

## Chapter 1: A Textual Universe

### I. INTRODUCTION

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. This 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 only started to use language in the last 200,000 years, while hominids have been around for about six 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.<sup>1</sup> 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 in 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 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’.<sup>2</sup> 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 American historian Elizabeth Eisenstein for Gutenberg’s technology as an ‘agent of change’<sup>3</sup> have been criticised as being 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

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<sup>1</sup> 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.

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

<sup>3</sup> Elizabeth Eisenstein, *The Printing Press as an Agent of Change: Communications and Cultural Transformations in Early-modern Europe*, CUP, 1979; an abbreviated edition was published, also by CUP, as *The Printing revolution in Early Modern Europe* in 1983.

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, it has only been possible with hindsight 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 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,<sup>4</sup> 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 pictures. 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

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<sup>4</sup> In *Phaedrus*, 274d-277a.

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 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.<sup>5</sup> We communicate when we talk to each other, when we make love and 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.<sup>6</sup> As the vessel for the replicatory mechanism of our genes we might even call ourselves a medium, which neatly illustrates the point.<sup>7</sup>

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

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<sup>5</sup> 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 organization 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).

<sup>6</sup> As James Beniger asserts in *The Control Revolution: Technological and Economic Origins of the Information Society* (Cambridge [Mass.] & 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).

<sup>7</sup> 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’.

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 particular types of knowing, and particular types of knowledge, and so ultimately affect the way we see the world and our place in it.<sup>8</sup> 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.<sup>9</sup> This has led to widespread scepticism 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 scientific 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.<sup>10</sup> 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

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<sup>8</sup> 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 to 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.

<sup>9</sup> 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 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 or 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.

<sup>10</sup> 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’.

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.

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.<sup>11</sup>

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 that 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.<sup>12</sup> Exasperation with the inadequacy of language is of course a hallmark of literary Modernism.<sup>13</sup>

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–Whorf hypothesis suggests, thought and action were not only socially mediated 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 organized by our minds—and this means largely by the linguistic systems in our minds. We cut nature up, organize it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way—an agreement that holds throughout our speech

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<sup>11</sup> C.S. Peirce, ‘Some Consequences of Four Incapacities’, in *The Philosophy of Peirce: Selected Writings*, ed. J. Buchler, London, n.d. [repr. of 1940 edn], p. 249.

<sup>12</sup> Fritz Mauthner, *Beiträge zu einer Kritik der Sprache*, 3 vols., Stuttgart, 1901-1902.

<sup>13</sup> 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 Gentleman. 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, 423-63. Beckett’s entire work has been dedicated to his attempts at renting the veil.

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 organization and classification of data which the agreement decrees.<sup>14</sup>

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 a 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 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.<sup>15</sup> 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.<sup>16</sup>

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 scepticism 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

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<sup>14</sup> Benjamin Lee Whorf, *Language, Thought, and Reality: Selected Writings of Benjamin Lee Whorf*, ed. John B. Carroll, [Cambridge, Mass] etc., 1956, 213-14; emphasis in the original.

<sup>15</sup> Terrence Deacon, quoted by Christine Kenneally, *The First Word: The Search for the Origins of Language*, New York, 2007, pp. 250-54.

<sup>16</sup> Kenneally, *The First Word*, pp. 103-11.

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 organized and transmitted. The assumption that mediums inform the way we experience the world and give shape to it 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 if, or even to what extent, but *how* mediums influence the way we see the world. I want to try and discover if 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.<sup>17</sup> For this I propose to use a historically comparative method. 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 will explain my actual working method in greater detail in section II of this chapter below.)

Studying this continuum also offers the opportunity to examine the *mechanisms* at work in medial change. It was, for example, never 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 might 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 mediums use 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 to 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.

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 World Wide 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.

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<sup>17</sup> 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.

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 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 was only understood by 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 at least to attempt to take the future in 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 sociotechnical view of knowledge and technology just propounded,<sup>18</sup> 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.<sup>19</sup>

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<sup>18</sup> A good model is that of Wiebe Bijker in *Bicycles, Bakelites and Bulbs: Towards a Theory of Sociotechnical Change*, Cambridge, Mass. and London, 1995.

<sup>19</sup> Beniger, *The Control Revolution*, p. 85.



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.’<sup>20</sup> 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.<sup>21</sup> 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 greater than that of any previous medial technology. The corollary of the fact that computers are Universal Machines<sup>22</sup> 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.<sup>23</sup>

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.

## II. 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 tries to ‘understand textual production as part of human social communication structures’.<sup>24</sup> A book historical 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.<sup>25</sup> It is no

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<sup>20</sup> Beniger, *The Control Revolution*, pp. 3-6.

<sup>21</sup> Bernard Stiegler, *Technics and Time, 1: The Fault of Epimetheus*, Stanford, 1998, p. 13.

<sup>22</sup> To be discussed in Chapter 4.

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

<sup>24</sup> 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).

<sup>25</sup> 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

coincidence, and sometimes useful—often even necessary—that book terminology, together with the comparisons that it invites, remains pervasively 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 historical 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 historical 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 historical perspective as a unifying perspective probably outweigh the disadvantages. The book historical 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 a new light on earlier technologies and offer unexpected insights in 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 datatypes, such as image and sound);
- The computer’s evolution from a standalone 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 datatypes);
- The development of human and computer-readable explicit markup as an alternative to implicit typographic markup that is only readable 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)

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characteristic of digital text, but it became one after the computer became part of a network.

