6 Paper and print

In the history of literacy, the printing press is usually described as the second quantum leap forward after the invention of writing itself. The standard narrative highlights Johannes Gutenberg's invention of the printing press in the mid-fifteenth century in Mainz, Germany. Because books no longer had to be copied individually by hand and could be mechanically mass produced, the press made it possible for many different people, physically dispersed, to view the same texts, images, maps, or diagrams *simultaneously* (Eisenstein, 1980, p. 53). This meant that texts, literacy, and knowledge could be much more widely disseminated, and that power could be redistributed out of the hands of a small priestly and scholarly elite to a more broad-based democratic base. The standard narrative has it that printing was the catalyst that made possible the Reformation, the Renaissance, and the Enlightenment, along with a wide range of -isms, including individualism, scientism, rationalism, and nationalism (Eisenstein, 1980; McLuhan, 1962).[1]

This standard narrative is, however, technocentric and Eurocentric, focusing on how a material tool revolutionized European society. The printing press *as an invented artifact* did not constitute a quantum leap forward; rather, it was the felicitous conjuncture of the printing press with just the right social, material, and economic conditions in Europe that made widespread social change possible.[2]

Indeed, in some respects the printing press might even be considered more reactionary than revolutionary (Pattison, 1982). Gutenberg did not introduce a new form of storing narrative and information, but mechanized the production of a familiar form.[3] For example, the earliest printed books imitated scribal manuscripts down to the finest details, incorporating the same idiosyncratic

[1] In a later condensed version of her book, Eisenstein (2005) explains that she purposely entitled it the printing press as *an* agent of change, not *the* agent of change. But she does not subscribe to multivariable explanations either – her view is that printing made many variables begin in interact in new ways (p. xix).

[2] A counter-technocentric position, arguing that many social innovations often attributed to print were already present in scribal culture, was first articulated by Bühler (1960).

[3] In French, printing was known as 'l'art de l'écriture artificielle.'

letterforms, ligatures, and abbreviations. They incorporated the same page layout, and even left blank spaces for artists to add elaborate initial letters by hand and to illuminate the texts individually just as they had done with manuscripts.[4]

In theory, printed texts could eliminate errors through careful editing and typesetting. However, early printed versions actually increased distortions and corruptions of texts, and when errors were produced in print, they were disseminated far more widely than they would have been with manuscript technology.[5] Besides errors that arose in the process of copy-reading or typesetting, the need to print pages out of sequence on folded sheets of paper also contributed to errors. In his 1492 treatise *de laude scriptorum* (In Praise of Scribes, 1974), Johannes Trithemius argued that scribes were more careful than printers and that parchment was a far more durable medium than paper.[6]

Nor was the technology itself entirely new. Ceramic movable type had been invented four centuries before Gutenberg in China, and even metal movable type had been developed in Korea two centuries before Gutenberg's time.[7] Printing was also known in the Muslim world long before being 'invented' in Europe.[8] The technology of the Gutenberg press was drawn from wine presses and cloth presses, which had come to Germany from the Romans. Gutenberg was a goldsmith by trade, and his true invention was to use brass casts to make unlimited uniform copies of letter sorts by pouring molten lead into the casts. His other key innovation was to develop an oil-based ink that would adhere to

[4] Similarly, today we find that ebooks try to imitate the printed book as closely as possible.

[5] Consider, for example, the so-called 'wicked Bible' published by the English royal printers Robert Barker and Martin Lucas in 1631, in which the word 'not' was accidentally omitted from the seventh commandment in Exodus 20:14 and read "Thou shalt commit adultery." The error was discovered and rectified before the printing run was finished, but some of the 'wicked' copies escaped being burned – one of which was advertised for sale for $89,500 on the Internet in 2010.

[6] It is ironic that just as Plato critiqued writing in the form of writing (*Phaedrus*), Trithemius chose to critique print in the form of print, and O'Donnell points out that some twenty-three years later, Trithemius actively praised "that wondrous and previously unheard-of art of printing books" (1998, p. 79).

[7] Woodblock printing on cloth (which involved carving a block for each page impression) was invented in China during the Han dynasty (third century CE) and printing on paper developed during the Tang dynasty (seventh century CE). The world's oldest printed book, a Chinese translation of the (Sanskrit). Diamond Sutra text printed in CE 868, is now housed at the British Library. Moveable type, invented by a blacksmith and alchemist named Bi Sheng in the eleventh century, involved separate characters carved on small blocks of moistened clay that were hardened in a kiln (later they were carved in wooden pieces). These characters could be arranged and attached to an iron plate to print a page and then broken up and redistributed for the next page. The first metal movable type system was developed in Korea in the early thirteenth century, and a volume dealing with Confucian ritual was printed with metal movable type in 1234.

[8] In the Muslim world, Arabic texts were block printed on paper, papyrus, or parchment as early as the tenth century. Block printing was also used briefly in Iran in the late thirteenth century and in the fifteenth century in Egypt (Bloom, 2001).

