A Graphic Renaissance

Part II

The origins of European typography
and design for printing

Printing Comes to Europe

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X*ylography* is the technical term for the relief printing from a raised surface that originated in Asia. *Typography* is the term for printing with independent, movable, and reusable bits of metal or wood, each of which has a raised letterform on one face. This dry definition belies the immense potential for human dialogue and the new horizons for graphic design that were unleashed by this extraordinary invention in the mid-1400s by a restless German inventor whose portrait and signature are lost to the relentless passage of time. The invention of typography ranks near the creation of writing as one of the most important advances in civilization. Writing gave humanity a means of storing, retrieving, and documenting knowledge and information that transcended time and place; typographic printing allowed the economical and multiple production of alphabet communication. Knowledge spread rapidly and literacy increased as a result of this remarkable invention.

Several factors created a climate in Europe that made typography feasible. The demand for books had become insatiable. The emerging literate middle class and students in the rapidly expanding universities had seized the monopoly on literacy from the clergy, creating a vast new market for reading material. The slow and expensive process of bookmaking had changed little in one thousand years. A simple two-hundred-page book required four or five months' labor by a scribe, and the twenty-five sheepskins needed for the parchment were even more expensive than his labor.

In 1424, only 122 manuscript books resided in the university library at Cambridge, England, and the library of a wealthy nobleman whose books were his most prized and sought-after possessions probably numbered less than two dozen volumes. The value of a book was equal to the value of a farm or vineyard. The steady growth of demand had led independent merchants to develop an assembly-line division of labor, with specialists trained in lettering, decorative initialing, gold ornamentation, proofreading, and binding. Even this exploding production of manuscript books was unable to meet the demand.

Without paper, the speed and efficiency of printing would have been useless. Papermaking had completed its long, slow journey from China to Europe, so a plentiful substrate was available. Over six hundred years passed before papermaking, which spread westward along caravan routes from the Pacific Ocean to the Mediterranean Sea, reached the Arab world. After repelling a Chinese attack on the city of Samarkand in A.D. 751, the Arab occupation forces captured some Chinese papermakers. Abundant water and bountiful crops of flax and hemp enabled Samarkand to become a papermaking center, and the craft spread to Baghdad and Damascus and reached Egypt by the tenth century. From there it spread across North Africa and was introduced into Sicily in 1102 and into Spain by the Moors during the middle of the twelfth century. By 1276 a paper mill was established in Fabriano, Italy. Troyes, France, had a paper mill in 1348.

The watermark (Fig. 5–1), a translucent emblem produced by pressure from a raised design on the mold and visible when the sheet of paper is held to the light, was used in Italy by 1282. The origin of this design device is unknown. Trademarks for paper mills, individual craftsmen, and perhaps religious symbolism were early uses. As successful marks were imitated, they began to be used as a designation for sheet and mold sizes and paper grade. Mermaids, unicorns, animals, flowers, and heraldic shields were frequent design motifs.

Early European block printing

The origins of woodblock printing in Europe are shrouded in mystery. After the Crusades opened Europe to Eastern influence, relief printing arrived on the heels of paper. Playing cards and religious-image prints were early manifestations. Circumstantial evidence implies that, like paper, relief printing from woodblocks also spread westward from China. By the early 1300s pictorial designs were being printed on

textiles in Europe. Card playing was popular, and in spite of being outlawed and denounced by zealous clergy, this pastime stimulated a thriving underground block-printing industry, possibly before 1400.

In 1415 the Duke of Milan played cards with ivory slats bearing images painted by famous artists, and Flemish nobles used engraved silver plates. Throughout Europe, the working class gathered in taverns and by the roadside to play with grimy cards that were blockprinted and stenciled on coarse paper (Fig. 5–2). Playing cards were the first printed pieces to move into an illiterate culture, making them the earliest European manifestation of printing's de-mocratizing ability. The games of kings could now become the games of peasants and craftsmen. Because these cards introduced the masses to symbol recognition, sequencing, and logical deduction, their intrinsic value transcended idle entertainment.

