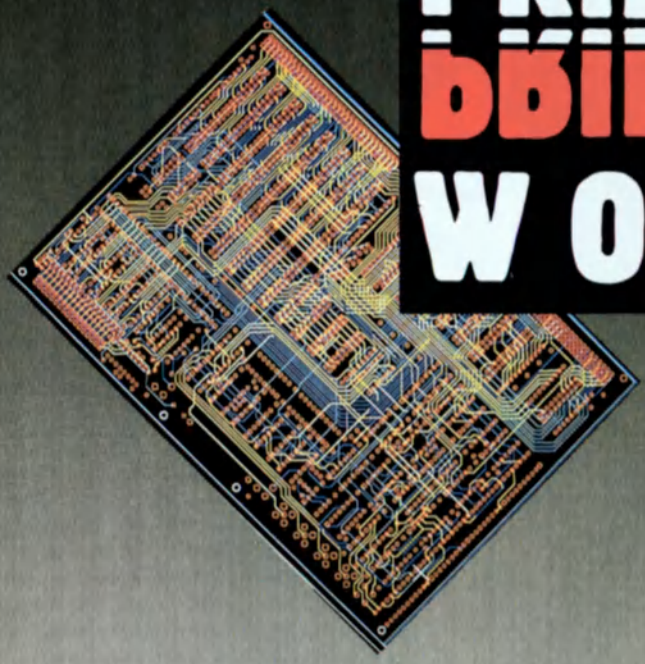
UNESCO The Courier
JULY 1988 - 9 French francs

From movable type

THE PRINTED WORD



to the microchip

Inspiring footwork

When sculptor Janus Kamban, who lives in the Faeroe Islands, saw our photo of a Sierra Leonean boy playing soccer (March 1987 issue, page 2) he was captivated by it. "I thought it would be fun to see the agile movement from other sides too," he wrote to us, "so I made a statuette of a playing boy." Below, a photomontage showing the statuette and the photo that inspired it.


A time to live...

Jumping for joy

52 Sierra Leone


Editorial

March 1987

The Courier

3

Photo © Janus Kamban, Torshavn, Denmark

6 *The Faeroe Islands, Denmark*

July 1988

Cover: Photomontage of a porcelain Chinese seal (17th century) with carved jade printing surface; image of electronic circuitry produced by a computer; at right, print control strip used for checking the accuracy of colour proofs.

Back cover: Detail of a page from the 42-line Latin Bible printed by Johannes Gutenberg (Mainz, c. 1455), the first book printed from movable type in the West. The typestyle is known as *Textura*, a Gothic script in which the design of the characters produces an interwoven effect. The decorative initial capital was added by hand.

The Courier
A window open on the world 41st year

Published monthly in 35 languages English French Spanish Russian German Arabic Japanese Italian Hindi Tamil Hebrew Persian Dutch Portuguese Turkish Urdu Catalan Malaysian Korean Swahili Croato-Serb Macedonian Serbo-Croat Slovene Chinese Bulgarian Greek Sinhala Finnish Swedish Basque Thai Vietnamese Pashto Hausa

editorial

Only a few years ago, it was widely contended that one of the great transformations of modern society was the decline of the written and printed word and the rise to pre-eminence of the audiovisual media of communication. Today, to paraphrase a remark once made by the American humorist Mark Twain when news of his own death had been prematurely and inadvertently published, it may seem that reports of the demise of the printed word have been greatly exaggerated. While for centuries after the invention of printing with movable metal type, printing processes remained essentially unchanged, today the production of books, periodicals and other forms of printed matter is being revolutionized by computerized type design and photocomposition, satellite text transmission and other new technologies. Paradoxically enough, the development of microcomputers and "desktop publishing"—in theory at least—may offer its practitioners the extensive control over many stages of the printing and publishing process that was enjoyed by the European printers of 500 years ago.

This issue of the *Unesco Courier* presents some landmarks in the history of printing and publishing from the invention of paper in China 2,000 years ago to modern electronic breakthroughs. It is largely devoted to practical developments, ranging from the evolution of calligraphy and typography in late medieval Europe to methods of computerized typesetting in modern China. Some of the problems of printing and publishing in the developing world are highlighted in an article on the book situation in India by Lokenath Bhattacharya, who reminds us that "the principal factors governing publishing activities in a country are its literacy rate, the size and nature of its educated population, and its educational policies and programmes".

Editor-in-chief: Edouard Glissant

LANDMARKS IN PRINTING

BY WERNER MERKLI

WERNER MERKLI, *of Switzerland, is editor of the German-language edition of the* Unesco Courier. *A specialist in printing technology, he was for many years a director of a leading Swiss publishing and printing company, and served as president of the Association of Swiss Printing Industries from 1976 to 1981. He was for 25 years president of the friends of the Swiss Gutenberg Museum, Berne. Among his published works are "Vademecum. An introduction to the graphic arts", published by Hallwag, Berne (2nd ed. 1967).*

FOR more than 400 years after Johannes Gutenberg's invention of a process of printing from movable metal type in the fifteenth century, all type was cast in a hand mould, the text was composed by hand, and printing was carried out on hand presses. It was not until the nineteenth century that typesetting and printing processes were mechanized. Since the mid-twentieth century, electronics and the microcomputer have revolutionized text composition, reproduction of illustrations and printing techniques.

Papermaking

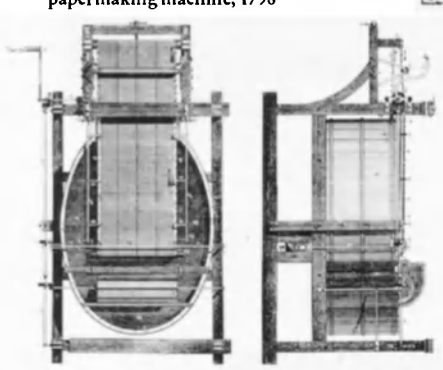
1. The earliest picture of papermaking in Europe is this woodcut made by Jost Amann for Hans Sach's "Book of Trades", printed in Frankfurt in 1568. Although almost all steps in papermaking are now highly mechanized, the basic process remains unchanged. Plant fibres are separated and wetted to produce pulp, which is filtered on a screen, leaving a sheet from which the water is pressed out. The dry sheet is further compressed and treated, depending on the use for which it is intended.

■ The art of papermaking (1) was invented by the Chinese as long ago as the second century BC (see article page 32), and travelled westward when Chinese papermakers, taken prisoner by the Arabs near Samarkand in AD 751, were forced to disclose their manufacturing secrets. In 1150 the art reached Spain, and by the time of Gutenberg, paper mills had been established in several European cities (2). Gutenberg thus had at his disposal a perfect printing material that was much cheaper than the parchment on which manuscripts were produced in the monasteries.

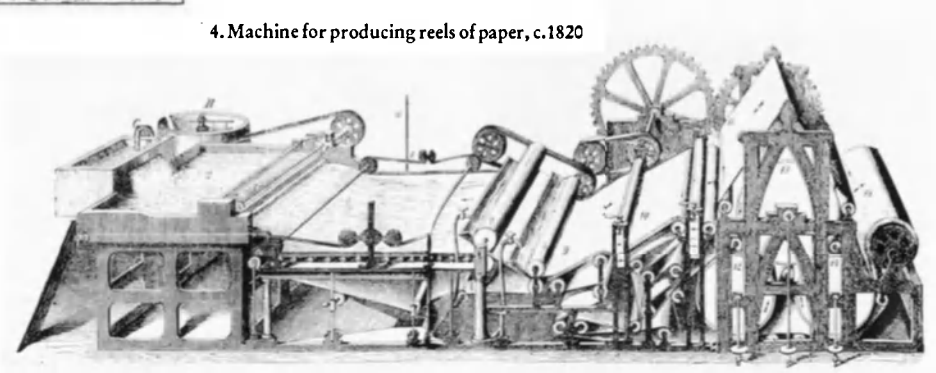
Papermaking was not mechanized until around 1800, when the first papermaking machine was invented by a Frenchman, Nicolas-Louis Robert, in the Didot paper mills near Paris. It used a moving belt, and paper was made one sheet at a time (3). In 1805 the English engineer Joseph Bramah devised a paper-moulding machine which used a rotating cylinder. This development later led to the production of continuous reels or "webs" of paper (4). The manufacture of paper is now almost entirely automated and quality control can be carried out by computer.

2. Detail from a late 15th-century woodcut from Nuremberg shows Ulman Stromer's paper mill, the first in Germany.

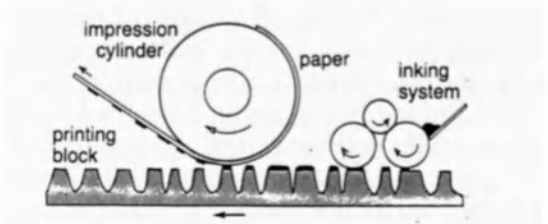
3. Side view and plan of Nicolas-Louis Robert's papermaking machine, 1798



4. Machine for producing reels of paper, c.1820



Letterpress



Letterpress is the oldest method of printing, and the only process which can use type directly. Printing is done from cast metal type or from blocks on which the image or printing areas are raised (in relief) above the non-printing areas. Ink rollers touch only the top surface of the raised areas, and the inked image is transferred directly to the paper. Above, operating principles of a type of letterpress machine with a flat bed and an impression cylinder.

■ Monastic libraries contain printed sheets dating from the ninth and tenth centuries which were produced from relief engraving on wooden blocks (5). Between 1041 and 1048, the Chinese smith Bi Sheng used a technique of printing texts on paper with movable characters made of earthenware, and printing was also carried out with characters cast in copper in a Korean printing works in 1403. Between 1436 and 1444, Johannes Gensfleisch zum Gutenberg, of Mainz, Germany (6), developed the type mould or matrix and originated a method of printing from movable metal type that was used without important change until the twentieth century.

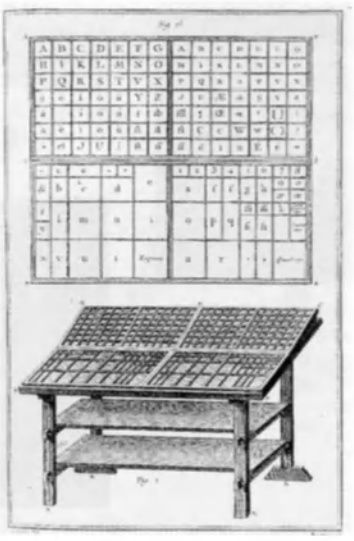
Gutenberg cut a punch in hard metal for every letter, accent and punctuation mark and struck it into a softer metal to make the mould for casting identical pieces of type. The type was made from an alloy of lead, antimony and tin. The finished characters were kept in compartmentalized typecases (7) from which the text was assembled. For printing, Gutenberg built a wooden worm-screw hand press (8), similar to a wine press. His printing ink consisted of a mixture of pinewood soot and linseed oil, which was spread on the printing surface with leather pads. To ensure better absorption of the ink, the paper was dampened before printing.

It is not surprising that the first book Gutenberg chose to print was the Bible, for at that time it was the work most in demand. His "forty-two-line Bible" (see back cover), so named because of the number of lines in each column, was printed in Mainz between 1452 and 1455, in an edition of 200 copies. The coloured initial letters to chapters and the decorations were added afterwards by hand, because so far as the design of the type (9) and the layout was concerned Gutenberg followed closely the model set by fine book manuscripts in the monasteries.

The art of printing spread rapidly all over Europe. Many efforts were made to improve the efficiency of the wooden press, and Wilhelm Haas, a typefounder of Basel, Switzerland, followed the basic design of the wooden press when in 1787 he developed the first all-metal hand press, which produced a better quality impression.

5. A modern woodblock-engraver

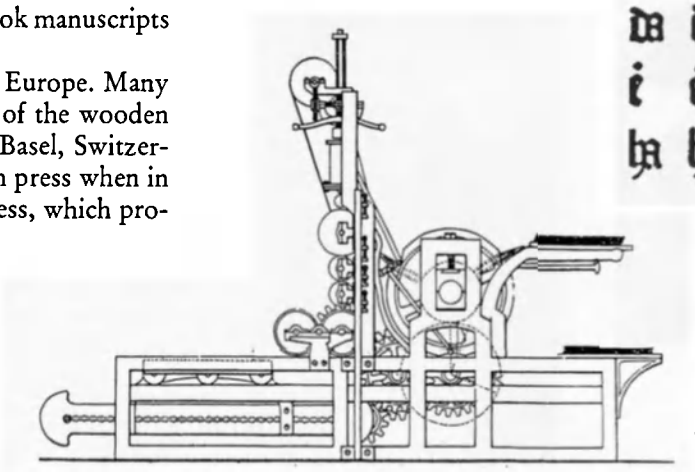
6. The oldest known portrait of Gutenberg. Copper engraving from *Vrais portraits et vies des hommes illustres*, Paris, 1584.



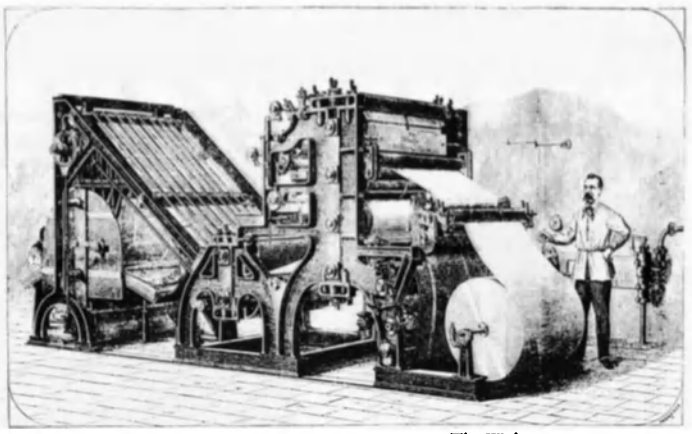
7. Illustration of typecases from Diderot's *Encyclopédie*

8. Gutenberg's press reconstituted at Leipzig in the 19th century. The press has a fixed, level lower surface, the "bed", and a movable, level upper surface, the "platen". The composed type, after being locked into a metal frame to make the printing block or "forme", was inked, covered with a sheet of paper, and pressed between the two surfaces.

9. Examples of letters cut by Gutenberg



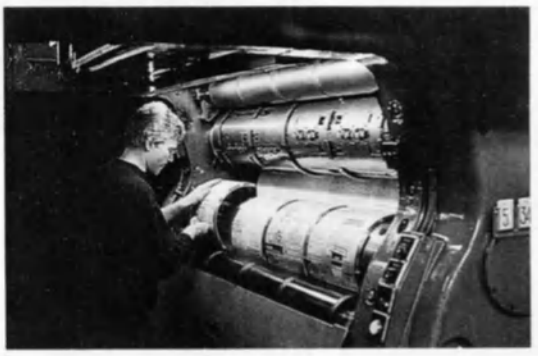
10. Diagram of Koenig's press (1811), in which the platen is replaced by an "impression cylinder"



11. The Walter rotary press, 1866

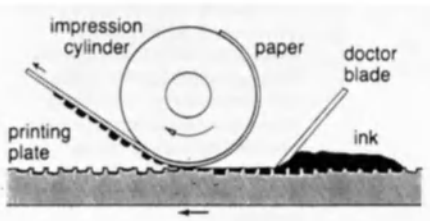
The idea that a rolling cylinder might be used in printing to overcome excessive manual strain was put forward in the early seventeenth century, but it was not until 1811 that the first steam-driven cylinder printing machine was patented by the German compositor and inventor Friedrich Koenig (10). Further progress was achieved in 1818 with the double rotary press designed by Koenig and his associate Andreas Bauer, in which paper printed on one side under one of the cylinders passed to the other cylinder to be printed on the other side.

In 1844 Richard Hoe in the USA patented the first rotary press in which the type was carried on a metal cylinder instead of a flat plate. In 1866 the proprietor of the London *Times*, John Walter, had the first rotary press fed by a continuous roll of paper constructed according to the American model invented by Jeptha Wilkinson (11), making it possible to print 14,000 copies of the newspaper per hour.



Above, preparing to print a newspaper on a rotary press.

Revolving at a rate of 35,000 revolutions per hour, modern rotaries can print 500 m of paper per minute.



Gravure printing, like letterpress printing, is based on a height differential between the image and non-image areas. In this process the image areas are recessed (intaglio) below the level of the non-printing areas. The surface of the printing plate is broken up into small cells holding different ink volumes, which constitute the image. The plate is flooded with ink and the surplus removed by a "doctor blade", leaving ink only in the recessed cells.

Gravure

■ This technique developed from the art of copperplate engraving, in which the design is cut with a gouge, or chemically etched, into a polished copper plate (12). The earliest known etching was made by the Basel goldsmith, painter and graphic artist, Urs Graf, in the fifteenth century. Printing from the engraved plates was done by hand. Later an engraved cylinder was used instead of a flat plate, and reels of the material to be printed were fed between it and the pressing cylinder. This idea proved attractive to printers of cloth in the eighteenth century, and in 1783 a multi-colour gravure press for making cotton prints was constructed in England by a copperplate printer, Thomas Bell. In 1860 Auguste Godchaux, a Paris publisher, obtained a patent for a gravure rotary press which would print on each side of the sheet.

A key invention in modern gravure printing was a photographic etching process using carbon tissue, developed by the Czech painter and graphic artist, Karl Klic, or Klietsch, in 1878. Since then, millions of illustrated publications have been produced by gravure printing (13).

