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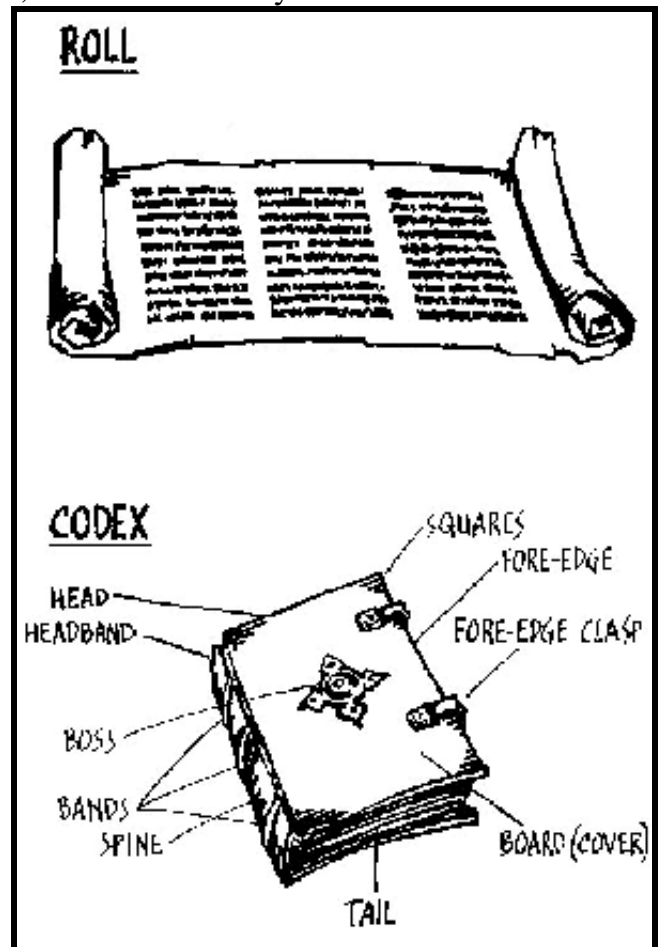
Medieval and Renaissance Book Production

Richard W. Clement

There is a widely held, yet erroneous, belief that the invention of the book was concurrent with the invention of printing. Somehow it is assumed that the act of printing--that is producing a book by mechanical means--endows the finished product with that essence that embodies a book. After all, the hand-produced book is called a manuscript, not simply a book, and early-printed books are called incunabula, books in their infancy. We are accustomed to think of the periods of manuscripts and printed books as distinct. Traditionally a scholar working in one of these fields has known little of the other field. Even our libraries have perpetuated this dichotomy: manuscripts are always separate from printed books, both administratively and physically. Yet historically this is a false dichotomy. The printed fifteenth-century book was a direct imitation of the contemporary manuscript book.[1] Yet perhaps talk of imitation is misleading. Gutenberg never intended to imitate anything or mislead anyone: he was merely making books by a new means. The end product was really little different than the product of the scriptorium. It was the means of production which was revolutionary, not the book itself. The book, or more properly the codex, was invented in the first century AD, and has continued to this day with relatively few changes.[2]

I. The Manuscript Book

In the ancient western world the book was in the form of the roll, which was usually made of sheets of papyrus sewn or glued together.[3] Papyrus sheets were made from thin lengths cut from the stalk of the plant, traditionally grown in Egypt, which were laid overlapping side by side in one direction and then in a similar fashion perpendicular to the first layer. This made for an exceptionally strong yet flexible surface. Its major drawback was that it was very difficult to write on the side on which the strips ran perpendicular to the direction of writing as the natural ridges of the plant disrupted the movement of the pen. There were various kinds and grades of papyrus generally distinguished by the width of the papyrus strips, e.g., Imperial was the best, Royal very good, and so forth. The standard size of the roll was about thirty feet long and seven to ten inches wide; the standard sheet size was about ten by seven and one-half inches, and writing was in columns about three inches wide, called *pagina*. The width of the sheet had no relation to the width of the column: the writing runs right across the juncture of the sheets. At the beginning of the roll there was usually a blank column left to protect the roll, but nothing equivalent to a title-page. On the other hand there might be a colophon at the end which would contain information about the book. The title or author's name was usually written on a label that was attached to the outside of the roll; it hung down from the shelf and served to identify it. Some rolls had rods attached to make rolling and unrolling easier and some were kept in leather cases. Because of the nature of the papyrus surface and of the roll itself, the text generally could only be written on one side, and the reader was forced to unroll one side and roll up the other as he read. From our modern perspective this seems a most cumbersome way to read, but it was obviously not so considered by the ancient reader.



During the first two centuries AD, only the roll was used for literary works. Martial (84-86 AD) is the first to mention a parchment codex.[4] He points out that it is more convenient for a traveler and how much space it saves in a library. He even gives the name and address of a publisher where one may purchase texts in codex form. However, it seems that this experiment failed, as there are no further references to the codex in this context for a whole century. In about 220 AD, lawyers began to concern themselves with the definitions for various kinds of books. In the *Digest* of Ulpian we find that the codex is an established and acceptable kind of book, but it was certainly not fashionable.[5] Indeed, the extant evidence from Egypt of Greek literary and scientific texts indicates that only by 300 AD did the codex achieve parity with the roll. However, if we examine the extant Christian works, a very different picture emerges. Of the surviving 172 Biblical texts that can be dated before 400 AD, 158 are in the form of the codex and only fourteen are in the form of the roll. All eleven of the second-century books are papyrus codices. As far as we know the early Bible was always written in the codex form. Of the non-Biblical Christian works, eighty-three are codices and thirty-five are rolls. Clearly the adoption of the codex was associated with the rise of Christianity.

At this point we may usefully ask two questions. Why did the codex displace the roll across the whole western ancient world, and why did the Christians adopt the codex right from the earliest times? Several traditional explanations have been advanced to answer the first question. 1) The codex is more economical. Both sides of the surface can be used, and thus by using the codex cost can be reduced by about 25%. Yet if economy had been so important, we see no attempt to use smaller more compact scripts or to reduce the size of margins which would have been natural in any attempt to economize. 2) The codex is more compact. In the earliest codices the amount of papyrus used was reduced by 50%. In addition the codex could be more easily stacked and shelved. 3) The codex was more comprehensive because several works, or individual parts of a work, which had hitherto circulated separately could be brought together as the codex could accommodate many more texts than could a roll. 4) The codex was more convenient to use. As we have already noticed, the codex is easier to handle, but this is a questionable assumption for those accustomed to rolls. 5) The codex is easier for purposes of reference, i.e., it is easier to locate a particular passage on a specific page or folio in a codex. However in the ancient world there was no such thing as a citation to a precise location, so this too is a questionable asset. Against these points we must consider the effects of conservatism. It is highly unlikely that the well-developed book industry of the ancient world would have altered its perfectly acceptable practices in producing rolls in exchange for codices without some external pressure.[6] And this is the key, because all of the traditional points in favor of the codex are internal or intrinsic. In fact, the shift from roll to codex was the result of external factors. We know that the earliest Christians adopted the codex quickly and entirely. A recent explanation for the invention of the codex is that it developed simultaneously with the *nomina sacra*, the abbreviated forms of the sacred names for God.[7] We know that the use of the *nomina sacra*, which was strictly Christian, was almost certainly begun in the Apostolic Age. There might well be a connection between this development and the adoption of the codex because both served to differentiate Christian books from Jewish and pagan books. We know that the *nomina sacra* originated in the East, in either Jerusalem or Antioch, and thus perhaps so too did the codex. This seems to be the most plausible explanation yet advanced to explain the Christian invention of the codex.

If this explains the origin of the codex, how can we explain its widespread adoption across the western ancient world? We know from the extant remains that the shift from roll to codex was a slow process which took several centuries. It was only by about 300 AD that we find equal numbers of rolls and codices. Yet within another century the codex was the most common format for all kinds of literature, Christian and pagan. After the promulgation of the Edict of Milan in 313, the influence of current Christian practice became progressively more powerful. We can only assume that the final impetus for the adoption of the codex must have been the success of Christianity.

Yet even with the triumph of the codex, rolls and wax tablets continued to be used. Each format had its appropriate use. Rolls were used for documents in the Vatican archives long into the Middle Ages and,

similarly, rolls were the favored format for archival documents in England well into the modern period. Likewise, the wax tablet, usually consisting of several wooden tablets hollowed out on one side and filled with wax and then joined together with thongs like a notebook, remained a common writing surface through much of the medieval period for initial composition, correspondence, notes, or business memoranda. The wax medium allowed for exceptionally quick writing, using a stylus, and when finished the surface could be easily smoothed for re-use. At the time of Pope Gregory the Great at the end of the sixth century, the wax tablet, the papyrus roll, and the parchment codex each had a specific and integrated role in book production.[8] Gregory's *Moralia*, a commentary on the Book of Job, is a case in point. Before becoming pope, Gregory served in Constantinople, where he preached a series of sermons on the Book of Job. These sermons were taken down in shorthand by a stenographer on wax tablets in a highly current script. Soon after, the text was transferred, still in an abbreviated cursive form, to papyrus rolls, and the wax tablets were smoothed over for reuse. Thirty-five papyrus rolls were used for the *Moralia*. After Gregory became pope in 590 AD, the text was transferred to parchment codices, six in all, written in a careful set uncial script using few abbreviations but the *nomina sacra*. While the codex was certainly the end product, the wax tablet and the papyrus roll played important and integrated parts in the production of the text. Papyrus rolls may have continued to be used in this manner for some centuries, but as papyrus became difficult and expensive to acquire (Mediterranean trade was disrupted and papyrus was no longer plentiful in Egypt, but had to be found far to the south in Ethiopia) we may assume that the small quantities of available papyrus were used for more permanent purposes. Wax tablets, on the other hand, continued to be used for initial composition for many centuries to come, and it was only with the rise of Scholasticism in the eleventh and twelfth centuries that authors changed from the ancient mode of dictating to a secretary who wrote using a wax tablet to the modern mode of self composition using a pen and parchment (or paper).