The first known European block printings with a communications function were devotional prints of saints (Figs. 5–3 and 5–4), ranging from small images fitting in a person's hand to larger images of 25 by 35 centimeters (about 10 by 14 inches). Image and lettering were cut from the same block of wood. These early prints evolved into block books (Figs. 5–5 and 5–6), which were woodcut picture books with religious subject matter and brief text. Each page was cut from a block of wood and printed as a complete word and picture unit. Because most of the few surviving copies were printed in the Netherlands after 1460, it is not known whether the block book preceded the typographic book. Drawn in a simplified illustration style, with the visual elements dominant as in contemporary comic books, the block book was used for religious instruction of illiterates. This form gradually declined during the fifteenth century as literacy increased. Common subjects included the Apocalypse, a forewarning of the final doom and destruction of the world. *Ars moriendi* (manuals on the "art of dying") advised one on the preparation and meeting of the final hour. Europe's population was decimated by the great cycles of bubonic plague, called the Black Death, which claimed one fourth of the continent's inhabitants during the fourteenth century and caused a thousand villages either to vanish totally or to be critically depopulated; death was an ever-present preoccupation.

5–3. Woodblock print of Saint Christopher, 1423. The unknown illustrator depicted the legendary saint, a giant who carried travelers safely across a river, bearing the infant Christ. The inscription below reads: "In whatsoever day thou seest the likeness of St. Christopher/in that same day thou wilt at least from death no evil blow incur/1423." One of the earliest dated European block prints, this image effectively uses changing contour-line width to show form.

5–4. Block print of the Annunciation, undated. The black area is an effective focal point unifying the two figures. The scroll, with a Latin inscription, serves the same communicative function as a "talk balloon." (The upper left corner of this print is missing.)

5–5. Block-book page from The Story of the Blessed Virgin, 1400s. This page attempts to justify the Immaculate Conception by a series of "logical" parallels: If the light of Venus's temple cannot be extinguished, if the moon is reflected in water, if a person can be changed into stone, and if man can be painted on stone, why should not the Blessed Virgin be able to generate?

5–6. Letter K from a grotesque alphabet, c. 1464. This page is from a twenty-four-page abecedarian block-book that presented each letter of the alphabet by composing figures in its shape.

5–7. Pages from an ars moriendi, 1466. A montage juxtaposes the deathbed scene with the subject's estate. One demon urges, "Provide for your friends," while the other advises, "Attend to your treasures." The densely textured text page recommends donating one's earthly goods to the Church.

In the *ars moriendi* shown (Fig. 5–7), eleven illustrations depict the temptation of the devil and the comfort of the angel on subjects such as faith, impatience, vainglory, and the final hour of death. Thirteen pages are block-print text. While the apparent raison d'être of the *ars moriendi* was to help people meet death, it also must be considered an early example of printed propaganda, for it urges the dying to put aside the desire to provide for one's family and to will one's estate to the church. The *Biblia Pauperum* (Bible of the Poor) was a compendium of events in the life of Christ, including testimony about how Old Testament prophecy was fulfilled (Fig. 5–8). Pages from *Ars Memorandi per Figuras Evangelistarum*, c. 1470 (Fig. 5–9), demonstrate the graphic power of hand-painting fluid washes of watercolor to enliven a woodcut's symbolic imagery.

Most block books contained from thirty to fifty leaves. Some prints were hand-colored, and stencils were sometimes used to apply flat areas of color to textile, playing card, and later block-book woodcuts. In addition, some fifteenth-century prints exist where woodblocks were used to print paste or gum, sprinkled with tinsel (minute sparkling fragments of metal), incrustation (minute quartz crystals with color), or flocking (powdered wool). These media were used as design elements to bring a vibrant tactile quality and luminosity to the image. The earliest block books were printed with a hand rubber in brown or gray ink; later versions were printed in black ink on a printing press. Because the hand rubber created too much indention to allow double-sided printing, the earliest block books are only printed on one side of the paper. Each double-page spread was followed by two blank pages, which were usually pasted together to preserve the visual flow of images and text. While the monastic designer might also cut his own woodblock, in the secular world the distinction between designer and cutter (*Formschneider*) was vigorously upheld by trade guilds. The cutters, who worked from the designer's ink layout on either paper or woodblock, were often members of carpentry guilds.

