

## WRITING MATERIALS: THE POLITICS AND PRESERVATION OF KNOWLEDGE<sup>1</sup>

Bonnie Effros

### INTRODUCTION

Just as we cannot communicate to those around us without gestures or spoken language, it is difficult to convey thoughts and desires in a more lasting manner (or to those at a distance) without either the written word or pictorial representation.<sup>2</sup> In Europe as early as the Renaissance, many scholars pondered the origins of language as intimately tied to writing symbols. They believed themselves a part of a grand cultural tradition that traced back to classical antiquity, and linked their own achievements with those of the ancient Greeks and Romans.<sup>3</sup>



Giambattista Vico (d.1744), a humanist philosopher in Italy, elevated the achievements of the ancient Greeks over those of all earlier civilizations because he believed they were the first to master alphabetic writing. In his view, mastery of writing in words as opposed to the hieroglyphic symbols of the Egyptians, freed Greek citizens from having to rely on priests or aristocrats. Rather than a “secret language” like cuneiform or hieroglyphs, what Vico described as “vulgar writing” was a key ingredient in the origin of democracy in classical Greece. From his perspective, alphabetic writing stripped figures and signs of their mysteries and gave people equal access to knowledge of truth. Letters made it possible for a greater number of people to learn to read and was intimately connected to their ability to participate in both religious worship and government in a direct and personal manner.<sup>4</sup>

*Figure One: In 1799, a French soldier during the Napoleonic invasion rediscovered the Rosetta Stone in the town of Rashid (Rosetta) in the Nile Delta. When the British defeated the French in 1801, they took it to the British Museum where it remains today. The top two registers of the inscription, which contain a decree issued by Ptolemy V in hieroglyphs and demotic Egyptian, were translated with the help of the Greek in the lowest register by the French scholar Jean-François Champollion in 1822.*

In the decades prior to the French Revolution, Enlightenment thinkers placed greater worth on reason and individual

thinking than on tradition, as had been the case during the Renaissance. The philosopher Nicolas de Condorcet (d.1794) pointed to the positive social good brought by recent inventions such as the printing press. Condorcet believed that the limitless reproduction of texts afforded by moveable print was key to the success of democracy, which he experienced firsthand as a delegate to the National Assembly at the start of the French Revolution. In fact, he credited this technological achievement with greater access to justice in human society. In his view, the proliferation of the written word broke the Church's monopoly over knowledge by allowing more individuals access to texts which they could read and judge for themselves.<sup>5</sup>

Those among you love numbers will be pleased to learn that Condorcet identified mathematics as the most universal and most perfect form of language. He viewed numbers and formulas as a highly developed alphabet and form of communication. Since most women and the poorer classes of his day had insufficient education to participate in this dialogue, Condorcet believed that improved schooling was essential to a just society.

These century-old debates about the origins of language-- and the direct connection between the written word and participatory democracy-- may seem part of the distant past to many of us. Yet, they are relevant because they offer unique perspectives on the challenges and opportunities of the digital revolution and recent innovations in

magnetic storage. The Renaissance offers a historical comparison that gives us a basis for measuring the impact of writing materials on society. This example allows us to ask if technological innovations like the internet and the ability to store ever-increasing amounts of data are actually making us more knowledgeable and



*Figure 2 – This opening page of the Gutenberg Bible at the University of Texas (Hubay 39), contains Saint Jerome's introduction. The style imitates a medieval manuscript with historiated initials, illustrations and double columns of Latin text on a single leaf. Unlike a hand-copied manuscript, it could be reproduced multiple times once the type had been set.*



improving the quality of our lives. They also give us the chance to consider whether the cost of entry (access to a computer or lack of education) excludes people who might benefit from this information.

The Enlightenment, too, helps us formulate vital questions about who controls knowledge in the digital age and what obstacles exist to full participation. Humanistic thinking encourages greater objectivity as we explore the politics of collecting, storing, and transmitting information both in the past and today. Whatever our conclusions, we cannot deny the deep and meaningful connections that exist between writing forms and media, and between the preservation of knowledge and the organization of human society.

### **HUMANS AND THE SEARCH FOR FUNCTIONAL WRITING MATERIALS**

From the earliest times, humans used various media for writing surfaces: including the walls of caves, stones, bones, bamboo strips, and ceramic sherds. Once inscribed with markings, these materials transmitted messages of religious, ritual, magical, and practical significance like trade inventories, curse tablets, and to-do lists. However, not all of these materials were equally accessible and efficient. They varied regionally in response to the availability and affordability of particular resources. In addition, written language was often out of reach for the vast majority of pre-modern populations, which were for the most part functionally illiterate.

In ancient Babylonia, priests used a metal stylus to mark soft clay tablets with cuneiform texts when they wanted to preserve their writing for the elite audience who could read them. Cylinder seals, rolled



*Figure 3 – This Chinese text was copied on bamboo strips using a brush and dates to the Warring States Period (475-221 BCE). These strips, read downwards and from right to left, are now held in the Shanghai Museum, and contain a discussion of the 'Shi Jing', or Book of Odes.*

over a similar medium, were particularly handy when priests wanted to reproduce texts multiple times. Once baked, such

