Ts'\ai Lun's Forgotten Contribution

Have you ever considered the importance of paper to your everyday life? The average American consumes approximately three or four times their body weight in paper each year, or about 600 pounds per capita. A good example of our use of paper comes from the following illustration. The battleship USS Massachusetts, built in 1942, required approximately 100 tons of paper to construct it, 16 tons for the blueprints alone! Paper, as much as printing, remains a vital and indispensable element of our lives even in this new “paperless society” with the advent of personal computers.

Yet like printing, paper is often taken for granted. Consider this: if the invention of paper had not made its way to Europe by the time of Gutenberg, the industry of printing would not have come together at that time. The success of Johann Gutenberg’s development of this revolutionary industry in 1450 depended in a large way on the availability of paper. Manuscripts at that time were written on costly vellum, the skin of calves. In the printing of his famous Bibles, Gutenberg printed 30 copies on vellum and about 150 on paper. The requirement for nearly 5,000 calfskins to complete the edition on vellum put Gutenberg into his precarious financial situation, resulting in his bankruptcy at the end of the printing project. Vellum proved itself to be far too costly of a substrate to print on.

Tours at the Printing Museum detail the lives of various characters from history including Ben Franklin, Mark Twain, Johann Gutenberg and Ts'\ai Lun, a Chinese eunuch from the late first century. Visitors always recognize the names of the first three but very few recognize the last nor do they understand his importance. Ts'\ai Lun is credited with the invention of paper in 105 AD, an invention that remained exclusively in China until 751. As little known as he is, this man’s invention ranks as one of the greatest in the history of civilization. The greatness and importance of the first three characters depended in a large part upon Ts’\ai Lun’s invention.

But it would be 1,000 years before the invention of paper reached Europe. When the Arabs invaded the town of Samarkand in northern China in 751, a
few of the prisoners from their victorious battle which they carried off to North Africa included skilled paper makers. The Arabs then began producing paper shortly after that date. Later it was apparently the Moors who brought the art of paper making to Spain, where the first European mill was established in 1085 in the town of Xativa. From Spain, knowledge of the invention went to Fabriano, Italy (which remains a papermaking town up to today), and then to France by the mid-14th century. Paper made it into Germany at the time of Gutenberg’s birth at the end of the 14th century. One of the reasons for the slow expansion of the knowledge of paper making, even after the spread of printing across Europe, was the secret nature of the art. Skills were passed from master to apprentice and not through the use of manuals or published information.

Paper was carefully formed one sheet at a time by craftsmen up until the invention of the papermaking machine at the beginning of the 19th century. The “vatman” would stand over a vat of water mixed with about 10% rag or cotton fibers. The tools of his trade were a rectangular shaped screen attached to a wood frame, called the mould, and a second wood frame of equal size, called the deckle. The vatman would place the mould and deckle tightly together and then submerge them into the vat at an angle. Under the water, he would level out the mould and deckle and begin to lift them to the surface, the deckle serving the purpose of catching the fibers over the screen of the mould. With great skill, the vatman would gently shake the mould side to side to interlock the fibers, forming a sheet of paper as he lifts the mould and deckle out of the vat with the excess water draining through the screen.

After the sheet was formed, the “coucher” removed it from the mould by coughing it onto a sheet of felt nearby. Pronounced “kooch,” couch is a French word meaning to lie down or recline. The couche literally rocks the mould on top of the felt from left to right, causing the wet sheet of paper to be detached from the screen and stick to the felt. You would notice at this point that the handmade sheet of paper has four fuzzy or feathered sides to it, something known as the deckle on the sheet of paper. This is similar to the imitation deckle you would see on pressed from the sheets with a tall, wooden squeezing press, a third man known as the “layboy” would lay the sheets on a table nearby. These were then taken by the “loftman” up to the loft where they were hung to dry. The paper would fully dry in about four days and then be dipped sheet by sheet into a sizing vat, dried again, and then finally pressed and calendered (similar to ironing) to make a smooth sheet. Production in a hand mill in one day could be as high as five reams of 18” x 25” paper, or 2500 sheets, depending on the number of workers.

The majority, if not all, of that 600 pounds of paper each of us consumes each year is made on a machine rather than by hand. Invented in 1798 and known as the Fourdrinier Machine, these are the now the largest machines in the world, ranging in length from 1,000 feet to over 4,000! The machine functions similar to the craftsmen in France many centuries ago: ground-up fibers (mostly wood rather than cotton now) are shaken together on a screen, placed on a felt, the water is removed and the paper is smoothed out. To see one of these large beasts you would probably have to travel to the Northeast to the Northwest, places like Wisconsin which have an abundance of forests and water.

Though it might not have the craftsmanship present in the paper of four centuries ago, the paper
we use today remains vitally important, despite the advent of the computer age. Ironically, the use of paper has greatly increased since the beginning of the “paperless society” ten years ago! An electrical shortage or the eventual inability to access a computer document because of an outdated program or system will greatly highlight to the current generation the value of paper and books. Paper serves as the medium of communication within our society and to our future generations. We are able to know of Ben Franklin’s life, his humor and inventions, because his famous Almanac and other works could be printed on paper.