5–8. Page from a Biblia Pauperum, 1465. In this typical layout, a cross-shaped architectural structure brings order to a complex page. Bible verses appear in the upper corners; David and three prophets are above and below with a quotation from each on a scroll. Across the center, the creation of Eve, the Crucifixion of Christ, and Moses striking the rock for water are shown.

5–9. Pages from Ars Memorandi per Figuras Evangelistarum, (Book of Notable Religious Figures)
c. 1470. Each image became a visual cue for the speaker and a symbolic illustration for the audience.

Movable typography in Europe

With the availability of paper, relief printing from woodblocks, and growing demand for books, the mechanization of book production by such means as movable type was sought by printers in Germany, the Netherlands, France, and Italy. In Avignon, France, goldsmith Procopius Waldfoghel was involved in the production of "alphabets of steel" around 1444, but with no known results. The Dutchman Laurens Janszoon Coster of Haarlem explored the concept of movable type by cutting out letters or words from his woodblocks for reuse. In his monumental book *Dutch Type* (2004), Jan Middendorp states that the Dutch

> managed to build up the Coster myth over several centuries. Eventually the Haarlem printer was believed to be Gutenberg's only serious competitor. Coster and his workshop were pictured by famous

artists and praised by Italian historians; his ingenuity became a source of pride and confidence for the Dutch in general and for the Haarlem printing business in particular. In the nineteenth century, theatre pieces about the printer of genius were staged in Paris, Antwerp and London. In Haarlem, massive Coster festivals were organized in fierce competition with the Gutenberg centennial celebrations in Germany; on Haarlem's main square a bronze statue was installed in 1856 that is still there today.

The judgment of history, however, is that Johann Gensfleisch zum Gutenberg (b. late 14th century, d. 1468) of Mainz, Germany, first brought together the complex systems and subsystems necessary to print a typographic book around the year 1450. The third son of the wealthy Mainz patrician Friele Gensfleisch, Johann Gutenberg apprenticed as a goldsmith, developing the metalworking and engraving skills necessary for making type. In September 1428 he was exiled from Mainz for his leadership role in a power struggle between the landed noblemen and the burghers of the trade guilds who sought a greater political voice. He relocated in Strasbourg, one hundred miles to the southwest, and became a successful and prosperous gem cutter and metalworker.

Early in 1438 Gutenberg formed a contractual partnership with Strasbourg citizens Andreas Dritzehen (who had received gem-cutting training from Gutenberg) and Andreas Hellmann (who owned a paper mill). He agreed to teach them a secret process for making mirrors to sell at an Aachen pilgrimage fair the following year. Mirrors were rare and difficult to manufacture. Molten lead was poured over glass, forming a reflective surface when it cooled; the difficulty was preventing the glass from cracking from the heat. When the fair was postponed until 1440, Gutenberg entered a new five-year contract to teach his partners another secret process.

When Dritzehen died in late 1438, his brothers Georg and Claus sued Gutenberg for either admission to the partnership or a refund. On 12 December 1439, the court ruled in Gutenberg's favor because his original contract specified that only one hundred florins would be paid to any partner's heirs. The record of this trial shows conclusively that Gutenberg was involved in printing. Several witnesses mention that the partners owned a press; woodturner Conrad Saspach testified that he had constructed the press. Testimony mentions type, a stock of lead and other metals, and a mysterious four-piece instrument secured by double handscrews (probably a type mold). Goldsmith Hans Dünne testified that as early as 1436 he had sold Gutenberg one hundred guilders' worth of material "solely for that which belonged to printing." In the mid-1440s Gutenberg moved back to Mainz, where he resolved the technical, organizational, and production problems that had plagued earlier typographic printing efforts. He had labored for ten years before his first printing and twenty years before printing the first typographic book, called the forty-two-line Bible (see Fig. 5–13).

