The futures of digital humanities is a matter of words

> ἔνθα καὶ ἠματίη μὲν ὑφαίνεσκον μέγαν ἱστόν,
> Then by day I would weave at the great web,
> νύκτας δ᾽ἄλλύεσκον, ἐπεὶ δαΐδας παραθείμην.
> but by night under torchlight I would unravel it.
>
> Homer, *Odyssey* 19.149-50

For Wayne McKenna

1. Prologue

The job I have been given is to take up "the whole question of digital humanities and the digital mediation of knowledge among the various humanities disciplines" with a view to "what's driving the change, where it is heading, and what the humanities might look like as a result" – and "what 'new media' might mean in this context".[1] I am tempted to ask ironically in return, "Is that all?" The question is fascinating and needs to be asked, but where does one begin on such a vast and uncertain project?

First, however, allow me to anticipate what I think an adequate response might be. For reasons I will explain it could not be what we almost always get: a projection of current technical know-how into an imagined future. Rather it would have to be a history written to address current predicaments in order to open up the complexity of the present as staging-post for the future. Its historiography would have to look like a perpetual weaving and unweaving of many threads, or like a bird's-eye view of a complex drainage system: strands of quite separate development or channels of diverse influence coming together and intermingling for a time before dispersing to mingle again elsewhere.[2] Speaking of the future, Terry Winograd and Fernando Flores have argued that,

> All new technologies develop within the background of a tacit understanding of human nature and human work. The use of technology in turn leads to fundamental changes in what we do, and ultimately in what it is to be human. We encounter the deep questions of design when we recognize that *in designing tools we are designing ways of being*. By confronting these questions directly, we can develop a new background for understanding computer technology – one that can lead to important advances in the design and use of computer systems. (1986: xi, my emphasis)

They suggest that confronting these questions also means bringing as much as possible of that unspoken understanding into the light so that it may be implemented or used to guide the design of things to come. This is no simple matter: such understanding is *tacit* and, its behaviours show, so highly variable that only by virtue of subtle argument can we even get close to speaking of "human nature and

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[1] Private e-mail, John Hartley, 4 May 2011, quoted with permission.

[2] Cf. Thomas Haigh in Mahoney 2011: 13.

human work" meaningfully. At the local level of the digital humanities we have more than half-century of work to draw upon. With this resource we can reasonably suppose that if we could only figure out how to be properly historical the discipline's past could tell us enough about what this discipline is that we might then articulate its intellectual trajectory. Then not only would we have a better purchase on its most promising futures, but we would also know how to look for the help this emerging discipline needs and have reason on our side when we adapt promising theories and practices to its requirements.

That gets us to the historical record, without which a forward-looking vision is likely to be a waste of time. But forming it into a genuine history is also a challenge: no one has yet done it, as holds true for computing generally (see Mahoney 2011). I won't do it here because I don't know how, but I will suggest some indications of its difficulty and its fascinations.

2. Projecting the future

I began by saying that projecting the future from known technological possibilities is a mug's game. However difficult the technical challenges and obviously desirable their solution would be, thinking in terms of inevitable outcomes is undesirable because it obscures choice and injects an enervating determinism into the discussion. We are in effect told, behold and prepare for what will be! – or more cautiously, behold what might be! But giving ourselves one *might be*, or two or three, or any number we can hold in our heads, is still too heavily deterministic (a topic I will return to later). What we need as builders of this future is to be ready in the moment to reimagine the outcomes of our previous efforts as these have been unpredictably realised in a world we can explore but not control.

The problem for the prognosticator is that the social world in which technologies are embedded does not stand still, stay uninvolved or simply acquiesce. An example of the error is computer scientist Ian Foster's "How Computation Changes Research", in which he places us in the year 2030 when, he imagines, developments have been realised as seems probable from observations of current technology (Foster 2011). His futurology runs aground on "the sheer number and scale of… problems not touched upon", as Alan Liu comments in a response accompanying Foster's essay (Liu 2011: 94). "Ultimately, perhaps we will not just work at knowledge", Liu rhetorically allows, "We will really *know* (i.e. make sense of it all)" (89). But who actually is this "we"? he asks. All of us know from science fiction what happens when you straightforwardly project ordinary life into a technologically advanced future. The movie *Just Imagine* (1930) is a good example: New York depicted as if in 1980 but inevitably populated by 1930s people behaving and thinking in 1930s ways amidst technologies that may not have been commonplace then but have a distinctly 1930s look.[3]

[3] See www.imdb.com/title/tt0021016/ (1 August 2011).