Simultaneous with the triumph of the codex, came the almost universal adoption of parchment as a writing surface for book production, though we cannot be at all sure that the use of parchment was an integral part of the process that favored the codex over the roll.[9] Supposedly parchment was invented at Pergamum in Asia Minor in the second century BC. The myth explains that the Ptolemies embargoed the export of papyrus from Egypt because they were jealous of the growing library at Pergamum which was beginning to rival the great library at Alexandria. Actually, supplies of papyrus were disrupted by the invasion of Egypt by Antiochus Epiphanes (170-168 BC), and so parchment was adopted as an alternative writing surface, not only in Pergamum but across the Mediterranean world. Through most of the Middle Ages, up to about the fourteenth century, parchment making was a major component in the manufacture of books, and continued to be of minor importance even after the invention of printing in the middle of the fifteenth century.

Parchment has traditionally been made from sheepskin, and vellum from calfskin,[10] parchment being usually thick and rough, vellum thinner and finer. However, once the skin has been prepared, it is difficult to determine what kind of animal it came from. It has become common simply to describe a finely prepared skin as vellum and the more ordinary sort as parchment. In any case, skins were usually soaked in a lime solution in wooden vats or in stone-lined pits. They were kept there from anywhere from three to ten days depending upon the temperature and were occasionally stirred and turned.



Finally they were washed in water. Each skin was then stretched on a frame--traditionally circular, but occasionally rectangular--and scraped with a *lunellarium*, a circular knife. Parchment, or sheepskin, was scraped only on one side; vellum, or calfskin, was scraped on both sides. Some medieval recipes state that the skin should be scraped when wet; others state that it should be scraped when dry. When the skin was dry and it had been scraped, it was re-wet slightly--one recipe recommends spraying the skin with a mouthful of good English ale--and then it was pounced, that is, it was rubbed with pumice.[11] This smoothed the surface and removed blemishes. The skin was then completely re-wet and dried again under tension. Finally it was finished again by pouncing, and perhaps by rubbing chalk or some other compound into it to give the skin a white smooth surface which would take the ink, but allow no bleeding.

Having prepared a writing surface, it was also necessary to prepare ink.[12] The ink commonly used in the ancient world was a carbon ink made of soot suspended in gum and water, similar to present-day India ink. It was not permanent and could be washed off. A much more permanent ink, called iron-gall ink, was more commonly used in the Middle Ages, and indeed long after. It was made by mixing either pulverized and extracted galls (which yielded tannic acid) or fermented galls (which yielded gallic acid) with ferrous sulphate (commonly known as copperas) or ferric sulphate, and with gum arabic to give it viscosity. When mixed properly, each of these formulae produced a fine permanent black ink, but when improperly mixed produced a highly acidic, or encaustic, ink which over the centuries has slowly burned its way through a great many manuscripts.

With the collapse of the western Roman Empire, so too collapsed the large-scale book trade. What saved book production in the west was the rise of monasticism. The first of the great monks in the west was Benedict of Nursia, who founded the large Benedictine house at Monte Cassino in 529 AD. The *Regula*, which guides the conduct of a Benedictine monastic community, says nothing about scholarship or book production, but does comment on reading.[13] Monks were to listen to readings at meal time and during services, and were to read privately in their own cells.[14] The texts were confined to the Bible and to the Fathers.[15] Time was specifically set aside for private reading,[16] and monks were expected to read at least one whole book each year. Private ownership of books was forbidden, and so it was essential to have a communal library. It was only a natural development that scriptoria were instituted to provide the necessary books. In 585 AD the monastery of Monte Cassino was destroyed by the Lombards and the monks were forced to move to Rome. There, under the influence of Pope Gregory the Great, the Benedictines became more scholarly, and book production, not only for local monastic needs but for the larger ecclesiastical community's needs, became an integral part of Benedictine life.

Another important monastic movement, though short-lived, was founded by Cassiodorus (ca. 487-ca. 580 AD), a Roman nobleman, who established a monastery on his estates in southern Italy at Vivarium around 540 AD. Cassiodorus saw the collapse of a society which could no longer maintain Classical culture, and so he gathered as many books as he could into his monastic library. He placed great emphasis on education and book production. In 562 AD he wrote his *Institutiones*[17] which set out his educational program. He understood the need for a repository of culture secluded from the chaos around him. He had specific guidelines for book production, and within the monastic community scribes had great status. Above the scribe, was an editor who compared the copy with the original, furnished marginal notes in red ink, and supplied punctuation. Cassiodorus insisted on orthographical correctness (he wrote a treatise on spelling *De orthographia*[18]), and he also advocated the use of omnibus volumes. Apparently the monastery died not long after Cassiodorus, but it inspired Gregory and certainly pointed the way ahead for the Benedictines.

Thus the example provided by Cassiodorus and the direct involvement of Gregory redirected the Benedictine movement so that the production and preservation of books became an integral part of western monasticism. In order to trace the spread of book production in the early Middle Ages we must trace the spread of monasticism. To some degree Rome remained a center of book production. Unfortunately we have little

evidence concerning lay production of books in Rome, but at least by Gregory's papal reign (590-604) we know that books were being copied for the pope by monks in their monasteries. There was a great demand for books in Rome-- it was a center for pilgrims and many wished to take books home with them. It was also customary that many pious and zealous Northern Europeans, their nations having recently converted to Christianity, would come to Rome, both to marvel at the still magnificent ruins and to purchase quantities of books to furnish the libraries of their newly founded monastic houses. One such Englishman was Benedict Biscop, who made five trips to Rome in the seventh century to supply the libraries of the twin monasteries of Monkwearmouth and Jarrow with large quantities of books, where in the next generation the great historian Bede was to write his *Ecclesiastical History* with little need to stir beyond the walls of the library. In addition to exporting books, Rome also exported monasticism. Yet the earliest flowering of monasticism in the North was in a most unlikely place and had very little to do with Rome. This was in Ireland. As the Germanic tribes overran Roman Gaul, some scholars apparently found refuge in Christian Ireland in the early fifth century and certainly brought books with them. Monasteries were founded as early as 444 AD and, like the Benedictines a century later, the monks realized the need for books. The Irish were great missionaries and travelers. St. Columba (ca. 521-597) began the conversion of Scotland in 563, and his disciples carried on and converted the northern English. St. Aidan (d. 651) founded the great monastery of Lindisfarne, famous for its book production exemplified in the Lindisfarne Gospels. In 596, Pope Gregory sent the monk Augustine and a band of forty followers to convert the English in Kent to Christianity and he found great initial success. Celtic and Roman forms of practice clashed in Britain, the former predominating in the north and the latter in the south, but at the Synod of Whitby in 664 King Oswy of Northumbria adopted Roman practice and thus all England acknowledged the authority of Rome. In any case, books and book production were important elements in both strains of monasticism, and as the Celtic houses gradually became Benedictine, the scriptoria benefited from the combination and continued to flourish. As Augustine's mission was finding success in southern England, the Irish monk St. Columbanus (543-615) set out across Europe and founded a series of great monastic houses, each of which became centers for book production, such as Luxeuil in Burgundy and Bobbio in N. Italy. In the same tradition, the English monk Boniface brought Christianity, monasteries, and book production to Germany a century later. Among the great monasteries he established was the one at Fulda, long famous as a center for book production.

By the time of the Carolingian Renaissance, the monasteries were firmly established as centers of power. Each had a scriptorium and many were actively copying the last surviving copies of Classical texts. Indeed we owe the transmission of the majority of Classical Latin texts to the work done in Carolingian scriptoria. Some scriptoria exerted great influence in codicological format and in the development and standardization of script, such as Corbie under Abbot Maurdrannus[19] or Tours under Alcuin.[20] Scriptoria and schools also came to be attached to cathedrals, and indeed there was even a Royal school, chancery, and a library. By the beginning of the ninth century, books and book production were a major part of cultural and educational life in Carolingian Europe, but unfortunately the advent of the Viking raids fragmented Europe and book production was severely curtailed.

The monastic scriptorium was generally one of three different types.[21] It could be a large room which may also have served as the library. The ninth-century "Plan of St. Gall" shows the scriptorium, containing a large central table and seven writing desks ranged along the walls, with the library above.[22] This was most typical of Benedictine establishments. Another possibility might consist of small individual writing rooms, each called a scriptoriolum. Writing might also take place in the cloister alcoves. Some of these alcoves were screened off and made into small chambers called carrells. Depending on the size of the monastery and scriptorium, there might be several classes of scribes though such distinctions varied with place and time. The librarian, *amarius* or *bibliothecarius*, was often in charge of the scriptorium, but the choirmaster, *precentor*, might also be in charge. The *antiquarii* were senior scribes and the *librarii* junior scribes. There might also be rubricators, miniators (or painters), illuminators, and correctors. Before the 12th century, scribes were almost always monks, but after this time there began to develop a class of professional scribes, often employed by

monasteries. Monks were generally unable to travel, but professional scribes could be sent to copy books at distant places. Monastic scribes generally worked about six hours a day copying. Including their religious duties, this accounted for all the daylight hours. Artificial light was rarely used, and silence was imposed upon the scriptorium, but copying was not silent. Silent reading was a development of the eleventh and twelfth centuries. Before that time, each scribe essentially dictated to himself and the scriptorium was filled with a dull murmuring. In order to communicate, an elaborate system of hand signals was devised.

