New Technologies and Renaissance Studies

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New Technologies and Renaissance Studies

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Contents

Preface

As Willard McCarty so rightly notes in the opening article to this volume, "wherever one looks, computing seems to be at or near the epicentres of disturbance." Most certainly, near the forefront of any examination of disciplinary pursuits in the academy today, among the many and very important issues being addressed one will inevitably find the role of computing and its integration into, and perhaps revolutionizing of, central methodological approaches. Published by Iter and the Arizona Center for Medieval and Renaissance Studies, the series *New Technologies in Medieval and Renaissance Studies* addresses this context from both broad and narrow perspectives, with anticipated discussions rooted in literature, art history, musicology, culture, and more in the medieval and Renaissance periods. Articles in this volume cover such topics as the digital reconstruction and re-presentation of archival materials, the adaptation of text encoding systems to address the concerns of manuscript studies, the pedagogical opportunities presented by the electronic medium, and well beyond.

The first volume of the series, *New Technologies and Renaissance Studies*, presents a collection of contributions to one ongoing forum for the dialogue which lies at the heart of the book series, the annual "conference within a conference" (as Arthur Marotti referred to it at the 2007 meeting in Miami) of the same name which takes place during the Renaissance Society of America gathering, dedicated specifically to the intersection of computational method and Renaissance studies. Papers in this volume exemplify those fruitful and productive exchanges, from their inception at the 2000 meeting in Chicago to the 2005 meeting in Cambridge at which Willard McCarty offered the opening keynote, which we have the pleasure of including as the opening contribution to this volume and the series, both.

Readers attuned to the pace of computing's evolution, and cognizant of the opportunities for our disciplinary pursuits associated with that evolution, will note that much of interest has happened even in the two years since our meeting in Cambridge. Those acclimatized to the trajectory and

tempo of electronic academic publishing will also rightly observe the passage of time since the Cambridge meetings. Indeed, valuable time has passed, much of note has happened, and intersection-points between computing and our disciplines have advanced. To this end, we are pleased to announce that our second volume is already in progress, and will see both electronic and print publication in as timely a manner as possible.

The editors wish to thank everyone involved in the conception and production of this volume, perhaps especially so—beyond the authors represented herein—Alan C. Bowen, Anabela Carneiro, Anne Correia and Karin Armstrong.

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Being Reborn:
The Humanities, Computing and Styles of Scientific Reasoning⋆

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> Of course, each scientist must master a certain palette of techniques, whether empirical or theoretical. Nonetheless, the idea of seeing how we can go beyond technique to answer fundamental questions remains crucial if the fruits of these techniques are to transcend mere data collection. (Arbib 2000, 214)

> . . . it is only by extending common sense in ways that render it fallible and susceptible to falsification that knowledge of the world can possibly advance beyond self-evident experience. What is obvious and familiar is thereby reinterpreted so as to incorporate coherently the unfamiliar and unusual. Such extensions, however, require profound empirical insight coupled with bold theoretical speculation, as common sense alone provides no intuitions to confirm or deny. (Atran 1996, 119)

Perspectives on Computing

The French term "renaissance," originally denoting "the great revival of art and letters, under the influence of classical models, which began in Italy in the 14th century," has come to mean "any revival, or period of

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⋆ This is a slightly revised version of a paper delivered in the first session of the New Technologies and Renaissance Studies sessions of the Renaissance Society of America conference, Clare College, Cambridge University, 7 April 2005.

marked improvement and new life, in art, literature, etc." (*OED*). Who constructed *the* Renaissance, for what purpose and to what effect are matters I leave to others who are more qualified to speak of them. It seems fair to say, however, that whatever we take that great change to have been, historically it is bound up with Gutenberg's technology, and so, by the comparison often made, we are invited to speculate about a contemporary renaissance somehow related to the computer. What grounds might there be for asserting such a rebirth, and what good would it do us to be thinking in this way?

This *is* an intellectually exciting time, and wherever one looks, computing seems to be at or near the epicentres of disturbance. We know enough now to credit assertions that as a straightforward means of access and delivery, computing has made a profound difference to scholarly habits of work and so to scholarship. At issue is not just quick delivery in bulk of what previously came in smaller quantities more slowly, but also directed or serendipitous access to many areas of learning otherwise effectively out of reach. These are only changes in scale and frequency, but they imply systemic effects. Consider, for example, what is likely to be happening to standards of argument, canons of evidence and genre-distinctions as the amount and variety of data available to a discipline mushroom. Consider also how a discipline's basic assumptions are likely to be affected by increasingly unavoidable encounters with standard terms and concepts in new and surprising contexts. Our disciplinary blinkers may be robust, but the evidence coming from beyond their ken is getting much harder to block.

The problem is, however, that by simply following up such implications of access and delivery, we silently take on the assumption that computing acts primarily to amplify and extend ways of thinking formed independently of it. In other words, we assume that the computer is a new kind of tool, like Archimedes' lever, and so proceed to ask more deeply unquestioning questions about its application, such as where the fulcrum is to be placed and how long a handle of what tensile strength is required to move a familiar obstruction. But we already know that computing is not simply a new tool or appliance—that, by the design of Alan Turing, it is an open scheme for the making of an indefinitely large number of tools. All around us is the evidence that, as Michael Mahoney says (2005, 1990),

there are *many computings* and no reason to think that their number will be limited by anything other than sloth, lack of ingenuity, backsliding or major human catastrophe. The better question to ask, then, is not what we can do with a given manifestation of the scheme, but rather what it means for scholarship to have taken on this curiously protean mold in which to cast its practices, thinking and communications.

The paradox is unavoidable: on the one hand, computing is what we implement it to do; on the other, it implements only what can be described with total consistency and absolute explicitness, leaving nothing, and therefore everything, to the imagination. So two questions are possible, one from each side of the paradox. The first is the historical question of how computing, thus restricted, has refracted the whole of scholarly inquiry into what methods or kinds of questioning. When we look at digital scholarship as a whole, that is, what *kinds* of things do we see? The second is the philosophical question of how computing directly serves the central purpose of scholarship, to ask ever better questions. How is questioning inherent to or at least compatible with digital form?

Neither question would occur to us, or at least survive the pressures of life to be asked, if we did not already have a perspective from which the multiple encounters of computing with the humanities can be surveyed and compared. This extra-disciplinary perspective is what has come to be called "humanities computing."[1]

Logically as well as historically, humanities computing can be said to originate with the bi-lateral curiosity joining the technical practitioner's focus on abstract method to the humanist-scholar's focus on a particular object of knowledge. Over the last half-century, practitioners have thus been motivated to ask the standard question of computer science—"what can be automated?" (Denning 1985)[2]—powered not by the computer scientist's interest in the theory of computation, but rather by the humanist's concern for practical application. While many scholars have emerged from such

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[1] For an extended argument along these lines, see McCarty (2005).

[2] By "standard question" I mean, with Denning, the central question of the standard view of what computer science is. There are other possibilities, for which see McCarty (2005 , ch. 4).

collaborative exchanges to pursue their research where it has led them, practitioners have stayed to collect, compare and codify the emergent digital methods. Thus they have discovered a loose but cohesible body of techniques, committed to no discipline but of use to them all. These techniques relate to research not according to subject matter but according to the type of data involved—discursive or tabular text, numbers, images, sound and other temporal media. They define a metaphorical space which we at King's College London call the "Methodological Commons."

So far so good—but not enough, not the whole story. The activity that began decades ago in computing centre offices, at help-desks and in collegial acts of kindness, has gradually become a way by which the technical practice of applied computing has taken on webs of significance interconnecting it with all the humanities at a basic level. Only very recently we have begun to understand that this informed, connected-up technical practice is an expression of the humanities rather than their servant or helpful side-kick—a computing that is *of* as well as *in* or *alongside* them. We can now say that the central event of this practice happens when scholarship confronts another form of itself in a comparative negotiation. In analytical work, negotiation is between relevant technical methods and the scholar's perceptions and beliefs about the artifact in question. In the synthetic phase, this step involves a similar negotiation between scholarly approaches to questioning and the craft of designing and implementing these approaches. Here I am squeezing a great deal into a few words. The key phrase is "comparative negotiation"—*comparative* because the discrepancy is essential, *negotiation* because the creative struggle for agreement, rather than the agreement itself, is the point.

In this paper my concern is not simply with the direct consequences of this scholarly *agon* but also with the broader implications of computing for how we conceptualize the humanities in a techno-scientific world. My argument comes in two parts. The first part (in the next two sections below) addresses the means and consequences of this negotiation, summarizing and extending an argument I have made elsewhere: that the central fact of computing for our purposes is its unlimited capacity to accommodate manipulable representations of knowledge. The second part (the next

two sections again) appears here for the first time. In it I ask, more ambitiously than wisely perhaps, where computing stands with respect to the humanities in the history of reasoning. I offer for further thought the possibility that the renaissance on offer comes from computing's framing of scientific method within the humanities. I conclude in a final section with some thoughts on where we might turn our attention next.

An Old Problem With Books

Let me set the stage by summoning an old problem from within the heartland of the traditional humanities.

In his essay, "The Renaissance of Books," Northrop Frye recounts a childhood sight of cultural authority: "several shelves of portly theological tomes in black bindings. . . [O]n a child," he wrote, these tomes

> . . . gave an effect of immense and definitive authority, of summing up the learning and wisdom of the ages. . . And yet when I was old enough to begin to try to use these books myself, I became aware of [an] important principle connected with books: the principle of the mortality of knowledge. . . [T]here was hardly a statement in any of these volumes which had not become demonstrably false, meaningless, or obsolete. . . The black bindings were appropriate: the books were coffins of dead knowledge. Their impressiveness as physical objects was grotesquely inconsistent with the speed at which scholarship moves, and it was clear that *books ought to have a very different sort of appearance if they are to symbolize the fact that genuine knowledge is always in a state of flux.* (1978, 49f my emphasis)

Here is as clear a statement as one could wish for, of a struggle against the winding sheets of an old technology, and of what is centrally required of a new one: responsiveness adequate to the speed and metamorphic fluidity of thought. Much the same problem, formulated by the textual editor Jerome McGann in spatial terms, is the difficulty in gaining formal perspective on codex-books from within that medium. Digital genres certainly allow for a perspective from without, but we have not yet figured

out how to harness the metamorphic potential of new media to create the "network with a thousand entrances" that critical theory has been imagining at least since Roland Barthes (McGann 2001, 53–74; Barthes 1998, 11–13). Stephen Fraade (1991, 1–23), who quotes Barthes, shows that such ideas are, for example, already to be found in the social nexus of earliest rabbinic commentary. Nothing new, then—except the urgent relevance of old ideas.

Their timeliness is curious. An important part of the reason they are so timely is, I think, that like other inventions, computing creates its own visible trail of precedents from the general fund of historical exemplars by highlighting just those problems it is able to deal with and the prior approaches to them that it can implement. (In other words, methods and tools are cognate.) The precedents thus identified yield in turn the encouragement and wise instruction we need to look past the formidably stubborn technical, psychological, conceptual and scholarly problems of implementation to the potential of the basic equipment we now have. We write the histories we need, get the tools we can use.

Computing is, as I noted, special among inventions. Its incorrigible plurality makes talk of its *advent* and *impact* seriously misleading. We may be forgiven for worrying about our reputations, but it is wrong to construe computing as if it were a singular, irresistible force, like a bowling ball, and its scholarly audience the wooden pins awaiting impact. Similarly misleading are the implications of the standard term "end-user": we are not mere recipients of whatever comes off the production line—unless we configure ourselves that way. Rather, in light of Turing's scheme, we are potentially "end-makers" of new scholarly constructs that we are free to imagine, build, try out and discard, or keep, at will. I suggest that the question facing us is not so much what we are to make (although that *is* a hard question), but rather the form of life out of which the futures we may choose to make with computing are to come. The question is, who do we think we are, and being thus, what do we want?

Digital Scholarship

I will answer that question. We are, let us say, inquirers into transcendent artifacts and events—things and situations which cannot in principle

be completely specified and so exhausted by our descriptions of them. Our fundamental method of inquiry is in consequence an endless cycle of assertion and denial, or what Michael Sells has identified as *kataphasis* ("saying" or "speaking-with") followed by *apophasis* ("un-saying" or "speaking away"):

> Any saying (even a negative saying) demands a correcting proposition, an unsaying. But that correcting proposition which unsays the previous proposition is in itself a "saying" that must be "unsaid" in turn. It is in the tension between the two propositions that the discourse becomes meaningful. That tension is momentary. It must be continually re-earned by ever new. . . acts of unsaying. (1994, 3)

The apophatic method thus reaffirms the ultimate inexhaustibility of the object but does not turn its back on the quest for better knowledge of it. Progress is not ruled out.

As vehicle for the apophatic method, then, computing is valuable precisely because it is, in Vannevar Bush's words, "a stone adze in the hands of a cabinet-maker" (1967, 92)—not just now, as we all know perfectly well, but forever. It can never be completely and entirely adequate to our scholarly purposes because *in principle* there will always be a difference between the object of study and the data taken to represent it, and *in principle* we will always want to know that difference. This is a stronger claim than saying that a representation is not identical to its corresponding object; it is to specify a particular kind of difference. This difference is at the heart of what is now being called "digital scholarship."

"Digital" begins as a metaphor of the digits or fingers of the human hand, which are distinct from each other, much alike and literally manipulative. It is often contrasted with the continuously variable or "analogue" quality attributed to objects viewed holistically. Consider the following two examples in Figure 1. The old-style clock-face (a) is ambivalent, both representing continuous movement and denoting discrete states; hence it may be read either digitally ("two forty-eight" or "two forty-seven and fifty-seven seconds") or as analogue ("getting on for three" or "almost two

(a)   (b)
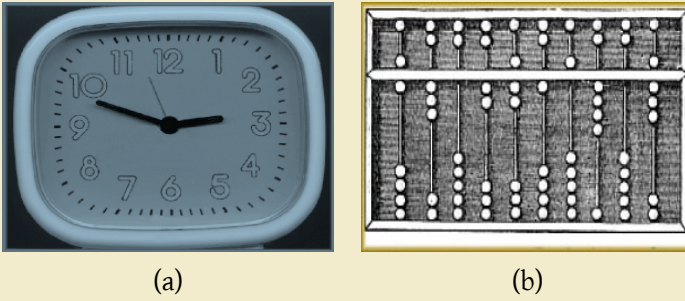
Figure 1

forty-eight").[3] Physically the abacus (b) allows infinite, analogue variation of position for each bead but, by a convention invariant across all cultures where the device is found, it is used and read only digitally, here (from left to right) "6302715408." To speak somewhat anachronistically, my point is the layer of processing between the object and how it is perceived, read or used. Consider now the limiting case in Figure 2: a physical device in which this processing has been implemented, in Boolean logic circuitry, such that only the digital interpretation is visible.

In Figure 3, an analogue waveform (of a musical note) is shown with a digital interpretation of it superimposed. As this figure suggests, in representing something analogically, we try by means of continuous correspondence for a faithful mimicry: the object changes in some way, and the representation mimics that change, move for move. In representing digitally, we use a standard, all-or-nothing unit-measure. We extract, as Warren S. McCulloch and Walter H. Pitts said in 1943, "a logical calculus of ideas immanent in the represented object."[4] We reduce likeness to a logical formalism operating on data, from which the represented object may be reconstituted. There are all sorts of advantages to this procedure,

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[3] The example is Nelson Goodman's (1976, 157ff), from a considerably more subtle and detailed philosophical analysis of an exceedingly complex and difficult subject. My use of the metaphor of human digits is not intended to contradict his point that "a digital system has nothing special to do with digits" (Goodman 1976, 160).

[4] I refer to the paper they wrote, "A Logical Calculus of the Ideas Imminent in Nervous Systems" (McCulloch 1988, 19–39), which John von Neumann took up most famously in his "First Draft of a Report on the EDVAC" in 1945.

Figure 2
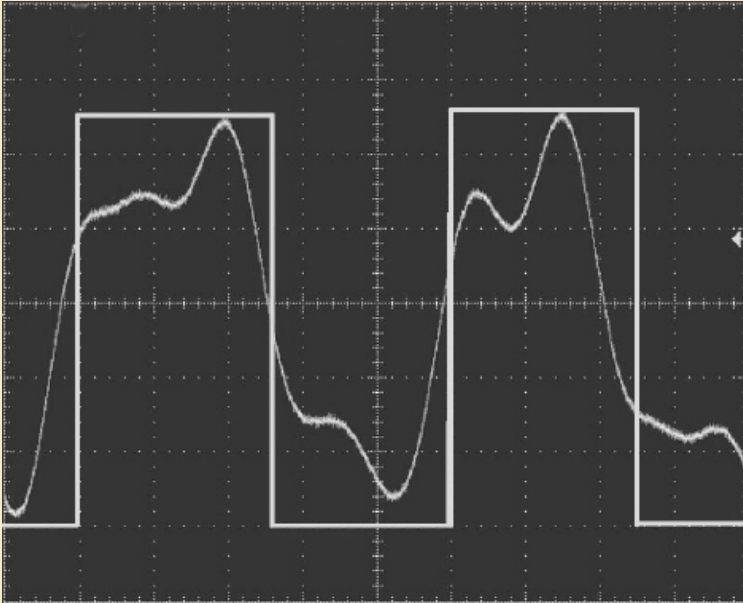
Figure 3

as we know. If your interest is in the engineering of likeness, such as in the case of a music-CD,[5] then the crudity of the representation is concealed by operating at a granularity finer than human ability to discriminate. If, however, your interest is in the transcendent reality of the original, then the digital method of representation is valuable for the purchase it gives you on the discrepancies of correspondence. The enhanced digital

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[5] Manovich (2001, 49–51) makes the point for film and animation. See his discussion of "The Myth of the Digital" (52–5).

ability to manipulate the approximation-to-likeness becomes a means of isolating, and so privileging, difference.[6]

Reasoning by constructing representations, then seeing how well they do in comparison to their originals, is intrinsic to how we think, I suspect. Traditional scholarship typically approaches the transcendence of artifacts by classification and categorization, then by studying how the individual work inflects or even violates the categories to which it has been assigned. The deliberate *implementation* of this style of reasoning began in the sciences centuries ago, where such representations are called models. Computing has made a radical difference to model-building in the sciences by reducing the time required to construct and reconstruct them, typically by an order of magnitude or more. (Watson's and Crick's work on DNA in the Cavendish Laboratory at Cambridge, using metal rods and wire for their modelling, provides a good example of how slow and cumbersome it once was.)[7] But the difference is not just a matter of efficiency. Since we are creatures in time, and time-scale shapes how we conceptualize and act in the world, this radical speeding up means a shift in thinking, from a focus on and investment in the thing to a focus on and commitment to the activity of changing it—from, that is, *models* to *modelling*.[8] Common tools for modelling have arisen in consequence of the homogenizing reduction of formerly disparate materials to data and of methods of transforming them to algorithms. The end-maker of do-it-yourself assemblages has in consequence become the norm.

From the common strategy of reasoning, it's tempting to infer that we have been modelling all along, and so to conclude that computing offers nothing essentially new here. The mistake is in overlooking the crucial difference: the quasi- or even semi-physical manipulation—as Lorenzo Magnani (2002, 309) says, "thinking *through* doing and not only, in a pragmatic sense, about doing." It is what Ian Hacking (2002, 180f) makes room for when he rejects "thinking" as "too much in the head," prefers

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[6] For quite a different view, see Smith (2005).

[7] The story is well told by Watson (2001, 83–91).

[8] The case for modelling is argued in McCarty (2005, ch. 1); a somewhat abbreviated version is given in the chapter by McCarty in Schreibman, Siemens and Unsworth (2004).

"reasoning" because it is also done "by talking and arguing and showing," then finds fault with it for not sufficiently invoking "the manipulative hand and the attentive eye." Note, then: at the same time as digitization reduces our artifacts to really rather crude representations, modelling expands our powers of reasoning about them. The trade-off, I suggest, is a sign that we are witnessing a genuine change rather than entertaining an empty claim (the no-free-lunch principle).

Thanks to the computer, modelling is taking root in the humanities. While we wait for the consequences to emerge, it would be well to consider what it means for the investments we are making, for our technical practice. An early computer scientist, Alan Perlis, asked in one of his delightful epigrams, "Is it possible that software is not like anything else, that it is meant to be discarded: that the whole point is to always see it as a soap bubble?" (1982, 11). Let me rephrase: is computing all about blowing software soap bubbles and learning from their evanescent behaviour? I think the answer is a qualified "yes," and I think that this answer is steadily requiring fewer qualifications as, increasingly, our tools turn for us into tool-maker's tools. When genuine histories of computing (rather than the chronicles of firsts we now have) become possible, one story I think they are likely to tell is of the computer becoming more and more a ludic, experimental device, for the humanities as well as for the sciences.

Stylistics of Reasoning

But what are the consequences for scholarship? What do these developments presage?

I have mentioned modelling and experimenting. These are important clues to an answer, because both play a prominent role in intellectual history. So, by a tried-and-true method of the humanities, we can look to our own history, thus backwards into the future—or at least to a trajectory for which we have the initial coordinates.

The trajectory I propose emerges from the intellectual history meticulously documented in a three-volume work by A. C. Crombie, entitled *Styles of Scientific Thinking in the European Tradition* (1994). Crombie confesses

that he was moved to write his "comparative historical anthropology" by the experience of years of teaching in Japan and crossing oceans to visit his native Australia. The practitioner of humanities computing will immediately recognize an ex-patriot's mode of thinking. Simon Tanner uses a religious metaphor to describe much the same thing: he calls it being "lapsed" from one's discipline of origin (Deegan and Tanner 2002, xii). The state of mind is a powerfully effective cross of alienation and engagement—and, I think, precisely what anthropologists mean by "participant observation."

I was led to Crombie's work by Hacking, whose commentary on it provides a philosophical bridge from the past to "the history of the present. That is Michel Foucault's phrase," Hacking explains, "implying that we recognize and distinguish historical objects in order to illumine our own predicaments" (2002, 182).[9] As a historian, Crombie is not concerned with the fact that the styles he documents are all thriving and available to us now. Hacking is.

Crombie documents six of these styles, each with its particular objects and modes of operation:[10]

- ⋆ The simple method of postulation exemplified by the Greek mathematical sciences;
- ⋆ The deployment of experiment both to control postulation and to explore by observation and measurement;
- ⋆ Hypothetical construction of analogical models;
- ⋆ Ordering of variety by comparison and taxonomy;
- ⋆ Statistical analysis of regularities of populations, and the calculus of probabilities;
- ⋆ The historical derivation of genetic development.

Modelling, for example, directs us to think in terms of "common explanatory principles" that the model shares with the modelled object. These principles, however, also underlie

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[9] For his commentary on styles of reasoning, see also Hacking (1985).

[10] The following list is from Hacking (2002, 182), compiled from several different versions given by Crombie. Note Hacking's argument throughout on the importance and qualified authority of this list.

> a general cultural style, classically directing expectation and as-
> sent in the analysis into their elements not only of the necessities
> and probabilities of the order of nature, but likewise those of
> human, animal and mechanical communication, of human be-
> haviour, and of visual art, music, poetry and drama. . . . (Crombie
> 1994, 1241)

A whole way of thinking, being and acting unfolds, and envelops us.

What interests me here is not modelling as such; rather, it is the idea that
reasoning has style. Hacking explains that a style of reasoning has nothing
directly to do with whether something is true or false. Rather it is what
creates a range of possibilities for being true-or-false. It is "a way to be
reasonable" (Hacking 2002, 188). To cite a choreographic analogy: within
a given dance style (as opposed to a particular dance within that style),
an indefinitely large number of moves will be true to it, others not; but in
neither case are these moves true or false absolutely. A clever choreogra-
pher could invent a jerky style within which moves that would otherwise
get a dancer sacked would be just right. Hacking cites Foucault's idea of
discourse, in each kind of which there are likewise categories of possibil-
ity and a specific range of either-true-or-false. This range defines what
Foucault called a "field of positivity," populated by candidates for positive
knowledge. The result is not subjectivism—Hamlet's "nothing's either
good or bad but thinking makes it so"—rather, the result is relativism,
which yields a plurality of styles.

Historically new styles are marked by the introduction of many novelties,
as well as new candidates for true-or-false, new kinds of objects, evidence,
laws or modalities, possibilities, and sometimes new kinds of classification
and explanation (Hacking 2002, 189). Having surfaced, styles then develop
and attain maturity, each "in its own time, in its own way" (Hacking 1985,
145, 155). Crombie documents the process meticulously, across almost
2,500 pages of text.

Computing is a historical event. There is much talk of innovation. Are we
witnessing the birth of a new style?

The Sciences in the Humanities

A slight detour before I deal with that question. I have been proceeding as if we could simply ignore the adjective "scientific" in Crombie's and Hacking's work so that I could get on with exploiting the history and philosophy of science, where the idea of a stylistics of reasoning has arisen. But before going further I must justify the mingling of sciences and humanities. It was, after all, also in Cambridge that Charles Percy Snow—novelist, physicist, civil servant and peer—delivered his Rede Lecture, "The Two Cultures," 46 years ago (see Snow 1998).

Along with the historian of science Lorraine Daston, I am concerned that so little is known about "the epistemology and practices of humanists," i.e. *how* we know what we know. I am concerned because computing raises precisely this question. Daston (2004, 363) notes that the historical and philosophical literature, "especially in English, is overwhelmingly slanted towards the natural sciences." There are perfectly good reasons why this should be the case. Hans-Georg Gadamer (2000, 3–9) and Carlo Ginzburg (1989), for example, explain the imbalance of attention by contrasting the opposed tendencies of nomological, Galilean science and the particularizing humanities: the one, in seeking out the law-like behaviour of things, formulates detachable means of knowing them; the other focuses on the uniqueness of the artifact and so is disinclined to abstract means from ends. Computing alters this comparative picture by requiring such a detachable means irrespective of the knowledge domain.

Earlier I spoke of the detachable methods with which the Methodological Commons is populated. But here as great a qualification must be made of these methods as I made for digital representation—because these methods *are* digital representations. It should now be clear that in realizing these methods computationally, we are *constructively inferring* them from the general obscurity of how we have been working—and that, however we have been working, it certainly has not been exactly in the manner we are able to model on the computer. The gift of computing to the humanities is as much or more creative as it is instrumental. By inducing us to model our heretofore largely tacit methods, it invites us to look backwards to what we have done and forwards to what we can imagine with it. It simultaneously raises the question of how we know what we

know and gives us the external means of probing for an answer (or, rather, a better question) by means of a digital approximation.

Here's where the stylistics of scientific reasoning enters the picture I have sketched out. I asked earlier if computing represented the emergence of a new style of reasoning in the humanities. This, again, is a historical question, so for an answer we can look to the history of humanities computing so far. There we find that possibly all the scientific styles of reasoning Crombie lists are exemplified in current work: *modelling*, as I have argued here and elsewhere; *experiment*, in the wide-spread empirical exploration of source materials on an unprecedented scale, for example in corpus linguistics; *taxonomy*, in the rampant ontologizing of knowledge engineers and the design of textual encoding and metadata schemes; *probability*, in literary stylistics and applications of computational linguistics in the language industries; and *historical derivation*, in studies of manuscript stemmata, for example. The one Crombian style I have omitted, *postulation*, requires more thought. In humanities computing (and in the strongly device-orientated fields of textual editing and lexicography) it corresponds, I think, to the crafting of what we may call, generically, "editions," viewed as metatheoretical statements, postulating the edited work as having the scholarly qualities attributed to it.

The populating of these styles by work in humanities computing would appear, then, to suggest that computing is not a new style at all, but rather a bounded scheme within which existing (and perhaps new) styles of scientific reasoning can be represented and applied. In effect computing raises modelling to the status of a meta-style, within which all the reasoning styles are included. It thus frames them conjecturally. It says to us, "Let's construct mechanical simulacra of our cultural artifacts and treat them as if they were natural objects. Here is what our scientific tradition has taught us that we can do with them."

Thanks, then, to Crombie's historical research and to Hacking's philosophical extension of it into a history of the present, we can see our situation with computing in a new light. What we can see, I suggest, is adequately diagrammed in Figure 4, where you will note the bounded scientific realm

The humanities

Computing

Styles of scientific reasoning

Modelling   Taxonomy   ?

Experiment   Statistics

Laboratory   Derivation

Construct   Construct   Construct

Artifact of study   Artifact of study   Artifact of study
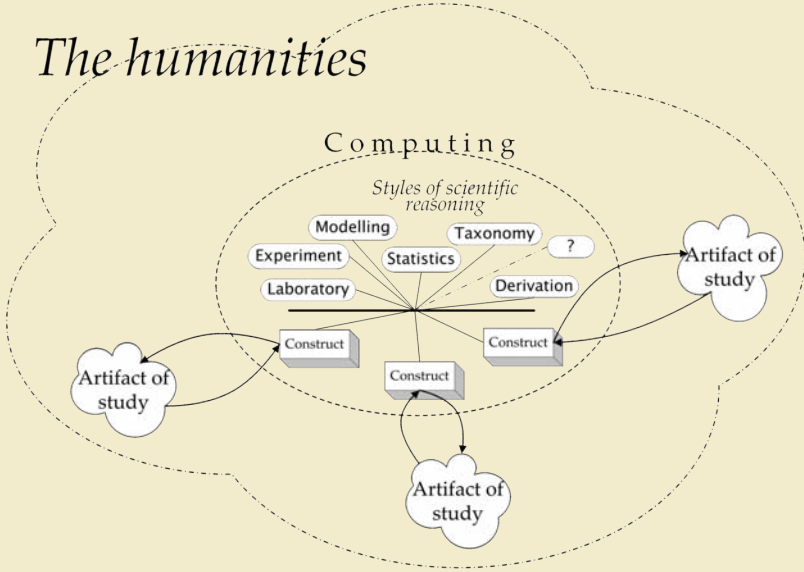
Figure 4

computing defines, the reasoning styles, the simulacra on which they operate and the negotiation between these simulacra thus analyzed and the artifacts considered in the usual way.

Annoying as C. P. Snow's lecture can be, as dated as some of the ideas are, we have him to thank for keeping the issue of a two-cultured world alive. It has pushed us to think about an unproductive if not destructive cultural barrier and how we might remove it. But now, after 46 years, I think not only that a proper reply is conceivable but that it would demonstrate a prominent role for those two crucial, bridging fields, the history and philosophy of science, in making better sense of computing for the humanities.

Unreasonable Effectiveness

What does this inclusion do for (and to) us? I am not arguing that at last we can demonstrate the superiority of the humanities, and so put to rest Snow's imputation that they are culturally exhausted. Rather I am

suggesting a new way of construing their relation to the sciences. Clearly the old image of disciplines polarized from hard to soft—the sciences at one end, the humanities at the other, the social sciences in between—will not do. Its emphasis on linear transition from one discrete unit to the next limits us to relation by contiguity, which is to say, no direct relation at all for most of the disciplines. Computing, I have argued, gives us relation by inclusion—not of the sciences themselves but of their reasoning styles, modelled on the computer.

The old distinction of hard *versus* soft turns out, once we deal with the implicit sexism, to cause no problem at all. Quite the contrary. With a playful imagination one can reconceive the hard programmatic core of included scientific method enveloped within its soft, interpretative integument as something like the genetically programmed seed within its fruit, ready to germinate and grow into a fruit-bearing tree.

In any case, framing scientific styles *is* fruitful. It re-acquaints us with an old and powerful tradition, gives us people to talk to and much to learn. It allows us to borrow from scientific practice in a critically self-aware way. It allows us to ask the methodological question of our own practice without danger of impoverishing ourselves. It educates and disciplines our probing. It enriches and strengthens our curriculum. It raises the stakes and helps to make the intellectual case for what we do. Many benefits, as we will realize in time. But greater than these is the field of intellectual conflict where the digital analytic mind-aspect and the synthetic analog body-aspect of computing come to grips. Around that field the humanities are, as Greg Dening (1998, 183) has said about disciplines generally, situated "on the edge of things in a great ring of viewers"—with humanities computing centre-stage.

At the end of his essay, "The Question Concerning Technology," Martin Heidegger (1977, 35) declares that "questioning is the piety of thought," *die Frömmigkeit des Denkens.* Questioning is, to paraphrase him, the scholar's critical devotion to the life of the mind, following it from change to change. What here is to be questioned is, I think, precisely the comparative negotiation between software construct and material artifact. This question maps straight onto the enigma posed by software itself—what, exactly, it is, or in more practical terms, what happens and could happen

when we formulate its relationship to the world it models.[11] There must be, we are told, a precise way of doing this—a mathematics of software—though no one currently knows what it might look like (Mahoney 2002, 38–42). One reason for trying very hard to find it, or cheering on those who know how to look, is to open up the greater enigma Eugene Wigner (1960) and Richard Hamming (1980) have called "the unreasonable effectiveness of mathematics"—"the astonishing power to establish truths about the world independently of experience" (Hacking 2002, 183). As scholars we take comfort and even pride in what rigorous schemes cannot net, but we really need to be moving on, to ask why they net anything at all?

Consider, for example, the intelligible patterns emerging from statistical analyses of literary texts, in the work of John Burrows and others.[12] Let us call what his methods do not catch the element of chance—that which happens for reasons or from causes we cannot adequately specify. Is it possible that here we see the humanities converging on the mysterious interplay of order and chance, and so inversely matching, with a humanist's own uncovering of determinism, what Hacking (1990, 1) has described from the other side as "[t]he most decisive conceptual event of twentieth century physics. . . the discovery that the world is not deterministic"? Is it possible that humanists, with their computers, are converging from the opposite end on the goal of the cybernetic programme in the life sciences—to gain, as Warren McCulloch declared in 1965, "a satisfactory explanation of how we know what we know, stated in terms of the physics and chemistry, the anatomy and physiology, of the biological system"?[13] In his introduction to McCulloch's collected papers, *Embodiments of Mind*, Jerome Lettvin gives me my next-to-last words: "Critics carp," he writes,

> that the current golems do not resemble our friends Tom, Dick, or Harry. But the brute point is that a working golem is not only preferable to total ignorance, it also shows how processes can be

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[11] For the enigma of software, see Colburn (2000); Mahoney (2002); Smith (2002); Smith (1995), 462).

[12] See the articles by Craig and Burrows in Schreibman, Siemens and Unsworth (2004).

[13] In "What is a Number that a Man May Know It, and a Man, that He May Know a Number?", McCulloch (1988, 1) (originally published in 1965).

designed analogous to those we are frustrated in explaining. . . It suggests what to look for. (McCulloch 1988, v–vi)[14]

It suggests, I suggest, that a particular kind of *looking for* is what computing has given us, and that what we do now is to see what we can find out, not only about our world but also about looking.

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A Pragmatics of Re-Conception?
(A Response to Willard McCarty, "Being Reborn: The Humanities, Computing and Styles of Scientific Reasoning")⋆

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No one would deny, I think, the connection of Gutenberg's technology with the "revival, or period of marked improvement and new life, in art, literature" (*OED*) that typifies our understanding of the Renaissance—and, indeed, it is now beyond commonplace in some circles to talk, today, of paradigm shifts, of new eras, and of McLuhan-istic "Gutenburg galaxies," the latter of these in the past tense.

By beginning as such, I don't mean in the least to denigrate; rather, my hope is to suggest what we all know, and what Willard so clearly, boldly, kindly, reasonably, and responsibly asserts within a new and exciting framework for us: that computing is changing (and will change further) the way in which we as humanists, new humanists, and computing humanists carry out our work *and*, further, that these changes have the potential to assist, significantly, our various endeavours toward what may well be a rebirth, or at least a re-conception, of the humanities. Many of these changes are access oriented—say, providing an internet edition of a particular manuscript, early printed book, or a group of each—and many are function oriented—say, providing freely-available electronic tools to search across large textual corpora, to integrate and explore digital bibliographic databases, etc.—but the most profound changes that will come

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will be those that we might have difficulty imagining at this point in time. Here, I suppose, I'm making reference to Jerome McGann's recent retrospective discussion of the Rossetti Archive in which he encourages us, adapting Shelley *via* Lisa Samuels, to participate with him in "imagining what we don't know" (1997). One thing I thought I did not know was a humanities that looks like the sciences, but your talk gives me good insight into that, convincing me that in many ways those I work with are already loosely practicing the scientific styles of reasoning you describe.

With good-natured mischief in mind, I'd like to introduce some thoughts toward an unsaying that could, I urge, require immediate unsaying itself by you. Chiefly, the thrust of my comments is this: How do we move—positively and responsibly, and also pragmatically—toward some unknown and difficult-to-articulate "good" that the adoption of computing methodologies is supposed to bring? Do we engage in activities of scholarship that have been deemed, traditionally, to be important, and ask ourselves how computing methodology can be adapted in service of those activities? Do we automate aspects of our practice and model our data in electronic form, gathering the results of that modeling all the while hoping that it will be to a good end, one we can hardly imagine at this point? Do we *await* the enlightenment that such scientifically-oriented methodologies as you note might bring, or do we *create* that enlightenment ourselves?

By engaging in activities of scholarship that have been deemed, traditionally, to be important, one cannot help but think that we are doing more of the same, just in a different medium (this in itself doesn't sound too bad). But how does doing more of the same contribute to a movement toward a "revival, or period of marked improvement"? And by automating aspects of our practice, and modeling in digital form those aspects of our data that we feel are important enough to render in this way, are we not participating in an artificial and, ultimately, impossible endeavour? Northrop Frye, too, spoke of these sorts of activities, in his keynote address at the University of Toronto, some 15 years ago, to the joint meeting of several humanities computing groups. In that talk, entitled "Literary and Mechanical Models," he expressed what he felt was the tremendous potential for computing in our related disciplines, chiefly as a tool to

allow us to bring scholarship out of the Wissenschaft era—where every scholar contributes his or her own bit of academic piece work as part of an assembly-line process—into what he terms the Neo-Wissenschaft era, in which scholars understand implicitly that their role is not solely to produce what we might call knowledge, but to provide at the same time the tools and techniques necessary for the comprehensive, responsible navigation of that knowledge. Computing is what he saw to be the chief facilitator of the new era he envisioned.

Willard, I think you've captured these concerns, and more, in your discussion, and done so such that they are energetically related. Your suggestion of a movement from scholarship's focus *on* the thing *to* the activity of changing it—that is, a movement from the model to the act of modeling—not only provides benefits in traditionally-accepted areas of our endeavour but, through the self-conscious act of understanding something by modeling it and then manipulating the model and studying the effects, such action also yields new insights of a very exciting kind. To understand the activity of changing the thing, one must strive for a much clearer understand of the thing itself. This makes excellent sense. But is there anything lost in changing focus? And what, in pragmatic terms, is to be gained by adding flawed, failed, and likely mistaken attempts at modeling to our stockpile of scholarship? Here, as John Unsworth and others might assert, is there an importance to our failure?

Surely, if we adopt a scientific style in our research, failure is the key to ultimate success. Experiment both controls postulation and leads to further exploration by observation and measurement, as you've said. But what is the exact nature of our experimentation in the Humanities? How do we measure our theories of analysis and representation—particularly in fields that quite strongly assert that measurement has no place, in which statistical analysis is antithetical? Modeling analogically, surely, presents a solution, and modeling's success is predicated, often, on useful failures informing the development of more suitable models. Taxonomy, postulation, and all others of the Crombian styles, I understand have a strong place in the project of humanities computing, but how do they sit in other areas of the humanities? And how can we bring them closer to those areas?

So, in response to your stimulating address, I show my great gratitude by encouraging you to press further on several points, and in pragmatic terms. . . and all this, of course, at the same time as I ask how I and others might actively and tangibly participate in the methodological commons you place so well within the laboratory of the humanistic sciences. Though I'm a step or more behind you, I am there, and want to participate in this rebirth.

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Digital Still Images and Renaissance Studies (with a Short Section on Digital Video)

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Introduction: The Advantages of Digital Imagery

This paper will demonstrate that, thanks to computers and the internet, the student of the Renaissance has facilities available in various media that far surpass in quantity and frequently in quality those available in the analog age. The internet is a world-wide collaborative effort and, even if some of that effort is directed toward profit rather than enlightenment, it could not today survive without the motor of commercial programs and systems to complement the growing quantities of materials put together by dedicated individuals, libraries, universities and other organisations, and often made available to all of us for no or little charge. The Renaissance itself gathered knowledge together in projects which got larger over time, from Cassiano dal Pozzo's *Paper Museum* to the great encyclopaedias and books of maps of the seventeenth and eighteenth centuries, many of which were also collaborative international efforts (cf. the letters of Claude Fabri de Peiresc). A constant feature of such ventures was the perceived need for illustrations, and as many as possible; and the internet could be considered just an updated version of such collaboration, on a more flexible support than paper, and offering the possibilities of much higher levels of quality imagery.

Digital images can be of much higher quality than those to be found in printed books, because the exigencies of most colour printing technologies mean that the prints are unsuitable for digitising (usually by scanning) into anything larger than the printed version; digital images made from

the original negative or slide could, however, be of very high quality—but the originals are not often available. But using a digital camera direct on the object, building, and so forth provides images which can be of dimensions similar to those projected in a lecture theatre—thereby offering opportunities for "close up" study impossible from the majority of books or slide collections. To expand: whereas each shot in an analog camera costs a quantifiable amount in film, digital cameras re-use the cards on which the images or other data are stored—so that it is only the eventual disk storage that must be paid for. Today, a hard disk of 250GB costs US $250 or less—and with even eight-megapixel (poster-sized) images taking up perhaps two megabytes, such a disk will hold well over 200,000 images. Hence we can expect digital image collections to offer much larger quantities of big, useful, permanently-coloured images for our work.

The larger the image, the greater the possibility of "being there"—of being able to use the image as a very good substitute for viewing the actual object or location. Digital imagery allows overlaying of one image with pointers to several others; the stitching together of individual images into large panoramas (Maarten van Heemskerck would have used the technique, had he been able to do so, for his *Panorama of Rome*); and small programs allow the user to zoom in and out of images, which can therefore be made to fit comfortably within a web browser.

All these features, together with overviews of the use of digital imagery as a substitute for the optical character recognition of text, and of copyright issue, will be illustrated below. The paper closes with a selection of Renaissance digital projects, all web-based, which confirm the growing advantages of digital over analog images. Hence readers can move beyond the few actual illustrations included below, to access websites where great quantities and varieties of Renaissance images are available.

The Prehistory of the Renaissance Still Image

Before the computer age, the use of images in Renaissance studies was restricted by considerations of cost, quality and availability. Before the

widespread use of offset-litho printing in the 1950s,[1] printing technologies for images were much more expensive than setting text, even when text was set up in type by hand. This meant that usually the text could not be illustrated to the extent it deserved. But in the 1970s, with the still-feral state of computer processing, photo-typesetting machines using various semi-automated technologies offered competition to typesetting by hand,[2] allowing the typesetter to generate not only a photographic of the work, but to have that work (union susceptibilities allowing—which was not usually the case in the 1970s) immediately photo-typeset in whatever conformation the designer required. As the term suggests, photo-typesetting was *not* digital, and it has been replaced by systems which deal with whole pages as digital images—so that today digital images are indeed no more expensive to print than text.[3]

Digitisation of text preceded that of images because it was a simpler task. In the 1970s, semi-computerised typesetting was still accompanied by analog images juggled into pasted-up galleys, and then the whole re-photographed—photo-litho. This process—the name *photo-typesetting* gives a hint—at last almost equalized the cost of type and image, allowing for a greater profusion of images to accompany text matter, although the

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[1] "Offset printing is a widely used printing technique where the inked image is transferred (or 'offset') from a plate first to a rubber blanket, then to the printing surface. When used in combination with the lithographic process, which is based on the repulsion of oil and water, the offset technique employs a flat (planographic) image carrier on which the image to be printed obtains ink from ink rollers, while the non-printing area attracts a film of water, keeping the nonprinting areas ink-free." (Wikipedia).

[2] "Phototypesetting is a method of setting type, rendered obsolete with the popularity of the personal computer and desktop publishing software, that uses a photographic process to generate columns of type on a scroll of photographic paper. Typesetters used a machine called a phototypesetter, which would quickly project light through a film negative image of an individual character in a font, through a lens that would magnify or reduce the size of the character onto film, which would collect on a spool in a light-tight canister. The film would then be fed into a processor, a machine that would pull the film through two or three baths of chemicals, where it would emerge ready for paste up" (Wikipedia).

[3] "A digital image is a representation of a two-dimensional image as a finite set of digital values, called picture elements or pixels" (Wikipedia).

images still had to be found and printed to suitable paper in the correct dimensions. Naturally, such images were still analog, *not* digital.

Image quality was still a consideration. A glance at illustrated books produced over the past 50 years will show improvements in detail and colour balance ranging from near-imperceptible to startling. This is especially the case with textbooks, where high-volume sales have meant the ability to produce high quality at modest cost. But quality in print production is still restricted by the dimensions convenient in a medium which should be portable, and disjunctures common in Art History lectures with projected slides are often seen, with a tiny Jan van Eyck reproduced at the same dimensions as the Sistine Ceiling. And what is or should be the colour balance of the Sistine Ceiling? Before or after which restoration or cleaning? Likewise for a Jan van Eyck or a Titian?

The final problem with analog images is bound up with the finite dimensions of print technology, and that is availability. All scholarly books and papers *select* images from the range available. Often done by the author, the difficulties inherent in locating suitable images is seen in the profession of Picture Researcher, whose task it is to fit word to image, at the same time navigating the shoals of copyright (some of which are illusory).

In our new Millennium, the restrictions imposed on images by print technologies on size and hence perceived quality are beginning to disappear. The ongoing development of fast networked computer technologies means that we are connected together *via* the web browser (and other protocols which we users don't need to bother about) across the world; and the ever-lowering cost of storage (the high cost of which caused the illusory *millennium problem*) means that large digital images can now be stored as well as sent across the network at a quality that challenges that of 35mm slides.

The remainder of this paper will outline the advantages of catalogued digital imagery twinned with computer networks and web browser software,[4] and suggest that by contrast it is high time that books on paper disappeared in favour of electronic storage—a field surveyed by other papers

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[4] For a history of the World Wide Web, see http://tim-berners-lee.ask.dyndns.dk.

in this collection. It will also discuss existing and potential applications of these technologies in Renaissance Studies, whilst remaining alert to the fact that all the computer technologies reviewed are *generic* (which is why the hardware and software are now so relatively cheap), and in no sense Renaissance-specific: a computer is as happy processing De Chirico (or the accounts of Paul Bremer's Coalition Provisional Authority in Iraq) as it is processing Raphael. I will not be arguing that a picture is *worth a thousand words*: apples cannot be compared with oranges; a word is a word, and an image is an image. No more, and no less: this pernicious phrase seems to derive from the notion that the task of images is to illustrate and illuminate text—which is but one of their functions.

Computer + Network + Web = Scholarly Publication

Although the content of digital images differs, all the technologies discussed below are *generic.* We should bless such generality, since Humanities disciplines have profited from research undertaken in various sciences, which produce affordable hardware and sometimes usable software (including Linux, now a viable and free alternative to Windows as a platform for a networked computer with a web browser). Again, scientists have led the way in developing web applications, such as procedures for the refereeing and mounting of online journals; and scientists were far quicker than Humanists to accept that online journals were the way of the future. Given the cost of many printed science journals, and the fact that science develops by the use of journals (rather than journals and books, as in the Humanities), this is hardly surprising. Five minutes in front of a web browser should convince anyone that the internet offers image and text characteristics (quality, variety, record-keeping, multimedia extensions, etc.) that the fast-moving sciences need to keep ahead of, and that the Humanities should adopt more than has hitherto been the case.

Given that every glowing pixel on a monitor is an image, just what is a computer image? How about a line or a page of text? Another paper in this volume will discuss text from print (Gants and Hailey) and Ray Siemens, Karin Armstrong and Barbara Bond discuss the problems of digitising manuscripts. Such digitised manuscript and printed texts are the companions of image collections, but we should bear in mind that

the boundaries between text and image remain blurred. We can accept that OCR'd text remains as text; but what about image-files of text, for example JSTOR (which, together with Gale Group and ProQuest, house *Renaissance Quarterly* online)?[5] Indeed, one of JSTOR's reasons for using image technology is the continuing unreliability of OCR:

> In JSTOR, some journals will have OCR accuracy rates as high as 99.95%. But, although our OCR is accurate for search purposes, it is unacceptable for display, owing to typographical, word order, formatting, and other elements that are not accurately represented. The appearance of typographical and other errors could undermine the perception of quality that publishers have worked long and hard to establish and that users of all kinds expect. (http://www.jstor.org/about/images.html)

From this short excursion, it may readily be seen that there are and will continue to be problems with the translation of some typefaces (and of course the great majority of manuscript sources) into digital characters, and this in spite of the excellence of modern OCR technologies such as FineReader,[6] some of which can even "learn" how to recognise awkward characters on the page. But many older publications are destined to remain, JSTOR-fashion, as images, because combinations of inking, typeface and paper texture will continue to defeat OCR technology. Renaissance texts will certainly be available digitally (and hence searchable) in cases where they are OCR'd from modern editions (such as The I Tatti Renaissance Library Series).[7] But even with clever software, it is unlikely that the most difficult (complicated, smudgy, badly inked, etc.) texts will continue to be digitised as images. Adobe's Portable Document Format (PDF) is a popular format to "[p]reserve the look and integrity of your original documents" (http://www.adobe.com/products/acrobat

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[5] cf. http://www.jstor.org/about/accessibility.html: "Rather than displaying the raw text for articles, we display and deliver page images in order to provide a faithful replication of the original print journals."

[6] ABBYY FineReader converts paper documents and PDFs into editable files.

[7] The I Tatti Renaissance Library series "is the first and only to make available to a broad readership the major literary, historical, philosophical, and scientific works—in English and in Latin—of the Italian Renaissance" (I Tatti website 2001).

/adobepdf.htm)—so popular that an online newsletter, PDFzone, provides buyers' guides for creation, conversion and management of PDF-format documents—to free products such as PrimoPDF (ActivePDF 2005), which underline the fact that this image format is here to stay.

A mere glance at any list of existing periodicals will demonstrate that the whole business (a noun chosen advisedly) has gotten out of hand. Ulrich's (see links at the end of this paper) lists 3,481 periodicals under the heading *History of Europe*, of which very few are electronic; the keyword *renaissance* produces 236 results, of which 42 are available electronically. It would be interesting to know whether a higher proportion of scientific periodicals (however published) is in the hands of scientists rather than publishers, as compared with those in the Humanities. I can think of no practical reason why the documents prepared by journal editors for print publication should not instead go immediately onto the internet, with little extra effort or cost—and perhaps with a useful increase in the number of images, or links to images somewhere else across the internet.

A final digital snag is provided by indexing—i.e., cataloguing. We are familiar with searchability via digitisation for text, but should be aware that there is a great difference between finding *text strings* and finding *meaning*—which is why a computer cannot produce a comprehensive or subtle book index, even though it can index the exact location of every word. A later section will examine having computers search for meaning in images—content-searching, which is a much more difficult problem than searching for meaning in text.

Analog and Digital

The culture wars between analog and digital are nearly won, with the ongoing demise of traditional film and of slide projectors with which to display analog images. Technology changes, and we must adapt: I remember Sir John Summerson devoting nearly half a lecture to the beauties of 6x6 grayscale slides as opposed to the new-fangled (in the early 1960s) 35mm variety; and Nicolai Rubinstein shaking his head over the thought of computers penetrating the Warburg Institute because in the future all the student would need to do was push a button, and out would come a Ph.D.

The Warburg Institute is now the home of several vigorous digitisation projects, including do-it-yourself digitisation sessions for students.

The crux of any kind of imaging, including digital, is *quality*, but this is a perceptual rather than a mathematical concept. Even to say that digital is "better" when pixellation reaches a certain standard (e.g., better than a 35mm slide) begs many questions. Digital cameras can now offer images at the resolution of analog cameras: they have good lenses for every pocket and need, and digital offers several advantages over analog, from image exposure onwards:

⋆ Cleanliness: digital cameras (except for the professional interchange-able-lens variety) are not subject to dust problems which dog so much film, especially when projected;
⋆ Instantaneous check on sharpness: this can be made by using the zoom function on the recorded image—whereas film must be developed, which takes time. Try scanning slides, and you might be surprised at the fuzziness of many 35mm images—not to mention the dust and the spots—a feature which scanner manufacturers often target;
⋆ Colour balance and adjustment: digital images can be adjusted one by one—which is not to say necessarily made into an accurate simulacrum of the original work. Any experimentation with film acts on the entire film. It is notoriously difficult to reproduce colours accurately with film: I used to possess four colour slides of the same Monet *Haystack*, all tonally different! And digital images can be digitally altered for a variety of reasons (as with O. J. Simpson's *Time* cover);
⋆ Copy/original: copy 35mm slides used to cost less than originals. The distinction disappears with digital, since every copy is an exact one;
⋆ Distribution and printing: digital images can be distributed over the internet, and printed as desired; the "printing" can be to a storage device such as a CD-ROM or another hard disk.

Searchability and Cataloguing *via* Digitisation—But Only For Text?

Well-printed texts are often susceptible to optical character recognition (or what more expansively could be called document understanding and character recognition); the difficult ones get left as images. But no *complete*

move from analog to digital is possible or perhaps desirable unless it can be perfectly done—hence the many projects which offer images of pages of text and perhaps images which are not searchable, being simply collections of "untranslated" pixels.

Another strong candidate for image-only digitisation is archives. Archival research sometimes requires feeling the weight and texture of the paper, finding watermarks, and comparing one paper with another: digital images can help, but there is no substitute for handling the original. Some archival projects are indeed under way (a collection of links, not restricted to art, can be found at the Stanford University Libraries' CoOL Digital Imaging site). But for large archives cataloguing and sheer size will remain the stumbling blocks, even assuming funding could be found. For even if it is not impossible to digitise all relevant archival material into images, the figures involved are staggering: for archives in shelf-kilometres: Australia: 270; Marseilles: 12; South Africa: 140; PRO Kew: 172. As for the Vatican, the *Schedario Garampi* (an index up to 1772) holds over 800,000 cards arranged into 125 volumes. The majority of such archives are of the written word, but many offer collections of drawings, prints and photographs. Cataloguing at the box or bundle level is easy, but each might contain several hundred sheets, with a very broad range of detail.

To be able to search digitally, finding-lists or catalogues of some kind are essential if time is to be saved. But comprehensive, in-depth cataloguing is expensive because it is skilled work requiring time and judgment, whether dealing with images or plays, video or research texts. Hence very few very large image-collections are methodically catalogued beyond the artist-subject-date-location outline. Even assuming the necessary funds, and although standards have been proposed in various areas, there is no general agreement to parallel the MARC format on just what should be catalog—although there are *national* efforts (such as that by the National Inventory Research Project to catalogue non-British Continental oil paintings between 1200 and 1900 in UK public collections,[8] or the Marburger Index, which aims to catalogue all art in Germany. Of course, such projects

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[8] "The National Inventory Research Project aims to help museums research and catalogue their collections and to present catalogue data on a publicly accessible website" (NIRP website).

catalogue what they *can* rather than what we believe they *should*—but the result is that, although we could probably gather together from the internet a fair selection of the works of Raphael or Michelangelo, we would not find uniform data-records with all the images.

It also bears stating that the deeper an image is catalogued, the more assumptions the cataloguer must make about the kinds of information the eventual user will require—and one can only extract from a computer what is entered into it. But as fashions in scholarship change, so the establishment of even iconographic guidelines (beyond the "fixed" iconographies of Christianity or classical mythology provided by systems such as ICONCLASS) seems both fragile and fugitive. Cataloguing a book fixes it in the scholarly consciousness for centuries; with images, a lightweight catalogue record is probably all that most of us can afford to write or to purchase, and all that will survive into the next generation—since we are building the internet for our descendants as well as ourselves.

Why not get that universal processing machine, the computer, to do the cataloguing? Content-searchable digital image collections is a fine concept, but yet to be practicable, although there are a variety of projects attempting to develop algorithms useful not just for students of the Renaissance, but also liable to make serious money if used by TV channels needing a shot of a certain subject quickly—the overwhelming reason why content-searching may become a reality one day soon.

Web Images: Chaos Unconfined

It is the growth of the internet on top of such (occasionally) automatic processing by computer that makes the web browser a flexible (if not ideal) method of exchanging multimedia data. During its ten years of existence, the internet has developed into a powerful but frustrating tool for learning and research. Huge quantities of material are available, but the inherent nature of the setup (ease of copying, and of mounting and developing websites), together with an all-too-human tendency to do-it-yourself, gives us an environment that is chaotic and repetitious, with such confusing redundancy that only search engines (and search engines that search other engines) can present some semblance of order. The

internet is valuable because images can be mounted in great profusion and viewed along with searchable text. But then how do we find them on the internet? We find books in libraries because cataloguing conventions have been developed over many decades which ensure that books in different libraries using the same system are always similarly placed relative to each other. It also bears stating that a printed book is inherently different from a web image (or web book) because its characteristics are fixed enough to be described and catalogued—and hence identified by the user. But as soon as digital images are created, we face difficulties because there can be no guarantee that five images of, for example, a Raphael on five different websites are the "same" image: they could be different in resolution, colour hue and saturation. Which of the 1,139 images of Raphael's *School of Athens*, catalogued by Altavista and Google, should we use, and how far can we trust it for accuracy? What about images which are incorrectly labelled, or not labelled at all?

Or to put the question another way, what can a digital picture *on its own* tell us, and can technology help us hack our way through the misleading thickets of the internet in search of that perfect image? Can a digital image survive if separated from its data-record—always assuming it ever had one? Digital images can certainly store data other than the image itself, as with the Exchangeable Image File Format protocol, which is common with today's digital cameras that store as JPEG. As well as details of exposure, resolution, time taken, flash on/off etc., this protocol allows the storage of standard "catalogue" information, such as artist, title, original medium, keywords, copyright information, source format, etc., which could lead us to hope that each digital image might eventually contain its own catalog information encoded into the EXIF details by using an editor such as RoboPhoto.[9]

Perhaps this chaos is to be expected (it is after all one of the endearing characteristics of the internet), but the propensity to re-invent the wheel burns with unarguable conviction in many an ignorant breast. But there is surely no reason why something like the MARC setup couldn't be used: a centrally-generated catalogue entry is created and disseminated to the

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[9] Further information on RoboPhoto can be found at (http://www.robophoto.com/exif.html.

multiple copies of the book (or other media) across the world; in a sense, something similar could happen with images, which exist in various versions on computers around the world.

