The brief career of the "e-book" has been plagued with fits and starts. In the twenty-some years since desk-top computers, palms, hand-helds, pods, and other devices have come into widespread use, a whole host of surrogates for traditional books have been trotted out with great fanfare and high expectations. In almost every case, these novelties are accompanied by comparisons between familiar forms and their reinvented shape in an electronic context. That legacy can be traced in nearly every descriptive title: the expanded book, the super-book, the hyper-book, or, "the book emulator" — my personal favorite for its touching, underdog, sensibility. Such nomenclature seems charged by a need to acknowledge the historical priority of books and to invoke a link between their established cultural identity and the new electronic surrogates.

Nonetheless, the rhetoric that accompanies these hybrids tends to suggest that all of the advantages are on the electronic side. The copy written in support of what are frequently new products bidding for market share contains conspicuous promises of improvement. The idea that electronic "books" will "supersede the limitations" of paper-based books and overcome the "drawbacks" of traditional books features largely in such promotional claims. But why? On what grounds?

The promotional rhetoric presumes that books are static, fixed, finite forms that can be vastly improved through the addition of so-called "interactive" features. Testing those claims against the design of various means of text access and display in electronic formats one encounters a field fraught with contradictions. Electronic presentations often mimic the most kitsch elements of book iconography while for the longest time the newer features of electronic functionality seemed not to have found their place in the interface at all. So we see simulacral page drape but very little that indicated the capacity for such specifically electronic abilities as rapid refresh and time-stamped updates or collaborative and aggregated work. E-book "interactivity" was largely a matter of multiple options within fixed link-and-node hyperstructures. The iterative aspects of digital processing, however, are finally making themselves felt in tools that are genuinely interactive and intersubjective and result in material transformation of the text and knowledge produced through the activity they support.

The recent design of two authoring and editing environments, Sophie, currently being prototyped by Bob Stein, and Collex, being developed by Bethany Nowviskie and Jerome McGann at SpecLab at the University of Virginia, are addressing some of the issues that hindered e-spaces from coming into their own. Sophie incorporates features of time-based, animated multimedia alongside texts and images in authoring software that is easy enough for classroom use, but multi-purpose in its applications. The design embodies certain residual legacies that echo book structures, particularly in the way it segments or modularizes its spaces and their sequencing. Collex is conceived entirely within digital functionalities (collecting, aggregating, making use of folksonomy technology and other networking capabilities) meant to support electronic publishing and scholarship. Its interface is strictly functional, with viewing areas for searching, display, and notation features rather than a global view of activity. Both projects are so new that issues of scale and sustainability, patterns of use, and graphical navigation issues have yet to reveal themselves. Both are highly promising. Still, I would argue, these and other electronic environments for reading and authoring expose our indebtedness to print culture at the conceptual level: what are the basic units for viewing and organizing text/image materials, how are relations among them ordered for reading and sequencing, how are they viewed and annotated? Understanding the way the basic spatio-temporal structure of the codex undergirds the conceptual organization of reading spaces is still important as we move forward with designing new environments for publication.
That the e-books were limited no one doubts. That newer projects are finding their way within a firmer understanding of the possibilities of electronic technology is evident. But my thesis is that the conception of these environments, from e-books to digital authoring environments for a range of purposes, could be informed by a different understanding of what traditional books are. This would be an understanding based less on a formal grasp of layout, graphic, and physical features and more on an analysis of how those format features effect the functional operation and activity of the work done by a traditional book. Or, to put it more simply, rather than think about simulating the way a book looks, we might consider extending the ways a book works as we shift into digital instruments.

A bit of review is in order as a way to begin. A glance at the literature on electronic books shows the persistence of hyperbolic claims spanning more than a decade. Stein's earlier experiment, Voyager, was an adventurous and frankly visionary early pioneer. Their design of online formats for hypertext and other new media presentations of experimental works launched its "Expanded Book" in the early 1990s, before the web was in operation, using CDs and other storage devices. But Voyager finally abandoned this development, out of money and out of spirit for the task, leaving behind some exemplary prototype projects. From these ashes, and with telling residual features, Sophie, already mentioned above, has arisen.

Earlier forms, particularly CDs and the alternative reading practices of hypertext story structures, have not found large followings in the ways we earlier expected. Hypertext fiction and the once-much-sought chimera of interactive films seem like ancient models of modular chunks and links between nodes, more work than reward. The one area where branching narratives and experimental pathways have taken off dramatically is in the design of games, a field that rarely feels compelled to reference books as a point of historical or conceptual origin. The experiment to develop new reading formats would appear to have reached an impasse if we judge by continuing addictions to traditional fictional forms, or even the activity of online reading by scrolling through a single text. But of course, few of us read with such sustained linearity in a digital environment. We may read in that way for informational purposes, but not for prolonged entertainment or scholarship.

