A distant mirror?; the Internet and the printing press

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The introduction of the printing press to Europe in the mid-fifteenth century, and its effect on the communication of information, are considered, largely by reference to the writings of Elisabeth Eisenstein. Analogies and similarities with the impact of the Internet are identified, as a way of gaining insight into the current communications revolution.

Introduction

The advent, and wide uptake, of the Internet since 1990 has ushered in what is generally regarded as a revolution in the communication of information and knowledge. While this revolution is in progress, its true significance is difficult to estimate. One way of gaining some insight into the matter may be to consider comparisons between the Internet and previous innovations, which have had drastic consequences for the transmission of knowledge.

The earliest two such innovations – language and writing – lie at such a distance in time from us that it is difficult to make any useful comparisons or draw lessons. Of the former we know little or nothing, though many intriguing speculations may be made regarding the evolution of language (see, for example, Pinker [1] and Deacon [2]). Of the origins of writing, more is known [3, 4], and comparisons may be made with those current cultures that have no written script. But in neither case can we examine the change wrought on the information culture of the time by the innovation, still less hear the views of the participants.

Conversely, a great deal is known about the most recent innovation, or rather complex of innovations, which characterised the communication and information revolutions of the nineteenth century. These innovations included mass publication of books and periodicals, steam transportation, national postal systems, electronic communication by telegraph and telephone, public and special libraries, bibliographic classification schemes and cataloguing rules, abstracting and indexing services, and many of the current systems of business document and record handling. They are summarised by Benninger [5] as a 'Control Revolution', whose effects still largely provide the framework – intellectual and, to a surprisingly large extent, technical – within which current information systems and services operate. But, precisely because of the multi-faceted nature of this 'revolution', it is hard to know which elements may be selected for comparison with the Internet; to select any one is certainly to ignore other highly significant, and certainly interacting, factors.

This leaves one remaining innovation, whose effects are certainly comparable to those of the Internet: the introduction of printing within Western Europe in the latter part of the fourteenth century. This innovation, and its results, has been comprehensively reviewed by Eisenstein in a two-volume work [6], and an abridged edition [7]. This authoritative work is taken as the basis for a consideration of what may be learnt by a comparison of the printing press with the Internet. The comparison is possible because we are dealing with the ramifications of a clearly defined technical innovation; and

because the careful scholarship of Eisenstein and many others has thrown up a remarkable amount of information on the effects of the printing press.

The comparisons made here are selective rather than comprehensive, are impressionistic rather than rigorous, and utilise rough analogies rather than detailed metrics. The Internet is not the same as the printing press, nor will its effects be the same; the interactivity and dynamic nature of the Internet, and its intermingling of formal and informal communication, ensure this. But it may be that there is sufficient commonality to create some interesting, and perhaps insight-provoking, ideas. Drawing too strong an analogy between present and past times is a danger in all historical studies, but the success of works such as that on which the title of this paper is based [8] suggest that it is a risk worth taking.

The print revolution

Eisenstein's main theme is the change brought about by the advent of printing on the information culture (though she does not use the term) of the time; from the age of scribes to the age of print. (For background on the scribal culture, see Reynolds and Wilson [9], or for a shorter account de Hamel [10].) She looks beyond the evident fact that a larger number of works became available in much greater quantity than beforehand, to consider the impact of the printing press on the structure of knowledge, and of thought itself.

That it was a true revolution, rather than a slow evolution, is worth emphasising. After the first establishment of printing workshops in the Rhineland in the 1450s, the craft spread throughout Europe rapidly. By the end of the century, about eight million books had been produced. While comparisons with the production of hand-written texts by scribes are extremely difficult, due to the limited information for earlier centuries, and the difficulty of defining what constitutes a book prior to the print era, this figure must correspond to several centuries at least of scribal production. One estimate is that at the time of Gutenberg, about 30,000 manuscripts contained the world's store of recorded information, to be compared with 1.25 million titles printed by the time of Shakespeare, 150 years later; truly a 'bibliographical explosion' [11, p. 75].

It is worth noting immediately that we tend to think that print equals text. However, as Eisenstein reminds us, we would do better to think of printing and engraving: the two technologies developed together. She quotes the view of the American scholar George Sarton that it is best to consider 'a double invention: typography for the text, engraving for the images'.

