New mediums: New perspectives on knowledge production

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Print still being the primary medium for the exchange of knowledge today, we may be said to be homo typographicus, *living in the 'Order of the Book'. However, we are rapidly making a transition from analogue to digital textual transmission. As we make that transition we need to avoid the pitfall of imitating familiar aspects of existing mediums, stopping us from recognising and making full use of salient characteristics of the unfamiliar new medium. Imitation happens on the level of technological features, but also—more insidiously—on a conceptual level, and it is helpful to scrutinise the technological features and concepts concerned closely. All technologies, writing and print no less than the digital medium, result from a process of discovery of their social uses more than they are technological inventions. Not only is the digital medium too new to have reached the transparency of print yet, it is likely that this will never happen. For, the computer being a Universal Machine, its potential is unlimited, and the digital medium will continue to grow and expand along with it. That is not to say that it has no distinctive features at all; just that these are not immanent. The Universal Machine has an unlimited potential for accommodating different work practices, but only if we can articulate our demands, as producers, distributors, or end users, will we be able to influence the digital medium's development and harness its potential.*

For centuries the book, the journal and other forms of print have served scholars as their chief knowledge instruments. Outside of the academy, too, the book has had a central role in the transmission of knowledge. Take textbooks in education, or reports in government—all products of the printing press. This is of course rapidly changing today. Scholars are busy exploring the most diverse forms of digital communication, of which many impressive examples can already be found.[1] And again, the same is happening outside the academy. In education electronic learning environments are taking over many traditional book functions; governments make use of many different forms of web-based communications, etcetera.

However, I would like to maintain that even today, amid the turbulent speed at which digital communications are usurping roles previously played by the book, most of our information habits remain book based. The extent to which we are still governed by the book and its institutions I like to indicate by the term 'Order of the Book'.[2] This Order of the Book is firmly based on a bibliographic frame of mind, fed by pervasive and intricate book-based information ordering, referencing and other aspects of our 'knowledge system'. But the persistent status of writing and print is equally apparent from the ubiquitous book-based metaphors that continue to govern our understanding of the broad spectrum of digital communications.

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[1] Many were shown at the Colloquium on Text Comparison and Digital Creativity.
[2] I explain the term more fully in my forthcoming book, provisionally entitled 'Digital text and the Order of the Book'.

In the context of the current rapid transformation, it is particularly instructive to take a look at the dynamic history of the textual mediums. Past textual practices—in manuscript and print—can help equip us for a better understanding of the digital present.

Technological invention and social discovery

Rather than springing forth fully armed from the brain of a mythical inventor, the printed book as we know it today has a long history of gestation. By that I don't wish to suggest that Gutenberg should not be called an inventor. Even if printing with moveable type may well have been inspired by existing Korean and Chinese practices, he did experiment with ways to cast the type, and introduced the art in Europe.[3] However, the achievement of a technological *invention* is invariably matched by an often lengthy process of *discovery*. Discovery is a social development, involving crucially the recognition of an invention's social uses and significance.[4] The process of discovery typically takes a great deal longer than the act of invention, and it is a great deal more diffuse. For a shorthand illustration of this discovery process we can take a look at some aspects of two earlier textual mediums: printing and writing.

In the case of the printing press, Gutenberg may or may not have invented the technique of casting types for reproduction on a printing press, but what he certainly did not invent was the reading machine that the book as a medium has since become. It took centuries of patient discovery before the printed book's distinctive characteristics were fully recognised. One particularly interesting example of such a characteristic is pagination. Page numbers depend on the property of identicalness of printed copies. While identicalness across copies of the *text* itself was certainly intended, in a bid to counter the unrelenting tendency towards corruption of manuscript transmission, identicalness of the text *on the individual page* was a coincidental side effect. Its potential as a helpful attribute in parsing the book's contents was only realised over time.[5] After Gutenberg's initial invention in the 1440s it was not till around 1475 that Nicolas Goetz of Cologne

[3] See Joseph Needham, ed., *Science and civilisation in China*, vol. 5, *Chemistry and chemical technology*, part 1, Tsien Tsuen-Hsuin, *Paper and printing*, CUP, 1985, pp. 313-19.