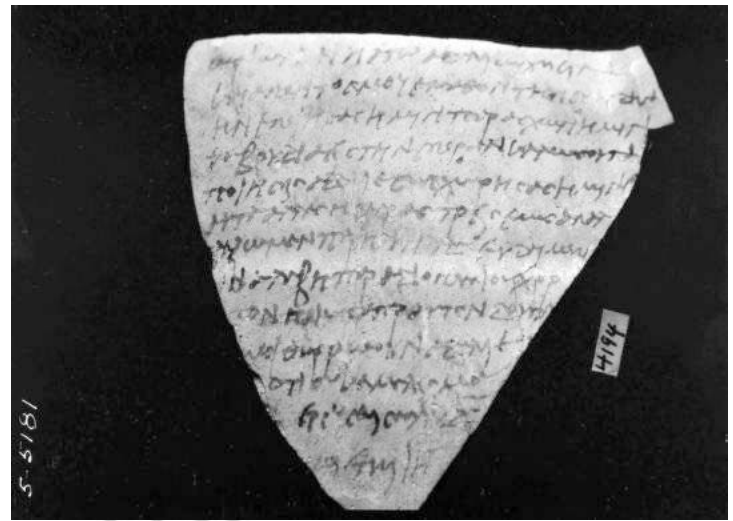
inscribed clay tablets were sufficiently durable to last millennia under the right conditions.<sup>6</sup>



*Figure 4 – This terracotta clay cone inscribed in cuneiform with a stylus commemorates the construction of the walls of Sippar by King Hammurabi. Now at the Louvre, it dates to the first half of the 18th century BCE and comes from Iraq.*

By contrast, the ancient Greeks and Romans chose stone carving for important messages that they intended to display in posterity such as grave markers. However, in daily life, for the sake of convenience and affordability, they often relied upon handy potsherds or ostraca, broken bits of pottery that provided a smooth surface and inexpensive material for writing. Wax-coated tablets in the ancient world, by contrast, offered the benefit of reuse after heating. This medium which was especially suited to classroom use, where children were learning to write. In eighth-century Korea and China, engraved wood allowed repeated reproduction of the written word by rubbing, a technique known as

xylography that was transmitted to the West only half a millennium later.<sup>7</sup>



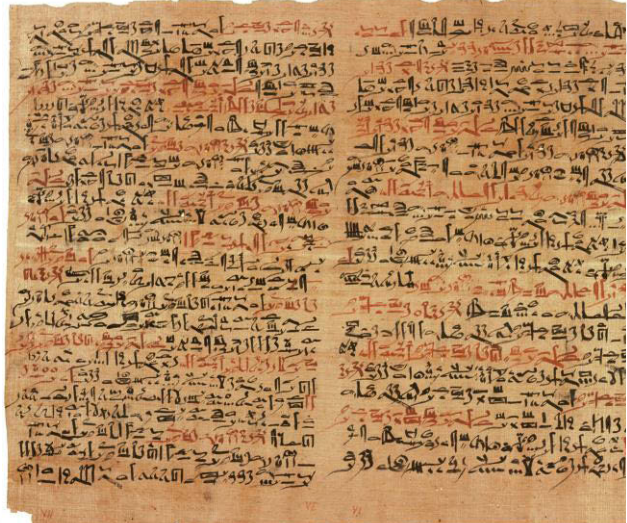
*Figure 5 – This late third-century ostrakon in Greek from the University of Michigan Library preserves a private letter concerning the use of oxen for sowing a field. It suggests that immediate tasks could be written on a variety of accessible surfaces and were not intended by their authors to be kept in perpetuity.*

The ancient Egyptians were among the first in the West to employ more flexible writing media, namely papyrus. (As we will see below, the use of silk as a writing material in China was similarly early.) Egyptian artisans manufactured this material from the papyrus reed, which grew mainly in the region known as the Egyptian Delta. To prepare the reeds, Egyptians cut the pithy centers of stalks of the plant into thin strips which they then placed side-by-side with superposed layers at right angles to form sheets. Pressed and beaten together while still moist, the fibers adhered even when



dry. The horizontal lines left by the papyrus strips became the guide for scribes to keep their writing (done with a reed brush) straight and level. Papyrus, however, was unforgiving in a number of ways if a scribe made an error. While erasure was possible with a sponge or an abrasive substance, it was not easy to write over the same spot. Other downsides to the material were that the sheets became brittle when dry and thus could not be folded. For this reason, papyrus sheets were rolled as a scroll. Likewise, scribes could only write on one side because ink bled through the semi-porous material.<sup>8</sup>

ACTIVITY: Watch a slide-show on the manufacture of papyrus:  
[http://www.lib.umich.edu/papyrus\\_making/#](http://www.lib.umich.edu/papyrus_making/#)



*Figure 6 – Dating to the Second Intermediate Period in Egypt, the Edwin Smith papyrus may have come from the capital of Thebes. Purchased in Luxor, this hieratic manuscript (Egyptian cursive) was donated to the New York Academy of Medicine. It is thought the oldest surviving*

*Western text of surgery, and includes material on surgery, gynecology, and magic.*

Papyrus reeds grew in few places other than Egypt and Ravenna on the Adriatic coast of Italy. Egypt thus exercised a near monopoly on the production and trade of this elegant, light-colored writing substance throughout classical antiquity. It became popular not just among the Egyptians but also among the Greeks and Romans, who were attracted by the relative affordability of papyrus rolls. With the advent and spread of Islam through the Middle East and North Africa in the seventh century, papyrus remained an important writing material for adherents of the new religion. Muslim administrators used the medium for official correspondence, legal documents, ledgers, and tax receipts. In northern Europe, however, climatic conditions supported neither the cultivation of papyrus nor its effective use since humidity hindered its preservation. Few surviving examples of papyrus in Europe date after the seventh century.<sup>9</sup>

### **DOES FORM DETERMINE FUNCTION?**

In Antiquity, like today, specific qualities of writing materials dictated the purposes for which they were employed. As we have seen, stone, for instance, was most suitable for epitaphs or public proclamations, whereas contemporaries did not see papyrus as having sufficient permanence and durability for long term preservation. For these reasons, papyrus was not commonly used for longer literary or sacred

texts. The accessible and cost effective medium nonetheless remained popular for day-to-day transactions like trade in the dry, hot conditions of North Africa and the Middle East. These examples should make us think about more recent technological developments and to what degree digital media like electronic books and newspapers are better suited to some objectives (like quick reading) than others (note-taking and deep engagement with a text).