But during the same decade that hypertext fiction went the way of Kahotek, the Net has become a fixture in contemporary life. Links and hyperlinks abound. Reading along these networked structures has become a habit, like browsing a newspaper. The vision of a reconfigured reading environment has been realized, but not in the way the proponents of electronic book or story space imagined. Enthusiasm for experimental engagement with alternative structures and invention of new artistic, literary, graphic, or information forms has leveled off considerably while hypermedia have become familiar, integrated in a daily way with reading in electronic space. A disconnect exists between the windows-based experience of online reading and the e-book industry's attempt at designing a visual format that suggests an extension of the traditional book for presentation or re-presentation of materials once only available in the bound codex. An even greater disjunction has existed between those designs and the conceptualization of formats suitable to the functions unique to electronic space. This is changing as new tools for assembling objects and promoting communications in virtual space are being developed. Textual, visual, graphic, navigational, and multimedia artifacts that are geographically dispersed in their original form can be aggregated in a single space for study and use, manipulated in ways that traditional means of access don't permit. The telecommunications aspect of new media allows creation of an inter-subjective, social space of shared use and exchange. Arguably, this latter is an extension of the social space of traditional scholarly or communicative exchange mainly by the change in rate, the immediacy, capacity to engage simultaneously in shared tasks or common projects. Conceptualizing designs in response to prototypes of e-books and assessing their design limitations is useful as a start.

To begin, I would suggest that the slowness by which new formats have arisen is as much the result of conceptual obstacles as technical ones. The absence of an e-book with the same brand-recognition as Kleenex or Xerox isn't due only to the fact that the
phrase "electronic document management and information display systems and spaces for inter-subjective and associative hyper-linked communication using aggregation, folksonomies, and real-time authoring and participatory editing" doesn't trip off the tongue. A stable nomenclature will no doubt emerge, and various palm-adaptation devices (Sony, IBM, etc.) are increasingly used for the display and reading of texts downloaded from a text-repository server source and kept for perusal or reference according to personal whim. But what aspects of the familiar book have any relevance for the design and use of information in this electronic environment? Are they the features that researchers such as IBM's Harold Henke refer to when they identify "metaphors" of book structure? What is meant by these "metaphors"? What does the malleable electronic display of data whose outstanding characteristic is its mutability have to do with the material object known so familiarly to us as the codex book? These questions devolve towards a single core issue — what do we mean by the "idea of a book"?

A look at the designs of the graphical interfaces for e-books gives some indication of the way conventional answers to this question lead to a conceptual impasse. Ex-libris, Voyager's Expanded book, and other "superbook" and "hyperbook" formats have all attempted to simulate in flat screen space certain obvious physical characteristics familiar from traditional books. The IBM research suggested that readers "prefer features in electronic books that emulate paper book functions." Functions are not the same as formal features. The activity of page turning is not the same as the binary structure of either the two-page opening or the recto—verso relations of paper pages. But most of what is understood by a "book" in the design of "electronic books" is fairly literal simulation. For instance, a kitsch-y imitation of page drape from a central gutter is one of the striking signs of book-ness. This serves absolutely no purpose, like preserving a coachman's seat on a motorized vehicle. Icons that imitate paper clips or book marks allow the reader to place milestones within a large electronic document. As in paper formats, these serve not only for navigational purposes, but also to call attention to sections within a larger argument. The substitution of pages and volume with a slider that indicates the depth or place within the whole reinforces our necessity to understand information in a gestalt, rather than piecemeal. Finally, the reader's urge to annotate, to write into the text with responsive immediacy, has also been accommodated in electronic book designs as note-taking capabilities for producing e-marginalia have been introduced.

The many "drawbacks" of traditional books are, therefore, supposedly to be overcome by introducing into electronic ones features like a progress gauge, bookmarks, spaces for annotation, search capabilities, navigation, and comments by the author. Such a list is easily ridiculed, since every feature described is already fully present in a traditional codex and, in fact, the very difficulty resides in simulating in another medium the efficient functionalities that exist in the traditional form. But other features of electronic space do add functionality — live links and real-time or frequent refresh of information. These are materially unique in digital media; even if linking merely extends the traditional reference function of bibliography or footnotes, it does so in a manner that is radically distinct in electronic space by the immediacy with which a surrogate can be called. Links either retrieve material or take the reader to that material, they don't just indicate a reference route. And the idea of rapid refresh materially changes the encoded information that constitutes a text in any state. Date stamping and annotating the history of editions will be increasingly important aspects of the information electronic documents bear with them. The capacity to materially alter electronic surrogates, customizing actual artifacts, or, at the very least, specifying particular relations among them, presents compelling and unique opportunities.

