

PAPER, ITS PAST, PRESENT AND POTENTIAL

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Paper is the human representation of an animal product adapted to man's use through the careful observation of its true inventors, the insects, specifically the wasp. The wasp has been making paper for several million years, by scraping cellulose fibre from soft woods, regurgitating it with its own mucus to create a paper-like substance for nest building. It is undoubtedly from an examination and replication of this production process that the first paper samples originated; starch paste made from boiled rice seems to have been used as a replacement for the wasp's mucus in early examples.

The year 105AD is often cited as being the year in which paper-making was invented. Its creation is attributed to Tsi Lun, an official of the imperial court of China. Recent discoveries however appear to place the first man-made papers some 200 years earlier. It now seems certain that Tsi Lun was the first person to work out a manufacturing method that would provide uniform sheets of this new material, and to produce them to a consistently high standard.

Although the manufacture of paper remained for many centuries a closely guarded secret of the Chinese, it eventually spread via Korea in the sixth century to the rest of the world. The first papers appear to have been made predominantly from hemp, but by the time that paper making technology had crossed China's borders, such diverse materials as rattan, mulberry, bamboo, rice straw and seaweed were also being used. According to Korean history, a Buddhist monk introduced paper making into Japan in 610AD. At first, Japan used paper for official records, however its introduction was contemporary with the introduction of Buddhism, and with the rise of the new religion came a rise in literacy and consequently the demand for paper as an information medium. Paper-making technology also spread from China to Tibet to supersede their more traditional writing media. Until this time, Tibet and Nepal had two main document forms, leaves of palm, dried and laced through with a draw string, and wood bark which was stripped from the trees in long swathes, folded into a concertina pattern and secured between wooden boards. This format was eventually stitched along one side, (the spine edge), to

hold it together, and it is in this form that Tibetan, Chinese and Japanese traditional bindings are still made today, but using modern materials.

From Samarkand, paper making spread to Baghdad in the eighth century, and on into Damascus, reaching Egypt and Morocco by the tenth century. Egypt had been famous 1000 years earlier for its papyrus writing material, however papyrus was capable of retaining its functionality only when rolled, hence Egypt's reliance on the scroll. When folded, papyrus cracked and was therefore not practical for the (then) new form of presenting information, the 'codex' or book. To reduce transportation costs, the papyrus industry had spread to Greece in the third century, but this did not save it from the dwindling demand and it eventually died out in favour of parchment. Parchment was made from the cured and tanned hides of sheep, the problem was that one sheep's hide would produce only one folio of parchment. To produce a book, therefore, a great deal of sheep had to be slaughtered. It has been calculated that the production of the Lindisfarne Gospel required about 500 hides of sheep! One of the most important trades with Europe consequently was that of paper, which started in the tenth century. To begin with, as paper was imported into Europe from Moslem countries, its use was looked upon as a manifestation of, and an invasion by Moslem culture, and in some cases was banned. Frederick II (the Holy Roman Emperor 1212–1250AD) declared that all official documents written on paper were to be considered as invalid. This is an early example of power exerted by a cartel. Wealthy land owners, who bred sheep and cattle for the manufacture of parchment and vellum seem to have applied economic pressure as a way of safeguarding their incomes. Whatever the forces behind the declaration, it appears to have been generally ignored. Had the dictat been observed, the Holy Roman Empire would have descended into a greater economic chaos than it already was at this time. It would have taken decades to work out who actually owned what after the paper indentures and deeds were invalidated. European attitudes had to change, and did with the advent of the printing press.

Although Gutenberg printed with the first movable type onto vellum to produce his now famous bibles in 1454, parchment was not uniform enough, or affordable enough for the production of mass printing. Paper on the other hand was produced in uniform

batches which allowed the printer to know after the first test prints that a full print run would succeed.

The first paper mills to be set up in Europe undoubtedly used cellulose fibre from plants; however as the level of literacy increased, new materials had to be sought to accommodate this. An alternative was found in rag. Old clothing, made of cellulose material, was recycled as paper. After years of being repeatedly washed and worn, the clothing fibres were already of an exceptionally pure quality. The paper industry benefited from this change in material resource, which made an already uniform manufacture even more reliable and long-lived.

