Changing our textual minds

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Towards a digital order of knowledge

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Abbreviations

ASCII	American Standard Code for Information Interchange
CSS	cascading style sheets
DTD	Document Type Definition
DTP	DeskTop publishing
EPUB	Electronic Publication (file format)
FTP	file transfer protocol
GUI	Graphical User Interface
HTML	Hypertext Markup Language
OCR	optical character recognition
OHCO	Ordered Hierarchy of Content Objects
OWL	Web Ontology Language
PDA	personal digital assistant
pt	point, a measure of type(face) size
PDF	Portable Document Format
RDF	Resource Description Framework
RTF	rich text format
SGML	Standard Generalised Mark-up Language
SMS	short message service (text message)
TCP/IP	transmission control protocol/Internet protocol
TEI	Text Encoding Initiative
WIMP	Windows, Icons, Mouse and Pull-down Menus
WWW	WorldWide Web
WYSIWYG	what you see is what you get
XML	Extensible Mark-up Language

Acknowledgements

This book started life as a course reader, collecting a few instructional texts on mark-up: what it is, what it does, and how to actually mark up texts. It has since gained in ambition and scope, and altogether lost its original purpose. It found its present form as an essay on the history of textual transmission in 2007, when a subsidy from the Dutch national research funding body, NWO, enabled me to take a six-month sabbatical, freeing me from teaching duties.

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Rotterdam/Leiden, June 2010

Introduction

From the 'Order of the Book' to a digital order?

Western culture is a mediated culture. Mediums, more than direct personal experience, define people's world picture. Starting with images in prehistory, mediation took off in earnest with the invention of writing. It accelerated as first print, and then new medial forms such as photography, film, radio, and television were invented at ever shorter intervals. In such a mediated culture, medial change has an enormous social impact. Already the current digital developments are showing to be no less momentous than those of the epoch-making historical changes that preceded them.

Books, newspapers, periodicals, and any number of old and new text formats are now finding digital form at a rapid, even exponential, rate.[1] Paradoxically, text is both the first and the last of the medial modes that is to go digital. It was the first in the sense that text was the first modality after numbers to become computable in the 1950s. Since then digital texts have become available in vast quantities, both digitised analogue texts and texts that did not exist in analogue form before, notably Web pages. At the same time – and this is the paradox – paper books, newspapers, periodicals, and other products of the printing press continue to persist in vast quantities. While digital photography, digital video, and digital music are now the norm, the entire analogue world of printing, bookshops, and libraries still largely continues as of old.

That it was the last of the medial modes to go digital is the result of that peculiar phenomenon in the dialectics of progress that an initial head start tends to turn into an eventual handicap.[2] The long-term

1 The history of e-book sales in the United States may serve as an example of such exponential growth: www.idpf.org/doc_library/industrystats.htm.

2 A phenomenon the Dutch historian Jan Romein termed the 'law of the

importance of text and print to society, and especially the gradual perfection of the book into the reading machine it is today, have given it a ubiquitous and hardy presence. In Western culture printed text structured in the form of books has become a major social organising principle, which I will be referring to as the 'Order of the Book'. The absence of the book as an organising principle and fixed point of reference is hard to imagine.

It is hard to imagine that the world of paper texts could go the way of analogue music, with the gradual disappearance of record shops and record companies. Yet there are many signs that it has already started to happen. The digitisation of textual transmission is proceeding so rapidly that already the consequences are huge and all-encompassing, indeed revolutionary. As reading practices move on line the once discrete products of the print world all become part of the digital textual 'docuverse', and that docuverse in turn becomes part of the all-digital array of mediums converged on the WorldWide Web. In the online digital domain, reading – once an isolated, private activity – is but one of a panoply of medial activities on offer. Increasingly reading has come to share the same space with shopping, watching a film or television, listening to the radio or a podcast, e-mailing or writing a blog entry.

Moreover, as I have argued elsewhere,[3] if the Order of the Book is gradually disintegrating, it is highly unlikely that it will be replaced by a similar but now digital order. The chief characteristic of the digital 'order' seems to be precisely that it evades a sense of order. It certainly evades the familiar one-way linear hierarchical order fostered by the print paradigm. This makes it all the more urgent to attempt to understand the implications of the digitisation process that is currently washing over us.

The chief purpose of this book is to 'make visible' the digitisation of textual transmission and what it entails, and to assess its (potential) impact. The advent of a range of 'new media' in the last 150 years or so has been studied in meticulous detail. In fact the impact of photography, film, radio, and television continues to be scruti-

diminishing lead' in *The Watershed of Two Eras: Europe in 1900* (Middletown CT, 1978), p. 4.

3 In 'Explorations in the Libroverse', forthcoming in the proceedings of the 147th Nobel Symposium, 'Going Digital: Evolutionary and Revolutionary Aspects of Digitization', Royal Academy of Science, Stockholm, 23–26 June 2009.

nised to this day. By contrast, the changes in textual transmission – though they are, as I shall argue, at least as pervasive and formative of our culture – have been comparatively neglected. Moreover, while the tremendous social change caused by an invention like the steam engine is rarely questioned, the notion that the printing press could be regarded as an 'agent of change' is anathema to most historians today. The transformativity of other technological inventions is readily accepted, but the notion of the transformativity of textual mediation seems for some reason unacceptable.

Among the more plausible explanations for this scepticism is the fact that text has been with us for such a long time. Text is old in the sense that its cultural transmission started a long time ago (if 5,000–6,000 years may be called long in human history), but it is also always old in each individual lifetime. Learning to read and write tends to happen so early in formal education, if not before, that humans have little conscious experience of pre-literacy, leaving text almost invisible as a technology. As a consequence our awareness and understanding of the formative role of *text* rather than 'the media' (usually confined to film, radio, television, and journalism) in human culture remains surprisingly rudimentary.

The need to redress this imbalance is one major reason why, despite the convergence of all modalities in the digital realm, in this book I will restrict myself to the modality of text. (Although I will naturally place text in the context of other modalities where relevant.) Despite the prominence of 'the media' in contemporary society, writing remains the most important medium for the transmission of knowledge ever devised. It has a long and continuous history of inscribing human culture. Text has given material shape to opinions, knowledge, creative ideas, and so on for centuries.

One advantage of this restriction in scope is, incidentally, that it allows the major – but by no means the sole – disciplinary perspective on this digital revolution to be that of book studies. Book studies used to be confined to the printed book and other products of the printing press. However, the recognition is now beginning to take hold that book studies should take a longer perspective, and deal with the history of textual transmission at large. Though an entire chapter will be devoted to a definition of terms later on, this distinction is worth stressing now. The material *book* is merely one particular, historical, form in which text is materialised. *Text*, on the other hand, is a system for the inscription of linguistic utterances by

means of characters, that both pre-dates the book and survives it. In other words, even if text as a *modality* remains constant, its materialisation as a *medium* has taken a variety of forms. A manuscript book, a printed book or digital text all use the same modality, but represent different mediums. In such a longer perspective the history of the book is merely a chapter in the history of textual transmission, which is the history of the production, distribution and consumption of text. The history of textual transmission is also the history of the interaction between textual form and textual content – in manuscript, printed and digital form – and of the social significance of that interaction. Though this longer perspective is relatively new, book studies is a long established discipline, which is itself of a multi- if perhaps not quite post-disciplinary nature. In this book I intend to borrow insights from many other disciplines, including linguistics, philosophy, science and technology studies, brain and cognition studies.

The method I will use to assess the significance of the digitisation of textual transmission is twofold. Chiefly I will give a descriptive historical account, along with an analysis of the importance of the major milestones: the inventions of writing, printing, and digital textual transmission. This historical account of the long and continuous history of inscribing human culture by means of text stresses the technological nature of textual mediation in order to make it more visible. The historical account also emphasises that the textuality that characterises Western society today is the outcome of a long and organic process. It began when the first forms of writing began to invade the oral mind set. Then printing changed not only the technological means by which texts were transmitted but equally the nature of their contents. Now the flood of digital texts is again affecting both the nature of the message and its social significance. The history of inscribing human culture has been, and continues to be, a process of continuities and discontinuities. Some elements of the earlier technology carry over into the new, while others gradually disappear and entirely new characteristics emerge. In this organic process technology will be found to play a pivotal role.

In the historical narrative the central focus will be on the introduction and next the development of the digital textual medium. It discusses the social implications attending on the change from predominantly paper-based to increasingly digital textual mediation. Despite all appearances to the contrary, I would suggest that the digital substrate has lent text a new and unfamiliar aspect. This

book probes especially what that unfamiliar aspect consists in, and what its significance is. While not ultimately immaterial, the inscrutable and conditional existence of virtual text, for example, gives it a ghostly and unstable quality. The convergence of modalities, as well as the convergence of formerly discrete mediums in a single digital medial space has repercussions that are not at once obvious but nonetheless far-reaching. The digital 'docuverse' enables new ways of accessing the text, both as a whole (the unitary text, conventionally identified, for example, by means of a library catalogue record) and as fragments of text within a collection of unitary texts. Moreover, the 'democratisation' of textual production, distribution and consumption creates an entirely new relationship between author and reader.

The second part of the methodology is that this historical account, although it concentrates on the digital developments in text transmission, will be a contrastive analysis of all of the textual revolutions and their impact: the introduction of writing, printing, and digital textual transmission. In this way historical knowledge about the actual development of the earlier relevant medial technologies of writing and printing can inform an understanding of the digital revolution that is now taking place. A historical comparison can establish certain technological properties that can be seen – at least in retrospect – to account for its later development and, importantly, its social consequences. For these properties I propose to use the concept of *salient properties*.

In this process, social factors play a role too. The historical account of the way the computer came to be the next major support for text stresses the sociotechnical nature of change. This suggests a spiral movement in the dialectic between social and technological factors, in which, however, technology acts as a catalyst. It both contributes the initial driving force and represents the conditions enabling change, initially as well as later. Technologies are usually created without a clear view of their full ultimate deployment. They usually suggest social uses *after* they are made available. It will be shown that these social uses are frequently not only additional to, but different from those foreseen by the developer of the technology. Instead of being steered by intentions, the development of technologies tends to be steered by inherent technological properties: their salient properties. Attending the unintended *uses* of technology there are obviously also unintended *social consequences*.

Such a comparative historical perspective on medial change also highlights the transformative nature of textual mediation. The book will suggest that medium change is as transformative as, for example, the evolutionary development of language in humans, influencing not only the form but also the content and nature of human knowledge. The implications are vast and, far beyond those who deal with text professionally (writers, educators, scholars, publishers, librarians), affect society at large, notably in such institutions as education and democracy. By helping to determine the way we think, they help to determine our culture and our identity.

This latest revolution in textual inscription is happening right now. It may be too early to bring to the analysis the right amount of historical distance to reach lasting verdicts about its significance, but I am convinced that studying the radical changes that are now happening will afford much-needed insight into the mechanisms at play. The findings from the comparison can be usefully applied to the present, offering a 'handle' to help understand present developments and perhaps even a measure of control over this process of change. Moreover, establishing the inherent properties of digital textuality in a historical perspective also allows a tentative extrapolation into the future. This is intended not as an exercise in fortune telling but to help gauge the pervasive transformative power of this latest textual revolution.

The book is organised as follows. Suggesting a parallel with language, Chapter 1 establishes the transformative nature of textual technology. It elaborates on the book's aims and the method it employs, and discusses the challenges to the task at hand.

Chapter 2 offers definitions of the terms most relevant to understanding textuality and its significance for human culture, and so sets the framework for the account of the historical development of textual technology and the contrastive analysis in the remainder of the book.

By presenting a concise account of the history of textual transmission up to the digital revolution, Chapter 3 presents the historical context in which to understand that revolution. However, it also demonstrates how contemporary developments in the digitisation of text throw a new light on the earlier revolution of printing, forcing a reinterpretation of 'known' facts. In fact it challenges the very notion what it was that Gutenberg invented and why that was, or was not, significant.

The main topic addressed in Chapter 4 is how developments in the digital transmission of text resulted from the interplay between social and technological factors, and how this relates to inherent salient properties of the digital medium on the one hand, and the social construction of these characteristics on the other.

Chapter 5 presents the particular constellation of salient technological properties that characterises digital text. It identifies some of the many social repercussions of this particular technological form of the medium, affecting both the nature of its messages and the connotation of digital textuality in the broader social sense.

Chapter 6 sketches in very broad outline some of the current and potential future effects of digital textuality, and, in so doing, returns also to a discussion of the nature of sociotechnical change in the light of the book's findings.

1

A textual universe

Over the last few decades many functions that have always been associated with books and other forms of print have been taken over by computers and the Internet. From encyclopedias to scholarly journals, and from office memos to books and reports, writing has moved into cyberspace. This book tells the history of how computers became a medium for the transmission of text and what that means for our textual universe. The story is neither very long nor very intricate. But, since it forms the latest chapter of the celebrated and much longer history of the spoken and written word in human communication, it deserves to be written as such. Considering that we started to use language only in the last 200,000 years, while hominids have been around for about 6 million years, even the history of language is not a very long one. But it is long, and extremely important, in relation to the history of civilisation. In fact, the two are so intimately connected as to virtually coincide. Every major event in the history of language – the arrival of digital textual transmission being no exception – has had momentous consequences for civilisation.

The first of these major events occurred about 5,500 years ago, when our ancestors started to produce the first written records: inventories, on clay tablets.[1] To testify to the significance we attach to the invention of writing, we use it to indicate the watershed between prehistory and history, and we believe that the formation of the state as an organisational principle depends on writing. Then, about 1440, less than six centuries ago, a German goldsmith by the name of Johannes Gensfleisch zum Gutenberg started experimenting with a new way of copying texts as an alternative to writing off each single

1 The invention of writing took place at various places in the world at roughly the same time. The perspective of this book will be from the Western world.

copy laboriously by hand. That his invention of printing with movable type has been one of the most crucial developments in the history of civilisation has been a truism since it was first stated by Francis Bacon (incidentally correctly tracing its history to China): 'printing, gunpowder, and the compass … have changed the appearance and state of the whole world'.[2] It was Gutenberg who, in recognition of that fact, was elected 'Man of the Millennium' in the *Time* polls held in the last months of the year 2000. Though the claims made by the US historian Elizabeth Eisenstein for Gutenberg's technology as an 'agent of change'[3] have been criticised as unduly deterministic, there is no doubt that without it the world would be so different as to be unrecognisable. (It is curious, incidentally, that there is such reticence about attributing causal influence to the technologies of writing and printing. Technology is never neutral, and invariably brings effects that were not foreseen or intended by its inventor. Few people hesitate in assigning a major agentive role to the steam engine in the transformation of Western societies from agricultural to industrial, and in the creation of capitalism. I will return to this later.)

Embracing the new digital medium adds a major new chapter to that transformative history of the transmission of text. The implications of writing and printing for human culture have been momentous, and there is little doubt that the digital developments will prove similarly momentous. By examining the continuum from writing and printing to the many digital text forms in current use I would like to trace how the computer came to function as a medium for the communication of texts, but, beyond that, also to begin to explore the wider cultural implications of the adoption of this new medium.

This is an ambitious goal. Though it appeared obvious to many contemporary observers that writing and printing were going to have momentous consequences, only with hindsight has it been possible to gain a better idea of the actual nature of those consequences, and how it was that these mediums were able to effect such vast change. Contemporaries could only guess at future developments, and though they managed to predict some, they could not, for all

2 Francis Bacon, *Novum Organum*, 1620, Aphorisms on the interpretation of nature and the empire of man, no. 129.

3 Elizabeth Eisenstein, *The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early Modern Europe*, Cambridge, 1979; an abbreviated edition was published, also by Cambridge University Press, as *The Printing revolution in Early Modern Europe* in 1983.

the wondrous human ability to project into the future, predict all of them. Plato had Socrates express the fear – with some justification, as it turned out – that the use of writing would cause a decline in our powers of memory,[4] but he could hardly anticipate the profound paradox that something that was going to 'fix' our utterances would in fact end up precipitating change. He also failed to anticipate that turning thoughts into objects would bring an 'objectivity' to human knowledge that it could never have achieved otherwise.

We would obviously deceive ourselves if we thought we could predict the longer-term significance of the changes brought about by medial change any more than our classical Greek or early modern forebears. But the challenge is hard to resist, for to be human is to be curious. We do, moreover, flatter ourselves with our ever improving knowledge and, what is more, conception of history – which of course we derive largely from our sophisticated mediums. We may not be able to intimate the sweeping cultural and socioeconomic transformations that it will be the privilege of later generations to discern and name. However, we will be able to perceive some of the elements of change that have already begun to manifest themselves, and we can try to ground them in an understanding of the nature of the digital medium.

Ambitious though this goal is, it might nevertheless be objected that it is too narrow. Apart from manuscript and print, we have invented various other new mediums over the course of the last century and a half to communicate the spoken word, as well as still and moving images. Between them, film, radio and television enable us to record, multiply, and even broadcast whatever words and actions we deem to be of interest to our fellow humans – or even only to ourselves. They have transformed society no less than have the textual mediums. Also, since the digital medium now covers the entire spectrum of modalities of existing analogue mediums, why restrict this investigation to writing? There are in fact some good reasons for singling out the digitalisation of *text* – always remembering, of course, its context in the current convergence of modalities. Leaving aside the fact that the long history of text is fascinating in its own right, the first reason is simply pragmatic. It is hardly feasible to do justice to the digital revolution at large in one book, especially if it is to be regarded from a longer historical perspective. Secondly, while

4 In *Phaedrus*, 274d–277a.

the social significance of the textual mediums is huge, its impact has been studied – perhaps even *noticed* – less than that of the so-called 'mass media' (film, radio, television). Again, I will suggest reasons why this might be the case later, but this comparative neglect needs to be addressed urgently.

Why is it that mediums have had such a transformative impact on our history? One obvious answer is: because we are social creatures and communication is our lifelong pursuit.[5] We communicate when we talk to each other, when we make love or war, when we watch the news headlines, when we read a book, or indeed when we write one. We communicate in order to stay alive. Although there are a host of other species that are social like us, humans have invented an impressive array of elaborate technological implements for the purpose of communication: mediums.

Where humans really stand out, though, is that we have looped mediums back into our language and consciousness. We use mediums to communicate with each other, but we also use the *concept* of mediums and communication to make sense of ourselves and our surroundings. Because it is such a very important activity to us, the concept of communication is central to our understanding of ourselves and the universe we inhabit. From the simplest movement of a primitive organism in reaction to a source of light or temperature to the social behaviour of a group of dolphins, or the very sophisticated ways we ourselves attempt to control nature, we regard all living organisms as communicating, whether they are interacting with each other or with their environment. In fact, the communication metaphor serves us to understand how, bowing to the greater imperative of the survival of the species, all organisms end up communicating their own genes in the process of procreation.[6] As

5 Cf. Raymond Williams, who writes in *The Long Revolution* (London, 1961) that 'All living forms have communication systems of a kind, but … in man, the process of learning and relearning, which is made possible by social organisation and tradition, has led to a number of communication systems of great complexity and power. Gesture, language, music, mathematics are all systems of this kind' (pp. 38–39).

6 As James Beniger asserts in *The Control Revolution: Technological and Economic Origins of the Information Society* (Cambridge MA and London, 1986), 'information processing might be … seen as the most natural of functions performed by human technologies, at least in that it is shared by every cell of every living thing on earth' (p. 59). Indeed, 'genetic engineering must itself be viewed as an information technology' (p. 58).

the vessel for the replicatory mechanism of our genes we might even call ourselves a medium, which neatly illustrates the point.[7]

That humans are the only species to have developed such sophisticated medial technologies – and that they use the concept of mediums and communications to make sense of the world they inhabit – points to the importance of mediums for human culture. But what exactly is it that causes mediums to have such a transformative impact? Can it be assumed that the changes that are now taking place in the continuum from manuscript and print to the digital transmission of text will be similarly transformative?

There is an influential – if controversial – twentieth-century tradition of thinking that, unlike that mysterious seventeenth-century element called ether, mediums are not fully transparent. Rather, they affect our cognition, and ultimately our social organisation. How this happens is through a 'bias' in the way they enable us to communicate. Manuscript, print, radio, television, and the digital medium each have traits that predispose us to particular types of knowing, and particular types of knowledge, and so ultimately affect the way we see the world and our place in it.[8] The notion that the development of communications technology is central to human history is intuitively compelling. The trouble with it is that the 'evidence' is largely circumstantial, and the 'theory' is very hard to prove or falsify.[9] This

7 Until we come to examine the term more closely (in Chapter 2), a preliminary definition of medium could be as follows: 'a construct consisting of a tool or technology with its (explicit) technical protocols and any implicit social protocols with the function to communicate information'.

8 This awareness began with the research of Milman Parry and his student Albert Lord into the oral tradition in the early twentieth century. Parry and Lord found that literature in the oral tradition was very different in nature from that produced in a literate society. Lord contended in *The Singer of Tales* (Cambridge MA, 1960) that there was in fact a complete divide between oral and literate composition. I will return to the debate this occasioned in Chapter 3. Famously Marshall McLuhan tried in *The Gutenberg Galaxy: The Making of Typographic Man* (Toronto, 1962) to analyse how our use of communication technology affects us cognitively. He holds manuscript, print, and the 'electric media' (radio and television) accountable for historically very different types of social organisation. With this much acclaimed, but also much criticised, study McLuhan in his turn inspired Eisenstein's notion of the printing press as an agent of change (Eisenstein, *The Printing Press as an Agent of Change*), which posited large-scale cultural effects directly caused by the printing press.

9 Ruth Finnegan has suggested, for example, that it is hard even to establish what it is exactly that proponents of the orality–literacy divide were actually

has led to widespread scepsis that it can be established that mediums have an instrumental role, and even to the downright denial of any instrumentality. But that is clearly to throw the baby out with the bathwater. Medial change concerns unique historical processes of a qualitative rather than quantitative nature, but that does not mean that nothing useful may be said about causality. Without being overly scientistic about it, the notion is too compelling to be dismissed out of hand. It is just a matter of finding a productive way to deal with it.

It is useful at this point to posit a parallel with language. In dealing with textual mediums such a parallel is obviously not so far-fetched.[10] Not coincidentally, the argument about the centrality to human history of the development of communications technology followed in the footsteps of a growing awareness, from the late nineteenth century, of the function and actual workings of language in human communications. In linguistic thinking, the notion was gaining ground that language was more intractable than had always been assumed. One central realisation was that our relationship with language is bidirectional. If we have made words mean something, we have done so only marginally more than words have taught us what we may mean in the first place. As C.S. Peirce wrote as early as 1868:

> Man makes the word, and the word means nothing which the man has not made it mean … But since man can think only by means of words or other external symbols, these might turn round and say: 'You mean nothing which we have not taught you, and then only so far as you address some word as the interpretant of your thought.' In fact, therefore, men and words reciprocally educate each other; each increase of a man's information involves and is involved by, a corresponding increase of a word's information.

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claiming. In *Literacy and Orality: Studies in the Technology of Communication* (Oxford, 1988) she distinguishes four possible levels of causal claim: that the technology of communication is the single cause of social development, determining the nature of society; that it is an important causal factor, but only one among several; that it is an enabling factor, opening up opportunities which may of may not be taken up in particular societies or periods; that it causes some things in society, but not everything (p. 38). A note of caution is certainly salutary, but Finnegan's attempts to weaken the more determinist position by comparing Western with non-Western cultures are ultimately not very convincing. I will return to the relativist debate later.

10 In fact, as we shall see in Chapter 2, some scholars regard language itself as a medium, too. However, since we are born with all the prerequisites for language I would hesitate to call it a 'tool or technology'.

> Without fatiguing the reader by stretching this parallelism too far, it is sufficient to say that there is no element whatever of man's consciousness which has not something corresponding to it in the word; and the reason is obvious. It is that the word or sign which man uses *is* the man himself.[11]

Thinking, in Peirce's view, is a quintessentially social activity which depends on language as a social construct. All knowledge, both of private feelings and thoughts and of the world, is expressed in signs that have been acquired socially. If thoughts are communicable it is because they have been conditioned by language, which is in turn a product of society.

Around the turn of the century the notion of language as a social construct gave rise to a fundamental critique of language as a communicational instrument. In his *Beiträge zu einer Kritik der Sprache* Fritz Mauthner, for example, comes to the gloomy conclusion that, since it is impossible to transcend the limitations of language, it is impossible to get to know things as they really are. Language always gets in the way.[12] Exasperation with the inadequacy of language is of course a hallmark of literary Modernism.[13]

Building on the ideas of Peirce and De Saussure of language as being socially conditioned, Edward Sapir and Benjamin Whorf in the first half of the twentieth century took further the notion that language had a formative influence on the way humans view the world. If the fact that humans have language at all sets them apart from other animals, the fact that they have *different* languages sets speakers of various languages apart from each other. If, as the Sapir–

11 C.S. Peirce, 'Some consequences of four incapacities', in *The Philosophy of Peirce: Selected Writings*, ed. J. Buchler, 1940, repr. London, n.d.), p. 249.

12 Fritz Mauthner, *Beiträge zu einer Kritik der Sprache* (3 vols), Stuttgart, 1901–02.

13 Samuel Beckett, who was an avid student of Mauthner, expressed his lifelong obsessive unease with the opaqueness of language best in his 'German letter' of 1937: 'Und immer mehr wie ein Schleier kommt mir meine Sprache vor, den man zerreissen muss, um an die dahinterliegenden Dinge (oder das dahinterliegende Nichts) zu kommen. Grammatik und Stil. Mir scheinen sie ebenso hinfällig geworden zu sein wie ein Biedermeier Badeanzug oder die Unerschütlichkeit eines Gentlemans. Eine Larve' (from 'German letter of 1937', in *Disjecta: Miscellaneous Writings and a Dramatic Fragment*, ed. Ruby Cohn, London, 1983, p. 52. See also Chapter 2, 'Language', of Ruud Hisgen, *Interpreting Samuel Beckett's* Worstward Ho, Vol. 2 of Adriaan van der Weel and Ruud Hisgen, *The Silencing of the Sphinx*, Leiden, 1998, pp. 423–63. Beckett's entire work has been dedicated to his attempts at rending the veil.

Whorf hypothesis suggests, thought and action were mediated not only socially but also linguistically, it would make a difference which language (or better, which language *system*) was used for this mediation.

> We dissect nature along lines laid down by our native languages. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organised by our minds – and this means largely by the linguistic systems in our minds. We cut nature up, organise it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organise it in this way – an agreement that holds throughout our speech community and is codified in the patterns of our language. The agreement is, of course, an implicit and unstated one, *but its terms are absolutely obligatory*; we cannot talk at all except by subscribing to the organisation and classification of data which the agreement decrees.[14]

The parallel with the case of mediums is a forceful one. Like language, mediums are codes, organised and classified in frameworks within which signs can make sense. Different communications technologies, by enabling different forms of expression, are therefore bound to influence the way we perceive the world.

It should come as no surprise that the Sapir–Whorf hypothesis was just as severely criticised as the notion that communications technologies have a formative impact on the human mind – and on history. In its strongest form the hypothesis suggested that if concepts lacked a linguistic basis in a particular language they simply could not be thought by users of that language. By the 1970s the hypothesis had been watered down to the decidedly uncontroversial belief that language can have an influence on thinking. Since then, however, a major new research area, the evolution of language, has begun to cast new light on the role of language in human history. One of the central questions being pursued is the question how and to what extent language and thought are related. It has been suggested, for example, that the fact that we have developed a language ability at all has decisively changed our capacity for thought. Language has given

14 Benjamin Lee Whorf, *Language, Thought, and Reality: Selected Writings of Benjamin Lee Whorf*, ed. John B. Carroll, Cambridge MA, etc., 1956, pp. 213–14; emphasis in the original.

us concepts that are not thinkable without language. One hypothesis even suggests that language did not develop as a consequence of the growth of our brain, but rather vice versa, it was our language use that increased the size of our brain.[15] Particularly interesting in the context of the parallel with mediums, the new research is also offering support for the Sapir–Whorf hypothesis. There is evidence that the classifications permitted by a particular language system do indeed affect the way we perceive the world, so that it does make a difference *which* language we speak.[16]

As a working hypothesis, then, I will assume that mediums, like language, have an influence on the way we think and, by extension, on society. The notions about the importance of language and mediums as they were being developed in the course of the previous century may have been intuitive, but they were perhaps too easily dismissed. I would submit, for example, that it was less the *substance* of what a perceptive media critic like Marshall McLuhan had to say about medial bias than the *style* of his writing that gave rise to the widespread scepsis about his ideas. Needless to say, I do not claim that mediums, any more than language, absolutely determine what we think. For one thing, besides language and mediums there are cultural differences and many other factors that play a role. For another, the prevalence of evolutionary, adaptational development in nature in general, and in the human brain in particular, means that mediums, again like language, are not a monolithic, immutable given. Like any of the tools we use we are capable of adapting them. But mediums do predispose us towards certain ways of thinking, and thus of seeing the world. What we know – what we *can* know – is to some extent determined by *how* we know it, i.e., the way mediums allow it to be organised and transmitted. The assumption that mediums inform the way we experience the world and give it shape is a compelling reason to make a thorough study of the impact of the digital textual medium. Inevitably the use of digital text with its unique blend of inherent properties will shape our knowledge and ideas differently than writing and the printed book have done.

As in the case of language, the question should not be whether, or even to what extent, but *how* mediums influence the way we see

15 Terrence Deacon, quoted by Christine Kenneally, *The First Word: The Search for the Origins of Language*, New York, 2007, pp. 250–4.

16 Kenneally, *First Word*, pp. 103–11.

the world. I want to try and discover whether it is possible to name and locate the sources of any bias that may derive from the use of the digital medium for the transmission of text.[17] For this I propose to use the method of historical comparison. Though interpretational controversies remain, the development, and social influence, of earlier textual mediums (writing and printing) are relatively well understood. By comparing the effects of their introduction and development with the introduction and development of the digital textual medium I hope to be able to obtain a clearer focus on the bias of the digital textual medium. (I explain my actual working method in greater detail in the second section of this chapter, below.)

Studying this continuum also offers the opportunity to examine the *mechanisms* at work in medial change. It was never, for example, a foregone conclusion that the computer would become a medium. No one made that 'invention', nor was the computer's medial potential initially recognised. In fact, much of the initial development of the computer was, if anything, *away from* any medial future, as Chapter 4 will show. Obviously, the process by which medial technology develops is less straightforward than may appear at first sight. Studying the transition of some medial functions from print to the digital medium will then contribute towards a more general insight into the *process* of medial change.

Studying mechanisms of change in the use of mediums should also lead to a better insight into the role of mediums in society in general. The role of the textual mediums is of particular interest here, since, compared with the mass media, as I have suggested, they have been rather neglected. Studying the history and present use of the computer for the transmission of text (however small a part this may be of all that computers are capable of) should contribute to a more general insight into this role, and to an appreciation of the transformational power of mediums which I have just outlined in general terms. This insight is also relevant in view of the fact that the digital medium is likely to change the very *concept* of mediums, which we use metaphorically to make sense of the world we live in. As that concept – the tenor of the metaphor – changes, so will our understanding of the world.

17 Obviously, if we could not discover any sources of bias, we would have to conclude that mediums did not have such an influence. But that will not be the case.

On a more pragmatic level, this exploration of the transition from writing and print to digital text will also serve us as day-to-day scholarly and/or professional users of forms of digital text. Understanding its inner workings helps to gain access to the medium's true potential. The WorldWide Web has made us all into publishers, in addition to being the writers and readers we always were. That makes us into much more rounded medium users, and gives us a much greater stake in the digital medium than we ever had in print. As active users of every link in the communications chain we vest a great interest in adapting them to our needs.

Markup languages for descriptive markup and metadata schemes furnish a good example of what I mean by saying that it is useful to understand the medium's potential. As *homo typographicus* we have come to rely on typographical 'markup' as one of the chief methods to convey structure and meaning. However, the meaning of typographic markup always remains implicit. Humans can understand the codes, but computers cannot. Explicit markup is designed as an alternative method to this implicit structuring; it can be understood by computers as well as humans. Descriptive markup is capable of adding information about the text at an analytical level that goes beyond what typography may express. The resulting new digital textual medium thus allows new research methods, but also allows new questions to be asked. The 'trajectory' (a term I will examine further below) of the invention and adoption of markup languages, to which I will return in Chapter 4, is a good illustration of the two-way shaping of technologies. The most powerful markup language, Standard Generalised Markup Language (SGML), failed to be adopted widely. In a typographic world its enormous potential and promise were understood by only a handful of people. This was in large part, no doubt, owing to its very austere appearance. Its highly successful offspring, HyperText Markup Language (HTML), did manage to break into public consciousness. However, in its emphasis on typographic presentation HTML seriously compromised the expressive power of SGML. It wasn't till the eXtensible Markup Language (XML) came along in 1998 that the analytical abilities of SGML were wedded with the transmission and publication functions of the much simpler HTML.

The process in which the digital textual medium has been taking over traditional print functions has not been going on for very long, nor is it finished by any means. Yet analysing the impact the digital

medium is already making is urgent for a number of reasons. One is to take advantage of the opportunity to observe the process as it is happening right now. The awareness of what mediums are and do is heightened by the introduction of a new medium. Also, if anything, the rate of change is only speeding up, and it makes little sense to wait for things to 'settle down'. The computer is endlessly adaptable, and it is unlikely that such settling down will happen.

Another reason for urgency is that it would be silly not to at least attempt to take the future into our own hands. Should we not grasp any opportunity to influence the development of the new medium? In keeping with the evolutionary view of both the human mind and the tools of language and mediums, as well as with the socio-technical view of knowledge and technology just propounded,[18] I suggest that what we are studying is a two-way process. Intuiting neurological findings several decades into the future, James Beniger suggested in 1986 that

> Because the human brain developed at least in part in interaction with the use of tools and other technologies including language, the processor itself [i.e., the brain] might be seen as an artifact of human invention or even of language.[19]

Turning this around, just as mediums shape our view of the world, it will be possible for us – at least to an extent – to take an active role in shaping mediums. '[U]nderstanding ourselves in our own peculiar moment in history will enable us to shape and guide that history.'[20] To this it is necessary to bring the historical insights already discussed. But we have to be wary of too high expectations. Technological change is to a large extent autonomous, and our influence is limited.[21] At all events the social nature of communication constrains the control of discrete individual agents. Rather, the development of mediums involves interaction between amorphous social, economic, and political forces.

The last, but not least, of our concerns is the very real possibility that the transformative power of the computer will prove to be vastly

18 A good model is that of Wiebe Bijker in *Bicycles, Bakelite and Bulbs: Towards a Theory of Sociotechnical Change*, Cambridge MA and London, 1995.
19 Beniger, *Control Revolution*, p. 85.
20 Beniger, *Control Revolution*, pp. 3–6.
21 Bernard Stiegler, *Technics and Time*, Vol. 1, *The Fault of Epimetheus*, Stanford CA, 1998, p. 13.

greater than that of any previous medial technology. The corollary of the fact that computers are Universal Machines[22] is that

> never before have [our technologies] been so powerful. Never before have they brought so many benefits. Never before have they had such potential for destruction … And never before has the task of understanding those technologies – how they are shaped, how they shape us – been so urgent.[23]

The least we can do is try to understand the nature of the technologies and their potential for change and try to define what we want from them, in relation to their potential.

Method

At the heart of this exploration will be an account of the – very recent – history of how computers became a medium for the transmission of text, leading up to the present state of affairs. This should be relatively straightforward. The chief perspective I will apply is that of book studies. Book studies try to 'understand textual production as part of human social communication structures'.[24] A book history perspective is a useful one also because book history as a discipline is centrally concerned with the dissemination of knowledge, which is also at the core of the digital revolution. Even those who are inclined to shrug off the history of the book as a burdensome relic of a superseded technology cannot evade the continuity that runs from script through print to digital text.[25] It is no coincidence, and sometimes useful – often even necessary – that book terminology, together with the comparisons that it invites, remains pervasively

22 To be discussed in Chapter 4.

23 Wiebe Bijker and John Law, *Shaping Technology/Building Society: Studies in Sociotechnical Change*, Cambridge MA and London, 1992, p. 306.

24 David Finkelstein and Alistair McCleery, *An Introduction to Book History*, New York and London, 2005, p. 4. As they see it, 'A significant theme to be drawn from our study is the increasing importance in book history studies of "mediation". Contemporary book and print culture historians are increasingly focused on answering questions raised by the mediating role of print' (p. 134).

25 The comparison will bring to light discontinuities too. Printing, for example, was expressly intended to disseminate text, while handwriting *could* serve that purpose. Dissemination was initially also not a primary characteristic of digital text, but it became one after the computer became part of a network.

present in all discussions of the digital revolution: from Web *pages* to electronic *publishing*. It is as well then to embrace the historical perspective as an opportunity for an analysis of this terminology, in order to gain a better understanding both of that which is being replaced and of that which is replacing it. Indeed, an important reason for choosing a book history vantage point is that in trying to assess the significance of the digital revolution it is precisely one of our problems that we remain firmly in the grip of our 'typographic condition'. We involuntarily look at the new developments with typographically biased eyes. A book history perspective can help to examine the familiar concepts (whether or not they are expressed in a familiar terminology) we stand in danger of using too glibly. The advantages of adopting the book history perspective as a unifying perspective probably outweigh the disadvantages. The book history perspective allows analysis of the continuities and discontinuities in the transmission cycle of texts, from their production via their distribution to their consumption. Recognising historical continuities and discontinuities can enlighten an understanding of the new phenomena that are now taking place. Conversely, a study of the digital forms of textual transmission may throw new light on earlier technologies and offer unexpected insights into the history of the book.

An historical account will identify which are the relevant inventions and innovations, and when and how they happened. Important milestones to be covered include:

- The computer's evolution from a tool for the manipulation of numbers to a tool for the manipulation of symbols, such as textual data (and later also other data types, such as image and sound).
- The computer's evolution from a stand-alone tool for the production of analogue text (documents to be printed out) to a full-blown medium (computer-in-a-network) for the transmission of text (and other data types).
- The development of human and computer-readable explicit markup as an alternative to implicit typographic markup that is readable only by humans: making text 'intelligent' (i.e., computable) through markup.
- The combined use at one and the same time of the computer as a medium and as a computing device capable of running applications other than those that are needed to play its role as a medium.

To provide a straightforward historical account is not particularly challenging. The only thing to guard against is taking a simplistic – and distortive – teleological view of developments. As Wiebe Bijker has warned,

> there is nothing inevitable about the way in which [technological trajectories] evolve. Rather, they are the product of heterogeneous contingency. [Bijker, *Shaping*, 17–19]

In the relatively short time that it took for computers to become competitors for print the intimate connection between text and computers that now exists has come to be taken for granted. The use of the networked computer as a medium for the transmission of text, in the form of mail, messaging systems, Web pages and so on, accounts for a vast proportion of Internet traffic. However, the connection between text and computers is more recent than the ubiquity and sophistication of word processors, e-mail clients, browsers, PDF readers, text editors, and DTP programs on today's personal computers suggest. Far from being conceived as a medium for the transmission of text, the digital computer initially was incapable of dealing with letters at all. In Arthur C. Clarke's story 'The Nine Billion Names of God' of 1953 it is still science fiction that a group of Tibetan monks, following an unusual vision, manage to harness the 'Mark V' computer they have purchased to process alphabetic characters – with the assistance of a team of programmers. Text came to the computer only slowly, during the 1960s, and the computer became a public medium for transmitting data still more recently, effectively during the 1990s.

It took quite a number of major and minor innovations before handling text became a standard function of computers. But in half a century of computing history enormous progress has been made. Certainly if such a job as that conceived by Clarke's monks – making the computer spew out a list of the 9 billion potential names of God instead of the usual rows and columns of figures – were to be organised today it would not require the arcane knowledge of two computer engineers and three months of their full-time labour. But Clarke's story is a good illustration of how the computer can be – and is still – used as a tool to manipulate text.

The successful completion of the programmers' task in Clarke's story, incidentally, had cataclysmic consequences. The moment the last name of God was printed did not just spell the end of the

monastery and its inhabitants but the end of the world. Although the programmers attempted to flee as soon as they learned about the purport of the monks' endeavours, their doom overtook them as

> Overhead, without any fuss, the stars were going out.[26]

What should be taken from Clarke's story is of course less the suggestion that computers are evil instruments than that there was a time when the very idea that they could – or, perhaps more important, that anyone might seriously want them to – manipulate text was still a science fiction. It isn't necessary to indulge in a full-blown 'what if?' history, but it *is* necessary to realise that there is never anything inevitable about events happening as and when they do. In addition the story serves as a salutary reminder – if one were needed – that computers are a very powerful technology, that their use may have unintended consequences of which we are not aware, and that there is always the possibility of those consequences not being benign. Remember Pandora and her box.

Historically, the introduction of the networked computer follows a long line of earlier milestones in the transmission of text, such as:

- Writing (*c.* fifth century BCE).
- The papyrus roll (*c.* second century BCE).
- The alphabet (*c.* first century BCE).
- The codex form (*c.* second century).
- Printing with movable type (*c.* 1450 in the West).
- Steam power and the rotary press (1820s).
- The electric telegraph (1844).
- The typewriter (middle of the nineteenth century).
- The offset press (*c.*1900).
- Two- rather than three-dimensional typesetting (1970s).

To bring this vast field down to manageable proportions I will look at the invention of writing and printing only, and briefly at that, in Chapter 3. To bring us into the digital present Chapter 4 will look in a little greater detail at how the computer acquired, and then developed, its text-processing capabilities. Among the most relevant landmarks are:

26 Arthur C. Clarke, 'The Nine Billion Names of God', in *The Collected Stories of Arthur C. Clarke*, London, 2000.

- Character representation (especially the ASCII character set).
- Graphical user interfacing.
- Windows, icons, mouse, and pull-down menus (WIMP).
- Computer networking.
- Word processing.
- WYSIWYG ('what you see [on screen] is what you get') and desktop publishing.
- Computer-readable explicit markup (SGML and its descendants).
- The Hypertext Markup Language (HTML) and the WorldWide Web (WWW).

More could be added, but I will regard some, such as memory and storage, and input/output devices (keyboard, etc.) as 'black boxes' in Bruno Latour's sense of the term.[27] That is to say, I will treat them as unproblematic concepts. They have acquired a set function which carries no, or not enough, particular significance for this exploration.

The history of the computer as a sequence of improvements in speed and other forms of technological sophistication is familiar enough. But it is also a process of accretion of very different functionalities. From being primarily a calculating tool (which of course on a basic level it always remains, regardless whether it deals with numbers or with words) it became a powerful text-processing tool before it became a transmission medium.[28] The computer can be used to create, edit, store, and print text, as well as for more advanced text processing, such as concordancing, indexing, establishing word frequencies and collocations, etc. It is the fact that the computer combines these powerful abilities to 'compute' text with its ability to also transmit and disseminate it that makes for the remarkable nature of the medium.

Though I will be looking chiefly at text, of course I won't forget that text is just one of a number of modalities used in human communication. The background against which the computer makes its appearance is the range of audiovisual mediums that have been newly invented and developed since the nineteenth century. In this context of medium history these are:

27 See Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society*, Cambridge MA, 1987, pp. 130–1.

28 Unless I specifically mention other situations, when I use the term 'digital medium' I will be including that transmissional capacity.

- Photography.
- The telegraph.
- Sound recording.
- Film.
- Radio.
- Television.

Without this context the digital medium would have gone through a very different development. While I don't want to dwell on these mediums' history, it will be useful by way of contrast to rehearse some of their distinguishing characteristics to help define those of the digital textual medium. For example: the speed of their transmission; whether they are intended to be used over time and/or distance; whether they are point-to-point or point-to-multipoint; what mix of modalities they employ. In the course of the last century and a half these mediums have presented us with a continuously changing mixture of modalities: text, sound (speech, music, etc.), still images, and moving images.

These other modalities will figure repeatedly, not just because they are so prominent in the broad range of mediums available today, but also because the digital medium is itself in fact an amalgam of all these medial modalities. They come together in the computer as equally many data types. The apparently seamless convergence of modalities in the digital realm is one example of what is very much a technological phenomenon, something that came about as a result of the particular constellation of its inherent properties.

But the bare facts of history, however salient, are no more than a starting point. To interpret the invention and subsequent development of the digital textual medium in such a way as to illuminate its significance in a social context, more than just a timeline is called for. In the second half of the nineteenth century the new genre of the detective novel suddenly made its appearance, and gained widespread popularity. The explanation of this phenomenon can be sought simply in the timeline of printing technology. Various innovations in book production allowed books to be produced cheaply enough for them to become consumer products, causing people to buy more books, naturally popular ones (like detective fiction) in particular. But without a large new reading public (resulting from largely *social* factors such as population increase, greater economic prosperity, improved education) the occurrence of this fact in a

timeline would not be very meaningful. It could therefore also be claimed that the origin was primarily social: the rise of a large group of new readers clamouring for popular entertainment. Either way, it is the intricate connections *between* the social and technological facts that need to be understood.

So while recording the facts about the digital medium's introduction and subsequent development, I want to ask questions about their implications, especially compared with the print medium, which has for a long time been the dominant medium for the transmission of text. As it developed, how did the budding digital medium adapt to social, cultural, and economic requirements? Conversely, what have been the social, cultural, and economic repercussions of the medium's technological characteristics? How has the increasing adoption of the digital medium for many types of textual transmission that were hitherto the exclusive domain of print affected the nature and content of textual communication in ways both intended and unintended? As I have suggested, it is likely that the 'form' of the medium will affect the message in diffuse ways, with a variety of social, economic, and cultural implications.

Earlier on I proposed to regard the gradual adoption of the digital textual medium where previously only the print medium had been used as a continuum in which continuities as well as discontinuities can be observed. Offering a way of understanding both the present and the past, and allowing to some extent even some speculative ideas about the future, such comparisons form the very basis on which the continuity of culture rests. The 'Order of the Book'[29] – that is, the world view defined by the codes of manuscript and print – is our natural point of reference, and it will remain so for the foreseeable future. Some aspects of textual communication change along with a change of medium and some do not, and some of these changes have a greater impact than others. For example, the 'limitations' of the codex became apparent only in the comparison with hypermedia and the WorldWide Web. Though it is not perhaps fair to single out one author (who is only one voice contributing to a large chorus), the following example is not untypical:

29 I will explain my use of this phrase, which was inspired by the title of Roger Chartier's *L'Ordre des livres* (1992; translated into English as *The Order of Books: Readers, Authors, and Libraries in Europe between the Fourteenth and Eighteenth Centuries*, Stanford CA, 1994), in Chapter 3 below.

> One of the major limitations of paper-based publications is their static nature. This poses significant inflexibility on them in terms of: how information can be stored within them; when, where and how they can be accessed; and the ways in which their contents can be displayed.[30]

It would make just as much sense to extol the fact that at least books '*don't* change their minds when you're not looking'[31] as one of their enduring strengths – and one for which, incidentally, no satisfactory digital equivalent has as yet been found. But the point of making such comparisons is less to utter blanket pronouncements on perceived strengths and weaknesses than to be able to perceive the salient properties of mediums and their consequences in the first place. If we must make comparisons of features – as indeed we must – we ought to make them as consciously and conscientiously as we can, in both directions.

What does it *mean*, for us as individuals and for society at large, that computers serve us for the production of printed communications as well as for the dissemination of texts that may look like they could have been conventionally printed but are in reality computer files? Ultimately it makes little difference to the listening experience whether a song played through the home hi-fi system comes from a CD or from a computer file. It remains the same song. But, as the music industry has found to its chagrin, socially and economically it makes a world of difference. The ease of copying digital files, and their distribution through peer-to-peer networks, have created a flood of piracy that the legal download model of iTunes, however successful, could do little to stem.[32] So to try and understand the significance of the facts as they develop is one important reason for this descent into (recent) history.

Just as it is necessary to avoid the teleological danger in an account of the historical facts, there are two, closely related, pitfalls to avoid in an explanation of those facts. These are the already encountered

30 P.G. Barker, 'The future of books in an electronic era', *The Electronic Library* 16, 3 (1998), pp. 191–8, at p. 194.

31 Peter Greenaway, *The Cook, the Thief, his Wife and her Lover* (1989); emphasis added.

32 Physical album sales decreased by 15 per cent in the first half of 2007, while sales of digital 'songs', though still a much smaller business, rose by 49 per cent over the same period (figures from Nielsen SoundScan, quoted in *New York Times*, 8 July 2007).

technological determinism, which suggests that technology itself determines its trajectory of invention, adaptation, and adoption, and its counterpart, social determinism, which suggests that technological change happens primarily in response to social demands and constraints, including economic ones. Taken in their absolute form neither offers a very satisfactory historical model to look at technological change. That a desirable potential inherent in the technology, such as that for networking, should have remained unrealised while social forces were pulling in a different direction, for example, is something that neither technological determinism nor social determinism by itself can properly explain.

Clearly there is enough evidence that both technological aspects and social forces play a defining role in technological development. Reflecting this, there is a growing school of historians and philosophers of technology that follow a 'sociotechnical' approach, combining elements of both. While incentives for change may be social and/or technological in any admixture, ultimately it is always the interplay of the social and the technological that defines technological development. This seems an attractive model, as long as we don't fall into the trap of assuming that to explain a particular phenomenon the proportions of the determining factors must always be technological and social in equal measure. If anything, I suspect that technological factors will often, if not always, weigh more heavily. The story of Pandora's box may be mythical but, as history has shown, we never cease to make inventions whose consequences we are unable to predict or even understand. Tales warning us that technologies have a life of their own abound in all cultures.

To aid an understanding of why and how developments took place I propose to make use of the concept of primary technological properties of mediums that I suggest can be shown to possess a certain explanatory power. These primary technological properties will turn out to cause secondary technological properties, which may in turn have various social consequences. In an intricate interplay, the social construction of the mediums and their inherent technological properties together define the way a medium is used, and so what it really is. A number of salient features have come to be associated with the digital textual environment. For example, it is widely thought that the WorldWide Web has:

- 'Democratised' access to information, posing a challenge to the hierarchical ordering of information, and 'disintermediating' access to it.
- Stimulated globalisation.
- Accelerated the speed of social change.