*Figure 7 – This scribe seated with a papyrus scroll on his lap suggests some of the difficulties in using a scroll for study. It is hard to mark one's place! Dated to the 19th-20th dynasty, 1295-1069 BCE in Egypt, this diorite statue at the Louvre Museum gives us some clues as to why a codex was preferable if one wanted to navigate quickly through a text.*

Something to keep in mind is that the format of papyrus, namely scrolls, influenced the way in which authors composed texts and people read them. The manufacture of papyrus rolls in standard lengths necessitated the division of literary works into books. Anyone familiar with the ancient Greek epic poems of the *Iliad* and *Odyssey*, for instance, should consider that scholars of Alexandria apportioned this work of the eighth century BCE into books relatively arbitrarily based on how much material fit on a scroll. By the time of the Latin author Virgil in the first century BCE, however, authors began to think of book divisions – today's chapters – as discrete parts of a work. In other words, writers took advantage of divisions introduced by their writing medium to structure their texts. In the *Aeneid*, Virgil applied this technique to represent changes in the narrative.<sup>10</sup>

Increased familiarity with the medium of the codex – what we know today as a book (see below) – gave birth to an intellectual shift and a revolution in literature which became dominant by the fourth century CE. We see similar steps being taken today, as engineers continue to modify the format of electronic books to meet the needs and expectations of readers. Whereas engineers designed the earliest Kindles to look like books with a plain white background, black print, and limited possibility to alter texts, today's touch screens allow readers freedom to manipulate the content and appearance of their reading.

## PUTTING QUILLS TO PARCHMENT

Contemporary to papyrus, parchment was a writing material made from animal skins. In the ancient Middle East, parchment was commonly made from skins of calves, sheep or goats. White animals were preferred since they tend to produce the lightest colored parchment. Vellum, the most desirable form of parchment because of its refined surface, referred exclusively to calfskin. Parchment, which was far more costly than papyrus, was developed first in ancient Egypt, Assyria, and Babylonia, but then spread to many regions that raised flocks. It provided material support for writing, painting, and other purposes.

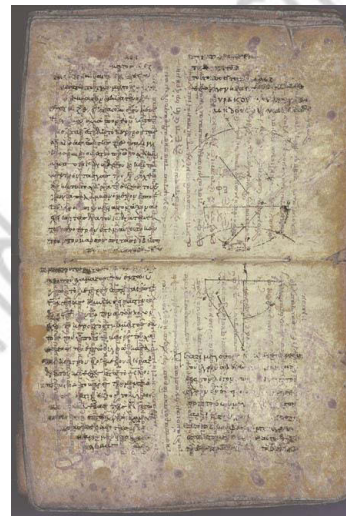
Despite its durability and versatility as a writing surface, parchment's cost was prohibitive. This technology thus never fully replaced the use of papyrus, ostraca, stone, and wax tablets for recording information.<sup>11</sup>

To prepare animal hides for writing, workers soaked the skins in a lime solution and removed the remaining hair and flesh (a characteristic that survives in parchment manuscripts, in which the hair and flesh sides are discernable). Workers washed and stretched the cleaned hides tightly on a wooden frame and scraped them with moon-shaped knives as they dried. When the hides were nearly dry, workers buffed the surfaces with pumice stone. From the fourth century CE, scribes began to fashion split quills from feathers as a firmer tool for writing than reed brushes. Quills quickly supplanted reed brushes for writing in the West due to their availability in virtually any

market. They offered exciting possibilities for artists who learned to incorporate shading and decorative work in written characters that had not been possible with reed brushes. The spread of parchment and quills contributed to the development of new letter forms and book design features.

ACTIVITY: See a modern demonstration of manufacturing parchment from the BBC:

<https://www.youtube.com/watch?v=2-SpLPFaRd0>



*Figure 8 – The high cost of parchment encouraged the erasure and reuse of entire manuscripts. The Archimedes Palimpsest, now at the Walters Art Museum in Baltimore, is a thirteenth-century Byzantine Greek prayer book made of parchment from several earlier manuscripts, including most importantly a tenth-century copy of at least seven treatises by the ancient Greek scientist and philosopher Archimedes.*

Parchment offered the advantage of lightness and flexibility, which meant ease of handling and transmission. The surfaces



were suitable for inks and colors and one could write on both sides. Scribes could make erasures and corrections. Parchment also accommodated folding and stitching and could be sewn together in scrolls or organized concertina fashion since sheets of parchment did not tear easily as papyrus. With a long life, parchment could be stored for more than a millennium in the right conditions and wear was minimal compared to papyrus. Due to cost, however, access to parchment was limited to those of financial means such as religious institutions and individuals of high status such as pharaohs, kings, and aristocrats.

