15. A NETWORK WITH A THOUSAND ENTRANCES: COMMENTARY IN AN ELECTRONIC AGE?

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For Don Fowler (1953–1999), 'at play in the fields of the Lord'

> Je genauer wir die tatsächliche Sprache betrachten, desto stärker wird die Widerstreit zwischen ihr und unserer Forderung. (Die Kristallreinheit der Logik hatte sich mir ja nicht ergeben; sondern sie war eine Forderung.) Der Widerstreit wird unerträglich; die Forderung droht nun zu etwas Leerem zu werden.—Wir sind aufs Glatteis geraten, wo die Reibung fehlt, also die Bedingungen in gewissem Sinne ideal sind, aber wir eben deshalb auch nicht gehen können. Wir wollen gehen; dann brauchen wir die *Reibung*. Zurück auf den rauhen Boden!
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> Ludwig Wittgenstein, *Philosophische Untersuchungen* 107[1]

> The extent to which people act with a clear idea of their ends, knowing what effects they are aiming at, is easily exaggerated. Most human action is tentative, experimental, directed not by a knowledge of what it will lead to but rather by a desire to know what will come of it.
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> R. G. Collingwood, *The Idea of History* (p. 42)

1. *Introduction*

In contemporary discourse about art, 'the shock of the old' plays off against 'the shock of the new,' the more obvious and apparently the older phrase. Shock may be particularly necessary against the blindness to art as anything other than decoration, but the new (in the strongly traditional sense of the unfamiliar, strange, surprising, subversive—indeed dangerous) also plays a role in scholarship. The history

[1] "The more narrowly we examine actual language, the sharper becomes the conflict between it and our requirement. (For the crystalline purity of logic was, of course, not a result of investigation: it was a requirement.) The conflict becomes intolerable; the requirement is now in danger of becoming empty.—We have got on to slippery ice where there is no friction and so in a certain sense the conditions are ideal, but also, just because of that, we are unable to walk. We want to walk: so we need *friction*. Back to the rough ground!"

of technology suggests that inventions have this role, a Janus-faced heads-up not just to peer uncertainly into the future, as may seem my mandate here, but perhaps more to wake up to and learn from the familiar, half-noticed devices which the new threatens to redefine or even displace. So with commentary, a very old, widely distributed and varied form, about whose electronic future I propose to reflect.

The scope of commentary is suggested by the etymology of the word, denoting thought about something, and is documented in the variety of its historical practice. As with the index, concordance, dictionary, and encyclopedia, this variety seems to belie any single name. The fact that we have one and that it stubbornly persists raises the question of essential characteristics. What might these be? The problem I have to consider, the metamorphosis of commentary into electronic form, requires an answer. (Perhaps 'metamorphosis' is the wrong word, since we and not some god command the shape-change; but as in Ovid we focus on a mysterious interplay between change and persistence.) The first question we ask, then, is what must survive into the new medium for the result to be recognizable *as* commentary. I am suggesting a view of the problem analogous to translation in Umberto Eco's sense: the interpretation of a text in two different languages, involving the culture of each ([2001]). The commentary as we know it is an historical product of particular 'styles of knowing,' as Simon Goldhill has said ([1999] 402), developed within the technological medium of the printed codex. Other such styles are available now, and the medium has changed. What are we going to say a commentary is such that these styles, and others as yet unforeseen, may be accommodated—alongside the old, if we so choose?

The analogy of translation breaks down quickly if we think in terms of the 'texts,' i.e., its particular objects. Our problem is not what might happen to any given commentary and is best not confined to a single tradition nor even conceived as a change from one format to another. Specific formats, which the shock of the new helps us to see in detail *as* formats, have something to teach us in their effects, as Fowler notes ([1999] 428), but are not the point here. My focus is on the mutability of format, which is not a temporary effect of a change in media but a new condition of work. This mutability—not the intellectually trivial though highly annoying impermanence against which we 'back up' our precious files or the chaotic variation of approaches we develop standards to control—is that which allows us perpetually to transform our resources and so keep

pace with imaginative change. Hence we need to think in terms of devising and stabilizing means to do so. What tools should commentary makers have to hand? Demographically who will these makers be? What might they be making, exactly?

The recent collection of essays edited by Glenn W. Most demonstrates that there are many answers to the question of what essentially a commentary is ([1999]). So much depends on the perspective from which the question is asked. In the (famously linear) medium of prose, mine must shift around in approach to the converging of commentary practice with computational means, but my eye is always on the crossroads. Indeed, I must roam rather far afield because the questions raised from their sleep by this converging are mostly about fundamentals of communication and reference—of which our genre is a studiously concentrated form. The relevant areas of research are so many and varied that I am constrained mostly to point them out as we pass. The work in some of these is developing quickly; I try my best to read the much more slowly changing tendencies in them—certainly *not* their unknowable future. (Undoubtedly there are several others I have not noticed: *mea culpa*!) My chief concern is as you might expect, the broadly technological, which in this context would not be flippant or pretentious to define etymologically, as the λόγος of a computational τέχνη. Above all my aim is to start us thinking about the qualities of imagination we must call upon to make the best of a very interesting situation.

The constructivist and computational approach with which I begin in fact radically simplifies the question of commentary essentials: all that matters to it are the basic mechanical processes. These are of course hardly sufficient to do full justice to the complexities of the genre, as Most argues for purely formal descriptions. I argue that the realities of actual practice and its complex results are essential to the computational question but postpone consideration of them to the end of the essay. Meanwhile I turn to the machine. I take up the question of its ontology, first to dispose of mental rubbish that vexes technological discussion, second to gesture at the philosophical conundrum that continuously fertilizes it. I then argue that the computer is at root a modeling device. I rapidly survey the history of its development toward end-user realization of this root-characteristic. For us, I argue, the main outcome is research on a world-wide 'digital library' of independently developed components. Proposing that we think in such terms, I consider what economists

call its 'system-wide' effects, dimly visible in the working environment that the Web provides. I touch on dire signs of socio-intellectual disintegration but argue that the evidence for this is an artifact of two errors: (1) imagining the digital library as if we were passive consumers of electronic documents originally designed for print; and (2) thinking in terms of abstract 'information' rather than embodied, mediated knowledge. Then I turn to the qualities of imagination that the complexities of the genre require us to develop lest we lose many of them in translation to the electronic medium. Finally I take up the question of reference to point toward the collaborative research ecology—of disciplines and, as Bateson said, of mind—on which so much depends.

I leave undiscussed possibilities that require our attention but which I have insufficient space to consider, for example the blurring of distinction between commentary and a number of other genres (such as the lexicon) that share its essential characteristics. I also do not discuss the complex political questions, for example of motivation and reward, that any actual future of electronic commentary-making will involve as much as its non-electronic past has.[2]

My title ends in a question to mark the plain fact that what follows is speculation, with summaries of and pointers to interesting research. To the reader wanting reassurance that the electronic commentary is a safe bet the best I can do is to return the late Paul Evan Peters's hearty optimism that at last "we are on the threshold of what can be productively thought of as human-kind's meso-electronic period" ([1994]).[3] This is not to say that the adventurous scholar cannot start experimenting, nor that there is no urgency that we do so, nor that it will not be intellectually rewarding, only that there are few precedents, many hard problems and no guarantees. So I begin.

2. *Mechanical essentials*

Obviously central to the definition of commentary is its relationship to the commented object. By definition commentary depends on its

[2] I am grateful to Simon Goldhill for pointing out my omission of this aspect of my question.

[3] He goes on: "after all the appropriate slack has been cut, the best that can be

object, but the relationship between the two is more complex than simple dependency suggests. The key to the relationship lies in a paradox of interpretation, which takes control of and to a varying degree remakes its object in the very act of its own subservience. The commentary is thus in a sense always primary. Some commentaries are plainly so because they straightforwardly create or constitute their objects.[4] Some are primary by default—they are all that remains of an event not otherwise recorded or an object which has not survived.[5] Performative events, even if repeatable, are sufficiently distinct from their commentaries in kind as almost to make them entities in their own right.[6] Such, though perhaps exceptional cases, help make the point—that commentary fundamentally *refers* but not necessarily or in any simple way *defers* to its object. It directs our attention elsewhere, but as governor of our thinking brings attention back. It leads by following, filtering, shaping.[7] This dynamic, performative aspect of commentary, I will argue, computing promises significantly to increase.

Citation (in the neutral sense of reference without deference) is particularly clear in its application other than to the commented object. Citation is often predominately to extrinsic facts, traditional sources, pre-existing arguments, and secondary discussion that it not only indicates but also summons, manages, and brings to bear on its text. (The point is sufficiently illustrated in Figure 1, discussed in more detail below.)

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said as far as I am concerned is that we are using crude tools with which we are having some uneven but very real success in fashioning crude but functional electronic artefacts."

[4] See John Vallance's notion of the 'non-submissive commentary,' for which his example is Galen on Hippocrates (1999); also von Staden's characterization of Galen's "recuperative elucidation of the obscure ancient voice" ([above] 114).

[5] John Philoponus' sixth-century Greek commentary on Aristotle's *De Intellectu* (a lost portion of the *De Anima*), itself lost and translated into Latin by William de Moerbeke, is an example. Compare J. D. Reed's aim "simply to contextualize Bion's words . . . to establish the meaning they yield against the wider usages of the Greek language, and to locate them within the dialectic of Greco-Latin literary history" ([1997] 87). Further afield are the texts that incorporate fragments of earlier lost works, using them for various purposes, e.g., Parmenides in Plato.

[6] For examples of medieval commentary on music see Reaney (1966); modern commentary on recorded music Philip (1992).

[7] See Fraade on the movements in Philonic commentary, which he likens to a guided journey of the soul to perfection, and his characterization of the commentary author's aim to serve as guide both to the individual reader and to the Alexandrian community ([1991] 10–12).