The Chimera of Technology: Three-Dimensional Images

In many quarters the impression still reigns of the computer as a magical black box which can do anything: load it with data, and these will be ordered; squirt it with images, and it will construct an *alternative world*—a *virtual reality* parallel to but as detailed and as convincing as our own. This is simply not the case, and there are strong arguments that it never will be—that is, that computers will never be able to construct and display an accurate and detailed representation of the interior of San Lorenzo, Florence, of the Roman Forum, or of the Vatican Museums—all entities invaluable for teaching and learning about the Renaissance, and certainly of great value for that majority who do not live in Florence or Rome.

The computer construction of virtual reality—"worlds" for short—got its first boost from military requirements for pilot and navigator training, because to do this with computers was always cheaper than in a plane or a ship. It is certain that generic "worlds" can easily be constructed, with colour, textures, atmospheric conditions, etc.—as can be seen from numerous computer flight simulators or even golf games. *Prima facie*, then, virtual reality seems an ideal technique for constructing far-away or even no-longer-existing buildings and spaces, so that they may be used in research and teaching. But it is here that the chimaera comes in: constructing "worlds" is skilled, painstaking and expensive work; in many applications, the computer's ability to clone elements and re-use them is essential to viability (such as almost any computer game)—but not in Renaissance Studies, where detail and accuracy are *always* both required; and if the technologies are so easy and computers so smart, why are we not all teaching with computer models of Shakespeare's Globe Theatre, the Sistine Chapel, and walk-throughs of the streets and monuments of Renaissance Florence?

The answer lies partly in the computer's ability (in skilled hands) to *create* an alternative world but not in any viable way to *reproduce* our world.

Look at any computer model of part of our world in, for example, VRML (the Virtual Reality Modelling Language) or any of its work-alikes, and it will immediately be perceived that there is an enormous difference in "feel" between the two—in lighting, coloration and especially in texture. This is because a computer model begins with armatures (in effect an accurately-measured, wire-framed skeleton which defines the boundaries of objects), and then clothes them with "textures"—that is, supposedly with the skin of real life. But even after years of dedicated work by software professionals, computer-created textures look artificial (which they are), so that it is a common construction technique to "clothe" the armatures of a computer model with cut-out textures from photographs of the actual object; although computers will certainly get faster and programs cleverer, it will be a very long time before academics will be constructing their own convincing details and accurate computer models.

Indeed, here the tedious circularity of virtual reality is displayed: disaggregate the object/room/building into a skeletal armature the computer can understand—and then rebuild it by applying real-world textures to it. The process is painstaking and tedious, and the quality of the result linear to the amount of time expended. But the end-result doesn't look like the real world, for the very good reason that it is *not* the real world.

The above Philippic is essential if Renaissance scholars are not to be misled by that hype which seems to be part of computer software promotion into thinking that such exciting technologies make still images "old hat"—and that the computer is the ideal platform for excursions into video and constructed worlds. Still images cannot be beaten for accuracy, detail and ease of use, as a subsequent section will demonstrate.

Using Images in Renaissance Studies: An Overview

All images of Renaissance artifacts are long out of copyright, with the *exception* of photographs of three-dimensional works. That is, while there is no copyright involved in a Donatello plaque (although the museum/gallery might want to charge for photographing it), there is indeed copyright inherent in photographs of (for example) his *Bronze David* in the Bargello, since three-dimensional works are considered to require skill on the

part of the photographer, whose intellectual property therefore resides with the photograph as an artistic creation in its own right. Of course, such considerations might be overridden by the local or other guidelines on The Acquisition and Use of Images in Non-Profit Educational Visual Resources Collections.[10]

In spite of the huge numbers of images available on the internet, many are useless for teaching, learning or research because they are too small, poor, or unreferenced. Thankfully, collections such as the Web Gallery of Art ("a virtual museum and searchable database of European painting and sculpture of the Gothic, Renaissance and Baroque periods. . . currently containing over 13,900 reproductions") help with "standard" works, even if they are not yet able to offer complete catalogues of an artist's work. Architecture of the Renaissance period is less well covered than painting, although sites such as Vitruvio and Art Images for College Teaching (AICT) are bridging the gap; William Westfall's longstanding Renaissance and Baroque Architecture shows what individual academic initiative can achieve.

But in spite of an increasing number of bright spots, initiatives in the image field have always been more patchy than those involving texts: I can easily find the works of Shakespeare online, in all kinds of editions; but where do I go for the complete paintings (let alone drawings) of Raphael? The answer is simple: collaborative efforts do indeed exist (as one might expect of people using networked, near-instant technologies with facilities for text, sound, still images and video)—but they are rarer than they should be. The proof of this is the continuing existence of "directories of directories"—online "guides" which are often very useful but, the longer they are, the more difficult to keep up-to-date, given the ever-changing ups and down of the internet. A longstanding and shining example is Chris Witcombe's Resources for the Study of Art History, online since October 1995. This site is exemplary, but its existence demonstrates that (as is the case with the wider web) provision of materials is chaotic and there is little concerted planning—and this, I repeat, for a medium the very name of which proclaims (near-immediate) world-wide communication with the enormous advantage of a cross-platform consistent interface.

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[10] The Intellectual Property Rights Committee has laid out guidelines for the acquisition and use of images that can be viewed on the VRA website.

What are the competent entities to divide up and fund the digitisation of essential image materials in Renaissance studies? And is there any sign of collaboration between museums and galleries to provide union catalogues of artworks? After all, *Dog in the manger* is not just the title of that dubious Caravaggio; and the majority of museums and galleries do not yet hold digital image catalogues of all their holdings. But a start on union image catalogues has indeed been made, as for example with the (British) Arts and Humanities Research Council-funded National Inventory Research Project, which

> aims to help museums research and catalogue their collections and to present catalogue data on a publicly accessible website. It is concerned in the first instance with non-British Continental oil paintings between 1200 and 1900 in UK public collections.

We might call it the artistic equivalent of the longer-standing A2A (Access to Archives) database "which now catalogues 8.5 million filed items from 390 record offices and other repositories."

But there is a dilemma here, given limited funds: should we go broad or deep? Broad surveys, useful for teaching and learning, seem cost-effective (costs recouped usually in kudos not cash); but it is difficult to see who would fund *ab ovo* large-scale digital image collections for research, given the enormous costs involved. Many collections of Renaissance images began as transfers from analog, and funded by the devoted work of interested staff, the actual cost of their work disguised in university, library or other institutional salaries. Thus my own site, ArtServe has been going since January 1994, contains well over 400,000 images, and receives over seven million accesses per week. It helps maintain the high profile of my university, but would have been impossible to maintain without research grants or the tacit acknowledgment that my time was well-spent maintaining a site which, in the commercial world, might well warrant a staff of four or five.

Images in Renaissance Studies: How to Use Them Effectively

The point of the following sections is to reinforce the fact that quality digital still images of Renaissance artifacts are now readily available, and

can be displayed in a variety of inventive ways in a web browser, and easily manipulated by the user. Stereo can be a help with both sculpture and architecture. Effective student use of images certainly needs attractive display technologies to explicate complicated spatial relationships. And for academics wishing to do-it-yourself (funds often not allowing have-somebody-else-do-it), all projects should be simple to set up and replicate across different buildings or *ensembles*. Elements of practicability therefore include ease of project generation; ease of use with a web browser, usually over a network, and possibly with suitable plugins; ease of replication into other similar projects using different materials but the same or a similar "skeleton"; and finally ease of updating and, if need be, extension (for example by adding to the number of images or panoramas, or video and sound). These days, the hardware is a relatively trivial cost in comparison with personnel; so the simpler the technologies, the lower the cost, and the more information will reach the users. All the techniques outlined above satisfy the criteria listed.

Big images can be stitched into large panoramas, and applets used to zoom in and out. Images can be mapped (just like an actual map) with mouse-sensitive co-ordinates: click within these, and an action is executed, which might be a jump to another image, to a page of text, or perhaps to sound. Such *imagemaps* might thus allow small sections of a very large image (perhaps a panorama) to be examined in detail by using such hotspotted links. Nor need the newly visible linked hotspot obscure the source imagemap, because merely moving the mouse over one image can be set up to induce the target (or a whole series of targets in succession) to be shown in an adjacent section of the browser. An extension of the imagemap idea is to have one image "control" another so that, for example, a panorama of the nave and crossing San Lorenzo in Florence can be linked to a ground plan of the church, so that the user can be given orientation: as the panorama is swung left or right, so the highlighted section of the groundplan changes. All the above can easily be packaged together into sophisticated and detailed presentations, and then perhaps packaged into executable programs for downloading and executing on the user's computer at a later date—and not necessarily using a web browser as the viewer.

The Bigger the Image, the Better!

Today's digital cameras can routinely produce 8mp or 10mp images. Digital camera lenses are getting wider and longer: 24mm and 280mm are now possible, and fisheye add-on lenses may sometimes be used to good effect in tight spaces. Many digital cameras now take interchangeable lenses.

All these factors mean that today's websites can serve digital images the size of a small wall, and panoramas can consequently be of 10 megapixels or more, offering good detail and excellent zoomability. Even if such monsters are too big for some uses today, it is always a good idea to expose the images at the highest possible resolution, cut them down for use today, store them carefully, and bring them into use as display technologies become faster. TFT screens have now almost completely replaced cathode ray tubes; some video cards (e.g., nVidia) allow one computer to drive two adjacent TFT screens as one, offering a "cinemascope" configuration that is excellent for viewing large images. One need not always rely on a network for instant viewing of such large images, because these can be bundled into an executable for download and local use.

Such ability to deal with very large images means that we can often see on the computer monitor details which would be impossible to see on-site without good binoculars or scaffolding. To make the point, consider two images of a panorama of the Arch of Constantine, the lower one of which is zoomed in to examine the fitting of the Hadrianic reliefs and their porphyry surround (Figures 1–2).

Simple Solutions Are Easiest and Best

A classically simple approach will probably look good in ten years time, whereas nothing dates so quickly as graphics (cf. 1995 VRML). Website developers should therefore forget the highly-skilled "flashy" technologies such as 3D modelling, VRML and its work-alikes, and anything that aims to construct virtual worlds, because all are difficult to build, requiring a high level of skill to attain anything respectable. They are also slow to build because the higher the level of detail, the greater the time needed to "tell" the software what to do. Indeed, the majority of "virtual reality"

Figure 1

Figure 2

projects are critically lacking in useful detail, and always will be, because software simply cannot "understand" the full three-dimensionality of the real world. As a test, make a list of the features you require from any "virtual reality" project, and then map the results against the costs. No results yet seen by me which show convincing VRML or other 3D construction of realistic and detailed space of a quality useful for research or teaching (I am *not* attacking the use of VRML for the presentation of small objects, to which the mechanics of the technology can be well suited). Similarly, no programs yet seen by me offer "effortless" construction of 3D space from photographs, stereo-video, or other media: all have to be hand-crafted, specially programmed, or both. As for expense, no financial statements yet seen by me convince me that VRML and the like are practicable for the ordinary, under-resourced teacher (even assuming an increase in perceived quality).

The results will confirm that it is preferable, instead, to use photographs, and plenty of them, certainly supplemented by plans and perhaps by

video. Such combinations allow plenty of scope for attractive and useful presentations, which will be much easier to update than VRML or its work-alikes. As we shall see below, imagemaps can be used to link elevations and plans to views; maps and floorplans can also be linked to panoramas to provide accurate spatial knowledge.

Panoramas: SM Del Popolo, Rome

Software now allows the computer to stitch together a series of adjacent images so that a very wide-angle image (wider than the human eye can see, if necessary) can be constructed. The best results are obtained by putting the camera on a tripod; in the study of art and architecture (especially large building complexes), the better the resolution, the more useful the image(s). Software for stitching excellent panoramas exists today and really does work, and any size of resultant image (dependent of course upon the resolution of the camera and the number of segments used in the making of the panorama) is relatively easy to construct. Conceivably, as the pixellation of digital cameras continues to increase (the latest models offer ten megapixels) and digital cameras with interchangeable and very wide-angle lenses continue to drop in price, so one-shot panorama solutions seem feasible. For tight locations (Renaissance chapels, for example) using fisheye lenses or 360-degree cones might become practicable—but fish-eye is a distortion, and the taking of several exposures in an arc (using a tripod) will surely continue to offer better resolution than such devices. As cameras get cleverer, so we might hope that hand-held exposures in gloomy interiors (Renaissance chapels again!) might become possible with grainless exposures at 800ASA, if not higher.

Figure 3 is a composite panorama of part of the north aisle of SM del Popolo, Rome, and the Chigi Chapel. Just over four megabytes in size, it has 9200 horizontal and 2600 vertical pixels—giving an indication of the amount of detail it can reveal when zoomed using one of the techniques outlined below.

Stereo For "Realism?"

A camera (and hence a photograph) is the result of a single "eye," namely the camera lens—and the result it produces is therefore "flat." Two human
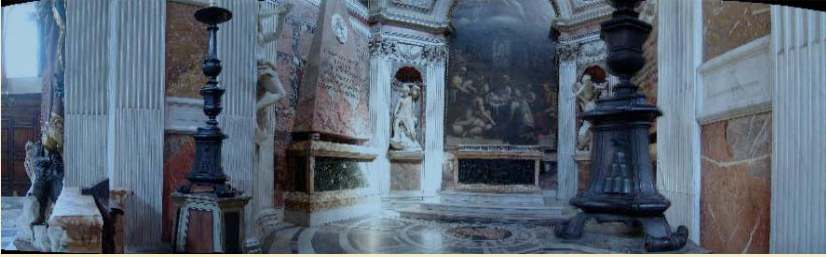
Figure 3

eyes generate stereo vision, which gives a sense of depth. It is simple to
set up two digital cameras (on a horizontal bar) to take exposures which
mimic the left and right human eye. Computer software then combines
the images together (usually giving the one image a red cast, the other
a blue one), and the user wears a pair of red/blue spectacles in order to
"unscramble" the dual image into the semblance of what the left and right
eye sees—stereoscopic vision.

This technique is clearly of particular interest for architectural *ensembles*,
or indeed for anything with more "profile" than bas-relief. Stereo cer-
tainly adds verisimilitude in studying architecture and sculpture (even
bas-reliefs), and making digital stereo pairs is possible using small cam-
eras. Plenty of inexpensive vest-pocket-sized but four- or five-megapixel
cameras are now available, and there are plenty of examples of how to
link the cameras with tripod and slidebar, in a package weighing perhaps
500 grams.[11] As with virtual reality, time is required to get things just
right for stereo; and given what the impatient find to be the hit-and-miss
nature of the process, a large number of images is advisable—a decided
advantage of digital, which is much cheaper and more convenient to use
than analog. And there is a fallback: even if not all your stereo pairs
"work," each individual image should still produce valuable information.
Confirmed masochists may wish to attempt stereo panoramas, because
the possibilities of it going wrong are doubled when trying to stitch to-
gether the output from two cameras. Stereo-video could also develop
into a pastime, given sufficient money and expensive technology: see

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[11] For an example of slide bar use, see Graphic Media Research's Digital 3D Camera at
http://ica.princeton.edu.

the Ladybug 2 from Point Grey Research, which has six video cameras to collect spherical digital video from over 75% of the sphere.

Flexibility and Ease of Imagemaps: A Renaissance
Sculpture, and the Chigi Chapel, SM Del Popolo

Mapping involves relating one "control" image to another, or to a series, so that each image helps the other by providing additional information. Such comparanda give context, because using a map or plan enables the browser user to get relationships between objects clear. Thus an elevation can act as control mapped to a series of details, or an aerial photograph of Cairo might be used together with elevations of the monuments. Using such mapping together with panoramas increases their utility, because a panorama by definition widens the context of a building or site.

Indeed, any image can be mapped to any others, in series, just like a set of Russian dolls (as happens in my demonstration of the Deesis Mosaic in Haghia Sophia). The advantages of such mapping over more complicated techniques are clear. It is quick and relatively easy to set up, and it is accurate (cf. VMRL), with panoramas scalable. The level of detail is dependent not upon skill and time spent (as with VRML), but upon the quantities of images one has available—offering great flexibility, because plans/elevations can be mapped to any level of detail. Furthermore, such setups work in any browser (locally or across the internet) that knows java. The technique described above is demonstrated in the example below, of a sculpture in the National Gallery of Australia: the browser presents the image to the right, and the hotspotted menu to the left. Movement from image to image can be made by clicking on the menu items, or by choosing the yellow hotspots in the image (which can be hidden). The user can zoom in and out of the image. Figure 4 shows the whole of the image, while Figure 5 shows the image after zooming into it.

Since the sophistication of the result depends only on the quality of the two-dimensional images used, such projects are easy to update simply by changing or adding to the photographs. What is more, it is easy to boiler-plate by setting up one plan/elevation, testing it, and then multiplying it with different sets of images.

Figure 4

Figure 5

Figure 6

Figure 7

In Figures 6 and 7, no clicking is needed, but the top image still acts as the control—the "map"—to what appears on the bottom. The engraving, in other words, has been set up with hotspots activated when the mouse simply moves over them. In Figure 6 the user examines the candelabrum; in Figure 7, the balustrade to the chapel.

But Where Am I? Imagemap Plus Groundplan with
Heemskerck's Panorama of Rome

One problem that arises when students study a series of images of a monument, or panoramas, is that they can get disoriented, because they cannot easily relate *elevation* to *plan*, and thereby fix the proportions and relationships of the various parts of the building or site into their correct sequence. Software can help mitigate this problem.

If the basic imagemap is a picture which is "hot" because various elements of it are mapped to other actions (other images, web pages, video, sound, etc.), a panoramic imagemap can easily be geared to a groundplan so that, as the centre of attention swings from right to left, or zooms in or out, so the software delineates the field of view in the associated map or plan. Thus the user can, for example, study a marble wall in the Sultan Hassan Mosque, and know exactly where on the building's plan that wall is located.

In Figures 8 and 9, the individual sheets of Heemskerck's panorama of Rome have been "glued" together by computer software, and linked with Nolli's plan of Rome, which appears underneath. Because of the linkage, rotating the Heemskerck panorama rotates the "searchlight" (clear area) on the Nolli plan, so that the elevation tracks the map—an imagemap, indeed. Similarly, zooming into the Heemskerck "tightens" the searchlight beam on the map to match, as the clear areas on the Figure 9 map demonstrates. The beauty of such a setup is that the map can be controlled from the panorama, or *vice versa*: that is, once a particular zoom angle has been selected on the panorama, the mouse can grab and manipulate the searchlight—and the panorama will move with it.
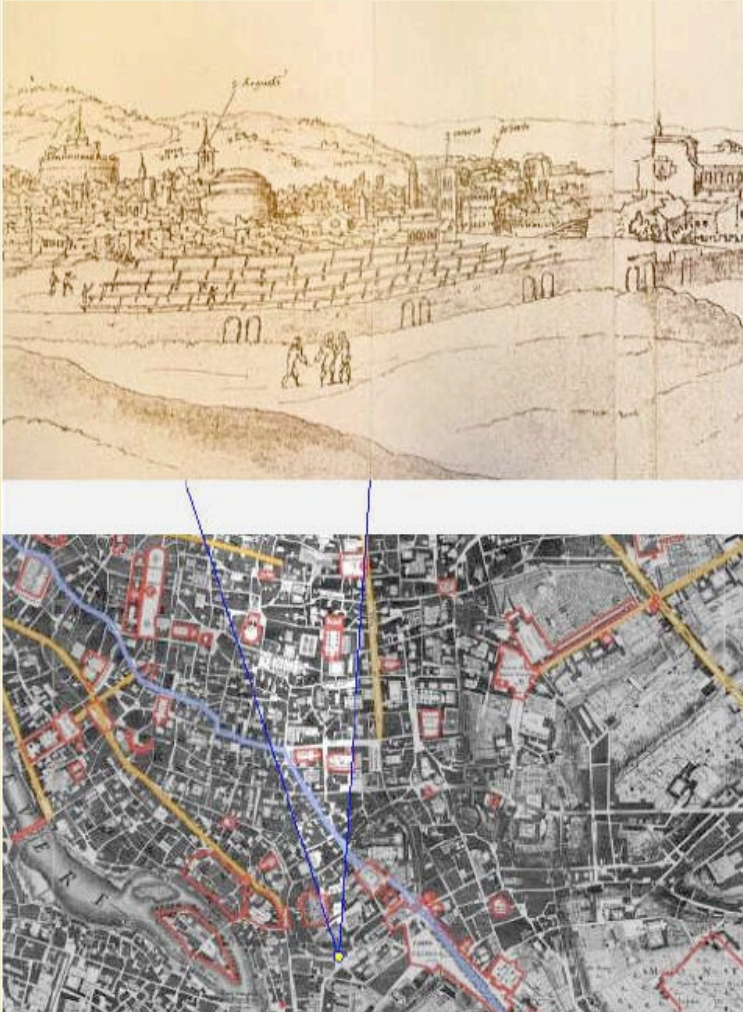
Figure 8
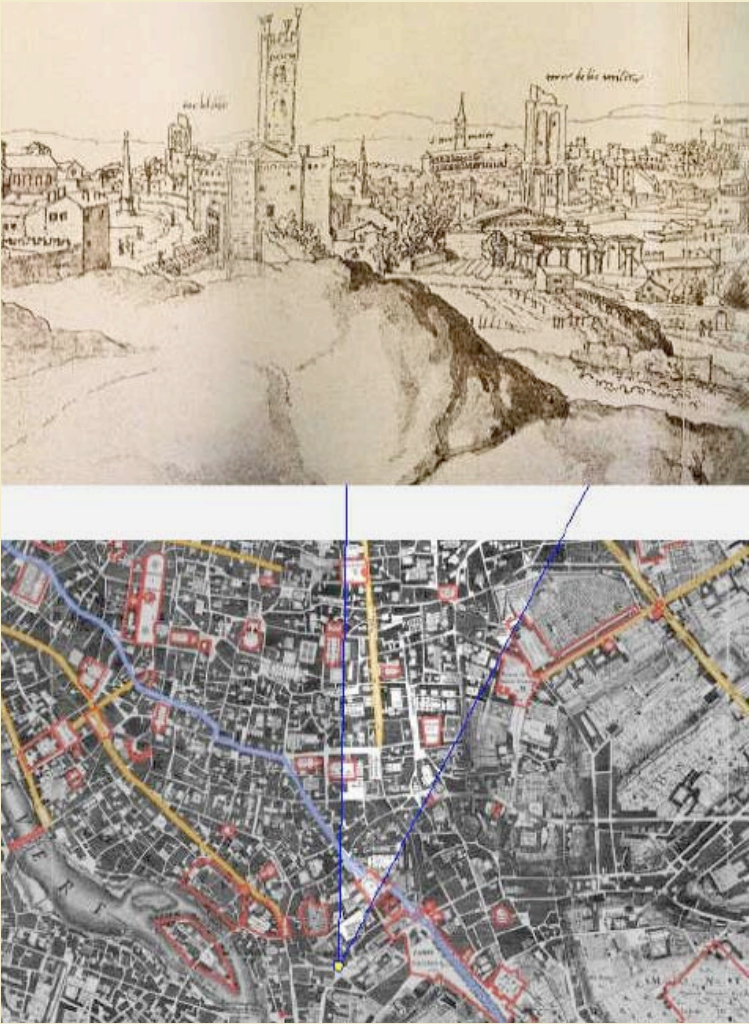
Figure 9

Video For "Realism?"

Although the majority of this paper is dedicated to digital still images, a
short account of digital video is in order—and not just because video is
simply a string of still images, and can be freeze-framed as such. For hav-
ing dismissed the notion of virtual reality using computer-constructed
worlds, surely digital video can provide a way of—for example—capturing
architectural *ensembles*, the more so because, in a world of television, we
are used to instant video, and might suppose that video on computers
is both easy and useful. Although video does have several advantages,
these are outweighed by its disadvantages. Video easily links in to im-
agemaps, triggered by a mouseclick, and the technology can provide
footage and panoramas in situations where still photography is "diffi-
cult," such as where tripods are discouraged, or where far-away details
cannot be reached with the smaller magnifications using the zoom lenses
of still cameras. This is especially the case in low light conditions, where
still digital photographs usually suffer from either flash-glare or, if shot
without flash, the noticeable grain caused by using a high ASA setting.
But because DVCam CCDs work to much lower light-levels than those of
digital still cameras, they can produce much better results—from which
individual DV frames (albeit at a relatively low resolution) can then be
duplicated as individual JPEG images, singly or as a sequence ditto. Users
should not be misled by the fact that many digital still cameras offer video,
because this is usually at very low resolution. Similarly, a growing number
of video cameras now offer the ability to take still images, but again at a
low resolution. Multi-purpose devices may work; but dedicated devices
tend to offer better results.

In most situations, the disadvantages of video outweigh the advantages.
Standard "video resolution" (in whatever standard is used, including the
now available HDTV, and whether analog or digital) is not high enough
to offer high quality images that can compete with modern digital still
cameras. It can be difficult to take a very bad still digital image; but taking
good-quality video requires skill and a tripod for consistent results. Then
if the results are to be viewed on a computer, further snags arise: although
computers are getting faster all the time, running video still imposes
a considerable load on most computers (not to mention on networks).

Usually, therefore, the video must be at a low resolution if the computer is not to freeze up.

A further disadvantage over still images used with computers is the matter of *control.* As with shooting video, manipulating and editing video on a computer is a skilled task, and the results are often not worth the trouble. Again, all that video cameras can do is zoom and pan, and they are controlled by the operator. Still images, on the other hand, when hitched to appropriate software, can be zoomed and panned, and the images are controlled by the *user*—a setup likely to be of more use for study and research.

Facilitating the Manipulation of Difficult Images: DjVu

Startling progress has been made over the past few years in the computerisation of "difficult" printed documents, often by reverting to capturing pages as images, and storing them in the PDF format. Other compression technologies offer the ability to navigate round very large images indeed: MrSid is used extensively in mapping and Landsat applications, and there seems no reason why Renaissance scholars should not adopt it, although our images are unlikely ever to get as large as GIS ones.

But there is another possibility for Renaissance and other Humanities scholars, namely Djvu which is a free technology that compresses images to much less than half the size of JPEGs (and, *a fortiori*, of TIFs) for comparable quality, and offers free software for encoding and viewing.djvu images, including browser plugins: DjVu "allows the distribution on the Internet of very high resolution images of scanned documents, digital documents, and photographs. DjVu allows content developers to scan high-resolution color pages of books, magazines, catalogs, manuals, newspapers, historical or ancient documents, and make them available on the Web." Although the startlingly low cost of storage and increasing speed of networks has made compression ratios less of a worry, perhaps, DjVU is especially appropriate for scholarly applications to do with archival documents, manuscripts or drawings, because it is "layered," being able to encode backgrounds separately from foregrounds, with the result that for a pen-and-wash drawing, for example, the user can choose to display the whole in colour, or just the background, or just the pen-strokes or

Figure 10   Figure 11

brush-strokes—an obvious boon for close study and analysis. The only
snag is that images must surely be preserved in some archival format, or
at least as JPEGs (if that is how they were shot)—and (batch) processing
is required to convert the same images to DjVu format, plus a plug-in to
view them in a web browser. But the results are very good indeed.

An additional feature of DjVu is a neat variation on zooming. The image
can be zoomed in and out, and sections of it can be selected for zooming
to a specified resolution. But the program also offers a "magnifying glass"
(the size of which can be varied, as can its magnification), which can be
manoeuvred over the surface of the image just as could a real magnifying-
glass over an actual work of art. Figure 10 shows a detail of the Tree of
Jesse Window at Chartres, while Figure 11 displays the magnifying glass
blowing up a detail of Jesse's head.

Examples of DjVu implementation around the world include Nevada His-
tory in Maps, The Searchable Ornithological Research Archive at the Uni-
versity of New Mexico, and Arabic manuscripts in the National Library of
the Czech Republic.

In many ways, DjVu is a competitor to PDF, as can be seen by comparing the
two formats in versions of Harold Bayley's *A New Light on the Renaissance
Displayed in Contemporary Emblems, or the Memoirs of the Dukes of Urbino*
(1909)—not to mention a long list of pre-1650 books in the Million Books
Collection such as Gustav von Bezold's *Die Baukunst der Renaissance in*

Deutschland, Holland, Belgien und Daenmark (1848–1934) and Alfred Gotch's
Early Renaissance Architecture in England (1852–1942).

So why isn't everyone using DjVu? Because the best technology does not
necessarily get widely adopted (consider betamax and VHS; and DjVu has
not got Adobe pushing it, let alone—one assumes—any competitive level
of funding). Again, most people seem satisfied with small images, which
after all fit current machine and network speeds. But our task with the
internet (just like that of any librarian) is to prepare for the future, and
to deal in images which are of sufficient quality and resolution to act as
substitute for the objects they represent: we know that bigger, better
images will be possible, and we need technologies that make efficient use
of computer and network capabilities, and of disk space. To ignore the
future is often to fail. One example of a system apparently configured
for today, rather than tomorrow, was the Visual Arts Network for the
Exchange of Cultural Knowledge—VanEyck—which noted that, although

> the quality of the images is to a degree source-dependent, a con-
> scious choice was made for images of such resolution as to balance
> quality of image on the one hand with speed of retrieval and pro-
> tection of intellectual property rights on the other. Images of
> higher resolution may be obtained, pending availability, from the
> participating content providers, together with the relevant terms
> and conditions.

But surely the IP is in the catalogue information, and certainly not in the
images. The system contained some 70,000 objects in 2002, and projected
200,000 objects by 2004. Its website—http://www.vaneyck.org—no longer
seems to exist.

Copyright and the Public Domain

Support for copyright also entails support for material in the public do-
main, and a clear and exact knowledge of how the one be distinguished
from the other: we must protect copyright, because it is intellectual
property; but equally we must jealously protect the public domain. The
situation is analogous to public rights of way across the landscape: if un-
used, these will also slide into private for-profit ownership. And without

concerted action, the Web will be handed on a plate to commercial inter-
ests who arrange a price for everything and are not interested in values, let
alone the public domain. Hence it is essential to recognise and defeat the
predatory behaviour of some image and text holders, many of whom offer
some well-out-of-copyright images for sale. This is unfortunately true
of many "public" (but often less-and-less publicly funded) museums and
galleries, who believe they can make money from reproductions of their
holdings, and who sometimes have bold copyright notices for images of Re-
naissance artifacts which go against any copyright law ever promulgated.
Fortunately, many academics have realised that the way to defeat unjusti-
fied commercial interests is to sidestep them by providing websites which
offer their images freely for the purposes of study and learning. My own
website, ArtServe, is only one of many (such as Prometheus) to do this.

Another way of defeating commercial interests is for academics and oth-
er professionals to publish their work directly onto the internet. This
is already happening with theses (and much more rapidly in scientific
disciplines), but there are few reasons why it should not happen with all
scholarly work, which would benefit from the ease with which images
can be combined with text (and sound, video, etc.) in web publications.
An aspect of the move from paper to digital is the difficulties libraries
have with paying for electronic media, for which print media, especially
journals, often have to be sacrificed. There is usually no cost saving in
this transition (thus defeating part of the point of digitisation). Concert-
ed action is needed to sidestep the purchase of expensive print or online
journals, many of which are very expensive indeed. For now that the main
expertise of the "publisher" has been replaced (first) by desktop publish-
ing and now by the internet, universities, departments, and individuals
can publish journals and e-books at little cost—and use the savings to
maintain print libraries, which may never be completely superseded by
things digital. A couple of decades ago, the expertise of the publisher was
needed to distribute books and periodicals; now this can be done on the
internet very quickly. More and more reference books are made available
digitally (such as the Grove Dictionary of Art Online); but can we look for-
ward to the day when such concerted and collaborative efforts are made
by the contributors themselves, using software such as Wiki?

Conclusion: Where Do We Go From Here?

It should go without saying that web publication should be the first port of call for scholarly books and papers, and also theses (protected or charged per-page if need be), with print-runs becoming scarcer—the more so for work which requires high-quality illustrations, and plenty of them.

But will it ever be possible to prepare a scholarly paper or a Ph.D. dealing with the Renaissance by just sitting in front of a computer, as Nikolai Rubinstein assumed would be the case? Back in the 1970s, the West was certainly running scared in front of the threat of Japan's Fifth Generation computers, which were supposed to develop artificial intelligence (AI) to such an extent that computers would indeed be able to develop into intelligent machines, able to "think" and make deductions. But AI never blossomed, and computers remain as stupid and circumscribed as ever, good at repetitive and uniform tasks. The old axiom that "if the task can be accurately described, then a computer can be programmed to execute it" holds good, and allows us to identify whole areas which it is highly unlikely that computers will be able to perform, because the tasks are simply not uniform enough. One area identified above is the construction of virtual "worlds" which are accurate and as fully detailed as the world in which we live. Another is the area of manuscript archives, where irregularity, paleness, creases, shadows, tears, and some handwriting that even humans have difficulty in reading will defeat optical character recognition, and ensure that, if ever large quantities of pre-print archives are digitised, it will be only as images—that is, as graphical and therefore unsearchable representations of writing and other markings on a page.

But at the undergraduate and, increasingly, at the sub-Ph.D. graduate level, rigorous and interesting courses in Renaissance Studies can be put together (samples of online course materials can be seen at Jeffery Howe's Art on the Web) which can make use of time and resources more efficiently than the old paper, chalk and lantern slide approaches. The web browser should be the interface of choice for the presentation of on-site lectures and seminars, and of course the portal for private study as well. It is only common sense to use such a standardised interface whenever possible—and indeed, the more people who write for such an interface, the more it will be used.

And if we put together the web browser (sitting on a network) with the growing availability of learning materials in various digital formats, it is clear that the academic community must eventually address the question of on-site versus remote teaching and learning for *all* students. Assuming face-to-face tutorials and seminars are seen as valuable, can lectures be easily replaced? How about a student looking at images in a web browser, and listening to the lecture on an MP3 player? How about another student downloading images for a seminar or a lecture from a bancomat-type distribution point, inserting a USB device to receive the contents? The technology is ready, and works well over the web as well as collected on the "hard disk" work-alike that is the USB device. But is the human contact of lectures the value-added element essential for education? Is using a private chat-room on the net in any way comparable to discussing an image face-to-face? In this area, the technology really does work well, but human factors might keep face-to-face universities going for decades yet.

Camera technology is also now mature, and the products cheap, with cameras of eight megapixels offering poster-size images, often *via* 8x or 10x or even 12x zoom lenses. There have been attempts to make a kind of "universal camera" by routinely having still cameras take video, and making video cameras capable of taking stills. But mixed devices have disadvantages to balance their qualities: until the Sony device mentioned above, still camera yielded video only at a postage-stamp resolution. Conversely a video camera (so useful in low light, and often with 20x or more analog zoom) yields still images no larger than can be obtained with a very cheap digital still camera. For example, the JVC GR-HD1 offers 16:9 aspect ratio for HDTV (which can offer naturally megapixel stills without internal trickery); but, once again, unless one especially needs a good zoom (this device offers only 10x analog) and one works in low light, the premium to be paid for such new technology might seem excessive.

But digital imaging is just as much a moveable feast as analog: "quality" depends in part on colour accuracy, and in part on definition—that is, on the dimensions and hence available detail in the digital image. In this regard, any long-standing and image-rich server (such as my own: http://rubens.anu.edu.au) exemplifies the changing technologies we have seen over the past decade, most conspicuously the introduction of digital

cameras. The first "prosumer" cameras offered about one megapixel, and were very expensive (CCD, in-camera storage on perhaps 8Mb wafers, hard-disk storage, network transmission). Today the best prosumer standard is ten megapixels, in-camera storage can be several gigabytes, a 2Gb SD card costs about $35, and a vest-pocket-sized 40Gb USB2 external disk-drive costs under US$100. Sony has also produced an eight-megapixel camera which also does 640x480 video—a huge advance on the other still-camera competition, because it offers relatively large images.

Nor will change stop here; it is only 15 years since 20Mb was a large hard disk, and when images could be digitised only by scanning—but not displayed world-wide because the internet did not exist. The future will certainly give us larger digital images: nothing can really be "fixed," since available pixellation keeps changing and networks get faster; thus the plentiful one-megapixel images on http://rubens.anu.edu.au looked brilliant in 1994, but scarcely shine now. The recurring nightmare of digitisation is any perceived need to re-do the process with improved technologies and resolutions, the difficult and unanswerable questions for images (not text) being "Is this resolution OK forever—or will it look as silly on the technology of 2015 as do today the images I digitised in 1995?"

APPENDIX 1:

RENAISSANCE-RELATED VENTURES WITH STILL IMAGES

Iconclass (http://www.iconclass.nl) "is a subject specific international classification system for iconographic research and the documentation of images," which is used by large and important collections around the world, such as the Princeton Index of Christian Art (http://ica.prince-ton.edu), the Bildarchiv Foto Marburg (http://www.bildindex.de) (with over 1.7 million images), the Netherlands National Library (http://www.kb.nl, Italy's Istituto Centrale per il Catalogo e la Documentazione (ICCD) (http://www.iccd.beniculturali.it). Its categories are essential for those institutions with the funds to catalog their materials in depth; amongst IC-CD's online image collections are 50,261 black-and-white images of Rome and the Abruzzi, 21,397 postcards, etc. (http://www.iccd.beniculturali.it), an Atlante dei Centri Storici (http://80.205.162.228/iccdms/index.html),

le Piazze storiche dell'Italia meridionale e insulare (http://80.205.162.233
/piazze/presentazione.htm), with over 10,000 images.

The Princeton Index of Christian Art (http://ica.princeton.edu).

Digital Scriptorium at Berkeley (http://sunsite.berkeley.edu/scriptori-
um): "an image database of medieval and renaissance manuscripts, in-
tended to unite scattered resources from many institutions into an inter-
national tool for teaching and scholarly research."

Iter: Gateway to the Middle Ages and the Renaissance at the University
of Toronto (by subscription) (http://www.itergateway.org).

The Warburg Institute Library Digital Collection (http://www2.sas.ac.uk
/warburg/mnemosyne/DigitalCollections.htm): "The aim of these digi-
tal collections is to make out-of-print source material on Medieval and
Renaissance studies freely available online"—and many of the books are
illustrated.

The Centro di Elaborazione Informatica di Testi e Immagini nella Tradizi-
one Letteraria at the SNS, Pisa (http://www.ctl.sns.it): "si propone di
realizzare progetti di ricerca che, avvalendosi anche della tecnologia in-
formatica, studino i complessi rapporti tra parola e immagine presenti
nella tradizione letteraria."

The Census of Antique Works of Art and Architecture known to the Re-
naissance (http://www.dyabola.de/de/projekte/projects.htm), the com-
puterization of which I initiated in the late 1970s, is now run by Dyabola:
"a computerised database of some 25,000 images and 40,000 documents."
It is available at Humboldt University in Berlin, at the Warburg Institute
in London, the Hertziana in Rome, and at the Getty Research Center.

Nolli's Map of Rome: It may be significant that the programmers on the
Piero Project moved on to dealing with Nolli's map, the best and most
detailed capturing of Baroque Rome, and of which there are several com-
puterised versions. This is a project which is in a much more manageable
two dimensions.

University of Oregon: The Interactive Nolli Map Website (http://nolli.uoregon.edu): This project shows the possibilities of "extending" two dimensions not only by making the map "zoomable," but also by optional layers which can add walls, fountains, gates, etc.

University of Oxford: Three-dimensional Analysis and Reconstruction of Paintings (using Renaissance paintings) (http://www.robots.ox.ac.uk/~vgg/projects/SingleView/examples.html).

La nuova topografia di Roma from Berkeley provides a simple enlargement of Nolli's plan (http://www.lib.berkeley.edu/EART/maps/nolli.html).

More plans of Rome: A broader view is provided by the Biblioteca Hertziana's COPRO (http://fmdb.biblhertz.it/cipro/)—the Catologo Illustrato delle Piane di Roma Online.

Forma Urbis: Another map project of interest for Renaissance studies (not least because Renaissance artists provide some of the evidence for lost sections) is of the classical map—http://formaurbis.stanford.edu/—the Stanford Digital Forma Urbis Romae Project.

Schoenberg Centre for Electronic Text and Image (University of Pennsylvania) includes The English Renaissance in Context (ERIC) funded by the National Endowment for the Humanities (http://dewey.library.upenn.edu/sceti/furness/index.cfm?nav=furness). The Centre also houses the Edgar Fahs Smith Collection on the history of Chemistry (http://dewey.library.upenn.edu/sceti/smith/index.cfm?nav=smith).

Renascence Editions: An Online Repository of Works Printed in English Between the Years 1477 and 1799 (http://darkwing.uoregon.edu/~rbear/ren.htm).

Theses should be published online immediately when they are accepted, with the ludicrous embargoing a thing of the past: this is beginning to happen: cf. ProQuest digital dissertations at Columbia University (http://www.columbia.edu/cu/lweb/eresources/databases/2554991.html); or more specifically, with Doctoral Dissertations in Musicology-Online at Indiana (http://www.chmtl.indiana.edu/ddm/). Other countries such as

Germany (http://www.dissonline.de) and Australia (the Australian Digital Theses Program) (http://thesis.anu.edu.au) are doing likewise.

Joint Warburg Institute / Warwick University project: Resources and Techniques for the Study of Renaissance and Early Modern Culture (http://www2.warwick.ac.uk/fac/arts/ren/warburgwarwick):

> The programme trains students to: Create and analyze databases for Early Modern sources; Digitize their own texts. . . ; Be familiar with a variety of online resources relating to the Renaissance. . . ; Interpret a variety of visual images. . . ; Have knowledge of the main resources for iconographic research and of the census of Antique works of art known to the Renaissance

and so forth.

APPENDIX 2:

PROJECTS TARGETING INDIVIDUAL ARTISTS AND AUTHORS

Alciato's Book of Emblems (http://www.mun.ca/alciato).

The Piero Project ECIT—Electronic Compendium of Images and Text (http://etc.princeton.edu/art430/art430.html): The page, which is undated, refers to a VRML model of Piero's *Flagellation* as "new," but the link to the necessary player (*Cosmo Player*) is broken and, in any case, this player is outdated. The *Flagellation* can certainly be manipulated with more modern players, but it is difficult to see extensive advantages for the study of Art History from such a large programming effort. The spatial relationships in this painting are well known, and can be admirably stated in a 2D diagram.

The Digital Michelangelo Project (http://www-graphics.stanford.edu/projects/mich) explains that "[r]ecent improvements in laser rangefinder technology, together with algorithms developed at Stanford for combining multiple range and color images, allow us to reliably and accurately digitize the external shape and surface characteristics of many physical objects." But the problem is the perennial one with VRML and other Virtual Reality applications—namely that the laser/computer combination cannot deal accurately with *surface textures*. The project caught publicity

because of the fame and size of the statue: laser renderings can be much more conveniently prepared of smaller works; but the utility of such techniques in the teaching and learning of Renaissance art history remain to be seen. Notionally, three dimensions (especially rotatable) are very useful in the teaching of the history of sculpture); and we look forward to a demonstrator project with a wide range of samples. Until then, still images will rule.

Gutenberg Digital (http://www.gutenbergdigital.de): from the State and University Library of Lower Saxony in Goettingen: "All 1282 pages of the two volumes of the Bible were scanned in at high resolution and processed for online presentation"—and are also available on CD-ROM.

Renaissance Dante in print from the University of Notre Dame (http://www.nd.edu/~italnet/Dante/); Francesco Colonna (or perhaps Alberti): the Hypnerotomachia Poliphili (http://mitpress.mit.edu/e-books/HP/index.htm and also http://mitpress.mit.edu/e-books/HP/hyp000.htm).

APPENDIX 3:

WEBSITES DEALING IN WHOLE OR IN PART WITH RENAISSANCE IMAGES

ACLS History E-Book Project (http://www.historyebook.org): "a collaboration of eight learned societies, sixty contributing publishers, and librarians at the University of Michigan's Scholarly Publishing Office. The result is an online, fully searchable collection of high-quality books in history, recommended and reviewed by historians."

Bodleian Library: Western Manuscripts to c. 1500 (http://www.bodley.ox.ac.uk/dept/scwmss/wmss/medieval/medieval.htm).

Druckgraphische Buchillustrationen des 15. Jh (http://mdz.bib-bvb.de/digbib/inkunabeln)).

Kaiserurkunden in Abbildungen (http://mdz.bib-bvb.de/digbib/urkunden1/kuia/@Generic_CollectionView;cs=default;ts=default).

Historisches Forum (http://edoc.hu-berlin.de/e_histfor/5): Band 5, 2005, "Sichtbarkeit der Geschichte: Beiträge zu einer Historiografie der Bilder."

Historische Literatur: Rezensionszeitschrift von H-Soz-u-Kult (http://edoc.hu-berlin.de/e_histlit/2004-4).

Joconde (http://www.culture.gouv.fr/documentation/joconde/fr/apropos/preface.htm), the Catalogue of French museum collections: 280,000 records from over 140 museums.

kunsttexte.de (http://www.kunsttexte.de): "*künstlerischen Präsentationen und themenspezifischen Beiträgen aus der Kunstgeschichte, aus der Musik- oder Literaturwissenschaft, aus der Philosophie, der Geschichtswissenschaft oder den Rechtswissenschaften offen-sofern sie einen direkten Bezug zur Kunstproduktion und -rezeption aufweisen.*"

Muqarnas: An Annual on the Visual Culture of the Islamic World (http://archnet.org/library/documents/collection.tcl?collection_id=86): vols 1–15 currently available online.

Downloadable.pdf files of *Renaissance News and Notes* (http://www.rsa.org/rnn.htm).

Downloadable.pdf files of *Renaissance Quarterly* (from 2004) (http://www.rsa.org/rq.htm).

Renaissance Society of America (http://www.rsa.org).

Semantic Web (http://semantic-web.ask.dyndns.dk): "a project that intends to create a universal medium for information exchange by giving meaning (semantics), in a manner understandable by machines, to the content of documents on the Web."

Ulrich's Periodicals Directory (http://www.ulrichsweb.com/ulrichsweb):

> In response to the evolving opportunities in serials information, ulrichsweb.com is now showcasing Open Access (OA) journals—free electronic full-text academic and scholarly journals from SPARC, PLoS, Biomed Central, the Directory of Open Access Journals, and other providers. Ulrichsweb.com subscribers can now search for and directly access the home pages and full-text of hundreds of these exciting new research resources.

Manuscripts: the Renaissance in the Vatican (http://212.77.1.230/en/v
_bav/manoscritti/index.shtml).

Visual Resources Association (http://www.vraweb.org): "A multi-discipli-
nary community of image management professionals working in educa-
tional and cultural heritage environments."

Wiki (http://wiki.ask.dyndns.dk): "a web application that allows users
to add content"—with software such as MediaWiki (http://mediawiki.
ask.dyndns.dk) which runs the very useful web encyclopaedia called
Wikipedia (http://wikipedia.ask.dyndns.dk).

The best online encyclopaedia? Wikipedia (http://wikipedia.ask.dyn-
dns.dk):

> one of the most popular reference sites on the Web, receiving
> around 60 million hits per day. Wikipedia contains approximately
> 1.5 million articles, more than 500,000 of which are in its English
> language edition, more than 200,000 in the German language and
> more than 100,000 each in Japanese and French. . . there is no
> formal review process.

Surely one big problem with such a setup (since we might expect ency-
clopaedias to be authoritative) is that, if anyone can edit it [". . . and we
encourage users to be bold. . . but don't be reckless!" (Introduction)], just
how authoritative can the end product be? Will the Wikipedia turn out
to be a brilliant idea, with splendid software, but dogged by anonymous,
insecure articles not written by experts?

Wiki encyclopaedia entries: Renaissance Architecture (http://en.wikipe-
dia.org/wiki/Renaissance_architecture), Italian Renaissance (http://en.
wikipedia.org/wiki/Renaissance_Italy), and Renaissance Warfare (http:
//en.wikipedia.org/wiki/Renaissance_Warfare).

<center>APPENDIX 4:

CONFERENCES AND REPORTS</center>

Kevin Kiernan *et alii*: Digital Imagery for Works of Art (http://www.dli2.
nsf.gov/mellon/report.html).

Pedro González: Computerization of the Archivo General de Indias: Strategies and Results (1998) (http://www.clir.org/pubs/reports/gonzalez/contents.html).

Dan Hazen *et alii*: Selecting Research Collections for Digitization (1998) (http://www.clir.org/pubs/reports/hazen/pub74.html).

Commission on Preservation and Access: Scholarly Resources In Art History Issues in Preservation (1989) (http://www.clir.org/pubs/reports/cpaarth/cpaarth.html).

Report of the Joint Task Force on Text and Image: Preserving the Illustrated Text (1992) (http://www.clir.org/pubs/reports/presillu/presillu.html).

Charles S. Rhyne: Computer Images for Research, Teaching, and Publication in Art History and Related Disciplines (http://www.reed.edu/~crhyne/papers//computer.html).

Improved Color for the World Wide Web: A Case Study in Color Management for Distributed Digital Media (http://www.color.org/wpaper2.html).

Robert Rieger: Tools and Techniques in Evaluating Digital Imaging Projects (http://www.rlg.org/preserv/diginews/diginews3-3.html#technical1).

RLG DigiNews: A bimonthly electronic newsletter that focuses on digitization and digital preservation (http://www.rlg.org/en/page.php?Page_ID=12081).

Howard Besser *et alii*: Introduction to imaging (http://www.getty.edu/research/conducting_research/standards/introimages).

Investigating the Renaissance: Examining material aspects of three early Netherlandish paintings using digital imaging techniques (http://www.artmuseums.harvard.edu/Renaissance).

APPENDIX 5:

PORTALS NATIONAL AND INTERNATIONAL

ARTHIST: Digital Resources and New Media (http://www.arthist.net/Link-ERes.html).

ARTHIST: H-net information network for art history (http://www.arthist.net/StartE.html): an excellent resource, with Networks (http://www.arthist.net/LinkENet.html) (i.e., associations, discussion lists, electronic networks, and art, galleries and exhibitions).

Art Museum Image Consortium (http://www.amico.org/AMICOlibrary/contents.html).

Digital Library Federation (http://www.diglib.org).

The European Library (portal) (http://www.theeuropeanlibrary.org/portal/index.htm).

Istituto Internazionale di Storia Economica "F. Datini:" Banca Dati Immagini (http://www.istitutodatini.it/biblio/images/it/presenta.htm):

> raccoglie immagini che possono essere utilizzate come fonti per la storia economica o come corredo di studi e ricerche sulla storia dell'economia e della società, con particolare riguardo all'età preindustriale.

Kunstbibliotheken-Fachverbund Florenz—München—Rom (http://www.kubikat.org/index.de.htm): network catalogue.

Portal Kunstgeschichte (http://www.kubikat.org/index.de.htm): "a growing online collection of high-quality, digital documentation of works of art from around the world" (over 100,000 items in 2002).

World Wide Web-VL History Central Catalogue (http://vlib.iue.it/history/index.html), which includes some later material from Virtual Library Geschichte—Frühe Neuzeit (http://www.geschichte.fb15.uni-dortmund.de/links) at the University of Erlangen-Nürnberg.

UNESCO Archives Portal: An international gateway to information for archivists and archives users (http://portal.unesco.org/ci/en/ev.php-URL_ID=5761&URL_DO=DO_TOPIC&URL_SECTION=201.html).

World Wide Web Virtual Library: History and Images Index (http://vlib.iue.it/hist-images/index.html).

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Arabic manuscripts in the National Library of the Czech Republic. Gallery. http://digit.nkp.cz/knihcin/digit/KatalogCD/EN/COLLEC_1/gallery.htm.

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Document understanding and character recognition WWW server. University of Maryland. http://documents.cfar.umd.edu.

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Renaissance Studies and New Technologies:
A Collection of "Electronic Texts"

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With the introduction of early digital processors such as the University of Pennsylvania's Electronic Numerical Integrator and Calculator (ENIAC) in the years immediately following World War II, humanist scholars began exploring ways in which they might use the new technology in their disciplines. The first linguistic and literary databases were large corpora compiled for analysis rather than simple texts designed for reading. In 1949 Fr. Roberto Busa began his concordance of the works of Thomas Aquinas, eventually producing more than six million individual punch cards that formed the basis for the 60-volume *Index Thomisticus* (1974–1980) and subsequent 1992 complete works in CD format, the *Thomæ Aquinatis Opera Omnia.* Soon more projects followed: the Rev. John W. Ellison finished the *Complete Concordance of the Revised Standard Version of the Bible* in 1952 (see Ellison 1957); Fr. Busa founded the Centro per l'Automazione dell'Analisi Letteraria in 1956 to aid scholars seeking to analyze ancient and classical texts (commencing with an index to the Dead Sea Scrolls in 1958); and the French government began transcribing large numbers of texts in 1957 as part of an initiative to create the *Trésor de la Langue Française*, a new French-language dictionary.

The development of electronic resources in the study of English language and literature followed the same path pioneered by Busa *et alii.* The University of California published Guy Montgomery's concordance to Dryden's poems in 1957, but the book itself was generated by running 240,000 hand-prepared index cards through an accounting machine. In 1959, Cornell University Press published as *A Concordance to the Poems*

of Matthew Arnold the print-out generated by a computer concordance program, and four years later it published a concordance to Yeats' poetry by the same scholar (Parrish 1959, 1963). Multi-author collections also began to emerge. Two national corpora were released in 1961: the *Brown Corpus of Standard American English*, the first machine-readable collection of American English texts; and the *Lancaster-Oslo/Bergen Corpus of British English*, which followed the same basic sampling principles as the Brown collection but employed a different encoding scheme. As part of an abortive effort to create an *Early Modern English Dictionary*, researchers at the University of Michigan collected citations from primary sources that became the *Michigan Early Modern English Materials*, an archive of over 50,000 records published electronically and on microfilm.

As one might expect, the works of Shakespeare in particular drew widespread albeit halting attention at this time. T. H. Howard-Hill created an old-spelling concordance of Shakespeare for Oxford in the 1960s, and he faced many of the obstacles common to early digitization projects. He employed what he described as an "English Electric KDF9" at the Oxford Computing Laboratory, a machine that at the time "was oriented towards paper-tape input" (Hill 1969a). The processor itself only held "32,000 machine words" at one time, not nearly enough "to hold even one text completely in store during computation" (Hill 1969b, 148–9). Consequently he shifted the texts back and forth between the processor and tape storage in a process familiar to viewers of old science fiction movies. Such a device imposed certain constraints upon the input: the distinction between roman and italic faces could not be retained, and the processor's character set did not support many of the common early modern features such as digraphs, tildes, ligatures, and accents. More important for bibliographers and textual critics, Howard-Hill did not have a good way of preserving physical phenomena found in early modern books, e.g., foul case and turned letters, and press variants.

In 1967, the Atlas Computer Labs in England introduced a strategy that would eventually provide a solution for this last problem. Count and Concordance Generation on Atlas, or COCOA, allowed database designers to identify textual features such as paragraphs or lines and generic parameters such as author and title using a simple set of in-line codes. As it

evolved, COCOA relied upon a minimized encoding scheme, i.e. the tags indicated the front of a data structure, and the back of that structure depended upon contextual elements. Meanwhile, an IBM research team led by Charles Goldfarb invented an alternate tagging scheme called Generalized Mark-Up Language (GML) in 1969, which improved upon COCOA by introducing a formalized grammar and a structural design based upon nested elements. This later became Standardized General Mark-Up Language, or SGML, the direct precursor of the current HTML and XML systems. An international group of computing humanists formed the Text Encoding Initiative in 1987 with the goal of creating standards to help individuals and institutions build on-line texts for teaching and research. The group has published mark-up guidelines for both SGML and XML encoding, and in 2000 it became a nonprofit consortium jointly hosted at the University of Bergen, Brown University, Oxford University, and the University of Virginia.

Electronic Text Archives

By the mid-1970s everything was in place for the emergence of the first large-scale accessible electronic text archives: digital technology had evolved to the point where researchers could store large data files; ARPANET, the forerunner of the modern internet, had come on-line; academic organizations such as the Association for Literary and Linguistic Computing had begun to form; and standard mark-up protocols had been developed. Lou Burnard founded the Oxford Text Archive in 1976 while still a graduate student, establishing a collection policy that stressed preservation, access, scholarly interest, and intellectual integrity. Early depositors ranged from Sidney Michaelson, the first Professor of Computer Science to be appointed at the University of Edinburgh, to Louis Ule, who keyboarded early modern texts as part of a project to prove that the works of Shakespeare were written by Christopher Marlowe. The OTA has grown from a handful of files to more than 2500 resources, most of which are freely available, although the level of editorial integrity and encoding sophistication remains mainly in the hands of the depositor. While the OTA staff has added SGML headers to aid in finding and evaluating electronic works, the content of the files themselves depends almost entirely on the rigor of the creators, and consequently the level of tagging varies:

early texts such as the anonymous *Arden of Faversham* still exist as untagged, all-capital transcriptions; others such as Shakespeare's "The first part of the Contention betwixt the two famous houses of Yorke and Lancaster" (*2 Henry VI*) have only simple COCOA tagging; still others feature TEI-compliant SGML encoding—many of the early-quarto transcriptions of Ben Jonson's plays created by Hugh Craig, for example.

For the first dozen years of its existence the OTA was the only major repository of its scope and ambition available to scholars of English language and literature. However, a second archive emerged in 1988 when members of the Scholarly Technology Group at Brown University established the Women Writers Project, an initiative with the stated aim of creating a full-text database of women's writing in English from 1330–1830. As a condition of its initial funding agencies the WWP was constituted as a partially self-supporting organization, and access to its texts is limited by a licensing agreement. Unlike the OTA (and subsequent electronic text collections), the WWP created their on-line holdings themselves, which allowed them to maintain a much higher level of consistency among files. The project's staff employ an explicit set of guidelines that dictate editorial rationale as well as the type and level of text encoding, giving the collection as a whole a valuable integrity.

Soon after the WWP was formed, other academic institutions began compiling their own archives of electronic texts from available sources. Rutgers and Princeton Universities established the Center for Electronic Texts in the Humanities (CETH) in 1991, an organization whose brief includes not only the creation and archiving of etexts but also a significant amount of development and research work. The CETH staff have built a number of analytical tools for the investigation of electronic resources, and they sponsor a summer institute for scholars, teachers and librarians interested in humanities computing. The University of Virginia followed close on the heels of CETH and founded its Electronic Text Center (ETC) in 1992 as a public access unit within the University Library. It strove to provide a wide variety of electronic texts featuring a uniform level of mark-up, first in TEI-compliant SGML and later in XML. Virginia's ETC also decided early on that it would include the training of faculty, staff, and students as part of its core mission, and over the years it has created a large collection of on-line

resources for those interested in compiling or using electronic resources. It has also inspired and served as initial home for a significant number of independent projects by scholars, for example the digitization of the entire back catalogue of *Studies in Bibliography*, a leading journal in the field of bibliographical and textual studies. Overall, however, its etext collections share the same reliance upon depositors for quality assurance as the OTA, and scholars need to pay careful attention to information about a file's creation and emendation history before including it in research plans.

