

EXPLORATIONS IN THE LIBROVERSE

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One of the *délices de Leyde* is the Bibliotheca Thysiana at the city's central canal, the Rapenburg, a few hundred metres away from the old university building. This beautiful library, built in 1655 in the stern Dutch classicist style by Arent van 's-Gravesande, forms the perfect embodiment of the ideal of scholarship and learning. What greets the visitor inside is a massive (certainly by seventeenth-century standards) collection of knowledge on a wide spectrum of subjects, resulting from centuries' worth of scholarship. Laid down in books neatly arranged on their shelves, this knowledge sits there in permanent readiness to be consulted and turned into further knowledge: *pabulum mentis* for its founder (Joannes Thysius) and his friends.

Thysius' well-ordered collection of seventeenth-century learning may serve for the purpose of this essay as a symbol of what I would like to call the 'knowledge system'. The knowledge system is characterised by such properties as order (as reflected in shelving and cataloguing systems); closure (each book being a finished account of a certain area of knowledge); stability (enabling readers at other times and places to consult the same knowledge; and indeed Thysius collection, which he left to the university, is still with us three and a half centuries later); registration (almost without exception on their title pages attribute the texts to known authors), and authority (the texts have been deemed of sufficient quality to have been enshrined in print).

One of the eye-catching objects in Thysius' library is a seventeenth-century wooden book wheel. If the physical library with its rows upon rows of knowledge incarnate can symbolise the knowledge system, this book wheel, being circular, is an apt illustration of the way in which it was used. This was in an iterative process which may be termed the 'knowledge cycle,' which is at the core of the knowledge system. In the knowledge cycle readers, consuming and digesting existing knowledge, become writers, producing books containing new knowledge, which can be read by new readers in turn. This process depends centrally on the properties listed earlier. The system of attribution and authority, for example, has in the course of time become very transparent. It can be epitomised by the footnote as it has evolved over time.¹ This system permits the reliable identification of, and attribution to, prior authoritative sources used in the knowledge creation process at large. The book wheel is one of the most ingenious machines ever devised to accommodate this universal scholarly practice.

The origins of this system are obviously very much older than the printed book, going back to the invention of writing, which first permitted the creation of a lasting material

record of human achievement. But if I take the printed book as my point of departure it is not only because of the fantastic human achievement it represents but, more to the point, because it was the printed book that afforded the means for this system to come truly into its own, and because it still dominates our thinking about the production, dissemination, consumption and preservation of knowledge today. This way of thinking is often referred to as ‘print culture,’ though I prefer the term ‘Order of the Book.’² The Bibliotheca Thysiana can be said to symbolise the Order of the Book as a repository of collective human knowledge in the form of an orderly and stable textual record. The knowledge system serves to create, disseminate, consult and preserve knowledge by recording, multiplying and distributing it, describing it bibliographically and collecting it in physical (or as we say in a world that is rapidly becoming dominated by the virtual, ‘brick-and-mortar’) depositories such as libraries, in the stable material form of print.

It is to this way of thinking about knowledge, dominated by the material book as a knowledge machine, that the term *libroverse* from my title refers. Admittedly, it is an ugly coinage. However, as a counterpart to the equally ugly but more established term *docuverse* (coined by Theodore Nelson, to whom the world also owes *hypertext*), it nicely epitomises the two-way application of mental (pre)conceptions about our knowledge environment, from the analogue to the digital and from the digital to the analogue. The comparison implied in this juxtaposition offers a good way to study some of the effects of the recent digital deluge on the book-based knowledge system.

My suggestion is that the docuverse as a universe of linked digital documents is a much more revolutionary departure from existing textual practices in the libroverse than even the most die-hard preacher of the digital gospel has proclaimed so far. So can we fit digital knowledge production, dissemination, consumption and preservation into this age-old, familiar, tried and tested analogue system which I have called the Order of the Book, or is Order of the Book at the end of its use-by date and does a revolutionary new (digital) knowledge system need to be built from scratch? Indeed, can we have a system at all? To help answer these questions, and to underpin my suggestion of the revolutionary nature of the docuverse, in this essay I would like to contrast two perspectives, one of continuity (the evolutionary perspective), and the other of discontinuity (the revolutionary perspective).