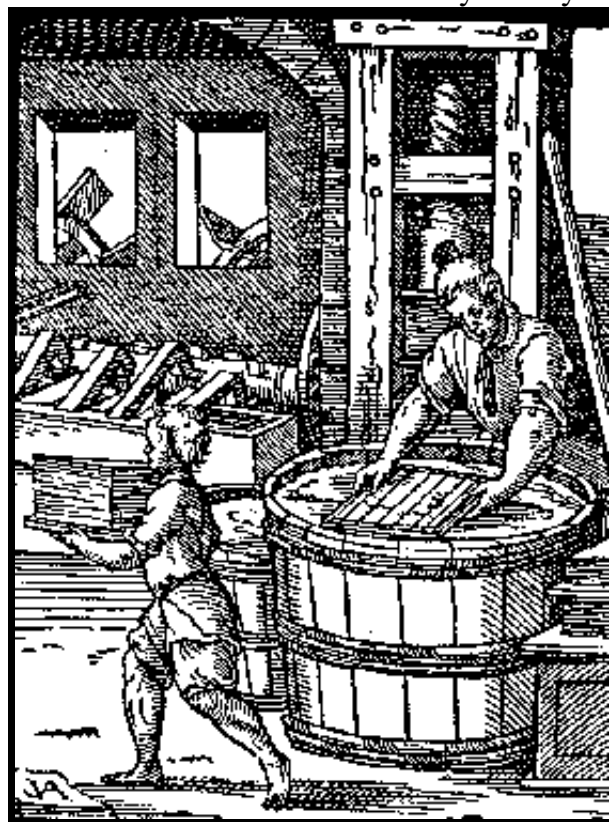
With the Gregorian Reform of the eleventh century, there was a shift away from the monastic scriptoria, as cathedral schools became more important and as cities developed notarial needs. By the end of the twelfth century monastic scriptoria had entered a period of dormancy that would only end in a brief flurry of activity in the fifteenth century. The newly established orders of friars (Franciscans and Dominicans) stimulated the book trade beyond the monasteries because they had no scriptoria of their own, but had need of books. Thus they had to obtain their books outside of their orders. As they favored small books, which they could easily carry, the production of smaller books was stimulated. At the same time the nascent universities created a new reading public. New texts, reference works, and commentaries were required for scholastic study, and these works were not the kind produced in monastic scriptoria. The new secular book trade became a licensed appendage of the university, consisting of stationers, scribes, parchment makers, paper makers, bookbinders, and all those associated with making books.[23] They enjoyed certain rights such as an exemption from taxes and the right to be tried in university courts. A stationer was appointed only after an enquiry to confirm his good standing and professional ability. He had to provide guarantees and take an oath. Books tended to be sold and resold through many generations and it was the stationer's responsibility to sell a book and buy it back and sell it again, and so forth. He could buy and sell only under certain conditions: he had to advertise the titles he had in stock, prices were fixed, and students and professors received discounts. In order to produce the large numbers of textbooks required by students and maintain their textual accuracy, the *pecia* system of copying was instituted.[24] The system began in about 1200 and ended in about 1350 in the North, and about 1425-50 in the South. It existed in at least eleven universities (seven in Italy, two in France, and one each in Spain and England) and probably many others. The stationer held one or more exact copies (the exemplar) of a text in pieces (hence *pecia*), usually a gathering of four folios (sixteen columns) or perhaps six folios. Each column had to have a certain number of lines (usually sixty), and each line a certain number of letters (usually thirty). Each exemplar was examined to ensure it was correct, and any exemplar found to be incorrect resulted in a fine for the stationer. Each part was rented out for a specific time (a week at Bologna) so that students, or scribes, could copy them. This way a number of students could be copying parts of the same book at the same time. Stationers were required to rent pieces to anyone who requested them, and the charges were fixed (e.g., at Treviso in 1318 the charges were six pence for copying, and two pence for correcting). The size of books began to decline, and script became more compact and the number of abbreviations increased. The two-column format became the norm, and ornament was almost abandoned on all books with the exception of the luxury trade. Soft cover bindings tended to replace wooden boards, and parchment became progressively thinner as the number of folios per gathering increased.

As we have seen, in antiquity books were read aloud, whether to oneself or in a group. There was no word division or punctuation (in the modern sense) in manuscripts, and one had to pronounce syllables and words aloud in order to distinguish them, a process analogous to sounding the notes when reading a musical score. Thus, dictation was the major mode of literary composition well into the Middle Ages. In the monastic scriptoria the scribe continued this mode in what was in effect self-dictation. However, in the eighth century in England and Ireland we find the first word division in manuscripts. This was a pedagogical device that aided those whose grasp of Latin was less than perfect. By the ninth century we find word division in manuscripts produced on the Continent, and by the eleventh century it had become commonplace. Word division began as an aid to oral reading, but far more significantly allowed the development of silent reading.[25] Thus with word division the scriptorium truly became silent. At the beginning of the twelfth century literary composition was still oral, but with the advent of scholasticism and its intellectual complexities, composition became

written and reading silent. Silent reading increased one's comprehension of complex ideas as one could take in information at a much faster rate. Wax tablets were found to be too small for the composition of complex treatises, and so authors began silently to compose directly on parchment or paper. Thomas Aquinas' script was deemed so illegible, however, that he had to read his own writing for a secretary who wrote it in a legible hand.[26] Gothic cursive script was a direct result of such authorial composition: it was a script that could be written very quickly, and yet was reasonably legible. As scholastic texts became more complex, books reflected these complexities in their organizational design and layout. These developments included dividing the text into chapters and sub-chapters, and the addition of tables of chapter headings, alphabetical tables by subjects, and running heads. New forms of punctuation, such as colored paragraph marks, were introduced. Quotations were underlined in red, marginal notes were added, and diagrams were supplied. The resulting multi-structured apparatus, perhaps most commonly seen in a glossed Bible or Psalter,[27] was visual and was meant for a reader, not a hearer.

At about this same time, paper became available for use in book production.[28] Though less durable and more difficult to write on than parchment, paper had one great advantage-- it was cheaper. Paper was, of course, invented in ancient China,[29] but it was not common in Southern Europe until the thirteenth century. Certainly by the fourteenth century, it was readily available to anyone at a reasonable price.

Paper was made from rags, usually linen. The rags were dampened and left to rot for four or five days. They were then placed in a stamping mill which transformed the rotting rags into a pulp of long fibers. The pulp was then transferred into a large vat (usually of about 330 gallons) which was kept agitated and warm. At least two workers were required for the papermaking operation, a vatman and a coucher. The vatman took one of two moulds (an oblong rectangular wire sieve mounted on a wood frame), fitted the deckle (a removable wooden rim which could be fitted on to the mould to make it into a tray-like sieve with a raised edge), and then dipped it into the vat so that the pulp-solution drained through the mould. This left a layer of matted fibers on the mould as the water drained away. The vatman removed the deckle from the mould and handed the mould to the coucher. The coucher rolled the newly-made piece of paper onto a piece of felt, and then handed the mould back to the vatman. Meanwhile the vatman had prepared another piece of paper with the second mould and the deckle. Together they could produce a sizable quantity of paper over a relatively short period of time-- about five and one half reams a day.

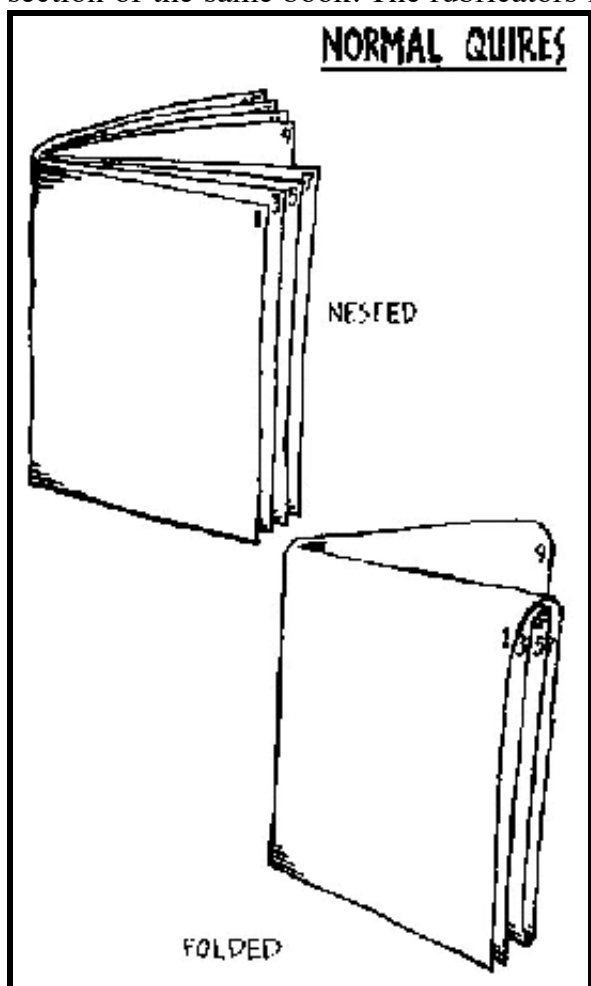


The pile of wet paper and felt, known as the post, was subsequently placed in a screw press, and much of the water was pressed out. It took an immense amount of pressure to press out the water and all of the workers in the mill had to turn out to help pull the long wooden lever which turned the screw. The pile of paper was reduced in thickness from about two feet to six inches. A third workman, the layman, freed up each sheet of paper, removed the felts, and placed the paper in a neat pile. This pile was again subjected to pressure and more water was removed. This process was repeated several times. The paper was then taken in groups of four or five sheets, which were dried suspended from ropes in a specially constructed drying loft. Drying the sheets in groups kept them from wrinkling.

Next the paper might be sized. If so, it was dipped into a vat containing animal size, a glutinous liquid made by boiling parchment or leather shavings in water. Size gives paper a relatively impermeable surface. This is

essential for writing with a pen, but much less so for printing. After sizing, the paper was once again dried. Finally the paper was subjected to a finishing process. Each sheet was burnished by rubbing it with a smooth stone. This produced a smooth surface and closed the pores of the sheet so that the writing ink would not bleed. In Italy in the fourteenth and fifteenth centuries, a new format was developed that humanist scholars believed recreated the aesthetic qualities of the book in the ancient world. Believing the Carolingian manuscripts containing Classical texts to be much older than they were, the humanists adopted the Carolingian minuscule script (the Italian rotunda version) as the "littera antiqua," the script of the Romans. In addition, they rejected double columns in favor of long lines, used much more space between lines, and provided wide ample margins. The result was an exceptionally elegant and legible book, which has remained a major model for book design ever since.

The emergence of a literate middle class in the later Middle Ages created a demand for new types of books. These tended to be popular works of a recreational or technical nature, which were often in the vernacular. We know very little about the beginnings of the book trade outside of the monasteries and universities, but certainly there was an independent trade by the late twelfth century. University stationers were free to engage in outside trade and no doubt did so. Books seem most often to have been made to order, but also occasionally for speculation--with no specific buyer in mind. Some orders were large: in 1437 a wholesale bookseller sent an order to a scriptorium in the Low Countries for 200 copies of the Seven Penitential Psalms, 200 copies of Cato's *Disticha* in Flemish, and 400 copies of a small prayer book.[30] Such an order implies true mass production and the development of the production line approach in which different workers consistently and repetitiously labored at specific tasks, perhaps even dividing the types of labor on a single book between different shops. Thus the textual scribes would be in one shop, each scribe repetitiously working on a quire or section of the same book. The rubricators might be in another shop, the illuminators in another, and so forth.