In 1908, two Germans with experience in cotton printing, Ernst Rolffs and Eduard Mertens, developed a flexible steel "doctor blade" to wipe excess ink from the printing plate. Later, the process of etching the printing cylinder was greatly improved by the introduction of automated, electronic engraving.

12. A copperplate engraver at work

13. Early example of a children's magazine illustration printed by gravure

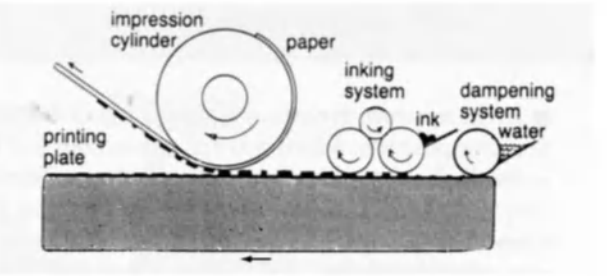
■ The lithographic technique was discovered by chance in 1796, when the Munich dramatist Aloys Senefelder, searching for a economical method of printing his own work, tried writing on a finely-ground stone surface and discovered the water-repellent properties of his greasy, oil-based ink.

Initially, the images to be reproduced were hand-drawn on a litho stone (14) and printed on a manual press (15). The impression was taken by pressing the paper against the inked stone with a scraper. Thanks to the mechanization of this technique with Georg Sigl's flat-bed litho press, introduced in Berlin in 1851, single and multi-colour lithographic printing (16) became very important, especially for printing packaging material.

As early as 1805 Senefelder had tried to find an alternative to the heavy litho stone, but it was not until 1904 that Ira W. Rubel and Caspar Hermann of New Jersey, USA, devised a thin metal plate to carry the image to be printed. After this had been inked, and the surplus ink repelled with moisture, the image was transferred to a rubber-coated cylinder and then to the paper (17). This form of indirect printing is known as offset. The fact that the printing plate, the rubber blanket and paper all ran on cylinders enabled higher printing speeds to be achieved from the start.

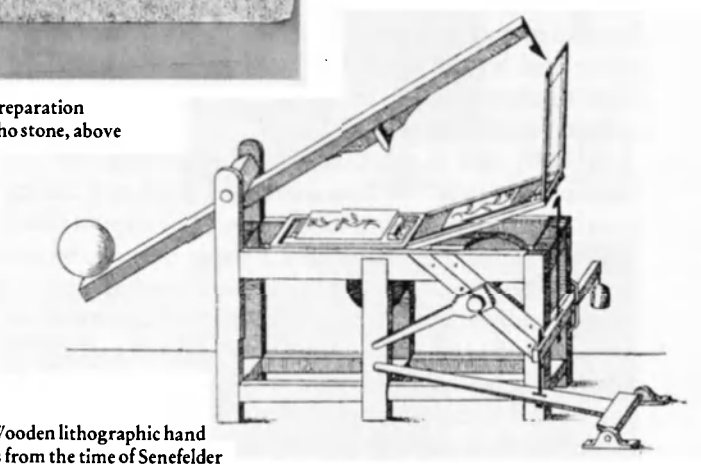
In the early offset litho presses, the need for dampening often caused serious problems and the impressions obtained were dull and blurred. After the Second World War, technical improvements combined with better inks and more thickly-coated paper, resulted in sharper impressions and higher ink saturation.

Today, large electronically-controlled offset rotary presses, with several printing units in sequence, can print both sides of the paper, in sheets or as a continuous web, at the rate of 30,000 impressions per hour (18).



In *lithography*, the printing and non-printing areas are on the same plane of the surface of a thin metal plate, and the definition between them is maintained chemically. The printing parts of the surface repel water when moistened but absorb the ink with which they are coated, whereas the non-printing parts absorb the water and repel the ink.

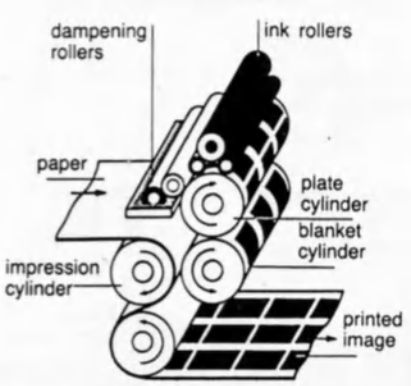
14. Preparation of litho stone, above



15. Wooden lithographic hand press from the time of Senefelder

16. Colour illustration by the Finnish lithographer Emilie Topelius was reproduced in a children's book, *Sagor*, published in 1847

17. *Offset lithography.* Basically the offset printing press consists of 3 revolving cylinders. The first cylinder carries the printing plate, the second carries a rubber blanket, and the third (the impression cylinder) presses the paper against the offset blanket. Other rollers feed the paper through the press.



18. An offset rotary press

■ In the nineteenth century attempts were made to mechanize text composition, which was still carried out line by line with individual metal characters assembled in a composing stick (19), following a process that had not changed greatly since Gutenberg's time. The first patent for a typesetting machine was taken out in 1822 by William Church of Boston; others soon followed (20).

But the real breakthrough in the mechanical setting and casting of type was achieved in 1884 by the German-born watchmaker Ottmar Mergenthaler in Cincinnati, USA, when he invented the Linotype machine, which could set 6,000 characters per hour as compared with 1,400 by hand. In the Linotype system (21), the brass matrices in which the characters are engraved in negative form are released from the storage magazine by typing on a keyboard, assembled into a line and moved into the casting mechanism. After casting, the entire lead line or "slug" is ejected and the matrices carried back to their position in the storage magazine where they remain on call for another line.

In 1897, also in the USA, the English engineer Tolbert Lanston separated the operations of setting and casting the type in his Monotype machine. In the Monotype system (22), again by typing on a keyboard, a paper tape on the setting-machine was punched with a different combination of perforations for each character. This punched tape mechanically controlled the typecasting mechanism, which cast each character individually. Because of the high quality of the type produced by the Monotype system, it came to occupy a predominant position in book printing.

Developments in photographic techniques led to many attempts to replace metal type by photographing the images of the characters (23). A successful early application of phototypesetting was the Lumitype system developed by two Frenchmen, René Higonnet and Louis Moyroud, in the 1940s. Production speeds exceeded 28,000 characters per hour on later models. In the Monophoto, introduced in England in 1950 as a development of the Monotype system, the characters could also be enlarged and reduced in size when projected onto film.

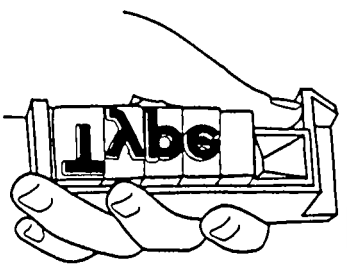
In 1955 sensational developments in electronics sounded the deathknell of Gutenberg's lead type. Instead of being controlled by perforated tapes, typesetting machines could now be driven by a computer programmed to expose the characters onto film, permitting an output of 30,000 to 100,000 characters per hour. A considerable acceleration in output—up to 600,000 characters per hour—was achieved in the 1960s with the development of faster computers and the use of a cathode ray tube (CRT).

Another significant development at this time was the introduction of the Optical Character Recognition (OCR) reading machine, which scans typewritten or printed text at the rate of 300,000 characters per hour to produce input to a computer-driven typesetter.

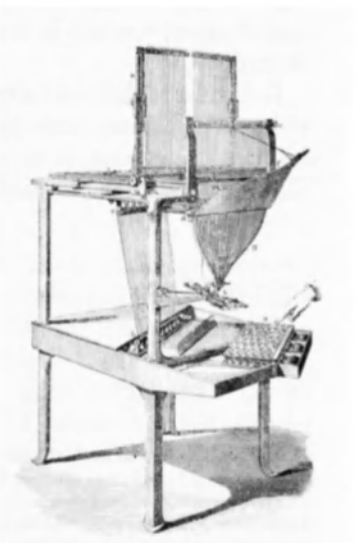
Considerable improvements in text input speeds were achieved with the introduction of integrated circuits and microprocessors into computer systems, as well as by the introduction of a visual display unit on which the selected characters appear as they are typed. The text can be read and corrected on the screen (24), before being stored in the computer's memory. However, there is a limit to the typesetting speed of machines using CRT technology, as each character has to be picked out individually from the image matrix.

Another approach was adopted in 1965 by Dr. Rudolf Hell, of Kiel, Federal Republic of Germany. In his Digiset system, a scanning device analyses each character electronically and breaks it down into tiny squares, which are stored in the computer's magnetic memory in digital form. When inputting text, these squares are recombined on film, again using a cathode ray tube, into characters of the required size and typeface. With a initial production speed of over 1 million characters per hour, this was another important breakthrough in typesetting.

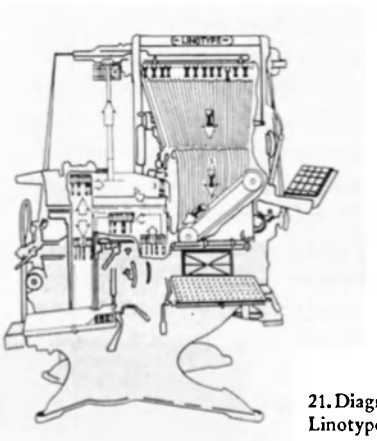
In 1976, the laser beam began to be used to replace the CRT beam for digital recording of the characters (25). The intense light beam from photons projects a sharper, clearer typeface. Digital storage of text opens up revolutionary possibilities for its high-speed transmission throughout the world, via satellite or fibre-optic cable.



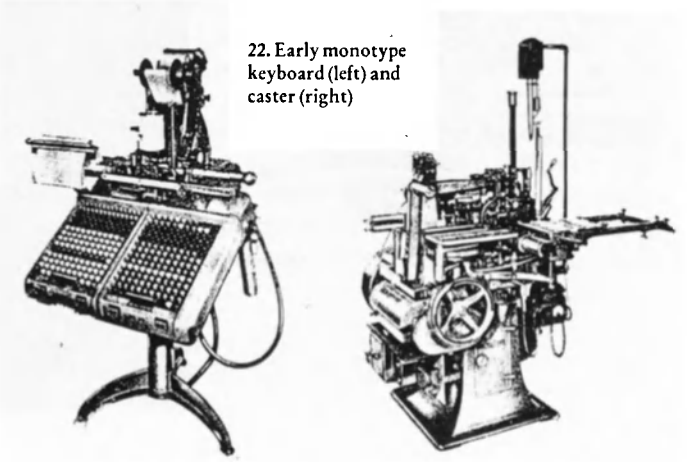
19. The composing stick holds pieces of type. The compositor sets the type upside down.



20. Hattersley's typesetting machine, London, c.1870



21. Diagram of Linotype machine



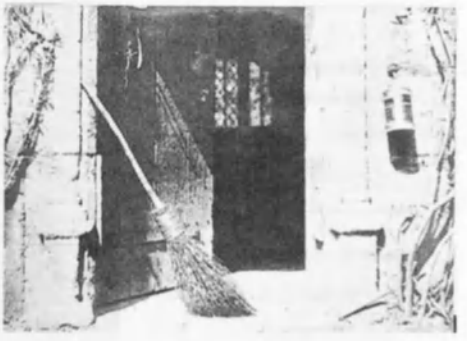
22. Early monotype keyboard (left) and caster (right)

■ Throughout the Middle Ages, beautiful copperplate engravings, etchings, woodcuts (26) and lithographic prints were produced by draughtsmen and painters by carving or drawing on printing blocks of wood or stone, or by engraving on metal plates. Discoveries regarding light and the theory of colour, together with the invention of photography in the nineteenth century, brought the potential of photographic processes to the printing industry (27).

Although solid lines can be printed directly using the letterpress and offset processes, the intermediate tones in photographs cannot. In 1881, the Munich copperplate engraver Georg Meisenbach succeeded, by photographing an image through a screen of crossed lines, in breaking down the image into tiny dots. In the resulting positive, the closely-spaced dots combine to form the darker tones of the original image, and the less dense dots yield the light tones. The screened image can then be recorded on to a printing plate in a process known as halftone etching. Screening is often carried out by electronic scanning today (28).

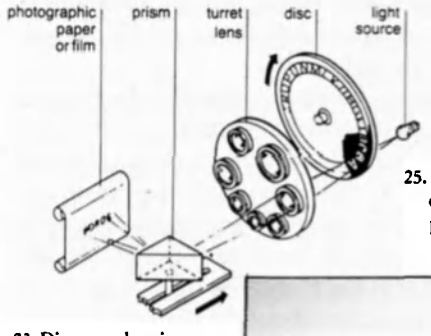
For the reproduction of tonal images in colour, however, three plates must be made—one each to print red, blue and yellow ink. Usually, a black plate is also made, because black ink adds sharpness to the printed copy. The first step is to separate the colours photographically in the original image. The colour separations are made by taking four separate photographs through different filters which block out all colours except the desired colour, and also through a halftone screen to produce the dot pattern required for printing. In colour printing, some of the different coloured dots fall close together and some are superimposed. The eye mixes the colours of the dots on the printed page into all the tones of the original. For example, what the eye sees as green is really an area of tiny blue and yellow dots. Experiments carried out in the USA between 1946 and 1950 led to the development of a process for making colour separations by electronic scanning, and by the late 1970s, following developments in electronics technology, the impulses from the scanner beam were digitized. The tiny dots which produce the tonal values of the reproduction are then reconstituted by laser beam, either on film or directly onto the printing plate.

26. In the early days of European printing, identical woodcuts were sometimes used to illustrate different people.



27. Photo from William Henry Fox Talbot's *Pencil of Nature* (1844-46), the first known book illustrated entirely with photographs

28. Electronic scanners (right) can be used to process images for printing. The image is fitted onto a revolving drum and reproduced by the scanner as a pattern of tiny dots. Far right, halftone dots enlarged



23. Diagram showing operating principles of a phototypesetting machine

25. Digitized character produced by laser

24. Composing text on screen

The electronic future

■ Developments in the printing industry during the coming decades will be primarily determined by advances in electronics. Desktop publishing technology (see article page 16) emerged in the 1980s for the processing of both text and image. Using electronic pencils and brushes, computer graphics can be created directly on the screen and integrated into the stored text. Furthermore, magnetic discs are being developed which can store over 1,000 million typographical signs (500,000 typewritten pages) and integrated databases will improve access to information.

Metal typesetting and letterpress printing processes have virtually disappeared within a short period. Thanks to the simplification of platemaking, however, the offset and photogravure processes have survived. Electrostatic printing, whereby an electrostatically-charged plate transmits a dry powder or liquid ink toner to plain paper, and inkjet printing, in which computer-controlled jets are used to spray hundreds of thousands of electrostatically-charged drops of colour per second onto the paper to produce text and images, are just two of the techniques which are leading to contactless printing, instead of printing from an inked plate. ■

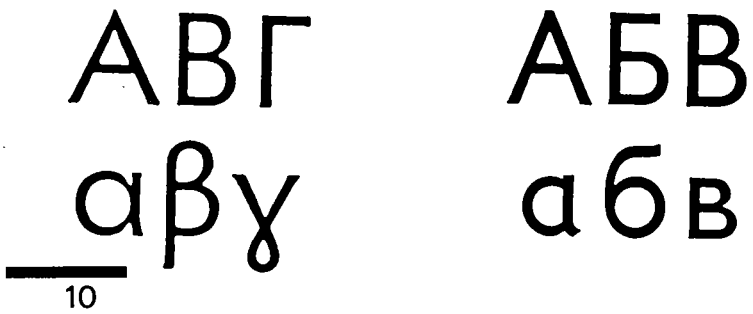
Calligraphy and typography in Europe

BY ROGER DRUET

Hittite hieroglyphic inscription from the ancient city of Carchemish, on the upper Euphrates (10th to 8th century BC).

Above, inscription in Phoenician script on the tomb of Ahiram, king of Byblos (10th century BC). The ancestry of Western alphabets can be traced back to the alphabet developed by the ancient Phoenicians.

Below, letters from modern typefaces in Greek (left) and Cyrillic (right). Cyrillic, the alphabet used for Russian and other languages of the USSR, as well as Bulgarian and Serbian, is derived from the Greek. It was probably developed in the 9th century AD by 2 Greek brothers often called the "apostles to the Slavs", St. Cyril, for whom it was named, and St. Methodius. Cyrillic was later developed into printing characters which were simplified in the early 18th century on the instructions of Peter the Great.



ALL typefaces, even the most modern digitized characters designed with the help of a computer, are based on forms of writing. This link between written and printed characters is particularly noteworthy in the history of European typographical design.

The Phoenicians and the Greeks, who invented the early alphabets from which Western scripts derived, were seafaring and colonizing peoples who needed to carry precise and legible messages over very long distances. Consequently the priorities of Western writing were speed of execution and simplicity of design.

The creation of phonetic alphabets (instead of ideographic systems) using only twenty to thirty signs for the transcription of language was a decisive step in a process of abstraction in which the Greeks played a leading role by considerably developing the Phoenician alphabet. The alphabet they created is the basis of the Latin characters used in many parts of the world today.

By the fourth century BC, the Golden Age of Hellenic thought, Ionic script had already developed the rectangular form of modern capital lettering. During the Greek and Roman classical era, writing acquired the harmonious and balanced form which is known as *lapidary* because of its resemblance to the monumental script used for inscriptions in stone. This script with its firmly chiselled grooves and broad strokes which stood out well in sunlight and were enhanced by shadow, answered a need for beauty and harmony but also expressed imperial power. Latin capital-letter script may be regarded as the basis of subsequent developments in Western scripts and, later, type designs.