1. *Continuity/Evolution*

It is often suggested that ours is the ‘information age,’ resulting from a veritable information explosion, and leading all of us to the brink of acute information overload. Explosions being the stuff revolutions are made of, we are apt to think that a revolution is what has hit us. However, we should remind ourselves that we are by no means the first generation to feel thus affected. There is perhaps more continuity than the term ‘revolution’ might suggest.

Many since Gutenberg’s time have lamented the proliferation of knowledge laid down in print, but solutions were not long in coming. These solutions tended overwhelmingly to use the very medium that caused the problem also to solve it: printed books, including annotated bibliographies, extensive lists of abstracts, and no end of encyclopaedias. One of the most familiar attempts at subduing the chaos resulting from the unbridled proliferation of printed knowledge is no doubt Conrad Gessner’s impossibly ambitious project of the *Bibliotheca universalis*, begun in 1545 and – to us unsurprisingly – never completed.

From the early twentieth century, solutions became more technological in nature. In the Mundaneum, proposed and actually begun by the Belgian Paul Otlet (1868–1944), the world’s combined knowledge was to be brought together and to be made accessible through a telecommunications system that encompassed both the documents themselves and the bibliographical system that described them.³

To try and manage an excess of information was also the prime motive for Vannevar Bush to invent his ‘memex’ in 1945.⁴ Slightly less advanced than Otlet’s vision of a World Wide Web *avant la lettre* this ingenious device is perhaps best understood as a twentieth-century makeover of the book wheel. Based on microfilm technology, it was designed to deal with  greater quantities of information than **Ramelli’s wooden machine**, but crucially, it too was intended to enable the user to make annotations and link ideas to their sources. The linking system of the  **Memex**, mechanically connecting microfilmed texts, has been hailed as the precursor of hypertext.

Since such referencing of authoritative sources, through footnotes, bibliographies and so on, remains the foundation of all scholarly work, it is not surprising that the WWW continues to support it. Indeed it improves on it in various ways. The WWW is no longer restricted to the individual scholar’s workplace but instead, as Otlet had already imagined, allows the user to tap into an unprecedented wealth of linked resources, and in return to share his own resources with other users. Furthermore,

there is no restriction to the extent and nature of the links. Apart from the usual bibliographical references, hypertext notes may also contain direct links to the referenced materials themselves, be they primary or secondary sources. The footnote – the epitome of scholarship – could in other words be said to find its ultimate expression on the WWW: the hyperlink makes it actionable and gives instant access to the material that is being referenced. (Talking about continuity, in retrospect the book wheel is also vivid proof that the much-vaunted non-linearity of hypertext that is supposed to have released us at last from the bonds of the linear book is not all that new.)

Besides accommodating, and indeed improving on the age-old practices of annotation and referencing, there are many more ways in which the digital medium continues well-established analogue practices. To manage identification and access of digital items, metadata substitute for catalogue cards. The mark-up of digital texts with forests of labels enclosed in angular brackets – for example according to the guidelines of the Text Encoding Initiative (TEI)⁵ – may look forbidding, but the system that underlies that forbidding appearance is firmly based on the same principles of hierarchical structure and order that underlie typographic texts, including the attribution to named individuals of every last character of the transcribed text and its critical interpretation. This means that for the benefit of humans it is easy to conjure up – with the help of a style sheet – a view of the marked-up data that conforms fully to the same typographic conventions that have been used for centuries in the world of books. But this way of encoding texts with mark-up enables not only humans but also the computer to decode their meaning. And the computer can be instructed to create all the usual props of scholarship that used to be made laboriously by hand, such as indexes or tables of contents, at the proverbial touch of a virtual button. Again, the computer is thus used to improve existing practices.

In the digital world the sum of human knowledge grows at an even more inordinate rate than in the analogue world, but just as in the case of books, the same technology that causes that growth can again be employed to keep control over it. Metadata and free-text search engines give access to anything and everything on the Web. A major contribution to this growth is the mass digitisation of legacy documents – for example of books by Google and other parties. This brings closer than ever that elusive ideal of collecting the record of all knowledge ever produced in the world, an ideal that goes back at least as far as the Alexandrian Library.