So what possible function, beyond a nostalgic clue to the reader, do features like gutter and page drape serve in electronic space? The icon of the "book" that throws its long shadow over the production of new electronic instruments is a grotesquely distorted and reductive idea of the codex as a material object. The cover of the book that contains links and clues in the video game Myst is a perfect example of the pseudo-gothic, book-as-repository-of-secret-knowledge clichés that abound in the use of the codex as an icon in popular culture. Let's return to the design of electronic books for one more
moment, however. If we ask what is meant by a "metaphor" in Henke's discussion and look at examples of e-book design, we see familiar formats, text/image relations, visual cues that suggest a book, and a number of other navigation devices (as per above) meant to make "use for novices" easy. The assumption that familiar forms translate into ease of use may be correct in the first iteration of electronic book-type presentations. But when we look at a table of contents, or an index, or even headers/footers or page numbers — or any of the other structuring elements of book design — it's difficult to imagine how we can consider these "metaphors" in Henke's sense. For these aren't figures of meaning, or presentations of an idea in an unfamiliar form. Quite the contrary, these are instruction sets for cognitive performance, along the lines of the assessment of cathedral spaces and memory theaters proposed by medievalist Mary Carruthers. Her reassessment of the revised notion of memory theaters recast them as designs for enacting a cognitive task of remembering rather than as formal structures memorized for storage and retrieval. I would argue that as long as visual cues suggest a literal book, our expectations continue to be constrained by the idea that books are communication devices whose form has a static and formal, rather than active and functional, origin. But if we shift our approach we can begin to abstract that functional activity from the familiar iconic presentation. One place to begin this inquiry is by paying attention to the conceptual and intellectual motivations that led to these format features. From this we can extrapolate the design implications that follow for new media.

Instead of reading a book as a formal structure, then, we should understand it in terms of what is known in the architecture profession as a "program" constituted by the activities that arise from a response to the formal structures. Rather than relying on a literal reading of book "metaphors" grounded in a formal iconography of the codex, we should instead look to scholarly and artistic practices for an insight into ways the programmatic function of the traditional codex has been realized. Many aspects of traditional codex books are relevant to the conception and design of virtual books. These depend on the idea of the book as a performative space for the production of reading. This virtual space, like the e-space, or electronic space of my title, is created through the dynamic relations that arise from the activity that formal structures make possible. I suggest that the traditional book produces this virtual e-space, but this fact tends to be obscured by attention to its iconic and formal properties. The literal has a way with us, its graspable and tractable rhetoric is readily consumed. But concrete conceptions of the performative approach also exist. I shall turn my attention to these in order to sketch a little more fully this idea of a "program" of the codex.

We should also keep in mind that the traditional codex is as fully engaged with this "virtual" space as electronic works are. For instance, think of the contrast between the literal book — that familiar icon of bound pages in finite, fixed sequence — and the phenomenal book — the complex production of meaning and effect that arises from dynamic interaction with the literal work. My model of the phenomenal codex draws on cognitive science, critical theory, and applied aesthetics. The first two set some of the basic parameters for my discussion. Invoking "cognitive models" suggests that a work is created through interaction with a reader/viewer in a co-dependent manner. A book (whether thought of as a text or a physical object) is not an inert thing that exists in advance of interaction, rather it is produced new by the activity of each reading. This idea comports well with the critical legacy of post-structuralism's emphasis on performativity. We make a work through our interaction with it, we don't "receive" a book as a formal structure. Post-structuralist performativity is distinguished from its more constrained meaning in work like that of John Austin, for whom performative language is defined by its instrumental effect. Performativity in a contemporary sense borrows from cognitive science and systems theory in which entities and actions have co-dependent relations, rather than existing as discrete entities. Performance invokes constitutive action within a field of constrained possibilities, not only the use of fixed terms to achieve particular ends. Thus in thinking of a book, whether literal or virtual, we should paraphrase Heinz von Foerster, one of the founding figures of cognitive science, and ask "how" a book "does" its particular actions, rather than "what" a book "is."

With these reference frames in mind, I return to my original question: What features of traditional codex books are relevant to the conception and design of virtual books? My
approach can be outlined as follows: (1) proceed through analysis of "how" a book "works" rather than by describing what we think a book "is"; (2) describe the "program" that arises from a book's formal structures; (3) discard the idea of iconic "metaphors" of book structure in favor of understanding the way these forms serve as constrained parameters for performance. The literal space of the book thus serves as a field of possibilities, waiting to be "intervened" by a reader. The e-space of the page arises as a virtual program, interactive, dialogic, dynamic in the fullest sense. Once we see the broader outlines of this program, we can extend it through an understanding of the specific functions that are part of electronic space.