[4] Scholars of Science and Technology Studies would refer to this discovery process as the social construction of social use and significance. Not only a technology is shaped over time, but also the market for it and labour and economic processes around it. Cf., for example, Wiebe Bijker, *Bicycles, bakelites and bulbs: Towards a theory of sociotechnical change*, Cambridge, Mass. and London, 1995.

[5] There is evidence that the popularity of page numbering in manuscripts was growing from about 1300, while numbering in incunables is extremely rare (just over 10%). Page numbering in (unique) manuscripts would obviously serve a different purpose than page numbering in printed books, and so there would be no *prima facie* case for continuity between the two practices. In fact, numbering in printed books may have begun as an aid to printers rather than readers. For a detailed discussion see Margaret M. Smith, 'Printed foliation: Forerunner to printed page-numbers?', *Gutenberg Jahrbuch* 63 (1988), pp. 54-70.

printed an edition of Werner Rolewinck's *Fasciculus temporum* using page numbers,[6] and it was not until almost a full century after Gutenberg's first printings that page numbering started to become common, exploiting an unintended but remarkable property of printing: namely, that all its products are for most intents and purposes identical in content and form. Similarly it took time for an awareness to grow that printing, rather than being the coffin for the spoken and written word that John Donne still saw in it as late as the seventeenth century, was in fact able to safeguard texts, increasing their chances to stay alive by the factor of their print run. All in all it took centuries for print to become the fully developed and almost fully transparent medium it is in today's society, with all the subtly interacting parts that contribute to make it into such a well-oiled machine. Besides page numbers these include also, for example, the running head, the table of contents, the index, and all the ingredients of its familiar interface.

Going even further back in history, writing went through a similar social development. As long as the number of initiates remained limited, no real social familiarity with writing could develop, and even a certain distrust of the written word could prevail. Comparing writing to the spoken word, Plato famously lamented the helpless fixity and unchangeability of the written text, which he thought left it unable to look after itself. He was also dismayed by its dangerous promiscuity. Once set down on paper, the author lost control over his words entirely, and a text could commune with anyone who encountered it.[7] Plato seems to attribute an agentive role to writing, as if it were less a dead object (as we are inclined to see in it) than an undead one. He certainly did not regard writing as alive: it lacked the presence of the spoken word.[8] He was not alone in this. Writers like Sappho, and later Horace stressed the deadness of the book's materiality and rated its longevity less than that of the living (i.e., spoken) word. At any rate, what Plato, Sappho and Horace shared is the suspicion that this technology was not socially very beneficial. Their reserve towards writing shows that various aspects of the materiality of writing that we now regard as positive achievements took time to emerge and become dominant. One of these was its potential for promoting objectivity—both in the literal sense and in the metaphoric sense so coveted by Plato. Ironically this objectivity was something Plato was particularly keen to advocate.[9]

Even the purely mechanical development of writing had its social effects. The increasing application of word spacing from the eleventh and twelfth centuries, for example,

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[6] Printed numbering of leaves had already occurred in 1470 (*ibid.*, p. 54).

[7] Plato's fears have been expertly analysed by John Durham Peters in *Speaking into the air: A history of the idea of communication*, Chicago and London, 1999, pp. 36-51.

[8] In fact, all writing, as all medial transmission, could be said similarly to lack the presence of the unmediated word—unless, that is, speech should also be regarded as a medium. However, I suggest that, being a function of the human body that does not require any technological 'extension', it should not.

[9] In *Preface to Plato* (Cambridge, Mass, 1963) Eric Havelock suggests that it was the perceived subjectivity of poetry—resulting from its being transmitted orally and being learned by rote—that drove Plato to banning poetry from his ideal state.

represented a major step in the creation of a literate society.[10] Before writing became common, it was often 'speech set down', and thus without word spacing. Without the application of consistent word spacing from the eleventh century the great medieval educational reforms could not have brought about writing's new, more central place in society. It made reading technically easier, allowing more people beyond a small priviliged group of initiates to read.

