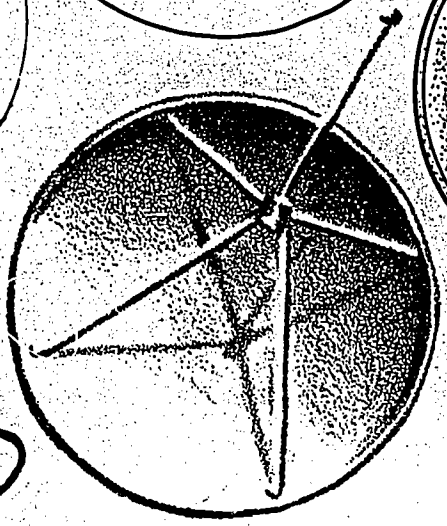
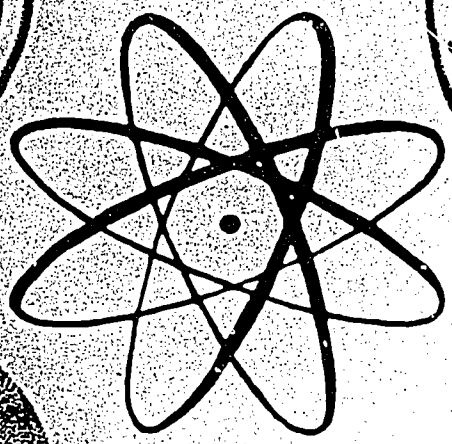
TECHNOLOGY AND LITERATURE

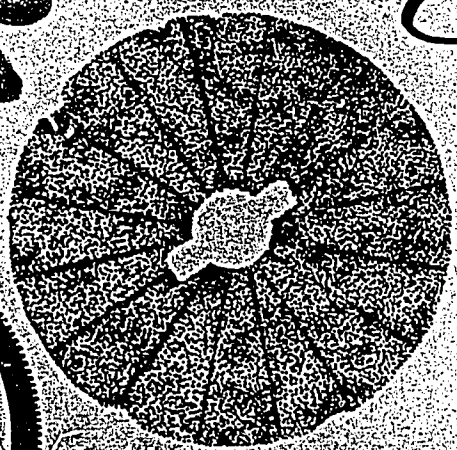












TECHNOLOGY STUDIES RESOURCE CENTER

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Stephen H. Cutcliffe, Editor

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TECHNOLOGY AND LITERATURE

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COVER DESIGN

The cover was designed by Alan Cutcliffe to represent the broad spectrum of topics in both the humanities and technologies covered in this working papers series. The central symbol of daVinci's universal man is juxtaposed with a multiplicity of images associated with the humanities and technology, all echoing the circular shape, hence the globe, gear, computer disk, grindstone, flower, atom, satellite dish, wheel, and sun. The choice of images also juxtaposes the modern with the historical, the philosophical with the practical, an intentionally thought-provoking contrast of scale and topic, corresponding with the intent of the series itself.

Copies of the TSRC Working Papers Series are available prepaid at $6.00 each (checks payable to Lehigh University) through the Office of the Bursar, Alumni Memorial Building #27, Lehigh University, Bethlehem, PA 18015.

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ACKNOWLEDGEMENTS

The plates illustrating Mark Greenberg's essay (pp. 27-33) are drawn from William Blake: The Marriage of Heaven and Hell, Introduction by Clark Emery (1963) and are herein reproduced with the kind permission of the University of Miami Press.

PREFACE

"Technology and Literature" is the fifth in an ongoing series of working papers being published by Lehigh University's Technology Studies Resource Center. The publication of this working papers series, in association with the Regional Colloquium for Technology Studies which serves as the major source for volumes in the series, is designed to help foster a regional research community in this field. It is our hope that the publication and distribution of papers from each colloquium in a working papers format will stimulate new research, facilitate wider dissemination of research and ideas, encourage peer response and adoption as ancillary texts for appropriate courses, and increase opportunities for these papers to be selected for subsequent publication in formal journals and anthologies after appropriate revision.

The Regional Colloquium for Technology Studies and the associated working papers series are activities of Lehigh University's Technology Studies Resource Center. The TSRC is engaged in the creation and dissemination of materials and programming that will lead to a greater understanding of technology on the part of a wide range of audiences, especially their understanding of the mutual interaction of technology and social institutions and values. Among other functions, the Center serves as a focus for academics from all disciplines to collaborate in pursuing research and educational opportunities in technology studies, both with academic colleagues and in conjunction withnon-academic sponsors. The Regional Colloquium and working papers series

are just two vehicles within the Center's many activities that are intended as means for expanding our understanding of the social context of technology in today's world.

The Colloquium from which the essays in this volume are drawn was organized in order to explore selected themes on the relationship between technology and literature. The program was co-sponsored by Lehigh University's Department of English and, albeit implicitly, it might also have been co-sponsored by the newly-formed Society for Literature and Science as all three of the Colloquium speakers were actively involved in the formation of the Society and now serve either as officers or on its Advisory Board (see note on contributors). The topics covered by the authors of these essays vary widely. Each writer develops in depth a focal theme within the area of technology and literature, their diversity testifying to the vitality of this emerging field.

In the first paper, Mark Greenberg reviews the Romantic William Blake's response to the impact of contemporary book printing technology on writing and artistic form. The Marriage of Heaven and Hell is a satirical critique of the then-new letterpress technique. Blake utilized the alternative, "non-traditional" format of illuminating printing. For Blake, "technology and aesthetics operate[d] reciprocally and dynamically," a relationship Blake struggled to deal with. As Greenberg further notes, "the Marriage is, at heart, an anatomy of writing, book production, reading, and interpretation." It is also an anatomy carefully dissected by Prof. Greenberg.

In the second paper, Lance Schachterle turns to the contemporary novelist Thomas Pynchon to explore his critique of technology. "The question Pynchon implicitly asks is to what ultimate ends are these operational results [of technology] applied." Pynchon views technology as extending beyond material objects to principles for organizing whole societies along certain lines, leading Schachterle to look at The Crying of Lot 49 and Gravity's Rainbow for what they reveal about ordered reality and in particular how the fear of death is routinized by technology.

Turning from analysis of individual writers and texts, Joseph Slade provocatively analyzes literature as a form of technology. Comparing literature and science he notes, "together and separately, then, literary and scientific information systems are technologies because they organize, store, display, and transmit knowledge." Again, "literature and science are alike in that both attempt to control nature, in the sense that control begins with description of the universe." And, finally, "the principal feature of language,...that the individual symbols, being arbitrary, can be decoupled from the reality they represent,... makes them technological, for it allows endless manipulation of the individual words themselves."

In response to these three papers, Edward Gallagher borrows the notion of three levels of "consciousness" applying them to the different approaches reflected in these papers and how they might be utilitized in a course in "Literature and Technology." For Gallagher, the organizing question is "how to live in and with a technological society." In Pynchon he senses technology as "an intrinsic threat to individuality," "efficiency warring

with love and care." Such literature can sensitize students to the human values questions surrounding technology - Consciousness 1, in the language of Charles Reich's typology (The Greening of America, 1977). Blake represents Consciousness 2, for while critical of technology, he utilizes it and fashions it for his own ends - an instance of E. F. Schumacher's "appropriate technology." Finally, literature as technology - Consciousness 3. Provocative and seductive, yet dangerous to Gallagher's mind, for if allowed to go too far, the humanist risks losing his or her perspective and role as social critic and defender of older cultural values.

In sum, then, these three papers represent a fascinating sampling of the array of themes falling within the broader topic of technology and literature. They suggest the richness of contemporary research in the field and, following Prof. Gallagher's commentary, are suggestive of themes that could be pursued through literature in a variety of technology and society courses.

Comments or queries on the Working Papers Series, the Colloquium for Technology Studies, or the Technology Studies Resource Center are welcome and may be forwarded directly to me.

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TECHNOLOGY, ROMANTICISM, AND BLAKE

Mark L. Greenberg

Four years ago in an article entitled "The Rise of Modern Science and the Genesis of Romanticism," published in PMLA, Hans Eichner offered the following summary assessment of Romanticism's relation to science:

> Romanticism is, perhaps predominantly, a desperate rearguard action against the spirit and implications of modern science --a rearguard action that...liberated the arts from the constraints of a pseudoscientific aesthetics but that was bound to fail in the proper domain of science.[1]

The largely mythic dualism underlying and energizing Eichner's distinction between "aesthetics" and the "proper domain of science" will no doubt strike readers aware of the history of modern ideas, though consciousness of this myth seems to have eluded the author. Eichner goes on in the essay to predicate his criticism of the failed Romantic quest to defeat Newtonian science on this astonishing generalization, which also culminates in a dualism:

> Within twenty years of the publication of Kant's last Critique, the major Romantic systems were devised, proclaimed, and began to fall apart again. For our purposes they can be characterized in a single sentence: they attempted to escape the dilemmas of the mechanical philosophy by replacing all its basic assumptions by the exact opposites.[2]

The Modern Language Association, which publishes PMLA, doubly endorsed such generalizing about a generation of writers: not only did it print the essay, but it also awarded Eichner the William Riley Parker Prize for the most outstanding article in

the journal for 1982. I am reminded of Blake's warning that "General Knowledge is Remote Knowledge it is in Particulars that Widom consists & Happiness too."

In his piece, Eichner continues to repudiate the application of Romantic aesthetics to science (slipping from the one field of discourse to the other), by fatuously dismissing Romantic contributions to the understanding of nature--and of scientific "method":

> The assumption that whatever the imagination seizes as beauty is truth or that rivers flow into the sea because they want to may inspire poets, but such notions are of no use to scientists. Thus, as far as our knowlege of nature is concerned, the Romantic epistemology was at best a brief episode in the history of western thought.[3]

By the end of this essay, Eichner reaffirms --in fact, he reifies-- a gulf between humanistic understanding and science more unbridgeable than that mapped regretfully by C. P. Snow almost thirty years ago. Indeed, he concludes his essay by creating a condition of desire and then declaring that such desire must ultimately remain "unfulfilled":

> It is difficult at times not to envy the certainties and the power of generalization of the mathematical sciences, and our students ardently long for a method of interpreting poems that is as "scientific," foolproof, and teachable as the method of analyzing ore samples. If our tale has a moral, it is perhaps that this longing must remain unfulfilled.[4]

My own students, whom I teach in undergraduate courses in Literature and Science and in a graduate seminar called "Interconnections: Science, Technology, Literature, and the Arts," already understand that the quest for scientifically repeatable

and generalizable methods for interpretation of literature would prove futile --or they quickly learn that such is not what literary interpretation (or hermeneutics) is about. They also learn that viewed historically and socially, that is, strictly from without, Romantic writers indeed began dissociating themselves from a society undergoing transformations wrought by industrialization and democracy. Though this is one of Eichner's main arguments, it was anticipated some time ago. Raymond Williams argued in Culture and Society: 1780-1950 that Romantic artists consciously cultivated "an emphasis on the embodiment in art of certain human values, capacities, energies, which the development of society towards an industrial civilization was felt to be threatening or even destroying."[5]

My students also learn that viewed from within, the forms of Romantic understanding of science and technology offer powerful tools for interpreting enterprises (like science and technology) conceived and shaped by the human mind as part of a culture and a community, promulgated in a symbolic system of enormous complexity called language, and enacted according to programs devised, advocated, and implemented by intensely engaged, often partisan professionals. Concerning often fierce psychological, linguistic, and political drives, the Romantics offered profound analyses, interpretations that anticipate many of our most advanced current theories of literature and also of the philosophy and history of science.

Romantic ideas about psychology, politics, war, love, language, community, and art today fuel sophisticated discussions about the philosophy and history of science and technology. In

ways about which they may not be fully aware, our most advanced theorists of science --and practicing scientists as well-- are heirs to Romantic ideas about how the worlds we claim to "study" are in many ways the worlds we have already constructed: "What is now proved was once, only imagin'd," says Blake. Rather than the simple replacement of mechanical figures with organic, the minute particulars of world making and mythologizing, and of the ontological relationship between language and the structures which it erects, constitute to my mind the chief features of the Romantic project that ought to inform discussions of Romanticism and science.

Observers like Eichner, viewing Romanticism's engagement with science remotely, inevitably pit the writers against the scientists. Careful readers know better, for the struggles Blake, Wordsworth, Coleridge, Shelley, and Keats engage in with science and technology are fundamentally Promethean: seeking to salvage and create as well as to destroy. Seen from without, Romantic writers pressed back against the psychologies and society engendered by the mechanical philosophy, wrestling with a system that doomed the kind of expression that might liberate the mind from the limitations inhering in all systems. Seen from within, these same writers enacted structures and, in the case of Blake, a technology, that fostered mental conditions that these poets believed were capable of liberating the perceiver by transforming the mind.

My subject is William Blake's original response in ideas and artistic form to the prevailing economics and technology of his time, subjects for Blake inseparable ultimately from the quest

for psychological and social health. For Blake (as for Wordsworth, Coleridge, Shelley, and Keats), questions of scientific methodology and technological advancement necessarily generate a network of associations which cannot be reduced to simplicities about mechanical versus organic form or explained merely as antinomian rejections of received scientific ideas. Viewed from within one artist's project, technology and aesthetics operate reciprocally and dynamically, a movement and an energy I hope to illuminate.

I

For William Blake (1757-1827), the network of relationships among producer, meaning, mode of production, and receiver reaches toward the condition of love.

> Reader [lover] of books! [lover] of Heaven
> And of that God From whom [all books are given,]

commences lines addressed "To the Public" at the beginning of Blake's long work, Jerusalem. The passage concludes with "Heaven, Earth & Hell, henceforth" living in "harmony," a consequence for Blake of his own printing.[6]

Like a fickle lover, Blake's Marriage Of Heaven and Hell has been wed to as many interpretations and approaches as interpreters have committed themselves to the ceremony of print. Blake seems to have planned it this way. The variety of literary and visual modes, the words delivered by a congeries of generally unspecified or unstable voices, and the elusive graphic elements, deliberately arresting and polysemous, have provoked numerous interpretations --all, as Paul Mann has observed, "true-- or at

least negotiable" within the community of discourse centered around Blake.[7] Commentators have explored the complex political, sexual, psychological, theological, and prophetic dimensions of the Marriage. Recently, Nelson Hilton has suggested that once "we begin to see" Blake's works "in terms of 'levels' (or different orders of levels), possibilities proliferate. We no longer devour the text, but begin to produce it, to play it."[8] Production and play seem to me dominant themes of the Marriage itself, encouraging our productive and playful engagement with it. For throughout, the work is concerned with its own material form, with the conditions of writing, printing, and the book, with the artist's desire to embody imaginative activity within physical form and to present their confluence as a product which is also the work's theme. In a number of ways, the Marriage mocks the dominant technology for disseminating ideas --letterpress-- which in its overwhelming success in the eighteenth century seems to Blake to overwhelm the feasibility not only for the individual artist to body forth --and evoke-- imaginative activity fully and economically, to identify with and sell his work, but also by its very success to forestall criticism of the compromises and limitations inhering in commercial typography. Even as we produce readings, the work focuses our attention upon production itself in terms of the book and of the reader of books.

II

The self-parody of form in the Marriage, its attack upon its own status as printed book and its exploitation of the commercial

and technological forces that produce works of art, may appear part of the "mock-book" tradition in Byron and Sterne, in Swift's Tale of a Tub, and in Pope. William Kinsley has studied Pope's Dunciad as "Mock-Book," illuminating its formal self-parody while mapping the tradition of the book as an "incarnation of wisdom and a metonym for learning and culture," as well as a symbol for nature, the "book of nature." [9] Blake, like Pope, Swift, and Sterne, satirizes book conventions. But Blake goes beyond such satirists in two ways. First, he anatomizes minutely the very process of printing, exposing the particulars of print technology's mediation between work and reader and, second, he perfects an alternative technology in which he embodies the "energetic exertion of [his] talent." Blake delivers his critique of books in a non-traditional format, his illuminated printing. "Living form" Blake calls it because it extends the movement of his hand in time and space; text and design printed from copper plates and then hand illustrated and colored allow the author to fashion the technology to his purposes rather than the other way around.[10] Instead of mocking print technology from within the form as had Pope, Swift, and Sterne, Blake deliberately satirizes it from without.