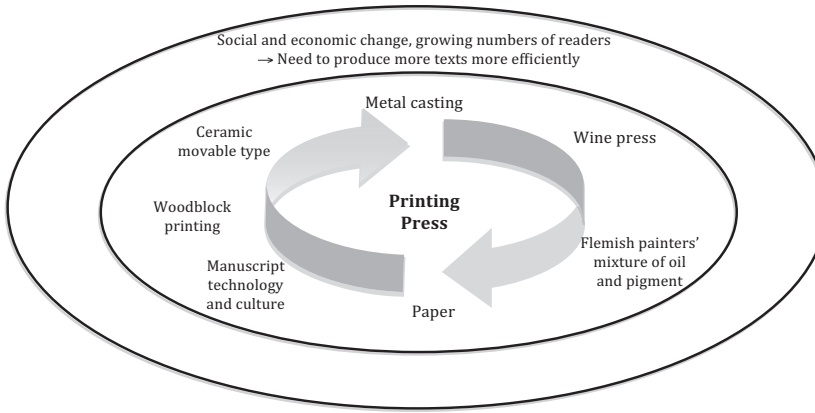

Figure 6.1 Available designs in the development of the printing press

the metal type, since the traditional water-based ink used in woodblock printing would not stick. Here, he was inspired by Flemish painters, who mixed pigment into a linseed-oil varnish (Steinberg, 1974, p. 25). Gutenberg's genius, then, was in bringing together tools and resources (i.e., available designs) from different spheres of activity – goldsmithery, bookmaking, wine making, painting – and synthesizing them in a novel way to satisfy a rapidly growing need for more efficient production of texts (Figure 6.1).

Print and society

If the technology existed across the Asian continent long before it did in Europe, why didn't printing become widespread there before it did in Europe? Essentially because of different social conditions. In the case of China, printing was under the strict control of its rulers, who limited the number of print copies and restricted their dissemination to an elite. Furthermore, unlike Europe, where printing was immediately realized as a profit-producing industry, China did not have a capitalist economy. In the Muslim world, printing encountered powerful social resistance.[9] The reasons were partly religious, partly economic, and partly technical. With regard to religion, only the handwritten word was considered sacred. As Ogier Ghiselin de Busbecq, the European ambassador to the Ottoman Empire, wrote from Istanbul in 1560: "the scriptures, their

[9] Arabic texts were nevertheless printed as early as the tenth century (block printed on paper, papyrus, or parchment) and block printing was also used briefly in Iran in the late thirteenth century and during the fifteenth century in Egypt. According to Bloom (2001) the oldest printed Arabic text that has survived is the *Kitab salat al-sawai,* printed in 1514 (p. 219).

holy letters, once printed would cease to be scriptures" (Káldy-Nagy, 1974, p. 203). Furthermore, the practice of cleaning typesettings with hog-bristle brushes made it all the more inconceivable to print the name of Allah in type (*ibid.*, p. 203).[10] Another reason was economic: printing would have supposedly put thousands of manuscript copyists out of work.[11] A third reason for the late adoption of printing had to do with the complexity of typesetting Arabic script. Because Arabic is a cursive script, letters are connected to one another and have different forms when they are in initial, medial, final, and free-standing positions. This means that a complete Arabic font, including vowel marks, can run to over 600 glyphs (Bloom, 2001, p. 218). Typographically, then, Arabic presented unique difficulties – and required greater typesetting skill – than languages that could be printed in uniform, discrete characters like English or Chinese. Ironically, the movable type printing press became widely used in the Islamic world only after the French occupation of Egypt in 1798.[12]

Clearly, the mere existence of the *technology* of movable type was not sufficient for its extensive use; the right social ecology was needed as well. The comparatively rapid success of printing in Europe depended in particular on three key factors. One was a good supply of readers to make the mass production of books be economically feasible. Related to this were the entrepreneurial ambitions of printers, who were motivated by the commercial potential of publishing texts. The third necessary ingredient was an abundant supply of a durable yet inexpensive material on which to print.

Concerning readers, a "vigorous literate culture" (Clanchy, 1979, p. 8) had been developing in Europe since the late twelfth century, when the growth of universities created an unprecedented demand for written texts, commentaries, and reference works. In cities such as Paris, Bologna, and Oxford, lay scribes worked in guilds to hand copy academic texts long before the arrival of print (Steinberg, 1974). By the late fifteenth century, a growing population (and growing numbers of readers) combined with an economy on the ascent translated into a viable market for booksellers. The printing press may have amplified the demand for books, but it did not create it in the first place. Like cuneiform writing in Mesopotamia, the print 'revolution' co-evolved with, but did not cause, increased societal complexity.

[10] Although Spanish Jews, Armenians, and Greeks had established presses in the Ottoman Empire, they were forbidden to print any material in Turkish or Arabic. When an Ottoman printing office was finally established in 1729, the Sultan allowed printing of any book except the Qur'an and other religious works. Only seventeen titles were published before the printing office closed in 1742. The Qur'an had already been printed in Arabic at the end of the fifteenth century, but outside the Muslim world, in Venice.

[11] Kaldy-Nagy (1974) points out, however, that the modest number of books suggests that most scriveners were not involved in copying manuscripts (p. 205).