During the ensuing explosion of digital library services in the 1990s, electronic text centers and archives usually followed either the CETH or the ETC model, i.e. specializing either in development or teaching. About the same time as Virginia's Center first appeared, Indiana University created the Library Electronic Text Resource Service (LETRS), a collaboration between the University Libraries and University Computing Services. Like the ETC, the LETRS initiative revolves around etext collections and assorted user services: they offer native and commercial etexts encoded in SGML/XML; they operate a Humanities Computing Lab in the main University Library for user access and development needs; and they provide consultation within the field of humanities computing to the Indiana scholarly community. Two years later in 1994 the University of Michigan followed suit and created the Humanities Text Initiative with the same core mission as existing centers, although the emphasis was on development rather than outreach. This technical side of the initiative was formalized in 1996 when the HTI became part of Michigan's Digital Library Production Service (DLPS), a shift that had a significant impact on etext delivery when the Service bought the rights to Open Text's SGML/XML search engine OT5. Under the guidance of the DLPS and its ancillary group the Digital Libraries eXtensions Service (DLXS), the Michigan staff began licensing the search engine, now dubbed XPAT, and distributing versions of popular Chadwyck-Healey and InteLex textual databases (see below) specially prepared for use with XPAT. To date DLXS provides over two dozen universities and other research institutions in North America, Europe, and Australasia with the powerful search software and database packages.

In addition to archives specializing in English-language works, a number of institutions have established electronic text centers dedicated to a variety of different linguistic traditions. The University of Chicago and the

Centre National de la Recherche Scientifique established American and French Research on the Treasury of the French Language (ARTFL) in 1981, combining the original data generated by the 20-year effort to compile a new French dictionary (see above) into a 2000-title corpus of seventeenth-to twentieth-century works. The University of Bergen has long been a leader in humanities computing and electronic text development. They currently support two technology research groups, one focusing on language (computational linguistics, corpus linguistics, terminology, and lexicography), the other on text (encoding standards and digital editorial philology), as well as the European Manuscript Server Initiative, which seeks to provide digital facsimiles of manuscript collections accompanied by sophisticated finding aids. Many other institutions and individuals have published archives of varying sizes on the internet; however, these archives frequently move due to changes in funding priorities or the relocation of those responsible for their maintenance. Until the public text archive movement becomes settled, the best strategy for locating digital materials is a combined application of internet search engines and consultation with resource directories maintained by numerous universities.

The increasing availability of inexpensive, powerful desktop computers and web servers enabled humanities scholars with more focused needs to create and distribute smaller etext archives based on their own work. Perhaps the most notorious example of this type of scholarship concerns the attribution of "A Funeral Elegy" to Shakespeare. Donald Foster created a lexical database he dubbed SHAXICON that included only relatively rare words, i.e., those that appeared in the Shakespeare canon 12 times or less. Using this database he argued that such words were not randomly distributed throughout the texts but rather clustered due to the fact that Shakespeare composed new plays while he was also on-stage performing existing ones. When he performed a rare word on stage, that word was retained in his memory and was much more likely to be employed in the play he was currently writing. Foster (1996) went on to use this resource as part of his *Elegy by W.S.: A Study in Attribution*, in which he laid out the linguistic and biographical evidence for Shakespeare's authorship. Six years later Foster recanted his attribution on the SHAKSPER discussion list after Gilles Monsarrat demonstrated the likelier composer to be John

Ford (SHAKSPER, Foster Letter). Gabriel Egan has subsequently created a public-domain version of Foster's database called SHAXICAN.

Like Foster and Egan, many scholars and students have created their own digital resources, and the ever-growing number of these collections prevents any attempt to include a comprehensive list in this essay. Furthermore, many early modern texts in public archives derive from the same out-of-copyright sources and print facsimiles: nearly all on-line Shakespeare texts descend from transcriptions of early folio and quarto witnesses (for example those created by Howard-Hill for his concordance) or from the so-called "Moby Shakespeare" that itself most likely comes from either the 1866 Globe Shakespeare or the 1911 Stratford Town edition; a popular digital version of Milton's *Paradise Lost* is in fact a silent transcription of the Scolar facsimile of the 1667 ten-book first edition. Nonetheless, certain special-interest archives rise above the crowd for their overall quality and application to Renaissance studies:

* Michael Best's *Internet Shakespeare Editions* project follows an evolving rationale for editing and tagging texts, and uses a peer-review system when considering submissions from individual scholars;
* Bernice Kliman's *Enfolded Hamlet* offers the second quarto and first folio versions of Hamlet in separate and combined forms for literary analysis;
* Hilary Binda's old-spelling edition of the *Complete Works of Christopher Marlowe* adds historical collations to the texts and plans to integrate horizontal press variants in the future;
* Ian Lancashire's *Renaissance Electronic Texts* site, though small, features SGML-tagged versions of neglected texts as well as a valuable set of encoding guidelines;
* Lancashire's *Representative Poetry On-Line*, a digital collection that grew out of the 1912 print *Representative Poetry*, includes a large number of early modern authors;
* *The Digital Scriptorium*, a joint venture between the Bancroft Library of the University of California, Berkeley, and Columbia University's Rare Book and Manuscript Library, is compiling an image database of medieval and Renaissance manuscripts;
* *Perdita*, a compilation of early modern women's manuscript writings has been underway since 1997 and plans to collect 400 witnesses (see

"The Perdita Project: Women's Writing, Manuscript Studies and XML Tagging").

However, despite notable efforts such as these, most early modern texts currently available from public repositories remain transcriptions from public domain sources with some level of tagging added for analysis or web presentation.

Commercial Editions and Databases

While academics, computer hobbyists, and public institutions were compiling on-line digital archives, commercial publishers also began testing the market for electronic editions and databases. Over the past 15 years, major university presses such as those at Oxford, Cambridge, and Michigan as well as commercial publishers such as W. W. Norton and Addison Wesley Longman have released a variety of products as stand-alone CD-ROMs or on-line networked resources. Although their primary focus has been on electronic journals, references, and education products, the academic presses have published important electronic titles. When Oxford began work in 1984 on the second edition of its *Oxford English Dictionary* (OED2), they decided to base the multi-volume text on pages generated from a master text in electronic form. This enabled them in 1992 to release the OED2 in CD-ROM and later as a subscription-based on-line edition. At the same time they also began publishing a series of editions under the series title "Oxford Electronic Text Library," eventually issuing in SGML-encoded form the *Riverside Chaucer*, the *Poetical Works of Samuel Taylor Coleridge*, the *Complete Works of Jane Austin*, and John Locke's *An Essay Concerning Human Understanding.* Cambridge also generated a number of digital resources, especially in collaboration with the Centre for Technology and Arts at De Montfort University; together they have published the annual *The World Shakespeare Bibliography* on CD-ROM for a number of years, *William Shakespeare: King Lear in Performance* (2000), a series of titles from Chaucer's *Canterbury Tales* ("The Wife of Bath's Tale," 1996, and "The General Prologue," 2000), and Johnson's Dictionary on CD-ROM (1996). Michigan has a less ambitious electronic agenda, with a digital catalogue headed by the *Society for Early English and Norse Electronic Texts* (SEENET) series and the *Dictionary of Old English Corpus in Electronic Form.* As

part of their popular classroom anthologies, educational publishers like Norton and AWL have pursued a strategy of augmenting their literary survey compilations with additional texts, usually short extracts from long out-of-print titles by Samuel Purchas, Walter Ralegh, Gervaise Markham, or Thomas Blenerhasset. A number of image facsimiles of early modern editions have also begun to appear in the marketplace, the most notable of which is the Octavo series; as of 2007 their catalogue included nearly four-dozen offerings.

A few electronic editions of major authors were published in the 1990s, although they are the exception rather than the rule. As one might expect, the works of Shakespeare were an early subject for electronic publishing. In 1988 both the *Riverside Shakespeare* and the *New Oxford Shakespeare* had a public release: the Riverside came bundled with the WordCruncher text analysis software and used a proprietary encoding system, while the Oxford edition was published on floppy disks and used COCOA. The *Riverside Shakespeare* was soon extracted from WordCruncher, its encoding shifted to SGML, and the text loaded onto the protected directory of many academic etext archives. Perhaps because teachers were familiar with the Riverside edition from its 1974 print version, it soon became the more popular of the two editions, spawning numerous educational resources as well as a list of textual errors posted on the SHAKSPER academic discussion list archives. Roy Flanagan also published on floppy disk his edition of the works of John Milton in 1990, an edition notable for its inclusion of a textual apparatus alongside its other secondary materials. Virginia's Electronic Text Center subsequently added SGML encoding and made this resource available in restricted form to its academic community. Beyond literary collections, the InteLex Corporation introduced its Past Masters series in 1989, a growing collection of mainly philosophical texts in English and English translations, and in 2001 introduced an English Letters series. The corporation now retails its products in both CD-ROM and networked form.

The most important (and controversial) commercial databases are those created by University Microfilms (UMI) and the Chadwyck-Healey company. UMI began microfilming books in 1938, creating its long-running *Early English Book* series as a facsimile companion to the first edition of the

Pollard and Redgrave *Short-Title Catalogue of Books printed in England, Scotland and Ireland, and of English books printed abroad, 1475–1640* (*STC*: the initial 1926 edition was replaced by a second expanded edition 1976–91). The company soon enlarged its activities to include a wide variety of scholarly material, including its *Dissertation Abstracts* and *Newspapers and Serials in Microfilm* products. Chadwyck-Healey was founded in 1973 as a microfilm-based publisher that reproduced such materials as Parliamentary papers, government archives, and other types of primary resources. Both companies responded to the increasing availability of computer technology by generating digital versions of their publications. In the mid-1990s UMI began converting its Renaissance and Restoration microfilmed books into digital form which became the basis of it *Early English Books Online* (EEBO) database. When completed the collection will include all of the titles in their *Early English Books I and II*, microfilm archives that cover most of the *STC*, Donald Wing's *Short Title Catalogue of books printed in England, Scotland, Ireland, Wales, and British America, and of English books printed in other countries, 1641–1700* (1972), and the UMI *Thomason Tracts* collection and *Early English Books Tract Supplements*. Chadwyck-Healey complemented its established publications with a new series of full-text literary databases that eventually encompassed a wide variety of genres (poetry, drama, prose, Bibles, criticism, and journalism) and languages (English, French, German, Spanish, Italian, and Latin).

For a number of years UMI had been publishing data in CD-ROM form under the subsidiary label ProQuest, and in 1995 they launched an on-line service using the same umbrella name. In 1999 UMI/ProQuest purchased Chadwyck-Healey, forming a large text-and-image service providing digital databases covering numerous subjects—business, journalism, science and technology, education, humanities and social sciences, and medicine. They then began augmenting their EEBO image archives with companion texts, in collaboration with Oxford University, the University of Michigan and the Council on Library and Information Resources, through the *Early English Books Online Text Creation Partnership* (EEBO-ECP). The current goal of this initiative is to create 25,000 electronic texts encoded in XML as a scholarly companion to their 125,000 digitized pre-1700 titles.

As large, high-profile, and expensive products, the ProQuest text and image databases have drawn criticism from a number of academic corners. EEBO generated its images from UMI microfilms, many of which were created in the 1940s and 1950s, and which suffered from legibility problems stemming from the high-contrast, stark black-and-white microfilm stock. In addition the digital conversion process often lacked strict quality control, with the result that many titles lacked openings or complete sections, included duplicate images, and assembled the page sequences out of order. The Chadwyck-Healey literary databases were also plagued with flaws that prompted criticism from scholars. Because the editors chose as their textual sources the latest public domain titles, the databases consisted of popular editions edited and modernized in sometimes eccentric fashion by Victorian editors mixed with less-popular, unmodernized first editions. As a result the data had no internal consistency concerning textual emendation and modernization. Furthermore, Chadwyck-Healey used as its guide for inclusion the *New Cambridge Bibliography of English Literature* (NCBEL) with some unintended consequences. Because Samuel Johnson and Jonathan Swift are not listed as poets in the NCBEL, their poems are not included in the *English Poetry 600–1900* database, thus ignoring such literary staples as "The Vanity of Human Wishes" and "A Description of a City Shower." Finally, Chadwyck-Healey altered from database to database its Document Type Description (DTD), the file that defines where and how all tags in the text can be used. Searching across multiple databases thus became more complicated since the basic structure of the documents differed among themselves.

A number of text development and analysis tools have been written over the past decades to complement the burgeoning text database offerings. The *Oxford Concordance Program* (OCP), developed under the directorship of Susan Hockey, was first released in 1981 as a mainframe-based KWIC concordance and frequency application (it was later written to work on the Windows operating system). In 1989 the first instantiation of *Text-Analysis Computing Tools* (TACT) was presented as a shareware package at the joint ACH/ALLC conference in Toronto. Built for the MS-DOS platform, TACT is a collection of linked routines to compile different kinds of concordances, frequency and distribution analyses, and collocation tables. Peter Robinson published his *Collate* software in 1991 for the Macintosh system,

an editorial and analytical tool designed to compare multiple textual witnesses and generate a variety of reports detailing the relationship among them. An updated version of *Collate* that accommodates texts marked up in HTML/SGML was released in 1994.

The most popular tools, however, have arisen from the rapid popularization of the internet in the early- to mid-1990s and the resultant adoption of basic HTML schema among humanists in the academy. The National Center for Supercomputing Applications (NCSA) at the University of Illinois released Mosaic in the spring of 1993, and while a number of previous web browsers had been written, Mosaic was the first to achieve widespread popularity. It was followed a year later by Netscape's Mozilla tool, and by Microsoft's Internet Explorer in 1995. In the area of SGML and XML online publishing, packages such as Anastasia (developed by Peter Robinson, Norman Blake, and Elizabeth Solopova for the Canterbury Tales Project; see below), PhiloLogic (created by ARTFL and the Digital Library Center at the University of Chicago), and the Versioning Machine (designed at the Maryland Institute for Technology in the Humanities) have greatly expanded support for scholars seeking to build textual resources that exploit the rich possibilities provided by sophisticated mark-up schemes.

Electronic Scholarly Editions

The bulk of the energy expended during the initial phases of electronic text development was directed at the transcription and collection of materials first published in codex (and sometimes scroll) form. These texts primarily supplied the basis for linguistic analyses aided by tools described above, and secondarily afforded readers wider access to works of humanist and scientific achievement that could be viewed only in the most simplistic of formats. However, many scholars also recognized the potential of digital technology to enrich the ways in which we organize and present the larger constellation of biographical, historical, sociological, and literary information surrounding literary texts. The history of scholarly editing can be viewed in part as the struggle to reconcile these disparate classes of data into a single coherent package. In his influential essay "The Rationale of Hyper-Text," McGann characterizes the problems facing editors of a traditional critical edition:

> Brilliantly conceived, these works are nonetheless infamously dif-
> ficult to read and use. Their problems arise because they deploy a
> book form to study another book form. This symmetry between
> the tool and its subject forces the scholar to invent analytic mecha-
> nisms that must be displayed and engaged at the primary reading
> level—e.g., apparatus structures, descriptive bibliographies, cal-
> culi of variants, shorthand reference forms, and so forth. The
> critical edition's apparatus, for example, exists only because no
> single book or manageable set of books can incorporate for analy-
> sis all of the relevant documents. In standard critical editions,
> the primary materials come before the reader in abbreviated and
> coded forms. (McGann 1994)

Computer technology not only frees the scholar from the constraints of
the codex form, it provides new tools and strategies for investigating lin-
guistic creations. Whereas electronic text archives are concerned mainly
with the "search-and-display" function, scholarly editors "find in the elec-
tronic medium opportunities to extend their notions of what constitutes
the work of art and how it can be read" (Shillingsburg 1996, 163). Deter-
mining just what constitutes an electronic scholarly edition has proven
as difficult as defining its print antecedent; nevertheless, the Modern
Language Association's Committee on Scholarly Editions has drafted a set
of "Guidelines for Electronic Scholarly Editions" and in 2006 published
Electronic Textual Editing, a collection of essays that outlines the current
standards applied to modern digital scholarly editions.

Scholarly editions, codex or digital, require a significant investment of
time and resources, and while a number of projects are currently under-
way, few have published anything. In 1989 the British Leverhulme Trust
awarded a three-year grant to the Computers and Manuscripts Project, an
initiative that set the stage for the Canterbury Tales Project (CTP). As of
2003 the CTP had issued three titles, all on CD-ROM: the "Wife of Bath's
Prologue" (1996); the "General Prologue" (2000); and the *Hengwrt Chaucer
Digital Facsimile* (2000). The project team has also developed and market-
ed an electronic publishing tool called Anastasia (Analytical System Tool
and SGML/XML Integration Application) which was designed to meet the
special problems posed by increasingly complex electronic editions.

A number of initiatives are now underway to edit in digital media canonical English Renaissance authors. Gary Taylor and John Lavagnino have been heading the Oxford Middleton Project since 1991, an ambitious enterprise involving nearly 60 scholars of early modern culture whose goal is to publish the complete works of Middleton in both print and electronic format. They will create their own camera-ready copy for printing from their digital files and encode the digital version in TEI-conformant XML. In the mid-1990s Ian Donaldson, David Bevington, and Martin Butler organized a group of two dozen scholars to edit the works of Ben Jonson. Initially this project was under the umbrella of Oxford University Press, but after disagreements over electronic publishing the edition moved to Cambridge University Press. Building upon digital strategies developed in both academia and private industry, the Jonson project has designed its edition as a pair of complementary resources: a seven-volume, modern text print edition, and a networked electronic edition containing the full print edition as well as original-spelling texts, digital facsimiles, and secondary archives. Publication of the *Cambridge Edition of the Works of Ben Jonson* is now planned for the spring of 2008. Recently Patrick Cheney, Elizabeth Fowler, Joe Loewenstein, and David Miller reached agreement with Oxford to create a new scholarly edition of the works of Spenser, while Raymond Siemens is preparing an electronic edition of an important sixteenth-century poetic miscellany (see "The Devil is in the Details: Encoding and Prototyping an Electronic Edition of the *Devonshire MS* (*British Library Additional MS 17,492*)" in this volume). The Modern Language Association has also given the go-ahead to publish the *New Hamlet Variorum* simultaneously in print and electronic form.

Case Study: The Academic Scholarly Archive

While the individual electronic edition has garnered a great deal of attention among scholarly editors and computing humanists, a growing number of universities has committed significant institutional resources to research and development centers, often under the aegis of the university library, which foster the creation of the next generation of digital publications: the electronic scholarly archive. The traditional scholarly edition is arranged hierarchically in a pyramid fashion, with varying amounts of primary, secondary, and tertiary documentation supporting

the freshly edited text at its pinnacle. The electronic scholarly archive replaces hierarchy with a multi-dimensional web structure that is both noncentralized and infinitely expandable. In this hypertextual environment, interpretive and editorial control transfers to the user, who is "encouraged not so much to find as to make order—and then to make it again and again, as established orderings expose their limits" (McGann 1994).

One of the earliest and most productive of research centers is the Institute for Advanced Technology in the Humanities (IATH) at the University of Virginia. Founded in 1992, IATH's state mission is "to provide scholars in the humanities, with the time, the tools, and techniques to produce lasting contributions to the human record, in electronic form." To that end, the Institute has provided fellowship support in the form of office space, advanced computer software and hardware, and technical expertise to dozens of electronic projects in a variety of fields. Early in its life, the IATH spawned two ambitious and influential archive projects which have set the tone for those that followed. The Complete Writings and Pictures of Dante Gabriel Rossetti, begun in 1993 by Jerome McGann and scheduled for completion in 2008, will include

> high-quality digital images of every surviving documentary state of [Rossetti's] works: all the manuscripts, proofs, and original editions, as well as the drawings, paintings, and designs of various kinds, including his collaborative photographic and craft works,

as well as "a substantial body of editorial commentary, notes, and glosses." A year later, Hoyt N. Duggan founded the Piers Plowman Electronic Archive. Unlike the Rossetti Archive, which has remained an IATH project accessible solely over the Internet, the Piers Plowman archive has partnered with the Society for Early English & Norse Electronic Texts and with the University of Michigan Press to publish a series of editions in CD-ROM format. Piers Plowman, a medieval dream-vision in alliterative verse, exists in three different versions (A, B, and C), each of which is represented by multiple textual witnesses, more than 50 manuscripts in all. The Archive's goal is to create a multi-level, hypertextually linked archive of all three versions, then employ those materials to reconstruct the archetypes (i.e. the common ancestor text) for all three witnesses.

In the years that followed the emergence of the Rossetti and Piers Plowman projects, the IATH has supported initiatives in the disciplines as diverse as linguistics, folklore, ethics, and architectural history, and the research topics have ranged equally widely in time and (virtual) space, from John Dobbins' The Pompeii Forum Project to LaVahn Hoh's The Circus in Europe and America: 1793–1930. IATH projects of particular interest to literary scholars include The Melville Electronic Library (John Bryant and Haskell Springer), The Walt Whitman Hypertext Archive (Kenneth M. Price, Ed Folsom, *et al.*), Dickinson Electronic Archives (Martha Nell Smith *et al.*), The William Blake Archive (Morris Eaves, Robert Essick, Jospeh Viscomi), and the Uncle Tom's Cabin and American Culture: Multimedia Archive (Stephen Railton).

The expansion into the humanities of increasingly powerful networked digital technologies has challenged scholars to rethink their definitions of what constitutes text. Each advancement in the computer's capabilities adds to the possible range of objects we might investigate. Our ability to represent in ever more sophisticated fashion the material forms through which information is transmitted forces us to consider anew the role those forms play in creating meaning. In his 1984 Panizzi Lectures, the bibliographer and critic D. F. McKenzie argued that we should include under the umbrella term text all

> verbal, visual, oral, and numeric data, in the form of maps, prints, and music, of archives of recorded sound, of film, of videos, and any computer-stored information, everything in fact from epigraphy to the latest forms of discography. (McKenzie 1985)

At the time, McKenzie's wide net raised not a few eyebrows. Today, it now appears to many distinctly conservative.

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Introduction

The study of early music has been dramatically affected by the advent of the internet. Perhaps the technology that has had the most profound influence on the discipline has been the availability of e-mail, discussion lists, and society listservs, providing scholars and lay people with opportunities to exchange ideas and materials without the delay of traditional modes of communication.

The best-known phenomenon in the emerging field of computer resources in music is the proliferation of sound files—mostly popular music—in compressed format known as MP3. To date that format contains very few examples of music written in the Early Modern era. The availability of sample music through on-line music stores such as Amazon.com and Barnes&Noble.com, as well as in other specialized sites such as *The Classical Music Archives* or the webpages of professors at numerous universities around the world, has changed the lives of scholars, students, professional musicians, and music listeners in general.

Technological advances are often accompanied by numerous growing pains. Following the advent of printing, texts were produced in an effort to reach wider audiences. Many of these, in a wide variety of subjects, especially music, were based on the most popular source materials. Printed books of music assumed diverse appearances, in large measure due to varieties in printing and notation. Today, music notation software has revolutionized the music publishing industry, but not without similar problems in lack of standardization. The advantages include allowing

composers to produce professional-quality scores and scholars to prepare critical editions more efficiently and economically. Optical music recognition (OMR) is still in the process of developing adequate techniques (MacMillan, Droettboom, and Fujinaga 2002). Once accomplished, OMR and other newer technologies will redefine the way musicians are able to analyze musical scores. A manuscript of 15th-century polyphonic music could be scanned and translated into modern notation, something that now can only be accomplished by a scholar familiar with the system of mensuration in place in the Renaissance. Other musical sources from antiquity through to the present day could be scanned and their content analyzed for melodic, harmonic, rhythmic and other basic ingredients.

Databases

The availability of searchable on-line bibliographical databases is probably the most beneficial computer tool for all music scholars in the last decade. One of the most useful and important bibliographical databases for music scholars is RILM (*Répertoire International de Littérature Musicale*). RILM Abstracts of Music Literature contains over 400,000 entries from over 500 scholarly periodicals from 60 countries with 140 languages and includes original-language titles, title translations in English, full bibliographic information, and abstracts in English.

The most important music reference in English has been the Grove's Dictionaries for generations of music scholars. *The New Grove Dictionary of Music and Musicians* volumes are available on-line and have greatly enhanced the usability of these valuable sources.

Other major resources include: RISM (*Répertoire International des Sources Musicales*); "Music manuscript after 1600" is an annotated index and guide to music manuscripts produced between 1600 and 1850 containing more than 412,000 works by over 18,000 composers found in manuscripts over 595 libraries and archives in 31 countries. The music manuscript database contains over 506,000 searchable musical incipits, which can be viewed as musical scores.

Hans Lenneberg's statistics in *On the Publishing and Dissemination of Music 1500–1850* (2003) reveal that more than a third of modern writings about

publishing and printing in his bibliography of over 326 titles deal with the first one hundred years of the field, while only 24 titles concern the 17th century, 64 the 18th, and 80 the 19th. What these numbers indicate is a trend in scholarship aimed at earlier periods of music history. We see similar patterns emerging in the types of music databases now available in electronic format.

The Scribe Medieval Music Database at La Trobe University is a collection of 6000 musical scores, color images, texts, and bibliographic information on medieval music, searchable by text or melody. It includes the complete annual cycle of liturgical chant taken from original medieval sources, and the complete works of selected composers from the twelfth to the fifteenth centuries (Stinson 1992).

CANTUS, a database started at Catholic University in the 1980s and now hosted at University of Western Ontario, contains indices of Latin ecclesiastical chants in over 70 selected manuscripts and early printed sources of the liturgical office. It is searchable by first few words, keywords, chant identification number or liturgical occasion. Further downloadable chant resources collected by an IMS (International Musicological Society) Study Group can be found at *Cantus Planus Archiv* at the University of Regensburg.

For scholars working on 16th-century motets, there is a database in progress at the University of Florida School of Music. There, a musicologist is working with computer scientists to incorporate programs for searching and dating of sources. The catalogue indexes manuscripts and printed anthologies produced between 1475 and 1600 and contains an estimated 33,000 motet and Mass Proper appearances. Each part of each motet is indexed as a separate record; the total number of records stands at 50,040 (April, 2002). The next phase of the database project will add the contents of single composer prints (Thomas 1999).

In development since 1989, *Thesaurus Musicarum Latinarum* (*TML*) is a full-text searchable database (with ASCII text and associated image files) containing a large corpus of Latin music theory written during the Middle Ages and the Renaissance. Similar databases of texts on Italian music theory and aesthetics are *Saggi Musicali Italiani* (*SMI*) and *Texts on Music in English from the Medieval and Early Modern Eras* (*TME*). Another source

for Italian treatises, from the Renaissance and early Baroque, is *Thesaurus Musicarum Italicarum* (*TMI*). One of the features of this collection, not available in others, is that the many terms are hyperlinked. The CD-ROM version of this database contains complete facsimiles and they are being made available on line.

Relics (*Renaissance Liturgical Imprints: A Census*) at University of Michigan is a database of worship books printed before 1601 and currently contains over 13,882 titles. The database can be searched by various fields including printer, publisher, language of text, country of probable use, and so forth.

Les sources manuscrites de la théorie de la musique by Christian Meyer (CNRS) is a general list of more than 1200 known manuscripts up to c. 1500. This database provides information concerning the date, origin, source, and RISM reference of each entry.

Computer Applications

Music historians have used computers for a range of tasks. Medieval and Renaissance applications include examples of computer-assisted examination and analysis of notational signs in twelfth-century manuscripts (Loos 1996), of the oral transmission of Old Roman chant (Haas 1997), and of a computer program to compare a number of motets with questionable attributions (Thomas 1999). There are a number of computer analyses of motets by William Byrd and other English composers that make an effort to confirm authorship (Morehen 1992; Wulstan 1992, 1995). There are also systematic studies of vertical sonorities and melodic features of works by Italian Renaissance theorists and composers (Moll 1996). One example took Palestrina's Masses from the Casimiri edition, entered them into a database without text using a MIDI synthesizer, where they were examined by customized programs, and manipulated by spreadsheet software. Areas of investigation included prolations and contexts of note spans and rests, including metric and textural aspects; the distribution of pitch classes, including the effects of mode; and the distribution of individual pitches correlated with voice ranges. Conclusions revealed that Palestrina's pitch-class collection was conservative and common voice ranges were narrower than previously reported (Miller 1992).

Images   In the area of musical images and iconography, work has been done with the superimposition of divergent sixteenth- and seventeenth-century prints, such as those in the William Byrd edition (Brett and Smith 2001). Other studies focusing on images include one that describes some post-processing procedures for scanned images in re-establishing the content of medieval sources for sacred vocal music preserved in the Vatican Library (Planchart 2001).

Another, The Digital Image Archive of Medieval Music (DIAMM), provides a new resource for scholars desiring to digitize, archive, and make available images of primary sources and to develop techniques of digital image-enhancement, or "virtual restoration," to retrieve lost data or improve the legibility of materials that cannot at present be read (Wathey, Bent, and Feely-McCraig 2001).

Notation   Another area of research concerns the transcription of tablatures. Software has been developed to facilitate the assignment of voices when transcribing tablature, lute and guitar, into modern notation (Charnassé 1991; Derrien-Peden, Kanellos, and Maheas 1991; Kelly 1995).

Performance Practice   Performance practice is an area in need of further investigation. There is one study that automatically assigns proper fingering for English keyboard music (1560–1630), examining 60 surviving manuscripts, half of which contain fingerings. Ten important works with fingerings are stored and analyzed and then applied to those without fingerings (Morehen 1994).

Conclusions

Recent scholarship is beginning to acknowledge the value of computer-aided research. In an article in *Acta musicologica*, Matthew Balensuela urges the use of computer searches of text to aid scholars who are studying early music theory (2003). He calls for a closer examination of treatises using computer-aided studies to investigate unacknowledged borrowings. Balensuela states "While databases like the TML can be an important resource in the study of early music theory, computerized text databases

are limited by the exactness of the text search and by the sources included in the database" (2003, 15). Once the limitations are addressed, it is hoped that more scholars will avail themselves of electronic resources.

In order for the technology to have an impact on how we study music in the Early Modern era, the compilation of massive amounts of data, and the development of newer and more sophisticated techniques for archiving and searching the data, must be accompanied by standard procedures and systematic instructions for creators and users. Portals and centralized organizations that can oversee the proliferation of materials will ensure quality and adequate use. Tracking and evaluation become critical tools to both the creator and user. Institutions must continue to recognize electronic scholarship and to encourage faculty members to employ the best of the web-based information in their teaching and research. Only then will the materials found in electronic format find their place alongside the standard printed materials. The advantages of ongoing revision, adaptation, searching capability, and immediate feedback should provide incentives.

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Iter: Building an Effective Knowledge Base

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The relationship of a card catalogue to a collection of print media is insufficient as a model for an online project that aspires to take advantage of the immense potential of the web for connecting different datasets. Indeed, as it becomes increasingly common to distribute digital collections over the web, it is very clear that online bibliographies and catalogues should provide more than a sophisticated body of databases which point or actively link to digital collections. Such bodies of metadata should aim ultimately to enable researchers to interact seamlessly with the digital documents themselves. Indeed, in this environment, the traditional distinction of metadata (or catalogues) and data (or collections) may well be finessed through an interface which searches both simultaneously. Of course, this raises new challenges of collaboration, access, knowledge management, standards, and delivery, all of which require answers reflecting the needs of the relevant community of scholars.

The shift from standalone (meta)data to a rich, interactive and interconnected digital environment provides the broad context for the present essay wherein I will focus on the strategies being entertained by Iter, Inc. to establish a robust gateway for the study of European culture. I will begin by outlining the current status of Iter's datasets, beginning with those which seek to provide metadata for

* the gamut of print and digital media used for formal scholarly communication (e.g., articles, essays, books, and reviews),
* scholars, the relevant academic societies and research institutions (e.g., directories, detailed information pages), and finally,
* the more ephemeral scholarly communications (e.g., calls for papers, awards, grants, research opportunities).

This will be followed by a brief review of Iter's collaborative initiatives. In the course of outlining Iter's projects and their interrelationships, I will give you some idea of what new developments one might expect to see in the near future especially with regard to more powerful searching tools and alerting services. I will then conclude with a few thoughts on the more challenging issue of the connection between metadata and the objects being described, the goal of building an effective knowledge base.

Let me begin by stating the mandate of Iter. Created in 1995 and incorporated in 1997 as a non-profit partnership, Iter is devoted to the advancement of learning in the study of European culture from 400 to 1700 through the development and support of electronic resources.[1] As its primary enterprise, Iter is creating a sophisticated gateway to all relevant resources which employs a network of bibliographies and databases, and which connects as closely as possible to the objects themselves.[2] This gateway for Medieval and Renaissance studies is to be comprehensive in scope, timely in its delivery of new information, and accessible to the academic community both with regard to cost and the use of technology. As its secondary enterprise, Iter assists in the development of digital research projects and services which complement its central mission.

To understand the context for this mandate, it is important to look at Iter's governance, because Iter is essentially a response to the needs of the academic community as they are represented by its scholarly societies and research centres. To be specific, Iter is governed by an Executive Board which currently includes the Director and representatives from two academic societies (Renaissance Society of America and Sixteenth Century Society and Conference), two research centres (Arizona Center for Medieval and Renaissance Studies at Arizona State

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[1] The early history of Iter is presented in Bowen 2000. Some of the initial challenges faced in creating Iter are examined by Iter's first Project Manager, Tracy Castell [1997]. Highlights of Iter's history are recorded on its website under "Project Information."

[2] Iter's primary focus is reflected in its name, which was inspired by Paul Oskar Kristeller's *Iter Italicum*, a massive finding aid for uncatalogued or incompletely catalogued, humanistic manuscripts. In so far as "iter" is Latin for the act of traveling as in a journey, or a course or route followed, it seems appropriate to the underlying conception of Iter as a gateway.

University, and the Centre for Reformation and Renaissance Studies at the University of Toronto), and the University of Toronto's Faculty of Information Studies and John P. Robarts Library (i.e., Information Technology Services). These six partners are supplemented by formal relationships with a number of non-profit academic organizations, including the Canadian Society for Renaissance Studies / Société canadienne d'études de la Renaissance, Institute for Research in Classical Philosophy and Science (Princeton), International Society of Anglo-Saxonists, Medici Archive Project, Medieval Academy of America, and MOISA: the International Society for the Study of Greek and Roman Music and Its Cultural Heritage. Through the composition of its Executive Board and its association with other academic organizations, Iter strives to identify and to address the large-scale needs of the scholarly community in a marriage of expertise in Medieval and Renaissance studies with that in information studies and in new technologies.

Core Projects

In its formative stages, Iter's partners were driven by the need for a truly comprehensive and up to date bibliography. This remains our central project. At the end of 2007, the bibliography surpassed 1 million records for publications in journals since the late 18th century (e.g., articles, reviews, review articles, bibliographies, catalogues, abstracts, and discographies) and in books (e.g., essays, encyclopedia entries), in addition to monographs and dissertations.[3] It is updated daily, with more than 60,000 new records added annually. Its latest search interface offers basic searching by keyword and advanced searching by author, title, and for selected records by Library of Congress subject headings, Dewey Decimal Classification, and expert keywords. The interface supports Boolean and positional operators, and allows the user to limit searches by language, publication type, and publication year. Results lists can be sorted by author, subject, title, relevance, or publication year (old to new or new to old). Records can be marked and conveniently emailed or downloaded.

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[3] The journals and collections indexed are listed on the Iter website. It is worth noting that journals are indexed from their inception.

Figure 1

The sample record (Figure 1) shows the richness of a full record and the use of hyperlinks to enable internal searches.

Future plans for the bibliography are ambitious. Although we have made an initial foray into the world of electronic resources, it is anticipated that Iter will soon offer a significant number of bibliographic citations for online research projects and publications, a frontier that raises substantial challenges with regard to the identification and collection of sources for research: further formats and media will be added thereafter. Beyond the continuing efforts to create a comprehensive bibliography, Iter is also working on connecting its records to the cited material. Two strategies are in play. Where possible, we have begun to embed urls in the records to take the user to the relevant materials: this technique has worked well, for

example, in supplying connections to ProQuest Digital Dissertations and to the titles in the Early English Books Online Text Creation Partnership. While this initiative is worthwhile, it is labour intensive and can be frustrating for a user when her/his institution does not have a license to see the source material. A second strategy provides a partial solution. Since January 2008, Iter's central bibliography has been in conformity with the OpenURL standard, a framework which in this context enables links to be created automatically between bibliographic records and their targets. Accordingly, at the large number of institutions which follow this international standard, individuals will find that Iter records will lead simply to the electronic resources licensed by their home institution without any intervention by Iter itself. A further strategy will be introduced in the discussion of individual subscriptions.

While this bibliography absorbs much of Iter's energy, the partnership is also committed to building a network of databases which will connect to and complement its central project by offering details about scholars, research projects, scholarly associations, and research centres. The range of these secondary databases can be sketched with three examples. The most mature is the *International Directory of Scholars* (hereafter *IDS*), an unusual resource in so far as it goes beyond the usual contact information associated with directories for academic societies by including fields for detailed information on research and teaching. Further, *IDS* is cumulative, not an annual directory typical of most societies, and has the potential to include much more data than is practical in print. A parallel project is found in Iter's rudimentary directory for Renaissance institutions that we expect to replace with a new, comprehensive directory for Medieval and Renaissance studies in co-operation with the CARA Data Project, sponsored by the Medieval Academy of America's Committee on Centers and Regional Associations. This new combined database will emulate the rich structure of what is available through *IDS*. Finally, Iter has made some headway in establishing a free news and announcements service. Our goal is to provide a sophisticated, web-based clearing house for information about calls for papers, conferences, programs, jobs, grants, prizes, and other announcements of interest to the scholarly community served by Iter. The news generated by this service would be distributed through RSS feeds in order to encourage the community to participate.

Collaborative Projects

In addition to its own central bibliography and complementary databases, Iter works with other organizations and individuals to publish and/or distribute research. For example, in cooperation with Brill Academic Publishers, Iter offers an online edition of Paul Oskar Kristeller's *Iter Italicum*, the massive finding listing of uncatalogued, or incompletely catalogued, humanistic manuscripts of the Renaissance, in Italian and other libraries around the world. Updating and improving access to this finding list is the first step in a program supported by the Gladys Krieble Delmas Foundation to enhance access to information about manuscripts. New and forthcoming projects include a number of resources for English studies such as John Shawcross's revised and greatly expanded Milton bibliography. This is the first in a series of co-publications with ACMRS, through Medieval and Renaissance Texts and Studies Online, which includes digital-born projects, such as Betty Travitsky's *Bibliography of English Women Writers, 1500-1640* (forthcoming in January 2009) and several finding tools from the MRTS print catalogue. A similar relationship exists with CRRS Publications, beginning with the distribution of their journals and newsletters, including *Early Theatre*, *Records of Early English Drama Newsletter*, and *Renaissance and Reformation / Renaissance et Réforme.* The collaboration with CRRS Publications will expand in the near future with the release of the first titles in The Other Voice in Early Modern Europe: The Toronto Series, edited by Margaret L. King and Albert Rabil, Jr. This project is an exciting continuation of the well-known University of Chicago print series.

Through its partnership with the University of Toronto Libraries, Iter also has the capacity to host or publish independent projects related to its mandate, such as Erika Rummel's *Electronic Capito Project* on Wolfgang Faber Capito. In this case, the website supplements the volumes of translated letters published by the University of Toronto Press. A more ambitious undertaking is the *Baptisteria Sacra: An Iconographic Index of Baptismal Fonts* with its images and detailed descriptions of thousands of fonts from the early Christian period to the 17th century. The scope of Iter's ability to support such independent research projects and, indeed, institutional initiatives, has yet to be fully explored. With access to a variety of platforms

including T-Space,[4] Open Journal and Open Conference Systems,[5] Iter is well positioned to host a wide range of scholarly initiatives, whether small or large in scale.

Personalized Access

A significant part of Iter's strategy for serving the community centres around the individual as opposed to anonymous institutional subscriptions, for the real strength of the evolving support systems is enabled through personalized access. There are a multitude of reasons for emphasizing personal access. At one end of the scale, individual subscriptions are practical necessity for those scholars who find their institutional access insufficient, when, for example, the institution limits use of their networks and services to on-campus terminals. Then, there is the notion of limited access for editing information. This includes the capacity for editing a personal record in the *IDS*, or keeping track of and editing submissions to the proposed announcements service—a sort of MyIter approach.

It is also essential that individuals have personalized access if they are to be able to choose to take advantage of links to external resources. In this regard, Iter may be able to negotiate individual access to large-scale projects which are not affordable to many institutions. If Iter is able to negotiate as a virtual community with owners of large online resources, it may provide some relief for independent scholars or for those at have-not institutions. For example, Iter might facilitate access to projects: in this model, individual subscribers to Iter will have the choice of having access to the full-texts for a very modest fee. Furthermore, personalized access is also the key to a proposed alerting service which will advise individuals of the arrival of materials in Iter's bibliographies and other resources that are relevant to the individual's interest. Given that Iter indexes more than 60,000 items in a year, this will be a considerable service. The strategy we

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[4] T-Space is the University of Toronto implementation of MIT's D-Space, a very user-friendly management system for archiving materials. The system ensures stable urls, support of many different formats, and increasingly powerful tools for searching.

[5] These open source systems were developed by the Public Knowledge Project for "the management, publishing, and indexing of journals and conferences."

are considering is quite straightforward. Incoming data will be checked against an individual's profile as established in their record in the *IDS*. In this profile, individual will have the option to choose from various categories defining interests in time period, geographic area, subjects. This will be used as the basis for selecting relevant materials as they arrive at Iter and sending notices to the individual as frequently as s/he chooses.

Iter as Knowledge Base

In 2009, Iter expects to release an interface capable of global searches. With such a system, the user might look up "Ficino," for example, and choose to apply the search to the bibliography, full-text resources, directories of scholars and research institutions, all or various components of a news and announcement service, discussion lists, and, through federated searches, to external online dictionaries, encyclopedias, and full-text projects. In an ideal world, Iter might be permitted to return results from large bodies of full-text, such as ACLS Humanities E-Book, JSTOR, ArtStor and so on, even though there may need to be some form of intermediate authentication for access to the document itself.

Given this development, perhaps it would be useful to reflect for a moment on what Iter is and might aspire to be. At the moment, a simple answer is that Iter is evolving into an integrated network of databases that point to the gamut of scholarly objects. In effect, it is becoming a starting point for navigating through a vast body of information. One might even be tempted to suggest that Iter provides a matrix which could be used to the advantage of other research projects, including full-text projects, in so far as they could be integrated into a broader network dedicated to a specific area of study.

Yet, I think that Iter itself might have the potential to do more. At this point, it is primarily (though not exclusively) a centralized body of metadata which, in various ways, connects the user to documents and other objects. In this way, it provides a most useful service as a gateway. However, I can imagine it evolving into something that might be better described as a knowledge base. Though the term is used loosely, it tends to signify a centralized body of information with management systems

that optimize information collection, organization, retrieval, and dissemination. Certainly Iter seems to fit the spirit of the definition now. But if Iter's metadata and the information it describes are encoded according to standardized systems, perhaps Iter could assist the user in interacting with the information itself.

With these final musings, I am trying to indicate that the near future for Iter seems relatively clear. We have a simple—though terrifyingly ambitious—plan to collect all relevant metadata and to connect it to the objects. Yet what is less obvious is the more distant horizon, particularly now that we are beginning to assess the possibilities of encoded texts, data exchange, and interoperability. For this work leads me to wonder if Iter might evolve into an organic, more substantial connection between metadata and data wherein Iter's resources and tools actually enable the user not only to discover information, but also to analyse and assess it. And it is here that life gets interesting. If Iter is becoming a knowledge base, it is one which answers very straightforward questions about an object—such as Who is working on it? What has been written about it? Where is the action? and so on. It might even provide some sort of answer to the question of What is it? through connections to dictionaries and encyclopedias. But what it cannot do is answer questions pertaining to text or document analysis. And it is here that I think Iter needs to build relationships with others so that it becomes a more comprehensive and effective research tool.

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ACLS Humanities E-Book Project[*]

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Background

The History E-Book Project (HEB) began in June 1999 when ACLS received a $3-million, 5-year grant from The Andrew W. Mellon Foundation. Three years later, two years ahead of schedule and considerably under-budget, it achieved one of its major goals when on September 1, 2002 the HEB website was launched online with over 500 titles reviewed and recommended by historians. HEB currently offers more than 1500 titles in all fields and areas of humanities scholarship and is expanding its coverage by nearly 500 titles a year. On July 1, 2007 HEB officially became ACLS Humanities E-Book.

ACLS has a long commitment to innovation in scholarly communication. In recent years it has addressed these interests with projects aimed at its various constituencies and their professional concerns. Its Cyberinfrastructure Commission and report seeks to address the current crisis in scholarly communication through the adoption of common digital standards and approaches on the highest levels of university administration. Its new Digital Innovation Fellowships seek to fund individual scholars' efforts to investigate key issues in the humanities with digital tools and techniques. The History E-Book Project grew out of the same underlying

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[*] This paper, originally presented at the Digital Technology sessions at the RSA meeting in Toronto in March 2003, has been substantially revised to reflect the ongoing status of the new ACLS Humanities E-Book (HEB). It will therefore discuss current modes and statistics, offer a tour through the site and its most salient features, and present some broader reflections on the status of electronic publishing of the scholarly monograph that HEB was intended to address.

concerns for scholarly publishing and was configured to address the declining reach, sustainability and responsiveness of the university presses as the publishers of our primary research: the monograph.

The project had two major objectives, which are definable and measurable. The first was to launch an online collection of books of high quality in the field of history. Most of these books are still in print, most date from the last two decades. These are works of continuing and major importance to historical studies—books that remain vital to both scholars and students, and are frequently cited in the literature. The second was to publish a corpus of new XML titles—electronic books of unquestioned quality that use electronic capabilities in ways that go beyond the merely illustrative to include varying degrees of access to wider and deeper sources of information and their analysis.

HEB also has eight general goals aimed at exploring the electronic potential for scholarly communication: its structures, assessment and rewards, preservation and access.[1] In this context, it was foreseen from the start that the day would come when the scholarly community must offer depth and quality over an undifferentiated mass of information: that the "good enough" mantra of the commercial world would have to be met with excellence.

Central to the success and sustainability of the project was our decision, made only months after the grant was awarded, to set new XML title development within the context of an existing aggregation. This made sense to us for several reasons: decades of publishing experience told us that no new series of books, no matter how important, could long survive without a vigorous publishing program behind it. Intellectually these titles also needed the deep and broad context of related historiography and the interoperable network of already established fields within which to place our new titles. Finally, the new digital world almost guaranteed that even seven dozen new XML titles would be lost amid the millions of sites and pages in the World Wide Web unless the project quickly established a reputation for the quality and depth of its collection. Absolute size

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[1] The eight general goals of HEB can be viewed at http://www.humanitiesebook.org/intro2.html.

was less important than creating a workable context and an attractive program for our subscribers and the scholarly community.

To achieve these goals HEB has several partners. First of all there are twelve ACLS learned societies with whom HEB works to determine the library of titles included on the site.[2] The societies collaborate through official liaisons, special committees, or individual scholars of known reputation. The societies include: the African Studies Association, the American Folklore Society, the American Historical Association, the American Musicological Society, the Association for Asian Studies, the College Art Association, the History of Science Society, the Latin American Studies Association, the Middle East Studies Association, the Organization of American Historians, the Renaissance Society of America and the Society for the History of Technology.

Our second group of partners is the university presses. These now include over 90 publishers, among whom are twelve partners in development for our new XML titles: California, Cambridge, the College Art Association, Columbia, Harvard, Johns Hopkins, Michigan, MIT, NYU, Oxford, the RSA and Rutgers. The university presses bring to the project both the unquestioned quality of their titles and the long and deep knowledge of the cultures of scholarly communication. HEB has continued to rely on these essential partners to tackle many of the difficult issues of publishing now facing the entire scholarly community. In addition to this group of presses we have over 300 individual authors or estates who have granted us non-exclusive rights to their books. In all this HEB is as much a laboratory as an agent for the creation of titles. As the horizons and possibilities of electronic publishing have grown, HEB has therefore also engaged libraries, learned societies and electronic publishing institutes to develop some of our more robust and born-digital works.

The library community has been an invaluable partner. From the very beginning it advised on the formation of HEB; prominent librarians sit on our review board; and libraries continue to advise us on all aspects of content, technology, usage, access and business models. Finally the

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[2] Read about the ACLS learned societies that have worked with HEB at http://www.humanitiesebook.org/societies.html.

Scholarly Publishing Office and the Digital Library Production Service of the University of Michigan have been essential allies. HEB has realized large economies in both development and ongoing operations precisely because of this partnership, as Michigan has enabled the project to piggyback on their back-end technology, to use their hosting services and to engage their development staff in all of our research and development. The relationship has been a long and mutually beneficial one and offers a model for the not-for-profit community: a demonstration of how pooled resources and experience can produce results that go beyond the capacity of any single-publisher or "zero-sum" approach.

As of July 2007, HEB had nearly 600 subscribing libraries and consortia and over 600 individuals who have subscribed as a benefit of membership in their learned societies. The Renaissance Society of America has been among the strongest supporters of this approach. Inexpensive individual subscriptions are available on the RSA website (http://www.rsa.org). These subscriptions allow students, faculty and staff to access this collection seven days a week, twenty-four hours a day using standard web browsers. Subscription prices are reasonable (from $385 to $2500/year based on Carnegie designations and FTE for institutions, $35 for individuals). Users can enter the collection via the homepage at http://www.humanitiesebook.org/ or through electronic (MARC) records, which are available free to subscribing institutions for integration into their online library catalogs.

The Titles   Of the 1500 titles online in 2006, nearly 30% are of direct interest to scholars of the Middle Ages and the Renaissance. They include over 250 titles covering Europe during the period from 400 to 1800, plus another 70 titles in Ancient European, and 75 in the American discovery and colonial periods. Smaller numbers currently cover Byzantine and Middle Eastern history. One of the special tasks of HEB has been to find and digitize extremely rare books of great importance to Renaissance studies. A good example is Remigio Sabbadini's *Il Metodo degli Umanisti*, with only two complete print copies available in the United States. Having such titles now available online highlights another important element of electronic publishing: access and preservation of rare, damaged or missing materials.

Bear in mind that all of these titles have been recommended by prominent historians and committees in their fields; many are also winners of prestigious awards granted by societies and other organizations, including Pulitzers, Bancrofts, Marraros, and National Book Awards. A breakdown by publication date of these 250+ titles will be of interest to this audience. Of these books 72 (or 28.5%) date from 1885 to 1969, 111 titles (44%) date from 1970 to 1989, and 69 titles (27.5%) date from 1990 to 2006. Titles include both in-copyright (197 or 78%) and out-of copyright (55 or 22%) works. The designations "in-print" or "out-of-print" have recently become meaningless, largely because of the advent of print-on-demand technologies and through their reprinting from such digitized collections as HEB. This compares interestingly to the entire collection currently online, of which 80% remain in-copyright and 20% in various stages of public domain, assumed "orphaned" works and the like.[3] Apropos of copyright concerns: HEB also now offers over 20,000 images, and not a single claim has been made against an image in our collection, largely the result of our DRM (digital-rights management) arrangements, our rights territory, and the scholarly use of these materials.

These medieval and Renaissance lists are slightly more skewed toward older titles than those of several other fields, perhaps because of the newness of work in fields like Women's Studies or Australasian Studies, perhaps also because of the greater impact of theory on more modern fields, or perhaps—though we have no empirical evidence for this as yet— because of the conservatism of medieval and Renaissance curricula and course reserves. We invite all RSA members to review our lists and to suggest more recent titles for possible inclusion.

Print-on-Demand   One of HEB's essential goals has been to demonstrate the practicality of implementing technologies that allow publishers to harness multiple revenue streams from the same files in any number of formats. Our print-on-demand (POD) program now makes available over 300 titles in all fields covered by the project. It brings back into print many

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[3] The College Art Association describes "orphaned" works as "works still in copyright for which no rights holder can be found" (http://www.collegeart.org/advocacy/000117).

important but hard-to-find titles for both research and classroom use, including the Sabbadini discussed above and over 40 other works in medieval and Renaissance studies. Titles are available at reasonable prices through either the University of Michigan's Scholarly Publishing Office or through such online resources as Amazon.com, Barnes&Noble.com, Powell's and others. Our program earns higher-than-expected revenues and has attracted substantial and favorable attention within the library community.

Usage   HEB serves an FTE (full-time-equivalency) of nearly 4.5 million readers with 550 institutional subscribers at universities, liberal arts, four-year and community colleges, two-year and secondary schools, including over 80 non-U.S. institutions around the world. Our subscriptions are growing at an average annual rate of about 30%. Librarians tell us that the site is used for four main purposes:

* primary research by scholars and their advanced students,
* electronic course reserves,
* collection development, especially among smaller institutions, non-U.S. schools, and new "digital-only" libraries, and
* a pedagogical tool on all levels for instructing students in the proper use of the internet and the elements of a reliable scholarly resource.

The site currently registers over 1.5 million hits (page views) a year. This figure is doubling every year. Our statistics (which track general but not individual activity) reveal that the average reader's session is now about 14 pages a visit. We cannot yet tell whether this is continuous reading or access to search-directed pages. But our statistics do tell us several interesting things: the first is that by sheer "print-run" metrics alone, our institutional subscription base is now about twice that of the average print sales for the standard monograph; that the audience available for history monographs in medieval and Renaissance studies is vastly wider and more varied than that for print ever was; and that we can now describe and analyze something about how monographs are being read—both in print and online.

Our online statistics seem to support what we have been hearing anecdotally about print monographs for at least the past decade. Monographs

are being accessed for data, for a brief summation of an author's thesis, and for further reference to sources and analysis, but they are rarely read cover to cover online. This may say something about modern reading habits, the discomfort level of our computer screens, or perhaps, and most troubling, about the structure of history monographs, the expectations of their readers or even the literary skill of their authors. While we have long suspected that "reports from the archives" rarely need to be—or ever are—read like the humanist discourse we all study and praise, the types of statistical tracking now available in the digital realm can expose all these hypotheses to objective study and analysis.

On the other hand, this new cultural *habitus* has also produced unambiguously positive results. Another finding derived from the collection is both a qualitative validation of HEB's title selection process and an illustration of the phenomenon described recently by Chris Anderson's *The Long Tail: Why the Future of Business Is Selling Less of More*. This book traces and analyzes the impact of the internet on traditional markets. Studying such digital aggregations as iTunes for music or Netflicks for movies, Anderson demonstrates how the traditional 80/20 rule ("20 percent of products account for 80 percent of sales and usually 100 percent of profits," p. 7) breaks down in the digital realm away from blockbuster hits, whether of books, films, music or any other mass-cultural product and away from single-source producers (big record, film, book companies), into a myriad of niche players who appeal to as diverse a myriad of audiences. The key is the new channels of the internet that bypass traditional distribution networks, even with newly emerging large players, such as Amazon.com or iTunes, and act more as open nodes of activity than as traditional market lynchpins. These aggregations share certain characteristics. They offer:

⋆ broad and deep collections drawn from many sources
⋆ ease of entry into the aggregation,
⋆ equality of prime "shelf space,"
⋆ robust cross-searchability,
⋆ fair pricing, and
⋆ easy delivery mechanisms.

In fact, an examination of all of the nearly 1500 titles currently in HEB— most history monographs, some over a century old—reveals that every

title has been read by subscribers at least once. That is a new phenomenon, unique to the digital world, quite unlike print sales in the traditional bookstore or publisher's "backlist." Its implications for the continued health of non-commercial, not-for-profit producers—including learned societies and university presses—are positive indeed, but only insofar as these scholarly producers collaborate to form the types of multi-producer aggregations that will appeal to a wide diversity of smaller niches: the libraries, schools and scholars who form the scholarly community.

Standards and Documentation   What then of the "history monograph" as a viable standard for scholarly communication in the digital realm? The History E-Book Project was charged with, and HEB continues to apply its energies to, the online publication of this venerable form. While we might all concede that another form—the article at whatever length—could more aptly present the vast majority of humanistic argument in more effective form, as long as universities, faculties and granting institutions (including ACLS itself) continue to base their hiring, tenure, promotion and reward decisions on the university presses' continued production of these titles, the monograph will remain the "gold standard." While moves away from the monograph—toward interactive websites, "digital commons," vast digital archives—are praiseworthy, necessary and help broaden the range and effectiveness of humanities research and writing, they do nothing to resolve the problem of the monograph's privileged position. Recent efforts among tenured faculty, university administrators and funding institutions to deny the complexity and intransigence of the problem, to belittle its importance, and/or to go off to solve *another* problem really offer no solution at all: these rhetorical and programmatic strategies merely postpone real and effective action to resolve what remains a fundamental crisis. HEB therefore takes it as a given of its core mission to grapple with how we are turning the problematic print monograph into a more useful and sustainable online form.