Anticipating ideas advanced in our century by Marshall McLuhan and by Lucien Febvre and Henri-Jean Martin, Blake perceives a fundamental identity between modes of artistic production and the ideas expressed by the producers.[11] In the Marriage he treats both at once. The new mode of reproduction he consciously develops as theme in the Marriage also reorients the way we

perceive art. It has, in fact, provoked new ideas about art as a social institution and the relationships among art, technology, and commerce, themes fruitfully studied of late by a number of commentators on Blake and eighteenth-century culture.[12]

III

The Marriage is, at heart, an anatomy of writing, book production, reading, and interpretation. Its themes identify with its form, and both serve perfectly to thrust against the subjects and letterpress format of other books while Blake expresses himself "printing in the infernal method" (14;39), writing with "corroding fires" (6-7;35). The union implied by the title of this Marriage occurs between artist, text, and perceiver; a union lost in part, according to Blake, by our fall into mechanical letterpress printing. As if to underscore this point, the dominant subjects of the Marriage are books, printing, visual organization enforced by type, writers as functions of printing, and interpretations of printed texts.

As a professional engraver Blake was intimately familiar with the technology and nomenclature of eighteenth-century printing, book production, and manufacture. Blake was conscious of the effects of printing upon readers, of the power extended in space and time of an author's disembodied words, of the ontological status regularly accorded a bound, typeset volume, and of the aesthetic limitations and economic imperatives behind letterpress. In a "Prospectus" to ten engraved works, including the Marriage, addressed "To the Public" and issued in 1793, Blake perceives the neglect of most genuine creators in terms of prob-

lems of producing and disseminating works of genius at an affordable price:

> The Labours of the Artist, the Poet, the Musician, have been proverbially attended by poverty and obscurity; this was never the fault of the Public, but was owing to a neglect of means to propagate such works as have wholly absorbed the Man of Genius. Even Milton and Shakespeare could not publish their own works.
>
> This difficulty has been obviated by the Author of the following productions now presented to the Public; who has invented a method of Printing both Letter-press and Engraving in a style more ornamental, uniform, and grand, than any before discovered, while it produces works at less than one fourth of the expense (692).

Overtly in this passage, Blake focuses upon the technology and economics of art in a commercial culture, charging that technology has failed to allow the "Man of Genius" himself to disseminate works he has concentrated upon. But Blake's choice of language --"a neglect of means to propagate such works as have wholly absorbed the Man of Genius"-- also suggests that the work becomes, "wholly absorbs," the artist, and that the limited expressive power inherent in letterpress distances producer from product from purchaser-perceiver, obscures the artist's identity while effacing the possibility of contact between the prolific and the devouring.

In the Marriage, Heaven and Hell cannot be wed until ideas communicated by the subjects and very form of books are challenged and "expunged." Blake says on the fourteenth plate of the Marriage, "But first the notion that a man has a body distinct from his soul, is to be expunged; this I shall do, by printing in the infernal method, by corrosives..." (39). As Blake may well

have known, the word "expunged" in his time was associated with printing, referring specifically to something marked for deletion. For Blake, printing composite form constitutes the achievement of identity between producer, product, and consumer, overcoming divisions which Blake expresses, significantly, in terms of his craft. Moreover, it is also worth noting that among all his major composite art works, Blake chooses to omit his familiar signature as printer or "Author and Printer" only from The Marriage of Heaven and Hell, this book about writing, printing, and books. He suggests thereby that the process of interpretation initiated by the Marriage renders authors of us all.

The Marriage is, in one important sense, a book about books and printing. The work's success, like that of any satire, depends upon our familiarity with the conventions and contexts involved; in this case, authors, books, and portions of books. Hence, we find Swedenborg and his writings parodied on plate 3; on plate 21 a voice reduces Swedenborg's texts to the "Contents or Index of already publish'd books." Elizabeth Eisenstein has explored the combinatory function of print, the book's joining between its covers diverse disciplines and far-ranging sources, as one of its chief features.[13] In the Marriage Blake sensitizes us to the imaginary library books contain and engender. "Thus, Swedenborg's writings," says Blake, "are a recapitulation of all superficial opinions, and an analysis of the more sublime, but no further" (22;43). Blake's book about books particularizes "Isaiah xxxiv & XXXV Chap" (3;34), in carefully-inscribed Roman numerals, typographical icons that evoke printed biblical texts.

Yet, at the same time, he undercuts biblical form by displacing it from its original context to his "illuminated" book.

On plate 4, "The voice of the Devil" (34; italics mine) inscribes a numbered list of three "Errors" in "All bibles or sacred codes," and then a numbered list of three "Contraries to these." A complex irony is at work: the "voice" "speaks" in carefully enumerated and printed words; words printed in the sense both of written characters designed to look like type, and also writing literally imprinted on the page. As McLuhan points out, "uniformity of codes are the prime marks of literate and civilized societies."[14] Along with ideas committed to writing, "codes" also implies cryptic langauge, secret symbols, sets of rules or laws and, as codex, books. We are reminded that in Blake's works the principle of repressive and exclusive reason, called "Urizen," writes most of the books. "Lo!" Urizen declares in The [First] Book of Urizen, "on/This rock, place with strong hand the Book/Of eternal brass, written in my solitude" (4:32-33;72); and in The Four Zoas Urizen "rangd his books around him" (77:19;353) and is accused by Orc of sitting "fixd obdurate brooding...Writing thy books" (79:10-11; 354). Indeed, Blake is fond of emphasizing the material (and cultural) status of his works as books by titling them such: The Book of Thel, The French Revolution: A Poem in Seven Books, The [First] Book of Urizen, The Book of Ahania, The Book of Los, and Milton: a Poem in 2 Books; Jerusalem, not labelled a book, is nevertheless divided into four "chapters." Blake's frequent use of "book" (and a related term) extends beyond titles: in all his writings,

"book" and its plural appear one hundred thirty times; and "print" in its various permutations appears over one hundred thirty times.[15] Throughout his life, Blake consciously expressed ideas embodied by these words; yet more than any other of his works, the Marriage concentrates Blake's fascination with the expressive medium's power.

The Marriage specifies and absorbs a number of particular books. In it, we encounter references to Paradise Lost, and several designs in the Marriage allude to events in the first two books of Milton's work. Blake also glancingly refers to Aristotle's "Analytics" and mentions the Book of Job, the Book of Proverbs, the "Jews' code," the Bible (as book and as book transformed into an infinitely extending pit), the ten commandments, and the writings of Paracelsus, "Behmen" (Jacob Boehme), Dante, and Shakespeare. Alvin B. Kernan has argued that during the mid-eighteenth century "literature" was emerging fully as a social institution whose canon consisted of received, quasi-sacred texts, parallel to the Bible in authority and power.[16] Blake's work recognizes this emergence as the Marriage absorbs and glosses a range of interacting printed texts and the ideas they disseminate. This often satiric intertextuality emphasizes print's combinatory function and its implicit sanctioning of authority through typographic fixity and repetition.

The Marriage, as I have argued, is a book about books; it is also a book against books or at least against received interpretations of existing books. Consider Blake's radical commentary on Paradise Lost, the Devil's correction of "Bibles or sacred codes," and the energetic and deliberately overstated "Proverbs

of Hell" as correctives to traditional proverbs and aphorisms. Writing itself provides the context for much of the writing and for portions of the visual field in Blake's book. Blake reminds us of this within his own context: the words "write," "writing," "wrote," "written," and "printing" appear thirteen times in the Marriage. Plates 4 and 10 graphically depict the act of writing and reading.

The Marriage of Heaven and Hell is not only a book about and against books, but a book whose composite form deliberately reproduces certain typographic conventions --the impedimenta of the book-- in order to parody them and ultimately to liberate us from the mental patterns they represent and impose. Elizabeth Eisenstein describes this esprit de systeme in which "regularly numbered pages, punctuation marks, section breaks, running heads, indexes, and so forth helped reorder the thought of all readers."[17] For Blake, such conventions represented linear, rational thought, mechanical repetition which dulled the senses rather than urging them to participate in the text, a false textual authority, fixity, and deadening order. Two of the most important books of Blake's time offer examples of just the kind of authority Blake attacks in the Marriage. In the "Preface" to that great book of books, the Dictionary of the English Language (1755), Samuel Johnson claims to impose order upon the chaos of language; and indeed typographically he does, calling forth a panoply of regular type faces and typographic symbols to categorize neatly English words, making the language itself appear rational, orderly, reducible to two nicely arranged, bound vol-

umes, fixed in its meanings, and limited to those meanings elaborated in Johnson's book. Moreover, Johnson's meanings and exemplary authority derive from other books. A quarter of a century earlier, Ephraim Chambers in his Cyclopaedia (1728) used dashes, brackets, and an array of type ordered into neat columns and spread across two pages to organize the plan of his work which represents, he claims, all knowledge --and by extension all that is knowable. Blake constantly and deliberately frees language from single meaning. For him English is that "stubborn structure, rough basement," upon which he built a shimmering, multi-dimensional edifice of words and images, a structure whose minute particulars and overall design urge us to enter into it.[18]

Urging our involvement in the Marriage, Blake depicts (and in part parodies) typographic symbols and ritual, specific prompts for the experienced reader of books. The work begins with a richly-colored title page (reproduced monochromatically in the Appendix, p. 29 of this essay), upon which a couple embrace below ground level while clouds unfold and flames ascend upward and to the right. Strangely, letters appear across this remarkable scene,heralding Blake's illuminated art. The words "THE," "HEAVEN," and "HELL" arrest us in particular: they parody large block letter type, and contrast markedly with the other words of the title, which are written in flowing script. Like Paradise Lost, the text begins with an "Argument" (see Appendix, p. 31). But in the Marriage, this Miltonic prose form is in verse and offers a cryptic, synoptic vision of human life prior to the coming of the prophecy that is the Marriage of Heaven and Hell. Significantly, the first and last stanzas of "The Argument" are

colored red --the printer's conventional "rubric," from which our sense of the word derives. The work ends with verse headed "A Song of Liberty" followed by lines headed "Chorus." Verses of the "Song," like biblical verse, are numbered. Sometimes, audacious section headings, such as "The voice of the Devil," "Proverbs of Hell," and "A Memorable Fancy" (parodies of Swedenborg's "Memorable Relations" that appear at five points in the work) seem to embody conventional functions and form --chapter headings, for example-- to announce remarkable information. Their very existence seems ironic and playful.

On eleven plates we notice catchwords. Philip Gaskell has observed that "although the full use of catchwords was general in English and in most continental printing until the later eighteenth century, they were not always considered necessary." [19] Surely Blake, who hand printed and colored every plate, would not require them, especially when we recall that the work was not being mass produced (only nine copies of the Marriage are known to exist). I believe these catchwords constitute a visual spur to readers to read on and, closer to my argument, a parody of a business whose workers were so dissociated from the products they produced that such a device was required. The appearance of catchwords here reminds us that an author literally gave up his text to the press. The technology of print organized materials according to its requirements and limitations, a condition Blake found unacceptable.

IV

A year before beginning work on the Marriage Blake described

three modes of human utterance in the "Introduction" to Songs of Innocence. Along with plate 15 (see Appendix, p. 33) in the Marriage, with which I shall conclude, the "Introduction" represents Blake's most profound depiction of the writing scene and of writing as a technology. This well-known poem advances from the Piper "piping down the valleys wild," a kind of order imposed upon the wilderness by music, to his singing a "song about a Lamb," to writing "in a book that all may read." The child, who requests the Piper to pipe, sing, and write, disappears, significantly, after ordering the book. The book extends the author's voice in space and time and joins his text to a world of texts, to the real and ideal library of all texts. The price of writing's stability, fixity, and permanence, Blake's Piper unconsciously acknowledges, is that he must also extend himself into the self-created technology of writing. The results imply a process which Blake describes anaphorically and in a parallel sequence of active verbs:

> And I pluck'd a hollow reed.
>
> And I made a rural pen,
> And I stain'd the water clear,
> And I wrote my happy songs
> Every child may joy to hear (4:16-20;7).

Every child "may" joy, but the author, distanced from what was originally a scene of oral communication, will not know his response. Breath in the written song has been reduced to individual letters and words, to breathless speech. In printed texts, as Blake knew, a system of repeatable individual letters

fragments words even further. Perhaps for this reason so many individual written letters in the Marriage are joined as in script, and trail spiralling lines. Staining the water also imples a trade of clarity for fixity and permanence. This trade, of course, need not imply a diminution of joy since safely inscribing the song preserves it; and the final line --"Every child may joy to hear"-- in one sense at least promises a reanimation of the verses as they are sung by others; though the "may," of course, also implies the possibility that they may not. Nevertheless, the author no longer has his audience before him; he thus loses the feedback of immediate response to his song. Frowns or looks of puzzlement might have led him to adjust his message. And he also loses variables such as tone, gesture, cadence changes, repetition --in short, spontaneity generally. Print extends an author's voice abroad, but without the author's "presence." Walter Benjamin, in his classic essay "The Work of Art in the Age of Mechanical Reproduction," terms this presence in an original work of art "aura," and he stresses the fundamental role of mechanical reproduction in its "withering."[20] The art work mechanically reproduced becomes separated from oral tradition, from the traditional relationship between author and listener or perceiver and, most important for Blake, works begin to be designed for the agency of reproduction.

Like graphic reproduction, its sister trade, print for Blake, then, reduced poetry and vision to individual unchangeable, repeatable letters. The typographical system (as Blake emphasizes in the Marriage), diminishes the possibility for

prophetic utterance: literally, speech is divided into sense-dulling black marks on white paper whose effect is to distance -- indeed, alienate-- reader from text. We do not concentrate upon words (or even, where present, designs) in a typeset work as living embodiments of expression, but only upon the messages "behind" them. The perceiver cannot become involved with the material representation of meaning or with materiality as meaning. For Blake, the typographical system itself emphasizes linear movement and the corporeal eye.

In the Marriage Blake "rouzes the faculties to act" partially combatting the closure and fixity of print. One cannot, for example, passively "receive" Blake's deliberately polysemous language networks or reduce to single meaning the work's richly detailed plates. One cannot profitably, or even comfortably skim the intricate interlinear and marginal designs or the large graphics and the text. And each of the renderings of the Marriage is unique, requiring us to brood upon each in order, ideally, to "read" Blake's work. In fact, David Erdman and two students who have studied each of the nine extant copies devote forty-five pages in a large-format book merely to describing and interpreting just the illuminations in the Marriage.[21]

On the fifteenth plate of the Marriage (see Appendix, p. 33), the printing system overtly becomes theme. A voice announces in the third "Memorable Fancy," "I was in a Printing house in Hell & saw the method in which knowledge is transmitted from generation to generation." The speaker then describes the process of "knowledge transmission" as it occurs in six chambers, parodying the six days of creation (40). This rich plate has

been interpreted variously. Mary Lynn Johnson and John Grant summarize the range of readings succinctly in their note to it: "this allegory on the transmission of knowledge refers both to the conceptual and productive aspects of creativity, to the cleansing of the senses, and to the process of etching."[22] And David Erdman has outlined its primary references to Blake's actual process of illuminated printing, observing that "Blake not only sublimated his description of the work processes but departed from their natural order."[23] Without denying the truth of the wide range of interpretations Blake's suggestive plate has evoked, another version of the plate emerges from my materialist reading of the Marriage, an interpretation the reader has probably anticipated. For Blake, the deadening effects of print can be traced to the very process of casting type, to its potential ultimately unfulfilled. I want to suggest that Blake's most profound comments on printing occur on the fifteenth plate as Blake anatomizes the casting of the individual type, revealing in the individual casting the forms of error.

