

The Gutenberg Revolution

The Golden Age



Marcilio Ficino
(1433-1499)
[Leonardo da Vinci]

If we are to call any age golden, it is beyond doubt that age which brings forth golden talents in different places. That such is true of this our age [no one] will hardly doubt. For this century, like a golden age, has restored to light the liberal arts, which were almost extinct: grammar, poetry, rhetoric, painting, sculpture, architecture, music ... and all this in Florence. Achieving what had been honored among the ancients, but almost forgotten since, the age has joined wisdom with eloquence, and prudence with the military art.... This century appears to have perfected astronomy, in Florence it has recalled the Platonic teaching from darkness into light ... and in Germany ... [there] have been invented the instruments for printing books.

— Marcilio Ficino, from a letter to a friend (1492).

Spreading the Word

Information is exploding so furiously around us and information technology is changing at such bewildering speed that we face a fundamental problem: How to orient ourselves in the new landscape? What, for example, will become of research libraries in the face of technological marvels such as Google?



Rosetta Stone
196 BCE
(British Museum, London)

How to make sense of it all? I have no answer to that problem, but I can suggest an approach to it: look at the history of the ways information has been communicated. Simplifying things radically, you could say that there have been four fundamental changes in information technology since humans learned to speak.

Somewhere, around 4000 BC, humans learned to write. Egyptian hieroglyphs go back to about 3200 BC, alphabetical writing to 1000 BC. According to scholars like Jack Goody, the invention of writing was the most important technological breakthrough in the history of humanity. It transformed mankind's relation to the past and opened a way for the



The Diamond Sutra
868 CE
Oldest printed text, on a scroll
(British Library, London)

emergence of the book as a force in history.

The history of books led to a second technological shift when the codex replaced the scroll sometime soon after the beginning of the Christian era. By the third century AD, the codex — that is, books with pages that you turn as opposed to scrolls that you roll — became crucial to the spread of Christianity. It transformed the experience of reading: the page emerged as a unit of perception, and readers were able to leaf through a clearly articulated text, one that eventually included differentiated words (that is, words separated by spaces), paragraphs, and chapters, along with tables of contents, indexes, and other reader's aids.



Kellis Isocrates Wooden
Codex
(4th century Egypt)

The codex, in turn, was transformed by the invention of printing with movable type in the 1450s. To be sure, the Chinese developed movable type around 1045 and the Koreans used metal characters rather than wooden blocks around 1230. But Gutenberg's invention, unlike those of the Far East, spread like wildfire, bringing the book within the reach of ever-widening circles of readers. The technology of printing did not change for nearly four centuries, but the reading public grew larger and larger, thanks to improvements in literacy, education, and access to the printed word. Pamphlets and newspapers, printed by steam-driven presses on paper made from wood pulp rather

than rags, extended the process of democratization so that a mass reading public came into existence during the second half of the nineteenth century.

The fourth great change, electronic communication, took place yesterday, or the day before, depending on how you measure it. The Internet dates from 1974, at least as a term. It developed from ARPANET, which went back to 1969, and from earlier experiments in communication among networks of computers. The Web began as a means of communication among physicists in 1981. Web sites and search engines became common in the mid-1990s. And from that point everyone knows the succession of brand names that have made electronic communication an everyday experience: Web browsers such as Netscape, Internet Explorer, and Safari, and search engines such as Yahoo and Google, the latter founded in 1998.

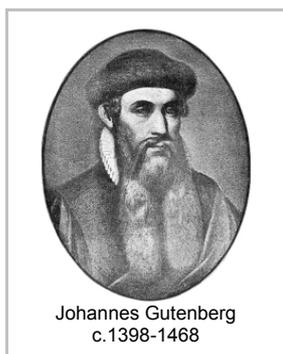


When strung out in this manner, the pace of change seems breathtaking: from writing to the codex, 4,300 years; from the codex to movable type, 1,150 years; from movable type to the Internet, 524 years; from the Internet to search engines, nineteen years; from search engines to Google's algorithmic relevance ranking, seven years; and who knows what is just around the corner or coming out the pipeline?