In examining these and other features, it will be useful to establish how they may be related to a medial bias, that is to say, to technological properties that can be associated with the medium. In doing so, it will also be useful to distinguish between inherent (inevitable, necessary), technologically determined, properties and contingent (transient), socially constructed, properties, and between known and emergent, and intended and unintended, properties and their consequences.

Challenges

To restate my aim, I want to explore how the 'code' of one medium (the printing press) with its particular constellation of features and the particular bias in which this results is now being supplemented and increasingly supplanted by the emerging code of another (the digital medium) with its different constellation of features and resulting bias. There are many ways in which the task I have set myself would appear, to a pessimist, doomed, or at least severely compromised, from the outset. To finish this introductory chapter I should like to examine some of the difficulties I will be confronting.

Inadequate vocabulary

To judge by what (and how much) is being published on the subject of how the existing mediums actually work, and how they affect society, even as yet another medium for communication is entering the scene, the peculiarly important role mediums have played and continue to play in our history is still being discovered. Even the instruments – the language – to discuss this are still being developed. So one of the first things to do is to establish a conceptual apparatus. The lack of shared vocabulary is surprising in view of the subject's importance. In discussing digital textual transmission the very terms 'medium' and 'text' are problematic. Such conceptual and semantic challenges are serious enough to devote a chapter to them; this will be Chapter 2.

The recentness of the medium history we want to study

The subject of the digital textual medium concerns very recent history indeed, which will make it difficult, for example, to recognise which historical lines will prove to be the significant ones – the ones that will impact the future. We always 'suffer from the chronic inability to grasp the essential dynamics of an age'.[33] Seeing how much we are still in the midst of change it may appear early to attempt to reflect dispassionately on a subject like digital textual transmission. Developments to date suggest that not only is change intrinsic to the nature of the new medium, but technological change seems to happen ever faster. Not only does it not appear possible yet to take the desired distance, but it looks increasingly doubtful if it ever will be. While the significance of what we can retrospectively dub Web 1.0 was still being assessed Web 2.0 was already making inroads, and Web 3.0 may be just waiting in the wings.

Yet there are reasons for some optimism, too. However difficult it may be to recognise the larger movements of history as they happen, '[t]oday, with our greater sensitivity to social consequences and to the future … we are more alert to the possible imports of technological and organisational change'.[34] Of course, greater sensitivity is no guarantee that we necessarily *understand* what is taking place. It will be eminently possible that many of the analyses attempted in this book will prove insignificant or plain wrong – even in the not too distant future. But that will still leave the net gain of an exercise in sensitisation to the important role of mediums in society. Those results will, I am convinced, prove as valuable now as in the longer term.

The problem of using a medium to study a medium

Dispassionate reflection is compromised even more profoundly by the fact that we are constrained to use mediums to discuss mediums. The difficulty this presents is not unlike the difficulty of studying consciousness by means of the conscious brain.[35] As Antonio Damasio phrases this challenge:

33 Beniger, *Control Revolution*, p. 2.

34 Daniel Bell, 'Introduction', in *The Computerization of Society: A Report to the President of France*, ed. Simon Nora and Alain Minc (Cambridge MA, 1980), pp. vii–xvi, on pp. x–xi, quoted in Beniger, *Control Revolution*, p. 3.

35 Again the parallel between language and mediums is instructive. Wittgenstein made the point that we cannot use language to get outside language in his *Tractatus Logico-philosophicus* (London and New York, 1955), 4.12–121.

> The investigation of the question [of consciousness] is to be conducted with the very same instrument that is being investigated, a situation that makes both the definition and the approach of the problem too complicated for comfort. Because of this conflict between observer and observed, the human intellect may be defeated by the task of understanding how the mind emerges from the brain.[36]

Damasio here writes about the mind emerging from the brain, but our concern is not all that different if we accept that it is not too far-fetched to say that our mind – at least in the sense of our world view – also emerges from our mediums.

This 'medial contamination' presents us with an age-old quandary, the same problem that faced Archimedes when he was supposedly considering how he could move the world. To provide ourselves with the necessary leverage to achieve such a feat we would need to obtain a vantage point outside our fully mediated view of mediums. Archimedes' predicament was ultimately a mechanical one. The problem worded by Damasio is of a different order. There is universal awareness of the challenge he identifies. However, Damasio believes that we should not let ourselves be discouraged by a philosophical problem like this: 'I agree that there is a real conflict here but the notion that it cannot be overcome is false' (p. 10). Though we still have not solved the quandary of consciousness, we are certainly making strides in our understanding of the workings of the brain. If we can make that much progress understanding the brain, surely we must be able to make some headway with the (digital) textual medium.

The 'invisibility' of the textual mediums

It could be said that, paradoxically, the textual mediums are so central to human existence as to be largely invisible.[37] So pervasive is the role they play in society that the implications of their use cannot be readily assessed. In a sense this 'invisibility' is a variation of the problem I have just observed with regard to the study of the brain. But at least in the case of the brain we are aware that it plays a central

36 Antonio Damasio, *The Fabric of the Mind: A Neurobiological Perspective*, The Hague, 1999, pp. 9–10.

37 Here again the parallel with language is striking: 'Ironically, what makes it so hard to discern how language evolved is a result of language having evolved. The worldwide web of words and rules that we inhabit is so vast, contracted, and dense, it's hard to look in from the outside' (Kenneally, *First Word*, p. 25).

role in the way we perceive the world, even if it is still not known exactly how. In the case of mediums such invisibility is a result of the fact that mediums are not regarded sufficiently as an instrument that contributes to a definition of who we are as human beings. As I have suggested, *all* mediums define our perspectives, frame our observations, and so create our world even as they limit our understanding of it:

> *media are the materials with which we define and construct reality, and mediation refers to processes by which reality is defined and constructed*. This is a deliberately broad definition which is intended to avoid a narrow focus on physical media and to highlight the importance of social and psychological processes of mediation.[38]

Curiously, this realisation has yielded a vast quantity of research in the case of the mass media while the subject of writing and printing by comparison is but a barren field.[39] I would suggest that this neglect is partly a classic case of familiarity breeding contempt (or, more precisely, a supreme lack of awareness) but chiefly results from the apparent transparency of text as a sign system:

> The routine use of a medium by someone who knows how to use it typically passes unquestioned as unproblematic and 'neutral': this is hardly surprising since media evolve as a means of accomplishing purposes in which they are usually intended to be incidental. And the more frequently and fluently a medium is used, the more 'transparent' or 'invisible' to its users it tends to become.[40]

38 Daniel Chandler, *The Act of Writing: A Media Theory Approach*, Aberystwyth, 1995, p. 3; emphasis added.

39 For example, in 'Culture, cognition, and evolution' (*MIT Encyclopedia of the Cognitive Sciences*, Cambridge MA, 1999, pp. cxi–cxxxii) Dan Sperber and Lawrence Hirschfeld note that writing, 'which is so important to cognitive and cultural development … is a form of expertise, although it has become so common that we may not immediately think of it as such'. Some notable exceptions are Chandler (*The Act of Writing*), Christina Haas ('How the writing medium shapes the writing process: effects of word processing on planning', *Research in the Teaching of English* 23, 2, May 1989, pp. 181–207) and Michael Heim (*Electric Language: A Philosophical Study of Word Processing*, New Haven CT and London, 1987), who have analysed the influence of writing technologies. Otherwise the most fruitful contributions to the subject have been made from the more anthropological perspective of Goody and Finnegan, and have chiefly concentrated on the transition from orality to literacy, also intensely studied by Walter Ong.

40 Chandler, *Act of Writing*, p. 9.

Of course the subservient function of writing as a medium makes such transparency or invisibility actually desirable:

> 'The wonderful thing about language is that it promotes its own oblivion: my eyes follow the lines on the paper, and from the moment I am caught up in their meaning, I lose sight of them. The paper, the letters on it, my eyes and body are there only as the minimum setting of some invisible operation. Expression fades out before what is expressed, and that is why its mediating role may pass unnoticed' (Merleau-Ponty 1962). For most routine purposes, awareness of a medium may hamper its effectiveness as a means to an end. Indeed, it is typically when the medium acquires transparency that its potential to fulfil its primary function is greatest.[41]

In fact, a lack of transparency, as in dyslexia, hampers proper social functioning.

How the familiarity of writing, and its apparent transparency, have given it a central place in our perception of the world is revealingly illustrated by the use in scientific literature of metaphors of textual information and its processing and communication. There is an illustrative passage from Erwin Schrödinger's *What is Life* (1944):

> It has often been asked how this tiny speck of material, the nucleus of the fertilised egg, could contain an elaborate code-script involving all the future development of the organism … the number of atoms in such a structure need not be very large to produce an almost unlimited number of possible arrangements. For illustration, think of the Morse code. The two different signs of dot and dash in well-ordered groups of not more than four allow of thirty different specifications … with five signs and groups up to 25, the number is 372,529,029,846,191,405 … with the molecular picture of the gene it is no longer inconceivable that the miniature code should precisely correspond with a highly complicated and specific plan of development and should somehow contain the means to put it into operation.[42]

The reason why it lends itself so well to the comparison, as Beniger comments, is precisely because the technology is so familiar:

> As happened so often since the advent of the Control Revolution, concepts from information and communication technology – here Morse's binary telegraph code – helped scientists to reconceptualise traditional subjects like cellular biology. Because information and

41 Chandler, *Act of Writing*, pp. 9–10.

42 Erwin Schrödinger, *What is Life?*, Cambridge, 1944, pp. 61–2, cited in Beniger, *The Control Revolution*, p. 56.

> control are so basic to living systems in general, nonspecialists who understood these concepts have managed to contribute to a wide range of fields. [p. 57]

This familiarity, Beniger suggests, has very deep roots. In fact, the deepest roots possible. Information and its programming and communication are, as I suggested at the beginning of this chapter, central to human society and culture because

> every living system must maintain its organisation by processing matter and energy. Information processing and programmed decision are the means by which such material processing is controlled in living systems, from macromolecules of DNA to the global economy. [p. 59][43]

We share the ability to process information with all living things, yet the enormous capacity of the human brain sets us apart from them at the same time. Speech, like other forms of language, is a special human way of information processing.[44]

As communication scholar John Durham Peters observes:

> One consequence of the impure diffusion of information theory was the rewriting of the great chain of being. On the smallest level, where the secrets of life are 'coded, stored, and transmitted,' we find J. D. Watson and F. H. Crick, discoverers of the double helix, viewing DNA as a code of genetic information. Neural synapses became switchboards and nerves telephone lines (reversing the metaphor from that of the nineteenth century, when telegraphs and telephones were 'nerves'); messenger RNA proteins were dubbed 'informosomes'. Moving up the chain, hormones and enzymes were couriers and the brain an 'information processor'. In the social world, we learned that marriages will work better when men and women 'communicate more' and 'share information about their feelings' with each other; that good managers must communicate effectively (that is, share information) with employees; and, internationally, that better flows of information between nations aid worldwide peace and understanding. From the blueprint of life itself to the world political order, communication and information reigned supreme.[45]

43 In *Print, Manuscript and the Search for Order, 1450–1830* (Cambridge, 2003) David McKitterick draws attention to Charles Babbage's significant penchant for making comparisons with printing in his works on the economy of the machine manufacturing industry. Printing is of course the very prototype of the mechanical manufacture of identical items.

44 See further Chapter 2.

45 John Durham Peters, *Speaking into the Air: A History of the Idea of Communication*, Chicago and London, 1999, pp. 23–4.

In *The Selfish Gene* Richard Dawkins famously employs the metaphor of books and writing to explain the nature and workings of DNA:

> Our DNA lives inside our bodies. It is not concentrated in a particular part of the body, but is distributed among the cells. There are about a thousand million million cells making up an average human body, and, with some exceptions which we can ignore, every one of those cells contains a complete copy of that body's DNA. This DNA can be regarded as a set of instructions for how to make a body, written in the *A*, *T*, *C*, *G* alphabet of the nucleotides. It is as though, in every room of a gigantic building, there was a bookcase containing the architect's plans for the entire building. The 'bookcase' in a cell is called the nucleus. The architect's plans run to 46 volumes in man – the number is different in other species. The 'volumes' are called chromosomes. They are visible under a microscope as long threads, and the genes are strung out along them in order. It is not easy, indeed it may not even be meaningful, to decide where one gene ends and the next one begins. Fortunately, as this chapter will show, this does not matter for our purposes.
>
> I shall make use of the metaphor of the architect's plans, freely mixing the language of the metaphor with the language of the real thing. 'Volume' will be used interchangeably with chromosome. 'Page' will provisionally be used interchangeably with gene, although the division between genes is less clear-cut than the division between the pages of a book. This metaphor will take us quite a long way.[46]

The interesting thing about Dawkins's metaphor is his awareness of the purpose it fulfils in his thinking. As he writes in the 'Preface to the 1989 edition':

> Expounding ideas that have hitherto appeared only in the technical literature is a difficult art. It requires insightful new twists of language and revealing metaphors. If you push novelty of language and metaphor far enough, you can end up with a new way of seeing. And a new way of seeing, as I have just argued, can in its own right make an original contribution to science. Einstein himself was no mean populariser, and I've often suspected that his vivid metaphors did more than just help the rest of us. Didn't they also fuel his creative genius? [p. xi]

Of course, these are only metaphors, attempts to catch in language the observation of real-world processes. In fact it is no accident that Dawkins, Watson and Crick, and Schrödinger used the metaphors they did. Naming these processes in the way they did is precisely because they speak to our familiarity with information and communication

46 Richard Dawkins, *The Selfish Gene*, Oxford, 1989, p. 22.

technologies of various kinds. Indeed, that may be the only reason that we can observe these processes at all.

Curiously it is precisely as a result of this ubiquitous use of metaphors based on information and communication technology and, especially, textual mediums that we have developed a blind spot for the real meaning of these tools. The terms are used as if they have explanatory power. And indeed, they do: but it comes at a cost. Our improved understanding of *other* concepts comes at the expense of our understanding of the very thing (the textual medium serving as a vehicle in the metaphor) that is meant to elucidate those concepts (the metaphor's tenor). Using the textual medium as a tenor in our metaphors keeps it from receiving the scrutiny that it deserves.

The elusive nature of mediums

After all this, we may not even have satisfactorily established what category of thing a medium is in the sense of its nature as a subject of investigation. In the preliminary definition I gave earlier ('a construct consisting of a tool or technology with its (explicit) technical protocols and any implicit social protocols with the function to communicate information') I declared mediums to be larger than a 'mere' technology. Yet I have treated them as a technology implicitly when borrowing the model of sociotechnical change to account for their development. I would contend that mediums are not a science, not an art, not even a mere technology, but that they contain aspects of all these. Certainly mediums have been frequently discussed as technologies and as forms of culture; they can be said to be like art in that – as they transmit and record – they also represent aspects of the world. Should they perhaps be regarded as relations?[47]

In 1979 Elizabeth Eisenstein launched the notion of a 'printing revolution' in her classic study *The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early-modern Europe*. The suggestion that a variety of epoch-making phenomena in the intellectual sphere were largely if not wholly caused by the printing press has drawn a lot of criticism. Especially Eisenstein's assertion that this made the technology of printing an

47 Cf. Lisa Gitelman, who writes in *Always Already New: Media, History, and the Data of Culture*, Cambridge MA, 2006, that 'Media are so integral to a sense of what representation itself is, and what counts as adequate – and thereby commodifiable – representation, that they share some of the conventional attributes of both art historical objects and scientific ones' (p. 4).

invention that was wholly *sui generis* was widely attacked. It will be one of the aims of this study to contribute to a better understanding of what mediums (especially textual mediums) are and do.

However chaotic the present state of this new digital textual medium, it is possible, even likely, that its introduction will have the same far-reaching implications as the invention of print. A 'digital order' may begin to undermine and supplant the familiar Order of the Book that has dominated society for some centuries. Such a digital order will not arrive fully fledged in our midst, simply to replace the existing order. The digital element is likely to make gradual inroads before it eventually comes to be seen as the dominant medium – but, as will be argued in Chapter 6, if that should happen, it is bound to happen much faster than in the case of the Order of the Book.

2

Concepts in textual mediality

The list of challenges that ended the previous chapter started with that of the inadequacy of current vocabulary. If nothing else, the lack of agreement on a shared terminology might be taken to indicate the lack of (conscious) attention for the history of the textual mediums. In fact, the confusion results at least as much from the subject's complexity. Textual transmission has been the domain of a wide range of disciplines, including history, literary studies, media studies, book history, linguistics, sociology, pedagogy, and archaeology. More recently these disciplines have been joined by computer science with its many sub-disciplines, such as human–computer interaction, natural language processing, and artificial intelligence, and by (cognitive) neuroscience.

Given such interdisciplinary interest, it is hardly surprising that even key terms like *medium* and *text* are problematic when discussing the computer-in-a-network as a medium for digital textual transmission. 'Mediation', for example, can be used to refer to a *function* in the transmission process, such as the role of a publisher as an intermediary, or it can refer to the *means* through which a text can be transmitted, such as manuscript or print. The longer the historical context the more prominent the vocabulary issue becomes. Changing meaning with each new medium, *text* is a truly chameleonic word; it is sometimes even taken to include oral utterances.

To place the digital textual medium in a longer historical perspective, a vocabulary is needed that covers enough key concepts to be able to signal and describe continuities and discontinuities in the historical development of the textual mediums. By describing and naming these concepts I will try in this chapter to create a vocabulary that will serve that purpose – and which can be understood by people from many different disciplines. In doing so, this chapter should

provide a frame of reference for the rest of the book. In discussing the concepts to be covered I will inevitably sometimes need to use concepts before they have been properly discussed. I doubt that that will be a problem. However, because the book is about the digital textual medium, let me recall the preliminary description I gave of the term 'medium' in the first chapter. I proposed there to regard a medium as 'a structure consisting of a technological tool with its (explicit) technical protocols and any implicit social protocols with the function to communicate information'. In what follows I shall build on this.

Communication

This book is about (textual) mediums themselves more than about the communication that they may effect, or about the informational content of the communication, so I will to some extent treat the concept of communication as a higher-level problem. Still, some idea about the relationship between mediums and communication is needed. Mediums are among the *instruments* we use in the *process* of communication. They are what enable a relation to be made, a 'channel' to be set up for communication between people who are not face to face. Humans are social by nature, a defining trait which they share with most primates, and to be social means to possess the propensity to communicate. Of all primates, humans have devised the most sophisticated communication systems. These are used not only for survival, as in the case of other living organisms, but also for self-expression, and the exchange of knowledge and ideas. Communication in that broader sense is central to human culture. The sophistication of our social structures would not be possible without it. Communication is therefore a key concept, not just for understanding the function of mediums but, because it is so central to human culture, for understanding life. We interpret the world and our place in it in terms of the concept of communication. Communication has become one of the most commanding and enduring metaphors of human culture. The relationship is a two-way one: the commanding place of communication defines culture, as much as it is culture that determines the importance of communication.

Not surprisingly, given the centrality of communication in human affairs, communication studies are a flourishing academic discipline. Communication studies and book studies, which offer the

central perspective for this study, are in many respects very different. Where communication studies as a discipline deals with the *process* of communication and the *actual* effects, book studies concentrates more on mediums as the *means* of communication and on their *potential* effects. Also, book studies is more historically oriented, and engages with the history of print culture from the time when the printed book began to compete with the manuscript codex to the present day. This book too focuses on the comparative (im)possibilities, the opportunities and obstacles which a particular medium (manuscript, book, or digital textual medium) presents for particular kinds of communication.

Yet there are also obvious areas of overlap between communication studies and book studies. They share, for example, 'a preoccupation with the means, processes and concepts by which meaning is established and communicated, and the societies, institutions and technologies that use, develop and govern mediums, print or otherwise'.[1]

Conventional definitions of communication studies tend to betray that difference in emphasis through their use of the word 'mind'. 'Mind' emphasises the intentions and effects of the process. From Classical times the most common view of communication has been that of a process somehow involving the transfer of thoughts, information, assertions, attitudes and so on from one mind to another. The famous pioneers of communication theory Claude Shannon and Warren Weaver, for example, consider communication as consisting of'all of the procedures by which one mind may affect another'.[2] Such a psychological definition, apart from going beyond my book studies approach, is problematic for the concerns of this book. We would need to broaden the term 'mind' sufficiently to be able to apply the definition not just to procedures between people, but also between people and computers, and between computers. After all, digital textual transmission deals with computers. Not only do humans communicate with computers, and instruct them to communicate with other computers in turn, but we are very close to being able to program them in such a way as to evince what we would judge

1 Kate Longworth, 'Between then and now: modern book history', *Literature Compass* 4 (2007), pp. 1428–43, on p. 1430.

2 Claude E. Shannon and Warren Weaver, *The Mathematical Theory of Communication*, Urbana IL, 1949, p. 3.

as intelligence.[3] A broader definition of communication is therefore needed than one that covers our commonsense notion of intelligent purposive human behaviour. (This is not necessarily to suggest that computers have minds and are conscious. It is just necessary to account for the fact that people can interact meaningfully with computers, and that we can program them to interact meaningfully with each other.) Perhaps Raymond Williams's definition of communication as 'the institutions and forms in which ideas, information, and attitudes are transmitted and received'[4] comes closer. While 'ideas and attitudes' still slants it towards human communications, 'information' is sufficiently broad to include also human–machine and machine–machine communications.

It is useful to make a distinction, as does John Durham Peters in his account of the history of the idea of communication in Western culture, *Speaking into the Air*, between dialogue – highlighting the possibilities and impossibilities of communication *per se* – and dissemination – the particular challenges of large-scale communication. The present book is interested in communication of the disseminative kind. Peters also usefully stresses that closure takes place at the receiving end (pp. 267–8), so that '[t]he other, not the self, should be the center of whatever "communication" might mean' (p. 265). The following chapters will show that, moving from spoken language via script and print to digital communication, the reader's heuristic burden continues to grow.

What should probably also be mentioned under the rubric of communication is the widespread exasperation about the difficulty, if not impossibility, humans encounter in their attempts at communication. Since language bears the brunt of people's vexation, this problem, already mentioned in Chapter 1, will be briefly discussed under 'Language and speech' below.

3 There is a growing group of scientists and scholars who call themselves transhumanists, and who believe that humans will be able to overcome the innate limitations of the human condition by harnessing such artificial intelligence and adding it to the conventional resources of rationality and technology.

4 Raymond Williams, *Communications*, London, 1962, p. 9.

Language and speech

Of all the means of communication humans have at their disposal, language is far and away the most important. Language is fundamental to our identity, both as a species and as individuals. Though there is still no certainty as to when and how exactly language developed, the notion that it arose as the corollary of an intense social consciousness is compelling. Because we don't share language (of the type that maps intricate symbolic meaning on to an intricate acoustic system) with even our closest evolutionary relatives, we do know that it must have evolved within the last 2 million to 5 million years or so, after humans and chimpanzees parted from each other. It is widely accepted that language is a product of natural selection. Prominent linguist Steven Pinker has no doubt that

> the human language faculty is a complex biological adaptation that evolved by natural selection for communication in a knowledge-using, socially interdependent lifestyle.[5]

However that may be, at this stage in our evolution every human being has an innate predisposition for the acquisition of language. This innate language ability is activated through contact with other human beings that have already had theirs activated: active language users. This happens during the extended period of childhood human children share with a few other species characterised by complex social interactions, such as apes and elephants. Every human child below the age of about six growing up with other speaking human beings will learn to speak competently without a formal learning process. Which language (or, less frequently, languages) are actually learned depends on which language(s) are spoken by the active language users to whom infants are most intensively exposed – usually the parents.

It is now thought that language is not so much a single monolithic ability, unique to man, but rather depends on a whole suite of faculties, each of which singly we share with other animals.[6] This suite of abilities includes: gesturing; self-awareness, memory, co-operativeness and reciprocation; vocalisation, imitation, (social) cogni-

5 Steven Pinker,'Language as an adaptation to the cognitive niche', in *Language Evolution: States of the Art*, ed. M. Christiansen and S. Kirby, Oxford, 2003, p. 16.

6 Kenneally, *First Word*, pp. 187–91 and 200–2.

tion, and communicative intention. But though we share with other animals both the general ability to communicate and many of these specific faculties that language builds on, the sophistication of human language stands out in a number of respects.[7] These include the capacity of language for symbolic reference, and most notably its extreme productiveness. The use of phonological and lexical building blocks in combination with linguistic categories, such as nouns and verbs, and syntactic patterning allows the production of infinite new meaning.

Not only is language most likely the result of a process of evolutionary adaptation, but in turn it causes change in its users. To what extent language affects thought is still the subject of research, as we have seen,[8] but the parallel between language and mediums suggested in Chapter 1 is an extremely suggestive one. In this context it is worth looking more closely at the effect of language on the brain and its development. Terrence Deacon is one of a number of researchers who believe that the increase in human brain size is not so much a precondition for our use of sophisticated tools and, later, language, but that, vice versa, it was the successful way we learned to integrate tools and language in more complex social behaviour that caused our brains to expand.[9]

7 We know that 'communication has evolved several times in the animal kingdom' (Pinker, 'Language as an adaptation', 25). Thinking along the same lines of convergent evolution, Simon Conway Morris has made the intriguing suggestion that it is not unlikely that language will develop in other species, too: 'what we call language is an evolutionary inevitability' (Simon Conway Morris, *Life's Solution: Inevitable Humans in a Lonely Universe*, Cambridge, 2003, p. 253. Cf. Kenneally, *First Word*, pp. 187–91. Recent findings corroborate that the capacity for language is not uniquely human: 'Significant activation in the left IFG in conjunction with other cortical and subcortical brain areas during the production of communicative signals in chimpanzees suggests that the neurological substrates underlying language production in the human brain may have been present in the common ancestor of humans and chimpanzees' (Jared P. Taglialatela, Jamie L. Russell, Jennifer A. Schaeffer and William D. Hopkins, 'Communicative signaling activates "Broca's" homolog in chimpanzees', *Current Biology* 18, 5 (11 March 2008), pp. 343–8, on p. 343).

8 Cf. Kenneally, *First Word*, pp. 103–11.

9 Kenneally, *First Word*, pp. 250–4. However, as Ian Tattersall contends, certain preconditions must be met before language can occur at all: the species must have already possessed 'the structures to permit speech' ('Language and the origin of symbolic thought', in *Cognitive Archaeology and Human Evolution*,

Along the same lines of evolutionary thinking language itself can also be regarded as evolving autonomously. Language as a system of information exchange functions in a larger social system. It might be regarded as a set of relations: between a speaker and the world; between two speakers; between a particular speaker and the other speakers of that language. Obviously this social dimension constrains the freedom of individuals to change the rules of the system. Rather, individuals must bow to the rules, at penalty of communication breakdown. To show just how limited the freedom of language users actually is, in a very powerful metaphor, Terrence Deacon has even compared language to an organism that is parasitical on humans. Language 'infects' its users, and adapts to ensure its own reproduction and survival.[10]

Language is the result, then, of a process of adaptation. But it in turn serves as an *agent* of change. Certainly the fact that language can also have unintended, even detrimental, effects[11] illustrates how little control we have over it. Moreover, it suggests the likelihood that its influence on thought is significant. Since language is a social system, however, there is no reason to stop at the individual. Effects of these evolutionary changes (the development of language and speech) carry over into the cultural sphere. Language has shaped human culture as much as humans and human culture have shaped language.[12] Language and speech contributed significantly to the tremendous increase in the speed at which cultural change has happened since we acquired language, which is estimated to have occurred within the last 200,000 years. From the moment we acquired language, the development of human culture began to speed up. Symbolic behaviour and tool use grew more widespread. (Agriculture, a more advanced type of culturation, is about 10,000 years old.) As I have suggested, and hope to be able to show, language shares this property with mediums, which also serve as catalysts for change – if not as *agents* of change.

In fact, underlining the similarity, language is often referred to as a medium, although it is also sometimes called an instrument or tool. The term 'medium' is used, for example, by the influential commu-

ed. Sophie A. de Beaune *et al*., Cambridge, 2009, pp. 109–16; see esp. pp. 114–16).

10 Kenneally, *First Word*, pp. 234–6.

11 Kenneally, *First Word*, pp. 283–6.

12 Kenneally, *First Word*, pp. 250–4.

nications scholar James Carey when he calls language 'the fundamental medium of human life'.[13] For reasons that should become clearer in the discussion of the concept of 'medium' below, to call language a medium is undesirable in the present context. James Beniger goes even further as a proponent of the language-as-tool idea.[14] I would like to suggest that words like 'tool' and 'instrument' are misleading because to use language we don't need anything that is external to the human body – as tools and instruments are. Also, such terminology suggests that we can choose to use language or not at will, and that we have control over it. In fact, language was not a conscious invention but an evolutionary adaptation. As a social practice language evolves organically; the effects of individual users' interventions are very limited. All in all, the terms 'medium' and 'tool' or 'instrument', referring to forms of *technology*, are better avoided in connection with language.

Writing/writing system

Unlike language writing always involves external tools, which justifies calling it a technology. Not counting the evolution of language, the technology of writing is probably the most transformative invention human beings have ever made. Among its most pervasive effects, it has accelerated the speed of change in human history – at least in those societies that developed writing. Compared to language and speech, writing, which began a mere 5–5,500 years ago, is a very recent invention. The first alphabetic script, still without vowels, dating from as recently as 1400 BC, is less than 3,500 years old. Writing systems were most likely introduced for the purpose of keeping records, i.e., for communicating information to people at a time in the future.[15] Different writing systems have been developed

13 James Carey, *Communication as Culture: Essays on Media and Society*, Boston MA, 1989, p. 83.

14 Beniger, *Control Revolution*, p. 85.

15 See Henri-Jean Martin, *The History and Power of Writing*, Chicago and London, 1994, pp. 8 ff. Cf. '[T]he scribes of Uruk mainly recorded such matters as business transactions and land sales' (Denise Schmandt-Besserat, 'The earliest precursor of writing', *Scientific American* 238, 6, 1978, pp. 38–47, p. 38; she compares the written records with bookkeeping tokens found in the Nuzi palace archives in Iraq, pp. 38–9); cf. also the myths about the origins of writing mentioned in Chapter 3 below.

independently in different places in the world, within a fairly narrow period.[16]

By enabling the production of written records, the advent of writing conventionally marks the epistemological watershed between prehistory and history. What literacy meant for contemporary society is harder to assess, although it is obvious that the changes, though gradual, must have been profound. To understand just how profound, Ivan Illich and Barry Sanders suggest, in *ABC: The Alphabetization of the Popular Mind*, that memory *as a concept* could not really exist without text.[17] At the same time, as Plato was the first to complain, it was ironically writing that started the decline of the role of memory in the transmission of culture. As literacy gained an ever more prominent position the human exercise of memory has indeed continued to decline. As George Steiner laments, 'Modern education is, more and more, institutionalized amnesia.'[18] In *Preface to Plato* Eric Havelock remarks on the development of a very different attitude to knowledge made possible by this 'reification of the word'.[19] Knowledge can now become *objective* in the literal sense of the word. It changes the nature of thinking and makes possible a distinction between fact and fiction: between history and epic poetry.[20] In their 'reification of the word' written texts paradoxically introduce a temporal quality missing from oral culture. Texts could now be new as well as dated. Written text also fostered a sense of ownership of the utterance, and authors could be known by their writings.[21] In his highly original but contentious *Origin of Consciousness* Julian Jaynes has even suggested that writing may have propelled humans into a fuller consciousness

16 This convergent development points to a possible parallel with the 'evolutionary inevitability' of language, meaning that, given time, every society, left to its own devices, would eventually develop writing in the same way as every society has developed language.

17 Ivan Illich and Barry Sanders, *ABC: The Alphabetization of the Popular Mind*, San Francisco, 1988, p. 15.

18 George Steiner, *Dissenters from the Book*, Boston MA, 2001, p. 6.

19 The term is Walter Ong's, from his *Rhetoric, Romance, and Technology: Studies in the Interaction of Expression and Culture*, Ithaca NY and London, 1971, p. 162.

20 Eric Havelock, *Preface to Plato*, Cambridge MA, 1963, pp. 276–305.

21 That authorship did not always exist but came into being, and its corollary, that the 'author function' may disappear again, is what interests Michel Foucault in *What is an Author?* (in *The Foucault Reader*, ed. Paul Rabinow, Harmondsworth, 1984 pp. 101–20).

than they had been able to experience in preliterate times.[22] Certainly if humans have become more conscious as a result of language (see under 'Language and speech' above), it is not too far-fetched to believe, as Julian Jaynes does, that this also goes for writing.[23]

Language is an exceptionally advanced means of communication, both in its spoken form and in its written form. Unlike language, writing is not an evolutionary adaptation. Like speech it needs to be learned on an individual basis. Where it differs from speech is that although in most countries in the world writing skills are held in high regard, and are frequently regarded as essential for full participation in society, writing is not universally acquired by all humans – not even by all humans living in literate societies. Many languages still do not have a written form, and until about a century ago writing was a skill that only a minority of people around the globe had developed. Writing and reading are much harder to learn than speaking and listening, even in cultures with universal or nearly universal literacy. It takes a great deal of practice to accomplish the skill of writing without too many errors. Learning to read and write consumes a major proportion of the time children spend at primary school. Not dissimilar to the way the acquisition of language on an evolutionary scale has enlarged the volume of the human brain, writing affects the way the brain works and even its sheer capacity.[24] How writing fits with evolutionary adaptation is a surprisingly under-researched area.[25] The evolutionary adaptation of the brain to reading, on the other hand, has recently received some attention.[26] It is likely that learning to write *depends on* the ability to speak. At all events,

22 In his *Preface to Plato* Eric Havelock, too, suggests that it is writing that was instrumental in bringing about 'a self-consciousness' ('Separation of knower from known', pp. 197–221, at p. 208).

23 Julian Jaynes, *The Origin of Consciousness in the Breakdown of the Bicameral Mind*, Boston MA, 1977.

24 Maryanne Wolf, *Proust and the Squid: The Story and Science of the Reading Brain*, New York, 2007, pp. 217–18.

25 In the previous chapter I quoted the remark by Dan Sperber and Lawrence Hirschfeld that 'writing – which is so important to cognitive and cultural development … is a form of expertise, although it has become so common that we may not immediately think of it as such. It would be of the utmost interest to find out to what extent this expertise is grounded in specific psychomotor evolved adaptations' (*MIT Encyclopedia of the Cognitive Sciences*).

26 See Maryanne Wolf, *Proust and the Squid*, chapters 2 and 3.

learning the skill of writing happens, *de facto*, *after* the acquisition of spoken (or signed) language.

Apart from the fact that writing is thus a social, or cultural, skill rather than an evolutionary adaptation, the chief reason why writing and reading are so much harder to learn than speaking and listening is that they use more complex brain processes. Writing and reading require a complicated interaction between the two sides of our brain. In addition to the linguistic cognitive processes involved in speech there are the visual processes of coding and decoding graphic scriptorial signs. But, compared with the sense perception of 'ordinary', non-scriptorial, images, clearly writing and reading use the sense of sight in a very different and highly specialised way. Script – alphabetical script more so than most other types of script – consists of (man-made) symbols without any intrinsic meaning, i.e., without reference to phenomena in the real world, but with a well circumscribed communicational value. Script is a code that all language users who wish to use the system must learn, and to whose rules they must agree to adhere. This added complexity makes the textual modality crucially different from the other modalities.

In view of this complexity it is misleading to place newspapers (and script in general, in handwritten, printed, or digital form) in the same category of 'media' as film, radio, and television, as we are apt to do in daily usage. Amid the excited talk of digital convergence it is easy to forget that the nature of the modalities that are being yoked together under the nomer of 'media' is in fact heterogeneous. Film, radio, and television are capable of transporting an observation made with the senses of sight and/or hearing to another time and/or place without changing modalities. By contrast, text is mediated by definition. Writing is not able to record and transport a sense perception directly to communicate an experience to others. A language utterance can try to capture a sense perception only indirectly. Because text does not involve substituting one of the senses by a recording device the textual modality has a different relationship to the human senses than do the other modalities.

A writing system is the means to inscribe human utterances (deriving from speech or thought) in a linguistic form, using graphic scriptorial signs to represent those utterances for the purpose of mediating them. This means that writing can also be regarded as a means of recording, albeit of thought or speech, not of the sense perceptions themselves. But writing as a sign system does not, as was

previously thought, depend on speech in the sense that it is 'speech set down'. According to most linguists today, writing and speech are parallel linguistic systems rather than writing being derivative. This tallies with the observation that, technically, 'writing is an extension of drawing, or more generally of graphic art'.[27]

It was one of Plato's well known objections to writing that as a form of communication it lacks gesturing and various other non-speech communicative linguistic devices. Also, writing is asynchronous: reading does not require the presence of the writer, and vice versa. An important difference between speech and writing is therefore that reading requires a greater heuristic effort than does listening, as will become clear in the section on 'Text' below. While a speaker can act on signals from the hearer, the writer can only try to imagine the difficulties his or her readers may have in interpreting the message and decide to accommodate them – or not.

Writing systems may be categorised by the technologies used into ones that merely inscribe the result (by stylus, chisel, pen, typewriter, keyboard with dedicated word processor) and those that also transmit (telegraphy, teletype, or the computer in a network).

Text

As the linguistic inscription that results from the use of a writing system, in an analogue or a digital form, 'text' is a form of language use distinct from oral compositions and utterances. Text is part of a graphic scriptorial sign system. In their analogue forms the signs can be read from the surface on which they are inscribed, and so are always immediately available. Texts in a digital (virtual) form must always be made legible for purposes of human consumption, on a screen, by way of a print-out, or through projection. (Though they may also be made audible by being read out by a synthetic voice or made sensible through printing in braille.)

While some influential thinkers, the famous linguist De Saussure prominent among them, have held that texts are derived from spoken

27 Roy Harris, *The Origin of Writing*, London, 1986, pp. 26–7. The origin of writing is now believed to lie not, as was suggested by Aristotle and is still widely believed, in attempts at recording speech, but represents 'an independent communicative code' (A. Morpurgo Davies, 'Forms of writing in the ancient Mediterranean world', in *The Written Word: Literacy in Transition*, ed. G. Baumann, Oxford, 1986, pp. 51–77, at p. 52).

language, it is now recognised that this is not the case.[28] Language is used to produce both speech and text, but in clearly distinct ways. A verbatim transcription of speech may be intelligible, but the derivative nature of the text from speech will be obvious, and even appear unnatural as writing. Apart from being linguistically different, the cultural functions of speech and text are widely divergent. Text is used for asynchronous communication. Unlike speech, text is a form of recording that enables relaying the recorded information at a different time and/or place.

Speech is a form of language that exists in a natural, i.e., unmediated, form as well as in a recorded or mediated form. Text, on the other hand, is always mediated, by means of a writing system. Though both are forms of language, text is processed very differently by the brain. Text requires skills additional to those included in the suite of abilities needed for speech, which were discussed under 'Language and speech', and 'Writing/writing system' above. To produce written texts is to encode language in a graphic form, which requires, besides cognitive semantic processing skills, fine motor skills and visual skills. Conversely, to read written texts requires visual discernment in order to interpret the graphic signs as representing language. The fact that reading aloud did not give way to silent reading until the High Middle Ages[29] is testimony to the fact that speech is a more basic form of language than text. Speech demands less brain processing power.

While text lacks the communicational aspects of gestures, expressions, eye movements, inflections, and so on that normally accompany speech, it does have non-verbal informational aspects of its own. The most obvious one is typography: the appearance of the text on the page. Typography can impart all sorts of information about the text, including hints about the nature of the text (for example whether it is poetry, a letter, or a school essay) or its structure. Less obvious, but certainly important, are other aspects of the presentation of the text, such as its binding or physical dimensions. In communicational terms it could be said that through such presentational – or 'paratextual'[30] – aspects the text is, as it were, making (subjective) assertions about itself, saying for example how seriously it should be taken, or what genre it may be. Some non-verbal information has an equivalent in

28 Cf. Harris, *Origin of Writing*, pp. 26–7.

29 See Paul Saenger, *Space between Words: The Origins of Silent Reading*, Stanford CA, 1997.

30 See Gerard Genette, *Paratexts: Thresholds of Interpretation*, Cambridge, 1997.

both speech and text. Emphasis can be expressed in speech, both prosodically and through gestures, and it can be made visible in text, through underlining or italics. But many things that can be expressed in speech (such as anger and other emotions) cannot, or can only indirectly, be expressed in text, and, vice versa, things that can be expressed visually in text (such as a new paragraph and other forms of textual structure) are difficult to express in speech. The lack of context (or, to be more precise, the difference in context between the text's production and its consumption) means that reading text tends to require a greater interpretative effort than listening to speech.

Most prominently, typography plays an important structuring role that speech lacks. The printed book furnishes an obvious example. Its typography identifies various textual levels and their various hierarchical relations, through such conventions as chapters, sections, subsections, footnotes, and so on (see further under 'Markup' below). In the same way as intonation, gestures, and other paralinguistic features are part of the meaning of spoken communication, this *mise-en-page* has become – for better or worse – part of textual communication. A literate society has internalised their meaning to the extent that people are no longer aware of the effort of interpreting them, and would be hard pressed to define their exact contribution. Sometimes typography can fleetingly impose itself on the conscious mind, for example in cross-cultural situations: just as a gesture may be misinterpreted, so might an aspect of textual layout.

Digital text

The technological means by which computers can be used to mediate text – the computing environment – requires some special attention. Part of the computing environment is the hardware. To simplify matters I propose to make a non-problematic equation between such hardware as is used to produce, distribute, and consume analogue text and the computers, cable or wireless connections, modems, routers, and so on that make up the infrastructure of the Internet (including also the electricity they need to function). But what sets digital text apart from analogue text is the fact that access to what may be called its linguistic informational content always depends additionally on software for its encoding in a form that humans as well as computers understand. This encoding takes place in one of two fundamentally different ways: typographically or by means of a markup language.

The linguistic content of a text is stored on the computer or digitally transmitted in files made up of codes representing the characters, spaces, hard returns, tabs, and such, usually according to the ASCII or Unicode conventions. Word processing can serve as a typical example of the typographical encoding of linguistic content. The typical word-processor file is an almost inextricable jumble of linguistic content and a certain quantity of formatting information. The way such formatting is encoded varies from one word processor to the next, and is usually proprietary. Proprietary word processing codes represent all sorts of typographic features, such as the font, type size, use of italics or bold, etc., in addition to information about the file (author, date of creation, etc.).

As *homo typographicus* we take pains to give digital texts a *mise-en-page* that is congruent with typographical conventions we are already familiar with from the analogue world. The sophistication of modern word processors and layout programs is such that it is possible to achieve the same level of typographic fine-tuning in a digital environment as we have long been accustomed to in the world of analogue print. Moreover, it is possible to preserve that sophisticated typography across users and platforms, notably in Adobe's Portable Document Format (PDF). This means that, by and large, we can equally effortlessly 'encode' as 'decode' digital text forms in the visual form to which we are accustomed.

Carrying over conventional typography into its digital equivalent is only one way to deal with text in a digital environment. In principle, markup languages – the second kind of encoding – function in a very comparable way. Here too the linguistic content is mixed with formatting information and information about the file – the chief differences being that the markup and the linguistic content are rigidly separated, and that what can be marked up is not just formatting information to control the text's typographic appearance but also all sorts of analytical, interpretative information (see the separate section on markup below).

The question what constitutes a text is difficult enough to answer in the analogue world. Clearly this difficulty is compounded by the software dimension of digital text. Applying an analogy between analogue formatting and digital formatting, it could be said that, proprietary or not, all formatting codes form an inalienable, because inseparable, part of the text. They can simply be regarded as the equivalent of the typography of an analogue text, which exists

only by virtue of its typographic form. But what about the software itself, without which the codes cannot be interpreted? That part of a markup language that encodes information about the structure of the text can be regarded as the digital equivalent of typography. But in that case, what about the analytical information, which is provided on the same level, to all intents and purposes indistinguishable from the structural information? And to bring up another dimension, in a hypertext system consisting of several 'lexias' and 'nodes', where does one text end and another begin? While I don't propose to supply an answer, such questions will be relevant for the discussion of the salient features of digital textuality in Chapter 5.

A last observation to be made on the subject of digital text is that, like digital information at large, the manner in which it is represented to our senses is of a non-continuous nature. In a theoretical sense this means that visually there will always be pixellation, even at the highest levels of resolution and sampling. In practice this can now usually be reduced to levels that play no functional role (although audio purists maintain that the digital representation of sound remains noticeably different from analogue sound). Digital printing, and analogue printing originated from digital sources, happens at resolutions to all intents and purposes indistinguishable from those of analogue printing. Unfortunately, such is not the case for current screen representations. Even at their best resolution, the screen representation is far inferior to the printed output of the same digital file, even on a printer of moderate resolution. However, improvements are expected from e-ink and e-paper solutions.[31]

Markup

Homo typographicus needs only to skim a text to know that it is a poem, a letter, or a chapter in a book. Genre and structure are easily deduced from typographical cues. Readers need only glance at a printed page to recognise that segments of text represent titles, footnotes, quotations, marginal glosses, and so on. Without reading a word of the text they are able to identify title pages, chapter openings, running text and other major divisions within a book.

31 'E-ink' and 'e-paper' refer to the same concept: a means of representing text that weds the flexibility of electronics with the readability of paper. This technology is used in e-book devices, such as Sony's Digital Book Reader, the iLiad by iRex Technologies, Amazon's Kindle, or the Cybook from Bookeen.

Logical elements in the structure of the text are rendered distinct by a variety of typographic means, such as type size, the use of bold, italics, different typefaces, white space, etc. The term 'markup' derives from the way explicit instructions used to be (and sometimes still are) added to a text so that the typesetter would know in what typographic style any part of the text was to be rendered in order to achieve proper structuring. In retrospect the term has also come to mean the *result* of such instructions. In other words, any written or printed text could be said to have an implicit markup.[32]

Typographic layout, of writing, but more so of print, has always been governed by conventions rather than rules. Conventions dictate, for example, the way we end one and begin another sentence, the meaning we attribute to punctuation marks and the white space surrounding characters, or how relative font sizes are used. The same goes for the direction in which we write, from left to right (other writing systems may write from right to left, top to bottom or even boustrophedontic, which is to say the way the oxen turn when ploughing: from left to right and right to left in turn). In the absence of unambiguous and universal rules about the meaning of typographical features, however, such implicit structure, guided by fluid and, worse, ambiguous conventions, is not suitable for machine processing. It would be a formidable challenge to instruct a computer to recognise under what conditions the same 12 pt italic type may variously represent a caption, emphasis, or a book title. To enable computers to deal intelligently with texts in spite of their lack of typographic understanding is the chief rationale behind the concept of explicit markup.

A markup language describes a variety of features of texts in such a way that these features can be understood by computers as well as by human beings. Textual features that can be encoded include the text's logical structure, its visual appearance, and a wealth of interpretative information. A markup language does so by making explicit descriptive statements about the structural and/or semantic function

32 See James H. Coombs, Allen H. Renear, and Steven J. DeRose, 'Markup systems and the future of scholarly text processing', *Communications of the ACM* 30, 11 (November 1987), pp. 933–47; repr. in *The Digital Word: Text-based Computing in the Humanities*, ed. George P. Landow and Paul Delany, Cambridge MA, 1993, pp. 85–118; cf. Allen H. Renear, 'Text encoding', in *A Companion to Digital Humanities*, ed. Susan Schreibman *et al.*, Maldon, etc., 2004, pp. 218–39.

of any part of the text (compared with the implicit statements about the text made by its typographic form), rather than about how that function should be represented typographically (as in typesetting instructions). These explicit descriptions take the form of codes – called tags – usually embedded in the text, but clearly marked to stand out from it. Because the tags employ so-called 'lower ASCII'[33] characters only, they can be read by any program that can read text, regardless of hardware, software, or operating system.

Markup languages were designed to facilitate and promote a more structural view of documents. To that effect, a markup language will state what the structural function of a particular textual element is. In the following fragment of coded text, for example, <caption> opens an element whose structural function in the text is that of a caption, while </caption> signifies the end of that element:

```
<caption>
  <text>Array of valves used in the ENIAC computer.</text>
  <credit>Photo: John W. Mauchly Papers, Rare Book and Manuscript
Library, University of Pennsylvania.</credit>
</caption>
```

In the structural view offered by a markup language a text is an Ordered Hierarchy of Content Objects (OHCO), where elements that are lower in the hierarchy are always contained in elements higher in the hierarchy. For example, in the caption above the elements <text> and <credit> are each other's siblings, and both are children of the element <caption>, i.e., they are contained in it. The full illustration element, including its caption, can be shown in a tree diagram (Figure 1).

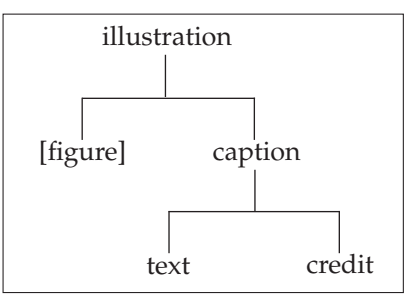

Figure 1

33 See Chapter 4.

In this way markup breaks the nexus that exists in analogue texts between typographic form and content. Where typographic form indicates structure implicitly, markup makes it explicit by naming the elements of that structure and assigning them a place in the hierarchy. For presentational purposes this markup can be converted back into a conventional typographical form by means of a stylesheet. The stylesheet might specify, for example, what a <text> element occurring within a <caption> may look like (say, 9 pt Bembo roman ranged left), and that this may look different from its sibling <credit> (which might be rendered as 9 pt Bembo italic). The separation of form and content thus also leads to much greater flexibility of presentation. The same text can be linked to any number of stylesheets capable of regulating how it is displayed to the finest detail. Vice versa, the same stylesheet can be used to render any number of marked-up texts (as long as they are marked up according to the same rules; see the explanation of the role of a DTD or schema below). Stylesheets may even change the order of elements, and selectively hide elements altogether. For example, the <credit> element might not be printed as part of the caption in the body of the book, but could appear instead in an 'Illustration credits' section in the book's end matter.