Blake surely knew that in his day each type piece was described in human terms --a kind of human anatomy of a cast metal structure in which the type "body" parts included "shoulders," "feet," "face," and most significant for Blake's depiction of the hoary writer Urizen, a "beard." Peopled with inhuman forms, the printshop in "hell" on plate 15 may refer to the possibilities implicit in printing gone wrong: the etching of the individual punch and hand work "hollowing" the matrix ossifies into the inflexible repetitiveness of the finished matrix into which type

is "cast." The apocalyptic activity of the "Lions of flaming fire raging around & melting the metals into living fluids" is abruptly transformed in the next chamber, where "Unnam'd forms" --possibly the printer's "forme" that holds the chases full of type-- "cast the metals into the expanse." Once "cast" --and we may understand this simultaneously as the process of pouring molten metal and as the distribution, the casting out, of books-- the finished product petrifies: "There they were receiv'd by Men...and took the forms of books & were arranged in libraries." Such arrangement of "received" and determinate works suggests the taming, perhaps even the imprisonment of living ideas in fixed forms. Or perhaps the "Men" themselves take the "forms of books," becoming what they behold, and are arranged in the libraries --or specialized categories-- that print makes possible. Either way, the point with respect to typographic reproduction remains the same. Blake signals a direction for this plate by illustrating it with an eagle clutching a serpent in its talons, a traditional symbol of unity, and perhaps a vision of the workers in the text above it transformed. The entire plate becomes, in this sense, illuminated art's answer to the print culture it anatomizes and struggles against.

In introductory verses addressed "To the Public" in Jerusalem (a portion of which I cited at the beginning of this essay), Blake voices the power of printed communication, if only formed by a sufficiently capacious technology. As the Marriage may be seen to represent, in Northrop Frye's phrase, the "Beethovenish coda" to eighteenth-century satires on the book and its technology,[24] so the beginning of Jerusalem seems the perfect coda to

Blake's anatomy of books and writing in the Marriage and a fit threshold for the 97 illuminated plates of Jerusalem that follow. Blake again invokes the image of the cave, here "awful" and "unfathomd," suggesting a quite different range of associations from those evoked by the Dragons' "cave" of the Marriage. Blake's "types" here shall not be "vain" (hollow, fruitless, self-directed), mass-produced and interchangeable metal castings, but types of human life delivered without recourse to the typographical system. The difference is one of attitude toward different kinds of writing and printing and their potential for engendering genuine change:

> Reader! [lover] of books! [lover] of heaven,
> And of that God from whom [all books are given,]
> Who in mysterious Sinais awful cave
> To Man the wond'rous art of writing gave,
> Again he speaks in thunder and in fire!
> Thunder of Thought, & flames of fierce desire:
> Even from the depths of Hell his voice I hear,
> Within the unfathomd caverns of my Ear.
> Therefore I print; nor vain my types shall be:
> Heaven, Earth & Hell, henceforth shall live in harmony.
>
> (3:1-10; 145)

NOTES

1. Hans Eichner, "The Rise of Modern Science and the Genesis of Romanticism," PMLA 97 (1982): 8-30; quotation from p. 8.

2. Ibid., p. 14.

3. Ibid., p. 24.

4. Ibid., p. 25.

5. Raymond Williams, Culture and Society: 1780-1950 (New York: Columbia University Press, 1958), p. 36.

6. I quote Blake from David V. Erdman, ed., The Complete Poetry and Prose of William Blake, Commentary by Harold Bloom (Berkeley and London: University of California Press, 1982), noted parenthetically in the text by plate and, where appropriate, line numbers, or for The Four Zoas, by page and line number, followed by the page location in Erdman. Here, 3:1-2 and 10; 145.

7. Mann offers a "materialist reading" of Blake in which "production is ...thetic" in "Apocalypse and Recuperation: Blake and the Maw of Commerce," ELH 52 (1985): 1-32; above citation, 2.

8. I quote "Blakean Zen," Studies in Romanticism 24 (1985): 189. Among the many responses provoked by the Marriage, the most useful in developing my approach have been those cited specifically in the notes, along with Morton D. Paley, Energy and the Imagination: A Study of the Development of Blake's Thought (Oxford: Clarendon Press, 1970), esp. "Appendix A."; David V. Erdman, Blake: Prophet Against Empire (Princeton: Princeton University Press, 1977), chap. 8, and Erdman, annotator, The

Illuminated Blake (Garden City: Anchor/Doubleday, 1974); Joseph Anthony Wittreich, Jr., Angel of Apocalypse: Blake's Idea of Milton (Madison: University of Wisconsin Press, 1975), esp. chap. 3; John E. Grant's note, "Regeneration in The Marriage of Heaven and Hell" in William Blake: Essays for S. Foster Damon, ed. Alvin H. Rosenfeld (Providence: Brown University Press, 1969), pp. 366-67, and Grant's brief debate with W. J. T. Mitchell in Visionary Forms Dramatic, ed. Erdman and Grant (Princeton: Princeton University Press, 1970), pp. 63-64; and Lawrence Lipking, The Life of the Poet: Beginning and Ending Poetic Careers (Chicago and London: University of Chicago Press, 1981), pp. 34-47.

9. "The Dunciad as Mock-Book," Huntington Library Quarterly 35 (1971-72): 30. For more on the history of the book as trope, see Ernst Robert Curtius, European Literature and the Latin Middle Ages, trans. Willard R. Trask (London: Routledge and Kegan Paul, 1953), chap. 16, pp. 302-47. On Blake's satire, see Robert F. Gleckner, "Blake and Satire," Wordsworth Circle 8 (1977): 311-26, and specifically on the Marriage and satire, consult Leslie Tannenbaum, "Blake's News from Hell: The Marriage of Heaven and Hell and the Lucianic Tradition," ELH 43 (1976): 74-99.

10. See W. J. T. Mitchell, Blake's Composite Art (Princeton: Princeton University Press, 1978), esp. pp. 3-39.

11.Despite his often vague and excessively modish language, McLuhan still has much to offer in The Gutenberg Galaxy: The Making of Typographical Man (Toronto: University of Toronto Press, 1962) and in Understanding Media (New York: McGraw-Hill, 1964), books informed by McLuhan's study of Blake.

See also Lucien Febvre and Henri-Jean Martin, The Coming of the Book, trans. David Gerard (London: NLB, 1976), esp. chap. 8, pp. 248-332.

12. On Blake, see the essay by Mann, cited above, n.2; Morris Eaves, "Blake and the Artistic Machine: An Essay in Decorum and Technology," PMLA 92 (1977): 903-27; and Michael Ferber, The Social Vision of William Blake (Princeton: Princeton University Press, 1985). Two useful collections of essays on the cultural impact of books during Blake's age have recently appeared: Isabel Rivers, ed., Books and their Readers in Eighteenth-Century England (Leicester and New York: Leicester University Press and St. Martins Press, 1982); and Raymond Birn, ed., The Printed Word in the Eighteenth Century, a special issue of Eighteenth-Century Studies 17 (1984).

13. See The Printing Press as an Agent of Change 2 vols. (Cambridge: Cambridge University Press, 1979). Many of the ideas elaborated in this two-volume work Eisenstein condenses in The Printing Revolution in Early Modern Europe (Cambridge: Cambridge University Press, 1983). Walter J. Ong's Orality and Literacy: The Technologizing of the Word (New York and London: Methuen, 1982) counterpoints differences "between the ways of managing knowledge and verbalization in primary oral cultures...and in cultures deeply affected by the use of writing," (p. 1).

14. Understanding Media, p. 87.

15. My source is the two-volume Concordance to the Writings of William Blake, ed. David V. Erdman, et al. (Ithaca: Cornell University Press, 1967).

16. The Imaginary Library: An Essay on Literature and Society (Princeton: Princeton University Press, 1982). On the literary culture of this period and its often antagonistic or self-consciously detached relationship with society, see Williams, Culture and Society.

17. "Some Conjectures about the Impact of Printing on Western Society and Thought: A Preliminary Report," Journal of Modern History 40 (1968): 15.

18. For the fullest exploration of the dimensions of Blake's language, see Nelson Hilton, Literal Imagination: Blake's Vision of Words (Berkeley, Los Angeles, and London: University of California Press, 1983).

19. A New Introduction to Bibliography (New York and Oxford: Oxford University Press, 1972), p. 53.

20. First published in 1936, the essay appears in Illuminations, trans. Harry Zohn (New York: Schocken, 1968), pp. 217-51.

21. See "Reading the Illuminations of Blake's Marriage of Heaven and Hell," by Erdman with Tom Dargan and Marlene Deverell-Van Meter in William Blake: Essays in honour of Sir Geoffrey Keynes, ed. Morton D. Paley and Michael Phillips (Oxford: Clarendon Press, 1973), pp. 162-207.

22. Blake's Poetry and Designs (New York: Norton Critical Editions, 1979), p. 94.

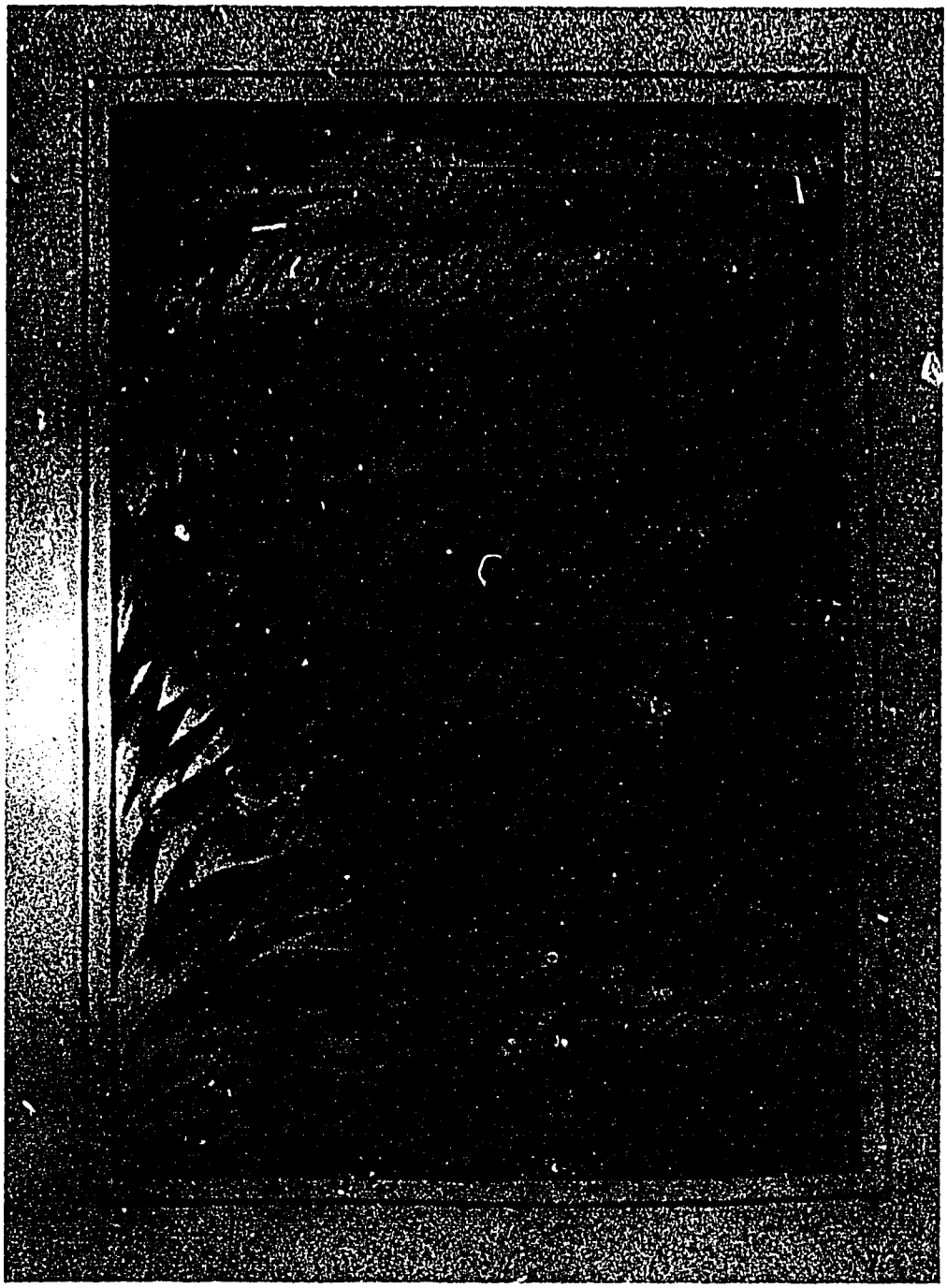
23. "A Temporary Report on Texts of Blake," in Blake: Essays for Damon, p. 411.

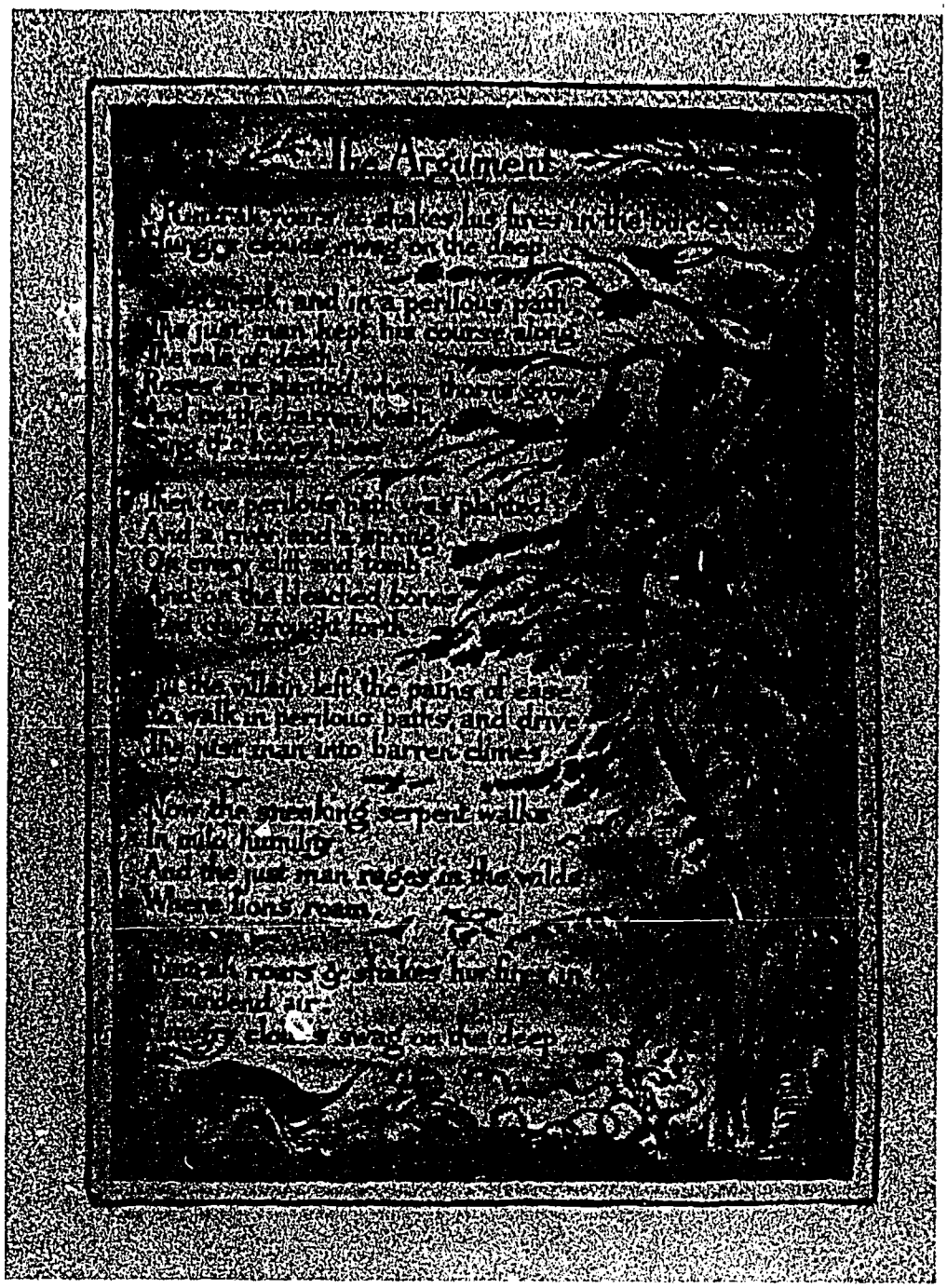
24. Fearful Symmetry: A Study of William Blake (Princeton: Princeton University Press, 1947), p. 201.