HEB's development strategy for its new XML titles has therefore been markedly different from those of several other projects currently underway. Rather than build a series of discreet HTML websites that depend on the talents and resources of individual scholars—and that have little promise of interactivity with one another, or of sustainability and
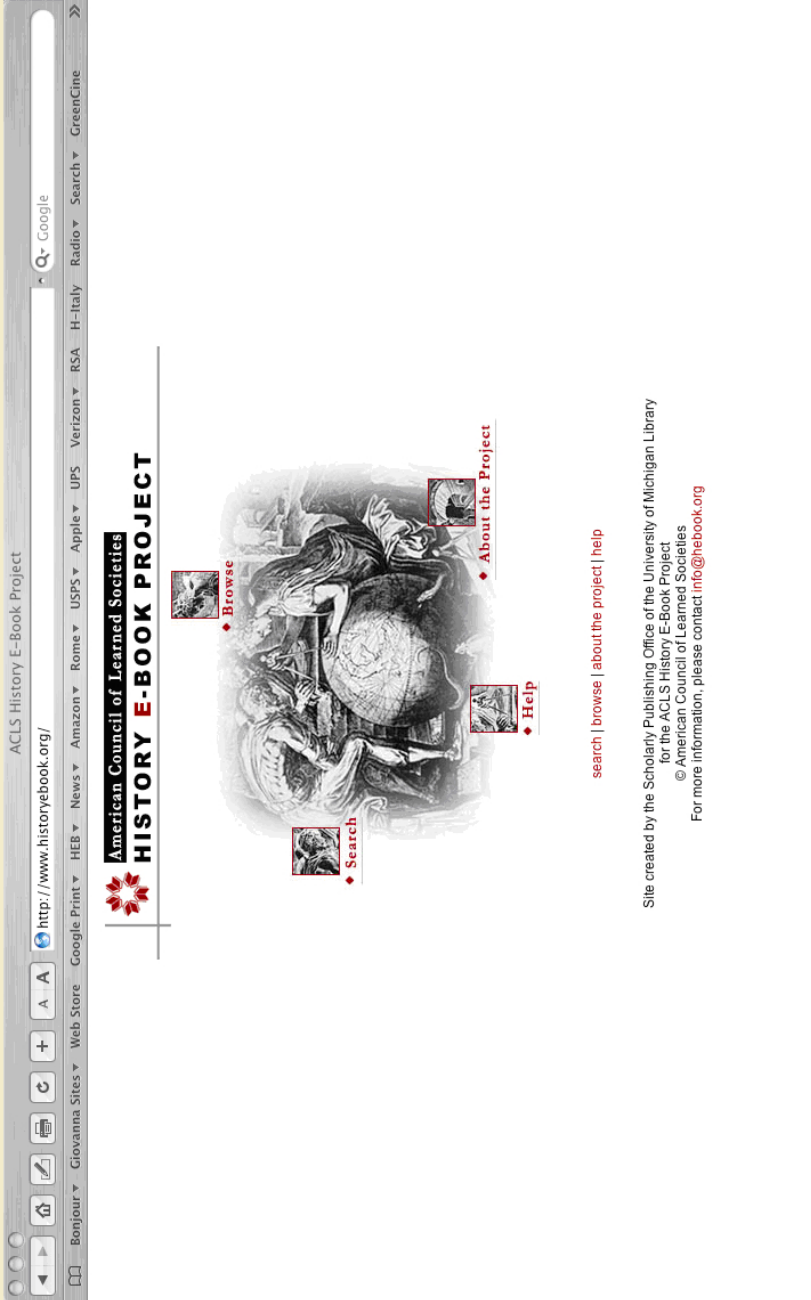
Figure 1. Home Page
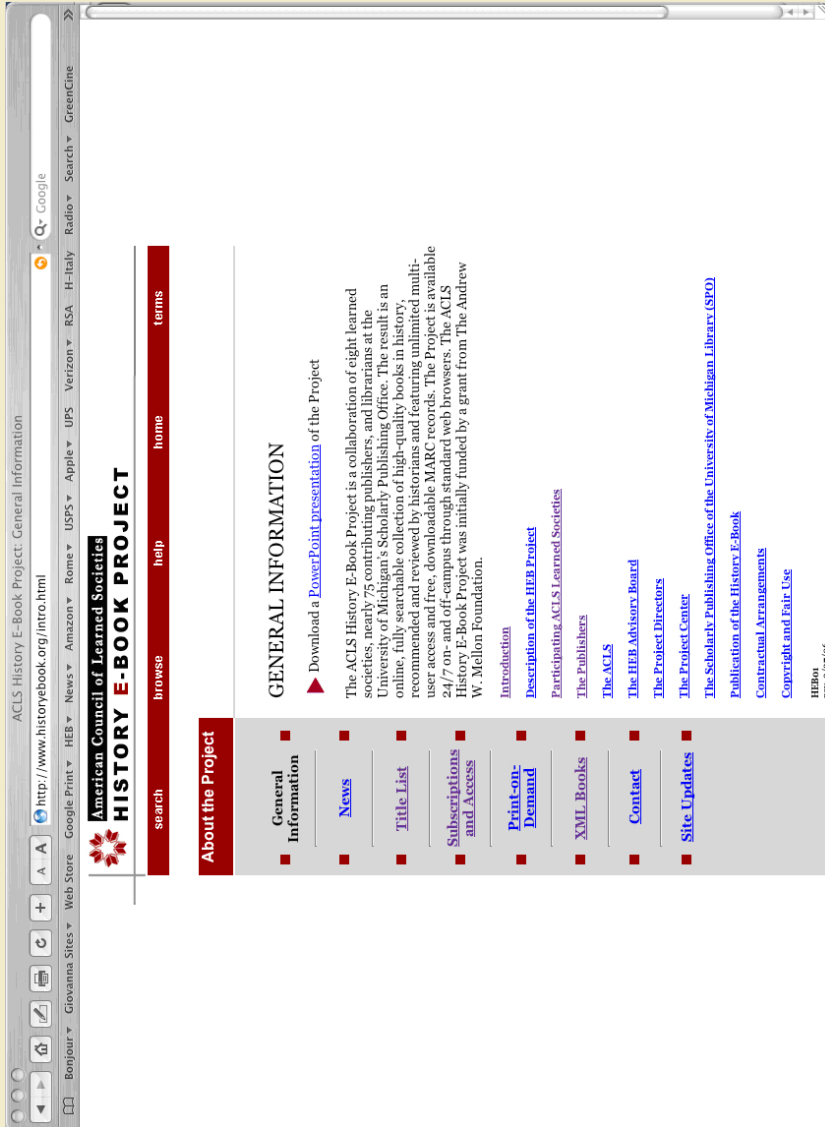
Figure 2. About the Project

scalability—HEB emphasizes the creation of infrastructure: deep and robust search capabilities, common tools, formatting, interface and interoperable standards. It thus spent its first three years of XML development creating coding and production modules that are economical and easy to use, parsable and replicable, transferable and scalable—and thus sustainable—as part of an electronic publishing program and an infrastructure of scholarly communication, available openly to authors, editors and publishers. These standards include citation and chunking methods, ongoing documentation and support publications.

The following brief demonstration will illustrate many of these points.

Demonstration[4]

The Home Page (http://www.humanitiesebook.org) displays our use of a consistent design from this page, on our brochures, and on our print advertising (Figure 1).

"About the Project" (Figure 2) is freely accessible to all (http://www.humanitiesebook.org/intro.html). It contains our complete thinking on our goals; information on our participating presses, societies and libraries; information on subscriptions, including terms and downloadable contracts; and our lists of current, new and forthcoming titles, divided by field and sortable by author or date.

Help Pages (Figure 3) are available to guide the user through the site (http://www.humanitiesebook.org/help.html).

The Browse function (Figure 4) allows the user free access to the full HEB site (http://ets.umdl.umich.edu/cgi/t/text/text-idx?c=acls&cc=acls&tpl=browse.tpl). The site permits three types of browsing: by author, by title and by subject. The subject browse is especially interesting since the browse lists are drawn dynamically from Library of Congress cataloging information in each title's MARC record. Access to full-text content is

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[4] The figures that follow reflect the History E-Book Project interface. Links provided here will bring the reader to the revised Humanities E-Book site. Function and design have been enhanced but page and title structures remain substantially the same.

Figure 3

Figure 4. The Browse Function

then available to our subscribers. Institutions can request a trial through email (subscriptions@hebook.org). Verification is by IP address, so it is transparent to the end-user. Subscription access is from on or off campus, and through special portals like library reserve lists and the library's on-line catalog.

The HEB collection combines two types of titles and technologies: OCR titles, marked by the red icon, and XML titles, marked by the blue icon. Both are fully integrated in a completely cross-searchable collection with common interface and standard tools and features.

The sample title displayed is Nancy Siraisi, *Medieval and Early Renaissance Medicine* (Figure 5), a page-image book (http://hdl.handle.net/2027/heb. 01534). Title Record Page elements include the Navigation Bars, with the top one for collection-wide navigation and the bottom one for navigating within the specific title. Each title record page includes an image of the book cover. When the cover is clicked, the image expands in a pop-up window. This is only one way of displaying images on the site; they can also be enlarged using a high-resolution image viewer—the same viewer housed at the University of Michigan employed by APIS for its online papyri collections. This is a particularly powerful tool when viewing manuscripts, sketches or engravings. The Title Record also includes a direct link to the publisher's website if the work is in print, or to the specific title if that site uses permanent URLs.

There are links from the Title Record Page (Figure 6) to bring the reader directly to online reviews in JSTOR, Project Muse or the History Co-op. For XML books, the user can access related historiography directly through a pop-up window as we include those titles on our site. The Title Record also includes cataloging information derived from the MARC record, which is free and downloadable by subscribing institutions, and which includes a permanent link to the title. The Table of Contents on the Title Record page is interactive and by clicking on a chapter title the reader reaches that chapter's opening page.

Pages can be viewed either in a larger or smaller format using the view button (Figure 7). The arrows at the top of the page provide access to next and previous pages, while the pull-down menu at the right allows

ACLS History E-Book Project: Title Record

http://ets.umdl.umich.edu:80/cgi/t/text/text-idx?c=acls;cc=acls;view=toc;idno=heb01534. · Google

Bonjour ▾   Giovanna Sites ▾   Web Store   Google Print ▾   HEB ▾   News ▾   Amazon ▾   Rome ▾   USPS ▾   Apple ▾   UPS   Verizon ▾   RSA   H-Italy   Radio ▾   Search ▾   GreenCine

American Council of Learned Societies
HISTORY E-BOOK PROJECT

| search | browse | help | home | terms |

☐ title record   ▪ contents   ▪ reviews   ▪ search this book

▪ save citation
☐ view my citations
▪ view search history

Medieval & early Renaissance medicine : an introduction to knowledge and practice
Siraisi, Nancy G.
Year: c1990.
Publisher: University of Chicago Press.
© University of Chicago Press
Publisher's Website

ⓘ page image

▼ view full catalog record

enter book ▶

MEDIEVAL & EARLY RENAISSANCE MEDICINE
Nancy G. Siraisi
An Introduction to Knowledge and Practice

● **table of contents**

Figure 5. Sample Title: *Medieval and Early Renaissance Medicine*

reviews

✓ Reviews of this work
  SQ: 46.3 (Autumn 1995): 370–371
  RQ: 47.1 (Spring 1994): 165–167
  SP: 67.3 (Jul. 1992): 747–748

catalog record

Title: Medieval & early Renaissance medicine : an introduction to knowledge and practice / Nancy G. Siraisi.

Author: Siraisi, Nancy G

Extent: 600dpi TIFF G4 page images

E-Distribution Information: University of Michigan Library, Scholarly Publishing Office
Ann Arbor, Michigan
2005
Permission must be received for any subsequent distribution in print or electronically. Please contact info@hebook.org for more information.

Source Version: *Medieval & early Renaissance medicine : an introduction to knowledge and practice / Nancy G. Siraisi.*
Siraisi, Nancy G
Chicago: University of Chicago Press, c1990.

URL: http://name.umdl.umich.edu/HEB01534

Subject Headings: • Medicine, Medieval

Note: • Electronic access restricted; authentication may be required

Encoding Description: **Project Description:**
Header created via MARC-to-XML-to-TEI transformation on 2005-01-26
Editorial Declaration:
This electronic text file was created by Optical Character Recognition (OCR). No corrections have been made to the OCR-ed text and no editing has been done to the content of the original document. Encoding has been done through an automated process using the recommendations for Level 2 of the TEI in Libraries Guidelines. Digital page images are linked to the text file.

title record

Figure 6. Links from the Title Record Page

ACLS History E-Book Project: HEB Book Page

http://ets.umdl.umich.edu/cgi/t/text/pageviewer-idx?c=acls;cc=acls;q1=plague.op2=and;o...   Q~ Google

CPT | News ▼ | CISF | Search ▼ | Lightning S | UPS | USPS ▼ | Web Store | Google Print ▼ | HEB ▼ | Amazon ▼ | Italy ▼ | Apple ▼ | Verizon ▼ | IMB | Naples Sites ▼ | Giovanna Sites ▼

American Council of Learned Societies

HISTORY E-BOOK PROJECT

search   browse   help   home   terms

■ title record ■ contents ■ reviews ■ search this book ■ search this book ■ page 8   ■ view + −

☐ save citation
☐ view my citations
☐ view search history

Medieval & early Renaissance medicine : an introduction to knowledge and practice.
Siraisi, Nancy G. *University of Chicago Press, c1990.*

◀ prev   next ▶

CHAPTER ONE

source for the physiological material was Cicero, who had presumably drawn upon a medical author. The passage is just as characteristic in its derivativeness and its subordination of secular learning to a religious purpose as it is in its use of scientific information from non-Christian sources.[9]

However, medicine considered as healing activity rather than as a branch of learning occupied a different and more complex position in the ideas of Christians of the first six centuries A.D.[10] In the most general terms, sickness, like all the other evils afflicting human life, was conceived of as a consequence of the Fall of Man, and hence as a consequence of sin. As St. Augustine (354–430) put it,

This very life, if life it can be called, pregnant with so many dire evils, bears witness that from its very beginning all the progeny of mankind was damned. . . . In fact, from the body itself arise so many diseases that not even the books of the doctors contain them all, and in the case of most of them, or almost all of them, the treatments and drugs themselves are painful. Thus men are rescued from a penal destruction by a penal remedy.[11]

On the question of whether disease was to be attributed to the particular sins of individuals or communities rather than to the general consequences of the Fall, different opinions were expressed. The founder of Christianity was twice recorded as refusing to ascribe injuries and disease to the sinfulness of a particular person or group rather than to that of mankind in gen-

Figure 7

the reader to access any page in the book directly—for example, when following a citation. There is also a "Search this Book" button in the lower navigation bar that the reader can use to perform any of the site's Simple, Boolean, or Proximity functions.

While resembling PDF files, the HEB collection is based on page-image technology developed at the University of Michigan that presents the pages on the fly using Tiff-to-Gif conversion. Searching is performed against text files behind these images and is highly accurate (99.99%) and robust. These text files are created from multiple optical-character-recognition processing of the tiffs. This is the same technology used by JSTOR.

The pages of XML titles look similar to the pages-image titles because we aimed for a standard presentation and interface, but the key elements of the XML texts are that they are fully searchable along with all other titles on the site; they are also robustly formatted in terms of book structure and parts, text block and type size. Images within the XML text can be enlarged, displayed in black and white or color at high resolution. Page breaks in "print-first" titles are indicated in brackets but omitted in "born-digital" titles. The paragraph numbers in gray allow for citation as we move more completely toward born-digital works, and they also enable chunking of text for web presentation, as well as statistical analysis and reporting for royalties. The consecutive numbering of all elements in the book is an example of HEB's approach: it resolves elegantly both the issue of citation and that of "chunking," and thus addresses both the scholarly needs and financial requirements inherent in sustainable scholarly publishing.

XML Tools and Features   HEB has used its alliance with university presses both to gradually move them toward robust XML publishing and for our own research and development: to cherry-pick a series of features appropriate to the titles the presses offered us in order to develop HEB's suite of XML tools and features. These were created as a series of open-source XML tagging modules that could be replicated, scaled and handed off to publishers, libraries and scholarly societies to produce predictably and economically any type of robust and born-digital title imaginable. To survey the resources available to authors and publishers, please consult our

ACLS History E-Book Project: XML Tools, Functions, and Capabilities

http://www.historyebook.org/xml-features.html

CPT | News ▾ | CISF | Lightning S | UPS | USPS | Web Store | Google Print ▾ | HEB ▾ | Amazon ▾ | Italy ▾ | Apple ▾ | Verizon ▾ | IMB | Naples Sites ▾ | Giovanna Sites ▾ | Search ▾ | Google

American Council of Learned Societies
HISTORY E-BOOK PROJECT

XML Tools, Functions, and Capabilities

return to main XML Books page

NOTE: To view sample links, you need to request a password or authenticate as a member of a subscribing institution.

		Description	Sample Link
Search:			
1.	Search Terms in Results List	Search terms are highlighted in yellow in search results list. To help identify relevance of hit, highlighted terms appear in context with 100 characters before and after the term.	Search results for "Rosetta Stone" (Reid, *Whose Pharaohs?*): [view]
2.	Search Terms Highlighted in Text	Search terms are highlighted in yellow on the text page. When you click an item in a search-results list, you are taken to the section of text which contains the matched terms. The highlighted terms help you to quickly identify where the search terms appear within the text. (In each instance the next / previous highlighted search term may be accessed by clicking on an arrow link.)	Search terms on text page (Reid, *Whose Pharaohs?*): [view]
Text Chunks:			
3.	Text Chunks	The text of each book is broken down and delivered in chunks by chapter, section, or paragraph range, according to the publisher's request. Delivering only portions of each book at a time to users enables us to track hits for usage and royalty purposes. For future books developed with multiple formats from the outset or born digital, text can be structured with shorter, more modular units which are better suited for	By chapter (Iriye, *Global Community*): [view] By section (Sigel, *Governing Pleasures*): [view] By paragraphs

Figure 8

list of XML tools and features (Figure 8: http://www.humanitiesebook.org/xml-features.html).

These tools and features range from our standard XML formatted text, pop-up notes and enlarged images, to our high-resolution image viewer, to the ability to compare versions of texts and images, related historiography, sound and video. We cannot here explore all the tools and capabilities available, but a few are of particular interest to Renaissance scholars.

Our first example (Figure 9) is a comparison of English and French texts from Thérèse-Adèle Husson's *Reflections: The Life and Writings of a Young Blind Woman in Post-Revolutionary France* (NYU Press).

Our next (Figure 10) is a two-up comparison of a Civil War battlefield sketch and its final published engraving from Joshua Brown's *Beyond the Lines: Pictorial Reporting, Everyday Life, and the Crisis of Gilded-Age America* (California).

Figure 11 is a high-resolution detail of the engraving on the right.

Next (Figure 12) is an example of a QuickTime music performance accompanying sheet music and analysis from Krystyn R. Moon's, *Yellowface: Creating the Chinese in American Popular Music and Performance, 1850s-1920s* (Rutgers).

HEB has also helped develop large and robust digital archives that will be hosted independently outside our subscription base and opened to ongoing scholarly correction and addition. Soon to be released is Benjamin G. Kohl, Monique O'Connell and Andrea Mozzato's *The Rulers of Venice*: a vast work of collaboration involving the Archivio di Stato of Venice, the RSA itself, ACLS and the University of Michigan's SPO. An early version of this research and data was presented at the Digital Technologies sessions at the RSA meeting in Toronto in 2003 (Figure 13).

The strength of our XML approach is that authors need not develop their own HTML websites, experiment with new "authoring tools," or engage their campus technology departments and budgets to reinvent what is readily available to any publishing entity that cares to use these tools.

Figure 9

Figure 10

Figure 11

230 For *The First Born*, Johnson wrote several songs reportedly based on Chinese melodies. "Chinese Highbinder Patrol" (1879), which a critic for the *New York Tribune* described as "authentic," "has an eerie sound, augmented by what American audiences saw as a combination of musical devices associated with the "Orient": grace notes, parallel fourths and fifths, a minor key, repeated sixteenth notes, and pentatonicisms (see ill. 20; listen to "Chinese Highbinder Patrol" (1897), recorded by Krystyn Moon.). [25] It also has a set of four sixteenth notes in measures 18 and 25 that are similar to a melody transcribed and published in *Chinese Music* by J. A. Van Aalst called "Ballad" (see ill. 21). Reviewers noted that the noisiness of Johnson's music was similar to that of the Chinese. "With the clash and c[...] the squeak and squeal of Chinese instruments and the oriental music," the second act of *The First Born* be[...] critic. [26] For the rest of his songs, Johnson could [...] Chinatown for inspiration or simply borrowed from the song tradition, with which he was already familiar.

THE FIRST BORN.

CHINESE HIGHBINDER PATROL.

By LEE JOHNSON.

INTRODUCTION.

Figure 12

They are standard, proven and simple to implement—and open source—leaving the scholar to do what she or he does best: the research and writing of humanist scholarship. As new research agendas emerge, of course, HEB is committed to developing coding modules to match these new needs. We are currently engaged in an XML title with a classical archeologist to develop 3D virtual reconstructions and will soon add those tools to our list of standard features.[5]

Searching   Robust cross-searching is key to any aggregation. Since HEB is a relatively small aggregation, the issue of vast commercial search engines like Google and Yahoo and their impact on scholarly research methods often emerges. As European medievalists we often like to do a search for a common term in fourteenth- and fifteenth-century studies: the "Black Death." When we first started doing this search, we assumed that the term "Black Death" would bring up materials narrowly focused on the great
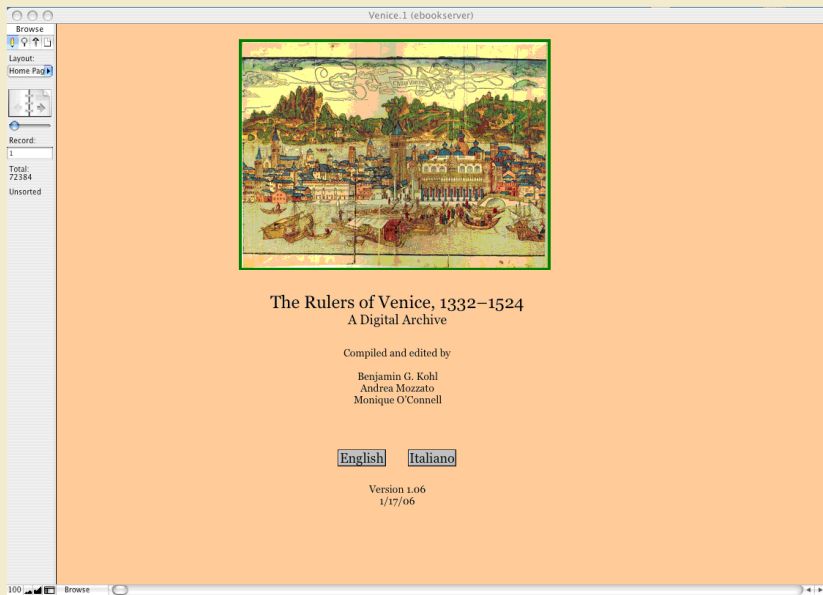
Figure 13. The Rulers of Venice

Figure 14. Black Death search on Google, March 29, 2006, 2:00 PM

fourteenth-century plague. The first time we recorded our search results from Google (November 19, 2005) we found 84 million results (discreet URL's). As of March 29, 2006 (four months later, at 2:00 PM EST) Google had returned 204 million results (Figure 14).

On March 29, 2006 at 6:00 PM (four *hours* later) the result was 219 million URLs (Figure 15).

Where does one's search through 219 million URLs begin? Where can it end? Scattered among the 219 million results is a stew of more or less reliable sites, including ones offering dolls of ebola, mad cow and sleeping sickness, classroom syllabi, television docudramas, Wikipedia entries, IATH resources, distance-education and other pages, serving up overviews, selected documents and brief case studies. But such an array only begs the question: which of these sites are reliable, and which are permanent, or at least stable, sources of information and analysis?

Between November 19, 2005 and March 28, 2006 the total number of sites on Google responding to this simple search term increased from 84 million to 204 million, or 243%. It grew by 15 million in just four hours. How many of these sites survived the four *months*, how many joined the web in the meanwhile, how many have permanently disappeared? How can we access result 10,000, let alone result 10 million, even with the most savvy "search within results"?

To be fair, Google also offers an advanced search; here we have narrowed our search down to .edu sites focusing on "Black Death," excluding "America," and updated within the past three months (Figure 16).

From 219 million our search now serves up "about 11" results, including 1 book, 5 course syllabi, 2 Power Point presentations (course work) and 1 undergrad term paper. Google itself has spared us viewing two "very similar" results (Figure 17).

We all know from our experience with Google that the relative stability of the most-hit sites reflects only that: what the "market" for information has decided, and more to the point, how many of these websites have paid Google for prominent placement. Without the preparation of the

Figure 15. Black Death Search on Google, March 29, 2006, 6:00 PM
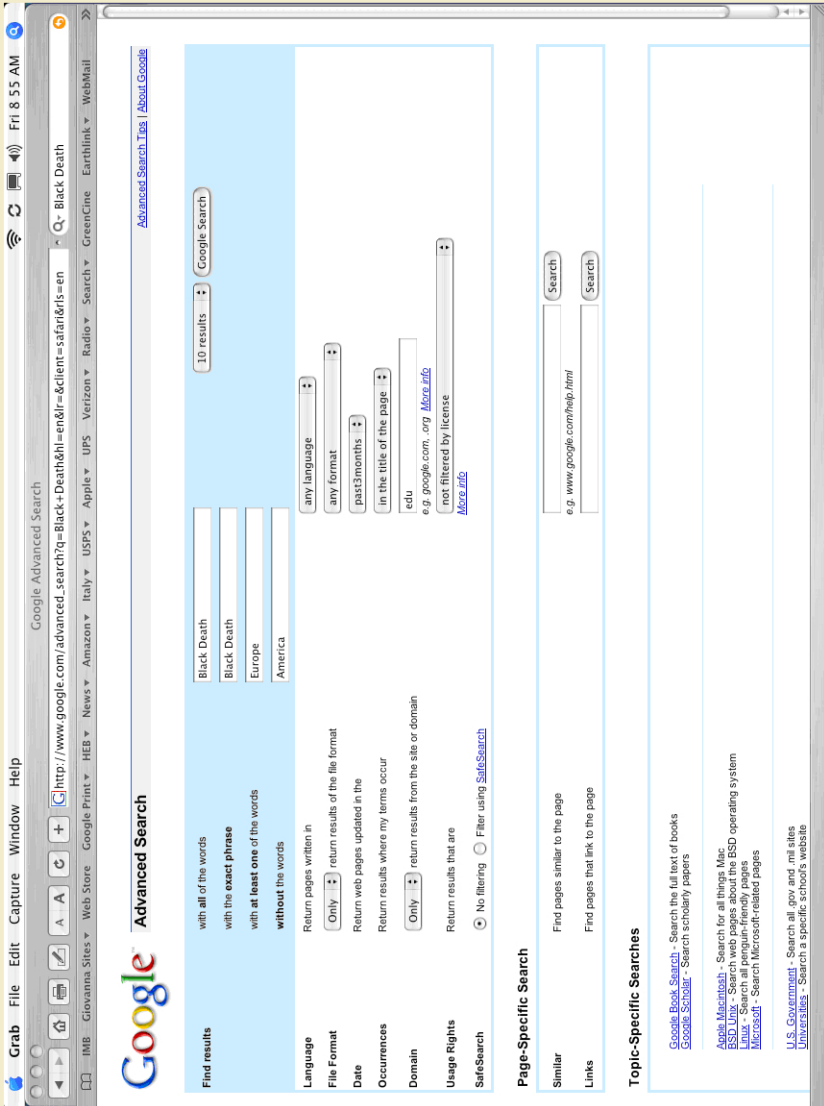
Figure 16. Black Death Results using Google Advanced Search, March 31, 2006, 8:55 AM

Figure 17. Black Death Results using Google Advanced Search, March 31, 2006, 8:57 AM

Figure 18. Black Death search on HEB, March 31, 2006, 9:15 AM

advanced search—still a haphazard approach—little of quality emerges. With Google's advanced search little of either quality or quantity is left.

By comparison, a similar search performed on HEB delivered up 1900 matches across 140 titles, or approximately.0000093 of Google's unfiltered results: a tiny fraction (Figure 18). But the result will bring up a selection of the most important works in the field, which now constitute 12.72 times Google's advanced search results by title and 172.72 times by "hit."[6]

Though these results narrowly focus on some of the most important works in the field, we can be certain of several things: first that the collection is of the highest quality and depth, second that our results will remain stable and as permanent as possible, and third that we will be able to use and then cite our online findings with complete confidence in our sources and the ability of other historians to verify our findings not only today at 2:00 PM but at any time and day 10 or 15 years from now.

A second result, however, may leave us somewhat disconcerted; and that is the (relatively) wide variety of studies and fields delivered up from our broad search even in this limited scholarly context. In addition to medieval Europe, we have before us titles from the Middle East, Africa, South Asia, the U.S. Southwest, the U.S. rural South, and the impoverished lives of many historical and contemporary cities. In short, "Black Death" delivers up to us something akin to Google's unfiltered results: not just the European fourteenth century but an in-ruption of the Global South, of the historical and contemporary margins, into our previously neat scholarly categories and boundaries.

We soon might begin to wonder whether it is appropriate for specialists to have such diversity and whether the ACLS collection's value might be diminished without some clear-cut methods of carefully delineating a search topic and territory. What if a student, unfamiliar with our strict specialty boundaries or with our powerful Boolean, Proximity, Bibliographic or Subject search engines, did such a search and found such results?

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[6] As of July 2007 Google Book and its "search within" content had yet to produce consistent results of use to the scholarly community.

Over the years we have come to realize that this type of result, this "history without borders" across a broad range of regional studies, disciplinary specialties and time frames fulfills much of the expectations of the digital realm and is exactly and precisely where the scholarly disciplines are headed both online and in the plans of provosts, deans and forward-looking scholars. Thomas Bender has recently surveyed this trend in the Chronicle (http://chronicle.com/weekly/v52/i31/31b00601.htm).

Such methodologies—whether in our consciously constructed policies or in our search results—by necessity break down barriers. They bring before the focused specialist and the new student familiar issues, here for example as diverse as trade and population. But they also raise issues of health, poverty and wealth, slavery and economic difference, the political structures and cultures of disease and illness, new global perspectives on marginalization and wholeness. By its very nature then online scholarship is an instrument of such change, whether on the massive and unregulated scale that Google serves up or in even the most carefully mediated collections that ACLS and its partners have assembled.

We cannot and should not make too much of one example—such evidence is anecdotal in a certain sense—but our constant use and reflection upon this collection as it grows and changes impresses upon us the realization that by its very nature electronic publishing—far more than the old print culture and its capabilities—breaks down boundaries, permits regional and global perspectives and enables comparative approaches that are both diachronic and synchronic.

But all this is not simply or mechanically achieved. Rather, the insights gained from such resources point to a newly emerging use of the book in the digital realm: as an essential building block of knowledge and scholarly communication, no longer isolated in its production, distribution or use.

Conclusions: The New Digital Monograph

Originally conceived as a library of discrete titles and accessible in much the same way as print books, the HEB collection also acts as an in-depth database much like the titles in iTunes. The impact of such aggregations on

scholarship is only now being realized as search results and research topics derived from its content begin to break down the traditional boundaries among subject specialties, providing the advantages and challenges of interdisciplinary, deeply diachronic and global perspectives. In addition, HEB finds that the traditional categories that so closely define the print monograph have been transformed in the digital realm: the balance between evidence and text, narrative and analysis in any new digital work has become increasingly fluid, and the consequences of this realignment are only beginning to be understood.

Further, just as the collection of footnotes in the traditional print article or monograph once acted as a portal to other scholarship in the print domain, so now the hyperlink, the pop-up image and the database serve the same purpose of scholarly focus and referral. In a certain sense, then, each new digital monograph acts like the traditional print footnote or bibliography: as a pointer to the best and most useful scholarship available on any given topic. But like its print analog, the digital monograph remains the work of the individual or of individuals in collaboration, with limited and subjective approaches to primary sources and their interpretation.

Interoperability, interdependence, and thus the functional modularity of individual works are becoming key to a new scholarship that is, and must be, collaborative and networked. Thus no one e-book—or single HTML website, no matter how comprehensive for a given subject—can possibly incorporate all the necessary referents to the quantity of material now available in any one discipline, area or research agenda. ACLS Humanities E-Book Project has begun to demonstrate that only well constructed digital collections that pay special attention to the quality, depth and relatedness of their content can hope to approach this goal.

EMLS: A Case Study in the Development of an Academic Ejournal

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Early Modern Literary Studies (http://purl.oclc.org/emls/emlshome.html) is a peer-reviewed online journal publishing articles on all aspects of early modern literature. No registration or subscription is required, and it is available for free to anyone anywhere in the world with access to a web browser. All articles which are submitted to it undergo double-blind peer review, but those which are successful are usually published within less than a year of submission: a process much faster than comparable print journals. Since its foundation in 1994, *EMLS* has published over 150 scholarly articles, and over 250 reviews of books, films, plays, and multimedia products. In a typical week, its servers record around 6,000 different readers in 80 different countries.

Clearly, then, *EMLS* is a success story—a project which harnesses new technologies, and which receives heavy use, day in, day out, by those working in the field. One context for this success story is the paradigm shift in how humanities as a whole perceive technology, discussed in other essays in this volume. But another, and equally crucial, context is the hard work of a group of geographically disparate enthusiasts on the editorial side, together with the talent and dedication of *EMLS*' hundreds of contributors over the years. This article reviews the process by which the journal found its way into this position, and addresses the question of what it might do next. Firstly, Ray Siemens discusses the circumstances

in which *EMLS* was established; then Lisa Hopkins carries the story on to 2003; finally, Matthew Steggle reviews the questions and issues facing the journal as it enters its fourteenth year of publication.

EMLS 1994–1998

Born in 1994 at a meeting of members of the University of British Columbia Renaissance Literature Discussion Group, *EMLS* enjoyed during its first few years of publication good acceptance as a credible academic resource by the community it intended from its outset to serve. By the journal's fourth year of existence, in excess of half a million copies of *EMLS* "documents"—papers, reviews, notes, announcements, and so forth—had been downloaded by a group consisting of some 3,500 regular readers and five times that number in occasional browsers; readers accessed the journal from its home site, at the University of Alberta, as well as its mirror site at Oxford University and its archive at the National Library of Canada. Another sign of its acceptance was that *EMLS* was being fully indexed by the *MLA International Bibliography*, the Modern Humanities Research Association's *Annual Bibliography of English Language and Literature*, and a number of other services and databases.[1]

The spirit of the time is, perhaps, best summed up by Willard McCarty's observation (1997, 169), at the Digital Resources in the Humanities Conference, that "electronic journals differ from print journals in their ability to connect readers to internet resources of potential interest to them, and, as well, to provide a virtual space for discussion and the exchange of ideas"; such features, we felt, offered challenges both exciting and daunting, because the potential uses of interactivity are unique to the medium and could thus fill an important niche for the community the journal serves. Shortly thereafter, in an assessment called "Recent Trends in Scholarly Electronic Publishing," Ann Okerson (1997) discussed the ways in which the more "venturesome epublications" were beginning to take advantage of the medium's special interactive features, including using sound, video, and soliciting feedback; she ended by noting the following "dilemma" for

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[1] For a review of *EMLS*' early history, and a previous stocktaking, see Dyck, Siemens *et al.* (2000).

journal editors and publishers: "a publication based on the print journal model cannot have real interactivity without moving away from paper process and content."

Such has it been with *EMLS*; at the same time that *EMLS* looked to the conventions of print journalism to gain acceptance in its community, the electronic medium offered entirely new and different ways of understanding our tasks as editors, and different ways of understanding the shape of our journal as well. As technology improved and the number of electronic resources for the study of early modern literature expanded, we found that we not only needed to find ways of keeping up with the pace of change and growth, but also that we needed to be able to inform our readers about it, for many of them were looking to *EMLS* as a resource that might assist them in the use of the new electronic materials. Our challenge as we saw it, then, was re-articulated; briefly put, it was as follows: working within a genre of scholarly publishing that is, on the whole, still engaged in the uphill process of gaining legitimacy in the humanities, how do we take advantage of the dynamism allowed by the medium to the fullest extent, and to the best advantage of our readers?

From its beginning, *EMLS* has needed to define its role as a new publication in a field characterized by established journals and the print medium. Therein lay a dilemma for the editors and editorial board: on one hand, the journal needed to take advantage of the electronic medium in order to justify using that medium but, on the other hand, the journal needed to operate and seem much like a print journal in order to establish its legitimacy as a scholarly resource. The approach taken to address this was to split *EMLS* into two distinct sections: the journal proper, and a section called *interactive EMLS*.

Defining a Credible Place in E-Publication: The Journal Proper

The journal proper, which publishes only fully refereed material, had from the outset faced what was then already the old question of the legitimacy of non-print publication. Issues that continue to influence the maintenance and development of this part of *EMLS* include some questions common to all forms of academic journal (how many people read it, and

who they are; who publishes in it; who cites what is published in it; and so forth), but also some pragmatics that do not affect print journals in the same way: what credit is given to those who publish in it, the accessibility of the journal, its permanence, its locatability, and so forth.

Such pragmatics that do not affect print journals appear to emanate from the single fact that to a significant number of academics then—less so now—the internet remained an unknown and largely misperceived entity: one without controls governing production, without precise and stable locations for information, without assurance that one's work would not be taken only to appear under someone else's name, and so on. A problem of perception of the medium did exist, the chief difficulty, it seemed, with online publications such as *EMLS* being that they did not appear on paper—paper being something which is universally understood, almost intuitively, with connotations of permanence and unquestioned ideas associated with the handling, storage, dissemination, and duplication of printed materials that are taken for granted.

In an effort to assuage such concerns—those associated quite closely with the nature of the electronic medium and its difference from print—the response at *EMLS* was to emulate the best that the world of the print journal had to offer and to supplement it with the best that electronic publication could offer to that print-oriented model: *EMLS* published three times a year—a decision which might have seemed strange, given the ease with which new material might constantly be incorporated (and, thus, enabling a form of ongoing publication);[2] its presence on the screen, articles linked hypertextually to a table of contents, emulated very closely what might be expected in a print journal;[3] *EMLS* established an international, respected

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[2] The issue-based publication schedule, borrowed from print models, provided a cycle of publication that, in 1994, seemed the most intuitive both for those involved in the preparation of *EMLS* and its readership.

[3] This was maintained after the first year in response to an informal survey of readers of electronic journals; in the survey, was asked how readers used the articles published by *EMLS* and other electronic journals. The majority replied that they used *EMLS* much as they might a print journal; they browsed, searched for, and scanned materials as one might in a hypertextual environment, but when they found something of interest most printed it out so that they could add it to their files, and annotate in the margins when they read.

editorial board, as one might find in other journals sharing its ambition, and founded stringent guidelines for the refereeing of published materials in the journal section;[4] the Readers' Forum that *EMLS* offered for reader feedback was moderated; and, as well, *EMLS* was a pioneer in providing instructions on how to cite electronic publications in bibliographies (these are in line with those now outlined in the most recent *MLA Handbook*).

We also explored concerns related to indexing and copyright. *EMLS* found indexing with the *MLA International Bibliography*, the Modern Humanities Research Association's *Annual Bibliography of English Language and Literature*, and a number of other services and databases. This was initially a struggle, for indexing groups did not immediately know how to handle electronic resources. One way to assuage concerns of indexers at the time was to solve the problem of a constantly-changing URL. We did this with the use of a Persistent Universal Resource Locator, a PURL, so that our URL—like a shelfmark—would remain constant, even though the physical machine on which *EMLS* resides could (and would) change.

The related concern of copyright was expressed to us initially by those who entertained thoughts of indexing *EMLS*. In the first year of publication, authors held the copyright to their published work. This was done for a number of idealistic reasons, but eventually became problematic for pragmatic reasons. This became evident when one indexer commented that they had found an exact mirror of our site on a machine in the southwestern United States; further investigation showed us that a number of people were copying pieces from our journal site and placing them on their own. Innocent enough, perhaps, but it did raise the eyebrows of those in our editorial group; we consulted with the lawyers at our university, who suggested the best way to protect the authors' rights was to protect our own and, on behalf of the authors, to have the editor of the journal assert copyright on all materials published, and then enter into an agreement with the authors that ensured their ownership and control of their materials.

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[4] All submissions are reviewed and vetted—double-blind, save for exceptional cases—by the editorial board and a number of other experts in the area. In the third year of publication, our referees had read over 60 articles during the course of a 12-month period. Our rejection rate was during that period in excess of 50%.

Disregarding, for the moment, that many aspects of print publication processes (especially peer review) for good reason transcend the print medium, attributes such as ISSN numbers, outlining of citation methods, editorial boards, and tri-annual publication have also been part of many similar electronic academic resources' quests for legitimacy—but not legitimacy for its own sake. *EMLS*, too, sought such legitimacy by evoking many indicators of quality in the print world; aside from the obvious benefits of several of these attributes, this was carried out also so that those who would publish with *EMLS* receive the appropriate and necessary credit for their work—both from the scholarly community at large and from more local, mechanical operations akin to those carried out by tenure and promotion committees.[5]

At that time, organizations such as the Modern Language Association, the Social Sciences and Humanities Research Council of Canada, the American Association for Research Libraries, the Canadian Association for Research Libraries, and others had made significant statements about the value of work published in the electronic medium and how it should be treated equally with that published in print; but these policies had not always done as much as they might for those who chose to fashion electronic scholarly publication in terms of what, at that time, one could call the "negative mythology" of the internet: that is, the view of electronic scholarly publishing—even with the expert guidance of the groups named above—that focused on ideas of impermanence, a lack of enforceable standards, and, worse, metaphors of chat lines and bulletin boards. Much

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[5] An important concern is this last point: that those who publish with us be ensured that they received not only a good readership but, also, *due credit* for what they published with us. Electronic publication of a journal, as with print publication of such a resource, is an act of service to the profession. Because of the positive benefits of electronic publication and dissemination—less cost, speed of publication (even with rigorous quality control), ease of access (assuming one has access to a computer), and greater cost-efficiency and management and retrieval of information—a scholarly journal in electronic form has a greater potential to serve the profession than one in print form. Service to a profession, moreover, requires that one meets the needs of that community, pragmatic and otherwise; and, if the profession does not recognize the legitimacy of work published in our journal (and thus, in essence, penalizes those who choose for many good reasons to publish with us), then we are not serving our readers properly.

of this, of course, was put behind us at a rapid pace, but such very pragmatic matters concerned us considerably in the way that they would not concern paper publications.

Defining a Place in E-Publication: *iEMLS*

Such are the sorts of professional pragmatics that faced what we might call *EMLS*-proper—the refereed section, that is, of *EMLS*. The other section, interactive *EMLS* (*iEMLS*), faced a different set of concerns: some longstanding, but others arising and evolving so quickly that they were difficult to identify. All questions pertaining to *iEMLS* are best understood in the context of the history of the section, which came into being with the second issue of *EMLS*, in mid-1995. Under guidance from our editorial and advisory boards, and with the input of several associate editors, *Interactive EMLS* was developed as an extension of *EMLS*, with an eye to fostering an online environment for academic interaction within the community of readers we serve. We believe now, as we did from the outset, that this interactive section of the journal could facilitate the useful, less formal processes laying behind the products of our discipline which, ultimately, make up the refereed section of *EMLS*-proper.

From the start, in *iEMLS* we tried to do a bit of everything: we posted electronic versions of early modern English texts; we offered scholars a place to post works-in-progress, pre-prints, and conference papers; we offered conferences a place to post calls-for-papers, programs, and registration materials; we hosted an archive for a listserv discussion group, a database of reviewed books pertinent to Milton scholarship, and various other resources. Knowing the potential of the electronic medium for this sort of interaction, but lacking a model and a clear path to follow for its development, *iEMLS* has tried a great variety of materials and methods. In retrospect, some were successful; others were not.

There are a number of reasons for both failure and success; however, perhaps equally important to cataloguing these is noting that the role of a resource like *EMLS* (and the *iEMLS* section)—and the way in which it can best facilitate scholarly interaction—had changed considerably in the first few years since its inception. This is especially true for *iEMLS*. Whereas it

first seemed possible (and even practical) to act as an umbrella for a wide variety of internet activities, it soon became no longer so. While once one of the very few scholarly presences on the internet for those interested in the literature of early modern England, *EMLS* and *iEMLS* were very quickly joined by a host of other sites, many of which were solely dedicated to individual activities across the range listed above. As such, those looking for electronic texts could find them in many archives, and better yet, on the internet sites of electronic publishers that were beginning to bring to their texts the best qualitative guarantees; many conferences began to post their own calls-for-papers and related materials electronically in listserv discussion groups and on websites of their own; and, likewise, scholars began circulating pre- and post-prints of their work on their own webpages. Given these changes in the audience that *EMLS* intended to serve, the role of *iEMLS* underwent revision, and, indeed, is likely to undergo continuing revision for as long as the internet continues to change the nature of scholarly practice.

In 1998, the editorship of the journal passed to Lisa Hopkins, during the preparation of *EMLS*' most ambitious issue to date—the guest-edited special issue *Literature and Geography*, whose numerous images brought both copyright headaches and technical challenges, the latter being compounded by the move of *EMLS* onto a new set of computer systems.

EMLS 1998–2003

When I took over the editorship of *EMLS*, I was so beset by the technical problems attendant on the already seriously overdue *Literature and Geography* special issue that it seemed like tempting fate to aspire to any kind of long-term vision for the journal. Some of these problems, and those which initially scared me most, related to my own inexperience at manipulating HTML and webpages, and I frequently found myself aghast at the consequences of unintended or misunderstood key strokes until the omnicompetent managing editor introduced me to the "undo" button. After that, the actual production of the journal became plain sailing, but it was not so easy to deal with the other problem besetting the *Literature and Geography* special issue, which was copyright. Although it is hard to find

clarity on the question of copyright on the internet (or indeed in scholarly publishing in general), it seemed clear that it was probably necessary and certainly wise to obtain permissions for each of the fairly considerable number of maps we proposed to include, something which proved time-consuming, painstaking work and, in one or two cases, impossible to ultimately achieve. Not until I had rounded up all necessary permissions, checked with copyright holders and authors that they were happy with the resulting wording and layout, and, eight months overdue, finally published the issue, did I begin to understand how much I had learned about both the strengths of the journal and the challenges it poses.

In the first place, during the course of that eight-month delay it became abundantly clear to me that people did actually read the journal, though they might not continue to do so if it permanently lost its reputation for punctuality. I received numerous plaintive or puzzled emails asking why it was still impossible to access the *Literature and Geography* issue. As our readership statistics have repeatedly confirmed since, people from all over the world read and value *EMLS.* One of the features most appreciated, particularly in countries with less tradition of English study and smaller academic libraries, is undoubtedly the fact that it is free, but timeliness is also an important consideration. This became particularly apparent during the dark days leading up to the cut-off point for eligibility for the last Research Assessment Exercise in Britain, when I received frantic emails pointing out that it made all the difference in the world to the author whether their piece was published in the September issue or the January one, since the criterion for the RAE was publication within the calendar year. It was also clear that, especially at times like these, another very attractive feature of the journal is the unusually short time which typically elapses between submission of an article, receipt of a decision on it and, if that decision is favourable, publication—which has not infrequently occurred as little as a month or six weeks after initial submission. As well as gratifying authors, this speed has also enabled us to intervene in extremely timely fashion in specific debates, as for instance with the publication of Richard Abrams' piece on the authorship of the Funeral Elegy for Master William Peter so soon after Donald Foster's initial retraction (see Abrams 2002). I have, therefore, made it a priority to ensure that the journal's reputation for punctuality and timeliness was not

endangered again, and it is my most substantial achievement as Editor that almost all the issues I have brought out since the *Literature and Geography* special issue have appeared in the calendar month whose name they bore.

I have also tried to develop the journal in other ways. The inclusion of maps in the *Literature and Geography* special issue did not only raise issues of copyright; the presence in the issue of both specially scanned-in images and links to other cartographic sites set me pondering about what we could do that paper-based journals could not. Being electronic in form means that we can include hyperlinks, images, film clips and sound clips, and all of these have appeared in the respective special issues on film and sound, not to mention the special issue, guest-edited by Gabriel Egan of Shakespeare's Globe, on the possibilities of virtual reality modelling of Elizabethan theatrical spaces. (Another lasting legacy of the *Literature and Geography* issue has been increasingly regular special issues of the journal, which seem to me to be a particularly fruitful way to concentrate minds on a topic and maximise ease of finding and retrieval for interested readers.) Although I have been aware of the danger that technical experimentation of this sort might descend to mere gimmickry, I am convinced that these are genuinely fruitful opportunities to explore aspects of early modern culture to which we might otherwise be oblivious, and I would be very interested to take the process further and explore, for instance, the possibility of modelling or representing the schemata of early modern firework displays, symbolic gardens, or triumphal entries. The other main consequence of being an electronic journal is that we have no space constraints, and so are able to host unusually long or complex projects, such as *Early Modern Libels*, an innovative edition/database undertaken by Andrew McRae and Alistair Bellany. Thus the future for the journal remains, I hope, bright.

Where Next for *EMLS*?

One of the interesting things about the history of *EMLS* to date is that the "subversive proposal" of the first days of online publishing—that it would mean the end of conventional corporate publishers—has noticeably failed to happen: in practice, many print journals have simply moved sideways, offering, either independently or in large consortia, subscription-only

electronic access to their print content. On the other hand, in the field of literary studies *EMLS* and a still surprisingly small band of peers, including *Renaissance Forum*, *Romanticism on the Net*, and *Early Modern Culture*, continue to explore the possibilities of true ejournals.

As such, the journal continues to face the interesting challenges of the internet, an environment which is notoriously technologically innovative; fast-moving and impermanent; good, if anything, for interactivity; and largely unread in detail. However, in working on *EMLS*, one learns that all four of these propositions need qualifying.

Technology   *EMLS* is currently published, as it has been since its origin, in hypertext markup language (HTML). More elegant and structured ways of encoding data are certainly technologically feasible, but HTML is readable by even the most basic of web browsing software; it is accessible to search engine spiders; and it is robust. Similarly, *EMLS*' free distribution means that there are no passwords or IP recognition to negotiate. The journal's success, and its continued wide readership, is partly a product of this "tractor technology" approach to the basic architecture, with the technological innovations mentioned above—images, sound, video and others—sitting on top of a basic structure which is as simple as possible.

Impermanence   As noted above, scholars value electronic publication because of the technological opportunities it opens up, and because of its sheer speed. However, as Ray Siemens notes above, electronic publication is still regarded with suspicion in some quarters, because of its perceived impermanence. One of the challenges facing *EMLS* in the future is to continue to overcome these prejudices. Longevity is not something one can acquire quickly, and even though *EMLS*, at thirteen years old, is a veteran in internet terms, it is still young in a field where many of the journals have pedigrees stretching back a hundred years or more. This is, of course, a problem that can only be addressed by continuing to publish, but electronic publication offers some particularly difficult hurdles. One of these is to do with its location—*EMLS* has already moved universities three times, and there still persist some links on the internet to its old

bases. (Ironically, if the internet weren't so permanent, this wouldn't be such a problem.)

To deal with this, *EMLS*' address has the form given on page 144 above. This so-called "purl"—persistent URL—is maintained by the OCLC, a worldwide federation of university libraries, and means that the URLs of the journal's home page and individual articles stay the same regardless of where in the world the journal may move to in the future. As well as multiple backups in its current base at Sheffield Hallam University in the UK, *EMLS* maintains a mirror site at the University of Toronto, and is also archived by the National Library of Canada. While much has been written about the future obsolescence of all computer media, *EMLS*' programme of active mirroring will certainly stave off such obsolescence for as long as work on the journal continues.

Interactivity   In some ways, another surprising aspect of *EMLS*, as of other attempts to marry scholarly activity with the internet, has been that interactivity does not at all work in the expected ways. "Virtual seminars," anticipated as early as the first issue of *EMLS*, have in practice met with limited success within the ejournal format, since scholars seem unwilling to commit themselves to posterity in such a dialogue format with anything less than a very well-argued note. On the other hand, *EMLS* has now published a respectable number of "reader's forum" contributions, which respond in the form of an academic note to a previous *EMLS* article. This certainly is interactivity, for all that it works best on a timescale of months rather than hours. *EMLS* remains interested in innovative methods of interaction and dialogue.

A second aspect of interactivity relates to the process of peer review. *EMLS* currently uses double-blind anonymous peer review, in which neither submitter nor reviewer knows each other's identity. However, in some other academic ejournals this process is being replaced by online non-anonymous peer-reviewing, in which an article is pre-printed in the journal in the form in which it was submitted, and is then discussed by those who have read it on an associated and freely accessible discussion board, leading to either rejection or preparation of an officially finished, "published" version. This system has clear advantages in fields where

the double-blind process has been open to abuse, for instance, where a referee is able to work out that the submitted paper is from a certain rival laboratory, and can therefore obstruct its publication until the referee's own lab has successfully published in that area. Should *EMLS* consider this alternative system? In a field such as early modern studies, where large commercial contracts rarely depend on who gets their article into print first, the advantages seem slight compared to the benefits of anonymity and frankness conferred by the double-blind system, but this is another area in which the journal must continue to monitor developments.

Readership   According to another commonly held prejudice, online journals are "write journals"—places which exist more for contributors than for readers.[6] To confront such an allegation involves establishing how many people read a given ejournal, but for *EMLS* as for its peers this question is surprisingly difficult to answer. With a print journal, of course, the matter would seem reasonably straightforward, since one would simply measure its print run, and with a print run of, say, a thousand copies, one could assume a thousand readers. The problem, of course, is that it doesn't work like this at all—one individual library copy of a journal may be read by dozens of scholars, while another may languish on the shelves and hardly be picked up by anyone at all. Many scholars working in university libraries will have had the slightly unnerving experience of obtaining a journal volume from the 1920s, say, and discovering that it contains pages still uncut. So it is difficult to establish an accurate readership figure even for a print journal.

EMLS currently uses a freeware package named *Analog* to analyse the server logs of the computers at its main base at Sheffield Hallam University. A strange consequence of the way that the internet's structure works is that server logs provide, at best, only a very rough guide to any measure of readership: for an explanation, see Turner (2004). However, in broad terms, these logs indicate that in the course of an average week, around six thousand distinct users, from, on average, eighty different countries, visit some part of Sheffield Hallam's *EMLS* site. Clearly, some of the traffic

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[6] For the term, and for many other interesting comments on the reception of ejournals, see Heimpel (2000).

on the site is due to automated search engine spiders rather than flesh-and-blood readers. But even the most pessimistic interpretation of the figures shows that the servers are distributing over 10,000 documents per week to flesh-and-blood readers. Few academic journals in print form would be able to claim a comparable readership.

These readers reach *EMLS* in a number of ways. Many come through other sites which link to the front page of the journal, in library catalogues or other meta-collections of online resources. There are hundreds of such links, and the number grows steadily over time—another way in which the internet is actually a much slower-changing environment than is generally recognized. Once in the site, there are various ways of navigating around it, including indices of each issue, a master-index of all articles, and an internal search engine.

But the statistics also indicate that many *EMLS* readers enter the site not at the front page, but directly into one of the articles. This may be because they have followed links from other, related sites, which take them directly to particular articles: among the most important of these referring sites for *EMLS* are *Mr William Shakespeare and the Internet* (Gray 1995–2007), where many of the journal's articles relating to Shakespeare are indexed; the *Milton-L Home Page* (Creamer 1991–2007), which similarly selects out *EMLS*' numerous articles on Milton; and Anniina Jokinen's "Luminarium" (1996–2007), which maintains indices of online articles on dozens of early modern authors. The other major route that leads directly into particular articles is through search engines, with Google alone accounting for over 1,000 referrals a week to the journal. Since the server logs preserve the search terms used to reach the journal, it is possible to keep an eye on what terms bring people to it, and, unsurprisingly perhaps, Shakespeare shows up a good deal in these listings—something also reflected in the fact that *EMLS*' most requested individual articles are generally those which discuss Shakespeare. The phrasings often also suggest that not all of those who consult the journal are the conventional audience of academic journals, since many of those who find their way to it appear to be school students working on specific assignments. The search terms also reveal that a handful of those people who download *EMLS* are in fact unlikely to find that the articles meet their needs—for instance, the user who entered

the search term "suck the brests" would doubtless have been surprised, and perhaps a little disappointed, to receive in return an old-spelling text of Gerrard Winstanley's *The True Leveller's Standard Advanced* (http://extra.shu.ac.uk/emls/iemls/resour/mirrors/rbear/digger.html).[7]

This facetious example shows up an obvious problem. While *EMLS* articles clearly have a lot of readers, many of these readers are not the traditional target audience of an academic journal: they include not just school students, and those whose excitement gets the better of their spelling, but non-specialists of all sorts across the world. One can, of course, shake one's head in dismay at this state of affairs. On the other hand, one might welcome the challenging thought that one's article will be accessible to and read by more than just a pool of those already initiated into the ways of the academy.

Perhaps, then, as with print journals, an ejournal should be judged not in terms of its raw readership figures but in terms of evidence of its wider reception. Like many websites, *EMLS* keeps a list of reviews by journals and other websites it respects at http://www.shu.ac.uk/emls/revemls.htm. The journal as a whole is now indexed by all the major print bibliographies in its field. But the bulk of its prestige must depend on the success of the articles it publishes. Individual articles in *EMLS* have gone on to win awards for distinguished publication, such as Lisa Gorton's article "John Donne's Use of Space" (*EMLS* 4.2), winner of the John Donne Society Award for Distinguished Publication in Donne Studies (1999); to be cited in standard print editions of Shakespeare; and, in many cases, to see print publication as part of longer scholarly monographs. These articles provide the best guarantee of the continuing relevance of the journal. Again, this cumulative reputation moves surprisingly slowly, and is a long-term project.

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[7] This is part of *EMLS*' mirror site of Renascence Editions, the celebrated electronic library of early modern texts developed by Risa Bear (http://www.uoregon.edu/~rbear/ren.htm).

Conclusion

After thirteen years, then, *EMLS* is only just getting started. Clearly, its prospects for future success will revolve around the concern central to all three of the contributions above—the question of how to make computer publication serve an academic community whose custom and practice up till now has been heavily committed to the medium of print. It takes into the future a large supply of patience, a philosophy based around doing the simple things properly—publishing to time and ensuring that all the links work—and faith in the quality of its future submissions, without which it is nothing.

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Creating a Website for *Writing on Hands: Memory and Knowledge in Early Modern Europe*⋆

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The hand, which Aristotle called the "instrument of instruments" (*De anima* 3.8), was for millennia understood as the appendage that supported, sustained, or enabled almost all other aspects of human activity. It was, and is, also the principal tool for many creative activities: writing, music or art making, and theatrical performance. Thus, when curator and early modern scholar Claire Richter Sherman brought to my attention her novel and unprecedented idea for an exhibition that examined the hand as a "meeting place of mind, matter, and spirit," I was intrigued. She had been collecting images of hands from the fifteenth through the seventeenth century that were inscribed with notations concerning the acquisition and dissemination of knowledge (Lukehart 2000, 7–8). They included the realms of anatomy, psychology, mathematics, music, rhetoric, religion, palmistry, and alchemy, among others. She had also been gathering bibliography which, together with the visual evidence, began to tell the rich but till-now fragmentary history of the hand in the early modern period. The exhibition Sherman envisioned would reintroduce conceptual frameworks for learning, remembering, and recalling both practical and abstract concepts by means of the hand (Sherman 2000, 13–17). As an art historian, I was excited about the prospect of organizing such an ambitious exhibition; as director of a college art museum, however, I was anxious about the means by which such complex ideas and arguments could be

shared with the general public, one that included not only professors and college students, but preschoolers and senior citizens. How would they understand or interpret the cognitive, physical, mnemonic, computistic, communicative, predictive, moral, and other functions of this remarkable tool in a digital, or better, virtual age? Further, given that there would be only two venues for *Writing on Hands*, both the curator and the director were looking for ways to bring the show to a wider audience than would be able to view it at either Dickinson College or The Folger Shakespeare Library. From these twin concerns was born the idea of creating a website that would simultaneously reach thousands of visitors and provide an interactive key to help decode historically remote and culturally or intellectually distant material.