There is also some evidence from England that some manuscripts were produced by groups of scribes in a loose relationship working at different locations.[31] A single scribe or stationer might receive a commission and then farm out sections to independent scribes, most of whom were notarial or chancery scribes. In England, in contrast to the Continent, established lay scriptoria seem to have been rare. Rather there existed a number of independent practitioners whose services were available to any of the various stationers who coordinated the production of books. Whatever a scribe's position or the scriptorial setting may have been there are a number of procedures common to the production of almost all medieval books.[32] Having assembled the appropriate materials--parchment or paper (or perhaps both), ink, and a pen (a reed in the early Middle Ages or a quill later)--it was necessary to produce a quire, or a gathering of leaves.[33] This could be accomplished in two ways. The more traditional way was to take four sheets of parchment or paper, fold each once, and then nest one inside the other, thus creating a booklet or quire. This was naturally the easiest method with large books. With smaller books, it was easier to use the folding method. By folding the sheet twice, one obtained a quire of four leaves or eight pages; by folding it three times one obtained eight leaves or sixteen pages-- the standard quire size of the Middle Ages (though it should be pointed out that the quire size varied with place and time).

If the book was made of parchment, it was essential that the sheets be positioned so that the hair, or outer, side

of the skin always faced another hair side, and likewise, that the flesh, or inner, side of the skin always faced another flesh side. The hair side of a skin is yellowish and rougher than the flesh side, which is often milky white. For aesthetic reasons, it was essential that at any opening of the book one see only one color and texture of skin. If arranged properly a reader is never even aware of the difference in the sides of the skin, but should hair face flesh the difference can be jarring. If the quire is constructed by the folding method, it will automatically form the correct hair-flesh pattern. Naturally there were unsolvable problems in arranging the hair and flesh sides when it was necessary for textual or other reasons to add an extra leaf or bifolium.

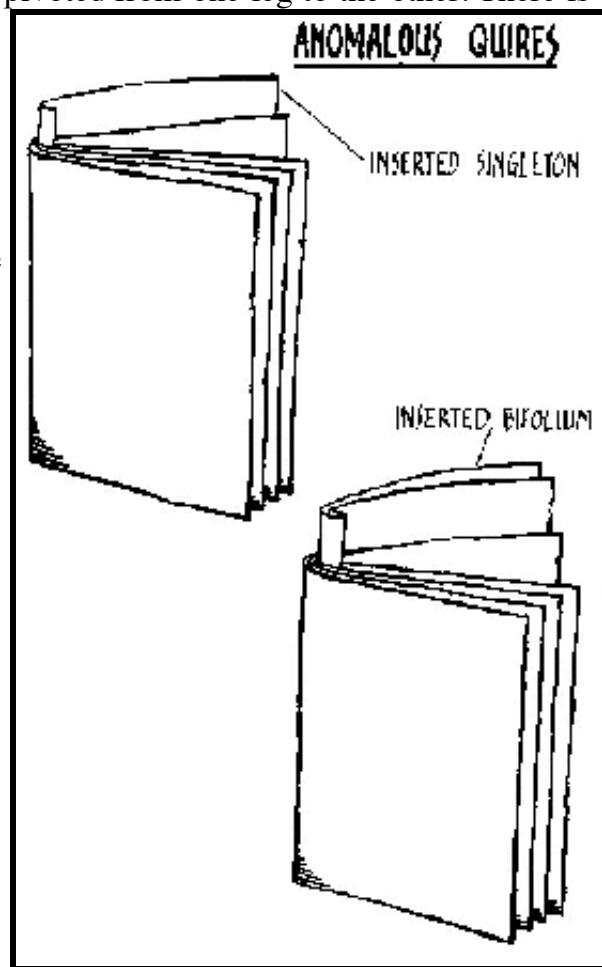
The next step was to prick the quire.[34] This produced a series of small, almost invisible, holes which acted as guides for ruling each page. These could be made by using a *punctorium* (a stylus or an awl), the scribe simply poking holes through the margin of the parchment or paper at regular intervals against a ruler to keep the line of prickings straight. A *circinus* (a pointed compass or dividers) could also serve the same purpose, but would maintain a standard interval between prickings as the scribe pivoted from one leg to the other. There is even some evidence that a star wheel was used; that is, a star-shaped wheel mounted on a handle which when pushed or pulled along a surface would prick it quickly and consistently.

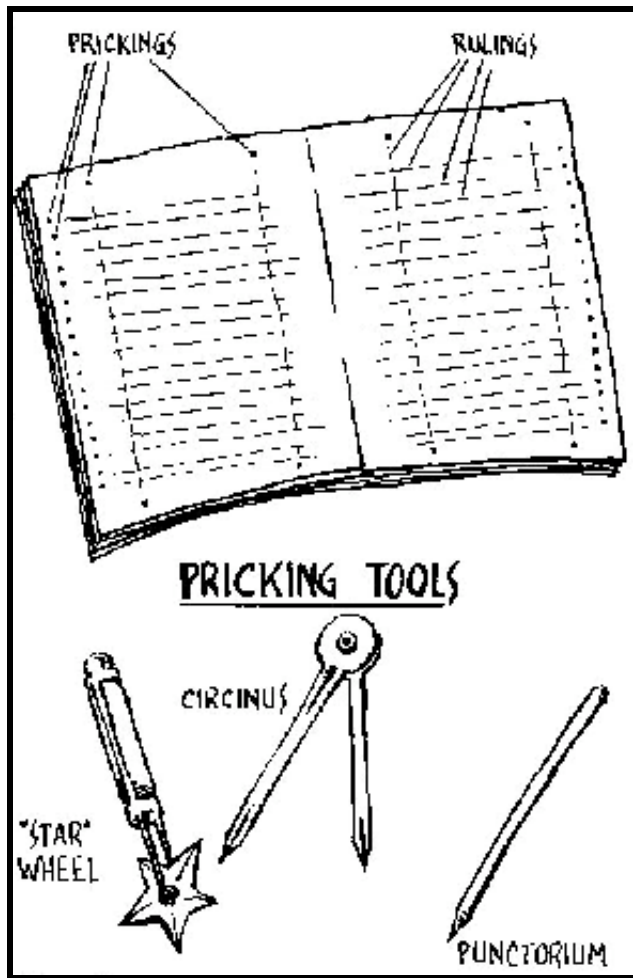
Occasionally pairs of wooden rectangular frames with sharp points placed at appropriate intervals on one frame and corresponding holes on the other frame were used and the stack of sheets was simply pressed between the frames creating all the prickings in one act. In addition to pricking along the side margins, it was usual to also place several prickings along the top and the bottom so as to delineate the textual frame. The quire might be pricked folded, which was the most efficient method as it required prickings down only one side of the leaf, or flat, which required prickings in both outer margins. In some instances we even have prickings in the inner margins.

After the quire was pricked, it was ruled.[35] There were generally three major modes of ruling. The first, usually associated with the early Middle Ages (though also commonly found in humanistic manuscripts of the fifteenth century which unconsciously adopted Carolingian practice in the belief that it was Roman) is the use of a stylus which creates a furrow as it is pulled across the surface. This method produces rulings that are nearly invisible and has the advantage of producing multiple rulings, on both sides of each sheet stacked in a pile. It is, however, rather unsuitable for paper as the stylus can rip or tear it quite easily. The second method is to use lead plummet, an early form of pencil. This usage is usually associated with the middle of the medieval period. The most common method of ruling at the end of the Middle Ages was the use of pen and ink. No doubt this was a result of the increased use of paper in book production in this period. Both lead plummet and ink were far less efficient than dry-point ruling as each side of each sheet had to be individually ruled. Combs, which pulled several parallel instruments across the surface at the same time, may also have been used in a few instances.

In preparation for writing, the scribe might well apply more pumice to the surface of the parchment to smooth it further, he might apply chalk to whiten it, and he might apply starchgrain to ensure that the ink would not bleed. Paper required almost no preparation, but the scribe might smooth it with a polished stone.

Now the scribe was ready to write. Although dictation to a group of scribes was quite common in the ancient





world,[36] medieval scribes copied individually.[37] The desk was at an angle, and often the scribe would hold a penknife in his other hand to hold the writing surface in place; the knife was also useful for making erasures by scraping off the still wet ink. The normal method of writing was to begin on the first page (the recto of the first folio) of the quire and copy the text straight through in its natural order. The scribe had to pause after finishing each recto (except for the middle bifolium) before going on to the verso in order to let the ink dry. As the scribe finished the verso, he added a quire signature to keep the bifolia in order. Each quire of the book was designated by a letter of the alphabet, and each bifolium of the quire by a number. Thus the second bifolium of the third quire would be designated Cii. Alternatively, a quire could have been copied out of page order, the scribe copying one side of each bifolium, then turning the stack of bifolia over and copying each of the other sides. There is even evidence that scribes folded and prepared sheets, but did not cut and open the quires before copying. Rather they unfolded the quire and copied their texts in the imposed order derived from the folding. As the scribe finished each page, he would take a fine-nibbed pen and lightly write instructions in the margin on how to fill blank spaces with rubrics, decorations, capitals, pictures, and the like. These instructions have rarely survived as they were usually trimmed away by the binder.

After the scribe had finished copying a quire, it was often checked by a corrector. It was his job to compare the exemplar to the copy and make sure there were no errors. When errors were found, they might be erased by scraping off the ink with a knife, or by applying a lightly acidic solution which would loosen the ink. The corrector could then supply the proper reading. In many instances the corrector simply lined through the error and supplied the correction interlinearly or marginally.

The next stage in book production was rubrication. Rubrication, almost always in red (*Rubrica*, red earth or red ochre), typically consists of chapter headings, or in more specialized texts such as commentaries, the word or phrase being glossed. In addition, the rubricator might supply colored paragraph marks and highlight capital letters in the body of the text. An associated stage was decoration. This typically consisted of painted capitals, often alternating in red and blue, and perhaps decorated with pen flourishes. The whole process of decorating, painting and illumination could be a complex one that could involve several different scribes and artists.[38] After having applied a base coat, the first step was usually to make an outline in pencil (lead plummet), and there is good evidence that pattern books and stencils were used fairly extensively.[39] When the image was judged to be satisfactory, it was inked and thus became permanent. If there was to be any illumination, or gilding, involved, it was done before paint was applied. Gilding was always carried out before painting, as the paint could cover any rough edges.