We are now witnessing the incunable period of the digital medium. Despite being in its infancy, and even if the time frame is vastly shorter than in the case of writing and printing, the digital medium as we know it and use it today also has an—as yet brief—history of being discovered as well as invented. Email, chatting, and word processing are among the most widely used applications on today's personal computers. Though Charles Babbage and Ada Lovelace already realised in the middle of the nineteenth century that computers could be programmed to calculate other things besides numbers, in actual fact it took a long time for the computer to evolve from a calculating machine to the language machine it has since become. Once computers could deal with text, in the shape of first word processing and then desktop publishing, they were initially used chiefly in the service of the existing textual medium: to replace typewriters, and to aid conventional print production.

There is no doubt that it was a triumph that we managed this replication of analogue textual practices and print functions in the digital realm so well, from writing and editing to the origination of printing plates, and more. Despite the triumph of the achievement it might be argued, however, that such 'imitation'[11] of the analogue in the digital did not really amount to what we now regard as the digital textual medium. To the extent that this new medium replicated the known functions of the book in the digital realm there was simply functional continuity. But the digital textual medium as we now know it went beyond mere replication. It could do something that none of the earlier textual mediums could do, taking digital textuality far beyond that of the book. Again it took a process of *discovery* for this novel medial potential to come into its own. Just as the technology of the printing press was able to do something that manuscript couldn't, viz. multiplication, the World Wide Web as a medium brought the new dimension of distribution. Email had already been established for the communication between remote terminals and the (mainframe) computer over the network. But again it took time and a major conceptual leap before the computer's networking capabilities were fully recognised. With Tim Berners Lee's HyperText Markup Language in 1991 the internet was turned into a full-blown textual medium, the World Wide Web, the latest addition to the sequence of clay tablet, scroll, codex, printed book.

Each step in the process by which the computer turned into a digital textual medium has necessarily been based on the nature of the computer as a Universal Machine. Computers

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[10] See Saenger, *Space between words: The origins of silent reading*, Stanford, 1997.
[11] For want of a conscious motive, this cannot be constructed as 'imitation' in the strict sense. What happens is that we cannot help but think in deep grooves.

can be made to perform any task that may be expressed by way of an algorithm, including the algorithmic handling of letters, words, text and increasingly even spoken language. This means of course that the computer's medial functions can be infinitely extended beyond the textual and communicative ones we have already invented and/or discovered and are currently familiar with. Just as importantly, the computer's medial function is but one of an infinite array of other capabilities. This is especially relevant in the present scholarly context. As scholars we use computers not just—and not necessarily even primarily—as a communication medium to represent and disseminate our research findings, but also as a means to help us perform the research itself.

The sociotechnical nature of the digital textual medium

In what follows I would like to see what we can learn about the *nature* of the digital textual medium, with a particular view to explore the relationship between its technological properties and their social effects. For this purpose it will be useful, in conformance to the conceptual distinctions with which we are familiar as denizens of the Order of the Book, to try and make a distinction between the digital medium—roughly speaking, book functions gone digital—and the overarching 'digital textuality' which has enabled the digital medium to come into being in the first place. Digital textuality represents a much larger set of digitial textual practices, including, for example, the field that has become known as 'digital humanities' or 'humanities computing'.

If to understand digital textuality we look for inherent technological properties (comparable to such a property as the identity of reproduction in the printing press), the first and most fundamental technological property is that digital textuality is based on the Universal Machine. This can be well illustrated by the intrinsical differences between the process of gestation of the medium of the printed book on the one hand, and that of the digital medium on the other. I'll name two.

First, the book's technological properties, as distinct from the sociotechnical uses we put them to, never really changed over the course of centuries. For example, we never managed to teach the printing press new tricks, such as, say, the multiplication of sound or moving images, or taking care of the distribution of the books it printed. The digital medium, by contrast, was a product of the unceasing development of the computer as a Universal Machine. In other words, while the book's gestation—the way it became a reading machine—was a process of discovery more than one of invention (the improvements after Gutenberg's first breakthrough occurred piecemeal over many centuries), digital textuality is a case of a continuous—and fundamentally unlimited—burst of inventions, each followed by its own process of discovery.