[12] www.library.yale.edu/neareast/exhibitions/earlyprinting1.html

Within the first fifty years following Gutenberg's invention, hundreds of printing presses were established in cities throughout Europe, and Febvre and Martin (1976) estimate that some twenty million books were printed (p. 248). Compared to the limited capacity of scribal guilds, this was clearly a huge expansion in the scale of production. Printers sought the most lucrative markets – university towns and commercial centers – and developed standardized procedures to maximize speed and productivity.

The third requirement, the plentiful availability of inexpensive material on which to print, was satisfied by paper. Introduced into southern Europe from the Muslim world in the eleventh century, paper was strong, smooth, flexible, and could be produced in uniform formats. Because it was made from recycled linen rags, paper was much cheaper than parchment, and could be produced in virtually unlimited quantities. If early printers had only had parchment to print on, their books would have been almost as expensive as handwritten manuscripts, and printing would not likely have taken hold to the extent that it did.

Although printing presses and books proliferated rapidly in Europe in the first fifty years after Gutenberg printed his first Bible, they did not immediately change the existing power dynamics of literacy. Three-quarters of the books published were in Latin and most readers were clerics or academics, so print began as a product of – and for – a very circumscribed segment of society. Although the printing press was initially welcomed by the Church because it increased dissemination of Bibles and other religious materials, it soon became apparent that the new print era also heralded unwelcome changes. The Church's tight control over the production of books was threatened, as was the Church's very language (since the Bible could now be published in vernacular languages as well as Latin). Mass dissemination of print also threatened communal recitation of prayers by making it possible for individuals to read and contemplate scripture privately. Circulation of the printed writings of Martin Luther, Jean Calvin, and other Protestant reformers so enraged France's King François I that he issued a series of restrictive laws, culminating in a 1535 decree outlawing all printing (by punishment of hanging) and ordering the closure of all book shops.[13]

Nor did the printing press immediately usher in more widespread literacy. Non-literate aristocrats could hire readers and scribes for their literacy needs. Peasants, on the other hand, had little need of or access to writing. It was among the emerging middle classes that literacy held the greatest promise, for in a culture that was increasingly in demand of written records, the ability to write assured a livelihood. But this demand for written documents preceded

[13] The extremity of the decree led to its recall within a month. A parliamentary commission was appointed to review the suitability of books (Pottinger, 1958, pp. 56–57).

the printing press, and for many lay scribes, print was more of a threat than a boon. During the sixteenth and seventeenth centuries, literacy rates in Europe remained low, especially in rural areas, and it wasn't until the late eighteenth century – more than three hundred years after Gutenberg's invention – that literacy rates came to approach even 50 percent among men in France and 60 percent among men in England.[14]

Scholarly practices remained largely unchanged following the arrival of the printing press. Given the still relatively high cost of books, scholars continued to copy texts by hand, including texts that had been produced on a printing press.[15] Even in the early eighteenth century, access to university libraries was often limited to professors, and teaching practices typically followed the medieval tradition of reading aloud from authoritative texts and commenting upon them (Melton, 2001, p. 90).

If print did not suddenly transform an oral society into a literate one, it was nevertheless appropriated in interesting ways into oral culture. Historian Natalie Zemon Davis writes that printing in sixteenth-century France (like the Internet today) established "new networks of communication . . . new options for the people . . . new means of controlling the people" (1975, p. 190). She explains how in village *veillées* in which books were read aloud, 'reading aloud' meant translating texts into the local dialect so the villagers could understand. In the case of long works, it also meant editing while reading. Reading was therefore far from a simple vocalization of print – it was a wholesale recreation and performance of texts. Non-literate peasants on the listening end were not passive recipients of information, Davis tells us, but participated in their own way in the new world of printing – not by reading and writing, but by actively interpreting and using the information that was read to them. Orality and literacy therefore suffused and transformed one another.

Similarly, Harold Love points out that even in late sixteenth and early seventeenth century England many key cultural texts were oral, and texts that were written were often intended for oral performance (2002, pp. 100–101).

[14] Melton (2001) provides literacy rates in several European countries with the caveat that statistics are based only on people's ability to sign their name in a marriage register. Women's rates tend to be about half those of men; however, Melton points out that many women learned to read without learning how to write, thereby underestimating women's literacy. Rural literacy rates were about half of urban rates, for both men and women. The single most important correlate, however, was wealth; Melton states that in Lyon and Koblenz, for example, virtually all upper-class men and women were literate at the end of the eighteenth century.

[15] Hand copying allowed scholars to select just the portion of a book that they wanted, without having to buy the whole book (just as we photocopy sections of books today), and if a book was not available in one's own country, hand copying was the only available option. Furthermore, in the early days of print, readers often preferred handmade books over mass-produced printed versions (O'Donnell, 1998; Reeve, 1983).

Because people's actual experience of texts often involved a mixture of speech, print, and handwriting, there was no clear-cut transition from 'oral' to 'literate' cultures, and practices in early modern Britain were better characterized as "intricate negotiations between the media" (*ibid.*, p. 102). In the next chapter we will see that the same holds true today, and that "negotiations between the media" aptly characterizes twenty-first-century literacies as well.