The earliest texts on parchment took the form of rolls or scrolls. For instance, the ancient pharaohs of Egypt (as early as c. 1500 BCE) recorded their law codes on leather rolls. The stitching between multiple pieces of parchment proved much stronger than the pasted joints of papyrus rolls. These scrolls resembled the modern Torah (Hebrew Bible) still featured in Jewish worship. Although papyrus manufacture continued for centuries, parchment began to supplant it as the most widely used writing surface in the West by the fourth century, which, as we will see below, was the same period in which the codex definitively replaced the use of scrolls. In fact, during the period in which both parchment and papyrus were employed, scribes copied many works of ancient literature from papyrus to parchment. Had this not occurred, many ancient Greek and Roman classics would not have survived for us today. In the Arab world, the transition

from papyrus to parchment occurred somewhat later due to the continued accessibility of the former from Egypt. Parchment was used widely in the Muslim world by the ninth century, but since papermaking technology had arrived from the East in the mid-eighth century, demand was never as great as was the case in Europe.

### ORGANIZING KNOWLEDGE: THE RISE OF THE CODEX

As early as the first century CE in the Roman Mediterranean, some papyrus but especially parchment texts began to take a different shape. Rather than retaining the shape of a roll, scribes gathered parchment leaves in a manner similar to wax tablets,



*Figure 9 – A Roman fresco from the Praedia of Julia Felix in Pompeii, and now in the Museo Archeologico Nazionale (Naples), displays a bound set of wax tablets and a stylus in the middle section of the lower shelf. It sits next to a contemporary scroll, suggesting that the two writing media existed at a contemporary period.*



which were often bound together as a collection for transcribing longer texts. The word codex, thus originally referred to two or more tablets fastened together.<sup>12</sup>

In the first centuries of the Common Era, scribes began for the first time to employ sheets of parchment in this fashion. They were sewn together at their central crease to form something akin to what we know as a book. Like scrolls, codices had a cover or binding but in this case they were made typically of wooden boards (which today have been replaced by cardboard).

Decorated with cloth, parchment, leather, metal or precious stones, wooden boards helped identify the content of books. Books



*Figure 10 – This fifteenth-century folding almanac, Ms. 8932, at the Wellcome Trust was composed in Latin and contains astrological tables and diagrams. A*

*physician might have traveled with this luxury manuscript hung from his belt for both practical reasons and as a sign of his status as a learned man.*

might include affixed tags or labels with the name of the author and title of the work on their spines. As we will see below, although not all genres of texts were copied into codices, Christian texts like the Bible, saints' lives, and liturgical works, were frequent candidates for such transitions because of the ways in which scholars studied them.

In China, by contrast, the scroll had much longer life in cultural life but was supplanted in the tenth century by what were known as "whirling books", which opened like an accordion. This design made various parts of the text more accessible than scrolls, which were difficult to manipulate. However, a significant flaw of the "whirling books" was that the paper from which they were fashioned was not very durable along the folded sections. During the Song dynasty (960-1279 CE), "butterfly" bindings became increasingly popular. This format involved printing only on one side of the paper and then folding it so that the blank sides were not visible.<sup>13</sup>

Similar to this technology, but with no direct connection to it, was an accordion-like instrument developed by Amerindians like the Mexica and Maya in Mesoamerica before the time of the Spanish Conquest in the sixteenth century. Used for recording religious rituals and other significant information, these artifacts were made of a

paper-like material composed of pounded tree bark or roots. Like paper, this substance could be polished in preparation for painting symbols and images.

Unfortunately, few original examples of this technology survive today since Spanish missionaries condemned indigenous works as idolatrous and confiscated and burned them when they had the opportunity.<sup>14</sup>

By contrast, in the West, scribes fashioned codices from several sheets of parchment cut to the same rectangular size and shape. They typically laid four of these together and folded them once to form the writing unit known as a gathering which was then sewn at the seam. This gathering produced eight folios (two-sided) or sixteen leaves (single-sided), and was called a quaternio or quire. So that quires could be bound in the correct sequence, they were marked with signatures (consecutive letters or numbers) on the last page at the top or bottom. From the late eleventh century, the first words of the next quire became signature marks. The regular employment of page numbers in a codex did not become common in Europe until the thirteenth century and the practice was firmly established by the sixteenth century.<sup>15</sup>

So what were the advantages of the codex over the scroll? To start, the codex offered convenience to scholars and worshippers, especially with large devotional texts like the Bible in Judaism and Christianity and the Qur'an in Islam. The format of the codex allowed people much greater ease of movement through long and complex texts

used in prayer or study. A reader could mark the leaves in a permanent or impermanent way at relevant passages or read pages out of sequence if it was desirable to review a passage or skip ahead. Moreover, as opposed to a scroll, a book could be held in one hand, allowing a scribe to read and write at the same time, something we largely take for granted today. Historians of technology think that the spread of Christianity and Islam helped popularize the effectiveness of the codex over the scroll not just for sacred texts but as a medium for organizing and conveying knowledge more effectively.

## **MEDIEVAL MANUSCRIPT PRODUCTION AND CONSUMPTION**

In medieval Europe, the main centers for the production, preservation, and copying of texts onto parchment were Christian monasteries. These were filled with monks or nuns, individuals who had pledged to lead a life of chastity, poverty, and obedience. Monastic houses typically had scriptoria, rooms where monks and nuns spent much of their time copying manuscripts by hand. Monastic leaders like Saint Benedict of Nursia in southern Italy in the sixth century emphasized in his *Rule* the importance of the written word in the lives of monks and nuns, and placed an emphasis on public readings of the Bible and other holy texts during mealtimes. Court chanceries were another location where clerics prepared documents during the Middle Ages. From the eleventh century, notaries who drafted legal contracts were



also to be found in commercial centers of Europe.