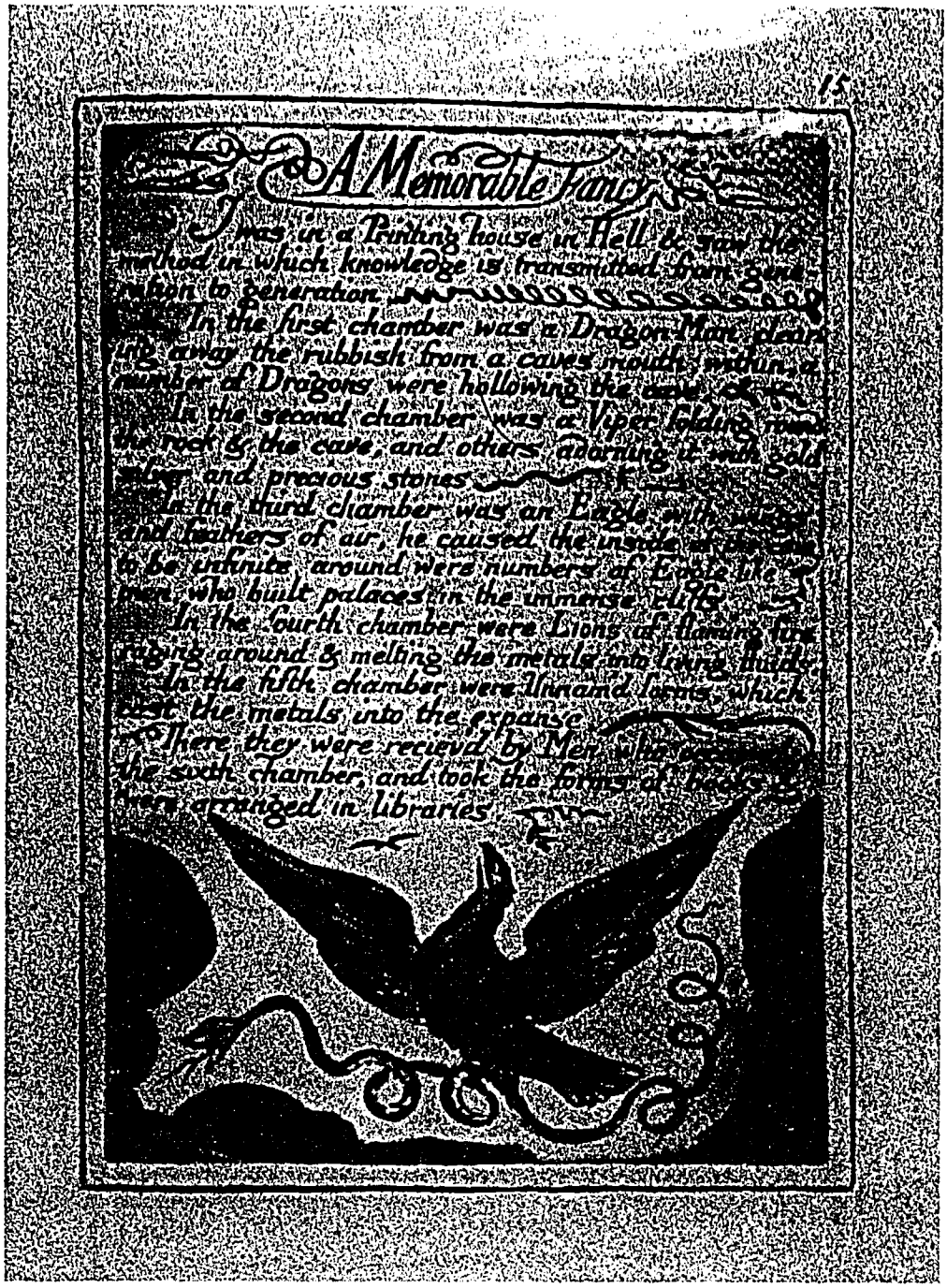
APPENDIX

Prints from

William Blake's The Marriage of Heaven and Hell







TECHNOLOGY, PYNCHON, AND THE MEANING OF DEATH

Lance Schachterle

No contemporary author writes with more interest in science, or more interestingly about it, than Thomas Pynchon. Pynchon's dual academic career at Cornell --first as a student in an advanced engineering science program, and then as an English major taking a class from Vladimir Nabokov-- is well known.[1] From Joseph Slade's pioneering book on Pynchon to the present, critics have much noted Pynchon's fascination with science and his use, as metaphors or even structural principles, of scientific concepts, especially those like entropy and information theory which arise from late nineteenth century statistical mechanics.[2]

Pynchon's fascination with technology has not gone unnoticed, either. From the mysterious V., titular character of Pynchon's first novel (1963) who tries to stave off death by replacing parts of her body with mechanical equivalents, through Oedipa Maas's quest for enlightenment in Southern Californian developments laid out like a "printed circuit," to the intricacies of design which propelled V-2s onto wartime London in Gravity's Rainbow, Pynchon's magisterial knowledge of modern technology is all-apparent, all-encompassing.

Yet the technology does not lend itself to critical discussion as easily as the science. The reason, I think, is clear. Technology as an ensemble of abstract operational concepts seems rather a cold, empty business to most humanists --

regardless of how much they as individuals might profit from its amenities. In contrast, contemporary science, especially in physics, can entice the literary critic with a powerful conceptual nexus, one, moreover, hospitable to the claims of individual subjectivity dear to critics still subscribing to the Romantic ideology of self. Major twentieth-century scientists like Heisenberg and Bohr, and knowledgeable popular writers from Bronowski and Polanyi on, are perceived in the humanistic community as rejecting outworn notions of science. They distance themselves from nineteenth-century views of science as an infallible, virtually autonomous enterprise by which nature yields truths whenever scientists apply objective rules of data collection and interpretation according to universally-accepted principles.[3]

Against received views of naive realism and positivistic limitations, the trend among contemporary historians and philosophers of science --as well as to some degree actual practitioners-- has been to accept the "Copenhagen Interpretation" of quantum physics which places boundaries on what science can know.[4] Such views even suggest that the individual consciousness of the observer cannot be privileged to exist apart from the phenomenon under inspection, but instead must be considered a part of an overall "system" as much consciously created as passively observed.

Thus to integrate the scientist conceptually into what science produces is to abandon the Newtonian notion of the scientist "framing no hypotheses," as observing nature with impartial detachment. "Relatedness" replaces cold neutrality;

the scientist comes to "care" in a way Heidegger presumably would approve. Such a position is bound to attract literary critics across a broad spectrum of liberal social commitments and hermeneutic proclivities.

But where do such ideas leave technology? No simple answer emerges. The technologists who make use of the principles science uncovers to engineer the domination of the physical world seem interested only in the operational results, not any underlying ideologies. What is the literary critical community to make of them? The engineer, slide rule in hand and plastic pocketliner pencil case in place, seems less cozy a fellow than, say, an Einstein with tongue sticking out. Here I think Pynchon helps us by focusing our responses on what we make of technology. The question Pynchon implicitly asks is to what ultimate ends are those operational results applied. What in technology consumes the interests of its practitioners? What drives us onward as consumers of technology?

I

One thing that drives us on as consumers of technology is our love of things. To frustrate the importunate and perhaps deceitful Metzger in a game of "strip Botticelli," in a scene early in The Crying of Lot 49, Oedipa Maas clads herself with everything she has brought along on her impromptu trip to San Narciso to begin sorting out the legacy of Pierce Inverarity, a former lover. She puts on "six pairs of panties in assorted colors, girdle, three pairs of nylons, three brassieres, two pairs of stretch socks, four half-slips, one black sheath, two

summer dresses, half dozen A-line skirts, three sweaters, two blouses, quilted wrapper, baby blue peignoir and old Orlon muu-muu. Bracelets then, scatterpins, earrings, a pendant." Who would have thought the young woman to have had so much clothes about her?

Looking at herself, thus arrayed, in the mirror, she:

> saw a beach ball with feet, and laughed so violently she fell over, taking a can of hair spray on the sink with her. The can hit the floor, something broke, and with a great outsurge of pressure the stuff commenced atomizing, propelling the can swiftly about the bathroom. Metzger rushed in to find Oedipa rolling around, trying to get back on her feet, amid a great sticky miasma of fragrant lacquer.... The can, hissing malignantly, bounced off the toilet and whizzed by Metzger's right ear, missing by maybe a quarter of an inch. Metzger hit the deck and cowered with Oedipa as the can continued its high-speed caroming.... She looked up past his eyelids, staring into the ceiling light, her field of vision cut across by wild, flashing overflights of the can, whose pressure seemed inexhaustible. She was scared but nowhere near sober. The can knew where it was going, she sensed, or something fast enough, God or a digital machine, might have computed in advance the complex web of its travel; but she wasn't fast enough, and knew only that it might hit them at any moment, at whatever clip it was going, a hundred miles an hour.... The can collided with a mirror and bounced away, leaving a silvery, reticulated bloom of glass to hang a second before it all fell jingling into the sink; zoomed over to the enclosed shower, where it crashed into and totally destroyed a panel of frosted glass; thence around the three tile walls, up to the ceiling, past the light, over the two prostrate bodies, amid its own whoosh and the buzzing, distorted uproar from the TV set. She could imagine no end to it; yet presently the can did give up in midflight, and fell to the floor, about a foot from Oedipa's nose. She lay watching it.[5]

Does one laugh more here with the gusto of the comedy or cringe

with the victims of the peculiarly mindless, if personified, manifestation of technology?

Let us consider the passage. Readers attuned to science will respond immediately to Oedipa's reference to the Newtonian clockwork universe, where as Laplace claimed, the future could be predicted, if technology produced the computational powers needed to extrapolate the movement of all ensembles of objects from present observed positions. "God or a digital machine" might predict the future movements of the spray can, but in her befuddlement, she can only duck. She and Metzger are the prostrate victims of escaping molecules of gas whose complex interactions under pressure obey those very laws of statistical mechanics, formulated as entropy, that inform Pynchon's fiction from his 1960 short story on.

Besides weakening Oedipa's resolution not to succumb to Metzger, the scene leads to other consequences. Three pages later, contemplating the shivered mirror, she remarks "Seven years' bad luck...I'll be 35" (CL49,41). Seven years then to thirty-five, the half way point of life in the Dantean formulation, half way through her generation. The spray can incident also establishes her current age as twenty-eight, allowing the curious reader of the first edition to estimate her year of birth as twenty-eight years before the first copyright date given in the book. The resulting date of birth is 1937, coincident with that of her author. Thus the errant spray can, miracle of consumer technology, points to a congruency in the life pattern of author and heroine. Like her author, Oedipa's "so temperate youth" was "mothered over" by "Secretaries James

and Foster and Senator Joseph" (CL49,104).

The simple, misguided missile of goopy hairspray yields up other hints to the reader. Why hairspray? Certainly, with the other paraphernalia of wardrope Oedipa deems necessary to bring on her adventure to disentangle the Inverarity estate, the hairspray bespeaks the conventionality of its possessor, whose earliest recorded act in the text is to return home from a suburban Tupperware party "whose hostess had put perhaps too much kirsch in the fondue" (CL49,9). Hairspray, by definition, fixes hair into place: it is a technological fix to render permanently in place that which naturally wanders. (The tendency of technology to employ artifice to freeze the natural in place will be noted subsequently.) Why does this young California woman, initially living so conventional a life, fear change?

II

Reflecting on this question can lead us to consider the wider meaning of technology in the novel. For Pynchon, "technology" signifies more than just a collection of objects, or of ways of making them. Like Jacques Ellul, Pynchon sees technology as rules for manipulating more than just material objects; technology extends as well to principles for organizing whole societies along certain lines. The obsession in his novels with central characters stumbling upon evidences of far-reaching plots constituting the hidden fabric of society resembles Ellul's distinctive generalizing of "technology" in The Technological Society.[6]

For Ellul, it will be recalled, technology is the pursuit of

maximum efficiency through universal applications of rationally-contrived rules which determine all behavior within a system. The hallmarks of technology are artifice (as contrasted to nature), standardization (as opposed to individuality), and orderliness (as opposed to mystery).

> Technique is a means of apprehending reality, of acting on the world, which allows us to neglect all individual differences, all subjectivity. Technique alone is rigorously objective. It blots out all personal opinions. It effaces all individual, and even all collective, modes of experience (TS,131).

What Oedipa comes to confront in The Crying of Lot 49 is the possibility that her former lover, the fabulously wealthy real estate mogul Pierce Inverarity, may have used his influence to weave around her a web of clues suggesting that a mysterious alternative communication system named W.A.S.T.E. exists. If the clues she encounters sustain the conclusion that W.A.S.T.E. is a monumental pratfall engineered by a spiteful ex-lover, then Inverarity's technique is awesome indeed:

> OK, Oedipa told herself, stalking around the room, her viscera hollow, waiting on something truly terrible, OK. It's unavoidable, isn't it? Every access route to the Tristero [the league of malcontents who presumably created W.A.S.T.E.] could be traced also back to the Inverarity estate. Even Emory Bortz, with his copy of Blobb's Peregrinations, (bought, she had no doubt he'd tell her in the event she asked, also at Zapf's), taught now at San Narciso College, heavily endowed by the dead man (CL49,169-70).

Inverarity's technique appears to have been relentlessly efficient indeed.

But Oedipa entertains three other possible hypotheses regarding the mass of clues adumbrating this secret communications

network. She may have hallucinated it, a victim of drugs she is not aware of being given. Or she may be fantasizing to the point of madness. Or the counter-cultural network might really exist, a product of the collective frustrations of all those who seek to reject the pursuit of efficiency Inverarity's estate symbolizes (CL49,170-71).

The novel, of course, ends with Oedipa suspended at the beginning of the auction of stamp lot 49 which she hopes will decide among these possibilities. But it is the possibility of W.A.S.T.E. really existing which intrigues most, for such a league provides an alternative to the crushing weight of Inverarity's testimony to efficiency. The sequence announcing the four possible hypotheses which Oedipa entertains begins with:

> She had dedicated herself, weeks ago, to making sense of what Inverarity had left behind, never suspecting that the legacy was America (CL49,178)

and concludes with:

> For there either was some Tristero beyond the appearance of the legacy America, or there was just America and if there was just America, then it seemed the only way she could continue, and manage to be at all relevant to it, was as an alien, unfurrowed, assumed full circle into some paranoia (CL49,182).

Replace "paranoia" with "care" and Oedipa's prescription for continuing in America sounds remarkably close to that offered by perhaps the greatest critic of technology in the twentieth century, Martin Heidegger. Here and elsewhere, Heidegger's late writings on technology sound remarkably close to Pynchon's perceptions. And his early masterpiece, Being and Time (1927), seems to inform both Oedipa and Inverarity's thoughts on

technology and death. Being and Time stresses the need for the individual to lay claim to personal self by rescuing it from the mass of inert society and meaningless material goods. Such a recovery is accomplished by recognizing the problematic relation of individual to mass society, by accepting a Kierkegaardian challenge to open oneself to uncertainties and tentativeness. Heidegger's formulation of this acceptance of vulnerability to Being is "Sorge" or "care."