Citation in turn underlies two other prominent characteristics: the discontinuous morselization of commentary[8] and the sequencing of morsels according to locations in the commented object, thus its literal sub-ordination. Neither is strictly necessary, of course. A. W. Verrall's *The Bacchants of Euripides* (1910) is an example of the commentary essay that discusses parts of the play in the order that suits its continuous argument. Graphical illustrations in literary works, such as the frontispiece to Gambattista Vico's *Scienza Nuova Seconda* (1730) or the engravings in George Sandys's translation of Ovid's *Metamorphoses* (1632), may be said to serve as commentary on their texts by spatial juxtaposition and iconographic reference to textually disjunct passages.[9] Thus we may conclude that morselization and subordination are more strong tendencies than necessary characteristics, but they are certainly normal in the commentary form with which classicists are most familiar.

Morselization of a kind is graphically expressed in 'continuous' prose by the convention of paragraphing (and before that by division of *scripta continua* into words and syntactic units), though normally counteracted by explicit transitions and implicit sequences of thought. In the usual sort of commentary these transitional devices are absent, but the implicit original sequence of the commented text of course determines the order in which they appear, and so supplies a continuity of thought. Thus to the reader deeply familiar with the commented text, these morsels may be read as continuous though stylistically choppy prose. My point, looking ahead to the shape-change, is this: that once readers are allowed easily to follow or rearrange morsels in whatever sequence they wish (as in current hypertext fiction), then a further erosion of the difference between continuous prose and morselized commentary will likely begin. In particular once commentary writers start composing for a medium

[8] The terms *citation* and *morselization* are adopted from Goldhill (1999) 393ff.; my indebtedness will be obvious in what follows.

[9] For commentary in the visual arts see the essays by Katharina Krause, Barbara Borg, and Luca Giuliani in Most (1999); for marginal mss. imagery as commentary on its text see Camille (1992); for page as image Bornstein and Tinkle (1998). Computational techniques of imaging, esp. hypertextual 'image mapping,' hold considerable promise for commentary on visual objects, such as paintings, emblems, and MSS pages, by allowing links to be attached to areas of the image; see Graham (1991), Nowviskie (2002), also Stephens (above) 85–7.

in which reader-determined sequence is a possibility, they are likely to respond, to adapt.

Nothing I have said or will say undercuts citation as a fundamental characteristic of commentary, but morselization and subordination are clearly less deeply rooted in the nature and so future of the genre. This is not at all to say that the latter two will be irrelevant, as they are hardly so in continuous prose, rather that we need to think rather differently about them. I will return throughout to all three characteristics, to say in more detail how I think they work and so how they might be implemented. For now, in accordance with Eco's notion of translation, we need to look directly toward the computational side and particularly at its culture to identify the recipient qualities of computing in which these characteristics may be given shape.

3. *Ontology*

I begin by questioning the ontology of computing. Is our machine a *tool* (implement) or a *medium* (environment)?[10] The question does not arise from a confusion of terms, both of which are apt in particular contexts, nor is it evidence of essentially unrelated applications to which the computer is put. Rather, I argue, it points to an underlying identity, which to grasp—and so to understand the possibilities of the electronic commentary—we first need to remove particularly troublesome mental rubbish about tools and media.

The word 'tool' has both concrete and abstract senses (*OED* n.). In the first instance it is a mechanical 'instrument of manual operation' with effects that shade from the physical toward the immaterial. Figuratively, however, it names anything used to effect something, whether the things in question are material or not; for example a person, a political doctrine or a philosophical method may be employed as a 'tool.' Like other devices with which we formulate and express thoughts, the computer significantly combines both senses: it is a

[10] Computing and communications (the chief context for computer-as-medium) have become inseparable: the world-wide telephone network is widely observed to be the world's largest computer; the main purpose of the computer, Terry Winograd argues, is to further communication among people ([1997] 150).

physical instrument (with various concrete as well as cognitive effects) and, as Régis Debray has argued for the codex, a pre-existing "symbolic matrix, the affective and mental schematisation in whose dependence we bind ourselves more or less unconsciously to the world of meaning" ([1996a] 140f.). We may wish to dispute how unconscious this binding now is: as I have suggested, the shock of new technology has awakened us to the ways that the book effects it, and the qualities of computing, with which we are just now re-binding ourselves, are quite conscious objects of attention (although as I will explain, maintaining awareness of them is no easy matter). Nevertheless, the point is that in both contexts tool and medium are really two sides of the same coin: the tool is an effecting medium, and the medium is an affecting tool. Both *mediate*, i.e., change as well as communicate: the tool action, the medium knowledge.

When I said earlier that commentary writers are *likely* to respond to the changed conditions brought about by computing, I thus meant not so much to suggest a probability as to point to the indeterminate though strong interrelationship of tendencies between us and our devices—the lines of force, if you will, binding us to the world of meaning and action.

To some degree all tools mediate (e.g., a chisel, which itself shapes how the sculptor works out and in a sense thinks out meaning). The more cognitively receptive the medium, however, the more insistently 'the content of the form' (White [1987]), requires our attention. The infinite regress implicit in that tricky turn of phrase suggests, however, that we enter on deeply problematic ground: indeed, the dichotomy of form and content is but one version of perhaps the oldest conundrum in the philosophy of mind, the 'mind-body problem.'[11] Unsurprisingly, then, for computing we find two equally unproductive but quite popular escapes offered in the literature.[12] These escapes frequently take shape in another version of the mind-body problem, namely the nature-nurture argument. Thus on the one

[11] See *The Oxford Companion to Philosophy*, s.v.; Onians (1951) s.v. *anima, nephesh, psyche*, which documents how complex the philosophical and religious traditions are on this point.

[12] As Debray has said, we need to thread our way toward "a third-alternative critical stance between the apocalyptic and apologetic tones, between the classical humanities' 'nothing essential can be technological' and the latest futurisms' 'everything is essentially a technical question'" ([1996b] 125).

hand the determinists argue for nature, talking as if development and use of the device were hardwired, like a genetic code, hence essentially unaffected by users, their culture, or historical contingencies. Our task, according to their view, is to discover this nature, then yield or resist depending on whether the determinism is cast in positive or negative terms. On the other hand the instrumentalists, as I am calling them, speak for nurture. They hold that such a device is 'just a tool'—i.e., not also an effecting medium, hence no more than a means of accomplishing whatever the nurturing tool-user has independently in mind. The tool may have particular capabilities and features, which are variously agreeable to our purposes, but these exist simply to be used or not as instruments of a pre-existing intention. How we think and what we want to do remain essentially unaffected by the qualities of the tool.

For commentary-making, then, we would appear to face a proverbial Scylla-and-Charybdis: either the computer will revolutionize the practice according to a pre-written script we need only decipher, or it will make no difference at all that we cannot now imagine from what we already know. These alternatives are, as I indicated, equally false; they both falsify the situation by taking flight from our central problem into realms of abstraction. Before we steer carefully between the monsters, however, we should observe that each has its grain of truth. The determinist's is that the medium/tool we use shapes practice: "Just as the dwelling comes before the dweller, or the earth before the peasant," Debray has pointed out, so the book comes before the writer of books ([1996b] 139). The instrumentalist's contrary truth is that the outcome is in the hands of the maker. This maker, whether writer of books, singer of tales, painter, or sculptor, works both with and against the inherited form. Thus, for example, the epic poet's *in medias res* in response to the imposed linearity of textual or oral presentation,[13] or indeed the inherent non-linear intertextuality of written language.

The history of technology demonstrates clearly enough that tools materialize ideas and that ideas arise from the use of tools. Hence the teleological notion, especially popular for computing, that the tool is a kind of prosthesis, an artificial limb of the mind/body, as

[13] Arguments for or assertions of a revolutionary non-linearity in hypertext have muddied the waters; see esp. Rouet and Levonen (1996) 12–15, Dillon (1996).

it were, that supplies what we formerly lacked.[14] Indeed, the psychologist Merlin Donald has argued in *Origins of the Modern Mind* that our species has evolved cognitively through a progressive externalization of consciousness in tools and other cultural artifacts. Thus although tools do not encode their own future, as the determinists would have, they do contain tacit knowledge of how their inventors conceptualized the world and related to it. Our old tools, however outmoded (or not), are never simply to be discarded, rather they need to be decoded for the methodological knowledge they contain. I will return to this crucial point later.

History also shows that although the relationship of tool-mind to tool-body remains enigmatic, we somehow manage to exploit the mediating effect of new tools intelligently, indeed to assimilate this effect. Nevertheless, puzzling out the future—for the commentary or for anything else technologically mediated—presents us with the severest cognitive and practical difficulties, as Geoffrey Nunberg has argued. The central problem he identifies is seeing past our own tendency to 'naturalize contingent features of the current order of things' ([1996] 105), as for example when futurologists of the 1950s envisioned how the house*wife* decades hence would do *her* work. But predicting outcome deserves James O'Donnell's condemnation as 'a mug's game' not merely because it is often badly wrong, profitless to the prophet and useful to others only in retrospect ([1996] 47f.), rather chiefly because it distracts us from our proper job—indeed, the only job we can actually do to prepare ourselves as commentary-makers. This is, I would argue, to understand how best to engage with our tools and materials so that (to paraphrase Lisa Samuels' phrase from Jerome McGann) we may constructively imagine what we do not yet know ([1997]). Prediction is no help at all: it stands back from direct, messy involvement, away from Wittgenstein's 'rough ground,' and so verges on the deterministic fantasy, as if the problem we faced were to puzzle out what in any case will happen. We cannot know.