In the eleventh and twelve centuries, however, book production in Europe shifted in part to cathedral schools and universities, and became the source of learning about topics like law, medicine, mathematics, and the humanities. From the thirteenth century, universities in Italy, France, Spain, Germany, and England (manned largely by Dominican and Franciscan friars) became the most important locations of textbook production, especially the composition and copying of commentaries and glosses on canonical authorities.

**SIDEBAR:** Have you ever wondered how medieval university students procured the books they needed for their studies? Medieval students (all male institutions – women were not allowed to participate) typically rented texts through local booksellers through what was known as the *pecia* system. Namely, rather than buying books, students rented carefully proofread exemplars by the quire (known as a *pecia*), and used them to make their own copies. Once returned, booksellers rented the same quires to other students. This system had the advantage of decreasing the replication of errors since each copy depended upon the same uncorrupted text. Students often sold their own copies when their courses were finished in order to pay off debts, including their beer tabs at local bars so common in university towns.<sup>16</sup>

Just because manuscripts were the bread and butter of medieval university learning does not mean that they were accessible to anyone but a small number of men, many of them clerics, who received a higher education. Scholastic manuscripts were written in Latin, which was no longer commonly spoken in Europe. They thus required significant learning to copy accurately and comprehend. Even worse, they included extensive use of abbreviations and there were often no distinct separations between words. Although these conventions allowed students to copy quickly, readers had to read the texts aloud, a practice that only changed in the sixteenth century when efforts were made to make texts more legible. These traditions and the use of Latin excluded many potential readers from access to these texts.

What kinds of texts were popular among the medieval elites who could afford them (or were members of institutions like monasteries that owned them)? The most common manuscripts were Latin bibles and books of hours, the latter being prayer books for private devotions. In the later Middle Ages, the most commonly copied manuscripts included annals, chronicles, and romances. Many of these were composed in the vernacular rather than Latin, which by this point was mainly limited to clerics. By the thirteenth century, wealthy patrons, both male and female, who wanted to expand their private libraries commissioned manuscripts from booksellers in cities like Paris. These shops

or scriptoria employed scribes and illuminators to create custom copies.<sup>17</sup>



*Figure 11 – Medieval books of hours such as this one associated with the fifteenth-century female aristocrat Catherine of Cleves encouraged pious contemplation. The mouth of hell depicted on the left was meant to instill fear of sin in its female reader. This work illustrates how books served both devotional purposes as well as exhibiting the wealth of their owners.*

### **PLANT FIBER TECHNOLOGY: THE ADVENT OF PAPER**

Paper was invented in China in the second century BCE. Composed of vegetal fibers like hemp, paper's cost was modest and it quickly replaced silk fabric as a writing material for all but luxury manuscripts. By the second century CE, paper goods probably entered into trade through the intricate network of roads and tracks that crossed Eurasia: the routes between China and the West known as the Silk Road. Travel across the Eurasian land mass was rudimentary and expensive with the aid of mules, camels, and oxen; the overland

itinerary also depended upon the political stability of the regions through which tradesmen passed.<sup>18</sup>

Knowledge of paper and the process by which it was made from cloth rags (usually hemp or linen) reached Persia by the seventh century and the city of Samargand by the eighth century. From there, the use of paper spread throughout the Islamic world in the ninth century, promoted by the Abbasid caliphs who employed it for official records. In Spain, which was controlled by Muslim rulers from the early eighth century, the know-how for paper-making passed to the Christian West. Eleventh-century Valencia, for instance, was an important urban center for paper manufacturing.<sup>19</sup> Italian papermakers refined these methods in Fabriano, including inventing the watermark, adopting gelatine sizing, and improving pulping methods. By the fourteenth century, Italian paper made in paper mills dominated European markets.

As opposed to parchment, paper provided a comparatively cheap writing surface. In the era before mechanical printing, we know that paper profoundly influenced scribal culture in medieval Islamic lands, since it was more abundant and accessible than parchment. However, paper was also more easily adapted to wood block printing popular in China and Korea from at least the eighth century. In Western Europe, paper's future looked very bright following the development of moveable type in the mid-fifteenth century. For this reason,



paper largely supplanted parchment by the sixteenth century due to cost, accessibility, and fit with new printing technologies. Paper thus had the important effect of opening up literate Christian culture to a much wider (though certainly not universal) array of readers than could afford such works when parchment was the prevalent writing material.



*Figure 12 – This detail comes from the woodblock print on the frontispiece of the Diamond Sutra, found in Cave 17 at Dunhuang in China. Now in the British Library, it is the oldest extant printed book with a firmly known date of 868 CE.*

Our knowledge of this history has important lessons that we can bring to bear on our understanding of the social impact and accessibility of digital media. Namely, how is the transition to digital technology affecting how we compose literature, organize and present information, and store data? While our ever-increasing dependence on computers, tablets, and smart phones may allow us to marshal large

amounts of data from a seemingly endless number of sources, we also need to ask how individuals and groups benefit from this information and whether all benefit equally from the digital revolution.