There were several methods of applying gold, both burnished and unburnished, in leaf or powder form within the same area, giving varieties of texture and color to the metal. Powdered gold or silver was made by grinding the metal with honey or salt; it was then mixed with glair, a common medium made from egg whites, or gum, and was applied with a brush, or could even be used with a pen. To ensure a smoother flow and coverage, yellow pigments were often mixed in, and the surface could be burnished to some extent with a tooth. This method was used more often for lines and rarely for the coverage of large areas, where gold leaf was required.

Gold leaf was attached directly to the surface by means of glair, glue, or gum which acted as an adhesive. Pigments such as terre verte, saffron, yellow ochre, or red brazil dye could be added to the adhesive so that the gilder would know exactly where to apply it. If the gold leaf was to be highly burnished it required a support. The support was built up with layers of *gesso* (powdered gypsum mixed with glue) applied with a brush. When the appropriate height was reached, the surface of the *gesso* was burnished until it was perfectly smooth. *Bole*, a waxy clay ranging in color from white to red, was painted on the surface so that the gilder would know which area to gild. Finally the gold leaf was applied with glair or gum, and then it was burnished, giving it the appearance of a solid piece of metal.

Now the scribe or artist was ready to apply paint. Each color was applied in turn and allowed to dry, with the final stage being the application of the stipple or white highlighting. The paint consisted of two elements, media and pigment. The medium, which turned the dry powdered pigments into a liquid paint, varied according to the choice of pigment. The foremost medium was glair, a mixture of egg whites and water. Gum arabic, vinegar, or honey might be added to vary the consistency, and water was used to dilute it. Glair could be used with almost any pigment. Another common medium was gum arabic (from the acacia tree) which came in solid lumps, called tears, which were powdered and then dissolved in water. After about a day the solution was strained and it was ready to use. Glue was made from horn or parchment and was mainly used for green pigments. Cheese glue was used almost exclusively with folium, and egg yolk was only used with a few pigments (orpiment, carmine, indigo, and azurite). These pigments were ground in egg yolk, which was subsequently washed out and the powdered pigment was then mixed with glair or gum arabic.

A variety of pigments was available to the medieval craftsman, and a number of these were suitable to be applied to parchment or paper. Black was essentially carbon-based ink. It consisted of lamp black, or soot, which was produced with a candle or oil lamp that was burned against a metal or earthenware surface from which the soot was collected. The soot was so fine it required no grinding. It was mixed with an egg medium. An alternative source for black pigment was charcoal made from vine twigs ground to a powder with wine or water, and then mixed with glue or egg as a medium. Blue could be produced by the use of several different pigments. Ultramarine was made from lapis lazuli and was the most highly prized and expensive of the blue pigments. It was essential to exercise great care in selecting good quality stones because it was quite difficult to remove impurities from the lapis. Azorium was made from azurite, but it could also be made artificially by placing a white powder such as alum or lime in a copper vessel with vinegar. The copper vessel needed to be kept warm for about a month. The pigment produced by this method often needed to be augmented by the addition of mulberry juice. Indigo mixed with white lead would also yield blue. Another source of blue color was the juice from blue flowers. The color could be stored in a clothlet, a clean linen rag moistened with water and quicklime, and soaked in the plant juice. When dry, the clothlet could be stored indefinitely. When needed it was placed in a gum solution to extract the pigment.

The brown pigment, bistre, was made from burnt resinous wood boiled in lye, and was used both as a separate color and as a shading over other pigments. Verdigris was the most common green pigment. It was made by placing strips or plates of copper above a quantity of vinegar. The resulting powder (copper acetate) was



scraped off the copper. It was often called Greek or Spanish green. Verdigris was not ground into powder, but was soaked in wine or vinegar and thickened by heating. A mixture of vinegar, egg yolk, and gum water was used as a medium. The color could be tempered by the addition of vegetable green pigments, or saffron. Terre verte and chrysocolla (malachite or copper carbonate) were also common green pigments. They were sometimes used for underpainting in gilding. Green pigment could also be extracted from plants and stored in clothlets. Another green was vergaut, a mixture of indigo and orpiment (blue and yellow). Gray, or veneda, was made from a mixture of black pigment and white lead.

Red ochre, the most common red pigment, was rarely used in manuscripts, but commonly used in wall painting. Vermillion was obtained from cinnabar, or through a chemical reaction of heating mercury and sulfur together to produce mercuric sulphide. Mixed with white lead it formed a flesh color, olchus or membrana. Red lead, minium or sandaraca, was prepared by heating white lead for several days. It was necessary to stir the pot every two hours, and it was suggested that one forego sleep for several days. It was recommended that vermilion be added to the lead to make it more brilliant. Brazil wood dye was the most useful red pigment for manuscripts. Wood shavings were soaked in a solution of lye, wine, or urine for several hours and then alum was added. The intensity of the color was a result of the quantity of alum added. Pigment was mixed with glair for red ink or for glazing over illumination. It could be precipitated into a powder and then mixed with gum to be made into paint. Purple was derived from a mixture of azurite and brazil wood, or the juice of bilberries and alum. A common purple pigment was folium, derived from the seeds of turnsole. It was used in the form of clothlets, and cheese glue was used as a medium. White was obtained by the use of white lead even though it was poisonous and turned black in the presence of certain other pigments. It was made by placing plates or strips of lead above vinegar. The white lead was scraped off, and wine was used as a medium. It could not be mixed with vermilion or orpiment, and so in those instances other white pigments such as ground bones or egg shells were used. Orpiment (an arsenic compound) was widely used for yellow, even though it was poisonous and rather coarse. Because it was so coarse it was customary to add another pigment, yellow ochre, to it which would give the painted surface a smoother appearance. Yellow ochre was rarely used by itself in manuscripts, as it was more appropriate for wall painting. Saffron was also used to produce a yellow pigment, though it was not permanent.

II. The Printed Book

As the fifteenth century progressed, so too increased the pressure on the book trade to produce ever larger quantities of books. The traditional scriptoria and ateliers were hard pressed to meet the demand. Indeed many monastic scriptoria, long dormant, found renewed life in meeting the growing demand for books. This renewal was stimulated, in part, by the ardent conviction of the importance of books and reading, and thus copying, by the Brethren of the Common Life, the Sisters of the Common Life, the Windesheim Congregation, and others.[40] Spurred on by recent reforms, many ancient Benedictine houses reestablished or greatly expanded their scriptoria. Yet even so, demand still exceeded production. The time could not have been more propitious for the introduction of a mechanical means of mass producing books.

There can be little doubt that Johann Gutenberg was the inventor, not so much of the printing press, but of the manufacture of movable type.[41] That was the key invention: the others--such as the press or the special ink--were subsidiary. The press, in the form of the common screw press used to press water from newly made paper or oil from olives, had been in existence for centuries. Printer's ink, even though a subsidiary invention, was a completely new development.[42] Unlike ink applied with the pen, printing ink had to be highly viscous, rather like a thick paste. It was made from lampblack and varnish.

Gutenberg was born into a patrician family sometime in the final decade of the fourteenth century.[43] In the

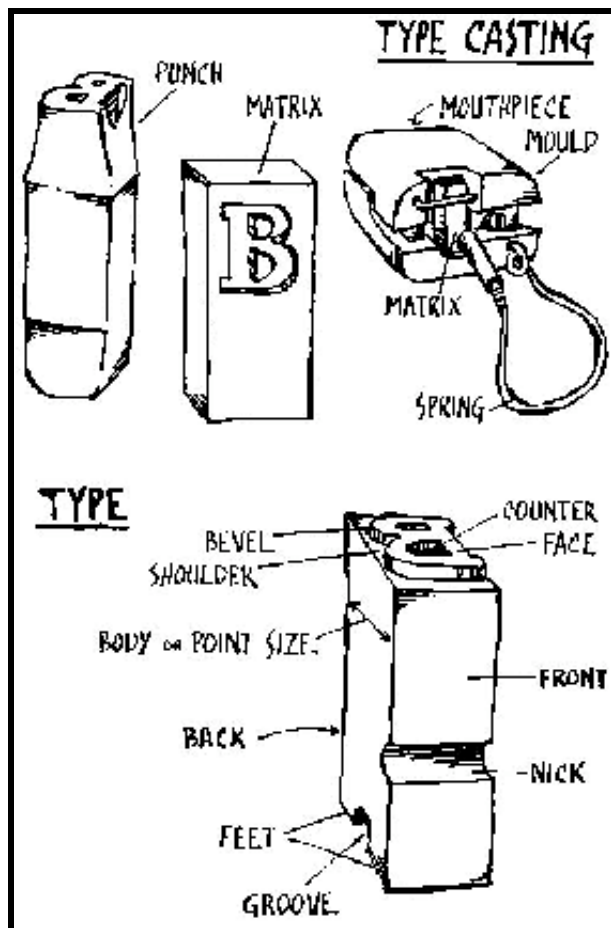
1430s and '40s we know that he was carrying on secret and expensive experiments in Strassburg which we may suppose involved typesetting and printing, but in 1448 he returned to his native Mainz. He was ready to make his first full-scale attempt at printing, but required money. This was loaned by a banker, Johann Fust, in 1450, but Gutenberg had to pledge his equipment. In designing the type, he had the assistance of a Paris educated scribe, Peter Schoeffer. The font of type designed and cut by Schoeffer and Gutenberg turned out to be too large for the projected Bible. It would allow too few lines of type per page and thus require a vast expenditure in paper and vellum.

Unfortunately the capital supplied by Fust had been exhausted in the preparation of the abortive first font (subsequently known as the B36 font as it was used in the 36 line Bible printed by Gutenberg in 1458) and a second loan was required in 1452. This time, though, Fust insisted that he be made Gutenberg's partner. He sensed that the new invention had the potential to be very profitable. The partnership was formed specifically to produce the Bible and not as a general publishing venture. To this end, Gutenberg and Schoeffer produced what we know as the B42 type (because the Bible was set in 42 lines per page). This is the type which was used in the so-called Gutenberg or Mazarine Bible. When the Bible was complete in 1455, Fust dissolved the partnership, in part because Gutenberg had been printing a number of small items and works on the side, and sued Gutenberg to recover his loan and interest. Gutenberg lost the B42 type and part of the equipment, but retained the older and larger B36 type and the rest of the equipment. Peter Schoeffer first became Fust's foreman, then his partner, and finally his son-in-law, and so founded the first great publishing firm, that of Fust and Schoeffer.