Typographic printing did not grow directly out of block printing because wood was too fragile. Block printing remained popular among the Chinese because alignment between characters was not critical and sorting over five thousand basic characters was untenable. By contrast, the need for exact alignment and the modest alphabet system of about two dozen letters made the printing of text material from independent, movable, and reusable type highly desirable in the West.

A number of steps were necessary in the creation of typographic printing. A style of letter had to be selected. Gutenberg made the obvious choice of the square, compact textura lettering style commonly used by German scribes of his day. Early printers sought to compete with calligraphers by imitating their work as closely as possible. This typeface without subtle curves was so well developed that the characters in the forty-two-line Bible are hardly distinguishable from good calligraphy. Next, each character in the font—small and capital letters, numbers, punctuation, ligatures—had to be engraved into the top of a steel bar to make a punch. This punch was then driven into a matrix of softer copper or brass to make a negative impression of the letterform.

5–10. These early-nineteenth-century engravings illustrate Gutenberg's system for casting type. A steel punch is used to stamp an impression of the letterform into a softer brass matrix. After the matrix is slipped into the bottom of the two-part type mold, the mold is filled with the molten lead alloy to cast a piece of type. After the lead alloy cools, the type mold is opened and the type is removed.
A. Punch
B. Matrix
C. Type mold (with matrix removed to show a newly cast H)
D. and E. Type mold (opened so that the newly cast H can be removed)

The key to Gutenberg's invention was the type mold (Fig. 5–10), used for casting the individual letters. Each character had to be plane parallel in every direction and the exact same height. Gutenberg's two-part type mold, which adjusted to accept matrixes for narrow characters (1) as well as wide ones (M), permitted large volumes of type to be cast with critical tolerances. Type required a metal that was soft enough to cast but hard enough to hold up for thousands of impressions, and that did not expand and contract when melted, poured into the type mold, then returned to a solid state as it cooled. As a metalsmith, Gutenberg knew that the silvery white metal antimony expands when it cools from a liquid to a solid state, in contrast to most metals, which contract when cooled. He developed a unique alloy of 80 percent lead, 5 percent tin, and 15 percent antimony to maintain a constant mass throughout the process of manufacturing type. Gutenberg needed as many as fifty thousand single pieces of type in use at a time, so the speed, accuracy, and economy achieved by this type mold and its casting process were critical. The type was stored in compartmentalized cases and pulled out letter by letter to set the lines. After a page was printed, the type was returned to the compartments letter by letter.

The medieval block printer used a thin, watery ink made from oak gall. This ink worked fine on a woodblock, because the wood could absorb excess moisture, but it would run off or puddle on metal type. Gutenberg used boiled linseed oil colored with lampblack, which produced a thick, tacky ink that could be smoothly applied. To ink type, a dollop of ink was placed on a flat surface and smeared with a soft leather ball, coating the ball's bottom. The ball was then daubed onto the type for an even coating of ink.

A strong, sturdy press capable of sufficient force to pressure the ink from the type onto the paper surface was needed. Ample prototypes existed in presses used in making wine, cheese, and baling paper, and Gutenberg adapted their designs, which were based on a large screw lowering and raising a plate, to printing. Gutenberg's press and system were used for four hundred years with moderate improvements. This precision machine allowed tremendous printing speed and consistent quality, in contrast to the hand-rubbing method of the Orient and early European block printers. Later improvements included a frisket to protect margins and other unprinted areas, modification of the screw to lessen the energy needed to print, and a quick-release feature so that less energy was needed to lift the plate than to lower it. Eventually, a mechanical linkage replaced the screw. The graphic arts craftsmen involved in book production are illustrated in Figure 5–11.

Early surviving examples of typographic design and printing include a German poem on the Last Judgment, four calendars, and a number of editions of a Latin grammar by Donatus. The earliest dated specimens are the 1454 letters of indulgence issued in Mainz (Fig. 5–12). Pope Nicholas V issued this pardon of sins to all Christians who had given money to support the war against the Turks. Apparently the agents selling manuscript copies early in 1454 learned of Gutenberg's work and realized the value of printing this letter in quantity. Seven editions in two styles were ordered during 1454 and 1455 and numbered in the thousands.