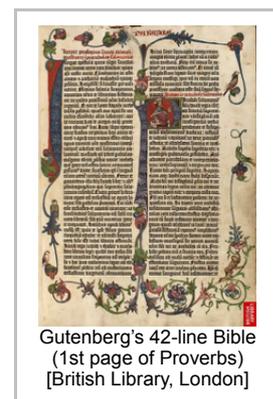
[Excerpt from Robert Darnton, "The Library in the New Age" in *The New York Review of Books* (12 June 2008)]

Robert Darnton, an American historian specializing in 18th century France, is the Carl H. Pforzheimer University Professor at Harvard (since 2007), having previously served as the Shelby Cullom Davis Professor of European History at Princeton University.

Johannes Gutenberg's Printing Press



The demand for learning seemed insatiable. The answer was the production of books printed on paper from movable type, in place of the old and imperfectly copied parchment manuscripts. Forty-five copyists working for two years under Cosimo de Medici produced only two hundred volumes; by 1500 there were in Europe at least nine million books, of thirty thousand titles, and over a thousand printers. The new printing spread with a rapidity that would have been impossible with the communications of a hundred years earlier. The first surviving specimen was [120] printed in



Mainz, on the upper Rhine, before 1447; three years later Gutenberg and Fust had set up there a partnership whence issued the famous forty-two line Bible and the thirty-two line Latin grammar of Donatus, symbolic of sacred and secular learning, the Reformation and humanism.

By 1465, the press had reached Italy; by 1470, Paris; London followed in 1480, Stockholm two years later, Constantinople in 1487, Lisbon in 1490, while Spain characteristically lagged behind till 1499. Thus by 1500 all the chief countries of Europe were provided with the means for the rapid multiplication of books. The consequences for intellectual life were momentous. The number of those who could share the best knowledge increased a thousandfold; it became worth while to learn to read, and to write for a wide circle of readers. A library could now contain a wide variety of secular works, instead of the few expensive writings of the fathers and doctors. Prices sank to an eighth of the former cost, and, judged by our standards, were low indeed. Ideas could now be sure of a wide hearing; and though the Church soon attempted to control the new force by her censorship, the printing-press had made it impossible ever to extirpate a living idea.

— John Herman Randall, *The Making of the Modern Mind: a survey of the intellectual background of the present age* (Cambridge, MA: Houghton Mifflin Co., 1940), pp. 119-120.

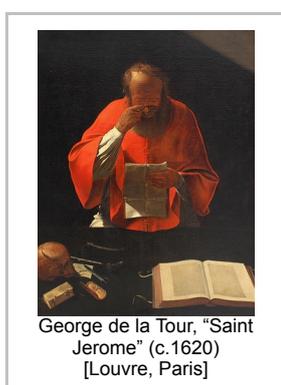
Silent Reading

Between the sixteenth and eighteenth centuries, as growing numbers of people learned to read, new ways of reading became popular. The most novel of these, as Philippe Aries has noted, was private reading in a quiet place away from other people, which allowed the reader to engage in solitary reflection on what he or she read. This ‘privatization’ of reading is undeniably one of the major cultural developments of the early modern era.