## THE INVENTION OF PRINTING

Efforts to make exactly reproducible multiple impressions go back thousands of years. In China, stone steles or upright stone slabs with engraved calligraphic texts were used to make rubbings or copies. As we have seen, in ancient Mesopotamia, stone cylinder seals were engraved around their perimeter so that when they were rolled across a receptive surface, they revealed their messages. The oldest printed material known (dated to 751 CE) is from Korea, and is now called the Dharani Sutra. The earliest extant dated printed work, the Chinese Diamond Sutra scroll, was printed from a woodblock in 868. The carving of over 80,000 woodblocks between 1236 and 1251, many of which still survive, supported an effort to print the Korean Buddhist scriptures in their entirety. In China, Pi Cheng innovated with movable type made from fire-hardened clay or liquid glue under the Sung Dynasty (960-1279). In Korea, cast metal type was first developed in 1234, two centuries before it made its debut in Western Europe.<sup>20</sup>

In the mid-fifteenth century, the German goldsmith Johannes Gutenberg, among others, invented cast-metal movable type in individual characters designed to be printed with a press. Once a page of type was

prepared, printers inked and printed them onto dampened paper with a wooden press adapted from those traditionally used to make wine or oil. The pages were hung out to dry and then proofread and gathered in the correct order. Printers also carved historiated or decorated initials and other illustrations onto wooden blocks made at the same thickness as the type so that they could be set in the form. They included this labor-intensive step to preserve a style that was common to hand-copied manuscripts on parchment and paper. Efforts to imitate the style of hand-copied manuscripts suggest that consumers of printed books considered the latter desirable. In fact, for a century after the advent of printing, luxury copies of the Bible were still copied by hand and printed copies in many cases were made to look like those written by hand.<sup>21</sup>

Activity: Watch the procedure of printing a single leaf on a Gutenberg-style press:  
<https://www.youtube.com/watch?v=DLctAw4JZXE>

Gutenberg first published Bible in 1456 using metal type, a wooden press, and Italian paper. Although he did make some luxury copies for elite clients on parchment, most printing was done on paper. From Germany, this important invention spread rapidly to workshops in Switzerland, Italy, Spain, France, and England. It created considerable challenges for those who wished to print texts in non-Roman alphabets such as Arabic, in which letter shapes varied depending upon their position at the start, middle or end of a

word, or Chinese, in which there are thousands of characters. Such considerations remain important today for hardware engineers designing computer keyboards and touchpads for global markets.

We should keep in mind that many kinds of documents like wills and private letters were not affected by the advent of printing press for centuries. Moreover, printing aggravated instead of eliminating some of the shortcomings of hand-copied manuscripts since rather than creating one defective copy, one might produce hundreds of corrupted copies. For this reason, for centuries after Gutenberg's invention, distinct communities remained loyal to the tried and true method of copying texts by hand: this was especially true of monks and nuns since it was a required component of the monastic day. Moreover, the creation of luxury manuscripts was a business controlled by well-organized and powerful guilds, especially in university towns where students were a source of profits. In the early decades of the print trade, guilds protected their interests by running competing printing workshops out of town.

### **THE PRINTED WORD: ACCESS, LITERACY, AND THE PUBLISHING INDUSTRY**

What were the ramifications of the invention of printing with moveable type in the West? This is an enormous subject, but here is some food for thought.<sup>22</sup>



To start, the set-up cost involved in printing was quite prohibitive. For instance, in Italy in 1483, the Ripoli Press charged 3 florins to set up and print a quintero (quire) of the Italian priest and scholar Marsilio Ficino's translation of Plato's *Dialogues*. This price might seem quite expensive if we know that a contemporary scribe might have charged a single florin per quintero to duplicate the same work. However, the Ripoli Press produced 1,025 copies of this work whereas the scribe could make just one at a time. Printing thus had the advantage of producing multiple copies at a reduced rate per copy. In other words there were significant economies of scale for works like the Bible for which there was always demand or for pamphlets that required broad circulation. This situation meant that sizeable libraries were no longer the exclusive preserve of monasteries or the elite.

It is certainly true that printing made many texts much more available, since bookshops could now print books on their lists in large quantities and libraries could acquire more works at a higher rate of speed. The end result was that scholars and literate members of the public had access to a much broader range of texts than had previously been possible. These workshops thus opened up the possibility of owning a book and stimulated interest in literature (and literacy) among a larger public readership than was the case previously.

An additional outcome of mechanical printing was the commercialization of the

reproduction of books, which some scholars have convincingly argued contributed to the commodification of the book. In other works, if books were increasingly seen as a desirable possession that was in reach of a greater number of consumers, printers competed for this market by making their books more attractive in a variety of ways. These options affected which works booksellers chose for printing, how they embellished their covers, and the choices they made about decorative fonts or large numbers of illustrations.

## **PRINTING AND REVOLUTIONARY THINKING**

The first print shops were centers of intellectual and commercial collaboration in which editors, proofreaders, writers, merchants and patrons of learning came together to produce books collaboratively. A useful corollary of that development was the serendipitous juxtaposition of texts and maps in early printing workshops. In other words, when everything from Bibles to atlases to works of science were brought together under a single roof, they supported non-traditional thinking and afforded opportunities for innovation that might not have otherwise been conceivable. An analogous example in the modern world is our daily dependence on digital search engines like google that allow us to input a key word regardless of topic. This kind of search often produces very different results than we would get if we followed the more old-fashioned method of searching by name of author or in a single subject area. While such finds are only

useful for scholarly research if they are put in their proper context, they nonetheless widen the spectrum of possibilities as was the case for those who frequented early modern printing workshops.