The organization and execution of the exhibition and its catalogue is a separate story. My concern here is to present a summary of the production of a website that allowed us to strike a middle ground between the erudition and completeness of the catalogue—which would be accessible primarily to a scholarly audience—and the brief wall and label texts—intended for an uninformed but curious public. In both cases, we were committed to the notion that objects on display and the ideas they materialized were intrinsically interesting if we could create a tool that would allow the latter audience to catch up with the former. My staff at The Trout Gallery agreed, and I had particularly intensive discussions with our registrar and autodidact webmeister, Dwayne Franklin, about how much we could achieve with then-current CD and web technology. Originally, my thought had been to create an interactive CD that would present summary catalogue entries and interactive images; from this basis, we could then generate a website. Time and resources conspired against this two-pronged strategy, yet the resultant compromise satisfied most of our goals.

Our first problem was to establish whether the works in the exhibition could be made interactive in the desired manner (Figure 1). That is, could we make images such as the hand in Jacopo Berengario's *Commentaria* (woodcuts attributed to Amico Aspertini, c. 1521) yield their secrets—obscured as they were by Latin inscriptions? I was assured by the CIO at the regional public library and by the founder of the Wisdom Tools project at Indiana University, that the technology was there if we could
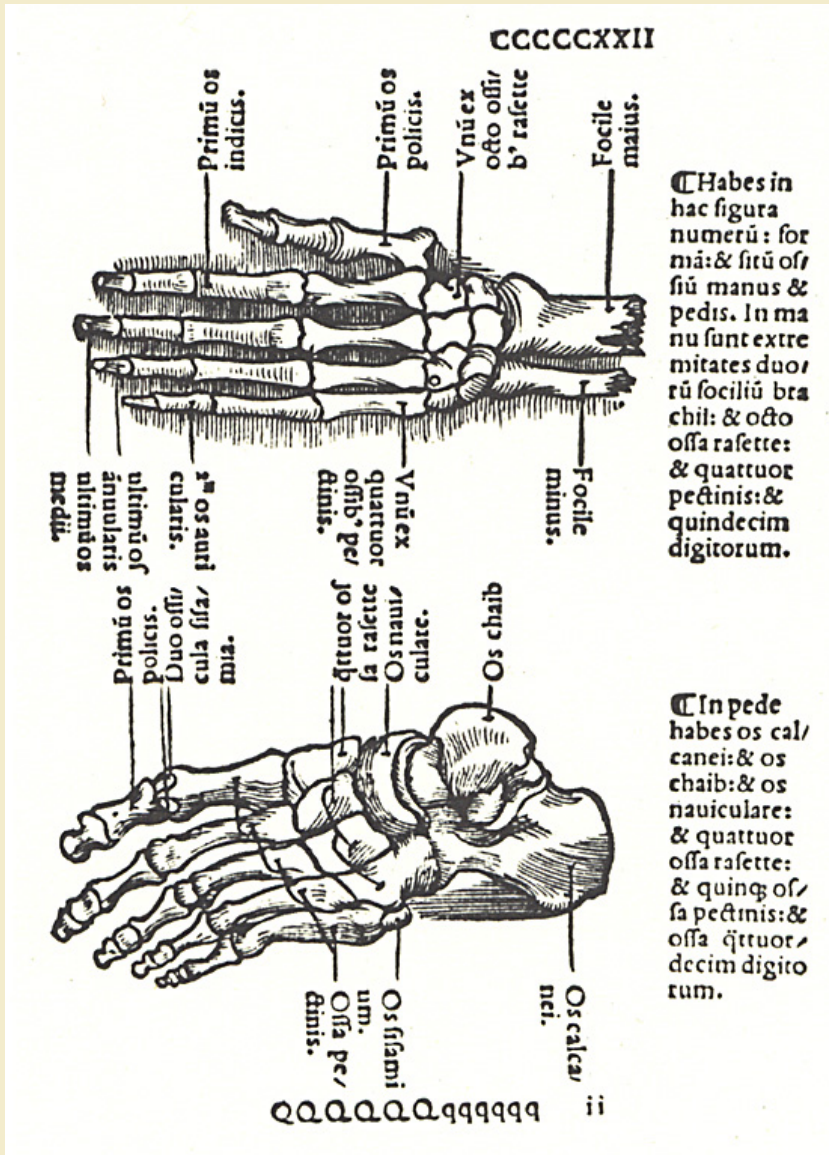
Figure 1. Attributed to Amico Aspertini, *Bones of the Interior of the Right Hand and Left Foot*, in Jacopo Berengario da Carpi, *Corpi commentaria cum amplissimis additionibus super anatomia mundini* (Bologna, 1521), fol. 52. History of Medicine Division, National Library of Medicine, National Institutes of Health, Bethesda, MD

find the inventive designers and the money to carry out the project. Since interactive design was in its infancy during the late 1990s, it was impossible to calculate the cost and the time this project would entail. In the meantime, we needed to focus on the issue of fundraising.

As it turned out, it was more difficult to find a granting agency willing to trust us than it was to find people who were able to create the website.[1] We went first to the National Science Foundation's (NSF) Informal Science Education program, thinking that they would be interested in the preponderance of images that touched on scientific principles: anatomy, mathematics, astronomy, and chemistry. In their negative response to our proposal, they highlighted reservations about the lack of scientists among our authors and advisors (though we were working with Martin Kemp, Brian Copenhaver, and Sachiko Kusukawa, as well as with chemists, biologists, and mathematicians at Dickinson College), and an overall skepticism about how an interdisciplinary exhibition could serve the scientific and mathematical agenda of the NSF. This is the catch-22 of grants: you cannot easily convince grantors without a well-advanced product in hand (a word I use advisedly). We went next to the National Endowment for the Humanities (NEH), arguing that the very interdisciplinarity of the exhibition suited many of their priorities. They were not persuaded. The NEH felt that the visual orientation of the exhibition trumped the humanities and worried that we would not pull in the audience we estimated.

Over the course of months, we still had not secured funding after having tried dozens of private foundations, and we were getting dangerously close to the opening of the exhibition. With a year to go, my colleagues in the grants office thought we should try the National Endowment for the Art's (NEA) new program of "Access to the Arts." Leading with the historic and aesthetic importance the images in the exhibition would have on a diverse audience, we emphasized the various means of reaching our public: a scholarly catalogue, outreach programs, seminars for teachers, a

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[1] Throughout this section of the paper, I will mention granting institutions by name because in this session, which was meant to encourage colleagues to follow tested models, one needs to be aware of the pitfalls. Our experiences at the Trout Gallery should not be seen as indicative of the possibilities for support or denial of others' proposals.

CD and website. We originally asked for about $150,000. Their positive response was enthusiastically welcomed, but it came with a new challenge: they offered only one third of the amount requested. Whereas we quickly regrouped and decided to use a private donation to help underwrite the catalogue, we had to scale back other aspects of the exhibition and the accompanying programs. We decided to use the money for three projects: the production of a brochure to be distributed free to teachers and viewers; the creation of a teacher's advisory committee for the outreach programs; and an interactive website. This left us with about $10,000 for the production of the website. The CD ROM was now off the table.

We chose a young local company, SAY1.net, to design the site. Jason Say and Mike Fiorill accepted the challenge, working closely with us for three months. My staff and I[2] (unpaid) were the content providers, selecting the images and catalogue entries to be included and creating the equivalent of story boards for each of the seven interactives. The web designers (modestly paid) were responsible for writing the codes and programs that would animate the static images and for creating the layout of the site. Jointly, we decided to arrange the site around the six themes of the exhibition: "Reading the Writing on Hands," "Handiwork of the Creator," "Messengers of the World," "Knowledge on Hand," "The Whole World in the Hand," and "Guiding Hands." Each section would include two catalogue entries and at least one interactive image. The visitor, we reasoned, would thus be able to experience the exhibition *in nuce*, reading the introductions to the various themes and sub-themes, viewing select images, reading the related catalogue entries, and then experimenting with the interactives. Impatient (or young, or semi-literate, or non-English speaking) visitors could leapfrog the reading and jump directly to the interactives by clicking on the appropriate button.

Why interactives? This was a personal quest. I had, earlier in 1999, asked students to look at dozens of museum websites; they found, and who would

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[2] The team at Dickinson College included Trout Gallery staff: Dwayne Franklin, Peter M. Lukeheart, Martha Metz, and Wendy Pires. We were assisted by student interns Sara Adams and Matthew Coleman as well as by an advisory board of Dickinson colleagues—Jo Anne Brown, Christopher Francese, Robert Leyon, Blake Wilson, and Chuck Zwemer—and by public school teachers Michael Delluva and Melissa Gallagher.

not concur, countless tedious sites then being produced by museums which did not take full advantage of the possibilities of interactivity. These institutions had a virtual presence, but there was no acknowledgement that the new medium could do more than concretize the image/text didactic program of an exhibition or a catalogue. It seemed pointless to create a static online catalogue when it was easier to buy a hard copy or to consult one in a library. The interactive technology allowed us to bridge the gap between a walking tour of books, manuscripts, and prints presented in plexiglas cases framed on the wall (Figure 2) and the hands-on activities that we provided for visitors to our outreach programs (Figure 3).

I want to preface this tour of the site with additional comments about why we chose the images and formats we did. First, we were limited by time and money. With only four months until the exhibition opened, the design team had to focus on making a strong impression in the fewest keystrokes. Second, the cost of "renting" photographs from museums and libraries is prohibitive, as anyone who has published an illustrated book well knows. Further, the licenses have to be renewed every year or two. So, if you want to keep your site online for the long haul, it involves a lot of correspondence, negotiation, and expense. We compromised by selecting almost entirely works that were either in the collection of our partner, The Folger Shakespeare Library, or in the public domain.[3] Finally, we were constrained by existing technology.

Writing on Hands depends to a great degree on what was at that time the cutting edge technology, Macromedia Flash. Flash technology allows for

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[3] I would here offer an aside that the National Library of Medicine and the Library of Congress grant unlimited access on uncopyrighted images once you pay for the initial photography. After the image is made, it is then public domain. The Mellon Foundation's ARTStor program is addressing exactly these issues of cost and accessibility of images for scholarly audiences. In the past year (2006–2007) several prominent museums have begun waiving the rights of reproduction fee for scholarly publications with print runs under 2000–3000 copies. Whether this policy will extend to website images remains to be seen. See the discussion in Hilary Ballon and Mariel Westermann, "Art History and Its Publications in the Electronic Ages. Report on a Study Financed by the Andrew W. Mellon Foundation," Houston Rice University 2006 (http://cnx.org/content/col10376/latest).

Figure 2. Elementary school visitors to *Writing on Hands: Memory and Knowledge in Early Modern Europe*, The Trout Gallery, Dickinson College. Photo: Pierce Bounds

Figure 3. An interactive project to recreate the layers of the hand in Jacopo Berengario's *Commentaria* (Bologna, 1521), The Trout Gallery, Dickinson College. Photo: Pierce Bounds

rapid, low-memory retrieval of images and information. One can also layer visual material, sound, and data without having to create separate images. In addition, using principles that mimic calculus, you can sketch a few stages of animation and the program fills in what cartoonists call "tweening" (what amounts to those thousands of cells that made early Disney and Warner Brothers cartoons so costly and so awe-inspiring). In addition, the technology was accessible to millions of average computer owners through Netscape or Internet Explorer. Our designers had extremely populist ideals which included their choice, wherever possible, to use open sourceware and programs (many from Linux) and their dedication to making the website available to people who might only have enough computer memory to run texts. In this way very few visitors were frustrated to find the site completely out of reach to their browsers.

At this point I will present commentary during a walk-through of the website and comment on some of what we were trying to achieve.[4] There is too much material to review the entire site in this study. The site opens to a flash title page and then presents a menu (http://www.itergateway.org /writingonhands). The visitor then has a choice of going through the exhibition by themes, in the order of catalogue entries, or simply by playing with the interactives. Much ink has been spilt regarding the variety of ways in which the public responds to an exhibition: the breeze through, the casual visitor, the dilettante, the serious amateur, and the academic.[5] We tried to offer something for everyone, realizing, of course, that each of these visitors will take away different ideas and express different criticisms. If we select Section I—"Reading the Writing on Hands"—subsection one—"Mentor, Metaphor, and Map"—we find Charles de Bovelles' image of the *Learned Man* (1511, fol. 60v). The image is described in great detail, with a full catalogue entry by the curator.[6] In it, we are introduced to the

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[4] The Writing on Hands project website is now archived and can be accessed at http://www.itergateway.org/writingonhands.

[5] Joaneath Spicer, James A. Murnaghan Curator of Renaissance and Baroque Art, has, for example, put this new system of multitiered didactic texts into practice at the Walters Art Museum, Baltimore, Maryland. See Spicer (1994).

[6] See Sherman and Lukehart 2000, 68–69 (http://www.itergateway. org/writingonhands /major_themes/theme1/sub_themes1/mentor_metaphor_map.html).

life of Bovelles, translations of the Latin inscriptions, information concerning the sensory paths to learning, and the reason for Bovelles' choice of the faculties of *auditio*, *locutio*, *lectio*, *scriptio*, and *imaginatio*. Bovelles' method follows that of the catalogue reader. In fact, as we shall see, the *studiosus palestrites* is also the web visitor's surrogate: he uses a multiplicity of senses to engage the imagination and hence to learn.

Moving to Section I, subsection 2—"Identity, Intelligence, and Creativity"—the visitor has a choice of reading the catalogue entry and/or selecting the interactive image of Andrea Vesalius' woodcut portrait (attributed to Jan Stephen van Calcar) from *De humani corporis fabrica* (1543: see Sherman and Lukehart 2000, 72–73, cat. 5). By selecting the interactive, we find rollovers that allow us to translate and interpret the image based on the catalogue entry (http://www.itergateway.org/writingonhands/major_themes/theme1/interactive1.html). As we move from bottom to top, the image itself "speaks," telling us about Vesalius and his self-presentation, his work on dissection, the cadaver, and the text on the table close to the flayed hand.

In Section II—"Handiwork of the Creator" subsection 2—"The Instrument of Instruments"—we are introduced again to Jacopo Berengario da Carpi's *Commentaria* (1521) with a woodcut illustration showing the hand surrounded by Latin inscriptions (http://www.itergateway.org/writingonhands/major_themes/theme2/interactive_image.html). This interactive again takes advantage of rollover technology that permits the visitor to translate both the Latin and the more complicated abbreviations that key to the parts of the hand as they were understood in the cinquecento. All of this material could also be read in the entry, but what museum educator Wendy Pires added could not easily be described in words. First, she redrew the hand to include the bones as they are now taught in anatomy classes, revealing the shortcomings of sixteenth-century knowledge regarding the number and placement of bones in the wrist—there is some speculation that Aspertini was copying Leonardo's drawings and that he misread a deeply shaded bone for an open space under the left thumb (Roberts and Tomlinson 1992, 77). Further, she added five more layers to the bone structure, including deep ligaments, dorsal ligaments, nerves, blood vessels, and skin. Thus, the viewer learns not only Berengario's

nomenclature and techniques of dissection, but also the current state of anatomical understanding of the structure of the hand. The experience exceeds what is commonly possible in an image/text presentation, whether in a book, exhibition, or unsophisticated website.

Section III—"Messengers of the World"—subsection 1—"The Sense of Touch"— presents Descartes' illustrated (by La Forge and Gutschoven) description of the sense of heat from his treatise, *L'homme* (1664). Here, the visitor encounters the Cartesian understanding of sensory experience (http://www.itergateway.org/writingonhands/major_themes/theme3/interactive_theme3.html). When the subject is confronted with a flame, a spirit moves up his right arm, shown as a red line, following a specific route that leads to the pineal gland where the sensation is interpreted. From the pineal gland, the "spirit," illustrated by a blue line, passes back through tube 7, to N; then through O/R, and finally to the muscle group in the biceps. The "spirit" enlarges the biceps, which causes the hand to retract (step 5), preventing it from being burned (Descartes 1664, 97: see Sherman and Lukehart 2000, 141–142, cat. 32). In this case, it took multiple readings of Descartes to tease out the correct reading of this sensation, which follows a decidedly different path from that of the more famous image of sight illustrated earlier in his treatise. We had to ask the web designers to redo the entire interactive, which uses tweening, in order to clarify the path to and from the pineal gland.

Section III, subsection 2, "Inscribing Memory"—examines the use of the hand in mnemonic theory. The ideas presented here owe much to Frances Yates' important scholarship on theaters of memory, which as anyone who has plowed through her texts knows, point to an era when tangible memory systems played a key role in the mastery of complex theories and long narratives for academics and rhetoricians (Yates 1969: see Carruthers 1990). In the entry on Girolamo Marafioti's *De arte reminiscentiae*, Claire Sherman presents the author's ingenious system of using 23 (following the number of letters in the Latin alphabet) parts of the hand, front and back, left and right, to stand for a total of 92 memory spaces in which concepts and terms can be stored for easy retrieval (Marafioti 1602, fol. 9: see Sherman and Lukehart 2000, 158–159, cat. 39). Reading about the method impresses one with the sophistication of the filing systems

available *avant l'ordinateur.* The interactive memory game designed by educator Martha Metz allows the visitor to try to recreate a narrative concerning the Huguenot writer and illustrator, Esther Inglis, by first reading and memorizing and then reordering terms in the 23 memory places on a left hand. (This interactive is no longer functioning.) This was our most problematic interactive; the applet required to run it only worked on Internet Explorer and then only performed well with faster modems. The downloaded version only shows us the finished placement of the narrative words.

Section IV—"Knowledge on Hand"—subsection 1—"Manipulating Time"—presents one of the oldest recorded methods of hand calculation. Although The Pierpont Morgan Library's significant eleventh-century manuscript of the Venerable Bede's computistic model for counting from one to a million was included in the exhibition, we decided to use the more easily read and deciphered revision in Luca Pacioli's *Somma di aritmetica* (1494, fol. 44v.: see Sherman and Lukehart 2000, 168–169, cat. 43). The left hand covers the numbers from 1–99; the right hand, 100–1000. Pacioli's charts make clear, in a way that the illuminations in Bede's manuscript do not, that the gestures of the left and right hands parallel one another. Thus patterns emerge that can quickly be learned. For the website, we made these connections even more visible with the addition of color and provided an infinite series of addition problems that could be solved by young visitors. The interactive only begins to hint at the notion of silent communication, but the structure of the process is laid bare (http://www.itergateway.org /writingonhands/major_themes/theme4/interactive_theme4.html).

In Section IV, subsection 2—"Steps to Singing"—we benefitted twice from Susan Weiss' contributions to the exhibition: first, we based our section on the Guidonian hand and solmization practices on her entries for the catalogue;[7] second, she organized a group of female vocalists at the Peabody Conservatory to sing and record the soft, natural, and hard hexachords (http://www.itergateway.org/writingonhands/major_themes/theme4/ interactive_singinghand.html). This proved to be one of the most daunting conceptual ideas for the non-musical audience, so we were grateful

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[7] Specifically, Hugo Spechtshart von Reutlingen's (1488 *Flores musicae*: see Sherman and Lukehart 2000, 176–177, cat. 47).

to find a multi-sensory means with which to illustrate sight singing. As the hexachords are assimilated aurally, the notes light up along the scales, reinforcing the theory visually. This was also a challenge for the web designers who had to choreograph a layer for the illuminated musical score that followed (more or less) the movement of the voices.

Section V—"The Whole World in the Hand"—subsection 1—"The Body as Microcosm"—allowed us to work with the dichotomy of man as simultaneously a microcosm and a reflection of the macrocosm. We selected the woodcut figure of Zodiac Man from Johannes de Ketham's *Fasciculus medicinae* (1522: see Sherman and Lukehart 2000, 200–202, cat. 57). Each month as the heavenly bodies changed their positions in the firmament, a different area of the body, moving from Aries at the top of the head to Pisces at the feet, was meant not to be treated by physicians or barbers. This interactive (http://www.itergateway.org/writingonhands/major_themes/theme5/sub_body_microcosm/interactive.html) collapses translations of the Latin inscriptions (courtesy of scholar Luke Demaitre) with a hybridized mandorla showing the constellations from a famous fifteenth-century manuscript. As the cursor passes over the body, the appropriate constellation illuminates. For example, when Taurus is in the ascendant, one should not have the eyes, neck, or throat treated; nor should one gargle.[8]

[Section VI—"Guiding Hands"—was intended to have an interactive image from Robert Fludd's *Pulsus, seu, Nova et arcana pulsuum historia* (1629–1631); that is, *God Taking the Pulse of Man.* At this moment the money ran out; time was short and we wanted the website to open with the exhibition. All the components of the script were completed, but it was not to be.]

We launched the site in the first week of the exhibition about 12 September and were stunned to find one of our earliest fans was none other than renowned hand surgeon Frank Wilson (2000), whose book on the hand was a recent best seller. The rise of the website was rapid, surpassing our wildest expectations. In our grant applications we had estimated a virtual public of 50,000–75,000 over the course of the first year; instead

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[8] Luke Demaitre's translations of the inscriptions on Ketham's Zodiac Man are found in Sherman and Lukehart (2000, 201–202, n. 7). The quoted passage reads, in the original, "*Taurus est signu[m] aprilis: malu[m] est mederi oculis: collo: & gutturi: &c*"

the numbers grew exponentially. By the summer of 2001, we had over one million hits. I mention this not for the bragging rights, but because the public for web-based projects is potentially gargantuan. From the causes that we could determine, the success of the site swelled by tens of thousands each time a review appeared. The first was a mention in the "Circuits" section of the *New York Times* in October 2000 (Freierman 2000); it was followed by a review of the exhibition in the *Washington Post* in December (O'Sullivan 2000, 31). In short order, we were reviewed again by the *NYT*, with special mention of the website. And then came something truly unexpected: not only had the cultural mavens picked up on the site, but so had techies and the public, as we learned when Yahoo made it one of their Top Picks in January 2001.[9] Subsequently, the *Writing on Hands* site was favorably reviewed by *The Lancet* (Larkin 2001, 1897), which brought the exhibition to the attention of doctors and surgeons worldwide. From there it is hard to interpret the specific reasons that have sustained a visitorship of several hundred thousand every two to three months, even two years after the exhibition closed in March 2001. Most likely it is a result of hypertext links from one site to the next among early modern scholars, bibliophiles, physicians, denizens of chiromancy, and even public school homework sites, as I learned from a recent ego surfing voyage.

As a parent and educator, it was gratifying to find *Writing on Hands* as a suggested link for those researching Renaissance culture on Big Chalk. As a historian of the early modern period and a museum director, it was equally as gratifying to read Michael O'Sullivan's perceptive response in the *Post* article of December 2000, which extolled the site as "excellent. . . user-friendly. . . with interactive exhibits that go well beyond what the artifacts are capable of doing from behind their glass enclosures. Logically designed and graphically striking, it's a good example of how the internet can expand on, without replacing, the bricks-and-mortar experience." At this point we have entered André Malraux's "museum without walls" (1949). *The Writing on Hands* website allowed the medium of the internet to provide

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[9] Yahoo! Picks of the Week 2001, http://docs.yahoo.com. picks/20010115.html: "A wondrous septet of interactive images animate the past. Don't miss the musical hand, the calculating hand, or Descartes' description of our sensation of heat."

both the terms and the technology for a new means of organizing and interpreting images and information, and that has made all the difference.

The interactives included on the *Writing on Hands* website represent amplified catalogue entries that bring together, through manipulation, image, text, context, interpretation, and functionality. Although these examples were created for a general public, one could easily ratchet up the conceptual, interpretive, and functional aspects according to the needs or expectations of the audience. If I can push W. J. T. Mitchell's picture theory a step further,[10] we have transcended the pictorial turn and encountered the interactive turn, which acknowledges an actual manuality or physicality of learning in the digital age. In that sense we have come full circle: Bovelles' terms of *locutio*, *auditio*, *lectio*, and *scriptio* continue to spark the *imaginatio*.

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[10] "If a pictorial turn is indeed occurring in the human sciences, art history could very well find its theoretical marginality transformed into a position of intellectual centrality, in the form of a challenge to offer an account of its principal theoretical object—visual representation—that will be usable by other disciplines in the human sciences" (Mitchell 1994, 15).

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Reading and Teaching Shakespeare in the Virtual Library⋆

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Since the work of Elizabeth L. Eisenstein on *The Printing Press as an Agent of Change* (1979), the history of the book and print has played a prominent role in Renaissance studies. Recognizing the once "unacknowledged revolution" catalyzed by printing, we now invoke the names of Gutenberg and Aldus and the titles of those volumes that serve as monuments to this upheaval in European culture: Vesalius' *De humani corporis fabrica*, the *Hypnerotomachia poliphili*, Ortelius' *Theatrum orbis terrarum*, or Tyndale's *Bible*, to cite just a handful (Eisenstein 1983, 3).[1] Our accounts of that period's social and political transformation, as well, incorporate the contribution of this technology of textual reproduction, a technology now evolving once again. In his book on *Hypertext* 2.0, George Landow predicts that

> electronic text-processing... promises (or threatens) to produce effects on our culture, particularly on our literature, education, criticism, and scholarship, just as radical as those produced by Gutenberg's movable type. (1997, 21)

As scholars we know all too well that digital technology has transformed our own working lives. Most of us compose differently now because we can manipulate text in ways we could not have imagined twenty years ago.

However, the transformations wrought by digital media affect more than just how we write. For those of us who profess Renaissance literary studies,

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⋆ Some portions of this essay were published previously in Bushnell (2000).

[1] On the analogies between the printing and the digital revolution, see Robertson 1998, chapter 1.

digital technology aims at the heart of our work, that is, the form of the manuscript and book. How will our teaching and scholarship change when the book may be transmitted in bits, whether disintegrated into coded text or transmitted in images? As Roger Chartier has observed, this new technology not only changes the way we reproduce text, but also

> the materiality of the object that communicates the text to read-
> ers. Until now, the printed book has been heir to the manu-
> script in its organization by leaves and pages, its hierarchy of
> formats. . . and its aids to reading (concordances, indices, tables).
> The substitution of screen for codex is a far more radical transfor-
> mation because it changes methods of the organization, structure,
> consultation, even the appearance of the written word. (1995, 15)

This essay explores a concrete example of what it means to read and teach Renaissance literature in a digital age, by examining an electronic Shakespeare library located in the Schoenberg Center for Electronic Text and Image (SCETI) at the University of Pennsylvania. This virtual rare book library was designed for the student as well as the scholar, founded on the notion that old books can be made new by new technologies. The uses of that library not only contribute to the developing conversation about pedagogy in Renaissance studies, but they also allow one to raise broader questions about the status of the book in an era of digital texts and internet communication.

The Book and the Screen

As Landow's parenthetical "threatens" suggests, digital technology and internet communication have generated both utopian and dystopian visions among literary scholars. For some, the electronic text and the internet promise the global democratization of culture and the transformation of "reading" into creative interaction. For others, digitization represents the death of the book, and the internet will cause the uncontrolled prolif- eration and cheapening of knowledge and writing.

The utopian view celebrates the electronic word as enabling new ways of reading and writing. In Robert Coover's words, to its advocates the elec- tronic text is a "radically divergent technology, interactive and polyvocal,

favoring a plurality of discourses over definitive utterance and freeing the reader from domination by the author" (1992, 3). Richard Lanham has called the personal computer "a device of radical democratization from its inception" (1993, 108): it creates a democracy of aesthetic production, granting the tools of art to those otherwise excluded and empowering them to publish. It also equalizes reader and writer, encouraging them to switch roles and interact. As Chartier notes, the computer returns us to a world of reading before the time of print, when it makes the reader "an actor of multivocal composition. . . . Like the medieval manuscript reader. . . modifying them, rewriting, making them one's own" (1995, 2). The personal computer, connected to a world of others through the internet, also sets the stage for a democracy of scholarship, in which scholars all over the world collaborate on the production of databases. In James O'Donnell's imagination, this movement has the power to generate a new form of scholarship, one that recalls the past:

> A world in which it is not quite clear who is the author of a collective, cumulative, and collaborative work of scholarship may sound very novel, but it is also very old. The late middle ages had already created such books, like the famous *Glossa Ordinaria*, the common and widely disseminated medieval Bible commentary whose origins are still shrouded in mystery and which continued to grow and be relevant for centuries. (1998, 63)

O'Donnell and others celebrate this potential disintegration of the "author function" as a kind of liberation.

To represent the dystopian view, one could take a page from Sven Birkerts' *The Gutenberg Elegies: The Fate of Reading in an Electronic Age*. Birkerts sees nothing to celebrate in the transformation of print, the book, and the world of scholarship, because for him the printed book is a private experience that preserves the aura of authorship between its covers. To Birkerts, through the medium of the book "the author masters the resources of language to create a vision that will engage and in some way overpower the reader; the reader goes to the work to be subjected to the creative will of another." Birkerts fears that with the advent of new technologies of reading this kind of "necessity is dethroned and arbitrariness is installed

in its place" (1994, 163). Thus, his anxiety stems from his belief in the authors and the power of the word.

For Renaissance scholars less wedded to such an image of authorial mastery, Birkerts' critique may fall flat. They might, however, take more note of Birkerts' argument that hypertext lacks the material stamp of history and the substance of the artifact. Birkerts sees as a primary effect of electronic text what he calls the "flattening of historical perspectives." As he puts it,

> the depth of field that is our sense of the past is not only a linguistic construct, but is in some essential way represented by the book and the physical accumulation of books in library spaces. . . . Moreover, we meet the past as much in the presentation of words in books of specific vintage as we do in any isolated fact or statistic. The database, useful as it is, expunges this context, this sense of chronology, and admits us to a weightless order in which all information is equally accessible. (1994, 129)

It is a valid criticism that hypertext or virtual libraries might in fact drive us backwards from our recent return to history, just as we have sharpened our awareness that texts are tied to the culture that produced them.

I, too, have a deep and abiding attachment to the form, feel, and even the smell of books and my work depends on them. Indeed, the resurgence of the history of the book and bibliography has been one of the more surprising and significant outgrowths of New Historicism in the past ten years. Chartier worries about the "violence [that can be done] to the texts by separating them from the original physical forms in which they appeared" (1995, 22). Yet one should recognize, as Chartier does, that this concern is a privilege of those of us who have easy access to research libraries or the money to buy old books ourselves. Yet, what Birkerts loves—the logic, shape, and resistance of the codex—is indeed compatible with the democracy of the internet, through the technology of the digital image.

The Virtual Furness Shakespeare Library

Over the past seven years a team of scholars and librarians at the University of Pennsylvania have worked to use the computer and the internet to make

old books accessible in a way they have not been before. With a grant from the National Endowment for the Humanities, this group has produced a substantial archive of high-quality digital facsimiles of both early modern books related to Shakespeare, as well as later editions, prompt books, and images associated with the plays from the Furness Shakespeare Library in the Van Pelt Library at Penn.[2]

Most importantly, however, this project was designed to be useful to teachers and students as well as scholars, by embedding in the archive tutorials to guide teachers and students in using old books to read and perform Shakespeare. It has been one of the unintended consequences of the emphasis on history and new textual studies in Renaissance studies that the books we write about are not available for teaching, and thus a gap has widened between our scholarship and our pedagogy. The Furness Shakespeare Library project has aimed to spread the love of the historicity and materiality of old books, by making them accessible to students and teachers through, and not in spite of, the power of machine. We have done this, not by producing hypertext versions of early modern books, but rather through the production of high-quality digitized facsimiles of those texts.

This project, called "English Renaissance in Context," integrates into the Furness Shakespeare Library archive the pedagogical elements needed to bring it to a wider audience. At the heart of this project is a set of materials for the study of English Renaissance culture drawn from the Special Collections Department (including the Furness Shakespeare Library) of the Van Pelt Library. This library has long served those scholars close by or who have been lucky enough to have the time or money to visit it. Now it has a greatly expanded potential.

In the late nineteenth century, Horace Howard Furness, one of the foremost early editors of Shakespeare, and his son, H. H. Furness, Jr., built an extensive library of materials on Shakespeare, including almost all of the

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[2] The project team included: Rebecca Bushnell and Michael Ryan, co-directors; Brett Wilson, Technical Developer; faculty and staff, Phyllis Rackin, Jim Kearney, Erica Lin, Lawrence Warner, Greg Bear, Daniel Traister, Antonio Vivas, Owen Williams, Jamey Saeger, Mia Yamamoto.

English-language editions of his plays, the first four folios, and many early quartos. The Library also holds a large archive of promptbooks, biographies, prints, photographs, letters, scrapbooks (with reviews and news reports about Shakespearean performances and performers), and playbills for the study of early stage history. In addition, the Furness Library contains primary and secondary texts covering the history of the Renaissance in Europe. As Daniel Traister tells the story, Furness and his son's collection was unique in its time because it was constructed for use, not for show, as the basis of their ambitious New Variorum Shakespeare project:

> The Furnesses' variorum edition of Shakespeare's works, like those other great monuments of Victorian scholarship, is rooted in a commitment to the good that can emerge only from a cumulative, rational methodology. (2000, 63)

The New Variorum was meant to bring together all past scholarship and editions of the plays; there "readers would be enabled to survey, at a glance, all they needed in order to grasp the difficulties of the text before their eyes" (Traister 2000, 63). The Furness Library, in that sense, was collected to produce a kind of "machine" for Shakespeare studies. In fact, the Variorum itself turns out to be just the kind of project that would lend itself to digital technology.

In 1996, the Furness Shakespeare Library staff and faculty from the English department began to discuss how to increase the Library's value as a research and teaching resource by expanding its accessibility.[3] Supported by an internal grant from the Instructional Computing Development fund of Penn's School of Arts and Sciences (SAS) and by the Van Pelt library administration, the Furness Library team started to assemble an electronic archive of images and texts from the collection, so that faculty and graduate students could link the Furness texts and images to their course

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[3] The original concept for the library was developed by Jamey Saeger, then a graduate student at Penn: the leaders were Michael Ryan, then Director of Special Collections in Van Pelt Library and Rebecca Bushnell. Other faculty involved in its development are Phyllis Rackin, Margreta DeGrazia and Peter Stallybrass; James Kearney, Brett Wilson and Owen Williams, then graduate students at Penn, were also critical to the project. Greg Bear, then the Manager of the Schoenberg Center for Electronic Text and Image (SCETI) played a key role.

home pages, ask students to consult the library from their home or dorm room, or use the library in classrooms equipped with computer projection hardware. In 1998, the Library and SAS received a three-year grant from the National Endowment for the Humanities to develop the site as a resource for teaching and scholarship for a world-wide community.

The project now exists in two, interrelated parts: an archive of digital facsimiles of early modern texts, mostly those related to Shakespeare, and an extensive set of teaching materials. This website is located at the University of Pennsylvania Library's server, as part of the Schoenberg Center for Electronic Text and Image (SCETI). According to the mission statement on its website,

> SCETI, a fully integrated digital library, was created in 1996 to publish virtual facsimiles of rare books and manuscripts in the Penn Library's collections. Its ongoing mission is to make accessible to the global community of scholars and researchers primary source materials that would otherwise be difficult to access. The site is free and open to all in the interests of knowledge and learning.

The "English Renaissance in Context," in conjunction with the Furness Shakespeare Library Archive, is the direct expression of that mission.

The Furness Shakespeare Library corner of the SCETI site stands alone as an archive of high-quality digital facsimiles of important primary and secondary texts in the Furness and Special Collections of the Van Pelt Library at Penn. At the time of the writing of this essay, the archive included ninety books, either complete or abridged and an extensive set of photographs and engravings. The archive's centerpiece is a facsimile of Furness' copy of the First Folio, accompanied by quarto versions of the plays, eighteenth- and nineteenth-century revisions and editions, travesties, promptbooks, and relevant sources and contextual materials when available. The archive is searchable and can be browsed, by author, date, or title. Once a text is selected for examination, the reader can "open" the text by chapter, page, folio or signature, or by act and scene (if a play). One of the site's unique features is its function for comparing two books at once, in adjoining frames. So, for example, if the reader wishes to emulate H.H. Furness, Sr., and collate the First Folio version of

King Lear with that of the 1619 quarto version, he or she can summon both up on the computer screen at the same time, "flipping" through the pages simultaneously and analyzing textual variants, large and small. The quality of the full-color reproductions invites the reader to appreciate details of typography, texture, handwritten marginalia, and even the stains of time. A zoom tool allows an even more finely grained analysis of the surface of the page. All that is missing is the smell of old paper and rotting leather bindings.

The virtual archive thus preserves the features of reading the book itself (albeit at a slower pace, depending on the speed of one's internet connection). The digital facsimile functions much like the codex, insofar as pages can be read either sequentially or by putting a digital finger at a spot anywhere in the text. It is true that the books are not searchable by word or phrase, since they are not marked-up at that level. While a loss for some forms of analysis, this quality preserves the opacity of the material book: the reader must focus on the surface and a word cannot be detached from its place on the page nor lose its typographical character. If, as D. F. McKenzie has observed, "the material forms of books, the non-verbal elements of the typographic notations within them, the very disposition of space itself, have an expressive function in conveying meaning" (1986, 8), then here the full range of meanings is inescapable.

The Electronic Class in the Digital Library

But what does the archive mean to the reader for whom the "vocabulary" of the form of the early modern book means nothing? To teach in the Furness Library is a very different task. To the student reader, the texts in the Furness archive may be physically accessible, but they are opaque in a different way. Like many readers accustomed to the scrupulously edited and annotated modern text, students will be puzzled, if perhaps charmed, by these digital facsimiles of yellowed old books.[4] The Furness Shakespeare Library site solves the practical problem of students' literal access to the rare book room, removing all physical barriers and requiring no gloves, identification, or bag searches. But what can they do there?

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[4] See Marcus (1996), on the significance of teaching and reading with unedited texts.

The complement to the Furness Shakespeare Library is "The English Renaissance in Context" (ERIC), an online "classroom" that guides students through the experience of reading Shakespeare and English Renaissance culture in the format of old books. The classroom is itself divided into two sides. One is a set of tutorials focused on four Shakespeare plays, leading the student through questions about a series of texts and images related to *Romeo and Juliet*, *King Lear*, *Richard III* and *The Merchant of Venice.* The other side is devoted more directly to teaching the history of the early modern book, with sections on "Looking at Older Books," "Making Books," "Folios, Quartos, and Publishing," and "Editing and 'Unediting.'" Each tutorial runs as a kind of movie, guiding the reader in real time through a structured inquiry into the topic at hand yet permitting him or her to jump out of the lesson or classroom directly into the archive to start an individual journey.

The tutorials for exploring the history of the book are meant to introduce students to the essentials of bibliography, but they are also designed to pique their interest in editorial questions: indeed, why *should* they care about typography or textual variants? In the first section on "Looking at Old Books," the lesson on title pages highlights the notion that the title page could function as an advertisement, while the tutorial on pages and their contents explains terms such as folio, quarto, and signature, using an animation of folded sheets. Ruth Luborsky prepared the tutorial on illustrations, explaining the eccentricities of wood cuts and their role in contemporary books (a zoom function encourages close examination of the details of the images). The section on "Making Books" reproduces the illustrations and text from Diderot's *Encyclopedia*'s entries on printing, as a complement to the first section. The other two sections offer a window onto the complex business of bibliography and textual editing. The discussion of "Folios, Quartos and Publishing" opens up the collection's "Pavier" quartos, and in particular its copy of the second quarto of *The Merchant of Venice* (1619), challenging the student to interpret Edward Capell's handwritten collations on this unique copy of the play, demonstrating the effort to construct the "perfect" text. The final section, on "editing and 'unediting' Shakespeare," takes advantage of the library's 1619 quarto of *King Lear*, which can be juxtaposed with the Folio version of the play: while the two version are now more commonly available, the

ability to see the page itself impresses upon the student the contrasts in type and format. In this exercise the value of the digital facsimile is that, while it promotes close examination, it resists alteration.

Each of the Shakespeare play tutorials exposes the student to a different way of working with the riches of Furness Library, taking them beyond what can be understood from a modern edition. For *Romeo and Juliet*, it means following the play's transformation through the eighteenth and nineteenth centuries; for *The Merchant of Venice*, using contemporary texts on subjects such as usury to unfold the play's themes; for *King Lear*, exploring three different ways of telling Lear's story, by Holinshed, Shakespeare, and Nahum Tate; and for *Richard III*, looking at the relationship between rewriting history and the stage history of the play. In all these cases, the website takes advantage of the full range of the Furness collection, including its multiple texts from the sixteenth and seventeenth century, and its collection of relics of Shakespeare performance.

The Merchant of Venice tutorial cuts across a group of sixteenth-century texts to follow three themes: anti-Semitism in Shakespeare's world, the status of usury and merchants, and contemporary English attitudes toward Venice.[5] The tutorials weave in and out of the Folio text of *The Merchant of Venice*, asking the student some familiar questions about character and plot design. What is different here is that the Folio text is now juxtaposed with other sixteenth- and seventeenth-century texts. To develop the theme of anti-Semitism, the student is asked to view the facsimile of Donne's Holy Sonnet, "Spit in my face, you Jewes" as well as Marlowe's *The Jew of Malta* (scanned from a copy owned by Lehigh University); for "Venice Englished," he or she is invited to turn the page (as it were) to the Folio's version of *Othello*, to view another version of Shakespeare's Venice. The cross-referencing goes beyond other plays and poems with which the advanced student might be familiar; for the theme of anti-Semitism, the reader can consult Alexandre Le Sylvain's *The Orator*; to consider early modern English attitudes toward commerce and usury, Henry Smith's

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[5] The *Merchant of Venice* tutorials were composed by James Kearney, then a graduate student at Penn and now an Associate Professor of English at UC Santa Barbara. Rebecca Bushnell wrote the *Romeo and Juliet* tutorials; the *Lear* tutorials were written by Phyllis Rackin and Rebecca Bushnell.

treatise *The Examination of Usury* and Miles Mosse's *The Arraignment and Conviction of Usury* are provided; for the study of Venice, the student can dip into Lewis Lewkenar's translation of Gasparo Contarini's *Commonwealth and Government of Venice* (1559). At any point the adventurous reader is invited to explore beyond the point of contact: the book is laid open on the relevant page, but it is easy to browse further. The salient effect is the common look of the books. While in fact they span over a century and a half in time, they suggest a shared world of reading and thought. While the facsimile preserves the integrity of the image, the digital technology allows immediate access and instant contrast.

The tutorials that explore the later transformation of Shakespeare's plays use the art of the digital facsimile to reveal the text's instability, For example, in a sequence on the poetry of *Romeo and Juliet*, after first comparing the balcony scene's love poetry with Shakespeare's sonnets of comparison ("So it is not with me as with that Muse" and "My mistress's eyes are nothing like the sun"), the reader moves to David Garrick's revision of the play, in which he removed many of the words that he found too vulgar and cut much of the rhyming text and puns. With Garrick's text of the balcony scene juxtaposed with a matching frame of the text of Q5, the reader may compare these two versions of the scene and identify where Garrick made changes. Where did he remove or clean up a rhyme? Where did he substitute new words? What kind of lines has he eliminated? From there, the reader travels to look at Richard Gurney's travesty, which is written in relentless rhyme. This exercise not only charts the changes in tragic taste, but also engages students in contemplating the impact of diction and rhythm on tragic style and tone. The later texts also look different on the page, bristling with stage directions, more space, and formality: there is no question that they date from a different era of the theater.

The second thread of the *Romeo and Juliet* tutorial plays differently with the chain of versions extending beyond the seventeenth century. This thread focuses on the revision of the play's final events after Juliet's death, including its mixture of comic and tragic effects. The tutorial centers on Garrick's radical revision of the tomb scene, where he had Juliet wake up before Romeo dies and added new lines for both to heighten the pathos at the end. The reader is asked to contemplate why Garrick made the

changes that he did and to speculate about a time when actors and directors not only cut scenes and lines from Shakespeare but also invented new ones. The reader can then look at Furness' unique copy of Edwin Forrest's annotated promptbook of *Romeo and Juliet* (Garrick's version as slightly changed by Kemble). Forrest's promptbook is strikingly hand-edited for performance, lopping off the end of the play right after Juliet's death with an emphatic "X." The text opens a window onto nineteenth-century theatrical taste and provides a view of a play text as a performance document. The tutorial ends with Richard Gurney's nineteenth-century parody of *Romeo and Juliet*'s ending (and some overwrought engravings of the tomb scene from eighteenth- and nineteenth-century editions). Experience has shown that the tutorials give students a dizzying sense of the instability of "Shakespeare," no longer the monument of the neat modern edition.

The other two tutorials, on *King Lear* and *Richard III*, play with the notion of Shakespeare as transformative—and capable of being transformed. The *Richard III* tutorial links the play to accounts of Richard's reign to be found in Holinshed and Hall's chronicles, as well as More's *Life of Richard III*. After looking at the shift from a historical to a performative Richard, the tutorial displays later theatrical Richards, beginning with Colly Cibber's recasting of the role and ending with a glance at Ian McKellen's cinematic tyrant.[6] The section on *Lear* considers the relationship between Shakespeare's and Holinshed's versions of Lear and Cordelia's story, using Penn's folio and quarto texts of *Lear*, as well as its copies of the 1577 and 1587 editions of Holinshed. The tutorial focuses on the differences between the historical and Shakespearean versions of Cordelia's character and story, where Shakespeare deliberately changed Holinshed to have Cordelia hanged at the play's end (in Holinshed, her forces win, and she lives to rule, only to commit suicide when she later loses the throne). The consideration of Shakespeare's rewriting of history leads to Nahum Tate's rewriting of *King Lear*, in which Tate, who found the death of Cordelia unacceptable, changed the ending once again to a happy one, where Cordelia suitably marries Edgar. The tutorial highlights the shifting representation of Cordelia, in both text and the theater. At the end of the tutorial, the student is invited to speculate how he or she might rewrite the play's ending.

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[6] The *Richard III* tutorial was written by Phyllis Rackin.

Working and teaching in the virtual Furness Shakespeare library, with its testimony to four centuries of reimagining Shakespeare, thus reinforces the idea of "Shakespeare" as an invention. This essay began by considering both the fears and hopes that hypertext would lead to disintegration of the author and the book itself. Anyone who spends any time studying in the virtual Shakespeare library will, however, soon see that print technology offers only the illusion of a stable text and authorship. Unlike hypertext, the digital facsimile retains much of the historicity of the text. It is not "flattened" out into identical typography, but rather appears on the screen as a unique artifact that bears the traces of its passage through time. The difference that digital technology makes lies not only in its providing access, but also in making multiple juxtapositions quick and sharp. The technology provokes the reader to move from text to text at the point of contact. Thus, reading and teaching in this virtual Shakespeare library certainly promotes the democracy promised by the prophets of the internet and the digital future. It also allows the student and scholar to reenter the past, and to see how the text of Shakespeare has always been in some way free.

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Performers on the Road:
Tracking Their Tours with the
REED Patrons and Performances Website

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The website under discussion in this essay was published five years ago, and we invite you to visit http://link.library.utoronto.ca/reed/. It contains data from all published REED volumes, but we have here limited ourselves to sampling the data from Lancashire, to show the range of materials available from every county.[1] The site results from a wish that has been expressed for at least a hundred and fifty years, to be able to trace the activities of professional performers of all kinds, on tour to the cities, towns, monasteries and households of provincial England. This wish was a major motive behind the Records of Early English Drama project, founded in 1975. Ten years into the life of the project, researchers had systematically undertaken to assemble information about the patrons under whose names many of these performers travelled. Who were these patrons? When and where were they born, and where did they live? Who were their families, titles, connections, spheres of influence? Out of the need to organize and maintain this host of details, the REED patrons database was born.

The painful first steps in database design, in 1985, used a custom-designed or "home-made" database written in BASIC, running on a (then) state-of-the-art computer with 64K memory and two 128K floppy drives. We mention these stone-age specifications to point out that severe constraints

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[1] The performance data for Lancashire venues are taken from George (1991). Lancashire, records of early English drama. Publication details for the REED series may be obtained from http://www.chass.utoronto.ca/~reed/publist.html #reed.

on memory and storage capacity affected our designs, and continued to do so long after computers became much more capacious. Figure 1 shows the tables, and the relational "common field" used to link them: the "Patron_ID." This was a memnonic identifier, our first mistake: don't use memnonics because they are puzzling, not intuitive. This simple table design survived migrations through dBASE II, III, and IV into Access 97 and Access 2000, and our progress to computers with unimaginable capacity. The project never had the resources or time to mount this database on a network or to write a front-end application to facilitate data-entry and retrieval, so as a result a small army of research assistants had to learn something (never enough) about dBASE or Access, and constant vigilance was needed to prevent errors or the use of duplicate datasets. The data were becoming more extensive and potentially more valuable, but were virtually unusable by the research community outside the REED office; even within REED, it required considerable knowledge of Access to construct queries and retrieve information.
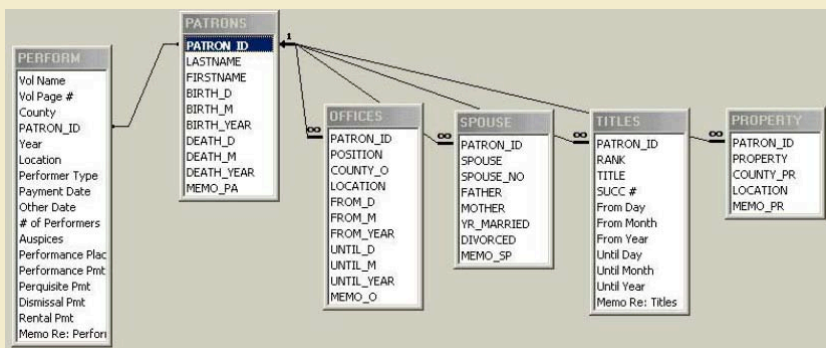
Figure 1

Enter the internet, bringing hitherto unimagined opportunities for data access and research. Our website project began in 1998 and, just like the internet itself, "Patrons and Performances" has expanded its horizons as it has moved to its internet home. The database structures have become more complex, first of all because we've created a web-based, password-controlled administrative site, called "the templates," wherein data-entry, updating and maintenance occur in controlled conditions. Hence our assistants don't need to be taught Access; all they need to

Figure 2

Figure 3

remember is their personal usernames and passwords. Figure 2 shows the Administrative home page, with the list of possible searches available. Figure 3 shows part of an event record, available for editing, with fields of controlled data (e.g., Troupes, Event Type). The data from REED's first eighteen volumes are all available for editing and checking, but until this process is complete the records are "shadowed" from public view. Any change, when saved, is available on the public site if the record is not shadowed, and the identity of each editor is permanently stored in the database. These pages are accessible from anywhere, so work has been carried out in London, Guelph, Toronto, Philadelphia and England.

The search capabilities of the internet provide the main reason that the databases have been extensively redesigned. For example, not many people (or computers) under the age of forty know anything about English "old money" (£. s. d.), so we've taught the computer this arcane coinage to enable calculation and comparison of payments to troupes. Similarly, dates before 1 February 1752, so-called "Julian calendar" dates, don't compute. Since our project's end-date is 1642, we have created a Julian calendar database that returns information about any date before 1650, such as the day of the week, feast day (if any), regnal year, and the like. With the help of a professional web designer we've created an attractive, user-friendly home page, illustrated as Figure 4. It incorporates context-sensitive help (How to Use this Site), and a scrupulously maintained listing of our sources (Sources of Evidence) to ensure scholarly reliability. The "Search by Keyword" feature is available on every search screen as well as the Home Page, and it is the most powerful search tool on the website. Users simply enter a word, or part of a word, and the search engine does a sequential search through every field of every record in the database, and returns the main entry record for every match. It has to be used with care—enter the letter "l," for example, and the query will return the entire database because every record contains an "l," somewhere. To demonstrate, an entry of "nok" returns four patrons (Figure 5); searches through the last of these patrons, in the data about his offices, reveals that Thomas Stanley was the 10th Baron Strange of Knokyn (a small manor and village in west Shropshire).

Figure 4

Figure 5

Before demonstrating other possible searches, we present a brief outline of the architecture and software under which the site is running. Because it is more robust in the environment of multiple users, the data are maintained in MySQL and queries are constructed and submitted in ColdFusion—the latter is a widely-used industry standard. A user is presented with one of a number of HTML query pages, and is able to construct the desired query by limiting the search in various ways. When the query is completed on the client-side, it is posted to the server and executed, with the results returned on another HTML page—various data elements are hyperlinked, allowing the user to proceed (or, "drill down," in ColdFusion language) to a more specific level of detail. Some of the fields added to the database facilitate this hyperlinking; many place-names in England are duplicated in different counties, for example, so each place in the databases is given a unique identifier to allow the database to interface with the interactive map, running under ARCIMS on another server. (The maps are discussed in more detail below.)

The task of determining what can be asked, and then of constructing the queries to accomplish the tasks, has been an arduous one and it is continuing—in response to our own experiences and the requests of users, we continue to develop the architecture of the site to improve its capabilities. One planned development will be that when a particular selection of performance events is requested (say, performances by the Queen's Men between 1590 and 1595), the query will return the listing, as now, but also will total the payments; this will allow comparisons between different companies' varying fortunes. We also plan to have, on the map, particular tour routes highlight themselves: for example, the lord president's men toured in the west in 1592–3—what roads did they likely follow? It's always difficult to be sure about such things because datings in annual accounts are often vague. But not always—we hope to be able to learn from exact dates, where they are found (796 occurrences, about 20% of the total), and such things as information about seasons and routes. We already can determine the most popular day for performances (Saturday, with 115 performances); as well, it is very surprising to learn that seventy-nine performances took place on Sunday, a day when such activities were frowned upon or forbidden.

This paper, then, describes a work in progress. We turn next to describe some of the search possibilities. From the home page one can follow a "Shakespeare Featured" link, which is really only there as a "tickler," to interest a casual visitor, and to ensure that the site can be Googled under Shakespeare. The main searches available there are for Patron, Event, Troupe and Venue, and each of these selections takes the user to its main query screen. Figure 6 shows the "Patron" search page, about to search for anyone with "Stan" in the name/office/title, and born after 1560. A listing of Stanleys is returned; clicking on one of these brings up his details (Figure 7) from which, as you can see, a look at his family tree or further searches into his offices, titles and properties are possible, as are investigations of related records about events, troupes and venues connected with the patron, William Stanley. Next, the "Event" search page (Figure 8) is set to search for performances, in domestic auspices, where players were paid more than £1 (= twenty shillings). The query returns a list of nine events, and clicking on one of them takes us to a detailed event page (Figure 9) for the Queen's Men at Dunkenhalgh Hall in 1615. As you can see, this detail page allows for various other searches: all records of the Queen's Players, details about the venue (Dunkenhalgh Hall), and patron information about Queen Anne.

Troupes can also be searched directly, using search "for troupe" to select a keyword or various search parameters (date, county, etc.), as seen in Figure 10. Every search can be a global search, for all records; performing that here brings up the thirty-nine distinctive troupes that occur in the Lancashire records. Perhaps, of course, the group called in one record "Sir Edmund Trafford's Minstrels" may be the same as the troupe named by another scribe as "Sir Edmond Trafford's Musicians"—we have no way of knowing, and cannot second-guess the records. Eventually, this search for all troupes will return over 600 troupes, so limiting a search using parameters is advisable. The twelfth troupe in the resulting listing, the King's Players (of James Stuart, king from 1603–25), returns a list of four events (Figure 11); clicking on the last of these brings up the Event Details page for the King's Players at Dunkenhalgh Hall, 16 December 1624, seen in (Figure 12). As with other details screens, this one provides, on the right-hand side, possible further search choices to discover further

Figure 6

REED

Records of Early English Drama

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for Event
for Venue
for Troupe

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Interactive Maps
Antiquarian Maps

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Search Tips

PATRON DETAILS:
STANLEY, WILLIAM (1561-1642)

Biographical overview

Birth Date: ca. 1561
Death Date: 29 Sept. 1642

Titles: Earl of Derby
2 titles listed
Offices: 11 offices listed
Properties: 27 properties listed

View the family tree
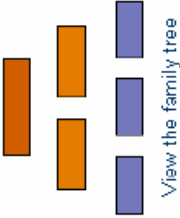
Stanley, William
Details of titles (2)
Details of offices (11)
Details of properties (27)

Search Related Records
Events naming patron
Patron's troupes
Venues owned by patron

Bibliographic Sources

Options
Start A New Patron Search

Figure 7

Figure 8

Figure 9

Figure 10

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Search Tips

King's Players

Search Related Records
Stuart, James (1566–1625)

Dunkenhalgh Hall

Options
Start A New Search

TROUPE DETAILS:
KING'S PLAYERS

Troupe Type: Players
Troupe Patron: Stuart, James (1566–1625)

Event(s) listed for this troupe:

Performance at Dunkenhalgh Hall	Dunkenhalgh, Lancashire	1620
Performance at Dunkenhalgh Hall	Dunkenhalgh, Lancashire	1620
Performance at Dunkenhalgh Hall	Dunkenhalgh, Lancashire	1624
Performance at Dunkenhalgh Hall	Dunkenhalgh, Lancashire	1624

Figure 11

Figure 12

details about the troupe, its patron, related other events at the playing venue, or materials about the playing venue itself, Dunkenhalgh Hall.

Another innovative way to navigate the website is through the Interactive Map that is an important interdisciplinary feature of the website. The GIS map of England and Wales has been newly designed in collaboration with the Cartography Office at the University of Toronto but it too has its origins in the 1980s.[2] A conference presentation in 1983 inspired the desire to demonstrate at a glance the many medieval and Renaissance performance locations identified by REED researchers—monasteries, private residences, towns—together with major routes they might have travelled across the kingdom and the rivers and other topographical features that might have influenced their choice of itinerary. Creating the demo map was not as easy as having the idea. There was no map in existence that would easily serve as a base and evidence for roads before 1642 was in short supply. The somewhat intractable sources relevant for producing a customized map included Matthew Paris' mid-thirteenth century map, indicating the main road north from Dover to Newcastle upon Tyne by the principal stops along the way; the famous mid-fourteenth century Gough map, with an extremely valuable network of roads, with distances, across the kingdom; and somewhat perversely, the typical source for Renaissance routes—not a map at all, but a road list naming the main stops along what the Elizabethan chronicler, Richard Grafton, termed "The high wayes from one notable towne in Englande to the Citie of London."[3]

The enormous styrofoam contour map with little coloured flags that resulted still hangs in the REED office as a quaint artifact, now supplanted by the multi-layered interactive map on the website.[4] The 1980s version is what cartographers call a 'generalized' road map for England and Wales

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[2] The mapping capabilities of the project are provided by the ArcGIS Geographic Information System software, and the Arc Internet Map Server. These are map and data browsing packages that have been extended for use in the WWW environment by Environmental Systems Research Institute (ESRI) Inc.