Finally, a common assertion is that the printing press was the key factor in disseminating Luther's and other Protestant reformers' ideas during the Reformation in Germany. It is undeniable that print played a significant role, but given the low literacy rates in sixteenth-century Germany, Scribner and Dixon (2003) estimate that only 2.3 percent of the German population could have encountered Luther's ideas via print. They argue that most information was passed by word of mouth through personal contacts, and that the real role of print was to inform 'opinion leaders' – literate and influential people – who disseminated the new ideas through oral communication, with sermons being the most powerful communication platform (p. 20). What print did, then, was to accelerate and broaden dissemination of information to such opinion leaders, creating more networks and spheres of influence through which new ideas could be spread.[16]

Print and language

Probably the most significant way in which the printing press influenced language was to introduce an ethos of uniformity and standardization. This happened at two levels: at the visual surface of the printed text and more broadly in the standardization of language use and in the determination of what counted as a language. Although manuscripts had been written in standard hands, variability from one scribe to the next was inevitable, and of course any individual scribe's handwriting could vary slightly from one writing session to the next, depending on posture, fatigue, ambient temperature, and so on. As manuscripts were transformed into printed texts, such individual variability was lost, as the same letter forms were used consistently within and across texts produced by a given printer. As Amalia Gnanadesikan puts it, printing shifted the process from *creating* letters to *selecting* letters (2009, p. 252). This shift was later extended

[16] But again, scholarly networks did not depend exclusively on print for their existence. In the seventeenth century, Henry Oldenburg at the Royal Society in England developed a precursor to a 'network server' by creating a central depot of letters sent in whatever language by scholars around the world – the letters would describe their latest discoveries, observations, and they could specify when they wanted the information released – right away or after a certain specified time delay. This gave birth to a kind of 'invisible college.' In 1665, Oldenburg went on to establish *Philosophical Transactions,* the precursor to all scholarly journals today (Chanier, 2004, p. 75).

by the typewriter and the computer, which allowed texts to be *composed* from the outset by means of selecting letters.

On a broader level, the printing press provided the impetus for European vernaculars (which had been mostly spoken) to be written, codified, and thereby legitimized as languages. Prior to the arrival of print in Europe, a diglossic linguistic configuration existed whereby the language of the Church, authority, and literacy was Latin, and the language of daily life in society was the regional vernacular. Although in the early years of printing most texts were published in Latin, by the sixteenth century printers produced increasing numbers of vernacular texts, motivated by the prospect of broadening their market base. The wide circulation of such texts helped consolidate and establish the literary languages of Europe and ultimately contributed to the decline of Latin.

Of course, there were many regional vernaculars. Those chosen for print (i.e., those most closely associated with power) became standard languages, whereas those that remained unprinted took on the status of provincial dialects. Early grammars for the most prestigious vernaculars were developed during the sixteenth century (Nebrija's 1493 *Grammatica Castellana* being a notably early contribution). These grammars provided a basis for filtering out many of the regionalisms that had marked earlier vernacular publications.

Print also gradually introduced new formatting, spelling, and punctuation conventions. Although many of the earliest printed books followed manuscript tradition in terms of layout and punctuation, new practices came to be established. For example, whereas rubrication (literally 'red-inking') had been used to show divisions in a text, printers found this too costly and made use of different fonts for headings, initial words, and main text. Quotations, which in manuscripts had been underlined in red ink, came to be indicated by quotation marks. On the other hand, paragraphs, which had been explicitly marked with symbols (such as the pilcrow, ¶), came to be marked by white space (indentation of the first line, or most recently, a preceding blank line in 'block' paragraphing) (Baron, 2000, p. 169).

Before print, spelling was highly variable, and abbreviations were commonly used. Producing a manuscript book was expensive, not only in terms of labor, but also in terms of materials (a Bible written on parchment required the skins of hundreds of sheep). Because of this expense, scribes saved space wherever possible and developed elaborate abbreviation schemes (Cappelli's *Lexicon Abbreviaturarum* lists some 13,000 Latin abbreviations).[17] Printed

[17] Some abbreviations were truncations, such as IMP.(ERATOR), CAES.(AR). Others involved special shorthand symbols, used alone (e.g., ⁊ for Latin *et*) or mixed with letters (e.g., q⁹ for 'quorum,' which uses a 'half R' or 'R rotunda' ꝛ). Some Latin abbreviations that we commonly use in English today are etc. for *et cetera*; e.g. for *exempli gratia*; lb. for *libra*; p. for *pagina*; R.I.P. for *requiescat in pace*; and when in Rome, the ubiquitous S.P.Q.R. for *Senatus*

books, which at first attempted to reproduce manuscripts as closely as possible, preserved abbreviations along with handwriting style, ligatures, illuminations, and layout conventions. Similarly, in both manuscript and early print books, word spellings were adjusted by adding or subtracting letters to fine-tune the length of each line of text so that a flush right margin could be maintained. Once printed, spellings took on a certain authority, and some of the 'anomalous' modified spellings became standard when dictionaries were made. Other techniques scribes and printers used to make text fit were adding or deleting whole words, increasing or decreasing space between words or between letters, substituting words for phrases, or vice versa (N. S. Baron, 2000).