Because the relentless expenses of research and development were a constant drain on Gutenberg's financial resources, in 1450 he found it necessary to borrow eight hundred guilders from Johann Fust (c. 1400–66), a wealthy Mainz burgher and merchant, to continue his work. The printing equipment was offered as collateral. At some point, Gutenberg conceived the idea of printing a Bible. Around 1452 he had to borrow another eight hundred guilders from Fust "for their common profit," establishing a partnership "in the production of books."

A heroic effort was required to produce this first typographic book, which is also one of the finest examples of the printer's art (Fig. 5–13). The large 30 by 40.5–centimeter (11.75 by 15–inch) pages have two columns of type with a generous 2.9-centimeter (.75–inch) margin between them. The first nine pages have forty lines per column, the tenth page has forty-one lines per column, and the rest have forty-two lines per column. It is not known whether Gutenberg followed a manuscript like this or whether he began a forty-line Bible and then increased the number of lines per column for economy. With 1,282 pages in a two-volume work, the increase of two lines per column saved an additional sixty pages. This fantastic project began with two presses, to which four were added. With lines of about thirty-three characters, each page had over 2,500 characters set from a font of 290 different characters. The generous number of alternate characters and ligatures enabled Gutenberg to achieve the richness and variety of the manuscript page. For further enrichment, blank spaces were left for decorative initials to be drawn in later by a scribe. A rigorous justification of the columns was possible because Latin words could be abbreviated freely. Up to six letters could be replaced by abbreviation symbols above the words. The edition of 210 copies consisted of 180 on paper and 30 on fine vellum, requiring 5,000 carefully prepared calfskins.

In 1455, as work neared completion, Fust suddenly sued Gutenberg for 2,026 guilders in payment of loans and interest. On 6 November 1455 the courts ruled in favor of Fust, with the requirement that he appear at the local monastery and swear before God that he was paying interest on some of the money he had loaned Gutenberg. Fust appeared and fulfilled the edict of court by taking the oath. Gutenberg did not attend. Instead, he sent two friends to beg Fust to give him more time. Fust declined and seized possession of Gutenberg's printing equipment and all work in progress; on the eve of completion of the immensely valuable forty-two-line Bible, which would have enabled him to pay all debts, Gutenberg was locked out of his printing shop.

Fust immediately entered into an agreement with Gutenberg's skilled assistant and foreman, Peter Schoeffer (c.1425–1502). An artist/designer experienced as an illuminator and manuscript dealer and a scribe at the University of Paris in 1449, Schoeffer quite possibly played a key role in the format development and type design for the forty-two-line Bible. If so, he may have been the first typeface designer. With Fust as business manager and Schoeffer in charge of printing, the firm of Fust and Schoeffer became the most important printing firm in the world, establishing a hundred-year family dynasty of printers, publishers, and booksellers. Schoeffer married Fust's daughter, Christina, around 1467. The new partnership's first venture was the completion of the forty-two-line Bible. As one of the forty-seven surviving copies bears a marginal notation that the hand rubrication, which is the application of red-ink initials and titles by a scribe, was completed on 24 August 1456, Fust probably acquired a nearly complete production when he foreclosed.

Sales of the forty-two-line Bible were brisk as Fust traveled widely to distribute them. An early author relates that Fust carried a parcel of Bibles to Paris and attempted to sell them as manuscripts. The forty-two-line Bible had no title page, no page numbers, nor other innovations to distinguish it from handmade manuscripts. Both Gutenberg and his customers probably wanted it this way. When the French observed the number and conformity of the volumes, they thought witchcraft was involved. To avoid indictment and conviction, Fust was forced to reveal his secret. This event is alleged to be the basis for the popular story, related by several authors, of the German magician Dr. Faustus (Johann Faust in an early version), who

grew dissatisfied with the limits of human knowledge and sold his soul to the devil in exchange for knowledge and power.