This has made for extremely fast development of digital textuality over the past half century. By all indicators (including, for instance, Moore's Law, that states that the number of transistors on a chip will double about every two years) that speed is not likely

to abate. Moreover, digital textuality can be regarded as a hybrid phenomenon. On the one hand we approach it as a replacement for writing and printing; that is to say, as a medium with expectations shaped by the Order of the Book. These expectations are nicely visualised in Robert Darnton's famous 'communications circuit'.[12] In addition to the medial function expressed in the communications circuit, however, what digital textuality has to offer is the entire gamut of the programming capabilities of the Universal Machine. These take it far beyond the medial functions of the book and make it into an extraordinarily versatile research instrument—or, better, sociotechnical research environment. Both are, moreover, so seamlessly integrated in the same computing environment as to be virtually indistinguishable. That is to say that digital text has access to any imaginable application, whether it already exists, for example in other disciplines—including science—or is yet to be created.

The second intrinsical difference between the processes of gestation of the medium of the printed book and that of the digital textual medium is that the book has over the centuries gradually become more and more transparent as a technology. This was possible because the technological properties of the printing press and its products never fundamentally changed. Its 'user interface' is now so familiar that our expectations of its functionality are rarely thwarted. We know very well what it can and cannot do.

Digital textuality, by contrast, is not similarly transparent, and this is problematic for us as scholarly media practitioners. It is this realisation, that transparency of the digital medium, however desirable, is not forthcoming, which led to the Text Comparison and Digital Creativity colloquium. Our primary aim as scholars is to communicate our research findings successfully. Digital textuality should not stand in the way of that communication, or interfere with our research findings in any way. For that reason we would obviously want our digital textuality to be just as transparent as the products of print have over the centuries become. Our primary interest lies in scholarly communication, not in the intervening media technologies which make communication possible.[13]

I fear, though, that such transparency is fundamentally impossible. It is questionable whether we will ever be able to internalise the properties of digital textuality, or even of the digital textual medium. The reason for this is its protean nature. Digital textuality is not only fundamentally new and recent, having developed too rapidly for any comparable familiarity to evolve.[14] But the fact that it is based on the programmable Universal Machine precludes such familiarity. In any case, the book's apparent transparency is no more than a chimera. It lulls us into a false sense that as a medium it is an undistorting clear window. Mediums are never value-free. They are not clear windows. Each medium represents a particular way to construct our knowledge. Notwithstanding the degree of

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[12] Robert Darnton, 'What is the History of Books', *Daedalus*, Summer 1982, pp. 65-83.
[13] What makes it possible to communicate *is* of course at the core of my own interests as a book historian—or, more properly, as a historian of textual transmission.
[14] Perhaps it has become transparent insofar as it may be possible to recognise a one-to-one relationship with the print media with which we were already so familiar.

familiarity we have reached with it, this applies also to the book. The difference is that we have internalised the properties of the book as a knowledge machine in a way we have not been able to do in the case of digital textuality, and most likely never will.

I fear that there is no simple way out of this predicament. The only realistic solution seems to be to become accustomed to the digital medium's changeability and to make ourselves thoroughly aware of what it does to our communication.

Medial transformativity

This brings me to the notion of medial transformativity. We not only have to live with the lack of transparency and continuous change as innovation will continue at a high pace, but also with the attendant and ongoing process of discovering the social consequences of every new development. Despite the continuity in function (i.e., the transmission of textual knowledge), there are in fact, as I have suggested, a great many discontinuities between the textual mediums. Each medium has its own bias, based on its technological properties. A simple example of what I mean is that the book and the digital textual medium represent two very different author–reader relationships. The book is a paper monument, which offers a fairly straightforward and widely recognised one-way hierarchical relationship between author and reader. It is not that readers don't bring meaning to the text; just that such creation of meaning is a private and individual affair which does not affect someone else's reading experience. Contrasting this with the more tentative and changeable, not to say fickle, form of the digital text brings into sharp focus its bidirectional and much more democratic nature. In these technological conditions, the shaping of meaning becomes a much more public and collaborative act.