Abbreviations gradually came to be less used in printed books because printers did not want to risk losing readers who might not understand what they meant. Moreover, as they shifted from expensive parchment to comparatively cheap paper, printers were less compelled to maximize the efficiency of the texts they printed by using abbreviations.

The history of these early printing practices reminds us that spelling is not 'natural' and is often shaped by the technological medium in which it is used. Moreover, the control and standardization of spelling (as well as grammar) is also a matter of social forces whereby the power elite set standards, and ordinary people's access and adherence to those standards largely determines their social mobility.

It is clear that the printing press both reflected and shaped the cultural evolution of Europe. However, as mentioned earlier, print was not a catalyst for social change in Central and East Asia. We will now return to this story to see how another technological innovation – paper – was.

Paper

The invention of paper is commonly attributed to Tsai Lun, a eunuch at the court of the Han emperor Wu Di in China in 105 CE, although archeological findings from the Xuanquanzhi ruins of Tunhuang in China's northwest Gansu province place the invention of paper some two hundred years earlier (Yi & Lu, 2010). Made from rags, hemp, or tree bark dissolved in water and then sieved through woven cloth stretched over a bamboo frame, paper was from the beginning made of waste products and therefore relatively cheap to produce.[18] It was also very light in weight. These were substantial advantages over competing writing materials such as bamboo, which was heavy, and silk, which was expensive. Over time, production techniques were perfected and paper was

Populusque Romanus (The Senate and the Roman People). The sign ⅂ for Latin *et* (and) is still used in Ireland today.

[18] It was not until the late nineteenth century that paper came to be made from wood pulp.

made in various qualities for different purposes. One key use of paper was for printing, which evolved from the ancient use of carved stone or bronze seals to make impressions on clay or silk, and from the practice of making rubbings from stone and bronze reliefs (Bloom, 2001, p. 36).

Papermaking spread to Korea, where the product was refined to new levels of quality, and subsequently to Japan in the early seventh century. Paper was introduced to Central Asia in the eighth century, allegedly by Chinese prisoners taken captive by Arabs during the Battle of Talas, although archeological evidence from Samarkand suggests that paper may have existed there centuries earlier (*ibid.,* pp. 43–45). In any event, with the unification of West Asia under Islam, the practice of papermaking migrated westward to Baghdad, Mecca, Egypt, Morocco, and finally to Spain. According to Bloom (*ibid.*), Spanish Christians began to use paper well before the year 1000, and their use of paper grew as they came to dominate greater areas of the Iberian peninsula. However, it was only after the arrival of the printing press in the fifteenth century that paper gradually came to replace parchment as the preferred medium for recording European thought.

In Islamic civilization, it was paper, not printing, that made possible huge advances in learning and new ways of thinking between the eighth and the sixteenth centuries. Paper was originally produced as an adjunct to papyrus and parchment to serve the administrative needs of the huge bureaucracy that developed during the Caliphates and the Ottoman Empire.[19] But its light weight, availability, and relatively low cost made it a catalyst for social, intellectual, and artistic innovation. The Hindu numeral system had spread through the Islamic world by the ninth century, and by the tenth century, the mathematician Abu al-Hasan Ahmad ibn Ibrahim al-Uqlidisi adapted the Hindu system to the affordances of paper and ink, developing the notion of positional decimal fractions and showing how to perform calculations without deletions (*ibid.*). Scholars collected and codified the oral traditions of Muhammad on paper, Greek bookrolls were translated into Arabic and written on paper, and new forms of literature, such as cookbooks and *The Thousand and One Nights* were copied on paper and sold (*ibid.*, p. 12).

Paper provided a convenient means for textualizing not only language, but also artistic designs, architectural plans, genealogy charts, and battle plans, which could be composed in one place and put to use in another (*ibid.*, pp. 215–16). This ability to separate things from their original context of conception and to recontextualize them in new settings, in new mediums, for new purposes, allowed ideas to be not only disseminated, but also transformed:

[19] A key difference from parchment and papyrus was that paper absorbed ink, making paper more secure from forgery (Bloom, 2001).

> Drafters could abstract a design from one place and apply it in an entirely different setting. The scale, too, might also change dramatically. An artist could, for example, draw a design observed on a Chinese carved lacquer bowl and put the drawing aside in a portfolio or album. A bookbinder or plasterer might come upon the drawing and transfer the design by means of stencil or pounce to another medium, perhaps a molded-leather book cover or a carved and painted plaster panel many times the size of the original lacquer bowl. The bookbinder or plasterer would never have seen the bowl, and the intermediary drafter might have had no inkling that his drawing would be translated into leather or stucco. *Designs were divorced from their original contexts,* and this free-floating quality of design became a feature of later Islamic art, particularly the art made for the court. (*Ibid.*, p. 191, my emphasis)

The idea of divorcing design from its original context (like writing, which divorces language from its original context of utterance) is crucial to understanding relations among language, technology, and literacy. In Chapter 2 we saw how this idea is extended in today's digital texts, whose content is divorced from form (at the level of machine representation) in order to allow those texts to be appropriately scaled across a broad variety of devices.