However, markup languages are more ambitious in their scope and can do much more than pander to *homo typographicus*. Beyond translating the implicit human-readable logical structure of the text's typography into an explicit machine-readable structure, markup languages can encode any relevant information about the text in such a way that that information can be understood and processed by a computer. This includes the so-called metadata (information *about* the text) and information of an analytical kind, such as editorial annotations, normalisations, glosses, etc. Because markup languages use lower ASCII characters only, and only a limited number of markup languages are shared widely around the world, markup languages also function as a powerful standard for data exchange. Currently the most widely used – though by no means the most powerful – one is HTML, familiar from Web pages, which can be interpreted by all Web browsers.

Markup derives its power from a number of pertinent concepts. Apart from being regarded as an OHCO, each individual text is treated as a member of a class of texts with which it shares a set of ontological features. The class of plays, for instance, recognises the existence of every structural element that a play may contain,

from acts and scenes to speakers and their speeches, from cast list and stage directions to authorial and editorial annotations. These elements, and the relations that obtain between them, are described in a set of formal rules called a Document Type Definition (DTD) or in a so-called schema. This DTD or schema is the model to which the markup in any document instance of its class must conform. For example, a DTD for the class of texts called poems can describe the commonly observed fact that titles always occur before the body of the poem. Once the decision that titles occur only before the body of the poem has been added to the poem DTD – the complete constellation of rules governing the behaviour of poems – the DTD becomes prescriptive, and poems which have titles that occur in the middle of a stanza will not be able to conform to the DTD. If it were felt that poems whose title occurs inside a stanza must also be allowed, the rules of the DTD would need to be changed to reflect this. Every DTD or schema also provides for a header section containing bibliographic information *about* the document, the metadata, such as author, publisher, date, language, revision history, and so on.

In order to harness the power of the computer for all sorts of text manipulation, a software application can be created, made up of one set of markup rules (in the form of a DTD or schema), any number of stylesheets to govern the document's visual representation, and any number of document instances: the texts themselves. Such a markup application can be used for all aspects of creating and using digital documents, e.g., editing, browsing (viewing), but also publishing, searching, formatting, transforming, indexing, and so on.

Just as in the case of other digital text forms, it is hard to establish the exact extent of 'the text itself' in marked-up text. In the analogue world it is not possible to divide a text from its form and structure: the text exists only as a (typographically) structured reading surface. The form this reading surface takes – with its white space, capital letters, font changes, italics, and so on – is in fact part of the text's meaning and so must be regarded as an intrinsic part of the text. In a digital text it would appear to be possible to a large extent to separate form and content: the text could be stripped of most of its markup, leaving only punctuation and word spacing. However, if the markup is taken out, the resulting string of characters is hardly functionally equivalent to a text inscribed on paper, which always includes markup, albeit of an implicit type, i.e., typography. Notably, digital text stripped of its markup lacks the (potential for) typographic

appearance that *homo typographicus* needs to make sense of it.[34] Then again, if 'the text' is asssumed to include the markup, should it not also be assumed to include the other components of the XML application: the DTD, the stylesheet(s), and even the software needed to interpret all of these together? On the principle of parallelism with the analogue world it could be argued that at least the part of the markup that indicates structure, the part of the DTD that rules the markup of that structure, and the stylesheet that makes the structure visible typographically, should all be considered part of the text. This would be difficult because markup systems make no principled distinction – cannot make a principled distinction – between the parts that encode structure and the parts that encode interpretations of the text's semantic content or metadata. Drawing parallels with analogue texts is useful, but ultimately the concept of markup in digital text may lead beyond the point where functionalities can be usefully compared.[35]

Modality

The types, or *modalities*, of information that can be communicated by means of a medium are not identical with the senses. I will use the term *modality* to refer to what in computer terms is called a data type rather than to one of the senses. Speech and writing, two of the most central modalities in communication, make use of hearing and sight, but they are obviously not identical with them. Conversely, only two of man's five senses (or eight senses if equilibrioception, thermoception and nociception are included), viz. sight and hearing, are used for medial communication. These have become the dominant duo for communication in Western society, both mediated and unmediated. Of the remaining three, taste is not really used in human communication, smell has a role in unmediated communication but cannot so far be mediated, while touch is confined to certain intimate situations. Its mediation is very much at an experimental stage.

34 Stripping markup can yield even more confusion for other reasons. If, for instance, a digital transcription of a manuscript text contains alternative interpretations of the same phrase, or editorial comments, stripping the markup is likely to result in unintelligibility.

35 Analytic markup makes statements about the semantic content of the text. Functioning as a metatext within the same 'textual space', it could even be regarded as text in its own right.

The medial modalities that I will distinguish are (alphanumeric) text,[36] still images, moving images, and sound. Between them these modalities are capable of mediating an extensive range of human expression, such as writing, speech; music; two-dimensional images such as drawings, linocuts, maps, and so on; film, etc. Historically, still images were the first to be mediated. Although their communicational function remains a subject for speculation, rock and cave paintings have been dated to at least 40,000 years ago. By contrast, the oldest signs that have been identified as writing have been found in the Middle East, and are no more than some 5,500 years old. Sound and moving images were first mediated just over 100 years ago, in the last quarter of the nineteenth century.

What modalities a medium can mediate is determined by its inherent properties. Moving images are the most versatile. Film is capable in principle of mediating all modalities, including text and still images, although it is not necessarily the most suitable medium for those. Print, for example, is much less versatile, and cannot mediate moving images or sound. The modal limitations of mediums, incidentally, account for a major part of medial bias. It has been suggested, for example, that the ease and cheapness with which the digital medium can reproduce images (including full-colour ones – always expensive to reproduce in print) are causing a shift in the balance between word and image as communicational modalities.[37]

In the reshuffling of medium use that always follows the introduction of a new medium, the relative importance of the various modalities – in McLuhan's terms, the 'sense ratio'[38] – also changes. In this view, first silent, then spoken, film added vision and sound to a medium landscape dominated by still images and text. In turn, the changing relative proportions of modalities would result in a different use of the brain, since the different modalities have different relationships to the senses. While this is undoubtedly true, medium use is of course not monolithic. Mediums function in very different spheres. To add them all up to form a single medium pie that can be variously cut up does not do justice to the varied functions of

36 In the present context – the use of the networked computer for the transmission of text – numbers are not significant as a separate modality. Where necessary I will also distinguish numbers as a datatype for computer processing.

37 Cf. Mitchell Stephens, *The Rise of the Image, the Fall of the Word*, New York, 1998.

38 McLuhan, *Gutenberg Galaxy*, p. 265.

different mediums (which may be used for news, entertainment, education, or general information), or to the fact that a new medium may carve out its niche less from the existing total medium use than from time previously not spent on mediums at all.

Still, as we saw earlier, there is indeed a significant distinction between text and the other mediums in the way the brain handles them. Photography, film, radio, and television all involve substituting the senses of sight and/or hearing for recording equipment in order to capture one or more of the modalities of still image, moving image, and sound. By means of such recordings the human sensory experience of sight and hearing can be faithfully relayed at a different time and/or place. Where all the other modalities use the senses exclusively, the modality of text, in addition to the sense of vision, requires what we call literacy.[39] Literacy involves a highly specialised coding/decoding activity in the brain to turn visual symbols into linguistic ones and vice versa. (Leaving aside the various motor skills needed for writing: moving the arm, hand and fingers.) Text always demands an act of interpretation over and above the interpretation of linguistic meaning – which speech also demands. As a result, people stand in a much more hermeneutic relationship to text than they do to speech or images, with which they have a direct perceptual relation.[40] This difference makes auditive and visual mediums like film, radio, and television into essentially different mediums from the textual mediums. This obviously has major implications for the manner in which information is processed and transferred through these modalities.[41]

39 This is literacy in the literal sense. When we talk about 'film literacy', for example, we use the term figuratively. Film literacy is about understanding the conventions of the film-making 'language' – another metaphor – the parallel being with literary conventions, which for an appreciation of literary value need to be understood over and above the literacy needed to decipher the words of the text.

40 Citing the case of oracles, and their disappearance in literate societies, David Olson has even suggested that, in primarily oral societies, interpretation of spoken words is virtually absent. The meaning the hearer assigns to them is regarded as being given by the speaker. See 'Interpreting texts and interpreting nature: the effects of literacy on hermeneutics and epistemology', *Visible Language* 20, 3 (1986), pp. 302–17, on pp. 305–6.

41 In addition, text also stands apart from other modalities in that seeing and hearing are essentially public modalities, in contrast to the essentially mostly private modality of text.

At first sight, in the digital element all communicational modalities appear to converge towards one single new medium. Historically the various 'mass media' have always been tied to a restricted set of modalities. Initially the only modality of the medium of film was moving images (and a very limited amount of text); later sound was added, in the form of speech and music. Radio has always remained a sound-only medium. Television comprises the same range of modalities as film. Though all modalities can be mediated digitally, the crucial difference in processing between text and the other modalities remains fully effective. It is important then to be alert to the special position of text in the range of modalities that the computer is capable of handling. The fact that all information can be reduced to a sequence of ones and zeroes obscures such essential differences.

Medium

The meaning of the term *medium*[42] is coloured most obviously by the catch phrase *the media*. In daily usage this phrase comprises the newspaper press, radio, and television, usually with film thrown in for good measure. The phrase *the mass media* or *the broadcasting media* indicates more clearly what that colouring represents: a large scale of operations and a wide public reach, together with their potential to sway public opinion. Less obviously, and potentially more treacherously, contemporary use of the term 'media' implicitly emphasises the notion of dissemination, through either broadcasting or multiplication. The term 'medium' is applied more naturally to printing (involving multiplication) than to writing by hand (involving neither multiplication nor broadcasting). When the prodigious production of the printing press was still a novelty, multiplication was the salient feature that needed emphasising; now dissemination through multiplication or broadcasting is the norm and we need to make a special effort to remember to include methods of text production that do not automatically involve either, such as handwriting or typewriting. For want of a better term (and because coining a new one would only add to the confusion) I propose to continue to use the term 'medium' despite these unavoidable connotations of multiplication

42 Note that *medium* can also refer to the publishing agent (the mediator who may (inter)mediate, or – in the digital era – be disintermediated).

and broadcasting. By employing the plural *mediums* rather than *media* I can avoid most of the potential confusion with mass media.[43]

A slightly more expanded definition of the term 'medium', based on the provisional one I gave in Chapter 1, could then read as follows: 'A medium is a construct consisting of a tool or technology with its (explicit) technical protocols and any implicit social protocols with the purpose of communicating information expressed in one or more of the modalities of still text, images, sound, and moving images over time and/or space.'[44]

Mediums can perform a range of functions, chief of which are 'recording' (or inscribing) a message on a substrate, disseminating it (through multiplication or broadcasting), and transmitting it. Table 1 offers an overview of the functions of a number of mediums, involving the modalities of text, sound and moving image. Multiplication and broadcasting can be regarded as together constituting a single property, that of disseminating content to an audience of more than one. Multiplication does so through the creation of multiple copies, one for each member of the audience, while broadcasting achieves a similar effect through making a single source available to an audience (usually of more than one person). An additional difference between the two ways of disseminating is that in the case of broadcasting, transmission and consumption take place at the same time.

The emphasis in transmission can be on the time or on the place axis, with a clear historical shift from the time to the place axis. The lack of portability of inscriptions in stone makes epigraphy clearly a case of transmission over time, while radio and television are the epitome of transmission over space.[45] The stand-alone computer, like

43 Here I follow David Crystal; see for example 'The changing nature of text: a linguistic perspective', in *Text Comparison and Digital Creativity*, ed. Wido van Peursen *et al.*, Leiden, 2010, pp. 229–51.

44 It could perhaps be objected that the phrase 'tool or technology' is tautologous. It is intended, in the vein of Walter J. Ong's *Orality and Literacy: the Technologizing of the Word* (London, 1982), to convey a broad interpretation of the word 'technology', including any writing tool.

45 In *Empire and Communications* (Oxford, 1950; rev. edn Toronto and Buffalo, 1972) Harold Innis develops the notion that the history of empires is to a significant extent determined by their means of communication, which may be biased towards time or place: 'The concepts of time and space reflect the significance of media to civilization. Media that emphasize time are those that are durable in character, such as parchment, clay, and stone. The heavy materials are suited to the development of architecture and sculpture. Media

Table 1 Medial functions

			Dissemination		
Modality	*Medium*	*Inscription*	*Multiplication*	*Broadcasting*	*Transmission*
Text (inc. still images)	Epigraphy	✓	✗	✗	T
	Manuscript	✓	✗	✗	T/P
	Print	✓	✓	✗	T/P
	CompStand-Alone	✓	✗	✗	T
	CompNet-work	✓	✓	(✓)	T/P
Sound (inc. speech)	Record/Tape/CD	✓	✓	✗	T/P
	Radio	(✓)	✗	✓	P
MovImg	Film	✓	✗	✓	T/P
	Television	(✓)	✗	✓	P

Note ✗ No. ✓ Yes. (✓) Possible. ***T*** Time. ***P*** Place.

epigraphy and manuscript, lacks the dissemination property. The computer acquired the dissemination property only when it became part of a network. This book's interest in the computer as a textual medium focuses on the network. Unless specifically mentioned otherwise, the phrase 'the digital medium' refers to the computer-in-a-network. In the case of print, records, CDs, DVDs, and film, the medium also leads to closure in the sense that a message is inscribed in multiple copies to remain available in an unchanging material form to be repeatedly consumed.

As I suggested in Chapter 1, a special difficulty arises from the fact that we use mediums to discuss them. It will by now have become clear why this 'medial contamination' is problematic. In scholarly research normally a distinction is made between the subject, the disciplinary paradigm and methods used to study the subject, and the (usually textual) medium employed to observe, discuss, and communicate whatever is known or learned about the subject. In the present case the problem is not only that the first two of these variables are both

that emphasize space are apt to be less durable and light in character, such as papyrus and paper. The latter are suited to wide areas in administration and trade' (p. 7).

textual mediums, but that this complication is in turn confounded by the inevitable bias of the (textual) medium that I am using.

Textual medium

The textual mediums are handwriting (including inscriptions in clay, stone, and so on), print, and digital text forms. In the digital medium probably the most prominent modality is the textual one. If not in terms of traffic (the number of bits transported), in terms of the number of discrete items (taking, for example, a Web page as a discrete item), and because the interface is almost invariably textual, textual transmission is more prominent than music or video. Textual mediums all function on at least three levels: through the linguistic expression of a message; the use of a writing system that encodes that linguistic expression; and use of a substrate on/in which the encoded language is inscribed, so as to enable its transmission. The development of the computer as a (textual) medium went through at least two distinct stages, which will be discussed in greater detail in Chapter 4. As a stand-alone device the computer could transmit text in much the same way as any other writing technology, such as manuscript of typewriting. The computer-in-a-network added the capability of direct transmission and dissemination.

Digital medium

It could be argued that there are many different digital mediums, such as CDs, DVDs, e-book readers, and so on. However, this book concentrates on just one: the computer-in-a-network. Despite the sense of plurality entailed in that concept, I will treat it as a singularity, and for that reason mainly speak of 'the digital medium' in the singular rather than the more usual plural.

Although its virtual nature is generally regarded as one of its most characteristic qualities, the digital medium, too, has a physical substrate. This is made up not just of such very tangible and visible hardware components as the computer, screen, keyboard, and many other devices, but also of the hard disks and Random-Access Memory (RAM) that store any informational content. Even the very bits that compose that content (as well as the software that makes it readable) are ultimately less ghostly than is usually assumed.[46]

46 It may take magnetic force microscopy to make visible the bits on the surface of a hard disk drive, but it can be done. Cf. Matthew Kirschenbaum, *Mechanisms: New Media and the Forensic Imagination*, Boston MA, 2008.

As the result of an evolutionary process of 'technological convergence' the digital medium is capable of mediating all modalities. Unlike in analogue mediums, there are no technical restrictions as to what aspects of still and moving images may be mediated, such as colour versus black-and-white only; half-tone versus line. The fact that the digital medium hosts all modalities apparently seamlessly in a single medial space means that the special position of text in the total range of modalities (which we just discussed in the 'Modality' section above) risks being obscured in spite of its prominence.

The mediums we can use for the communication of the modality of text – the textual mediums – form a sub-set of the mediums for linguistic communication. The larger set of mediums through which we are capable of recording and transmitting language, in the form of speech, also includes radio, film and television, and sound recording. The textual mediums are handwriting, print, and digital text forms. I will usually be referring to the last as 'the digital textual medium'.

Now that we have defined our terms, we can concentrate on the main task at hand: to study the continuum between handwriting and print, and between print and digital text forms.

3

The Order of the Book

The human textual condition

Among the most deeply influential inventions of the Western world are writing and the tools we use for it. By allowing the spread of culture beyond the time and place of the spoken word these have affected the course of history more than any other human invention. We refer to the Islamic and Judaeo-Christian cultures as cultures of the book. The phrase is intended to convey the significance of the Torah, the Bible and the Koran in the religious tradition, but it conveniently reflects the way culture at large is a culture of written language. The importance widely attached to the book has, if anything, only increased as a faith-based understanding of the world has had to make room for secular forms of knowledge after the invention of printing. The Enlightenment is rooted in the very book culture originally created by the dominant religions against which so much of its intellectual energy was directed. It could not have occurred without a deep reliance on print.

This 'textual condition' was a long time in the making, but from slow beginnings it grew exponentially. It began with the first forms of manuscript writing, tentatively adopted in a few places in the world at roughly the same time, some 5,500 years ago. From there literacy spread only slowly beyond the arcane use of administrators, clerics, and professional writers. Literacy was relatively widespread in the larger urban centres of classical and Hellenistic civilisation such as Athens, Alexandria, and Rome.[1] Even slaves were frequently taught to read and write so that they could perform scribal, secretarial, or

1 Even then, literacy remained well below 10 per cent of the population; see W.V. Harris, *Ancient Literacy*, Cambridge MA and London, 1989, pp. 3–24, 323–37, and *passim*.

librarian duties.[2] However, it took centuries before, in the High Middle Ages, urbanisation began to stimulate literacy on a larger scale, and more widespread education made reading and writing available to a wider cross-section of society. The invention of printing with movable type reinforced it in an unprecedented way, resulting in the Western world in what I have called the 'Order of the Book': a culture deeply defined by the codes of print. In spite of the competition of radio, film, and television, the Order of the Book has consolidated in our time. The importance of the written word in communication may be said to have culminated in Western society around 1900, before the onset of the fierce competition for people's time and attention of the audio-visual mediums of the twentieth century. At the turn of the century the newly achieved mass literacy had turned print into the most widely available source of news and entertainment – in the shape of cheap novelettes, illustrated magazines, and an unprecedented and never again equalled variety of newspapers, published in massive print runs. Despite the enormous range of medial modalities available through film, television, radio, and the WorldWide Web, culture has continued to be suffused by text of all kinds. With the continuing prevalence of books as a vehicle for the transmission of knowledge, notably in education, the written word still holds a culturally privileged position.

At the beginning of the 1990s, in a matter of just over five years, the WorldWide Web took the world by storm. From just a few computers serving static Web pages it grew to a massive network whose size can be approximated only very roughly. The number of Internet users (estimated at 1.8 billion as of December 2009) is growing by approximately 250 million a year.[3] The Web is now used for shopping, booking airline reservations, watching films, downloading music, listening to radio programmes, and making telephone calls. Yet despite this panoply of functions and modalities, the Web – a textual medium from its inception – remains dominated by textuality in the form of Web pages, e-mail, instant messaging, blogs, and text files of all kinds, including complete books.[4]

2 See Harris, *Ancient Literacy*; cf. Horst Blanck, *Das Buch in der Antike*, Munich, 1992, p. 37; H.L. Pinner, *The World of Books in Classical Antiquity*, Leiden, 1958, pp. 30–1.

3 See 'World Internet Users and Population Stats', www.internetworldstats.com/stats.htm.

4 Available statistics, e.g., European Commission, *European Cultural Values*,

As I suggested in Chapter 1, by dint of our long familiarity with it, text has become so transparent as to make it all but invisible as a technology. The extent to which we have internalised our textual condition can easily be illustrated. Think of the astonishing ease with which we are capable of assessing unconsciously the purport of textual messages without even reading a word of the actual text. Just to glance at a printed surface is to reach a reliable verdict on the nature of its contents, and to interpret it as a letter, a free advertising rag, or a book of a certain import. We truly deserve to be called *homo typographicus*.

In the continuum from print to digital textual transmission I have posited, this textual condition persists. Before examining how digital text found itself a place in a culture already dominated by textual mediums this chapter will take a closer look at those existing textual mediums – manuscript and print. How did they create our textual condition and how did they influence, and continue to influence, the way we see the world? In taking a closer look at the adoption and development of manuscript and print it will be possible to learn something about the mechanisms of medial change. Moreover, if it is true that *how* we transmit knowledge (i.e., through the use of manuscript and print and their distinct possibilities) has implications for *what* knowledge may be transmitted, this should point to the sources of any bias that may occur in the use of these two textual mediums.

As I have suggested in Chapter 2, writing and printing have played a very important historical role in that they have laid down necessary conditions for change. However, the effects come from a mixture of social and technological factors. While the argument about the extent of any causal relationship between the use of – especially textual – mediums and the development of culture is obviously of enormous importance, it has so far proved to be too complex to admit firm conclusions. Society is not the outcome of a historical trajectory leading us from a benighted past to an enlightened present. If

2007 (http://ec.europa.eu/culture/eac/sources_info/studies/pdf_word/values_report_en.pdf), show that e-mail remains the most common online activity, accounting for 68 per cent of leisure time use, while, for example, 39 per cent use the internet to read newspapers (p. 25). By contrast, downloading music stands at 27 per cent, and films and television at 16 per cent. In addition, of course, all of the non-text modalities, including even the software enabling it all to run, are firmly embedded in textual interfaces.

something can be learned about this relationship between social and technological factors without falling into the pitfall of a teleological interpretation of history so much the better.

Some notable features and effects of writing

It is now generally assumed that the earliest uses of script tended to pertain to the registration of property and commercial transactions.[5] Developed from tokens and marks representing objects from the external world, graphic symbols were used to register, to count, to represent, and of course to preserve and the records thus created over time.[6] The main drive for the invention was, in other words, economic. The oldest such writing is Mesopotamian. Text was inscribed in clay tablets using a reed stylus with the characteristic shape that gave the scripts originating there the collective name 'cuneiform' ('wedge-shaped'). The first use of that word is found in an ancient Sumerian source which also happens to contain a particularly interesting assertion about the origin of writing. Writing, according to this myth, was supposed to have been invented by King Enmerkar of Uruk for the specific purpose of being able to write a letter.[7] The importance of correspondence in the Sumerian bureaucracy was reflected by the frequent use of (fictional) letters as examples in the writing schools. As a myth of origin the story of Enmerkar's invention is significant if for no other reason than that it stresses the ability of writing to bridge distance rather than any perceived need to preserve records over time – although this was perhaps so obvious as to be taken as read.

Despite the tremendous effort that it takes to learn to write, the technology of writing (and printing) has obtained a lasting and vital

5 See the section 'Writing/writing system' in Chapter 2 above.

6 Script developed from the graphic representation of the physical world; not from speech, as used to be commonly assumed (Harris, *Origin of Writing*, p. 26).

7 Enmerkar sends a messenger who is meant to narrate the message orally as well as carrying a written text. See Herman Vanstipthout, 'Enmarkar's invention of writing revisited', in *DUMU-E2–DUB-BA-A: Studies in Honor of Åke W. Sjöberg*, ed. Hermann Behrens *et al.*, Philadelphia, 1989, pp. 515–24. Cf. the myth of Bellerophon, mentioned below. In *The Origin of Writing*, chapter 1, 'From folklore to technology', Roy Harris gives various other myths about the origin of writing.

place in human culture. It is very difficult to imagine its absence,[8] and such a condition can be apprehended only as through a glass, darkly. Paradoxically, for example, when writing was still novel its use could be regarded as dangerous, for the very same reason as it could now be thought risky *not* to write something down, i.e. that writing things down creates a physical record. As Plato stresses in his *Phaedrus*, the severance of the connection between the originator of the knowledge and the audience leads to danger and uncertainty. The fate of the recorded word is unpredictable. Once words have been put into writing their author no longer has any certainty as to who will read them, and when or where:

> Writing allows distortions of address: words meant for two ears only are overheard by others. To record is to relinquish control over the confidentiality and personal destination of the message.[9]

Today the world has not only grown used to the fact that records have a life of their own, but it has actually come to depend on that fact. Awareness of its independent existence has been integrated in the way written and printed text are treated. In fact society has come to depend on this continued objective existence to the extent that it would be at a loss without it.

Many momentous social effects can be associated with the gradual adoption of writing and the spread of literacy in Western culture. Bearing in mind at all times that such a brief treatment will not be able to do justice to the gradualness and diffuseness of the process, I should like to discuss briefly some of the most prominent of them.

The diminishing role of human memory

A popular conception of writing is that it is, in Plato's terms,'a specific … for the memory'.[10] The frailty of human memory is a notorious, eternal, problem. However prodigious the feats of memory that people may once have been capable of,[11] every writer on the subject,

8 Walter Ong makes a persuasive attempt in *Orality and Literacy*.

9 Peters, *Speaking into the Air*, p. 40. He calls this phenomenon the 'promiscuity' of the text (p. 29 and *passim*).

10 Plato, *Phaedrus* 274e (trans. Benjamin Jowett).

11 Examples abound; cf. James O'Donnell on Jerome (*Avatars of the Word: From Papyrus to Cyberspace*, Cambridge MA and London, 1998, pp. 4–5); Augustine (himself a man reputed to have had an excellent memory) on Simplicius (Mary Carruthers, *The Book of Memory: A Study of Memory in*

from classical times to the present, has invariably stressed the vital importance of practice. Memory is like a muscle that needs constant exercise to stay fit, as neuroscientific brain research regularly proves. The need for such constant exercise has steadily declined since the invention of writing as a means of inscribing knowledge that would otherwise have to be remembered.

In his *Phaedrus*, which amounts to an exceptionally sensitive and extraordinarily visionary treatment of this issue, Plato discusses writing in terms of the advantages extolled by its proponents versus his own darker suspicions that this *pharmakeion* or 'specific' would bring more trouble into the world than good. The Egyptian god Theuth (or Thoth), Plato has Socrates tell us, 'was the inventor of many arts, such as arithmetic and calculation and geometry and astronomy as well as draughts and dice, but his great discovery was the use of letters'. When this prodigious inventor presented writing to Thamus (the god who was then the king of all of Egypt) he explained that it would 'make the Egyptians wiser and give them better memories; it is a specific both for the memory and for the wit'. To which Thamus sensibly replied:

> O most ingenious Theuth, the parent or inventor of an art is not always the best judge of the utility or inutility of his own inventions to the users of them. And in this instance, you who are the father of letters, from a paternal love of your own children, have been led to attribute to them a quality which they cannot have; for this discovery of yours will create forgetfulness in the learners' souls, because they will not use their memories; they will trust to the external written characters and not remember of themselves. And so the specific which you have discovered is an aid not to memory, but to reminiscence. As for wisdom, it is the reputation, not the reality, that you have to offer to those who learn from you; they will have heard many things and yet received no teaching; they will appear to be omniscient and will generally know nothing; they will be tiresome company, having acquired not wisdom, but the show of wisdom. [*Phaedrus*, 274e–275b]

As the subsequent dialogue between Socrates and Phaedrus shows, Plato shared Thamus's scepsis, as have many commentators since.

Medieval Culture, Cambridge, 1990, pp. 18–19), and Leah S. Marcus on Elizabeth I ('From oral delivery to print in the speeches of Elizabeth I', in *Print, Manuscript and Performance: The Changing Relations of the Media in Early Modern England*, ed. Arthur F. Marotti and Michael D. Bristol, Columbus OH, 2000, pp. 33–48, on p. 37).

In *Prometheus Bound*, for example, Aeschylus, clearly basing himself on the same myth as Plato, has Zeus punishing Prometheus for bringing the alphabet into the world.[12] Paradoxically, the adoption of writing, which is now apt to be regarded as a patent 'specific … for the memory', in ancient Greece and elsewhere may well have led if not to the 'invention' of memory then at least to an unprecedented consciousness of its significance.[13]

Theuth is not just the god of writing but also the god of death, who keeps a record of the weight of dead souls.[14] The association Plato makes of writing with death – as against 'living memory' – is something he shares with many poets after him. Among the more famous is Horace. His confident claim in his 'Exegi monumentum' (*Odes* iii.30.1) that his poetry, more durable than bronze, has brought him immortality is a familiar topos. But it is easy to forget that, paradoxically, he places no trust whatsoever in writing. The material substrate on which we have come to rely so much for dissemination and preservation he sees as being vulnerable to mould, fire, moths, and other destructive natural forces.[15] For his immortality he relies, not on writing, but on that same 'living memory' that Plato also holds in superior regard. Again, this is strikingly removed from a literate society's attitude to writing. The saying 'verba volant, scripta manent' (the spoken word flies, the written word remains) is now usually regarded as a eulogy on writing – 'flying' representing an undesirable sort of transience and evanescence. But to apply this

12 Also, 'Documents can be flourished in a comedy of Aristophanes to back up an oral statement with the implication that only shysters would use this resource; the written word is still under some suspicion or is a little ridiculous' (Eric Havelock, *Origins of Western Literacy*, Toronto, 1976, p. 71).

13 Simonides of Ceos (*c*. 556–468 BC) is usually regarded as the 'inventor of the system of memory-aids' (Frances Yates, *The Art of Memory*, London, 1966, pp. 17, 43). It is inviting to speculate on the significance of the precise historical moment when he did so, shortly after the introduction of writing in Greece. Could there be a connection with the anxiety provoked by the use of such a material substrate as papyrus for the inscription of valuable thoughts and utterances?

14 Jacques Derrida, who draws attention to this in 'La pharmacie de Platon' (in *La Dissemination*, Paris, 1972, p. 104), also recalls the double meaning of the Greek word *pharmakon* ('specific'), meaning *remedy* as well as *poison* (pp. 108–11).

15 In 'To his Book' Horace complains of the 'unaesthetic moths' eating his books (*Epistles*, Book 1, xx).

to the classical mind-set may be a misinterpretation betraying a deep cultural chasm. Homer spoke approvingly of 'wingèd words', and 'verba volant, scripta manent' strongly resembles Paul's sentiment in his second epistle to the Corinthians that 'the letter killeth, but the spirit giveth life' (3:6). It conveys the belief that writing is pathetically inert and hidebound, and that it is only the spoken word that is truly capable of reaching across to the person one wishes to commune with. However this may be, outside of administrative, military, and other such utilitarian settings, it definitely took time for the preserving power of writing to become appreciated.

The quantifiability of knowledge

As knowledge became available in a tangible form it could also be treated as a quantifiable commodity, and could be collected from various sources. The library of the temple at Nippur that was excavated in the 1890s contained more than 20,000 tablets. Though many of them were of an administrative nature, together they formed an impressive record of the linguistic, geographical, religious, botanical, medical, and other knowledge of the Sumerians. But the most famous and most ambitious of the early collecting initiatives was no doubt that of the great classical library of Alexandria. In bringing together, by fair means or foul, all known texts of the late classical world in physical form it represented an ideal model for centuries to come.

It was only in the era of print, when the unstemmable proliferation of books had made the task of physical and intellectual collecting too daunting, that this form of collecting was gradually replaced by systematic bibliographical efforts. Most monumental among these was the herculean feat performed by Conrad Gessner (1516–65), the 'father' of modern enumerative, or systematic, bibliography. In his *Bibliotheca universalis* he aimed to include bibliographic references to all writers who had ever produced scholarly works in one of the languages of science – Latin, Greek, or Hebrew. However modest by comparison with the grand Alexandrian enterprise, even this bibliographic vision already proved too ambitious. The sheer volume of information being produced in the Western world had already become forbidding. After having published a further three volumes Gessner gave up. But bringing together the world's knowledge had become an ineradicable human urge. Having caused the problem in the first place, it was the same technology, printing, that also

furnished a solution, albeit of a different nature. The massive *Encyclopédie* of Diderot and d'Alembert (thirty-five volumes, 1751–80) can be regarded as one of the outstanding tributes to man's encyclopedic instinct – as well as a monumental milestone in printing history. After a succession, in the first half of the twentieth century, of visionary but ultimately abortive attempts based on microfilm – notably by Paul Otlet in Belgium and Vannevar Bush in the United States – the encyclopedic inclination has since gained new perspectives in the Internet era (about which more in Chapter 5).

Objectivity

As Jack Goody and Ian Watt have suggested, written records encourage 'scepticism … about received ideas about the universe as a whole'.[16] The material written record allows observations made by one person to be judged by another, who may be removed from the first in time and space. Objectification in the literal sense of the materiality of the written word thus led to reflexivity, and the possibility of greater objectivity in the figurative sense in which it is now usually understood. A written account may in itself not be much more objective than one that is orally transmitted, but the existence of the account as a written artefact will at least enable comparison with other accounts, allows of correction, and will make it less susceptible to adaptation or corruption over time.[17]

The critical distance resulting from writing is a point also stressed by Eric Havelock in his *Preface to Plato*. In explaining Plato's attack on poetry as an attack on an educational system rather than on poetry as such, Havelock interprets Plato's objection as being aimed at rote learning in an oral society. According to Plato, learning by heart poems such as the *Iliad* and *Odyssey* made it impossible to take distance from the opinions expressed in them, and to distinguish properly between opinions and facts. How very ironic therefore that Plato did not recognise the great promise of writing – a technology which he denounced – as a 'specific' against the indoctrination of orally transmitted knowledge.

16 Jack Goody and Ian Watt, 'The consequences of literacy', in *Literacy in Traditional Societies*, ed. Jack Goody, Cambridge, 1968, pp. 67–8. See also Jack Goody, *The Domestication of the Savage Mind*, Cambridge, 1977.

17 In *Literacy and Orality* Ruth Finnegan illustrates the ease with which oral accounts (in her examples of genealogies) are adapted to new realities (pp. 20–1).

Consciousness

One of the largest and most controversial claims for writing has been made by Julian Jaynes in *The Origin of Consciousness in the Breakdown of the Bicameral Mind* of 1976. In this influential book Jaynes suggests that consciousness, in the particular sense in which he uses the term, is connected with the development of writing. This sense is that of a process by which individuals are enabled to look at themselves from the outside, so that they become capable of seeing themselves as distinct persons with a particular past, and directing themselves towards a particular imagined future on the basis of their own judgements and decisions. Language offers the primary instrument with which to create the potential for this sense of consciousness, but in Jaynes's view it is writing that crucially accelerates the process.[18] This would naturally involve both the objectification and the rationalisation aspects of writing discussed above. It leads Jaynes to place the development of this particular type of consciousness squarely in the period in which writing was beginning to gain ground: the second millennium BC. The famous exhortation to 'know thyself' inscribed in the temple of Apollo at Delphi, and variously attributed to a number of Greek sages of the sixth and fifth centuries, would according to Jaynes have been an impossible formulation in an era before writing had advanced to the position it had come to hold by the time of Solon. That was when, as Jaynes claims, 'the operator of consciousness is firmly established in Greece'.[19]

Abstraction and rationality

The classicist Eric Havelock was among the first to make the claim, in his *Preface to Plato* (1963) and *Origins of Western Literacy* (1976), that the invention of writing was a condition for the escape out of a mind-set dominated by subjectivity and myth to rational and analytical thought.[20] For some decades this remained one of the

18 'The importance of writing in the breakdown of the bicameral voices [which represent man's preconscious motivation] is tremendously important. What had to be spoken is now silent and carved upon a stone to be taken in visually' (Julian Jaynes, *The Origin of Consciousness*, p. 302). Compare also Havelock, *Preface to Plato*, notably 'Separation of knower from known', pp. 197–214.

19 Jaynes, *Origin of Consciousness*, p. 287.

20 To support similar claims, Ong cites at great length the extensive fieldwork among illiterates in the Soviet Union of the Russian psychologist Aleksandr Luria in *Orality and Literacy* (pp. 49–55).

more hotly debated claims for writing.[21] More recently, Maryanne Wolf has added to Havelock's side of the balance the weight of new research in cognitive neuroscience, psychology, and linguistics to stress the 'increasingly sophisticated intellectual skills promoted by reading and writing'.[22] Current neuroscience suggests that 'the new circuits and pathways that the brain fashions in order to read become the foundation for being able to think in different, innovative ways':[23]

> By its ability to become virtually automatic, literacy allowed the individual reader to give less time to initial decoding processes and to allocate more cognitive time and ultimately more cortical space to the deeper analysis of recorded thought. Developmental differences in the circuit systems between a beginning, decoding brain and a fully automatic, comprehending brain span the length and breadth of the brain's two hemispheres. A system that can become streamlined through specialisation and automaticity has more time to think. This is the miraculous gift of the reading brain.
>
> Few inventions ever did more to prepare the brain and poise the species for its own advancement. As literacy became widespread in a culture, the act of reading silently invited each reader to go beyond the text; in so doing, it further propelled the intellectual development of the individual reader and the culture. This is the biologically given, intellectually learned generativity of reading that is the immeasurable yield of the brain's gift of time. [*Ibid*., pp. 216–17]

The debate about the cognitive effects of reading and writing has certainly not been concluded. But it seems incontrovertible, for example, that the process of writing fosters – if it does not in fact require – greater precision of formulation. The realisation that a reader may dissect the verbal tissue of thoughts after gaining access to them in a material form could not but tend to a greater exactness of expression in the writing process. Further, at the very least the *capacity* for rational thought is aided by writing, if only as a result

21 Among the more vociferous critiques was that of Ruth Finnegan in her already cited *Literacy and Orality*. Though she strikes a welcome note of caution in the face of a tendency towards a simplified oppositional model in which orality and literacy are in clear-cut opposition (p. 175), her argument is ultimately not very convincing. At the end of the day, the Limba peasants whom she presents as evidence for a capacity of abstract and detached analysis did not, for all that, develop an industrial society or contribute to scientific discoveries.

22 Wolf, *Proust and the Squid*, pp. 217–18.

23 Wolf, *Proust and the Squid*, p. 217.

of the objectification discussed above. These are all preconditions for the sophisticated rational thinking on which philosophical and scientific advancement is based.

Indisputably, the literate mind-set is very different from the oral mind-set. This difference will manifest itself in many ways. Some are obvious, such as the relative importance of memory, which has already been discussed. Walter Ong has suggested that our constant awareness of ourselves as being 'situated every moment of [our] lives in abstract computed time of any sort' is another outcome of literacy. Other effects are a great deal more diffuse and subtle – and thus harder to imagine. Among them are the ways in which the awareness of an essential difference between speaking and writing plays out. As linguists have come to realise in the twentieth century, writing is not speech inscribed but a means of expression in its own right. Writing demands a very different register, characterised, among other properties, by greater exactness of expression. Writing, as Plato showed so pointedly in the *Phaedrus*, is out in the world on its own, and cannot rely, as speech can, on the help of gesture, facial expression, elucidation on request, etc.

All these diffuse social effects can be mostly attributed to one salient property that distinguishes the technology of writing from orally transmitted knowledge: the fact that writing has a physical, tangible form. That writing involves the creation of a physical object is its most distinctive feature. The invention of writing made it possible in a very literal sense to detach the self from the thought it had. In other words, knowledge could become independent from the person who held that knowledge. And so, for example, Bellerophon could be instructed to carry the folded tablet on which had been graved many 'life-destroying signs' ordering his own death, as Homer narrates in the *Iliad*.[24] On a larger scale, and less immediately deadly, writing in this way enabled the continuity of culture as well as its dissemination.

That the 'objectification of the word' is the most salient technological feature of writing is not to say that no other salient features are relevant in assessing its effects. The fact that it is a technology – a special skill that must be actively learned – is one of them. The arcane nature of the use of writing by administrators, clerics, and professional writers has already been mentioned in the introduction to this

24 Book VI, 168–9.

chapter. What this draws attention to once again is that writing is a technology. As such it requires a conscious learning effort, while language is learned by any human child merely by being subjected to it. Unlike speech, writing divided the world – as to a significant extent it still does – into those who have access to the meanings it inscribes and those who have not. Possessing the faculty of reading and writing gives power. It does so not just by giving access to written sources that remain closed to others, but also by extending the very capacity of the brain to think.[25]

Some notable features and effects of printing

Johannes Gutenberg of Mainz is credited with the invention, in the middle of the fifteenth century, of the technique of printing with movable metal type. A flourishing trade in manuscripts had existed in Europe for some time, especially after paper, newly introduced in Europe in the twelfth century, became more widely available in the fourteenth, coinciding with the rise of literacy levels. Gutenberg's major innovation was to think of a way to separate the text to be copied into its atoms: the individual characters (letters, abbreviation signs, ligatures, numbers, and punctuation marks). The ability to correct the text before copying, and to reuse the cut types afterwards, added to the paradigm shift in the copying of texts.[26]

Printing is the first example of modern industrial production. After an initial capital investment in the means of production (a printing press and movable type) a series of identical copies of a product – a particular text – could be manufactured. It was an industrial process which involved a clear division of labour, and resulted in workflow efficiency that compared very favourably with manuscript

25 Wolf, *Proust and the Squid*, pp. 217. Extending the brain's capacity by exercising it in this way resembles the brain's evolutionary development as a result of exercising the language ability posited by Terrence Deacon (see Kenneally, *First Word*, pp. 250–4).

26 In both China and Korea printing with movable type pre-dates Gutenberg's invention, and may have inspired it (Joseph Needham, ed., *Science and Civilisation in China*, Vol. 5, *Chemistry and Chemical Technology*, Part 1, Tsien Tsuen-Hsuin, *Paper and Printing*, Cambridge, 1985, pp. 313–19). China was first with movable types made of porcelain (around AD 1040; *ibid*., pp. 201–3), while Korea was the first to use metal type, in the early thirteenth century (*ibid*., pp. 325–6).

production, even with the already efficient pecia system.[27] For each individual book, the investment in time involved in composing the type was only a few times what it took for a scribe to make a single copy of the text. True, that was only part of the total investment. Besides the initial capital investment in plant and other equipment there was the labour cost of the actual printing process, as well as the cost of paper – recurring and substantial. Even if the cost of paper per copy was no higher than in the case of manuscripts, the total for the entire print run was now payable before any copies had been sold, while in manuscript production paper needed to be paid for only if and when a copy of a book was made. As this was usually done to order, little risk was involved.

Nevertheless, printing was an extremely efficient means of multiplication, which must have catered to an existing need: that of a growing reading public demanding for more copies to be produced faster at competing prices – without of course forfeiting legibility. Lucien Febvre and Henri-Jean Martin have suggested that Gutenberg's contemporaries may have accepted printing as no more than a device for reproducing mechanically the texts most in demand'.[28] The resulting *lowering* of book prices was not necessarily foreseen – let alone intended – by its inventor. Rather it developed gradually, as a side effect of the industrial method and competition among printers.[29]

As in the case of writing, a number of sweeping social changes have been associated with the printing press. Elizabeth Eisenstein has made a far-reaching claim for the effects of the printing press as an'agent of change'. In her two-volume work *The Printing Press as an Agent of Change* (1979) she asserts that there are three major events in the cultural history of the West that could not have happened without it:

27 The pecia system divided the source text in a number of sections so that they could be simultaneously copied (Lucien Febvre and Henri-Jean Martin, *The Coming of the Book: The Impact of Printing, 1450–1800*, London, 1976, p. 21).

28 *The Coming of the Book*, p. 248; see also Jan Willem Klein, 'Ghescreven ofte gheprent: aspecten van de (Goudse) Middeleeuwse boekproductie' (Written or printed: aspects of Gouda medieval book production) in Herman Pleij, Joris Reynaert *et al*., *Geschreven en gedrukt: boekproductie van handschrift naar druk in de overgang van Middeleeuwen naar Moderne Tijd*, Gent, 2004, pp. 67–84, at p. 70.

29 See, for example, John Man, *The Gutenberg Revolution: The Story of a Genius and an Invention that Changed the World*, London, 2002, p. 217.

- The Renaissance, with its revival of classical literature and the impulse it provided for early modern humanism.
- The Reformation, which began with Luther posting his ninety-five theses on the door of the castle chapel at Wittenberg in the form of a single handwritten note, whose contents and import were rapidly disseminated by the printing press, and which depended on the personal study of the word of God.
- The scientific revolution, which depended on the exactness of print and the ease of access to the record of other people's ideas.

Eisenstein's book occasioned a good deal of criticism, which after almost thirty years still reverberates. Though much of it was directed at her methods rather than the substance of her argument, much of the argument unfortunately got drowned in the sea of criticism. In 1976 an English translation had appeared of *l'Apparition du livre* by Lucien Febvre and Henri-Jean Martin of 1958. With its subtitle *The Impact of Printing, 1450–1800* and a last chapter entitled 'The book as a force for change', *The Coming of the Book* made claims not all that dissimilar to Eisenstein's, yet it had evoked no such fierce protests. The difference, and a chief point of criticism of Eisenstein's argument, was that Eisenstein had paid much less attention to the technology's social setting.[30] Attributing a certain autonomous agency to the printing press, she was accused of displaying unwarranted technological determinism. By treating the printing press as a technology *sui generis*, in fact she placed it outside conventional models of historical change.

Some technological properties of print

To be sure, without the social embedding of the technology (the definition of the roles of such human agents as authors, printers, censors, booksellers, distributors, and readers) and the acceptance of the conventions of print (for example, its 'registration', 'certification', and archiving functions for scholarship),[31] printing could not

30 Also, Eisenstein made the mistake of prominently acknowledging her indebtedness to the ideas of Marshall McLuhan, whose unique style – a blend of the apodictic and the oracular – and unconventional form of writing have always caused him to be regarded as something of a maverick by 'serious' scholars.

31 Adrian Johns discusses these points at length in what amounts to a book-length attack on Eisenstein, *The Nature of the Book: Print and Knowledge in the Making* (Chicago and London, 1998).

have had the effects it had. But though the printing press may not have been the sole agent of change, with its salient technological properties it nevertheless did more than merely create conditions that fostered change: there are some good reasons for regarding it as an 'agent of change'. What were these properties?

- *Increased speed of copying*. The greater speed of copying compared with manuscript production allowed information to be disseminated much faster. Increased speed of copying and the increased number of copies represent two sides of the same technological coin. Printing requires the setting up of type, and a great deal of preparation in make-ready. This investment in the initial stage of production can be justified only if it is in some way made up for later. Admittedly, this is an economic imperative; there is no intrinsic *technical* reason why it would not enable a low speed of copying in a small number of copies – or even the printing of a single copy. However, that would patently be perverse. The process of printing was *designed* to increase both the speed of copying and the number of copies produced.
- *Increased number of copies*. Through the increased number of copies a greater number of people could be reached, leading to the record of human knowledge becoming more widely accessible. Equally, as Eisenstein has stressed in her discussion of the religious debate that gave rise to the Protestant Reformation, the printing press soon also started to widen access to *new* ideas. Luther's ninety-five theses had by no means been the first attempt to reform the Catholic Church. But the fact that this time his original handwritten note could be printed and disseminated in such large numbers of copies so fast gave his ideas much greater impact beyond the immediate place (Wittenberg) and time (31 October 1517) of their original publication.
- *Legibility*. The very fact that printing meant the repetition of identical shapes made print easier to read than most handwriting. Even the earliest examples of printing are mostly extremely legible. The type Gutenberg used for his Bible has been praised lavishly, and the forty-two-line Bible counts among the most beautiful books ever printed.

Unintended properties of print

It is of course impossible to isolate technology completely from its social setting. Without the socioeconomic motive to recoup costs and maximise the return on the investment made on typesetting, the number of copies made in print might not have increased as much compared with manuscript production. Again, without the drive to make a profit the speed of copying might have grown more slowly. As it was, the drive for speed was a constant socioeconomic factor, further strengthened by a developing explicit social demand for speed, for example in the case of news. Nevertheless, it is significant that these were the properties that were singled out for comment in contemporary descriptions. That texts could be so effortlessly multiplied in so many copies in such a short period, and in such legible letters, without scribal errors, was a source of amazement and admiration to many.[32] Apart from the sheer wonder at the technological achievement that printing represented, speed and quantity are repeatedly commented on. Together with the ability to correct the set type and to reuse the individual sorts (which woodblock printing did not offer), they were likely the primary incentive for Gutenberg's invention of printing with individual metal types.

For its inventor speed, number of copies, and correctability represented economic motives first and foremost. Yet these same properties could equally benefit various other social interests, such as those of scholars in disseminating new knowledge, and of the Church in disseminating the word of God in more reliable and, importantly, more uniform editions.[33]

But this fantastic new technology of printing, with its intended salient properties of increased speed and quantity (fulfilling an existing demand), also brought along unintended properties no less salient.

32 For example, to Bishop Enea Silvio Piccolomini, who writes to the Spanish cardinal Juan de Carvajal about the clarity of the type produced by 'that miraculous man in the vicinity of Frankfurt', which he suggests his correspondent may have been able to read without difficulty, and even without glasses (quoted in Paul Hoftijzer, *De lof der boekdrukkunst*, Zutphen, 2003, p. 7).

33 E.g., Ursula Rautenberg, 'Von Mainz in die Welt: Buchdruck und Buchhandel in der Inkunabelzeit', in *Aventur und Kunst. Vom Geheimunternehmen zur ersten Mediarevolution*, Mainz, 2000, pp. 236–47, at p. 240.

Identity of copies

To all intents and purposes all copies produced by the printing press were identical.[34] As we have just observed, such identicalness across individual copies was certainly intended as far as the *text* itself was concerned. It was a property that was particularly welcomed by the Church in its attempts at standardising the liturgy and the text of the Bible,[35] but it offered an efficient antidote more generally to the unrelenting tendency towards corruption of manuscript transmission. However, identicalness of *the individual page* was a coincidental side effect. To some extent it was even an undesirable one, as it turned books into industrial, 'off the rack' products compared with the bespoke nature of the manuscript book. Just as it took time when writing was first invented for the concept of permanence of the record to develop,[36] it took time for awareness of the particular usefulness, especially for referencing and scholarship, of this aspect of printing to emerge.