At a higher level of abstraction, this medial bias may be constructed as a form of inevitable interpretation of the data to be transmitted. The chosen medial form dictates to a considerable extent what aspects of the data (say, someone's knowledge about an aspect of the world) are foregrounded, and what aspects will remain underexposed. 'Text is knowledge represented as matter', as the description of the theme session 'Knowledge creation and representation' in the invitation to the colloquium had it. Moving information from one medial carrier to another without changing it is impossible: each carrier will provide its own interpretation of that information.

In this sociotechnological process of medial transformativity, more often than not technology has the upper hand. We tend to invent technologies for which we only discover social uses afterwards rather than the other way around. Looking at manuscript and print we already considered some examples earlier, but the same goes for Edison's sound recording device, which he had intended for office dictation, or email, which developed out of the need to communicate with fellow mainframe users at a distance. No one could have foreseen the vast growth of the twentieth-centure music industry, or the central importance of email in every scholar's daily work, just as the mobile phone was not

invented to extend total control over the life of everyone over the age of ten.

Stages of digital textual transmission

I have so far concentrated on the medial aspect of digital textuality and its history. With the help of the distinct stages I have identified in the history of computing as a technology and as a digital textual medium we can retrospectively recognise three relatively distinct phases also in social digital textual practice: the way we have as humanities researchers used the computer for text processing (in the widest sense).

While bearing in mind the remark made earlier about the unconscious nature of much of the 'imitation', *Stage 1* might be characterised as the imitation stage: doing the same things as we already did using analogue techniques, but with help from the machine.[15] It is a fascinating question to what extent searching, sorting, matching and the prodigious memory that computers have to offer go beyond being mere digital equivalents of old-fashioned analogue processes. Can the computer be programmed to do things that are fundamentally different, and not just faster, more precise, etcetera?

In this stage the computer was used in the service of traditional forms of knowledge creation. Both word processing and desktop publishing were geared towards the production of conventional 'hard copy'. That is to say, they were used to create traditional monuments attributed to named individuals, in the conventional paradigm of a hierarchical author–reader relationship. Father Busa's concordance to the work of Thomas Aquinas, begun in 1947, has been hailed as the world's first humanities computing project. However magisterial the project's scope and execution, it may be argued that it was ultimately in a conventional mould. While the *method* was new, the *result* was not, and it did not lead to new research questions.

In *Stage 2,* which includes the start of the World Wide Web, we witness the construction of a new medium for knowledge creation and, most importantly, dissemination. Crucially, it saw the birth and development of the concept of markup, which was one of the chief technologies to further the dissemination function. Internet technology (based on the bidirectional flow of traffic) stimulated peer-to-peer horizontal collaboration. Yet at the same time the traditional hierarchical paradigm of knowledge production, with experts producing knowledge to be consumed by end users, persisted.

A curious phenomenon that we can recognise in retrospect as characterising this stage was the emphasis on the production of raw data. The computer was very often used for the production of scholarly 'semi-manufactures'. This had no doubt much to do with the sheer magnitude of the investment of intellectual and financial resources in mastering digital

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[15] This 'imitation' stage is, incidentally, also a necessary stage in the sense that culture demands continuity. Memetic thinking corroborates this: only if ideas are accepted will they be successfully replicated (see Susan Blackmore, *The meme machine*, OUP, 1999).

work methods. One notable effect of this phenomenon was the deferral of the interpretive burden, which shifted more and more from the instigator of the scholarly communication to its recipient. For much the same reason, collaboration, both disciplinary, among humanities specialists, and interdisciplinary, between humanities specialists and computer scientists, was another notable characteristic of many humanities digitisation projects.

The most notable application of the concept of markup for use in the humanities still remains the Text Encoding Initiative (TEI). The history of its guidelines during this period, from 'P1'[16] down to 'P5',[17] testifies to the strength of its concept. The TEI has been able to remain at the forefront of textual work in the digital humanities for more than twenty years since its inception in 1988. Yet its strength continues to lie in monumental productions in the conventional mould (whether in print or digital), with the markup concentrating on forms of fixity inscribed by experts, whether they operate singly or collaboratively.

More recently we can be said to be entering *Stage 3*, the democratisation stage, which has also brought us Web 2.0. This marks the end of the 'hieratic period', with the scholarly and IT priesthood in charge. It is also characterised by the realisation that the computer offers more advanced processing abilities than we had been using in the humanities.