Heideggerian "care" is the root of Sartre's famous trio of "Despair," "Anguish" and "Forlornness" in his "Existentialism" essay.[7] Despite the apparent cheerlessness of the nouns invoked, for both thinkers "Care" and its associated cluster name concepts which bring freedom to the individual to engage actively in disclosing personal Being. Individual coming-to-Being, the famous Heideggerian "Da-sein," can be authentic only as "Being-for-death," as acknowledging that life exists only in time, not beyond it. The authentic person, acknowledging the finiteness of human control over Being, thus cultivates an openness to the vicissitudes natural to life --a life which ends in death, the greatest, most inescapable and unshareable vicissitude possible.[8]

In this context, we see both Oedipa's growth and Pierce Inverarity's radical dishonesty. Oedipa's fear of change was noted earlier, and the greatest change, surely, is death. In the novel she comes to show "Care" for both life and death. While pursuing an apparent W.A.S.T.E. messenger, she comes upon a derelict and deserted sailor in a flophouse under a San Francisco freeway. Rather than ignore the ancient mariner, she remains to

comfort him, cradling him in her arms and meditating on the time of his inevitable death. Her meditation, too long to quote here (CL49,125-30), weaves together her memories of collegiate loves, of freshman calculus with its DT's which come to signify the delirium tremens of the old man and the Delta Time of shrinking to zero in death. More largely, her reflection captures for her for the first time a sense of a world of suffering that she, insulated in suburban Kinneret-among-the Pines, has largely evaded. This scene has often been noted as a secular "pieta"; it might also serve as an emblem of Heideggerian "Care."

In contrast, Inverarity uses all his powers to escape "Care." His technique, in the Ellulian sense, struggles to manage all around him in the most efficient way. The America he personifies is one of Big Deals. His dazzling entrepreneurial skills amass and lose him fortunes, and he glories in the complexities of wheeling and dealing across the face of the land. His craft leads Oedipa to suspect that, if he arranged all the W.A.S.T.E. hints to mislead her, the colossal joke might be Pierce's slap from across the grave --perhaps even a machination which he hoped would enable him to escape death itself. "Had something slipped through and Inverarity by that much beaten death?" (CL49,179) she ponders.

And Inverarity embodies that very will to alter the land which aroused Heidegger's ire in his famous late essays on technology. For Heidegger, man opens consciousness to Being through relating to the world around; if this relationship is caring and directed, the disclosing of Being can take the form of art, of poisesis. In true poisesis, if coming-into-Being involves

craftsmanship or techné, the emphasis falls on the discovering of Being itself, as in art. Techné, Heidegger laments, however, more recently has displaced Being in favor of the objects with which techné works. Heidegger cites two examples of techné, old and new: the peasant farmer working the land, letting the seed sprout, root and grow with minimal interference, and the modern technologist-farmer, forcing the land to bear more with chemical and mechanical interventions.[9] Inverarity, with his land dealings, goes one step further than Heidegger's engineer-agriculturalist by shaping and dividing the land to bear the detritus of Southern California culture.

Techné, with its modern stress on challenging or provoking things, rather than letting Being speak through them, has two consequences. Because the individual will enters into determining how things are to be used, the individual is caught up within the technological system of "Challenging-Revealing." This entrapment and ultimate limiting of the individual Heidegger calls "Gestell," or "Enframing." "The essence of modern technology is Enframing," (QT,25) for Enframing encloses coming-into-Being within the boundaries set by the will which determines how things are to be used. "Enframing conceals that revealing which, in the sense of poisesis, lets what presences [here, a verb] come forth into appearance." (QT,27)

Not only is the consciousness thus bounded and demeaned, but so are objects. Objects regarded as fixed and dead, as tools to serve technological purposes, no longer disclose Being by standing against the individual consciousness and thus letting

Being in. Objects thus called upon to "stand by" for future use become the "Standing-Reserve" (Bestand), means not to the pursuit of Being through caring, but to "regulating and securing" (QT,16). What Heidegger here is saying, I think, is that ideally objects should challenge us to open ourselves to Being by admitting our own vulnerability and emptiness; such a relation lets Being in and can take the form, say, of the poetry of Hoelderlin that Heidegger so loved. But objects shorn of their innate mystery of otherness, challenged to "stand by, or to be on call for a further ordering" (QT,13), give us a false sense of security and fullness.

Heidegger is arguing, through his sometimes clotted neologisms, that modern technology's greatest threat is its sense that all man's questions about the world have been answered, that man can be secure in his possession of the power to alter things as the will dictates. Even science, seen as the satisfying of human curiosity about objects, becomes caught up by techné. Heidegger writes of the impact of technology on modern physics in a passage similar to Heisenberg's observations about the role of the perceiver in science, but with a darker conclusion: "Because physics, indeed already as pure theory, sets nature up to exhibit itself as a coherence of forces calculable in advance, it therefore orders its experiments precisely for the purpose of asking whether and how nature reports itself when set up in this way" (QT,21).[10] Presumably physics could be addressed in other ways, with other anticipated results thus accruing.

To the humanist tradition, especially in the European formulation, nothing is more distressing than the assumption --

especially among Americans-- that technology confers an escape from contingency.[11] So potent does modern technology appear, especially in and to America, that Heidegger's key terms, "regulating and securing," have become routinized into the fabric of our experience. We expect things to work as they are engineered. Chance has no role. Though Laplace had not the calculating machine to predict the future, we may have. Thus, when accident appears, as it did on January 28 of this year on a colossal scale when NASA's attempt failed to render as routine the chanciness of space travel, our shock is all the greater. No techné, Heidegger might say, exists to domesticate death, to secure us against it.

III

So protean a book as Gravity's Rainbow invites readings and readers of every sort, and neither Pynchon's concern with technology nor with death has been unnoticed. Yet, no one reading has, or could, exhaust this book's dross and richness, and I think looking at Pynchon's concern for technology as a regulating system for maximizing order and security, while routinizing the fear of death, can "open" some new thoughts on his work.[12]

To most people reading this near-900 page behemoth for the first time, the book seems to involve an enormously elaborate plot concerning the pursuit of information about the German V-2 project right after the cessation of fighting in World War II. Most first readers scratch earnestly for the details of a vast plot, hints of which are strewn about with a liberality

anticipated only in the late Dickens of Little Dorrit or Our Mutual Friend. In the end, this apparent narrative thread proves illusory. Indeed, for the reader raised on the "technique" of the comparably complex and variegated Victorian novel, Pynchon's displacement of that genre's anticipated technology of construction comes as quite a shock, as we shall see.

We shall approach the book by contrasting the two main characters, Tyrone Slothrop and Captain Weissmann, known as Blicero, whose relationships to the rocket program articulate Pynchon's meaning beyond the ultimate irony of a plot that collapses under its own weight. Slothrop, scion of a Western Massachusetts family rooted in radical Puritanism, appears by some kind of perverse psychological conditioning to have developed a sexual anticipation of where V-2's will fall on London. Blicero, an exemplar of German imperial culture, uses his position as an officer in the rocket corps to act out his own fantasies about the exhaustion of the European tradition of high culture he so loves. Much of the "action" of the novel involves Slothrop and Blicero's attempts to use the V-2 for their own ends, as well as the counterplots of others to use them as vehicles for gaining control of this new technology in anticipation of the oncoming cold war.

Blicero had served with German forces subduing the Herero revolt in the colony of South-West Africa in the second decade of the century --a campaign, Pynchon darkly warns us, in which German technology was for the first time pressed into the service of genocide. There he met and fell in love with a young, half-

breed male Herero whom he named Enzian, honoring his favorite poet Rilke. This homosexual coupling of German intellectual and African boy close to the primitive instincts of his nearly-exterminated tribe seems one of the few instances of meaningful love in the book. Through Blicero feels guilt for accepting the advances of the trusting boy (GR,13 and again at 376) their love seems genuine: Enzian, always presented with respect in the story, never loses his love or care for his "slender white adventurer, grown twenty years sick and old" (GR,769).

Perhaps had Weissmann, like Kurt Mondaugen, disappeared into the African desert in disgust with the barbarity of his people, he could have come to terms with the heart of darkness which for Pynchon beats with a healthier energy than the deracinated pulse of Europe. But he returns to Germany, ultimately to the rocket program. He contrives a sado-machististic fantasy life with a young Dutch brother and sister, Gottfried and Katje, in which all yearn for death in the witch's oven fabled in Hansel and Gretel (GR,109). Thwarted by his perversions from seeking any healthy love, Weissmann adopts the name "Dominus Blicero," Lord of a Whiteness which signifies his enchantment with death. His energies are sublimated into making the German rocket program successful, a commitment he teaches Enzian to accept as the ultimate knowledge about masculine love.

It began when Weissmann brought him [Enzian] to Europe:

> a discovery that love, among these men, once past the simple feel and orgasming of it, had to do with masculine technologies, with contracts, with winning and losing. Demanded, in his own case, that he enter the service of the Rocket.... Beyond simple steel erection, the Rocket was an entire system WON, away from the

> feminine darkness, held against the entropies of lovable but scatterbrained Mother Nature (GR,377).

In Blicero's exasperated case, technology becomes identified with a masculine victory over what he fears: women, nature, chance. His career marks the trajectory of the German fascination with the rocket. Pynchon shows clearly that German rocket research began as genuine Heideggerian techné: a coming-into-Being of a new range of human experience, a playfulness, a joy of boys sporting themselves amidst the grinding drabness of the Weimar Republic. For example, Pynchon shows at length how a young engineer, Franz Poekler, dedicates himself to the dream of a rocket flying to the moon to relieve the unbearable gloom of his life; how Poekler lives for the fantasies of the German cinema; and how ultimately the infant rocket program receives its first taste of all-magical "funding contracts" for the making of the film Die Frau im Mond (GR,178-86).

As the quotation above suggests, the history of the German rocket illustrates Heidegger's argument for Gestell or Enframing. For Blicero the rocket becomes an instrument of fulfilling his personal vengeance on Mother Nature. The V-2 breeds a technology whose perfection --described in some detail through the novel-- presses chance out of the system. The fantasy object of the cinema becomes a vehicle to propel a ton of high explosives on London citizens, a warhead whose supersonic and hence unannounced arrival proves to Londoners the only weapon they cannot get used to. ("But then last September the rockets came. Them fucking rockets. You couldn't adjust to the bastards. No way" [GR,24]). Heidegger's argument of technology

as "Challenging-Revealing," of imposing will upon Nature to yield up power at the cost of cutting self off from growth into new Being, could be no better illustrated.

And death results. Not only of nameless Londoners, of occasional minor characters introduced to us by name, but of the dissolution, if not physical death, of Blicero and all he loves. In a climax surely inspired by the Goetterdaemmerung, Blicero reserves a last rocket, specially insulated with a new erotic polymer, to launch his Gottfried into the heavens. Blicero's romantic, death-sodden rhetoric compels a terminal vision of the bitterness of Europe, now about to be reinfected with a new virulence of technology from an America which has forfeited its own chances of life by lunging for empire. Blicero's invocation to Gottfried to escape to the heavens, perhaps to a new life on the moon free of earthly gravity, takes on such power and weight that the reader may be swept up by its very potency (GR,842-44).

Yet Blicero is clearly mad, literally impotent. His love for Gottfried has been "waste, yes, futility" (GR,841). His projection of Gottfried into the heavens creates not a Rilkean Angel, but a sacrifice of an innocent last seen with "the first star hang[ing] between his feet" (GR,887) as the rocket inevitably reaches its high point and begins its fatal return to earth in inevitable submission to gravity.

In Heidegger's terms, the attempt through technology to submit Being to the "Challenging-Revealing" of total domination not only fails to create a system immune to chance, but closes off that openness to experience which Weissmann as a young man

seemed to demonstrate in his love of poetry and Enzian. Making of the magic of early rocketry the quite literal "Standing Reserve" of a weaponry stockpile routinizes the charisma (to use a phrase from Max Weber Pynchon enjoys [GR,378]) of discovery. Or, if you prefer a pithier Pynchonesque formulation, the failure of Weissmann's attempt to turn the parabola of descent into an arc of escape may be summarized as:

Lovable but scatterbrained Mother Nature - 1.

Masculine technologies - 0.

It remains for Enzian, leader of a small band of Hereros in the undefined Zone between competing German conquerors, to see the rocket differently. For him, the Black Rocket --throughout paralleled to Blicero's deathly 00000-- embodies the strength of his beleaguered people to master a European technology in the face of their oppressors. The rocket which they shepherd through the last pages gives them a quest, an identity, an opening to Being, which serves as a counterforce to the death-wish of some of their compatriots. The novel does not record their launch, success, or failure, but their rocket shows a racial poisesis which is creative. Perhaps they survive.

IV

Blicero reads Rilke, especially the Tenth Elegy. Tyrone Slothrop reads Plasticman comic books. In that contrast they prefigure European and American sensibilities --the grand rhetoric of middle European high culture versus the malleability of American experience. But as readers of the novel know, Slothrop more than reads Plasticman, he may be plasticman. Clues

and discoveries suggest that as a young man, Slothrop may have been sold to the omnipresent technological genius, Lazlo Jamf, whose mastery of organic chemistry and his Fascist power politics combine to make him the novel's arch-scientist. Jamf's vision (GR,672-74) of the ionic bond as a seizing of power, in contrast to the insipid sharing of covalency, accords with his politics and enables him to conquer new areas for technology. Plastics, emulsions for movie film, rocket propellants, synthetic dope, and the sensuous insulation which proves to be Gottfried's shroud all result from Jamf's Enframing of the original (literal) dream of Kekule's organic molecular benzene ring (GR,478).

While Jamf was at Harvard, he seems to have been working on yet another technology to seize power --a synthetic organic substanceto condition humans. The system Jamf explored would have won the admiration of Ellul's efficiency-seeking technocrats. Abandoning the expensive measuring apparatus and monitoring of the pioneer student of conditioning, the Russian Pavlov (another gray eminence among the novel's technologists), Jamf hit upon conditioning an infant, Tyrone, to contract an erection upon stimulation with his mysterious substance. Why an erection? "[A] hardon, that's either there, or it isn't. Binary, elegant. The job of observing it can even be done by a STUDENT" (GR,97).

Jamf, it is hinted, failed in his responsibilities to extinguish Tyrone's conditioning after ending the experiments, and some lingering affinity between Tyrone's cock and the Jamf-chemistry of the V-2 makes Tyrone anticipate where V-2's will hit by making love to various London pickups at locations subse-

quently struck by the revenge weapon. The discovery that Tyrone's record-grid of conquests overlaps the grid of rocket hits throws into convulsions conventional scientific wisdom, as somehow Tyrone seems to abrogate cause-and-effect by responding to the rockets before they explode.

Though Slothrop only haltingly grasps why British intelligence becomes so interested in him, others quickly take an interest in his curious condition. In particular, he is pursued throughout by the Pavlovian psychologist Edward Pointsman, whose professional dedication to binary thinking --on or off, 1 or 0, is prefigured in his name, which in British parlance signifies a switchman who shunts railcars from one line to another. Slothrop's prevision so affronts Pointsman's dedication to cause and effect that Pointsman vows "I will find [how his mind works] if I have to open up his damned skull" (GR,104). To this end, Pointsman's dedication to the technology of behavioral conditioning enlists the support of a diversity of spies and agents monitoring Slothrop's actions --even an obliging octopus named Grigori.

In the end, all who seek Slothrop's secret --including Slothrop himself-- fail. Slothrop, ostensibly on a secret mission to gather intelligence about the V-2 program, becomes actor in and progressively victim of an incredible succession of misadventures. His failure differs from Blicero's. Rather than try to dominate the rocket, Slothrop simply loses interest in it. He has made a "Standing-Reserve" not of things, but of women, especially in his endless and increasingly perverse sexuality.

Appropriately the last female we see with him for any length of time is a friendly sow.

As he pursues the mysteries of the rocket through the Zone, he himself becomes a mystery. He assembles hint after hint about the plots pullulating about the rocket, only to have his own consciousness unravel in the face of increasing complexity. The paranoia which drives him to affix the dark hints of his own sale by Jamf to the German rocket finally yields to the opposite --an anti-paranoia where nothing connects. Though many readers have reviewed this "anti-paranoid part of his cycle" (GR,506) as his demise, he may, in Heideggerian terms, be escaping from the Enframing which hitherto has trapped everybody in the story itself. The latest point chronologically in which we see him sounds like a Heideggerian opening-into Being, as escape through rejection of the "Challenging-Revealing" which has conditioned him before. After puzzling over a graffiti he finally identifies as a schematic of the V-2 guidance system, he recalls his past up to this point. The rich memories of a country childhood in Western Massachusetts flood his consciousness, providing a personal pattern of order which dissolves the vain quest to order the political empire-building of the Zone. "Slothrop sees a very thick rainbow here, a stout rainbow cock driven down out of pubic clouds into Earth, green wet valleying Earth, and his chest fills and he stands crying, not a thing in his head, just feeling natural..." (GR,729). Blicero has rejected feeling natural; here, in accepting Being for itself without imposing his will on it, Slothrop escapes the rocket's technology. Rather than die, he simply drops out of a book in which everyone else

continues to hide in self-deceit his own vulnerability to chance, to Earth.

