Dawn of Science

8. The Printed Page

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Previous parts:
Resonance, Vol.15: p.498; p.590; p.684; p.774. p.870, p.1009; p.1062.

The invention of printing spread literacy and spurred the Scientific Revolution.

The first four centuries of this millennium, the period 1000–1400, witnessed instability and turmoil in much of Asia and Europe. The Arabs started fighting among themselves and their empire began to break up. From the remnants of the Western Empire, several smaller states sprang up in Europe but they were never at peace with each other; they were also bent on carrying on the 'holy' crusades against the Turks, often for political ends. This was also the period (about 1220–1250) which saw the rise of the Mongol power in Asia under Chengis Khan and his descendants who destroyed the cities of Bokhara, Samarkhand and Baghdad. To cap it all, there was an outbreak of the 'Great Plague' epidemic (around 1348) which spread through Europe, North Africa, Russia and even parts of China, wiping out entire populations.

This was certainly not an atmosphere in which science could grow, and indeed science suffered. However, there came up at the turn of the 15th century an invention, which totally transformed the history of mankind. It was the invention of the movable printing process by Johannes Gutenberg (1398–1468) somewhere around the year 1430. This single invention exerted more influence on the Scientific Revolution than all the scholarly expositions of several medieval scientists.

For all this, the story of the printing press is a tragic one, as far as the inventor is concerned. Gutenberg was the son of a patrician in the city of Mainz (now in Germany). There he was associated with the goldsmith's guild and learnt several skills in metal work. Unfortunately, his colleagues who were envious of his growing skills and prosperity managed to get him exiled from Mainz.

Keywords
Gutenberg, printing, movable types, compass.

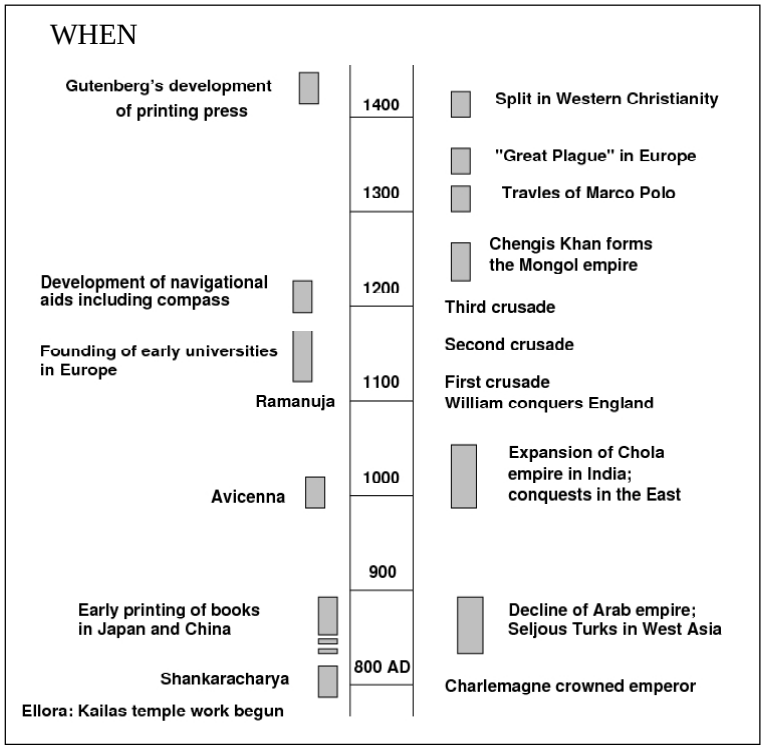


Figure 1.