Cyrillic script, which was adopted by Orthodox Christians for the Slavonic languages, particularly in Russia, emulated these upright, monumental styles of writing. Systematically used as a phonetic form, it became a widely employed substitute for Latin script in the Slav countries. The invention of Cyrillic script, derived from a Greek book hand, is attributed to the ninth-century Greek missionaries Cyril and Methodius, and was standardized by the Byzantine Emperor Constantine VII.

After the heavy *quadrata*, or square capitals, the basis of all Latin scripts, and the Roman *rustic capitals*, an early form of cursive script, writing evolved towards the rounded *uncial* script. In the ninth century, Charlemagne imposed on the Holy Roman Empire the form of small lettering now known as Carolingian miniscule, which included most of the features of the lower case Latin alphabet. The official adoption of this cursive script did not bring about the disappearance of capital letters, but it was the dominant hand of Western Europe throughout the ninth century and served as a model for later innovators until the dawn of European printing in the fifteenth century.

With the foundation of universities in Europe in the twelfth century, parchment became scarce. A new script, known as black-letter or Gothic, as angular and narrow as the Gothic pointed arch, answered the needs of the moment

Printing was originally conceived as a process for the mechanical reproduction of manuscript. Many early printers came to typography through calligraphy, and the work of some later typographers has also been influenced by styles of handwriting. Right, specimen Western scripts from Roman times to the 18th century.

AA	*Lapidary* (from 600 BC)
Λ	*Quadrata*, Roman square capital
ΛΛ	*Rustic*, Roman cursive capital
ΛΑΔ	*Uncial*, rounded capital (from 3rd century AD)
aΛd	*Carolingian miniscule* (8th-9th century)
	Gothic (12th-15th century) Evolution from *Textura* (left) to *Rotunda* (right) *Capital* revived for initials (15th-16th century)
a	*Bastarda* vernacular script (15th century)
Aad	*Humanist* classical revival (14th-16th century)
Aa	*Chancery* cursive script (15th-16th century)
a	*Rounded* book hand (17th-18th century)

in that it took up a minimum of space. The expression of thought seemed to be channelled through a kind of grid. This design gave rise to two basic scripts: the rigid, vertical *Textura*, used primarily for liturgical texts; and a more flexible script, *Rotunda*.

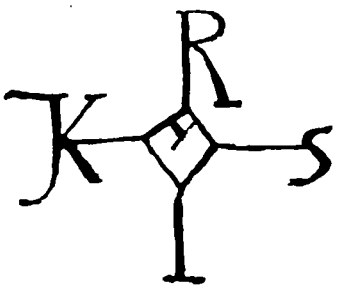
In the fifteenth century, the angular Gothic script, having been appropriated by the lettered classes in France, became known as *bâtarde* or *Bastarda*. The invention and use of spectacles also made it possible for writing to become smaller. It was not until the end of the sixteenth century that the Germans introduced capital letters into the Gothic alphabet for woodblock printing. Hitherto, the place of the "dropped initials"—initial letters at the beginning of a page or chapter, which covered two or three lines of text—had been left blank, to be filled in by the illuminators.

For engraving, the Germans had adopted a spiky kind of script, whose rather fussy, fractured style suggested its name, *Fraktur*. The great painter and engraver Albrecht Dürer, who thought that letters could be governed by mathematical laws, undertook to impose a constructive discipline on Gothic script. This admirable undertaking culminated in a balanced appearance for each character.

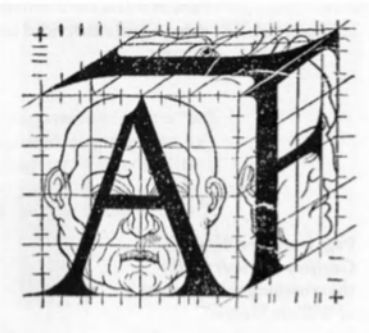
Around 1440, the German printer Johannes Gensfleisch, known as Gutenberg, of Mainz, took the remarkable step of bringing together and organizing all the processes of printing: punch-cutting, making matrices, type-casting, composing and the use of a hand press. Once the discovery had been made, the art of printing spread rapidly. The Gutenberg forty-two-line Bible (see back cover), the first great feat of Western printing, was printed in Gothic lettering. Subsequently, Gutenberg increased his range of typefaces to almost 300 so that he could reproduce different scripts as accurately as possible.

The humanist scholars of fifteenth-century Italy never took to Gothic script. Petrarch considered that it looked blurred from a distance and caused eyestrain close to, as if it had been created not to be read, but for some other purpose. The Italian Renaissance therefore turned for inspiration to classical Antiquity, and calligraphers revived ancient monumental lettering, thus returning to a simplicity and clarity that are still characteristic of printing today. The West, influenced by its artists, pursued the chimera of "divine proportion", the mathematical relationship believed to be the key to beauty. Leonardo da Vinci sought it in the human body, as did Dürer and the great French typographer Geofroy Tory, who studied the composition of letters according to the proportions of the human body in the *Champfleury* (1529), a treatise on type design.

An important event which encouraged a new approach to printing was the sack of Mainz in 1462, which forced many of Gutenberg's collaborators to leave the town. They took the secrets of printing to several European countries. Around 1470 one of them, the French engraver Nicolas Jenson settled in Venice, where he drew inspiration from humanist scripts in designing a new type with wedge-shaped

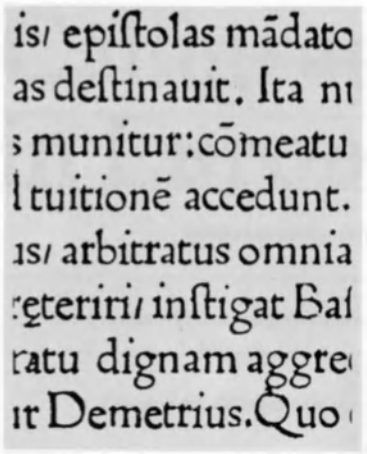


Signature of Charlemagne, c. 800 AD. The Emperor, who could not write, merely added his own flourish to the monogram painted for him by the copyist.



Letter patterns from *Champfleury*, the first theoretical treatise on the designing of type (1529), by the French printer Geofroy Tory, who later became the royal printer of King François I.

Ornamental capital letter, left, from the *Bible Historiale* (c. 1380) attributed to a copyist known as Pierre Comestor ("Peter the Eater"), is one of the earliest European depictions of a person wearing spectacles. The invention of spectacles made it possible for writing styles to become smaller.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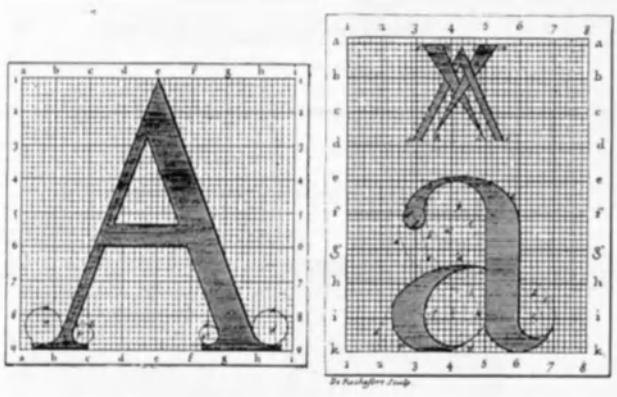
ir Demetrius. Quo

The type created by the French printer Nicolas Jenson (c. 1420-1480) and known as "roman" is generally considered to be the first consciously designed according to typographical ideals rather than manuscript models. Left, specimen of text printed in Jenson's roman.



These drawings show a capital and lowercase "a" in a typeface known as *Romain du Roi*, which was commissioned by Louis XIV in 1692 for the exclusive use of the royal printing works. The drawings, made by Nicolas Jaugeon, a leading member of the committee charged with the design of the typeface, form part of a set prepared for the guidance of the type-cutter, Philippe Grandjean. The committee turned away from the principles of calligraphy and designed each letter on a mathematical basis, using a grid subdivided into tiny squares.

Page from *The Works of Geoffrey Chaucer* (1896) the crowning achievement of William Morris' Kelmscott Press. Critical of the mediocrity of contemporary machine-produced books, Morris reverted to the hand press, handmade paper and specially-made ink and typefaces. His *Chaucer* was printed in black and red, and contained 87 woodcuts by the leading English painter and designer Sir Edward Burne-Jones, plus an abundance of borders, initials and ornaments designed by Morris himself.

The first italic typeface was cut around 1500 by Francesco Griffo for the Venetian humanist and publisher Aldus Manutius. The design was based on the cursive writing of the papal chancery clerks. Left, modern *Garamond* italic, named after its designer, Claude Garamond (c. 1480-1561), who was inspired by the publications of Manutius. (This issue of the *Courier* is set in *Garamond*.)

serifs. This pure and beautiful style was known as roman, a name which would in future be applied to typefaces with an upright design. Among the heirs to his workshop in that illustrious city was the learned Aldus Manutius, one of the great figures in European publishing. His type designer, Francesco Griffo of Bologna, cut the first example of a sloping type which became known as *Aldine* and is today called italic. It was based on the informal cursive writing developed by chancery clerks to speed their work.

The sixteenth century was the Golden Age of calligraphy in Europe, rich in great calligraphers such as Ludovico degli Arrighi, Ugo da Carpi, Giovanniantonio Tagliente and Palatino in Italy, Jean Beauchenne in France and Roger Ascham in England. As progress was made in copper engraving, so a cursive script with slender finials (terminal hooks) emerged and came to fruition in the work of Lucas Matherot and Louis Barbedor.

In France, where the development of printing was influenced by the work of Geofroy Tory, the Estienne family was prominent. One of its members, Robert Estienne, was printer to King François I. He entrusted Claude Garamond with a royal command to cut typefaces for editions of classical Greek texts. The famous *Grecs du Roi* which resulted were uncluttered and elegant. Garamond, the first commercial typefounder, also designed the roman and italic typefaces which bear his name and which played a leading role in European typographical design until the end of the sixteenth century.

In this great humanist movement, Christophe Plantin (see page 14), a French bookbinder who became a citizen of Antwerp and a printer, acted as a connecting link with the Netherlands, where a great dynasty of printers, the Elzeviers, had come to the fore and would be active until the beginning of the eighteenth century. The Elzeviers gave their name to an elegant wedge-serif typeface.

In 1692, during the reign of Louis XIV and classicism, Abbé Nicolas Jaugeon of the French Academy of Sciences was given the task of creating a new typeface. His design, cut by Philippe Grandjean, was called *Romain du Roi* and was reserved for the exclusive use of the Imprimerie Royale—the Royal Press. This cold, majestic script was first used in 1702.

The eighteenth century was an age of elegant typography in Britain. The typefounder William Caslon cut a highly legible typeface which is still in use today. *Caslon* was the typeface in which a Baltimore printer issued the official copies of the United States Declaration of Independence. Another English printer, John Baskerville, who taught calligraphy, designed a graceful, balanced typeface which revolutionized typography and is still popular.

In eighteenth-century France, Louis-René Luce, engraver to King Louis XV, introduced the rational spirit of the Enlightenment and the Encyclopedists into typographical experimentation, while Pierre-Simon Fournier and François-Ambroise Didot invented the point system of typographic measurement. Both Didot's son Firmin and Giambattista

ABC ABC
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Specimen letters of 2 typefaces designed in 18th-century Europe, *Baskerville* roman (far left) and *Didot* roman (left). With the creation of the typeface that bears his name, John Baskerville (1706-1775) made a major contribution to the development of English fine printing. Another important step towards modern typography was made in France, by Firmin Didot (1764-1836), whose typeface is a far cry from the flowing lines of earlier designs which were natural to pen or brush.

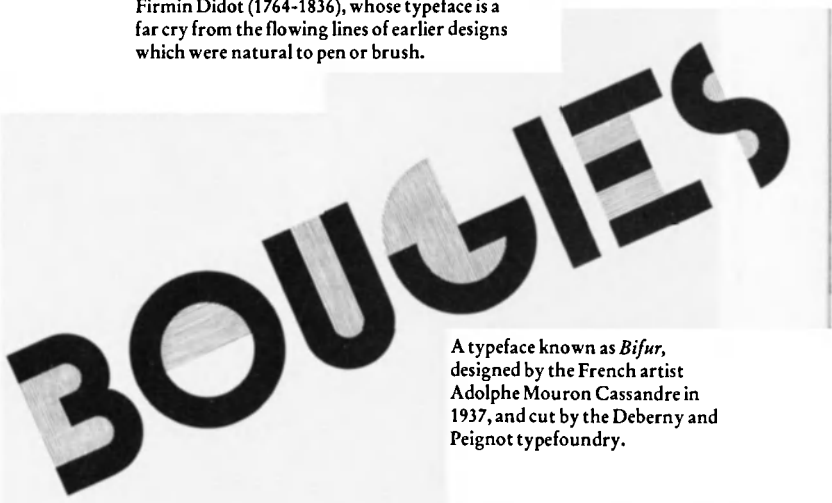
Bodoni of Parma were inspired by Baskerville's work to create very similar forms of austere lettering with strongly contrasting thick and thin strokes. Their work influenced nineteenth-century type design in several countries.

The development of lithography, a process of printing from a stone surface invented in 1796 by the dramatist Aloys Senefelder (see page 7), encouraged printing from types based on calligraphic script with fine, supple curves. From 1830 onwards, as a result of scientific and technical advances and the development of industry and trade, a dynamic form of typography came into being through the work of typefounders such as Alexandre de Berny and Théophile Beaudoire. *Egyptian,* with its slab serifs, and *Fat Face,* still widely used in the press and advertising, were highly fashionable typefaces.

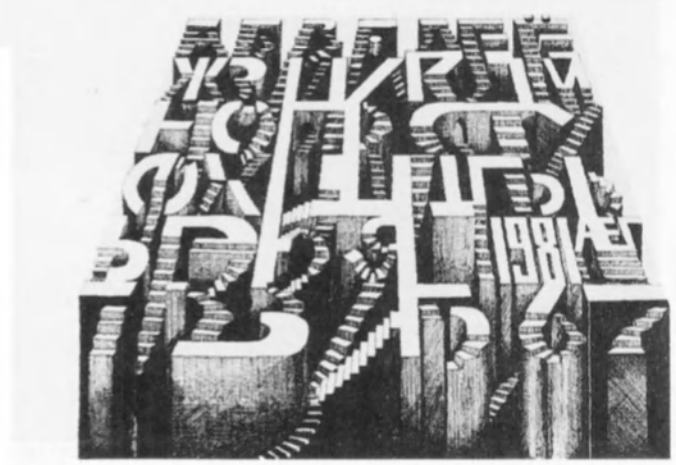
William Morris, the poet and writer who made a major contribution to the revival of English decorative art in the late nineteenth century, was the leader of the Arts and Crafts Movement which took inspiration from the styles of medieval times. The work produced by his Kelmscott Press had a strongly individual graphic personality and exercised wide influence. In France, George Auriol and the painter and engraver Eugène Grasset were among the masters of Art Nouveau. The latter received support from the typefounder Georges Peignot, who later, with his son Charles, produced a range of typefaces which would dominate printing until the advent of phototypesetting in 1956. *Peignot,* designed by the French poster artist Adolphe Mouron Cassandre in 1937, and *Bifur,* a shaded script of great originality, are among the finest typefaces cut by the Deberny and Peignot typefoundry.

Today, although computerization is widespread, there is a welcome revival of interest among young people in the art of calligraphy, which is encouraging the search for and creation of new designs. Outstanding modern designers of digitized letters include the great German calligrapher Hermann Zapf; Adrian Frutiger of Switzerland; Ladislas Mandel, José Mendoza, Albert Boton, all of France; as well as the young French designer of *Arin*, Franck Jalleau.

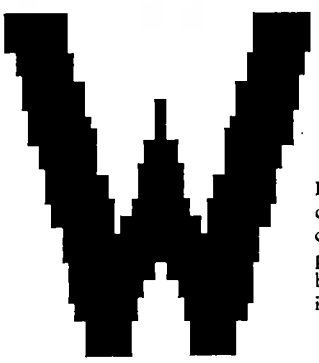
We are at the dawn of a new age of typography. Lettering is no longer created by lead objects but by strokes of light. Photocomposition systems can now provide higher screen resolution, allowing sharper definition of characters, as well as an immense variety of typefaces, offering great scope for creativity. Soon, these machines will achieve a degree of sensitivity close to that of handwriting, and will give typographers a degree of control over the design of lettering far superior to that of early electronic typesetting systems. But to safeguard an entire heritage of craftsmanship, metal type must not be allowed to disappear. ■



A typeface known as *Bifur,* designed by the French artist Adolphe Mouron Cassandre in 1937, and cut by the Deberny and Peignot typefoundry.

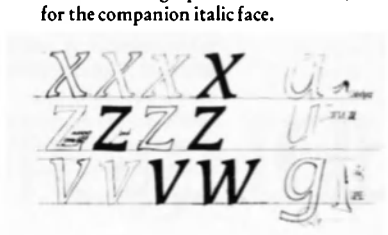


Above, *Labyrinth* (1981), a photographic print by Albertas Gurskas (born 1935), a graduate of the Lithuanian SSR Art Institute.



Enlargement of a letter "w", digitized for generation by computer. When the letter is printed at normal size, the "steps" become, or should become, invisible.