Conscious cultivation of this salient property took even longer.[37] It was not till around 1475 that Nicolas Goetz of Cologne printed an edition of Werner Rolewinck's *Fasciculus temporum* using page

34 Correction on the press, or accidents with the type, frequently caused textual variation, which was, however, usually minor. In the case of Gutenberg's Bible, the decision to increase the print run after the first sheets had already come off the press necessitated resetting of entire pages, using forty-two lines instead of the original forty. However, the variations concern spelling (especially the resolution of abbreviations) mostly. See Christopher de Hamel, *The Book: A History of the Bible*, London and New York, 2001, pp. 207–11.

35 See Rautenberg, 'Von Mainz in die Welt', p. 240; De Hamel, *Book*, pp. 194–5.

36 Its potential for permanence was judged much less than that of living memory, and faith in the inscriptional permanence of the material substrate grew only slowly.

37 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 per cent). Page numbering in manuscripts, which are by definition unique, 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. Note that the usefulness of pagination depends to a large extent on the genre and nature of the text concerned.

numbers,[38] and it was not until almost a full century after Gutenberg's first printings that page numbering started to become common.[39] Fixation and standardisation (at least across most of a print run) of information on the printed page, both in terms of the substantials and accidentals of the text itself and in terms of the typographic *mise-en-page*, aided textual stability and thereby the scholarship that depended on that.[40] More generally, page numbering, contents pages and indexes could all make use of this feature. They offered convenient ways into the text and made a crucial contribution to the *machine à lire* that the book has since become.[41] The identity of content across copies fostered the growth of bodies of shared knowledge. This led, paradoxically, to both fixity and change: fixity because of canonisation; change because such bodies of shared fact provided points of departure for forays into new areas of knowledge, as the scientific revolution of the seventeenth century evidences.[42]

Increased exactness of information

Closely connected with the identity of copies was the greater precision in the transmission of detail that printing enabled. This meant that much greater exactness in the representation of knowledge could be achieved, through the use of such typically typographic aids as tables and different typefaces, font sizes, and white space as a means of ordering information. The faithful – and with the use of engraving techniques more precise – reproduction of illustrations, too, represented a significant improvement. These were refinements that could be relied on for an entire edition. Uniformity, predictability, consistency, and standardisation were prerequisites for analytical and scientific thinking, but also for improved organisation, as, for example, in bureaucracy. Again, this greater precision was a

38 Printed numbering of leaves had already occurred in 1470 (Smith, 'Printed foliation', p. 54).

39 Febvre and Martin, *Coming of the Book*, p. 88.

40 In *The Nature of the Book* Adrian Johns also stresses the time it took, not just for identity of copies to become a reliable property of print, but especially for the awareness of that property to become sufficiently widespread for it to be generally exploited.

41 The phrase is that of Paul Valéry in 'Les deux vertus d'un livre', in *Oeuvres*, Vol. 2, Paris, 1960, p. 1249.

42 Mistakes, if they went uncorrected, could obviously mar an entire print run: identity of copies has its down side.

by-product of printing technology rather than a property designed by its inventor in reply to an existing social demand.

Without the availability of the technology in the first place there would have been no opportunity for these various effects, and so, in a very real sense these unintended properties of printing can be regarded as 'agents of change'. Precisely because they were unintended – side effects, so to speak – it can be argued that at least until such time as their usefulness became recognised, and their properties were consciously harnessed in the 'knowledge industry', a form of agency may be attributed to them. This may not have been enough to cause such major events as the Renaissance, the Reformation, and the scientific revolution singlehanded, but it makes printing rather more than a mere addition to a long list of contributing factors.

Diffuse social and economic effects

One obvious practical consequence of the invention and spread of printing was the growth of a large body of printers, typesetters, correctors, booksellers, and so on. They gradually organised themselves in professional bodies, some existing, such as the scriveners, some new. But, intended or unintended, the primary technological features of printing led to further effects, which, though themselves unintended, nevertheless went on to become extremely significant. They may be called the secondary, social, effects of print. They include the following:

- *Lower prices*. The lowering of book prices resulting from the shift from manuscript to print removed barriers to the ownership of books, and thereby improved access to the ideas they contained. Ideas and knowledge could thus spread more widely, both formally (through education) and informally. Also, the skill of reading, once acquired, did not have to languish for want of reading materials.
- *Increased chances of preservation.* As larger numbers of the same text were produced, that text was more likely to survive in the longer term as multiple copies were dispersed over collections geographically widely apart.[43]

43 This in spite of the truth of the book historical dictum that 'the more there were, the fewer there are', referring to the phenomenon that much popular printed matter was so intensively used, or treated so casually, that few copies remain.

- *Diminishing control over access to information.* More directly consequential, and in line with Plato's misgivings about writing, were the fears of both Church and State about the uncontrolled spread of knowledge and information. The institution of censorship was thus a necessary corollary of the invention of the printing press, even if its effectiveness has always been rather limited.
- *The anonymity of the eventual reader.* Diminishing control over access to printed information was an effect that gave rise to mixed feelings, not just on the part of the authorities, but equally on that of authors. From the author's point of view print makes for a still greater degree of anonymity of the eventual reader than in the case of writing. The larger market demanded by the increased number of copies furthered dispersal over a larger geographic area, while selling out the edition might take longer, leaving the text to find new buyers and readers long after the death of the author and the original publisher. This represented an element of uncertainty that was not welcomed by authors, who were careful about who they were entrusting with their text.[44]
- *The expansion of individuality.* As many commentators have remarked,[45] print was also a major factor in the development of the sense of individuality that marks modern society. More so than writing, print enables anonymous, private intercourse with the text, bypassing the personal contact of oral communication. As, first, reading moved from the public (reading aloud, reading in social settings) to the private sphere and, next, the growing choice of reading matter made the likelihood of two readers sharing the same reading experience more and more remote, the reader's communion with the text served to stress the individuality of the experience.
- *Termination of the one-to-one relationship between production and consumption.* Manuscript books were usually copied on demand only. Printing a large number of copies of a book without the prospect of certain sales introduced commercial risk-taking into the book trade, and with that the marketing 'push' of the commercial interest of the printer–publisher. This meant that Hermes – the printer's economic considerations – became increasingly drawn into Pallas Athena's cultural and scientific sphere.

44 Of the many authors who felt that way about their writing, Erasmus and Spinoza are among the best-known.

45 E.g., Ong, *Literacy and Orality*, pp. 130–2.

- *Stimulus to new writing*. What printing did in the first instance was offer wider access to existing knowledge and information. The efforts of the early printers had, unconsciously or consciously, been focused on the preservation of existing knowledge: the further dissemination of the most popular canonical texts. However, as the market for canonical texts became saturated, printers began to cast around for new markets. Soon the printing press became a convenient means to circulate new writing.

Increased speed and spread of dissemination of knowledge lead *ipso facto* to a general speeding up of the process of change.[46] At the same time, as has often been stressed, printing created conditions for conservation and standardisation as much as conditions for change. An often cited example, also mentioned by Eisenstein (*ibid.*, pp. 117–18), is the standardisation of language. Education played a significant role here, as young learners were increasingly subjected to standard primers and a more fixed spelling. Also, in combination with the greater attention to substantials (e.g., in text editions), attention to the literal form of texts, the 'accidentals', grew too.

These apparently contradictory effects – change and 'fixity' – that took place over a considerable period of time sprang from the same medium, and ultimately find their root cause in the same salient features of the technology and the social practices that made use of them: the identity of copies, and increased exactness of information.

Reactions to printing

Not surprisingly, Gutenberg's 'Black Art' was subjected to very similar diatribes as writing had been. The problem of 'unauthorised' access to knowledge that was regarded as dangerous in the wrong hands was only exacerbated by the printing press. The call for censorship was therefore one of the inevitable side effects of printing. On a more directly practical level, as the abbot Johannes Trithemius (Johan Tritheim) was quick to recognise, printing posed a threat to the livelihood of copying clerks in the monasteries, which meant that a whole way of life would be coming to an end. (The archdeacon in Victor Hugo's *Notre-Dame de Paris*, who is heard sadly exclaiming as he

46 This has been remarked frequently in more recent times (e.g., by C.P. Snow in *The Two Cultures*, Cambridge, 1959; Bernard Stiegler, *Technics and Time*, p. 15, or Alvin Toffler in *Future Shock*, New York, 1970). However, starting from extremely slow beginnings, the process has been going on at least since the invention of writing.

moves his hand from the printed book on his desk to the church outside his window, 'Ceci tuera çela,' could have been modelled on him.) It was, however, not just the gainful employment of devout monks in the scriptoria that explains Trithemius' preference for the manuscript book: it was also the love they brought to their work. He wrote a famous treatise in praise of scribes – which he had printed for better effect – arguing that, owing to the spiritual nature of their work, scribes exerted more care than printers.[47]

Especially in literary circles, similar sentiments could be heard. As late as the seventeenth century the spoken word was widely venerated more than writing, which was regarded as but a poor substitute. 'I know what dead carcasses things written are in respect of things spoken,' writes John Donne to the Countess of Montgomery, echoing Paul in his second letter to the Corinthians.[48] Live speech indubitably comes first in the hierarchy, but manuscript is always to be preferred to print. This is how John Donne expresses his preference for manuscript, centuries after the invention of printing:

> Parturiunt madido quae nixu praela, recepta,
> Sed quae scripta manu, sunt veneranda magis
> […]
> Qui liber in pluteos, blattis cinerique relictos,
> Si modo sit praeli sanguine tinctus, abit;
> Accedat calarno scriptus, reverenter habetur,
> Involat et veterum scrinia summa Patrum.[49]

In these lines Donne represents the conviction, still widely and deeply held in his day, that the personal care lavished on a manuscript somehow made it more alive than the industrial products of print,

47 Johannes Trithemius, *De laude scriptorum* (1494). See also James O'Donnell, 'The pragmatics of the new: Trithemius, McLuhan, Cassiodorus', in *The Future of the Book*, ed. Geoffrey Nunberg (Berkeley CA and Los Angeles, 1996), pp. 37–62.

48 Quoted by Richard Wollman in 'The "press and the fire": print and manuscript culture in Donne's circle', *Studies in English Literature* 33, 1 (1993), pp. 85–97, on p. 90.

49 'What presses give birth to with sodden pangs is acceptable, but manuscripts are more venerated. A book dyed with the blood of the press departs to an open shelf where it is exposed to moths and ashes; but one written by the pen is held in reverence and flies to the privileged shelf reserved for the ancient fathers.' Quoted by Harold Love in *The Culture and Commerce of Texts: Scribal Publication in Seventeenth Century England*, Amherst MA, 1998, pp. 152–3. The English translation is Love's.

and that speech, issuing directly from the mind or memory, was more alive than either.[50] Plato makes the same observation in the *Phaedrus* when he contrasts 'the living word of knowledge' with 'dumb' writing. Note the contrast in this respect between Donne, the poet, and Bacon, the scientist, who, not coincidentally, had great faith in the printing press as an agent for the dissemination of knowledge. And apart from economic and literary–cultural reservations, aesthetic ones may have played a role. Print is an industrial process. By extension, the book as a product is not just an object but a disposable commodity.[51]

There were many other, less radically oppositional, ways in which the manuscript tradition continued side by side with printing.[52] The ascendancy of print was a gradual affair, and its hegemony was never to be complete.

The Order of the Book

In spite of all misgivings when they were first introduced, these two textual technologies of writing and printing have gradually increased their hold on society. They have brought about the irredeemably textual condition of Western society. The concept of an 'Order of the Book' that I introduced in Chapter 1[53] offers a convenient shorthand

50 Ben Jonson, overseeing the production of his own monumental *The Workes of Benjamin Jonson* (1640), was clearly of a different opinion, but in that respect he was considered by many contemporaries a pushy renegade.

51 It has been suggested that bibliophiles who wished to remain faithful to the manuscript hired scribes to turn the text of any printed book they wanted to add to their collection back into manuscript. It is doubtful if by such a desperate act they managed to breathe any more life soul into the text. Eisenstein discounts the notion that snobbish prejudice against printed books as 'vulgar machine-made objects' was widespread (*Printing Press*, pp. 48–9), yet she admits that 'a large number of the manuscripts made during the late fifteenth century were copied from early printed books' (p. 51). The reason may of course have been simply that the printed book was no longer available, or because it was cheaper if one did the copying oneself.

52 See, for example, G. Dicke and K. Grubmüller (eds), *Die Gleichzeitigkeit von Handschrift und Buchdruck*, Wiesbaden, 2003; Harold Love's *Culture and Commerce of Text*; David McKitterick, *Print, Manuscript*; Arthur F. Marotti, *Manuscript, Print, and the English Renaissance Lyric*, Ithaca NY, 1995.

53 As I mentioned there, the phrase was 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*). *The Order of Books* talks of the order

for a culture whose entire social fabric is defined by the textual codes of manuscript and print. What I mean by that is roughly as follows. The Order of the Book presupposes widespread access to a formal education based on book learning, and a high literacy level. On this educational foundation is based a more general social dependence on literacy. Literacy is needed to be able to function in society. In other words, literacy does not just offer access to the formal knowledge that is contained in books, it enables people to participate fully in all aspects of social life. For such full participation it is necessary for everyone to have access to the information contained in newspapers, periodicals, signs, manuals, guides, contracts, advertisements, printed tickets, pamphlets, broadsides, timetables, programmes, and other manifestations of writing and print. The more the Order of the Book advances, the more generally ingrained becomes the ability to engage with the form of the book as a 'reading machine', i.e., as a technology that is expository and linear in nature, which requires a certain mental concentration and patience. This ability could be termed a 'meta-literacy': an understanding of the relationship between form and content, and the ability to appraise the status and value of printed information. Furthermore, the Order of the Book is based on a written legal code and written contracts. It tends towards representative democracy with universal suffrage, based on the assumption of universal accessibility of relevant knowledge; and to freedom and pluriformity of the press. This is usually complemented by a high symbolic value being attributed to books (in our time expressed through, for example, government policies).

The Order of the Book has its roots in the manuscript era, but the widespread literacy it presupposes could not be achieved before the era of print. Even then growth was slow. To measure the extent of

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that governs the world of books, and the way in which books and libraries manage to represent – or fail to represent – the world at large. However, where Chartier chiefly discusses the world of books itself, I will be taking the liberty to suggest also a reverse relationship, with the order that characterises the world of books in fact having come to determine largely the order that obtains in (Western) society. I think Chartier himself hints at the legitimacy of such a view when he writes in his Epilogue: 'If the object that has furnished the matrix of this repertory of images (poetic, philosophical, scientific) should disappear, the references and the procedures that organize the "readability" of the physical world, equated with a book in *codex* form, would be profound as well' (p. 91).

its diffusion it is not enough to take into account quantitative data such as the literacy ratio and book production statistics; qualitative ones that may be much harder to measure must be reckoned with too. The ease with which people read, for example, depends also on the degree of exercise required by a given society: how necessary literacy is if one wishes to be an integrated member of that society. Also crucial is the exact role of reading and writing in the education system, one vital factor being whether these skills are taught early enough in a child's development.[54] Though more precise estimates could be made, depending on the criteria used or the countries or regions one focuses on, it is not until the second half of the nineteenth century that the Order of the Book could be said to have generally arrived. In spite of the host of new mediums that have assaulted its position from the late nineteenth century it has persisted to this day. It has in time been served by all of what I have called the textual mediums: manuscript, print, and digital text.

A vast infrastructure for the production, distribution, and consumption first of manuscripts and then of the printed word, growing in both size and extent, supported the process by which the Order of the Book became socially established: printing shops, bookshops and bookstalls, libraries and archives. Politically the flow of knowledge was checked by a system of imprimaturs and bans, privileges and censorship. Intellectually it was governed by an intricate system of bibliographic control. In the Order of the Book the organisation of knowledge is defined by the literate mind-set. Countless mechanisms were put in place to achieve this. Catalogues, bibliographies, and other book lists assured that the existence of books was made known, that books could be found in bookshops or borrowed from libraries. To ensure that passages in the text could be located, the knowledge contained in books was harnessed by page numbers and tables of contents, by footnotes and indexes. Facts could be looked up in massive compendiums and encyclopedias, organised according to alphabetic or analytical principles.

The use of these systems was taught in schools and universities, initially only to the privileged few but, however rudimentarily, to ever

54 Havelock, *Origins of Western Literacy*, pp. 22–4; Wolf, *Proust and the Squid*, p. 20. The period of literacy in ancient Greece and Rome described by Havelock did not achieve anywhere near the almost full literacy achieved in the West by the turn of the twentieth century. The resulting forms of democracy were correspondingly different.

more people as education eventually became regarded as a key to prosperity and general civilisation. The Republic of Letters that came into being in the Renaissance had many descendants in various forms of intellectual society: networks of early scientists, connected through correspondence and learned journals, academies, salons, the *sociétés des gens de lettres* of the Enlightenment, and ultimately the modern university. In the seventeenth and eighteenth centuries intellectual and social ferment was based on the publication of an endless flow of tracts, pamphlets, and newspapers that were read in coffee houses everywhere. This gave rise to what has become known as the 'public sphere', the hallmark of the modern democratic state.[55]

The establishment of the Order of the Book happened quite slowly in Europe. At times progress was virtually imperceptible. A look at the history of the United States by contrast brings both the Order of the Book and its democratising tendency into sharp focus. It also offers an excellent illustration of the connection suggested earlier between writing (and, *a fortiori*, print) and rationality. Neil Postman has referred to the United States as 'the first nation ever to be *argued* into existence *in print*':

> Paine's *Common Sense* and *The Rights of Man*, Jefferson's Declaration of Independence, and the *Federalist Papers* were written and printed efforts to make the American experiment appear reasonable to the people, which to the eighteenth-century mind was both necessary and sufficient. To any people whose politics were the politics of the printed page, as Tocqueville said of America, reason and printing were inseparable. We need not hesitate to claim that the First Amendment to the United States Constitution stands as a monument to the ideological biases of print. It says: 'Congress shall make no law respecting the establishment of religion, or prohibiting the free exercise thereof; or abridging freedom of speech or of the press; or of the right of the people peaceably to assemble, and to petition the government for a redress of grievances'. In these forty-five words we may find the fundamental values of the literate, reasoning mind as fostered by the print revolution: a belief in privacy, individuality, intellectual freedom, open criticism, and community action.[56]

55 Jürgen Habermas, *The Structural Transformation of the Public Sphere: An Inquiry into a Category of Bourgeois Society*, Cambridge, 1989. See also Asa Briggs and Peter Burke, *A Social History of the Media*, 2nd edn, Cambridge, 2005.

56 Neil Postman, *Technopoly: The Surrender of Culture to Technology*, New York, 1992, p. 66 (emphasis in the original).

American society is based on the presumption not only of widespread if not universal literacy but equally on unrestricted access to all ideas promulgated by the press. 'There is not a single line written by Jefferson, Adams, Paine, Hamilton, or Franklin that does not take for granted that when information is made available to citizens they are capable of managing it.'[57] Complete freedom of the press is a precondition for the project of a democratic republic.

The new institutions that were forged in North America after the constitutional break with Britain were thus not just politically new. They were suffused by a post-Enlightenment frame of mind in which equality replaced class, and decisions were informed by rational thought instead of by custom and convention (such as the English legal code with its Roman law roots). In creating the US constitution James Madison was thoroughly influenced by Rousseau and that monument of print, *l'Encyclopédie*. In Europe in the meantime it was never a foregone conclusion that the democratising tendency of the Order of the Book was indeed the way forward. Repression of all dissident thinking continued, through various forms of secular and religious censorship, including the *Index librorum prohibitorum*, which remained in force until 1966. The American experiment, by contrast, was able to make a fresh start on the inspiration of the intellectual ferment of the European Enlightenment.

Still today 'mere book knowledge' can be disparaged by practitioners of skills that are best transmitted orally. But the broad stream of knowledge flowed increasingly through formal schooling rather than an informal oral tradition. Such formal schooling is a precondition for the broad basis of shared knowledge that an ever more 'knowledge-intensive' society has come to depend on. It is also a prerequisite for being able to choose a different path through life (a different career, say) from that customary in one's immediate social sphere, especially one's parents, and thus it is an instigator of social change. Of course, even when print was on its triumphal march, oral and manuscript transmission of knowledge persisted, but their relevance diminished over time.

By the middle of the nineteenth century both the diffusion and the status of the written word had risen to unprecedented heights. There was tremendous optimism about the improvement of the human condition through literacy. Regarded as a symbol of civilisation, the

57 Postman, *Technopoly*, p. 67.

book was placed on a pedestal. The ideal of civilising and improving the lot of the lower classes inspired, each in its own way, first the more enlightened bourgeoisie, and later the socialists. No one ill at ease in the world of books and learning would find a place in the halls of power. Mass literacy moved democracy from the partial, class-based democracy of the beginning of the nineteenth century to the popular democracy, based on universal suffrage, of the beginning of the twentieth century. In a spiral movement, two factors drove up the position of print in the nineteenth century. On the one hand technological improvements in printing (for example, the invention of cylinder presses, and the use of steam power) and paper making (mechanisation, and the use of wood pulp instead of rags) made print cheaper and brought it within wider reach, suffusing society with a strong incentive towards increased literacy. On the other hand, increased literacy, resulting from improved education, and such factors as better lighting and increased leisure time fed the demand for print.

Under these conditions print could, and did, become cheaper, going some way to meet the demands of the newly literate masses. In line with the rise of a consumer market at large, the market for print became increasingly sensitive to consumer demand. Lower prices were complemented by entirely new genres, aimed at reading for popular entertainment. Detective novels, suspense, horror, kitchen novelettes, cartoons, and other new forms of sensational literature were mostly intended to be consumed only once, and so could exist only if they could be sold sufficiently cheap to make them disposable. (Inversely, the investment in the new and much faster cylinder presses caused their owners to cast about for ways in which to make them profitable through publishing more popular reading matter.)

With this 'descent of print' into society the nineteenth century saw the decisive transition from intensive to extensive reading. Instead of returning to the same few familiar texts, consumers discovered the delight of the new. But printed matter of all kinds became more prevalent, and as more printed information of all kinds had to be absorbed, typographers looked for means to help *homo typographicus* to process their reading more efficiently. The nineteenth-century 'invention' of bold-face type to add to the existing roman–italic contrast nicely illustrates the point. This has been explained as a belated response to a longer-felt social need – now become more pressing in an era in which people were subjected to print so much

more intensely – for greater emphasis rather than simple distinction. Employed especially in lists, tables, dictionary entries, language primers, and other such highly articulated text forms, bold type took a prominent place in the graphic representation of structure in text. Facilitating a faster interpretation of the structure of printed material, it was highly useful in a society increasingly drenched in print, but was especially helpful for the broad classes of newly literates to whom reading was not yet second nature.[58] The widespread adoption of bold type is thus illustrative of the growing dependence on print, and so the 'bold idea' can be said to have made its own modest contribution to the establishment of the Order of the Book.

Among the fastest-growing print products of the nineteenth century were newspapers and periodicals. Family magazines, and special-interest ones, such as boys' magazines, fashion magazines for women or sports magazines for men were especially popular in an illustrated form, with much pictorial (increasingly photographic) content and often large advertising sections. As far as newspapers were concerned, long-distance communications such as the telegraph and telephone made it easy to bring not just local news but also news from other parts of the world. International news had always been of obvious use to governments and merchants, but it would have been hard to predict the immense popular appeal of news. News became one of the most ubiquitous forms of popular entertainment. Despite the fact that most of their contents had no practical usefulness to the majority of their readers,[59] by the turn of the twentieth century the consumption of newspapers had reached staggering proportions. In Paris in 1910, with a population of around 2.5 million, 5 million papers were printed every day. In 1900 *Le Petit Parisien* alone printed 1.5 million copies daily.[60] The phenomenon of a medial form intended and developed for a small professional market being discovered and adopted by the general public is one

58 Michael Twyman, 'The bold idea: the use of bold-looking types in the nineteenth century', *Journal of the Printing Historical Society* 22 (1993), pp. 107–43.

59 A point made eloquently by Neil Postman in *Amusing Ourselves to Death: Public Discourse in the Age of Show Business*, 1985, repr. London, 1987, pp. 65–81.

60 Catherine Bertho, 'Les concurrences', in *Histoire de l'édition française*, Vol. 4, *Le Livre concurrencé 1900–1950*, ed. Henri-Jean Martin *et al*., Paris, 1986, pp. 23–35, at p. 23.

that we will encounter again in the case of the digital medium.

Until the arrival of the 'new media' – film, radio, television – the position of print in the provision of news, entertainment, and education was unassailable. But from the turn of the twentieth century the new mass media began to compete for leisure time and attention. The death of the book has been pronounced again and again.[61] However, though the printed word has indeed had to concede space to the new media, it has not disappeared – nor indeed has it even diminished significantly in importance. In fact, the Order of the Book is hardly less vital today than it was in the nineteenth century. As we now realise, of course, mediums rarely completely disappear. But books and print did have to redefine their place each time the constellation of mediums changed with the arrival of a fresh competitor.

Various factors have contributed to the continuing vitality of the Order of the Book. To begin with, by the turn of the century the products of the printing press had become a major source of entertainment. Apart from newspapers, the new genres of detective fiction, popular romance, and other popular reading matter already mentioned, new publication forms, such as high-circulation (illustrated) magazines, pulp literature, and comic books did much to consolidate its position. From an advocacy of literacy point of view the spread of popular reading around the turn of the century may be said to have happened just in time. If the position of books was

61 Among the first to predict the coming demise of print was Tommaso Marinetti, to whom it was obvious that 'The book, the most traditional means of preserving and communicating thought, has been for a long time destined to disappear, just like cathedrals, walled battlements, museums, and the ideal of pacificism … The Futurist Cinema … will … collaborate in a general renewal, substituting for the magazine – always pedantic – for the drama – always stale – and killing the book – always tedious and oppressive' (from 'La cinematografia futurista', *Italia futurista*, 11 September 1916, cited by Robert Gross in 'Communications revolutions: writing a history of the book for an Electronic Age', *Rare Books and Manuscripts Librarianship* 13, 1 (1998), pp. 27–43 (also at www.ala.org/ala/acrl/acrlpubs/rbm/backissuesrbmlvol13no1/gross.PDF). But then Marinetti *wanted* the book to disappear. Edward Tenner reports that 'In 1895, even before the commercial success of Thomas Edison's phonograph, a pair of French satirists only half jokingly published a chapter on "The end of the book" that predicted its replacement by audio mediums. The authors even included a drawing of a climber on a mountaintop with a proto-Walkman' ('Rebound', *Boston Globe*, 24–6 April 2004). One of these satirists, Octave Uzanne, is discussed in Chapter 6 below.

under attack, it was especially from the new media's competition for leisure time and entertainment. Even in this regard print had by then clearly attained a relatively strong status. But that it could continue so strongly was perhaps somewhat surprising in view of the greater challenge reading presented compared with the ease of watching and listening, which did not make the additional mental demand reading does. Especially in terms of entertainment the new media were a very appealing alternative to reading for pleasure. Then again, audio-visual mediums also reinforced the printed word in various ways. There were listening and viewing guides; the new media popularised books through dramatisations, serialisations, and other adaptations, and simply through their attention to the world of letters at large.

Then, too, print never ceased to develop technologically. The major twentieth-century innovation in printing technique, offset lithography, was based on the late eighteenth-century invention of lithography – a planographic form of printing. Offset lithography offered a range of advantages, such as a cleaner and faster work process, cheap storage of printing plates, and a convenient way to combine illustrations and text. In conjunction with phototypesetting it was to become a powerful force in the democratisation of print production from the 1970s on. In the meantime the demands of ever more complex bureaucracy and administration in business and government were also making a substantial contribution to the continued hegemony of the Order of the Book. The typewriter, telex, fax, offset printing, and such all helped to shore up the textual underpinnings of society.

Then in the last quarter of the twentieth century what has been perceived as the next major challenge to the Order of the Book presented itself: the advent of the digital medium. In the sense that it encompasses a huge world of digital entertainment, the digital medium can be regarded as yet another attack on the supremacy of print. There is, however, a major difference, in that the computer, unlike the mass media – radio, film, and television – is itself also a textual medium, at least in part. Although numbers, obedient to strict mathematical logic, were more obviously computable than text, eventually text showed itself amenable to being made computable too. As will be seen in the next chapter, it took a while to discover why this was even useful, and how it could be done. At a time when typewriters seemed efficient enough for the work they were actually

used for it was not easy to see what would be gained by 'computing' text.

As the next chapter will show, one prominent, and somewhat surprising, outcome of the advances in digital technology was the tremendous ease they brought to the production of conventional books, especially through DeskTop Publishing (DTP). Even more significantly, digital technologies are enabling entirely new production processes. Digital printing and printing on demand are a hybridic production process. Using a digital file that can be manipulated in various ways and distributed across the Internet, this process combines the advantages of virtual digitality (about which more in Chapter 5) with the option that it can be turned into a physical book at any time and in any number of copies. By making it easier for books to be produced in limited print runs this enables the publication of books that would not otherwise be published at all, and allows books to remain in print long beyond what would have been possible with conventional printing techniques (Chapter 5). The same file, or a derivative, also serves as an e-book, which may be read on a dedicated e-book reader, but also on a computer, PDA, mobile telephone, or other screen.[62]

Interestingly all these new digital communication devices, such as the PDA or mobile telephone, once again did not just challenge literacy, they also contributed to shoring it up, though not necessarily in the same way as the earlier new media had done. Rather than looking for the print medium to provide all sorts of support functions, modern digital communication devices have themselves textual interfaces (think of menus) or in other ways require literacy to operate them. More significantly, they are frequently used for textual forms of communication. Take the example of the mobile telephone. It is now equipped as standard with a camera and music player, but it is also used for SMS, for browsing, for e-mail, and for a host of other text-based services. Computer games, chatting, e-mail, the World-Wide Web, etc., all require reading and writing skills. The reading of books may have been in decline for some time.[63] However, purely

62 E-books have not been hugely successful so far, but the current generation of e-readers, using e-paper/e-ink, is changing this. The 'screen' used by e-paper is reflective, like normal paper, and has contrast and definition resembling those of print. It thus solves many of the problems usually associated with reading from screens.

63 See, for example, the statistics in the regular surveys by the US National

'functional' reading (the reading you do when you are really doing something else) is, if anything, probably on the increase.

Despite the barrage of new media in the twentieth century, then, books have remained, to this day, the standard by which all else is judged. Socially, the seriousness associated with books and book learning is inculcated from an early age. Here the status accorded to the book in education is decisive. There is no doubt that compulsory education, now standard in all Western countries, did most to promote the book, structurally and formally, and to safeguard the position of reading. Thus the authority of books, based on the trust they inspire, is likely to remain a crucial factor in the foreseeable future. Film, radio, television changed the medium landscape,[64] but the textual tower still stands to dominate it. The use of audio-visual mediums in the classroom always remained a form of icing on the cake, almost a concession to the need to prepare children for the existence of a less culturally elitist society outside the classroom. It has never seriously challenged the position of the book in the curriculum. Even today the reliance on books has hardly diminished yet. E-learning is still at an experimental stage. Even apart from print mediums, text is everywhere. The daily barrage of textual signs, advertising leaflets, forms, food packaging, subtitles, instructions, and so on shows no sign of abating.

But, over and above all this, it seems as if print and writing were able to offer something that other mediums do not. Certainly it tends to be assumed that the printed book and reading represent essential values of some sort, even if we may be hard put to say what they might be. The linearity that facilitates argument and narrativity; the concentration and patience that reading requires; the solitary contemplation it promotes; the purely linguistic nature of text: these may all be ingredients. Research into the elusive benefits of reading as a way to transmit knowledge is beginning to be carried out in a more systematic way only now, as traditional forms of reading and literacy are increasingly coming under threat. In *Proust and the Squid* Maryanne Wolf shows 'how inextricably related knowledge

Endowment for the Arts on reading. The latest is *To Read or Not to Read: A Question of National Consequence*, Washington DC, 2007. The decline must be seen in the context of the appearance of other mediums.

64 Many commentators have identified ways in which these mediums have thoroughly changed society. Cf. Postman, *Amusing Ourselves to Death*; McLuhan.

and literacy are' (p. 220) and attempts to name some of the values literacy brings, citing research to back up the claims that they are indeed dependent on our textual condition.

A RAND report about 'the benefits of the arts' focuses especially on literary (book) reading, citing philosopher Martha Nussbaum, who 'claims that great literature is better suited than philosophy itself to conveying "the value and beauty of choosing humanly well"'.[65] The report suggests, for example, that literary reading offers an 'expanded capacity for empathy' more complex than that offered by games:

> There is a startling economy at work here, a two-way street, inasmuch as the books we read flow inward into us, add to our stock, enrich our perceptions, stir our inmost feelings; yet art and literature also, quite wonderfully, draw us out, hook us up (imaginatively, emotionally, neurally) into other circuits, other lives, other times.[66]

Such analyses remain rather limited and tentative. It would be worth examining more structurally not only whether reading and writing offer unique values of some sort, but also whether there is a difference in this respect between printed and digital mediums.

Most people today would agree that writing, printing, and literacy are beneficial to the individual and to society. This was not always the case. Only in the nineteenth century did this notion really become widespread. At least to an extent, this probably testifies to the very human fear of change. And perhaps the critics had a point with their reservations about the impact of these two technologies. For better or for worse, they have certainly shown themselves to harbour, like Pandora's box, unintended properties, with social consequences that could not only not be foreseen but, more ominously, could not be undone. But, more important than the question of good or bad,

65 Quoted in Kevin F. McCarthy *et al.*, *Gifts of the Muse: Reframing the Debate about the Benefits of the Arts*, Santa Monica CA, 2004, www.rand.org/pubs/monographs/MG218, p. 49 n. 15.

66 Arnold Weinstein, *A Scream goes through the House: What Literature teaches us about Life*, cited in *Gifts of the Muse*, pp. 47–8. The same point has been made by Susan Greenfield, for example in the BBC World programme *The Forum*, 20 April 2008: children who are insufficiently exposed to the experience of reading because they spend six hours a day at a computer screen gaming simply lack the neuronal pathways for empathy. Even if the game should be technically about rescuing a princess, the focus is not on the plight of a human being in danger but on winning the game. See also her *Tomorrow's People: How Twenty-first Century Technology is Changing the Way We Think and Feel* (Harmondsworth, 2004).

optimists and pessimists alike have been incapable of imagining most of the large-scale social changes that can be recognised in retrospect. Plato may have been right about the effect of writing on memory, but even his visionary insight failed to imagine the impact writing could actually have on culture and society. The famous statement confidently made by Douglas Hartree, Professor of Mathematics at Cambridge in the 1950s, that five computers would suffice to satisfy the world's computing demand[67] is – *mutatis mutandis* – no different than, say, the fifteenth-century attitude to the printing press. The brawl between Fust and Gutenberg was, at least partly, based on the idea that there was not enough room for more than one printing establishment. No one could have predicted either those massive changes in our world view or the role print has come to play in everyone's daily life. The circulation and effects of print were initially restricted by limited literacy and, when that threatened not to be enough, by a system of tight control by government and Church. The mass literacy of today, complemented by a mass market for print that caters for any taste in any social group, would have been as unthinkable then as the notion of individually owned personal computers connected to a global network would have been in the 1950s or 1960s. Though neither today's massive consumption of print nor the ubiquity of personal computing was foreseen by anyone, both have actually come about – with all the associated social consequences. Just as print has become totally embedded in the very texture of society, the same is now happening with the computer.

In all this, one recurring prediction is never fulfilled. However threatening the first appearance of a new medium may be, the newcomer never manages to kill the existing means of mediation. Whatever the effects of the printing press, what it did not do was spell the end of the manuscript: existing mediums are rarely made redundant by new mediums.[68] Plato did not foresee how writing would develop from what he saw as an alternative to speaking to an entirely new form of communication with rules of its own (exemplified in the large-scale shift from poetry to prose). Similarly, neither film, nor the radio, nor the television, was able to cause the demise of the printed book. (Of course they were not designed as alternatives to the book, but they were regarded by many as a threat to many of the book's functions.) The digital medium, on the other hand, offers

67 See Chapter 4.

68 The telegraph and the telex are exceptions.

a more pointed threat. The e-book readers on the market so far have not managed to offer a satisfactory substitute for the printed book. The screens have been too small, the devices too clumsy, and the interfaces not intuitive enough. But it will be just a matter of time before these problems are solved, and digital text forms may offer viable competition to print. Yet the chance that the digital mediums will succeed in making print obsolete where the earlier twentieth-century new media failed is slim.[69] What happened then, and what we are likely to witness again, is a period in which functions were redefined and redistributed, until after some time a new balance ensues. That print will become less prominent in this process is likely; that it will disappear altogether less so. What can be seen in this redefinition and redistribution of the medial roles is that the definition of literacy changes. It can be confidently predicted that that is what will happen again with the introduction of digital forms of textual transmission.

In these circumstances, the conclusion seems inescapable that it is inordinately difficult to make any predictions about the social consequences of medial change. Not only are there a huge number of factors involved in medial development, but they may combine in all sorts of unpredictable ways. The significance of features designed by inventors pales in comparison with the unintended and unimagined consequences of other features, whose existence had often not even been suspected. Actual developments rarely happen as they were foreseen, and always much more slowly than would seem necessary in retrospect. Nevertheless, the evidence is there that mediums decisively influence our relationship to the world around us. A deeper understanding of the salient technological properties of mediums does help us to account for and understand the social effects better. This is obviously the case in retrospect, with the invention of writing and printing, but the same method can be applied to the technology whose meteoric development can be observed right now: the digital medium. That is what I propose to do in the next two chapters. First I will examine the birth and early development of the technology itself (in Chapter 4), then its salient features and their social consequences (in Chapter 5).

69 It seems somewhat premature to talk of the 'late Age of Print' (e.g. N. Katherine Hayles, 'The condition of virtuality', in *The Digital Dialectic: New Essays on New Media*, ed. P. Lunenfeld, Cambridge MA and London, 1999, pp. 68–94, on p. 87), as if the days of print were already numbered.

4

A brief history of text and the computer

The central role of text in the development of the computer

The first programmable digital computer was built in the 1940s. The processing of text is an even more recent practice, dating from the 1960s. It was only in the 1990s that the computer also began to offer a serious alternative for the *distribution* of texts. Yet in less than half a century computers have insinuated themselves into the texture of society to such an extent that it could not function without them. This chapter examines how the computer has come to play in such a short time such a predominant role specifically in the textual world. Some major milestones in the development of what has since become the digital textual medium can be identified.

In the nineteenth century the single-purpose calculating machine was first conceived to have the potential to be turned into a 'Universal Machine' capable of performing tasks that may be expressed by way of an algorithm. In the 1940s the first Universal Machines were built. In the 1960s the computer as a Universal Machine was enabled to process text, which gave it a role in the text creation phase. In the 1980s the graphical man–machine interface of the computer greatly enhanced the possibilities for the typographical rendering of text. It enabled the computer to play a central role in the production of printed matter. The graphic interface also paved the way for two different ways to treat text digitally: the logical and the typographical. In the 1990s the computer was included in a network, which enlarged its role as a communication tool from that of an aid in the production of analogue printed matter to a new, fully digital medium in its own right, also comprising distribution and consumption.

In his 'communications circuit'[1] Robert Darnton has conceptualised the entire transmission process of books and other printed text forms as it has functioned for several centuries. This model visualises a process in which various consecutive actors work together under varying cultural, economic, and political conditions to disseminate an author's text so that it can reach its readers. Laying the communications circuit over the transmission process of digital text, this model will identify the similarities and differences (or continuities and discontinuities) between the new digital medium and its predecessor the print medium.

The process of making texts public and disseminating them comprises various distinct stages. These roughly correspond to those identified in the communications circuit: the creation of the text (writing), followed by its production (multiplication), distribution (the moment the text is made public), and finally consumption (reading). However, to inspect the different stages in the development of the role of the computer in the transfer of text more closely, I would like to propose one small adaptation to this chain of stages. I would like to place a magnifying glass over the first link in the chain, the 'creation stage', which is the phase in which the content and form of the text have not been finalised. Besides the writing of the text by the author this phase also comprises its editing, whether this is done by the author or by someone acting on his or her behalf (for example, the publisher's editor). Technically, this means drawing a distinction between (1) text entry (2) text recording, and (3) the manipulation of the text once it has been entered. Recognising this fluidity in the creation stage, comprising writing and editing in any number of iterations, makes it easier to trace the development of the computer's role in the writing process. Roughly three stages in that development can be recognised. These partly overlapped, but they are fundamentally different enough to treat them separately. The stages are (1) the representation of text on the computer (entry, recording, storage), (2) the manipulation of stored text for scientific and professional applications, and (3) the actual word processing on the PC, as an aid in the authorial thinking and writing process.

Among the most popular computer applications today are no doubt chatting, word processing, e-mailing and Web browsing, all

1 See Robert Darnton, 'What is the history of books?', *Daedalus*, summer 1982, pp. 65–83.

text-based pursuits. But also, outside these text applications, text is the key to our computer use. In all arithmetic, analytical, medial, and other applications for which the computer as a Universal Machine lends itself, text has a central place. On the WorldWide Web – and on the Internet in general – text is the most common way to organise, search, and find information, even when that information itself is not a text but, for example, a music file or an image. In all daily dealings with the computer text furnishes the chief interface, of the operating system as well as the applications. Files are named and stuck in folders, which are again named using text. But also, beyond this kind of daily consumer use, language is the basis of all human–machine interaction. All modern programming languages use a form of natural language. Also markup (one of the most important ways to encode text on the computer – and the technical basis of publication on the WorldWide Web) is an entirely textual practice.

In the previous chapter I described how Western society is shot through with the social and cultural significance of books as the main means to transmit knowledge. I have called this the Order of the Book. Against this background it seems only natural, and in fact almost inevitable, that the computer was to be deployed for textual communication as soon as it became possible, and that the whole human–computer interaction became a textual affair. Indeed, the eagerness with which the word processor was embraced in the 1980s seems to confirm that idea. Given the prominence of text-based applications in popular computer use today, the question even presents itself why the computer was invented as a calculating machine rather than a language machine. As it is, the computer continues to have to recalculate all those textual data and instructions that we feed it to the only meaningful units which it knows: ones and zeroes. Why would it not be possible to calculate with language itself? The idea may seem stranger than it is. His whole life, Wilhelm Leibniz continued to believe in the construction of a language consisting of logical symbols that could be manipulated by means of a calculator. Such a language, and a machine to 'calculate' it, would enable any philosophical debate to be settled with the click of a button.[2] That Leibniz's dream has still not been achieved is not so much because

2 In *The Courtier and the Heretic: Leibniz, Spinoza, and the Fate of God in the Modern World* (New York and London, 2006, p. 79), Matthew Stewart gives an account of this ideal of Leibniz.

such a logical system of symbols is not viable.[3] The real problem is that the subtle shades of meaning we can – and want to be able to – express with natural human language are simply not amenable to being reduced to a system of logical symbols.

Zeroes and ones it was, then. For the sake of convenience, however, it was felt necessary to devise a way to cast instructions to the computer into a humanly intelligible shape. Hence program lines, menus, file names and the like now all have a human-readable form, even if behind the scenes the computer still calculates with the only numbers it knows: ones and zeroes. No user now stops to think that every keystroke is converted into a series of binary numbers. In fact, in our perception language is the primary way in which we deal with the computer today. The numbers that the computer really crunches appear to play no more than a subordinate role; the numbers seem to dance to the tune of the text. But, once, the reverse used to be the case, and, thinking from the binary heart of the computer, the quest was for a way to represent letters.

Given the enormous importance of text for average daily computer use, it is striking how much effort it still took before the computer could actually deal with text. How did that process take place and why did it take so long? What factors impeded and stimulated it: design and chance, unintended effects, failure of intended effects, etc.? This chapter will reconstruct that process in general outline.

That text has come to take a central position on the computer appears at first sight to be only natural – a reflection of the importance of text in society. At the same time some commentators point out that text is actually beginning to lose its prominence.[4] They are obviously not suggesting that we are about to engage in a direct binary data exchange with the computer, or that humans have recently acquired massive training and experience in symbolic logic. What they mean is that, in addition to text, other modalities, especially images, are playing an increasingly important role in

3 Alfred North Whitehead and Bertrand Russell's *Principia Mathematica* (1910–13) is impressive evidence that it is, even if Douglas Hofstadter is right with his interpretation of the implications of Kurt Gödel's explosive article in 1931 for the fate of Russel's fortress, which he deemed impregnable (see Douglas Hofstadter, *I Am a Strange Loop*, New York, 2007, chapter 10).

4 Steven Johnson, *Interface Culture: How New Technology Transforms the Way we Create and Communicate* (New York, 1997, see pp. 148–52), is one of the exceptions.

digital communication, as in society at large. This is often referred to as the ascendancy of visual culture.[5] One simple explanation for that increase of other modalities could be that the digital medium makes it easy, as a result of the convergence identified in Chapter 2, to integrate modalities such as images and sound in text. But the notion of a visual culture is not that new, and certainly pre-dates the advent of the computer. From the beginning of the twentieth century in many places in the world all kinds of visual language have been designed for signs, packaging, and other forms of communication.[6] In the middle of the last century De la Fontaine Verwey finds in his contribution to *Copy and Print in the Netherlands* that the image, '[s]uperseded for a time by the book', 'has resumed its ancient rights and is engaged in fulfilling tasks that have for centuries been carried out by the printed word'.[7]

Not only are the signs that text is beginning to lose its prominence still rather faint, the role of text has probably simultaneously been strengthened in other ways, such as the largely textual interface of the computer and the Internet, but also the extraordinarily popularity of texting on the mobile phone. To judge by the popularity of social networks, blogs and the comment function on so many Web sites, it may well be the case that more people write – at least with a form of publication in mind – than ever before. The phenomenon is not necessarily always equally visible, however. An example of a less directly visible use of text is the way key words are assigned to images and sound in order to enable us to search for them. This may be a transient phenomenon while the searchability of images and sound through other images and sound is still in its infancy. For the time being at any rate the entire digital world – including games and chatting – is accessed by means of text.

5 See, for example, Stephens, *The Rise of the Image, the Fall of the Word*.

6 There was enormous belief in the potential of images (in the form of pictograms and icons, but also image-based statistics) in promoting efficient information transmission. A particularly prominent and tireless advocate of the use of information graphics was Otto Neurath, the inventor of the Isotype (International System of Typographic Picture Education) symbols in the 1920s. After fleeing his native Austria in the 1930s he founded the International Foundation for Visual Education in The Hague, and later the Isotype Institute in Oxford.

7 H. de la Fontaine Verwey, 'The twentieth century', in W. G. Hellinga, *Copy and Print in the Netherlands: An Atlas of Historical Bibliography*, Amsterdam, 1962, pp. 59–67, on p. 59.

If the relationship between text and other modalities is indeed changing, the change, at least so far, seems not particularly drastic. Nonetheless, in a longer historical perspective a situation may well be imagined where text need not necessarily be the most important means of communication. I will return to this speculation in Chapter 6.

The history of computers and computing

There was initially little evidence of the important role that text was to play in the digital world. The history of the advent of text to the computer starts with two major developmental leaps in the history of the computer itself. Two in particular are important: (1) that from machines with only one function to multi-function machines, and (2) that from mechanical to electronic, digital machines. In the category of machinery with only one function, two are of particular relevance to the history of the computer as a machine for the processing of text. The first is the calculator, which still forms the heart of every computer. The second is the typewriter, which delivered, in the shape of the keyboard, the chief means of input for the computer today. In addition, there are a number of more specialised machines, some of which I will also briefly mention.

The history of the calculator as a forerunner of the computer goes back some four centuries. In 1623 Wilhelm Schickard (1592–1635) from Tübingen made a six-bit 'counting clock' which could add and subtract. He called his machine a clock because the machinery was reminiscent of one. The instrument was entirely mechanical. When half a century later Wilhelm Leibniz began to work out his idea of a digital calculator he was a great deal more ambitious. His machine was to be capable of processing universal logical symbols. In spite of his unbridled ambition and dedication he never managed to go beyond a kind of mechanical pocket calculator which could add, subtract, multiply, and divide. Like Leibniz in the seventeenth century, the British mathematician Charles Babbage in the nineteenth century had the vision that calculators could be used for purposes other than making numerical calculations. In the intervening centuries scientific knowledge and instrument-making skills had advanced so much that Babbage was able to take the implementation of his ideas further than his predecessors. Although Babbage never built more

than parts of his 'Analytical Engine',[8] on the strength of his design he can be considered as the creator of the first Universal Machine. Like the calculators of Schickard and Leibniz, it was entirely mechanical (it was to be powered by steam) and made use of decimal instead of digital numbers, but it was programmable, separated the data from the program, and was capable of loops and conditional branching. That was more than most computers were capable of even a century later. Babbage was even considering exporting the outcome of calculations to punched cards. This notion, inspired by the Jacquard loom, would have enabled the machine to write and store its own programs.

Charles Babbage had the vision; Ada, Countess of Lovelace, a fellow mathematician who heard him expound on it one night over dinner, was one of very few people who understood its implications. Recognising that on a higher level of abstraction computing was not counting but the manipulation of symbols, she proceeded to devise a number of algorithms that might actually have been executed by the Analytical Engine had it ever been built. When Lovelace translated an article on the Analytical Engine by the Italian mathematician and military engineer Luigi Menabrea she added some very percipient notes of her own, amounting to twice the length of the original article. In these notes she correctly predicted that a machine like the Analytical Engine might be used to compose music, produce graphics, and perform a variety of scientific tasks:

> [I]t might act upon other things besides *number*, were objects found whose mutual fundamental relations could be expressed by those of the abstract science of operations, and which should be also susceptible of adaptations to the action of the operating notation and mechanism of the engine. Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent.[9]

8 Originally Babbage had designed a simpler 'machine', which he named the 'Difference Engine' because it was able automatically to generate tables of the intervals (or differences) between sets of numbers resulting from programmed series of progressive additions. The machine could produce a print of the tables.

9 'Sketch of the analytical engine invented by Charles Babbage, Esq.', by L.F. Menabrea, with notes by Ada Lovelace, reprinted in Charles Babbage,

Evidence that the vision of Babbage and Lovelace could become reality was delivered by Alan Turing only in the middle of the twentieth century. According to Turing his abstract 'Turing machine' was capable of executing all functions which can be calculated in the form of an algorithmic procedure. Modern digital electronic programmable computers which met Turing's requirements were first developed in the 1940s.