The reason we organise meetings like the Colloquium on Text Comparison and Digital Creativity (and they happen everywhere now) is probably twofold. Firstly, we are becoming more aware of the fact that the computer represents a truly new medium. Though we have only just started our investigation of the technological properties of the digital textual medium, we are already beginning to find out about some of the particular ways in which it is so very different from print and, more importantly about the implications of those differences.[18] Secondly, there is a sense that we are staying behind compared to the sciences.[19] Whether justified or not, this fear has led to an increasing sense of urgency about moving humanities work practices into the digital realm. It is this third stage that I would now like to examine in a little more detail.

Building new knowledge instruments

With the growing awareness, not only of the fact that the digital medium is fundamentally different from the print medium, but also of the nature of the differences, we are in a

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[16] C.M. Sperberg-McQueen and L. Burnard, eds, *Guidelines for the encoding and interchange of machine-readable texts*, Chicago and Oxford, 1990.
[17] *TEI P5: Guidelines for Electronic Text Encoding and Interchange*, ed. Lou Burnard and Syd Bauman, Oxford, Providence, Charlottesville and Nancy, 2008.
[18] My forthcoming 'Digital text and the Order of the Book' attempts to analyse some of these implications.
[19] The KNAW's Virtual Knowledge Studio was founded as part of a movement to counter such fears.

position to think more consciously about the creation of new knowledge instruments to supplement—or replace—the printed book. It might be helpful to think of a number of basic categories of models in which the computer may be used in the creation of such new knowledge instruments.

Model A we might call the 'markup model'. It entails the formal inscription of pre-existing qualitative knowledge[20] in much the same way as has been done in manuscript and print for centuries. The chief difference is that the exigencies of the software (especially the rules which the markup has to obey in order to be 'valid') will frequently force previously implicit, unconscious knowledge to be made explicit. In addition, the markup model has evolved to accommodate the more 'democratic' practices of what we have identified as Stage 3 in the development of digital textual transmission. The wide availability of more user friendly application software (especially after the creation of XML out of the powerful but unwieldy SGML) has certainly lowered the entry barriers. Equally, libraries and other institutions are now taking strides in offering 'lay' environments for the use of TEI and other markup for the transcription of a variety of primary sources.

Model B involves using the computer in ways that are primarily based on quantity. Now that we have become comfortable with text processing as a form of symbol manipulation, we can cast around for all sorts of new ways in which text may be subjected to computer treatment. Here the sciences can also offer inspiration, challenging us to turn their methods and inventions to unforeseen uses.[21] Often such ways of treating text will be based on statistical methods, requiring digitised materials in bulk (if only for training purposes). What sets this model apart from the others (at least from A and C) is that it offers a vista of yielding types of knowledge that are fundamentally different in the sense that they are not based on existing human knowledge or insights, or human analysis.[22]

Despite the fact that both Model A and Model B involve sophisticated use of computing power, they are conventional in the sense that they still involve mainly highly trained experts. The resulting knowledge is hierarchical, top-down. *Model C*, however, involves 'using the user', and forms a significant departure from this conventional mould of expert knowledge creation. Apart from peer-to-peer horizontal collaboration, it entails vertical collaboration between experts and non-experts. It is of course hugely facilitated by the Web 2.0 developments of recent years. By analogy with the concept of 'Mode 2' production of knowledge[23] this can be called a 'Mode 3' type of knowledge production and research.

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[20] This is not to suggest that the application of markup, which requires extreme discipline and rigidity, does not propagate new qualitative insights into the nature of the material being marked up.

[21] Roger Boyle gives a nice illustration of the possibilities in his paper elsewhere in this volume.

[22] In his contribution to this volume, John Lavagnino shows that a computer being fed quantitative statistical data may well come to a different verdict than a human taking into account (also) qualitative judgements of a kind that we will find it difficult to program a computer to take into account.