There is conceptual continuity too, borne out by ample linguistic

evidence: we tend to discuss the docuverse in terms of the libroverse. The typographic vocabulary of the internet, for example, is essentially the same as that of the book. Web metaphors, too, show their heritage in the world of the book, with Web *pages* being *published*, *scrolled*, *browsed*, and *bookmarked*. Even the word *library* is still current, even though libraries are being turned into ‘information resource centres’ at a furious rate. Outside of Special Collections, library holdings are increasingly digital and have less and less to do with (paper) books, rendering the term more and more metaphoric.

The history of knowledge machines (which offer ways to process the sum of human knowledge) began with writing, continued with the printed book, and has now reached the computer. That history has always been, and appears to continue to be, based on such order and structure that enable the full identification of the sources of our knowledge, and their attribution to known individuals and materials. From the original wooden contraption designed by  *Ranzani* to Bush’s microfilm reader to the WWW, the book wheel may be said to epitomise the knowledge system, thus also becoming a symbol of the continuity between the old and the new.

2. *Discontinuity/Revolution*

The case for evolution certainly seems strong, and the continuity perspective is, moreover, a soothing one. However, the very fact that a Nobel symposium on the subject of digitisation is being organised (and so many symposiums, conferences and colloquiums like it the world over) suggests that we are not altogether easy about it. In fact, the appearance of continuity may well be deceptive. How much discontinuity might be hovering under the relatively placid surface just described? In the perspective I would now like to take I will begin by simply identifying some of the discontinuities that suggest themselves to a critical observer. Next I would like to suggest why these discontinuities matter: what their effects on the knowledge system are.

In fact, this discontinuities perspective has a longer history than the continuities one. It goes back to such early hypertext theorists as George P. Landow, Jay David Bolter and Richard A. Lanham: all proclaimants of a textual revolution.⁶ (Paradoxically the unbridled zeal with which the likes of Landow, Bolter and Lanham proclaimed the revolution may well have led many to underestimate the revolutionary potential of digital textuality.) In the discontinuity perspective, I join them in proclaiming a revolution, although not necessarily for the same reasons. This is largely

a matter of reflection afforded by hindsight. These authors wrote when the real revolution, that of computers linked in a global communication network, had simply not yet happened. The World Wide Web was only launched in 1991 and its potential had yet to be recognised.

With the benefit of the hindsight that we have since acquired, I would like to single out the following three chief reasons why digital textuality, first by itself, and then augmented by the fact that this digital textuality no longer takes place in a standalone environment but on the Internet, and more particularly the World Wide Web, is really revolutionary and offers greater discontinuity than continuity with analogue text and the libroverse.

1. Digital text has its being in an environment that is not exclusively textual: the computer is now also a new medium for 'texts' in other modalities. Initially this was just still images and computer-generated graphs. Now it includes anything that can be medially transmitted, such as moving images, speech and music.

2. Digital texts remain computable. This translates into a number of effects, of which I will single out two:

(2a) The first is what I like to refer to as instability. By that I mean that texts may simply vanish, or be made to vanish, instantly and, more pervasively and potentially more disruptively, intrinsically lack closure. Both form and content are subject to continuous change. Lack of closure and its companion non-linearity (which I suggested was less of a departure from existing reading habits than the theorists claimed) are tropes familiar from hypertext theory, which hailed them as a liberation from the confining textual space provided by the Order of the Book.