Technology embraces more in Gravity's Rainbow than just the stories of Blicero and Slothrop. In the sense given by Ellul, technology as the pursuit of maximum efficiency through systemization of effort controls the war itself. The narrator throughout stresses the dominance of cartels of industries which stretch even across the battlelines of the conflict. Nothing in the book counters the paranoia repeatedly expressed that the war itself is simply an instrument to maximize efficient use of resources in the service of expanding new technologies. "Don't forget the real business of the War," Pynchon writes, "is buying and selling. The murdering and the violence are self-policing and can be entrusted to non-professionals" (GR,122). True Technology (Pynchon uses the capital "T" in the long description of it on page 607) fears only the cessation of funding which may come with war's end. And true Technology renders the individual impotent: "Once the technical means of control have reached a certain size, a certain degree of being connected one to another, the chances for freedom are over for good" (GR,627).

V

Against such monolithic power, what chance does the individual have? Not much, but some. There is genuine love in the book, even moments of the religious peace which passeth all understanding; and these moments do show that some chances for freedom remain.

The best-known lovers in the book are Roger Mexico and

Jessica Swanlake. To Jessica the affair with Roger is a passionate fling while separated from her earlier lover Jeremy to whom she knows someday she will return. For Roger, Jessica is everything. His role in the novel as the most committed lover, indeed as a D. H. Lawrence kind of figure, is related directly to his attitudes about technology and the System. A statistician, he serves as Pynchon's spokesman for the uncertainties of nature and of technology. In explaining to Jessica the random distribution of V-2 hits throughout London, he stresses that the Poisson distribution can only define the probability of hits clustering around the target bullseye, not predict exactly where a rocket will fall (GR,62-63). Throughout the novel he engages in a dialectic debate with Ned Pointsman, his opposite by virtue of Pointsman's insistance that science reduces all phenomena to cause and effect.

As the student of probabilities not absolutes, Roger can live between Pointsman's binary opposites, 0 and 1 (GR,63). He hates the System which dominates their lives and struggles against it. His love for Jessica is so powerful because she represents all that Technology and the System cannot take away. For him she is always new, always changing, not pinned down. Her wondrous novelty rests on her unpredictability, her refusal to succumb to any kind of conditioning or pattern:

> His life had been tied to the past. He'd seen himself a point on a moving wavefront, propagating through sterile history --a known past, a projectable future. But Jessica was the breaking of the wave. Suddenly there was a beach, the unpredictable, new life... nothing was fixed, everything could be changed, and she could always deny the dark sea at his back, and love it away (GR,146-47).

In Heideggerian terms, what Pynchon is saying is that for Roger his love opens him to new Being, reveals his vulnerability to another in a way which helps him define his own nature. Jessica is a genuine Other against whom he comes into fuller being, not just an object (or Standing-Reserve) for sexual convenience.

Pynchon points to the magic of love to dissolve the Enframing of Technology by quite literally making the woman in his other pair of lovers a witch. Geli Tripping, who comes complete with a trained owl and a proclivity to lurk in the Harz Mountains, determines to win the Russian intelligence officer Vaclav Tchitcherine away from the war. To prepare the appropriate love potion she consults an old woman, who assures her "You're in love. Technique is just a substitute for when you get older" (GR,837). Thus enboldened, Geli succeeds in winning her love away from his pursuit of the Black rocket commandoes, and in so doing presumably saves him from fratricide as well. In a scene as powerfully written as anything in the amazingly diverse prose of this novel, Geli's presence fills Tchitcherine with a sense of Pan coming to bring him new life, away from the System to which his loyalties were earlier fixed (GR,838-40).

At least one other scene in the novel depicts an escape from the death the war brings, and points toward another chance for freedom. Surprisingly, the scene discloses the power of religion to awaken spiritual powers that liberate. Given Pynchon's well-known agreement with Max Weber that Protestantism is at the root both of Capitalism and Technology, one would not anticipate Pynchon ascribing much potency to a religious service. Yet the

Advent service that Roger and Jessica attend early in the novel fills both them and the reader with a sense of the awe that the Christmas story can still evoke.

For the most part in the novel, religion is just another instrument of the System to exact efficiency and conformity out of individuals. Presumably Pynchon would side with one of his characters who argues that "Religion was always about death. It was used not as an opiate so much as a technique --it got people to die for one particular set of beliefs about death" (GR,818). Yet as Pynchon carefully explains, a religion not based on Good versus Evil, the Elect versus the Preterite, could bring real salvation, not death. Tyrone Slothrop's ancester William preaches just such a heresy, a religion saving both the Elect and the Damned (GR,647-48). Jessica and even the sceptical Roger feel the power of such a faith when they hear the choir of servicemen perform Evensong in a rural church. This great prose-poem setpiece (GR,148-59) concludes with the assurance that, like Geli the Witch's invocation of Pan, recollecting the "New Baby" (GR,155) can still bring freedom:

> So this pickup group, these exiles and horny kids, sullen civilians called up in their middle age, men fattening despite their hunger, flatulent because of it, pre-ulcerous, hoarse, runny-nosed, red-eyed, sore-throated, piss-swollen men suffering from acute lower backs and all-day hangovers, wishing death on officers they truly hate, men you have seen on foot and smileless in the cities but forgot, men who don't remember you either, knowing they ought to be grabbing a little sleep, not out here performing for strangers, give you this evensong, climaxing now with its rising fragment of some ancient scale, voices overlapping three- and fourfold, up, echoing, filling the entire hollow of the church --no counterfeit baby, no announcement of terrible night, only, damn us,

> our scruffy obligatory little cry, our maximum reach outward --praise be to God!-- for you to take back to your war-address, your war-identity, across the snow's footprints and tire tracks finally to the path which you must create by yourself, alone in the dark. Whether you want it or not, whatever seas you have crossed, the way home...(GR,158-59).

VI

Illuminations such as this are rare in Gravity's Rainbow. For the most part, technology seems winning. The mad, random-flying hairspray can has become the rocket vengeance-weapon capable of "chuck[ing] a ton of Amatol 300 miles and blow[ing] up a block full of citizens" (GR,607). In the last page, the rocket is about to come down on our heads.

Gravity's Rainbow thus shows more fully than anything else Pynchon has written what the dangers of technology are. Pynchon seems positioned in the camp of Ellul, Heidegger, and others who regard technology as an intrinsic threat to individuality. More than in V. or The Crying of Lot 49, technology here is in the hands of System personified, dedicated to making the rocket perfectly predictable. Those who dedicate their lives to this technology, like Blicero and Pointsman, become themselves perfectly predictable. The world as run by "the Firm" is a model of undifferentiated efficient units, a victory of Entropy over Energy.

Heidegger argued, you may recall, that the greatest threat of technology was its tendency to make the future appear routine, predictable, dead. Things became means to achieving objectives, to imposing the will over nature --not ends to be valued as providing, in their mysterious apartness, access to a greater

sense of Being. We have seen how thoroughly Thomas Pynchon articulates this point through his fiction. Blicero's pursuit of the rocket-technology progressively deadens him to all that had made him attractive before: while preparing to fire Gottfried beyond the realm of an earthly death, he rarely recalls or expresses care for Enzian, the one possible source of his salvation. And the managers of the System, the Lyle Blands and Pierce Inverarity's, use their command of Its efficiencies to try to escape from death itself.

Technology, with it pursuit of efficiency, sameness, and predictability, robs us of the chance to take a chance, to open up to the nature of Being. Roger Mexico, who can live with the probabilities, between Zero and One, emerges as technology's chief opponent. He can live with risk, risking an affair with Jessica. His final fantasies of disrupting the victory parties of "the Firm" depict his challenge to those, like Pointsman, who would manage his life. And recall Tyrone Slothrop himself, who we are told in the end is "just feeling natural" (GR,729). "Feeling natural" seems to be Pynchon's best prescription for avoiding technology's siren call to pretending certainty.

We may ask, has Pynchon become predictable? All three of his novels center around elaborate narratives rich in details which point to --but never arrive at-- some underlying resolution bearing on the secrets of the System. In the technique of the Victorian novel, as noted earlier, such resolutions affirm an order to the social and moral universe: rewards, punishments, fortunes, marriages are meted out in careful proportion to just

deserts. But for Pynchon, as we have seen, the plot never coalesces because the order upon which it relies never coheres. All the hints about Slothrop's links to the rocket merely dissolve in the end; no resolution to the mystery appears. Indeed, the last word we hear on the matter is a denial of any causal relation, and the assertion that Slothrop's condition showed that "he might be in love, in sexual love, with his, and his race's, death" (GR,861).

So thoroughly does Pynchon explicate this vision in Gravity's Rainbow that we might fear the author has succumbed to his own technique. What can he say next? Given Pynchon's notorious reticence, we can only speculate what he is working on now. Faithful readers of Pynchon can only observe, "We Await Silent Thomas' Encore."

NOTES

1. Precisely what Pynchon studied at Cornell is not known, since his college transcript is said to have disappeared. Those who claim to have seen it intimate that Pynchon's knowledge of science probably came as much from reading done outside class as from his engineering physics classes. What biographical facts are known about this notoriously reticent author are conveniently gathered in Mathew Winston's "The Quest for Pynchon" in Mindful Pleasures: Essays on Thomas Pynchon, ed. George Levine and David Leverenz (Boston: Little, Brown, 1976), pp. 251-63.

2. See Joseph Slade, Thomas Pynchon (NY: Warner, 1974). Alan J. Friedman's "Science and Technology" surveys those subjects in Approaches to Gravity's Rainbow, ed. Charles Clerc (Columbus, Ohio: Ohio State Univ. Press, 1983), pp. 69-102. Excellent chapters stressing Pynchon and science occur in two recent critical interpretations of modern science and literature: N. Katherine Hayles's The Cosmic Web: Scientific Field Models and Literary Strategies in the Twentieth Century (Ithaca, NY: Cornell Univ. Press, 1984) and David Porush's The Soft Machine: Cybernetic Fiction (NY: Methuen, 1985).

3. See, for example, Werner Heisenberg, Physics and Philosophy (NY: Harper, 1958); Niels Bohr, Atomic Physics and Human Knowledge (NY: Wiley, 1958) and Gerald Holton's essay, "The Roots of Complementarity" in his Thematic Origins of Scientific Thought (Cambridge, MA: Harvard Univ. Press, 1973), pp. 115-61; Jacob Bronowski, Science and Human Values 1965 (NY:

Harper, 1972); and Michael Polanyi, Personal Knowledge: Towards a Post-Critical Philosophy (Chicago: Univ. of Chicago Press, 1958).

4. See, for example, Mary Hesse, Revolutions and Reconstructions in the Philosophy of Science (Bloomington, IN: Indiana Univ. Press, 1980) and Kurt Huebner, Critique of Scientific Reason (Chicago: Univ. of Chicago Press, 1983).

5. The Crying of Lot 49 1965 (Philadelphia: Lippincott, 1966), pp. 36, 38-39. (Sections appeared in periodicals in 1965.) Subsequent quotations to the novel will be cited in the text as CL49.

6. Ellul's 1954 book made its impact on English audiences after its translation as The Technological Society (NY: Knopf, 1964). The author's "Note to the Reader" stressed the breadth of the references to technique and technology: "technique is the totality of methods rationally arrived at and having absolute efficiency...in every field of human activity" (xxv). "Technique is not an isolated fact in society (as the term technology would lead us to believe) but is related to every factor in the life of modern man; it affects social facts as well as all others" (xxvi). References here are to the Vintage paperback, 1964, and will hereafter be cited in the text as TS.

7. See Sartre's essay "Existentialism," in Existentialism and Human Emotions (NY: Philosophical Library, 1957), pp. 18-32.

8. These general comments on Heidegger derive largely from George Steiner's Martin Heidegger (NY: Viking, 1978), especially Steiner's second chapter on Being and Time.

9. References to Heidegger's essay "Die Frage nach der Technik" are from the translation by William Lovitt in The

Question Concerning Technology (NY: Garland, 1977). Lovitt's introduction and notes are helpful in establishing the chronology and wordplay of the essay, and the volume contains several important related essays. Page references to the essay "The Question concerning Technology" will be cited in the text as QT.

10. Heidegger several times refers to Heisenberg's 1954 lecture "The Image of Nature in Contemporary Physics" (QT,23). Those wishing to pursue similarities in these two thinkers can turn to Heisenberg's Physics and Philosophy (see note 3 above).

11. The distinction between American and European expectations regarding technology was made vigorously by Jean-Claude Lejosne, Chair, Applied Languages, University of Metz, at the "Bridges II" Conference, Maine Maritime Academy, Castine, Maine, May 19, 1984.

12. Gravity's Rainbow (NY: Bantam, 1974), p. 116. All further references to this edition are cited in the text as GR.

LITERATURE AS TECHNOLOGY

Joseph W. Slade

In an article occasioned by the recent PEN Writers' Conference in New York, Susan Sontag refers to the writer as a member of a quasi-religious order:

> There is a specific historic process, starting in the 18th century, by which "literature" is separated off from other forms of writing (such as journalism, belles lettres, hack fiction, history) and the profession of "the writer" (someone who creates "literature") comes into being. I subscribe entirely--the correct word might be devoutly--to this modern, secular idea of literature as a calling, which assumes an artistic hierarchy, which assumes literature as privacy--as a social contribution, if you will, but only because the writer knows how to distance himself or herself from the collective din, above all, the din of the state.[1]

As political statement, which is how Sontag intends it, this description of the writer's trade can hardly be faulted. The problem is that she does not really say what literature is, only that it is serious business, that it is special, and that the creation of it is a private vocation. When Sontag speaks of literature as a secular calling, however, another image that comes to mind is that often advanced by scientists, who cling to a similarly romanticized vision of the lone researcher whose devotion to an idealized scientific method sets his investigations apart from lesser forms of inquiry.

Not really cases of special pleading, these similar conceptions are nevertheless attempts to elevate literature and science above ordinary professions, and thus to separate them from the collective dynamics of a technological culture. Over the past several decades, the stature of literature has been diminished by

two factors. The first is the greater authority of science, which speaks in voices more respected than those of the literature Sontag idealizes. The second is the competition from other media, principally the electronic, whose voices are more pervasive in our culture than that of the writer who carries on his work privately. Fortunately, despite the articulations of distinguished spokespersons like Sontag, the myths of semi-holy office (for a writer's pen is no more the finger of God than the chemist's beaker is a chalice) are beginning to erode, to be replaced by an understanding of the writer's role as a contributor to the technology that shapes our world. Since the principal technologies of our time are informational, the legacy of a second industrial revolution that has replaced concepts like energy, force, and work with others like messages, signals, and codes, the place of literature in our culture needs to be reexamined. That the writer is a technologist, and that what he creates is technology, are ideas made inevitable by discoveries both scientific and literary. Or, to put matters more simply, perhaps these ideas are merely the consequence of reexamining the nature of language and of writing, technologies that we take too much for granted. Acknowledging the technological character of literature may allow writers to chart directions instead of engaging in empty hostility, and encourage them to think themselves full participants in our culture instead of rearguard defenders of older values and forms.