Dramatic demonstration of these dynamic principles can be drawn from historical and artistic examples. An anonymous sixteenth-century painting of a book from the Uffizi Gallery collection, at first glance simply a depiction of an object, provides a vivid, if unexpected presentation of how a book works. This image reveals a phenomenal book that arises from the material embodiment, showing its graphic elements as the means to enact dynamic functions. The book is arrayed in an odd position in the painting. Its pages, presumably vellum, fan out in an artifice of display. No book would hold this position without an elaborate device, so clearly this is not a naturalistic depiction, but one motivated by another agenda. That singular display marks the first distinction between a realistic portrayal of an actual book, which this is not, and a conceptual investigation of a phenomenal book. This is a book whose identity is projected from its material forms, but isn't equivalent to them. The phenomenal book doesn't negate the formal properties of a physical object, quite the contrary. The phenomenal book can be envisioned as having the same relation to a physical book as a musical performance of a work has to a score. The material substrate, and its formal particulars, are the instructions for that performance. In the sixteenth-century depiction, the book's manner of display exceeds the showing of literal pages in a sequence, and instead, creates an image of a full e-space of the book as a conceptual, relationally produced work.
The book in the Uffizi painting shows pages that are improbably varied. This in itself marks a move from the representation of a literal to that of a phenomenal object. A certain measure of visual unity is achieved by the fact that all the pages show the same script. We are certainly meant to imagine that this is a single object. But then the book's pages offer very varied kinds of information and graphical formats: double-columned text with a gold initial letter on black ground, musical notation on a page with a black majuscule on a gold ground, a page with interlinear rubrication that seems to stretch across the full page facing another double-columned text page in which red and black paragraphs alternate. Another page repeats elements of this format, reinforcing our expectations about the uniformity of design within a single work. The final sheet, of which we can glimpse just the lower right-hand edge, seems to bear a full-page illumination, bordered with floral motifs. A skull, the hem of a robe, a bit of architecture can be glimpsed in the edge of the image. These hold a promise never to be fulfilled, and we assume the existence of the entire page by virtue of the power of suggestion, another instance of phenomenal rather than literal representation. In fact, in this case as in the rest of these partially glimpsed openings and pages, we are offered an understanding of the relations among elements within the volume as much as of the individual parts. The suggestion of unity produced at the interplay graphical sameness and variety is just an idea of continuity, not its literal documentation. This is a virtual book. The literal "spaces" are shown in such a way as to create a figurative and phenomenal e-space of exchanges and relations. Even understanding what this book is in

Figure 11.1 An anonymous sixteenth-century painting of a book from the Uffizi Gallery collection. Photograph: Scala/Art Resource, NY.
formal, literal terms, seems to require our being shown many of its parts in relation. Action and use are suggested by the individual elements — the musical score, place markers, the variety of textual presentations — and this suggestion is reinforced by the presentation of the volume as peculiarly suspended in movement. The improbable disposition of pages provides multiple points of view and insight. The image offers a veritable catalogue of possibilities. The painting isn't an image of this book, but of the many books comprised by a single work. The work flaunts Jerome McGann's assertion that a book is never "self-identical." A book doesn't close on itself as a static, inert artifact between boards or covers.

The book we see in this sixteenth-century painting embodies many of the features we think of as defining the iconic image of the codex. But this idea is infused with different agendas of use that have morphed dramatically at particular historical moments under the pressures to perform different functions or meet specific needs. Roger Chartier, tracking the development of book culture, noted several crucial technological and cultural milestones. The shift from scroll to codex in the second to fourth centuries and the invention of printing in the fifteenth century are possibly the two most significant transformations in the technology of book production. Further substantive changes come with the industrialization of print production in the late eighteenth and nineteenth centuries and then with the electronic dissemination of texts. Other technological innovations mark important developments, but shifts of cultural attitude are not always coincident with technological changes. For instance, reading habits are transformed as monastic approaches are replaced by scholastic attitudes toward texts in the twelfth through fourteenth centuries bringing about dramatic changes in format. The textual apparatus and paratextual structures of indices, tables of contents, footnotes, and marginalia all emerge to enable the reading practices associated with scholastic culture. Recovering the reading practices that gave rise to these structures make them appear in a whole new light. No longer just format features, but structuring devices, they take on an active aspect.

The historian of medieval culture, Malcolm Parkes, described the way these transformations of format came about. In earlier usage, books were the basis for linear, silent reading of sacred texts broken by periods of contemplative prayer. These habits gave way to the study and creation of argument as the influence of Aristotle on medieval thought brought about increased attention to rhetoric and the structure of knowledge. Readers began to see the necessity to create meta-textual structures for purposes of analysis. To facilitate the creation of arguments, heads and subheads appeared to mark the divisions of a text. Marginal commentary not only added a gloss, an authorial indication of instructions on how to read the text, but also created a summary outline in the margins of points visually buried in the linear text. Contents pages provided a condensed argument, calling attention to themes and structures and their order within the volume as a whole. The graphic devices that became conventions in this period are aspects of functional activity. They allow for arguments to be abstracted so they can be used, discussed, refuted. These elements are devices for engaging with texts in a manner radically distinct from that of reflection and prayer. Argument, not reading, is the purpose to which such works are put, and their formal features are designed to provide a reader with a schematic overview, but also with the means to use the work in rhetorical activity.