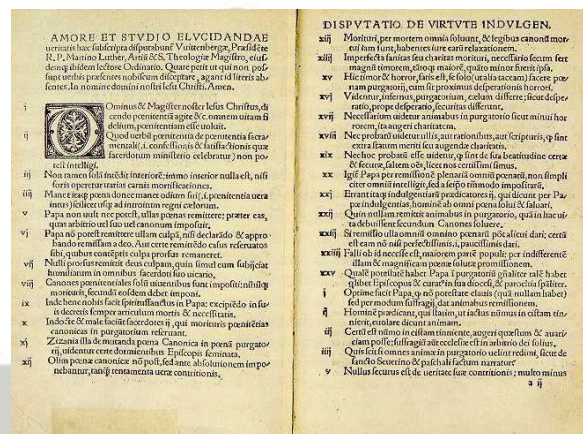


Figure 13 – In 1517, the Catholic monk Martin Luther is thought to have posted his 95 Theses on the door of the church in Wittenberg, Germany, to protest what he saw as corrupt practices including the sale of indulgences for salvation. Although the document was originally hand-written in Latin, by the following year he translated it to German and printed it. This technology allowed him to circulate numerous copies of the document in a short period of time. Authorities were not able to stop the spread of what they saw as dangerous ideas.

In a time when we are all familiar with the mantra of the internet bringing about a more democratic world, a promise that has proved somewhat hollow and elusive at best, thinking about the invention of printing has particular resonance. The advent of mechanical printing had a number of unintended consequences by legitimizing and popularizing works that

would not have previously circulated widely because they were seen as suspect by the Catholic Church. To be certain, religious leaders were concerned about the distribution of unauthorized works on theology, astrology, alchemy, and magic.

**SIDEBAR:** Martin Luther's translation of the Bible from Latin to German in the early sixteenth century challenged the longstanding monopoly of the Catholic Church. Unlike his predecessors, whose manuscripts were burned when they were condemned and executed as heretics, Luther circulated thousands of copies far and wide in the Holy Roman Empire. Luther's successful resistance to the Church's demands and his evasion of Church censors led to the birth of the break-away religious movement of Lutheranism. Scholars suspect that Luther would not have succeeded in his reform agenda had it not been for the technological advantage of printing.

Religious authorities were not the only public figures made uncomfortable by the freedom of expression offered by printing. Powerful lay rulers like monarchs and aristocrats were especially concerned about individuals and groups that sought to reach a public audience with pamphlets and books criticizing secular leaders and advocating alternative political models. The relative ease with which an individual could reproduce hundreds of copies of any particular work meant that it was difficult



for monarchs to enforce effective bans on texts they deemed unacceptable.

### **HAS DIGITIZATION CHANGED OUR RELATIONSHIP WITH THE WRITTEN WORD?**

Why is it important to learn about the birth of the codex? The French historian Roger Chartier has suggested that we consider the digital revolution in terms of the “longue durée” or the long term. In other words, we need to think about the possibilities digital texts and their transmission create not just in the here and now but over the coming decades and centuries.<sup>23</sup>

First, how does the digital revolution change how we engage with a text? Theoretically, at least, readers can interact with texts more fluidly. Previously, we underlined, took notes, or wrote in the margins of books. Today, readers can index, annotate, copy, recompose, hyperlink, and move digital texts. In essence, each person becomes an active participant in the text. In this way, digital works blur the distinction between reading and writing and between author and reader, since any reader with a digital device has the ability to create new texts from fragments that have been spliced and reassembled. Of course, there is a thin line between this practice and plagiarism if one claims this work as his or her own without acknowledging the original sources of such blended works. If we look around the classroom today, however, not all students have embraced technological change and continue to take notes the old

fashioned way. Some recent studies suggest that the act of writing (as opposed to keying it into a computer or tablet) helps us retain information more effectively.

Second, there is no doubt that the digital revolution has changed how we order and store information. With magnetic storage devices, readers can construct unique collections of original texts whose existence and organization depend upon their individual whims (and the texts to which they can gain access). One can not only store but also modify or rewrite these works at any moment. These technologies challenge not only traditional ideas of literary property and copyright, but also reshape conceptions of what a library is, what one should do there, and how it should look. We can each create our own libraries in a way that was not long ago confined exclusively to institutions and elites. However, we must also be conscious that these libraries are easily erased or destroyed. All of us are familiar with the panic that sets in if our computer crashes or our hard drive fails. With rapidly changing technology, storage technology like floppy disks have quickly gone out of use as they were replaced by CDs, DVDs, and USB drives. Not only are older formats difficult or impossible to read with a new computer, but these storage devices were never intended for the long term. Most forms of magnetic storage must be backed up since they become unreadable in less than a decade.



*Figure 14 – The fourth floor stacks of the Free Library of Philadelphia, a city that received one of the largest grants offered by Andrew Carnegie. With these funds, Philadelphia constructed twenty-five branch libraries between 1905 and 1930. Although the Central Library, which houses the Free Library chartered in 1891, was not part of the endowment, it became one of the most important libraries in the world with over one million volumes.*

These many factors suggest that the digital revolution will not cause the printed word to disappear overnight as industry pundits often predict. A historical perspective suggests that just as the scroll imposed its organization on the early codex, so handwritten codices imposed their form upon the earliest printed texts. These shaped the early form, structure, and layout of the successive media in which knowledge was conveyed. Essentially, one could argue that printed books have done the same to ebooks, especially in light of users' attachment to the tactile experience they love about reading an authentic paper book

or newspaper. Over the course of several generations, however, it is likely that the memory of this experience will fade and new readers will prioritize some aspects of book culture while eliminating others depending upon their needs. With that, some features of the codex will remain embedded while others will be discarded.