Liu notes that such predictive speculations conveniently ignore the messy "social, economic, political, psychological, cultural, and ethical" dimensions of human existence. Like him I am cautious and critical, but I hang back from prognostication for a simpler reason: its vulnerability to the unpredictable or even merely the overlooked. Perhaps not just fortuitously, Liu's summary formulation, "We will really *know*" echoes the emphatic declaration inscribed on mathematician David Hilbert's tombstone, *WIR MÜSSEN WISSEN / WIR WERDEN WISSEN* – "We must know, we will know!" – which he spoke in September 1930 (Vinnikov 1999). Within six years, before his death in 1943, hope for knowing in the mathematical sense he intended had been destroyed, first by Kurt Gödel's incompleteness theorem (1931), then by Alan Turing's negative proof of the "decision problem" (1936) – in a paper in which, as by-product, we get Turing's sketch of the abstract machine from which the changes I am asked to survey, and all that brings us together here, have in part come (McCarty 2005: 167-70). As so often happens, out of a passion for an absolute – in Hilbert's case, an axiomatic bedrock to mathematics – erupted numerous fructifying questions and a host of unforeseen, and I think unforeseeable, consequences.

Figure 1

If even within the rigorous world of mathematics world-altering surprises are possible, then how much more so for technological invention and its complex outcomes?[4]

3. Writing the history

As I suggested, the historian's response is that we prepare ourselves for what is to come by understanding where we have been. For the digital humanities in the first instance this means looking to the last 60 years of professional literature on the subject. The writings of the early period, from the first work in 1949 (Busa 1980) to the public release of the Web in 1991, yield the most helpful results because computing was new then, and the need to justify and explain its relevance to the humanities was commonly felt. Furthermore, as I will explain later, we have reason to think that the first decades of this period gave a kind of stamp to the field that has had great shaping influence on what has followed.

Historian of computing Michael Mahoney argues that typically an innovative field

[4] Consider, for example, IBM's announcement (at the time of writing) of "cognitive computing" circuitry in a working prototype which, if equal to the promise, would change what we mean by "computer". See the press release, 18 August 2011, www-03.ibm.com/press/us/en/pressrelease/35251.wss (20/8/11).

constructs its legitimacy by identifying precedents (2011: 56). To recall my recent metaphor, the field weaves its interrelations with the past from available strands and so creates a history in order that its innovations may fit into a recognizable tradition and be understood. But the fit is seldom or never perfect. Between computing on the one hand and the humanities on the other – at that time as two-cultured as we might imagine – the fit was very rough. Thus in the early years we find anxiety occasionally overcoming professional decorum when the massively publicised, enormously hyped, culturally prestigious and successful machine from the techno-sciences came into contact with literary texts, artistic images, sculptures and music. Technical difficulties were painful in ways we can now hardly imagine, but of more enduring historical value are the struggles for recognition within the disciplines of application. Matters came to a head in the mid 1960s when the honeymoon period seems to have ended for humanities computing (and almost simultaneously for machine translation and artificial intelligence).[5] A genre of complaint and blame fixing lasting almost to the present day began then, inaugurated by the first article of the first issue of the first professional journal of the field, *Computers and the Humanities*. In "The Next Step", literary critic Louis Milic expressed his impatience with the unimaginative though useful work published to that point (Milic 1966). His view from within must have been widely shared in related disciplines, though perhaps for different reasons, since it soon became evident that mainstream critics were not even bothering to notice work that should at least have upset them. By 1989 it was clear, as Rosanne Potter wrote, that literary computing had "not been rejected, but rather neglected" (1989: xvi). When she reviewed the subject two years later for *Computers and the Humanities* Potter identified 9 articles reflecting on the state of the art. All of these, she noted, pointed to theoretical poverty, the most incisive of them indicating as the core problem the dominant and highly positivistic "idea of text" taken from ageing New Criticism (Wittig 1978). This diagnosis seems not to have had much of an effect on the inertial course of the field, however. Jerome McGann observed it still to be the case for the interpretative core of the humanities at the beginning of the 21st Century (McGann 2004), despite the popularity of the digital humanities in the forecourts of interpretation.