Paper and language

In the Islamic world, the most important written text was of course the Qur'an. Although the oral literary tradition based on memorization and recitation remained vital, the written Qur'an assumed an increasingly important role when paper became available. Religious scholars were at first reluctant to transcribe the Qur'an on paper, as it was normally copied on parchment. However, given that a single Qur'an required the skins of about three hundred sheep, paper eventually won out. The oldest paper edition dates to the tenth century.

The medium of paper had an effect on the Arabic script. The Kufic script, traditionally used to write the Qur'an on parchment, and characterized by simple geometric shapes, gave way to an angular 'broken Kufic' that contrasted thick and thin strokes and was sometimes vertically elongated. This new script was well suited to the characteristics of paper and carbon ink and was more legible and easier to write. It was used for a wide variety of purposes, both secular and religious, and was popular among Christians as well as Muslims. This broken Kufic script led to the development of a more flowing rounded cursive similar to the Arabic script used today (Bloom, 2001, pp. 103–106).

The physical format of the Qur'an also changed with the accepted use of paper. Parchment editions of the Qur'an had been in landscape (horizontal) format, which differentiated them visually from Christian and Jewish scripture, which respectively took the form of codices with vertical orientation and bookrolls with horizontal orientation. Paper editions of the Qur'an, however,

were in portrait (vertical) format (*ibid*., pp. 103–104). In the next chapter on electronically mediated discourse, we will again see that changes in the material medium are accompanied by changes in the form of writing.

The form of paper itself also had great cultural significance. When mainstream production of paper shifted to Europe in the fourteenth century, European paper began to be imported in Syria, Egypt, and North Africa. But the watermarked images of animals and symbols (and Christian crosses) again raised questions of the suitability of paper for religious writing (*ibid*., p. 13). Once again, material and technological innovations find themselves subject to sociocultural filters when it comes to their adoption.

With respect to literacy and the overlay of written tradition upon oral tradition, the development of paper has been described as the "industrialization of memory" (Debray, 1991). And over the centuries, paper has certainly played a key role in the industrialization of society. Yet today, in the face of digitalization, which at least theoretically makes paper records obsolete (Sellen & Harper, 2002), the paper industry often highlights the 'human' face of paper: a medium of sentiment, a medium of personal meaning that binds us to our past and that we bequeath to our loved ones, as one paper company advertises on its website:

> Birth certificates. Wedding albums. Autographed books and baseball cards. Paper mementos are among our most treasured possessions. And although digital media is gaining an increasingly important role in today's world, it can never replace the warm, tactile touch of paper. After all, scrapbooks don't require startups or shutdowns. Magazines never crash. And while flash drives are a convenient way to store images, wearing one around your neck just doesn't have the same effect as your grandmother's antique locket. Computers may keep records – but paper leaves a legacy.[20]

Although it is a technology, paper has become naturalized, imbued with human significance both at the level of society and at the level of the individual.

In the next section we turn to a technology of the nineteenth and twentieth centuries that combined paper with print, but was designed for widespread personal use by individuals.

The typewriter: a personal printing press

The origins of the typewriter go back to at least 1714, when an English engineer named Henry Mill applied for a patent for his *machine for transcribing letters* that would print letters on paper "so neat and exact as not to be distinguished from print" and whose impression would be "deeper and more lasting than any other writing, and not to be erased or counterfeited without manifest discovery"

[20] Domtar paper. www.paperbecause.com/paper-is-purposeful/the-paper-legacy

(Bliven, 1954, p. 24). However, it took over 150 years and dozens of other similar inventions before a marketable machine actually named 'Type-Writer' arrived on the scene. Attributed to Christopher Latham Sholes, a newspaper editor and politician from Wisconsin, the prototype Type-Writer was inspired by the piano, with alternating black and white keys that triggered typeface hammers that brought an inked cloth ribbon into contact with paper to leave a printed impression. The ribbon had to be hand-inked, the hammers produced only upper case letter forms, and typists couldn't see what they had typed until they had completed an entire line of text. Nevertheless, the arrival of the 'literary piano,' as the editors of *Scientific American* had called an even earlier prototype, signaled the obsolescence of "the laborious and unsatisfactory performance of the pen" and heralded "a revolution as remarkable as that effected in books by the invention of printing."[21]

After failing to interest Western Union in his machine, Sholes turned to Philo Remington, whose company manufactured firearms and sewing machines. Demand for firearms was down since the end of the Civil War, and the company had extra production capacity. Remington bought Sholes's patent and marketed the first Remington typewriter in 1874. Sales were slow, given that the Type-Writer cost $125, but one of the early adopters was Mark Twain, who, despite his distaste for the machine, became the first writer to submit a typescript to a publisher.[22]

One particular technical problem that Sholes and his collaborator James Densmore had faced was that the type keys often jammed if they were struck in too quick succession, requiring the typist to stop and pry the type bars apart. The original keyboard displayed the alphabet in sequential order but split across two rows of keys, as follows:

- 3 5 7 9 N O P Q R S T U V W X Y Z

2 4 6 8. A B C D E F G H I J K L M

Densmore suggested reordering letter keys in an unfamiliar pattern to slow down typing. Sholes consulted with his mathematician brother-in-law, asking him to reorganize the key configuration so that the type bars that most often got stuck would be separated. Many calculations and experiments led to the four-row 'QWERTY' configuration that is still used on English language keyboards to this day. Sholes claimed that this scientific arrangement of the keys would boost typists' speed and efficiency. It may have done so to the extent that typists spent less time prying apart stuck type bars, but, keeping in mind that typing was done with only two fingers at the time, the QWERTY layout

[21] *Scientific American*, Volume 1017, Issue 1 (July 6, 1867), p. 3.