(2b) The second effect of having texts in a digital rather than analogue form may be equally obvious, but bears contemplating nevertheless. That is that digital textuality is a hybrid phenomenon. It is a replacement for writing and printing – that is to say, a medium capable of replacing many functions of those much more familiar media – and at the same time digital text, because of its inherent instability, can be subjected to all of the programming capabilities of the computer as a Universal Machine. These capabilities take digital textuality far beyond the medial functions of the book and make it into an extraordinarily versatile research instrument – or, better, sociotechnical research envi-

*ronment. Medium and research environment are, moreover, so seamlessly integrated in the same computing environment as to be virtually indistinguishable.*⁷

To illustrate what I mean by this continuing computability take the (deliberately very simple) example of full-text searching. Digital texts can of course be found as whole entities, i.e., no different from the integral physical items library catalogue records refer to. Such items (let's call them books) may contain an index created by the author, or an editor or publisher, accessible upon retrieval of the item from the library shelves. However, in a full-text search of the docuverse a user 'computes' the docuverse of texts on the internet in order to look inside all of them at once, bypassing the conventional means of access through library catalogues that only lead to the entities as a whole, and indexes that only become available upon retrieval of each individual item.

3. In combination with the fluidity of computable text the two-way server–client architecture of the computer-in-a-network has enabled a distributed digital knowledge creation and exchange environment (i.e., what in the world of scholarship is now called e-science, cyberscience, etc.) 
The so-called collaboratory is perhaps the most familiar concrete example.

Having identified what I regard a number of fundamental discontinuities as such, I would like to single out some salient *consequences* they might carry for the way the knowledge system functions. In the digital information environment *more* things can be done than in its analogue counterpart, but I would like to emphasise that even when we appear to be talking about doing the *same* things, in crucial ways these are done *differently*. Why do these differences – the discontinuities I have just identified – matter?

1. The multimodal nature of the digital environment, seamlessly integrating text, still images, graphs, moving images, speech and music, enables very different forms of knowledge inscription than the preponderantly textual one that has reigned supreme for so many centuries. Ultimately this might spell the end of the privileged position of text as the basis for the dissemination of knowledge.

2. Full text searching. That digitisation (and a fortiori mass digitisation) creates new ways of access, with full text searching taking the place

of indexing can, as I suggested, easily be constructed as a continuity. However, its consequences are potentially revolutionary, for example because to a large extent it bypasses the experts that conventionally create and guard access to textual resources: bibliographers and librarians. That the experts are up in arms about the lack of quality and integrity both of the digitised data themselves and of the alternative access offered to them is certainly not deterring users.⁸

That the same computing environment in which digital texts always remain computable functions both as a medium and as a workspace where texts can be manipulated in any way, *and* that this environment encompasses the entire internet has some truly revolutionary consequences:

3. The multiplicity of authorship. The Web's collaborative means of knowledge production favours multiple authorship, leading to what may be called a 'granularity issue' in attributing individual contributions (which may be very small) to named actors. There are – at least practical – limits to the scope of such attributions. This obviously threatens conventional notions of both authorship and ownership on which the libroverse has come to depend.⁹

4. The porosity of the boundary between actors inside and outside the traditional knowledge system. In Web 2.0 the process of knowledge creation has spread to include all web users, also inviting 'amateur scholarship'. Commenting and tagging of web resources by general users regardless of formal qualifications are good examples of such 'democratic' knowledge production. The mixed provenance from inside and outside the traditional knowledge system leads, for example, to questions about the assessment of quality.

5. The porosity of the boundary between knowledge that is the result of a process of 'digestion' (rational deliberation, or however one may wish to define scholarship) and knowledge that is left implicit in the raw materials presented. Digital editions proffer a good example. These are often presented as archival collections of primary data that remain to be 'computed'. That is to say, there remain choices to be made by the user, who needs to establish the relative value of the various raw materials. The rawness of these 'scholarly semi-manufactures' leads to what I have called elsewhere the 'deferral of the interpretative burden,'¹⁰ i.e., from the editor to the reader.