Nor are our uneducated desires any better. Thus a commonplace response from the computing help-desk—a description of various relevant things computers can do, followed by the question, 'what do

[14] See Lyotard (1984) discussed in Landow (1997) chapter 6; the literal incorporation of the idea in the closely related speculations about the merging of technology and life in a 'bionic future,' for which see Zorpette and Ezzell (1999).

you want to do?'—leaves us as much at a loss: it merely restates the question within the mindset of existing methods on the one hand and on the other the current possibilities and limitations of computing. Even if it does not assume that old means are simply replaced without fundamental change to the methodology or results, it certainly gives the practitioner no help in imagining how the new can be developed and what the consequences to scholarship might be. Actual examples of electronic reference works are somewhat better than lists of possibilities and promises; they at least demonstrate concrete lines of development. But examples are of course limited to what has been done, and done so recently that the consequences and implications are only beginning to emerge. Examples are very few, as Hans Walter Gabler recently noted for electronic textual editions ([2000] 115).

Help appears, however, once we begin to look around the disciplinary terrain for how other equipment-orientated fields combine ideas, instrumentation, and material in their research.[15] As I have argued elsewhere (McCarty [2002]) a primary source is the history, philosophy, and sociology of science and technology, often gathered under the rubric of 'science studies' but also pursued in each of the disciplines separately. Whether, as Richard Rorty has suggested, we are verging on an end to the epistemic wars between C. P. Snow's 'two cultures' ([2000] 23), the study of science from without has during the last two decades become preoccupied with questions particularly relevant to us.[16] As a result we now have to hand powerful means of understanding collaborative and experimental knowledge-making in which equipment plays a significant role. For my purposes here the philosopher Ian Hacking's analysis of how hypothetical entities become real is particularly suggestive. Assertions (such as my own) that tools are 'agents of perception and instruments of thought,' the metaphor of prosthesis and the historical idea of cognitive externalization have a common limitation, namely that they do not bring

[15] I say 'equipment-orientated' advisedly for the help these fields have to offer my particular set of questions, not to suggest that commentary-making or any other area in which computing is applied is or should become equipment-centered.

[16] Three closely interrelated developments particularly: (1) a deconstruction of objectivity, including but not limited to social-constructivist theories of knowledge, for which see Galison (1999) and the references in McCarty (2002); (2) an attack on the supposed unity of 'the scientific method,' beginning with Feyerabend (1975); and (3) a sustained focus on experimental science as a primary form of knowledge-making rather than as a handmaiden of theory, for which see Hacking (1983).

us to the present moment when knowledge is actually discovered—or, as science studies would significantly have it, *made.* Hacking's philosophical analysis, for example of the microscope, proposes a more complex, subtle and active role for our research tools, as the means we use to make things real by manipulating them ([1983]). Since, as he argues, there is no one scientific method, and since experiment does not necessarily follow theory (although in particular cases it may), we should view our research tools as heuristic instruments for expanding not merely our abilities (as in Donald's view) but more the world we real-ize. It is in this sense that I suggest we regard the electronic commentary as an experimental, constructivist undertaking with no need for a pre-existing theory or scheme of what it should be.

4. *Modeling*

The software engineer William Kent prefaces his classic study *Data and Reality* with a warning message to mapmakers: "highways are not painted red, rivers don't have county lines running down the middle, and you can't see contour lines on a mountain" ([1978] xix). Kent is writing about knowledge-representation,[17] which is for us perhaps the most basic intellectual activity computing has to offer. His point is that like maps representations are *models*:[18] fictional, at best verisimilar constructs we use to stand in for phenomena otherwise out of reach. Modeling is a pragmatic, experimental activity, whose intellectual aim is to discover the consequences of the model. Because models are fundamentally not true, modeling is chiefly a

[17] Knowledge-representation is a subfield of artificial intelligence concerned with the design and use of computing systems for representing knowledge, including the kinds of reasoning that can be done with such systems; see Unsworth (2001). Kent is concerned more broadly with the intellectual problem of how (human) knowledge translates into data and data-structures, e.g., in a database system. For commentary-making as I am considering it here the primary form of knowledge-representation is hypertextual and related markup, as discussed below.

[18] I am using this polysemous word in the sense common to physics and related fields, "a manipulable representation of an object or process constructed for the purpose of study"; cf. *OED* n.2a: "A representation . . . of some material object artificial or natural, showing the proportions and arrangement of its component parts. *Working model,* one so constructed as to imitate the movements of the machine which it represents"—not in the sense of a Platonic ideal. For the literature on modeling up to 1994, see McCarty (1994) 278–80.

quest for *meaningful failure*. The best model, that is, comes as close as possible to a perfect and complete representation of what is known about the phenomenon in question yet fails perfectly to duplicate its behavior. Its failure as an artifact of engineering is its success as an instrument of science.[19]

Scholarly forms and formulations, I would argue, have in broad terms always been thus: in principle the truth about a commented text, for example, fits uncomfortably within the strictures of the commentary form, whatever that may be, just as categories by nature never do complete justice to the categorized. Hence the melancholy sentence of the Preacher (that there is nothing new under the sun) might seem final, but as with the mechanical qualities we see in the traditional artifact, here too the continuity is in respect of particular features determined by the computational perspective. From this perspective, then, a commentary is a *model* of what is known and thought about its text, and the tradition of commentary on this text is a history of model-building and rebuilding. (I return to the question of perspective in Section 8, below.) In consequence of it we tend to become especially aware of the tentativeness and impermanence which have always characterized scholarly works but perhaps not been so obvious. The electronic medium also, however, provides the means radically to shorten the time-scale of change by making changes relatively easy to accomplish. Building becomes more obviously re-building. Play, in the sense of *serio ludere*, is encouraged. Scholarly monumentalism, at least in its present form, becomes very difficult to maintain or credit.[20]

[19] On failure see Unsworth (1997), McCarty (2002). Rescuing the failure of systematic constructs from the dustbin suggests an answer to the central problem of *die Geisteswissenschaften* ('human sciences') with which Gadamer begins *Truth and Method*. Unlike the sciences, in which research strives to discover regularities and so to subsume individual cases to a law, the ideal of the humanities, he notes, "is rather to understand the phenomenon itself in its unique and historical concreteness" ([2000] 5). Modeling, as I have argued, implements regularities provisionally, without the normative status of law, in order to illuminate that concreteness.

[20] Monumentality is precisely a contested issue for the print medium, where the grand scale and relative permanence of monuments are instantiated in the costly physical book. Usually 'monument to scholarship' is a term of high praise, but it can also suggest uncritical reverence or other anti-intellectual ways of construing authority. Indeed, authority and monumentality are interdependent ideas. The electronic medium brings permanence (though not grand scale) into question, and with it what we mean by authority, how it is established and maintained. Unfortunately the grander scale required to explore authority and permanence in the electronic

5. *Devolution*

The role of modeling in scholarly applications may now seem obvious, but it has only been so for a relatively short time. The longer-term developments that have enabled us to think in its terms deserve a brief look, since they lead us to several quite important consequences of what we might call the constructive mutability of computing.

The history in question is not simply about the development of faster, cheaper and more capacious machinery. It also shows the increasing sophistication of systems toward stability and standardization on the one hand and accessibility on the other. We witness, that is, the gradual transfer of ability to construct artifacts from highly specialized technicians to ordinary users—simultaneous with the increasing technical sophistication of these users.[21]

In hardware the transfer of ability has happened through the evolution of what until recently was called the 'microcomputer' and the spread of the Internet. Especially in the form of the World Wide Web the Internet completes the decentralization of computing by giving individual machines access to other machines and to the computer-as-network. Thus the indefinitely extensible if not chaotic variety from which individuals may select *ad libidinem.* It gives scholars the means by which they may collaborate and the possibility of a distributed working environment, about which more later.

In local software the basis for devolution of constructive power has been laid by the change from a serial computing environment to the concurrent design we now use, with its asynchronous, interactive graphical user interface (GUI).[22] Serial computing, which more or less mandated the completion of one program before the next

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medium is not allowed me here; see Frye (1976) for suggestions, and for a discussion of various aspects of size in commentaries see Kraus (above) 8.

[21] Several people, such as Mark Weiser and Donald Norman (1999), argue for the 'disappearing,' 'ubiquitous,' or 'invisible' computer, i.e., for the machine completely to become an unremarkable part of everyday artifacts, continuing the development that has resulted in the hidden applications of computing in cash-point machines, automobiles and so forth—perhaps a contemporary example of the externalization that Donald argues for ([1991]). Note Andy Clark's remark that "We use intelligence to structure our environment so that we can succeed with less intelligence. Our brains make the world smart so we can be dumb in peace!" ([1997] 180). My argument, however, concerns scholars and others who learn by making and re-making things self-consciously.

[22] See Winograd on 'interaction design' ([1997]).

could be run, made interaction with machines clumsy and slow. Programs therefore tended strongly to monolithic, 'black box' designs, in which the user provided the input and received the output but had little direct responsibility for the process. What scholars did on the machine thus tended strongly to diverge from their other work in both the sequentiality and opacity of the computing applications. Even custom-built software separated the conception of problems (domain of the scholar) from the computational means of working them out (bailiwick of the programmer) and so came at a significant cost. It did not just keep computing to the few. It made the importance of computing for scholarship difficult to understand by focusing attention on the necessarily expensive, relatively inflexible product rather than the interactive, heuristic process. It thus inhibited us from understanding that at issue is a reconceptualization of our artifacts and how we relate to them, not a faster and cheaper means of producing the old kind.

In contrast the asynchronous, concurrent design of the GUI not only permits several programs to run simultaneously, it also strongly favors the development and use of 'component' software, i.e., independently developed, interoperable primitives designed to be used and reused in the construction of unforeseen larger processes, somewhat as alphabetic letters are assembled to spell arbitrarily many words in many languages.[23]

Admittedly the ordinary user can see only hints of such a future for software applications. Currently he or she has a choice between two constraining alternatives: either to adapt a miscellaneous collection of mostly commercial applications to his or her purpose, seldom if ever satisfactorily, or to adopt a closed, essentially unmodifiable system of components that have been carefully designed to work with each other. Experience suggests that however we define our primitive operations, the set of them is not closed. A toolbox system that offers internal compatibility at the expense of openness seems doomed, particularly since its hidden constraints and assumptions are bound to work against the more fundamental changes in method. Scholars need a means of inventing new primitives and building new tools easily.