Obviously, using a book for prayer is an active engagement with the text. But the sequential, linear, reading style didn't require any extra apparatus as a guide. The development of graphical features used to provide an abstraction of the contents shows a radical change in its attitude toward knowledge. Ordered, hierarchical, with an analytical synthesis of contents, the book that arose as the instrument of scholastic lectio is distinct from that object which sufficed for monastic reading practices. Readers came to rely on multiple points of access and on navigational devices providing search capabilities through the meta-textual apparatuses of contents, indices, page numbers, running heads, and so on.

Parkes makes his point by contrasting a page from an early thirteenth-century manuscript of excerpted auctoritates with that of an early fifteenth-century page in
order to trace the appearance of paratextual features. In his earlier example, the
sources are noted in a graphical manner that is clumsily embedded in the overall text
block lines. In the later work, the excerpts are organized alphabetically. Each section
within the later book is marked by a letter that stands alone at the top of the page, and
conspicuous rubrication reinforces the modeling of content with a graphical code.

The important point here is not just that format features have their origin within specific
reading practices. The significant principle is relevant to all reading practices: that the
visual hierarchy and use of space and color don't simply reference or reflect the existing
hierarchy in a text, they make it, producing the structure through the graphical
performance. Such approaches seem self-evident because they are so familiar to us as
conventions. Conceptualizing the book in terms of its paratextual apparatus required a
leap from literal, linear reading to the spatialized abstraction of an analytic meta-
structure. Differentiating and identifying various parts of a codex went hand in hand with
the recognition of separate functions for these elements. Function gives rise to form,
but the form sustains activity as a program that arises from its structure.

We inherit that scholastic model, frequently oblivious of the dynamic agency of its
graphic elements. We may find headers a delightful feature on a page, chapter breaks
and subheads convenient for our reading in reference materials, but rarely do we shift
from our notice of the graphic presence of such items to a more general observation
about them as coded instructions for use. The modern table of contents abstracts the
structural relations of the substance of a work into a condensed presentation. The lines
of its text, and the accompanying page numbers, function as cognitive cues, pointers
into the volume. The information space of a book appears as the structure of its layout.
But the analytic synopses in the index and contents are organized to show something in
their own right as well as to enable specialized reading tasks.

Various statistical analyses of content appeared as paratextual apparatuses, in medieval
manuscripts and even their classical predecessors, sometimes motivated by the need to
estimate fees (counting of lines) as much as from a studious purpose. The habit of
creating commentary through marginal notes establishes a space of conversation within
a single page. And the palimpsestic nature of such conversations has a rich lineage in
commentaries upon sacred texts. An interwoven cultural document like the Talmud is in
effect a record of directives for reading. The interpretive gloss is designed to instruct
and guide, disposing the reader toward a particular understanding. By contrast, as
Anthony Grafton points out, the footnote makes a demonstration of the sources on
which a text has been constructed.\(^9\) Justification and verification are the primary
purpose of mustering a scholarly bibliography to the support of one's own work. Thus
footnotes may occupy a humbler place, shrunk to the bottom of a page or transformed
into endnotes at the finish of a section or work. Marginalia must be ready to hand,
allowing the eye to take in their presence as visual adjunct if they are to be digested in
tandem with the flow of the original text.

Other familiar features of the codex, such as page numbers, are linked to devices like
the signature key and register list of first words on sheets. These originally functioned as
instructions from printer to binder. The half-title is also an artifact of production history,
having come into being with the printing press. Sheets already finished, folded, and
awaiting binding needed protection on their outer layer, hence the half-title. Medieval
manuscript scribes, keenly aware of the scarcity and preciousness of their vellum
sheets, indicated the start of a text with a simple "Incipit" rather than waste an entire
sheet on naming the work, author, or place of production.