6. *The porosity of the boundary between object and tool. As a result of the continuing computability of the digital text, the digital knowledge environment is focused strongly on the process, both of knowledge creation and of knowledge dissemination, rather than on the outcome (the frozen contents, or ‘monuments’ of knowledge familiar from the Order of the Book).*¹¹

7. *The rate of growth of digital data. Both absolutely, as the population grows, and relatively, as a percentage of the population, the number of people thronging to gain access to the net continues to grow, and with it the power to add to or change the digital textual record.*¹² *This growth is hardly hampered by an physical constraints: the cost of storage memory continues to be dropping at about the same rate as computing power is growing. If one adds to this the versioning challenge that results from the fact that these data remain in a permanent state of flux, one can readily imagine the Sisyphean nature of the task of maintaining some semblance of bibliographic order.*

8. *The rate of change of the computing environment. Computers being universal machines, new digital technologies will keep being invented. The rate of such inventions will only accelerate. Already there is a continual influx of new technologies before there is even time to understand properly the nature and implications of existing ones. Any future is unforeseeable, but the problem is that the unforeseeable future is no longer experienced as being far ahead – or even in the future at all: it is constantly with us now. This means that, whether as scholars, publishers, librarians or archivists, however hard we are trying to dam the tide of innovation and change, through such aids as metadata, controlled vocabularies, ontologies and preservation schemes, we are bound always to lag behind.*

Not a conclusion

The concept of a conclusion being rather alien to the nature of the docuverse, which is characterised by lack of closure, I won't attempt one. However, I *would* like to suggest that after five centuries and a half, we might need to give up the book as our chief model for the production and dissemination of knowledge. Incidentally, I don't mean this at all as an apocalyptic view; I like to think that I am rather matter of fact about it.

Conditioned by centuries of print, Western man has evolved to be *homo typographicus*, and the apparent continuities between analogue and

digital text (expressed at the most basic level in that both are character based) are apt to mislead him. In reality the universe of digital texts is more alien to our sensibilities than we have been ready to admit – or have even begun to recognise. The discontinuities are significant and the very different nature of the digital textual medium represents a major challenge to our knowledge system, which is firmly based on the analogue practices of a pre-digital information architecture shaped by the particular nature of the printed book.

I think we need to recognise the prominent role of technology in causing major discontinuities in our knowledge system.¹³ Our very concept of knowledge has been shaped by the Order of the Book, that is to say, by properties that resulted from the technological affordances of print that I listed at the beginning of this essay. It would be naive to think that the advent of the digital medium would not affect it, in the various ways I have suggested, and other.  For example, the digital media are eating away at the strong time-honoured connection between what is regarded as knowledge and the Order of the Book's system of attribution and authority.¹⁴ This means that one of the effects of digital textuality is to question the very concept of what knowledge is.

We live in a transitional era, between an orientation towards the past (the Order of the Book) and a digital future of some sort. In this transitional era the analogue knowledge system, which by dint of its long history continues so far to dominate our thinking, is straining to accommodate the products of the digital textual medium. For this, however, it is not well suited. Our instinct continues to be to create order and control in the spirit of the Order of the Book. The more the digital information environment resists this, the more our ingrained typographical habits are in danger of becoming like a straitjacket or, worse, like a Procrustean bed.

At the same time there is (as yet) no digital knowledge system. In fact, I fear that it may simply prove impossible even to design a digital knowledge *system* – at least one bearing any resemblance to a system as we conceive it. The technological nature of the digital medium, as well as the use we make of it socially, are too much at odds with the knowledge paradigm of the book. So perhaps the wheel needs to be reinvented after all – and it may not much resemble a book wheel – or any other wheel that we know.

In the meantime, the knowledge system – or those who continue to believe in it – may be fighting a rearguard battle in trying to assert its continuing value and usefulness. The *coup de grace* as I see it is the strong pressure that is building up even from within the traditional knowledge

system to open the floodgates to methods and products from outside the knowledge system.¹⁵ If this pressure was not ultimately caused by the nature of the digital medium itself we might perhaps conspire to ostracise the upstart authors. As it is, the very properties of the digital knowledge environment predict the likeliness of the system yielding to this pressure.