The paper making industry however has not always run smoothly. The biggest down-turn happened almost two hundred years after the conversion to rag. For two hundred years, literacy remained constant, and the paper-making and printing industries were capable of fulfilling demand. The Victorian era saw a further change. The industrialisation of the world generated more literacy, which resulted in a greater demand for the printed word. This in turn placed a greater burden on the paper-making industry. Paper seconds, and even thirds, were diverted to the printers rather than being sent to the board makers. The first casualty of the printing boom therefore were the board-makers who had to find new sources of material. Soon, an alternative was found, and throughout Europe, book-boards began to be made out of the straw waste from farming. In some of the port cities, another alternative was also found; waste ship's ropes were purchased and recycled, (from where the expression 'money for old rope' originates). Both of these new boards were yellow in colour, the main difference being that in rope board, there are generally small flecks of embedded tar to be found. Both types of board were highly acidic, which resulted in acid damage to the good paper that they encased. Even so, the printing and paper industries were still unable to cope with the ever increasing demands of the newly literate. It was about this point in 1855 that a new industrial process was developed to mechanically grind wood into a consistency similar to that of paper pulp. This 'machine ground wood pulp' fulfilled the requirements of the reading public, but was also highly acidic, and the books were doomed to a short life. Demand however ensured the continuation of this paper for over 100 years after its problems were first

identified. It was only in the 1980s that the problem of acidic paper finally began to be addressed and new technologies emerged to increase its longevity. Also at this time in the craft industries, private press and bookbinding professions, there was a resurgence in the use of traditional materials and technologies. A trend which has continued to this day. Once again, hand paper-making is a profitable industry.

The industrial age also generated new uses for paper, from its incorporation in the make up of electronic components to packaging. The world consumption of paper today is somewhat above one third that of wheat, and a little over one quarter that of steel. Packaging is the largest of the usage categories, consuming 45 per cent of sales. With recent realisation of the potential environmental harm that can be caused by non-degradable plastic packaging, this percentage is again on the increase. Printing and writing papers are the next use category at 35 per cent: Of this, 6 per cent is catered for by the hand paper-making industry and a further 15 per cent is newsprint (machine ground wood pulp) paper. The remaining 20 per cent contains such unusual items as the paper windings for electronics mentioned above and Christmas decorations. In Britain alone, approximately 210 kg of paper per person are consumed per annum, over half of which is imported: This figure too is on the increase. It is perhaps worth mentioning that since the onset of the 'Internet-Age', an age that predicted the increase of electronic communication, and the disappearance of the 'paper office', paper consumption has increased by approximately 90 kg per person per annum. Paper continues to grow as the largest workhorse of the communication culture.

With recent improvements in printing technology, such as internet connectivity and print-on-demand, minimum order stockpiling and assessing marketability will no longer be a criteria for publication. Providing that information is available, it will be printable regardless of whether the demand is one or one million. There will be a renaissance for the printed word. It would be foolish to say that the paper industry in the next few decades will not undergo radical changes, it will. The industry will become more focused. Wastage will be reduced, which will in turn increase our ability to manage our environmental resources more efficiently. The use of non-sustainable resources will disappear.

How will this miracle happen? The answer is the internet (or its successor). Imagine a bookshop fifty years from now. It will not contain shelves stocked with books that may or may not be purchased by the public. It will contain rows of terminals. Perhaps it will also double as a coffee shop where you can drink a beverage while searching for the book you want on a terminal recessed in the table. You will be able to dial up the item you want and it will be instantly downloaded to the print-on-demand machine at the back of the shop, printed individually for you and delivered to your table by the waiter with the bill. No wastage, no remaindering. If no one orders a particular book, it will never be printed. On the other hand, if the data is electronically available, it will be accessible to even those with minority interests. My penchant is for minor eighteenth century gothic novels, but the demand for such a book as *The Midnight Bell* by Francis Lathom will probably be less than a hundred people per annum, world wide. No matter, with this system, I will still be able to buy a freshly printed copy, literally hot off the press. Then of course, there is the more ephemeral media of the journal. Using the new technology, no journal will ever go out of print. I will be able to order any copy, from any date instead of having to scour antiquarian shops in the vain hope that I might find the elusive missing one from my set. Digitisation of existing journals is already happening, and it will not be long before all current and past periodicals of worth exist in a virtual form. Once completely digitised I will be able to order any issue of *Curtis's Botanical Magazine* all the way back to its first in 1787, and without having to pay incredible prices to dealers either. Science fiction? No, the technology is already available; the internet and printer-binding machines that can even produce hardback and paperback alternatives, in quantities from one to infinity. The changeover to the new bookshop is almost upon us, but what is the common feature of all of this? Paper. All of our technological advancements are still based around this 2000 year old medium. Power-free, non-backlit paper will continue to be the front line interface between mankind and the electronically held sum total of human knowledge for many decades, if not centuries to come. After all, suppose you reached the grand denouement of an Agatha Christie, and the battery failed?

Let's face it, paper is here to stay.

RECOMMENDED READING

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