The familiarity of conventions causes them to become invisible, and their origin within
activity even more so. For instance, the complicated formal structure of a page of
Euclid, printed by Ernst Ratdolt in Venice in 1482, doesn't bear conspicuous hallmarks of
the processes by which its design elements have evolved. We can't recover the stages
by which each of the elements in this page came to function as it does. But clearly,
each element embodies decisions. The graphic forms carry information. Spacing, type
size, hierarchy of titles to sections of proofs, divisions between image and text and the
subdivisions therein are all structuring elements. Though not strictly semantic, these
elements are the dynamic scaffolding from which the production of meaning arises and in
which it is embodied. The relations among elements figure in the argument created on the page, and their origin in a step-by-step process of abstracting the rules of such arguments, codifying them into graphical forms, is visible in what appears to be a fixed and static format. The program of the Euclid pages is so complicated and conspicuous that it is still probably easier to see that it functions as an instruction sheet for dynamic production of reading than in the case of simpler-seeming pages of a classic reference or a garden-variety academic publication. I cite these less-conspicuous-seeming reference books only because the apparently unmarked seeming condition of their pages comes from their familiarity. A phenomenal book is latent in the pages of any text, and in this respect the Euclid and reference text all encode potential programs of activity. The conventions of codex format are a legacy. The metaphor of those formats, their figured presentation of meaning, is a condensation of an argument that is specific to the codex. That argument is made in material structure and graphical form as well as through textual or visual matter. Recovering the dynamic principles that gave rise to those formats reminds us that graphical elements are not arbitrary or decorative, but serve as functional cognitive guides.

This brief glance at the historical origins of familiar conventions for layout and design should also underscore the fundamental distinction between scroll and codex. The unified-seeming and very determinedly linear scroll format, in which navigation depended on markers (ribbons or strips protruding) and a capacity to gauge the volume of the roll on its handle, is striking in contrast to the flexibility and mobility of the reader’s relation to information in codex format. When the paratextual features are added, the codex becomes a dynamic knowledge system, organized and structured for various routes of access. The replication of such features in electronic space, however, is based on the false premise that they function as well in simulacral form as in their familiar physical instantiation. In thinking toward a design of electronic textual instruments, we would do well to reflect on what the action is that every graphical feature can serve, as well as what informational reference it contains as part of production or reception history. But the electronic information space, I suggest, has other functionalities specific to the electronic medium, points I will touch on at the end of this piece in sketching our work on the Ivanhoe project. Even so, understanding the dynamic program of the codex is important for designing electronic work.

Artists and poets provide other conceptual understandings of the codex through their investigation of its material forms. For instance, the structure of a codex might well be grasped as a figure, as a spatialized shape with a dynamic form. The most remarkable achievement in this realm may still be that of Stéphane Mallarmé in his late-nineteenth-century vision of Un Coup de Dés. The graphical form of that work exploits the codex as a three-dimensional space. The relation of each page to the next accrues to create the work as a whole shape. The lines in this work, weighted by typographic style and size, hang like elements of a mobile, suspended in careful balance to each other. The paper almost disappears, as the figure of the poem rises. Mallarmé’s poem offers a structuring means through which to experience the spatial form of a book. Between the original work and the interpretations to which it gives rise the process of interpretation intervenes in the potential field of the book, carving out a shape from points in relation to each other that have semantic, poetic, affective, and other dimensions to them.

By contrast, the equally striking work by OuLiPo writer Raymond Queneau, the author literally cut the pages of his 1961 Gallimard publication, Cent Mille Milliard des Poèmes, to provide access to the entire catalogue of lines within. The physical effect of hyperlinking through these cuts is dramatic. The page surface can be delved into, connecting it to the deep space of the volume. The lines can be turned. The work is recomposed and remade by each turning. The possibilities, though not endless, are of a significantly high number, a factor of the combinatoric form. The format features actually establish parameters for performance of the work. This shifts the conceptualization from that of a poem as fixed artifact to that of a work whose existence is contingent on the active engagement of the reader. Always true, now demonstrated, this principle re-imagines the space of the book through artistic imagination, revealing the dynamic properties of the codex.
If Queneau enacts the performative potential of the physical book, contemporary book artist Brad Freeman also reveals the lie of the printed book as static artifact. Shifting and contingent relations are registered on the table of contents page of Freeman's 1998 *Muzelink*, a work whose very title suggests the associative processes of artistic invention of which it is a striking example. The contents page was typeset initially at a formative stage of the project. The dummy book in which the original was bound became a journal for recording changes. The work changed through accretion, deletion, revision. The history of those changes is marked on the sheets. The prediction of the table of contents turned out to be continually subject to transformation throughout the production process. This book was not a fully formed artifact whose production merely brought it into being. The book shows the bringing into being as a highly self-conscious but emergent process which produces a printed work as a record of its making, rather than as a result. As an effect of accretion, the work suggests the continuing trajectory of linkages that keep producing the work from the book, the phenomenal e-space from the literal space.

The simultaneous existence of two kinds of spaces, phenomenal and literal, is evident in the interplay of levels of illusion in Janet Zweig's *Heinz and Judy* (1985). Zweig separates the layers of spatial illusion into distinct registers, each appearing to occupy a discrete depth in relation to the flat surface of presentation of the page. Her theatrical staging within the layered text takes advantage of the dramatic potential of the page as a play of action. Where are we to locate the work in this instance? The surface of the page serves as a scrim, in an indeterminate place between projected shadow from behind, activity precipitated from above (scraps of paper laid, illusionistically, onto the page as if cut from another sheet), as a surface on which are scribbled, palimpsestic, traces of another reading. The sheets are also used to support a conventional text block, thus playing with the invisible or neutral status to which they are so often relegated. The effect of these various layers is to destabilize the sheet. No single identity can be assigned to it. The paper floats, is receptive, functions according to several codes of presentation simultaneously. And the space created is very much a virtual e-space constituted by relations among these modes and their capacity to produce effect. The reading of such a page necessarily results in a contingent work, one that uses the codex to advantage while undercutting its fixed identity.