The stalemate becomes historically significant when we ask Anthony Kenny's question: why "computers came just at the wrong time… when scholars' interests were moving from textual studies to critical theory" (1992: 9-10). Was the move to the theoretical high ground in the 1950s and 1960s in some sense a reaction to the juggernaut of quantification fuelled by the spectacular early successes of computing, as Kenny speculates? This juggernaut arose in the Anglophone world with the triumphalism of victory in World War II, in which superior technology played a spectacular role and the utopian promise of computing seemed limitless. But as the immediately subsequent Cold War progressed, the computer began to take on sinister baggage through the uses to which it was put, for example in workplace

[5] For humanities computing, Milic 1966; for machine translation, ALPAC 1966 and Wilks 1972: 3-4; for AI, ; Dreyfus 1965.

automation, military defense systems and in the "electronic battlefield" of Vietnam.[6] These remained culturally dominant until, in 1991, the end of the Cold War and the beginning of the World Wide Web inaugurated a great change.[7]

I am radically simplifying the historical situation here (also omitting the role of personal computing hardware) in order vividly to raise a crucial series of questions: why did these events happen when they did? How are they connected? More generally, what *is* the scope of an historical enquiry into the digital humanities? How far afield must we go properly to contextualize it? Strands of development come together, but why? By what kinds of circumstances or forces are they nudged or triggered into relation? My specific purpose in asking is to begin to tease out a way of understanding technological history that can then be used to ask what beyond specific digital phenomena is shaping the cultural forms of the digital for the future, and how this shaping is to be grasped so that we might be shapers as well as shaped. Was there a process at work then which we can see now?

The occasional clues within the professional literature of those initial decades – mostly anomalous remarks and odd emphases – may seem quite minor and thoroughly dated, but they are worth following up to get to the desires and fears of the time. (Again we are schooled to ask the same of the present for the future: what are our shaping desires and fears?) These prove significant beyond their bulk and time. Two examples.

First is the repeated linking of the computer with "drudgery", especially during the early period. It is true that the burden of calculation prior to machinery was a very real problem: it required mathematical abilities but made their exercise unworthy of those caught up in the activity (Pratt 1987: 20-44; Goldstine 1972: 8ff). Drudgery in the humanities is much rarer, but it can be found, more in some kinds of work than others.

Milic zeroed in exactly here. He noted that while good things were being made as a result of offloading drudgery onto computers, scholars' discovery of relief from "the brute labor of scholarship" had already led to their shift of interest from exploration to the type of work that "puts a premium on labor-saving" and so holds them "to projects which do not begin to take account of the real complexity and the potential beauty of the instrument". They were, he thought, "in danger of becoming [the machine's] victims" or mere attendants (1966: 3-4). He noted "the odium likely to greet" (which in fact did greet) some of the more imaginative ideas on offer – such as the automatic poetry-generation that linguist Margaret Masterman promoted as

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[6] On workplace automation, see Zuboff 1984; on computing in the Cold War, Edwards 1996; on the Cold War more generally, Whitfield 1996/1991.

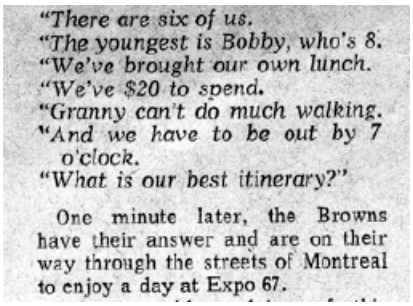
[7] The events in question are these: Tim Berners-Lee's initial proposal for an information management system, March 1989; the fall of the Berlin Wall, November 1989; Berners-Lee's formal proposal for a "WorldWideWeb", November 1990; public release of the Web, August 1991; dissolution of the Soviet Union, December 1991.

research into poetics.[8]

Now as then assigning the role of drudge to computing tends severely to militate against imaginative play, participatory exploration or experiment. It also, as Milic and others noted, invokes the language applicable to those devoted to a life of drudgery, namely servants and slaves. Once that language becomes the language of computing, the machine is thereby anthropomorphized as an underling; the technicians who tend it fit all too easily into the all-too-familiar position of "rude mechanicals"[9]. Caught up in the master/servant dialectic, high-status users, such as senior academics, tend to be affected analogously as masters are by their servants, that is, put into a relationship often imagined as that of parent to child. As Ruth Gladys Garcia has shown, this relationship is, however, potentially quite ambiguous, readily flipping polarity so as to infantalise the master (Garcia 2009: 11). But whichever polarity is active, separation is ensured, inequality reinforced and (by our lights, certainly) the potentialities of both master and servant attenuated. Projection of the ancient social model onto the machine and into the culture of its use thus works powerfully against design for conversational interaction – against the computer as interlocutor and for it as passive respondent – and so shapes the future of the discipline and all it touches.

The problem we have had and continue to have – and will have if we do nothing about it – is illustrated by the striking similarly of two near-term predictions for computing, one made in 1965, the other in 2001.