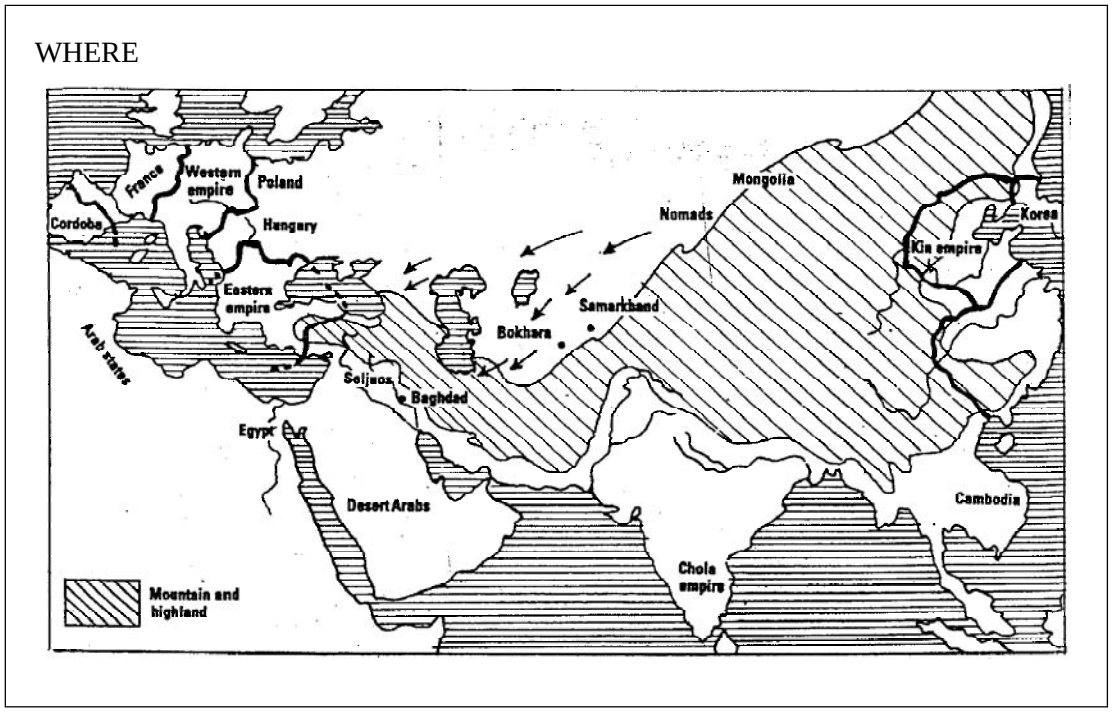


Figure 2.

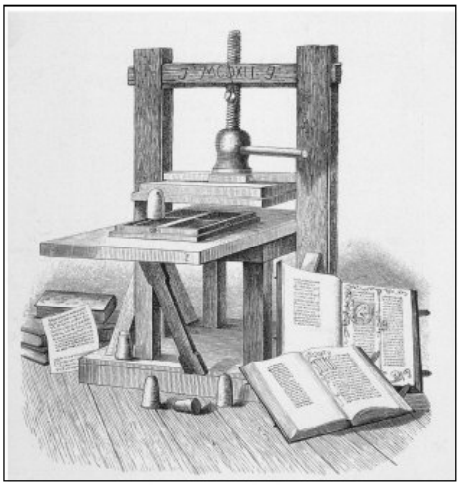
Books had been printed as early as AD 764 in Japan and China using primitive techniques – the text was cut out on wood and, by spreading ink on it the woodcut was transferred to paper.

Texts used to be reproduced mechanically much before Gutenberg's time, but in a really primitive form. As early as the second century AD, the Chinese had the three essential elements of printing: paper, the manufacture of which was known to them; ink, the basic formula of which was known for centuries; and surfaces, on which letters and texts could be engraved conveniently. All the ancient civilisations had used some form of seals and insignia, which constituted the earliest form of printing. In fact, books had been printed as early as AD 764 in Japan and China using primitive techniques – the text was cut out on wood and, by spreading ink on it the woodcut was transferred to paper. But this process was so laborious that it never caught on in the Arab world or in Western Europe.

In Gutenberg's time, books in Europe were essentially reproduced by copying them laboriously by hand. This meant that books were few and expensive and only monasteries, universities and very rich people could possess them. What is more, every copy introduced the chances of errors creeping in which is unthinkable in the case of religious texts. (Jewish copyists of the *Bible* took the elaborate precaution of counting the total number of letters at the end of copying!)

Gutenberg's genius was in realising that by producing a series of small and durable metallic seals, each representing a single letter, printing could be made much more efficient. The letters can be assembled to form a page and once printed the page can be broken down and reassembled to make up the next page. So here was a possibility of printing unlimited copies of books using the same basic set of printer's seals.