Some features of the writer's technological function, like those of the scientist's, are obvious. Pressed, the writer will

admit that technology does have something to do with his craft. He knows that he uses pen, typewriter, or word-processor, and he knows that the printing, binding, and distribution of the pages he writes are technological processes; he may even know that the first product of the First Industrial Revolution was a book (a user-friendly, "random-access, fully indexed, compact and portable storage and retrieval device").[2] Elizabeth Eisenstein has detailed some of the profound alterations wrought in our culture by the industrialization of writing in her superlative The Printing Press as An Agent of Change.[3] Ironically, the scientist is frequently just as reluctant to cede to technology the important part it plays in the "doing" of science. Earlier generations thought of technology as applied science, and to the degree that inventions embody information generated by science, it is an accurate notion. Historians of science like Cyril Stanley Smith and Derek de Solla Price have pointed out, however, that because of the elaborate apparatus so often required to carry out experiments, science is perhaps better characterized as applied technology. In disciplines like particle physics, the equipment is so immense that platoons of researchers must coordinate the cycles of high speed accelerators and their ancillary sensors and computers. Yet even the single scientist laboring alone in his laboratory must master machines designed and engineered to measure biological or chemical reactions--or invent the technology himself. As a result, on occasion a frustrated scientist will claim that he cannot "do" much science because interpreting data takes a back seat to running equipment. That is rather like a writer's complaining that typing gets in the way of his thinking.

Questions of hardware aside, the practice of either science or literature involves coming to grips with the informational bases of individual disciplines. Those bases must be construed as complex technologies, accumulations of data and skills. Writers are conscious of past literary traditions extending well beyond the eighteenth century that Sontag uses as a benchmark: trains of narrative forms and fictional characters, sequences of technique and perspective, strands of thought and feeling that shape present consciousness. Here readers find moral lessons, templates for experience, corroboration of prejudices, emotional tutelage--the strip maps, in short, of human culture. Writers write in those same traditions and draw on them for precedents, allusions, inspiration, models. Every science has a history and a tradition too, beginning at least with the invention of the scientific journal in the 17th century and continuing with the growing professionalism which tightened disciplines in the 18th and 19th. Around universities and research labs scientists bemoan the tedium of plowing through the "literature" of a field in order to check conclusions, challenge observations, design or replicate experiments.[4] Gone, apparently, are the days when Alfred North Whitehead could boast that "A science which hesitates to forget its founders is lost." Now the data piles up in books, in computer memories, in the thousands of scientific journals published every year. One of the dilemmas of a literate culture is that we seem unable to forget anything, and as a consequence are in danger of drowning in information.

Whatever else the terms literature and science may mean,

they also refer to rough categories of information. The kind of information we call literary is the stuff of human experience, data qualified by inner states of mood, imagination, and emotion. By contrast, we think of scientific data as objective information gleaned by carefully controlled observation, capable of quantification and precise, unambiguous expression. That these distinctions are far from watertight is obvious to anyone familiar with both areas of knowledge. In their accretions of information, literature and science serve as technological resources for our culture. Whether we call them databases or, just as commonly, the literatures of various disciplines (although doubtless Sontag would not so call them), these compilations function as tools for further investigation, as ideas to be endorsed or rejected, as capital in an information economy, or, more poetically, as the life-blood of civilization.

Because scientific conclusions and literary insights are both preserved as texts, scholars have begun to explore common themes and rhetorical strategies among those texts. Some of the affinities are superficial, some illuminating, some profound. Convergences are more apparent in some disciplines than in others. The "softer" sciences seem most literary. Lionel Trilling has remarked, for example, that "psychoanalysis is a science which is based upon narration, upon telling,"[5] and anthropologists and sociologists have made similar observations about their disciplines.[6] But physicists and chemists and paleontologists and astronomers "read" the book of nature (Paracelsus called it reading "signatures") in order to translate its messages into forms that are frequently literary. In his essay,

"The Literary Character of Economics," Donald McCloskey has noted general similarities:

> Scientists of all sorts, however, and in particular economic scientists, think and persuade with metaphors, authority, and considerations of symmetry, beauty, and moral weight, just as humanists of all sorts think and persuade with numbers, experiments, and considerations of economy, power, and productive force. The proportion in which they select the various tools of thought will depend on what exactly they are thinking about, not what allegiance they have to the literary or mathematical branches of the intelligentsia.[7]

Writers themselves absorb and transform the information of science, as Gerald Holton has said in praise of William Faulkner: "There are writers and artists of such inherent power that the ideas of science they may be using are dissolved, like all other externals, and rearranged in their own glowing alchemical cauldron."[8] The more scholars attempt to span the two cultures, the more they learn that the bridges are information technologies. Most astonishing, perhaps, has been the discovery by molecular biologists that the information codes that produce genetic configurations resemble more than anything else the language codes that ultimately produce literature.

Together and separately, then, literary and scientific information systems are technologies because they organize, store, display, and transmit knowledge. Broadly conceived, a technological culture represents a concatenation of craft and discovery, a process of rationalization and artifice, a marshalling of method and information; these have made two industrial revolutions possible. In this very real sense, information is tech-

nology. The idea is actually ancient, as Hugh Aitken points out when he equates Edwin Layton's phrase, "technology as knowledge,"[9] with Aristotle's notion of information as man's "reasoned state of capacity to make."[10] But, if the idea of information as technology is an old one, a newer one is that language, as a means of coding information, is also a technology. Behind the different gestalts of information, behind the different vocabularies, behind the different cues, values, and behaviors of many disciplines, stands language itself.

A language, whether natural or artificial (like a computer language, for instance), is a system of symbols-- all of them arbitrary, although the knowledge of what they signify is shared by those who are literate in that language. Most familiar to us are verbal languages: systems of words, phonetically spoken or symbolically rendered by graphic systems, perhaps alphanumeric, perhaps not (Chinese has no alphabet, and Hindi has semi-syllabic scripts). These symbol systems are codes. Language, says Jeremy Campbell, "is a code which preserves the orderly structure of the messages of speech in ways so ingenious that they are still not fully understood."[11] Information "informs," provides pattern and order without which no message can have meaning, and it is this order that language encodes. Orderly messages are information, although the degree of information is determined by such factors as probability, redundancy, and noise. It is as information that we understand the world. As Campbell puts it, "Nature must be interpreted as matter, energy, and information."[12]

We produce literature by encoding messages in language. Literatures may be oral, but we more commonly consider them

written. The science that we call modern did not exist prior to writing, because oral traditions could not store sufficient information. The anthropologist and linguist Jack Goody maintains that "science, in the sense we usually think of this activity [as accumulated skepticism] occurs only when writing makes its appearance."[13] Symbol systems we call mathematics precede writing by about four thousand years, but arithmetical systems can not store or code as much information either. Those who balk at calling language a technology because of its "naturalness" or its automatic, unconscious aspects should not hesitate to so designate writing. Writing materializes language by symbolizing the symbols of speech; one technology makes use of another. In addition to coding in symbols, writing serves two other technological purposes. These, according to Goody, are storage and display:

> . . . the storage function . . . permits communication over time and space, and provides man with a marking, mnemonic and recording device. Clearly this function could also be carried out by other means of storage such as the tape-recording of messages. However, the use of aural reproduction would not permit the second function of writing, which shifts language from the aural to the visual domain, and makes possible a different kind of inspection, the re-ordering and refining not only of sentences, but of individual words. Morphemes can be removed from the body of the sentence, the flow of oral discourse, and set aside as isolated units capable not simply of being ordered within a sentence, but of being ordered outside this frame, where they appear in a very different and highly "abstract" context.[14]

Writing frees language from the limitations of the storage capacity of human memory, and displays it in ways that foster highly flexible and yet precise manipulation. Information can be

coded, stored, and displayed in other ways, of course, as in the succession of images in the cinema or television. Whether the medium is also the message is a complicated question, but presenting writing by means of technologies like printing or digitization does add other kinds of symbolic notation: margins, typography, formatting, and so on. We manipulate these symbols also as methods of ordering information; in other words, we use them technologically.

Classifying language as a technology may seem odd to those who think of invention solely in terms of fairly obvious tools--farm implements, say, or vacuum cleaners. To be sure, technology does refer to physical things: material products, devices, machines, systems designed and built by engineers of all kinds. The term can indicate a specific "artificial" tool like the stone axe or the steam turbine, but also "natural" instruments like the human hand (which Jacob Bronowski calls "the cutting edge of the brain" in The Ascent of Man) or the symbol system that he uses to communicate information about those tools. Tools effect transformations of many kinds, some of them powerful.

Humans have cherished the power of words, signs, and images for as long as they could reproduce them. To name something, to represent or symbolize it, is to acquire power over it, as the Book of Genesis has reminded us for millennia: "In the beginning was the Word." Literature and science are alike in that both attempt to control nature, in the sense that control begins with description of the universe. And linguistic power can corrupt as absolutely as any other, or so Thomas Pynchon

believes. In Gravity's Rainbow, he lays the responsibility for technological excess at the door of language, the medium of

> name-giving, dividing the Creation finer and finer, analyzing, setting namer more hopelessly apart from named, even to bringing in the mathematics of combination, tacking together established nouns to get new ones, the insanely, endlessly diddling play of a chemist whose molecules are words . . . .[15]

What Pynchon notes metaphorically, John Kouwenhoven notes discursively: the vocabularies of art and technology--words like fabricate, frame, forge, artifice, engineer, contrivance, device, form, craft, design--suggest the fraudulent, the sinister, or the duplicitous.[16] Language too is deceptive, and we are as suspicious of it as of other technologies.

Some decades ago, Benjamin Whorf and Edward Sapir announced that language functions as a filter for a linguistic group; it mediates, colors, or affects--although it does not necessarily determine--a culture's knowledge of the world. That is as true for the languages of science as for the languages of literature. Whorf believed, for instance, that the structures of Indo-European languages embodied assumptions about space and time, and that people who spoke them were predisposed to think in peculiarly linear ways about such concepts. But whether humans actually think exclusively in language is unclear. Einstein insisted that he did not; "certain signs and more or less clear images" "just came to [him]," he said, although he specified that they appeared in meaningful patterns.[17] The patterns, of course, are important. Linguists from Ferdinand de Saussure and Ernst Cassirer to Roman Jakobson have argued that in unified systems of language or signs meaning derives not so much from words or

individual symbols as from the functional relationships between them, a conclusion very much in accord with modern information theory.

The differences in vocabularies--between German and French, between science and literature--are not nearly so important as differences in the relationships that bind words in different languages. Translating words is pretty easy; translating the relationships is pretty hard. Whatever the symbol system, messages must be coded in ordered patterns to preserve intelligibility. To be informative, however, a message must contain some novelty, some surprise. Without order there can be no meaning, but too much order suppresses information; the trick is to establish the proper dynamic. Modern linguistics, which has been directed away from the older study of phonetics and morphology chiefly by Noam Chomsky, concentrates instead on the relationships which ensure meaning in statements. Below the surfaces of language, at a distance from individual words, linguistic structures and algorithms, the rules of grammar and syntax, govern transformations of meaning while still allowing speakers--and writers--enormous choice in the coding of messages. Like information theory, Chomsky's theories of universal grammar deal with information at its source, where it is coded, before it is spoken. Where Sapir believed that humans are in a sense at the mercy of their language, Chomsky believes that they are merely constrained by grammar which can still generate messages of near-infinite variety, novelty, and range of meaning. Communicating is enormously complex.

Language's complexity has become central to many disciplines. Indeed, one reason for the sustained authority of modern science has been the recent willingness of scientists to examine the language they use. That has not always been the case. There is little evidence, moreover, to suggest that practitioners of the harder sciences changed their minds about language because of what linguists were saying. Prior to the advent of quantum mechanics, most physicists, with most of their colleagues in other branches of inquiry, subscribed to the positivist view of language, a view increasingly rejected today. Positivism was an attempt to endow discourse with the invariance of Newtonian principles, to distill precision from a language prone to sloppiness. Positivists assumed that a detached observer could make empirically verifiable observations of events and translate them into accurate statements free of ambiguity. It is of course difficult to express even very formal propositions unambiguously, as anyone who has ever tried to translate Godel's Theorem or the Second Law of Thermodynamics into language appropriate for various disciplines can attest. Even Thomas Kuhn, it has been asserted, used the word paradigm in twenty-one different senses in the first edition of his famous volume, The Structure of Scientific Revolutions.[18] It is almost as difficult to make objective observations.

Physicists themselves--or rather the Principles of Indeterminacy and Complementarity, the so-called Copenhagen Interpretation of reality--undermined positivism. Field physicists have transformed the Newtonian billiard-table universe of discrete, predictable forces into a space-time continuum in which events

are connected in a mutuality that includes the observer, and whose dynamics, as a consequence, resist articulation. If many quantum physicists are still uncomfortable with the ambiguities of a unified field, the boldest have accepted the limitations of sequential analysis and the lack of objectivity implicit in the act of observing. The corollary to Niels Bohr's axiom--"We are suspended in language"--is that laboratory observer and observed event resemble teller and tale. As N. Katherine Hayles points out in The Cosmic Web: Scientific Field Models and Literary Strategies in the Twentieth century, because all language--natural or mathematical--presumes and aims at an order that is "linear, fragmented, and unidirectional," it cannot adequately capture a holistic field in constant interactive motion.[19] Language thus blunts the scientist's wish to measure and quantify just as it mocks the writer's need to give the world forms that elicit human meaning. In attempting to describe reality, both writer and physicist confront the self-referentiality of language that is inextricably part of what is being described.

The physicist, to be sure, has taken the long way 'round the matter. The principal feature of language, although not of all symbol systems, is that the individual symbols, being arbitrary, can be decoupled from the reality they represent. More than any other, that feature of language--and writing--makes them technological, for it allows endless manipulation of the individual words themselves. Just as a child acquires mathematics by discovering that he does not actually have to handle ten apples or oranges in order to add 7 and 3, so he becomes adept at language

by learning that he can talk about toys or ideas without actually seeing or touching them. Once one recognizes that the symbols can be decoupled, can stand alone, then the self-referentiality of the symbol system is obvious. Understood from that perspective, language ultimately must refer to itself.

Physics also spawned information theory by way of the thermodynamics of Rudolf Clausius, the statistics of James Clerk Maxwell, and the probability equations of Ludwig Boltzmann. The new discipline was articulated by William Shannon, whose theorems of 1948 established the relationships between probability, redundancy, and noise. Concepts of entropy associated with both thermodynamics and information theory would later figure prominently in another major branch of science with the work of Ilya Prigogine, "the poet of thermodynamics," who won the Nobel Prize in chemistry in 1977. Five years after the publication of Shannon's papers on codes, Watson and Crick began the deciphering of the double helix--the information system known as DNA. Since that time, grammar and syntax have been terms common to molecular biology, linguistics, and information theory. These three disciplines still fertilize each other.

Although the metaphorical and literal richness of genetic grammar and protein syntax--the information of life--should be attractive to literary scholars, the various "post-modern" schools of criticism have been more attracted to the paradoxes and indeterminacy of physics. That tropism indicates the authority of physics, which is only now being displaced by biology as the dominant science of our time ("physics is the great collective work of art of the twentieth century," Bronowski has said).

That authority in a sense legitimizes the indeterminacy that is so crucial to the kind of close reading advocated by structuralists and deconstructionists.

The literary critic and the physicist have different agendas, of course. The physicist accepts the indeterminacy of self-referentiality only after he has exhausted rational alternatives. By contrast, the critic embraces indeterminacy from the outset, primarily, one suspects, because to do so makes for clever readers. The scientist, like the writer of literature, wants to describe an event in a field of events without limit; the literary critic wishes only to decipher messages embedded in a finite, completed text. While the writer in the last analysis has no control over what such readers interpret from his text, his obligation is to code his meaning in language of enough redundancy to free his message from error or noise.

Although the audience for literary criticism is a reading rather than a writing one, the various schools--hermeneutics to deconstructionism--implicitly acknowledge writing as a technology. However autonomous a literary text, it became a text through the technology that produced it. Few critics would use the term, however, for the myth of the writer as spurner of technology is enduring. Besides, technology, an essentially vulgar word, seems shabby beside structuralism.

Nevertheless, writers who have doubtless never heard of information theory appear to be more conscious of what we might call the technological nature of language. As evidence, Tony Tanner has found in recent American fiction what he calls a

"foregrounding of language,"[20] by which he means an extremely self-conscious use of writing skill, a willingness not just to do tricks with words but to push language to the limits of its constraints. Writers have always been fascinated by language and have experimented with its different properties for centuries, but usually they have not advertised its artifice so deliberately.