The first (Figure 2), written nearly 50 years ago by a correspondent for the Toronto *Globe and Mail*, imagines a typical domestic quandary soon to be solved, the journalist thinks, by a massive mainframe. The other, a decade old but still current, carries the name of the inventor of the World Wide Web, Tim Berners-Lee, in a prominent *Scientific American* feature on the so-called but yet to be realized Semantic Web:


"There are six of us.
"The youngest is Bobby, who's 8.
"We've brought our own lunch.
"We've $20 to spend.
"Granny can't do much walking.
"And we have to be out by 7 o'clock.
"What is our best itinerary?"

One minute later, the Browns have their answer and are on their way through the streets of Montreal to enjoy a day at Expo 67.

Figure 2 (Webster 1965)

> The entertainment system was belting out the Beatles' "We Can Work It Out" when the phone rang. When Pete answered, his phone turned the sound down by sending a message to all the other local devices that had a volume control. His sister, Lucy, was on the line from the doctor's office: "Mom needs to see a specialist and then has to have a series of physical therapy sessions… At the doctor's office Lucy instructed her Semantic Web agent through her handheld Web browser. The agent promptly…. (Berners-Lee, Hendler and Lassila 2001: 36)

[8] On computerized poetry, Masterman and McKinnon Wood 1970 and Masterman 1971; cf Leavis 1970 for a severe reaction; note Milic 1966.

[9] The term is Shakespeare's, referring to Bottom and his fellows in *A Midsummer Night's Dream*, III.ii.9.

Since 1965 progress has clearly been made in all but the imaginative form of computing: nearly forty years on computing is still in the popular imagination an obedient servant assigned to drudgery.

Identifying the computer thus and so reconfiguring the user as liberated for another purpose also invokes the curiously vacuous ideal of leisure, with the nagging question of what the thus liberated person is to do, hence what he or she is then *for*. It points also to the disturbing social effects of automation rippling through the society from long before Taylorian principles and Fordist practices codified industrial relations (Zuboff 1988); indeed, it identifies industrial automation as the future. While the release of Charlie Chaplin's *Modern Times* and the publication of Alan Turing's crucial paper in the same year, 1936, is a coincidence (but both responding in their very different ways to the same thing?), nevertheless the circumstances of work depicted in both have repeatedly been dominant in applications of computing.

Nor has the "knowledge worker" been spared. Effects on intellectual work have not simply been a matter of making it more convenient, for although artificial intelligence has progressed more slowly than expected, the distinction between knowledge known and information processed has been steadily eroded. This erosion began very early in the scientific work given specific form by Turing;[10] it entered the public sphere through popularisations in newspapers, magazines and books, such as Edmund Callis Berkeley's *Giant Brains, or Machines that Think* (1949), and was reinforced by highly respected experts. The possibility of the computer transgressing one of the few remaining areas of human uniqueness, the ability to reason, could thus have seemed imminent to scholars from the beginning of the digital humanities. Traces in the professional literature tell us that the threat seemed real enough, opening up the question of what remained for the scholar to do, and thus to be for.[11]

Despite the technologist's many disappointments by problems that have proven far more difficult than initially suspected, this threat lives on, though the level of hype has declined. It is given real bite, however, by a tradition that goes far beyond the immediate historical circumstances of computing's entry into the broader culture. I am referring to the general assault of the sciences on human identity. Sigmund Freud's often repeated catalogue of the "great outrages against [humankind's] self-love" is the best known account: he lists Copernicus in the 16th Century, Darwin in the 19th and then himself, for "the third and most irritating insult… flung at the

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[10] The influence of machine on brain and brain on machine forms a cybernetic loop: from Turing's imagined mathematician to his abstract machine (1936); from that machine to McCulloch's and Pitts' model of the brain (McCulloch and Pitts 1943); from their brain to von Neumann's design for digital machinery (1945, as we know from its neurophysiological vocabulary and McCulloch 1961: 9); from that design to models of cognition; and so on. Cf Otis 2001 for the reciprocal relationship between ideas of the body and designs for machines.

[11] See e.g. Pegues' curious reassurance that "The purpose of the machine is... to free the humanist for the important work of literary criticism by providing him with large and accurate masses of data that may be used by him in the work *which only he can accomplish*" (Pegues 1965: 107, my emph.); Nold 1975.

human mania of greatness" – the psychoanalytic discovery that we are not masters of our own house (1920: 246-7). But, as the molecular biologist Jacques Monod explains (1972/1970: 47-8), the moral imperative to defeat human self-deception that Galileo championed is by its very nature set against humankind's anthropocentric illusion. Hence with the progress of the sciences Freud's list can only be the beginning of an indefinitely extensible catalogue that has in recent years seemed to grow by the day. From its very beginning computing has inspired and powered the assault as well as joined it.