5–11. Jost Amman, woodcut illustrations for Ständebuch (Book of Trades), 1568. This little book presented over a hundred occupations, from the Pope to the scissors sharpener. Amman's crisp illustrations were accompanied by the prolific poet Hans Sachs's descriptive rhymes. The occupations of the graphic arts are shown here.
A. The parchment maker is shown scraping animal skins to produce a smooth surface after they have been washed, stretched, and dried.
B. The papermaker lifts his mold out of the vat as he forms each sheet by hand.
C. The typefounder is depicted pouring the melted lead into the type mold to cast a character. The foreground basket is filled with newly cast type.
D. One printer is shown removing a newly printed sheet from the press while the other one inks the type. In the background, compositors are shown setting type at typecases.
E. The designer is illustrated as he draws an image in preparation for a woodcut or copper engraving. (This is probably Amman's self-portrait.)
F. The woodblock cutter carefully cuts the drawing or design into a block of wood.
G. The illuminator, who originally applied gold leaf and color to manuscripts, continued his craft on the typographically printed page.
H. One bookbinder collates the pages of a volume by hand. The other prepares a book for the application of the covers.

5–12. Johann Gutenberg, thirty-one-line Letters of Indulgence, c. 1454. The written additions in this copy indicate that on the last day of December 1454, one Judocus Ott von Apspach was pardoned of his sins.

On 14 August 1457, Fust and Schoeffer published a magnificent psalter in Latin with a monumental 30.5 by 43.2–centimeter (12 by 17–inch) page size (Fig. 5–14). The large red-and-blue initials were printed from two-part metal blocks that were either inked separately, reassembled, and printed with the text in one press impression, or stamped after the text was printed. These famous decorated two-color initials were a major innovation; their typographic vitality and elegance rival the most beautiful manuscript pages. The psalter in Latin was also the first book to bear a printer's trademark and imprint, printed date of publication, and colophon (Fig. 5–15). A translation of the colophon reads: "This book of the Psalms, decorated with beautiful capitals, and with an abundance of rubrics, has been fashioned thus by an ingenious invention of printing and stamping without use of a pen. And to the worship of God it has been diligently brought to Completion by Johann Fust, a citizen of Mainz, and Peter Schoeffer of Gernsheim, in the year of Our Lord 1457, on the eve of the Feast of the Assumption."

Another important innovation appeared in Fust and Schoeffer's 1459 edition of *Rationale Divinorum Officiorum* (Rationale of Holy Duties) (Fig. 5–16). This long volume explaining religious ceremonies was the first typographic book that employed a small-sized type style to conserve space and increase the amount of text on each page. This achieved significant economy in presswork, ink, and parchment.

Other major works included a beautiful Latin Bible (1462) and an edition of Cicero's *De officiis* (On Duty) (1465), which was the first printing of a classic from antiquity. Typographic printing spurred interest in ancient Greek and Roman culture. As knowledge from the ancient world and the medieval era began to spread through the printed word, the fusion became a catalyst for the creation of the modern world.

During a 1466 Paris trip to sell books, Johann Fust died, probably of plague. Peter Schoeffer and his associate, Conrad Henkis, who married Fust's widow the year after Fust died, continued this highly successful printing business, producing broadsheets, books, and pamphlets.

While Fust and Schoeffer were selling Bibles and printing psalters, Johann Gutenberg, who, like many innovators, was running a heartbeat ahead of his time, drifted into bankruptcy and in 1458 defaulted on interest payments for a 1442 loan. Although he was past sixty years of age and down and out, he had