Means of activating the codex form in imaginative ways are a favorite sport of artists making books. Innumerable devices have been engaged to demonstrate the virtual e-space of traditional book forms from the painting of fore-edges, the use of the gutter as a way to connect separate openings through the spine, the interconnection of elements across turnings so that the literal edge of pages is countermanded by the continuities within the structure of the work as a whole. This short list of examples could be amplified with innumerable others. Though these books are static artifacts in the conventional sense with the finite sequence of their pages fixed into the binding, they each demonstrate the way in which a book is as much a manifestation of what it does as what it presumably is. The distinction that supposedly exists between print and electronic books is usually characterized as the difference between static and interactive forms. But a more useful distinction can be made between two ontologies — active and passive modes — that are relevant across media. Interactivity is not a function of electronic media. The capacity of a literal book to be articulated as a virtual dynamic space is exhaustible, while any attempt at reducing a work to its literal static form is probably almost impossible.

Media do matter, however, and the specific properties of electronic technology and digital conditions allow for the continual transformation of artifacts at the most fundamental level of their materiality — their code. The data file of an electronic document can be continually reconfigured. And an intervening act brings a work into being in each instance, operating on the field of potentialities. In digital files we can take advantage of the capacity of electronic instruments to mark such changes rather than merely registering them within the space of interpretation. In addition, two other functions mentioned above are given specific extension within electronic space: aggregation of documents (as documents and as data) and creation of an intersubjective exchange. The calling of surrogates through a "portal" in electronic space (as
pointed out by Joseph Esposito) not only allows materials from dispersed collections to be put into proximity for study and analysis. The ability to resize, rescale, alter, or manipulate these documents provides possibilities that traditional paper-based documents simply don't possess. (Looking at a manuscript scanned in raked light, enlarging it until the fibers of the paper show, is a different experience from handling an autographic work in most special collections.) The electronic space engages these technological mediations of the information in a surrogate. But electronic space serves as a site of collaboration and exchange, generative communication in an inter-subjective community that is integral to knowledge production. Information, as Paul Duguid and John Seely Brown so clearly pointed out, gains its value through social use, not through inherent or abstract properties. The virtual e-space we envision takes all of these features, themselves present in many aspects of the traditional codex, but often difficult to grasp clearly, and makes them evident. All those traces of reading, of exchange, or of new arrangements and relations of documents, or expressions of the shared and social conditions in which a text is produced, altered, received can be made evident within an electronic space. These very real and specific features of virtual space can be featured in a graphical interface that acknowledges the codex and traditional document formats as a point of reference, but conceives of this new format quite distinctly.

I'll conclude with a few notes on our recent attempts to conceptualize the design of just such a space in our Ivanhoe project. In thinking about this as an electronic tool for critical studies, we have intent to link these concepts with a functional design for their presentation. Linking identity to activity has been crucial in that process, so that the already several-times repeated theme here of replacing the identity of what a book is with what it does carries through into electronic space. The actions of calling a text, of declaring an edition, of creating a space for interpretation, of reflecting individually, and of intersubjective engagement with materials and a community are all essential to the act of interpretation. We begin with the notion of a discourse field, a domain of references and materials that form the productive ground from which a work emerges. This requires a very different presentation within an interface than simply creating simulacral bookmarks (that simulate their conventional form) or hyperlinked footnotes (that conjure a surrogate in record time). Neither call attention to the subjective nature of the interpretive act, even though both are instrumental-seeming devices for access or navigation. The real effect of such devices is to create a stream of relations. Individual subjectivity, the personal act of interpretive reading, is evident in this space of configured connections. The mechanical efficiency of bringing a text or document onto a screen space isn't merely an act of technologized communication, but is able to be seen and marked as an interpretive act. The dynamic action encoded in a codex's program of text and paratext isn't merely a means of interconnecting static elements. That interpretive act, the creation of what I keep referring to as the phenomenal, virtual e-space of the codex, produces a work in each iteration. Making that fact evident requires vivid, graphic demonstration of what such a virtual e-space is as an emergent work, as the effect of interpretation. The capacity of electronic media to record and display reception histories, to produce them as an ongoing feature of a document, may prove to be the single most significant feature distinguishing e-books from their print precedent. An interface that creates a platform for interpretive acts to be noticed as such, called to our attention as performance. The idea is to mark the shift from the conception of books as artifacts, or documents as vehicles for delivery of content, and instead demonstrate the living, dynamic nature of works as produced by interpretive acts.