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[23] Note the particular example of the development in hypertext systems from monolithic design to so-called 'open hypertext,' for which see Wiil, Nürnberg and Leggett (1999).

Much therefore remains to be done before we can easily construct approximate computational analogues of what we do (and invent new devices) by assembling and customizing component software. But the direction of technological progress seems clearly to be opening up an opportunity for us to become designers of our own tools. As Brown and Duguid have recently noted in *The Social Life of Information*, "We are all, to some extent, designers now" ([2000] 4).

In parallel with the devolution of constructive power, large-scale, widely accessible repositories of data have been developed in the humanities and social sciences. For us the earliest examples are textual collections such as the *Thesaurus Linguae Graecae* (TLG), first on magnetic tape then CD-ROM.[24] More recently the World Wide Web has given access to lexical databases and 'archives' of images and aural data as well; for classics the primary example is, of course, the Perseus Digital Library (Smith, Rydberg-Cox, and Crane [2000]). Though wisely made for immediately pragmatic reasons, the decision of the TLG Project to produce the Greek text without software for manipulating it is paradigmatic of a fundamental division between basic resources of data on the one hand and various standard ways of transforming and combining them on the other.[25] Even when, as with the Perseus Project, both are kept under one roof, the design which cleanly separates data from software allows two important flexibilities: the development and straightforward application of new tools, embodying new ideas, to old data; and the application of tools across data-sets, extending even to otherwise very different disciplines.

6. *Library*

Thus we find ourselves staring at a new manifestation of an ancient idea: the research library, in which diversity of reading practices is encouraged by a fundamental separation of singular and relatively unchanging resources from their manifold and highly changeable uses. Indeed, the idea of aggregated, flexibly structured knowledge

[24] For the history of the *TLG* see the remarks in Brunner (1993); Berkowitz (1993) especially n.3.

[25] For the relationship between the object-orientated model (which combines software with data) and the library model of aggregated sources separated from any particular uses of them, see Bradley (2002, forthcoming).

is fundamental. Digitization of such resources produces the incunabular and now commonplace 'digital library,' by which is meant the searchable electronic collections built up by a conventional institution in a single place.[26] To borrow a phrase from Jerome McGann, this incunabular library is I suspect 'in winding sheets rather than swaddling clothes' ([1997]), however, since networking offers the possibility of a far more powerful means of aggregating digitized knowledge: a singular and world-wide[27] library constituted from geographically distributed, independently developed resources.[28]

For a moment, rushing past without brushing aside the formidable difficulties standing in its way, let us imagine such a working environment (of which the current Web, including such things as the Perseus Project, gives but a hint). Within this environment, in 'cyberspace,'[29] scholars could extract what they need to produce commentaries either in printed form as now or as relatively book-like packaged electronic 'products' with various improvements and extensions to the print-based form.[30] These would then go onto the shelves or into the electronic collections of relatively conventional libraries. The potential for us in the devolution of constructive power is more radical than that, however. As a singular, world-wide entity, the digital library offers us the possibility of devolving responsibility for what is now the scholarly end-product to the end-user, who would put together the commentary he or she needed from the relevant bits and pieces wherever they might be found, e.g., textual editions, other commentaries, lexicons, image archives, secondary literature,

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[26] For this sense of digital library, see Fox and Marchionini (2001), who introduce the most recent issue of a major computing journal on the subject; Perseus is explicitly a digital library in this sense (Crane et al. [2000a]). I recognize but do not discuss here the idea of the 'hybrid library,' which combines printed and electronic resources.

[27] The term 'world-wide' presumes, of course, a definition of 'world' in which such things as use of a digital library are possible. I therefore use the term with implied scare-quotes.

[28] On the world-wide digital library and the central problem of interoperability see Paepcke, Chang, García-Molina, and Winograd (1998).

[29] A metaphor (very) loosely used to characterize in spatial terms what people do with computers. The term was coined by William Gibson in his novel *Neuromancer* ([1984] 51). For an attempt at definition see (e.g.) the *Principia Cybernetica Web*.

[30] Many if not most of the CD products we now have are historically conservative in this sense, e.g., the *OED on CD-ROM*, the *CETEDOC Library of Christian Latin Texts*, or *The Wife of Bath's Prologue on CD-ROM*: self-contained entities that marry source material to the means for its analysis.

morphological parsers, concordances, and so forth. Hence authorial responsibility would be shifted to preparation of these bits and pieces for whatever combinations might later be made. I call this henceforth 'the DIY commentary.' The widely scattered (indeed, also world-wide) academic cottage-industry, together perhaps with some forms of institutional support, is fully capable of the loose collaboration necessary to produce a sufficient stock of such resources and so to allow for the DIY commentary.

Imagining the benefits is not hard: more or less immediate access to primary and secondary sources in full, including the sort of plural, eclectic primary text advocated by Robinson (2000); construction of *variorum* commentaries;[31] interconnection with lexicons, morphological parsers, and other sorts of automatic analysis tools; inclusion of images, hence potentially a much larger role for them;[32] the 'folding comment' and reader-determined paths described by Fowler ([1999] 427); and so forth. Such imaginings, several already realized in the Perseus Project, are what we can expect from anyone familiar with the basics (though implementation is very hard). In fact we need little more than the work of Perseus, amplified and extended to a distributed cottage-industry of scholars, to suggest them. This work is crucial to our understanding of what we face because our previous experience, it turns out, is in practice not as helpful as we might think. "We have found theoretical extrapolations to be of little use in developing digital libraries," Crane and colleagues have recently written. "A densely interlinked interactive medium has proven so different from the print environment . . . that we find it hard to predict with any accuracy what will and will not work" (Crane et al. [2001b]). Here, however, I want to put aside the immediate accomplishments of Perseus and whatever benefits a world-wide digital library might bring so that we may focus on the problem-horizon.

The chief technical problem is *interoperability*, i.e., the ability of independently designed components to communicate successfully with-

[31] A particularly notable example of the possibilities is provided by the *Stellenbibliographie zum* Parzival *Wolframs von Eschenbach*, which uses computationally simple techniques to create a line-by-line commentary (probably otherwise a practical impossibility) from existing, ongoing scholarship; see Yeandle (1998).

[32] See Sandys' commentary on the *Bacchae* (1900) for its use of images; the images and other visual aids in Perseus. In his comment on lines 661–2 (Figure 1), Dodds remarks that he found no snow when he climbed Cithaeron in April; is it inconceivable that an embedded video of Cithaeron within a scholarly commentary, or indeed selected enactments of scenes, would be helpful?

out specific knowledge of each other, and wherever possible without human intervention (Paepcke, Chang, García-Molina, and Winograd [1998]). Geography is technically irrelevant, except when bandwidth is a problem: the components will normally be distributed only because the makers are. What matters is that each component is able to handle any arbitrary input and produce within the domain of its intended use an artificially intelligible response. Although this is in fact a very difficult problem that no one currently knows how to solve,[33] we nevertheless have good reasons for hope: it is firmly on the 'critical path' of current digital library research in computer science; indeed, it is crucial to the projected development of most if not all large-scale computing systems. It is very clearly what people in the industry want to happen, so if it is soluble it very likely will be realized, though in what form and which decade is impossible now to say.

The social and political problems of the worldwide digital library may turn out to be much harder, beginning with objections to the very notion of public, openly collaborative work (which implies a social ideal not to everyone's taste) and reaching to strictures on kinds of information that some will insist for professional, national, military, religious, or other reasons must not be distributed. Anyone who thinks that the commentary is entirely free from such considerations should look more closely at its history (Most [1999]). But even if within the confines of a safely academic discipline we are not thus vexed, the central question of our common purpose remains: do we *want* the DIY commentary—or any other particular change in the practice of commentary-making that the electronic media promise?

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[33] To get some idea of the difficulty consider, for example, the apparently straightforward situation in which a software component requests definition text from an online lexicon. Of all the potential problems that might arise, consider only those following on the request for definition of a homographically ambiguous form, such as Latin *maris* (up to six possible solutions). A question requiring an answer for only one of these could not be resolved without reference to context; automatic analysis might eliminate some possibilities for this particular question, but in general resolution of such ambiguous cases would require 'natural language understanding' software better than anything we now have—or some combination of software and intervention from the user. Furthermore, access to lexical information would need in general need to be recursive (i.e., to allow for repeated accesses with refined queries) to discover whether analysis of the context was required and if so of what kind.

7. *System-wide effects*

How can we know whether we want it? The quite difficult intellectual exercise which I think this question requires of us is to puzzle out the consequences insofar as we can project them from current circumstances. Here I prefer to adopt a term from economics and so think about 'system-wide effects'[34] of the DIY approach. Of course, framing the effort in terms of interacting components in a system is by nature an exercise in modeling and so cannot tell the complete truth. It disciplines us, however, to think in terms of a whole (and so to define what we consider the whole to be), to resolve it into its components, and to work out their interactions. The effort is for us thankfully subsumed within the broader, ongoing analysis of electronic publishing.[35] Here I have space only for a few examples of what that analysis suggests about the commentary.

Scholarship as we conceive it naturally depends on our ability to document the sources we use, secondary and primary. One system-wide effect (of which we already have a foretaste from the Web) is revealed when we ask in what sense the DIY commentary *is* a document. How is the user of a temporary, perhaps even unique construct to record a meaningful, lasting reference to it? A technical answer is more or less already available: components would carry an identifier, not entirely dissimilar to a 'uniform resource locator' (URL), so that any particular DIY 'document' would be in the first instance something like a table of contents.[36] The harder, ontological question remains, however. Current bibliographic references are to commonly-held objects; the DIY reference would be to a potentially, even normally unique, private construct. In other words, Duguid notes, we face the potentially serious intellectual and social problem of *demassification* ([1996] 83ff.). If standard reference sources are replaced by idiosyncratic ones, what then happens to scholarship? Duguid observes "the increasing ease with which socially complex technolo-

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[34] I am grateful to Colin Day for the term (e-mail 23/06/97); see Day (1995). Systems theory is a field of its own; see Bateson (1972), Klir (1991).