Letters from *Arin* roman (below right), a new computer typeface designed by Franck Jalleau, of France. The design, which won an award in an international typographical design competition held in 1987, moves away from the square outlines of early digitized type and returns to calligraphic sources. Below, a study for the companion italic face.



ABC
abc

ROGER DRUET, *a leading French typographer and calligrapher, has been professor of graphic design and the history of writing at the Ecole Supérieure des Arts Appliqués, in Paris, since 1960. He is the author of numerous studies on the art of writing in ancient and modern times, notably* La Civilisation de l'Ecriture *(1977).*

Posthumous portrait of Plantin by the great Flemish painter Peter Paul Rubens (1577-1640). It is now in the Plantin-Moretus Museum.

Photo © E.t. Felt, Antwerp

CHRISTOPHE

PLANTIN

The master-printer of Antwerp

BY FRANCINE DE NAVE

AaBbCcD

FRANCINE DE NAVE, *Belgian historian and palaeographer, is director of the Plantin-Moretus Museum in Antwerp and of the Antwerp Print-Room. She is the author of many books and articles on the history of Antwerp. A longer version of the present text has appeared in* Belgique, des Maisons et des Hommes, *published by Nouvelles Editions Vokaer, Brussels.*

CHRISTOPHE Plantin was born some time around the year 1520 in Saint-Avertin, near the French city of Tours, and served his apprenticeship with the bookbinder and bookseller Robert Macé in Caen. In 1549, after a brief stay in Paris, he moved to Antwerp, at that time the hub of Western European trade, and set up a bookbinding business.

Antwerp suited his purpose perfectly, as it was ideally situated to provide the equipment and raw materials necessary to set up a bindery. And since it was also a major financial centre, the capital necessary to create a business was readily available. In addition, it was a city which attracted wealthy art-lovers of all kinds.

Plantin had been in Antwerp for only a few years when, following a wound to his arm, he abandoned bookbinding in favour of printing. The publication in 1559 of a description of the magnificent funeral ceremony of the Holy Roman Emperor Charles V, by his son Philip II of Spain, established Plantin's reputation, and he quickly found himself at the head of what would prove to be the most important printing-house in Western Europe during the second half of the sixteenth century.

Between 1563 and 1567, Plantin printed and published over 200 titles, ranging from annotated pocket editions of the classics to liturgical works, Hebrew Bibles, richly illustrated anatomical treatises and botanical studies.

Now a man of substance, Plantin enjoyed great celebrity and was surrounded by a circle of influential friends and acquaintances, one of whom—Gabriel de Cayas, secretary to Philip II—was to play a decisive role in the further development of his affairs. It was Plantin's ambition to produce an authoritative edition of the Old and New Testaments; de Cayas secured financial backing for the project from the Spanish king, who also sent to Antwerp, to serve as its specialist editor, his chaplain—the humanist Benedictus Arias Montanus.

The undertaking, which took five years to complete (1568-1573), was an outstanding success: a copiously annotated edition of the Bible in four languages (Hebrew, Syriac, Greek and Latin), running to eight massive volumes in folio. This *Biblia Regia* or *Biblia Polyglotta*, as it was known, not only constituted a personal triumph for Plantin; it was also the most voluminous publication ever produced in the Netherlands by a single printer. Its appearance marked the beginning of the most prosperous period of Plantin's business.

Thanks to the success of the Polyglot Bible, and through the influence of Arias Montanus, Plantin, who had already obtained the office of *prototypus regius* (royal printer) from the Spanish monarch, was accorded a monopoly in the sale of missals and breviaries in Spain and its colonies overseas. The lands in question rapidly became

Frontispiece of Plantin's masterpiece, the 8-volume *Biblia Sacra* or *Polyglot Bible*, published in 4 languages (Latin, Greek, Hebrew and Syriac).

Photo © Rare Books and Special Collections Division, Library of Congress, Washington, D.C.

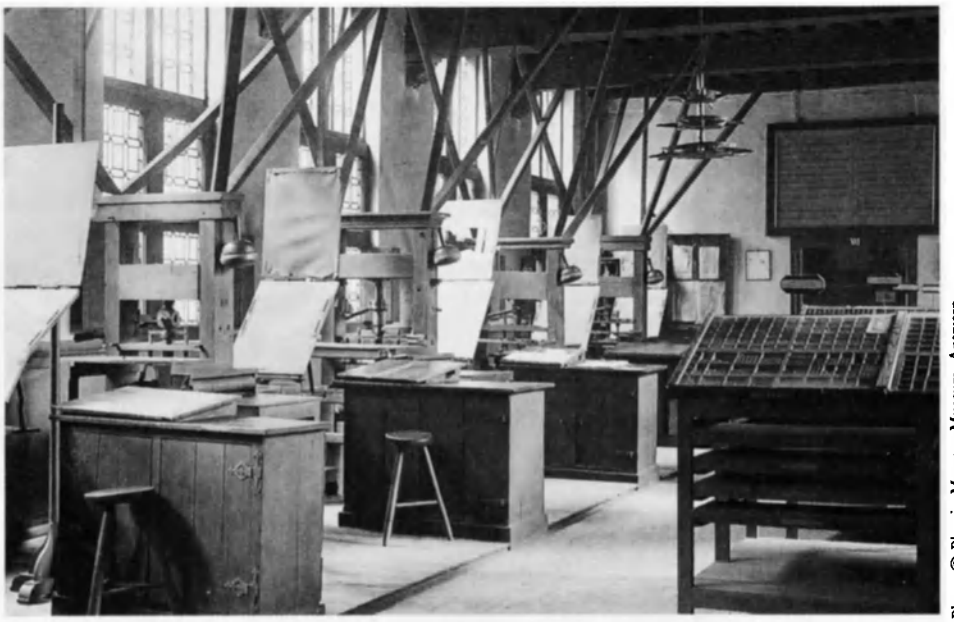


Photo © Plantin-Moretus Museum, Antwerp

Antwerp's Plantin-Moretus Museum is established on the premises of Christophe Plantin's printing office and residence. The 16th- and 17th-century printing works has been reconstructed in the museum (above).

his most important clients, and carried his fortunes to their zenith.

No fewer than sixteen presses were at work in Plantin's printing-house—an enormous figure when it is remembered that the biggest printer in France at the time, Estienne, was operating only four. The number of his employees confirmed Plantin's ascendancy: there were 54 staff living and working on the premises in 1574; with the addition of those who lived or worked at home the total must have been in the region of 150. Work went ahead at a feverish pace; 12- or 13-hour days were the norm. Each press had to meet a daily target of 1,250 printed sheets, or 2,500 pages. But the typesetters, printers and proof readers were by no means dissatisfied with their lot: they were pieceworkers, and a high output commanded excellent rates. Plantin's workers were among the best-paid in Antwerp.

Quantity was not, however, the sole concern. Plantin insisted on the highest quality as well. The paper mills of the southern Netherlands at the time produced only mediocre material, so he imported the finest paper from Germany, and more especially from France. The type used for printing his publications had to be perfect as well, and he called on the best typecutters of the age: Claude Garamond, Robert Grandjean, Guillaume Le Bé and Hendrick van de Keere, besides playing an important personal role in the development of typestyles in Western Europe by importing the roman and italic typefaces currently in use in France.

Concerned also with the quality of the illustrations, Plantin preferred to print them from engraved copper plates, which produced finer lines and more delicate tones than the wood blocks generally utilized. If the latter gradually fell out of favour for book illustrations, it was because of the success enjoyed by Plantin's publications.

Plantin was equally attentive to the content of his books. Despite his monopoly of the sale of liturgical works, his presses were not exclusively engaged in turning out missals, breviaries, antiphonaries,[1] diurnals, books of hours and psalters. He applied himself to publishing the most outstanding literary works of the post-humanist age: collections of the classics or of laws, principles and maxims; school books; the first edition of *Variarum lectionum libri III* by the Flemish humanist Justus Lipsius and *Origines Antwerpianae* by the physician Goropius Becanus in 1569; and, in 1574, the first dictionary of the Netherlandic language, the *Dictiunarium Teutonico-Latinum*, compiled at his request by his proof reader Cornelius Kiliaan.

Tragedy came to Antwerp in 1576, against the troubled background of the wars of religion in which the Low Countries were embroiled for much of the second half of the century. In what came to be known as the "Spanish Fury", mutinous bands of Spanish mercenaries sacked the city, massacring hundreds of its citizens, plundering and destroying everything in their path. Plantin's printing-house was spared, but its output was seriously affected. After the "Fury", Antwerp joined in the rebellion against Spanish absolutism. Trade with Spain, on which the prosperity of Plantin's enterprise had depended, fell into a decline. In 1578, only six presses were functioning; after 1583 there would never again be more than ten.

Under such circumstances, Plantin had little choice but to work with the Republican rebels. He was appointed official printer to the city of Antwerp, governed at the time by a Calvinist magistrate, and later became printer to the Duke of Anjou, French ally of William of Orange, the charismatic leader of the rebellion. The printing-house thus took on a new lease of life, and works of considerable importance were soon emerging once again from the presses.

Towards the end of 1582, Plantin had to face another turn in his fortunes. Spanish troops were threatening Antwerp, so he considered opening a branch office further north, to which, if necessary, his activities might be evacuated. He left Antwerp for Leiden, where his old friend Justus Lipsius, who was associated with the recently established Calvinist University, had obtained for him the franchise of the university press, then he worked for a time in Cologne, but by 1585 he had returned to Antwerp.

Four years remained to the master printer. The publication of the *Martyrologium Romanum* of Cardinal Baronius in 1589 was Christophe Plantin's last major undertaking. When he died, that same year, he left behind a vast enterprise, the printing-house he had created, which would survive him for another three hundred years. ■

1. Books of chant melody and text in the Roman Catholic Church. *Editor.*

The modern typeface known as *Plantin*, based on a design used by the Antwerp master-printer.

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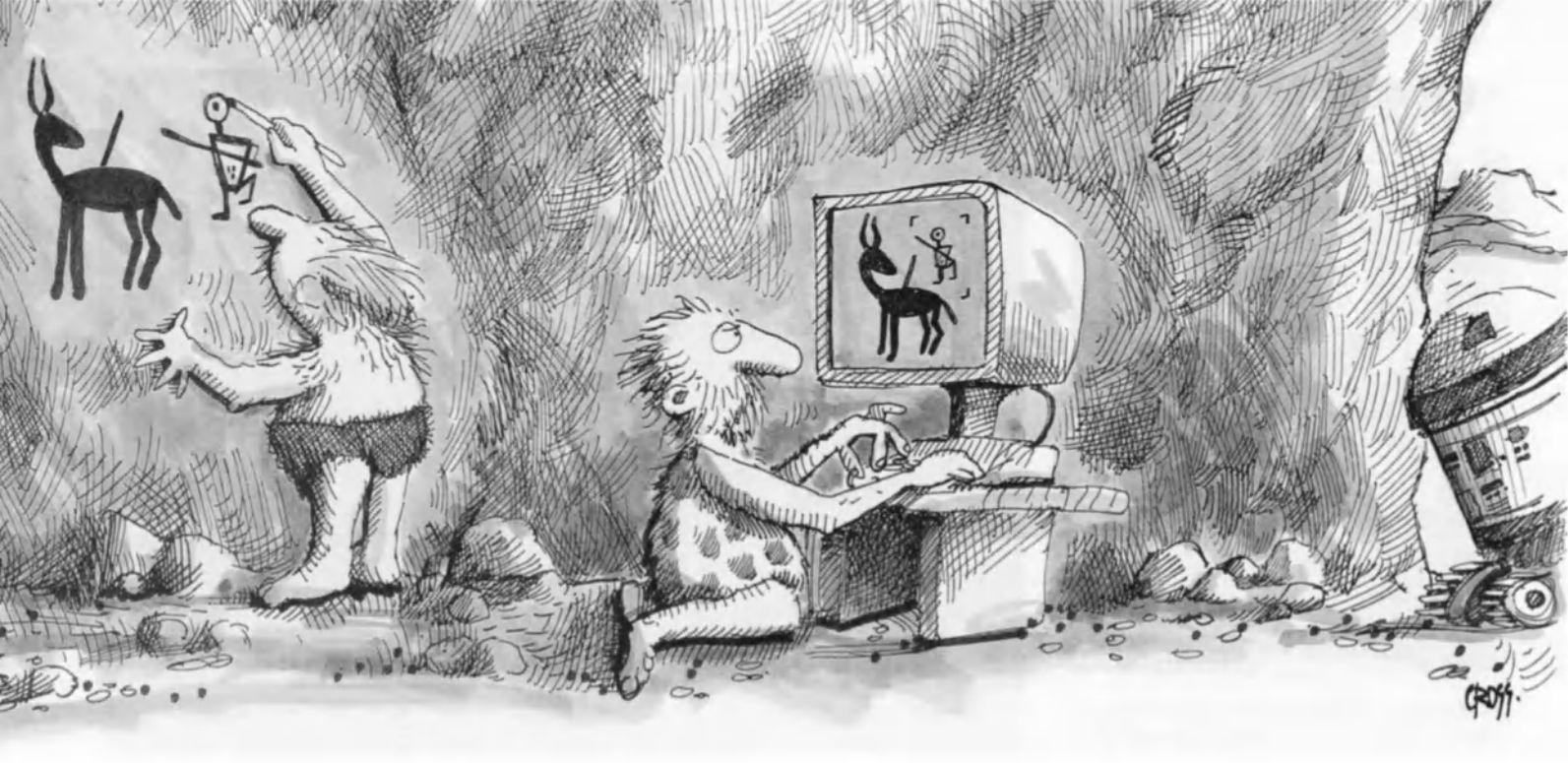


THE DESKTOP REVOLUTION

BY HOWARD BRABYN

One of the many possibilities offered by do-it-yourself electronic publishing systems using personal computers may be to help developing countries meet their needs for textbooks and other printed materials.

IN 1473, explaining the somewhat slipshod appearance of his latest publication, a printer of Parma in northern Italy declared that because rivals were about to bring out the same text, he had had to rush it through the printing process "faster than you can cook asparagus".

This colourful hyperbole bears eloquent witness to the astonishingly rapid spread of publishing in the second half of the fifteenth century. Barely twenty-five years after Johannes Gutenberg had originated his new method of printing (using movable metal type, a press and an oil-based printing ink), printing had spread to nearly all the major trading centres of Europe. In the first half of the fifteenth century the number of manuscript books in Europe could be counted in tens of thousands; by the year 1500, more than 9 million books had been printed.

The history of printing and publishing, like that of all human progress, is a record of the interplay between technological innovation and social change. Whilst each of these two streams of human activity promotes the other, with each in turn playing the leading role, the really crucial leaps ahead have always been made when the two converge to become an irresistible tide. Thus, whilst it was made technically possible by Gutenberg's discoveries, the development of printing in Europe, "The German Art" as it was at first called, was equally a response to the spread of literacy and to the social climate of the Early Renaissance.

The early printers were men of many talents. Not only did they design and cast their own typefaces, they also fulfilled the functions of publisher, editor, printer and bookseller. Only bookbinding and the manufacture of paper were left to others. William Caxton, for example, the first English printer, was an accomplished linguist and himself translated from the French the first book to be published in English, *The Recuyell of the Historyes of Troye* (1475), which he printed on the press he had established in Bruges.

One of the great early printer-publishers was the Venetian Aldus Manutius (1449-1515). In 1490, Aldus began producing the first printed editions of many of the Greek and Latin classics. Later he pioneered the production of cheap pocket editions, with what for those days were large print runs of 1,000 copies to keep down the cost, and commissioned the first italic typeface (see page 12). In 1502, he published Dante's *La Divina Commedia* on which his famous imprint, the anchor and dolphin, appeared for the first time.

As the demand for books and publications of every sort grew, the days of the great printer-publishers were numbered. The only way the book-hungry market could be supplied was by specialization and the division of labour. As a consequence the world of publishing gradually took on a new form, which has lasted until modern times, with the functions of author, publisher, printer, bookbinder and bookseller becoming separated.

Significantly, however, the name of Aldus Manutius has become associated with the current revolution in the publishing world, for Paul Brainerd, the man who in 1985 coined the phrase "desktop publishing", is president of the Aldus Corporation, the firm that produced one of the first programs capable of composing and formatting text merged

with graphics on a computer for subsequent output to the new generation of printing and typesetting machines.

What exactly is desktop publishing? Basically it is the application of personal computers to the entire range of the publishing process, from the typing in of the author's original copy to the final printing of the publication. It is a means of producing documents, complete with graphics, ranging from one-page information or advertising leaflets, through brochures and price lists, to newsletters, magazines and even books, on equipment which can comfortably be housed on a reasonably large desk.

The basic equipment, or "hardware", required consists of a computer, complete with a visual display unit (screen), a keyboard and a movement sensing device known as a mouse, an optical scanner and a laser printer. The programs, or "software", needed to operate the equipment consist of a "page description language" which translates the image on the computer screen into a set of digital instructions that the laser printer can follow, and a composition program to drive the entire system.

The advent of desktop publishing was as sudden as its social and economic implications were profound. As recently as 1970, the text sent by a publisher to a professional printer would be set in "hot metal" by methods not fundamentally different from those used by Gutenberg and Caxton some 500 years earlier. By 1985, typesetting to professional standards could be achieved in the office and in the home.