This brings me back to Sophie and Collex, their specific capabilities and designs. Sophie's authoring environment borrows from the modular sequence of page structures. Each screen is equivalent to an opening in a book. The software includes animation and real-time actions, borrowing the basics of Flash-type animation (elements, timelines, frames, and a library) in a "lite" version. Sophie documents look like HTML pages, whether sequenced or linked, and the robust character of the project permits it to be useful for authoring born-digital documents that incorporate time-based media or effects in a fairly intuitive interface. Sophie is a multimedia composition space that is meant to be as easy
to use as a word processing program, and it bundles what have been rather more industrial-level skills into a usable format. Its strength is that it offers a suite of production tools for a non-technical user, familiar with special effects in the graphics and text universe and in need of an affordable and powerful application. Costs of licensing and use are minimal with Sophie, compared to the overhead on industry products from Macromedia or Adobe, since it was created with foundation backing and sponsorship specifically for educational use. As a tool, Sophie is itself interactive, that is, it produces iterative documents through activities that materially alter the text. The documents it produces can be interactive in the old sense, artifacts that have multiple options or special effects activated through use.

The Collex tool is being designed to facilitate online collections, exhibits, and publishing. It makes use of: aggregation of information (through data processing features like folksonomies and tag clouds); a networked collection (in which the objects are provided with Collex-specific metadata); a community of participants whose collections have varying degrees of openness and access; and high-level search capabilities (facilitated by Lucene to work with specific features in existing metadata of Collex objects as well as to perform more broad-based searches). Collex's design is born digital, which is to say, it uses interface features such as sliders, automated list generation, tag cloud hierarchies marked graphically, that are all enabled by data processing and interactivity. It is meant to support a community of commentary (in its current, initial application in the NINES project, the Networked Infrastructure for Nineteenth Century Electronic Scholarship, this is specifically a professional scholarly community with peer-review requirements, but those are imposed for this particular community and not a requirement of Collex's use) and exchange. Materials in Collex have to have specific metadata, and Collex can't freely acquire objects from the web (Sophie can). In that sense, Collex works within established collections and boundaries, while Sophie is eclectic and free-ranging. Published Collex documents can be produced in HTML, XML, and be put into RSS feeds. A Collex document can be viewed as a series of "pages" or in scroll form, with text/image elements present as live links. A facsimile manuscript image in a Collex document can be blown up and studied in detail. Collex objects collect commentary from many sources, and the commentary on them accretes.

The functions that digital technology affords more readily than print media are those of accretion (and processing) of data, aggregation (pulling things together in virtual space that are either separated in physical space or don't exist in physical space), real-time and time-based work, and community interactions in multi-authored environments. But the iterative aspect of digital work fostered by multiple-author environments is also a crucially distinctive feature. Developing a graphical code for representing these functions in an analytic and legible semiotics of new media will still take some time. Ivanhoe is one attempt in this direction, because it was meant to abstract and schematize information in diagrammatic form. Other information visualizations lie ahead, and the conventions for linking functionality and format are emerging.

Conclusion? The pernicious effect of introducing a new technology is that proponents of the invention tend to mis-characterize older forms. One wonders if typographers in the mid-fifteenth century said "script" with the same knowing tone, slight curl in the upper lip, smug with the secure sense that their metal faces were a superior invention over the hand-drawn efforts of traditional scribes. The balance sheet of history shows no such clear division among accounts. Writing persists, to this day, with its intimacy and immediacy, while print forms and other mass production technologies continue to carve up the space of communication according to an evermore-complex division of ecological niches. Books of the future depend very much on how we meet the challenge to understand what a book is and has been.

The idea of "the book" guiding design of e-books has been a commonplace, grotesquely reductive and unproductive. No single book exists, so no "idea" of "the" book could be produced in any case. The multiplicity of physical structures and graphic conventions are manifestations of activity, returned to book form as conventions because of their efficacy in guiding use. The notion of a metaphor applied to an element like a table of contents is highly misleading. This is not a metaphor at all, but a program, a set of instructions for performance. By looking to scholarly work for specific understanding of
varieties of attitudes towards the book as literal space and a virtual e-space, and to artists and poets for evidence of the way the spaces of a book work, we realize that the traditional codex is also, in an important and suggestive way, already virtual. But also, that the format features of virtual spaces of e-space, electronic space, have yet to encode conventions of use within their graphical forms. As that happens, we will witness the conceptual form of virtual spaces for reading, writing, and exchange take shape in the formats that figure their functions in layout and design.

Notes


5 Anonymous oil painting, Uffizi Gallery, Florence, Italy, encountered on a visit there in 2001.