It was always one of the key features of the traditional knowledge system that it tried to defend itself against impostors and interlopers. However, a new knowledge production paradigm may need to set aside traditions of gate-keeping, selection and control, the checks and balances of the analogue knowledge system, based on hierarchy and experts. Instead it might be left to the end user to analyse and make sense of huge quantities of undifferentiated data.¹⁶

We are closer than ever to bringing together the record of all human knowledge. However, we are rapidly losing our control over it. So I would like to make a case for adopting a much messier concept of knowledge.¹⁷ Stephen J. Gould advocated an understanding of the descent of man that substitutes for the image of a tree (a hierarchical image if ever there was one) that of a bush. Just as he maintained that humans are but a ‘tiny, late-arising twig on life’s enormously arborescent bush – a small bud that would almost surely not appear a second time if we could replant the bush from seed and let it grow again,’¹⁸ we need to revise our hierarchical view of knowledge. We might have to replace it with a more rhizomatic view, lacking all order or system. This new knowledge paradigm is a ‘free for all,’ where the ‘system’ is replaced by the network. In negotiating this massive network of information – this ‘world brain’ – we may need to learn entirely new ways to extract the knowledge that we seek. Rather than rely on ready-made knowledge attributed to individual minds, we may need to explore our own pathways through the collective hoard of facts and opinions, for example using hosts of tiny bots and other assorted artificial intelligences to ‘make sense’.

The problem with this vision is of course that we will gradually have to let go of our innate desire for control. We have to abandon a system that has constructed our view of knowledge, our view of the world, and ultimately our view of ourselves for so long, but is now becoming antiquated. This may not be easy, but if an eighteenth-century Anglican clergyman could do it, so can we. For Laurence Sterne’s *Tristram Shandy* must serve us as a remarkably early and very instructive deconstruction of the book as a knowledge machine:

Thus – thus, my fellow-labourers and associates in this great harvest of our learning, now ripening before our eyes; thus it is, by slow steps of casual increase, that our knowledge physical, metaphysical, physiological, polemical, nautical, mathematical, aenigmatical, technical, biographical, romantical, chemical, and obstetrical, with fifty other branches of it (most of 'em ending as these do, in -ical), have, for these two last  ries and more, gradually been creeping upwards towards that  of their perfections, from which, if we may form a conjecture from the advances of these last seven years, we cannot possibly be far off.

*When that happens, it is to be hoped, it will put an end to all kind of writings whatsoever; – the want of all kind of writing will put an end to all kind of reading; – and that in time, – As war begets poverty; poverty, peace, – must, in course, put an end to all kind of knowledge, – and then – we shall have all to begin over again; or, in other words, be exactly where we started. (Laurence Sterne, *Tristram Shandy*, Chap. 21)*

And if we have any doubt whether we are capa of willingly destroying our carefully constructed knowledge machines, let's face it, the new generation is already doing it. They appear very happy to forego the guidance of their elders and betters, and to be comfortable in finding their own way through the jungle.

References

- 1 See Anthony Grafton, *The footnote: A curious history* (London, 1997).
- 2 A phrase inspired by the title of Roger Chartier's *L'Ordre des livres* of 1992 (translated into English by Lydia Cochrane as *The order of books: Readers, authors, and libraries in Europe between the fourteenth and eighteenth centuries*, Stanford, 1994).
- 3 See, for example, Françoise Levie, *L'homme qui voulait classer le monde: Paul Otlet et le Mundaneum* (Bruxelles, 2006).
- 4 Vannevar Bush, 'As we may think,' *Atlantic Monthly*, July 1945, pp. 101–8.
- 5 The latest edition is *TEI P5: Guidelines for electronic text encoding and interchange*, ed. Lou Burnard and Syd Bauman (Oxford, Providence, Charlottesville and Nancy, 2008).
- 6 George P. Landow, *Hypertext: The convergence of contemporary critical theory and technology* (Baltimore and London, 1992) (rev. edns 1997, 2006); Jay David Bolter, *Writing space: The computer, hypertext, and the history of writing* (Hillsdale, N.J., Hove and London, 1991) (rev. edn., 2001); Richard A. Lanham, *The electronic word: Democracy, technology, and the arts* (Chicago and London, 1993). Theodore Holm Nelson's *Literary machines* of 1981 preceded them by a long stretch, but Holmes was too visionary to be taken seriously by more than a handful of followers. It was the invention of the World Wide Web by Tim Berners Lee in 1990 that served as the foremost catalyst for his ideas.
- 7 See Adriaan van der Weel, 'New mediums: New perspectives on knowledge production,' in Wido van Peursen et al. (eds), *Text comparison and digital creativity: The production, presence and meaning in digital text scholarship* (Leiden: Brill, 2010).
- 8 As regards searching and finding it is worth noting, incidentally, that the multimodality of the digital environment, where all modalities mix freely, is creating an imbalance in this respect. Where search capabilities are concerned, some modalities turn out to be more equal than others. Time-based media, which are on the increase also in the scholarly sphere, require a different way of access than text, and they cannot (yet) be searched in the same way as text-based ones. (See, for example, the *Journal of Visualized Experiments*, <http://www.jove.com/>, which was established as a new tool in life science publication and communication, to visualise the 'intricacies of life science research': 'Visualisation greatly facilitates the understanding and efficient reproduction of both basic and complex experimental techniques, thereby addressing two of the biggest challenges faced by today's life science