Hence – so my argument goes – the clues of a profound disquiet about digital machinery we find in both high- and low-brow journalism, advertising and other forms of popular literature, including cartoons and comics, especially but not exclusively during the early period. Such publications are an obvious first port-of-call not only because they were so quick to react but also because scholars when at home could not have avoided at least some of them. These sources of scientific information, gossip, speculation and hype demonstrate among other things that beyond doubt scholars were exposed not only to the claims and fantasies about computing but also to the genuine excitement surrounding the new machine. The question then becomes why they were not more curious than they seem to have been – why, as Milic said, they were satisfied "with such limited objectives" as we find in the professional literature (1966: 4). "We are still not thinking of the computer as anything but a myriad of clerks or assistants in one convenient console", he concluded. And here, again, is the question to whose various forms I keep returning: What about now? To what degree do we think any differently today?

By far, unsurprisingly, the most imaginative and enthusiastic responses to computing outside of its immediate developers came from artists, actors, filmmakers, novelists, poets, architects and makers of other cultural artefacts. Catalogues of exhibitions, such as *Cybernetic Serendipity* (Reichardt 1968), numerous articles in the journal *Leonardo* (1968-), the historical retrospective essays in *White Heat Cold Logic* (Brown et al 2010) and cultural histories such as Katherine Hayles' *How We Became Posthuman* (1999) and Hugh Kenner's *The Counterfeiters: An Historical Comedy* (2005/1968) document the wealth. To choose but one example: the career of Gordon Pask, creator of "maverick machines" (Bird and Di Paolo 2008), suggests how surprisingly, wonderfully adventurous the early experimenters were – we might say, so far ahead of their time as still in essential ways to be ahead of ours. And again I ask, why is that? What is holding us back? What went wrong?

Looking back at that early period in the digital humanities we must ask why such dull choices were being made. Practitioners were not forced by the technology, however primitive-seeming to us, to choose as they did. We know by looking to those wild artistic productions the great degree to which they were not forced. And yet again, looking from the present into the future, considering what seems an imaginative pathology, we must ask how we might treat the disease so as to do better?

5. Destinations evolve

So far I have argued that predicting the future by projecting it from current technical know-how misleads: it ignores the multiple contingencies of history and human nature and so cannot prepare us to become knowing actors in making the future where it is made, in the present moment. I have argued that the history of the digital humanities, which we neither have nor know how to write but can begin to glimpse, is essential to that preparation. I have indicated how, once we allow ourselves to look outward into popular as well as scientific and scholarly contexts, the facts we do have begin to suggest the questions out of which history could be written. I have indicated a few of these. In the remainder of this chapter I want to turn first (in this section) to question our freedom in doing anything about the future, then (in the next) to consider what we might do.

Better *techné* should mean greater freedom to change the material conditions of life for better or worse, but discussions involving it so often imply an inevitable outcome, therefore a narrowing rather than expanding of possibilities. The deterministic language we find ourselves using – "impact" is currently the worst but not the only offender – implicitly places us in a space populated by objects like billiard balls, acted on by forces beyond our control, acting on others by impacting them.[12] I myself have verged on such language by suggesting we think about a *trajectory* for the digital humanities, though I was implying a piloted vehicle of exploration rather than an unmanned projectile. But now I want to be more cautious than before, not just to avoid suggesting that scholarship is a helpless creature of Fate but also to question our whole way of speaking about these matters. For if we cannot get around this deterministic way of speaking, we cannot begin usefully to imagine the possible futures of the digital humanities, or anything else involved with technology.

When television was still relatively new, Raymond Williams began his study of its effects by noting the technological determinism in ordinary discourse:

> people often speak of a new world, a new society, a new phase of history, being created – 'brought about' – by this or that new technology. Most of us know what is generally implied when such things are said. But this may be the central difficulty: that we have got so used to statements of this general kind, in our most ordinary discussions, that we can fail to realise their specific meanings…. For behind all such statements lie some of the most difficult and most unresolved historical and philosophical questions. Yet the questions are not posed by the statements; indeed they are ordinarily masked by them. (2004/1974: 1).

The curious fact is that although this determinism is trivially easy to dismiss as simply "wrong-headed superstition or… a form of false consciousness",[13] brushing it aside is evidently no cure: the majority of people, inside the academy and beyond, keep on talking as if machines made history. What is worse, by suggesting that

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[12] On "impact" see Law and Whittaker 1986 (quoted below); Pannabecker 1991 and Petrina 1993; Edwards 1994.

[13] Wyatt 2008: 172. On determinism see also the essays collected in Smith and Marx 1994.

nothing but perversity or stupidity is causing us to be so wrong-headed, dismissal only re-masks the important questions to which Williams has pointed.