[23] Michael Gibbons, Camille Limoges, Helga Nowotny, Simon Schwartzman, Peter Scott, &

Some interesting claims are beginning to be made for 'the wisdom of crowds' not least by James Surowiecki in his book by that name.[24] It will be a huge challenge to learn to trust such democratic forms of knowledge production.[25] That they are touted by many enthusiasts as being just as good if not better as the expert type might not necessarily help. However, the aspersions cast by scientists on long-familiar scientific types of knowledge production and research just might.[26]

Mode 3 type of knowledge production involves a radically different way of presenting knowledge. In fact it is a matter of publish data first, and select, edit, perfect them later.[27] In fact that may be identified as a general tendency: to publish information earlier, but defer its interpretation to turn it into knowledge. This is a social consequence of certain inherent properties of the medium, such as notably the fact that storage is cheap, copying costs nothing and doesn't exhaust the original, etcetera. In learning to value such more democratic forms of knowledge production we will have to make an even greater hermeneutic effort as we turn the data we consume into something that we feel can be called 'knowledge' in the scholarly sense.

This type of democratic knowledge creation by unnamed collectives might be termed 'amateur humanities'. What will be particularly interesting to see is if the knowledge resulting from this type of knowledge creation will be different from the knowledge derived from more traditional forms of knowledge creation, or whether the same 'truths' will turn out to be arrived at by different methods.

Lastly, *Model D* is a variation of Model C, which we might term 'using use'. It involves logging the use that is made of existing resources with a view to learning from it in ways that may improve those resources. Web users already frequently experience such automated analysis of queries and other forms of use; Amazon.com's cheerful greeting, followed by their equally cheerful and more or less apt buying suggestions, no doubt being among the most familiar encounters. Such logging should give us a better grasp of how our new knowledge instruments are being used, giving us a chance to improve them.[28]

Martin Trow, *The new production of knowledge: The dynamics of science and research in contemporary societies*. London, 1994.

[24] James Surowiecki, *The wisdom of crowds*, New York, 2004. Cf. also Cass R. Sunstein, *Infotopia: How many minds produce knowledge* (OUP, 2006) and David Weinberger, *Everything is miscellaneous: The power of the new digital disorder* (New York, 2008).

[25] In her contribution to this volume Vika Zafrin cites Noah Wardrip-Fruin as saying that 'it turns out that the blog commentaries will have been through a social process that, in some ways, will probably make me trust them more'.

[26] Cf., for example, Sheila Jasanoff, 'Technologies of humility: Citizen participation in governing science', Minerva 41 (2003), pp. 223–44; Sal Restivo, 'Modern science as a social problem', *Social Problems* 35 (3), pp. 206–225 (1988); and Helga Nowotny's 'Transgressive Competence. The Narrative of Expertise', *European journal of social theory*, Vol. 3, No. 1 (2000), pp. 5-21.

[27] See David Weinberger, *Everything is miscellaneous*.

[28] In fact, accountability systems and new research ethics increasingly demand such logging.

Of course all of these models can—and do—occur in any combination. What all of them have in common is the need to do two things:

(1) We need to establish the 'true nature' of the computer (in inverted commas, because the computer's nature as a Universal Machine eliminates the possibility of inherent properties). This is the process I have termed *discovery*.

(2) We need to be very creative and proactive in helping develop the way we can use the computer for advanced text processing. This involves innovation, modelling, and enormous creativity. Only if we can articulate our demands can we hope to make any real progress. Acting on such well-articulated demands is what might be called *invention*.

I have drawn historical parallels in the hope that they will contribute to a better awareness of where we stand as humanities scholars in relation to the digital textual technology. The technology is not only new but likely to remain new for as long as we keep developing it, that is, forever. Yet culture demands continuity. Fortunately, the underlying structures are likely to remain stable; they will prevent irreparable breakdown of things like communication, knowledge generation, curation of our 'history', etc. I would suggest that the structure that is underlying knowledge transmission may well be the Order of the Book. Even if this should just be a convenient metaphor that needs to be tested against an empirical practice, it would confirm once more the continuity of the critical role of humanities scholarship across any historical knowledge regime—including our own. If there is a lesson to be learned or a conclusion to be drawn, it would appear to be that we will need to keep reinventing our working methods—and thereby ourselves as well.