If you have never seen or felt a sheet of handmade paper, a visit to the Printing Museum would be worth your time. A tour through our exhibit on the history and use of paper will introduce you to the greatest invention of all time. And you might even get the opportunity to meet Ts’ai Lun as you make your first sheet of paper!

**Pages of Adventure: The Reading Tour**

“They were succeeded by a clanking noise, deep down below; as if some person were dragging a heavy chain over the casks in the wine-merchant’s cellar. Scrooge then remembered to have heard that ghosts in haunted houses were described as dragging chains.”

In mid-sentence, the reader pauses and interjects “I’ve read this book, many times, but every time Egyptian craftsmen on the banks of the Nile can be seen manufacturing the first paper-like substrate—papyrus, the word from which we derive “paper”. Visitors roll open and then close a papyrus scroll in the same way the ancients did. The transition from papyrus and the necessary scroll form of the book, to vellum and parchment with the familiar style we recognize as a book, can be seen with examples of beautiful illuminated and hand manuscripts from the “Dark Ages”.

Visitors learn of the great role China has played in the invention of paper in the late 1st century and of printing in 8th century. The 1100-year spread of paper from Asia to Europe is traced with the stories of Ts’ai Lun, the Chinese inventor and the transmission of the secret to the Arabs by way of Chinese papermakers taken prisoner following a battle in 751. Visitors have the opportunity to make their own sheet of paper by hand, much as the craftsmen in Italy and France did five hundred years ago.

The museum guide prints a 16-page signature for each member of the group on 1870 Gordon platen press, discussing the role the printing press played in the spread of knowledge around the world from Gutenberg’s day up to today. The visitors learn how books are produced, from the printing of multiple pages on large sheets of paper known as signatures, to their sewing together and attachment to cloth-covered chipboard forming the finished book. After the group experiments with folding their freshly printed signatures, they are sewn together with a needle and thread on the bookbinders table. With the gluing of the sewn signatures to the boards, the book is completed and ready to be taken home as a keepsake of the tour.

The presentation then turns to the impact of books on history, discussing their powerful ability to spread ideas and incite mankind to both good and evil. Examples are cited from The Bible, Thomas Paine’s *Common Sense*, A Communist Manifesto,
Uncle Tom's Cabin and Rachel Carson's Silent Spring.

Beginning a transition to the second portion of the tour, the presentation traces the development of the novel and the capacity of books to entertain and illuminate within the context of a memorable story.

From this historical tour of the development of books, the group is whisked into a darkened hall where the flashing lights and clanking, spinning components of H.G. Wells' Time Machine propel them into the realm of books, the imagination itself.

Our time travelers make six stops on their journey, visiting scenes from books. At each, they pause long enough to learn a little about an author and his or her book, then hear a particularly engrossing passage read by the tour guide.

While the scenes and books visited vary from time to time, a typical tour might include stops at an early American inn to hear a passage from Johnny Tremain; a medieval workshop for a page or two from John Steinbeck's The Acts of King Arthur and His Noble Knights; a Victorian parlor to share a ghostly visit extracted from Charles Dickens' A Christmas Carol; the entry to a Chinese temple to hear from Betty Boop Lord's In the Year of the Bear and Jackie Robinson; Mark Twain's editorial office for a sampling of Huckleberry Finn; and finally, to the porch of a hacienda for an excerpt from the Tombstone Epitaph.

The passages read are carefully selected for succulent language, powerful imagery and dramatic tension. While selections range from classics to contemporary literature, a particular effort is made to include books embraced by standard curricula and recommended reading lists. The format of the Pages of Adventure Tour is flexible enough to be modified for suitability to any grade level.

Pages of Adventure: The Reading Tour takes a different approach to literacy. Rather than attempting to teach students how to read, which is properly the responsibility of parents and teachers, we want to excited them about the potentials of being able to read. While the students are captivated by the visual sets and powerful literature, the guide is constantly and yet subtly reinforcing the concepts that reading is their key to taking an adventure, that with their imagination and the words of the authors they can travel to any time, any place, at that moment—books are the power source for the only time machine they have access to. But more than this, reading and specifically literacy are their keys to taking an adventure in life, they are their tools for success which need to be held on to.

A wide range of ages have enjoyed this new tour at the Printing Museum since its introduction in 1994. It has helped to propel the museum beyond a static display of old machinery into a dynamic facility where visitors can experience the impact of history on their everyday lives.

David Peat Donates Rare Books to the Museum Library

A number of boxes arrived at the beginning of the summer, a donation from David Peat of Indianapolis, Indiana. Enclosed were numerous books on printing history, early trade journals and other books. The highlights include a rare copy of Legros and Grant's Typographical Printing Surfaces, regarded as the bible of books on the history of composing machines. One of the odd-ball typesetting machines of the 19th century discussed in that book is the Dow Composing Machine. Mr. Peat also donated a rare 19th century prospectus pamphlet for the Dow Machine, possibly unique in the world.