Writing specifically about the metaphor of "impact", John Law and John Whittaker argued some years ago that,

> Our problem… does not lie in the fact that consequences, sometimes good and sometimes bad, have followed from the introduction of new technologies…. It lies, rather, *in the vocabulary that is used to describe these consequences*. This vocabulary is Newtonian in character. [Computers] are treated as being like projectiles which arrive from [wherever] and subsequently have an "impact" on social arrangements. It is as if the social world were best seen as a set of craters, the passive target of bits and pieces that are lobbed at it. This is surely wrong. (1986: 21)

Surely it is. But, as they say, the important matter here is the vocabulary – the words that bear the implicit perspectives – not the truth or falsity of any proposition these words are used to articulate.[14] In his essay on television Williams seems to me exactly right when he argues that "the reality of determination is the setting of limits and the exertion of pressures, within which variable social practices are profoundly affected but never necessarily controlled" (2004/1974: 133). But beneath the level of argument and beyond the specialised fields where it happens – hence in all the other academic disciplines and in the popular media – the billiard-ball/projectile analogy of impact, borne into use by its vocabulary, keeps uncritical belief in circulation. What can be done?

My suggestion is first to examine the remarkably successful analogy of impact close up so that we may figure out where its weaknesses lie, then to look for a stronger one, providing a better way of thinking and speaking. Some analogy is required because that is how we reason, by inferring conjecturally from the known to the unknown, or from simpler systems that we understand to more complex ones that we don't. Unlike a proposition, the correctness or incorrectness of an analogy is beside the point – all analogies are false by definition. Rather they are useful in proportion to their strength. Thus the projectile analogy isn't so much wrong in itself as it is weak. The question we need to ask is how it fails: how is the computer *not* like a projectile, the disciplines *not* necessarily like a defenceless and passive target?

The projectile's otherness with respect to its target holds true: the digital computer *did* originate elsewhere, in the techno-sciences of warfare and commerce, and remains a techno-scientific instrument. So also the machine's autonomy, since by definition and design it *is* an automaton. The radical change in our working practices

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[14] Here I use the terms "metaphor" and "analogy" more or less interchangeably; both are highly polysemous terms. For the literature on analogy see the summary in McCarty 2005: 28-9. The work on metaphor over the last three decades has shown that figures of speech are figures of thought with profound consequences for everything we do; see esp Ortony 1993 (first edition 1979) and Gibbs 2008. Note also Morgan and Morrison 1999, whose collected essays show that scientific models do not merely stimulate research but also shape and direct it; also see McCarty 2005: 20-72.

likewise confirms the aptness of a projectile's forceful impact. But the analogy breaks down fatally when we consider the necessarily instantaneous and irreversible linearity of this impact. Truth to computing in any discipline or other human culture requires cybernetic feedback between incoming technology and recipient practices, in an interaction that continues for as long as we wish to imagine, in ways that are not predictable and in which the technology is continually modified by its recipients. To put the matter another way, the analogy fails because no projectile's target has the remarkably robust self-identity of human social institutions, which change much more selectively than promotional hype would lead us to believe. Change in them is negotiated and very often rejected. How else could the library, for example, have endured in recognizable form for the last 5,000 years?

As an alternative I suggest that we look to the sciences of our times for an analogy that preserves otherness and forceful change but substitutes interaction for impact and assertive self-identity for passive victimhood. Rather than think in terms shaped by linear causality – which, again, is not simply wrong, rather inadequate to our more complex problem – I suggest drawing an analogy from biological evolution. A very strong candidate is molecular biologist Jacques Monod's formulation of evolutionary struggle, not for a Spencerian "survival of the fittest" in contest among individuals but between an organism's genetically programmed "reproductive invariance" and the randomness of the environment in which the organism lives. In *Chance and Necessity: An Essay on the Natural Philosophy of Modern Biology*, Monod makes a persuasive case for the origins of the entire biosphere, in all its rich complexity, in this evolutionary struggle.

By invoking Monod I am suggesting that we think of the relationship between computing technology and the disciplines of the humanities as a moment by moment becoming of their futures, to some degree unpredictably, through an ongoing contest between the disciplines' strong sense of themselves on the one hand and all that contingently affects them, including the relentless development of digital technologies, on the other. If the analogy holds, then it offers a way not only of avoiding both disciplinary essentialism and technological determinism (again the two extremes in Raymond William's argument) but also of interrelating the academy and society much more helpfully than the old monastic or the new commercial models have to offer us now.