The binary principle was used not only for the calculations themselves but also for the way in which the data were encoded. Just as numbers can be represented both in a binary system and in a decimal one, the same is true in principle also for text, image, and sound. In the case of numbers and text the number of discrete characters is very limited, and each character can be represented by a limited number of bits. For Latin script, a single byte (eight bits) can encode 256 unique characters. Modalities like image and sound are more complicated to encode. Here the signal has to be divided into any arbitrary number of constituent components. Dividing an image (or sound) into discrete particles means that transitions will never be continuous but always incremental. The number of components per unit of signal (for example, pixels per inch) decides the realism of the binary representation: the more the better. But, however high the number of pixels per inch, the realism of a digital rendition can in principle never be equal to an analogue rendition. In spite of all its shortcomings the relevance of binary representation is that all data in all modalities and all the calculations that could be applied to them, can be encoded in the same binary fashion. This makes 'binariness' the 'element'[10] in which the much-vaunted convergence of modalities (on which more in Chapter 5) can take place.

The typewriter is the second single-function machine besides the calculator that has been of great importance in developing text encoding on the computer. Some of the earliest typewriters were designed for the blind,[11] which nicely illustrates how deep the divide can be between an inventor's intent and the actual social use of an invention. Of special interest for the present topic is the case of the keyboard. Of all the ingenious typing systems ever designed[12] it

Science and Reform: Selected Works of Charles Babbage, ed. Anthony Hyman, Cambridge, 1989, pp. 243–311, on p. 270. Emphasis in the original.

10 The term is Michael Heim's, from *Electric Language*, p. 102.

11 Michael H. Adler, *The Writing Machine*, London, 1973, p. 48.

12 Adler, *The Writing Machine*, p. 25–90.

was that by Christopher Sholes, the creator of the first typewriter to be taken into commercial production, that became the standard. This was the keyboard with the well known QWERTY layout.[13] The most important legacy of the Sholes keyboard is that the characters found on his keyboard are now still the atomic building blocks of text on the computer. The standard computer keyboard has no accented characters, makes no distinction between a hyphen and an em dash, or between the decimal point and the full stop, and lacks all sorts of special characters: from typographical through mathematical to currency signs. Instead it was visual appearance only that decided whether a separate character was created.[14] The computer keyboard encodes individual letters binarily and enters them into the computer. Just as on a typewriter, this is done by assigning a single character per key, although that number may be increased by using the shift key (and on the computer in addition various function keys).

Among the many inventive and less inventive alternative text entry systems that did not make it must definitely be mentioned the idea of Douglas Engelbart, also known as the inventor of the computer mouse,[15] to enter the thirty-one characters of the standard five-bit code of the 'teletype' (the forerunner of the telex) by pressing five keys in any combination ($2^5 = 32$).[16] Engelbart worked on this 'five-key handset' in the 1960s as part of his ambitious Framework for the Augmentation of Man's Intellect framework, which will receive more attention later in this chapter. While the idea was not new (in the course of the nineteenth century several typewriters with piano-type keyboards had already been designed) and certainly had advantages, it was up against the dominance the QWERTY keyboard had by then already acquired. This was in use in large parts of the world, and generations of typists had learned typing blind using the QWERTY layout.

13 The QWERTY layout is still in use in many countries, for example throughout the English-speaking world. In some other countries the layout differs. France uses the AZERTY keyboard, while Germany and some Eastern European countries use the QWERTZ keyboard.

14 Hence on some keyboards no separate figure 1 was included, the letter l being regarded as suffiently similar in shape.

15 See Thierry Bardini, *Bootstrapping: Douglas Engelbart, Coevolution, and the Origins of Personal Computing*, Stanford CA, 2000, pp. 81–102.

16 See Bardini, *Bootstrapping*, pp. 58–80.

The typewriter did not take the process of creation–editing–production–publication–distribution–consumption beyond the creation stage. It took care of the 'data entry' and 'storage' (anachronistic terms for functions that were really created only by the computer) of a text but could do little for its reproduction, publication, and distribution.[17] As a medium this does not distinguish the typewriter substantially from manuscript – with the exception perhaps of the degree of readability. In that regard the typewriter only very partially approaches printing type. That did not, however, keep its inventors from stressing this property, even in the case of the very earliest machines.[18] The magnifying glass that I placed over the creation and editorial phase shows that the typewriter is a rather poor performer when it comes to the manipulation of text.

Among the more specialised techniques that are relevant in the history of the computer certainly belongs telegraphy, and in particular the Baudot system for text input dating from 1874. That is the standard five-bit code already mentioned in the discussion of the keyboard. Despite the limited number of characters (a maximum of thirty-two) that could be encoded with the five-bit system, this character encoding by Emile Baudot (1845–1903) remained in use in the digital electronic environment until it was replaced by ASCII in the middle of the 1960s.[19] Since the Morse system with its dots and dashes is also binary, Baudot's encoding system lent itself particularly well to transfer to the computer.

Another specialist device for the processing of text that deserves attention was the typesetting machine used in print production.[20] The typesetting machine used the typewriter keyboard to its advantage (albeit the typesetting machine's keyboard was equipped with

17 Except of course with the rather limited help of the carbon copy. The stencil machine and the duplicator can be disregarded. While these techniques make use of a typewriter to record the text, multiplication is a separate step which requires a duplicating machine.

18 'A British engineer, Henry Mill, was granted British patent No. 395 in 1714 for a device capable of impressing letters on paper or parchment one after another "as in writing", the product being so neat and exact as to be indistinguishable from printing' (Adler, *The Writing Machine*, p. 47).

19 Bardini, *Bootstrapping*, pp. 65–79. More will be said about ASCII (American Standard for Information Interchange) later in this chapter.

20 Other, more marginal systems that can be mentioned were for example those used for the generation of titles and subtitles for film and television, which were also becoming more sophisticated as time went on.

substantially more keys: the Monotype had four complete sets of QWERTY keys, one each for roman, italic, bold, and small capitals). At least four major improvements which were applied early if not for the first time in the typesetting industry have been of great importance to the development of digital word processing. These were the use of a storage medium, in the form of the punched tape of the Monotype typesetting machine from 1887; the application of the teletypewriter for remote typesetting through the six-bit code of the TeleTypeSetter (TTS) in the late 1920s; the application of the computer in the third generation of phototypesetting machines from the late 1960s, and the development of the concept of markup in the 1960s and 1970s, about which more later.

History of word processing

We have become thoroughly used to the fact that in the digital electronic world all modalities can be rendered in a single medial environment. To make this possible, the calculator, as a forerunner of the computer, had to evolve from a machine to answer arithmetical questions to a machine that could perform calculations in which the aim was not the numerical outcome, but the manipulation of numbers as symbols. In word processing these symbols stand for the characters that make up a text, but also for a variety of codes that define the typographic representation of those characters. Simply put, the history of word processing is the history of how the computer as calculator married the typewriter, stimulated by the inspiring examples of mechanical 'word processing' offered by the telex and the typesetting machine. But even though it is tempting to write history into the present, this is a simplistic representation of the facts. Despite the advanced ideas of Babbage and Lovelace in the nineteenth century, the *rapprochement* between the computer and the typewriter in fact took quite some time. If for example Turing and other computer pioneers had such non-numerical use of computers in mind, it was certainly not for the processing of text in the present sense of the term.

Reasoning back from the present, word processing has the three ingredients that became visible under the magnifying glass at the beginning of this chapter. In order of their development these are: (1) text entry, (2) storage for reuse, and (3) manipulation of the entered text. The first of these is the least interesting: that is what the

typewriter had already been doing very well for over a century. The distinction between 'text entry' and 'storage' is obviously something of an anachronism: the typewriter did both simultaneously. But 'storage for reuse' will transpire to be fundamentally different. (The three above-mentioned functions play at the level of individual texts. Above that level there is also the function of information management: organising access to texts. That aspect, too, is obviously of great importance in the context of the history of the computer as a textual medium. I will return to it under the heading 'Document management' below.)

Even when the computer could handle text it took a long time before the implications of this fundamental distinction between text entry and storage for reuse – and the opportunity it offered for further manipulation – became really clear. The word processor as it was developed in the course of the 1980s is based on that slow recognition of the implications of the ability to alter and reuse text even during the creation process. A major breakthrough was therefore the integration between the two distinct levels of text entry and editing. That this distinction was initially often made between them betrays the origin of word processing in the office environment. It shows that insight into the real possibilities of word processing dawned only slowly.

Mechanical. The typewriter as it was invented and improved in the course of the nineteenth century could only 'enter' and record text. Once the text was recorded ('inscribed' on paper) reuse was not possible except by retyping it, and correcting was possible only by crossing out previously typed text and adding new text with pencil or pen. The earliest example of reuse (and, to a lesser extent, correction) of text after it was entered is that of the already mentioned punched tape of the Monotype typesetting machine from 1887. The output of Monotype keyboards was solely to the punched tape, which in turn served as input for a casting machine. The purpose of employing punched tape was not primarily reuse but separating two very disparate activities in the labour process, enabling more efficient plant use. The automated casting took less time than text entry: about one and a half to two typesetters were needed to keep one casting machine employed. Nevertheless the result of this functional separation was that composed type no longer needed to be preserved for a possible reprint but could be set again from the punched tape. Compared with storing set type this also saved a great deal of physical storage

space and expensive metal. This system of separating text entry and storage through a punched tape has been much imitated. In telegraphy, for example, it was used to be able to send the same message to different recipients.

The computer. Even before the Second World War the first electric typewriters could be found in offices, but in order for reuse and manipulation to be made possible the computer was needed. It was the Second World War that gave its development a major impetus, for example by the pressing need for accurate ballistic calculations. Experiments with new technologies and new architectures took place at a feverish pace, and the period between 1941 and 1948 saw tremendous progress. From this short period date all the famous forerunners of the modern computer: the Zuse Z3 by Konrad Zuse in Germany, the Atanasoff–Berry Computer by John Vincent Atanasoff and Clifford Berry in the United States, the Colossus of Tommy Flowers and others in the United Kingdom, the Automatic Sequence Controlled Calculator by Howard H. Aiken of IBM, and the Electronic Numerical Integrator And Computer (ENIAC) by John Mauchly and J. Presper Eckert, the latter two both from the United States. The British 'Bombe', too, co-designed by Alan Turing to decipher encoded enemy messages, was an example of the enormous computing power that was being generated for the war effort. In the present context the Bombe, despite its limited functionality, is especially interesting because the symbols manipulated by this electromechanical device represented letters, perhaps for the first time in computer history.

As a result of all these military and government exertions the capabilities of the computer slowly began to be recognised more widely. In 1949 the Italian philosopher and Jesuit Father Roberto Busa conceived the idea of using a computer in a scholarly project that involved text. Busa completed this massive pioneering project, a concordance of the work of Thomas Aquinas, after working on it for twenty-four years. (It is not unthinkable that Arthur C. Clarke's famous story 'The Nine Billion Names of God' of 1953 was inspired by Busa's project.) His Index Thomisticus has gone down in history as '[t]he first electronic text project in the humanities'.[21] Even if Busa's use of the computer in the avant-garde of digital word processing

21 Susan Hockey, *Electronic Texts in the Humanities: Principles and Practice*, Oxford, 2000, p. 5. For a definition of humanities computing see Willard McCarty, *Humanities Computing*, Basingstoke and New York, 2005.

was primarily computational in nature, like the deciphering of German secret messages it concerned the manipulation of symbols (representing text) as conceived by Babbage and Lovelace a century earlier.

However challenging as computational problems, the cracking of codes and creating of concordances were ultimately quite straightforward functions compared with the present-day capabilities of computers. In the early 1960s the computer pioneer Douglas Engelbart had much grander expectations of the relationship between text and the computer. In his essay 'A conceptual framework for the augmentation of man's intellect' of 1963 he formulates his concept of an advanced form of text manipulation as an aid to thinking.[22] Engelbart was imagining a 'writing machine' whose description begins to sound faintly familiar to routine users of the modern word processor:

> [L]et the reader consider an artifact innovation appearing directly within the relatively low-order capability for composing and modifying written text, and see how this can affect his hierarchy of capabilities. Suppose you had a new writing machine – a high-speed electric typewriter with some very special features. You can operate its keyboard to cause it to write text much as with a conventional typewriter. But the printing mechanism is more complicated; besides printing a visible character at every stroke, it adds special encoding features by means of invisible selective components in the ink and special shaping of the character.
>
> As an auxiliary device, there is a gadget that is held like a pencil and, instead of a point, has a special sensing mechanism which can be moved along a line of the special printing from your writing machine (or one like it). The signals which this reading stylus sends through the flexible connecting wire to the writing machine are used to determine which characters are being sensed, thus causing the automatic typing of a duplicate string of characters. An information-storage mechanism in the writing machine permits you to sweep the reading stylus over the characters much faster than the writer can type; the writer will catch up with you when you stop to think about what word or string of words should be duplicated next, or while you reposition the straight-edge guide along which you run the stylus.

22 Douglas C. Engelbart, 'A conceptual framework for the augmentation of man's intellect', in *Vistas in Information Handling*, Vol. 1, *The Augmentation of Man's Intellect by Machine*, ed. Paul W. Howerton and David C. Weeks, Washington DC and London, 1963, pp. 1–29.

> This hypothetical writing machine thus permits you to use a new process of composing text. For instance, trial drafts can rapidly be composed from rearranged excerpts of old drafts, together with new words or passages which you insert by hand typing. [pp. 6–7]

Here we find the functionality of text manipulation during the composition process clearly articulated for the first time. That Engelbart's flight of fancy resembles the idea of a word processor is hardly startling from a twenty-first-century perspective. What is surprising is that the concept was apparently still so new in 1963. Engelbart was looking for a way to use language, in combination with certain technological 'artefacts', methodology, and training, for 'increasing the capability of a man to approach a complex situation, gain comprehension to suit his particular needs, and derive solutions to problems'.[23]

Like the rest of the volume in which it appeared, Engelbart's article is an example of remarkably advanced thinking. From a present-day vantage point, however, Engelbart is providing a needlessly complicated technological solution to something that is regarded as a basic and rather obvious functionality. It is tempting to wonder why he made it so difficult for himself with his special ink and optically readable characters.[24] Apparently Engelbart was not aware of the tremendous progress that was already being made in the office environment. Obviously Engelbart's way of thinking resembled that of Leibniz more than that of an office clerk: like Leibnitz, he was a scientist. But what most people do with text on the computer today resembles the work of a secretary more than it does the scientific ambitions of people like Leibniz or Engelbart. In the world of office machines there was obviously less consideration of scholarly needs, and ambitious ideas such as Engelbart's about the computer as a tool for thinking were certainly not being addressed there. But the office environment did produce very concrete results. It was office automation that ultimately yielded a decisive contribution to solving Engelbart's technical problems, even though it meant a radical simplification compared with the functionality that Engelbart had in mind.

The first machine to be actually called a 'word processor' was a very mundane machine intended for office use, the IBM magnetic tape

23 Engelbart, 'A conceptual framework', p. 1.

24 Such optically readable characters characters were in actual use, for example in banking, for a long time.

Selectric typewriter of 1964. It was followed in 1969 by the magnetic card Selectric typewriter (which could also be used as a computer terminal). Such single-function machines that could perform only word-processing remained on the market at least until the beginning of the 1990s. The early word processors still did not make text manipulation very easy. The office environment was focused mainly on the basic input and output functionality, and much less on the manipulation function. In many respects these word processors resembled very much the way typewriters worked. For example, separation of the text entry and editing functions long remained a feature of word processors. This is quite likely attributable to the passive role of the office typist, who was not required to think but simply to record a text faithfully from manuscript or dictation.

The office environment may not have had much of an eye for Engelbart's ideals, but conversely Engelbart, who was so committed to using the computer in the process of thinking – as a knowledge instrument – quite overlooked the everyday opportunities that word processing was to offer. Regarding the computer as a manipulator of higher-level symbols he was not able to recognise more mundane uses. It was simply too big a step from the creation of a machine that could calculate mathematical questions and be deployed in heavy thinking tasks to a machine that could perform such simple operations as importing, storing, and moving pieces of text.

After the invention of the word processor, it still took some time before the dedicated appliance was fully overtaken by word processing on the (personal) computer. Without doubt the most important development in the processing of text was that the emphasis gradually shifted from the capture of a 'correct' text to the creation, during the thinking process, of a new text that did not yet exist. Though the result still fell short of what Engelbart had envisaged in the way of a 'knowledge instrument', it was no doubt an improvement. That improvement was less technological in nature than conceptual. Determining a 'correct' text was based, implicitly or explicitly, on a real or assumed ideal-typical entity (such as a manuscript, or a verbatim record of speech, or the *oeuvre* of Thomas Aquinas). Of course, the possibility of correction which a word processor offered was desirable to the extent that it made it easier for users to achieve the ideal of an error-free text. But further manipulation of the text such as Engelbart had in mind was not required in this kind of use. What was needed was a recognition of the principles underlying the

possibilities of 'storage for reuse' and 'correction' as they were already in use. The reuse of existing text fragments, moving and editing the text, and inserting new fragments during the composition process were actually existing possibilities; it was just that the spirit of Engelbart did not yet inhabit their execution.

Examining the properties of the present-day word processor, it can be concluded that a latent need for it must have been present at an early stage. This was certainly not widely recognised. Among the few who had a vision of its possibilities besides Engelbart was a young sociology student by the name of Theodor Holme Nelson. With the programming project that Nelson started as an M.A. student at Harvard University in 1960 he had in mind nothing less than the creation of a word processor with exactly the kind of functionality that the world is now accustomed to. What he wanted was 'a text-handling system which would allow writers to revise, compare, and undo their work easily'.[25] Unfortunately, though Nelson had the vision, he lacked the means to realise his idea. A few years later, like Babbage, he abandoned his first project to address an even more ambitious one: the concept of hypertext.

Hypertext, the term Nelson coined around 1965, certainly spoke to the imagination. The concept brought together the thought process and the writing process, combining the two in a single system capable of identifying connections between thoughts expressed in fragments of text and all kinds of other materials. In this way hypertext, like the ideas of Engelbart, went far beyond mere word processing. The purpose was for computers to meet the needs of humans to organise and link in a meaningful way both the sources of their knowledge and its reflection in their own texts. In this description the hyperlink seems no more than the digital development of the footnote. However, this fails to do justice to its concept if not its execution. (To Nelson's grief, the public implementation of hypertext in the WorldWide Web trailed far behind the functionality he had planned.) The dynamic possibilities of hypertext as envisaged by Nelson are much greater than those of the footnote. The close way, for example, in which composition and presentation could be matched was designed to make hypertext a potentially very powerful tool in (the

25 The programming project took place in the context of a computer course for the humanities. See Christopher Keep *et al*., 'Ted Nelson and Xanadu', www2.iath.virginia.edu/elab/hfl0155.html.

representation of) the thinking process. It has been suggested, for example, that using hypertext Ludwig Wittgenstein would have been better able to shape his thinking and composition process.[26] In any case, hypertext would have been able to do better justice to the not very linear way of reading required by Wittgenstein's philosophical writings. Clever though Nelson's idea of hypertext may have been, as in the case of the word processor, it proved a more sophisticated application than the ordinary computer user was looking for.

But there were other incentives apart from the ones coming from the market for office machines and, to a lesser extent, the need for thinking machines in science. There was, for example, the quest for a good way to improve the two-dimensional output of the typesetting machine, for the benefit of offset lithographic printing. The computer proved an excellent tool for programming word break routines and to calculate visually pleasing word spacing, and in the early 1960s it was introduced in typesetting machines.[27] By the 1970s the so-called 'third-generation' typesetters were fully computerised, and used digitally stored characters which could be electronically manipulated in a variety of ways.

Another major impetus came from the computer world itself. This was the need to enter instructions and data in computers not at the binary machine level (which was extremely laborious and error-prone), but at a higher level of abstraction. To this end hexadecimal keyboards were deployed, which could handle clusters of binary numbers simultaneously. Also the need to communicate with other users away from the mainframe resulted in growing importance being attached to text entry and processing.

Even if it was in a not very targeted form, and rather slowly, the breakthrough of word processing did eventually happen. And only when the word processor was actually there did it become apparent what latent need it filled. As the concept became clearer,

26 Jos de Mul, 'Wittgenstein 2.0', in *Philosophy of the Information Society*, Vol. 1, *Proceedings of the Thirtieth International Ludwig Wittgenstein-Symposium in Kirchberg am Wechsel, Austria, 2007*, ed. A. Pichler and H. Hrachovec, Publications of the Austrian Ludwig Wittgenstein Society, new series 6, Frankfurt am Main, 2008, pp. 185–211.

27 It had been previsaged by Georges Bafour, André Blanchard and François Raymond (BBR) in France in 1954 (L.W. Wallis, *A Concise Chronology of Typesetting Developments, 1886–1986*, London, 1988; 2nd edn, Upton upon Severn, 1991, p. 27).

its possibilities came more into view, and more functions could be developed and further refined. In this way the word processor was finally able to move – however slowly – away from the typewriter. It developed from an application which rigidly distinguished between the entry of text and its editing into an application in which text entry, storage, editing, and all sorts of further operations were fully integrated. Today's word-processing application is meant to serve both the thinking writer and the office clerk. Ultimately perhaps it never really succeeded in being all to everyone. Certainly the word processor is more suitable for office use than to assist in the creative thought process. As tools in the thinking process new applications more similar to what Engelbart had in mind have since been developed, such as outliners and mindmappers.

Given that the preconditions for the capability of text processing were already theoretically present around 1950, the development of word processing as a functional concept was actually quite slow. It is not difficult to identify reasons for this slowness. Without doubt the main reason was insufficient demand for storage of text for reuse on the social side. Apart from the very simplest form (the creation of a 'correct text') there was a total absence of any demand for manipulation of the entered text. The ideas of Engelbart and Nelson were too idealistic and sophisticated to lend themselves to mainstream applications. Employing computers for the tasks that typewriters were used for in the 1950s and 1960s – simple office correspondence and reports, or the small market for specialist purposes such as for typesetting machines – was simply too expensive. In addition, other priorities had prevailed for the development and deployment of computers during the Second World War. Computers were a product of the military–scientific complex; it was only there and in the largest civilian companies that there was enough money for the acquisition and development of advanced equipment and applications. In the military, sophisticated ballistic calculations swallowed up the money and the best minds. In offices, at the elementary level of the average secretary manipulation of text was simply not at issue. This situation did not change substantially until the mass-produced microprocessor became available in the mid-1970s.

It is also in this light that the famous prediction by Douglas Hartree, Professor of Mathematics at Cambridge in the 1950s, should be regarded: that the world would never require more than five

computers.[28] Such predictions were obviously based on a calculation of the need for computing power for such things as were then being done with computers. These were mathematical calculations, preferably of things which, once calculated, would remain ever valid and useful, such as the census results or nautical tables. (Compare the tables that Babbage's difference engine could produce.) Such calculations could neither be too short, or it wasn't worth the investment of writing the program, nor too long, or the error-prone computers of the time would not run for long enough to finish the calculations. Had Hartree been able to consider the cheap microprocessor in combination with the possibilities of text processing he would no doubt have come to very different conclusions.

In sum, that a clearly existing, if latent, need for the functionality of word processing was not being translated into product development resulted from two factors, which were locked in a vicious circle. First, computers and programmers were too scarce and expensive to allow sufficient demand for an application like a word processor to arise. Secondly, there was the inability to imagine the functionality of a word processor, so that insufficient demand could arise for the devices on which those applications could run.

> In the mid-seventies, several years before the Apple II first exploded on to the marketplace, an Intel engineer called a meeting of the company's board of directors to make an impassioned case for building a personal computer. He rolled out his vision of a future where consumers bought digital machines for their homes the way they currently bought televisions, stereos, and vacuum cleaners. The fact that Intel already possessed the technology – the chips, the integrated circuitry, the power supply – to make a machine for less than ten thousand dollars made the case a particularly compelling one, even though the behemoth mainframes of the day regularly sold for hundreds of thousands of dollars. But the board wanted an answer to a question that seems self-evident to us today: what were people going to do with these personal computers?

28 'I went to see Professor Douglas Hartree, who had built the first differential analysers in England and had more experience in using these very specialized computers than anyone else. He told me that, in his opinion, all the calculations that would ever be needed in this country could be done on the three digital computers which were then being built – one in Cambridge, one in Teddington, and one in Manchester. No one else, he said, would ever need machines of their own, or would be able to afford to buy them' (Lord Bowden, 'The language of computers', *American Scientist* 58, 1970, pp. 43–53, on p. 43).

> Amazingly enough, the engineer didn't have a satisfactory answer: his most compelling scenario involved filing electronic versions of cooking recipes. Of all the eventual hightech applications devised for the personal computer, all those spreadsheets and word processors and video games, the best he could come up with was a digital version of Mom's tuna casserole. It was like inventing the wheel and then immediately demonstrating what a wonderful doorstop it made.[29]

Such an attitude stems from thinking patterns that are determined by familiarity with existing technologies and practices, such as in this case the typewriter, and system cards in a card index. Using the technology of the typewriter the emphasis was on capturing and transferring an existing text as correctly as possible, not on the integration of thought and reflection in the writing process. If one had been able to imagine the functionality and had made it available (cheaply enough) it would certainly have generated a demand. (In the case of the mobile phone there was also no question of an explicitly existing demand; the mere fact that the functionality became available apparently woke a dormant need for a device that allows people to talk to each other at all times of the day and night.)

Document management

Ted Nelson already made an appearance in his capacity as one of the most visionary developers of the concept of hypertext (and inventor of the term). In many respects Nelson was inspired by Vannevar Bush. (In his *Literary Machines* of 1981 Nelson reprinted Bush's complete essay 'As we may think'.) It is Vannevar Bush who has gone down in history as the 'onlie begetter' of the principle of hypertext. Despite many similarities one big difference between Bush and Nelson was that, where Nelson was mainly interested in the creative writing process, Bush focused more on document management. In his workstation for the scientist, called the 'Memory Expander', or simply 'Memex', he had designed an ingenious system for storing and linking existing pieces of information (and annotations about them). In 'As we may think', the famous article in which he introduced his

29 Steven Johnson, *Interface Culture*, p. 148. With the knowledge of hindsight we would perhaps not place recipes at the top of the list of promising applications, but as David Weinberger writes in *Everything is Miscellaneous: The Power of the New Digital Disorder* (New York, 2008, pp. 44–45), the computer can certainly reinvigorate the genre of the cookbook.

Memex in 1945,[30] Bush suggested that, now that the war was over, science was facing a whole new challenge. That challenge was the task of making the expanding volume of human knowledge more accessible and more manageable. Instead of man's physical force it was time to strengthen the power of the human brain. Man had to gain more control over the knowledge he had accumulated in the course of the centuries. To that end, Bush devised an organising principle that was based on associative links instead of the usual alphabetical and systematic referencing systems. Such a principle, according to Bush, did more justice to the way the human brain works. In the microfilmed books, articles, notes, and correspondence contained in his Memex the investigator could leave 'thinking trails' that linked relevant sources by means of assigned codes. These thinking trails remained available to the user at all times and thus formed an 'intimate supplement to his memory'.

> It consists of a desk, and while it can presumably be operated from a distance, it is primarily the piece of furniture at which he works. On the top are slanting translucent screens, on which material can be projected for convenient reading. There is a keyboard, and sets of buttons and levers. Otherwise it looks like an ordinary desk.
>
> In one end is the stored material. The matter of bulk is well taken care of by improved microfilm. Only a small part of the interior of the memex is devoted to storage, the rest to mechanism. Yet if the user inserted 5000 pages of material a day it would take him hundreds of years to fill the repository, so he can be profligate and enter material freely.
>
> Most of the memex contents are purchased on microfilm ready for insertion. Books of all sorts, pictures, current periodicals, newspapers, are thus obtained and dropped into place. Business correspondence takes the same path. And there is provision for direct entry. On the top of the memex is a transparent platen. On this are placed longhand notes, photographs, memoranda, all sort of things. When one is in place, the depression of a lever causes it to be photographed on to the next blank space in a section of the memex film, dry photography being employed.
>
> There is, of course, provision for consultation of the record by the usual scheme of indexing. If the user wishes to consult a certain book, he taps its code on the keyboard, and the title page of the book promptly appears before him, projected on to one of his viewing positions …

30 Vannevar Bush, 'As we may think', *Atlantic Monthly*, July 1945, pp. 101–8; also at www.theatlantic.com/magazine/archive/1969/12/as-we-may-think/3881/.

> It affords an immediate step … to associative indexing, the basic idea of which is a provision whereby any item may be caused at will to select immediately and automatically another. This is the essential feature of the memex. The process of tying two items together is the important thing.
>
> When the user is building a trail, he names it, inserts the name in his code book, and taps it out on his keyboard. Before him are the two items to be joined, projected on to adjacent viewing positions. At the bottom of each there are a number of blank code spaces, and a pointer is set to indicate one of these on each item. The user taps a single key, and the items are permanently joined…
>
> Thereafter, at any time, when one of these items is in view, the other can be instantly recalled merely by tapping a button below the corresponding code space.

These thoughts of Bush's must have spoken to the imagination of his contemporaries. The system that Bush had in mind not only gave the user access to all relevant scientific information. He could also organise that information in a way that was tailored to him personally.

The creation of personal thinking trails through the linking of documents is central to Bush's concept. However, it is somewhat misleading to base the role of Bush – and others – in the creation of hypertext entirely on that. Practically speaking, the notion of hypertext quite changed in the course of time. To Bush the focus had been on the storage and consumption (organising and providing access) of knowledge produced by others, less on the production of new knowledge (although that was certainly facilitated by the Memex), and not at all on distribution (sharing new knowledge). The restrictions are obvious. For example, the operator of the Memex is not connected to other users; access to the stored data is limited to one person. While microfilm as a technology has now all but become obsolete, at the time it held a great promise of miniaturisation. Yet what is – again – striking is that he makes no mention of the computer at all, while as director of the Office of Scientific Research and Development during the war he had witnessed the feverish activity that had gone into its development. It confirms our earlier observation that at that time the worlds of text and the computer were still far apart.

One might argue that it is unfair to express such criticism with the benefit of hindsight. But for example the Belgian Paul Otlet had conceived the idea of universal access to centrally stored knowledge

as early as the 1930s. A network of 'electric telescopes' would enable users to browse millions of linked documents, images, and fragments of sound and moving images, to send each other messages, and even to meet in virtual communities.[31] That Otlet did not manage to secure for himself a more prominent place in the history of the Internet and the WorldWide Web is tragic in light of his visionary ideas. But it is perhaps indicative of the fact that the focus of information management was already beginning to migrate to the other side of the Atlantic Ocean.

Despite the fact that Bush was using the technologies of his time and did not think it a problem that the material in the Memex was tailored to the wishes and needs of a single scientist, it is clear that his views on the individualisation of the organisation of information played a very important role in the development of the textual world in which we now live. Bush recognised the need for a different way of organising and dealing with textual knowledge. What we also have largely to thank him for is the vision that knowledge may consist of discrete chunks of text on the user's system, and that those chunks may in some way be connected with one another.

However obvious it may now seem, again it took time before the concept of 'files' on the computer representing such chunks of information belonging together was developed. Texts or even fragments of text were initially simply placed *seriatim* on the storage medium, with codes indicating the beginning and end of the corresponding parts. The importance of files has only recently started to recede again. As a method to control access to information on the hard disk it is being overtaken by full text retrieval. Since PCs have become powerful enough, the hard disk (and every other storage medium connected to the computer) is being permanently indexed and text can be retrieved by keying in a distinctive word, regardless of where the file is physically or logically located. Ironically enough, we may be said in a certain way to be returning to the old situation. Before long the distinction between documents and the 'information space' to which individual documents belong will probably no longer be significant. The PC's hard disk is turning into a miniature Internet, which may be accessed through the services of a miniature Google.

31 See Armand Mattelart, *The Information Society: An Introduction*, London and Thousand Oaks CA, 2003, pp. 42–3, and Françoise Levie, *L'Homme qui voulait classer le monde: Paul Otlet et le Mundaneum*, Brussels, 2006.

In fact, with the increasing popularity of Web-based applications and disk storage soon the distinction between a local hard disk and the public Internet is likely to fade still further.

GUI and WYSIWYG

In 1979 a delegation of Steve Jobs's Apple Computer company was offered a tour of Xerox's Palo Alto Research Center (PARC). Here they were shown a remarkable human–computer interface that experimented with a wholly new way of giving the computer instructions. Opinions differ as to Apple's indebtedness to Xerox for the main concepts used in their revolutionary operating system.[32] Whatever the case may have been, Apple ended up hiring quite a number of ex-Xerox staff to build the Apple Lisa of 1981. The Lisa sported a Graphical User Interface (GUI) with a Windows, Icons, Mouse and Pull-down Menus (WIMP) environment. It closely resembled what Xerox had been experimenting with (but had not seen fit to develop commercially), based on original ideas going back to the early 1970s, when Xerox had the ambition to challenge the dominance of IBM.[33] The Lisa laid the foundation for the Apple Macintosh with its advanced graphic capabilities and its legendary user-friendliness. Through the metaphor of desktop, folders, and files a graphic facade was built which screened the ordinary user from the raw reality at system level.[34] This trend to shield the user by creating a black box around complex technology is also evident more generally in the design and further development of the WorldWide Web.

As early as the 1960s Douglas Engelbart had been experimenting with various input devices to aid human–machine interaction. Among his many achievements was the invention of the mouse, patented in 1970. Engelbart's efforts were primarily focused on scientific users. Apple's GUI interface, however, made the computer more accessible also to laymen, who were not necessarily waiting to be induced into

32 Some say the word 'theft' is not too strong. However, John Seely Brown and Paul Duguid (*The Social Life of Information*, Boston MA, 2000, pp. 159–61) stress that what Xerox showed Apple were far from marketable technologies. The concept of the GUI needed 'several advances in the hardware and software design'. It took Apple all of those five years from 1979 to 1984 to get it right.

33 Brown and Duguid, *The Social Life of Information*, pp. 150–1.

34 Steven Johnson, *Interface Culture*, p. 15.

the esoteric world of the computer geek. By the 1980s it had become clear that, with the arrival of the microcomputer and personal computing, interfacing was no longer just a concern of professional users, but had become a major general issue. When the computer came increasingly to be used by people who were not programming experts and had little interest in the technological side of computing, the need for a more intuitive user interface became pressing. That the Association for Computing Machinery (ACM) organised its first Computer–Human Interaction conference in 1982, one year after the presentation of Apple's Lisa, was therefore not a coincidence.[35] In the WIMP environment the entry of often very cryptic letter combinations on the command line was replaced by fold-out menus and the like worded in ordinary language, even though the language was wrapped in graphical elements. However, it is not easy to make icons unambiguous, and to this day they are almost always accompanied by textual explanations, frequently in the form of a 'mouse-over'.[36] Communicating in symbols other than linguistic ones is not easy for humans. That goes for social communication, but also for human–machine communication. The GUI interface reinforced the textual foundation on which the whole human–machine interaction had come to rest ever since the introduction of higher-level machine languages.

The WIMP and GUI interface led toward the 'what you see is what you get' (WYSIWYG) possibilities of DeskTop Publishing (DTP). The classic example was Aldus's PageMaker for the Apple Macintosh, introduced in 1984.[37] What WYSIWYG word processors and layout programs offered was an improvement of the typographical capabilities of the computer. This resulted in a better connection to

35 Again, not coincidentally, the 1980s saw a tremendous outpour of books on interfacing, such as Ben Shneiderman's *Software Psychology: Human Factors in Computer and Information Systems*, Boston MA, 1980, and *Designing the User Interface: Strategies for Effective Human–Computer Interaction*, Reading MA, 1987; Donald Norman, *The Psychology of Everyday Things*, New York, 1988; P. Ehn, *Work-oriented Design of Computer Artifacts*, Stockholm, 1988 (see also Christine L. Borgman, *From Gutenberg to the Global Information Infrastructure: Access to Information in the Networked World*, Cambridge MA and London, 2000, pp. 118–19).

36 Edward Tenner, *Why Things Bite Back: Technology and the Revenge of Unintended Consequences*, New York, 1996, pp. 194–6.

37 The earliest WYSIWYG program had been Bravo, produced at Xerox PARC in 1974.

the textual environment outside the computer, which is based on centuries of typographic conditioning. It made it possible to use the computer for laying out text graphically for reproduction in print.

DTP, in other words, was again a product of our mind-set as *homo typographicus*, typographic beings. It was designed to produce conventional print. All popular reproduction techniques of the 1960s and 1970s, such as offset lithography, electronic stencils, and photocopying, used the same method for origination of the printing forme (i.e., to produce camera-ready copy): cut-and-paste. The cut-and-paste method derives its name from the way text set in galleys by means of phototypesetting was cut up to page or column lengths and pasted on to imposition sheets. These imposition sheets were photographically transferred to printing plates (or electronic stencils) for multiplication. In this method, before the text could be typeset the specifications had to be decided by a designer, who relied on expert knowledge and prior experience to envisage the visual effect of any typographic instructions. Any trial-and-error approach to design was forbiddingly expensive. Corrections to the typeset text required further keyboarding by the typesetter, the generation of fresh galleys, and a fresh round of cutting and pasting. The cost of correction thus formed a significant expense in print production.

The WIMP and GUI environment of the Apple Macintosh provided the environment in which the cut-and-paste process could be performed digitally by the computer. In this way DTP brought the full functionality of computerised typesetting – and more – to the personal computer. Instead of typesetting the text first in galley lengths for physical cutting and pasting, computer layout programs such as PageMaker allowed the layout of the text *prior to* typesetting, in exactly the same way as word processing had allowed editing and correction prior to printing out a text. In these circumstances the result of the typographic 'encoding' was no longer a matter of typographic knowledge and imagination, as it had been in the pre-DTP days, but became instantly visible.

Typing, whether or not in the shape of word processing, in offices was and remained a clerical job, performed by secretaries and data entry typists. Similarly in the typesetting industry composing type for printing was a heavily unionised trade and so a jealously guarded oligopoly. But when miniaturisation and microchips ushered in the era of 'personal computing' this changed irrevocably. In combination with Adobe's PostScript page description language of 1969, which

enabled the WYSIWYG layout to be output to a laser printer or phototypesetting machine, PageMaker caused the DTP revolution of the mid and late 1980s. Page layout programs took the graphic design industry by storm, and DTP democratised the origination stage of print production.

The greater user-friendliness of the GUI/WIMP interface began to shift labour away from the trained specialist worker and eventually caused a shift in control over the entire production process, from the editorial office to the author. Authors, who had already begun to submit their word-processed work on disk, could now become responsible – voluntarily or by publishers' request – for providing finished camera-ready copy to the publisher. Especially in the case of scholarly publishing, where direct monetary rewards for the author are rare anyway, the author or editor was often placed in charge of the entire production process leading up to actual printing.

The advent of WYSIWYG computing and easy-to-use DTP applications in turn accelerated and completed the shift from letterset printing to offset lithography. This had far-reaching consequences for the 'democratisation' of print production. It succeeded in breaking the hold of specialist workers and their unions on print production, completing the process of liberalisation begun with the introduction of offset lithography in combination with various crude cut-and-paste techniques. It was a powerful combination, as the student-led political protest movements of the 1960s clamouring for the democratisation of the means of production had already discovered. While a comparison between this minor twentieth-century print revolution and Gutenberg's invention that created the original Order of the Book may seem far-fetched, it is highly unlikely that the 1960s and 1970s could have become the era of political protest, mass democratisation, 'underground' culture, and popular revolution that they were without the proliferation of cheap and accessible print enabled by offset printing.

For a decade the extreme user-friendliness of its GUI/WIMP interface gave Apple, at least in the graphic industry niche, an unchallenged competitive edge over Microsoft with its command-line operating system, MS DOS. Observing the success of the Macintosh, in 1983 Microsoft announced its own version of a GUI/WIMP environment, which was to be called Windows. Its release in 1985 was no great success, however, and it was not until version 3.0 in 1990 that it gained significant third-party support. From that moment, however,

it proceeded to take the world by storm. For better or for worse, and whoever ought to be credited with the honour, Microsoft's development of Windows meant the end of the command line interface for the average computer user, and it firmly established the GUI/WIMP environment and WYSIWYG as the way forward.

This represented a major victory. *Homo typographicus* had an intuitive tendency to transfer an irredeemably typographical view of text to the digital environment as much as possible. The word processor, for example, has progressed from codes that were visible to the user, via codes that could be made visible on request (as in WordPerfect's famous 'underwater screen'), to totally invisible and inaccessible codes, as in most word-processing applications today. While continuing to perform the same function, the visible formatting markup of old has now become invisible; at the same time the effect of that formatting is now instantly visible where once it could only be imagined. The desire of *homo typographicus* to look at the typographical surface of text rather than its underlying 'raw' structure contrasts with the more structured view taken by the specialist professionals. This applies both to the human–computer interaction and to the manner in which they regard text. It is worth noting that, ironically, precisely by making the computer into a better tool to continue existing analogue practices, *homo typographicus* actually severely curtailed the computer's potential to foster greater awareness of the logical structure of text. The WIMP/GUI environment has exiled not only the commands and codes that structure the typographical text to a place behind the scenes but also that logical view of text in general.

Markup

There is no doubt that the GUI has made the computer incomparably more user-friendly. However, those who dealt with books professionally had other priorities than user-friendliness. The sheer volume of documents being processed, notably in the publishing world, stimulated a more structured approach to text. The exigencies of scale pointed inexorably in the direction of automation, which placed very different demands on the computer. For those who handled text professionally the steep learning curve in acquiring the necessary knowledge and skills for a more structured approach to text constituted no obstacle. Even though typography as yet

remained the ultimate goal (for it would still take some time for the digital transmission of text via the Internet to come off the ground), as early as the 1960s the insight had begun to take hold that a text's content and its typographic appearance could be separated from each other in a digital environment, and that this was, moreover, a meaningful distinction to make in the editing and production process. This led to the recognition that all text had an underlying structural pattern, regardless whether this was made explicit through computer encoding or remained implicit in the text's typography.

Chapter 2 showed how documents can be classified into categories, or 'types', on the basis that they contain the same structural components, regardless of how they may look typographically. Publishing companies and typesetting establishments were well used to employing codes as a short description of the typographic format for chunks of text. In the case of an article for a scientific journal there might be codes to identify such indispensable elements as author, title, synopsis, and the text itself, consisting of, for example, paragraphs, citations, illustrations, footnotes, and a bibliography. From this existing encoding practice aimed at typographic form it was not such a very big step to apply encoding to structure instead of form. The recognition of the structural nature of document types was based on the understanding that a text's structure was not dependent on its (accidental) layout, but that structure is already implicitly present in every text, being as it were brought into the light by the typographic form. This led to the development of the Standard Generalised Markup Language (SGML), which was accepted as an ISO standard in 1986, and later the eXtensible Markup Language (XML) already discussed in Chapter 2, which was accepted as a standard in 1998. Introducing this markup in the editing and production process of large publishing houses resulted in significant savings. This applied not just to the production in print of the publications themselves, but also for streamlining the entire editorial work flow. In the SGML/XML encoding could also be included all kinds of metadata, such as the authors' contact details, the date of delivery, particulars about the editing and peer review process, and so on.

The principle of markup, with its emphasis on structure instead of typography, was an approach to text in line with the logical approach to text that was encouraged by the logical nature of the computer. An additional advantage was that markup opened up far-reaching possibilities for all sorts of other advanced text processing. Initially

this concerned especially publishing houses, where there was an immediate economic need for them, and some scholarly applications. But ultimately markup proved to be interesting also for a wider audience. The main impetus to the popularisation of markup came from its deployment on the Internet, with the creation by Tim Berners-Lee of the HyperText Markup Language (HTML) and the WorldWide Web, followed by the first graphical Web browser Mosaic, developed at the American National Center for Supercomputing Applications. HTML is a simplified application of SGML.

It is not inconceivable that if word processing under MS-DOS and the command line had remained in existence longer, it would have resulted in wider acceptance of markup as an alternative way to regard text.[38] The graphic developments in computer text processing, as in human–computer interaction, which responded to the wishes of *homo typographicus*, have thus led to parallel worlds of digital textuality that only partly overlap.

Networks and standards

This chapter has so far been mainly concerned with the production stage of digital text forms. But the advent of text to the computer has culminated in the Internet and the WorldWide Web. This has resulted in major changes also in the distribution and eventually also consumption of texts. The pre-digital distribution of text in other than paper form has a long history, which warrants at least a cursory glance. The telegraph was the first method that enabled rapid remote communication without the visual limitations of smoke and semaphores. Storage on punched tape made it possible to send the same text to multiple recipients. The telex was an improvement on the teletype, with its fixed lines, and made it possible, as with a telephone, for an individual connection to be made with any other subscriber connected to the system. It was mainly a system for the military, government, and industry. Although everyone could make use of it through the services of post and telegraph offices, there was no direct public access to the system.

The instant distribution of text across the globe was thus admittedly not new, yet connecting computers in networks was a crucial new development. As Manuel Castells has phrased it, 'the Internet was

38 As it is, the functionality of markup is approximated most in the use of styles in a word processor.

born at the unlikely intersection of big science, military research, and libertine culture'.[39] The first networks arose from the need to share scarce and therefore expensive computer time. Not long afterwards, the ARPANET (the Advanced Research Projects Agency Network; later, with the addition of 'Defense', Darpanet) was founded.[40] By means of a network terminal application it was possible for clients to give instructions to the host computer. Soon (1971) ARPANET also gained a function for human communication, through e-mail – an alternative to the phone. The 'inter'-net originated when the existing networks such as ARPANET, PRNET and SATNET were linked in a new 'network of networks'. The importance of this military origin for the technological characteristics of the Internet will become clearer in the next chapter.

The 'grass-roots tradition of computer networking'[41] has had further major implications. The Internet is based on three principles:

> a decentralised network structure; distributed computer power throughout the nodes of the network; and redundancy of functions in the network to minimise the risk of disconnection. These features embodied the key answer to military needs for survivability of the system: flexibility, absence of a command center, and maximum autonomy of each node.[42]

The packet switching architecture, in which all messages are broken up into small packets which can reach their destination through any route before being reassembled at their destination, explains how the network can be as reliable as it is. These design principles still define much of the nature of the medium as it has developed since.

In the 1970s and 1980s use of the budding Internet gradually widened from the initial select group of scientists and military users. It wasn't till the birth of the WorldWide Web in 1991 that the real expansion of the computer-in-a-network began. This gave hypertext the chance to grow from an authoring system (first hinted by Vannevar Bush and invented by Theodore Nelson) to a publication format. The WorldWide Web as Tim Berners-Lee implemented it in HTML offered much of the functionality that Bush had already described (with the notable exception of making annotations to sources),

39 Manuel Castells, *The Internet Galaxy*, Oxford, 2001, p. 17.
40 Castells, *Internet Galaxy*, p. 10.
41 Castells, *Internet Galaxy*, p. 12.
42 Castells, *Internet Galaxy*, p. 17.

but there was less room for Nelson's more advanced ideas about authoring and collaboration. It is only authors and/or publishers who manage and control the links to pages that they publish, and HTML offers no straightforward two-directional traffic between author and reader. Also, the unit of information is much larger than the 'lexias' (the smallest meaningful elements in a text eligible for reuse) anticipated by Nelson. With the development of the Internet and then the WorldWide Web digital text processing expanded further. In addition to digital composition, editing and production there now also arose the possibility of distribution in digital form and hence that of digital consumption. This meant that it was no longer necessary for the digital process to culminate in an analogue product by printing out files and messages.

When transmission over the network in one form or another (for the exchange of programs or data) gained in importance, standardisation obviously became imperative. In the era of letterpress, printing standards differed widely, with different national systems for measuring type size and different type heights. This is not to say that no one was interested in standardisation. The DIN (Deutsche Industrie Norm) paper sizes like A4, for example, have caught on (though by no means universally: they are not used in the United States). It is simply that in the physical world of print standards doesn't play a significant role, and so standardisation was simply never achieved beyond some few limited domains. In a computer network designed to exchange information it is no longer feasible – let alone desirable – to allow local, or even national, standards to flourish in the way they proliferated in the print era. Just like the advent of international long-distance trains spelled the end of the patchwork of national railway gauges in Europe the Internet too requires full standards compliance to ensure smooth traffic.

Standards for efficient and effective communications between computers are needed at different levels. For character representation the 1963 American Standard Association's ASCII (American Standard Code for Information Interchange) became the standard seven-bit code for data transfer. It is still used on most personal computers in the Western world.[43] In the ASCII table each character,

43 Many mainframes still use Extended Binary Coded Decimal Interchange Code (EBCDIC), descended from punched cards, and devised by IBM at the same time.

number or symbol equals one byte of information. For example: 01000001 represents A, 01100001 represents a, and 00110011 represents 3. ISO Latin 1 (ISO standard 8859:1) is an eight-bit set which provides standard encoding for accented characters in Latin scripts. Importantly, as the lowest common denominator of computer character encoding ASCII remains in use for markup in SGML and XML, with HTML as their ubiquitous and most visible application.

By the late 1980s disk space and memory constraints had relaxed sufficiently for a sixteen-bit encoding system, called Unicode, to become a feasible alternative. In 1991 version 1.0 of Unicode was launched, and it has been under development since. By using two or even more bytes per character it aims to represent a much larger proportion of the world's characters in a single system. Though it still hasn't covered them all, the Unicode standard represents a major step forward, and despite its slow development it has attracted widespread support. It has been implemented in many technologies, including XML, Web browsers, and most operating systems.

Apart from the display of text, there are also standards for its transmission (the TCP/IP protocols and their predecessors) and application protocols, of which e-mail and file transfer (FTP) are the most important. When the WorldWide Web was implemented the standards for Web pages were added: first HTML as originally designed by Tim Berners-Lee and derived from SGML; later also XHTML and XML, with associated stylesheet languages, such as CSS and JavaScript. Although some 'de facto' standards still exist (that is to say, conventions that are regarded as standard purely on the basis of their wide dissemination), the trend is clearly in the direction of open standards. It is by dint of standardisation that many so-called Web 2.0 applications (such as mashups – the combination of data from different sources into a new application) are possible.