What conditions made it possible? First of all, people needed to acquire a new skill: the ability to read without pronouncing the words as they were read. Otherwise the reader remained subject to communal constraints while reading in a library, say, or a room where others were present. Silent reading also made possible the immediate internalization of what the reader read. Reading aloud was slow, laborious, and externalized; silent reading was faster, easier, and more immediate in its impact on the inner self. Apparently, during the Middle Ages, one group of readers after another mastered the technique of silent reading. The first were the copyists working in the monastic scriptoria. Then, around the middle of the twelfth century, scholars in the universities acquired the ability. Two centuries later the lay aristocracy learned to read silently. By the fifteenth century silent reading was the norm, at least for readers who also knew how to write and who belonged to segments of society that had long been literate. For others, who belonged to groups that slowly learned to read and for whom books remained strange, rare objects, the old way of reading no doubt remained a necessity. As late as the nineteenth century, neophytes and maladroit readers could be identified by their inability to read silently. In Labiche’s play *La Cagnotte* (1864), the farmer Colladan replies to a person who loses patience when he reads a very private letter out loud: ‘If I read out loud, it’s not for you, it’s for me... Whenever I don’t read out loud... I don’t understand what I’m reading.’ Silent reading opened new horizons for those who mastered it. It radically transformed intellectual work, which in essence became an intimate activity, a personal confrontation with an ever-growing number of texts, a question of memorization and cross-referencing. It made possible a more personal form of piety, a more private devotion, a relation with the sacred not subject to the discipline and mediation of the Church. The spirituality of the mendicant orders, the *devotio moderna*, and even Protestantism, all of which presuppose a direct relation between the individual and God, relied heavily on silent reading, which enabled at least some people to nurture their faith on private reading of spiritual books or the Bible itself. Finally, silent, secret, private reading paved the way for previously unthinkable audacities. In the late Middle Ages, even before the invention of the printing press, heretical texts circulated in manuscript form, critical ideas were expressed, and erotic books, suitably illuminated, enjoyed considerable success.



Johannes Vermeer, "Girl Reading a Letter at an Open Window" (1657), oil on canvas
[Staatliche Kunstsammlungen, Gemäldegalerie, Dresden]



George de la Tour, "Saint Jerome" (c. 1620)
[Louvre, Paris]

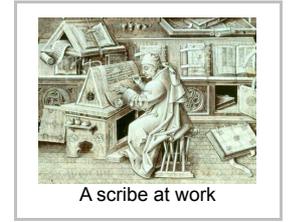
Although the invention of printing was indeed a ‘revolution’ in that it made it possible to produce a large number of identical copies at a cost much lower than that of copying by hand (even at a time when print runs were small and printing costs quite high), it should not be credited with intellectual and psychological changes that were really the result of a new method of reading, regardless of whether the text was printed or manuscript. By the sixteenth century, the ‘other revolution’ — the revolution in reading — was already accomplished, although it had only recently made its impact felt on laymen and remained incomplete, since large numbers of readers who had not yet mastered writing were incapable of reading silently. There seems to have been a clear division between those for whom reading was a private act and those for whom it remained a communal act, perhaps

even an act of class solidarity.

[Excerpt from Roger Chartier, “The Practical Impact of Writing” in *History of Private Life*, vol. 3: *Passions of the Renaissance* (Harvard University Press, 1993)]

The Manuscript Culture of the Middle Ages

Before the advent of printing in the middle of the fifteenth century, treatises in medieval science and natural philosophy depended for their existence on manuscript copies. As a consequence, they were subject to all the vagaries and uncertainties of any system that must rely on a scribe or copyist to produce one or more copies from an exemplar or to record a lecture as it was given. Medieval Latin texts were subject to more than the ordinary scribal vicissitudes — errors of commission and omission because medieval copyists had developed an elaborate system of abbreviations that served to speed the process of copying and also tended to save paper. These abbreviations frequently added an element of uncertainty to an interpretation of the text, both for someone who wished to read it as well as for someone who wished to copy it. The difficulties in deciphering medieval manuscripts affect modern understanding of medieval science in two basic ways.