"Analogy is an identity of relationships", not of things, Simone Weil once pointed out (1978/1959: 85). But to invoke an analogy is to assume that the two parties involved operate under the same laws, or exist in the same world: otherwise the relationships would be incommensurable. That social systems are made by biological entities as extensions of their evolutionary development would thus seem to make analogies between the two inherently promising. Perhaps this likelihood, the rising cultural importance of biology and apparent fitness of Monod's model are enough to recommend further exploration. Limited space stops me from doing that here.

6. Destination is resonance

What might we look forward to?

Writing in the mid 1970s for the journal *Leonardo*,[15] operations researcher Michael Thompson observed that "when the user directly 'converses' with the machine… the almost instantaneous replies immediately suggest the possibility of improvisations, as if on a musical instrument" (1974: 227). His analogy – researcher is to computer as musician is to instrument – points back to the cybernetics of human-machine systems.[16] Among many other things, cybernetics inspired an exuberant flowering of experimental art (to which I referred earlier) at least in part because, as Roy Ascott said, it represented "a development in science which [held] out the promise of taking art seriously" (1968: 257) and so giving it new scope for action. The action it inspired was specifically interactive and participatory, constituting in the words of cinematographer and haptic digital artist Jeffrey Shaw "a new relationship between the producer and the consumer of artefacts, one where the builder of the interactive system and its users participate in a situation of cocreative formulation, discovery and experience" (Shaw, Kenderdine and Coover 2011: 223).

It seems to me that the central question for research in the digital humanities most promisingly begins here, with the artists. The question is how – with help from several other fields – we might design and engineer digital means for enabling a corresponding relationship between interpreter and artefact, or in simpler terms, how we might put into the interpreter's cognitive hand a tool as powerfully co-creative as a chisel or a paintbrush. For the humanities I am thinking, for example, of nothing more exotic than the phenomenology of reading, when according to the best theorising we have reader and text co-create each other. (Or say that something else happens when we read, or look at a painting, or listen to music, critically. The challenge is to model that digitally.) But when we consider the current products of the digital humanities, fine and helpful as they are, we see very little if anything at all that gets beyond the forecourts of interpretation to that inner core of scholarly experience, to where scholarship actually happens. What we see mostly are "knowledge jukeboxes", as I call them: resources which are clever to be sure, filled with important data whose manipulation and vending does real service to the humanities, but still built for research that in large measure happens elsewhere by other means. What's stopping us from going further?

There are *very* difficult technical challenges. But more formidable because less visible than they is a notion which, like technological determinism, remains powerful despite persuasive argument from the specialists. It comes to us with the popular term *mediation* – which I have been studiously avoiding throughout this essay. Now is time to say why.

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[15] *Leonardo* was founded in 1968 in Paris to emphasise "the writings of artists who use science and developing technologies in their work"; see www.leonardo.info/ (2 August 2011).
[16] On the cybernetics movement and its legacy, see Heims 1993; Dupuy 2000/1994; Husbands and Holland 2008.

Mediation is a highly complex word entangled within several different systems of thought. The difficulty it causes us in present context stems from a failure to distinguish two senses of its root term *medium*: (a) a neutral conduit or instrument, and (b) something like an ecological niche or cybernetic system.[17] Referring to (a), Williams remarks that, "In most modern science and philosophy, and especially in thinking about language, this idea of a medium has been dispensed with" (203). Nevertheless it remains, instantiated for us in the form human-machine communication thought to be and so constructed as a linear point-A-to-point-B process across an interface.

There are at least two historical sources for this idea of human-machine communication: the mathematical model proposed by Claude Shannon and Warren Weaver in 1948-49, and the actual experience of using digital machinery in the 30-year period from the first installations in businesses and universities until the widespread adoption of the "microcomputer" in the 1980s. Let me explain briefly.

In his *Scientific American* popularisation of the model (1949), Weaver begins by asking, "How do men communicate, one with another?". He lists several means familiar to his readers, then in effect reduces the human situation to the diagram

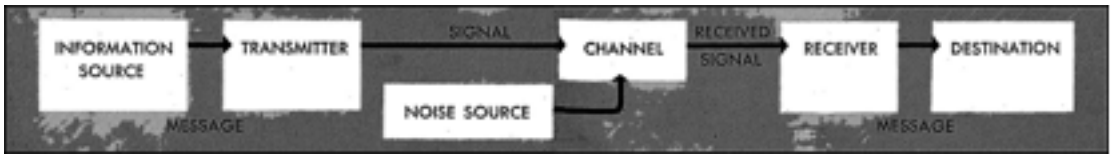

Figure 3 (Weaver 1949)

given in Figure 3, which passes into mathematical form, picks up both the world-changing potential for widespread application *and the authority of the science it invokes*, then returns to ordinary discourse as an answer to his initial question: This is how men communicate, one with another. The clarity of the argument and demonstrable success in application made this "transmission model of communication" hugely influential well beyond engineering. Despite opposition from the relevant social sciences and from system designers, it continues; "its endurance in popular discussion is a real liability", as David Chandler has written.[18]