Standards also play a role, albeit a less crucial one, in document formats, for example of word processors. As in the case of text representation, standardisation of document formats was not an issue as long as computers remained expensive and independently operating appliances. When the microchip led to the mass production of PCs a host of *de facto* standards came into being which were created by accidental market share. A well known example is how the current hegemony of Microsoft Word followed the decline of WordPerfect, which did not make a successful transition to the GUI era. When exchange of information became more important, and *a fortiori* when

the network started to experience strong growth, the usefulness of standards for document formats and markup gradually became more widely recognised. In addition it became clear that *de facto* standards had their limitations. The users of commercial file formats depend on the supplier (they must have a licence themselves, but so must everyone who wants to be able to open the file), and the company may go bankrupt, ending support. Open standards can prevent such 'lock-in' and above all are more future-proof. The expectation that standards, whether open or *de facto*, are eternal has appeared to be an illusion. The only feasible solution is to devise standards which are not just possible but easy to replace in the future with new standards. The ideal standards are publicly available, transparent, well documented and as far as possible platform-independent.

Conclusion

This chapter followed the development of computers from independent mechanical calculating machines to digital computers linked in a network and functioning as a textual medium. The social use of the computer has developed too, from individual use patterns to more social and communicative ones. It has been a development of hardware, but also of software. The history of the representation of text and the use – and understanding – of the role of standards is a good example of the extent of the transformation involved.

The development of the digital textual medium has been a hesitant process, with a great deal of trial and error, along a winding route. The processing of text initially represented an attempt to transfer a thoroughly familiar typographical world view wholesale to this new medium. This tendency to regard the new in terms of the old is a very human one. It could also be observed in the case of the introduction of printing with individual lead types. The first printed books could hardly be distinguished from the manuscripts that they replaced. However, neither is a case of conscious imitation. Rather, it is a matter of involuntarily following familiar conventions and continuing along a known road. It is inevitable that the possibilities the new medium offers are not always fully recognised at the time, even though they may look obvious in retrospect. There are always people with enough imagination and originality to sketch that kind of potential, but if their thinking connects insufficiently with what is usual at the time their ideas will not be recognised.

Though I have deliberately painted an image of hesitation, trial and error, and a meandering pat, this may be somewhat misleading in at least one respect. For it would be wrong to believe that it took *a long time* for the computer to become a major force in text processing. Compared with the slowness with which humans learned to read and write, and even with the time needed for the triumph of the printing press, the transformation of the computer from a number cruncher to a digital medium happened at breakneck speed. Despite the trial-and-error fashion in which it happened, a mere half a lifetime saw the creation of the digital computer, its appropriation for an extremely efficient process of writing, editing, and the production of printed matter, *and* its transformation into an entirely new worldwide medium in which text, images and sound can be mixed at will and transferred across the globe instantly.

Nor was that even all. The Internet – and later the WorldWide Web – is just one of the many things that the computer has been deployed to create. The printing press could do only one thing: multiply text. The computer, by contrast, is the most versatile machine ever devised by humans. Even just with regard to medial applications, its possibilities are limitless. Besides text, it now also processes still images, sound, and moving images digitally. The Internet may be regarded as the 'ultimate' medium. Unlike any other medium, the computer-in-a-network connects not only all links in the communication chain of production, distribution, and consumption but also other modalities, and so allows the ultimate convergence of all traditional mediums. It unites virtually all properties of all existing mediums.[44]

Within those medial possibilities this book covers text only – but

text is, as I have argued, a crucial component in the mix of modalities. The processing of text was probably the first, and certainly the most important, symbol-manipulatory use of the computer that was not aimed at a numerical outcome. The great significance of being able to use the computer as a word processor was that it made text into something fluid and pliable. Electronic digitality gives text (like all digital modalities) the property of virtuality (whose significance will be the subject of the next chapter). Initially the computer was no more than a 'prosthesis': an aid to the creation of analogue text. Word processing created a digital production environment for the creation

44 Although the broadcast opportunities are still limited by the current bandwidth.

and storage of text. This might be called the level of 'digitality *per se*': the existence of textual information in an electronic digital format. It was the creation of networks of computers, combined with standards of all kinds, for example for markup, that turned the computer into a medium – a medium that far exceeds the production of the printing press. The network makes use of electronic digitality to multiply and distribute the flexible text. In the history of textual transmission the computer-in-a-network adds to the recording of text (in characters) and its multiplication (in print) the dimension of its distribution. Calling the digital text a medium is saying something very different from calling writing or the printing press a medium, even if all these mediums comply with the definition that I gave at the end of Chapter 2: 'A medium is a construct consisting of a tool or technology with its (explicit) technical protocols and any implicit social protocols with the purpose of communicating information expressed in one or more of the modalities of still text, images, sound, and moving images over time and/or space'

What is particularly noticeable in the development of the digital textual medium is its absolute interdependence with the development of the computer in a more general sense. In other words, it is not as if the hardware and software required for the medial function were developed wholly independently from the hardware and software needed for other applications. The processing of text served an end in itself but was also a means to control the computer more efficiently. The Internet got a medial function through which humans could communicate with other humans, but it arose from the need to be able to communicate remotely with the computer itself – the few large mainframes that once used to be all the world knew.

The inseparableness of the development of the Universal Machine and the digital textual medium is illustrated well by the dualist – or hybrid – view of text that persists today. On one hand it has proved possible to refine the typographical rendition of text on the computer to a high standard of sophistication. That does justice to the fact that after so many centuries of the Order of the Book *homo typographicus* has come to regard the use of typography as an integral part of the writing process. *Homo typographicus* uses typography to structure the text while writing. WYSIWYG in word processors is an aid to such structuring, and the PDF format makes it possible to preserve the subtlest typographic effects during the transmission of the text. On the other hand, the computer has served to emphasise the logical

or structural form of text as it is reflected in markup as an Ordered Hierarchy of Content Objects (see Chapter 2). This hybridity is nicely illustrated by Tim Berners-Lee's HyperText Markup Language (HTML) – that crucial step in the creation of the computer-as-medium. HTML eagerly makes use of achievements from our typographic history (such as the <i> and <b> elements to render purely typographical conventions like italic and bold) but no less of new achievements that only come into their own in a digital context (such as the hyperlink or the addition of metadata to a document).

Typography has a long track record as an aid in structuring text. Slowly the lesson is being learned that although typography may have become second nature to humans, the computer is severely handicapped in a typographical environment. This does not of course mean that typography will have no future in the digital environment. It does mean that humans will need to pay more attention to the logical form of text, even if that is much less intuitive. For the logical form of text is better suited to the nature of the digital technology and will enable the computer to process the text in many further ways than a typographic rendition. What exactly that nature is, is the question the next chapter will deal with, through an analysis of the intended and unintended primary and secondary properties of the new medium.

5

Salient features of digital textuality

With the Internet, but more particularly with the WorldWide Web in the 1990s, a wholly new textual medium sprang into being. In the previous chapter I approached the birth of this new, digital, medium from a longer historical perspective. Some landmarks in its development truly stood out. After the computer became a Universal Machine it could run every conceivable type of application – of which word processing and networking were indispensable for the function it has now as a textual medium. Word processing was the final outcome of a longer process of harnessing the computer to deal with text in the first place. As a corollary of that process, the computer's interface also became primarily textual. That computers next became linked in a global digital network changed their medial role from that of being mere aids in analogue text production and printing to that of a wholly new digital medium in its own right. This new medium had properties far surpassing those of earlier mediums. Crucially, the digital medium covers the entire communications circuit, including the production (writing, editing) of texts, down to their distribution and even consumption. Moreover, where other mediums can at best represent only some modalities, the computer offered the possibility to represent the full spectrum of modalities (text, still and moving images, and sound) in a single medium.

The digital medium's uniqueness is often expressed in terms that compare it to other mediums. Some of the many properties that are often attributed to the digital medium have been mentioned in passing. There is, for example, the extraordinary ease with which endless numbers of copies can be made without loss of quality. But, equally, the medium's 'textual instability' and lack of closure – of the typographic form as well as content – are features that set this medium noticeably apart from earlier ones. I would like in this

chapter to examine these and other properties in a more structural manner, also analysing exactly where they come from technologically.

It will be helpful to do so by ordering the features that characterise the digital textual medium into a kind of hierarchy. At the top tier of this hierarchical ontology are the inherent or core properties of the computer; below them on the second tier are the technological features of the digital medium made possible by the computer, and at the bottom the social consequences that in turn derive from these technological features.

Core technological properties

The previous chapter described how the Universal Machine was conceived and created in its electronic and digital form, and how this enabled the processing of text – though it took some time for word processing to be developed as such and eventually to find its present widespread acceptance. Also the linking of computers in a network brought a whole series of derivative but very profound technological consequences. These major developments offer the key to the identification of the crucial core technological properties of the computer of which the digital medium makes use. These are (1) that it is a Universal Machine, (2) that as a Universal Machine it functions electronically and digitally, and (3) that it operates in a network.

Universal Machine

As a Universal Machine the computer is more than just a medium for text transmission, the way for example a book is. As a technology that can manipulate symbols the computer can be used for all tasks for which algorithms can be programmed.[1] That the Universal Machine manipulates symbols is the property of the digital medium that has enabled the convergence of the various medial modalities that exist today. In the same way as text has been made machine readable, this

1 In her translation of Menabrea's article Lovelace had already said of Babbage's Analytical Engine that this 'may be described as being the material expression of any indefinite function of any degree of generality and complexity' (Menabrea, 'Sketch of the Analytical Engine invented by Charles Babbage', in *Science and Reform*, p. 267). On the basis of the program for calculating a series of Bernoulli numbers that she wrote for the never completed Analytical Engine, Lovelace has often been called the first computer programmer. The claim is dismissed by Anthony Hyman (*Science and Reform*, p. 243).

has been done with the other modalities: sound (music, speech), still images, moving images. The computer as a Universal Machine now represents and processes them without significant restrictions in the form of ones and zeroes. All modalities are thus fully integrated into one and the same medial environment, for example in a Web browser that is equipped with the necessary plug-in modules.

That the computer is a Universal Machine means that it is an instrument capable of performing on text not only all medial functions such as creating, editing, storing, publishing, distributing and consuming it, but also operations of various kinds that never used to be part of Darnton's 'communications circuit'. To take an example, the computer can perform statistical analysis, based on the computation of word frequency and word proximity. In this way, for example, stylistic phenomena, but also authorship issues may be examined.[2] Such 'humanities computing'[3] operations can take place in the same medial environment, either wholly independently of the computer's medial function or, more interestingly, in such a way that it enhances that function, as for instance in the case of a journal presenting access to articles on the basis of tag clouds.

The programmability of the Universal Machine, which is infinite in principle, is also the property that most piques the human imagination. The infinite diversity that follows from that programmability has for example given rise to the expectation (hope to some, fear to others) that the computer may come to rival if not surpass humans in intelligence. In many areas the computer definitely has the upper hand. Calculating is an obvious example in the light of its calculator origin, but it also beats the human brain easily in sheer power of memory. Meanwhile the point has been reached that computers are capable of defeating the best chess players in the world. So far, the computer's growing ascendancy over what the human mind can accomplish has mostly been confined to certain well defined areas.

2 See, for example, Hugh Craig, 'Stylistic analysis and authorship studies', in Schreibman *et al*. (eds), *A Companion to Digital Humanities*, Maldon, etc., 2004, pp. 273–88. On the basis of such techniques in 1996 the magazine *New York* unveiled the identity of the writer of *Primary Colors*, a *roman à clef* about Bill Clinton's campaign for the US presidency (see Johnson, *Interface Culture*, pp. 152–3).

3 Part III, 'Applications', of *A Companion to Digital Humanities*, ed. Schreibman *et al*., pp. 271–468, gives a good overview of different applications of humanities computing.

A computer with mental powers that are just as versatile and agile as a human being's has yet to be created. The question of whether computers will be able to possess human intelligence, consciousness, and emotions would not seem to be directly relevant to the subject of this book. Yet it is. All developments in the digital medium occur against the backdrop of the Universal Machine's programmability. When discussing the notion of 'intelligent text' a little later, that metaphor in fact indicates that text on the computer need not stay within the domain of the word processor, but may be the object of a whole arsenal of approaches and processes similar to and beyond the examples just given under the nomer of 'humanities computing'. It is primarily our own imagination that determines the limits of what is possible. The emotional responses that the computer in its guise of machine-as-human has always evoked will be discussed further under the heading 'Social impact' later in this chapter.

Digital–electronic nature

The second core property is the digital–electronic nature of the Universal Machine. To create, store, and redisplay stored text, and to publish and distribute it, a combination of hardware and software (operating system and application software) is needed. This combination of hardware and software is what I have called in Chapter 2 the 'computing environment'. While the substrate on which the digital text is stored (working memory and storage medium) consists, like the rest of the hardware, of tangible and visible matter, the text itself is virtual in nature. Virtual here means 'existing conditionally'. In more precise, albeit negative, terms, a virtual text is an intangible, invisible, and unreadable representation of that text. It is stored in such a way that it may, under certain conditions, be made visible, legible, and tangible. One of those conditions is, for example, the availability of electricity.

This virtuality gave text for the first time in history an 'inscrutable' form, like moving images (e.g., video) and sound (a cassette tape) had known for a long time. That is to say that examination of the physical substrate – say, a CD, a memory chip, or a hard disk – gives barely any impression of the nature or extent of the material that has been recorded on it. This requires specialised hardware and software. That material may be images, music, numbers, spoken word, film, or text, in any combination and quantity. Without the availability of the 'computing environment', consisting of the right combination of

hardware and software (and the necessary electricity) the registration might as well not have taken place at all.

In the computing environment text is not only virtual in nature and inscrutable in form, but also machine-readable. To be able to 'calculate' it, text is represented in the computer in the shape of a binary code for each constituent character, space, punctuation mark, etc., along with codes for its (typographic) representation on screen or in print. (The computer can also represent text purely as graphics, i.e., as a collection of dots. These pixels are of course also represented in binary form, but the characters they represent cannot be manipulated individually. By applying OCR to the collection of pixels that together represent the text, graphic text can be made machine-readable.) In the era of the stand-alone computer there was no standard for text representation; at IBM several character sets were even used side by side in a single company. The desirability of a standard became an absolute requirement when computers had to be able to communicate effectively in a network. For a long time that standard was ASCII (1963); now it is increasingly Unicode (under development since 1991) that has to ensure the interchangeability of texts between different applications and operating platforms.

The property of machine-readability, however obvious, is crucial precisely because that makes it possible to manipulate the text. The digital, machine-readable record thus has the property that it is not permanent. That is to say that a text recorded or 'inscribed' on a medium or in working memory is not actually being recorded or inscribed in the analogue sense, but can be changed or erased at any moment. This is a property that follows from the nature of the computer as a calculating device. If the parts of the text were locked in an unvarying relationship to each other, they would not lend themselves to 'calculations'. It is the fluidity of the virtual data that determines the nature and potential of the digital text. The computing environment itself incidentally always remains available, it never becomes exhausted. Interestingly enough, that goes for the text being processed as well. The operations performed on it never exhaust the text, and it can be saved in its original form as well as in any form that results from an operation. Each of the versions preserved can in turn serve as a starting point for further processing, and so endlessly on. The text never gets an unchangeable, final form, except when it is exported out of the computing environment, by being printed out in so-called 'hard copy', for example, or when it

is burned on to a CD or DVD (although in that case the text still remains machine-readable and therefore continues to lend itself to further processing; the CD or DVD just represents a 'snapshot' of the text in a given state).

Network

The third core characteristic of the digital medium is that it exploits the possibility of communications between computers. Strictly speaking, this is of course not a core property. After all, network communication is one of the infinite number of possible applications of the computer as Universal Machine. The main reason to regard this particular application as a core feature, nevertheless, is a pragmatic one: namely that it is at the basis of so many other important properties. This emphasis on the network does justice to the enormous significance of the communications dimension of the digital medium – in general, but especially for textual transmission.

As recounted in Chapter 4, the Internet was created in 1969 when the first two computers of the ARPANET, designed by the Advanced Research Projects Agency of the US Department of Defense, were linked to each other. Soon flow-controlled protocols for two-way traffic became a networking standard. This means that the data to be sent are divided into packets of a certain size, which may be sent via any route to the specified address. The protocol keeps a continuous tab on the dispatch and safe arrival of the packets between the sending and receiving computer, and rejoins the packets again after arrival. Since 1978 the TCP/IP set of protocols has been used for this purpose. Although developed for military purposes, the network was soon used for scientific communication of all kinds. In 1991 started the publicly accessible WorldWide Web invented by Tim Berners-Lee. In the context of the communications circuit, the special significance of the linking of individual computers in a network is that this network lends itself not only to the creation and production but also to the *distribution* of machine-readable, manipulable, virtual text.

The 'docuverse': the information space of the Internet as a medium

The combination of these three core properties in the digital medium has led to a whole new kind of information space. This phenomenon is well covered by the term 'docuverse', which originates from Ted

Nelson's concept of hypertext.[4] In order to delineate the contours of the docuverse I will try to characterise that space based on a number of second-tier characteristics derived from the technological core properties described above. Drawing parallels with the press (and other mediums) will bring the implications of these core technological properties into sharper focus.

Speaking in terms of advantages and disadvantages always carries the danger of limiting one's perspective, since they are inevitably advantages and disadvantages compared to a standard, which often remains implicit. Moreover, such a standard is usually not fixed, because humans are inclined to view advantages and disadvantages mainly in the light of their present circumstances. Also advantages often have an unpleasant and not very predictable tendency to turn into disadvantages in the longer term. (The opposite happens as well, but unfortunately that seems less often the case.) Nevertheless, the use of the terms make sense. As Spinoza already makes clear in his *Ethics*, humans can judge their interaction with the world around them only in terms of what is advantageous versus what is disadvantageous or causes hurt – a form of Darwinian natural selection. In this characterisation of the Internet as a medium I will inevitably use the perspective of the *homo typographicus* that someone of my generation is and remains. But in so doing in any case I have named my standard. I will try to apply it as openly as possible and without personal prejudice. The question whether the properties I will be discussing are intentional or unintentional is as relevant here as it was in the cases of writing and printing discussed in Chapter 3.

In a comparison with the communication circuit of the printing press a large difference in functionality becomes obvious. The first of the three core properties of the digital medium is that, being a Universal Machine, the computer – the hardware heart of the computing environment – is infinitely functionally expandable. The printing press on the other hand does only one thing: it multiplies. In the constellation of operations which lead from the creation stage to the finished product many other technologies besides the printing press play a role. For the writing, distribution, and consumption of text the printing press is not suitable. Also, a printing press can handle only text and still images, while the digital medium can process all

4 Ted Nelson, *Literary Machines*, published by the author, Sausalito CA, 1981, repr. 1993, pp. [4/15].

modalities of all other mediums. Just as the limitation of the printing press was unintentional, the computer became the unlimited and comprehensive medium that it is now in a fairly random way.

The new textual instability

That the computing environment is of a digital–electronic nature I have previously defined as the core property responsible for the virtuality, inscrutableness, machine-readability, and manipulability of text (and other data). Here the instability of the digital text stands out as a crucial difference compared with the products of the printing press. The printing press has in the course of time created a (largely unconscious) expectation of stability and permanence of form and content. (That this took time, and that stability, but also reliability, were not self-evident in the early days of the printing press, as Adrian Johns has convincingly demonstrated, does not alter the outcome of the historical process.[5] The outcome was suggested – if not predetermined – by the salient properties of the printing press.) The virtual nature of the digital text, however, works against such closure. The digital text can keep changing shape constantly. Form, content, and even the existential state of digital text may at any time and with the slightest effort be changed. What often tends to be regarded as one of the greatest achievements of print thus falls away: the stability and permanence of the textual foundation on which we have raised the cathedral of our culture, and science and scholarship in particular. All new knowledge that humans acquire builds in part on the corroboration or refutation of existing knowledge. That that previous knowledge is fixed and that it can always be referred to is the security society has learned to trust as the world of manuscript and Bible was gradually overtaken by the Order of Books and scientific rationality.

The lack of closure – compared with print – of the digital text is dual-faced. Compared with the modern book publishing process the information space of the Internet as another medium in which texts are

5 In *The Nature of the Book* Johns has stressed the social process through which the expectation of stability and reliability was able to evolve. He elaborates on the instability and confusion that characterised the early period of printing. Johns suggests that the exceptions to the stability that the printing technology brought with it, for example due to the phenomenon of correction on the press and piracy, were actually numerous enough to make instability to the rule (see, e.g., p. 31).

published and distributed is extremely unstable. Machine-readability brings with it boundless manipulability, which can be extremely difficult for *homo typographicus* to cope with. At the same time, this manipulability is a very useful function of machine-readability. Word processing is based on it, but, beyond word processing, the potential of the lack of closure and the lack of permanence of the digital text is huge. It is due to the influence of our typographic history that it is only relatively slowly being recognised and mobilised as a valuable property. To the potency of the lack of closure I will return under the heading of 'Intelligent text' below.

The end of the copy

From the description of the virtual nature of the digital text it was already implicitly evident that it follows from that virtuality that unlimited copies can be made of the text without deterioration and without significant cost. This property was also not planned, and this time, too, it represents a Janus head. The architecture of the Internet ensures that transmission of data in fact creates a clone of the original data on the receiving machine. To be able to read a Web page the browser on your computer (the client) makes a copy of the data residing on the server. Sending a file from one computer to another, for example via e-mail or FTP, ensures that after the transmission is completed the receiving computer contains an identical copy of the original file. However often a document or page is requested by users, this never exhausts the document. In analogue terms, the digital document has as it were a built-in copying press, which manufactures a copy for any potential reader. Not only are these copies made at extremely low production and distribution cost, but they are in fact so perfect that the fundamental distinction between original and copy is no longer relevant. The advantages are obvious. The disadvantage – in the terms in which we are now accustomed to think – of the extreme ease with which perfect digital copies can be made and distributed in the digital information space is chiefly the threat it poses to copyright.[6]

6 Dirk Visser, Professor of Intellectual Property Law at Leiden, even suggested in his doctoral dissertation *Auteursrecht op toegang: de exploitatierechten van de auteur in het tijdperk van digitale informatie en netwerkcommunicatie* (Intellectual property right on access: the exploitation of the author in the age of digital information and network communication, The Hague, 1997) to remove the ban on reproduction from copyright law.

As early as the 1970s the traditional concept of authorship was denounced by critics like Michel Foucault, Roland Barthes, and Jacques Derrida. The ease of digital copying, cutting, and pasting came just at the right time to illustrate in daily practice what they had already claimed in a philosophical and theoretical sense. If the author was not already dead in theory, it was time for a fundamental recalibration of his status for reasons of actual practice.[7]

Digital distribution

As a stand-alone word processor, and even as a layout and typesetting machine, the computer was never more than a tool in the existing print production process. The use of word processors and layout programs led to greater efficiency, but the entire process remained focused on eventual reproduction, through the printing press or laser printer. It was the communication between computers in a network that gave the big push to the emergence of a new medium in which distribution (and consumption) of machine-readable virtual text in a digital form was possible. The digital medium thus seamlessly integrates all functions from Darnton's communications circuit in a single environment. Moreover, digital distribution takes place without significant cost to the parties directly involved (see Chapter 4).

Architectural flatness

That the network architecture of the burgeoning Internet addressed strategic military applications and specifications from the beginning was of crucial importance. To ensure that in cases of damage to the network the data traffic could always continue the Internet is non-hierarchical and flat. Interestingly, this architecture also became closely associated with the egalitarian hacker culture of the computer pioneers.[8] In an environment where all other users were in fact by definition peers, the only restriction in the use of the network was the technical knowledge required to access the Internet as a medium for sharing text and making it public. As more people gained access to computers and the Internet, that knowledge became more commonplace. Soon software was written for a variety of functions that placed the network at the convenient service of all and sundry

7 It is ironic in this light that, as we have seen, the digital information space precisely yielded efficient new means to solve questions of authorship.

8 Castells, *Internet Galaxy*, p. 14.

for the creation, production, distribution, and consumption of text. Thus things were steadily made easier for the user. When in 1991 Tim Berners-Lee launched the WorldWide Web, it presented few barriers to prospective users. Since then, so many online publication tools have become available that no technical expertise is required at all.

Two-way traffic

The architecture of the Internet is based on two-way traffic between a client and server computer. But, in principle, any computer can be both the client and server (and, being a Universal Machine, have an unlimited number of other functions). The existence of this continuous contact between client and server – which can be logged – constitutes an important difference to the situation in the world of physical texts. Publishers who distribute books through bookshops have no idea where those books end up. The process is one of essentially one-way traffic. I will return to the subject of logging and its uses in 'The docuverse and the Universal Machine' below.

Low cost

Besides ease of access the costs of Internet use are also low. Governments and scientific institutions have invested heavily in infrastructure, a form of cost allocation which was partly motivated by the concept of the digital highway as a parallel with physical roads. Together with the dropping cost of disk space, and the fact that little investment in production is required, this makes the WorldWide Web as a publishing medium particularly cheap. Again, the comparison with print is instructive. The nature of print technology makes the costs involved in its production and distribution high. The technical knowledge needed for printing, for example, has always remained relatively high, and the requisite training is expensive. Some of those costs have also to be incurred digitally (e.g., editing and design), but a significant portion of the costs is mostly or even entirely absent: the initial outlay in reproduction by means of printing (paper, printing costs, binding) and the cost of physical distribution. The low cost of publication on the Internet leads to a low economic threshold, and thus to a rapidly increasing amount of published information. However, some infrastructural constraints remain, especially in poorer countries, but also in less densely populated areas.

Speed

The transmission reach of the network is now global and the transmission speed of broadband so high that any computer connected to the network anywhere in the world can be reached almost immediately.[9] The place where information is consumed may be different from the one where the publication takes place – and that in turn can be different from where the creation took place. In this way the digital information space has, in fact, made both distance and time irrelevant. The combination of range and speed is now making place-shifting possible, in addition to the already existing concept of time-shifting introduced by the video-cassette recorder.

Although the many-to-many architecture is difficult to compare with the traditional one-to-many architecture of the broadcast mediums, the new medium with its wide distribution and high speed has broadcast potential. That means that in principle it is possible for many users simultaneously to 'tune in' to the same material, held on one or more other Web sites. By means of so-called 'streaming media' successful broadcasting experiments have already taken place. In addition, the Internet is increasingly used to make archived radio and television broadcasts available as streaming media or downloadable files.

Convergence

In the digital medium all modalities converge. With the emergence of digital distribution via broadband the convergence of all vertical medium columns (music, radio, television, newspapers and magazines, books, and now also games) could, in principle, take place. But that the technological possibility of such far-reaching convergence exists, does not automatically entail social acceptance. Whether, when, and to what extent convergence will actually happen, remains to be seen. For example, it is possible that consumers will prove to have a strong preference for combinations of certain (dedicated) devices with certain types of information (or modalities). Despite the potential of various devices to integrate a variety of functions, many people for example appear to prefer to use devices tailored to a single

9 Internet use, population statistics and Internet market research data for over 200 individual countries and world regions may be found at www.internetworldstats.com. The broadband statistics (www.internetworldstats.com/dsl.htm) show that in some countries up to one-third of Internet users had broadband connections in 2007.

specific function (such as phone, music player, PDA) rather than one device with multiple functions. In addition, analogue mediums will not disappear overnight. The fact that fiction, for example, is still consumed in printed form much more readily than scientific journals or reference works may not quickly change, in which case its production and dissemination are likely to remain predominantly analogue.[10]

Access through content

Through the possibility of querying the full-text contents of all documents in the digital information space, access to information is being transformed. Using keywords and phrases as search terms gives direct access to passages on Web pages, but also in digitised books, bypassing the need to go first through traditional bibliographic methods and then to locate the relevant passage by reading the whole text. In this way the digital information space not only provides access to entire books and articles, in the way a library catalogue does, but also directly to passages within these books and articles. (This interestingly applies also for books sitting on a bookshelf at home which, given the same edition, can be accessed in the same way as their digitised counterparts, by searching them full-text on the Internet.)

Besides their storage and preservation function providing access to information has always been a crucial function of libraries in the value chain. Filtering, organising, and creating metadata are the main grounds for libraries' existence. They carry out these tasks with the help of the sophisticated system of bibliographies and library catalogues made familiar by the Order of the Book. Searching and finding on the Internet on the other hand completely bypasses traditional ways to gain access to texts through the bibliographic apparatus and so also ignores aspects of validation and certification of the content. Compared with an actively filtered and orderly information environment such as the library the information space of the Internet can be regarded as a kind of black box, where the most reliable information is thoroughly mixed up with materials of more doubtful status, without context and without any indication of their origin or trustworthiness. The extra demands placed on users by

10 But note that digital printing and 'print on demand' can make use of distribution via the Internet.

their active role in the discovery and assessment of such information whose provenance and integrity remains unclear will be discussed more extensively later.

The possibility to locate text in the digital information space through full-text searching (whether in a tailored environment such as Google Books or through a full-text search on the Internet at large) can be said to signify the end of 'the document'. Documents that were originally physically separately published now form a *de facto* unit in the digital information space or 'docuverse'. The continuity of this textual space represents a fundamental difference in relation to the world of material documents, where physical separation also means logical separation. If the library of Alexandria was to function as the information space it was designed to be, its books had to be gathered in the physical location of the library. The Internet brings together virtually, in any desired location, information that may physically reside in the most diverse places in the world.

The docuverse and the Universal Machine

The fact that the 'communications circuit', familiar from the analogue world, can also be used to model digital communications suggests a high degree of continuity between the world of books and the docuverse. But there are discontinuities, too, for example in the way the docuverse lends itself to searching and finding *inside* texts. However, the chief cause of discontinuity is probably that the docuverse is not just an information space, but is also only one of the digital equivalents of activities and operations from the communications circuit that have been made possible by the Universal Machine. Not only are the search methods that the digital environment offers much more advanced than the older analogue ones. The same goes for many other digital translations of analogue practices. These are advantageous in that they are usually faster, easier, more convenient, more exact, or otherwise 'better' ways to reach the same or similar results. But apart from such more or less equivalent activities and operations, the Universal Machine also offers possibilities for the treatment of text (and other modalities) that were not available in the traditional communications circuit at all. Furthermore, these advanced additional possibilities are available in the same docuverse where the digital communications circuit also takes place. Under the general heading of what might be called 'the creation of knowledge

about text', I want to discuss a couple of categories of ways to create and store that knowledge.

In Chapter 2 under the heading 'Markup' text encoding was presented as an alternative to typography to indicate the structure of text. That is how, for example, much of the HTML coding of Web pages works. But more sophisticated markup languages, based on XML, are capable of much more. Markup languages can 'encode any relevant information about the text in such a way that information can be understood and processed by a computer', as Chapter 2 expressed it. The application of analytical information about text through markup can be succinctly referred to with the phrase 'making text intelligent' or 'making a text knowledgeable about itself'. This is a shorthand way of saying that markup can serve to instruct computers to recognise certain constituent parts of texts, to teach them the meaning of parts of texts, and to make them do things with that 'knowledge'.

As Chapter 2 made clear, the type of information about the text that can be captured ranges widely, and includes information about the structure of the text; about its typographic design; about its interpretation, as expressed in editorial notes, standardisations, glosses; and so on. By far the most important of these is information about the structure of the text. That is to say, information about the exact function and mutual relationships of all the elements of which the text is made up. The emphasis on structure can be well illustrated by the case of a doctor's prescription. Here the unambiguous encoding of the structure of the document ensures that, for example, the patient data are not confused with information about the doctor or the pharmacist. The contrast between, for example, handwritten and printed information that ensures in the paper world that the data on doctor and patient are not mixed up is replaced by digital markup codes which make explicit the structural function of each constituent part.

While in this example form is almost irrelevant, in most day-to-day circumstances (typographic) form is hugely important. Markup in such cases also serves as an alternative to the function of typography in analogue text. Information about the structure of the text offers the possibility, for example, to make the presentation of the text independent of output and device. Once encoded in XML a text is medium-independent, and by using a stylesheet it can for instance be converted to a typographical format such as PDF (for printing or screen), but also to another markup format, such as HTML (for the

Web) or EPUB (for an e-book reader). The design simply adapts to the requirements of the device. The design of a whole series of texts can be adjusted by changing a single stylesheet.

The degree of objectivity with which the structure of documents can be captured in markup depends on the level of depth required, as well as on the nature of the text. The information contained in a doctor's prescription will leave little room for subjective interpretation. The same applies, in line with their already pre-structured nature, to forms. In other texts there will be more room for interpretation. A novel, for example, would tend up to a certain level to have a clear structure: there are preliminary pages created under the publisher's responsibility, containing, for example, a title page and publication data, the main body of the work supplied by the author, for example divided into chapters, and maybe some end matter. But within the chapters of the main work there may be a structure, too: a narrative one, for example. Themes, persons, acts, and events may form part of the structure. The analysis requires interpretation, which is by its nature subjective. On the whole, the older the text the greater the role of interpretation. This is the arena of textual scholarship, which also gratefully and intensively makes use of the analytical capabilities of descriptive encoding.

The intellectual effort needed to apply editorial notes, standardisations, glosses, and so on is not fundamentally different in nature in a digital than in an analogue environment. Regardless of whether the results are displayed by means of analogue footnotes or digital markup, the same text analysis and interpretation have to be performed. Where there is a substantial difference is in the wider possibilities that markup offers for the computer processing of interpretations that have been added to the text. For example, an editorial apparatus may or may not be included in a text edition, or only those notes may be displayed which are relevant in a particular context; or an index of relevant terms or names may be automatically generated.

Though the processing possibilities are greatly broadened by the computer, the concept of the creation and publication of an authoritative text enriched with interpretive expert knowledge by an appropriately skilled person is thus not new. In that sense, the practice of what I have called 'making text intelligent' is still strongly motivated by a notion of scholarship that was fully determined by the Order of the Book. But the Universal Machine offers vistas of entirely different ways of dealing with text and textual meaning. That brings us to the

edge of the communications circuit, familiar from the world of the book, to enter the field of humanities computing – even if there are, as previously noted, all kinds of links.

Actively making text intelligent has so far continued to rely on individual expert interpretation and is therefore labour intensive. Instead of making text intelligent, it is also possible to apply artificial intelligence to text. That is to say that the computer can be instructed to analyse text on our behalf. An example is the commercial application of statistical analysis by Amazon:

> Capitalized Phrases, or 'CAPs', are people, places, events, or important topics mentioned frequently in a book. Statistically Improbable Phrases, or 'SIPs', are the most distinctive phrases in a book. Just as CAPs and SIPs give you a quick glimpse into a book's contents, a movie's actors, directors, and plot keywords give you more information about that movie.[11]

These kinds of uses of the computer are perhaps a better exponent of the new digital order than making text intelligent by hand. The main challenge to the use of forms of artificial intelligence is building the instruments. Once they have been built, they can be applied to any text present in the docuverse. Thus the results can immediately increase exponentially.

A third way in which the Universal Machine can learn about text and then make the information available to humans shifts responsibility for supplying that information from a limited group of experts to Web users in general. The principle of the wiki is a well known example of the 'democratic' way of adding knowledge to the Web. In the case of wikis this concerns new knowledge. But according to a similar process also information about existing texts could be added. For, once texts are available digitally, they can always be further processed and edited. The digital information space is ideally suited to break the hierarchical relationship between an author or editor and the reader – which is also still at the foundation of the 'conventional' process of making text intelligent. Instead of delivering himself up to the passive consumption of an interpretation generated by an expert author or editor commissioned by a publisher, the consumer can exercise similar activity himself. Different people can comment on same digital text, giving rise to, for example, various – virtual – combinations of texts and commentaries. Not surprisingly, in view of

11 Amazon Web site, www.amazon.com/gp/phrase/help/help.html.

the long-established and familiar hierarchical system of knowledge generation, this is not being widely adopted yet.

There is a fourth way to let the Universal Machine aid in textual interpretation, and this is potentially the most powerful one. This involves tapping Internet users' online activities, which may be totally unconnected with the textual interpretation question at hand. A good example is the way Google uses so-called CAPTCHAs to improve optical character recognition (OCR) in the Google Books programme. CAPTCHA stands for 'Completely Automated Public Turing test to tell Computers and Humans Apart', and it is familiar to Internet users from the images of deformed characters that have to be deciphered so that online companies know that they are dealing with a real person. Google works with a company called reCAPTCHA[12] which takes its word images from scanned print materials. Google can compare the result of deciphering an image whose text it already knows with an image whose text it doesn't know, and so the byproduct of the deciphering act is the solution of an OCR question.

In these various ways the Universal Machine can 'learn' about the content of texts and place its 'knowledge' in the hands of humans. Thus slowly the contours can be seen to emerge of what Tim Berners-Lee has called the Semantic Web. This is a web where information can be analysed and interpreted entirely by computers. By combining the highly flexible and analytical XML with description techniques such as the Resource Description Framework (RDF) and the Web Ontology Language (OWL) conventional texts can be transformed into machine-readable descriptions of the data that these texts contain. In so doing they represent the knowledge that humans have about those data, but, because those descriptions are machine-readable, they offer powerful ways to process the knowledge contained in those texts with the help of the computer. This also opens up prospects to instruct the computer, for example to apply formal logic to these texts. Although daily practice does not yet make full use of the possibilities, the technologies to achieve this kind of scenario exists now.

Another dimension of the use of the Universal Machine in the docuverse is that not only the content of texts, but the way they

12 reCAPTCHA is a company co-founded by Luis von Ahn, about whose work more will be said below.

are used, can be analysed. The logging of the user traffic in the digital information space is again dual-faced. That is to say, there are both very valuable and very dubious reasons for logging the use of digital sources. One useful purpose, for example, is to improve the functionality and the nature of materials on offer. The owner or curator of a digital collection can adapt the presentation of materials from the collection to the implicit user wishes that emerge from an analysis of the user traffic. There are obvious drawbacks associated with this functionality. As all Web users know from experience, Web use always leaves many traces behind. Sometimes users are aware that their use is being logged, for example when they instruct their Internet browser to accept cookies, small text files that are stored on the hard disk of a client visiting a Web site, which store information about the visitor's activities. But even without such an intimate relationship between server and client, visits and visitor behaviour can be recorded. Web statistics can be maintained using IP addresses. A very basic example is the fact that many Web sites (like Google) adjust their ads to the client's geographic location. In most cases the user will not be aware which Web activities are being logged and by whom. The semantic Web, too, may lead to greater erosion of privacy, and more readily accommodate attempts at censorship. Armed with text-analysis software, authorities of all kinds may, legally or illegally, make good use of advanced semantic Web description techniques to scan Web pages in an automated fashion for content deemed offensive, dangerous, or unacceptable in any other way.

In the hands of a harsh government logging the user becomes a kind of invisible digital counterpart of Jeremy Bentham's Panopticon. The efficiency of the docuverse in this regard is such that Big Brother can meet all its surveillance needs with very little effort. Criminals, too, can benefit from users' generally rather limited awareness of the number of tracks they leave behind. And even if that is not problematic at the moment itself, it may become so at some later time. In the docuverse a forgotten activity or unguarded remark may surface at any time. Because it is almost impossible for users to cover their tracks, this can all too easily lead to a loss of privacy. (To many people this is not an issue; see 'Private domain becomes public domain' below.)

Social characteristics of the docuverse

Loss of privacy is one of the more recently recognised insidious social consequences of the digitisation of our everyday existence, but there are countless other consequences, both more and less desirable ones. Not surprisingly, the advent of the Internet and the growth of the WorldWide Web as a medium have induced and continue to induce a never-ending stream of social commentary. The awareness to what extent humans are the product of their history is greater than ever before and the role of mediums in that history has been thoroughly investigated. Especially our dramatic experiences with the demagogic force of mediums in the course of the twentieth century have given us an extra-sensitive medium antenna. However, the main focus of the attention has been on the way the 'mass media' have been *used*: much less on the intrinsic properties of mediums, and even less on the intrinsic properties of the *textual* mediums – with the (partial) exception of newspapers. In the early days of the Internet, text was the preponderant modality, and little 'mass' was involved. The Internet was not a public medium. It came from the strategic interests of the US Department of Defense and the scientific world. After the rise of such mass mediums as film, radio, and television, the demagogic potential of the Internet did not initially seem particularly large. Yet from the start people assigned to this new technology far-reaching social implications. It was soon predicted – correctly, as it turned out – that its impact on our culture would be no less radical than that of Gutenberg's movable type. Though this was not in itself an outrageous prophecy, it was nevertheless possible to make exaggerated claims for the new medium. For example, Ted Nelson characterised the subject of his book *Literary Machines* in this way: 'This book describes the legendary and daring Project Xanadu, an initiative toward an instantaneous electronic literature; the most audacious and specific plan for knowledge, freedom and a better world yet to come out of computerdom.'[13] The high expectations concerned especially the revolutionary possibilities that the Internet and the hypertextual precursors of the WorldWide Web offered for interactivity and collaboration. Instead of passive consumption the digital medium promised to promote active participation in the

13 Cover of the 1993 edition. See also George P. Landow, *Hypertext: The Convergence of Contemporary Critical Theory and Technology*, Baltimore MD and London, 1992, p. 19.

textual discourse. The medium would bring about a flourishing 'wreader'-ship.

It took some time before the WorldWide Web, although it was built on the very foundation of hypertextual linking of information, began to honour its promise of hypertext for the masses. The use of the HyperText Markup Language (HTML) made the WorldWide Web indeed hypertextual. Initially, however, its actual functionality remained far behind what hypertext theorists like Ted Nelson and George Landow had conceived. There was hardly any two-way traffic and collaboration was only indirectly possible. Indeed, the average Internet user took very little interest in the opportunities for collaboration that lay behind Ted Nelson's original idea of hypertext. It therefore took some time before the opportunities for co-operation offered by the Internet with its flat architecture, democratic access, and two-way traffic with global reach were also used outside the scientific community.

An important factor in this delay was the rapid colonisation of the Internet by commercial interests. Commercial companies approached the Web mainly from a traditional industrial top-down perspective (from producer to consumer, from seller to buyer). In that model interactivity had no obvious place. Only gradually did the realisation grow that bi-directionality was a salient technological property of the medium, with a dynamics of its own. Since then the two-way traffic has been used in a more creative way, especially by the largest and most successful 'e-tailers', such as Amazon.com or Apple, and the possibilities for interactivity have been improved. Instant messaging and blogs are very popular, while wikis offer an interactive writing and editing environment for just about every conceivable kind of use. When the possibilities of interactivity began to crystallise, and the democratic potential of the Internet was recognised more broadly, commercial companies chimed in by devising new business models and scenarios which were less top-down oriented and were better suited to the nature of the technology.[14]

14 That the main business model is shifting from paying for content and intellectual property to other models, including paying for advertising, or 'freemium' (see Chris Anderson, *Free*, New York, 2009) is a source of concern about the erosion of a conventional professional information environment. *The Cult of the Amateur: How Today's Internet is Killing our Culture* (London and Boston MA, 2007) by Andrew Keen is meant as a warning of the harmful consequences. I will return to this later in this chapter.

But the advent of the Internet inspired not only optimistic scenarios. Its emergence as a medium invoked many more sombre reactions. One of the more eloquent and better-known ones was Sven Birkerts's early pamphlet *The Gutenberg Elegies: The Fate of Reading in an Electronic Age* of 1994. Invoking an ominous quotation from Antonio Gramsci, Birkerts situated culture in these digitising times in a place, wedged between books and the digital medium, where 'the old is dying and the new cannot be born'.[15] Besides a certain disdain Birkerts's book notably expresses grave concern that the computer as a technology could well have all sorts of undesirable consequences:

> A change is upon us – nothing could be clearer. The printed word is part of a vestigial order that we are moving away from – by choice and by societal compulsion … This shift is happening throughout our culture, away from the patterns and habits of the printed page and toward a new world distinguished by its reliance on electronic communications … The evidence of the change is all around us, though possibly in the manner of the forest that we cannot see for the trees. The electronic media, while conspicuous in gadgetry, are very nearly invisible in their functioning. They have slipped deeply and irrevocably into our midst, creating sluices and circulating through them. I'm not referring to any one product or function in isolation, such as television or fax machines or the networks that make them possible. I mean the interdependent totality that has arisen from the conjoining of parts – the disk drives hooked to modems, transmissions linked to technologies of reception, recording, duplication, and storage. Numbers and codes and frequencies. Buttons and signals. And this is no longer 'the future', except for the poor or the self-consciously atavistic – it is now. Next to the new technologies, the scheme of things represented by print and the snail-paced linearity of the reading act looks stodgy and dull. Many educators say that our students are less and less able to read, or analyse, or write with clarity and purpose. Who can blame the students? Everything they meet with in the world around them gives the signal: That was then, and electronic communications are now.[16]

The stealth by which Birkerts perceives the electronic medium to be invading society clearly adds to his fear. It is that same invisibility already identified in Chapter 1 as one of the problems that especially

15 Sven Birkerts, *The Gutenberg Elegies: The Fate of Reading in an Electronic Age*, New York, 1994, p. 121.

16 Birkerts, *Gutenberg Elegies*, pp. 118–19.

the textual mediums face, but appearing now in a more sinister guise.

A similar fear spoke from Neil Postman's *Technopoly*. Postman believes that in our 'technopolis' we allow ourselves to be dominated by technology more generally, of which computers are merely the most advanced and threatening example. Though Postman's book is about technology in the broadest sense, textual mediums (manuscript, print) and language receive his special attention because, as already suggested in Chapter 1, they play such a decisive role in how we interpret and experience the world, precisely because of their invisibility. Maybe Postman's, like Birkert's, reservations are primarily motivated by the fact that word processing, and in even stronger measure the Internet, engage the computer deeply in the sensitive field of human communication.

Fear of technology is of all times, and the arrival of each new medium is accompanied by cultural pessimism. Plato's objections to the artificiality of writing, which was also a technology, after all, bear witness to this, and the art of printing elicited similarly gloomy responses. But technophobia disappears and the criticism is silenced once a certain familiarity grows. Also, the nameless fear of the computer was probably greater while it remained in the exclusive service of scientists in white coats, invisible to the rest of the world. The plot of *2001: A Space Odyssey*, for example, was driven by the scary vision of HAL, an artificial intelligence with all-too-human features, trying to impose its – or *his* – will on humans. However, this fear has still not altogether disappeared. That has not only to do with the fact that the computer is still relatively new. The technology is also, unlike writing and printing press, not static. Based as it is on the Universal Machine, it continues to evolve, and so continues to be capable of springing new – and potentially unpleasant – surprises.

The Universal Machine as automaton

One of Walter Ong's central propositions is that writing, too, just like the printing press or the computer, is a technology, a tool of *homo faber*.[17] That writing was the first step in the 'technologisation of the word' is a useful insight that has found a wide reception in recent decades. In this book, too, I have stressed the continuity from writing through printing to the digital processing of text. But writing, printing, and digital text should not be uncritically equated as so

17 Ong, *Orality and Literacy*, pp. 81–3.

many forms of technology. There are essential differences between these technologies. The disjunction between writing and print, and again between print and the computer, is greater than the concept of the technologisation of the word – with its implication of underlying continuity – may suggest.

However important the role of the printing press has been in cultural history, however many genii it may have helped to release from their bottles, it has never – *pace* Elizabeth Eisenstein – been more than a passive instrument in the hands of man. This is where the comparison of digital text with writing and printing as technologies is flawed. In the first place the computer as Universal Machine has many more capabilities. Not only more than the printing press, but *more than any other human invention* to date. Its flexibility alone makes it an unimaginably powerful tool. The computer as a technology harbours a fundamentally infinite number of as yet unimagined capabilities. Secondly, the computer's sophistication is already such that it may be called an emergent life form.

The inscrutability of the computer offers a direct parallel with the human mind: 'It has invited speculation on a special relationship between computers and the equally inscrutable brain.'[18] Humans have an irresistible tendency to anthropomorphise, which is stronger as the object in question has more human features. Involuntarily we assign human characteristics to computers, especially when they perform tasks in the field of language and communication. That is not limited to the way in which one finds oneself talking peevishly to one's computer when it dictatorially imposes its blindly mechanical way of working. We are faced with the inescapable fact that the computer as Universal Machine is able in principle to surpass humans in intelligence. Maybe a machine like HAL, with its eerily human features, its 'insecurity', and the manipulative behaviour with which it is 'deliberately' trying to deceive the crew of the spaceship is not (yet) realistic. Nevertheless, the combination of artificial intelligence and robotics has already led to a large arsenal of machines that show aspects of human behaviour. The distrust of critics like Postman and Birkerts is not incomprehensible, and not unfounded.

During the sixteenth, seventeenth, and eighteenth centuries the world witnessed what E.J. Dijksterhuis has so appositely called the

18 Sherry Turkle, *The Second Self: Computers and the Human Spirit*, New York, 1984, p. 22.

'mechanisation of our world picture'.[19] In that mechanisation the printing press played a major role. Its role began early in the sixteenth century, with the widespread dissemination of the Lutheran heresies, and grew steadily, with the appearance in print of ever more scientific and philosophical reflections that equally gnawed at the authority of the only true Church. They undermined the divine order, and not only our world picture but also our picture of ourselves as human beings in that world came under heavy fire. With his notion of the dualism of body and mind Descartes had tried to safeguard some of the special status of humans as the highest aim of God's creation. Although the body had to obey the same mechanisms as the rest of the world, the human mind, through its immortality, participated in the divine. Spinoza gave this makeshift solution short shrift in his *Ethics* by stating that spirit (thinking substance) and body (extended substance) obeyed the same laws, and were merely two different manifestations of a single substance:

> Here, before we proceed any further, we must recall what we showed above: namely, that whatever can be perceived by an infinite intellect as constituting the essence of substance belongs to a unique substance alone, and consequently that thinking substance and extended substance is one and the same substance, which is understood now under this and now under that attribute.[20]

A century later Julien Offray de la Mettrie carried Spinoza's insight into the materialistic nature of the human mind to its logical extreme, concluding that people were nothing more than machines.[21] That people were revealed to be mere mechanisms left nothing of the divine that they had always perceived in themselves. The human-as-machine notion – the microcosmic counterpart of the macrocosmic discovery that the earth was not the centre of the universe – definitively robbed human beings of their immortal soul and of their place at the head of creation.[22]

19 E.J. Dijksterhuis, *The Mechanisation of the World Picture*, London, 1961.

20 Spinoza, *Ethics*, Part 2, Proposition 7, Scholium (quoted in the translation of G.H.R. Parkinson, Oxford, 2000, p. 118). See also Part 3, Proposition 2, Scholium.