[35] The best work so far is the collection of essays edited by Nunberg (1996), but see also the articles in the *Journal of Electronic Publishing*.

[36] Multiple tables of contents for a single pool of online articles is now a commonplace; indeed the idea is a natural consequence of hypertext. A more complex implementation would be required in a DIY scheme but could be solved with no great technical effort.

gies can be made not just for broad masses of people, but for small groups and individuals. . . . In brief," he declares, "centrifugal forces of individualization and separation are coming into conflict with centripetal social needs, which were met previously and unproblematically through shared or common material objects" ([1996] 84), e.g., the printed book. One outcome, already visible online, is the attempt to produce and consume information "with less reliance on impersonal forms and more on personal warrants for legitimation," as with hypertext and especially as hypertext is depicted in the liberationist rhetoric about it ([1996] 84). Historical precedents suggest a crippling, paradoxical consequence may result: privatization rather than the democratization of knowledge preached by the liberationists, i.e., a highly problematic retreat from public forms and institutions into civil society, "glimpsed in some of the more Hobbesian enclosures of cyberspace," as he says ([1996] 88).

The threat of demassification seems cause enough for the fearful cry of *o tempora, o mores!* and so a retreat from DIY. This threat is real enough for caution, but more needful of our attention are the assumptions implicit in the system whose effect demassification is. I will return to the point in a moment.

Another system-wide effect begins with Debray's point about the pre-existing matrix that intellectual forms supply. Let us, for example, imagine a future E. R. Dodds writing his commentary on the *Bacchae*[37] for a fully implemented digital library.[38] Given the strong tendency of the electronic medium for morselization, and so for a loose structure of interlinked but unbound components, let us say that the future Dodds composes his substantial introductory essay on Dionysus, Dionysiac religion and traditional elements in the *Bacchae* with the possibility of its independent status in mind. The question

[37] In this essay I use Dodds (2nd edition 1960; 1st edition, 1944) as my standard example of the classical commentary. The *Bacchae* has been the subject of commentary for over 500 years, since the Aldine edition of 1503, and it has been extensively studied for the last two centuries. I chose Dodds' commentary in particular primarily because of certain formal features that would challenge a DIY design: an introductory essay that may be regarded as an independent contribution to scholarship; citation and use of numerous secondary sources of varying kind; long discursive glosses; variation in types of reference; masterful concision; a fine sense of audience.

[38] To make matters simple (though entirely unrealistic), I assume that this library offers no more than we can comfortably project on the basis of current technology, and I suppose that non-technical problems, such as copyright, have been solved.

then is, how will pre-knowledge of digital unboundedness affect composition of the essay? (The short answer is, we do not know.) Later on I will return to the matrix-effect in a much more obvious form, but for now I want to indicate the emerging *disaggregation* problem, as it is called.[39] This problem also turns up in one of the more popular issues exercising those who think about writing in the hypertextual medium, namely argumentation, which traditionally leads the reader through a strictly pre-determined sequence. What happens when reader-determined sequencing of morselized prose must be treated as a given?[40] No one is certain, but recent work suggests that the matrix-change does not put an end to argument, rather establishes new conditions for it and requires corresponding rhetorical means. *Mutatis mutandis* the future Dodds will be writing a rather different sort of essay—though again we do not know how it will be different.

An important conclusion to be drawn is that *dis*aggregation is a by-product of our imitative way of conceptualizing the electronic medium, as if our task were to translate pre-existing printed documents and the working methods that produced them into electronic form. From a creative, writerly perspective the change looks very different: it means rethinking those methods so as to anticipate their endless, unpredictable *re*aggregation by future readers—or in more familiar terms, their recontextualization. (Note what has happened here: the possibility of creative adaptation to our changed circumstances makes the system we analyse much less brittle.)

What might such anticipation involve? Unboundedness implies that recontextualization is plural, ultimately unpredictable. Current experience with the Web is sufficient to show that although a pastiche of found objects can be serendipitous, the prospect of a 'docuverse'[41] indefinitely expanding and yawning before us like some "dark |

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[39] Brown and Duguid include both demassification and disaggregation among the aspects of what they call the '6-D Vision' of disintegrating forces; they argue that this vision is flawed by its narrow concern with abstract information ([2000] 22). See Nunberg (1996), which I use extensively below.

[40] See Carter (2000); the other references in McCarty (2000) III.B.2. The argument that sequences of logical or structural entitles in hypertextual documents are less rigidly determined than those in a codex is a subtler and more difficult one to make than would appear. I assume it here but argue the essence of the case in Section 10, below.

[41] The term 'docuverse' was coined by Theodore Holm Nelson to denote what we now call the digital library, though in a radically ideal form; see Nelson (1982).

Illimitable Ocean without bound, | Without dimension . . ." (*PL* 2.891–3) is not usually what we need or want.[42] The question is how to exercise or plan for control.[43] Explicit descriptors within each component (i.e., metadata) is a commonplace solution. Perseus, for example, is focusing primarily on "ways in which documents can be designed from the start to interact with other objects in the digital library" (Crane et al. [2000b]).[44] Complementary research in 'adaptive hypermedia' is based on an explicit profile of the reader (including his or her information-seeking behavior) to tailor-make the product.[45] Automatic adaptation essentially mechanizes the writer's traditional attention to audience, which has of course been implemented in various features of the printed codex from the beginning. The historical Dodds, for example, adopted an explicit (mechanical) device in his 1944 commentary: square-brackets, with which he enclosed material intended for the scholars but not the 'schoolboys' in his audience ([1960] vi).[46] Indeed, commentaries automated along such lines promise help in the needed effort to reach a wider variety of audiences.

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[42] Nunberg suggests that we not "try to close off the collection in some arbitrary way, but . . . provide benign [Ariadnes] (both automatic and flesh and blood) who can help users thread their way through the maze" ([1996] 129). Our situation is, however, somewhat different from Theseus's, as the docuverse has no center to delimit the quest and no fixed shape or singular thread to discipline experience. Milton's Chaos seems more to the point—or the 'book of sand' in the short story of that name by Jorge Luis Borges.

[43] Here I deliberately ignore current solutions and ongoing research in computer science that assume arbitrarily structured documents such as one finds on the Web. In other words, I assume that the DIY commentary is written for a matrix that we are now figuring out how to design.

[44] Research also proceeds under the heading of retrieval and extraction of information from the Web; see Amitay (2001). For reports on related work, see the journal *Markup Languages*.

[45] For a technical overview of adaptive hypermedia see De Bra, Brusilovsky, and Houben (1999); McCarty (2000) III.C.2 'Adaptive and dynamic hypermedia.' The adaptive approach was suggested in the 1970s by Gordon Thompson, who proposed a 'serendipity machine' based on automatic observation of a person's information-seeking behavior ([1979]). A simple but effective implementation is used by the online bookseller amazon.com to suggest related items.

[46] As Figure 1 shows, he also marked his audience more subtly, for example by spelling out the names of Latin playwrights and their plays, thus 'Seneca . . . *Thyestes*,' and by citing the minimum information needed by a well informed (but not mind-reading) reader, e.g., 'Verrall's notion that 662 is interpolated . . .' (not citing Verrall 1910, the only possibility) or 'ἀνεῖσαν χιόνος L. Dindorf, to avoid . . .' (carefully pointing to Ludwig rather than his brother Wilhelm). See Section 10, below; also Stephens (above).

The demands of recontextualization are, however, both more serious and more promising than that. Dodds' humorous admission that he had often silently 'pillaged' his predecessors ([1960] vii) is a scholar's conventional recognition that explicit referential gestures are only the proverbial iceberg-tip of a massive, implicit intertextuality. Because implicit conversation among texts is inherent to language, as among other artifacts to culture, much will not change in the transition to electronic forms. Reference will, however, be affected in at least two ways: obviously, by the manual and automatic forging of hypertextual links; less obviously, by the loss of physical closure imposed by the codex, within which reference has operated since the invention of that device. What happens when the physical fact of that closure is no longer a condition of work—when, for example, the parts of a commentary are no longer bound together and so their intertextuality is not privileged? I will return to these questions later.

I began my analysis of system-wide effects by discovering the threat of demassified information, then at least partially answered that threat and other disintegrative tendencies by shifting from the more or less passive user's perspective to the active experimenter's. The former amounts to a kind of determinism, as does the liberationist's scenario of 'information wanting to be free'[47]—and getting the chance at last. But, as that intriguing personification suggests, a deeper problem is to be found in what Nunberg has trenchantly called the 'impression of information' ([1996]).

Information is an astonishingly successful idea. In popular usage it even characterizes the era in which we live, 'the Information Age.' Its colorless, odorless, tasteless ubiquity makes it exceedingly difficult to grasp critically—which fact, and the uneasy feeling that comes before it, should make us very suspicious. Nunberg defines it in the material sense as "a uniform and morselized substance . . . indifferent not just to the medium it resides in but also to the kind of representation it embodies . . . a *noble* substance" (that '*wants* to be free') as unreactive and unchanging as the Pythagorean soul, . . . *errat et illinc | huc venit, hinc illuc, et quoslibet occupat artus.*[48] Nunberg argues

[47] The battle-cry, 'information wants to be free,' is usually attributed to Stewart Brand; see Clarke (2000), who traces its lineage tellingly to John 8:32—and note the crucial differences!