[3] The Matthew Paris and Gough maps are reproduced in Harvey [1991, 74, Map 57 (BL: Cotton MS Claudius D.VI, f 12v) and 78, Map 61 (Bodleian Library: Gough Gen. Top. 16)]. Grafton's road list was first published in Grafton (1570). See further MacLean (1992).

[4] A print version of the styrofoam map was also published with the conference paper: see MacLean (1988).

before 1642 and in various print versions it has served REED purposes for some years. However, professional cartographers for understandable reasons reject such sources when they begin their GIS mapping, and a generalized route map will not do when the goal is to allow the user to zoom in to river valleys and individual places plotted according to their pre-1642 locations rather than their modern industrialized expansions. The Interactive Map that serves as our visual base for exploring performance venues and other places associated with patrons' residences and office titles is therefore derived as much as possible from the earliest detailed route maps available, in John Ogilby's *Britannia*, published in 1675. From the sample shown from Ogilby's strip maps (Figure 13), the reader can see that very precise detail is mapped, if somewhat eccentrically to our eyes, and this detail allows us to trace recognizable if often minor modern road lines on the modern Ordnance Survey maps required for our GIS cartography. The modern sources used for the maps were various. Base mapping was adapted from the Digital Chart of the World dataset which has a nominal scale of 1:1 000 000. Further details of place location, county boundaries, and routes primarily came from the Ordnance Survey of Great Britain sources. Where the modern route can only be speculative because of the sources, a dashed line differentiates it from those that can be traced with confidence. The historical and cartographic sources of evidence for the Interactive Map are listed individually in the Bibliography, accessed on the top bar of the home page, but there is also a concise summary, "About the Maps," accessible from the top bar of the Interactive Map page.

Turning now to the website's Interactive Map (Figure 14), we have at the top layer England and Wales with the historic county boundaries drawn and the most important cities in the kingdom that had acquired county status. The different coloured squares locate performance places identified by REED researchers to date—red for towns, blue for private residences and purple for monasteries. If we are curious to know more about a particular region we can use the zoom-in tool on the upper left to move in for detailed coverage (Figure 15). The coloured crosses which appear at lower layers allow the user to track locations associated with patrons' offices and minor residences but not with performance events. Clicking on the right to call up a different map layer, we can ask for a relief version of the map (Figure 16). And we can keep zooming in closer to

Figure 13

track a particular route or performance location, using the distance tool on the lower left tool bar to measure either in mileage or kilometres the distance between one place and another (Figure 17).

Figure 18 shows a section of the main road north from London to Carlisle also indicated on Ogilby's strip map (Figure 13), the road connecting Warrington with Wigan, Preston and beyond. The relief displayed easily illustrates why this route north on the west side of the country tended to be preferred from Roman times onward. A later version of the website will allow the user to access the cartographic sources of each stretch of road which have been coded with this further "footnoting" feature in mind.

There will be some informed users who may have a particular interest in the Lancashire residences of the powerful Stanley earls of Derby and they will quickly notice three not far from this stretch of road to the west—Knowsley, Lathom and New Park. By using the "Select single location" tool on the left, it is possible to search the databases by clicking on an individual

Figure 14

Figure 15

Figure 16

Figure 17

Figure 18

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Lathom House
History

Search Related Records
Events at venue
Troupes at venue
Patrons who owned venue

Bibliographic Sources

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Start A New Venue Search

Venue Details:
LATHOM HOUSE

Located in Lancashire: Lathom
Private residence
Built 1459-95
MAP IT

Gatehouse Approach
Gatehouse Approach 2
Lathom House from a distance
Tudor Lathom

Overview

Principal house of the Stanleys until its destruction in the Civil War when the family removed to the Isle of Man.

A fortified castle, Lathom seems to have had a number of towers which accounts give variously as 7, 9 or 11 in number.

The building itself was of vast extent, with a massive keep - the Eagle Tower - rising in the midst, and surrounded by embattled curtain walls, strengthened by seven lofty towers, the whole being encircled by a wide ditch or moat, across which access was gained by a drawbridge communicating with a portcullised gateway' (Croston, *County Families* 86).

2 miles from Ormskirk, not far from the main road N.

Current Status

No trace of the original structure remains and until late 20th c. excavations the original site was uncertain.

Figure 19

location, such as Lathom, the Stanleys' principal residence in the period
A further click of the mouse connects the map with the Venues database
(Figure 18) and delivers historic and architectural information as well as
images of the many performance venues used as alternative theatres by
touring professional entertainers outside London. From the Venues page
it is easy to migrate to performance events data, or to biographical data
on performer patrons.

Searching via the map may encourage more free-spirited exploration.
For example, a user might zoom in on Lancashire looking for Stanley
residences, but might look about the neighbourhood for comparative
purposes, finding Smithills on the other side of the main road north, not
far from Manchester.

Clicking on Smithills highlights the location and brings up a wealth of data
on a very intriguing performance venue that has survived the centuries
(Figure 19). In this case it has been an advantage to be the property of
gentry rather than nobility with royalist inclinations in the seventeenth
century. The website allows us to include a range of images, some nine-
teenth century and others taken during a site visit—wherever possible we
aim to explore these venues, with digital camera in hand and measuring
instruments at the ready.

The typical performance space in a private residence would have been the
hall where the host held formal entertainments and it has been assumed
that Smithills Great Hall (Figure 20) was such a location for the Renaissance
performers on record there in the Shuttleworth family accounts. This hall
is a remarkable late fourteenth century survival, full of character, but for
a sixteenth century family it might have seemed small, dark and uncom-
fortable with its central fireplace (Figure 21). In the newer east wing
was the more fashionable dining space known as the Withdrawing Room
(Figure 22), with an ample bay window and fine panelling. Relevant archi-
tectural details, including measurements of both spaces as well as a ground-
plan are included (Figure 23). In many cases later restorations or "im-
provements" have masked or removed original features and these too are
outlined wherever possible under the heading "Renovations." And in the
Performance History section the case is concisely made for the Withdraw-
ing Room as the likely venue for entertainment between 1582 and 1596.

Figure 20

Figure 21

REED
Records of Early English Drama

Feedback   How to Use This Site   Bibliography

Search the Records
for Patron
for Event
for Venue
for Troupe

Search by Keyword
Search Tips

About This Web Site
Sources of Evidence
Present Data Coverage
Development Team
Credits and Sponsors

Search the Maps
Antiquarian Maps
Interactive Maps

Smithills Hall
Overview
History

Performance Spaces
Great Hall
Withdrawing Room

Search Related Records
Troupes at this Venue
Events at this Venue

Options
See This Venue On A Map
Start A New Venue Search

SMITHILLS HALL

Located in Lancashire: Smithills
Private residence
Built 14th c.
MAP IT

Performance Space: Great Hall

Width: 25' Length: 27' 6"
Built: 14th c.

Located in the N range of the courtyard.

N and S walls rebuilt in stone in the 16th or 17th c. E and W walls have their original timbers and bold quatrefoil bracing.

The spere trusses also decorated with the quatrefoil motif mark the place where the screen would have been located at the W end

Renovations

18th c. Hall converted to serve as a brewhouse. The side walls were raised, a false roof and upper floor inserted that damaged the spere trusses (Taylor, *Old Halls* 62; Smith, *Archaeological Journal* 144.31).

1950s Hall restored to approximate its original condition.

Back to Venue Overview

Descriptions
Ceiling
Minstrels' Gallery
Screens passage description

Views
Doors
Fireplace
Great Hall S wall
High End
Low end

Figure 22

Whereas the performers on the Lathom House list were familiar troupes patronized by royalty or nobility, the list at Smithills is rather different (Figure 24). These patrons were mostly less familiar gentry—Mr Edmund Trafford, for example. His biographical details are included in the Patrons database—the page linked with Properties (Figure 25) shows his residence, hyperlinked with the Venues page on Trafford Hall (Figure 26), now demolished to make way for Greater Manchester. And we can do similar investigations of other patrons on the Smithills' Troupes list—Mr William Tatton, for instance, whose residence at Wythenshawe does survive.[5]

The map complements as well as facilitates such searches (Figure 27). If we look one last time at the Smithills area, we can see why some of these people were associated with troupes performing just north of Manchester: Mr Atherton's musician from Atherton Hall west of Manchester; Mr Trafford's musicians from Trafford Hall to the south; Mr Tatton's musician from Wythenshawe in the same neighbourhood; and a little further to the southeast, Sir Peter Legh's musicians and players from Lyme Hall.

This has been a whirlwind tour of just one small section of Lancashire. We intend that the Interactive Map will allow much more for researchers in future—a layer illustrating diocesan county boundaries, for example, to complement ecclesiastical appointments identified in some patrons' biographies and more local roads, as our research progresses in consultation with historical geographers. This is an ambitious project, with an ever-widening circle of research associates and, we hope, engaged users. We have provided an easy avenue for feedback, so that if a user has a comment on the site or a suggestion for its improvement at any time it will come to us by email. We trust that, in turn, the website will enhance appreciation of the importance, range and variety of professional performance in the counties of England before 1642.

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[5] Now part of the suburban area of Greater Manchester, Wythenshawe Hall is not yet included in the Venues section on the web site because it lay just over the border from Lancashire in historic Cheshire. Such Cheshire data will be added in 2004.

Figure 23

Figure 24

Figure 25

Figure 26

Performers on the Road

Figure 27

Figure 28

Feedback   How to Use This Site   Bibliography

REED
Records of Early English Drama

Venue Details:
TRAFFORD HALL

Located in Lancashire: Trafford
Private residence
Built 16th c.
MAP IT

Overview

Little is known about the half-timbered residence of the Trafford family.

Located near the main road to Chester SW of Manchester with an unobstructed view of the Irwell River and across to Ordsall Hall (*Country Houses* 178).

Current Status

Demolished.

Source

REED *Lanc 151, 166*.

Search the Records

for Patron
for Event
for Venue
for Troupe

Search by Keyword

Search Tips

Trafford Hall
Excavation Site

About This Web Site

Sources of Evidence
Present Data Coverage
Development Team
Credits and Sponsors

Search the Maps

Antiquarian Maps
Interactive Maps

Trafford Hall
History

Search Related Records

No events listed.
Patrons who owned venue

Bibliographic Sources

Options

See This Venue On A Map
Start A New Venue Search

Figure 29

Figure 30

Figure 31

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The Perdita Project: Women's Writing, Manuscript Studies and XML Tagging

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Many recent critics of Renaissance English literature happy to work within the broad parameters of "new historicism"—happy, that is, with its emphasis on "the historicity of texts and the textuality of history"—have nevertheless balked at its quasi-structuralist emphasis on impersonal ideological systems. One common response has been to stress instead the complexly mediated "agency" of individual writers.[1] In a penetrating analysis of this phenomenon, Nigel Wheale has highlighted the influence of two important sister disciplines: the "new social history"—centrally concerned with "individuals as active agents within their life-worlds, able to negotiate with conventions of their time and place (and thus with) discourses which earlier work viewed as oppressively all-embracing" (1999, 10)—and the "history of the book," the study of the many material components of Renaissance textual production.[2] Underpinned by these influences, an increasing number of critics now pay close attention to the socially-situated act of writing in the early modern period, highlighting the often very complicated roles both of the writer and of other people immediately implicated in the moment(s) of textual composition and construction—addressees, patrons, members of coteries, printers, scribes,

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[1] Curtis Perry observes "a renewed emphasis in a great many recent studies on the material circulation of texts, on the specific strategies used by different writers, and on the causal significance of the social work done by literature, either as propaganda or by contributing to cultural ideals, stereotypes, and fantasies" (1997, 6).

[2] The material writing practices analysed by the history of the book could be seen as a subsection of the new social history's interest in more general individual agency.

editors. This shift in critical fashion has been accompanied by a fresh appetite for "old historicist" research into primary sources. Happily, it has also coincided with the development of a new generation of electronic technology sophisticated and flexible enough to present elaborate information about large quantities of archival material to academic users in a complexly searchable form.

This set of circumstances forms part of the intellectual context for the work of the Perdita Project (based jointly at Warwick University and Nottingham Trent University under the directorship of Elizabeth Clarke) which has since 1997 been recovering and contextualising the literary agency of more than three hundred sixteenth- and seventeenth-century English women by producing a detailed electronic catalogue of the manuscripts they compiled.[3] In this essay I will be looking at some of the ways in which the Perdita catalogue will use XML encoding (or "tagging") to contribute to our knowledge of two important areas: women's writing in the Renaissance, and Renaissance manuscript practice.

I

Thanks to a long and impressive tradition of feminist scholarship, texts by early modern women now have a high profile in many university courses on English Renaissance literature. Certain writers—Aphra Behn, Mary Wroth, Margaret Cavendish—have entered the canon. Yet, as Margaret Ezell (1987) pointed out twenty years ago, a longstanding critical bias towards authors who wrote printed books has led to a skewed impression being given of early modern women's writing. Because print publication, particularly of original non-religious works, was avoided by many women, the Renaissance women writers most commonly studied on degree courses have tended to be anomalous figures—"isolated eccentrics protected by their husbands' ranks, such as the Duchess of Newcastle and the Countess of Winchelsea, or persecuted victims of popular prejudice, such as Katherine Philips and Aphra Behn" (Ezell 1987, 62–3). Ezell argues that

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[3] Perdita was started at Nottingham Trent University by Elizabeth Clarke and Victoria E. Burke. Gillian Wright, Jill Seal and Jonathan Gibson have also worked as full-time researchers on the project.

"The modern emphasis on publication as the measure of feminine accomplishment discredits any method of intellectual exchange that does not conform to twentieth-century practices as refuges for the intellectually repressed or second-rate" and that for this reason Renaissance women's writing in manuscript has traditionally been belittled and ignored. "If all that is known is a list of women who published their works", Ezell concludes, "we do not really know who the women writers of the seventeenth century were or how and why they wrote" (1987, 64).[4]

The electronic catalogue assembled by the Perdita project will for the first time give scholars an overview of women's involvement in the early modern manuscript system. One of its most important functions will be as a finding-aid. Renaissance manuscripts—scattered throughout libraries, record offices and private collections—are often very difficult to track down. Finding relevant material, particularly texts written by little-known authors, can be a chancy business. The Perdita catalogue will be a unique source of information about the location of more than 400 manuscripts put together by early modern women. It will also contain easily accessible information about opening times and access to repositories.

The Perdita resource will not be a catalogue of all manuscripts written by early modern English women. It has been restricted to manuscripts compiled between 1500 and 1700 containing texts longer than one or two pages and it omits legal documents and letters. Even within these limits, though, it cannot possibly be exhaustive. As years go by, many further women's manuscripts will be discovered and, it is to be hoped, incorporated in future editions of the catalogue. At the moment, the Perdita catalogue boasts texts in many different genres, both "literary"

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[4] Since Ezell wrote, several pioneering works have highlighted early modern women's manuscript writings. See, in particular, the two poetry anthologies edited by Greer *et al.* (1988) and by Stevenson and Davidson (2001). As well as produce its electronic catalogue, Perdita has encouraged scholarship on Renaissance women's manuscripts in more traditional ways, setting up a series of one-day colloquia (in collaboration initially with Trinity College, Cambridge, and latterly with St. Hilda's College, Oxford and the University of Reading) and producing two printed books (Burke and Gibson 2004; Seal and Wright 2004).

and "non-literary," including single-author poetry collections, transla-
tions, account-books, recipe-books, schoolroom exercises, calligraphic
display manuscripts, memorandum books, songbooks, collections of ser-
mon notes, spiritual journals, prayer-books and prose and verse miscel-
lanies. Thus, the Jacobean love sonnets of Lady Mary Wroth (Folger
Shakespeare Library MS V.a. 104) rub shoulders with Anne Phelips' col-
lection of sermon notes (Somerset Record Office, DD/PH 205), the early
seventeenth-century financial accounts of Anne Archer (British Library
MS Additional 27622) and the recipe-book of Margaret, Countess of Cum-
berland (Cumbria Record Office, MF JAC 332). As well as generic variety,
the manuscripts display considerable variety in physical form, ranging
from the beautiful calligraphic manuscripts of Esther Inglis to the almost
illegible jottings of Elizabeth Isham's memorandum book (Northampton-
shire Record Office IL 3365).

Women could play many different roles in manuscript production, and
a wealth of information about this—crucial raw material for the authors
of future histories of early modern women's writing—is provided by the
Perdita catalogue. As well as composing original texts, many women
collected together writings (in prose and verse) in "miscellany" manu-
scripts, occasionally altering texts in the process (Burke and Gibson 2004).
Sometimes women wrote out their own texts in fair copies (sometimes for
presentation, sometimes just for reference), sometimes they employed
scribes. Many manuscripts, meanwhile, were put together by more than
one person. The Perdita catalogue shows that women from a wide range
of intellectual, political, social and geographical contexts compiled man-
uscripts for a great diversity of purposes, with many different types of
audience in mind.

Electronic publication will allow this information to be presented to users
in easily digestible and complexly searchable form. The Perdita catalogue
is not a database. Instead, the Perdita team has been producing very
detailed catalogue entries—including some quite long sections of text—
tagged up in XML—Extensible Markup Language, a recent development
of SGML (Standard Generalised Markup Language). XML tagging enables
lengthy pieces of research text to behave like entries in a database. It
is, therefore, a suppler and much more rewarding medium in which

to produce research than older, database-reliant applications. While databases restrict the user to a set of predefined and therefore Procrustean little boxes, XML allows information to be packaged in more complicated ways, more adaptable to the unpredictable nature of the research data.

There is no space here to describe XML tagging in any detail. A short example, though, will give an idea of the sort of techniques involved. What follows, split up into paragraphs for easier reading, is an example taken from a Perdita manuscript entry of the tagged-up version of Elizabeth I's name.

```
<respStmt>
    <name
type="person"
key= "ELIZ01"
reg="Elizabeth I, Queen of England, 1533–1603"
role="scribe translator binder">
Queen Elizabeth I</name></respStmt>
```

The text in boldface ("Queen Elizabeth I") is all that would appear to the user of the catalogue. The rest of the text—everything, that is, in angle brackets—is invisible tagging, material for computer software to interpret and deliver to the user in search results. Thus, <respStmt> (short for "responsibility statement") signals that Elizabeth is in some way responsible for the manuscript. The nature of her responsibility is spelt out later on, in the three words "scribe translator binder" following "role." Meanwhile, "key" provides Elizabeth with a unique identification number, and "reg" provides a standard, regularised form of her name. All of the tagging in angle brackets has the potential of being searchable. This technology has allowed the Perdita team to tag for searching a very wide range of aspects of its manuscripts—people involved in their production, political and religious allegiances, first and last lines of texts, places of manuscript origin, dates, handwriting styles, watermark types and so on. Users of the electronic catalogue will be able to combine search terms such as these to find material relevant to their research.

Tagging of this kind is widely used in the production of complete electronic texts of literary works, many of the conventions for which have been

developed by the TEI (the Text Encoding Initiative). The Perdita project, though, is not producing complete tagged texts; instead, the Perdita catalogue consists of detailed descriptions of manuscripts, in the manner of a traditional *catalogue raisonnée*. In its final form, the electronic catalogue, freely available on the internet, will be linked to subscription-only electronic images of some of the original manuscript texts, published by Adam Matthew. Manuscript description does however come within the remit of the TEI, and specifically of MASTER, (Manuscript access through standards for electronic resources), an XML format designed at De Montfort and Oxford universities for cataloguing medieval manuscripts. The MASTER conventions provide a template for the structure of each entry and an extensive set of tags. A MASTER manuscript description consists of six main sections:

* *The manuscript identifier*: the manuscript's shelfmark, the name of the repository it is in and other information needed to identify it.
* *The manuscript heading*: a short summary of the manuscript's physical nature and textual contents.
* *The manuscript contents*: a contents list with brief details about each item.
* *The physical description*: describing paper, handwriting and binding.
* *History*: information about the provenance and subsequent history of the manuscript.
* *Additional*: a final section containing information about reproductions of the manuscript and other *miscellanea*.

The framework follows the basic structure of a traditional, non-electronic manuscript catalogue entry: classmark and brief description, followed by a contents list, a physical description and provenance details. MASTER's entry structure is therefore conservative. What distinguishes MASTER-based catalogues from traditional manuscript catalogues is the very rich tagging built into them.

Perdita catalogue entries contain two sections not specified by MASTER. The first of these is made up of biographical material about the woman (or women) whose involvement with the manuscript has led to its inclusion in the Perdita catalogue. (This could be the author of the text or, alternatively or as well, the scribe and/or compiler.) The second added section

is called "Context and Purpose," a fairly extensive section of text, hypothesizing about the functions the manuscript was intended to perform, and its historical and literary contexts. The addition of these two new sections emphasizes, over and above the MASTER framework, the individual histories of specific manuscripts, and allows for detailed exploration of the agency of individual compilers, authors and scribes.

One other area in which Perdita has adapted MASTER is in the use of physical description. The physical details of Renaissance manuscripts—the way in which the paper was folded and bound, the sequence in which a scribe worked, the existence of missing pages and so on—are often crucial to a full understanding of the texts of the manuscript in question. MASTER was initially set up to catalogue medieval illuminated manuscripts—manuscripts that are in a loose sense, "factory" (*scriptoria*) products—so it tends to assume that literary composition and physical structure are separable, that the physical construction of the manuscript can be analysed independently of the composition and ordering of its texts. This is not the case in a large number of manuscripts included in the Perdita catalogue, many of which were both intellectually conceived and physically assembled by the same person.[5] In such manuscripts as these, inevitably, the process of textual composition was very closely linked to the process of physical assembly. Conceiving of the Manuscript Contents section of a description as dealing with "intellectual" rather than with physical units, the MASTER conventions have a tendency to hive off physical features in the section on Physical Description, not linking them much to other parts of the overall manuscript description. To compensate for this, the Perdita catalogue includes details about physical assembly in the Manuscript Contents section. Entries, meanwhile, will be displayed to users in a split-screen format, with the manuscript contents permanently visible in one section of the screen. It will be possible for users to view the manuscript contents opposite any other section of the description, thus making it much easier to get an overall picture of the intellectual and

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[5] Frequently, too, manuscripts are physically altered later in their lives to reflect the interests of later owners (pages are torn out and rearranged, and so on)—another example of intellectual organization supervening on physical construction. For examples, see Section II, below.

physical structures of the manuscript. Users could, for example, look at a physical description's account of how the various hands in a manuscript differ from each other alongside the manuscript contents' detailed list of all the textual items in the manuscript, reading off one against the other, flicking about *ad libitum*. This split screen approach should make it much easier for users to get a clear, overall sense of the manuscript than would be possible in a printed version of the same description.

By adapting MASTER in this way, the Perdita team has aimed to achieve two things: to give, in each individual entry, as full an impression as possible of the key features of the manuscript in question, and, at the same time, to enable users to employ complex searches to identify relevant material for their own research. We hope that the effect of the catalogue on research into women's manuscript writings will be considerable.

II

The recovery of "lost" women's agency in manuscript production is a prime aim of the Perdita project. Equally important, though, is Perdita's contribution to early modern manuscript studies more generally. It is to be hoped that the project's example will help initiate other, similar cataloguing projects, as XML encoding has the potential to transform early modern manuscript studies.

Early modern English manuscript studies is a flourishing growth area. After a period of comparative neglect, when manuscripts tended mainly to be used as the quarry for witnesses to canonical literary texts, over the last twenty or so years, English Renaissance manuscript studies has finally to come into its own, with seminal work being done by Peter Beal (1980, 1988), Harold Love (1993), Henry Woudhuysen (1996), Steven May (1991), Arthur Marotti (1995), Margaret Ezell (1993, 1999) and Mary Hobbs (1992) among others. Even so, the picture we have of English Renaissance manuscript culture is decidedly patchy, and riddled with uncertainty. In large part, this state of affairs is the result of the complexity of the manuscripts themselves, a complexity inhering largely in the fact that each manuscript is a unique physical object, with an individual and often complex, difficult-to-trace history. A manuscript may have been

started by one or more person or persons, for one or more purpose or purposes and then it may have been switched to another purpose by the same person or persons or by somebody else. Manuscripts are often messy and difficult to read, are often assembled from the pieces of other manuscripts, are often written in several different hands that may or may not be all by one person, often include stretches of blank leaves and often start at both ends. A manuscript in the Perdita catalogue now in St. Paul's Cathedral Library in London, for example (MS 52 D.14), was started by one Knightley Chetwode in the 1620s as a collection of transcribed sermons by Donne and Joseph Hall. Katherine Butler then, in 1696, added a section of miscellaneous poetry following the sermons, meanwhile starting a section of prose extracts on the last page of the book, reversed, working backwards. Further prose texts were added following Butler's in two unidentified late eighteenth-century hands. The Perdita catalogue lists many manuscripts in which this sort of thing happens. Frequently, manuscripts started as literary collections only to have recipes and a range of their miscellaneous texts added to them later. It seems to have been slightly less common for the reverse to have been the case. Manuscript pages may disappear, and texts may be cancelled, altered or supplemented, for all sorts of reasons. So, for example, appearances of the same "text" in different manuscripts often differ from each other, sometimes quite radically, reshaped, reshaped and reshaped again, by successive "authors" and/or "compilers." Bits break off from poems and attach themselves to other bits of poems. Attributions of authorship, of course, are as variable as the texts themselves, shifting as the texts they attempt to ground travel through the manuscript system. In Anne Southwell's miscellany (Folger Shakespeare Library MS V.b.198), Henry King's famous exequy is attributed to "Master Barnard, brother to Mistress Jernegan that died at Acton" (Klene 1997). Many texts, meanwhile, will always remain anonymous.

The keynote of English Renaissance manuscript culture, then, is complexity rather than inevitable indeterminability or *aporia*. Behind these confusing bits of paper are fantastically complicated and often quite inaccessible secret histories, but histories nevertheless. In Perdita's case, those histories form an important part of an important and hitherto marginalized part of the history of women's experience.

This complexity is largely responsible for the comparative neglect of Renaissance English manuscripts early in the twentieth century, when the methodologies of modern literary criticism and of analytical and descriptive bibliography were being set in place. In this period, the study of messy, chaotic, informal Renaissance manuscripts got lost, squeezed between scholarship on medieval illuminated manuscripts on the one hand, and scholarship on Renaissance printed books on the other hand.

A few years ago, Henry Woudhuysen summed up the state of play in English Renaissance manuscript research very succinctly. He pointed up the absence from manuscript studies of the extensive reference materials taken for granted by print scholars:

> In the past few years, largely as a result of Beal's work, manu-script studies may be said to have come of age, but they have not yet grown up. The subject still needs its STC (i.e., Pollard and Redgrave 1976–91) to catalogue the books themselves, its McKer-row and Gaskell to explain how they were physically produced, and its Greg and Bowers to establish how they should be described, what can be deduced from their make-up and how their role in the editing of texts might be freshly considered in theory and in practice. It also needs a series of facsimiles illustrating a wide range of scribal hands. (1996, 6)

The best way for manuscript studies to move forward, to address Woud-huysen's challenge and to engage with the complexities in manuscript culture, is, I would argue, electronic. More specifically, I would argue that the development of XML-based, web-mounted resources such as Perdita is the best way for manuscript scholars to move towards the successful implementation of Woudhuysen's wish-list.

Woudhuysen begins by mentioning the need for a manuscript STC (a "Short-Title Catalogue" comparable to Pollard and Redgrave's catalogue of printed books (1976–91), and thus a comprehensive list of all English Renaissance "literary" manuscripts). Perdita will sample just a tiny num-ber of manuscripts—no more than about 400. But if other electronic manuscript cataloguing projects, big and small, used in libraries, univer-sity department and in the enthusiasm of individuals, follow and can be

searchable alongside Perdita, rigorously peer-reviewed, we'd be on our way, slowly but surely, to a manuscript Short Title Catalogue. Such a resource would, of course, be searchable in far more complex ways than the STC or EEBO (Early English Books Online, the STC's electronic successor). As with Perdita, a user would be able to combine search terms in a range of different ways. Users would be able to search for, say, all manuscripts written in French in italic hands in libraries in the USA, all religious poems in manuscripts produced in Nottinghamshire before 1620, all manuscripts with incomplete poems more than 40 lines long, and so on. Woudhuysen also points to the need for extensive facsimiles of a wide range of scribal hands. Clearly the best way to do this would be to attach images of sample pages to XML manuscript descriptions. The biggest hurdle to this will probably be copyright anxiety on the part of the big libraries. Much of the rest of what Woudhuysen says—about the need for manuscript Bowerses, Gregs, McKerrows and Gaskells (important figures in print bibliography)— highlights our general ignorance about English Renaissance manuscript practice *tout court*. An XML resource such as Perdita would be an ideal tool for co-ordinating research on these topics, as it would allow a user to compare all sorts of features across a large number of manuscripts. It would be easy to locate manuscripts which shared structural features (such as watermarks and types of contemporary binding), the involvement of the same people (in a range of different roles), places of origin, date and so on. The more extensive the XML resources the closer we would come to something approaching an accurate view of the nature of English Renaissance manuscript culture.

I end with a thought about the genre of the Perdita resource. Throughout this paper, I have been describing Perdita as an electronic "catalogue," and of course it will perform a cataloguing function. Yet each entry will also include sometimes quite lengthy texts about the manuscript itself and its author or compiler. In addition to functioning as a catalogue, then, Perdita will therefore also be, in effect, a collection of short scholarly articles. Many printed *catalogues raisonnées* take this form too, of course, but the electronic nature of Perdita adds an extra dimension. In the future there are likely to be an increasing number of projects like Perdita—projects, that is, that attempt to digitize information about large amounts of primary material and that also involve a certain amount of expository text.

What we will probably begin to see is a generic blurring between electronic catalogues and monographs. Already, there is a trend for early modern projects applying for grant funding to think in terms of producing both an electronic resource and a more discursive study, usually a printed monograph. To what extent, though, might the two types of text, monograph and digital catalogue, gradually amalgamate and turn into a new scholarly genre—a monograph, say, based on many primary sources and tagged electronically in a similar way to MASTER and Perdita? Texts of this sort would be, in effect, catalogues hiding inside monographs, or, depending on the point of entry into the resource, monographs hiding inside catalogues. There is, too, the additional, and slightly unnerving, prospect of an interactive take on all this: the potential for users of such a resource to produce their own work, linked in electronically. Possibilities such as these are extremely exciting, and work on realising them is only just beginning.

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Encoding Renaissance Electronic Texts⋆

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In 1991 Michael Sperberg-McQueen published nine axioms for an electronic theory of text, the first of which is: "A markup language reflects a theory of texts in general" (1991, 35). A mark-up language written in SGML implies a theory of interpretation informed by a positivist epistemology. SGML tag elements, even simple ones like <**body**>, are delimited, well-formed, and knowable objects that can have potentially unambiguous relationships. Axiom 4, "Texts are linguistic objects" (1991, 37), shows that anyone who uses SGML-conformant tagsets works within a paradigm at odds with much literary theory, which often regards texts as subjects. By that I mean that texts can be thought to exist only when uttered by someone, or when recreated by someone cognitively in hearing or reading them. Such texts are only realized as mental processes. Cultural objects like texts take shape from the subjects who apprehend them, but because these observer-readers affect the language that they observe and read, all texts as apprehended are also inherently uncertain and in respects unknowable. Sometimes we no longer speak the language of a text, other times we doubt that we share common assumptions about how certain words mean. Belief in what might be termed the indeterminacy of "textual objects" frustrates willingness to describe them in SGML regular-expression automata.[1]

⋆ This paper was delivered at the Renaissance Society of America meeting in Toronto on March 28, 2003.

[1] See the convenient summaries in Makaryk (1993, 139–44, 562–63, 633–36). Positivist paradigms also do not serve the skepticism found, for instance, in the literary theory of Roman Ingarden and Wolfgang Iser, who accept generally the phenomenological philosophy of Edmund Husserl, Martin Heidegger, and others.

When we encode texts, we as subjects utter them. To encode any text with someone else's tags is potentially an inauthentic cognitive act. If we take over someone else's tagset, we express our own understanding with another's concepts and words and often for different purposes. Rather than trying to persuade anyone to use the Text Encoding Initiative, or EAD, or my encoding tagset, I recommend that everyone take responsibility for their own. If such texts date 400 years before TEI, one might conceivably have to devise elements and syntax that depart from current ISO standards. If one is not interested in the encoding of content, not concerned with what is called rendition, display, or format, one might give up on SGML because it exists to encode content. For instance, should SGML encoding be used to prepare texts for the analysis, not of their subject matter, but of the print or manuscript technology that produced them? The specific purposes of research drive our need to create an encoding language (Lancashire 1995).

In 1987 I attended the founding meeting of the Text Encoding Initiative and afterwards took part in its committees until TEI P3 was published in 1994. I had been encoding texts in COCOA-type tags from the early 1980s so that I could retrieve instances of repeating words and phrases. I needed some way of attaching, to each line of data, reference information such as title, author, date, and speaker. Encoding enabled me to do that. TEI promoters argued that ISO SGML was a better encoding language. Like so many others, I have benefited from TEI analysis of textual elements, but I came to believe that "The SGML community has not demonstrated that it can handle the most basic textual structures of use in the humanities..." (Lancashire 1996). By those I meant (a) the total character set used by scholarly editions of works in the Early Modern English period (that of Sir Thomas More, Shakespeare, Milton, Hobbes, and the young Newton) and (b) an early book's bibliographical structure. Mind you, neither character set nor bibliographical structure interests a linguist or inheres in what Sperberg-McQueen would term a "linguistic object."

The Renaissance character set includes brevigraphs, abbreviations, ligatures and other special characters, for instance, found in Joseph Moxon's *Mechanick Exercises* (1677–1683), a printing manual. Editors need to know

how to encode these unusual characters for the textual apparatus of scholarly editions. Two years ago the Digital Scriptorium, located in Berkeley, published unofficial but TEI-supported guidelines on encoding medieval and Renaissance manuscripts. They recommend that an encoder create entity references for each special letter-form, such as

> &xanglicana;
> <!ENTITY xanglicana "x" ><!-- representing anglicana x
> character -->

and keep a sketch or graphic image as a record of what each was like. To do so assumes, however, that early letter-forms resemble existing entity references such as ampersand and soft hyphen, which are abstract models, not exact shapes, of these characters. There is no agreement yet, however, on Anglicana or Secretary character sets. No one has modelled early manuscript characters by type. The Berkeley recommendations are also unhelpful for brevigraphs. "In literary transcriptions," they say, "abbreviations may be expanded without comment; it is customary, in philological and paleographic transcriptions, to mark the expansions of abbreviations as such, with brackets or font shifts" (Digital Scriptorium 2001–02).

The Women Writers Project publishes a list of recommended entity references that has much to recommend it. Syd Bauman in 1999 added these three entity references for the *p* brevigraph:

> ENTITY pmacr SDATA "pre"> <!-- p with a macron, contracting 'pre'
> ENTITY phook SDATA "pro"> <!-- p with a hook
> through the descender, contracting 'pro'
> ENTITY pbar SDATA "per"> <!-- p with a bar through
> the descender, contracting 'per' or 'par'

These entity references, however, only treat printed characters. The same is true of the larger body of special characters recognized by the Early English Books Online/Text Creation Partnership (EEBO/TCP) project at the University of Michigan in Ann Arbor, which publishes, informally, guidelines on inputting. It includes entities for Tironian signs such as the brevigraphs for initial *con* or *cum*, and terminal *rum* and *us*. Neither

project, however, faces up to the character set presented to editors by manuscripts. How are we to distinguish between multiple forms of *r*, short, long, and sigma forms of *s*, and brevigraphs such as terminal swash *es*? We need reliable names for the orthographic "objects" listed, for example, in Adriano Cappelli's *Dizionario di Abbreviature* (1973); and that is a sizable task.

The second problem is how to represent, simultaneously, the multiple structures found in a book. A printer sees a quarto book as gatherings and inner and outer formes. The reader sees it as sequential pages. The eight pages of a quarto gathering are not printed in text order but normally are set, four pages each, in two physical formes or frames. In the standard quarto, type for pages 1, 4–5, and 8 is placed in the outer forme, and type for pages 2–3 and 6–7 in the inner forme. The printer prints one forme on one side of a large sheet, and the other forme on the other side. After folding, the pages appear in a different order. Because several compositors can work on a quarto, and because they set pages as required by the need to fill a given forme, each forme may be the responsibility of a different compositor. As a result, textual variants will sometimes occur only within a given forme. I analyzed compositorial spelling habits of Shakespeare's *Sonnets* (1609: Cook and Lancashire 1998) in this way. The poetic content of this book of course shows a third structure: numbered sonnets, sometimes crossing page boundaries. SGML can only handle two structures for any text, and then only one at a time.

Faced with these two problems, I drafted some hybrid encoding guidelines, an early version of which are online at the Renaissance Electronic Texts site, that compare COCOA and SGML tagging systems and make a preliminary classification of special characters and brevigraphs. This trial identifies the problems but certainly does not pretend to solve them. They were, however, a step towards an Early Modern dictionaries database titled the *Early Modern English Dictionaries Database (EMEDD)*, in revision as the *Lexicons of Early Modern English (LEME)*. *EMEDD* enables registered researchers to search through sixteen dictionaries or glossaries, but *LEME* draws on more than one hundred manuscript and print lexical works from 1480 to 1700. Although in preparing the texts for these lexicons, I use TEI tags such as <**expan**>, I devise arbitrary codes to represent brevigraphs in selected attributes and rely on a linked facsimile reproduction of the

original page to show what these old characters look like. For example, a transcription of a sample word-entry in Rycharde Banckes' herbal (1525), for "Agnus castus", copes with e-macron, o-macron, and a-macron abbreviations in this way, as well as the y/superscript_e brevigraph (see Figure 1). Although I do not need entity references for these because I am expanding abbreviations, I do need a way to record the original abbreviations in attributes.

If the Text Encoding Initiative or any other project is addressing these two issues now, that is good news because SGML suits all texts that, like *LEME*, are encoded for content. The Banckes sample shows *LEME*'s three-level encoding hierarchy: above, alphabetical or topical groups (<**wordgroup**>) that hold mid-level word-entries (<**wordentry**>), which in turn contain low-level forms or headwords (<**form**>) and explanations (<**xpln**>). Within a <**form**>, a <**xpln**>, or a <**note**> tag, four other elements can be seen. Any expansion of a contraction or abbreviation occurs within <**expan**>. Where font changes unpredictably, an <**f**> tag appears. Any word or a phrase within these three elements that is cited or drawn attention to is encoded as an <**expression**>. The anchor tag <**a**> serves for cross-references. Elements may have a number of attributes, including language and type. In general, I encode minimally because *LEME* includes so many different kinds of texts. The encoding serves one basic purpose: to segment what I interpret as headwords and explanations within a word-entry.

Lexicographical elements in modern encoding systems such as TEI are anachronistic when applied to eccentrically organized Renaissance lexicons. These lack many elements we expect to see in dictionaries today, such as pronunciation, part-of-speech, or sense differentiation. The most challenging difference is that early lexicons make no firm distinction between *translation* (what a bilingual or polyglot lexicon gives) and *explanation* (what an encyclopedia offers) and only rarely implement what we term *definition* (in a monolingual dictionary today). Because these texts as they were at the time of their making are partially unknowable by us now, I must interpret them, using my knowledge of the period, in the course of encoding: for that reason, the texts become subjective, subjects of mine

(compromised by my own theoretical understanding, they partake of my mind). They and the tags I use cannot be termed objects.

My interpretation strikes at the heart of what these lexicons are taken to be. Most dictionaries today consist of word entries with at least a headword and a definition. Renaissance lexicons lack both of these, *as we understand them, in my opinion.* A modern headword is always a lemma or a lexeme, that is, a normalized spelling of a word in a standard inflectional form. Noun headwords, for example, take the nominative singular form; verbs take the infinitive form, and so on. The concept of a lemma or a lexeme barely exists in the Early Modern English period. Headwords, which lack standard inflection and spelling, may not even be in English. Our present concept of a lexical definition also is hard to find before the late seventeenth century. Early lexicographers give three basic types of information in the explanatory part of a word-entry: an equivalent word in another language, a logical definition of the thing denoted by the word, and notes and anecdotes. Renaissance semantics might be termed denotational or thing-directed. Only a few technical minds so needed a precise vocabulary that they defined words as such. It remained for philosopher-scientists in the Restoration period such as Bishop John Wilkins and William Lloyd to transfer the explanatory part of a lexicon from the thing to the word, and even that innovation was slow in coming, because Samuel Johnson recognized only the logical sense of definition in 1755, not the lexical (Lancashire 2002).

Excerpts from three sample lexicons may serve to illustrate the potential unknowability of early lexical texts. An entry from Rychard Banckes' herbal (1525), typically, gives a headphrase that might be either Latin or English (the *OED* allows that phrase to be an English headword entry). The explanatory part gives two other names for this plant (like a polyglot lexicon) and a full description of the thing (like an encyclopedia of plants). Agnus castus can be recognized from its red leaves, yellow flowers, and black berries, and it grows in dry woods. The herb has many curative "virtues" or powers. It keeps one chaste, makes one sweat out bad humours, dries out male sperm, ameliorates dropsy and bitarge, causes headaches (if eaten uncooked), takes headaches away (if applied in a

plaster), and leads a woman to lactate. Nothing is said about the meaning of the words "agnus" and "castus." This is no lexical definition.

My second example, from John Hall's medical glossary in 1565, is the entry on "Amygdala" (see Figure 2). Font and position show that a word-entry in Hall's table has three parts: a centered headword in italics; an explanation in black letter; and marginal notes, also in italics, that anglicize Greek words, document sources, and highlight technical terms in the word-entry. What can we deduce about the headword? If its italics indicate Latin (all English words in the explanation are in black letter), then this is a bilingual glossary. The overwhelming number of Hall's headwords have Latin inflections, and by titling this glossary "the Interpretiue Table vpon Lanfranke hys worke," he suggests that the headwords are directly from Lanfranke's Latin work because the word "interpretiue" then was understood to signify "translating." Yet Hall also uses some plainly English headwords, such as "Aloe" and "Chirurgery," and the book's title page tells us that the table gives "the names of diseases and simples with their vertues, as also of all other termes of the arte opened." Maybe Hall regarded these Latin headword names as *de facto* English medical vocabulary. There is reasonable doubt as to the language of the headword.

Hall's black-letter explanation first gives an equivalent in Greek. Then it identifies the subject as bitter-tasting almonds and gives two more names for them in Latin and Greek. After describing the medicinal powers of bitter almonds, Hall turns to sweet almonds. Are these two senses of the word "amygdala," one bitter (and termed "amara") and the other sweet (and lacking a special term)? I think not. Hall shows how five words ("amygdala," "amara," "almonds," and two Greek words) denote *things*, bitter and sweet almonds. He does not explain the morphological or semantic features of those words. But neither does Hall give us exact logical definitions of those things, with *genus* and *differentiae*, because from what he says we could not tell the bitter nuts from the sweet, or either from things like coconuts, unless we tasted them. He assumes we know what almonds look and taste like. Instead, he tells us of their effects on us, one of their many differentiating qualities. Doubt, then, exists about what exactly follows the headword. Hall's explanation combines a polyglot discussion of the English, Greek, and Latin words for two things,

and an account of what effects they will have when taken medicinally. We have elements of a modern polyglot dictionary to aid in translation, and advice on how certain medicines work.

Last, what are we to make of Hall's marginal notes? They might index the explanation, except that they hold new information about authorities and lack the English word "Almondes." They appear to extend or amplify the entire entry: note that they itemize the headword too.

To tag Hall's entry according to any standard encoding guidelines for modern dictionaries is complicated by our doubt as to the language of the headword: if it is English, then we must tag what follows as senses and definitions; if it is Latin, then we must tag what follows as translations or equivalents. Neither alternative looks reasonable. Just as red and black butterflies are not two senses of the noun "butterfly," so it is with bitter and sweet almonds: the *OED* defines the noun "almond," in its first sense, as "The kernel of a drupe or stone-fruit, the produce of the almond tree, of which there are two kinds, the sweet and the bitter." Assuming Hall's headword is English, then his explanatory segment has only one sense and lacks all significant information found in the *OED* definition. If Hall's headword is Latin, and what follows is a translation, other problems occur. Only the word "Almondes" can be said to give an English equivalent for the Latin, and the two terms take different numbers, singular and plural. The rest of the entry discusses, not translates.

Hall's practice in crafting headwords and explanations is no more problematic than dozens of other lexical writers of the Early Modern English period. My third example is from *An exposition of certaine difficult and obscure wordes, and termes of the lawes of this Realme* by John and William Rastell, as published in 1579 . This book revises John Rastell's abridgement of the English statutes, which first came out a half-century before, structured like the 1579 edition, except that it had a small section devoted to "Exposicion of old wordis" (fols. 85r-87r). This offers entries on some very old Old English and French terms employed in legal manuscripts. At first the book mainly described concepts under headwords (except for this brief section on words), but by 1579 the entire book was reconceptualized as word-based, using a title that once applied only to three leaves formerly. William Rastell in 1579 drew on the by then well-established hard-word

glossary or "exposition," but he still uses, loosely speaking, denotational semantics. The explanation consists of four complete sentences that explain what a person has to do to be an "accessory." The fourth sentence, by using "one" instead of "hee," implicitly brings the reader (along with the world) into the explanation. Rastell casts his definitions in a logical mode. The idea of "senses" is only fuzzily present. He begins with two kinds of accessory but then adds a third in the last sentence.

In my experience, SGML encoding languages and tagsets, which are very effective for most modern texts, pose problems for Renaissance books and manuscripts. Embedded in TEI tags are modern assumptions of language, text, and genre partly incompatible with Renaissance thought. For example, early lexicons are sometimes simultaneously bilingual and monolingual. Their so-called "definitions" at once translate words and explain things more than they define words. So many foreign words were imported into English in this period that contemporaries might have thought that their own native tongue was polyglot. One contributory stream to the growth of the traditional monolingual English lexicon was the hard-word glossary. Although monolingual, this offered equivalents or translations of words imported from another language and arbitrarily used as if they were English. In other words, the first monolingual English glossaries were functionally indistinguishable from a bilingual lexicon.

Researchers should take as much personal responsibility for tagsets as for editorial procedures. Tag elements and syntax should be consistent with what is known about the texts. Ideally, we should encode as ISO SGML recommends. By all means, take as much as possible from TEI. Standardization arguably facilitates uniform retrieval from a world e-library. But if either SGML or TEI forces an editor to compromise interpretation of a text, then standardization comes at too steep a price.

¶ De virtutibus herbarū/& primo de litera A.

¶ Agnus castus.

This herbe Agnus castus/that mē do call Turesayne / & otherwyse Parke leues. This herbe hathe leues sōdele reed lyke vnto þ leues of Orage. And this herbe hathe seno wes on þe leues as hath Plātayne / and it hathe yelowe floures and bereth blacke berys/and it groweth in dry woodes. The vertue of this herbe is/it wyll kepe men & women chast. For as Discolidion & Platena do say / this herbe is called Agnus castus/for the knowlege and the vse of this herbe maketh men chaste. Also this herbe wyll open the poores of a man and let out wycked humours and spyrytes of his body. This herbe destroyeth the moysture of mannes sede. Also the same Auctour saythe that yf this be sothen with fenell sede in Ypsell / it is good to destroye the Dropsy. Also yf this herbe be sothen with Smalage and Sage in salte water / and afterwarde þ hynder parte of mannes heed be well wasshed therwith it heleth it & vnbyndeth an euyll that is called Bitarge. Also this herbe destroyeth the fowle lust of lechery/and it be dronken / or yf it be borne aboute hym. Therfore somtyme they do ete it costed / bycause it shall kepe thē chaste. For yf this herbe be eten rawe/ it wyll engendre heed ache. This herbe is good to defye the hardnes and stoppynge of the mylte. Also a playster of this herbe / is good to do away the ache of a mannes heed that is engendred of wycked humours. This herbe is dry.

¶ Apium.

¶ This herbe Apium/ is an herbe that mē do call Smalache/other Merche. The vertue of this herbe is thus. It

Figure 1. "Agnus castus" from Rycharde Banckes' herbal (1525)
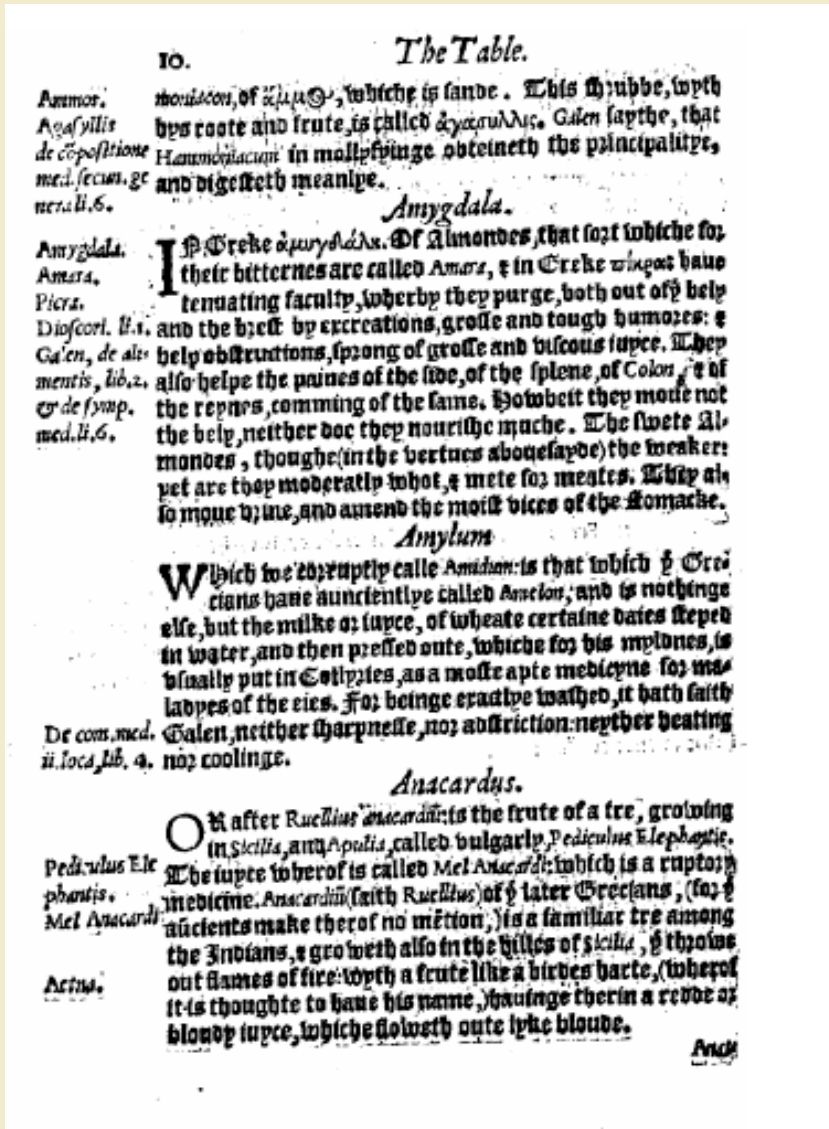(Image reproduced by permission of the British Library from the reproduction on Early English Books Online)

Figure 2. "Amygdala" from John Hall's medical
hard-word glossary (1565)
(Image reproduced by permission of the Henry E. Huntington Library from the
reproduction on Early English Books Online)

APPENDIX 1

Here begynnyth a newe mater, the whiche sheweth and treateth of ye vertues [and] proprytes of herbes, the whiche is called an herball. London; Rycharde Banckes, 1525: a1v. STC 13175.1. (see)

<**wordentry type="h"**>
 <**form lemma="agnus castus(n)"**>&para; Agnus castus.
 <**/form**>
 <**expln lemma1="tutsan(n)" lemma2="park leaves(n)"**>
THis herbe <**expression lemma="agnus castus(n)"**>Agnus cas-
tus <**/expression**> / that m<**expan t="e_"**> en<**/expan**> do
call <**expression lemma="tutsan(n)"**>Tutesayne<**/expression**> /
&amp; otherwyse <**expression lemma="park leaves"**>Parke leues
<**/expression**>. This herbe hathe leues so<**expan t="o_"**>om
<**/expan** >dele reed lyke vnto <**expan y="y+e"**> the<**/expan**>
leues of Orage. And this herbe hathe senowes on <**emend err=**
"hisleues">his leues <**/emend**> as hath Pl<**expan t="a_"**>
an<**/expan**><**emend err ="​"**>&shy; <**/emend**> tayne / and
it hathe yelowe floures and bereth blacke berys / and it groweth
in dry woodes. The vertue of this herbe is / it wyll kepe men &
women chast. For as Discolidion & Placeus do say / this herbe is
cal&shy; led <**expression lemma="agnus castus(n)"**>Agnus
castus<**/expression**> / for the knowlege and the vse of this
herbe maketh men chaste. Also this herbe wyll open the poores
of a man and let out wycked humours and spy&shy;rytes of his
body. This herbe destroyeth the moysture of mannes sede. Also
the same Auctour saythe that yf this be sothen with Fenell sede
in Aysell / it is good to destroye the Dropsy . Also yf this herbe
be sothen with Smalage and Sage in salte water / and afterwarde
<**expan y="y+e"**>the<**/expan**> hynder parte of mannes heed
be well wasshed therwith it heleth it & vnbyndeth an euyll that is
called Bitarge. Also this herbe destroyeth the fowle lust of lech-
ery / and it be dronken / or if it be borne aboute hym . Therefore
somtyme they do ete it rosted / bycause it shall kepe the<**expan
t="e_"**>em<**/expan**> chast . For y this herbe be eten rawe / it
wyll engendre heedache. This herbe is good to defye the hardnes and
stoppynge of the mylte. Also a playster of this herbe / is good to do

away the ache of a mannes heed that is en­gendred of wycked humours. This herbe is dry.
    </**xpln**>
</**wordentry**>

OED word entries

(a) *agnus castus* æ;gnAs kæ;stAs. L. agnus, a. Gr. agnoj name of the tree, confused with agnoj chaste, whence the second word L. *castus* chaste. A tree, species of Vitex (*V. Agnus Castus*), once believed to be a preservative of chastity; called also Chaste-tree and Abraham's Balm (? Baum).

(b) *tutsan* tA.tsan. Forms: <alpha>; 5 totsane, toutsayne, 6 totsan, tutsane, 6- tutsan, 7 tutesain; <beta>; 6 tutson, -sone, -som, -some. app. of Fr. or Anglo-Fr. origin. But the mod.Fr. *toute-saine* is not in Cotgr. (who gives tutsan, perh. from Lyte), and is known to Hatz.-Darm. only from 1762, when it appears in the Dict. of the Académie, whereas the name is found in Eng. c 1400–50.

A name applied to various plants on account of their alleged healing virtues; formerly to Agnus Castus, and, in French, to Sanicle (Hatz.-Darm.); now, in Eng., to a shrubby species of St. John's-wort, *Hypericum Androsæ-mum*, with strongly aromatic foliage and berry-like fruit; formerly es-teemed as a vulnerary. Also called park-leaves.

(c) '*park-leaves*' ? Obs. app. f. park sb. + leaves, pl. of leaf. A name for the shrub Tutsan (*Hypericum Androsæmum*). Also, with early herbalists, the tree *Vitex Agnus castus*: the name *agnus castus* having app. been applied to both (see Turner *Names of Herbes*, A viij b).

<center>APPENDIX 2</center>

John Hall. *A most excellent and learned vvoorke of chirurgerie, called Chirurgia parua Lanfranci Lanfranke of Mylayne his briefe: reduced from dyuers translations to our vulgar or vsuall frase, and now first published in the Englyshe prynte by Iohn Halle chirurgien.* London, 1565: p1v. STC 15192. (see Figure 2)

<**wordentry type="h"**>

<form lemma="amygdala(n)">
Amygdala.

</form>
<xpln>
f type="bk">I</f>N Greke
<expression
xml:lang="EL">&#03B1;'&#03BC;&#03C5;&#03B3;
&#03B4;&#03AC;& #03BB; &#03B72;</expression>
. Of Almondes, that sort whiche for their bit-
ternes are called <expression lemma="amara(n)"
xml:lang="LA"><f type="i">Amara</f></expres-
sion>, & in Greke <expres-
sion xml:lang="EL"> &#03C02;&#03AF;&#03BA;&
#03C1; &#03B1; </expression>: haue tenu-
ating faculty, wherby they purge, both out of <expan
type="y+c">the</expan> bely and the brest by ex-
creations, grosse and tough humores: & help ob-
structions, sprong of grosse and viscous iuyce. They also
helpe the paines of the side, of the splene, of <expression
lemma="colon(n)"> <f type="i">Colon</f> </ex-
pression>, & of the reynes, comming of the same.
Howbeit they moue not the bely, neither doe they nourishe
muche. The <expression lemma="almond_sweet(n)"><f
type="bl">swete Al­mondes</f></expression>,
thoughe (in the vertues abouesayde) the weaker: yet are they
moderatly whot, & mete for meates. They al­so
moue vrine, and amend the moist vices of the stomacke.
</xpln>
<note type="m">
<expression xml:lang="EL"><f
type="i">Amygdala </f></expression>.
</note>
<note type="m">
<expression xml:lang="EL"><f type="i"   >Amara
</f></expression>.
</note>
<note type="m">

```
    <a name="103ref42"><expression xml:lang="EL">
<fr>
type="i"> Picra</f> </expression>.</a>
</note>
<note type="m">
      <source><f type="i">Dioscori.</f> <expression
    xml:lang="LA">li.1. </expression> </source></a>
</note>
<note type="m">
    <source><f type="i">Galen</f>, <expression
    xml:lang= "LA"> de ali&shy;
   mentis, lib.2.</expression>
    <f type="i">&amp;</f> <expression xml:lang="LA">
    de symp.
   med.li.6.</expression></source></a>
</note>
</wordentry>
```

OED word entry

a'mygdal ? Obs. ad. L. *amygdal-a*, a. Gr. amugdalh an almond; probably con-
tinued and extended to sense 2, through the OFr. *amygdale* and med.L. *amyg-
dala* a tonsil.