That much of the story is well known. In addition, however, the viral idea of a neutral conduit drew strength from users' formative encounter with computing machinery during the mainframe era, *when the transmission model diagrammed experience*. Like a signal in Weaver's diagram, the typical user had to traverse physical distance from office to computing centre to deliver his or her program, back and forth as many times as it took to get it to work properly. The "turn-around time", measured in hours or days, compelled very careful planning, proofreading and checking; the casual experimentalism we now practice was then unknown. The

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[17] In Raymond Williams' more philosophical terms, (a) "the neutral process of the interaction of separate forms" and (b) "an active process in which the form of the mediation alters the things mediated, or by its nature indicates their nature" (1983/1976: 204-7).

[18] Chandler 2008; OTA 1995: 77. See also McLuhan, Hutchon and McLuhan 1978: 93-4, which reports on work eventually published in McLuhan and McLuhan 1980.

formidably rebarbative nature of the whole process (its "noise") gave purchase and staying power to the linear metaphor. So also the public's vicarious experience of the machine, copiously imagined in the popular press, which mythologised it, in one telling instance as "The Oracle on 57th Street" (IBM's World Headquarters, where from 1948-1954 the huge, glittering Selective Sequence Automatic Calculator was on public display).[19]

Once computers became "personal" one might think that immediate presence, faimiliarity and interactivity would work to defeat the transmission model, the more so as machines became faster and friendlier. But we know from various sources that social phenomena are marked, often indelibly, by the historically specific contexts of their origins.[20] They are, as we say, *imprinted.* I suggest, then, that this is what happened during the cultural assimilation of computing in the early years, and that we need a new figure of thought, such as Thompson's, to replace that imprint.

7. Watchfulness

My argument for the future as we might build it, then, is that it lies most hopefully in the exploration of an analogy of resonance, conversation or the like. If computing is to be useful for more than putting stuff out there and getting it back again then we'll have to confront the predicament toward which (to borrow words from Wittgenstein) "the crystalline purity of [algorithmic] logic" drives us: "slippery ice where there is no friction", rendering us "unable to walk".[21] Projecting current know-how into the future gives us no traction. It gives us only a better engineered "myriad of clerks or assistants in one convenient console", not the sighting of "the real complexity and the potential beauty of the instrument" that Milic longed for. And ultimately, as Winograd and Flores said, the question is what "ways of being" we want to make possible.

But the world does not stand still, as I said earlier. Joseph Weizenbaum's argued in 1972 that "much more subtle and ultimately much more important side effects" of computing are at play than our immediate research projects conceive. For the humanities, the proverbial thief in the night seems to me the accumulation of primary and secondary resources – all those knowledge jukeboxes bulging with their texts, images and sounds. What does it mean to have these as the regular furniture of research?

My best guess is that there are at minimum four threshold effects:

(1) spreading of the researcher's attention over a widening field of possibilities under constraints of time, with growing emphasis on interdisciplinary research, a concomitant imperative for us to understand how to do it well

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[19] *Saturday Evening Post*, 16 December 1950; see "John Bakus", IBM Archives, www-03.ibm.com/ibm/history/exhibits/builders/builders_backus.html (27/8/11).
[20] Stinchcombe 1965; cf. Lounsbury and Ventresca 2002; Tillyard 1958: 11-12.
[21] *Philosophische Untersuchungen*, trans. G. E. M. Anscombe.

and a shift from an essentialist epistemology, which seeks knowledge by going deep, to one that proceeds by assembling and correlating a multitude of voices, and so going wide (cf. Rorty 2004/2000);

(2) rising importance for many fields of argument in the face of ever greater masses of easily available evidence for any conceivable proposition;

(3) growing realisation that along with the everything else in the living and non-living world our cultural artefacts are fundamentally probabilistic and theorizing about them susceptible to computational modelling and simulation (McCarty 2010: 5-6); hence

(4) bridging of the sciences and humanities by making explicit the conjectural space in which digital models of these artefacts allow them to be treated as if they were natural objects and so fit subjects for scientific reasoning (McCarty 2007).

So here, I think, is the digital medium in that other, better sense: not a Shannon-Weaver gauntlet to be run but as water is to the swimmer, gravity to the dancer or wood to the carver. William Wulf once remarked that engineering practice is "design against constraint" (2000). Here, perhaps, are our constraints.

"What's driving the change, where is it heading and what might the humanities look like as a result?" Frighteningly, thrillingly, it's up to us.

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