research community: i) low transparency and poor reproducibility of biological experiments and ii) time and labour-intensive nature of learning new experimental techniques.’ I am indebted to Ernst Thoutenhoofd for drawing my attention to this phenomenon.)

- 9 Recently on TEI-L, the Internet discussion list of the Text Encoding Initiative, under the heading ‘question about translators in biblFull’ a discussion took place on the relative significance of contributions varying in nature and extent to the intellectual content of a work. The example was given of ‘crowd-sourced translations’ in a social networking site, where many individuals contribute **too small units of information to document** (TEI-L, 27–29 May 2009).
- 10 Adriaan van der Weel, *op. cit.*
- 11 This is also implied in the view of Clifford Lynch: ‘The role of libraries, he argued, will shift from primarily acquiring published scholarship to a broader role of managing scholarship in collaboration with the researchers that develop and draw upon it.’ (Diane Goldenberg-Hart, ‘Libraries and changing research practices: A report of the ARL/CNI Forum on e-Research and Cyberinfrastructure,’ *ARL: A bimonthly report on research library issues and actions from ARL, CNI, and SPARC*, 237 (December 2004), pp. 1–5, at p. 1).
- 12 *Time* magazine characterised this development well in 2006 by electing as their ‘person of the year:’ *You* (*Time*, 13 December 2006).
- 13 Clifford Lynch stated a few years ago that ‘massive changes in scholarly practice are occurring across all disciplines.’ He argued that ‘new practices, products, and modes of documenting and communicating research will have far-reaching implications for all organizations involved in managing the scholarly record and supporting the ongoing enterprise of scholarship’ (Diane Goldenberg-Hart, *op. cit.*, p. 1).
- 14 Referred to as ‘reputational control mechanisms’ by Virtual Knowledge Studio (Paul Wouters, Katie Vann, Andrea Scharnhorst, Matt Ratto, Iina Hellsten, Jenny Fry and Anne Beaulieu), ‘Messy shapes of knowledge: STS explores informatization, new media, and academic work,’ in *The handbook of science and technology studies*, eds. E. J. Hackett, O. Amsterdamska, M. Lynch and J. Wajcman (Cambridge, MA), pp. 319–35, at p. 333.
- 15 Cf. 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). Also compare the fascinating experiments conducted by Luis Von Ahn as described in

- his lecture 'Human computation' (Google TechTalk, 26 July 2006, <http://video.google.com/videoplay?docid=-8246463980976635143>).
- 16 Cf. what is already happening in the case of digital text editions, as I have observed above.
- 17 I am indebted for that phrase to Ernst Thoutenhoofd, who alerted me to one of the Amsterdam Virtual Knowledge Studio's research projects, called 'Messy shapes of knowledge.' See, for example, Virtual Knowledge Studio, *op. cit.*
- 18 Stephen J. Gould, 'The evolution of life on earth,' *Scientific American*, 271 (October 1994): pp. 85–91 (also at <http://brembs.net/gould.html>; I am indebted to Ruud Hisgen for pointing out this parallel). That it 'would almost surely not appear a second time if we could replant the bush from seed and let it grow again' offers a nice parallel with the fact that certain knowledge creation processes, too, are becoming so complex as to be to all intents and purposes unrepeatable, which was one important rationale for the foundation of the *Journal of Visualized Experiments*.