  1. An almond. Obs.
  2. pl.
     a. The tonsils
     b. The almonds of the ears

<div align="center">APPENDIX 3</div>

Rastell, John and William. *An exposition of certaine difficult and obscure words,
and termes of the lawes of this realme, newly set foorth and augmented, both in
french and English, for the helpe of such younge students as are desirous to attaine
the knowledge of ye same.* London, 1579. STC 20706.5

<wordentry type="h">

<**form lemma=“accessory(n)”**>Accessories.<**/form**>
<**xpln**> Accessories are in ii. sorts, the one before the offence, the other after the offence is done.
<**p**>
Accessorie b<**expand t=“ee”**>ee<**/expand**>fore the fact, or offence is h<**expand t=“ee”**> ee<**/expand**> that commaundeth or procu&shy; reth an other to doe felony and is not there present him selfe when the other doth it, but if h<**expand t=“ee”**>ee<**/expand**> b<**expand t=“ee”**>ee <**/expand**> pre&shy;sent, then h<**expand t=“ee”**>ee <**/expand**> is also prin&shy;cipall.
<**p**>
Accessorie after the of&shy;fence or fact, is he that re&shy;ceyueth, fauoureth, or ay&shy;deth a felon, knowing wel of the deede that hee hath done.
<**p**>
Also one may be acces&shy;sorie to an accessorie, as if one feloniously receiue an other that is accessorie of a felonie, there the recey&shy;uer is an accessorie.
<**/xpln**>
<**/wordentry**>

OED word entry

accessory æ.ksesari, ækse;sari, , sb. and a. . . . 1. One who accedes, or gives his accession (formerly *access*) to any act or undertaking; an adherent, assistant, or helper. In Law: ‘He who is not the chief actor in the offence, nor present at its performance, but in some way concerned therein, either before or after the fact committed.’ 1768 Blackstone *Comment.* IV. 35.

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The Devil is in the Details:
An Electronic Edition of the *Devonshire MS* (*British Library Additional MS 17,492*), its Encoding and Prototyping⋆

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Now well over a decade since our contemporary idea of the electronic scholarly edition was first fully articulated in Charles Faulhaber's "Textual Criticism in the 21st Century," we do take a number of things about the electronic scholarly edition for granted. Faulhaber's (1991) publication in *Romance Philology*—and subsequent work, such as that carried out by the MLA Committee on Scholarly Editions[1]—outlines the essential components of such an edition. These include its core, the base text (in encoded format),

plus standard textual and critical apparatus, and pertinent external textual and graphical resources, critical materials, and so forth, all in electronic form and with their navigation facilitated by hypertextual means and the text's analysis facilitated by additional software (Faulhaber 1991, 134 ff). When someone mentions an electronic scholarly edition today, the type of edition that will come most readily to mind is, typically, this one.

What might come to mind less readily are the details involved in creating such an edition, and the wide variety of issues that underlie such an edition's production. In this paper, we hope to address a number of these issues, as they have been encountered in the course of work involved in envisioning and preparing an electronic edition of a document best known, perhaps, in relation to the work of poet Thomas Wyatt, his *Devonshire MS* (*BL Add MS 17,492*)—a document which, beyond housing the work of Wyatt, reflects a dynamic group of men and women operating in and around Queen Anne Boleyn's court in the mid-1530s. We explore pertinent aspects of our project as we encountered them, from the point where it was felt that the material being edited could best be treated by an electronic scholarly edition, to concerns related to representing the text of the edition at standards that were at once in keeping with those of scholarly editing as well as textual encoding and, finally, to our approach on matters related to developing the prototype of a user interface that allows appropriate access to and navigation of the materials of the edition for its intended readers. In doing so, our contribution is as much a rationale for the edition as it is a narrative of the edition's construction to date; by taking such an approach, we are encouraged to think that the piece might be of use to those engaged in similar projects, encountering concerns that—in such similar work—could not be too dissimilar from our own experience.

The Matter of the Edition, and its Critical Context

While the essential components of an electronic scholarly edition are often documented, and exemplified, much less frequently presented is a rationale for editing a specific document electronically, with an eye to the basic suitability of the original document for such treatment. But some materials, truly, do lend themselves more readily to the electronic medium

than others, and such is the case with the *Devonshire MS*. The form of the electronic edition promises not only to work toward capturing the widely-referent and miscellaneous nature of the manuscript itself, but also its remarkable physical elements, and its salient features as identified by a long tradition of literary historical and critical treatment.

The Nature of the Manuscript, its Compilers, and its Critical Context   The *Devonshire MS* (*BL Add MS 17,492*) is a poetic miscellany—a "courtly anthology," as Raymond Southall (1964b, 15) has called it, or an "informal volume" as Paul Remley (1994, 48) has suggested—consisting of 114 original leaves, housing some 185 items of verse (complete poems, fragments, extracts, and annotative remarks). It contains a mix of courtly poetry by the canonical early Renaissance poets Thomas Wyatt and Henry Howard, the Earl of Surrey ("O Happy Dames"); the work of, or transcriptions of the work of others, including prominent court figures Mary Shelton, Margaret Douglas, Mary Howard, Thomas Howard and, perhaps, Anne Boleyn (as per Southall 1964a, 143); and transcribed extracts of medieval verses by Chaucer, Hoccleve, and Roos. Physical evidence dates it between 1525 and 1559; internal evidence narrows those dates slightly, and suggests that the period in which it saw most intense activity—writing and circulation—was the mid-1530s.

The text of the manuscript reflects the interests, activities, and opinions of a dynamic group of men and women operating in and around Boleyn's circle. This was a key time for many of those who are best represented by the manuscript. Wyatt was an experienced courtier who had already introduced his own brand of politic translation of Petrarchan and contemporary Italian poetic models into courtly poetics. Mary Howard, in her mid-teens in 1534, was married to Henry VIII's son Henry Fitzroy and had entered into Boleyn's circle; possibly, by some combination of herself, Fitzroy, and their marriage she had brought the manuscript to that group, for the original bindings bear their initials. Howard would enter her brother, Surrey's, poem "O Happy Dames" into the MS after this eventful decade. In the mid-1530s, Boleyn's cousin Mary Shelton was in the same circle as well—and, indeed, was chastised in 1535 by Boleyn for entering into a book of prayers the sort of lyrical-poetical "trifles" one finds in the manuscript (Remley 1994, 65n19). Thomas Howard, half-brother to the

Duke of Norfolk, would die in the Tower in 1537, after being imprisoned for his love for, and private betrothal to (in 1536), Margaret Douglas, niece of Henry VIII. Douglas, who was also confined for participating in the secret love relationship, was a Tudor court lady, dependent on the king's favour, required to play her part in public ceremonies, and also part of the circle that surrounded Boleyn. Lastly, Anne Boleyn, just recently married to Henry VIII at the beginning of this decade, would meet her end just after its middle (in 1536), and activity in the manuscript relating to the circle that surrounded her would lessen after this time.

Historically, the *Devonshire MS* has been privileged in literary history as a main source of Thomas Wyatt's poetry—this, since G. F. Nott borrowed it from the Devonshire collection for his early nineteenth-century edition of Wyatt and Surrey, and since its 1848 addition to the collection in the British Library. Some early critics, Nott included, participated in an examination of Wyatt's poetry that attempted to situate it within the circumstances of his life at the time he wrote it; the best-known of these treatments involve Wyatt's works, as represented in the *Devonshire MS* (but not exclusively there), that are seen to gloss his love relationship with Anne Boleyn, works such as "They flee from me," "My lute awake," and others. The manuscript's importance remained such until the middle of the twentieth century, when the manuscript was seen by a group including Raymond Southall, John Stevens, Ethel Seaton, Richard Harrier, and others to have import as a document that was the product of multiple authors, representing their private and public concerns in ways allowed them by the social context that Henry VIII's later court provided. While Wyatt's presence was by no means diminished by this new focus, the contributions to the manuscript of Mary Shelton, Margaret Douglas, Thomas Howard, and others, gained an increased importance therein.

Work of the later twentieth century situated more firmly such critical focal points. Movements in the literary and textual criticism of Renaissance writing demonstrated a renewal of interest in the social context of literature and a concomitant concern with the conditions of literary and textual production. Critics and scholars accepted that an understanding of the rich and diverse connections that existed between poetry and power in English Renaissance society was central to a critical comprehension

of its literature; at the same time, they demonstrated that the focus of such literary study needed to be broadened beyond attention to canonical figures alone.[2] Further, they acknowledged that the key to determining the poetic-political significance of literary works was their currency within the very circles that their contents addressed; attention shifted, then, to the examination of the contents of manuscript poetic anthologies and miscellanies—documents, that is, such as the *Devonshire MS*.[3]

Courtly manuscript miscellanies and poetic anthologies such as the *Devonshire MS* are now seen to "represent the meeting ground of literary production and social practices" (Marotti 1993, 212). They are understood to have the potential to reveal as much about the dynamics of poetry and politics as they do about the conditions of literary production in the early Renaissance—a process which Seth Lerer has recently shown to encompass the realms of public and private, blurring many preconceived notions about literary materials by exposing "confusions and conflations among poetry and drama, private letters and public performances" (1997, 38). Furthermore, composed as they often are by the authoring and collection of materials from diverse sources by (often) several people over a span of time, these miscellanies and anthologies offer invaluable contributions to our understanding of those who gathered and originated those materials, as well as to our ability to comprehend the ways in which they saw the relation of those materials to themselves and to the world around them.

In addition to receiving new and significant attention because of the way in which its contents were seen to reflect the interactions of poetry and power in early Renaissance society, the *Devonshire MS* was recognised, at the same time, to be a document that reflected further, similar, concerns associated with gender and literary production at the time.[4] In it is found

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[2] Consider exemplary studies such as Greenblatt 1980, Norbrook 1984, May 1993, Fox 1989, and Goldberg 1989.

[3] See, for example, May, who has pointed out that it is the study of the literary materials that were actually in court circulation that is most profitable; as he notes, "the study and editing of these manuscripts is vitally important to any accurate understanding of the role of literature at court" (1993, 274).

[4] See, for example, recent studies by Heale, Remley, and Baron; Southall's work is traditionally cited as the central discussion of the manuscript and its import. On the importance of the *Devonshire MS* specifically, see Boffey (1993, 180; and 1985).

one of the earliest examples of the explicit and direct participation of women in the type of political-poetic exchanges housed by the MS, and much of the finest recent work on the manuscript has focussed on it as the product of a multi-gendered coterie, a primary site of women's involvement in the poetic-political world captured by the early Tudor lyric.[5]

Work such as this suggests very well the significance the *Devonshire MS* has to us today. We assume, still, its importance to Wyatt and his canon, but we are very interested in all the authors and the social authors—those copyists, annotators, and arrangers associated with Boleyn's circle in the mid-1530s—represented in the manuscript. We are interested in the manuscript as a document that not only contains the poetry of Wyatt—typically for use in a collation against that found in Wyatt's *Egerton MS*—but as a document whose contents reflect, vividly, the interactions of a number of the notable and important members in the courtly community that produced it. Moreover, just as some early critics worked diligently towards identifying Wyatt's own early works with the situation of his life at the time in which he wrote them—chiefly, as circulated poetic responses (a type of epistolary politics) to aspects of his relationship with Anne Boleyn,[6] but also well beyond—so, too, have studies since the middle of the

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[5] This is suggested by several exemplary critical works, but three shall be mentioned. The first, Elizabeth Heale's "Women and the courtly love lyric" explores the roles of Margaret Douglas, Mary Shelton, and Mary Howard/Fitzroy and discusses "the evidence [the manuscript] yields of the parts women might have played as copiers, audiences, respondents, and, in a variety of senses, producers of love poetry in the early Tudor court" (1995, 297); Helen Baron's 1994 "Mary (Howard) Fitzroy's hand in the Devonshire Manuscript" confirms that Surrey's sole contribution to the MS, the poem "O Happy Dames," is in the hand of his sister Mary Howard/Fitzroy, and also provides the very valuable service of making public her work with the various hands of the manuscript in a convenient table, identifying the personal hands of Margaret Douglas, Mary Shelton, Thomas Howard, Mary Howard, and others; Paul Remley's "Mary Shelton and her Tudor literary milieu" focuses specifically on Shelton's role in the MS, and her use of a deliberate method that "attempt[s] to recast poetry written by others as a new and proprietary sort of literary text" to the end of, for example, documenting "the sense of outrage felt by her circle at the unjust imprisonment of two close acquaintances (Margaret Douglas and Thomas Howard) and [...] to protest the mistreatment of women by self-serving lovers" (1994, 42).

[6] This extends to Greenblatt (1980) and Siemens (1997), and beyond.

twentieth century to our own time sought to identify how the various poetic utterances of the several identifiable contributors to the *Devonshire MS* had resonance with the events of their lives, lives which were played out on a very public stage at the time of their involvement with the MS.[7] Perhaps the best known of the exchanges found in the manuscript is the love poetry exchanged between Margaret Douglas and Thomas Howard, associated with the time when they were threatened, separated, and im- prisoned for their marriage contract; discussed by Remley, the exchange takes place over several poems that may well be original, combined with "a pastiche of lines from Chaucer's *Troilus and Criseyde*" (1994, 51 ff).[8] Less well-documented by recent work, though, is the way in which the majori- ty of the individual entries in the manuscript not only have the potential to relate to other materials within the manuscript but, also, further into the contemporary events beyond the borders of the manuscript itself.[9]

This said, what is made clear by the scholarship surrounding discussion about the manuscript's exchanges is that there is much work still to be done; the nature of these exchanges is highly-contested at many levels, from the identification of hands to the interpretation of individual pieces in specific social and historical contexts—and, just slightly beyond the concerns of the group that has occupied itself with the *Devonshire MS*

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[7] From Southall, to Heale, Baron, and Remley—each of whom quite aptly (even if disparately) addresses significant elements of the manuscript, its contents, and the community that produced it, and each quite definitely reflects our current interest in the *Devonshire MS*.

[8] The significance of their choices, and an analysis of the ways in which they adapted such verses to their own situations, represents one way of exploring the social and political dynamics of courtly poetry, as is attention to the content and presentation of the poems they composed, as inscribed in the MS.

[9] Such may be the case with Wyatt's "If yt ware not" (78v), which contains a burden that echoes a motto employed by Anne Boleyn (in 1530), in turn echoing a line from Henry VIII's "Pastime With Good Company" (*ca.* 1509) which is itself an echo of one of the mottos employed by the Burgundian court in which Henry likely first met Boleyn. While often referred to as "If it ware not," the title of the piece as derived from the *Devonshire MS* is "my yeris be yong even as ye see," with the *incipit* and burden "Grudge one who liste this ys my lott / no thing to want if yt ware not." See Siemens (1997).

specifically, there lies the issue of whether such slight lyrics can be interpreted in the way that tradition and recent critical trends pertaining to the manuscript have suggested that we might.

Capturing the Manuscript's Salient Features—Physical and Critical   As this rich critical context suggests, the *Devonshire MS* has considerable import for contemporary scholarship, and yet it has never been edited in its entirety, nor has it been made available in any conveniently-accessible way to the growing audience of scholars and students that is engaging its contents. As noted by Elizabeth Heale, to work now with the poems of the *Devonshire MS* one must shuffle between older editions of Wyatt (chiefly that by Muir and Thomson) and add to that transcriptions available in a scholarly article by Muir. Even so, not all the contents of the manuscript are available in this way; those which are available are "sometimes in a very inaccurate form" (Heale 1995, 297n6) and wholly divorce the immediately textual content of the manuscript from some indicators of meaning that are highly-significant in a coterie-produced document: extra-textual annotations, the telling proximity of one work and another, significant gatherings of materials, images entered into the manuscript at the same time as the text, and so forth. Archival microfilm copies of the manuscript, while not widely available, can be had and they do make available most textual and extra-textual indicators of meaning, but they do so only for those who possess the very specialized palaeographical skills to read and interpret the original; such concerns have kept much of the writing in manuscripts akin to the *Devonshire MS* out of critical concern for some time. Microfilm reproductions, moreover, do little to illuminate the contents of the manuscript with the valuable interpretative context provided by scholarship.

The goals for the work of an editor of the *Devonshire MS*, thus, must be manifold if the edition produced is to meet the needs of scholars, critics, and students today, for what is needed is something that accomplishes much, providing: an accurate, complete text of the manuscript, treated in accordance with the established principles of diplomatic editing, and one that also suggests the importance of the textual context of the manuscript's entries; a textual apparatus that documents accurately the relation of the manuscript's contents and witnesses and direct textual influences; and

a critical apparatus, and further materials, that can appropriately illuminate the necessary context for the manuscript established by scholarship. Just as important as the above is that the material included in the edition must be able to be navigated in a way that allows access to pertinent primary and secondary materials without unduly interrupting the natural processes associated with reading and studying poetry of this type.

Quite early on in our work, we determined that the production and dissemination of an edition of this sort, with its many goals and materials to interrelate, would best be carried out electronically. An electronic edition permits the display of a manuscript facsimile alongside, or interspersed with, the edited text; here, this can demonstrate the clear connection between the manuscript's poetry and the people who wrote it, for in a good number of cases the poetry and its annotations are in a recognisable autograph. An edition in this medium also allows the inclusion of a great number of materials related to the text of the edition itself, both primary (witnesses and pertinent contemporary documents and objects: other literary works, historical letters, legal documents, artwork, and other court-centred materials) and secondary (criticism, historical studies, etc.)—plus, it allows the navigation of all these materials *via* hypertext and other computer-assisted means. Further, it requires the transcribed text of the manuscript and other relevant textual materials to be represented by a consistent document encoding scheme that provides detailed bibliographic description (verifiable *via* the electronic facsimile) and, beyond, facilitates searches to aid in critical and scholarly analysis.

Provided electronically, the edition can best emphasise the *Devonshire MS*' historical context and the manner in which that context is engaged by the contents of the manuscript. It encourages readers—from keen undergraduates to field experts—to realise fully what the *Devonshire MS* represents to us today at the same time as it will allow them to explore, for themselves, the accepted and contested assertions and arguments of past scholars and critics. Moreover, an electronic edition of this kind is best able to reflect the unique nature of the manuscript's contents, which present complete exchanges between those associated with the manuscript and, at times, also represent parts of larger exchanges that take place beyond the borders of the manuscript. Such an edition best

prepares its readers for what is most significant about the object of the edition: the poetic exchanges that render the personal and the politic, and the private and the public, of not only a canonical poet, but the concerns of the coterie of men and women that together are represented in the *Devonshire MS.*

Representing the Manuscript Electronically *via* Textual Encoding

The manuscript comprises an exciting body of material, one that is significant to scholars and students alike, and we have resolved to create an electronic diplomatic edition as best fit to facilitate engagement with that material. Such a decision leads, naturally, to discussion of the details necessary for this to be accomplished. About such passages from thought to act, it has been said that it is in the details that the devils are found. Lightly put, our experience does reflect the wisdom of the aphorism—if "devils" can be considered to be "challenges" and "opportunities" (both euphemisms for "problems"), and if "problems" can be properly anticipated by forethought and planning as much as by being willing to embrace case-by-case decisions as unique and difficult-to-anticipate situations are encountered.

The priority guiding the manner in which we make those decisions is our intention to retain a sense of the original book. To do that, we want, in the production of our electronic edition, to create what a reader expects from all diplomatic editions.[10] Thomas Wyatt's "I finde no peace and all my warre is done," as found on 82r–v of the *Devonshire MS* provides an

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[10] As might be expected in such an edition, the images of each folio will be available if the reader so wishes, and the details replicated in the transcription can be compared with the image. The transcription itself should ideally be oriented to opened pages, much as one might read them in the physical volume, with facing verso and recto, with formatting (columns, annotations, indentations, &c.) retained, as well as any paper properties documented. Capitalization is retained, as is spelling. We mark text that is cancelled, added, elaborated, and emphasized. Figures, such as brackets, pictures, lines, and rules are included. We record scribal abbreviations, repeat apparent errors, and show where illegible sections elude transcription. Each hand is designated, and there are notes that detail each scribe's identity (if it is known), characteristic habits, and deviations from those patterns.

example of a poem as it appears in the manuscript, which also, incidentally, demonstrates the dominant script in the manuscript, and the practice of one of its more dominant scribes, together with a transcription of the manuscript, is shown in Figure 1.
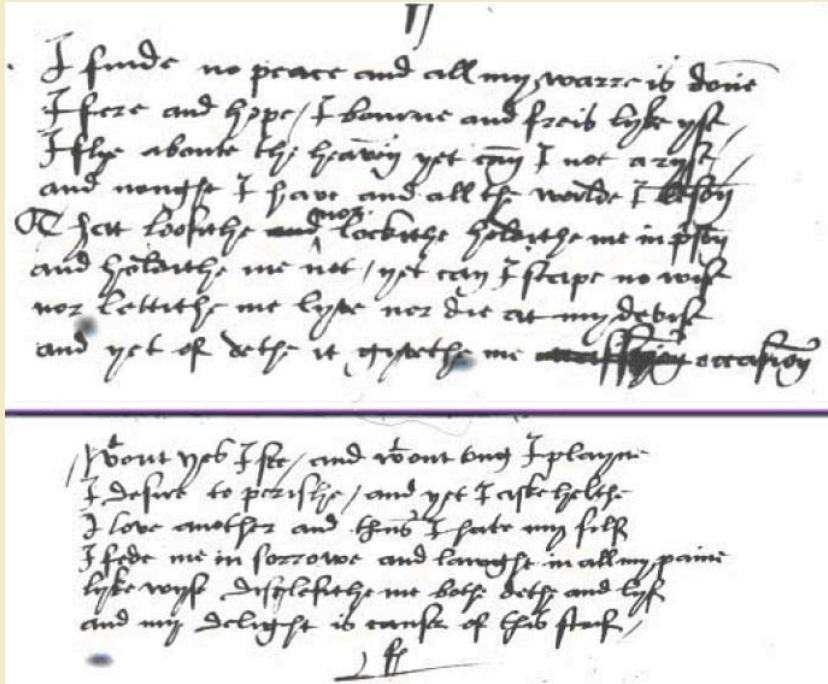

Figure 1

I finde no peace and all my warre is done
I fere and hope / I bourne and freis lyke yse /
I flye aboute the heavin yet cann I not aryse /
and nought I have and all the worlde I leson
That loosithe ~~and~~ ^nor. lockithe holdithe me in prison
and holdithe me not / yet can I scape no wise
nor lettithe me lyve nor die at my devise
and yet of dethe it gyvethe me ~~occassiyon~~ occasion
                                                    [new foliation]
Without yes I see / and without tong I playne
I desire to perishe / and yet I aske helthe

> I love another and thus I hate my silf
> I fede me in sorrowe and lawghe in all my paine
> lyke wyse displesithe me bothe dethe and lyf
> and my delight is causer of this strif /
>   [flourish] fs

Our document-centred orientation requires us to recognise both biblio-graphic aspects and conceptual units; that is, we recognise that the doc-ument is both pages and poems. The project employs overlapping, but cooperating, hierarchies of organization. This organization is defined and regulated by a Document Type Definition (DTD), which is a schematic relat-ed to our encoding, written in words and symbols, of allowable ways that the parts that contribute to a complete text are associated, one to the other.

Since our interest is in recording physical aspects of the text, as well as its poetic components, and in doing it electronically, we identify and instruct the computer, *via* the use of encoding, or markup, as to the features we want to mark.[11] For example, the encoded file is marked with pivotal points, or milestones, that indicate page breaks and column breaks. The aspects of a diplomatic edition that readers expect, which is a replication of the bibliographical features of the original, are available. Encoding is always interpretation, but we are trying as faithfully as possible to replicate a sense of scribal practice in a scribal community by retaining a focus on the physical entity.

While retaining the orientation to the visual, the encoded file is also divided into conceptual chunks. The basic unit in that organization is the poem, or poem fragment, which extends to include epigrams, anagrams, and comments that seem to form a thought-unit. Each "poem" (let us call it for simplicity, even though there are units that are not poems as such) is divided into stanzas and lines. A title is applied (in our case, it is the *incipit*) and an author designated (when the work is attributed to a particular person). By attending to both the bibliographical details and

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[11] Markup, or encoding, is akin to labeling the various parts of a text and the charac-teristics of each part as it appears on the page and functions in the document. For example, the word "*elan*" could be encoded as: <foreign lang="fr">elan</foreign>. The "labels" that distinguish the feature from its context are called tags.

the conceptual units, we intend to present a complete and complementary documentary record—as much as it is possible to do so.[12]

Choosing an Encoding System and Principles of Procedure   The process of encoding begins with the choice and application of an encoding system, the pattern of markings that one applies to the text being edited in electronic form so that the computer can process the text and its various elements and attributes—so that we as readers can properly use the text and its related materials. The widespread applicability of the Text Encoding Initiative's Guidelines for XML (Extendable Markup Language) make TEI-XML a choice of an encoding system that is well-supported by the Humanities Computing community internationally. A text encoded in TEI-XML relies on a tagging grammar, a DTD, which provides a subset of the range of encoding options. A DTD is the framework of choices within which the encoding operates, and by which encoders ensure that the accumulating file always obeys its own rules, helping to maintain accuracy and consistency.

Following the decisions to encode in XML, and to adhere to the *TEI Guidelines*, is the decision of which DTD is most appropriate for a particular project, as the purview of the Text Encoding Initiative includes an immense variety of types of texts. To select an appropriate tagging grammar for one's own project, a survey of the material to be encoded and a definition of the project's goals is the first step. The process of transcription enabled us to learn the dimensions and relationships of the contents

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[12] In doing so, we have encountered some situations where we are not able, with our present understanding and organization, to replicate the manuscript exactly as we would ideally wish to do. For instance, a scribe has written what appears to be a crossed out letter on a series of pages. Since poems are inscribed over the marks, they are incidental to the poem, but pertinent to the page. We are not yet able to convey that detail, which is small, but could be important, as well as we would like using our current encoding practice. We are also dissatisfied with the way we record situations in which the poetic line differs from the physical line, since a poem's organization into stanzas and lines does not always coincide with the way the scribe writes it, which is also important to us. Elsewhere, scribes violate what might be, to us, the convention of leaving a physical space between stanzas, and it is significant that the scribes do not adhere consistently to that idea, so the style sheet that we devise to display the text will have to reflect scribal habits, not modern standards of layout. Those small, but significant, details are some of the devils to which we refer in our title.

of the manuscript. The task of transcription was immensely challenging and immensely fulfilling. The manuscript was inscribed by nineteen different hands, using mostly non-professional secretary script.[13] Once the transcriptions were completed and collated, the project team was aware of the dimensions and relationships within the manuscript itself. The next challenge was to create the framework within which we wanted to work, to select a DTD that met the needs of the nature of the material, the manuscript, and the needs of the project, a diplomatic edition.

A project-specific DTD will, ideally, fit with needs that one can envision at the outset of a project but, also, leave room for growth and change with the needs of the project over time; a DTD must be flexible enough to accommodate unforeseen situations and expandable enough to meet future, as yet unspecified desires.[14] The TEI offers TEI-Lite, a DTD which has a simplified grammar that meets the needs of a wide variety of projects. However, for our purposes, it would not allow us to encode to the level that the manuscript's complexities and our intentions require. After

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[13] Because it was not meant for circulation beyond a limited group of friends and family, it is a very personal document, which strengthened our commitment to represent the scribes and their production fairly and accurately, in a way that the scholarly community, and a wider audience, can appreciate the scribes, their situations, and their work, as we do.

[14] Fortunately, support in making the decision of which DTD to adopt is readily available. The Humanities Computing community is an invaluable source of experience and guidance for new encoding projects. For example, the TEI list-serv is a resource that offers a beginner access to experts, and a perspective on current issues in the community. Many Humanities Computing projects readily share their own DTDs and publish their encoding guidelines and editorial policy statements, which is an opportunity, even though the parameters are designed for different bodies of work, and with different goals, to learn, adapt, and model aspects that are applicable to the specific project with which one is concerned. It is always of value to understand how other projects meet similar challenges as those that our project team faced, and continues to face. The expertise and advice of each member of a project team itself greatly contributes to any enterprise conducted within its purview, and choosing a DTD is a vital step that benefits from the input and viewpoints of the project's team members. The TEI's *Pizza Chef* is a crucially important resource for designing and generating a basic or customized DTD, depending on the complexity of a body of material and the aims of project team, as the nature of the document and the intentions of the project have been defined by them.

consultation with members in the Humanities Computing community, we chose to create a customized DTD, using the TEI's *Pizza Chef* site,[15] and with reference to the *TEI Guidelines* and its section relating DTDs to particular fields and bodies of work. Using XML, choosing to follow *TEI Guidelines*, and constructing an appropriate DTD, both robust and fine-tuned for immediate and long-term utility, represents only the first of many, ongoing, decisions.

In the task of applying the encoding within the parameters of our chosen DTD, and after testing the DTD on the first ten folios to determine that we had a workable pattern, we applied the DTD to the remaining 83 folios; in doing so, we maintained two standards. The first was consistency: even if a choice was discovered to be less than optimal, we continued in that pattern until all of the text was complete. Rather than use two (or more) different practices, if the entire manuscript is encoded in a consistent way, global changes can be made afterwards.[16] (Alas, it is only in practice that plans are revealed to be ideal, adequate, or unfortunate.) The second standard was accountability. As we encoded, we maintained regular documentation. While it may seem at the time that a certain situation or decision is so transparent as to be unforgettable, the use of detailed documentation ensures that neither the original encoder nor any

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[15] With the *Pizza Chef*, guided by detailed instructions, a DTD designer chooses an appropriate base (prose, verse, drama, speech, dictionary, terminology, general, or mixed), adds such toppings (optional components) as seem necessary to the project's intention, and such flavourings (entity sets) as seem appropriate.

[16] For example, in the first pass, the tag <closer> was used to mark a scribe's "fs", appended to the end of a poem, which is an abbreviation for "finis." When, later on, a different scribe placed a flourish before and around the "fs", and it was desirable to record that, it proved not possible, within the DTD, to use the element <figure> and <figDesc> to record that phenomenon within the element <closer>. Rather than adapt the DTD to allow such a use, all the <closer> elements were changed globally to be <l> (line) elements, which does allow the inclusion of elements to describe a flourish. All instances of "<closer>f<expan>ini</expan>s</closer>" were found and replaced by "<l>f<expan>ini</expan>s<./l>," and then the instances where the scribe had inserted a flourish were moved from their placeholders (in comments) into the element by using the command "find," and then "copy" and "paste," a process which is lengthy to describe but relatively straightforward to accomplish.

subsequent one will lack a basis on which to proceed.[17] Other encoders may continue working with the document after the initial encoding is complete, and the project may evolve in ways that cannot be anticipated at the outset, but with the firm foundation of documented encoding, all those working with the document can refer to, build on, or adapt that project's foundation.

Another successful practice we employed to encode the manuscript was to build up layers, by proceeding in phases. The manuscript was encoded completely at a conservative level before the second phase commenced. That layer of encoding deepens, clarifies, and augments the first. A third phase will add still more depth. By proceeding in stages, consistency will be maintained and the encoding can be tested at every stage to ensure that it meets the requirements as they evolve.

Beyond the encoding decisions we make each day as we work, there are larger concerns that our team discusses. We worry, for example, about what is lost by representing the document at one step removed from the original *via* an elaborate encoding system—especially when we can render the original quite decently *via* electronic facsimile. In answer to this, we remind ourselves that an image is only a visual representation and, by itself, cannot clearly convey the information it contains except to those very few who have the hard-earned, learned expertise to receive it. Our hope is that much of what needs to be conveyed can be captured in our encoding. We note that encoding, as it is practiced professionally, with attention to the highest bibliographic standards, adds a valuable layer of description to the manuscript image—description that can be interpreted by the computer and, by extension, be of best service to the reader of the electronic text.

Encoding the Text   Thomas Wyatt's "I finde no peace and all my warre is done," as found on 82r–v of the *Devonshire MS* and as seen just above

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[17] For example, the <revisionDesc> element of the TEI header is a list of all significant changes that were applied to the file, recorded as work progressed. In addition, comments were extensively employed to record decisions and situations that needed to be rethought.

provides a sample of the first phase of encoding, the transcription; below is a sample of encoded text at first pass, done at a minimal level, prepared for a more detailed second phase of encoding.[18]

```
<TEI.2><!-- material omitted --><text><body><div0>
    <head><bibl>
<title>I finde no peace and all my warre is donne</title>
<author>Thomas Wyatt</author><note>unattributed in D; at-
    tributed in LEge</note> </bibl>
<note>Hand 8 (per Baron) </note></head>
<lg>
<l>I finde no peace and all my warre is do<expan>n
    </expan>ne</l>
<l>I fere and hope / I bourne and freis lyke yse /</l>
<l>I flye aboute the heavin yet can<expan>n</expan> I not
    aryse /</l>
<l>and nought I have and all the worlde I <sic corr=
    "seson">leson</sic> </l>
<l>That loosithe <del>and</del><add>∧nor.</add> lock-
    ithe holdithe me in p<expan>ri</expan>son</l>
<l>and holdithe me not / yet can I scape no wise</l>
<l>nor lettithe me lyve nor die at my devise</l>
<l>and yet of dethe it gyvethe me <del>occassiyon</del>
    occasion</l>
<pb/>
<l>W<expan>ith</expan>out yes <note>eyes</note>I see /
    and w<expan>ith</expan>out tong I playne</l>
<l>I desire to perishe / and yet I aske helthe</l>
<l>I love another and thus I hate my silf</l>
<l>I fede me in sorrowe and lawghe in all my paine</l>
<l>lyke wyse displesithe me bothe dethe and lyf</l>
<l>and my delight is causer of this strif /</l>
<l>f<expan>ini</expan>s</l></lg></div0></body>
    </text></TEI.2>
```

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[18] The transcribed text is represented in bold, and the coding in normal typeface. In the sample, which is simplified, and which represents an early stage of encoding, there is no encoded indication of the various graphic forms that each scribe employs.

Ideally, one's target in choosing an encoding system should be a tagging grammar that is detailed enough to represent accurately the structure and content of the text being encoded, and one that reflects an accepted system, so it can be understood and used by others. But, once a system is chosen, decisions do not end there. The way in which the text is encoded decides its ultimate utility. The proper application of an encoding system to a literary text is full of the rigour of bibliography (physical, textual, analytical, &c.); this is not surprising, as textual encoding at this level is the computing application of that field. In choosing and applying a tagging grammar to a body of text, large decisions are often tested and proved, or disproved, by the way they impact on small, day to day decisions at a level of intimate involvement with the text. That close involvement, coupled with the desire to represent the manuscript's character and contents adequately for a wider audience has provided examples of situations that our current encoding treats in a minimal way, but that have been flagged with comments for a fuller treatment that will allow the audience to explore the manuscript for themselves, and to encourage contributions to an even better understanding of the situations we have encountered as we have worked. Those same circumstances and that same intention also provides examples of decisions that are not yet made, which will test the limits of our system and our editorial principles. Some examples of each type of encoding challenge follow.
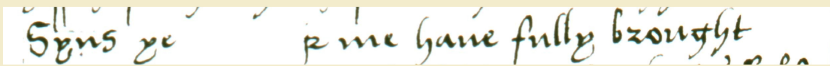

Figure 2

Encoding the Text: Intentional, Meaningful Gaps   In the example seen in Figure 2, a deliberate gap has been left in the transcription of a excerpt from William Thynne's 1532 printing of Chaucer's *Troilus and Criseyde*; "O very lord o loue o god alas" appears on f. 29v in the hand of Thomas Howard.[19]

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[19] Thynne's version of Chaucer reads:

O very lorde/ O loue/ O god alas
That knowest best myn hert/ & al my thought
What shal my soruful lyfe done in this caas

As noted by Paul Remley and others, this excerpt is part of a literary exchange between Howard and Margaret Douglas, likely during their separation imposed by Howard's imprisonment. In Chaucer's *Troilus and Criseyde*, we find the name of Criseyde in this position, but by that omission, and spacing, left here, it might be presumed that the name "Margaret" should or could be inserted. In the very least, we must note the suggestion of meaning that is left by such a visible absence in the MS; the blank space suggests this, as does the expectation in the MS that the blank space contribute something to the meter. Such an omission as we see here suggests that Howard is adapting the extant verse to the personal situation shared by the couple. By transcribing and transforming (or adapting), Howard indicates that, while the general sentiment or situation of Chaucer's verse is similar, the particulars are different—the verse is relevant, but the name of the person concerned is known well enough to his intended audience that it need not be written, and/or it is too sensitive to specify.

Clearly, the intention is for something to be present here. Since the omission is significant, it must be encoded, and explained in a note. As an initial move, we have encoded the line as

   <l>Syns ye<space></space> & me haue fully brought</l>;

but further delineation, including, perhaps, the employment of the various attributes of the <space> element, such as its extent, and an indication of the encoder responsible for the decision, together with a sufficiently full explanatory note must be appended.

       If I forgo that I so dere haue bought
       Sens ye Creseyde & me haue fully brought
       In to your grace/ and both our hertes sealed
       Howe may ye suffre alas it be repealed (IV. ll.288–294)
The version in the Devonshire manuscript reads:
              O very lord/ o loue/ o god alas
       That knowest best myn hert / & al my thowght
       What shall my sorowful lyfe donne in thys caas
       Iff I forgo that I so dere haue bought
       Syns ye [_____ _____] & me haue fully brought
       Into your grace and both our ~~hat~~ hertes sealed
       howe may ye suffer alas yt be repealed

Encoding the Text: Word/Image Substitution Another instance that demands a more extensive treatment than we have as yet applied is exemplified by an item found in Wyatt's "What no perde ye may be sure" (19r): a heart-shaped diagram in the line which reads: "within my [insert: heart-shaped image] shall styll that thyng, seen," seen in Figure 3.
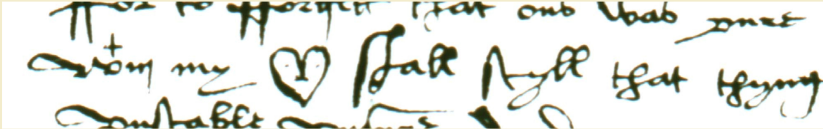

Figure 3

At its simplest, we could have treated the symbol as an abbreviation, as the brevigraph indicating the word "within," is treated, but that, by itself, is lacking. At least, though, it would make the reader aware that the word "heart" is our interpretation of what exists in the manuscript. In the interim, until such a time as we link an image with the encoded file, we have marked the instance with a comment, and encoded it as

w<expan abbr="w+t+">ith</expan>in my <figure><figDesc>
heart shaped drawing, with dots for eyes, and a line for a mouth
</figDesc></figure>shall styll that thyng</l>.[20]

By encoding the line so as to indicate that a pictograph is in that position and describing it, and then by linking an image and adding a note explaining something of the circumstances, other scholars can work with an accurate text, and benefit from the results of our care to properly document and indicate changes we have made, which, in turn, document the change the scribe made when he or she copied out Wyatt's poem.

Encoding the Text: "Coded" Text and Annotations Often an understanding of the biographical circumstances that surround the composition or presentation of a poem greatly enhances the experience for the reader, and is

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[20] The code used to record the abbreviation is that derived by RET (Renaissance Electronic Texts), which provides the most comprehensive and descriptive set of abbreviation codes for Renaissance scripts available, enabling the encoder to precisely delineate a specific scribal practice.

crucial to a scholarly appreciation of it. Many of the poems and annotations in the *Devonshire MS* benefit from such an explanation. An example of "coded" text, with a response, and annotations that debate the merits of the poem (or the courtier who addresses the lady) piques our interest, and makes us determined to encode and present the poem so that others can share the intriguing exchange. The poem concerned is "Suffryng in sorow in hope to attayn," which is often attributed to Wyatt (6v–7r), shown in Figure 4.[21]

The poem itself is an appeal for love of a woman, but several features of the text suggest a more specific application. The first letter of every stanza, taken together, forms the name "SHELTVN" (Remley 1994, 50, 70n45). A response, in Mary Shelton's hand at the bottom of the poem (7r), is as follows: "ondesyred sarwes / reqwer no hyar / may mary shelton" (Figure 5).

In modernized language the tart message is: "undesired service / requires no hire," a response that illuminates both a specific and a cultural situation. Margaret Douglas has written next to the beginning of the poem (6v), "fforget thys"; immediately below, Mary Shelton writes: "yt ys worthy" (see Baron 1994, 331). We have encoded the poem as an acrostic, and encoded its associated annotations, but we have not yet composed an adequate contextual note to explain the circumstances and the significance of the relationship between the poem's content, its acrostic reference, the pertinence of the marginal, annotative exchange and the way in which the situation relates to the lives of the intended recipient and sender.

Encoding the Text: Retrieval of Degraded Text   To this point, we have demonstrated interest and concern in encoding sufficiently well, to our standards, what is immediately available in the text. We are aware of what is as yet unfulfilled in our treatment to illuminate and amplify adequately what is in the text to the satisfaction of our audience and ourselves. In a reversal, the next instance involves something that is absent, or nearly so, in the text of the manuscript. All the instances thus far are visually apparent

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[21] At least one scholar has suggested that the poem might have been written by Thomas Clere, who was Shelton's lover in the 1540s, but a majority of the editors of Wyatt's work include the poem (Remley 1994, 70n45).
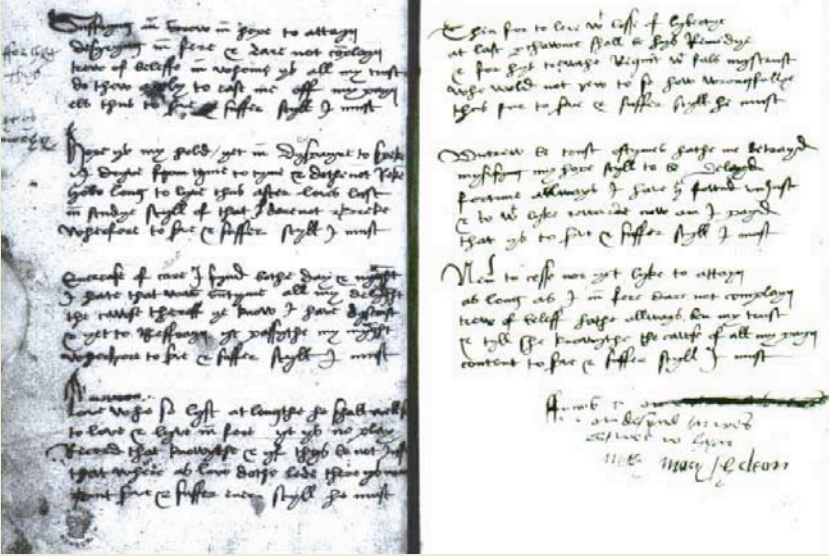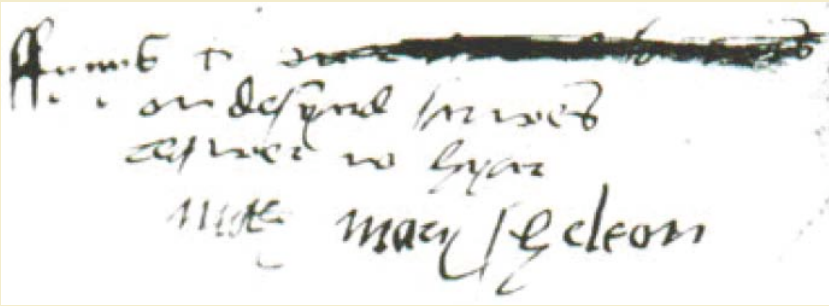
Figure 4

Figure 5

in the document's original and its digitized facsimile. Below, the concern turns to the proper documentation of what is impossible to verify in the digitized image produced from microfilm and extremely demanding to verify even in consultation with the original, except with specialized equipment.

Since the time the *Devonshire MS* was first catalogued and indexed, we have been aware of a poem entitled "My heart is set not to remove," which was

once thought only to exist only in one form, a three-stanza lyric in the hand of Margaret Douglas. These are the three stanzas, as they appear on f.65r:

> my hart ys set nat to remowe
> ffor wher as I lowe ffaythffully
> <small>I know he welnot slake hes lowe</small>
> nor never chang hes ffantecy
> I hawe delyt hym ffor to plese
> in ~~hal~~ hall that tovchet honesty
> who ffeleth greve so yt hym hes
> plesyt doth well my ffantesy
> and tho that I be banysht hym fro
> hys spek~~et~~ hes syght and company
> yet wyll I in spyt of hes ffo
> hym lowe and kep my ffantasy

The three stanza version of the poem focuses on aspects of love and lovers, highlighting their dedication despite their separation, and speaks of the action of an apparent foe.

Using a mixture of computing techniques involving digital image manip-ulation, as well as other standard textual technologies and processes, we are recovering another version of the same lyric, in the same hand, but in a four stanza version (58v–59r), which is insubstantially different from the known version save for the additional stanza, which reads as follows:

> do what they wyll and do ther warst ^w??st
> ffor all they do ys wanety
> ffor a sunder my hart shall borst
> sow[r]rer then change my ffantesy

As with the earlier example provided by Thomas Howard's adaptation of Chaucer to demonstrate his love for Douglas in separation, here Douglas demonstrates the same for him. The poem's meaning is sharpened by an awareness of the biographical circumstances that may have prompted its composition. Margaret Douglas seems to be vowing her constancy in the face of the disapproval of her uncle and guardian, King Henry VIII, to her *mésalliance*. Political reality may have dictated the first line of the fourth stanza "do what they wyll and do ther warst." The additional

stanza completes the symmetry of the poem poetically and demonstrates her understanding of the consequences of their affair. The last two lines of the recovered stanza return poetically to the last line of the first stanza, which is: "nor never chau*n*g hes ffantesy," and the poem ends with her reciprocal assertion of her loyalty: "ffor a sunder my hart shall borst /sow[r]er then change my ffantesy." The actions of the foe(s)—though in vain—lead to heartbreak; its associated sorrows are able to change the fantasy of the female lover's experience.

The poem is more sophisticated with the additional stanza, but we do not know, given the condition of the text, if she intended it to be read, if she suppressed it deliberately, or if other forces, such as natural degradation, are at work. Further work is required with the manuscript page to recover, fully and without doubt, what is very deteriorated (perhaps deliberately faint, marred, or erased) marking. Then, we must encode this poem adequately so as to indicate its physical condition, including indications of the degree of confidence in our transcription of particularly faint letters, and provide remarks that enable our readers to understand the significance of the version and the biographical context in which it is situated.

Encoding the Text: Encoding Cruxes   We wish to capture as much pertinent information as possible in the encoding, and to enhance that encoding by references to contextual conditions and situations but we also encounter situations that challenge the parameters of our knowledge and the perceived limits of the encoding system we have chosen. So far, we have discussed situations in which we know what needs to be done to enhance the experience of an audience encountering the poems of this manuscript. But there are, as well, situations in which we are unsure how to proceed at this time.

In large part, these situations reflect concerns that lie at the heart of the documentary editing tradition, chiefly centring on the problem of how detailed the encoding must be to capture the salient features of the document. In some cases there are marks that a scribe has made and we are unsure whether or not they are meant to be significant, and thus must be encoded, or if they are idiosyncratic practices, and thus unremarkable for that particular scribe in that situation. At issue here are matters

such as majuscule/miniscule substitution[22] and scribal abbreviation or accentuation points in unexpected locations.[23] In addition to these cruxes at the juncture of editorial practice and scribal practice, we have yet to create all the links between poem units that we will employ, and are currently categorizing the types of associations we want to establish.

Creating the encoded text has involved, and will continue to offer, challenges not all of which are resolved to our satisfaction as yet, but our involvement with the manuscript details—and our intention to reproduce the sense of a densely interactive text whose voices speak not only within the text, but which also comment and reflect the world in which the scribes lived—has given us an appreciation and respect for the sometimes anonymous men and women whose poetry and annotations we record. To share that sense of involvement at the same time as we share the encoded text with the audience that we expect will be interested in our project, the electronic interface toward which we are working will also foreground the manuscript and will facilitate the use of electronic tools to navigate both within and without its virtual covers. Development of that interface is currently underway.

Establishing an Interface Prototype Suitable to the Material of the Edition

Despite the natural shortcoming of not being in the familiar book-form, electronic editions have a distinct advantage over their print counterparts

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[22] For instance, many of the scribes use the majuscule form of a letter, but in a miniscule position. We are unsure if that use is meant to add emphasis, or if it is simply the way that person chooses to shape that letter. In some situations, it seems as though those forms are significant, and thus, ought to be encoded, perhaps using the element <hi>, signalling a "graphically distinct" portion of text. For example, in Wyatt's "What menythe thys when I lye alone," the scribe uses majuscule letters in a miniscule position in the phrase "Rage & Rave," where it seems possible that he or she intends to emphasize the alliteration, but he or she also uses the form in the phrase "many A yere," where it seems less likely (12v–13r).

[23] Other scribal habits, such as using the symbol that usually indicates an omitted "ra" associated with a word such as "myght," drawing lines that resemble extended macrons, usually indicating an omitted nasal, over words like "cannot," and inserting drawings, such as cross-hatches, on some pages have us wondering where, how, and if we ought to record those instances.

because of the vast resources that they can make readily available to their readers. An electronic edition can be updated as newer information or reconsideration makes necessary, images can be easily included, and supporting material and tools that can be included are, theoretically, almost unlimited in scope. With the assistance of automated text analysis tools, processes such as word searching, word distribution, word collocation and so forth, are quickly available without a great interruption to the natural reading process, and thus encourage a close affiliation of a reader's (computer-assisted) analysis of a text and one's linear reading of it. Hypertextual navigation of extra-textual resources provides and assists in the management of a significant amount of related material extra to the text of the edition itself, similar to that available in a good research library, or group of libraries. As such, the electronic edition makes accessible dimensions of the text, or dimensions suggested by the text, not always conveniently available in other ways. For these reasons, the electronic edition represents a meeting ground of text and criticism—at both representative/documentary and interpretive/analytical levels; the reader of the electronic edition is often explicitly enacting analytical processes upon the text at the same time as he or she reads it.

At the moment, the focus of our research group is not so much what extra-textual materials to include in our edition—this is a fairly clear-cut decision; rather, our chief challenge in this regard is how one might include this additional material such that the reader can most easily benefit from it. Our concern lies as much in how we represent the textual materials we have—*via* encoding, as is discussed above—as it does in how we present those materials, *via* the computer display, to the reader. As such, the search for an adequate visual representation of the edition is a central focus of our work at the moment.

Because the electronic edition is intended to follow the model of diplomatic editions, and because a chief interest in the manuscript is the way that the scribal community that produced the manuscript interrelated through it, a chief priority in establishing the parameters of the display is that it would foreground the manuscript itself. As part of our ongoing work, we experimented with several forms of indexing, including, in the first instance, a graphical index used as reference in our transcription,

verification, and encoding processes (see Figure 6). The centre column contained thumbnails of the pages, while the foliation and *incipit*s were listed beside the corresponding page. While this index was a useful and convenient way to visualize the relative location of a poem, its use quickly prompted us to develop certain ideas about how the prototype of the interface for the edition should work. Our goal became to provide an unprecedented level of access to the manuscript by integrating the facsimile images with the transcription of the text.

That said, it is also our intent to do so *via* an interface that allows this access in a way that does not overwhelm the reader with information. Previous electronic editions have relied on the idea of frames, presenting many aspects of the text at once in separate, small boxes. We found this approach visually cluttered and—especially to those new to the field, or new to the electronic environment—distracting and misleading, for the plethora of options had the potential to detract from the reader's experience of the text. The main text was continually pushed aside by the textual variants, the facsimile variants, the commentary, and the sources frame. For all its admirable qualities, one of the best examples of the hypertextual scholarly electronic edition, the *Arden Shakespeare* CD-ROM (seen in Figure 7), raises such concerns.

In contrast, despite its DOS-based visual interface, the simplicity of *TACT*'s textual display and the power of its analytical tools, combined with its plain text navigation, have considerable merit (see Figure 8), yet it was not designed to be an edition engine; its display is oriented more for analysis than for reading, and its operation is text only.

Our hope, considering the models provided by hypertextual editions such as the *Arden Shakespeare*, and by dynamic texts such as those produced for *TACT*, was that we might combine the visual simplicity and navigational power of *TACT* and other similar packages with a graphical interface, capable of handling hypertextually-associated text and images, such as that of the *Arden* and other like editions. In short, we explored ways in which to present all of the elements of a scholarly edition, while clearly retaining the central, privileged position of the primary document in our edition.

Figure 6

Figure 7

Figure 8

We also concluded that interaction with the edition should be *via* a delivery mechanism that is, as much as possible, independent of an operating system. The conclusion we reached is that we should work towards envisioning the final interface of our edition to be implemented as a rich internet application. Internet applications are served through a web browser, using a carefully developed, cohesive interface that ideally works in the same fashion as any desktop program, using the same computing paradigms, and on any platform;[24] rich applications incorporate multimedia elements, including images, sound, text, and video. Ideally, these applications offer a seamless transition from a standard computing environment to the edition served on the internet. The use of the internet, rather than a CD-ROM distribution, allows the easy updating of the edition, while at the same time easing access for many users. The computing requirements of an internet application are, by definition, low: an internet connection, a web browser supporting standard protocols, and perhaps a plug-in.[25] In comparison, a traditional program interface, such as that for the *Arden Shakespeare*, would require a software installation. It is also important to note that we hoped out prototype might have the best chance possible to reach beyond the current limitations of technology and, indeed, survive the inevitable changes in computing technology; we realise that the advancement of internet technologies over the next three years, and beyond, will push our prototype in unexpected ways; our approach, then, was to focus on what is possible at the moment but, much more importantly, what might be possible in three years, at least.[26]

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[24] Examples of rich internet applications include: internet banking sites, games played *via* the internet, and shopping portals such as eBay.com.

[25] Plug-ins offer enhanced functionality when browsing the internet *via* a small download that is installed into your browser. The Macromedia Flash plug-in is installed in 97% of all browsers. Java is equally ubiquitous. For a full survey, see http://www.macromedia.com/software/player_census/flashplayer/.

[26] Since our base text is in XML, we should be able to partner our text with any scripting language in order to develop our application. XML is commonly used with the scripting languages JavaScript, Perl, Python, PHP and Ruby in web applications. Not all of these languages are designed for graphical presentation, but we will choose the language which best suits our final prototype. The XML text supplies the content, while the chosen scripting language controls how the content is displayed using standard interface elements. Macromedia Flash, a widely-used and distributed platform (albeit proprietary) for internet applications, uses ActionScript within the proprietary Flash

The results of our exploration, and prototyping of interface, can be seen in Figure 9.
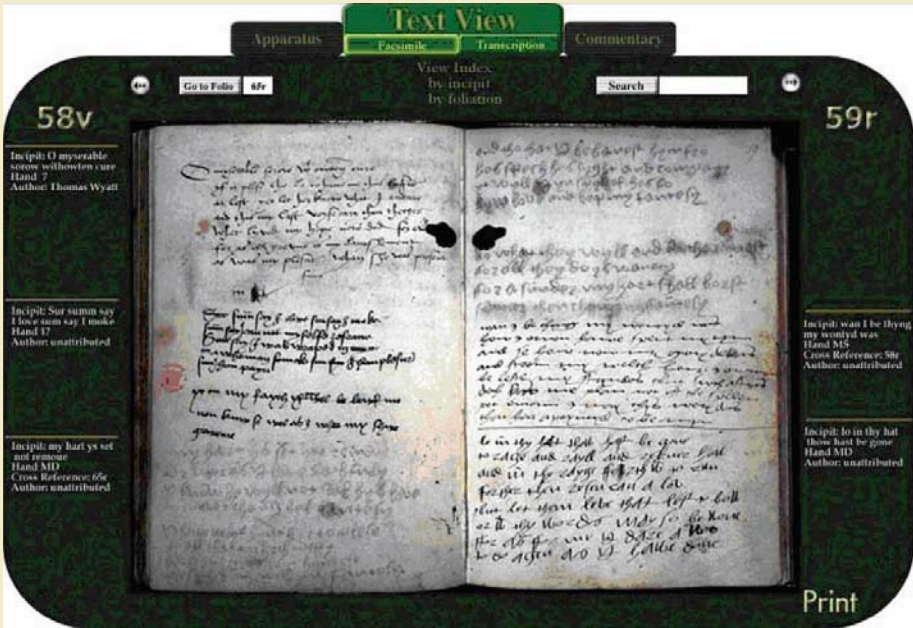
Figure 9

At the top of the application are three tabs: Apparatus, Text View, and Commentary. Our intent is to emulate the structure of a print edition: an index and prefatory materials, the text itself, and the commentary on the text. The bulk of the edition, and of the application, is focused on the Text View tab. The Text View has two subsidiary tabs, Facsimile and Transcription, in order to facilitate switching from one view to another, although the facsimile view remains the default option for the application. Across the top of the application are the navigation options: an index by *incipit* or by foliation, buttons to move from page to page, an option to type in a specific folio number, and a search box with options to

interface, and content is drawn from an XML file. See also "Java Technology and XML" at http://java.sun.com/xml/, for an overview of how a programming language can be used with XML data. While this site speaks solely of Java, the principles apply to any language.

search the manuscript, within the commentary, apparatus, and related electronic resources. The tab metaphor is easily understood by anyone who uses physical bookmarks; the quick finger in the endnotes, another in the commentary, and another marker in the bibliography is common practice. For the reader using the electronic edition, the interlinked tab windows allow an easy and natural movement from one aspect of the text to another, and then a quick return to the main activity of reading. For example, when reading the poem "My heart is set not to remove," the Apparatus or Commentary tab will call up the corresponding notes and documentation of that poem as a starting point for further exploration. The Text View should be treated as the "master" key of the application, and all other tabs will be supplementary to it.

The facsimile of the manuscript page is the centre of the main view, and all of the ancillary information is associated with it. Within the facsimile view, each poem is identified in the margins with the *incipit*, the hand, the internal witnesses, and the author of the poem. These marginal notes will be drawn from the XML file that includes the witness information. In order to associate the notes with the *incipit*, each facsimile image will have the "poem spaces," indicating the portion of the image that corresponds with each *incipit*. We intend to add meta-tagging to the images, designating the physical space of a poem's presence on the page, and associating that space with the transcription of the poem. When a reader is examining the facsimile view, placing a mouse over an *incipit* will activate a pop-up text note of the transcription of the corresponding poem (see Figure 10).