[48] Nunberg (1996) 116f. (my emphasis), *OED* s.v. 'noble' a., Ovid, *Met* 15.165f.

that our impression of this curiously powerful and elusive substance is, however, an artifact of the very system it characterizes: it originates, he shows, in "certain practices of reading and the particular representations that support them" ([1996] 110, 114f.). Hence, "information is a mode of reading" ([1996] 123). Its properties—"metaphysical haecity or 'thereness,' transferability, quantized and extended substance, interpretative transparency or autonomy—are simply the reifications of the various principles of interpretation that we bring to bear" on the information-genres: newspapers, modern reference works, census reports etc. ([1996] 116). Its material properties, as he says, reify "the material properties of the documents that inscribe it"; its semantic properties "are the reflexes of the institutions and practices that surround the use of these documents" ([1996] 120).

If the informational mode of reading is bound up with the materiality of its documents, then the 'impression of information' should be faltering with the growth of electronic forms. This seems counterintuitive: digital data, like the Pythagorean soul, is capable of indefinite transformation without change. But again, only in the informational mode of reading are we apt to think that meaning inheres in these data and not in their embodied form. Furthermore, Nunberg argues, computing undermines this mode and the genres which support it by failing to preserve their social and material boundaries.[49] Hence the signs of disintegration we observed in the autochthonous forms of electronic communication are likewise artifacts of the informational perspective ([1996] 124f.). Perhaps, as has been suggested, these are comparable to the anomalies in a moment of Kuhnian 'extraordinary science,' when the crisis they force precipitates a major shift in how we conceptualize the world.[50] In any case, as a number of cogent essays have recently argued, the partiality and reductiveness of 'information' clearly do not help us with the embodied qualities of knowledge on which wise use of computational forms depends.[51]

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[49] Thus Nunberg argues that online self-publishing, which increases the proportion of writers to readers, works against the impression of objectivity and autonomy on which information depends, and the proliferation of such documents against our ability to circumscribe authority ([1996] 125–9).

[50] See Kuhn (1970) 84–91, to which I refer for the historical point that major changes are sometimes preceded by apparently minor problems with the order of things. I avoid the term 'paradigm shift' because of its confusing popularity.

[51] See the essays collected in Nunberg (1996), Zeitlyn, David and Bex (1999), Brown and Duguid (2000). For visual data see Arnheim (1969), Tufte (1990).

8. *Imagination*

I have argued that the major difference in the offing—or at least the only one about which we can be confident—is the opportunity to create and experiment with models of commentary. This can be done immediately, though in a very limited way, using a mixture of local and online resources.[52] In the short to medium term major work is almost certainly to be circumscribed by the localized 'big science' projects, such as Perseus. I have argued, however, that far more interesting possibilities for the future of commentary-making appear to lie elsewhere, in the convergence of user and maker of tools in a world-wide digital library. There are numerous technical, social, and political impediments, but as I argued the history of computing clearly demonstrates this convergence.

Modeling is not an activity with which many commentary-makers are likely to be familiar: the tools for it have only recently become available in the humanities, and conscious play with the devices of scholarship is not commonplace. Nevertheless it is quite literally happening all around us, in business, government, and the sciences, where verisimilar scenarios and simulations provide the basis for real choices. Modeling is thus deeply implicated in social changes that do affect us, profoundly if only indirectly. Such peripheral activity is professionally important to classicists because it means that familiarity with modeling is not very far off; nearly everything is in place for us to alter our practice accordingly. Indeed, to note with Goldhill (1999) that glossing changes as socio-intellectual fashions change seems tantamount to observing that the practice is one long modeling exercise. Once we admit that thought, the codex is apt to appear self-evidently to have been a modeling device from the beginning, though a rather slow and clumsy one, and the various commentary forms we inherit models. Electronic tools (having become by the change in perspective no longer different in kind) will then correspondingly appear as different chiefly by the quantitative measures of speed and

[52] See, for example, the *Vergil Project* (Farrell [1995–]), *Trajan's Column* (McMaster Column of Trajan Project, 1999), the *Stellenbibliographie zum* Parzival *Wolframs von Eschenbach* (Yeandle [1998]), the Rossetti Archive (McGann [2000]). For classics Perseus and the online version of the *TLG* can serve as major components in locally constructed reference works; see my *Analytical Onomasticon . . . Sampler* for an example (McCarty [1999]).

cost, with a nod to qualitative effects derivable from those or related to concerns seemingly of little immediate interest to the practice.

A slippery slope, indeed, at the bottom of which lies a muddled confusion of old and new, in which computational modeling seems nothing essentially more than what we formerly did and *vice versa.* The operative word here is the adverb *essentially*: accept its force and the inherited form becomes impossible to see as it was, even approximately. Significant aspects of it are rendered invisible to us before we even begin to attempt translation. The potential of the machine is likewise obscured.

The problem I am pointing to does not lie in the computational perspective *per se,* which we must assume in order to see which features of commentary translate into the electronic medium. Rather the problem is with seeing henceforth in any other way but the computational. Yet of course we must. Faithful translation (in Eco's sense) requires that we interpret commentary—the activity, not any specific format—simultaneously in the two very different media with respect to their cultures. If we can do this, then specific features lost or mangled in translation become visible, and attempts to re-create them in the idiom of the new environment can follow.

Earlier I recognized but postponed consideration of Most's point that purely formal analysis cannot do full justice to the complexities of the genre. Since, as Nunberg says, we have the greatest difficulty seeing which of these are contingent, we must pay attention to them all, in their cultural context as faithful translation demands, though as outsiders looking in. Whether we choose actually to implement any particular feature of old commentary practice in the new depends on a number of factors beyond my present scope, for example the theory of language that the former assumes (see Boyarin [1999], Goldhill [1999]). We must, however, be able clearly to imagine what we once knew as well as what we don't know.

In history, for example, the former kind of imagination is central to the question of how the story of anything may be understood once the world that informed it is gone.[53] This is not simply a matter of getting one's facts and motives right. Thus M. I. Finley, in *The Use and Abuse of History*, sees the emergence and continuing health

[53] The historiographical literature is immense; see Collingwood (1946; 1994), with the summary of more recent work by the editor.

of his discipline not in scrupulous spade-work as such, though that is *sine qua non*, but in its struggle to separate from its origins in poetic myth so that it may tell a different kind of story ([1975] 11–33). In the introduction to his *Geschichten der romanischen und germanischen Völker* Leopold von Ranke makes the same point (adding to it the separation of history from moral instruction), then famously comments that his work 'will bloß zeigen, wie es eigentlich gewesen ist': it '*wants* only to show how it *actually* was.'[54] This statement has provoked, Finley notes, an endless debate; I want to make but a single point with it. Yes, fulfillment in the trivial sense is 'a fantasy impossible of realization,' as O'Donnell says ([1996] 48f). But with the ethnographer Clifford Geertz I argue that just because one cannot fully grasp other people (or past phenomena) 'in their immediacy and their difference'[55] does not mean the effort is vain: impossibility drives it on,[56] disciplines and deepens it, redefines the pivotal *eigentlich*.[57]

Thus the scholarship I advocate for software design is fundamentally of as well as in the humanities and can be every bit as intellectually demanding as our native fields. (No doubt like historiography it deserves an equal intensity of debate as well.) In any case I think we can be quite optimistic about its application to commentary-making. We have actual use of printed commentaries to study and draw upon and the still-living practice of their production, to some degree *wie es eigentlich gewesen*. More than most disciplines classics has fostered the historiographical imagination that Finley describes, even if at times truth has seemed a matter merely of prodigious *Sitzfleisch*. Nothing essential to the task is foreign, and only some of it new.

The computational perspective discovers other kinships as well, in earlier scholarship. Take, for example, the strikingly congruent approach to allusion that Ziva Ben-Porat worked out 25 years ago in

[54] "Man hat der Historie das Amt, die Vergangenheit zu richten, die Mitwelt zum Nutzen zukünftiger Jahre zu belehren, beigemessen: so hoher Ämter unterwindet sich der gegenwärtiger Versuch nicht: er will bloß zeigen, wie es eigentlich gewesen ist" (Ranke [1824 = 1874] vii).

[55] Geertz (2000) 74; see esp. the previous chapter, 'Anti Anti-Relativism,' 42–67; Geertz (1973) 30.

[56] "I have never been impressed by the argument that, as complete objectivity is impossible . . . one might as well let one's sentiments run loose. As Robert Solow has remarked, that is like saying that as a perfectly aseptic environment is impossible, one might as well conduct surgery in a sewer" (Geertz [1973] 30).

[57] See, for example, Eric Voegelin's idea of history created 'through retrospective interpretation' ([1956] 128).

a systematic explication of this 'device for the simultaneous activation of two texts' ([1976] 107). Similarly, Steven Fraade exemplifies an equally congruent way of thinking about commentary in his more recent literary and socio-historical analysis of the Midrash *Sifre to Deuteronomy*, in which he focuses in detail on how the genre works, specifically with regard to the processes of reference and engagement of the communities in which the *Sifre* functioned. Somewhat further afield, in the wilder realms of cultural and literary theory, are the postmodernist writings on textual plurality and openness, for example Roland Barthes' *S/Z*, from which Fraade and my title both quote. Such scholarly kinships put powerful analytic means in our hands, though we do need to take care what claims we make about them.[58]

Don Fowler's broadly postmodern agenda is likewise a source of optimism for the commentary, his imagery of flowering and fertility pointing the possibilities for making our intellectual problems worse, as he says, rather than solving them. At this moment (and, I have argued, by nature) computing is particularly well suited to assist problematization. Indeed, Jay David Bolter argues, the commentary and computing seem particularly well met on both sides ([1993]). The computational perspective may rearrange our intellectual topography and so require our agnostic skepticism, but the fact is that commentary provides close to an ideal means of exploring many of the scholarly capabilities of computing without fatal compromise, as he suggests. Fowler notes that, for example, commentary is open 'in principle' to the indefinite accretion (and so to plurality) which computing makes trivial to accommodate; an argument that the physical facts of book publishing have thwarted a tendency in the idea of commenting that computing particularly favors would appear to follow. The mechanical essentials that I argued for—citation, morselization, and subordination—may be highlighted by computing but are also characteristics that pre-date it. They map easily if not almost perfectly into the technology of reference, i.e., hypertext—and push it, as we will see.