Figure 3. Gutenberg's printing press.



Though the idea was simple, its execution was not. To be successful, Gutenberg needed to develop techniques, which would allow him form tiny letters out of metallic pieces with uniform quality. It was also necessary to produce good quality ink. All this took Gutenberg nearly 20 years.

During these years, however, Gutenberg got involved in several lawsuits with his partners and financiers and unfortunately lost most of them. Gutenberg was naturally anxious to keep his project a secret to prevent others from cashing in on his idea. But the legal proceedings brought out into the open the nature of the project which he was working on and many of his financiers were quick to pounce on the possible profits. Notable among them was Johann Fust who won a crucial lawsuit against Gutenberg around 1450. As a result of this judgement – in which the court decided that Gutenberg had no reasonable means of paying back his creditors – Gutenberg had to hand over his entire printing press and the tools to Fust.

This was just around the time when Gutenberg was getting ready for the printing of a beautiful version of the *Bible* – now well known as the *Gutenberg Bible* – printed in double columns with 42 lines in each page in Latin. It is widely considered to be a commendable work of art and is one of the most expensive books

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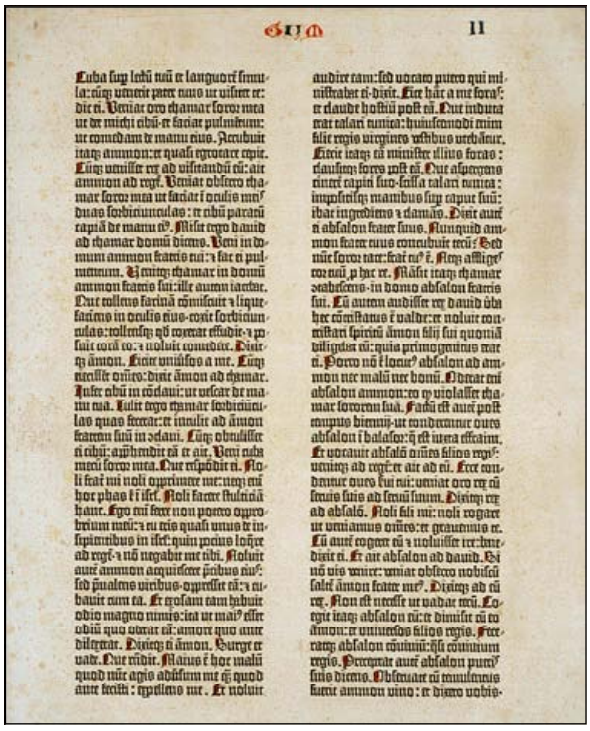


Figure 4. A page from the Gutenberg Bible.

Courtesy: Museo della Stampa, Genova.