The first way in which the difficulties in deciphering medieval manuscripts affects our understanding today concerns the integrity of an author's work as it was copied and recopied and read by students and scholars over the course of centuries. Because copies might vary drastically as a result of scribal errors introduced at any point in the dissemination process, we may infer that the reader's understanding of an author's intent in some, and perhaps in many, passages was almost unavoidably distorted. Reliance on handwritten and handcopied works meant that versions of the same treatise in Paris, Oxford, and Vienna might differ substantially. In astronomical and mathematical texts, for example, essential diagrams and figures may have been included in some versions, but omitted or included only partially in others. Even when a diagram was included, scribal errors might reduce or destroy its utility. In purely verbal texts, words might be omitted or added by the scribe. Many of the copies of medieval works that have survived were not made by professional scribes, but by students who had copied the texts for their own use. Such copies were often passed along to other students, who would introduce more errors and changes. To these formidable problems, we must add that of legibility. The handwriting of copyists was frequently difficult to decipher and all too often was simply unintelligible.

University stationers, or booksellers, had as their responsibility the production of reliable texts for university personnel. They would often receive the pristine version of a treatise directly from its author. From this original they would make one or more copies. The stationers were authorized to lend all or parts of the texts to students who, for a fee, could copy it for their own use. Obviously, student copies varied in quality. Many were subsequently passed on to other students for further copying. Errors were inserted at virtually every stage of the process of multiplying and disseminating texts. Perhaps the only exception to this generalization are copies of the Bible, which were carefully supervised.

The second way that the interpretation of medieval manuscripts may affect our understanding of medieval science has to do with the limits imposed on modern scholars who read or edit treatises written in the Middle Ages. Most scholars would probably begin with a list of the extant manuscripts of the treatise in question. The quality of those manuscripts, which managed to survive the ravages of time, determines the level of intelligibility of that treatise. In most instances, significant gaps in our understanding of that treatise will probably remain even after modern scholars have completed an edition of it.

It is evident that differences between an original version of a medieval treatise and all the copies that were subsequently made from it were at best considerable and at worst vast. From our vantage point, we can see how difficult it must have been to do science in the Middle Ages. The preservation of reasonably faithful versions of the basic Greco-Arabic texts that had been translated into Latin was itself a major task. To this we must add the vast array of medieval scientific texts, commentaries, and questions that were copied and recopied. Unfortunately, not all texts were copied and recopied. Many treatises simply disappeared. During the Middle Ages, knowledge was as likely to vanish as to be preserved. An enormous effort would have been required just to maintain the status quo, or to restore a text that had been corrupted. Although we cannot measure the detrimental effects on medieval science and natural philosophy that followed solely because of a dependence on handwritten manuscripts, we may plausibly

conjecture that they were enormous.



Printer operating a screw press.

The introduction of printing in the mid-fifteenth century significantly altered this picture. With the advent of printed books, knowledge in general, and technical information in particular, could be disseminated with a speed and accuracy that could scarcely have been imagined in the age of manuscripts. Science was a particular beneficiary of printing. Identical copies of a scientific work could be spread through Europe in a relatively brief time. And yet, the precise role of printing in the generation of the Scientific Revolution is in dispute. We must ask if, in the absence of printing, the old scribal system could have been improved to multiply copies of scientific treatises and thereby meet Europe's intellectual needs. And would the ever-expanding royal, ducal, municipal, and university libraries

have provided European scholars with sufficient access to allow the continued expansion of science and learning? Fortunately, we need not answer these questions in this study. The foundational contributions to early modern science that are its focus had already been formed long before Gutenberg's printing press converted Europe from a manuscript to a print culture.

Although manuscript reproduction and dissemination posed serious problems in the Middle Ages, we must not conclude that the problems were insuperable. Despite the formidable obstacles just described, the quality of the handwritten texts available to medieval scholars in science and natural philosophy was often more than adequate to allow for their comprehension and for the addition of significant contributions to learning. The legacy that has reached us is one that we can comprehend and often admire. The core of that legacy was Aristotle's natural philosophy, which was deeply rooted in the medieval university [...].

— Edward Grant, *Foundations of Modern Science in the Middle Ages* (New York: Cambridge University Press, 1996), pp. 51-53.