Five key technical advances made this possible:

- the development of a new generation of very powerful personal computers;
- the development of page description languages to drive laser printers and phototypesetters;
- the development of small, comparatively cheap laser printers with a printing resolution (300 dots per inch) capable of producing output of "publishable" quality;
- the development of composition languages to drive the whole desktop system which can easily be operated by users with very little knowledge of computers, typesetting or graphics;
- the development of scanning devices which can "read" photographs, drawings and previously typed or printed texts and feed them into a computer where they can be modified as required and incorporated into the document to be produced.

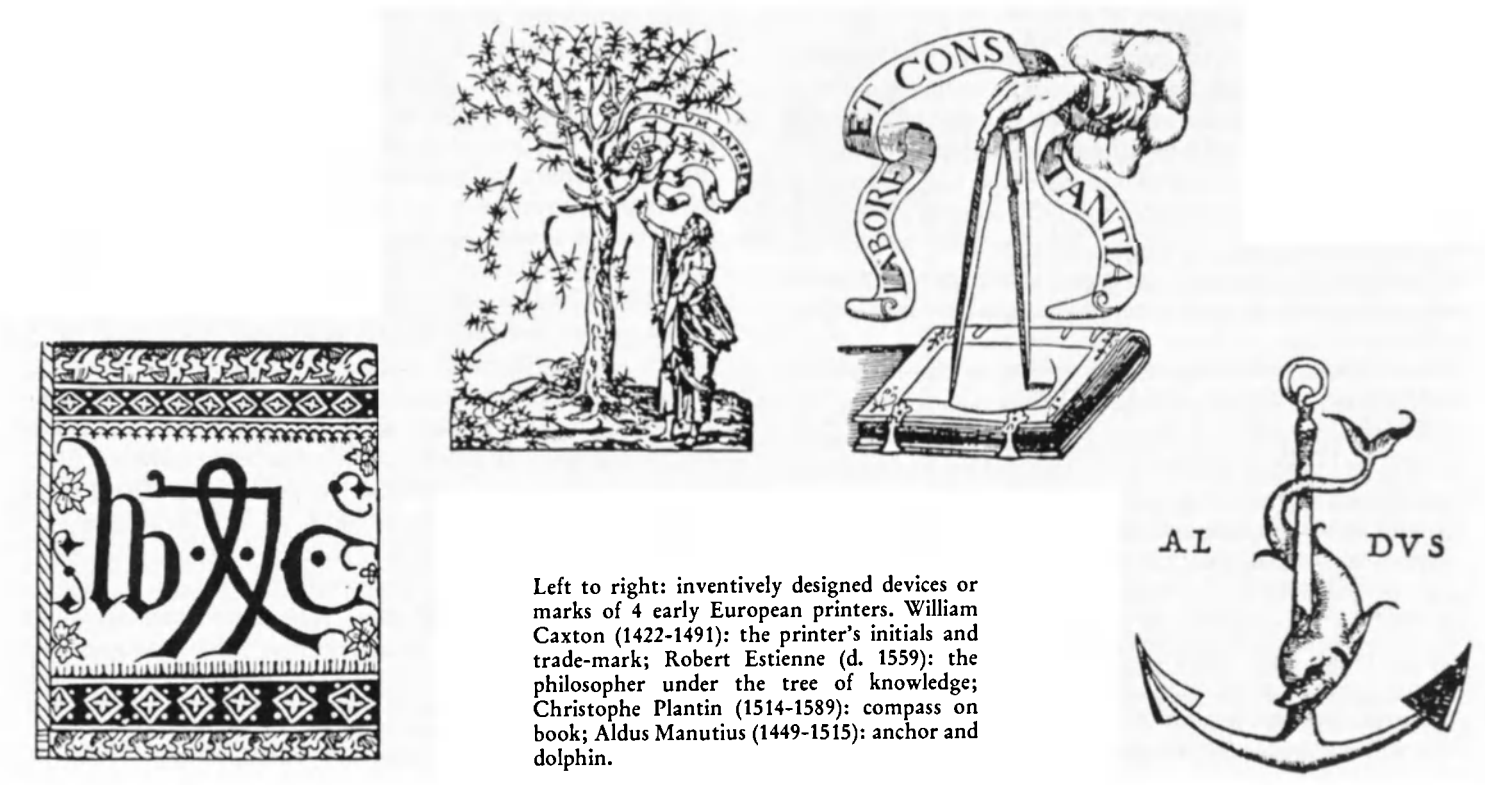
Coupled with the development of new manufacturing methods which have brought the price of this equipment tumbling down (it is now possible to buy a complete desktop publishing system for US $10,000 or less, and prices are still falling), these technical advances constitute a revolution of worldwide scope and importance.

Anyone who uses such equipment is, like Aldus Manutius and the early printer-publishers, in a position to control the entire publishing process, from initial selection of what is to be printed, through input of text and graphics, to final output of the printed page. Only rather rudimentary methods of bookbinding are available to the desktop publisher, however, and, as in the days of Aldus Manutius, quality bookbinding is likely, for the time being, to remain a separate domain.

Desktop publishing has swept away most of the barriers that for centuries have stood between those who want to publish and their potential readers. Composition programs and page description languages have replaced the craft skills of the printing process and handed back the choice of what is to be published to the author.

A good desktop publishing package will offer a wide choice of typeface styles and sizes, number of columns per page, justified or unjustified text, automatic hyphenation of words at the end of lines, insertion of graphics and automatic flow of text around them, as well as automatic page numbering and spelling checking.

There is nothing now to prevent the author of a specialist or minority interest book that no publisher will handle



Left to right: inventively designed devices or marks of 4 early European printers. William Caxton (1422-1491): the printer's initials and trade-mark; Robert Estienne (d. 1559): the philosopher under the tree of knowledge; Christophe Plantin (1514-1589): compass on book; Aldus Manutius (1449-1515): anchor and dolphin.

These pages from *Man Belongs to the Earth*, a new report on Unesco's Man and the Biosphere (MAB) Programme, were prepared for the press using the techniques of desktop publishing. The 175-page report, published in English, was written and compiled by Howard Brabyn and Malcolm Hadley.

Photo Unesco Courier

The basic equipment of a desktop publishing system: computer, visual display unit, keyboard, movement sensing device ("mouse"), and printer.

Photo Unesco

because it might not be profitable, or of a potential literary masterpiece whose merit is not immediately recognized, from publishing it himself.

Clearly, because of the problems of storing and handling the huge quantities of paper involved, the ordinary member of the public will not be in a position to print more than a few hundred copies of a brochure, a newsletter, or even a short book. Nor will he or she have the organization to distribute a daily newspaper or to handle sales of a book that turns out to be a best-seller. For the time being at least this will still be the domain of the major newspaper proprietors and the publishers with their well organized bookselling outlets.

Nor should it be forgotten that, despite the impressive functions that desktop publishing software has to offer, the layout and appearance of the printed page will depend upon the skill and taste of the operator. Many of the basic rules of good page design can be quickly learned, but these need to be complemented by flair and practical experience.

The wider social, political and economic implications of desktop publishing are equally profound. Censorship, whether by governments or by powerful interest groups, will be much more difficult if not impossible to impose. Minority groups will find it easier to make their voices heard and, with the development of electronic transmission, frontiers will no longer be effective barriers to information.

For the developing world the possibilities would appear to be enormous:

- It will no longer be necessary to fund the huge capital investment involved in setting up a traditional printing works and distribution network (a complete desktop publishing package can be bought for as little as a quarter of the cost of a single professional typesetting machine).
- A three-month training course in desktop publishing will replace the long and costly apprenticeship of the traditional print craftsmen.
- Costly distribution of books, newspapers, etc., over large areas, often with an inadequate or non-existent road and rail infrastructure, will be replaced by electronic transmission of the material to be published, in print-ready form for local printing.
- The cost of school textbooks will plummet as will the cost of revising and up-dating them. No wasteful stocks of unused books will be built up since it will be much easier to match local print runs to local demand.
- Each area will be able, where necessary, to modify textbooks to meet specific local needs.

The advantages are not limited to the developing world. The desktop publishing revolution may well lead to the creation of the first personalized, electronic newspapers which would be transmitted directly to the home or office for printing on a laser printer. Subscribers with home or office computers and printers could indicate those subjects that interest them most and these would be included in the personalized newspapers that would be transmitted to them at any time they cared to specify.

Charles Geschke, who with John Warnock pioneered one of the earliest and most widely used page description languages, recently declared: "One of my fantasies is to wake up in the morning and have my automated clippings service deliver me a sheaf of papers on my printer at home with exactly the kind of articles that I would be interested in."

Such fantasies may well soon become reality. Thanks to the desktop publishing revolution, news of what is happening anywhere in the world will soon be instantly available. Perhaps more important still, we will all one day have direct access to the accumulated sum of human knowledge and culture very much "faster than you can cook asparagus".■

HOWARD BRABYN, *of the United Kingdom, is a Paris-based writer and journalist with a special interest in the popularization of science. He was formerly editor of the English edition of the* Unesco Courier.

Unesco and the printed word

Over 8,000 titles have been published by Unesco or under its auspices in over 70 languages, since the founding of the Organization in 1946. Right, the latest edition of *Index translationum*, Unesco's annual guide to world translations.

■ The rural press in Africa

In Africa today only 15 out of every 1,000 people are reached by daily newspapers, and the use of the press as a medium of mass communication presents many problems, especially in the rural areas where 80 per cent of the population lives and where over 800 languages are spoken. And yet the printed media can play an important role by bridging the communications gap which prevents isolated farming communities from taking full part in national development programmes and by providing excellent follow-up materials in literacy teaching. For many years Unesco has co-operated with Member States in this field by helping to create rural newspapers, by training journalists and by providing other forms of technical support. One current undertaking, the West and Central Africa News Agencies Development Project (WANAD) based in Cotonou, Benin, is serving 13 national news agencies. As part of its activities WANAD, which was launched in 1984 by Unesco with finance from the Federal Republic of Germany, provides training for journalists in the fields of international relations, health, rural development and the environment. A sister project, SEANAD, was set up in 1986 in Southern and Eastern Africa. Above right, front pages of rural newspapers from 2 WANAD Member States: issue of *Kpodoga,* published in the Ewe language by the Institute of Adult Education of the University of Ghana; special International Literacy Day (8 September 1987) issue of *Tew Fema,* published in the Kabyie language of Togo.

■ Practical training for publishers

As part of its efforts to stimulate book publishing in the developing world, Unesco has organized a number of regional training courses for publishing personnel in Asia and the Pacific, Latin America, Africa and the Caribbean. Over 200 people attended these courses in 1986 and 1987. During a 6-week course jointly undertaken by Unesco and the University of the Philippines Institute of Mass Communication in December 1987, participants were divided into 3 teams, each of which was given a manuscript about rice and asked to prepare it for publication as an illustrated booklet. Each team had to edit the manuscript, prepare it for typesetting, correct proofs, lay out the text, design the cover, and write publicity material. Left, the booklets produced by the 3 teams.

■ Children's books in Asia and the Pacific

Launched in 1970 by the Tokyo-based Asian Cultural Centre for Unesco, the Asian/Pacific Copublication Programme (ACP) is a venture designed to provide children in countries of Asia and the Pacific with reasonably priced illustrated books. Good stories and illustrations by authors and artists from different countries are selected and published in an English version. Participating countries use this master edition (as well as films of the colour illustrations, which are also provided free) to produce editions in their own languages. ACP books have so far been translated into some 27 Asian languages and more than 2.5 million copies have been printed. Right, illustration from *Folk Tales from Asia for Children Everywhere* (Book 6).

■ Book development in Latin America

The Regional Centre for Book Development in Latin America and the Caribbean (CERLALC) was founded in Bogotá in 1971 by an agreement between Unesco and the Government of Colombia. Participating countries today are Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, the Dominican Republic, Ecuador, El Salvador, Nicaragua, Panama, Paraguay, Spain and Venezuela. The Centre aims to promote the production and distribution of books and to encourage the reading habit, taking account of development programmes as well as the public and school library systems in each country. In addition to the professional training courses which CERLALC organizes for publishing personnel, it has launched a copublication programme of children's books for Latin America. The aim is to publish good-quality children's literature at low prices by sharing the production costs between all the participating countries. The first title to be published was "Tales, Myths and Legends for Latin-American Children", in an edition of 20,000 copies (above left, cover of the Portuguese version). Today publishers from 15 countries are taking part in the programme, and 6 titles have been published, totalling (with reprints) 332,000 copies.

Computerized typesetting in China

BY XU LIAN-SHENG

THE technique of printing using movable type was invented by Bi Sheng in China between 1041 and 1048 and not, as is widely believed, by Johannes Gutenberg in fifteenth-century Europe. The type used by Bi Sheng was made of earthenware, but in later times in China it became common to use wood, enamelware or metal. With the development of movable lead type, "hot metal" came to be used all over the world for the mass production of printed works.

The low cost of setting lead type, which could be melted down after printing so that the same metal was used over and over again, made this technique the mainstay of the printing industry for centuries. With the rapid progress of photocomposition, however, and especially the computerization of typesetting in recent years, movable lead type has inevitably become obsolete.

In China, setting movable type has always been a complex and exhausting job because of the huge number of characters in the Chinese language. A typesetter has to walk between five or six cases of type and reach high and low in order to find and retrieve the required pieces.

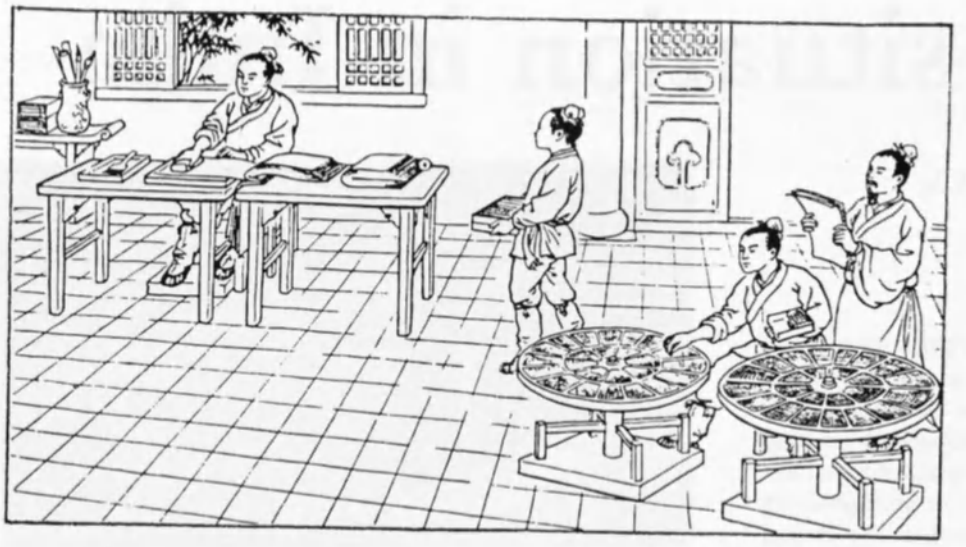
A modern version of this problem arises with computerized typesetting. A regular keyboard will suffice for entering into the computer all the letters of Western languages, but has far too few keys to enter the thousands of Chinese characters.

Two methods can be used to solve the problem. One is to make a large keyboard with each key representing a Chinese character, the finding and entering of which are done by an operator. The advantage of this method is that the operator can see the character to be keyed in. The disadvantage is that the keyboard has to be very large and the arrangement of the keys is extremely complicated. The operator takes a long time to learn by heart the position of each character, and searching among the mass of keys is a laborious task.

The other method is to use a keyboard the same size as that of a Western-language computer and enter each Chinese character by striking more than one key in a certain pattern which reflects the construction of that character. A number of systems have been developed in accordance with this principle; they all make use of either the vocal or the written features of a given character.

An operator using the vocal method has to transliterate the characters into the Chinese Phonetic Alphabet and then key in the letters. For instance, to enter the word *China*, which has two characters, the operator strikes the letters making up the words "Zhong Guo" (the phonetic pronunciation of the word). The advantage of this method

XU LIAN-SHENG, *of China, is deputy director of the Photosetting Centre of the China Research Institute of Printing Science and Technology. He also played a leading part in the design of China's KY Microcomputer Photosetting System.*



Drawing of Wang Chen's movable wooden type printing process, developed in the late 13th century, some 250 years after Bi Sheng's invention of movable type. Right, a compositor typesetting with characters ingeniously arranged in revolving typecases to enable rapid retrieval. Left, brushing the back of a sheet of paper to take an impression from the inked printing block.

Illustration from *Science and Civilisation in China*, Vol 5, Part 1, by Tsien Tsuen-Hsuin and Joseph Needham © Cambridge University Press, 1985

An operator working on one of the first computerized typesetters for the Chinese language, the KY Microcomputer Photosetting System developed at the China Research Institute of Printing Science and Technology.

Photo © Xu Lian-Sheng/Chinese edition of the *Unesco Courier*, Beijing

◀ Cases of metal type in the composing room of a daily newspaper in China. The Chinese writing system, which is ideographic rather than alphabetic, uses several thousand characters.

Photo Gosset © Sygma, Paris

A Chinese typewriter. The tray contains some 2,500 characters individually cast in lead and arranged face up. Above is a sheet of paper on a roller, and the typing mechanism, which is moved into position above the required character. The operator then pushes a lever which lifts the character out of the tray and forces it against the inked ribbon. ▶

Photo Unesco/Georges Servat

Below, Chinese ideograms printed using modern metal type, in different typestyles and sizes. Bottom, the basic elements of Chinese script, from which all ideograms are constructed.