Gutenberg limped along for a couple of years, publishing small but popular items such as calendars, but by 1458 he was able once again to print a Bible, the 36-line Bible. In 1460, possibly in Bamberg, he attempted to solve the problem of reprints and standing type. The nature of printing requires that type be distributed back into the type cases periodically so that new pages can be set; no printer had enough type to set a whole book without reusing it many times over. It would have been prohibitively expensive to leave a whole book in standing type over the years so that it might be reprinted when necessary. What Gutenberg did was to cast his type, not in single letters, but in two-line slugs, that is, in two lines of text in one piece of metal.[44] He tried this with a popular encyclopedia of the day, the *Catholicon*, containing over 700 pages. It must have taken an immense amount of metal. Yet it was a good choice as it was reprinted from the slugs in 1469 and 1472 by Gutenberg's heir, Dr. Humery, who no doubt reaped a great profit. Gutenberg's second invention, the two-line slug, was stillborn, and indeed was never even discovered until 1982.

To print, one must have type.[45] The first step is to make a punch, a steel rod on the end of which is cut a relief pattern of each letter. The punch was then hammered into a small block of copper, called a matrix. The matrix fitted into the bottom of the mould, a steel box made in two parts and clad in wood for insulation. The typesetter held the mould in his right hand and poured liquid metal into it with his left, instantly giving the mould an upward jerk to force the metal all the way to the bottom of the matrix. Releasing a spring, the piece of type (called a sort) fell out and he repeated the process. A good typesetter could produce about 4,000 sorts in a day.

The first stage in printing is composition. When the printer had decided on a text to print, it was necessary to



cast off the copy. He had to determine how many pages the work would take, how many lines per page, and so forth. This was also essential for determining the amount of paper to order. We occasionally find marks in manuscripts left by printers as they marked up copy for the compositor. The compositor, with his copy before him, began to set the text in type. The type was traditionally kept in two cases: capitals were kept in the upper case and the minuscule letters were kept in the lower case. The compositor reached into the appropriate case and assembled a line of text in a composing stick, a small adjustable tray that could accommodate several lines of type. So as to justify the line he would alter spelling, abbreviate words, or adjust the spaces between words. Once the stick was full, he would transfer its contents to a galley tray in which the page would be built up. After the page was complete, additional items might be added, such as running heads, folio numbers, catchwords, or signature marks. Signature marks were necessary because in the binding process it was essential to identify the order of the sheets, and on each sheet the order for folding. The gathering, a quire in manuscripts, is called a signature in printed books.

The next stage is imposition. The compositor took the pages and arranged them on a large flat stone, known as the imposing stone. By means of the signatures, catchwords, and folio numbers, he arranged the pages in the appropriate order. The pages of type were surrounded by the chase, a rectangular wooden frame. Wooden blocks, called furniture, were used to fill in the empty space, and wedges of wood, known as quoins, were used to lock in the type and furniture and make it secure. The finished product is called the forme. If there is one page in the forme the result will be a broadside (which is only printed on one side); two pages will produce a folio; four a quarto; eight an octavo, and so forth.

Illustration and decoration in printed books generally was achieved by the use of woodcut blocks that could be locked into the forme together with the type and printed in the same process.[46] Though woodcut blocks, and the prints made from them, had commonly circulated before the invention of printing, it was the use of such blocks in printing that created a huge demand for the services of woodcutters. In creating a block, the cutter first drew the design in reverse, or pasted a drawing of it, directly on the block. The block was typically made of a plank, a piece sawn with the grain and planed down from a tree of fairly soft wood such as sycamore, beech, apple, or pear. Those spaces that were to remain blank were cut away with a knife or a burin which left the lines or spaces that would be inked in relief. The block thus functioned in the same manner as type: the relief surface received the ink and produced a reverse (i.e. correct) black-line image on the paper. A small proportion of these relief images were cut on metal, the most common being dotted in the *manière criblée*, which is a white-line cuts in which the relief forms the background. A black-line version of the *manière criblée* was commonly used in early French printed Books of Hours.[47]

The pressman next pulled a proof sheet from the forme. This was turned over to the corrector and his reader. The reader read the original copy while the corrector followed along on the proof sheet to ensure that the text was correct. The process was often repeated with one of the first sheets from the press run. Inevitably there were corrections to be made. As the printing run continued, corrections continued to be made to the forme. This has, of course, created many intricate and interesting problems for bibliographers. It is said that because of these innumerable continuous changes, no single copy of an early printed edition is identical with any other.

The next stage is the actual presswork.[48] It was first necessary to undergo the process known as make ready. This consisted of making register, that is, laying the first forme relative to the bed of the press and the press points (which hold the paper) so that when the paper was printed on one side, turned over, and replaced on the points, the pages of the second forme would fall square on the backs of the first. Then the tympan sheet was fixed, that is, pasting a sheet of paper to the face of the tympan where it served as a guide to positioning the sheets on the tympan during the printing of the first forme. And then the tympan was finished, which consisted of wetting the tympan parchment and packing in a folded woolen blanket between the outer and inner tympan. Next the frisket was prepared by covering it, pulling an impression of the forme, and then cutting out the printed areas. Finally the forme was checked for any odd pieces of loose type lying on it.

he might supply several bifolia that functioned as flyleaves. The book might be soft- or hardbound. A softbound book was usually covered in vellum or parchment, though stiffened leather was also used. The bands, to which the quires of the textblock were attached, were laced through several slits in the cover and tied or fastened. This provided a lightweight yet durable binding even for large volumes. A hardbound book was bound in stout boards in the medieval period, or perhaps pasteboard in the Renaissance, and covered in leather, pigskin, or the like. The boards were attached to the textblock by running the bands through small holes bored in the beveled hinge edge of the boards and then fastening them on the inside with wedges, or, if they came through to the outside, with pegs. For the medieval period, the boards were made flush with the textblock as books were stored on their sides, but as books came to be stored upright, binders extended the boards to protect the textblock. As a protective measure for books laid flat, medieval binders added metal bosses to the covers and metal corners. Titles were written on the fore-edges and not the spines, and covers were usually held together with metal clasps. The covers might be decorated with simple tooling, or more detailed panel stamping, or even elaborate metalwork laden with jewels. Yet most ordinary medieval books had only modest bindings with little decoration, and indeed many books had no bindings at all beyond a protective piece of parchment that wrapped around the quires of the book and might, or might not, be loosely attached. We must remember that the nature and elaborateness of a binding was directly related to an owner's willingness to pay for it.

Given the great demand for books in the middle of the fifteenth century, it is not surprising that the art of printing spread rapidly despite any efforts Peter Schoeffer may have made to swear his workman to silence. There is some evidence that Gutenberg may have moved his press, following the breakup of the partnership, to Bamberg, but in any case printing was under way in Strassburg in 1460, in Cologne in 1465, in Basel in 1468 and continued to spread up and down the Rhine valley as former journeymen of Gutenberg and Schoeffer set up their own presses. Two intrepid Germans, Conrad Sweynheim and Arnold Pannartz, crossed the Alps in 1464 and introduced printing to Italy in Subiaco and then Rome. Many others followed. By the 1470s presses were functioning in most of the countries of western Europe, and by the end of the century every major city in Europe could boast of at least one printing establishment. Though the appearance of books changed little in the transition from manuscript to printed book, the trade itself was radically transformed. Naturally many scribes were no longer needed for book production and some became printers. Those who specialized in decoration, illumination, or painting continued



to find employment for some time as such treatment continued to be applied to some printed books into the next century. However, there was still ample opportunity for former book scribes to find employment in chanceries and as notaries and in the large mercantile establishments, especially in Italy, and the image of the sudden demise of scribal culture at the hands of the printers is greatly exaggerated.[50] The early printers more than met the current demand for books. In fact, they produced far more copies than could be sold and prices plummeted, a printed book costing perhaps 20% or less of what it would cost to produce an equivalent manuscript. Though in real terms books remained expensive objects. Such quantities of books made possible the independent bookseller (as distinct from the stationer who had a hand in production). The trade became speculative and capitalistic as the volume of production kept increasing, and it was only natural that printers and publishers came to be concentrated in commercial centers, the primary one being Venice. Thus books printed and published in Venice could be marketed to booksellers throughout Europe by utilizing established

trade routes. Likewise other commercial centers, such as Paris or Lyon, flourished as regional centers for book production, but, on the other hand, printers who had settled into the smaller provincial cities and towns found their markets limited and their ability to compete diminished. The production of books had become a modern business.

From the first, printed books were little different in appearance from manuscript books. Certainly the type fonts were modeled on the local scripts in common use, or the scripts appropriate for certain types of books, such as law books or service books. Signatures, foliation, and catchwords were all used in manuscripts before they were taken up in printed books. So too was the apparatus common to learned books.

There were, however, several developments which printing did stimulate.^[51] The first was the register. In one way this was similar to the *tabula rubricarum* (which was a table that served as a guide for the rubricator) because it could also serve to indicate the completeness of a book. The *tabula* was in fact the forerunner of the table of contents, and this indeed is what a register is in German books. (Although it should be pointed out that tables of contents are found in many manuscripts, some very early.) The true register is a summary of the signatures of a book. It seems to have been an Italian invention of about 1470, and it took several forms. The usual early form was to arrange the catchwords in vertical columns and the beginning of each gathering was indicated by a blank line. Subsequently letters of the alphabet were added to designate the gatherings. Around 1480 the catchwords were omitted and the signatures were described in terms of the number of sheets. Finally at the end of the century we find only a list of signatures and an indication of format. The register served two functions: it informed the binder as to the particulars of a book's structure, and it enabled a buyer to determine the completeness of his potential purchase.