To a considerable degree, the emphasis on the character of written language and the forms of modern literature has been deepened by challenges from the non-print media. Competition has made the writer more aware of his tools. Early in this century, the cinema began to appropriate the story-telling function of literature, a theft repeated by television a couple of decades later. Today, television is the principal story-telling medium of our culture. Virtually all of its messages--commercials, programs, news--are stories told in images augmented by sound. As the new media captured ever larger sectors of territory previously held by literature, the serious writer began to change his codes. One need think only of the narrative revolutions in poetry and fiction in the teens and twenties, mutations that depended on writing of great skill and coding of great complexity. Both The Waste Land and Ulysses, to choose the finest examples, were shaped by information of enormous novelty, rendered in novel form. These and other works, in what might be called reverse appropriation, also borrowed images from the new media.

The impact of the visual should never be discounted, not only because images are inescapable in our culture but also

because they are persuasive. "It is pictures rather than propositions, metaphors rather than statements, which determine most of our philosophical convictions,"[21] Richard Rorty has said, perhaps a little too dogmatically, although William Blake, a genius at home with diverse codes, would probably have agreed. Blake's paintings, their messages coded in signs, supplemented his writing, reinforced and extended the meaning of his poetry.

While many people are troubled when highly persuasive media like television begin to supercede writing, we should remember that even the lowest genres of writing (say, in Sontag's artistic hierarchy) are capable of messages in codes more complex than can be expressed by the combination of image and sound in the very best of television programs. Picture and image systems, while capable of syntactical analysis and perhaps of grammatical statements, are nonetheless simplistic compared to writing. "Unlike print," Joshua Meyrowitz has written, "television's symbolic form resembles the things it represents. Television pictures--like all pictures--look like real objects and people; television speaks in a human voice."[22] But, if television speaks with a human voice, writing (somewhat paradoxically, since writing is assumed to be far less "technological" than television) speaks as technology--a voice made even more human by the artifice that is the glory of our species. In contrast to television's visual symbols, written symbols, in themselves meaningless, must be learned and memorized before we can order them into messages. The decoupling of the written symbols which makes texts ultimately self-referential also makes possible abstract combinations in

order of virtually limitless complexity. Codes so complex require masters of language, and that is what writers of literature are.

Redefining writing as we have done will probably not better equip the writer to compete in an information economy, but it may lighten the burden by custom assigned him: that of serving as high culture's first line of defense against the encroachments of a mechanical technology. With his role demystified, he may discover kinship with other makers and coders beyond those he meets at writers' conferences. Nor will redefining writing as technology put literature on an equal footing with science, but it may encourage the writer to translate the information he can find in increasingly accessible disciplines. Science has reshaped the humanities of our time--science may even be the humanities of our time--because its ethical concerns, its social ramifications, and its political consequences are those which most fully engage us. The writer's job is not so much to balance claims from the different disciplines as it is to translate what seems important into forms that delight and instruct. His is a technology of the intellect but also of ideology. Because of it he can be Shelley's unacknowledged legislator of mankind or just a human distanced from the state. Because his language can code for gender, race, emotion, violence, and a host of values, it can oppress or exalt.

The languages of science and the languages of the humanities mediate our knowledge of the world; they are the technologies in which we live. As a master coder, the writer of literature knows how to sort through the barrage of information that assaults us

daily, to find the messages that may be most valuable but most elusive, and to encode them anew. That is the task Thomas Pynchon has set himself, and that is the intent and theme of White Noise, a recent novel by Don DeLillo, which, as it happens, is also an interesting study of writing. To write literature, as the structuralists and their colleagues maintain, is to create a world in a text, but it is just as important, as one of the characters in Gravity's Rainbow suggests, "to get the texts straight." William Shannon's Second Theorem asserts that with proper coding it is possible to transmit even under noisy conditions a message that is as free from error as the sender cares to make it. That kind of accuracy is a theoretical upper-limit, but it is something any writer can shoot for.

NOTES

1. Susan Sontag, "When Writers Talk Among Themselves," New York Times Book Review (January 5, 1986): 22.

2. Gary Marotta, "Letter to the Editor," The Chronicle of Higher Education (March 23, 1984): 23-24.

3. Elizabeth Eisenstein, The Printing Press as an Agent of Change (New York: Cambridge University Press, 1980).

4. For discussion of how prior knowledge (and social, political, professional, and economic constraints) can limit and shape investigation, see Ludwik Fleck, Genesis and Development of a Scientific Fact, trans. Fred Bradley and Thaddeus J. Trenn (Chicago: University of Chicago Press, 1979).

5. Lionel Trilling, Sincerity and Authenticity (Cambridge, Mass.: Harvard University Press, 1974), p. 140.

6. See, for example, George Marcus and Dick Cushman, "Ethnographies as Texts," Annual Review of Anthropology 11 (1982): 25-69; and Richard H. Brown, A Poetic for Sociology (New York: Cambridge University Press, 1977).

7. Donald N. McCloskey, "The Literary Character of Economics," Daedalus 113 (Summer 1984): 99.

8. Gerald Holton, "Einstein and the Shaping of Our Imagination," Albert Einstein: Historical and Cultural Perspectives: The Centennial Symposium in Jerusalem, ed. Gerald Holton and Yehuda Elkana (Princeton: Princeton University Press, 1982), p. xx.

9. Edwin T. Layton, "Technology as Knowledge," Technology and Culture 15 (January 1974): 33-42.

10. Hugh G. J. Aitken, The Continuous Wave: Technology and American Radio, 1900-1932 (Princeton: Princeton University Press, 1985), p. 14.

11. Jeremy Campbell, Grammatical Man: Information, Entropy, Language, and Life (New York: Simon and Schuster, 1982), p. 67.

12. Ibid., p. 16.

13. Jack Goody, The Domestication of the Savage Mind (Cambridge: Cambridge University Press, 1977), pp. 46-47.

14. Ibid., p. 78.

15. Thomas Pynchon, Gravity's Rainbow (New York: Viking, 1973), p. 391; Pynchon's ellipsis.

16. John A. Kouwenhoven, Half a Truth Is Better Than None (Chicago: University of Chicago Press, 1982), pp. 209-10.

17. Quoted in Roman Jacobson, "Einstein and the Science of Language," Albert Einstein, ed. Holton and Elkana, pp. 141, 148.

18. Margaret Masterman, "The Nature of a Paradigm," Criticism and the Growth of Knowledge, ed. I. Lakatos and A. Musgrave (Cambridge: Cambridge University Press, 1970), p. 65.

19. N. Katherine Hayles, The Cosmic Web: Scientific Field Models and Literary Strategies in the Twentieth Century (Ithaca, NY: Cornell University Press, 1984).

20. Tony Tanner, City of Words: American Fiction, 1950-1970 (New York: Harper and Row, 1971).

21. Richard Rorty, Philosophy and the Mirror of Nature (Princeton: Princeton University Press, 1979), p. 12.

22. Joshua Meyrowitz, "The Adultlike Child and the Childlike Adult: Socialization in an Electronic Age," Daedalus 113 (Summer 1984): 31.

COMMENT AND RESPONSE

Edward J. Gallagher

The role of responder is an unenviable one. Both panel and audience wonder what he will do to bring together such diverse papers. Both panel and audience wonder if we really need whatever it is he will do, wonder whether we just can't move on to more important things.

To understand my response, you have to understand what is on my mind at this time. Next semester I plan to teach an undergraduate course entitled "Literature and Technology." At this moment it is simply a line on the Registrar's roster. I have ordered no texts, set no goals, thought out no tactics.

"Literature and Technology" is, in a sense, a new area, a new preparation for me. Although I was very much involved with our STS Program in the old days, from 1970-1977, when we were "inventing" STS here, I have been "away" now for almost a decade. I have not really thought about STS matters for a long time. But I am now coming back, and this course is very much on my mind.

I assume that the Big Question still is: how to live in and with a technological society? So, how should an undergraduate course in "Literature and Technology" be taught in 1986? What should its purpose be? What goals should it have?

Let's suppose that these three papers represent three different answers or approaches to these questions. And let's borrow the terms "Consciousness 1," "Consciousness 2," and "Consciousness 3" from Charles Reich's Greening of America to talk about them.

First, Professor Schachterle's paper on Pynchon. Let's call a course made up of Pynchon-like material Consciousness 1. Pynchon, in fact, seems like an old friend. He was not in my courses in the early 1970s, but (if Gravity's Rainbow had been available) he could have been. I think he would have felt at home there.

For, yes, in the early 1970s I was a Luddite. Sorry, Professor Greenberg, I pitted the writers vs. the scientists, the mechanical vs. the organic. In a course called "Technology and Human Values," I encouraged students to think of technology as the enemy. In my science fiction courses, I defined science fiction as "our culture's imagination of disaster."

I felt, with Pynchon, that technology was winning, that the rockets were falling on our heads. I felt, with Pynchon, that technology was an intrinsic threat to individuality. I saw, with Pynchon, efficiency warring with love and care.

I relished Ellul. Reading Ellul was like looking in the mirror, like hearing my own voice. Statements like this from Ellul drove me crazy: "No technique is possible when men are free. When technique enters into the realm of social life, it collides ceaselessly with the human being to the degree that the combination of man and technique is unavoidable, and that technical action necessarily results in a determined result. Technique requires predictability and, no less, exactness of prediction. It is necessary, then, that technique prevail over the human being. For technique, this is a matter of life and death. Technique must reduce man to a technological animal, the king of the slaves of technique." Wow! He still drives me wild!

I didn't know Heidegger, but if he felt that technology assaults death and chance, then we were brothers too at that time. I didn't know Heidegger, but if he felt that the authentic person acknowledges the finiteness of human control over being, then we were brothers too at that time. I didn't know Heidegger, but if he felt that "the essence of modern technology is Enframing," and that the magic of love dissolves that enframing, then we were brothers too at that time.

I too found it silly to think that technology answered all moral questions, found it absurd to think that technology confers an escape from contingency, and I used to construct courses on these bases. On this rather conservative campus, I was a quiet holy terror. I felt that students needed this tonic of wildness to wake them up, to sensitize them to important technology and human values issues. And the students at that time, even the engineering students, loved this approach. Consciousness 1.

But my perception of technology shifted and so did my conception of courses.

Second, Professor Greenberg's paper on Blake. Let's call a course made up of Blake-like material Consciousness 2. In the mid-1970s I encountered E. F. Schumacher, and he replaced Ellul on my hit parade.

Small is Beautiful, Appropriate Technology, Alternate Technology (a phrase professor Greenberg uses). Wow! Now here was a way to balance the negativity I felt about contemporary technology with a positive and a practical element.

Schumacher, it seemed to me, spoke with simple common sense. What we need is a technology of production by the masses, making

use of the best of modern experience, conducive to decentralization, compatible with the laws of ecology, gentle in its use of scarce resources, and designed to serve the human person instead of making him the servant of the machines.

Confer what Professor Greenberg says about the Blake of The Marriage of Heaven and Hell. Blake not only anatomizes, satirizes, mocks, and parodies bad technology, he invents a better one. No Luddite here! Blake points out what is bad but does not stop there. Blake fashions the technology to his own purpose. And Blake cultivates our creativity as well as his own.

Frankly, I had never seen an illustrated Marriage before reading Professor Greenberg's paper stimulated me to do so. But I have long been familiar with the power of Blake's words "rousing the faculties to act." I have a mania for collecting quotations. In fact, I drew up a collection of quotations entitled A Thousand Thoughts on Technology and Human Values (Lehigh University STS Program, 1979). Anyway, in a journal I kept during college I find the following stimulants from the "Proverbs of Hell" section of Marriage:

"Drive your cart and your plow over the bones of the dead"

"The road of excess leads to the palace of wisdom"

"He who desires but acts not, breeds pestilence"

"The lust of the goat is the bounty of god"

"The wrath of the lion is the wisdom of god"

"The nakedness of woman is the work of god"

"Expect poison from the standing water"

"Exuberance is beauty"

"Sooner murder an infant in its cradle than nurse unacted desires"

Though, then, I have long felt the power of such words to unlock creative inner energy, now, through the visual element, through technology, I can see further how Blake "renders authors of us all."

Now I never got around to embodying this appropriate or alternate technology in literature courses, though I did encourage it in Independent Study projects and in a course called "Case Studies in Technology and Culture." But I'll bet it's done in courses like Professor Greenberg's "Interconnections: Science, Technology, Literature, and the Arts." Interconnections: ripe title, isn't it?

Consciousness 2. Another way of structuring a course on literature and technology.

Third, Professor Slade's paper on literature as technology. Let's call a course made up of Slade-like material or philosophy Consciousness 3.

Literature as technology! Wow!! I am really taken by this idea, and for several reasons. First, it comes very close to a favorite saying of mine by Georgy Kepes (#668 in my A Thousand Thoughts): "it is not with tools only that we domesticate our world." Then, I realize that it is probably where Consciousness 1 and Consciousness 2 would have developed, if I had stayed with STS. It was in fact the way our Program developed. After all, we were originally called Humanities Perspectives on Technology before we became the Science, Technology and Society Program. And, why, even the Luddite Pynchon (in a New York Times article

on October 28, 1984, entitled "Is It Ok To Be a Luddite?") says writers should feel at home in the computer/information age.

Professor Slade's prose is provocative, exciting, seductive. Several of his ideas will find their way into my journal (and perhaps into the next edition of A Thousand Thoughts, after this edition sells out):

> "Writers are conscious of past literary traditions....Here readers find moral lessons, templates for experience [great!], corroboration of prejudices, emotional tutelage --strip maps [super!], in short, of human culture."
>
> "Information is technology."
>
> "It is as information that we understand the world."
>
> "Literature and science are alike in that both attempt to control nature, in the sense that control begins with description of the universe."
>
> "Laboratory observer and observed event resemble teller and tale." [I watched you nodding your heads in approval at this one particularly].

But now enter "Slade the Betrayer." I, frankly, find myself kind of appalled at the use to which Professor Slade makes of his exciting points about literature as technology. And I hope I am not misrepresenting him or mis-emphasizing him.

Let me quote both from his introduction and his conclusion:

> "Acknowledging the technological character of literature may allow writers to chart directions instead of engaging in empty hostility, and encourage them to think themselves full participants in our culture instead of rearguard defenders of older values and forms."
>
> "Redefining writing as we have done . . . may lighten the burden by custom assigned [the writer]: that of serving as high culture's first line of defense against the encroachments of a mechanical technology. With his role demystified, he may discover kinship with other makers and coders beyond those he meets at writers' conferences."

Empty hostility?! Less than full participants in culture?!

Rearguard defenders?! Older values?! Lighten the customary burden?! Hmmmm!! Grrrr!!

Now I never got to Consciousness 3, but, frankly, when I see it here in these terms, what it does is arouse the Consciousness 1 in me that I thought long gone.

From somewhere down deep inside me, I can feel my Consciousness 1 --wheezing, arthritic, virtually comatose, out of wind, fires banked, flabby and flatulent-- struggling to say to Professor Slade: who speaks for values, who lives on the periphery of culture all the better to see culture, who has the perspective needed to define the "is" from the "ought"????

Maybe we should not be so quick to give up the myth of the writer holding a separate semi-holy office. If I understand Professor Slade correctly, I sense that we lose something important in such mainstreaming of the writer. I sense the taming of the critic. I sense Prometheus Bound.

For even Pynchon (in the Times article), even though comfortable in the information age, looks beyond the information age: "If our world survives, the next great challenge to watch out for will come . . . when the curves of research and development in artificial intelligence, molecular biology, and robotics all converge."

"Oboy," he says, "it is certainly something for all good Luddites to look forward to."

So, though I sense that the culture is more comfortable with Consciousness 2 and Consciousness 3, I hope there is always an element of Consciousness 1 in our teaching of undergraduates --

which, after all, should always be our main business-- undergraduates who sometimes look more soporific and valueless and lost than ever to me.

We need the voices from the wilderness, Luddite voices. We need, to quote a favorite romantic, friction to make the machine run smooth.

"Down with all kings but King Ludd," says the not-so-silent Thomas.

And Amen I say!

And I also say, thank you Professors Greenberg, Schachterle, and Slade for raising our consciousness in more than three ways!

END

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