We may close with Chartier's warning that: "The library of the future must also be a place that will preserve the knowledge and understanding of written culture in the forms that were and still are today, very much its own. The electronic representation of all texts whose existence did not begin with computerization should not in any way imply the relegation, forgetting, or, worse yet, destruction of the objects in which they were originally embodied. More than ever, perhaps, one of the critical tasks of the great libraries is to collect, to protect, to inventory..."<sup>24</sup>

The message that we should take from this warning are the potential challenges of digitization. We must evaluate what digital formats and electronic storage mean for the quality of our lives, engagement with knowledge, and preservation of information for the near and long-term future. While change may be inevitable, and a current generation of children will never know life in the absence of these technologies, we must observe how they affect our day-to-day existence, the ways in which we learn, and the methods by which we preserve knowledge of the past. These choices will

indelibly shape how humans live with together in the future.

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<sup>1</sup> I would like to dedicate this essay to my doctoral advisor Professor Richard H. Rouse, who instilled in me, among other things, an abiding appreciation for the mechanics of books and book culture.

<sup>2</sup> Elizabeth Hill Boone, "Aztec Pictorial Histories: Records without Words," in *Writing Without Words*, edited by Elizabeth Hill Boone and Walter D. Mignolo (Durham: Duke University Press, 1994), pp. 50-76.

<sup>3</sup> Chartier focuses on Vico and Condorcet as symptomatic of these larger questions. Roger Chartier, "The Representation of the

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Written Word," in his *Forms and Meanings: Texts, Performances, and Audiences from Codex to Computer* (Philadelphia: University of Pennsylvania Press, 1995), pp. 6-24.

<sup>4</sup> Giambattista Vico, *On the Most Ancient Wisdom of the Italians. Drawn out for the Origins of the Latin Language* [1711], translated by Jason Taylor, New Haven: Yale University Press, 2010.

<sup>5</sup> Condorcet and Keith Michael Baker, "Sketch for a Historical Picture of the Progress of the Human Mind: Tenth Epoch," *Daedalus* 133.3 (Summer, 2004), pp. 65-82.

<sup>6</sup> Jean-Jacques Glassne, *The Invention of Cuneiform: Writing in Sumer* (Baltimore: The Johns Hopkins University Press, 2003).

<sup>7</sup> Roderick Whitfield and Anne Farrer, *Caves of the Thousand Buddhas: Chinese Art from the Silk Route* (New York: George Braziller, 1990).

<sup>8</sup> Bridget Leach and William John Tait, "Papyrus," in *Ancient Egyptian Materials and Technology*, edited by Paul T. Nicholson and Ian Shaw (Cambridge: Cambridge University Press, 2000), pp. 227-253.

<sup>9</sup> Michael McCormick, *Origins of the European Economy: Communications and Commerce, AD 300-900* (Cambridge: Cambridge University Press, 2001), pp. 696-728.

<sup>10</sup> Kelly Sloane, "Epic Illustrations: Vergil's Aeneid in the Vergilius Vaticanus," 2005-2006 Penn Humanities Forum on Word & Image, Undergraduate Mellon Research Fellows. URL:



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[http://humanities.sas.upenn.edu/05-06/mellon\\_uhf.shtml](http://humanities.sas.upenn.edu/05-06/mellon_uhf.shtml)

<sup>11</sup> Ronald Reed, *The Nature and Making of Parchment* (Leeds: Elmete Press, 1975).

<sup>12</sup> J. A. Szirmai, "Wooden Writing Tablets and the Birth of the Codex," *Gazette du Livre Médévale* 17 (1990): 31–32.

<sup>13</sup> Tsien Tsuen-Hsui, *Paper and Printing, Science and Civilization in China* 5.1, edited by Joseph Needham (Cambridge: Cambridge University Press, 1985), pp. 227–233.

<sup>14</sup> Alan R. Sandstrom and Pamela Effrein Sandstrom, *Traditional Papermaking and Paper Cult Figures of Mexico* (Norman: University of Oklahoma Press, 1986), 3–31. Walter D. Mignolo, "Signs and Their Transmission: The Question of the Book in the New World," in *Writing Without Words*, pp. 220–225.

<sup>15</sup> Bernhard Bischoff, *Latin Palaeography: Antiquity and the Middle Ages*, translated by Dáibhí Ó Cróinín and David Ganz (Cambridge: Cambridge University Press, 1990), pp. 20–48.

<sup>16</sup> Mary A. Rouse and Richard H. Rouse, "The Book Trade at the University of Paris, ca 1250–ca. 1350," in their *Authentic Witnesses: Approaches to Medieval Texts and Manuscripts* (Notre Dame: University of Notre Dame, 1993), pp. 259–338.

<sup>17</sup> Christopher de Hamel, *A History of Illuminated Manuscripts* (London: Phaidon Press, 1997).

<sup>18</sup> Tsuen-Hsui, *Paper and Printing*, pp. 52–83.

<sup>19</sup> Helen Loveday, *Islamic paper: a study of the ancient craft* (London: Archetype Publications, 2001).

<sup>20</sup> Jixing Pan, "On the Origin of Printing in the Light of New Archaeological Discoveries," in *Chinese Science Bulletin* 42.12 (1997): 976–981.

<sup>21</sup> Elizabeth L. Eisenstein, *The Printing Revolution in Early Modern Europe*, 2nd, rev. ed. (Cambridge: Cambridge University Press, 2005).

<sup>22</sup> Lucien Febvre and Henri-Jean Martin, *The Coming of the Book: The Impact of Printing 1450–1800* (London: Verso, 1997).

<sup>23</sup> Chartier, "The Representation of the Written Word," pp. 6–24.

<sup>24</sup> Chartier, "The Representation of the Written Word," p. 24.