The printer's mark or device was another development. It was not uncommon for a scribe to sign his name in a fifteenth-century manuscript, but the use of a mark was more particularly suited to the press. These woodblock designs acted as trademarks which informed a prospective buyer at a glance that a book was the product of a known publisher. Fust and Schoeffer used the first such device in 1462. At first the device was placed at the end of the book below the colophon. But in Paris, the printer's began using larger and larger woodcuts which often could not fit in such a restricted space. When this was the case, they were transferred to the usually blank first page--a development which contributed to the development of the title page.

Although the mature title page was a product of the sixteenth century (as indeed was pagination), there were several early developments which contributed to it. The placement of the printer's device on the first leaf of a book has already been mentioned. By 1470 it was common to leave the first leaf blank, no doubt to protect the text block. The information which we are used to finding on the title page was of course in the colophon at the end of the book. By the 1480s we find half-title pages containing title and perhaps author. These half-title pages also served an advertising function, as a customer could quickly see what a book was about. However the fifteenth century never saw a truly complete title page; that belonged to the sixteenth century. Printing certainly stimulated some changes in book format, and it most certainly revolutionized the book trade, but in fact the printers merely took over and adapted a very successful and ancient format. Printing mechanized the production of books in the fifteenth century, but it did not fundamentally alter the structure of the codex, which has been one of the most successful, durable, and significant inventions of the past two-thousand years.

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[1] On this point see Curt F. Bühler, *The Fifteenth-century Book: The Scribes, the Printers, the Decorators* (Philadelphia: University of Pennsylvania Press, 1960), pp. 45-47, 80.

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[4] See Roberts and Skeat, *The Birth of the Codex*, pp. 24-29.

[5] *Ibid.*, pp. 30-34.

[6] Stanley Morison, in his *Politics and Script: Aspects of Authority and Freedom in the Development of Graeco-Latin Script from the Sixth Century B.C. to the Twentieth Century A.D.*, ed. by Nicolas Barker (Oxford: Clarendon Press, 1972) argues that changes in script have often been the result of external political changes. His thesis is interesting, though generally considered to be overdrawn.

[7] See Roberts and Skeat, *The Birth of the Codex*, pp. 57-58.

[8] See Richard W. Clement, "Two Contemporary Gregorian Editions of Pope Gregory the Great's *Regula pastoralis* in Troyes MS 504," *Scriptorium* 39 (1985): 89-97.

[9] See Richard R. Johnson, "Ancient and Medieval Accounts of the 'Invention' of Parchment," *California Studies in Classical Antiquity* 3 (1970): 115-22.

[10] See R. Reed, *Ancient Skins, Parchments and Leathers* (London: Seminar Press, 1972); Michael L. Ryder, "Parchment: Its History, Manufacture and Composition," *Journal of the Society of Archivists* 2 (1964): 391-99;

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[11] See Dorothy Miner, "More about Medieval Pouncing" in *Homage to a Bookman: Essays on Manuscripts, Books, and Printing Written for Hans P. Kraus on his 60th Birthday*, ed. by Helmut Lehmann-Haupt (Berlin: Gebr. Mann Verlag, 1967), pp. 87-107.

[12] See M. De Pas, "La Composition des encres noires," in *Les Techniques de laboratoire dans l'étude des manuscrits*, Colloques internationaux du Centre national de la recherche scientifique 548 (Paris: Centre national de la recherche scientifique, 1974), pp. 121-32; and De Pas, "Les encres médiévaux," Colloques internationaux du Centre national de la recherche scientifique 559 (Paris: Centre national de la recherche scientifique, 1977), pp. 55-60; also see the older but still useful David N. Carvalho, *Forty Centuries of Ink* (New York: Banks Law Pub. Co., 1904; reprinted, New York: Burt Franklin, 1971); and C.A. Mitchell and T.C. Hepworth, *Inks: Their Composition and Manufacture* (London: Griffin & Co., 1904).

[13] There are many editions of the *Regula Benedicti*; I have used *Regula sancti Patris Benedicti*, ed. by Edmund Schmidt (Regensburg: Pustet, 1892).

[14] *Ibid.*, chs. 38, 42.

[15] *Ibid.*, chs. 9, 73.

[16] *Ibid.*, ch. 48.

[17] Cassiodorus, *Institutiones*, ed. by R.A.B. Mynors (Oxford: Clarendon Press, 1961).

[18] Cassiodorus, *De orthographia liber*, ed. by Ludovico Carrione (Antwerp: Plantin, 1597).

[19] See Françoise Gasparri, "Le Scriptorium de Corbie à la fin du VIII^e siècle," *Scriptorium* 21 (1967): 86-93; and Leslie Webber Jones, "The Scriptorium at Corbie: I. The Library, II. The Script and the Problems," *Speculum* 22 (1947): 191-204, 375-94.

[20] See E.K. Rand, *A Survey of the Manuscripts of Tours* (Cambridge: Medieval Academy of America, 1929).

[21] See Florence de Roover, "The Scriptorium," in *The Medieval Library*, by James Westfall Thompson (Chicago: University of Chicago Press, 1939), pp. 594-612; F. Dressler, *Scriptorium opus: Schreiber-Mönche am Werke* (Wiesbaden: Reichert, 1971); Monique-Cecile Garand, "Manuscrits monastiques et scriptoria aux XI^e et XII^e siècles," *Codicologica* 3 (1980): 9-33; H. Martin, "Notes sur les écrivains au travail" in *Mélanges offerts à M. Emile Chatelain* (Paris: A. Champion, 1910), pp. 535-44; and Jean Vezin, "La Répartition du travail dans les 'scriptoria' carolingiens," *Journal des Savants* (1973): 212-27.

[22] Walter Horn and Ernest Born, *The Plan of St. Gall: A Study of the Architecture & Economy of & Life in a Paradigmatic Carolingian Monastery* (Berkeley: University of California Press, 1979). For the state of monastic production in the late period in England, see A. I. Doyle, "Book Production by the Monastic Orders in England (c. 1375-30): Assessing the Evidence," in *Medieval Book Production: Assessing the Evidence*, ed. by L. L. Brownrigg (Los Altos Hills, Cal.: Anderson-Lovelace, 1990), pp. 1-19.

[23] See Graham Pollard, "The University and the Book Trade in Mediaeval Oxford," in *Beiträge zum Berufsbewusstsein des mittelalterlichen Menschen* ed. by P. Wilpert and W. Eckert (Berlin: De Gruyter, 1964),

[24] See Jean Destrez, *La pecia dans les manuscrits universitaires du XIII^e et du XIV^e siècle* (Paris: Editions Jaques Vautrains, 1935); and Graham Pollard, "The Pecia System in the Medieval Universities," in *Medieval Scribes, Manuscripts and Libraries: Essays Presented to N.R. Ker*, ed. M.B. Parkes and A.G. Watson (London: Scolar Press, 1978), pp. 145-61; Louis J. Bataillon, Bertran G. Guyot, and Richard H. Rouse, eds., *La production du livre universitaire au moyen âge: exemplar et pecia*, Acts du symposium tenu au Collegio San Bonaventura de Grottaferrata, May 1983 (Paris: Centre national de la recherche scientifique, 1991).

[25] See Paul Saenger, "Silent Reading: Its Impact on Late Medieval Script and Society," *Viator* 13 (1982): 367-414.

[26] See A. Dondaine, *Secrétaires de Saint Thomas* (Rome: S. Tommaso, 1956); and P.-M. Gils, "Le MS Napoli, Biblioteca nazionale I.B.54, est-il de la main de St. Thomas?" *Revue des sciences philosophiques et théologiques* 49 (1965): 37-59.

[27] See Christopher De Hamel, *Glossed Books of the Bible and the Origins of the Paris Booktrade* (Woodbridge: D.S. Brewer, 1984).

[28] See Charles M. Briquet, *Les filigranes: Dictionnaire historique des marques du papier* (1923; reprinted, Hildesheim: Olms, 1977); Dard Hunter, *Papermaking: The History and Technique of an Ancient Craft* (New York: Knopf, 1947); and Joel Munsell, *Chronology of the Origin and Progress of Paper and Paper-making* (Albany, 1876; reprinted, New York: Garland, 1980).

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[30] Lucien Febvre and Henri-Jean Martin, *The Coming of the Book: The Impact of Printing, 1450-1800*, trans. by David Gerard (London: Verso, 1984), p. 28. See also R. H. Rouse and M. A. Rouse, "The Commercial Production of Manuscript Books in Late Thirteenth-Century and Early Fourteenth-Century Paris," in *Medieval Book Production: Assessing the Evidence*, ed. by L. L. Brownrigg (Los Altos Hills, Cal.: Anderson-Lovelace, 1990), pp. 103-15.

[31] For notes on the production of manuscripts in late medieval England, see H. E. Bell, "The Price of Books in Medieval England," *Library* 4th ser., 17 (1936-37): 312-32; A. I. Doyle, "The Shaping of the Vernon and Simeon Manuscripts," in *Chaucer and Middle English Studies in Honour of Rossell Hope Robbins*, ed. by Beryl Rowland (London: Allen and Unwin, 1974), pp. 328-41; A. I. Doyle and M. B. Parkes, "The Production of Copies of the *Canterbury Tales* and the *Confessio Amantis* in the Early Fifteenth Century," in *Medieval Scribes, Manuscripts, & Libraries: Essays Presented to N. R. Ker*, ed. by M. B. Parkes and Andrew G. Watson (London: Scolar Press, 1978), pp. 163-210; George R. Keiser, "Lincoln Cathedral Library MS. 91: Life and Milieu of the Scribe," *Studies in Bibliography* 32 (1979): 158-79; Graham Pollard, "The Company of Stationers before 1557," *Library* 4th ser., 18 (1937): 1-37; and Kathleen L. Scott, "A Mid-Fifteenth-Century English Illuminating Shop and Its Customers," *Journal of the Warburg & Courtauld Institute*, 31 (1968): 194-95.

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[33] See Léon Gilissen, "La Composition des cahiers: Le pliage du parchemin et l'imposition," *Scriptorium* 26 (1972): 3-33; G. I. Lieftinck, "Mediaeval Manuscripts with 'Imposed' Sheets," *Het Boek* 3rd ser., 34 (1960-61): 210-20; Pieter F. J. Obbema, "Writing on Uncut Sheets," *Quaerendo* 8 (1978): 337-54; Graham Pollard, "Notes on the Size of the Sheet," *Library* 4th ser., 22 (1941): 105-37; Pamela R. Robinson, "The 'Booklet': A Self-contained Unit in Composite Manuscripts," *Codicologica* 3 (1980): 46-69; and Charles Samaran, "Manuscrits 'imposés' et manuscrits non coupés: Un nouvel exemple," *Codices manuscripti* 2 (1976): 38-42.