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[58] Unless we are regarding these conceptually related works themselves as historical artifacts, we use them creatively in support of what we do. The formerly popular notion of a 'Convergence of Contemporary Critical Theory and Technology,' to quote the subtitle of Landow (1997), makes the historical error and, as Fowler notes, "is naïve: deferral of meaning is a property of text *per se*, not of any realisation of it" ([1999] 430).

Fowler observes that the openness of commentary lies "not in anything essential to the form but in the reading practices that it encourages" ([1999] 440). His observation is precise: the mechanical characteristics of this form as we now have it stimulate but do not necessarily cause the accretive response: the fact that one has a cabinet perfect for the display of curiosities does not force one to keep a *Wunderkammer*, although it may be said to encourage the practice.

Space prevents me from little more than gesturing toward the kind of imagination that the marriage of computing and commentary requires. The intellectual struggle to develop it is especially exhilarating because of the genuine kinships we discover along the way—signs, I think, that we are bringing together what (at least for us) belongs together—without which of course there would be no point to any of this.

9. *Collaboration*

In our translational analysis of commentary the historiographical imagination (let us call it) is shared by the several disciplines we need to involve. We may think of them as meeting in an interdisciplinary commons—literally, a collaborative center of specialists; figuratively, the ideal computing humanist's mental equipment; or (possibly best) some combination.[59]

The computer scientists Darrell Raymond and Frank Tompa have emphasized in their fine analysis of the *Oxford English Dictionary* that some mechanical features of the artifact are immediately obvious, while others can only be inferred from actual use, hence from the community that use defines.[60] The overlap of their field with the social sciences points to the fact that the methods of the latter are apt to be better for this than introspection or informal survey because to a significant degree users' knowledge about use is tacit, and the discipline of eliciting reliable answers out of variable subjects is not

[59] In any case, I would argue, it has implications for our disciplinary curricula, especially at the M. A. level; (post)graduate programs are in development at several institutions on both sides of the Atlantic.

[60] Raymond and Tompa (1988); for typical research of this kind, though based on considerably less complex artifacts, see the articles by Marshall in McCarty (2000).

a trivial one.[61] The historian, possibly several of them, is schooled to discover what was tried but did not work and to understand relevant contingencies as such (see Hesse [1996], O'Donnell [1996]). The philosopher is disciplined to avoid easy escapes from the unresolvable conundrum underlying the relationship between form and content. He or she is also good for a robust epistemology of experimental knowledge-making to counterbalance the historian's tendency to privilege happenstance over principle. For the commentary or other artifact of literature, the literary critic is the one to work out how the historically situated ideas of language and literature are reflected in it—how (in Goldhill's words) a particular 'style of glossing' betrays an equally particular 'style of knowing.'

As a result of the (internal and/or external) collaboration, we can expect better knowledge of how the traditional artifact works as a device—a question to which I will return again shortly; its interrelationships with those it serves; the dependencies of its form and functions on the constraints of the matrix for which it was conceived; the opportunities missed or virtues abandoned for no good reason; and finally, as suggested, its socially constructed nature.[62]

The limitations of others are as always rather easy to spot. The harder question is how not to embed our own historically provincial limitations so deeply into our devices that we cannot easily remake them. In political terms, how do we go beyond a mere change in government to provide for a continuing revolution? I have suggested in effect that the computer offers us more than just another turn of the wheel, that we misuse it if we do not exploit its constructively changeable nature to keep pace with imaginative change. Although plurality is part of the postmodern agenda, it seems to me

[61] The role of tacit knowledge in software design and beyond is a very active area for research, beginning particularly with Polanyi (1962) and (1966); see also for example Suchman (1987), Bodker, Greenbaum and Kyng (1991), Hutchins (1995), Nardi (1993) and (1996), Brown and Duguid (1996), Östman (1997). For tacit knowledge in the study of experimental scientific practice, see Collins (1992).

[62] This remains a useful term despite its over-stretched applications. As Hacking points out, social constructivism turns on the idea that an artifact or practice (e.g., the commentary as we know it) "is not determined by the nature of things . . . [but] was brought into existence or shaped by social events, forces, history, all of which could well have been different" (Hacking [1999] 6f.). Although social-constructivists often go further, to criticize, discredit or attempt to dismantle the phenomenon in question, all my argument requires is that no feature of the commentary beyond its mechanical essentials be regarded as intrinsic to the device.

that in allowing for maximum diversity of constructions we are not restricting the electronic commentary to that or any other agenda, now or in the future. Nevertheless, if we do our job well diversity will become more difficult to suppress and Fowler's call for "an emblem not of monumental solution but of the continuing fertility of problematization" far harder not to act on ([1999] 441).

10. *The rough ground*

An essential stage in the analysis is a thorough survey of actual examples. Before setting any limits, consciously or otherwise, we need to bring into focus the stubborn variety of commentary practice, which is a great deal more so than we might expect. In this penultimate section I want to look at variety in commentaries under two heads: the components of the works we call commentaries, and the referential gestures used in the commentary notes.

As for components, it is all too easy to generalize subconsciously from a favored commentary and so proceed on the assumption that give or take a minor bit the genre as a rule comprises a standard list of parts, e.g., preface, introductory essay, edited text, notes, indices and bibliography. Even within the single discipline of classical studies, for a single ancient text, a survey of artifacts quickly disabuses us of such a notion, however.[63] The formal variety is, as I said at the outset in raising the question of essentials, sufficient to make us question use of the same name to cover all instances. Between the covers of a book (any genre, in fact) are surprisingly few constraints. Intended audience is one cause of variety I have touched on, but the resulting variation goes much further than Dodds' use of square brackets to warn the 'schoolboys' in 1944 away from expert notes. A more recent commentary to the play assumes, for example, that the monolingual reader has no classical education whatever and so provides pronunciation help for the proper names (Bagg [1978]). I

[63] I exclude as invalid as well as unwise the proviso that in an artifactual analysis we only consider 'serious' commentaries, thus possibly excluding, for example, Gilbert Murray's on the *Bacchae* in 'The Athenian Drama for English Readers' series (1911), perhaps even Geoffrey Kirk's considerably more sophisticated commentary on the same play with English translation (1970). I am also very cautious to label any instance of the variety we find as meaningless. For the range of classical commentaries see also Kraus (above) 8, also (on translations) 3 n.12.

cite this example not to argue that we need to accommodate a widening range of readers (which we do) in his way (perhaps not), rather to illustrate how an assumption of audience permeates the work. This becomes significant to analysis of components when we note how physical boundedness defines the immediate context for anything within a codex. Thus the author can reasonably assume that the reader has read what comes before, has been otherwise exposed to its physically present 'paratext' or will look around within the book if puzzled.[64] Hence a great number of tiresome things do not need to be stated for each part of a bound book in order to avoid massive disorientation—a very well recognized and much discussed problem in cyberspace.

In the face of this variety, which would seem fatally to compromise the separability of components, commentary in cyberspace may appear in danger of heading for quite a different result, one fears: interoperability at the high cost of conformity. The technical problems are indeed very hard. A well-known tendency in computer science is to simplify hard problems so that, as David Hilbert wisely remarked, they are difficult enough to entice the researcher but not so completely inaccessible as to mock at his or her efforts (Hilbert [1900] 254). Agonistic collaboration seems inevitable, but we need to be prepared for it by understanding the extent of the problem—the now discovered 'fertility of problematization' that the codex fostered—the solutions we might turn to and what compromises (if any) we might be willing to make.

Such problems continue all the way down to the commentary paragraph, which likewise displays substantial variety, from the tightly focused discussion of textual variants particularly characteristic of earlier examples to the discursive mini-essay with footnotes.[65] In the later examples, citation is not simply or perhaps even primarily to the text commented on but especially to the wealth of primary and secondary material conventionally brought into play. The final question

[64] See Genette (1987), (1997) for "those liminal devices and conventions, both within and outside the book, that form part of the complex mediation between book, author, publisher, and reader" (frontispiece).

[65] For the former see (e.g.) Elmsley (1821) or Hermann (1823); for the latter Dodds (1960), with Cruickshank (1893), Sandys (1900) and Tyrrell (1928) approaching. One would suppose that the separate commentary volume, such as Roux (1970), would especially favor the mini-essay. See further Budelmann 157–61 and Henderson 227 (both above).

I wish to raise is exactly *how* this wealth is and might be brought into play.

Citation is especially important for my purposes because it so obviously converges on an analogous computational device, the hyperlink. Indeed, it is this convergence of devices that prompts us to think the commentary an ideal genre to computerize. We must therefore be very cautious. Stuck (e.g.) on the tribrach in line 662 of the *Bacchae* and puzzling over the cogency of Dindorf's suggested emendation, it is all too easy to end our thinking with the thought that it would be really rather nice if Dodds' commentary were on the Web and so his reference *ad loc* to 'Descroix, *Trim. iamb.* 159, 162' only a click away.

This thought would be the right one, without qualification, if 'citation' and 'hyperlink' were entirely synonymous or if they referred with minor variation in meaning to the same phenomenon, but they are not and do not. The distinction between them is in fact of such importance that, it would be fair to say, the future of commentary in the electronic age depends on our understanding it.

'Hyperlink' is a curiously elusive term, though not quite as slippery as 'hypertext' or the more general 'hypermedia.' The problem with these terms is that they are ill-defined abstractions we mistake as well-defined, concrete things. They are nevertheless very useful because no one yet knows the full range of possibilities for implementing referentiality; meanwhile they serve as stopgaps for expressing in a vague sort of way what we can only partially, though significantly, realize. The hyperlink as most of us experience it, on the Web, is widely recognized to be brutally simplistic in the context not only of what is described in technical typologies and specifications but even of stand-alone systems built decades ago.[66] The experts who write about the possibilities tend silently to assume this context, so that the rest of us are less than able to follow. How possibly, we are apt to wonder, can hypertext be all *that* powerful when what we see on the Web is clearly not?[67] I note again with-

[66] For technical specifications and standards, see especially DeRose (1989) and McCarty (2000) II.A. The superior sophistication of several early systems is a commonplace; see Van Dam (1988), DeRose and Van Dam (1999), and the entries listed in McCarty (2000) II.A.