[22] The typescript was *Life on the Mississippi*, and it was typed not by Twain himself, but by a female secretary from his handwritten manuscript.

actually made typists' movements less efficient because it maximized the distance that their fingers needed to travel in typing most words (Beeching, 1974). Besides reducing the incidence of jams, the QWERTY layout also positioned all of the letters in the word TYPEWRITER in the top row of letter keys, a feature that salesmen used to full advantage when they demonstrated the machine.

Although a number of other keyboard layouts have been invented since Sholes's time, and these have been claimed to be more scientific and efficient (most notably the one developed by Dr. August Dvorak in 1932), none has been able to replace the QWERTY standard.[23] Once again, we see that technological factors may sometimes be an impetus for change, but in many cases they are not, and that what makes the difference is the social context of the time and place. The technical problem that QWERTY targeted no longer exists – it has been irrelevant ever since the development of the typeball and was permanently put to rest with the personal computer. And yet QWERTY has prevailed – not because of any inherent technical superiority, but rather because of social inertia born of comfortable human habit and the consequent economic risk that any manufacturer proposing a new standard would face.

Unlike the technologies of handwriting and print, which do not favor certain scripts over others, the typewriter and the computer keyboard that evolved from it have a clear structural bias toward alphabetic writing. This is not surprising: a limited character set was a precondition for the typewriter; without an alphabet, the typewriter would not even have been conceivable. Attempts were made at adapting the typewriter to other scripts. For example, Underwood developed a Japanese typewriter based on the Katakana syllabary in 1923. However, because it could not include Kanji (Chinese) characters, which were typically used in conjunction with Katakana, the typewriter was not even marketed as a writing tool, and its use was largely limited to the preparation of billing statements in large companies (Gottlieb, 2000). Another limitation was that the typewriter imposed horizontal writing, whereas Japanese writing was most commonly formatted vertically. Finally, the typewriter's need to space characters uniformly created an unusual appearance on the page, and typists had to remember to insert word spaces to avoid ambiguities (Gnanadesikan, 2009, p. 129). A later typewriter designed in the 1960s for the Hiragana syllabary suffered a similar fate. It was not until the late 1970s, when word-processing technology made it possible to input Kana characters and convert them to Kanji, that the potential of the personal printing press was finally realized – but at the staggering cost of $37,000 per machine (*ibid.*, p. 130). Today, Japanese computer keyboards

[23] For debate on QWERTY and DVORAK keyboards from an economic perspective, see David (1985) and Liebowitz and Margolis (1990).

retain the QWERTY keyboard, but they also print kana characters on the keys, facilitating the inputting of multiple scripts.

If the typewriter's design posed problems for languages written in non-alphabetic scripts, it contributed to the global spread of alphabetic writing by influencing decisions about what script to use for newly written languages. As Gnanadesikan points out:

> In the newly global economy that came in the wake of colonialism and saw the growth of new multinational corporations, the result was to advantage those nations whose scripts fit easily onto a typewriter keyboard. (*Ibid.*, p. 267)

In sub-Saharan Africa, for example, the Roman alphabet (sometimes extended with additional letters) has often been deemed the most practical means to transcribe languages that have not traditionally been written "because it looks international, because individuals already educated in the colonial languages (English, French, and Portuguese) already know it . . . and because of the lasting, arguably pernicious influence of the typewriter" (*ibid.*, p. 261).

With electronics, type keys were freed from singular mechanical connections to typeface characters. Any key could theoretically be programmed to produce any character – in any language or script. This is the principle that allows the QWERTY keyboard to be used in Chinese, for example. Perhaps the most common way to write Chinese characters on computers is to use the standard Roman alphabet keys on a QWERTY keyboard to write in *pinyin* (Roman phonetic transliteration), which activates a menu of Chinese characters that correspond to that phonetic representation. The user then chooses the appropriate Chinese character from the menu, and this is inserted into the text. An alternative procedure (called Wubi) maps components of Chinese characters (radicals and strokes) onto the QWERTY keyboard. One enters these character components in the same sequence as one would handwrite them on paper. Wubi-configured keyboards are divided into five regions, each designating a different type of stroke: horizontal, vertical, left-falling, right-falling, and hook. For experienced typists, this way of entering characters is far faster than using *pinyin.* Yet another way of entering Chinese characters is with finger movements on a touchscreen – pattern recognition software converts the hand-traced forms into printed characters.

Today, the accessibility of self-publishing via websites, blogs, social networking sites, and online forums has led to the production of a staggering amount of writing published by non-professional writers. The publishing industry's traditional role in legitimizing text and gatekeeping what can become 'public writing' has become to some extent democratized. This significant change has also made possible the sharing of what was once specialized knowledge of professional printers with ordinary individuals. One important such area of knowledge has to do with the semiotics of typeface.