21 In *L'Homme machine* (1747), translated as *Machine Man* in *Machine Man and other Writings* by Ann Thomson (Cambridge, 1996).

22 Still today new evidence continually comes to light that puts the special place of humans in creation in doubt. That chimpanzees are indeed 'prepared' for speech is just one of the most recent examples (see Taglialatela, *et al.*,

Barely did we get over the shock that the human-as-machine is no more than a mechanism, or we are about to be overtaken by the machine-as-human. It is not easy for humans to accept their limitations. But there is one crucial difference between the realisation that people are essentially nothing more than a machine and the idea that a machine might just become 'human'. In the case of the human-as-machine notion the point was the discovery and then acceptance of a pre-existing reality. The irony of the development of the machine-as-human, however, is that this is entirely our own doing. In making this invention we may be seen as hoist with our own petard. Instead of the failed humanoid Frankenstein, we are now well on the way to build a superior intelligence. Ultimately, according to futurists like Ray Kurzweil, it will be possible with our technologies to 'improve' human beings and achieve 'transhumanism'. Our situation, however, is more perilous than that of the sorcerer's apprentice, because this time there is no sorcerer to help us to get back control over runaway technology. The computer is not the only example: with genetic engineering and nanotechnology we have manoeuvred ourselves into the same predicament.

As early as 1984 Sherry Turkle observed that '[c]omputers are not good or bad; they are powerful'.[23] Of course that is so, but they *do* possess certain technological characteristics, intended but also unintended, which stimulate certain developments more than others. Our problem – our tragedy – is that we do not know all the properties before they actually manifest themselves, and so cannot predict the developments through which they will carry us. Our relationship with technology is ambiguous. On the one hand with the progression of our technological ability we take fate increasingly into our own hands. This fosters a feeling of power and control. But, ironically, that control also confronts us all the more with the fact that we are ultimately responsible for all that we make of ourselves and all that we do.[24] This is all the more acutely painful because we are so imperfect as creators. Again and again we seem to lose control

'Communicative signalling'). In *I am a Strange Loop* Douglas Hofstadter has made similar observations about the sliding scale on which awareness can be attributed to humans and other living creatures.

23 Turkle, *Second Self*, p. 323.

24 Alain de Botton has expressed this quandary very well in his *Status Anxiety* (London, 2004); see also Jos de Mul, *De domesticatie van het noodlot* (Kampen and Antwerp, 2006).

over things, things do not work as we had imagined, or they have unexpected side effects.[25] In this regard it is instructive to reflect that the prediction that the computer would bring about the paperless office has still not come true. (Nor does it appear that the invention of teleconferencing will lead to less travel; rather the opposite will prove the case. The greater our virtual world becomes, the smaller the real one will seem.)[26]

Social changes in the digital textual space

It requires little imagination to see that, whether intended or unintended, the practice of reading and writing, and our whole concept of literacy, are strongly influenced by the digital technology. Musings on technology-as-threat represent a fascinating, valid, and possibly healthy because sobering wider perspective on the relationship between technology and social change. However, since they concern only the computer's first-tier properties, i.e., those of the Universal Machine functioning electronically and digitally in a network, they lack specificity. All kinds of phenomena are making their appearance in close conjunction with digital technology. These include the zapping attitude to text, the sheer amount of immediately accessible documents, mostly hypertextually linked, that are already present in the digital information space; the rapid increase in the volume of that information space; its uneven quality, and the instability of digital textuality. In the remainder of this chapter I intend to examine these social phenomena somewhat more systematically, and in greater detail, regarding them as social consequences of the second-tier properties I have already defined.

Zapping text

The hypertextual nature of the Internet has focused much attention on readers' freedom to make their own way through the information provided. This is freedom, however, not just to discover a personal path through one text, but also to click away from that text to another

25 See, for example, Edward Tenner's sobering *Why Things Bite Back*.

26 This observation is confirmed by Peter Hall: 'A notable fact: during the third and fourth Kondratieffs, when information technology was first developed and then diffused throughout the world, no reduction in travel or face-to-face contact was ever observed. On the contrary, innovations in telecommunications were always paralleled by innovations in transport technology' (Peter Hall, *Cities in Civilisation: Culture, Innovation, and Urban Order*, London, 1998, p. 962).

text or Web site more quickly. Zapping as a concept may derive from television, but it is highly applicable too to the world of digital text. Technologically this is stimulated by two phenomena: the clickable link and the docuverse as one single information space. (The poor quality of present-day computer screens is also likely to contribute to the tendency to read shorter pieces of text.)

In addition to the readers' awareness of the ever-beckoning vistas beyond their current position in the docuverse there is also the constant competition for attention *in the same digital space* from a plethora of other than the textual modality, including games, video, and music.[27] The printed book is itself a medium in isolation, and in turn it fosters private communion with the text. Such a dedicated form of reading is almost impossible to maintain when digital text occurs in the context of other digital modalities.[28]

In reply to changing reading processes, writing changes, too. Notably, shorter text units make their appearance, and existing text is frequently reused, made easier by widespread cut-and-paste habits.

As an example of the kind of 'morbid symptoms' that according to Birkerts typically make their appearance in an 'interregnum', he observes rather mournfully how people discard the familiar forms of book-based literacy. By that he means a literacy based on the linear order of the book, which is 'bound to logic by the imperatives of syntax'.[29] In the 'electronic order', which has yet to prove itself, on the other hand,

27 This applies perhaps most forcefully to the younger generation. See, for example, Wim Veen, *Flexibel onderwijs voor nieuwe generaties studerenden* (Flexible education for new generations of students), inaugural lecture (Delft, 2000), and W. Veen and F. Jacobs, *Leren van jongeren: een literatuuronderzoek naar nieuwe geletterdheid* (Young people learning: a literature search for new literacy), Surf-reeks No. 10, n.d. [2005], www.surffoundation.nl/download/Leren_van_jongeren.pdf.

28 The extent of young people's ability to multi-task effectively remains uncertain. In the face of a great deal of optimism (exemplified by Wim Veen among others; see above) neuroscientist Susan Greenfield asserts that 'we have the potential to multitask whilst listening, but not whilst reading' (*Tomorrow's People*, p. 58). Her doubt about the efficiency of multi-tasking is shared by other neuroscientists, such as Eyal Ophir, Clifford Nass, and Anthony D. Wagner, 'Cognitive control in media multitaskers', *Proceedings of the National Academy of Sciences of the United States of America* 106, 37 (15 September 2009), pp. 15583–87.

29 Birkerts, *Gutenberg Elegies*, p. 122.

> the visual and nonvisual technology in every way encourages in the user a heightened and ever-changing awareness of the present. It works against historical perception, which must depend on the inimical notions of logic and sequential succession. If the print medium exalts the word, fixing it into permanence, the electronic counterpart reduces it to a signal, a means to an end.[30]

The shorter length of the texts that are being read, in conjunction with the greater freedom of readers to find their own path, and the constant distractions offered by other mediums and applications in the same digital space, leads to circumstances that are in any case less conducive to discursive argumentation.

Drowning in seas of text

The first reactions to the Internet gave, understandably, little attention to the massive dimension of the medium. The Internet had been planned as a comprehensive network, but only with the then small group of scientific users in mind. The long-term implications of the non-hierarchical nature of the network for broad access, not only for the consumption but also for the publication of digital text, were not foreseen. The result has become all too prominently visible and goes under the general nomer of information overload. That is the term used to characterise the experience of an overwhelming amount of information, which is not only increasing daily, but in which everything is linked to everything else as well. This information does not have the limitations of the conventional publishing process. The book as a physical product is the result of a process of careful consideration – if only for economic reasons – by the author and publisher of the relative merit of all materials that could in principle be eligible for inclusion. The book as artefact demands from the author a completed manuscript of a certain, always limited, size. Moreover, sound or moving images have no place in it, and use of color is limited by financial considerations.[31]

The history of information overload is of course much longer. In the oral tradition redundancy does not exist, in the sense that each

30 Birkerts, *Gutenberg Elegies*, p. 123.

31 It is of course quite conceivable that the zap effect will on average promote the shortening rather than extension of texts. However, in principle, the freedom of variable length increases, and so, more importantly, does the total amount of information, regardless of the length of individual chunks.

utterance is relevant in its context.[32] Also few people will have suffered from information overload in the world of the manuscript: the period was characterised by intensive rather than extensive reading. Moreover, there were not many libraries with large collections, and access to them was limited. The production of new manuscripts was simply on demand. It makes sense to assume that the abundance began with the printing press. Not only did the number of books increase rapidly, but printers printed first, and only then looked for a market for their products. A book like *Theatrum humanae vitae* by Theodore Zwinger, Professor of Medicine at the University of Basel, is a telling manifestation of the problem that confronted early modern scholars dealing with the growing production of the printing press. The work is an anthology of notes on an unlikely variety of topics, for which the author drew from a huge number of books. His endeavour first took the shape of a book of 1,400 pages, published in 1565, but the posthumous 1604 edition, edited by his son, already ran to 5,000 folio pages of closely set type in double columns.[33] Its popularity (five editions in forty years, and subsequent editions into the eighteenth century) demonstrates the use for such a work. It presented the notes that someone who wanted to stay *au fait* would have been able to make himself if only he had had time to plough through the steady stream of new publications coming off the press.

The rapid increase in the amount of information as a result of the almost threshold-free publishing opportunities offered by the Internet confronts us even more pressingly with the same problem. This is not just a matter of bulk. The quality and relevance of this increased flow of information are another point of concern. In *Amusing Ourselves to Death* Neil Postman has observed the implications of the international telegraph traffic in the second half of the nineteenth century for the increase in newspaper news. Much of it was of little relevance to its readers, having no bearing on their daily existence. However, news was regarded primarily as a source of amusement, and people subjected themselves quite voluntarily

32 As Ong points out, *within* the utterance redundancy does occur, but this is redundancy of a very different kind. Repetition and variation are aimed at enhancing the success of communication (Ong, *Orality and Literacy*, pp. 39–41).

33 See Walter J. Ong, *Interfaces of the Word: Studies in the Evolution of Consciousness and Culture*, Ithaca NY and London, 1977, pp. 171–81.

to this additional supply of pointless information.[34] The apparent lack of discernment of the 'masses' led to major intellectual distaste for the democratisation of knowledge and information in the early twentieth century.[35] Somewhat similar responses to the increasing flow of not always impeccable information on the Web can be heard today.[36]

Incidentally, there are many things Internet users plagued by information overload can do to help them to select the material they really want to know about. The relevance of search results might be improved, for example, by more advanced types of searching than those offered by Google's 'I'm feeling lucky' search field, through the use of alerting services, RSS feeds, tagging, social bookmarks, and so on.

Fragmentation

In addition to the sheer quantitative growth of information, there is a growing tendency towards fragmentation of the textual space. On one hand, there is a boom in the number of discrete units of information, on the other their availability in the information space of the Internet means that they can be read (and potentially made relevant) in an unprecedented number of lines of argumentation and other contexts. The road up in the hierarchy from data through information to knowledge (not to mention wisdom) is also a process of contextualisation. Short meaningful text fragments on the Web can be reused in a new context, such as a blog. For example, there is a tendency to produce more scholarly 'semi-manufactures'. That is to say, collections of data are published with the intention that they should serve as a basis for interpretation by others. The infinite number of potential combinations of discrete units of information contributes significantly to the sense of information overload.[37]

34 Postman, *Amusing Ourselves to Death*, pp. 65–72.

35 The most famous exponents of European culture pessimism at the time evincing this attitude are undoubtedly Ortega y Gasset and Oswald Spengler. In *The Intellectuals and the Masses: Pride and Prejudice among the Literary Intelligentsia, 1880–1939* (London, 1992) John Carey gives an entertaining if somewhat caricatural portrait of the conflict between intellectuals and the masses in Great Britain, where it was exacerbated by the well developed class consciousness of British society.

36 One is that of Andrew Keen, which I will discuss further below.

37 Cf. the observation of Jos de Mul that 'The greater the freedom of choice, the

The growth of the knowledge space

With its previously listed second-tier technological properties the Internet has given new impetus to an old instinct: the gathering of knowledge. The ease and low cost with which new information can be brought on line, and the possibility of bringing together text virtually from widely dispersed locations has given the human encyclopaedic tendency a new impetus. The Project Gutenberg (1971) and its international followers (including the Dutch counterpart, the Project Laurens Janszoon Coster) are semi-scholarly initiatives with the aim of creating and distributing as many 'e-texts' of classical works as possible. In addition, there are various scholarly initiatives, in the form of so-called 'electronic text centres', of which those of the Universities of Oxford and Virginia are perhaps the best known. As the publishing possibilities of the Internet also increased outside the scientific world, individual initiatives began to flourish also.

The scholarly and private initiatives to fill the digital libraries dwindle in size compared with recent initiatives that, somewhat unexpectedly, come from commercial quarters. The largest contribution to the universal digital library is now being provided by search giant Google. The profitability of Google's search engine is directly related to the degree in which it is regarded by the user as a better finding machine than the competition. Especially non-scholarly and younger users have higher expectations than most of what they think they are able, or ought to be able, to find in the digital information space. Thus they confirm daily what the director of the national library of the Netherlands, the Koninklijke Bibliotheek, said in 2005: that non-digital books will soon simply no longer be visible.[38] So if Google wants to maintain its existing advantage, it is in the commercial interests of the company to bring on line not only new but also existing texts. This is precisely what is happening, and at a frantic pace.

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greater the uncertainty and hence the entropy … Information overload is not just about the quantity of the information, but also about the fact that the different and frequently conflicting messages increase our uncertainty about the state of affairs' (*Cyberspace Odyssee*, Kampen, 2002, p. 144; my translation).

38 Juurd Eijsvoogel, 'De stelling van Wim van Drimmelen: een boek dat niet gedigitaliseerd is, bestaat straks niet meer' (The thesis of Wim van Drimmelen: the book that has not been digitised soon won't exist any more', *NRC-Handelsblad*, 10 December 2005).

In the course of history the question of which texts were worth perpetuating has had to be asked with the advent of every new medium. This happened at the invention of writing, the invention of the codex, and the invention of the printing press. Now the same question is again at issue. But there is one important difference. In a library printed works were stored and used besides manuscripts. They were described in the same manner, to be found in the same library catalogue and to be consulted in the same library. On the Internet, encouraged by Google, people search more and more just on content. That way any manuscripts and printed works that are not digitised disappear from our ken. That makes the digitisation decision much more urgent than previous similar decisions in the transition from book to codex, or codex (and book) to print.[39] With the creation of digital copies in any case it is not necessary to resort to such measures as Ptolemy III is reputed to have taken to expand the collection of the library of Alexandria: having his customs officers seize any books on board ships that entered the harbour. That does not mean that there are no problems collecting texts in digital form, but these are mostly in the area of intellectual property rights rather than material ownership. One of the biggest constraints here is that of the copyright protection of books up to seventy years after the death of the author. This threatens to cause a significant lacuna in the universal digital library.

Inspired by Google's good (the size of the scanning operations) but also disappointing (the quality of the scans) example, its commercial competitors and library consortia have also entered the mass digitisation fray. All these digital versions of existing books end up in the same ever swelling information space that is now also being filled with film, television, radio, archives, blogs, forums, online magazines, newspapers, and scholarly journals. How large that information space is now, is unknown. The size of the Web can no longer be expressed in numbers of Web pages: so much information is now held increasingly in databases, yielding their contents only in response to a user query. At any rate, despite the enormous energies being lavished on digitisation programmes around the globe, involving information

39 Leaving such decisions in the hands of commercial companies like Google is not without risk. The Google digitisation project has little if any programmatic foundation. Decisions are mainly led by pragmatic considerations such as the accidental presence of books in contracted libraries, and restrictions set by copyright legislation.

from all disciplines, and including our vast cultural heritage, digital information still represents no more than a tiny percentage of the records created through the ages. This percentage will grow at a rapid rate, not only as a result of mega-projects such as Google's, but also because the sheer amount of information that is being produced from day to day increases at an exponential rate, and most of it is now created digitally.

However, difficult areas remain. In the analogue world, the books in which our knowledge is stored exist in the same space as the textual archives and special collections of libraries, with their correspondences, notes, reports on which much of that knowledge is based. In the docuverse nice successes are being achieved with large-scale digitisation of books and making them machine-readable. But digitising manuscript materials remains handiwork. Handwriting recognition remains fraught with difficulties. It is not obvious that it will be possible to make the same digitisation effort in the world of special collections and archives as in that of printed books. For the time being we live – and perform our scholarly duties – in a dualistic universe where vast dust-ridden archives of analogue paper exist side by side with extensive digital repositories. We will continue to need both for some time to come. But the analogue generation dies off and the new generation knows only what is digital, endangering long-term historical awareness.

Private domain becomes public domain

After the invention of the printing press a distinction grew between the manuscript as at most a semi-public expression and the press as a way of making texts fully public. The long transitional period during which such a distinction became more broadly meaningful is very well documented.[40] In the digital domain the difference between private and public has become virtually meaningless. On the evidence of the exhibitionistic ease with which people share intimate details about their personal lives on television or via the use of their mobile phone in public places this must be at least in part a broader social development. But it must be to a large extent due to the fact that the personal and the public coexist without clear boundaries in the same information space. Even if one puts information on the Net without

40 For example, by Harold Love (*The Culture and Commerce of Texts*) and by Gerd Dicke and Klaus Grubmüller (eds, *Die Gleichzeitigkeit von Handschrift und Buchdruck*).

the deliberate intention of sharing it, chances are that sooner or later it will be found by a search engine. Also, others may consider an intention to limit the publicness of certain materials less important than the author and, whether or not with evil intentions, be more readily disposed to rescue it from its obscurity. Video clips and photos are continuously posted on YouTube and Flickr against the wishes of the maker and/or the person portrayed. As many have found to their chagrin, it is virtually impossible to undo such acts of making public.

But mostly privacy and obscurity are precisely not the intent. To be findable for others is the goal from the outset – even when it comes to material about which others might perhaps be inclined to raise their eyebrows. To be able to be found and to be connected to other texts published in the huge information space that is the Internet is a major incentive to place texts and other materials there, regardless of ownership problems. Just as to be called on the mobile phone is a sign of popularity, or at least proof of existence, so it is to be found on the Internet.

The Social Web

Not only the medial content itself but also all meta-information about it is located in the same information space where the Universal Machine's massive and ever expanding variety of applications can be applied to it. This fact, joined with the two-way architecture of Internet traffic, has created the conditions for the so-called Web 2.0 environment. Web 2.0, despite the somewhat vague meaning, is a concise way to refer to a number of related phenomena that have occurred over the past few years – since about 2003. These are phenomena like the development of Web communities and services, such as social networking sites,[41] blogs,[42] and so-called

41 On the so-called social networking sites, such as Facebook, MySpace, and LinkedIn, users can create personal profiles, with biographical data, personal preferences and the relationships maintained, virtually or in real life, with others. Thus virtual communities can come into being on the basis of shared personal preferences, work, and so on.

42 Blogs (short for 'Web logs') are a popular publication platform for personal views on any conceivable subject. The shape resembles that of the diary, in which notes are organised primarily by date. By assigning descriptive tags the notes can also be grouped thematically. From personal confidences to reflections on the news or the results of scientific research, everything can be found in blog form. Most blogs are maintained by one person, but there are also collective blogs.

folksonomies,[43] and wikis, about which more below. The perception of the Web is thus changed from a structure in which a small number of providers publish Web sites for a large number of users to a platform where all users can publish their own knowledge and opinions. The focus is now on the opportunities for participation and interactivity.

It is often stressed that the innovation that the term Web 2.0 suggests lies in a changing use of existing technologies more than in the development of fundamentally new technologies.[44] Anyway, in conjunction with the huge growth in the number of users, a new way of thinking about the Web has come about.[45] And it is not a matter of just thinking: the interest in social mediums is growing rapidly.[46]

One of the best-known mechanisms to improve the quality of the collective knowledge on offer is without doubt the wiki. The principle of the wiki was invented not only to mobilise the 'wisdom of the crowd' but also to regulate it. The way it works is that everyone can both make a contribution themselves and correct the contribution of someone else. Wikis do not necessarily have to be publicly accessible. Closed wikis provide an excellent infrastructure for interest groups consisting of experts and/or non-experts to pool and organise their collective knowledge. This self-regulatory environment, as in the case of open-source software, is designed to lead to better quality. Eventually, in the process of writing and rewriting, the best information should float to the top. Whether or not that is the case in the

43 Folksonomies are taxonomies that result from non-experts collaboratively assigning descriptive tags to digital material. On http://del.icio.us, for example, users can publish their bookmark collection and assign tags to Web sites. Folksonomies are often visualised in so-called 'tag clouds', which show relations between tags.

44 For example, Tim Berners-Lee in '*developerWorks* interviews: Tim Berners-Lee', 22 August 2006, www.ibm.com/developerworks/podcast/dwi/cm-int082206txt.html.

45 How radical the social and economic impact of Web 2.0 can be is demonstrated by C. Pascu *et al.* in 'The potential disruptive impact of Internet 2-based technologies', *First Monday* 12, 3 (5 March 2007), www.firstmonday.org/issues/issue12_3/pascu/index.html.

46 Market research by Hitwise in 2006–07 showed an increase of 668 per cent (www.businessweek.com/the_thread/blogspotting/archives/pdf/Tancer%20Web2expo1.pdf). However, active participation remains still far behind the passive use of the Web.

publicly accessible wikis is not always clear.[47] An objective measure of the quality of software is rather easy to establish: for example, whether or not the software functions as advertised, and the reliability with which it does so; its robustness, expressed in the duration of the period that it continues to work without failure; security, expressed in the degree to which it is resistant to hacking. But in the atmosphere of encyclopaedic contributions to, for instance, Wikipedia less objective standards apply. Especially political and aesthetic motives appear to play a strong role in the wording of the 'facts'. In the continuing tug-of-war 'corrected' versions of articles keep being 'improved'. In a more general sense, this is the problem of the Internet already identified: the qualified expert and the self-appointed expert move in the same information space. It is up to the user to discern the difference, and that is no easy task.

The contribution of non-experts, also called 'the wisdom of the crowd', is particularly interesting in cases where automation is not possible. In the case of the above-mentioned applications the aim is for the user to make a conscious contribution. In the case of the various projects that Luis von Ahn has devised under the name of 'human computation', the Internet user is not even aware what contribution he makes (or even that he is making one).[48] Since they are playing games that are entertaining enough in their own right the users need no further motivation. Von Ahn's games are a good example of collective power when it comes to contributing to digital knowledge creation.

With the increasing involvement of the non-expert, however, again a part of the interpretive burden is shifting from the instigator of the communication to its recipient. As noted in Chapter 3, that was already one of Plato's objections to the written compared with the spoken word.[49] More generally, the emphasis in digital

47 In 2005 the British journal *Nature* examined the reliability of a number of scientific entries from both Wikipedia and the *Encyclopaedia Britannica*. The two publications were a close match. 'Only eight serious errors, such as misinterpretations of important concepts, were detected in the pairs of articles reviewed, four from each encyclopedia. But reviewers also found many factual errors, omissions or misleading statements: 162 and 123 in Wikipedia and *Britannica*, respectively' (Jim Giles, 'Internet encyclopaedias go head to head', *Nature* 438, 7070, 15 December 2005, pp. 900–1).

48 These are examples of collective tagging; see www.cs.cmu.edu/~biglou.

49 On the other hand, in the digital world this shift of the interpretation to a

communications is shifting increasingly from the transfer of knowledge (where readers can in principle remain passive, trusting their source) to the transfer of information which can lead to knowledge. The reader bears a heavier responsibility for at least the validation of knowledge, but more often also for its constitution. That shift is exacerbated by several other developments, such as the zap-like nature of the medium and the changing context in which text can be deployed. The argumentational and more generally discursive nature of the linear analogue text seems to be taking an ever less prominent place in the digital environment.

Text of typing monkeys and other quality issues

The social developments sketched so far pose especially urgent questions about the quality of the digital offerings. That average quality is often perceived as low has various causes. Firstly, there is the already mentioned low threshold to active participation in the medium, which has led to an avalanche of publications of the most diverse kinds: from scholarly data collections to personal effusions of an often toe-curling nature. Poor average quality is the other side of the coin of ease of access and lack of control. Never before in history has the ability of humans to express themselves in a public medium seen such explosive growth. Without any economic disincentive, social inhibitions, or political control, anyone can publish what they want. The traditional distinction between user and publisher is vanishing: the medium is truly in the hands of the user.[50]

Andrew Keen, a reformed Internet entrepreneur, has severely criticised what he regards as the appalling quality of the digital information space. In his book *The Cult of the Amateur: How Today's Internet Is Killing our Culture,* he compares the legion of self-publishing amateur writers, film makers, and musicians with typing monkeys who together produce an endless and depressing amount of mediocrity. Keen's reaction to the way the Internet has developed in recent

later point in the communications circuit is somewhat offset by the previously reported shift to an earlier moment when findings are shared: by people in general, for example through blogs in the public space; by scholars in their own scholarly circuit.

50 One of the interesting side effects of unbounded popular access to the digital writing space is that it may well have increased writing activity overall. Blogging, MSN messaging, updating FaceBook pages, sending SMSs are all social forms of writing that hardly had an analogue equivalent.

times reflects the widely shared view that the democratic idea on which the Internet was founded has tragically derailed.

A related issue is the perceived lack of moral tone. It is true that the level of rantings and ravings is high. The ease with which people tend to give their uncensored opinions seems to invite eye-for-an-eye, tooth-for-a-tooth reactions. While speculation about the cause abounds, it must be admitted that the medium's anonymity is very likely a contributing factor.

A very different quality issue concerns the precision, or rather the lack of it, with which existing information is being digitised. The new – born digital – information is not always reliable, but also the transfer of existing information is not always good. The reliability of Google's scanning and OCR, for example, is often criticised. The absence of the traditional economic model for the publication of this information is likely to be one cause.

This, and such a phenomenon as text disappearing, add to the perception that the digital environment does not live up to the standards of the book that is so familiar that it has come to serve as our gold standard. Its instability is one of the most striking features of digital text. Digital texts are often here one day and gone the next. Even more easily than a piece of paper – let alone an entire book – a digital text can be destroyed for ever. Even if a copy has been preserved somewhere, the integrity of that copy is not guaranteed. Just as easily – but much more difficult for the reader to see – the text on a Web site may have been changed without any account of the changes being rendered. (In many Web pages published under some form of editorial responsibility changes are well documented, as in the case of Wikipedia. But publishing on the Internet is not reserved for responsible publishers.) The ease with which a digital text can be changed unfortunately goes hand in hand with the invisibility of the change. Thus readers are hard put to know which version of a text they are reading.

Coming from a typographical world, we are too easily tempted to experience instability mainly as a form of unreliability or untrustworthiness. It may be necessary to take a slightly different view of the phenomenon of instability. It is after all precisely by the grace of that property of instability that the entire digital docuverse exists at all. Moreover, the network preserves much, too, which inadvertently makes for greater permanence than is often assumed. Saving occurs both intentionally and unintentionally. In the first category

belong, for example, Internet archiving projects and the creation (for whatever reason) of local copies of material published elsewhere on the Web; the second includes the copies generated on the client computer or in caches on proxy servers as a result of consultation and distribution. As was already argued in 'The end of the copy' (one of the second-tier properties of digital text) these copies are not functionally distinguishable from the original. However, the fact that those files are no longer in their canonical location (URL) does cast doubt on their integrity. The least we can do is learn to live with this instability, which is not only useful to a degree that we don't always recognise, it is after all also technologically determined. That is not always easy to accept for *homo typographicus*. It is precisely our ever-growing historical awareness (which is linked with our medium use) that ensures that we are fully aware of the importance of our textual record to our identity.

To discard documents deliberately is one thing; letting them languish (as a result of 'link rot' or not migrating outdated formats) is something else. Yet this too is a typical problem of digital technology. Unless actively resisted, digital ageing is inevitable. Digital ageing has two main causes: the physical deterioration of the physical supports, and digital obsolescence, from changes in hardware, storage format and operating system and application software. There are strategies to deal with it, such as renewal of the physical substrate and/or making copies; the migration of file formats or operating systems; and the emulation of hardware platforms, operating systems or applications. Conscious preservation is without doubt one of the biggest challenges of the digital era. The efforts made to achieve digital longevity – preservation of digital documents and ensuring access to them in the long term – in the constantly evolving hardware and software environment may be great, but the speed of change – and thereby the process of ageing – is increasing all the time.

Status of digital information

All these aspects of quality and ephemerality jointly lead to profound questions regarding the value and status of digital information. The deterioration of the status of text in a digital environment is an insidious but not necessarily new phenomenon. With every cheap edition of the classics ever published something of the 'aura' of the original artwork was lost. Indeed, the whole idea of 'the original' has been severely compromised by the invention of printing. Yet the digital

medium has marginalised the notion of the original even further. In a sense, this is paradoxical. After all, digital copies cannot be distinguished from the 'original'. But even if the same quality can be ascribed to each digital copy as to the 'original', the value of both is nevertheless irrevocably lower, on the same economic principle that makes a mass paperback less valuable than a copy of a book composed and printed by hand in a limited edition. For this devaluation to occur, no actual copies even have to be made. The awareness that the 'copying press' built into the document has the potential to keep running indefinitely suffices. This, combined with the already mentioned instability and low average quality of what is on offer on the Internet, results in an inevitable sense of expendability. In other words, the content is tainted by its form.[51]

Internationalisation

The Internet is global and in principle knows no boundaries. The market for information, commercial or non-commercial, is by definition largely global. One of the ways in which this becomes evident is through the use of English as a lingua franca. Not only is English the language of the communication itself, it is also the technical meta-language that makes communication possible. HTML and XHTML – the code languages that make the Web possible – can use only English tag names because browsers read only English. In principle it is possible to use the meta-language XML to write markup languages in any human language that can be displayed in Unicode. For practical reasons, however, XML is predominantly written and used in English, precisely because XML is designed as an interchange format. The use of, for example, Arab element names would mean that not only could these not be read by people who don't understand Arabic, but also not by non-Arab software and more generally not by

51 It is possible that, while the significance of the book in the transfer of information (as opposed to leisure) decreases, paradoxically the iconic significance of the book as a cultural medium increases. This would in any case be one possible explanation for the fact that the number of books sold is increasing (for the Netherlands see, e.g., the GfK *Jaargids 2008*, chapter 19, 'Lezen en gamen favoriete vrijetijdsbesteding' (Reading and gaming favourite leisure pursuits), while the time spent actually reading decreases (see, e.g., Frank Huysmans, 'De openbare bibliotheek in Nederland en de veranderende leescultuur sinds 1975' (The public library in the Netherlands and the changing reading culture since 1975), *Jaarboek voor Nederlandse boekgeschiedenis* 14 (2007), pp. 179–92).

computers that are not equipped with an Arabic writing system. A certain cultural homogenisation is the inevitable result.

Also in the case of non-linguistic modalities, which play a growing role on the Web, there is a certain homogenisation in evidence. Communication is often supported with sound, colour, and graphics, which are less language- and culture-bound than text. The Web interface too mutes cultural differences. While a Japanese book differs from a Dutch book by needing to be read from back to front, a Japanese Web site does not have to be read from bottom to top. Because the technological constraints (such as the use of HTML) are equal for any language, the entire typographic and multimedia information space tends towards international convergence.

Globalisation leads to new social relations, but also to other economic (commercial) relations (see further 'Communities' below). The instruments for international regulation lag seriously behind this tendency. On the one hand local decisions may have international implications; on the other hand local laws are often inadequate when it comes to a medium that is by definition international.

Communities

Someone who reads isolates him- or herself and simultaneously is part of a community of readers, in particular readers of the same book. That readers are alone with the text they read is often observed to be a characteristic that distinguishes written communication from oral communication.[52] This is not only a social consequence of the technology, it is also the result of the demand that the physical activity of reading makes on the brain.[53] But, in addition to the isolation of the direct physical environment that is created by reading, the book also offers access to a virtual spiritual community. As long as reading was the privilege of a small group in society this sense of community did not even have to be about a particular text. Merely being able to read meant being part of a small, select social group. Now that reading is no longer reserved for an elite, the actual content – a specific text or genre – plays a larger role. Such a community does not have to exist synchronously; the reading experience can be shared with people at another place and time. Like a book, a computer screen isolates the reader of a digital text from his or her immediate surroundings.

52 See, for example, Ong, *Orality and Literacy*, p. 74.
53 Cf. Greenfield, *Tomorrow's People*, p. 58.

But, just as with a book, through a computer screen the reader can also participate in a virtual community. In fact the screen – provided that it is part of a computer that is connected to the Internet – offers even more opportunities for that. The screen provides a vista of a communicative world without borders. The sense of community lies not only in the experience of a virtual connectedness, but also in actual and interactive communication. This may also find other than written expression, for example through moving images (webcam) or audio (Voice over IP, or VoIP). However, in some respects the screen can limit the sense of community, too. It is a technological property of printing that it is profitable only in a certain print run. The idea of wider dissemination is a core property of the technology of printing. It is precisely one of the salient characteristics of the digital medium that there is no minimum 'edition size'. That is to say, the mean size of the digital audience may be much lower than that of the print audience. A tension thus becomes discernible between, on the one hand, the (potential) global reach of the Internet as a medium and, on the other, the medium's ability to reach small, previously not economically or technologically accessible, communities: a niche audience. Digital publication can respond to a very individualised interest much better than print can. 'Publishing' has always been regarded as a form of broadcasting, but it is starting to make the transition towards narrowcasting even now. Online database publishing of scholarly periodicals, for example, allows such narrowcasting much more readily than print-based publication of the same material. The limits to what individual readers could find are in fact determined not by lack of material to their liking but by the scarcity of their time and attention: the so-called attention economy.

The narrowcasting capabilities of the Internet will obviously have an impact on the sense of community. If it is assumed that communality is an important basis for certain processes (such as, notably, democratic ones) that have a utility or are prerequisite for the way society functions, this could have all sorts of social consequences. However that may be, the global nature of the Internet puts pressure on the notion that 'imagined communities' are supposed to be based on geographical closeness. If the public sphere of shared political, economic and cultural interests will be replaced by imagined communities on the basis of purely personal interest, this may benefit the individual, but not necessarily the community of which they are part geographically.

The interface

'Interface' is typically defined as human–machine interaction. In particular, the term is mostly used for the way humans can control the computer's software: the operating system and applications. All modern computer interfaces now being of the Graphic User Interface (GUI) type, they use Windows, Icons, Mouse, and Pulldown menus (WIMP). This digital interface is almost always quite emphatically present. The screen on which the digital text and other information is presented to the user always provides a significant number of buttons, icons, and pull-down menus. Depending on the computer's operating system and the application being used, this arsenal of controls on two different levels (of operating system and applications) can, to a greater or lesser extent, form a unit.

But the operation of the software is just one part of the human–computer interaction. Two further elements which contribute to ensuring access to digital text need consideration. One element is the representation of the text itself (within the operating and application software) and the other is the decisive contribution made by the hardware.

As regards the representation of the text itself, presentation software (mainly browsers) offers quite modest possibilities for variation. As far as the WorldWide Web is concerned, the bandwidth of this variation is fully determined by what is pre-programmed in browsers. There (X)HTML and XML are the standard exchange languages. It is precisely the requirements of interchange that impose restrictions on the presentation, in spite of all stylesheets' possibilities. At first glance this seems to apply to a lesser degree to another exchange format, the popular Portable Document Format (PDF), which perfectly emulates the typographical capabilities of print. PDF was devised to get better control over the instability of digital form and it has proved a very effective solution. PDF files are platform-independent and describe the typographical shape of every page with exacting precision. Yet certain restrictions persist, perhaps precisely because of the implicit reference the format makes to the typographical capabilities of printing. The user will always remain very conscious of the screen as a kind of frame through which he looks at an image of typographically shaped text. This effect is further strengthened by the fact that the operating system usually remains – more or less emphatically – present in the presentation of the text.

The screen as a frame draws attention to the determining role that

the hardware plays in the interface. In practice, a user usually works with a single screen, on which all digital information is displayed. Therefore it is always the properties of this single screen that determine the representation of all information, regardless of the potentially very diverse nature of that information. This screen is always rectangular, almost always landscape-oriented, full-colour, and backlit. Moreover, current display technology is characterised by a low resolution, which also severely limits the typographical possibilities. Few fonts prove properly legible on the screen. Instead of the unity between content and form that occurs in the case of printed information (which is determined by the publisher) the presentation of digital text will thus be adapted to and determined by the hardware. All this makes for a high degree of uniformity. Besides the computer screen there are screens of mobile phones, PDAs, e-book readers and so on. But, again, the shape of the screen remains the same per hardware category whatever the information that is being displayed, and so largely determines the representation. Only the newest generation of e-book readers uses a fundamentally different technology. Their black-and-white screen is reflective and has a high resolution, but the technology is only in its infancy. Here at least the role of the operating system and application software are potentially less intrusive, since these are basically single-purpose devices (which is, however, at the same time their besetting weakness).

The author or publisher of a digital text therefore has relatively little control over the form in which it reaches the reader. On the one hand this is the result of the restrictions imposed by the hardware and software, leaving only limited influence on the way in which it is displayed on the screen of an individual user. This low bandwidth makes for a certain homogeneity of form. All digital texts, regardless of provenance or quality, look identical. On the other hand individual readers – within the same limits – have the freedom to determine what form they want to impose on the enormous diversity of as yet 'unformed' content to which they have access. Users can adjust the interface to their own tastes and preferences through both pre-programmed 'skins' and fully self-programmable elements. The limited control the publisher of digital text has over its visual appearance, added to the consumer's own influence, makes for a situation that is diametrically opposed to that of the book as a medium. The book features an unbreakable nexus between content and form, the form being fully determined by the publisher. From the moment

that form is fixed, the text can be relied on always to present the same content in the same form, offering exactly the same presentation for every reader everywhere. It is this characteristic of printing which has enabled all sorts of subtle typographical distinctions to become so firmly lodged in the collective (un)consciousness of *homo typographicus*.

It is instructive to carry the comparison with the physical book a little further. It works in two directions. Armed with our new knowledge of computers, it appears that the book – without our knowing it – also already had an 'interface'. Just as in human–machine interaction the interface is an informational layer that offers the user functional access to the 'content' of the computer, the book as a reading machine also has functional properties that offer the reader access to its content. Together these form the 'user interface' of the book. This includes, materially, the form of the codex (which unlike the scroll allows browsing) with its characteristic rectangles of text, surrounded by white; the reading direction, both of the lines on the pages and of the pages in the book; the presence of such ordering elements as page numbers, table of contents and index; the canonical order of the elements that make up a book; and the presence of identifying title, author, and other publication data on the binding, the cover, the title page, the colophon (or reverse title page). In a less material sense it also includes the use of these elements in reference systems such as footnotes and bibliographies. Also characteristic of printed texts is of course that their physical form as a unit coincides with the unity of content, while digital texts are submerged in the docuverse.

The digital text forms that are becoming so important have freshly opened our eyes to the by now so intuitive way in which books provide access to the text. The interface of the book is so self-evident that instructions for its use are unnecessary. It is its predictability and familiarity that make the book's canonical user interface so intuitive. The history of page numbering in Chapter 3 demonstrated that this predictability and familiarity arose only slowly. Gradually the concept of the book has become increasingly predictable and reliable. It goes without saying that you always know where you are in the text, by the presence of page numbers, headers, or footers, but also by the thickness of the part of the book already read in relation to the unread part. Between the beginning and end of the book the page numbers go up. The thickness of a book allows you

to estimate – roughly – the extent of its content – something that is made possible by the conventions that have come to determine the choice of format of the book, the type size, and the proportional relationships between them. Our familiarity with the conventions is such that a single look at the physical form allows us to determine very reliably the nature of any printed text. Drama or prose, children's book or scholarship, entertainment or newspaper: they can be easily recognised from a distance without any conscious effort or thought.

Conversely, looking at the digital textual medium armed with a thorough knowledge of the book, the clumsy nature of the digital interface contrasts sharply with that of the reading machine that the book has become in the course of time. We are so familiar with the interface of the book that we are hardly aware any more of the intuitive way it works. In the case of the digital textual medium, it is often still necessary to have recourse to such instructions as 'Click here to go to the next page'.

The book interface offers achievements which have come to be appreciated as a great good. As a result of both the extent to which we are conditioned by our familiarity with the book and the continuity in function between book and digital text, we expect involuntarily and unconsciously to find in the digital medium some of the properties of the book interface. What are then found lacking in the comparison are things like a digital alternative to the concept of the page, and a typographical form language that is subtle enough to be able to recognise genres. But also, for example, the fact that a text once printed no longer changes, appears to be a useful property that is often sorely missed. Not only does the analogue text as a whole always remain equal to itself, but a certain passage in a book always remains firmly anchored to a physical location in its layout. For example, a reader may even remember to have come across a certain remarkable observation 'somewhere at the top of a left-hand page'. It is also these properties that enable the impressive granularity of our bibliographic referencing system. This is the type of certainty of the printed text and the comfort it provides that are sought in vain in the digital world.

The whole digital interface bears the heavy stamp of the software and hardware that define it. They restrict the possibilities for familiar interface elements of the book to be translated into the digital environment. But how bad is this? It makes no sense, after all, to wish ourselves a horseless carriage. It may be a technologically

fascinating challenge to create a faithful translation from one interface to the other, but how useful is it to try to transplant every feature of the book interface to the digital environment? Does our future really lie only in the past? Had not we better ensure that the digital interface does justice to the inherent properties of digital textuality? Should the digital interface not exploit the fluidity of the digital text, its non-linearity, the possibilities of non-verbal communication that result from the use of other modalities, instead of treating them as problems to be resolved? For example: what kind of 'meanings' may hyperlinks have and how can they be expressed? How can we enrich the specific digital 'form language', typographically or otherwise? How can users gain a better representation of the nature and extent of the text that is being accessed through their screen at a given moment? It is precisely the fluid, virtual form of all digital text that forces the question how its visualisation can best do justice to the content.

From this viewpoint, that the digital interface must do justice to the inherent properties of digitality, it is easy to believe that it is only a matter of time before the interface to digital information begins to crystallise and appear as familiar as the predictably unequivocal interface of the printed book. That would, however, be a dangerous assumption. That notion misunderstands the dynamics of the digital medium. Not only is the digital interface still evolving, with new navigation methods as well as new *standards* for navigation continuing to be developed for the foreseeable future. It is also unlikely that a digital interface will ever be 'finished' in the way the book's interface is. The computer is, after all, a Universal Machine. In the meantime, the expectations based on our familiarity with the book are not likely to disappear quickly either. For the book itself will not disappear quickly from a society all of whose institutions are intertwined with books and print.

Conclusion

In Chapter 1 I introduced the concept of primary technological properties of mediums and suggested that these may provide an explanation for certain second-tier symptoms, which in turn cause social effects. In Chapter 3 I showed how this mechanism works in the case of the introduction of the printing press. In this chapter I have applied the same approach to the digital textual medium. It is

clear that in both cases there are indeed far-reaching social effects that can be traced back to certain primary technological properties. What picture emerges if we look at the social impact of the introduction of the digital textual medium?

Many of the phenomena discussed in this chapter can be placed under the general nomer of the democratisation of the means of publication. For someone who got stuck in the era of the printing press, and had missed the development of the digital medium, the current situation would have been utterly inconceivable. As an alternative to the typewriter, authors now have available a computer and a word-processing application. For the publication of their writings they now have that same computer on which they have written them, which serves as an alternative to the triad of printer–publisher–bookseller. The computer-in-a-network – again the same device that runs the word-processing application – does in a matter of seconds the hard work of distribution that used to take months. And it does not stop there, because the reactions from readers can be expected to start flowing in – again on the same apparatus – almost immediately. Authors can read these comments themselves but, if they choose, they can offer to share both their work and the responses it evokes with all and sundry – and react again to the responses. That is a form of direct two-way traffic that is totally alien to the world of print.

In one fell swoop the possibility of self-publishing has removed the entire slowly grown system of authorisation that belongs to the traditional publishing process. That includes the control of quality that the publisher used to exercise. At the other 'end' of the communications circuit the same applies. The value of the intermediary role of libraries as instruments of regulation and ordering and bookshops as instruments of selection is absent in the docuverse. As a result the reader is confronted with materials of very variable quality and diversity, mixing information intended for a larger public with very private information in one textual space. Moreover, all that information is connected: readers need to pick their own route through the abundance of – fragmented – information. For this they can click on hyperlinks, but also search by content with the help of search engines. Either way users can zap their way from one piece of information to the next. The multimedia quality of the Internet encourages that: it is the same consumption behaviour to which the television viewer is accustomed.

The status of digital text is adversely affected by its varying quality. This is reinforced by the here-today-gone-tomorrow (or at least changed-tomorrow) character of Web texts. This means that the digital medium represents a momentous break in the historical evolution towards ever greater permanence of the repository of human knowledge. The flexibility that characterises oral knowledge disappeared when knowledge was put in writing. Instead a degree of permanence and objectivity emerged. In the tradition of manuscript transmission this still remained somewhat limited, due to the fact that in the process of copying small adjustments could continue to be made, consciously or unconsciously. With the production of printed matter began an irreversible and unstoppable process of stabilisation and canonisation of knowledge that gradually led to the monumentality that we have come to associate with print. The process is reversed by the digital medium, placing a heavy interpretive burden on the reader's shoulders and making high demands of consumers' critical faculties.

In addition, the digital medium is not limited to the simple transfer of text. It is hardly even possible to separate the medium and its conventional functions of production, distribution, and consumption represented by the communications circuit from what the Universal Machine can do.

The list of social consequences of the inherent technological properties of the digital medium above ended with the instability of the digital interface and the difficulty of translating familiar elements from the interface of the book to the digital environment. This very method, of drawing parallels with other textual mediums, has of course been suggestive of continuity. Indeed, in Chapter 1 I myself introduced the concept of continuity in textual transmission, from handwriting to print to digital. I did that primarily on the basis of the *function* of transmission: in all cases the purpose is to transmit texts from one person to another that have in some way been 'inscribed'. In this chapter I have again suggested continuity in many ways, for example through the use of the same term, 'user interface', for both books and the digital medium in the last item on the list of social consequences. At the same time, however, every item on the list has shown major discontinuities between the social consequences of print and digital textual transmission. Based on this survey, it must be concluded that the degree of social continuity is much less than one may involuntarily have come to expect from the functional

continuity between these two technologies and the fact that all sorts of conceptual correspondences can be recognised between them. The conclusion seems inescapable that not only the technological characteristics of books and the digital medium but also their social consequences are indeed very different.

6

Coda

> So the whole question comes down to this: can the human mind master what the human mind has made?[1]

Digital text and the Order of the Book

In Chapter 3 I posited that we are still living in what I have called the Order of the Book. I suggested that the book, in its material form and its institutionalised social role, represents a particular way of regarding the world. The material form of the book makes it an instrument that naturally favours the creation of lasting records of human thought, and that naturally imposes a hierarchical, orderly, and linear order on those records. Books are self-contained, unchangeable, authoritative: monuments of achievement. By extension, in a literate society like ours, an education system based on books favours a hierarchical, orderly, and linear way of thinking. In this manner the Order of the Book strongly influences – even determines – our way of conceptualising the world.

In Chapter 5 I argued that the digital textual medium, by contrast, constitutes a more level form of cultural transmission: democratic, fluid, tending towards disorder, consisting of endless chunks of textual matter, connected actively and deliberately through links, and passively and potentially through search queries, allowing endless permutations and recombinations. Moreover, these text chunks also find themselves in the company of chunks of other modalities, in equally rich variety and quantities. The well governed and orderly textual world in which everything has its place is being confronted by

1 Paul Valéry, quoted in Langdon Winner, *Autonomous Technology: Technics-out-of-control as a Theme in Political Thought*, Cambridge MA and London, 1977, p. 13.

a docuverse of text and other modalities that is decidedly disorderly, even anarchic. In this universe texts behave in ways never before encountered, defying our attempts at control – at least when we apply the methods familiar from the Order of the Book.[2]

That digital texts may be collections of ones and zeroes residing on a disk instead of being a pile of paper; that such a disk may be accessed from anywhere in the world now that it is connected to the digital network; that those texts remain in a permanent state of flux: the implications of the new, virtual nature of text are only just beginning to become clear. The docuverse is characterised by mushrooming quantity, but also by lack of recognisable standards to judge quality, and by impermanence. It is intensely connected and truly global, but also highly fragmented. It comprises not just text in the narrow old-fashioned sense defined in Chapter 2, but also 'texts' in the wider sense given to the word by Don McKenzie:

> verbal, visual, oral and numeric data, in the form of maps, prints, and music, of archives of recorded sound, of films, videos, and any computer-stored information, everything in fact from epigraphy to the latest forms of discography.[3]

In McKenzie's Order of the Book all of these heterogeneous categories of text forms – including, we note, the distinct category of 'computer-stored information' – remained neatly and meaningfully distinguishable. On the Internet, however, all such 'texts', regardless of modality, now assume the same ethereal form of ones and zeroes. The written texts that used to be read in dedicated concentration and silent union between writer and reader, separate from any engagement with other mediums, are now moving into a larger medial universe where they compete with all the other texts clamouring for attention. What is more, those competing texts are no longer content to lie waiting patiently till a curious human deigns to turn enquiring eyes to them, but they insinuate themselves continuously, through inviting hyperlinks, through trawling searches, and even through dancing icons and beeping alerts, and active RSS feeds.

2 See Adrian van der Weel, 'New mediums: new perspectives on knowledge production' in *Text Comparison and Digital Creativity*, ed. Wido van Peursen *et al.*, pp. 253–68. In *Everything Is Miscellaneous* David Weinberger suggests useful strategies as an alternative to our instinct towards control.