[34] See L. W. Jones, "Where are the Prickings?" *Transactions and Proceedings of the American Philological Association* 75 (1944): 71-86; Jones, "Pricking Manuscripts: The Instruments and their Significance," *Speculum* 21 (1946): 389-403; Jones, "Pricking Systems in New York Manuscripts" in *Miscellanea Giovanni Mercati* 6 (*Studi e testi* 126 [1946]): 80-92; Jones, "Ancient Prickings in Eighth-Century Manuscripts," *Scriptorium* 15 (1961): 14-22; and Jones, "Prickings as Clues to Date and Origin: The Eighth Century," *Medievalia et Humanistica* 14 (1962): 15-22.

[35] See D. K. Coveney, "The Rulings of the Exeter Book," *Scriptorium* 12 (1958): 51-55; Leon Gilissen, "Un élément codicologique trop peu exploité: réglure," *Scriptorium* 23 (1969): 150-62; Gilissen, *Prolégomènes à la codicologie* (Ghent: Editions Scientifiques, 1977); and T. S. Pattie, "The Ruling as a Clue to the Make-up of a Medieval Manuscript," *British Library Journal* 1 (1975): 15-21.

[36] See T. C. Skeat, "The Use of Dictation in Ancient Book Production," *Proceedings of the British Academy* 42 (1956): 179-208.

[37] See E.M. Thompson, "Calligraphy in the Middle Ages," *Bibliographica* 3 (1897): 280-92.

[38] For further information see Ernst Ploss, *Ein Buch von alten Farben: Technologie der Textilfarben im Mittelalter mit einem Ausblick auf die festen Farben* (Heidelberg: Moos, 1962); Daniel V. Thompson, *The Materials and Techniques of Medieval Painting* (London: Allen and Unwin, 1956), and Cennino d'Andrea Cennino, *Il Libro dell'arte* (1437), trans. by Daniel V. Thompson, *The Craftsman's Handbook: The Italian "Il Libro dell'Arte"* (New York: Dover, 1954). Among the many surveys and studies of illuminated manuscripts see J. J. G. Alexander, *Medieval Illuminators and Their Methods of Work* (New Haven: Yale University Press); J. J. G. Alexander, *The Decorated Letter* (New York: Braziller, 1978); J. J. G. Alexander, *Italian Renaissance Illuminations* (New York: Braziller, 1977); J. J. G. Alexander, "Scribes as Artists," in *Medieval Scribes, Manuscripts, and Libraries: Essays Presented to N. R. Ker*, ed. by M. B. Parkes and Andrew G. Watson (London: Scolar Press, 1978), pp. 87-116; Janet Backhouse, *The Illuminated Manuscript* (Oxford: Phaidon, 1979); Robert G. Calkins, *Illuminated Books of the Middle Ages* (Ithaca, N.Y.: Cornell University Press, 1983); Christopher De Hamel, *Scribes and Illuminators*, Medieval Craftsmen Series (Toronto: University of Toronto Press, 1992); Christopher De Hamel, *A History of Illuminated Manuscripts* (Oxford: Phaidon, 1986); David Diringer, *The Illuminated Book: Its History and Production* (New York: Praeger, 1967); Virginia Wylie Egbert, *The Mediaeval Artist at Work* (Princeton: Princeton University Press, 1967); A. Grabar and C. Nordenfalk, *Early Medieval Painting* (Lausanne: Skira, 1957); Grabar and Nordenfalk, *Romanesque Painting from the Eleventh to the Thirteenth Century: Mural Paintings* (New York: Skira, 1958); John Harthan, *An Introduction to Illuminated Manuscripts* (London: Her Majesty's Stationary Office, 1983); John Harthan, *The Book of Hours* (New York: Crowell, 1977); Sandra Hindman, *Text and Image in Fifteenth-Century Illustrated Dutch Bibles* (Leiden: Brill, 1977); Hindman and James Douglas Farquhar, *Pen to Press: Illustrated Manuscripts and Printed Books in the First Century of Printing* (College Park: University of Maryland Press, 1977); James H. Marrow, "Introduction," in *The Golden Age of Dutch Manuscript Painting* (New York: Braziller, 1990); Carl Nordenfalk, *Celtic and Anglo-Saxon Painting: Book Illumination in the British Isles, 600-800* (New York: Braziller, 1977); W. Oakshot, *The Sequence of English Medieval Art* (London: Faber and Faber, 1950); Lillian M.C. Randall, *Images in the Margins of Gothic Manuscripts* (Berkeley: University of California Press, 1966); David M. Robb, *The Art of the Illuminated Manuscript* (South Brunswick: A. S. Barnes, 1973); L. Valentine, *Ornament in Medieval Manuscripts: A Glossary* (London: Faber and Faber, 1965); and Kurt Weitzman, *Ancient Book Illumination* (Cambridge: Harvard University Press, 1959).

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[40] See Albert Hyma, *The Brethren of the Common Life* (Grand Rapids: Eerdmans, 1950); and Regnerus R. Post, *The Modern Devotion: Confrontation with Reformation and Humanism* (Leiden: E.J. Brill, 1968).

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[42] See C.H. Bloy, *A History of Printing Ink, Balls and Rollers 1440-1850* (London: Wynkyn de Worde Society, 1967).

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[44] See Paul Needham, "Johann Gutenberg and the Catholicon Press," *Papers of the Bibliographical Society of America* 76 (1982): 395-456.

[45] For various discussions of typography see Harry Carter, *A View of Early Typography up to about 1600* (Oxford: Clarendon Press, 1969); Henk Drost, "Punch Cutting Demonstration," *Visible Language* 19 (1985): 98-105; Pierre Simon Fournier, *Fournier on Typefoundry: the text of the Manuel Typographique (1764-1766)* trans. and ed. by Harry Carter (New York: Burt Franklin, 1973); A. F. Johnson, *Type Designs: Their History and Development* (London: Andre Deutsch, 1966); Alexander Lawson, *Printing Types: An Introduction* (Boston: Beacon Press, 1971); Stanley Morison, *Letter Forms: Typographic and Scriptorial: Two Essays on Their Classification, History and Bibliography* (London: Nattali & Maurice, 1968); Morison, *Selected Essays on the History of Letter-Forms in Manuscript and Print*, edited by David McKitterick (Cambridge: Cambridge University Press, 1981); Morison, *A Tally of Types* (Cambridge: University Press, 1973); Stan Nelson, "Mould Making, Matrix Fitting, and Hand Casting," *Visible Language* 19 (1985): 106-20; Talbot Baines Reed, *A History of the Old English Letter Foundries*, new ed., rev. and enl. by A. F. Johnson (London: Faber and Faber, 1952); Daniel Berkeley Updike, *Printing Types: Their History, Forms, and Use: A Study in Survivals*, 3rd ed. (Cambridge, Mass.: Belknap Press of Harvard University Press, 1962); and H. D. L. Vervliet, *Sixteenth-century Printing Types of the Low Countries* (Amsterdam: Menno Hertzberger, 1968).

[46] For some discussions of early book illustration, see *The Art of the French Book from Early Manuscripts to*

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[47] Line-engraving was commonly used to make prints on paper in the middle of the fifteenth century, and etching was likewise used at the beginning of the sixteenth century. Neither of these processes was extensively used in books in the period under consideration, though subsequently such plates became very common, and as their production required a press wholly different than the platen press used in printing, they fall outside the scope of this essay.

[48] See D. F. McKenzie, "Printers of the Mind: Some Notes on Bibliographical Theories and Printing-House Practices," *Studies in Bibliography* 22 (1969): 1- 75; James Moran, *Printing Presses: History and Development from the Fifteenth Century to Modern Times* (Berkeley: University of California Press, 1973); and Joseph Moxon, *Mechanick Exercises on the Whole Art of Printing* (1683-4), ed. by Herbert Davis and Harry Carter (London: Oxford University Press, 1962).

[49] Some discussions of binding are in Cyril Davenport, *Royal English Book Binding* (New York: Macmillan, 1896); Edith Diehl, *Bookbinding: Its Background and Technique* (New York: Rinehart, 1946); S. Gibson, *Early Oxford Bindings* (Oxford: Oxford University Press, 1903); E. P. Goldschmidt, *Gothic and Renaissance Bookbindings* (London, 1928; reprinted, Niewkoop: De Graaf, 1967); Hellmuth Helwig, *Das deutsche Buchbinder Handwerk: Handwerks- und Kulturgeschichte* (Stuttgart: Hiersemann, 1962-65); Helwig, *Einführung in die Einbandkunde* (Stuttgart: Hiersemann, 1970); G. D. Hobson, *Bindings in Cambridge Libraries* (Cambridge: Cambridge University Press, 1929); Hobson, *English Binding before 1500* (Cambridge: Cambridge University Press, 1925); N. R. Ker, *Fragments of Medieval Manuscripts Used in Pastedowns in Oxford Bindings, with a Survey of Oxford Binding, c. 1515-1620* (Oxford: Oxford Bibliographical Society, 1954); Dorothy Miner, *The History of Bookbinding 525-1950 A.D.: An Exhibition Held at the Baltimore Museum of Art, November 12, 1957 to January 12, 1958* (Baltimore: Walters Art Gallery, 1957); Paul Needham, *Twelve Centuries of Bookbinding 400-1600* (New York: Pierpont Morgan Library, 1979); Howard M. Nixon, *Five Centuries of English Bookbinding* (London: Scolar, 1978); Graham Pollard, "The Construction of English Twelfth-Century Bindings," *Library* 5th ser., 17 (1962): 1-22; and Pollard, "Describing Medieval Bookbindings," in *Medieval Learning and Literature: Essays Presented to Richard William Hunt*, ed. by J.J.G. Alexander and M.I. Gibson (Oxford: Clarendon Press, 1976), pp. 50-65.

[50] See Richard W. Clement, "Italian Sixteenth-Century Writing Books and the Scribal Reality of Verona," *Visible Language* 20 (1986): 393-412.

[51] See Konrad Haebler, *The Study of Incunabula* (New York: Grolier Club, 1933).

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