

Chapter 2: Concepts in Textual Mediality

INTRODUCTION

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 this 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 is a flourishing academic discipline. Communication studies and book studies, which offers 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,

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, 1949, p. 3.

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 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' definition of communications 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. 267-68), 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.

LANGUAGE AND SPEECH

Of all the means for 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 onto an intricate acoustic system) with even our closest evolutionary relatives, we do know that it must have evolved within the last two to five 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

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.

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; cooperativeness and reciprocation; vocalisation; imitation; (social) cognition, 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

⁵ Steven Pinker, 'Language as an Adaptation to the Cognitive Niche', in *Language Evolution: States of the Art*, ed. M. Christiansen and S. Kirby, OUP, 2003, p. 16.

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

⁷ We know that 'communication has evolved several times in the animal kingdom' (Pinker, op. cit., 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*, CUP, 2003, p. 253. Cf. Kenneally, *The 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. Tagliatela, 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. 343-48, on p. 343).

⁸ Cf. Kenneally, *The First Word*, pp. 103-11.

⁹ Kenneally, *The First Word*, pp. 250-54. However, as Ian Tattersall contends, certain preconditions must be

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, effects¹¹ illustrates how little control we have over it. Moreover, it suggests the likeliness 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 cultivation, 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 communications 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.

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

¹⁰ Kenneally, *The First Word*, pp. 234-36.

¹¹ Kenneally, *The First Word*, pp. 283-86.

¹² Kenneally, *The First Word*, pp. 250-54.

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

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

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 inventions 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 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

¹⁵ See Henri-Jean Martin, *The History and Power of Writing* (Chicago and London, 1994), pp. 8ff. 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*, vol. 238, 6, pp. 38-47, p. 38; she compares the written records to bookkeeping tokens found in the Nuzi palace archives in Iraq, pp. 38-39); cf. also the myths about the origins of writing mentioned in Chapter 3 below.

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, 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 and London, 1971, p. 162).

²⁰ Eric Havelock, *Preface to Plato*, Cambridge, Mass, 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* (pp. 101-20 in *The Foucault Reader*, ed. Paul Rabinow, Penguin, 1984).

contentious *Origin of Consciousness* Julian Jaynes has even suggested that writing may have propelled humans into a fuller consciousness 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 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, 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 to 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 even more so than most other types of script—consists of (manmade) 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

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. 197-21, at p. 208).

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

²⁴ Maryanne Wolf, *Proust and the Squid 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*, 1999).

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

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 nomenclature 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 might 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

²⁷ Roy Harris, *The Origin of Writing*, London, 1986, pp. 26-27. 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.

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 printout, 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 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 additional skills to the ones 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 also 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 Ages²⁹ 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 might be. Some non-verbal information has an equivalent in 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) can not, or 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

²⁸ Cf. Roy Harris, *Origin*, pp. 26-27.

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

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

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 paratextual 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 might 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 additionally depends 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, etcetera, in addition to information about the file (author, date of creation, etcetera).

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 finetuning 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 we can, by and large, 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 only exists 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 ‘lexia’s’ 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 to 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, this 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 only needs to skim a text to know that it is a poem or a letter, or a chapter in a book. Genre and structure are easily deduced from typographical cues.

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 being used in recent e-book devices, such as Sony’s Digital Book Reader, the iLiad by iRex Technologies, Amazon’s Kindle, or the Cybook from Bookeen.

Readers only need to 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. 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, etcetera. 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 might write from right to left, top to bottom or even boustrophedonic, which is to say the way the oxen turns 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 might 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 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,

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): 933-947; repr. in *The Digital Word: Text-based Computing in the Humanities*, eds. George P. Landow and Paul Delany, Cambridge, Mass., 1993, pp. 85-118; cf. Allen H. Renear, ‘Text Encoding’, in *A Companion to Digital Humanities*, ed. Susan Schreibman *et al.*, Maldon, Oxford and Carlton, 2004, pp. 218-239.

³³ See Chapter 4.

<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 thus:

[Illus: tree diagram]

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> might look like (say, 9pt Bembo roman ranged left), and that this might look different from its sibling <credit> (which might be rendered as 9pt Bembo italic). The separation of form and content thus also leads to a 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, etcetera. 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 one—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 only occur 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 instance or 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 only exists 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 assumed 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

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.

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 might 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 datatype 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.

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, etcetera. 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 a hundred years, 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 fullcolour ones—always expensive to

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.

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.

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 different mediums (which may be used for news, entertainment, education or general information), and to the fact that a new medium may carve out its niche less from the existing total medium use but 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 than the textual mediums. This obviously has major implications for the manner in which information is processed and transferred through these modalities.⁴¹

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

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

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

³⁹ This is literacy in the literal sense. When we talk about, for example, 'film literacy', 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.

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 catchphrase *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 usage of the term ‘media’ implicitly emphasizes 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 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 to communicate 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

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

⁴³ Here I follow David Crystal; see for example ‘The Changing Nature of Text: A Linguistic Perspective’, in *Text Comparison and Digital Creativity*, eds. Wido van Peursen *et al.*, Brill, forthcoming.

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*, to convey a broad interpretation of the word ‘technology’, including any writing tool.

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 make epigraphy clearly a case of transmission over time, while radio and television are the epitome of transmission over space.⁴⁵ The standalone computer, like 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.

Modality	Medium	Inscription		Dissemination		Transmission
				Multiplication	Broadcasting	
Text (inc. still images)	Epigraphy	x	-	-	-	T
	MS	x	-	-	-	T/P
	Print	x	x	-	-	T/P
	CompStandAlone	x	-	-	-	T
	CompNetwork	x	x	(x)	(x)	T/P
Sound (inc. speech)	Record/Tape/CD	x	x	-	-	T/P
	Radio	- (x)	-	x	x	P
MovImg	Film	x	-	x	x	T/P
	Television	- (x)	-	x	x	P

Table 1. Medial functions. Legend:

- No
- x Yes
- (x) Possible
- T Time
- P Place

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 is presented by the fact that we use

⁴⁵ In *Empire and Communications* (OUP, 1950; new, 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 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).

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 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 standalone device the computer could transmit text in much the same way as any other writing technology, such as manuscript or 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 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

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 vs B&W only; halftone vs line. The fact that the digital medium hosts all

⁴⁶ It might 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, Mass., 2008.

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 subset 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.