The semiotics of typefaces

Typographers often seek to make type as 'transparent' as possible, not distracting the reader's attention from the writer's work (Warde, 1956). At the same time, however, there is a very long tradition, from Egyptian hieroglyphs to illuminated manuscripts to advertising today, of texts that purposely call attention to their surface visual form, beckoning the reader to look *at* them as well as *through* them (Lanham, 1993). Calligraphy and typography are semiotic modes in their own right, contributing their own nuances to the meanings prompted by words (van Leeuwen, 2005a). Fonts put new faces on words, and in so doing they affect our reading of those words. Consider how font design characteristics add a dimension of coolness, warmth, or cutesiness to a greeting.

HELLO hello hello

Conversely, we can be led to make associations between different words by means of similar typographic design, as in a 2010 Greenpeace campaign aimed against Nestlé, the company that makes KitKat candy bars, for buying palm oil from companies that destroy Indonesian rainforests and pushing orangutans toward extinction. The typography and red color was designed to lead readers to make an association between a KitKat bar and the word 'killer,' as shown in Figure 6.2.

Like language, typeface has meaning potential, but not predetermined meaning as in a code. Typefaces, like other aspects of style, get culturally appropriated and therefore can 'mean' different things in different cultural and historical contexts. For example, the Nazis appropriated Gothic script as a symbol of German nationalism; stickers from the early years of the Third Reich displayed slogans like "Feel German, think German, speak German, be German, even in your script" (C. Burke, 1998, p. 148). However, in 1941, when Hitler realized the importance of communicating his case to the wider world, he rejected Gothic script, calling it a Jewish invention ("*Schwabacher-Judenlettern*"), and decreed that the Antiqua typeface was to be the "normal script" of the German people (Steinberg, 1974, p. 293). In early modern England, on the other hand, Gothic script had been appropriated by the common people because it was thought to be the easiest script to read.

Today, Helvetica is an example of a typeface that is both revered and reviled, and is even the subject of a feature film.[24] Developed in 1957 by Swiss typographer Max Miedinger, Helvetica was designed to be modern, legible, comforting, and 'neutral' in the sense that the typeface itself should not convey

[24] *Helvetica* (Hustwit, 2007) is an 80-minute documentary about the development and use of the typeface and the controversy that surrounds it.

Figure 6.2 Greenpeace's appropriation of the visual design of the Nestlé KitKat logo

any meaning and thus be 'open' to interpretation. Many cities have adopted Helvetica for their public signs displaying the dos and don'ts of street life. Critics of Helvetica condemn its lack of rhythm and contrast, its boring predictability, and its overuse in society.

Typefaces might be considered expressions of identity – just like clothes, haircuts, eyeglasses, and other visual design accouterments – and in this light it is notable that social networking sites such as Facebook and MySpace allow users to modify typefaces in their personal spaces (the default fonts are Lucida Grande and Verdana respectively). However, in comparison with the many ways in which social networking users are unwittingly being homogenized by algorithms that make them behave in consistent, predictable ways, the typeface choices may be little more than a superficial gimmick to provide an illusion of agency.

Because visual design features such as typeface and layout contribute in significant ways to the meanings people make and take from texts, there is a substantial responsibility to understand the visual pragmatics that underlies

their use. Kress and van Leeuwen are two scholars who have contributed much valuable work in this area (Kress & van Leeuwen, 1996, 2001; van Leeuwen, 2005a, 2005b, 2006) and we will consider the pedagogical implications of this topic in Part III.

Conclusion

We have seen in the last two chapters how technologies of literacy have affected humans' relationship to language. The invention of writing allowed language to be separated from speakers' bodies and distanced from the original context of utterance. Paper, by providing a cheap, light, foldable medium, offered wider access to writing and drawing, and thus broader use of textualization and recontextualization. Print introduced the *mechanization* of writing, imposing another degree of spatial and temporal distance between the author and the final form of the work (a distance that had been introduced during the manuscript era by scribes). The typewriter made a simplified version of print accessible to the masses; it made printing personal and portable, but still maintained mechanical intermediaries between writer and written product.

The story of paper and print illustrates how material, social, and individual dimensions interact in producing new designs of knowledge, learning, and social life. The fact that printing did not become widespread for centuries in either China or the Muslim world leads us to the conclusion that it was not the technological innovation of movable type alone that made printing viable. Rather, a favorable social–economic–material ecology had to be in place to allow the technological innovation to take hold. Paper and print influenced the social–economic–material ecology by making it possible to circulate ideas to an unprecedented degree, and, for the first time, to archive texts at a potentially unlimited number of sites. In so doing, paper and print changed both the individual's and society's relationship to written language. These developments were crucial for the development of nation-states, the notion of the public sphere, and the consolidation of academic disciplines, especially the sciences.

Today, digital devices introduce a further stage of transformative separation between humans and language (albeit hidden from the eye), as HTML and other computer codes intervene between the embodied biomechanical movements of writing and the display of signs on screens of various types and sizes. The connections between these devices also make it possible for individuals to disseminate their writing with unprecedented speed and breadth of dispersal. It is to electronically mediated writing that we turn in the next chapter.