Illustration from *Science and Civilisation in China*, Vol 5, Part 1, by Tsien Tsuen-Hsuin and Joseph Needham © Cambridge University Press, 1985

is that anyone who knows the correct pronunciation of the character to be keyed in can operate the machine without previous training. The disadvantage lies in the high rate of duplicated codes due to the fact that there are so many homophones in Chinese.

Various methods of text input make use of written features. All Chinese characters can be broken down into basic structural components, which are few in number. If these components are properly arranged on a keyboard, any Chinese character can be keyed in by grouping them. For example, the word 国 (country) is composed of 玉 and 口. Both the number of key strokes needed to enter a character and the rate of possible duplicated codes can be reduced to a fairly low level if the breakdown of the components is correct. Furthermore, the operator does not need to know how to pronounce the character. This method is clearly useful since there are so many local dialects in China that sometimes people who live fifteen kilometres apart cannot understand each other.

One practice commonly used to increase operating speed is the word-group method, whereby the operator strikes a single key to enter a frequently used word or phrase.

Another problem is that Chinese text may be set either vertically or horizontally (in some magazines articles are set both ways), and a good composing system must be capable of meeting these requirements. What is more, a number of Chinese magazines publish articles containing words or passages in foreign languages, and so we also need a system which can set Western language texts as well as those in Chinese.

With regard to output—the generation by the computer of text in the required format—the biggest problem is how to cope with the mass of data involved in processing a huge number of characters each of which, for the computer, has an information content many times higher than that of an English letter. Various methods have thus been devised for compressing this information into abridged form so as to take up less of the computer's memory. This is an area in which there is a need for further study and development.

Computerized typesetting in the Chinese language has already made remarkable progress and, as it comes to replace metal typesetting, will surely play an increasingly important role in the Chinese printing industry. ■

The book situation in India

BY LOKENATH BHATTACHARYA

INDIA, which publishes about 20,000 titles annually, is the eighth largest book producing country in the world. With a healthy climate for authorship, democratic policies and institutions, increasingly well-equipped printing plants, availability of locally produced paper, editorial expertise, a functioning network of distribution and a growing community of readers, the country also has the largest publishing infrastructure in the developing world.

According to a survey of the Indian book industry carried out by the National Council of Applied Economic Research, there are some 3,000 active publishers in India, including about 100 large firms bringing out a minimum of 50 titles per year. Educational publishing occupies the most prominent place. Although the great bulk of publishing is in private hands, about 450 agencies in the public sector are also active in this field. In fact, the central government has emerged as India's largest single publishing agency, and now accounts for about 20 per cent of the country's book production.

The problems of authorship and publishing in India should be seen against a background of enormous linguistic and ethnic diversity. Fifteen major languages are recognized by the Constitution as national languages. They are, alphabetically, Assamese, Bengali, Gujarati, Hindi, Kannada, Kashmiri, Malayalam, Marathi, Oriya, Punjabi, Sanskrit, Sindhi, Tamil, Telugu and Urdu. All these are independent languages, not dialects or variations of another language, and most of them have quite extensive literatures of their own. Each is spoken by millions of people.

In addition to the major languages and a few others such as Dogri, Konkani, Maithili, Manipuri, Nepali and Rajasthani which, though not as important, are still spoken by large numbers of people, there are nearly 400 tribal mother tongues in India, most of them with no written literature at all. The problem of scripts, too, is almost as complex. The eleven major script systems, used in addition to the Perso-Arabic and Roman, are Nagari, Bengali, Assamese, Manipuri, Oriya, Telugu, Kannada, Tamil, Malayalam, Gujarati and Gurumukhi.

Then there is the oral tradition, the majestic presence of the spoken word, which even today is far from being superseded. "Talking" books, as opposed to written ones, are still a familiar sight. Wandering minstrels board a train or gather in village fairs, and keep an audience spellbound with what they recount or chant. Even to this day, busy marketplaces in cities like Calcutta undergo a magical transformation in the evening when groups of people assemble to listen to an episode of the *Ramayana* or the *Mahabharata*.

The following figures give some idea of literary activities in the major Indian languages, as well as works written in English by Indian authors. In one recent year, India produced a total of 21,265 titles—77 in Assamese, 1,302 in Bengali, 10,438 in English, 972 in Gujarati, 2,633 in Hindi, 306 in Kannada, 595 in Malayalam, 1,514 in Marathi, 322 in Oriya, 597 in Punjabi, 177 in Sanskrit, 910 in Tamil, 817 in Telugu, 352 in Urdu and 253 in other languages. Around 33 per cent of the total were literary works (except in the case of

LOKENATH BHATTACHARYA, *Bengali poet and essayist, is a former Director of the National Book Trust of India. He is the author of a Unesco publication,* Books and Reading in India, *and of* The Prose Poems of Lokenath Bhattacharya *(1972) and* The Drum of the Guru *(1979).*

Photo © Robert Taurines/CIRIC, Paris

English, in which creative writing is negligible in India). There is also the fact that less than 7 per cent of India's total population know an Indian language other than their own mother tongue although, since major language speakers are not solely confined to specific areas or towns, all the States and Union territories are multi-lingual.

Hindi, because of the numbers of people who speak it, has been declared the official language of the country and every effort is being made to promote its development and use at the national level. The yearly output of publishing in Hindi is second only to that in English.

Proficiency in English, instead of hindering the growth and richness of expression in all the major Indian languages, has significantly contributed to it. Today, India ranks as the world's third largest producer of books in English, after the United States of America and the United Kingdom.

The principal factors governing publishing activities in a country are its literacy rate, the size and nature of its educated population and—since textbooks and other allied supplementary reading material are the mainstay of the book trade, especially in a developing country—its educational policies and programmes. While literacy and reading habits are nowhere synonymous, literacy remains the first pre-requisite for the growth of a reading programme.

The last Indian census taken in 1981 shows the country's literacy rate to be about 37 per cent, registering an increase of nearly 7 per cent over the previous figures of 1971. This

◀ **Browsers at a New Delhi bookstall**

Typesetting by hand at the *Kerala Times* in the industrial town of Ernakulam in the State of Kerala, southwest India. According to the latest (1987) edition of Unesco's *Statistical Yearbook*, there were 1,334 daily newspapers in India in 1984, with an estimated total circulation of almost 15 million.

Photo © José Mayans/CIRIC, Paris

Photo © Carlos Freire, Paris

Engrossed in a book, a traveller waits for his train on Howrah station, Calcutta.

increase does not mean that there has been an appreciable fall in the number of illiterates in the country. On the contrary, due to a considerable expansion of population figures during the decade, India's illiterate population has increased by as many as 48 million.

This partly explains an apparent paradox. Despite the fact that India is one of the leading book producing countries, its per capita publishing figures remain far below the world average. Similarly, the consumption of books per person per year is as little as 32 pages in India, as against an average of 2,000 pages in the industrially advanced countries. As regards print-runs, the Indian average still lags far behind the international average—books in Indian languages rarely exceed a print-run of 1,000 copies, while those in English do rather better with print-runs of between 1,000 and 2,000 copies.

This notwithstanding, the progress achieved in recent years, especially since Independence, gives grounds for optimism about the future of printing and publishing in India.

Today, India's printing industry is on the threshold of a revolution as an increasing number of printers are switching from hand composition to mechanical or photographic typesetting with high-grade equipment. However, the overwhelming majority of printing presses operative in India are still letterpress, the rest being sheet-fed offset litho machines, mostly single colour. While much of this equipment is imported, India has now started to manufacture a wide variety of presses, offset as well as letterpress.

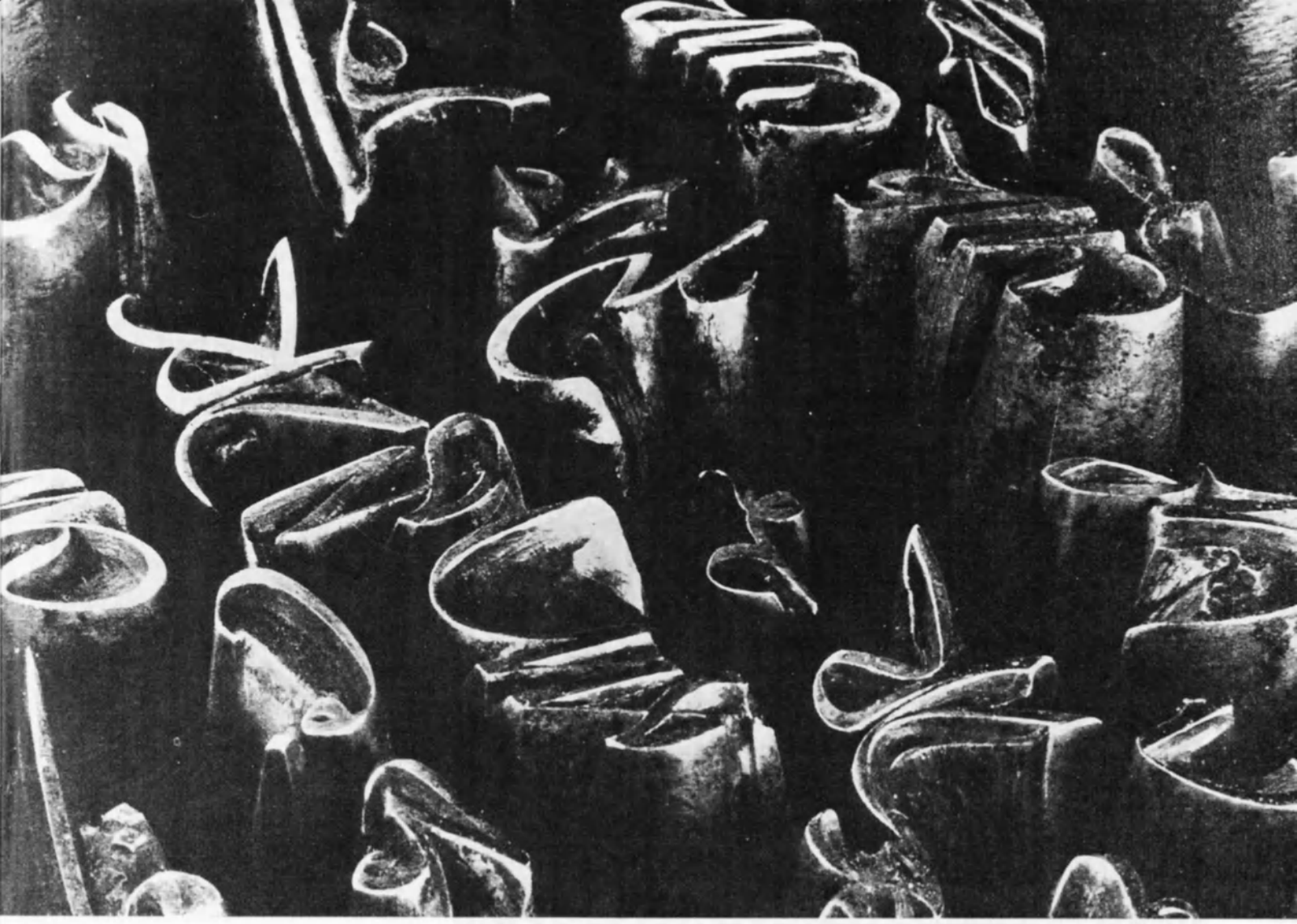
Considering that Gutenberg's epoch-making invention, introduced to India in 1557 by a Jesuit missionary, took only a little over a hundred years to reach the country in an age when communications were much slower than today, it seems likely that new technologies will take a fraction of that time to spread not only through the big towns, but to the rural areas. Already, desktop publishing is making inroads, with the introduction of personal computers and laser printers.

Moreover, publishing has been introduced as a course of study in several Indian universities, and there are in-service training facilities for editorial and production personnel. Various professional institutions, in the public as well as the private sectors, offer annual awards and other material benefits to encourage good writing and excellence in printing. Book fairs and exhibitions are now held all over the country, and increasing numbers of books are being translated from one Indian language to another. ■

Photo © Imprimerie Nationale, Paris

Photo © Carlos Freire, Paris

Magazines pour from the press at a modern printing plant at Faridabad, 40 km south of Delhi. According to Unesco's *Statistical Yearbook*, India consumed 388,000 tonnes of newsprint, printing and writing paper in 1984, more than twice as much as in 1970.



First impressions

Arabic early printed texts

BY CAMILLE ABOUSSOUAN

Above, early 17th-century punches for making Arabic type, designed by Lebanese craftsmen at the Maronite College of Rome. They were brought to France in 1614 by the French diplomat and ambassador to Rome, François Savary de Brèves, who intended to set up an "Oriental Languages Printing House", and are today preserved in the Imprimerie Nationale, Paris.

ARABIC characters made their first appearance in a printed book in 1486, when a Dominican monk named Martin Roth printed at Erhard Reuwich's workshop in Mainz the famous account of the "Voyage and Pilgrimage Overseas to the Holy Sepulchre of the Holy City of Jerusalem, written and recorded in Latin by Bernhard von Breydenbach". In this original work, the narrative is interwoven with novel descriptions of scenes from urban life. Erhard Reuwich is thought to have drawn and engraved the plates in this book, which contains the first example of a complete Arabic alphabet in a printed work, together with a Latin transliteration, a map of Jerusalem and a charming engraving showing Lebanese, dubbed Syrians, in a vineyard, and wearing magnificent turbans.

This, however, was only the reproduction of an Arabic alphabet. It was not until the reconquest of Granada several years later that the need for a printed Arabic text arose in Europe. In 1492, the last Muslim kingdom of Andalusia fell to the Spanish Catholic sovereigns Ferdinand and Isabella,

CAMILLE ABOUSSOUAN, *Lebanese writer and diplomat, was formerly his country's permanent delegate to Unesco and vice-chairman of Unesco's Executive Board. A bibliophile specializing in works of the 16th, 17th and 18th centuries, he is the author of many studies on the history of Lebanon and the Near East. This article is an abridged version of an essay which appeared in* Le livre et le Liban jusqu'à 1900, *a work published under Mr. Aboussouan's direction to accompany an exhibition, held at Unesco's Paris HQ in 1982, on the history of the book in Lebanon.*

Left, title page of the polyglot Psalter, in Latin, Hebrew, Greek, Arabic and Chaldean (a form of Syriac), published by the Genoese Oriental scholar, Agostino Giustiniani, in 1516. Below, this flowered "aleph" (the first letter in the Arabic alphabet) from the Psalter is one of the first ornamental letters in Arabic printing.

Photos from *Le livre et le Liban*, Unesco/AGECOOP, Paris, 1982

The Arabic alphabet from "The art of learning the rudiments of the Arabic language" (1505), a textbook by the Spanish scholar Pedro de Alcalá. Each Arabic character is transcribed into the Latin alphabet, which is printed in a Gothic typeface. ▶

The printing works of the University of St. Joseph has been Beirut's biggest since it was established in the 19th century. Below, as depicted in an old engraving.

Medal struck by the Paris Mint to commemorate an exhibition on the history of the book in Lebanon, held at Unesco's Paris HQ in 1982. The medal depicts the monastery of St. Anthony at Qazhayya, in Lebanon, where the first printing establishment in the Arab world was founded around 1610. Photo © Paris Mint

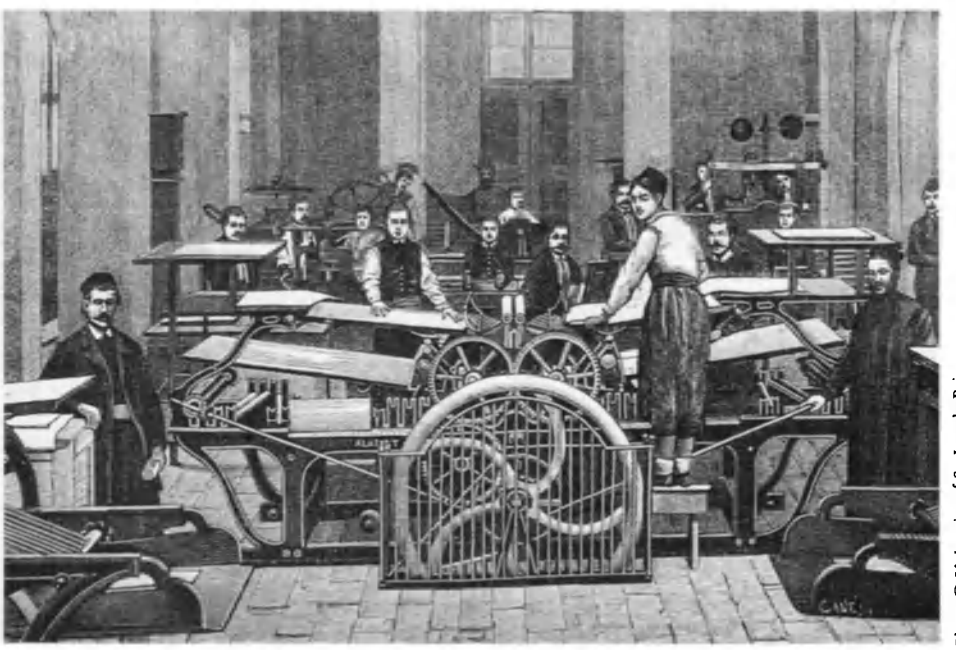


Photo © University of St. Joseph, Beirut

Photo from *Le livre et le Liban*, Unesco/AGECOOP, Paris, 1982

who had by their marriage united the two powerful kingdoms of Aragon and Castile. Anxious to bring the Andalusians back to Christianity, the Spanish rulers ordered missionaries to evangelize the country again. It soon became apparent that this goal could not be attained without using the Arabic language. In 1505, Archbishop Fernando de Talavera, the first prelate appointed to the new diocese, had two Arabic textbooks printed for use by missionaries who could not speak that language. The title of the first was: *Arte para ligeramente saber la lengua araviga* ("The art of learning the rudiments of the Arabic language"); that of the second: *Vocabulista aravigo en letra castellana* ("Arab glossary in Castilian characters"). Their author, the scholar Pedro de Alcalá, a native of the prestigious university city of Alcalá de Henares near Madrid, wrote them in Latin script. The typeface is Gothic.