Engraving provided not merely illustrations, but mathematical formulae, scientific diagrams, and the like; thus by the end of the fifteenth century, letters, numbers and pictures were all amenable to reproduction, with the printed book allowing interplay between all the elements. While it would be trite to regard this as a kind of Renaissance multimedia, it is as well to remember that technologies for integrating text and graphics have been available for a considerable time. The simplistic idea that printing moved the communication of information from graphic image to text, and that the Internet and similar media are redressing this balance, is not borne out by several strands of evidence presented by Eisenstein; not least the fact that the immediate impact of printing/engraving was to make recorded images much more readily available.

Of course, one distinction between the printing press and the Internet may seem immediately evident. Printed books were aimed, initially at least, at a small and elite market, whereas the Internet is accessible to a mass audience. Though literacy rates through history are notoriously difficult to assess, Eisenstein presents evidence to show that they may have been higher than generally assumed; but clearly the proportion of people who could afford to purchase significant numbers of printed books would not have been large. However, the distinction may not, in fact, be so marked. It is clear that the advent of the printed book affected the lives, thoughts and beliefs of many more than those who acquired private libraries.

Eisenstein refers to a 'knowledge explosion', accompanying the 'Northern Renaissance' of the fifteenth century, with the literature of the period, involving writers from Marlowe to Rabelais speaking of the 'intoxication' of the availability of written knowledge. In fifteenth century England, the printers and booksellers catered 'to the needs of lowly bakers and merchants as well as to those of lawyers, aldermen or knights [7, p. 32]'.

It seems that printed books were used by a rather wider cross-section of the population than might have been thought, and that their availability had an influence well beyond the scholarly elite. This may not be so far removed from the situation of the Internet, in that many people who have never used the Internet know of it, have opinions about it, and are aware of its power to change the information landscape with which they are familiar.

Paradoxes of print

In two respects, Eisenstein shows how the printing press, far from creating an entirely new form of information product, built on, and extended, what was already present, with sometimes paradoxical results.

For one thing, many of the concepts and techniques of information design, which were known to the scribes of the time, found much wider expression in print. Most strikingly, alphabetical order only became widely understood from the sixteenth century, though the alphabet itself had been devised many centuries before. This change may be attributed to book indexes and catalogues of books, themselves the results of the adoption of printing [7, p. 64-73]. When each copy of a work had to be produced by hand, the index, title page and similar aids would be produced to meet the individual, and idiosyncratic, needs of each reader; only with mass production of uniform texts did the need for standards in such matters become important. Similarly, when libraries and booksellers had a small stock of individual manuscripts, the products of scribal industry, there was again no need for the standardised form of arrangement of a catalogue. But:

> after the advent of printing, however, shelf lists were supplemented by sales catalogues aimed at readers outside library walls, while any index compiled for one text could be duplicated hundreds of times [7, p. 66].

Printing promoted not only standard forms of cataloguing and indexing, but also systematic use of such aids to the reader as footnotes, cross-references, page numbering in Arabic numerals, consistent title pages in works, tables of contents, links between text and figures, and so on. All of these elements had been known in scribal culture; indeed, features such as tables of contents, cross-referencing and page numbering date from the introduction of the codex, the earliest form of a book with individual pages rather than a continuous scroll, in late Roman times. They could find full application, however, only in a world of print. Of course, there is a linkage between the two, in that catalogues of whatever kind are immeasurably easier to construct, given consistent tables of contents; an idea which has a parallel in modern metadata issues.

This element of using the new technology to enable the instantiation of ideas devised at an earlier time finds some parallels with the Internet, most obviously in its use of the ideas of hypertext, devised by scholars of earlier times, such as Vannevar Bush [12] and Ted Nelson [13]. Rada [14] and Gilster [15] argue that the origins of hypertext are to be found in those early manuscripts, which allowed footnoting, cross-referencing, and page indexing, to give connections between different parts of the text. In this view, printing simply extended the applicability of the idea, allowing links to other texts. Because of the standardisation imposed by the printing process, a reader could follow a link to any copy of the cited text, with confidence that they would all provide identical information; this would not have been possible in the era of hand-written manuscripts. Its digital implementation simply makes the process faster, and allows immediate access to linked documents.

The second point in considering the relation of printing to the products of the older scribal culture concerns the nature of what

was printed. For one thing, while the usual assumption is that the printing press was used to promote humanist texts, and the earliest works of modern science, it is clear that, for the first few decades of printing at least, older works outnumbered new writings. Classical and Arabic texts were accompanied by arcana, occultism and 'fraudulent esoteric writings', so that:

> we must not think only about new forms of enlightenment when considering the effects of printing on scholarship. New forms of mystification were encouraged as well [7, p. 48].