perfected his craft and completed his research. It is believed that with financial support from Mainz citizen Dr. Conrad Homery, Gutenberg was able to establish a new printing shop. Some scholars view him as the printer of the thirty-six-line Bible, a late-1450s reprint of the forty-two-line Bible with similar but less refined type. His *Catholicon*, an encyclopedic dictionary, was published in 1460 with a colophon—perhaps in Gutenberg's own words—stating that the work was published "with the protection of the Almighty, at whose will the tongues of infants become eloquent and who often reveals to the lowly what he hides from the wise." On 17 January 1465, Archbishop Adolf of Mainz appointed Gutenberg courtier with the rank of nobleman, entitling him to clothing, keep, and "twenty matter of corn and two fudder of wine each year." The flyleaf of a book owned by a Mainz priest bears an inscription stating that "the honorable Master Johann Gutenberg died 3 February 1468." Based on prior agreements, Dr. Homery petitioned the courts for ownership of the "forms, letters, instruments, tools, and other things pertaining to the work of printing" that belonged to the late Gutenberg. On 26 February 1468, the archbishop transferred possession to Dr. Homery, who promised to keep this equipment in Mainz and give first preference to Mainz citizens in the event of future sale.

5–13. Johann Gutenberg, pages from the Gutenberg Bible, 1450–55. The superb typographic legibility and texture, generous margins, and excellent presswork make this first printed book a canon of quality that has seldom been surpassed. An illuminator added the red and blue headers, initials, and text by hand.

5–14. Fust and Schoeffer, page detail from Psalter in Latin, 1457. The red and blue initials are the earliest example of color printing in Europe.

5–15. Fust and Schoeffer, colophon and trademark from Psalter in Latin, 1457. The double crests are thought to symbolize the two printers.

For a brief few years, printing was centered in Mainz, as Fust and Schoeffer, Gutenberg, and former apprentices who had established their own firms were located there. Ironically, the swift spread of printing was hastened by a bloody conflict. German nobles were involved in power struggles that erupted into full-scale war. Leading a sizable army, Adolf of Nassau descended upon Mainz in 1462 and sacked the town. Plundering and looting brought trade and commerce to a halt. Warnings from other towns in Adolf's path enabled many Mainz merchants and craftsmen to load everything possible on wagons and carts and flee. Many younger printers and apprentices did not return. Rather, presses were soon established as far away as France and Italy.

Copperplate engraving

During the same time and in the same section of Europe that Johann Gutenberg invented movable type, an unidentified artist called the Master of the Playing Cards created the earliest known copperplate engravings (Figs. 5–17). Engraving is printing from an image that is incised or cut down into the printing surface. To produce a copperplate engraving, a drawing is scratched into a smooth metal plate. Ink is applied into the depressions, the flat surface is wiped clean, and paper is pressed against the plate to receive the ink image. The finest work of the Master of the Playing Cards is a set of playing cards using birds, animals, and wild men as images. The quality of his drawing suggests that he probably trained as an artist rather than as a goldsmith. The skilled execution implies that these playing cards were designed and engraved by someone who had already mastered engraving, not someone struggling to perfect a new graphic technique.

Scholars have speculated that Gutenberg, in addition to inventing typographic printing, may have been involved in the research and development of copperplate engraving. Images by the Master of the Playing

Cards have now been associated with Mainz illuminators, including artists involved with Gutenberg's printing works during the 1450s. The links binding these early printing innovators together are illustrations of birds, animals, flowers, and figures duplicated in the engraved playing cards, an illuminated Bible produced in Mainz during the early 1450s, and the illumination added to a surviving copy of the forty-two-line Bible.

5–16. Jan Fust and Peter Schoeffer, page from Rationale Divinorum Officiorum, 1459. The innovative small type is combined with wonderfully intricate printed red and blue initials that evidence the early printer's efforts to mimic the design of the manuscript book.

5–17. The Master of the Playing Cards, The Three of Birds, c. 1450. Masterly design and placement of the images in the space enhanced the sureness of the drawing and use of line for tonal effects.

This circumstantial evidence raises exciting possibilities.
Was Gutenberg striving to perfect the printing not just of scribes' lettering but of the magnificent ornamentation and illustration of the medieval manuscript as well? Was engraving pioneered as a means to print illustrations onto the typographic pages, which could then be hand-colored? Did Gutenberg explore using engraving plates as molds to cast relief versions so that illustrations could be printed with type? These provocative questions, still without definite answers, indicate that Gutenberg's research might have carried the printed book in a different direction from its subsequent development.