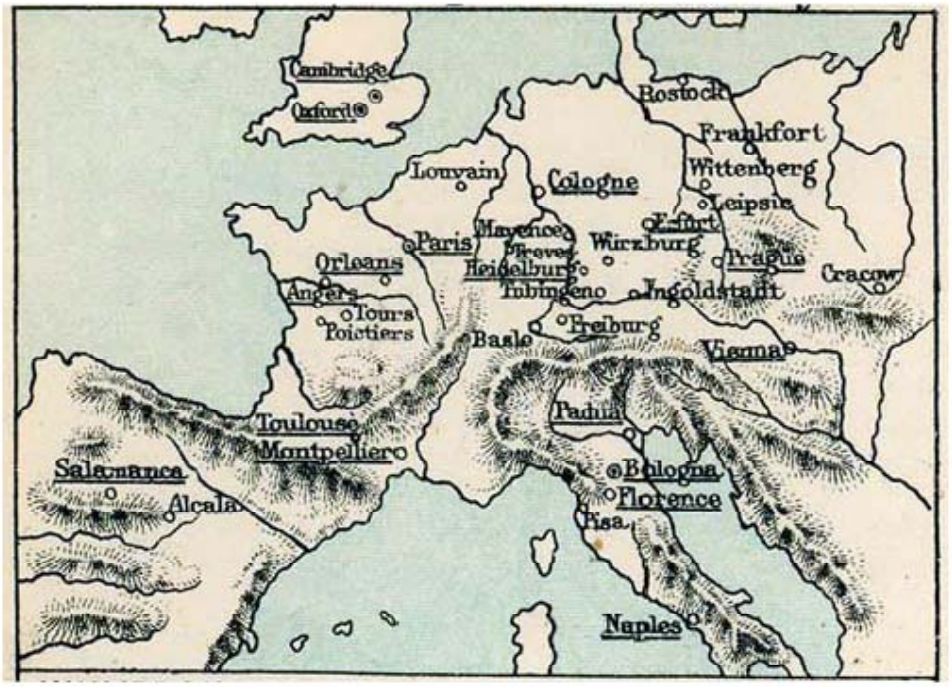
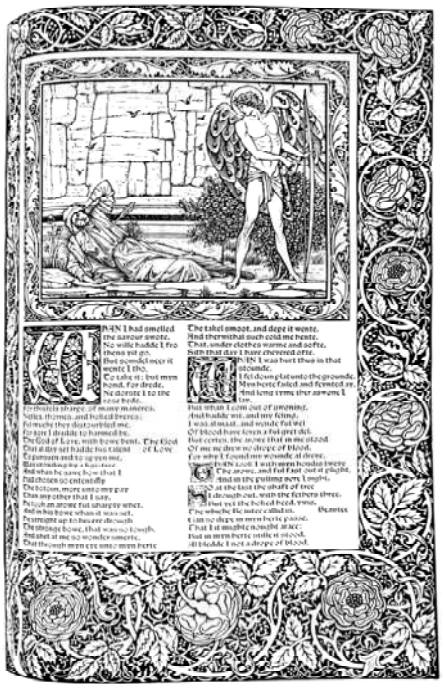


Figure 5. Medieval schools and universities in Western Europe.

Adapted from: http://www.emersonkent.com/map_archive/europe_universities.htm

Box 1.

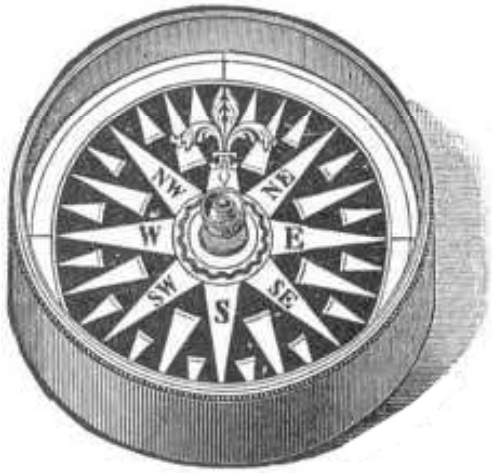


A printed page from the Chaucer.

Courtesy: http://www.britannica.com/EBchecked/topic-art/611830/3199

Box 2. The Mariner's Compass

Talking about inventions which changed the world, one should not ignore the development of the magnetic compass, which gave European navigators the confidence to sail the deep seas. The use of magnets in the form of lodestones was known to the Greeks as early as 500 BC. It is also probably true that for centuries Chinese navigators had used magnets to determine directions.



But in Europe the idea caught on only around 1200 and the early compasses were very primitive. It was Peregrinus, an engineer in the army of Louis IX of France, who developed a workable compass. He put the compass needle on a pivot (rather then on a floating cork as was done earlier) which he placed in the middle of a graduated dial. This simple idea made the mariner's compass a practical and very useful tool.

in the world today. Technically, of course, it was not Gutenberg who brought out this book, but Fust and his collaborators.

Though Gutenberg died in debt, a broken man, his invention transformed the world. The technique of printing quickly spread all over Europe. Though initially only religious texts came out of the press, it wasn't too long before scholars started using this medium to spread their good word. It is, for example, very unlikely that Martin Luther would have succeeded in his rebellion against the Church except for the fact that he could print and distribute large numbers of pamphlets. And since printing provided cheaper books, literacy rose and the ranks of the educated community swelled. This heralded the coming of the Scientific Revolution.

Suggested Reading

[1] Joy Hakim, *The Story of Science*, Smithsonian Books, Vol.1, 2004.

[2] James Dyson, *History of Great Inventions*, Edited by Robert Uhlig, Telegraph Group, UK, 2001.

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