The initial effect of printing, even in the academic sphere, was to greatly expand the holdings of libraries, but with material of very diverse quality: an assessment and sorting came later. Something of the same pattern, albeit on a very much reduced time-scale may be seen in the emergence of subject gateways to bring quality assessment, and access by standard means of resource description, classification and indexing, to the burgeoning mass of Internet material [16].

Nor were more popular subjects neglected:

> There is simply no equivalent in scribal culture for the avalanche of 'how to' books which poured off the new presses, explaining by 'easy steps' just how to master diverse skills, ranging from playing a musical instrument to keeping accounts [7, p. 64].

Even current concerns over the effect of the Internet in making pornography, and other salacious material more readily available was mirrored in the early decades of print, with printers enthusiastically providing 'scandal sheets, "lewd Ballads", "merry bookes of Italie" and other "corrupted tales in Inke and paper" [7, p. 94]'.

Print culture, over the centuries, has evolved sophisticated forms of scholarship, divided and sub-divided into disciplines and schools of thought, each with its own methods and standards. But this was by no means so in its early decades, or even centuries. The extent to which the interests of the early modern scientists overlapped into subjects such as alchemy, astrology, and mystical numerology is striking, Sir Isaac Newton being only the most obvious example. In its early years, print culture as a whole was characterised by a 'somewhat wide-angled, unfocused scholarship [7, p.45]'. This should be borne in mind, when considering some of the complaints of traditional scholars against an over-reliance on networked resources; perhaps every new communication medium must pass through such a stage.

The wandering scholar and the digital nomad

One aspect of the early years of printing strikes a close note of similarity with the Internet: the way in which distance is overcome in giving access to information. The centuries between the establishment of the first universities and the widespread adoption of printing were the time of the 'wandering scholar', travelling between universities, monasteries and other places where manuscripts were to be found. Travelling was absolutely necessary, when the scribal system meant that it was unlikely that copies of a range of material in any discipline could be found in any one place. Printing meant that universities and other institutions, even private individuals, could possess the major corpus of a discipline in one place; the era of the 'sedentary scholar' was established. The analogy with the ability of the Internet to bring the corpus to a still more focused location – the user's desk – seems clear. Of course, the Internet, with other digital technologies, facilitates communication and information access for mobile users. (See, for example, Makimoto and Manners [17].) But, rather than any kind of reversion to the wandering scholar, this can be seen as simply an extension of the printing press's ability to provide knowledge to its users wherever they may be; information comes to the user, rather than the user having to travel to the information, but in a fuller manner.

McGarry [18] points out that the 'invisible colleges' of scientists, stemming from the seventeenth century, were made possible only by printing, making possible the scientific journal as a form of communication, and by the development of the first person-to-

person postal services. He suggests that subsequent advances in communication (to the time of writing in the mid-1970s), particularly the telephone, air mail, and long-distance passenger air travel, enabled members of such colleges to communicate, and meet in person, much more rapidly than was possible by the conventional publication process. Subsequent developments in electronic communication via the Internet have speeded up the communication process still further, arguably minimising the need for physical presence and transfer of paper documents. This may be seen as another example of the Internet bringing out the same qualitative change as the printing press: enabling person-to-person interaction among specialised interest groups, and allowing for a subtle mix of formal and informal interaction.

Quality and repeatability

Another effect of printing was to greatly diminish the role of 'commentator and glossator': those scholars who, for want of access to a range of texts, devoted their whole lives to analysing and re-analysing a single text. Though it is unlikely that such could be found today, it is not unreasonable to suggest that the highly specialised forms of scholarship which thrive in a print-based academic culture may be under threat from the ability of the Internet to deliver a wide variety of relevant material outside the immediate domain as expressed by, for example, a printed scholarly journal.

This ties in with the point made above – that the early years of print were characterised by the printing and distribution of many copies of elderly texts. Yet it was the very availability of the texts for comparison and cross-checking, Eisenstein argues, that stimulated the emergence of new forms of knowledge. This is shown by the examples of planetary theory within astronomy, botanical knowledge as expressed in herbals, and cartography. For the latter, the atlases of Abraham Ortelius, which went through many editions allowing the older erroneous maps to be compared and supplanted. The very concept of having a standard and repeatable version of a text (or map or diagram), which can be corrected and improved in successive editions, of course, is a feature of printing/engraving which was impossible in a scribal system of hand copying of manuscripts. This led to a variety of tools for data compilation and comparison, including dictionaries, lexicons, concordances and the like, which form the basis for modern print scholarship, but which existed only in rudimentary form before Gutenberg. The development of equivalent tools for Internet information will be a major step in marking the maturity of the new medium.

