

Key Historical Developments in Printing Technology

105 AD **Paper**

Its invention is attributed to Ts'ai-Lun, a member of the Chinese Han emperor's court. The word paper is derived from papyrus, which had been made for thousands of years from thin strips of the marsh plant of the same name, pressed together and dried.

True paper, unlike papyrus, is made by breaking down any fibrous plant material into loose fibers, which are then mixed in water in a large vat. A fine screen is submerged and then raised to capture a thin layer of fibers, which is then dried, making a sheet of paper.

Paper is most often made from wood, cotton or flax, but can be made from many sources.

4th-7th c. **Block printing**

Printmaking methods for text were also developed in China. The plate for an entire page would be made from a block of wood by pressing a hand-lettered page to its surface to leave character marks in ink and then carving out the surface around the characters. The remaining raised surfaces would then be inked and a piece of paper pressed onto it. This type of printing is called **xylography**, or relief printing. It is also referred to as **letterpress**.

1040-1275 **Moveable type**

In 1040, another Chinese man named Pi Sheng created a moveable type press by making individual characters out of clay and gluing them together to form the printing plate. Wooden character slugs were made by Wang Zhen in 1275.

Although this innovation saved considerable time carving the plates, it didn't bring about wide distribution of reading materials, partly for cultural reasons and partly because of the nature of the Chinese language, which has thousands of characters each representing a word—rather than needing only 26 letters as in Western languages, a Chinese printmaker needed thousands of character slugs to assemble a printing plate.

1452 **Gutenberg's press**

Johannes Gutenberg is credited with the invention of the moveable type press in Germany around this date. Although he lost the press to his business partner due to debt, the Bible that was printed with it is likely the first commercially successful printed product.

The character slugs were made out of cast metal and assembled into lines of type inside a frame, which was then placed in a press similar to a wine press, the letters inked and a piece of paper pressed on them. Coinciding with and probably in part responsible for the start of the Renaissance and the Protestant Reformation, Gutenberg's press made possible the wide-spread distribution of books and literature for the first time in human history.

1430s

Intaglio

Around the time of Gutenberg's press, a new printmaking method emerged that would allow for mass production of drawn images. Using a copper or zinc plate, an artist would etch, or scratch, a drawing into the surface. The plate would then be inked, and excess ink wiped off leaving the ink only in the grooves. Pressing a piece of paper on the plate would then reproduce the drawing.

This method was the opposite of older relief printing, in which the parts not to be printed are carved away. It was also much quicker and the plates much more durable.

1727

Stereotype

William Ged, a Scottish goldsmith, invented a method for making a duplicate plate of a block of letters, thereby preserving the originals which would otherwise be worn down in the printing process. He made a mold of the first plate using plaster of Paris and used that to cast another plate out of lead. This would make a single, solid plate which would be used in the printing press.

Later, this method was also used to make flexible plates for use in rotary presses, which require the plate to be wrapped around a drum.

1847

Rotary press

Richard M. Hoe, an inventor living in New York City, developed a press that, unlike the Gutenberg press which printed one sheet at a time on a flat plate, had a continuously rotating cylinder that the printing plate was wrapped around. Either sheet-fed or web-fed, that is, fed by a roll of paper, it printed at a much higher volume.

1886

Linotype

The first, real advance in printing technology since Gutenberg was the creation of the linotype machine, which automated the process of arranging characters into lines of type. A single operator using a keyboard could now create the lines, which would be cast from molten metal inside the machine. The slugs would subsequently be melted and reused to create more lines.

Invented in the U.S. by German-born Ottmar Mergenthaler, the linotype machine, besides greatly increasing productivity, also facilitated changing font sizes, leading and margins in order to fit copy, which was a huge boon to newspaper production. The New York Times was the first paper to adopt it, and it spurred a huge growth in books, magazines and newspapers.

A similar machine, the **monotype**, was patented by Tolbert Lanston in 1885. It produced type in individual characters instead of the solid rows that the linotype produced. More expensive to operate, it found greater use in high-quality book printing.

1826-1880s **Photoengraving**

This process allowed photographs, whose technology was also just emerging, to be printed on presses. The first known example was made in 1826 by Joseph Niepce, a Frenchman, who successfully transferred an etching to a printing plate through the use of light-sensitive chemicals. It didn't find widespread use in publications till later in the century, however, when newspapers and magazines started using photos.

The process involved the use of screens to reduce the solid tones of a photograph to small

dots, called halftones: Since printing presses only printed solid black, the only way to create a gray tone was through the use of half-tones. The photo would be reshot through a screen of anywhere from 65 to 170 lines per inch — the finer the mesh, the more detail could be reproduced. Today, newspapers typically have a line screen of 85, high-quality magazines of 150-170.

1903

Offset lithography

Lithography is a printing method that takes advantage of how grease repels water. Stone lithography, invented in 1798, is done with a grease pencil or paint on a flat piece of limestone. Artwork is applied to the stone surface with the grease, and then the surface is wetted. The greased areas repel the water. When ink (which is also oil-based) is next rolled on, it only sticks to the greased areas, and the stone can now be placed in the press to make a print.

In 1903, Ira Washington Rubel, an American, accidentally discovered that printing to a second, rubber surface and then using that to print to paper produced a superior result. Printing to a flexible rubber plate also allowed lithography to be used with rotary presses. Offset lithography simply means printing from the original plate to a second plate, which is then used to print to the paper.

Modern presses use aluminum plates instead of stone. The photo image of the phototypeset paste up board is transferred to the aluminum plate through a chemical process. The aluminum plate is then wrapped around a press cylinder next to a second cylinder wrapped with a rubber plate. The aluminum plate is inked, the ink transferred to the rubber plate and from there to the paper.

1940s

Phototypesetting

The phototypesetter supplanted the linotype machine, although not overnight. Often the two processes are referred to as hot metal (linotype) and cold print (phototypesetting).

Essentially, the phototypesetter replaced cast metal with a photographic process. It produced a single column of text on paper, which was then pasted up on a board along with screened photographs and other graphic elements to lay out the page to be printed. The paste up board would then be photographed and turned into a lithographic printing plate.

The first machines could not match linotype in quality, as there was some distortion in the type. By the 1970s, though, phototypesetters began to push the linotype machine into obsolescence.

1900s

Serigraphy

Also known as silk screen or screen printing, the process of squeezing ink through a screen above a stencil dates back to 10th-century China. Silk is rarely used; screens are more often metal, nylon or polyester.

Commercial screen printing came into widespread use in the 20th century. It's used to print on clothing, fabrics, billboards and packaging.

1980s

Digital Prepress

The advent of the computer age and digital technology has significantly altered the printmaking process. Prepress, which covers all the steps prior to running the press, can

now be done on personal computers, from editing to page design to platemaking. Text is typeset on computers and photos, shot with digital cameras, are edited and half toned in Photoshop. Graphics are created digitally and proofs output on digital printers.

Printing plates can be made from film generated directly from digital files in a process called computer to film, but even that advancement is being replaced by more direct computer to plate. And the presses themselves are operated through computer commands.

1990s

The Internet

In the last two decades, the Web has been increasingly replacing newspapers and magazines as the primary source of news and information. But the print industry is still strong and there is still a huge demand for printed products from books to advertising material.

That may be changed by such devices as Amazon's Kindle portable reader, and we may be headed for a future devoid of ink on crushed plant fibers. There are still price, accessibility, reliability, security and convenience issues to be addressed before print is abandoned. There are also significant problems with the Web being the main source of news content, as nobody has come up with a viable business model to support news gathering operations. What the future will bring is anybody's guess, but you will be the generation that decides it. Good luck.