[67] I acknowledge that simple, even simplistic things can be deployed in powerfully consequential ways, but here I am concerned rather more narrowly with the semantics of reference within the link.

out stopping to develop it further, the need for a meeting of minds: we would benefit considerably from the literature of hypertext research (McCarty [2000]); computer scientists correspondingly, from the commentary literature.

Allow me to illustrate the difference between hyperlink and citation by considering some specific examples from Dodds' commentary on *Bacchae* 661–2, included here as Figure 1. I will make only a few rather simple points about this particular patch of rough ground.

661–2. 'Where the white snow's glistening falls never loose their grip.' If this means, as some suppose, that it never stops snowing on Cithaeron, the exaggeration is monstrous; it is still considerable if we take it to mean that the snow lies in places all the year round (I found none when I climbed the mountain in April). We may have here nothing more than a conventional poetic commonplace (Meurig-Davies, *Rev. Ét. Gr.* lxi [1948], 366); but I suspect that Eur. insisted on the snow because it was the right setting for a strange tale of maenadism: on Parnassus, and probably on Cithaeron too, the ὀρειβασία was a mid-winter rite. Like most southern peoples, the Greeks felt (and still feel) snow to be a little uncanny: to early poets the snowflakes were, like the lightning, κῆλα Διός, 'shafts of God,' a threatening visitation from the skies (*Il.* 12.280, cf. Wilamowitz, *Die Ilias u. Homer*, 216). So Sophocles, describing the horror of Niobe's eternal vigil upon Sipylus, says χιὼν οὐδαμὰ λείπει (*Ant.* 830). **βολαί** usually 'acts of throwing,' can also mean 'things thrown,' just as βαφαί can mean 'things dipped' (e.g. poisoned arrows, *Her.* 1190). The translation 'radiance' (L.S.)[9] is quite unjustified. For **εὐᾱγεῖς**, 'bright,' cf. Parm. 10.2 εὐᾱγέος ἠελίοιο and other passages quoted in L.S.[9] The original spelling may have been εὐαυγεῖς, as in διαυγής, τηλαυγής, ἀξαυγής (πώλων . . . χιόνος ἐξαυγεστέρων, *Rhes.*304).[1] [Verrall's notion that 662 is interpolated, the messenger having broken off his sentence at ἵν' οὔποτε, is surely incredible. And the line seems to have been known to Seneca, who was misled by it into citing the absence of snow on Cithaeron as a symptom of extreme drought, *Thyestes* 117f.—ἀνεῖσαν χιόνος L. Dindorf, to avoid the tribrach composed of a single word coinciding with the foot. But this rhythm, which is rare in Aesch. and Soph. (except in the first foot), is admitted relatively often in the later plays of Eur. (Descroix, *Trim. Iamb.* 159, 162). There are at least five other instances in the *Bacch.*: second foot, 18, 261, 1302; fourth, 731, 1147.]

[1] Cf. now G. Björck, *Das Alpha Impurum*, 147.

Figure 1

Let us begin with the reference in Figure 1 to 'Maurig-Davies, *Rev. Ét. Gr.* lxi [1948], 366.' My argument in particular is that this citation is not identical to a hyperlink which takes us (in a loose sense) to the referenced page, nor is it the same kind of thing unless we choose to restrict ourselves to a very high level of generality—and so lose our footing on Wittgenstein's *Glatteis*. Since printed reference and hyperlink are in two different media and have markedly different attributes, our effort in translation significantly obscures both if we think of them as the same. Nor is it correct to assume that one (the link is the technologist's obvious candidate) improves upon the other: this would prejudice our results by downgrading attributes of the supposedly inferior one before we were able to see them both for what they are. They are simply different.

'Maurig-Davies, *Rev. Ét. Gr.* lxi [1948], 366' and other printed references are, we might say, highly coded, conventionalized sets of instructions on how to find the items in question, should you choose to seek them out at some considerable trouble, expenditure of time and perhaps money. Such deterrents have the effect of putting what seems to have been in the author's judgment quite secondary, here Maurig-Davies' *ipsissima verba*, out of reach. To have quoted them would have been to make a very different kind of statement. How would one translate such a reference faithfully into electronic form? The possibility of immediate leap into the full-text of the article might well distort the commentator's intention even further, and so foreshorten his expressive range.

A second example. "For **εὐᾱγεῖς**, 'bright,' cf. Parm. 10.2 εὐᾱγέος ἠελίοιο and other passages quoted in L.S.[9]" turns on Goldhill's 'grounding problem of the commentary format,' the infamous *cf.*[68] My point here is that the reader is almost certain to have a copy of the ninth edition of the Liddell and Scott *Lexicon* to hand and so (unlike the previous example) is apt to look up the passages to which Dodds refers, hence also to encounter the other senses of the word, "2. of actions, *holy, lawful* . . . 3. of offerings or services, *undefiled*: hence, *lawful*. . . ." Would a hyperlink directly into the full *Lexicon* suit perfectly, or would the future Dodds wish to shape the reader's expe-

[68] Goldhill (1999) 397; Gibson (above) 331–56. I will not attempt an analysis of Dodds' usage but refer the reader to Goldhill (393–409) for an extensive unraveling of another case.

rience, e.g., by causing the first sense to appear highlighted or by selecting it exclusively? (Both would require a more sophisticated linking technology than available on the Web, but that is only a matter of implementation.)

A third and final example. In reference to the snow on Cithaeron, the commentator adds parenthetically, "I found none when I climbed the mountain in April," and he goes on to make some anthropological observations about the Greeks. The image of Dodds climbing the sacred mountain to be *there*, at the site of the ὀρειβασία, speaks volumes, but which of these do we judge relevant to the purpose? Would a future Dodds want to substitute or add a video clip of an ascent? As for the anthropology, one can imagine (as so often in this great commentary) wanting to go off to read much more, especially if anthropological interests brought one to the *Bacchae* in the first place. So, might the future Dodds supply a hyperlink to a monograph on the uncanny in meteorological phenomena?

Questions of authorial intention seem legitimate to ask of citations: they are nominally, after all, encoded actions. One wants to know, as Goldhill points out, what one is expected to do. Unresolvable as this sometimes is, its technological function in this historical moment is to ask what might comprise an adequate artificial language in which to make our cyberspatial references. The goal is to put in hand an adequate set of referential building-blocks, so that the making of worthy online commentaries can proceed, and to have perhaps in other hands the means to devise other building-blocks as use of the first, bootstrapping set reveals. If I am right about the development of computing, then history, computer science, and the mass market are all unwittingly on our side. Like a patient in a hospital, we can feel considerably more secure than otherwise because we have a very, very interesting case.

11. *Conclusion*

I fear that most of the above will repel my intended audience of classicists with a formidable vision of unexpected difficulties, as if one were to reach out for a light-switch but encounter an untried treatise on electricity—or more accurately, its future author, still unclear about what to say. This was not, I think, the kind of problematization that Fowler had in mind when he praised the great

Norden for opening up difficulties in *Aeneid* 6.469 ([1999] 442). Yet, I would argue, all of the above is in the spirit of his mischievous, deeply intellectual purpose, to make the important things harder to ignore, to help us stay awake.

Consider what is on offer immediately: the chance not merely to rethink everything to do with the commentary form, rather more to do so in constructivist terms. These terms are made meaningful by the tools we now have, which although primitive do allow us successfully to fashion "crude but functional electronic artifacts" (Peters [1994]). These are far from adequate—our artifacts should always seem so—but they are enough in the world of things to encourage powerful thought-experiments. In the world of computational things we tend to value intricate, complex, algorithmically sophisticated tools, and so to undervalue what we have, "a stone adze in the hands of a cabinetmaker" (Bush [1965] 92). Yet the hand-operated printing press, handmade type, ink, and paper were also 'crude but functional'; if we look to our books we can see what inventive souls did with them.

So many basic matters have been stirred up by the advent (note that word!) of computing that we need to be very alert and hardy enough to chop through all sorts of tangled mental growth on our way to the imagined garden. Or so it may seem. In the book by Peter Matthiessen whose title I quote in the dedication, the jungle is one place seen successively through the eyes of three people: a Protestant missionary, a Catholic priest, and a native. One tends readily to recognize oneself in either the first or the second; the native, however, is at play, and for him the jungle is 'the fields of the Lord,' or—in an alternate translation of Isaiah 32:12—'the fields of desire.' Engaging the old problems yet again, in a new and interesting form, is a sign of life.

Is there anything new under the sun? I think of the Israeli poet Yehuda Amichai's poem on his thirty-second birthday:

> And my good deeds grow smaller
>
> and smaller. But
> the interpretations around them have grown huge, as in
> an obscure passage of the Talmud
> where the text takes up less and less of the page
> and Rashi and the other commentators
> close in on it from every side.

With no disrespect to all the commentators, computing can send them packing when they're not wanted, bring them back, make them primary, concord their words, and so on, as can be imagined. The activity which computing greatly, newly enhances is endless, serious play. Perhaps the most important new thing for us is the prospect of dealing more imaginatively, deftly with tradition than we could before. And commentary practice also looks forward in another sense, to a greatly expanded though solidly traditional role it could take. In the disaggregated docuverse, what is so clearly needed is the knowledge of how to reaggregate. Commentary is our expression of that knowledge.[69]

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[69] I am grateful to Gregory Crane for pointing out that "the web, which tends to present 'morsels' . . . creates a vacuum that clamors for commentary. . . . [T]he comment attached to the fragment one is reading will become more and more prominent, because *that* is how text is going to be experienced and because it's *easy* to link text to commentary" (e-mail 5/6/01).

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