We should also note one rather paradoxical feature of this process, identified by Eisenstein: an initial degradation in the quality of books, ranging from scripture texts to botanical herbals. In the hands of printers wishing simply to produce rapid profits, the errors, which had always been present in manuscript copies, were replicated, and in some cases increased. (Nor could an individual scribe commit the kind of 'standardised error' which created the 'wicked Bible' of 1631, when the word 'not' was omitted from the Seventh Commandment.) However, the much greater availability of printed copies from varied sources meant that such errors could rapidly be identified and corrected, so that the ultimate result was a higher overall quality. There seems to be an echo here of concerns about the quality of Internet materials produced without the quality control processes of conventional print-based publishing, raised in the intervening centuries to a high level of sophistication.

Not only was the content of many printed works to some degree archaic, but so was the form and style of their production. The choice of script was carefully chosen, in many cases, to imitate handwriting, decorations equivalent to those added by scribes were included, while erasers and paintbrushes were applied to the final product to give an imitation of a hand production [18, 14]. It may therefore not be surprising to find how many Internet resources are simply screen-based versions of what might be expected on the printed page. The development of information with novel structure and design to suit

the capabilities of the new medium is slow in coming; as with printing, this is due to a combination of lack of imagination on the part of information providers, with a perception that users will be happier with the kind of product with which they are familiar.

Other features of the introduction of printing strike surprisingly modern chords. There is a concern for preservation of material over time. On the one hand, there was general belief that paper would not last as well as parchment, so that printed material would be necessarily more ephemeral. On the other, there was a rapidly increasing recognition that the making and dispersal of multiple identical copies was the best defence against the loss of material contained in a few manuscripts, however carefully guarded. Here we may see a precursor of current concerns about digital preservation, and also the feeling that something placed on the Internet is, in a way, invulnerable to censorship. Of course, the origins of the Internet were in the US defence agencies' ARPA network, which relied on the concept of decentralised passage of messages through a redundant network; not without an analogy in the preserving role of multiple print copies.

Social aspects of the new technology were not ignored. 'Complaints about the 'sullen silence' of newspaper readers in seventeenth-century coffee houses point to the intrusive effect of printed materials on some forms of sociability' [7, p.94] appear to echo current concerns about the isolating effects of over-reliance on the Internet. Similarly, Eisenstein's identification of the amplification and reinforcement of 'myths and clichés', often stemming from ancient scribal sources, but gaining much deeper roots in print, seems to have something in common with the modern phenomenon of Internet myth and spoofs (see Gilster [15, Ch. 4], and Crawford [19, Ch. 11]).

Conclusions

It seems clear that many of the issues and consequences surrounding the introduction of the printing press, as it succeeded scribal manuscript production, have a similarity to those noted as the importance of the Internet increased.

We should not expect too exact a correspondence, for reasons noted above. Also, while print rapidly replaced manuscript, the same is not necessarily true for Internet and print. Gilster, for example, argues that networked information sources extend, rather than supplant, the power of print; 'the two technologies intertwine like DNA strands, the double helix of the twenty-first century's intellectual revival' [15, p. 26].

Nonetheless, examination of an earlier communications revolution may provide lessons for understanding the one currently under way. McGarry [18] argues that the fundamental relationship between a medium of communication and the one that it replaces is an initial dependency of the new on the old form, and some of the issues discussed above support this.

Crawford [19] suggests an alternative general rule: that new media complement rather than replace the old. However, with respect to the printing press, his comparison is with oratory, rather than with the written scribal manuscript. Oratory has not been supplanted entirely, though the nature of spoken communication has been changed dramatically by the availability of printed materials, whereas the hand-copied text has not been a viable information product for some hundreds of years. Our view of the impact of the Internet on the world of print may, if we follow Crawford's thought, depend on whether we believe that it is a new way of presenting the written word, in which case print may be expected to wither as did the scribal manuscript, or whether we see it as an entirely new medium of communication, in which case it may be expected to find a niche alongside speech and print.

Gilster offers a rather broader perspective:

> I see the Net as having the same effect all technology does. It offers new possibilities that have to be considered within the context of an unchanging human nature [15, p. 22].

Examining earlier technological innovations, where their significance can be

appreciated over the gap of time, may be a way of assessing this. The printing press may indeed offer a reflection of the nature and significance of the Internet.

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