The first twenty-one pages of the *Arte* are given over to grammar, and the next twenty-seven consist of Catholic prayers in Arabic, instructions for confession in Spanish and in Arabic, the ordinary of the mass, and instructions for votive masses, all in Arabic. By way of introduction to the vocabulary, a short three-page note explains the author's method of transcription: the vocabulary is in alphabetical order, but under each letter three separate categories contain first verbs, then nouns and lastly adverbs, conjunctions and prepositions. The verbs are given in three forms: present, perfect and imperative; nouns are given in both the singular and the plural.

This work, which is a curiosity in the history of both linguistics and typography, is also the first and perhaps the most practical of all attempts to transcribe Arabic into Latin characters. The alphabet on the twentieth page is in north African script, and the language taught in both of Pedro de Alcalá's works is the vernacular, which the Spanish missionaries needed to communicate with the converted Moors. In a few places, the author indicates differences between this and the written language.

As in Breydenbach's book, the Arabic alphabet is thus reproduced, together with its Latin pronunciation, but it is transcribed from the Maghrebian calligraphy also found in Agostino Giustiniani's magnificent *Psalterium Hebraeum, Graecum, Arabicum, et Chaldaicum,* the first polyglot Psalter, which was published in 1516 at Genoa (then a major printing and paper manufacturing centre) in five languages: Hebrew, Greek, Arabic, Chaldean (Syriac) and Latin.

Agostino Giustiniani (1479-1536) belonged to the Genoese branch of the Giustiniani, one of the great families of northern Italy. A Dominican who became the bishop of Nebbio in Corsica, he was a learned student of Oriental languages and a friend of great humanists such as Pico della Mirandola, Erasmus and Sir Thomas More.

Giustiniani was the author of an audacious project to publish a polyglot edition of the Bible in Hebrew, Greek, Arabic, Syriac and Latin, which would make known all existing versions of the Bible and enable them to be compared, while also serving as an instrument for studying these languages. He began with the Psalter, and when this was not a commercial success, the project was abandoned. Even so, it was a remarkable achievement for the time.

The preparation of this masterly work was an arduous task, as Giustiniani noted in his dedication to Pope Leo X, who had written the preface: "Our work has been long ...". This can easily be imagined. At that time no matrices or fonts of Arabic type existed; the alphabets in the books of Breydenbach and Pedro de Alcalá were printed from woodcuts, and there were few Hebrew typefaces. Moreover, the work had to be revised by several proof-readers with knowledge of at least three non-European languages.

It seems that Giustiniani had already ordered and transcribed the texts to be published as early as 1506. It is more than likely that the design and casting of the characters had been done long before the publication of the Psalter, which thus pushes back even further the creation of the first printed text in movable Arabic type.

The Arabic text alone occupies a forty-one-line column containing an average of 160 words per page for 246 pages. The two examples of initial letters in Arabic which appear in the book are very beautiful—a flowered "aleph" in a frame and a "tah" similarly adorned. These are certainly the first ornamental letters in Arabic printing.

In 1529, Master Geofroy Tory, a French typographer, engraver and author from Bourges, published his fine treatise on typography, the *Champfleury* (see page 11), in which he attacked the use of the Gothic typeface, and included an Arabic alphabet with a key to its pronunciation. Meanwhile, the German, Latin and Spanish editions of Breydenbach, and its French translation by Nicolas le Huen, regularly reproduced the Arabic alphabet of the 1486 edition, as did Sébastien Mamerot's work entitled "The journeys overseas of the noble Godefroy de Bouillon who was King of Jerusalem. Of the good King Saint Louis and of several virtuous princes", which was published in the late fifteenth century.

In 1538, the French humanist Guillaume Postel, who had accompanied the embassy sent by King François I to Constantinople, and who styled himself "The Cosmopolitan", or "Citizen of the World" as we should say nowadays, published his "Arabic Grammar" in Paris, the first of its kind to be printed. ■

«L'ENCYCLOPEDIE»

An eighteenth-century best-seller

AS soon as the first volume of the first edition of the supreme work of the Enlightenment, Diderot's *Encyclopédie*, reached the subscribers, in 1751, it became apparent to the authorities in France that the book was dangerous.

It did not merely provide information about everything from A to Z; it recorded knowledge according to philosophic principles expounded by d'Alembert, the co-editor, in his "Preliminary Discourse". Although he formally acknowledged the authority of the Church, d'Alembert made it clear that knowledge came from the senses and not from Rome or Revelation. The great ordering agent was reason, which combined sense data, working with the sister faculties of memory and imagination. Thus everything man knew derived from the world around him and the operations of his own mind.

The *Encyclopédie* made the point graphically, with an engraving of a tree of knowledge showing how all the arts and sciences grew out of the three mental faculties. Philosophy formed the trunk of the tree, while theology occupied a remote branch, next to black magic. Thus Diderot and d'Alembert presented their work as both a compilation of information and a manifestation of *philosophie*. They meant to merge those two aspects of the book, to make them seem like two sides of the same coin: Encyclopedism; and the men behind it became known not merely as collaborators but as Encyclopedists. Traditional learning, they implied, amounted to nothing but prejudice and superstition.

So beneath the bulk of the *Encyclopédie*'s twenty-eight folio volumes and the enormous variety of its 71,818 articles and 2,885 plates lay an epistemological shift that transformed the topography of everything known to man.

The *Encyclopédie* was a product of its time, of mid-eighteenth-century France, when writers could not discuss social and political questions openly, in contrast to the prerevolutionary era, when a tottering government permitted a good deal of frank discussion. The book's radical element did not come from any prophetic vision of the far-off French and industrial revolutions but from its attempt to map the world of knowledge according to new boundaries, determined by reason and reason alone. As its title page proclaimed, it claimed to be a "dictionnaire *raisonné* des sciences, des arts et des métiers"—that is, to measure all human activity by rational standards and so to provide a basis for rethinking the world.

Contemporaries had no difficulty in detecting the purpose of the book, which its authors acknowledged openly in key articles. Diderot and d'Alembert had laid out such pleasant paths through the arid expanses of knowledge that one could merely follow their lead, stopping now and then to enjoy the flowers along the way, and still have the satisfaction of belonging to the intellectual vanguard. One did not even have to read many other books, for the *Encyclopédie* was a library unto itself. The editors did not list the works that it rendered obsolete, but anyone who consulted its *Discours préliminaire* would have no difficulty in distinguishing between the heavy tomes of traditional learning and the streamlined, modern model. From the appearance of the first

volume in 1751 until the great crisis of 1759,[1] the *Encyclopédie* was denounced by defenders of the old orthodoxies and the Old Régime, by Jesuits, Jansenists, the General Assembly of the Clergy, the Parlement of Paris, the king's council, and the pope. The denunciations flew so thick and fast, in articles, pamphlets, and books as well as official edicts, that the *Encyclopédie* seemed doomed. But the publishers had invested a fortune in it, and they had powerful protectors, notably Chrétien-Guillaume de Lamoignon de Malesherbes, the liberal Directeur de la librairie, who superintended the book trade during the crucial years between 1750 and 1763.

The scandal continued to sizzle and spread as volumes 3 to 7 appeared and as skilful polemicists like Charles Palissot and Jacob-Nicolas Moreau fanned the flames on the side of the priests. On the other side, Voltaire loaned his pen and his prestige to the cause; and Diderot and d'Alembert found the ranks of their collaborators swelling with other illustrious writers, including most of the men who were beginning to be

BY ROBERT DARNTON

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Photo © Jean-Loup Charmet, Paris

Volumes from the 18th-century French *Encyclopédie, ou dictionnaire raisonné des sciences, des arts et des métiers* ("Encyclopedia, or Classified Dictionary of Sciences, Arts and Trades"), edited and published by Denis Diderot and Jean d'Alembert. The original large-format folio edition (1751-1772) consisted of 17 volumes of text and 11 volumes of plates.

identified as *philosophes:* Duclos, Toussaint, Rousseau, Turgot, Saint-Lambert, d'Holbach, Daubenton, Marmontel, Boulanger, Morellet, Quesnay, Damilaville, Naigeon, Jaucourt, and Grimm. They also claimed Montesquieu and Buffon, whose works they cited constantly, though it seems that neither wrote anything expressly for the *Encyclopédie.*

Nothing could have been better for business than the continued controversy and the volunteer corps of authors. The publishers had envisaged a first edition of 1,625 copies, but the subscriptions poured in so fast that they increased it three times, until it reached 4,255 copies in 1754.

The *Encyclopédie* became smaller in size and cheaper in price as it progressed from edition to edition.[2] While the format shrank from folio to quarto and octavo, the subscription price fell and the size of the print-runs increased. Having satisfied the "quality market", the publishers tried to reach a broader public by producing in quantity.

The "democratization" of the *Encyclopédie* had limits,

First page of the alphabetical entries in the first edition of the *Encyclopédie.*

ENCYCLOPÉDIE,

OU

DICTIONNAIRE RAISONNÉ DES SCIENCES,

DES ARTS ET DES MÉTIERS.

A A

Photo © Jean-Loup Charmet, Paris. Bibliothèque des Arts Décoratifs, Paris

Photo © Roger-Viollet, Paris

Plate from the *Encyclopédie* showing operations in the composing room of a printing shop. Top left, a compositor transfers metal type (such as the letter "S" and the different-sized blank spaces for separating words shown in 1) from typecase to composing stick (2) to make a line. Top centre, another compositor moves a line to a tray or "galley" of type where, with other lines (3) it forms part of a page. Top right, a third compositor has locked two pages of type inside a metal frame and is levelling the printing surface ready for the press.

however, because even the cheapest edition would have seemed expensive to the common people. The book remained beyond the purchasing power of peasants and artisans, even though some of them may have consulted it in *cabinets littéraires* (reading clubs).

Diderot and his collaborators had done their share of the work, but that was only the beginning of a long process which culminated around 1780 with the reproduction and distribution of their copy on a mass scale throughout Europe. The text that reached the general reading public, if not the masses, differed somewhat from theirs, however, because it, too, suffered from the strains of the production process.

In his prospectus for the quarto edition (1777-1779), Joseph Duplain, a Lyonnais bookseller who managed the enterprise, had promised not only to reprint the original text in its entirety but also to improve it in three ways: to correct its numerous typographical and factual errors; to add a great deal of new material; and to blend the four folio volumes of the *Supplément*[3] into it. He never intended to produce a literal copy of the first folio edition but rather to create a superior version of it—or at least to persuade the public that he had done so. The correcting, augmenting and blending would require a great deal of editorial work, so the contracts provided for a *rédacteur*. Duplain gave this job to the Abbé Jean-Antoine de Laserre, an Oratorian priest and a minor literary figure in Lyons. Laserre therefore became the successor of Diderot and the intermediary through which Diderot's text reached most of its readers in the eighteenth century.

For the most part he left the text alone, not because he respected it but because he did not have time to make changes. He worked at a furious pace, cutting out references to the eight volumes of plates that were not to be included in the quarto, attaching snippets from the *Suppléments* to the main body of the book by bits of his own prose, and reading over the final amalgam of printed and manuscript copy that was to be mailed out to the printers. As a half dozen printing shops were working on different volumes at the same time, he could hardly keep up with their demand for copy.

Having sent for copy, presses, type, ink, paper, ink-ball leathers, candles, quills, imposing stones, galleys, chases, and a hundred other articles, the printing shop needed men to put

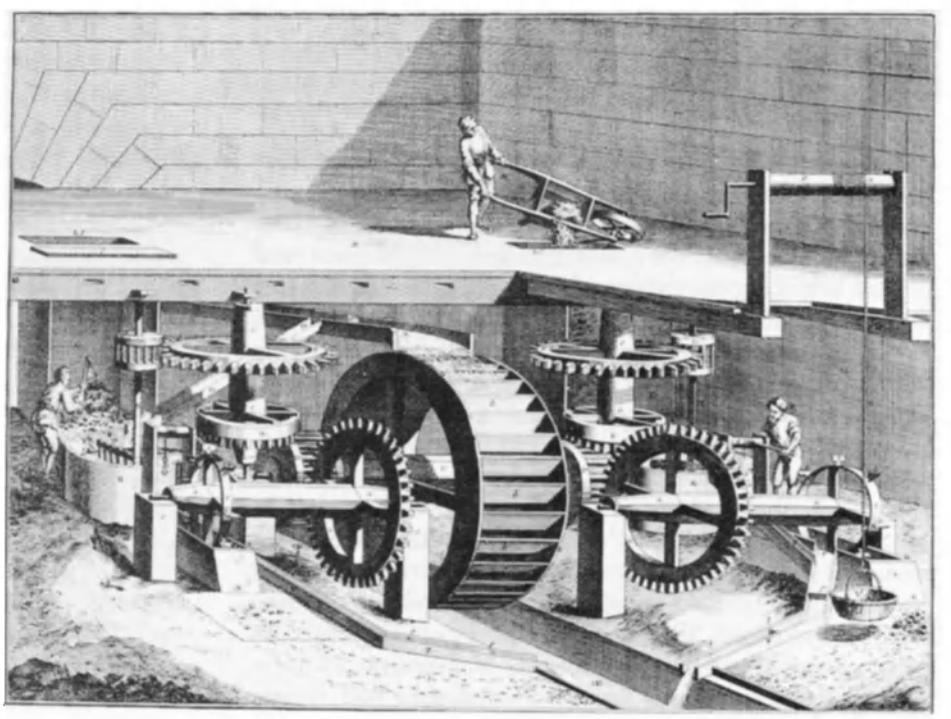
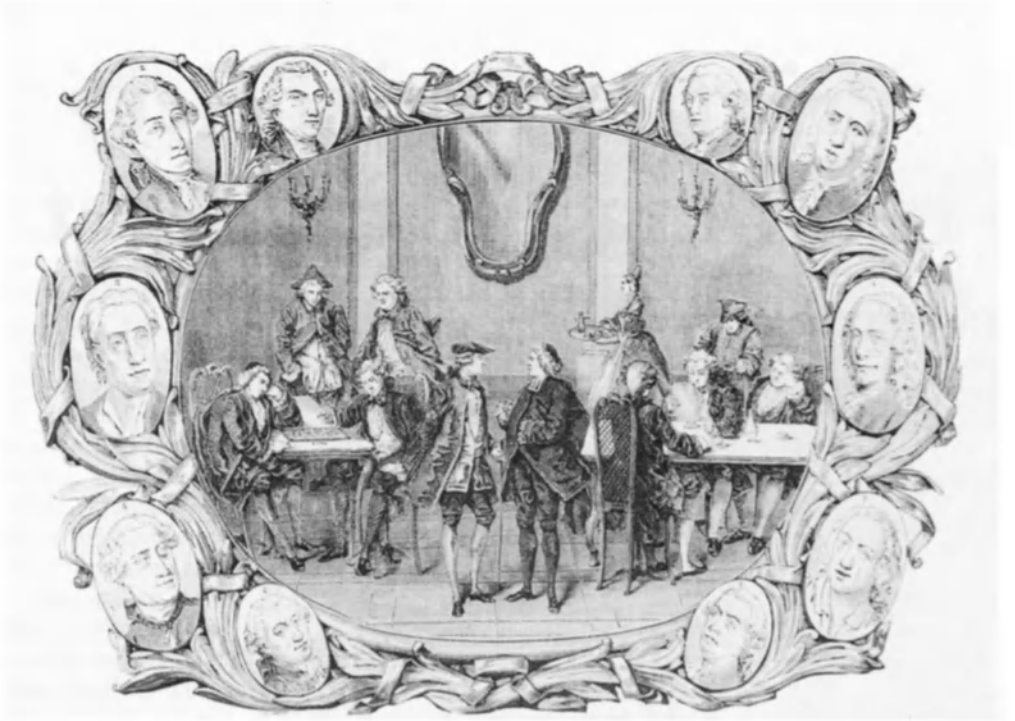


Photo © Diderot Foundation, Paris

Plate from the *Encyclopédie* showing machinery used to wash out impurities from iron ore.



Portraits of some of the "Encyclopedists" surround this scene in the Procope café in Paris, a well-known meeting place for literary figures. Anti-clockwise from top left: Buffon, Gilbert, Diderot, d'Alembert, Marmontel, Le Kain, Jean-Baptiste Rousseau, Voltaire, Piron and d'Holbach.

the matter in motion. It ordered the workers pretty much as it ordered the equipment and ran into the same problems of supply and demand. But it also had to cope with the peculiarities of printers as human beings. They had no notion of joining a firm. Instead, they worked by the job, coming and going according to the availability of tasks and their own inclination. For printing was a tramping trade. Men went where they could find work, even if they had to hike hundreds of kilometres. When work abounded, they sometimes changed jobs in order to collect travel money or simply by "caprice", as they put it. They came and went at a furious pace during the *Encyclopédie* boom, which sent repercussions throughout the migratory circuits of France, Switzerland, and parts of Germany, producing as much competition for workers as for paper.