3 D.F. McKenzie, *Bibliography and the Sociology of Texts: The Panizzi Lectures, 1985*, London, 1986; enl. edn, Cambridge, 1999, p. 13.

The absence of entrance barriers in this heterogeneous docuverse has thoroughly democratised the means of textual production and dissemination. Anyone may publish anything, of any quality or quantity, subject only to legal restrictions – and even these tend to be easily circumvented. When the need to select – which dominates conventional book production – falls away, writers and other information providers don't have to limit the extent or nature of the materials they publish in any way. Think of the way analogue photos involve film that needs to be developed, with prints made at a certain cost per photo. Compare that with taking digital photos, at virtually no actual cost, in quantities limited only by the capacity of storage memory, whose cost keeps dropping steadily.

The way these digital texts are consumed is very different too. Once networked, their full text can be searched as a body. This new form of access replaces the identification, location, and searching of relevant texts through the conventional bibliographical mechanisms that reigned in the world of print and imposed a hierarchical order on them. It brings novel ways of finding, promoting serendipity, but it also stimulates a sampling and zapping manner of reading. This way of consuming text is not unlike the way image and sound are consumed in today's world of multi-channel television and the seas of 'songs' that have replaced the 'albums' of yore. The search algorithms employed by various search engines may order their results in any number of ways, but whatever that order may be, those results will in no way resemble the outcome of conventional analogue searching, using card catalogues, indexes, footnotes, and the browsing of physical books. Where the use of consciously designed hyperlinks is still vaguely reminiscent of the print practice of footnoting, search engines offer an entirely new experience, for which no ready parallel presents itself in the Order of the Book.

One of the less obvious, and therefore more insidious, effects of the digital medium on the consumption of text concerns the shift of the interpretive burden on to the shoulders of the ordinary reader/user. As a result of the lack of restraint on publication imposed by the digital medium the tendency is clearly towards the provision of ever more data, including notably also more raw, unpolished materials. For example, in addition to an authorial narrative, argument, or interpretation based on certain sources, the sources themselves may be presented. Sources can be published in the shape of an addition

to the authorial narrative,[4] but they may also, by extension, and more radically, take the place of the authorial narrative, leaving their interpretation to the reader. The cheapness of disk space and the absence of entry barriers means that anyone may place anything on line. The fact that something is 'published' on the Web thus says nothing about its status in the range between what in the Order of the Book would be called, say, source, note, draft, or polished final product. Moreover, not all final products will be polished and bear the seal of a publisher, library, or other organisation which may be trusted to have applied certain known or inferable selection criteria to it. It is then left to readers to sift through the vast mass of materials available in the digital document space with the help of any devices they can muster. The use of search engines or portals to *locate* resources is the easy part. The challenge begins when it comes to judging the status and quality of the material found. In the Order of the Book the distinction between materials 'touched' by the instruments of the actors inside the traditional knowledge system and those not so privileged always used to be a vital one. In the digital arena the distinction is harder to make, especially as the number of participants grows, but also more relevant. Here the familiar bibliographic aids (including the metadata that replace them in the digital realm) must be supplemented by – in so far as they don't give way altogether to – new ones, such as collective tagging, user commenting, or aggregating services. Ultimately the onus is on the individual, not just as a passive consumer, but also as an interpreter, for himself and others, of the nature and status of the texts he encounters and consumes.

Employing a single perspective (that of book history) to the sequence of textual mediums that has culminated in the Internet has thrown into sharp relief – and due detail – the enormous scale of the medial shift that is going on right now. It shows that there is, in fact, considerable discontinuity between print and the digital textual medium. However, when imposing this single perspective at

4 See the idea of a 'layered' book developed by Robert Darnton in 'The new Age of the Book', *New York Review of Books*, 18 March 1999, www.nybooks.com/articles/54. In scholarly publishing this has been conceptualised as enhanced or enriched publication (see William W. Cope and Mary Kalantzis, 'Signs of epistemic disruption: transformations in the knowledge system of the academic journal', *First Monday* 14, 4, April 2009, www.uic.edu/htbin/cgiwrap/bin/ojs/index.php/fm/article/viewArticle/2309/2163.

the outset of this book, I did so on the assumption that the shared textuality of manuscript, print, and the digital textual medium would make for continuity before anything. And indeed, while I have been emphasising the discontinuity, there is undeniably continuity as well. The publication in a digital form of texts that used to be published and distributed as, say, printed journals or books surely constitutes an obvious case in point. Moving the contents of the *Encyclopaedia Britannica* on line has perhaps changed how it may be used, but it did not fundamentally change the text itself. The resulting digital publication remains what it always was: an encyclopedia under strict editorial design and control whose contents are widely regarded as trustworthy. When a newspaper like the *New York Times* runs a Web site with the same content in parallel to its printed edition, the impressive digital archive spinning off it represents a fantastically useful additional resource, but the articles presented to readers every day on the Web are still largely the same as the ones delivered to the subscriber's doorstep. Books increasingly have a hybrid existence on paper and as a digital file for download, as, for example, the titles Amazon.com offer for their Kindle e-reader. (All this is apart from the fact that most printed books today start out their lives as digital files. That, regardless of how they end up being consumed, all texts are derived from digital files is a crucial aspect of that part of the digital 'revolution' that is not immediately obvious, and perhaps still remains largely a potentiality. Remember the example of the music industry mentioned in Chapter 1.)

A more fundamental continuity lies in the fact that the digital textual medium in being textual depends on the same dual skills of reading and writing as do manuscript and print. Text is processed in the brain differently from the (moving or still) images that we watch and the sounds (speech as well as non-speech) that we listen to, even though all now find themselves in what looks like one homogeneous medial space. This distinct form of cognitive processing is why I placed the textual mediums together in a category of their own. Whether by stylus and clay tablet, pen and paper, or keyboard and screen, writing means committing thoughts in the form of readable characters which enable those thoughts to fly out over time and space to be read. It is the same writing and reading skills – taught in schools using manuscript and print – that are carried into the digital realm. Thus text, regardless of medial form, remains the chief way

in which knowledge is transmitted. This must rank as a powerful manifestation of continuity, surely.[5] In view of the fact remarked earlier, in Chapter 2, that reading is a far from natural brain activity, however, it is worth contemplating that, if it wasn't for the fact that our education system remains firmly based on books and literacy, the digital medium would probably be a great deal less textual in nature.[6]

On a meta-level, too, there is a particularly noteworthy form of continuity. This is the fact that mediums themselves foster social and technological change. It should not be surprising, therefore, that mediums themselves are not immune, either, to mediums as agents of change. Among the more gradual changes the book has brought about is, for example, the almost imperceptible shift over the centuries in the social position of the book itself. As the Order of the Book established itself the book's interface remained hierarchical, orderly, and linear throughout. The content and appearance of books, their quantity and price, meanwhile underwent drastic changes. In their wake, the book's position in society transformed subtly but inexorably. That the Bible was the first product of the printing press was nicely symbolic of the book's social status in the mid-fifteenth century. Since all knowledge, and so in a sense every book, was claimed to derive ultimately from that one first source, the first generations of printed books could be said to bask in the light of The Book. When by the time of Copernicus humans were losing their unique place in the cosmos, people had to get used to the notion that the world could not only be explained and understood,

5 Although the current state of affairs may be transitional (with a natural generational growth of the number of 'digital natives') there are suggestions that the multimedial and distractive context of digital reading, and the very different haptic experience, make for cognitively significant discontinuity. See, for example, Anne Mangen, 'Hypertext fiction reading: haptics and immersion', *Journal of Research in Reading* (2008), pp. 404–19, and Terje Hillesund, 'Digital reading spaces: how expert readers handle books, the Web and electronic paper', *First Monday* 15, 4 (5 April 2010).

6 'We humans were never born to read. We learn to do so by an extraordinarily ingenuous ability to rearrange our "original parts" – like language and vision, both of which have genetic programs that unfold in fairly orderly fashion within any nurturant environment. Reading isn't like that. Each young reader has to fashion an entirely new "reading circuit" afresh every time. There is no one neat circuit just waiting to unfold,' Maryanne Wolf is cited as saying in the thought-provoking contemplation 'Does the brain like e-books?' (*New York Times*, 14 October 2009).

but actually be *made* by humans. Vice versa, if the world, and humans' place in it, was not fixed, people had increasingly to rely on their own observations and rational thought. Scientific explanation began to rival religious truths. The instruments humans were building were capable of showing them how things worked, taking the mystery of God out of the equation. The products of the printing press no longer had to be sanctified by divine authority, and knowledge was no longer sacrosanct. In effect, as knowledge became human-made, it became ever more subject to change. The digital medium, which enables more people to participate in the production of knowledge, has further accelerated this process.

It was the invention, first of writing, but more so of the printing press, that speeded up the process that ousted religion from its controlling and secure place at the apex of human knowledge, and encouraged its replacement by the combination of scientific observation and human reason that we have come chiefly to depend on since the Enlightenment to make sense of the world and our place in it. In writing and printing we created instruments that allowed us to create an unlimited range of further instruments of exploration and creation, fostering the illusion that we have control over the world. Paradoxically, by the late nineteenth century the sheer quantity of books, and their common availability in smaller, lighter, cheaper, and thus ever more ephemeral formats, had begun to undermine their own authority. This was the case even if they continued to present the same kind of content, which increasingly of course they did not. In addition to books as products of the eternal search for truth – whether that was scientific, philosophical, or religious – more and more books became sources of fleeting entertainment. As the majority of books that came on the market moved into the realm of recreational reading they were ready to be treated more casually.

In this process of democratisation of knowledge, some of the qualities that I have just attached to the digital medium were already prefigured. The book's ubiquity had made it a democratising force, as well as imbued it with the same sort of recombinatorial potential that characterises the digital medium. The more books were being produced, and the more widely they were available at affordable prices, the more they represented a fount of knowledge to anyone with the inclination and intellectual ability to improve their understanding of any field of human endeavour. The same changing circumstances allowed readers all the more readily to find their own,

uncanonical, way through that knowledge.[7] As in the case of the digital medium, not all that was made public deserved the label of 'knowledge'. The deluge of reading matter, popular or otherwise, was a concern to people around the start of the twentieth century no less than is to us the uncontrolled information explosion of the early twenty-first.

The changes in the place of the book in society took place gradually, in some cases over a period of centuries, and their impact is not comparable to the immediacy of the transformations in the field of dissemination and consumption that the digital medium has brought with its two-way Internet traffic, its ready accommodation of the smallest and most widely dispersed communities of like-minded souls, its wealth of free access to the broadest range of products of the human mind. However, even if the *nature* of the changes in the Order of the Book did not resemble these digital transformations, and even if they were only slow and incremental, yet underneath the semblance of order still exuded by the book's unchanged interface and reinforced by the long-established infrastructure of bibliographical control, the transfiguration of the textual world had already begun. Certainly the precipitate *rate* of change from the end of the nineteenth century prefigured the turmoil of twentieth-century developments in the sphere of new mediums.

The transformativity of the digital medium

> When technology extends one of our senses, a new translation of culture occurs as swiftly as the new technology is interiorized.[8]

Over the course of the preceding chapters it has become clear that, more than merely attending on social change, medial change facilitates and even actively initiates it. Visionaries like Vannevar Bush and Douglas Engelbart saw a role for technology in enabling new ways of information processing. They were clearly aware that this amounted to more than just another, more convenient, way of arranging the same information. It is obvious, for example, from the title of Bush's essay 'As we may think' that Bush regarded his Memex as enabling different ways of thinking, which was also what Engelbart thought

7 Jonathan Rose documents many, some very moving, cases in *The Intellectual Life of the British Working Classes*, New Haven CT and London, 2001.

8 McLuhan, *Gutenberg Galaxy*, p. 40.

of his revolutionary text processor. In Chapter 1 I declared it my working hypothesis that, like language, mediums have an influence on the way we think and, by extension, on our construction of the world. It was in search of the causes of this influence that I wanted to explore the salient features of the textual mediums. In Chapter 5 I argued that a large number of social effects can be attributed to secondary, and these in turn to primary, properties of the digital medium. The detailed analysis of these effects has provided a great deal of evidence for the notion of medial transformativity.

In the meantime, of course, the transformative potential of the digital medium has by no means been exhausted. The number of digital-born documents has grown exponentially, and many analogue texts have already been turned into digital ones, extending the way they can be used. But it is still a relatively new realisation that some of our ingrained typographical habits are not standing us in the best stead in a digital environment. As more digital texts are created they will increasingly come to reflect their digital nature. That is to say, we will write differently, and we will write different things. In addition, the development of the medium has not come to a close. Like the Universal Machine, whose expansive nature they inherit, digital text and the digital medium will develop further. (How, we cannot know, but in 'The textual future' below I hazard a guess or two.)

Since we find ourselves in the midst of these changes it is too early for any pronouncements on how the digital medium's transformative properties will affect the way we may think in the longer term. As a matter of speculation it is not really part of the subject of this book. But that does not mean that nothing can (or should) be said about it. A few commonsense inferences can be drawn, based on the observations made so far. That a shift in textual discourse is taking place from an author-centred to a reader-centred orientation, for example, seems incontrovertible. The trend towards the production and consumption of shorter units of text also seems unmistakable. The digital medium is a way of transmitting knowledge about the world that is inherently unstable, is not ruled by discursive logic, and is informed by a democratic temper. These characteristics have already changed our ways of thinking – and our concept of the world – in various ways. The way we construct knowledge, for instance, is rapidly becoming more social and more democratic, and so in the short run less fixed. This 'flattening' may well represent the next paradigm shift in our way of knowing. After the shift from knowl-

edge based on religious authority to knowledge based on scientific authority we appear now to be moving to a sort of social knowledge based on personal convictions.

In an article entitled 'Is Google making us stupid? What the Internet is doing to our brains' Nicholas Carr has described how his use of the Internet has affected the way he works and thinks thus:

> Over the past few years I've had an uncomfortable sense that someone, or something, has been tinkering with my brain, remapping the neural circuitry, reprogramming the memory. My mind isn't going – so far as I can tell – but it's changing. I'm not thinking the way I used to think. I can feel it most strongly when I'm reading. Immersing myself in a book or a lengthy article used to be easy. My mind would get caught up in the narrative or the turns of the argument, and I'd spend hours strolling through long stretches of prose. That's rarely the case any more. Now my concentration often starts to drift after two or three pages. I get fidgety, lose the thread, begin looking for something else to do. I feel as if I'm always dragging my wayward brain back to the text. The deep reading that used to come naturally has become a struggle.[9]

Carr found his own experience to chime with those of many of his friends and acquaintances. Certainly his description of these effects, though dramatic, does not sound entirely unbelievable. If Carr's article can perhaps be dismissed as a merely personal anecdote, others have invested considerable time and effort in analysing the way mediums are affecting our brain. In *Everything Bad is Good for You: How Popular Culture is Making us Smarter* Steven Johnson offers a persuasive account of how over the last few decades mediums (games, television, the Internet, and film) have changed the nature of our intelligence. Remarkably, this change is towards forms of intelligence that are especially amenable to being detected by conventional intelligence tests, hence appearing to make us smarter. Despite the good news heralded by the subtitle of his book, however, Johnson admits that there are 'hidden costs' to the achievement of the particular kind of smartness he describes:

> [I]t is true that a specific, historically crucial kind of reading has grown less common in this society: sitting down with a three-hundred-page book and following its argument or narrative without a great deal of

9 Nicholas Carr, 'Is Google making us stupid? What the Internet is doing to our brains', *Atlantic Monthly*, July/August 2008, www.theatlantic.com/doc/200807/google.

> distraction. We deal with text now in shorter bursts, following links across the Web, or sifting through a dozen e-mail messages. The breadth of information is wider in this world, and it is far more participatory. But there are certain types of experiences that cannot be readily conveyed in this more connective, abbreviated form. Complicated, sequential works of persuasion, where each premise builds on the previous one, and where an idea can take an entire chapter to develop, are not well suited to life on the computer screen.[10]

The prominent British cognitive scientist Susan Greenfield comes to very similar conclusions. Greenfield has made a number of intelligent predictions about the cognitive future of the human race in *Tomorrow's People.* In this book-length essay she projects effects of technology, departing from clearly established present trends. Since the mind is in a two-way relationship with technology, Greenfield writes, '[j]ust as we can ponder on how we will view new technologies, so those new technologies will impact on how we view the world' (p. 63). Not surprisingly, the technology Greenfield zooms in on in the chapter on education is the computer. She predicts a more immersive IT-based learning environment, suggesting that as a result perhaps 'future generations will no longer have the attention span or cognitive skills to follow the narrative of a story' (p. 167). She admits that 'we have no idea whether this new type of environment will be ultimately beneficial or deleterious. It could be the case that multimedia stimulation, assaulting the senses, hard-wires the brain for faster cognitive processing. On the other hand, what about reflection and imagination?' (p. 169).

> As children and adults alike participate in novels and games, and as those same users have less and less practice at abstract thought, less imagination and less time for reflection, so there is a risk that the significance of facts and the desire to understand what is happening to and around you may diminish. [p. 174]

In the longer term, will our potential – and our willingness – to engage with the world analytically be affected?

Greenfield's exploration is of course speculative. However, being

10 Steven Johnson, *Everything Bad is Good for You: How Popular Culture is Making us Smarter*, Harmondsworth, 2006, p. 185. Carr and Johnson have been joined more recently by many other commentators. See, for example, the contributions to a section on 'The Future of the Book' in the autumn 2009 edition of *The Wilson Quarterly*, pp. 47–64.

based on a thorough neuroscientist's understanding of the working of the human brain, it ought to give us to pause. Is the scenario she sketches a cause for alarm? Only if we presume to

> judge new minds by old values. Since the essence of the human brain has been, for tens of thousands of years, adaptability to new external demands, perhaps we should simply face the fact that the new generation of brains will be fundamentally different from ours, in that they will be specifically suited, cognitively and physically, to computers and a cyber-world. [p. 169]

The immersive and fast world of text messaging and computer games is a long way from the contemplative, intensive reading of the pre-industrial era, even if the first signs of a less contemplative and more information-gathering and learning type of reading behaviour go back to the twelfth century.[11] McLuhan's style may have rubbed too many scholars up the wrong way, but he was nothing if not a visionary first of all in recognising the insidious effects of medium technologies and secondly in surmising how they affect human cognition. Once again (and I will dwell on this phenomenon a little longer in the next section) the accelerating *rate* of change since McLuhan has intensified the effects.

The mechanisms of change

I have demonstrated how social effects were derived from technological properties. Does that mean that it is possible to conclude that these effects are wholly determined by technology? Of course not – at least, not on the basis of the evidence collected so far. I have confined myself to social factors that had their origin in technological properties; I did not examine any *external* social factors. For example, I did not address the issue of the penetration rate of the digital medium. The rate at which new technologies are adopted is affected by a variety of external factors.

11 Citing Ivan Illich, *In the Vineyard of the Text* (1993), W.P. Gerritsen has suggested that such an information-gathering and learning type of reading behaviour is described in the twelfth-century *Didascalicon* of Hugo of Sint-Victor (W.P. Gerritsen, *Het alfabet als zoekinstrument: een beschouwing over de geschiedenis van de alfabetische index*, Leiden, 2003, pp. 18 ff.). This fits neatly with the renewed application of word spacing and the growth of silent reading at that time (see Chapter 3 above).

A prime factor is consumer motivation. Depending on its perceived practicability, pleasure, and pay-off, willingness to try new technology may range from eagerness to active resistance. A powerful role is also played by the amount of persuasion, or even downright pressure, exercised by commercial interests on consumer motivation. An instructive comparison is with the way the chip card is being pushed by banks eager to reduce the cost of cash payments. Consumer resistance has not stopped banks from closing deals with government and business to stimulate its use.

The 'accretion' effect here plays a significant role. Invariably a point is reached in the adoption process when it is speeded up, not necessarily voluntarily but as a result of the fact that the alternative is to be stuck with a dying technology or service. Here an instructive parallel is with mobile phones. After the critical point was reached when voluntary adoption of mobile phones had made the provision of public phones uneconomic, the remainder of the public were forced to adopt the mobile phone by the lack of a public alternative. The same looks set to happen in the case of the increasing online consumption of scholarly publications, initially journals, but eventually also monographs. Online consumption will drive up the price of their printed counterparts until the critical point is reached when it is no longer economic for publishers to produce them. There are clearly advantages to the academic community in having digital journals, but commercial interests are likely to be the prime driving force behind digitisation. Either way, the driving force is social rather than technological. In this respect it is worth considering a similar scenario for the case of ordinary books. Supposing that e-book readers are going to be widely adopted, there will inevitably come a moment when the number of people who choose a digital download instead of buying the paper edition reaches a critical level. This is the moment when demand for the physical product drops below the point where a paper edition can be economically produced. Below a certain print run the book's retail price will simply become so high that people will elect to buy the digital edition instead, effectively putting an end to the print format (except in the more expensive print-on-demand form).

Not least, there is the goverment's role in speeding up or slowing down the adoption rate of digital alternatives to print. Governments at many levels may do so through any number of formal and informal policy instruments, such as the level of investment in infrastructure,

the choice between providing digital or paper-based information and services, proffering or withholding digitisation subsidies, sales tax regimes, and so on.

The links I established in Chapter 5 between social change and the medium's technological traits made a strong case for technology-driven social transformation. Technology appeared to have a tendency to impose its own agenda on society. However, technological change is not autonomous, and many social factors play a role. By and large, though, all these social factors would affect the *rate* of change more than the nature of the changes. While social factors may affect the adoption rate of the digital medium, it is the medium itself that causes the social changes, not us. Even inventors and creators of technology have little influence. A direct link between effects projected by inventors of technologies and actual social effects, for example, is missing, or at best extremely tenuous.

The preceding chapters presented a number of great thinkers and innovators who consciously attempted to influence the social construction and use of knowledge through their ideas and inventions concerning mediums and medium use. In that role Paul Otlet, Vannevar Bush, Ted Nelson, and Douglas Engelbart made a personal appearance, but there are of course countless others whose individual contributions I did not pause to consider. Indeed, of many individual contributions there is probably no record at all. Ultimately, though, the different way of thinking engendered by the digital way of representing text and the knowledge it contains can only very rarely be pinpointed to a particular inventor or the intentions behind a particular invention, and no projected trajectories were being followed. Rather, different ways of constructing and using knowledge, and different ways of thinking, have emerged as unintended effects of the joint workings of a number of technological properties.[12] The list of historical examples of inventors who envisaged entirely different uses for their technologies from the ones that were eventually embraced socially is endless.

The conclusion that the role played by technology is indeed larger

12 As Mark Poster has phrased it: 'I maintain that technologies are no more monosemic than language or action, that the impact of technologies is never the linear result of the intention of the creators or of their internal, "material", capabilities' (in 'The digital subject and cultural theory', in *The Book History Reader*, ed. David Finkelstein and Alistair McCleery, London, 2006, pp. 486–93, on p. 492).

than that played by social factors seems inescapable. The limited extent of human control over technology is clearly a major issue. It is one thing to create technologies that work. The real challenge is how to control them. Not only do they not necessarily turn out the way their inventors had envisaged, but they are put to uses no one had foreseen. In that sense technologies can be said to have more 'side effects' than intended effects. Moreover, once a technology has been devised it cannot be put back in its box. If people see a certain use for a technology, that is how that technology will be used. The mere realisation that a certain technology is capable of being created will, more often than not, lead to its eventual creation, regardless of social desirability. Similarly, the realisation that an existing technology has a certain potential tends to lead to that potential being realised, regardless of the intention of any inventor or creator. This lack of control over technology has far-reaching effects in the case of medial technologies because mediums play such a central role in the social construction of knowledge. Those effects are the more insidious because, as we saw in Chapter 1, the human brain has a habit of trying very hard to make mediums invisible.

The basic imbalance between the social and the technological roles in the sociotechnical mechanism first posited in Chapter 1 can also be explained by a 'memetic' view of cultural transmission. In *The Selfish Gene*[13] Richard Dawkins first introduced the concept of the meme as a unit of cultural transmission in analogy to the gene as the unit of genetic transmission. He based his concept on the more fundamental notion that 'all life evolves by the differential survival of replicating entities' (p. 192). With this notion Dawkins laid the foundation for a universal Darwinism, which applies the Darwinian view of biological evolution to other disciplines:

> The gene, the DNA molecule, happens to be the replicating entity that prevails on our own planet. There may be others. If there are, provided certain other conditions are met, they will almost inevitably tend to become the basis for an evolutionary process.
>
> But do we have to go to distant worlds to find other kinds of replicator and other, consequent, kinds of evolution? I think that a new kind of replicator has recently emerged on this very planet. It is staring us in the face. It is still in its infancy, still drifting clumsily about in its primeval soup, but already it is achieving evolutionary change at a rate that leaves the old gene panting far behind.

13 Dawkins, *Selfish Gene*, chapter 11, 'Memes: the new replicators'.

> The new soup is the soup of human culture. We need a name for the new replicator, a noun that conveys the idea of a unit of cultural transmission, or a unit of *imitation*. 'Mimeme' comes from a suitable Greek root, but I want a monosyllable that sounds a bit like 'gene'. I hope my classicist friends will forgive me if I abbreviate mimeme to *meme*.[14]

Memetic cultural transmission, then, is the transmission, through imitation, of units of culture, or memes, by human brains functioning as their vehicle. The memes obey their own evolutionary imperatives. As 'selfish' replicators, like our genes, the memes we create are bent on achieving longevity, fecundity, and fidelity of reproduction. However, just as genes adapt to the material and social conditions of their organisms in order to maximise their chances of survival, the memes, too, adapt to the circumstances of their human hosts.[15] In the sociotechnical mechanism of cultural transmission, technology, like nature, has the upper hand over social influences, or nurture.

The obvious example of memes in the present context is medial technologies. As memes, medial technologies are of an unusual type in the sense that, while being memes themselves, they are also implicated in the process of copying other memes from one human host to another. They could be called 'meme-replication technology'. The longevity, fecundity, and fidelity to which memes aspire is aided significantly by the longevity, fecundity, and fidelity that can be bestowed on them by the various mediums employed in the copying process. An important characteristic of mediums as memes is that they aid the dissemination of memes not only vertically (i.e., diachronically through time), like genes, but also horizontally (i.e., synchronically, through space).[16] This dual role of being themselves memes that want to be transmitted while at the same time assisting in the transmission of other memes is a characteristic they share with language. It is part of the parallel between mediums and language I posited in Chapter 1. Indeed, regarded as a meme, language has been called a parasite or, more sympathetically, a symbiont in its

14 Dawkins, *Selfish Gene*, p. 192.

15 As Daniel Dennett has phrased it, 'a human mind is itself an artefact created when memes restructure a human brain in order to make it a better habitat for memes' (quoted by Susan Blackmore in *The Meme Machine*, Oxford, 1999, p. 207).

16 Susan Blackmore made a first attempt at applying memetic theory to mediums in *The Meme Machine*, especially in the chapter 'Into the Internet'.

relationship with the human brain.[17] This is a useful way to look at mediums too.

Both the sociotechnical mechanism and the memetic theory suggest the evolutionary nature of the transformative process that mediums engender. As an evolutionary necessity, continuity is a social intuition. This is illustrated, for example, by the way we try to adapt many digital practices to our long-standing analogue habits. Why, then, do we nevertheless tend to experience the development of the digital medium as revolutionary rather than evolutionary? One reason may be the lack of control implied by the memetic view of mediums and technology, of which we become more aware as society comes to depend on them more. Another reason is the impact and scope concerned. Already the consequences of the digital medium are greater than those of the coming of the book. Compared with the manuscript, print offered greater convenience of reproduction in the sense of improved speed and reliability. But the scope of the digital medium has widened tremendously compared with writing and print. The digital medium covers in addition the writing, distribution, and consumption of text, making it much more comprehensive as a medium.

But what is making the effects of all this truly intrusive and revolutionary is the increasing speed of the changes. That the rate of cultural and social evolution is speeding up,[18] leaving 'the old gene panting far behind', is explained well by memetic theory. Here the dual role of language and mediums is particularly obvious: writing, and *a fortiori* printing and the digital textual medium, are themselves causing the acceleration of change by helping the replication of new products of human culture. Small wonder, then, that books are beginning to be perceived as too slow for effective communication compared with the digital medium. Much of the most relevant thinking on digital culture happens on the Web, which in turn accelerates change. In fact the speed of change is so fast that we are almost beginning to

17 By Terrence Deacon in *The Symbolic Species: The Co-evolution of Language and the Human Brain*, Harmondsworth, 1997, pp. 110–15. See also George van Driem, *Languages of the Himalayas* (2 vols), Leiden, 2001, Vol. 1, pp. 33 ff.

18 This is in itself not a new observation; cf. Alvin Toffler, *Future Shock:* 'compared with the biological evolution of the species, cultural and social evolution is extremely rapid' (p. 21). Citing Julian Huxley, he goes on to say that 'The tempo of human evolution during recorded history is at least 100,000 times as rapid as that of pre-human evolution' (p. 22).

experience a generation gap, with younger generations thinking and working on this side of the divide, leaving older generations, brought up on a strict diet of print, feeling out of the loop on the far side.

As a consequence, the very concept of literacy appears to be in need of adjustment. Children appear to be comfortable with multi-mediality, non-linearity, and multi-tasking, processing streams of discontinuous information in which iconic and linguistic information are intermixed in a radically new way. It has even been suggested by some that they are able to follow – as well as reproduce – the narrative lines of a number of television programmes they watch simultaneously and do their homework while maintaining their social network.[19]

If not our scientific understanding of the Darwinian nature of most social as well as natural processes, then our day-to-day experience ought to have taught us by now how little control we have over the technologies we invent – and emphatically that includes mediums. Though we may *know* that our tools make us as much as we make our tools, in reality that notion, in so far as the realisation has hit home at all, has become a sort of new piety – all but an abstract thought. Curiously, we continue to behave as if we were capable of creating technologies as straightforward tools with which to mould ourselves and society as we wish. There is a certain amount of cognitive dissonance in the way we continue to believe that we can have everything under control at the same time as we know that we cannot. Humans continue to play lord and master over nature and society even as scientific research yields ever more evidence that free will is largely if not wholly illusory.[20] Yet somehow this fails to instil the necessary humility into our thinking. The risk that indeterminate and indeterminable long-term consequences of nanotechnology and bioengineering may affect us adversely is obviously huge. From time to time the obvious lack of control we have over them raises concern that we

19 See, for example, the inaugural lecture of Wim Veen as Professor of Didactics and Curriculum Development, 'Flexibel onderwijs voor nieuwe generaties studerenden', p. 5. Newer research suggests that such multi-tasking is much less efficient than has been thought; for example, Eyal Ophir, Clifford Nass, and Anthony D. Wagner, 'Cognitive control in media multitaskers', *Proceedings of the National Academy of Sciences of the United States of America* 106, 37 (15 September 2009), pp. 15583–7.

20 The more our scientific knowledge about the way the human brain functions grows, the greater the evidence that Spinoza was right, and it is merely a mistaken belief that our will is free.

are possibly insufficiently equipped 'to come to grips with the ragged fringes of human understanding – the unknown, the uncertain, the ambiguous, and the uncontrollable'.[21] Yet even then all attempts to regulate the development and application of technologies with such obviously far-reaching consequences and their attendant risks fall spectacularly short.[22]

Mediums, by contrast, are barely even regarded as technologies. Especially the textual ones singularly fail to raise any concern, let alone alarm. Even most social scientists focus their interests on the human agents *behind* medium use, rather than on mediums as agents in their own right. True, as a technology mediums must be denied a *motive* to change their users. But that does not mean that their use doesn't have any effects on their users. They are all the more insidious in their consequences for their innocuous appearance as neutral conduits.

It is not at all certain that such attainments of conventional literacy as rational discursivity and the analytical habit *are* set to disappear as the digital textual medium gains ground. Moreover, it is not necessarily problematic should they do so. As Susan Greenfield suggests, the new generation of brains may simply adapt to the new reality. But it is important to realise that, should they disappear, then no one will have willed it to happen, and, what is more, no one will have been in a position to stop it from happening.

The textual future

> No man of intelligence will venture to express his philosophical views in language, especially not in language that is unchangeable, which is true of that which is set down in written characters. [23]

21 Sheila Jasanoff, 'Technologies of humility: citizen participation in governing science', *Minerva* 41 (2003), pp. 223–44. See also Tenner, *Why Things Bite Back*, and Cornelia Dean, 'Handle with care', *New York Times*, 12 August 2008.

22 At least Jasanoff proposes taking a position of humility against a long history of positivist optimism about our ability to calculate, and thus control, technological risks. Yet in the final analysis her assessment of the problem remains essentially positivist and optimistic, too. Given a more humble attitude on our part, she suggests, we should be able to make a better job of assessing risks and be able to prevent disaster. I doubt that the history of technology justifies such optimism.

23 Plato, 'Seventh letter' 343a, in *The Platonic Epistles*, trans. J. Harward, Cambridge, 1932, p. 137.

The death of the book has been pronounced countless times. That prolific French man of letters Octave Uzanne is on record with the following prediction in a story entitled 'Le fin des livres' (The end of books):

> I do not believe (and the progress of electricity and modern mechanism forbids me to believe) that Gutenberg's invention can do otherwise than sooner or later fall into desuetude as a means of current interpretation of our mental products … our grandchildren will no longer trust their works to this somewhat antiquated process.[24]

As the slightly antiquated wording of this quotation already suggests, Uzanne is here not assessing recent digital developments. In fact his story, from the collection *Contes pour les bibliophiles* which he produced with his friend Albert Robida, who made the magnificent drawings for it, dates from 1894, and the 'modern mechanism' in question was phonography. Though the entire piece is very tongue-in-cheek, it evinces a technological optimism that is still very much alive. The now almost forgotten Uzanne (1851–1931) got much of his vision of the 'intellectual life of Tomorrow' wrong. The 'highest situations' in journalism have never become 'reserved for robust young men with strong, resonant voices, trained rather in the art of enunciation than in the search for words or the turn of phrase', and 'literary mandarinism' has not disappeared.

So why do we persist in this game of fortune-telling if it is clearly so hazardous? That is of course less because we are so interested in the future of our technologies than because we continue to be fascinated by, if not obsessed with, our own future. In that regard, Uzanne got it a lot less wrong. He believed in 'the success of everything which will favor and encourage the indolence and selfishness of men'. This includes the replacement of writing by sound recording:

> Hearers will not regret the time when they were readers; with eyes unwearied, with countenances refreshed, their air of careless freedom will witness to the benefits of the contemplative life. Stretched upon sofas or cradled in rocking-chairs, they will enjoy in silence the marvellous adventures which the flexible tube will conduct to ears dilated with interest.
>
> At home, walking, sightseeing, these fortunate hearers will experience the ineffable delight of reconciling hygiene with instruction; of nourishing their minds while exercising their muscles, for there will be

24 Octave Uzanne, 'The end of books', *Scribner's Magazine* 16 (August 1894).

> pocket phono-operagraphs, for use during excursions among Alpine mountains or in the cañons of the Colorado.

It may not be the iPod's main claim to fame that it favours and encourages 'the indolence and selfishness of men', but that we can observe its fortunate owners listening '[a]t home, walking, sightseeing' with an 'air of careless freedom' is beyond doubt. It just took a little longer than he was imagining, but in the age of personal audio systems podcasts and audio books have certainly begun their triumphal march on our car stereos and personal audio systems.

So let me indulge in a little speculation. And let Octave Uzanne's failure to predict the future correctly not lull us into a false sense of the book's impregnability. The phonograph was not a textual medium: the computer is. The computer's role in shaping us into what we are going to be cannot easily be overestimated. Its transformative properties as more and more textual traffic is moving from analogue to digital channels have already been spelled out. The speed at which the transformations are taking place has accelerated beyond anything we have seen before. To add to that, if the developments of the last century and a half are anything to go by, the future is going to be increasingly mediated overall. That is to say that mediums will be used for ever more social purposes. Take the examples of the recent mediatisation of, say, shopping, making airline reservations, or sharing photographs. Whether in the form of the invention of new mediums, or through novel uses of existing mediums, the mediatisation of the future is likely to be mostly digital. Not only is the digital medium as we know it being used for entirely new forms of mediation, this also involves new modalities being added to the existing range of the digital medium. Experiments with cyber-sex may serve as a case in point. If successful they would add the modality of touch, leaving smell and taste the only senses that cannot yet be mediated, but, as observed in Chapter 2, neither is a dominant force in objective (repeatable) social communication.

Transformations in medium use have been going on for centuries, but towards the end of the nineteenth century their speed began to accelerate dramatically. Since that time the number of mediums has grown rapidly, and so, in consequence, has the importance of mediums to society. As film, radio, and television in turn carved out prominent positions for themselves, the relative importance of text in the medium spectrum diminished accordingly. However, the 'new media' have only partly taken the space of text: mostly from time

spent on leisure, and gathering news (though that could be called a leisure-time pursuit as well). The use of text has never fallen below the minimal threshold automatically set by its use in education. In terms of such crucial areas as knowledge transmission, especially in education, and administration text has so far held its own, even if the future is not at all certain.

As I suggested at the end of Chapter 5, it is clear that we are in a transitional stage. In the competition with the book – and other existing mediums – the digital textual medium is in a process of finding its own niche. This happens by elbowing the book and other mediums into theirs while it solicits general acceptance of itself in its own right. Two major questions insist themselves. The first is: if text does manage to hold its own, how will the book and the new digital textual medium cohabit? Will the book continue to serve as the most efficient reading machine for the many purposes it now serves, at least for the foreseeable future, or will digital reading machines take over from the book? The second is a more fundamental question: in the increasingly mediated future I have just sketched, what may be the continued role of text? As other communicational modalities, both existing ones and ones yet to be devised, continue to make inroads into the field of text, may not text lose its important position in human communication?

I would first like to have a look at the question how the relationship between printed and digital text forms is likely to develop. Can any factors perhaps be identified that impede or stimulate the development of one at the expense of the other? Some functions are being shifted from print to digital, for the new entrant's growth is, inevitably, at the expense of existing mediums. That is as we would expect. However, I suggested earlier that the differences between the two mediums are huge, leaving ample room for complementarity. That would appear to point to the likelihood of each of the two textual mediums being able to find its own niche. Against that view of complementarity it may be argued that, as the use of the digital medium proliferates and speeds up, the specific features of the book that are incapable of being replaced digitally (such as its haptic, hierarchical, unchangeable, monumental nature, and the less distractive reading experience it offers) are likely to become gradually less in demand socially, making them less relevant. Moreover, as a Universal Machine the computer possesses the capacity to offer substitutes (either by imitation or by the creation of alternatives –

which may be even better suited to a particular purpose) even for properties which we deem to be irreplaceable.[25] This would lead inexorably to a diminishing importance of the printed book.

Roughly speaking, either of two scenarios may be envisaged. The first scenario is that the two medial systems will continue to coexist. In this scenario, each medium has strengths of its own (resulting from its salient features) sufficient for it to attract particular uses. After an equilibrium was reached, peaceful coexistence between the two textual mediums could ensue. In this scenario books will continue to be produced and read in large numbers, far into the future, even if they will not necessarily command the centre of the cultural stage. Besides the evanescence, non-linearity, multimodality of the digital medium the book will continue to offer desirable fixity, linearity, and mono-modality. Even as it has come to the end of its evolution, the book cannot really be equalled as a pretty near perfect 'reading machine'. The Order of the Book may lose its monopoly, but it will not give way to a digital order. Over the centuries we have come to cherish fixity and linearity, and it is simply too important to be able to read books anywhere, at any time, independent of electricity, to be able to scribble notes in the margin, to turn down the corner of the page to mark our place.

The second, competing, scenario is one in which we see the new medium asserting its ascendancy over the old. This involves the digital medium subsuming most of the crucial functions of print. Any characteristics for which a digital substitute may be devised will be assimilated. Other characteristics will gradually lose their importance. We may now think that some of them are worth holding on to, but that is merely because of our mind-set as *homo typographicus*. Soon the sense that these features are important will lose its urgency, if only by a simple process of attrition. In this scenario the Order of the Book will gradually morph into a digital order of sorts.[26]

25 Whether the 'vook' (video-enhanced book; www.vook.com) constitutes either a suitable substitute for existing functionality or a credible example of the sort of novel functionality destined to win the hearts and minds of modern readers remains to be seen. See www.nytimes.com/2009/04/05/business/05stream.html for an example of such a reimagination of the printed page. See also http://movels.wordpress.com/.

26 Note that, as I have argued elsewhere ('New mediums: new perspectives on knowledge production'), the fact that such a digital order will be based on the Universal Machine precludes the arrival of a stable new order.

In favour of the second scenario is the consideration that there is no reason to assume that the relationship between print and the digital medium as it now exists is more than a temporary and utterly contingent state. The digital medium will continue to develop as it has done over the last few decades. As it develops, and as new generations of digital natives grow up, digital textuality will become ever more capable of taking over any remaining distinctive functions of print. In other words, it is only a matter of time before a digital order asserts itself. That a total eclipse of the book by the digital textual medium has not happened yet does not mean it will not happen soon. To set off the last small but vital development only a small trigger is needed. It might be, for example, the development of a device even more book-like than the existing e-paper devices, or a killer application for digital books comparable to the iPod/iTunes combine for music, such as possibly the iPad. (Again, the transformational effects of mediums are increasingly quick to make themselves felt. Both the speed with which new mediums were invented and the speed with which their effects came to be felt have grown exponentially. If the digital medium continues that line of development, we can be sure that whatever transformative power it embodies will take effect almost immediately. Never mind that the effects are likely to be ever more drastic.)

The trigger that might set off the eclipse of the book need not be a technological one, of course; it could equally be one of the social factors discussed earlier. So far, in education, the book has remained the main vehicle for the transmission of knowledge. The education curriculum has always presented a natural vantage point from which the Order of the Book could be established and maintained. Here the hierarchical, orderly, and linear nature of the book's interface has always been notably at home. That interface represents a particular way of reading and using texts that is well suited to the hierarchical process of knowledge transmission. But in this natural habitat of the printed book – its last major stronghold – change is imminent. It has been noted that not only children's medial experience outside of school is becoming more and more important to them, but the discrepancy between their experience of mediums outside of school – dominated by digital games, mobile telephones, and computers – and inside school – mainly books – is growing rapidly. Confronted with this concern, many educationists are now pleading for a medium use in the curriculum that reflects better the everyday reality

of children outside of school.[27] If this should lead to a major reduction in book use in education, which is not an unlikely scenario, this would be bound to undermine the very foundations of the Order of the Book. In fact, it would not inconceivably spell its end.

The codex form of the book has been with us a long time. Accustomed as we were to that form, not surprisingly, the computer was at first (as is usual with new mediums) made to emulate the book. Such continuity is a social instinct, but the book had also come to represent a pinnacle of achievement: the perfect reading machine. As *homo typographicus* we did not want to give up what we persist in regarding as the achievements of typography. Increasingly, however, we will be able to recognise that in essence both books and their digital counterparts are tools for structuring and disseminating information, each with their own nature. Exploring the digital medium's own potential for structuring information, without constant regard to how it is done in print, will free us from ultimately unproductive attempts at recreating the book in digital form and allow us to discover the 'inherent possibilities' of the digital medium, thus speeding up the advent of a digital order.

One argument may perhaps be raised against this second scenario. Of the three criteria for measuring evolutionary success listed by Dawkins – longevity, fecundity, and copying fidelity – the digital medium has spectacularly improved on fecundity and copying fidelity. However, it appears – at least so far – to be letting us down badly in terms of longevity. But perhaps this is a classic pitfall of Darwinism. We should not be asking for the type of longevity that benefits *us*, but the gene (or in this case the meme) itself. From the digital medium's own perspective its longevity would seem assured: the Universal Machine will be able to adapt to changing circumstances much better than any previous medial technology, including notably the printing press.

That this second scenario is the more likely scenario makes the future of our typographic heritage a pressing concern. For the

27 See, for example, Jaap van Loon and Geeske Steeneken, 'Wat moet de internetgeneratie met een schoolboek? Heeft het boek op school z'n langste tijd gehad?' (What is the Internet generation to do with books? Has the book in school had its day?), in *Jaarboek voor Nederlandse boekgeschiedenis*, ed. Adriaan van der Weel, Leiden, 2007, pp. 111–31, or *Educating the Net Generation*, ed. Diana G. Oblinger and James L. Oblinger, Boulder CO, 2005 (also available in pdf at http://net.educause.edu/ir/library/pdf/pub7101.pdf).

younger generation books and manuscripts may soon hardly exist unless they are available digitally. This raises the urgent question – one among many – which books and manuscripts will need to be made available digitally. On the surface the numerous mass digitisation initiatives carried out by Google and others are answering that question for us: everything. The reality is of course a different one. Not only is there much room for improving Google's digitisation, but also current copyright restrictions are hampering the digitisation of a very large body of very important texts, covering in fact much of the twentieth and twenty-first century. A large and important part of the textual record is thus threatening to disappear below the horizon of the younger generation. A further important question, and one that remains definitely unanswered, is *how* digitisation should be done in each of the scenarios. Our cultural inheritance needs to be made accessible to the digital generation in a form that speaks to them. Bridging the functional divide between the two textual modes will require a great deal of thought. Which properties of manuscript and print can be transferred straightforwardly to the digital environment? How do we deal with the ones that cannot be transferred easily? There are many challenges there, chief among them learning how to deal with turning the solid, unchangeable monuments of print into the continual, ever-changing events of the digital realm. We are of course trying. One recent example has been the rendition of the Bible in mobile phone language.[28] It is a translation of the most monumental and lapidary of books into the most ephemeral and unstable form imaginable for it. But is it a successful way of ensuring the continuing access to an important part of the Western cultural heritage? Are 'digital monuments' viable at all, or is the very term a contradiction?

Let's assume for the sake of the argument that the second scenario will indeed take place. Digital text is ascendant, and the eclipse of the printed word is imminent. How would we then know a digital order if we found ourselves in one? What would a digital order look like? One obvious characteristic would be for the digital interface to become as intuitive as that of the printed book. The digital reading experience would have to be no less satisfactory than that of a true reading machine. Perhaps more telling would be if we found the

28 www.smstransl8r.com/bible.php instantly translates random fragments from the Bible into SMS language.

digital interface insinuating itself into our metaphorical language in the same way centuries of print did for the book. That would testify to the digital text acquiring a status in its own right (after the loss of status of the digital text compared with print that we encountered in Chapter 5). If sufficient new metaphors developed we could surmise that the book was in the process of being replaced as an icon.

Beyond the question about the relative position of analogue text versus digital text, the second question, about the long-term significance of the textual modality, analogue *or* digital, in a largely if not wholly digital medial future, is even more speculative, and even harder to answer. The present situation, in which it is not clear what the relationship between printed book and digital text is going to be, I have called a transitional stage. Having identified the computer's nature as a Universal Machine as its most salient property, we have to accept, though, that this means that, properly speaking, we cannot really assign any properties to it at all beyond what I have termed in Chapter 5 its core properties. As a Universal Machine the computer could not be more protean. A specific example was when I decided to assign 'networking' as a primary property. In reality, I had to admit, this was a later invention, which occurred some time into the process of the Universal Machine turning into the medium it has become. Networking might thus more properly and fundamentally be styled an 'inherent potential' of the Universal Machine. In the same way, the Universal Machine will undoubtedly prove to harbour numerous as yet unconceived and inconceivable 'inherent properties' as a function of its unlimited inherent *potential*. Does this mean that all those properties I assigned it in Chapter 5 are not really properties? Of course not, but it does mean that this 'transitional stage', as I have called it, is not likely ever to end. It also means that the properties I have identified to make predictions about the future development of the digital medium, or even to make definitive assessments about the medium's influence, cannot safely be relied on.

Predicting the future was hazardous enough without taking cognisance of the fact that we are dealing with a medium that is an offspring of the Universal Machine. Just as it is quite possible that some of the properties we *have* recognised will prove to have unexpected implications, it is virtually certain that digital text will prove to have all sorts of properties – secondary technological ones – that we have not yet recognised. In particular it is not too far-fetched to believe that the computer as a medium will enable more intuitive forms of

communication than text in written characters affords. Writing was, after all, a curious invention, considering the processing demands on the brain of the cognitive effort involved. Textuality may appear to have been contingent on a series of historical circumstances that are now coming to an end. It may be on the verge of being replaced by different, more efficient forms of machine-to-machine and machine-to-human communications.[29] Experiments with the use of speech, both for interfacing with the computer's operating system and for text entry, are already proving successful, for instance. Digital photos taken with a mobile phone can be sent instantly to make reasonably eloquent statements of various kinds, and are increasingly used as a substitute for text-based communications.

Text has long coexisted with other modalities. However, each of these lived in its own realm. Digitally, text shares its medial space with all other modalities, opening the door to more direct competition from other modalities, existing or new. In the short run the value of text has appeared to increase, as a function of the way we have been accustomed to interface with the computer over the last few decades. But in the longer term other modalities may well prove to have advantages over text. What shape our machine-to-machine and machine-to-human communications might take is anyone's guess. For all we know, they may even involve brain implants and artificial telepathy. Whatever may transpire, it is certainly possible, and not even unlikely, that textual communication will come to be regarded as cumbersome, and be relegated to a less prominent position.

Whether or not this will indeed happen, medial changes are already occurring on a scale that would have been scarcely imaginable only a few years ago. The effects of these changes are vast. The world is not a given which just sits there passively and patiently waiting to be studied and eventually known. Rather, our mediums define our perception of the world: of ourselves, and our culture. At the same time, our mediums are an important part of our culture. How may we know that culture if it determines our way of seeing it? How can we 'see our glasses' to determine how they give shape to what we are seeing? In this book I have tried, in spite of the challenges I listed at the end of Chapter 1, to see the lenses in my spectacles at the same

29 Susan Greenfield for one is confident that 'our future will probably not include such word-based communications' as word processing and e-mail: *Tomorrow's People*, p. 87.

time as the world that they allow me to focus on. I fear it has proved a tall order, like Baron Münchhausen dragging himself out of the morass by his own hair. But, being human, I needed at least to have made the attempt.

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