With this option, the reader can compare the transcription of an individual poem within the manuscript view. Other entries are linked to their complement within the apparatus or commentary tab. For example, clicking on a specific hand name will show the palaeographic details and study of that hand. In this way, our electronic edition facilitates access to the manuscript. Continuing with the example of "my hart ys set nat to remowe," discussed above, while viewing 65r the reader can quickly
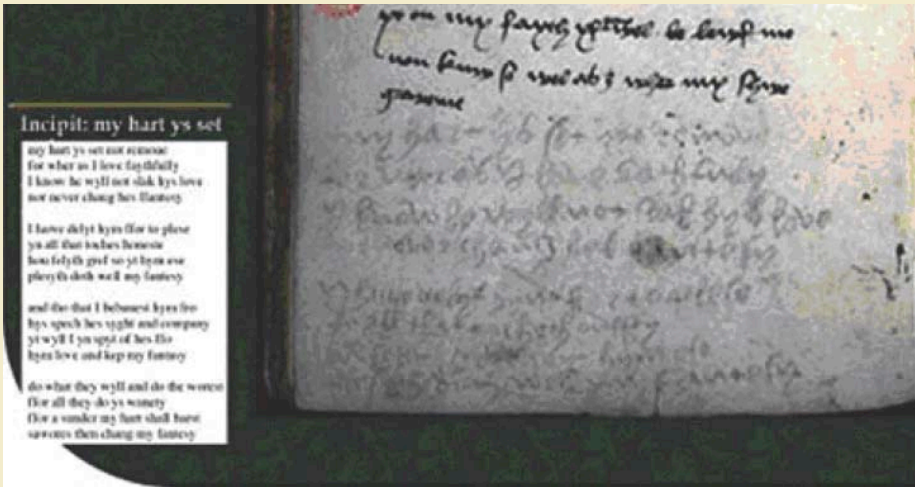
Figure 10

call up the facsimile of the internal witness on 59r using the "Go to folio" button (see Figure 11).[27]

While in the facsimile view, a right click on the manuscript page offers magnification (Figure 12). At the bottom of the application, the percentage of magnification is shown, along with a link to return to the original size. The edition also offers visual aids to palaeographical study, enhancing the experience of the manuscript for the reader.

The Transcription element of the Text View (Figure 13) correlates with the Facsimile view, following our goal to place the document at the center of the edition. Its intent is to follow quite closely the model set by the display of the text in a diplomatic edition—save for the relation of

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[27] The image in Figure 11 is a composite, in which 64v was scanned from a microfilm and 65r was scanned from a colour slide. The difference in resolution and contrast, which is apparent even in reproduction, indicates the need for higher quality images when digitizing manuscripts. While microfilm may be perfectly adequate for a printed text, the scribal variations in a manuscript are much easier to discern from a colour slide. The original TIFF image used to produce the image used here was scanned at from a colour slide at 4000 dpi, with excellent results. While the application must use compressed images in order to be served *via* the internet, the quality difference between scans of the colour slide and the microfilm is still remarkable.
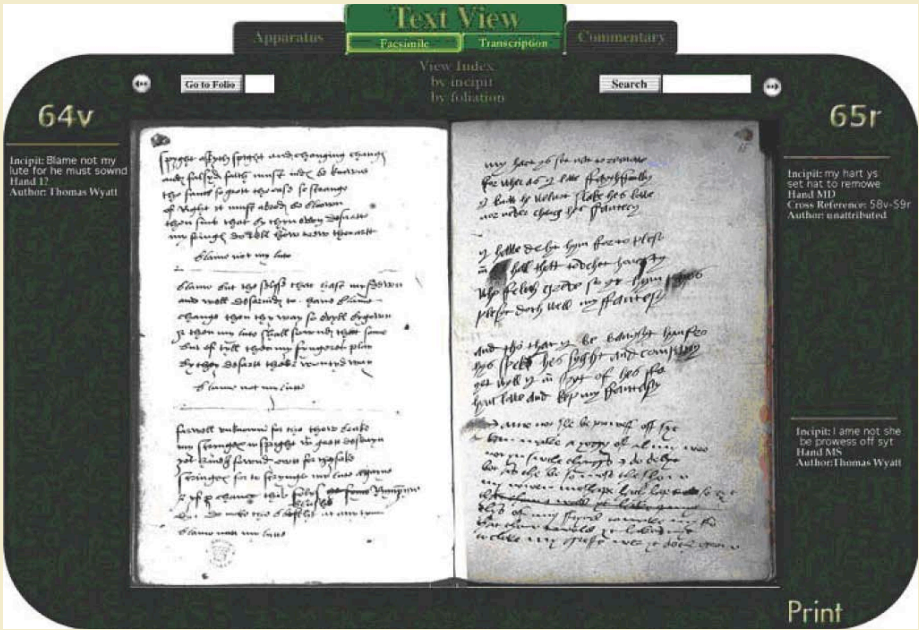
Figure 11
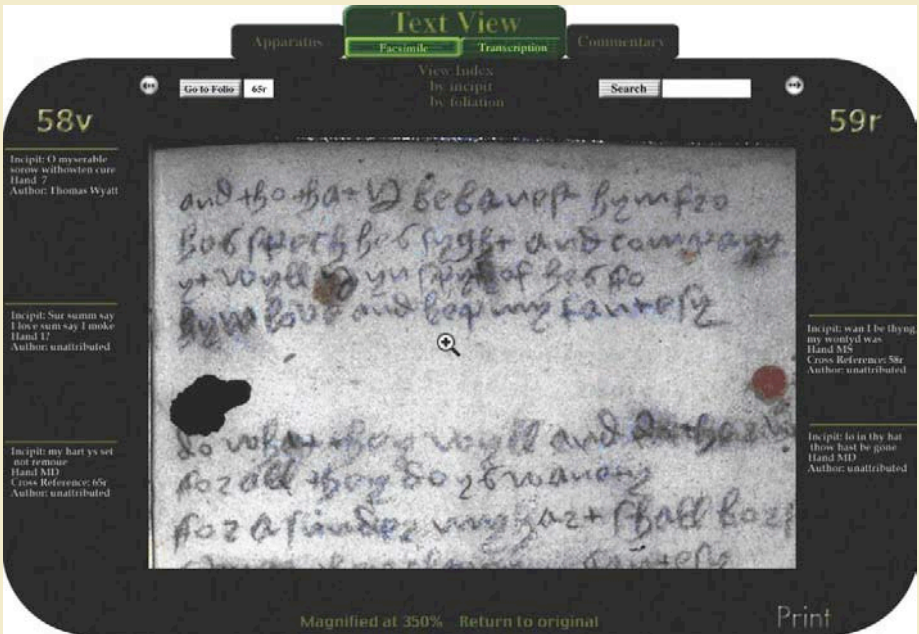
Figure 12

apparatus and commentary, discussed above. We retain marginalia and other annotations and significant features within the transcription view, and elide most other non-textual markings, with the understanding that they are readily available *via* the Facsimile view.[28]

Since no transcription can convey the full details of the page, the Facsimile tab must remain the default view of the e-edition in order to achieve our goal of engaging the reader with the manuscript.

Another area that we are currently discussing is how we will integrate external resources to the transcription. At the moment, our prototype
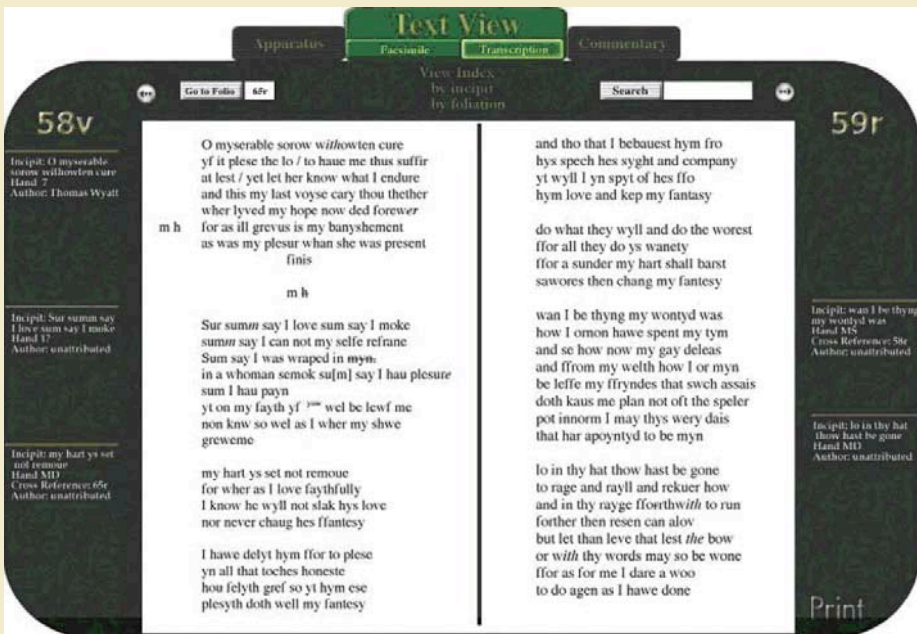
Figure 13

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[28] For example, the horizontal line in the manuscript dividing "wan I be thyng my wontyd was" and the next poem "lo in thy hat thow hast be gone" (59r) could be rendered with a horizontal-line in the transcription; but we worry about whether the transcription view is the proper place to render these extra-textual artifacts. An ink blot, a drawing, or brackets spanning several lines cannot be viewed in the transcription, although our encoding indicates its presence.

suggests only lexicographical aids—such as the right click offering options to search a word within the manuscript, the *Oxford English Dictionary*, the *Michigan Early Modern English Materials*, and *Lexicons of Early Modern English*. As resources become available through other projects, we intend to explore ways and means of accessing these resources from within the electronic edition. And we wish to incorporate them in such a way that the activity of reading is enriched by these tools, but not superseded by them.

It is almost too soon to speak of how exactly our edition will look, or how exactly the edition will be implemented. The main elements of this prototype could be implemented using Macromedia Flash MX, which is quickly growing into the pre-eminent platform for rich internet applications. It seems likely that future technologies for building multimedia internet applications will use some similar combination of XML and a scripting language. Currently, the SMIL (Synchronized Multimedia Integration Language) specification standard from the W3C is very promising. Although SMIL was developed for presentations, SMIL may grow over the next few years into an excellent and essential component of the final edition. But, as in all things, there are many paths to choose from—some not yet trodden.

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Coincidental Technologies: Moving Parts in Early Modern Books and in Early Hypertext

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I

In his epilogue to the 1477, first, edition of *The Dictes or Sayengs of the Philosophres*, William Caxton advised his readers "that If they be not wel plesyd wyth all that [they have found in the book] they wyth a penne race it out or ellys rente the leef out of the booke" (Crotch 1956, 30).[1] "Scratch out the bits that do not suit you, or simply tear the whole page from the book." This irreverent attitude toward the product of the printer's craft, initially unexpected, especially from the printer himself, may not be as unexpected or as rare as one would first think. It is true that modern scholars work more commonly with books that are complete examples of the early printers' craft than we do books with leaves "rente" out or with passages "race[d]" (erased) with a pen. But in a conversation at the Folger Shakespeare Library, Peter Blaney explained that "books don't survive, libraries do." What Blaney meant was that the individual copy of any early printed work that makes its own way through the centuries to our time is rare indeed, and that it is much more likely that any early book now held in a national, a private, a university, or a research library has survived the ravages of time precisely because it made its way into some reasonably careful soul's collection (i.e., library) at a fairly early date. The result is that the books scholars examine hundreds of years later are likely to be books that from the start were treated with exceptional care, copies

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[1] I am grateful to Barbara Bond of the University of Victoria for calling this epilogue to my attention.

that were unlikely to suffer the indignity of erasure or renting. Modern scholars have been examining a somewhat skewed data set, in other words. True, extant books are all we have to work with, and any speculation about the treatment received by copies that failed to survive must remain not only speculation, but, worse still, uninformed speculation. The ideal bridge to cross the gulf between the typically well-preserved "library" book and the would-be rugged individual that failed to survive on its own might be books that have *invited* treatment similar to that recommended by England's first printer.

Books that invite, even require, the reader to "rente the leef out of the booke" were in fact published in remarkably high numbers in England from the middle of the sixteenth well into the seventeenth century. On the continent, books of this sort were published from at least as early as the 1474 edition of Regiomontanus' *Calendarium* (Gingerich 1984, O'Conor 1995). The *Calendarium* has been identified as the first printed book to make use of volvelles, and it is the incorporation of volvelles into the printed work that furnishes the requirement to "rente the leef out of the booke." A volvelle, also, in some early modern texts, referred to as a rundel, is a piece of paper glued or tied to a leaf (i.e., page) in order to complete an image the rest of which has been printed on that leaf. The volvelle was to be tied or glued such that it could rotate, sometimes eccentrically, around a centre. Volvelles are most often circles (see Figure 1), but they are not only circular. Other volvelles are stick-like, some with a single axis (Figure 2), some with two axes (Figure 3).

To tie the volvelle into a background image printed on a leaf required puncturing both the volvelle and the background image, probably with a needle and certainly with strong but fine string. For example, the volvelles reproduced as Figure 1 were intended to be tied to the background image reproduced as Figure 4. There are many extant copies of books with images held together in this fashion, for example the Folger Shakespeare Library's 1584 edition of *The Arte of Navigation*, the Library of Congress' 1589 edition of the same text, once owned by Henry Percy, the ninth Earl of Northumberland, also known as the Wizard Earl, the Dibner Library's 1540 copy of Peter Apian's *Cosmographia*, and the Dibner's 1563 edition
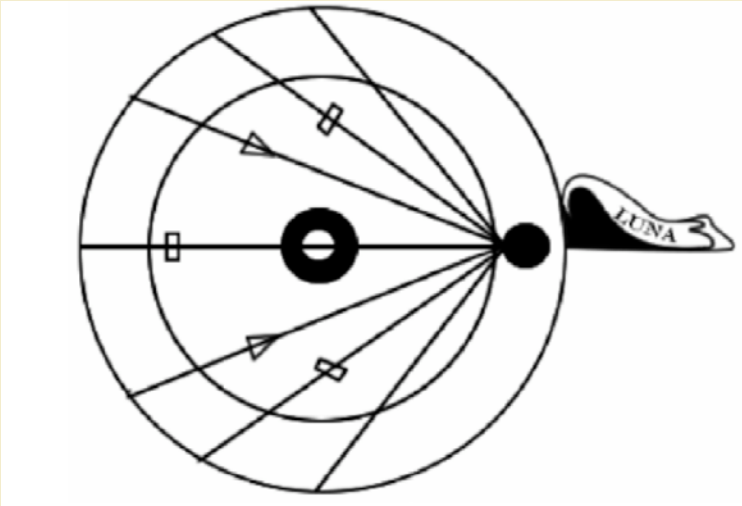
Figure 1a. The Lunar Volvelle for Cortés'
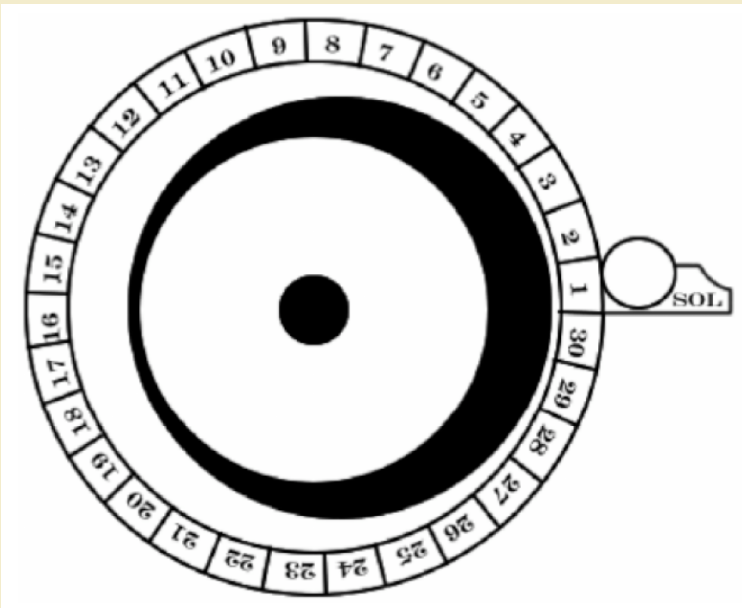Demonstration of a Declination Instrument

Figure 1b. The Solar Volvelle for Eden's
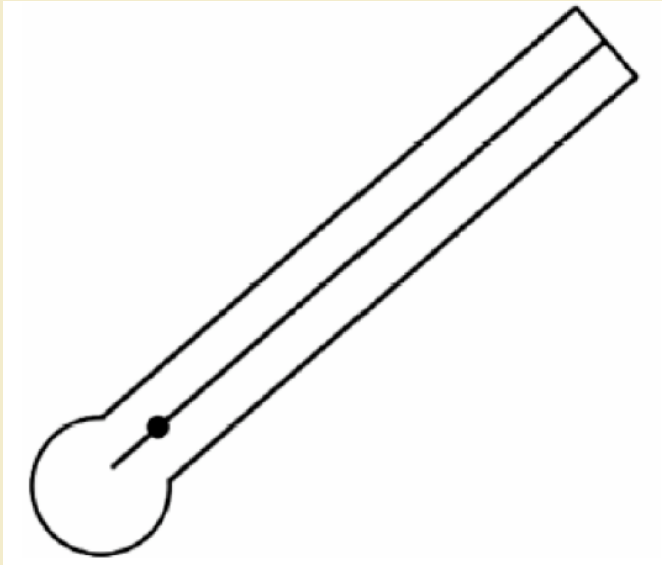Demonstration of a Declination Instrument

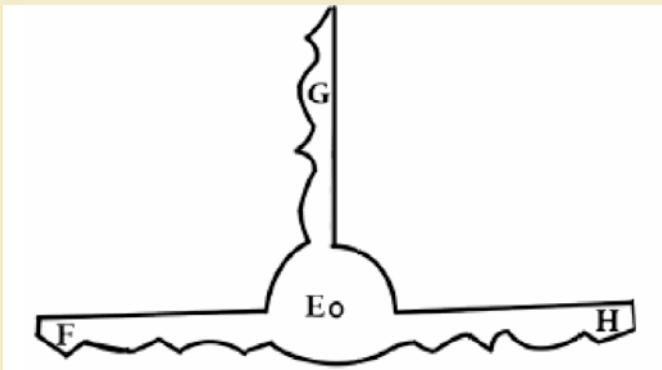Figure 2. Volvelle with a single axis

Figure 3. Volvelle with two axes

of Sacrobosco's *Libellus de sphaera*.[2] Although less common, there are also extant copies with a master-page of volvelles still intact and none of the would-be moveable images assembled; an example of such a text is the Library of Congress' copy of Francesco Giuntini's 1577 *Commentaria* on Sacrobosco's *La sfera*. Included on a typical master-page would be a number of small, often fairly ornate, circles intended to function as glue caps. In books with volvelles tied in, these caps are sometimes glued in on the recto and the verso of the leaf to which the volvelles are tied, outside, as it were, the protruding ends of the string, thus protecting the leaves on either side from puncture by the knotted end of the string. In books where the images are assembled by gluing rather than by tying, a central hole in the volvelle (or volvelles, depending on the intricacy of the instrument represented by the image) is large enough that an area of the glue cap can be glued to the leaf through the hole while an overlapping area toward the perimeter of the glue cap serves to hold the volvelle(s) in place. In order to attach the volvelles to background images printed elsewhere in the book, it would be necessary either to tear out the leaf with the volvelles printed on it, or to remove that leaf before binding, or, conceivably, to cut each volvelle individually from the master-page as the reader encounters the background image along with its attendant instructions for assembling the image. But I have encountered no texts dissected in such fashion, nor have I read of anyone else finding such a text. The instructions for assembly are usually printed close to where the reader finds the background, but they are seldom if ever transparently easy to follow. In fact, I have examined eleven copies of Richard Eden's *The Arte of Navigation* (1561) held in North American libraries, and a further four on microfilm, and the only copy I have found with every image correctly assembled is the copy once owned by the Wizard Earl.

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[2] With permission from the Smithsonian Institution Libraries, images of movable pictures from these and other of Apian's and Sacrobosco's texts held at the Dibner Library of the History of Science and Technology are posted on my web space on the Acadia University faculty server, at http://plato.acadiau.ca/courses/engl/rcunningham /index.htm.
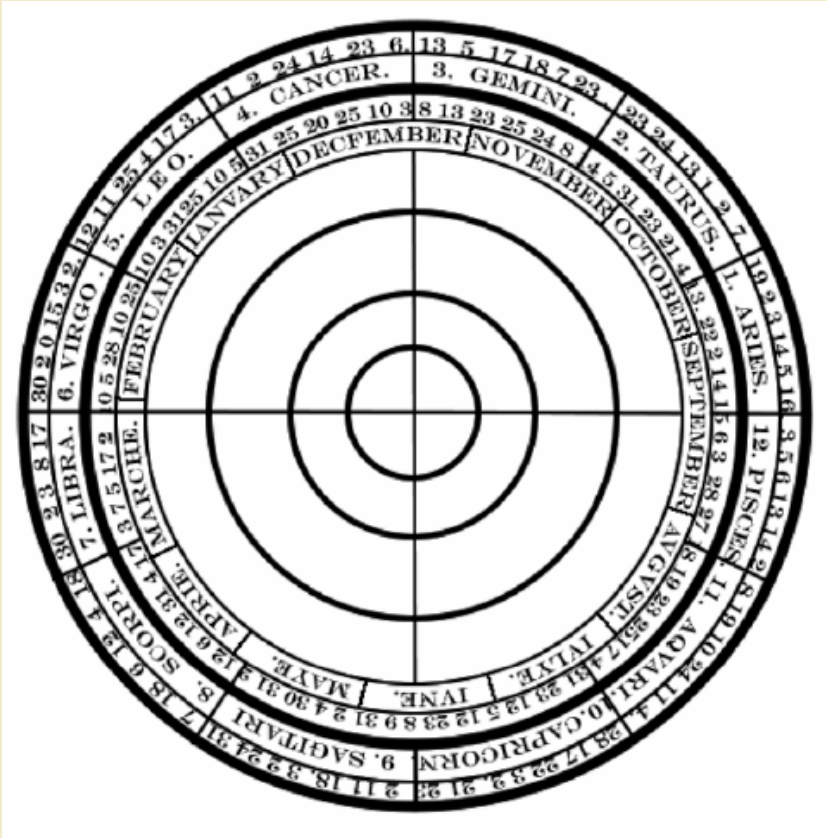
Figure 4. The background of the Declination Instrument to which would be attached the volvelles represented in Figure 1

My own research into what variously have been called movable books, books with moving parts, mobiles in books, and eccentric books[3] began when I encountered the Folger Library's 1584 edition of Eden's *The Arte of Navigation*. In 1558, Stephen Borough was invited to visit the Casa de Contratación in Seville, Spain, where Spanish ships' pilots were trained. He returned to England with a copy of Martín Cortés' *Breve compendio de la sphera y de la art de navegar*, the large format (folio) Spanish text published for the purpose of training Spain's ocean-faring pilots. Eden was commissioned by Borough and the Muscovy Company to translate Cortés' *Breve compendio* for the purpose of turning "ignorant pilots and mariners into knowledgeable ones able to navigate a ship across an ocean..." (Waters 1992, 11). Eden's text was published no fewer than eight times from 1561 to 1630. Initially, the successful printing history of *The Arte of Navigation* led me to expect to find that books with moving parts were a publication phenomenon in the realm of the mechanical arts—what today would be called technical books. Everyone has heard the cliché "a picture is worth a thousand words" and in our intensely visual age that is often true. Thus, it would seem to make sense that images, even complicated images with moving parts, would most commonly appear in texts aimed at a readership of people—in the case of mariners it is fair to say men—whose general level of literacy might make the inclusion of pictures not only worthwhile, but necessary. In *Printing, Selling and Reading 1450-1550*, Rudolf Hirsch suggests that

> many of the woodcuts (and also early picture books...) were presumably acquired by unsophisticated people, of whom many may have been illiterate or semi-literate. ... pictures were often more than an adornment or a device to attract readers; they were also meant to facilitate the understanding of the text. It follows therefore that many of these pictures (especially those illustrating vernacular texts) were drawn and produced for people whose ability to read, or to absorb what they read, was limited. (1967, 4–5)

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[3] See Haining (1979), Evers (1985), Gingerich (1981, 1984), Lindberg (1979), and Walker (1988) respectively for the use of these descriptions.

Although his comments are specifically intended to explicate xylographi-ca (i.e., block-books), Hirsch's invitation to conclude that woodcut images in early printed texts produced specifically for those who were semi-literate at best, and illiterate at worst, is far from a unique perspective.[4] Yet, there are problems with this assumption, regardless of how much sense it initially seems to make.

First, while *we* live in an age that is undeniably, intensely, visual, sixteenth-century English readers (much less non-readers) neither enjoyed nor suffered similar cultural effects to those produced by the constant bom-bardment of images experienced by people in the twentieth and early twenty-first centuries. Second, a mere glance at an image such as that reproduced in Figure 5 makes it obvious that not only are some pictures not worth a thousand words, the opposite is more likely to be true: a thousand words would seem little enough to competently explain the image. Third, and most damning to the idea that images with movable parts were published primarily as a means of enhancing communication with a semi-literate or illiterate readership, these books did not arrive on the reader's desk pre-assembled. Rather, the reader had to assemble these images, using the volvelles provided with the text, from instructions printed in close proximity to the leaf on which was printed the image background (e.g., Figure 4).

The study of books with moving parts refutes the idea of the image as ex-planatory mechanism for the reasons provided above (they were printed in a non-visual age; they were complex; assembly was required), but also because far from residing solely, or even largely, in technical books, mov-able images originated in books on astronomy, astrology, and cosmology: in short, they first appeared in books directed toward the comparative-ly highly-educated readers of natural philosophy. Nor did such images embark on a cultural migration downward toward the less literate lower classes. Throughout their comparatively brief history of just about a cen-tury and a half versions of mobile images continued to appear in texts printed for natural philosophers, cartographers, and geographers even as

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[4] A block-book is one in which each full page was impressed from a single woodcut, rather than from moveable type. Block-books typically subordinated text to illustration, and their creation was very labour intensive.

they appeared in texts offered for the sake of instructing mariners, gunners, surveyors, or instrument-makers. And as can be seen from Figure 5, the care and aesthetic effort put into the production of some of these woodcuts argues forcefully against their serving a strictly utilitarian purpose.

<div align="center">II</div>

While it would appear, from the work of Owen Gingerich (1981, 1984) and Juliet O'Conor (1995), that the 1474 edition of Johann Müller's (i.e., Regiomontanus') text on calendrical reform, *Calendarium*, was the first printed book in which volvelles appeared, other early examples can be found in sixteenth-century cosmographical works by Peter Apian, and in a variety of editions of and commentaries on Sacrobosco's astronomical treatise *Tractatus de Sphaera* from the same period. The *Tractatus* dates originally from about 1220, about the same time Sacrobosco, less well known as John of Holywood or John of Halifax, was appointed to the University of Paris as professor of Mathematics, and it "was widely used throughout Europe from the middle of the 13th century. Clavius used [it] in the sixteenth century and it was still the basic astronomy text until the seventeenth century" (O'Connor and Robertson). Interestingly, the first printing of the *Tractatus* occurred in 1472—two years before Regiomontanus' *Calendarium*. I have not yet had an opportunity to examine a 1472 edition of Sacrobosco's work, but there is no reference in secondary literature to its containing movable images. And I am disinclined to think it did contain such images, since in the editions I have examined the first appearance of images with moving parts occurs in the 1563 edition prefaced by the *Praeceptor Germaniae*, or "Germany's teacher," the humanist pupil of Martin Luther, Philipp Melanchthon. The Dibner Library of the History of Science and Technology, in the Smithsonian Museum of American History, holds an astonishing array of Sacrobosco texts, from Italy, Germany, Belgium, France, Spain, and England, including the Melanchthon edition just noted. The earliest printed Sacrobosco at the Dibner is 1478. This text, *Iohannis de Sacrobusto['s]. . . Spera mundi*, printed in Venice, contains images that a reader who has seen later versions of the *Tractatus* might freely interpret as prototypes of the movable pictures that will appear in those later versions. The Dibner holds no fewer than fourteen other Sacrobosco texts printed in Venice, Liepzig, and Paris from 1485 to 1554.
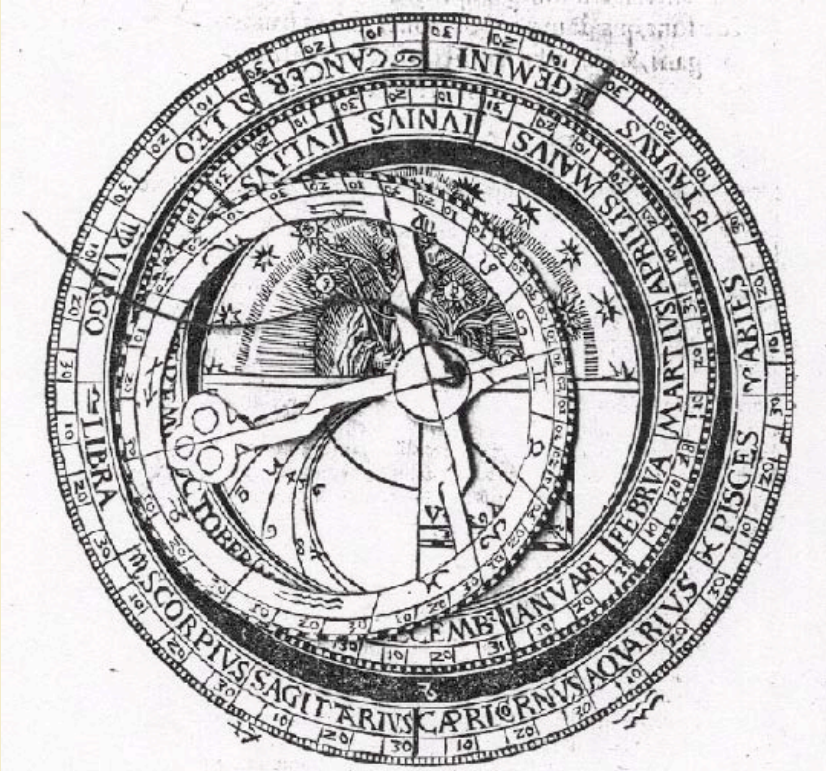
Figure 5. From Gemma Phrysius' edition of
Peter Apian's *Cosmographia*, Antwerp, 1540
(By permission of the Dibner Library of the History of Science and Technology,
American Museum of History, Smithsonian Institution Libraries)

While the majority of these texts are, strictly speaking, commentaries, they nonetheless reproduce large portions of the Tractatus under a variety of titles. None of them printed prior to Melanchthan's 1563 edition contains movable images, but they all contain images which would later find their way into navigational and other texts with moving parts. The 1534 Venetian edition entitled *Liber Ioannis Sacro Busto de Sphaera* is particularly interesting because it contains a series of images that will later evolve into a movable image of an hour-finding instrument in the *Breve compendio* of Martín Cortés, and therefore of course in Eden's *Arte of Navigation*. It is tempting to say of this series of images that to produce a sense of motion it demands much more of a reader's imagination than do actual moving images (either of the primitive sort found in later editions of Sacrobosco *et cetera* or of the sophisticated kind found in twentieth-century movie houses). However, this strikes me as possibly a logical, and certainly an historical, fallacy. To conclude from a series of images that suggests motion *to us* that it would have offered a similar suggestion to a readership that had almost certainly no experience of movable images is to oversimplify both print and cultural history. I do not believe that these texts offer a record of a culture that was inexorably striving to become us, nor that they offer a record of printing history that could not have become other than the dynamic media of the internet. However, it can be enlightening to look back from our current vantage point at texts that, however it may be explained, came to lend themselves better than most to the introduction of images with movable parts.

Another series of texts printed with movable images during the sixteenth century are those attributed to Peter Apian. Apian, also known as Peter Bienewitz or Bennewitz, but more commonly as Petrus Apianus, was "a leading applied mathematician" of his day who, by dint of his work as a cosmographer, could claim some expertise in architecture, astronomy, cartography, geography, mathematics, navigation, and surveying (O'Connor and Robertson). Apian entered the University of Leipzig in 1516 and completed his baccalaureate studies in Vienna by 1521 before being appointed lecturer in Mathematics at the University of Ingolstadt in 1527 (Scheuer). Before securing his appointment at Ingolstadt, Apian published the *Typus orbis universalis*, a map of the world based on work by Martin Waldsemüller, and a geographical commentary on the Typus which was in turn

entitled *Isagoge* (i.e., Introduction). But it was the publication of Apian's 1524 *Cosmographia seu descriptio totis orbis* that assured his place among the leading cosmographers of Western history.

Apian must have considered education an important part of his publication program, since the *Cosmographia* follows in the tradition of the *Isagoge* in its provision of a series of introductions to weather and climate, mathematical instrumentation, and map projections in addition to the various elements of cosmography named above (O'Connor and Robertson). In 1540 Apian published what is undoubtedly the most spectacular example ever published of a text with movable pictures, the *Astronomicon Caesareum*, which he dedicated to a probable former student, Charles V, Emperor of the Holy Roman Empire. That same year Gemma Phrysius' 1533 expanded edition of Apian's *Cosmographia* was printed in Latin, in Antwerp, and a copy of that text is currently held in the Dibner. It is from the Dibner's copy that the image reproduced as Figure 5 in the current work is drawn. Phrysius' edition of the *Cosmographia*, originally published seven years earlier, in 1533, was a best seller throughout Europe, not just in Latin but also in the major vernacular languages. The *Astronomicon Caesareum* was so spectacular that there is no way it could have penetrated the popular consciousness; but the *Cosmographia*, and another of Apian's books, the *Instrument Buch* (Ingolstadt, 1533), were clearly intended to do just that. Indeed, as an instrument maker who offered for sale many of the instruments described by Apian in the earlier text, Phrysius had an entirely obvious interest in supporting the publication not only of Apian's text, but of the ideas and instruments it proposed. The copy of the *Instrument Buch* held by the Dibner contains many images, some of which are quite evidently backgrounds to the kind of instruments that would have volvelles. The volvelles themselves are printed on leaves with text on the reverse; as a result, removing the volvelles to make use of them on the background images would damage the book. Doing so might even imperil the sense of the text which describes the instruments of which the volvelles are meant to be a part. Stitched in at the back of the book is a gather of slightly smaller leaves each of which has a quadrant-like image on only one side of it. These seem clearly meant to be available to the reader for assembly of the paper instruments themselves.

Although the very name of Apian's *Instrument Buch* gestures at a social
descent in the readership toward which the book with mobile images
was directed, publication of the *Astronomicon Caesarium* indicates that
even as the movable image ventured outward from the library of the
educated reader to gain employment in the workshop of the craftsperson,
it continued to maintain its residence, at least for a time, in the library of
the elite reader. And while Apian's *Cosmographia* continued to be published
in Latin, the language of the educated class, it also ventured among
the masses, especially after being edited and expanded by Phrysius, in
Europe's major vernacular languages. And a very few years later, in 1551,
Cortés' *Breve compendio* was printed as a large format folio text in Seville
specifically for the purpose of educating Spanish pilots and navigators for
travel on the open ocean.

When Stephen Borough was invited to Seville in 1558, it was to visit
the Casa de Contratación to observe the system of training for oceanic
navigators which the Spanish had been developing for fifty years. Borough
returned to England carrying many items of interest to the study of
navigation, perhaps chief of which was a copy of the *Breve compendio*.
Shortly thereafter Borough and the Muscovy Company commissioned
Richard Eden to translate Cortés' text. In his introduction to the 1992
Scholars' Facsimile reprint of the 1561 edition of *The Arte of Navigation*,
D. W. Waters maintains that

> Borough had no difficulty. . . persuading the Muscovy Company of
> the public good that would ensue from the publication in English
> of this vitally important work, that it would turn ignorant pilots
> and mariners into knowledgeable ones able to navigate a ship
> across an ocean. . . . (1992, 11)

The Arte of Navigation was republished in 1572, 1579, 1584, 1589, 1596,
1615, and 1630. While the Stationers' Register carries no record of the
number of copies published with each new printing, by any reasonable
measure this is a popular and an important text. Again in his introduction
to the Scholars' Facsimile edition, Waters reports that Eden's text "had
been the navigational textbook above all others, the navigational bible in
effect, of seven generations, and was to be of an eighth, of English pilots
and navigators. . . " (1958, 22). *The Arte of Navigation*, with its remarkable

publication record, guarantees the establishment of a secure beachhead for the movable image in the books and the workplaces of mechanical artisans, craftspeople, and many who were only marginally literate. *The Arte of Navigation* was published in quarto, and in order to fit all the images from the original folio text of the *Breve compendio* some were turned on their sides. But other than this obvious modification, the changes made in images of the English copy from those in the Spanish original are impressively few. Some of the images in Cortés' text originated in SacroBosco's *Tractatus*, thus providing a clear record of their heredity. Of these, some are near copies of those found in earlier texts, and others are obviously "new" versions of images intended, for example, to demonstrate the shape of the Earth or to explain the eclipse of the moon. Some of the maps in Eden's translation are hybrid versions that have Anglicized some place names while leaving others in the original Spanish.

In the three books of *The Arte of Navigation* there are six backgrounds to which volvelles are sometimes attached, although this is not to say that when all the images are correctly assembled there should be six. In fact, there should be only five. The most common mistake is made in the fourteenth chapter of the first book, which is entitled "The Horizontal Circle." This chapter is devoted to an explanation of why "we maye ever see [only] halfe the heaven" (Eden 1561, Sig. B7r). At the end of the chapter is an image of a circle quartered (horizontally) by a polar axis and (vertically) an equatorial line. Each quarter of the circle is marked in ten degree increments from "10" to "90" moving from the pole to the equator. This image often has volvelles attached to it that rightly belong on the image described as a "Demonstration of Northeasting," and which in the 1561 edition appears at Sig. J2r. The frequency of this mistake calls attention to the difficulty inherent in assembling these images, to the abstruseness of the accompanying printed instructions, and to the likely unfamiliarity of the readership with the instruments the movable images represented. Whether this was an unfamiliarity borne of the reader's lack of navigational experience due to youthfulness or due to social station it is impossible to say. But it is worth remembering Blaney's imperative that "books don't survive; libraries do."

III

In an attempt both to recover the experience of assembling some of these images and to make them available to a wider readership than has access to specialized research libraries, I determined a few years ago, in the late 1990s, that it would be worthwhile to use the dynamic potential of the computer and the internet to try to create and publish an electronic version of *The Arte of Navigation*. In making this attempt, important parallels between the first print revolution and the current, electronic print revolution presented themselves. Primarily, the book itself, and the idea of "renting," "eracing," or in any way altering it might well have been as foreign to early modern readers and craftspeople as are the modern computer-based technologies that promise to make the reproduction of these movable images possible. It is one thing to purchase and install a video game on one's home computer; it is quite another thing to have to create or modify that game oneself. And yet, by analogy, this is what faced the reader of the early modern book with movable parts. Bad enough such a reader should have to read text that is arduous, abstruse, and in a very real sense foreign to his experience. But add to that the fact that the book is incomplete, and can only be completed through a form of physical engagement with it that nothing in the reader's previous experience with books will have prepared him for. Given this set of difficulties, it is no wonder that the vast majority of extant copies of *The Arte of Navigation* are incorrectly assembled. And given that *this* is true, it follows that to be an accurate representation, an electronic copy of the same movable images will need to allow modern readers of digital media to make similar mistakes to those made by early modern readers of print media.

Although the idea of creating an electronic version of *The Arte of Navigation* presented itself several years ago now, I have not yet managed to achieve this goal. But, thanks to the technological expertise available at my home institution, the project is at last moving forward. Acadia University, geographically isolated in rural Nova Scotia, is one of Canada's most technologically advanced universities. Every student is issued a laptop computer upon enrolment, and as a result the support mechanisms in place and constantly developing are thorough and impressive. I mention Acadia's geographical isolation because the need, and now the opportunity,

to overcome geographical, political, professional, or social distances is precisely what drives the impulse to create electronic texts that mimic, as nearly as possible, early modern originals.

The most important support mechanism available for the production of electronic texts, and for the development of innovative software and applications, is the Acadia Institute for Teaching Technology (AITT). In the late fall of 2002, as we worked together to develop the Humanities HyperMedia Centre @ Acadia University, I asked Craig Place, the manager of the AITT, if he thought it would be difficult to re-create, as a dynamic, reader-operated image, the "demonstration," to use Eden's term, of a Declination Instrument (Figure 6). I had already spent dozens of hours trying either to find a suitable code in any DHTML-derived language, or to use a major software manufacturer's combination graphics and motion software to produce the effect I sought, but had only managed to produce a very clumsy movie of the motion I sought to replicate. Not only did my attempt operate poorly, it reduced the reader to a mere viewer who could have no effect on the image. Place determined what I wanted, and assured me that the AITT could manage it.

The results of their efforts are viewable and, most importantly, manipulable at http://plato.acadiau.ca/courses/engl/rcunningham/Dec.htm. It is important to stress that this is our first such instrument, and that although it allows the reader to manipulate the image, it does not require the reader to assemble it. Future revisions of our "text" will more closely mimic the original in that regard. But for now it is a step forward in the print technology of the internet that we have managed to create an image that the reader of the webpage can rotate to right or left, using either of two dials, or volvelles, and that as a result of that rotation allows the relative "dark of the moon" demonstrated by the original movable image (when correctly assembled) to increase or decrease (cf. Figure 6).

The instrument, in Eden's text the demonstration of the Declination Instrument, is now labeled the Hudson-Dawe Dial, in recognition of the two Acadia University students who created it. At the time Janice Hudson was a fourth-year English major and Trevor Dawe was a third-year Computing Science student; both were employees of the AITT, and they collaborated on the instrument's creation. Hudson used Macromedia's *Fireworks*

Figure 6. An image of an assembled Declination Instrument
(By permission of the Folger Shakespeare Library)

to compose the instrument's multiple layers of graphics, and Dawe used Macromedia's *Flash* to animate Hudson's graphics. Like me, Dawe started with the assumption that he would be able to find a similar item some-where on the internet, from which he could model his code. Like me, he was unable to find any such item, but unlike me he was able to write his own algorithm to drive the image's animation.

Hudson composed vector-based graphics so that the finished instrument could be re-sized in any browser without the problems of pixelation that would have accompanied raster (i.e., bitmap) graphics.[5] The composition of these graphics took Hudson, who has a good deal of experience working with a variety of graphics-creation software, six to eight hours. From this it follows that the creation of a hypertextual *Arte of Navigation* with all the appropriate movable images will be very time consuming, and labour intensive. Because each image is unique, there is very little hope that a template could be devised to hasten the process. Once again, this seems analogous to the creation of the original text.

It is said that Martín Cortés spent most of the decade of the 1540s writing the *Breve compendio de la sphera y de la art de navegar*. Study of that text demonstrates that many of the images used by Cortés were taken from a more or less common stock of images to be found in cosmological and other texts of the period. Yet closer study reveals that these images were made anew for the *Breve compendio*, thus necessitating the commitment of a number of hours of artistic labour by someone capable of carving the woodcut used to imprint the images of the background and its volvelles. Just as with computer graphics, the problem of scaling the volvelles to fit the background image would have come into play, probably slowing down the process of producing the woodcuts. From the 1551 edition of Cortés' *Breve compendio*, Richard Eden translated images to be found in cosmological and other texts of the period. Yet closer study reveals that these images were made anew for the *Breve compendio*, thus necessitating *The Arte of Navigation*. The fact that it took two to three years from the time of commission to the time of initial printing alerts us to the fact that here again the author, and in all likelihood the woodcut artist(s), had to commit

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[5] Were it a bitmap, the individual pixels would separate and become increasingly visible as the image was enlarged.

a great deal of time-consuming labour to the project. Remember that the Spanish original was a folio publication, and the English translation was always a much smaller quarto publication, and that this required some of the images to be rotated ninety degrees. Spanish text included in or appended to the woodcut diagrams was, sometimes partially, sometimes wholly, translated into English. And once again, the problem of scale had to be considered as separate blocks were cut in order to print images that would eventually find their way onto a single background. All in all, the comparisons between the work involved in producing *The Arte of Navigation* in the sixteenth century and reproducing it as a digital object in the twenty-first century are remarkable.

Trevor Dawe created the animation for the Hudson-Dawe instrument using Macromedia's *Flash*, and although he had no similar digital model to guide his work, and therefore no documentation or example to guide his work, he was able to write the algorithms necessary to create the motion and flexibility desired to create a reader-controlled instrument. The animating algorithms are a different order of digital being from the graphics, and so in this we are confident we will be able to create a template into which a reader will be able to place various, basically similar, graphical representations in order to create the full range of movable pictures appropriate to an electronic edition of *The Arte of Navigation*. Web-based applications such as Macromedia's *Flash* make it possible for computer programmers to create the environment in which a reader will be able to manipulate images in a manner that will allow them to put the wrong volvelle(s) on a background as easily as putting the correct volvelle(s) there. We have not yet achieved this level of sophistication, but we continue to work toward this goal. In this work we once again parallel the early modern carvers who cut the wood blocks to make possible the prints that readers would then assemble on their own. No early modern reader of a text with mobile images had to cut his own wood block in order to complete the book, and analogously no twenty-first century reader will have to learn to program a computer in order to complete the proposed electronic copy of *The Arte of Navigation*.

Comparisons between the sixteenth-century originals and hypertextual reproductions of those books may help us to better understand, and

should certainly help us to better appreciate, the processes of reading, understanding, translating, composing, and printing early modern books with movable parts. And while these comparisons can also help us to appreciate our own creative and re-creative efforts, and to recognize that while the media is new the task is old, they should also lead us to better understand the process of reading itself, of how mistakes in reading comprehension occur, and of how—as either reader or writer—they can best be avoided. Finally, by creating digital works that follow Caxton's advice to his readers "that If they be not wel plesyd wyth all that [they find in the book] they. . . race it out or ellys rente the leef out of the booke" we can reduce the perceived gap between reader and writer in an age when literacy once again, as it did in the sixteenth century, stands ready to offer or to thwart full participation, depending on the degree to which readers actively engage with the material they encounter.

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The Exploration and Development of Tools
for Active Reading and Electronic Texts

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The Active Reading project at Sheffield Hallam University is concerned primarily with creating an electronic scholarly edition of a Renaissance work which illustrates the textual variants between published editions of that work, serving to expose the editorial process and allow the reader to make the editorial decisions. This essay aims to illustrate the advantage of using interactive technologies and text encoding tools to enhance understanding of the editing process. A prototype edition has been generated by encoding various texts of a poem by Sir Thomas Wyatt in XML (Extensible Markup Language), and employing various methods for displaying the material. The resulting edition and the research generated will offer new ways of comparing textual variants, and of reading and understanding these texts—for use in research, in teaching, as a learning tool, and as a template for the creation of future electronic editions.

In discussing the methodological approach of the research, it is important to bear in mind the nature of the work, and the two domains between which it falls. In researching both the literary and technological aspects of the project it is clear that there is a distinct divide between methods and also in communications between these two domains. A discrete writing style for each area has necessitated a style specific to that of Humanities Computing. By combining elements of research and methodological style from both domains, I have attempted to work within the boundaries of each and contribute to the style of work that is applied in Humanities Computing.

The current popularity of editing, and the upsurge in the availability and use of hypertext and text editing tools, has encouraged the development of tools to enhance Active Reading as well as editing. This project aims to improve the techniques currently employed in developing electronic editions of Renaissance texts, by producing a new edition of a Renaissance play upon which future editions of other such works can be based. Currently no electronic edition exists, to my knowledge, which attempts to display the variants between all published editions of a text, and which allows the reader to edit those variants. The purpose of generating a new edition in this way is to:

* Produce a template from which future editions can be created;
* Enable students of literature to better understand both the editing process and the ways in which variations between different editions of a text can occur;
* Design an effective interaction mechanism and interface for the presentation of considerable amounts of text in combined form (that is, displaying more than one text on screen simultaneously).

Through the study of the editorial process, I hope that a better understanding can be gained of how decision-making in editing can completely transform the meaning of a text. In recent times there has been a backlash against editorial tradition, with editors becoming divided over whether it is appropriate to alter an "original" text or texts in any way, or whether the emphasis should be placed on the production of new editions, with the editor featuring almost as a secondary author to the work. Scholars such as Randall McLeod are ambassadors for the belief that no two early modern printed texts are exactly the same, and that all texts of this period are therefore unstable. McLeod believes that "photography has killed editing"[1] and that there is no longer any rationale for editing and no point in producing critical editions (Foakes 1999, 430).

The issue of multiple texts and whether or not editors consider it appropriate to publish more than one version of a text, is another central focus of the work of the Active Reading project. An example that has initiated considerable discussions within the literary community, in particular

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[1] Cited in Hill (1994, 373). Also cited in Foakes (1999, 430).

amongst subscribers of the SHAKSPER Electronic Conference, is that of the Arden edition of *Hamlet*, which promised to be the first major edition to split the play into its three versions (Burrow 2002).

In producing an interactive text for reference and comparison between different published versions of a work, a certain amount of responsibility is passed to the reader. The process of Active Reading is as much about how the reader wishes to engage with the text, as it is about how simple and effective that text is to engage with. Through the use of hypertext as a medium in which to present literary texts, the occupation of the reader is becoming more and more akin to that of the editor, and indeed the writer.

As the percentage of people with the ability to produce hypertext content increases, and as the frequency of internet and computer usage amongst college and university students increases as well, the reader can no longer passively skim over the written word, but becomes increasingly more involved in the creative process of reading and understanding (Roast *et al.* 2002, 109). Therefore, the effect is greater access to, and a growing readership of, older literary works amongst younger readers which may enable an understanding and enjoyment of a broader reading matter.

With reference to the study of literary works the activity of reading is not a static one, but one in which readers actively engage with the text in ways that are personal to them. However, the concept of active reading is generally overlooked when considering the technological tools that could be employed to support it. By observing the way readers read and perhaps edit a paper-based text, it is clear that interactivity holds the key to the reader experiencing some involvement with the text on a personal level.[2] As readers annotate, underline, cross out and highlight, they are actively moving the text around and making personal editing choices in order to aid their understanding of the material.

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[2] Trials were undertaken involving the observation of Undergraduate students using an interactive text of the Wyatt poem *They Flee From Me*, which was produced for this project. Subjects answered questions on their use of the application, their ability to perform tasks, and were asked to compose their own versions of lines of the poem, using the interactive tool.

The Active Reading tool is aimed at developing the reader's understanding of the text, and at exploring the concept of textual variants between different editions of a work. The tool enables the reader to take on the role of editor, selecting from the available variants to produce what is in their opinion the best version of the text—a form of "personal editing" if you will. This will then allow readers to realise the implications of choosing between various versions of a text. In addition to selecting the editing method by which the electronic edition will be created, it is important to relate the tool back to the end user (or reader), and to carry out evaluative studies in order to improve and develop the tool. By undertaking studies observing the way users interact with the tool and noting any possible errors or problems they may encounter, improvements and refinements can be made overall.

From a computing standpoint, by completing an initial "Characterisation of User Groups," it has been possible to identify the target beneficiaries of the research produced, and to generate a prototype edition of a Renaissance text catering for these users. By examining as many opinions of editing as possible, I can take a position amongst them with which to develop a new edition of a text. For the purposes of this project, the production of an electronic edition will be approached with the view that no part of the text will be concealed or deleted, but will instead be appropriately presented to allow for maximum access to variants in the text, and to utilise these variants to re-create the text. Earliest individual versions of the quarto and folio text will be presented, along with the facility to edit the text based on a selection of available variants from those editions.

The modern role of the editor could be considered to be a balancing act—to attempt to reconstruct an original text, and to produce an edition of the text that could be more accessible for reading purposes and perhaps for use in performance. It is important therefore to establish a task model for the role of editor. In modernising texts and in reading literature of any period, it is important that ". . . we engage with the language of the time as far as we can, even if it is impossible for us to reconstruct exactly how it was spoken or interpreted" (Adamson *et al.* 2001, 109).

In researching and investigating into different editorial processes, in addition to evaluating existing models of editing (both on paper and on the

screen), I have begun to mould a preliminary model of editing through the development of an interactive electronic tool. A model of editing examined includes that offered by Richard Proudfoot: "[The model] edition would combine facsimile and modernised texts within a single volume, arranging them in parallel on facing pages and supplying each with its own kind of commentary" (2002, 140). The ideal model for producing an electronic edition would be divided into six areas:

* encoding,
* evaluation,
* refining of existing application,
* further evaluation,
* analysis,
* publication of the edition.

The additional complication to overcome in my work, however, is the issue of multiple texts.

Eight different online texts of Sir Thomas Wyatt's poem "They Flee From Me" have been collected, due to the availability of the versions in electronic format, and these eight individual versions combined to form one interactive text, with "clickable variants." By "clickable variants" I mean that any words that are not the same between all the editions of the text would be hidden behind a marker or "choicepoint"; the reader could then click on that choicepoint with the mouse, and reveal the variant word or words from each specific edition. As readers hover their cursors over the variant, the status bar at the bottom of their browser windows displays the name of the edition from which that variant comes.

Firstly, by marking up the eight editions of "They Flee From Me" using XML, it was possible to sketch out which words in the twenty-one-line poem appear in every edition, and which appear only in certain editions of the text. In collaboration with the department of Computing at Sheffield Hallam University, I have encoded a prototype electronic edition of the poem and collated the eight available published editions to form a "Combined" version. This enables the textual variants between the eight versions to be effectively hidden from users at first glance, until they

click on highlighted question marks in the text and the hidden words or phrases appear.

To do this, a combination of XSL (Extensible Stylesheet Language) and JavaScript was employed, enabling a cycling effect of the variants—each time the user clicks on one of the question marks ("choicepoints"), a word appears from a different edition of the poem. For example, there might be four variations in spelling of the word "kindly" in a line, therefore if users were to click on the choicepoint concealing the word "kindly," they would be able to click four times, cycling through to reveal a new word each time, until they returned to the choicepoint again (Figure 1).
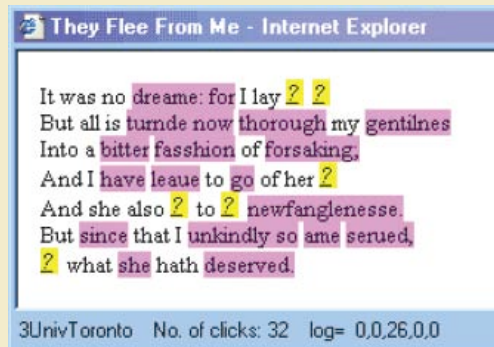

Figure 1. Choicepoints can be
seen in yellow, with revealed
words highlighted in pink

```
<line ID="10">
    In
       <versions>
          <version><text>thyn</text><id>1Unmodernised</id></version>
          <version><text>thinne</text><id>2FirstPrinted</id></version>
          <version><text>thin</text><id>3UnivToronto</id></version>
          <version><text>thyn</text><id>4London1913</id></version>
          <version><text>thin</text><id>5ModernSpelling</id></version>
          <version><text>thin</text><id>6Netpoets</id></version>
          <version><text>thin</text><id>7London1904</id></version>
          <version><text>thinne</text><id>8ChadwyckHealey</id></version>
       </versions>
```

Figure 2. The encoding of variants on the word "thin"

The design rationale which enabled the definition of the XML mark-up scheme involved an account of the editorial process, as well as outlined

decisions with implications for display, such as word wrapping. An example segment of the XML file for "They Flee" illustrates how a variant word, in this case "thin" or variant spellings of it, is encoded (Figure 2).

After experimenting with varying versions of the application, I eventually decided to use frames to display two copies of the poem at the same time. The frame on the left hand side (LHS) shows a combination of eight editions of the poem, with an interactive element enabling users to click on variant words in the text. The frame on the right hand side (RHS) displays one version of the poem at a time, with hyperlinks allowing the user to move between editions.

The use of JavaScript to enable interactive display mechanisms has proved effective in being able to combine the varying editions of a text; however, it must be noted that should another technological means of providing interaction be deemed more appropriate, this will of course be alternatively adopted. Trials of several different methods of display have been completed involving the colouring of different variants, layering of the texts of different editions, as well as making the variants appear randomly within a combined edition of all the texts. Future work in this area will be looking at the possibility of using "tooltips" or other rollover methods, involving the concealing and revealing of sections of text.

So far I have completed an evaluation of the use of the prototype to produce an initial set of user results giving feedback on various elements of the application. The prototype was intended rather more as a probe, to investigate responses to the concept of the application, which would then enable amendments to be made, and further evaluation completed. One preliminary aspect which was measured during evaluation was the number of times the reader clicked the left hand mouse button whilst using the "Combined" version of the poem "They Flee From Me." A timer was set to record the number of times the reader clicked on a variant word in response to certain questions, which was then recorded on the status bar of the browser, and which can be seen in Figure 1 as "No. of clicks." This enabled me to determine how much the users were interacting with the poem.

During the evaluative phase, it was important to note exactly how users were interacting with the text(s). Readers seemed to favour the ability to

look at whole copies of the text, rather than utilising the interactive nature of the "Combined" version of the poem. Although they did find the high-lighting feature a useful tool in comparing variants, many said that they would have preferred to be able to use this tool in both the "Combined" (RHS) and "Individual" (LHS) versions of the text. The most significant issues to arise included those of screen resolution and the size of fonts caus-ing lines in the poem to wrap-around, in addition to readers being unable to view two full versions of the poem onscreen at once. The urge to print out the material (as is often a symptom of reading excessive text onscreen) appeared to be suppressed by the fact that the poem was only twenty-one lines in length, and therefore fitted on the screen in its entirety.

Looking at alternative methods of interaction would consist of examining further the potential of JavaScript to transform the text into a more inter-active tool. It would therefore involve looking at different experimental renderings of the final application, and considering aspects such as font size and style, use of colour and layout, scrolling and possibly size of display area for the text. David Scott Kastan agrees that "the material form and location in which we encounter the written word are active contributors to the meaning of what is read" (2001, 2). It is therefore necessary that the interface of the application be as clear and simple as possible to read text from, not differing excessively from the original medium or paper-based edition of the text, and facilitating comparisons between different versions of the text.

Conclusion

In order to examine multiple texts more closely, Charlton Hinman de-veloped a "collator"—a mechanical device allowing a reader to compare more than one copy of a text in detail. Randall McLeod also developed the "McLeod Portable Collator," a portable stereoscopic collation for simulta-neous comparison of two copies of a printed page (Stanford University 2003). The Hinman collator uses electrical lights and mirrors to converge two texts into one, highlighting variations between the copies (Ferguson 1999). In some respects, this is similar to one of the experimental tools produced by Dr. Chris Roast for this project—the "They Flee From Me" "Transparencies/Floats" (2002) prototype allows the user to place each of

the eight versions of the poem as a layer on top of one another, in order to compare the variants.

The work on "They Flee From Me," however, is not the end in itself, as ultimately I propose to produce an Active Reading edition of the multiple texts of *King Lear*. It will be valuable to produce a design-rationale/account of the editorial process to document the project's development, for use in the production of future editions or revisions of existing editions. Producing a "model of editing" for use as a template for the creation of future editions would similarly be beneficial in documenting the process. There are only a very small number of accounts of the creative activity of editing, and in particular of editing an electronic text—this research aims to provide such an account for reference in the development of future editions. Although other e-editions of multiple-version texts exist, there are few which explore the potential impact of variants between versions on the text as a whole, and none which make available this material adequately and effectively through the use of interactivity, as my work, I hope will.

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