Psychologically, nonstandardized work must have differed considerably from the kind of work that was then being imposed on the labouring classes in England. The pace of work in the factories was set by clocks and bells, by the opening and closing of gates, by fines and beatings, and ultimately by the production process itself; for later, in assembly-line production, the men were reduced to "hands", and work streamed past them in an endless, undifferentiated flow. The compositors and pressmen worked at their own pace. They exerted some control over their production.

Some mastery over the production process did not mean that the workers developed any special affection for the real masters of it. The *bourgeois* retained most of the power and manipulated it brutally, by hiring and firing, while the workers responded with the few devices at their disposal. Although they may have felt some pride in their craft, they took shortcuts and compromised on quality when it made labour easier. The results can be seen in any copy of the *Encyclopédie* today—clear, crisp typography for the most part, but margins askew here, pages misnumbered there, uneven register, unsightly spacing, typographical errors, and smudges—all of them testimony to the activity of anonymous artisans two centuries ago.

In the era of the handmade book there existed a typographical consciousness that disappeared sometime after the advent of automatic typesetting and printing. Like their forerunners of the Renaissance, the compositors of the *Encyclopédie* made lines by transferring type from cases to composing sticks; they made pages by moving lines from the composing sticks to galleys; and they made formes by imposing the pages in a chase. Compositorial practices could go no further in the direction of speed and efficiency until the introduction of mechanization, in the form of cold-metal typesetting machines during the 1820s, Linotype in the 1880s, and electronic composition today. Presswork, too, did not advance by any great leaps forward in technology before the adoption of the cylinder press from 1814 and steam power in the 1830s. The *Encyclopédie* was printed on the venerable common press, in essentially the same way that books had been printed for the previous two or three hundred years.

A whole world had to be set into motion to bring the book into being. Ragpickers, financiers, and philosophers all played a part in the making of a work whose corporeal existence corresponded to its intellectual message. As a physical object and as a vehicle of ideas, the *Encyclopédie* synthesized a thousand arts and sciences; it represented the Enlightenment, body and soul. ■

1. In January 1759, the procureur général of the Parlement of Paris warned that behind the *Encyclopédie* hovered a conspiracy to destroy religion and undermine the State. The Parlement promptly banned its sale and appointed a commission to investigate it. But authority over the printed word in France belonged to the king. On 8 March 1759, the Conseil d'Etat reaffirmed the king's authority by revoking the book's privilege and forbidding the publishers to continue it. The *Encyclopédie* went onto the Index librorum prohibitorum, the list of books banned by the Roman Catholic Church, on 5 March, 1759, and on 3 September Pope Clement XII warned all Catholics who owned it to have it burned by a priest or to face excommunication.

2. In addition to the six versions of Diderot's basic text (three reprints of the original folio edition, one quarto and one octavo edition), totalling almost 24,000 copies before 1789, there were two quite different works that used it as a point of departure: Félice's *Encyclopédie d'Yverdon*, printed between 1770 and 1780 at 1,600 copies, and Panckoucke's *Encyclopédie méthodique*, begun in 1782 at a print-run of approximately 5,000 copies.

3. The *Supplément*, in four folio volumes of text and one of plates, was published in Paris and Amsterdam in 1776 and 1777, in a print-run of 5,250 copies. It had no formal connection with the original *Encyclopédie* and involved a new group of contributors and publishers.

Printing and society in China and the West

BY TSIEN TSUEN-HSUIN

The invention of papermaking is traditionally attributed to Tshai Lun, a Chinese court official who developed the idea of forming a sheet of paper from the macerated bark of trees, hemp waste, and rags. In the 18th-century picture, above, Tshai Lun is shown surrounded by 4 attendants and with brushes and writing tools before him. In foreground are a pig and a chicken. According to legend these animals were the first to separate the wet paper sheets with snout or beak.

Illustration from *Science and Civilisation in China*, Vol 5, Part 1, by Tsien Tsuen-Hsuin and Joseph Needham © Cambridge University Press, 1985

Setting wooden movable type at the Imperial Printing Office of the Ch'ing court, around 1733.

Illustration from *Science and Civilisation in China*, Vol 5, Part 1, by Tsien Tsuen-Hsuin and Joseph Needham © Cambridge University Press, 1985

OF all the products from the ancient world, few can compare in significance with the Chinese inventions of paper and printing.

Paper was invented in China some time before the Christian era. From early in the second century AD its manufacture became improved, using new materials and superior techniques. By the third century it had become widely used in China itself and had begun to migrate across the Chinese borders; it reached the Western world only just prior to the modern age. Printing from wood blocks was first practised by the Chinese around 700 AD, and movable type was used several centuries earlier than Gutenberg. Even the indelible ink of lampblack, which has been manufactured in the West under the misnomer "Indian Ink", can be traced back to Antiquity in Chinese civilization. It was the introduction of these ingenious elements that made possible mass production of written records for wide circulation.

Paper was not invented expressly for writing, as has often been presumed. It was extensively used in China in the fine and decorative arts, at ceremonies and festivals, for business transactions and records, monetary credit and exchange, personal attire, household furnishings, sanitary and medical purposes, recreations and entertainments. It was not used for writing until perhaps early in the first century AD, and even then did not entirely replace the more cumbersome bamboo and wood slips as the chief materials for making books until the third century. But when it came, the use of paper enabled books to be cheaper and more portable, though their extensive production and wide distribution was not possible until the invention of printing.

There is a long history of pre-printing techniques in China, including the use of seals for stamping on clays and later on silk and paper, of stencils to duplicate designs on textiles and paper, and of the inked impressions taken from stone inscriptions. All these processes gradually led to more efficient methods of the mechanical multiplication of copies and to printing. Movable type was introduced by the middle of the eleventh century and multi-colour printing some time in or before the twelfth century. The movable type was first made of earthenware, but later various other materials, including wood, metal, and a variety of ceramics, were also adopted.

Because of the great number of characters in written Chinese, woodblock printing was used far more often than movable type for book production in China until recent times. Wood blocks were simpler and more economical, and could be stored easily and were readily available when a reprint was needed; movable type was preferred only for large-scale production of voluminous books. Nevertheless, both wood blocks and movable type have gradually given way, since the mid-nineteenth century, to the modern printing press.

The prerequisites for a useful invention included both the physical and the mental readiness for the event; besides a creative mind and a popular demand, proper materials and the essential basic techniques must be available. Since all the material facilities for the invention were present in Europe as well as in China, why did the invention occur in one civilization but not the other?

The early use of printing in China was chiefly due to the early invention of paper, the specialized use made of seals and rubbings for duplication, the greater need for mechanical aid in duplicating texts written in a complex ideographic script, the standardization of Confucian texts used for civil service examinations and, finally, the demand for great quantities of Buddhist scriptures which could not be met by hand-copying. In the West, paper was not introduced until a rather late date, seals were not used as duplication devices, rubbing was not known until fairly recently, while printers were restricted by craft unions or guilds. The relative simplicity of the alphabetic script also lessened the need for a mechanical duplication aid.

Thus the materials and techniques necessary for the invention of printing were either not developed, or did not lead in the direction of a printing process. Furthermore, there was no such incentive or demand for huge quantities of copies as devel-

oped in connection with Buddhism; the needs that did exist could be met by hand-copying. Until all these factors were changed in the middle of the fifteenth century, the threshold for the invention of printing was not reached in Western society.

Printing facilitated the economical mass production and distribution of books and had profound effects upon European thought and society in the late fifteenth and early sixteenth centuries. It stimulated the spirit of the Renaissance and the Reformation, which in its turn promoted further development of papermaking and printing until there was a flourishing publishing industry. It also helped to establish national languages and indigenous literature, and even to encourage nationalism itself; it popularized education, spread literacy, and increased the chances of social mobility. In short, almost everything in the progress of modern civilization can be linked in one way or another to the introduction and development of printing in the Western world.

Mass production of texts increased their chance of survival or preservation and reduced the probability of their loss through neglect or the destruction of single collections. But it did more than this. Wider distribution of texts and the enlargement of the reading public meant that the clergy's monopoly of learning was challenged by laymen, including lawyers, merchants, tradesmen, and artisans, who became important consumers of books. At the same time, the pride of place hitherto taken by religious works was gradually superseded by texts of humanist authors. With this increased readership and a broader spectrum of subjects, scholars became more aware of inconsistencies and contradictions in hallowed texts, weakening their faith in the validity of old views, and setting the stage for the advancement of new learning.

The standardization of texts resulting from printing stood in contrast to the corruption that was bound to be present in all hand-copied texts. The printing press does not guarantee freedom from textual errors, but the requirement for multiple proof-reading before sending to the press and the distribution of errata to correct mistakes after printing, paved the way for the improvement of future editions. The editorial functions of the early printers also brought about a degree of systematization of book format not to be found in the age of scribes, and this gradually created a habit of systematic thinking by readers, as well as promoting the organization of knowledge in many diverse fields.

For their part publishers naturally encouraged the growing use of the vernacular which brought an expanding market. As books became easier to publish in national languages, printing stabilized the vocabulary, grammar, structure, spelling, and punctuation of each, and, furthermore, promoted its use. Once fiction was printed and widely circulated, the common language became firmly established; this, in its turn, facilitated the eventual growth of specific national literatures and cultures.

The first portrayal of a Chinese bookshop can be seen in this detail from a 12th-century painting entitled "The Spring Festival on the River Bank".

The popularization of education and the spread of literacy were also closely related to the expansion of printing. As books became cheaper and easier to obtain, more people were able to gain access to the printed texts which eventually affected their outlook on the world and their position in it. And, naturally enough, easier access to printed material promoted the rise of literacy, which stimulated a still greater demand for more books.

In general, printing in Europe from the sixteenth century onwards was vigorously expanded, supporting many drastic and radical changes in thought and society. On the other hand, the progress of printing in China and other nations in East Asia was comparatively constant with modest changes occurring within a stable tradition. These diversities reflect the distinctive characters of Eastern and Western cultures, especially their attitudes towards material life.

Chinese society has long been dominated by the Confucian tradition, which concerns itself primarily with proper human relationships and social order by way of moral teachings and ethics, rather than with pursuance of material advance and extreme changes in society. The high degree of social and cultural stability over long periods in Chinese history, especially from the thirteenth to the nineteenth century, contrasts greatly with the constant turmoil of life and intellectual unrest during the same period in the West.

Such different environments in China and the West were certainly bound to affect the role of printing, and in this sense printing was not only shaped by the political and social conditions of the time; it also exerted an equal effect on those conditions. ■

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Glossary

blanket: the sheet of rubber or other flexible material used to cover the impression cylinder of an offset printing press.

block: an illustration, halftone or line art, as engraved in metal for letterpress printing.

carbon tissue: paper coated with gelatin that can be rendered photosensitive and exposed to light before being applied to a metal surface of any shape.

chase: in letterpress printing, a steel frame in which metal type and blocks are locked for printing or platemaking.

composing stick: in hand composition, a tool in which each line of type is assembled and justified.

composition: both the setting of type and the arranging of the type on the page. Some typesetting systems can set whole pages at a time, while on others each column of type must be set and the result assembled as a page.

composition program: a set of instructions for a computer-driven typesetter.

compositor: a person or company who sets type, also referred to as the typesetter.

continuous tone: an image that has greys or shades of colour, and which cannot be reproduced in that form by most printing methods, because the thickness of ink cannot be varied during printing. (See **halftone**.)

cursive: applied to flowing typefaces that resemble script handwriting, with connected strokes and curved lines.

cylinder or **flat-bed press:** a printing machine on which the type forme is carried on a flat bed under a revolving paper-bearing cylinder. (See **rotary press**.)

digital or **digitized** type: that which is drawn with the aid of a computer as steps on a grid, and stored as digital dot or line patterns, rather than as photographic images. If the dot or line density is high enough (see **resolution**), the result can look clean and crisp.

dot matrix printer: forms characters by firing a series of small needles at the printing ribbon, so transferring dots to the paper.

face or **typeface:** a complete set of letters and other characters in a particular design or style. Typefaces come in families of different weights (light, medium, bold), different point sizes, and different slants (roman, italic, other oblique).

font or **fount:** a complete set of the characters in one typeface and size.

forme or **form:** metal type and blocks for illustrations assembled in a chase and ready for printing or platemaking.

galley: a copy of typeset material arranged in columns instead of made up into pages. The term comes from the galley or tray of type and the copy of typeset material that was traditionally made by hand for use in proofreading before the press ran.

Gothic or **black-letter:** a general term for a family of typefaces with dark, angular characters made up of contrasting thick and thin strokes, developed in the late Middle Ages in Germany and the normal text type in Northern Europe in the early years of printing.

gravure or **intaglio:** any of various printing techniques using an etched or engraved plate.

halftone: an image that has been broken up into tiny dots, which when viewed from normal distances create the illusion of continuous tone.

hot metal: general term for typesetting machines casting type from molten metal. "Hot type" technologies are being increasingly replaced by "cold type", using photographic or electronic processes to create an image.

ink jet printer: forms characters by spraying a very fine stream of quick drying ink onto the material to be printed. Drops of ink are either electrostatically or thermally charged as they leave a tiny nozzle.

input: data entered into a computer.

integrated circuit: minute electrical circuits containing thousands of electronic components on a chip of silicon.

justify: in text composition, to space out lines uniformly to the desired length, so creating a straight-sided column of text, as here. **Unjustified** text has a ragged edge on one or both sides of the column.

laser printer: forms characters by depositing dots of carbon onto ordinary paper. A **laser typesetter** deposits points of light onto photographic paper. In each case, the characters which are output are made up of tiny dots.

layout: the conceptual arrangement of the text and illustrations on a page. (**Makeup** is the actual physical or electronic page assembly.)

letterpress: the primary form of printing, taking an impression on paper from an inked, raised (relief) printing surface.

line art: illustrations containing only blacks or whites, with no intermediate tones, which can be reproduced without a screening process in the same way as text.

lithography or **litho:** literally, "stonewriting"—printing from a dampened, flat surface using greasy ink, the principle being the mutual repulsion of oil and water. Originally the printing surface was a porous stone but later a metal plate was used.

lower case: the small (miniscule) letters in a font of type, so named from the lower compartments of typecases used in letterpress hand composition, where the most frequently used letters were kept. The capitals, or **upper case** letters, were kept in the upper compartments.

magazine: the case holding the matrices (moulds) on a typesetting machine.

matrix: the individual brass character moulds on a typesetting machine.

(micro)chip: a tiny slice of silicon with electronic circuits etched into it.

offset: the development of lithography by which the image is not printed direct from the plate but "offset" first onto a rubber-covered cylinder, which then performs the printing operation. (See **blanket**.)

output: data generated by computer in the required format.

photocomposition or **phototypesetting:** the production of printing copy, on film or paper, by photographic means.

plate: the metal, paper or plastic sheet containing the image to be placed on the printing press.

platen: a flat plate in a letterpress printing machine that presses the paper against the type forme.

platen press: a letterpress printing machine which presses two flat surfaces together to make the impression.

point: a measure of size used in layout and typesetting, most often used to indicate the size of type.

print-run: the number of copies of a publication to be printed.

program: a numbered list of instructions to make a computer do a particular job.

register: the correct alignment of the separate plates in colour printing.

resolution: in computers, the number of tiny squares on the screen which a particular system can control. The higher the resolution, the sharper the image, thus giving better quality type and graphics for printing purposes.

rotary press: a machine for printing from a revolving cylindrical forme, usually onto a continuous reel of paper.

rotogravure: a system of intaglio printing whereby ink contained in the cells of a printing cylinder are transferred to paper.

screening: to break up images that have continuous tones into patterns of tiny dots, with the darker tones represented by larger or denser dots. This can be done photographically, or electronically with a scanning machine. (See **halftone**.)

slug: a line of type or a blank line set on a typesetting machine.

software: computer programs, as opposed to **hardware**, or the machinery itself.

web: a continuous reel of paper, often used on printing machines instead of single sheets.

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1

2

3

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The *Unesco Courier* goes to press

At Unesco's Paris HQ

1. Editorial planning
2. Editing text on screen
3. Choosing illustrations
4. Page layout and cover design

At the printer's

5. Assembly of filmed pages for platemaking and printing
6. & 7. Making printing plate
8. Removing imperfections from plate
9. Offset press

5

6

7

8

9

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The Courier

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Incipit epistola sancti iheronimi ad
paulinum presbiterum de omnibus
diuine historie libris. capitulū primū.

FRater ambrosius
tua michi munus-
cula pferens. detulit
sil et suauissimas
lrãs. q̃ a principio
amiciciarum. fidē pba-
te iam fidei et ueteris amicicie noua:
pferebant. Uera enim illa necessitudo ē.
et xpi glutino copulata. q̃m non utili-
tas rei familiaris. nō pñcia tantum
corporum. nō subdola et palpans adulacō.
sed dei timor. et diuinarum scripturarū
studia conciliant. Legimus in ueteribus
historiis. quosdā lustrasse puincias.
nouos adiisse pplos. maria trāsisse.
ut eos quos ex libris nouerant: corā
q̃ uiderent. Sicut pitagoras memphi-
ticos uates. sic plato egiptū. et architā