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, email 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 nine 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 fulltime 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.<sup>26</sup>

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 importantly, 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 on a long line of earlier milestones in the transmission of text, such as:

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

- Writing (c. C5BCE)
- The papyrus roll (c. C2 BCE)
- The alphabet (c. C11 BCE)
- The codex form (c. C2)
- Printing with movable type (c. 1450 in the West)
- Steam power and the rotary press (1820s)
- The typewriter (middle of the C19)
- The telegraph (1844)
- The offset press (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:

- Character representation (esp. the ASCII character set)
- Graphic user interfacing
- WIMP
- Computer networking
- Word processing
- Wysiwyg and DeskTop Publishing
- Computer-readable explicit markup (SGML and its descendants)
- The Hypertext Markup Language (HTML) and the World Wide 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.<sup>27</sup> 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.<sup>28</sup> 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 abilities 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

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<sup>27</sup> See Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society*, Cambridge (Mass.), 1987, pp. 130-31.

<sup>28</sup> Unless I specifically mention other situations, when I use the term ‘digital medium’ I will be including that transmissional capacity.

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:

- 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 datatypes. 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 a widespread popularity. The explanation of this phenomenon can simply be sought 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, and 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 to 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'<sup>29</sup>—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 only became apparent in the comparison with hypermedia and the World Wide 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:

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.<sup>30</sup>

It would make just as much sense to extoll the fact that at least books '*don't* change their minds when you're not looking'<sup>31</sup> 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 make 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 for the listening experience whether a

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<sup>29</sup> 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.

<sup>30</sup> P.G. Barker, 'The Future of Books in an Electronic Era', *The Electronic Library* 16, 3 (1998), pp. 191-98, at p. 194.

<sup>31</sup> Peter Greenaway, *The Cook, the Thief, His Wife and Her Lover* (1989); emphasis added.

song played through the home hifi 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.<sup>32</sup> 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 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 between 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 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 World Wide Web has:

- 'Democratised' access to information, posing a challenge to the hierarchical ordering

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<sup>32</sup> Physical album sales decreased by 15 percent in the first half of 2007, while sales of digital 'songs', though still a much smaller business, rose by 49 percent over the same period (figures from Nielsen SoundScan, quoted in *NYT*, 8 July 2007).

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.

### III. 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, to a pessimist, appear 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.

#### *1. 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.

#### *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’.<sup>33</sup> Seeing how much we are still in the midst of change it might 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

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<sup>33</sup> Beniger, *The Control Revolution*, p. 2.



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 organizational change'.<sup>34</sup> Of course a 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.

### *3. 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.<sup>35</sup> As Antonio Damasio phrases this challenge:

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.<sup>36</sup>

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 worldview—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 of 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 a 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

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

<sup>35</sup> 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), 4.12-4.121.

<sup>36</sup> Antonio Damasio, *The Fabric of the Mind: A Neurobiological Perspective*, NWO Huygenslezing, The Hague, 1999, pp. 9-10.

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.

#### 4. 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.<sup>37</sup> 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 role in the way we perceive the world, even if it is still not known exactly how. In the case of mediums this invisibility is the 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.*<sup>38</sup>

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.<sup>39</sup> 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.<sup>40</sup>

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<sup>37</sup> 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, *The First Word*, p. 25).

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

<sup>39</sup> For example, in 'Culture, Cognition, and Evolution' (*MIT Encyclopedia of the Cognitive Sciences*, 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): 181-207) and Michael Heim (*Electric Language: A Philosophical Study of Word Processing*, New Haven & London, 1987) 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, Finnegan, and have chiefly concentrated on the transition from orality to literacy, also intensely studied by Walter Ong.

<sup>40</sup> Chandler, *The 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.<sup>41</sup>

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 fertilized 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.<sup>42</sup>

The reason why it lends itself so well for 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 reconceptualize traditional subjects like cellular biology. Because information and 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

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<sup>41</sup> Chandler, *The Act of Writing*, pp. 9-10.

<sup>42</sup> Erwin Schrödinger, *What Is Life* (CUP, 1944), pp. 61-62, cited in Beniger, *The Control Revolution*, p. 56.

maintain its organization 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).<sup>43</sup>

We share the capability 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.<sup>44</sup>

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.<sup>45</sup>

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 book-case containing the architect's plans for the entire building. The 'book-case' 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

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<sup>43</sup> In *Print, Manuscript and the Search for Order 1450-1830* (CUP, 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.

<sup>44</sup> See further Chapter 2.

<sup>45</sup> John Durham Peters, *Speaking into the Air: A History of the Idea of Communication*, Chicago and London, 1999, pp. 23-24.

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.<sup>46</sup>

The interesting thing about Dawkins' 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 popularizer, 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? (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 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.

##### *5. 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

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<sup>46</sup> Richard Dawkins, *The Selfish Gene*, OUP, 1989, p. 22.

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?<sup>47</sup>

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 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 (esp. 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 farreaching 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 will eventually come to be seen as the dominant medium—but as will be argued in Chapter 6, if this should happen, it is bound to happen much faster than in the case of the Order of the Book.

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<sup>47</sup> Cf Lisa Gitelman, who writes in *Always Already New: Media, History, and the Data of Culture* (Cambridge, Mass, 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).