Other exceptional items in the donation include a bound volume of the Inland Printer from 1888, a bound volume of the Printing Art magazine from 1907, and a metal tube used for making printer's composition rollers in the 19th century. Many thanks to Dave for his generosity toward the Museum!
A Curator’s Journey to the Cradle of Printing

It’s Mecca for printers, and at least once in their career every devoted member of this profession must set his or her face toward Dusseldorf, Germany, to attend the DRUPA printing and paper tradeshows (DRUPA is a contraction of the German words for printing and paper). Since it occurs only every five years or so, there remains a finite number of opportunities to be awestruck by the magnitude of the DRUPA and the divinely-inspired (and occasionally, the not-so-divinely-inspired!) technology on display. DRUPA is like no other tradeshows of any industry in size or spirit, accurately described as the largest in the world, a fact your feet will give quick witness to!

This pilgrimage to DRUPA 95 was jointly sponsored by the Printing Museum, Gutenberg Tours and Printing Industries Association of Southern California, and it included 61 faithful from across the country—publishers, dealers, printers and educators. Beginning in the historic city of Münster, we planned to visit the DRUPA, Mainz, Cologne, Berlin, Prague, Vienna and Budapest.

A highlight of my visit to the DRUPA was a stop at the Indigo Co. booth. For those unaware of Indigo, they are the manufacturer of a printing press which utilizes a printing process they describe as “digital offset.” Unlike other digital presses which essentially use a computer to digitally image some form of a traditional offset plate, the Indigo press is able to print customized four-color images using only one set of printing cylinders (instead of the usual four). With each revolution of the cylinders, each of the four process color images is sent digitally from a computer to what was formerly called the plate cylinder; with each revolution, 100% of the inked image is transferred to the blanket cylinder, gradually layering a wet four color image; on the fifth revolution the blanket cylinder prints the complete image onto the paper or substrate and the process begins again for the next sheet of paper.

To highlight this technology, a salesman talked about the Indigo press while pre-polled information from each member of the large audience was entered into a computer. During the talk the Indigo was printing customized, personalized four color newsletters for the audience, each one complete with separate articles and color photographs reflecting the person’s highlighted interests. Every second the Indigo press kicked out a color newsletter, completely different from the previous one and the one to follow it! And with no printing plates. Imagine short run printing brought down to a total quantity of one impression per image! From a printing historian’s perspective, this was a truly fascinating experience. I regularly study innovative and revolutionary changes in the printing industry, the last one really being the advent of desktop publishing. But we have not truly seen a major change in the printing processes since the advent of offset lithography. Should this Indigo technology of “digital offset” filter down to more affordable machinery, we will soon see a major revolution on the printing side of the equation, similar to the recent changes in typesetting.

At each trade show I attend, I always look for the most historic piece of machinery on display, partly out of a boredom of modern technology (notwithstanding the previous paragraph!). Nothing is as sexy to me as an old cast-iron printing press! At this DRUPA the winner appeared unexpectedly at an auxiliary MAN Roland Co. booth—a beautiful flatbed newspaper press from 1845. It was the first printing press manufactured in Augsburg, Germany, by the company that would become MAN Roland, beginning their long role as a leader in world-wide press manufacturing.

Powered with the strength of a costumed printer who turned the giant wheel, the press was printing beautiful one-color letterpress posters as keepsakes, personalized only with the visitor’s fingerprints from the wet ink, 1,000 impressions an hour—a far cry from the Indigo E-Print only minutes away. The press was there to highlight the 150-year history of
MAN Roland in the printing business. Should you ever visit Augsburg, Germany, visit their manufacturing plant as we did 5 years ago as a group during our DRUPA 90 Tour. Besides the impressive manufacturing facilities you will see their display of early printing machinery dating from this 1845 press up to the present, many of the pieces being very rare examples of printing history.

After DRUPA our tour of printing history continued with a visit to the world famous Gutenberg Museum in Mainz. Besides the DRUPA, there are a few places in this world every respectable and venerable member of our trade must visit: Benjamin Franklin's print shop in Philadelphia, the Printing Museum in Buena Park (I hold a biased opinion!), the Printer's Devil Pub on Fleet Street in London and the Gutenberg Museum.

On the second floor of the museum you are able to walk through a dimly-lit vault where the treasures of the Museum are held: early manuscripts leading up to two copies of Gutenberg's Bibles and examples of printing from Fust and Schoeffer, the successors to Gutenberg's presses and type.

A demonstration of typecasting and 15th century printing was performed for the group in the recreated print shop of Johann Gutenberg. One of the members of our group was even selected to pull the bar on Gutenberg's press to print a page of his famous bible. But lest anyone fool you, Gutenberg's actual printing press did not survive—one's was built around 1965!

Around you on the walls of the museum was a display of the many faces of Gutenberg. As is typical with historical figures, their true likeness is unknown. The first illustration of Gutenberg was created about 70 years after his death. Since that time, he has assumed many faces including young and clean shaven to old and bearded. Each country and every generation seemed to portray him in the common look of their day.

Our visit to the Gutenberg Museum was made especially pleasant by a visit with Getraude Benöhr who is in charge of the International Gutenberg Society, along with Dr. Hanebutt-Benz, director of the museum. They joined us for a German lunch next to the museum overlooking the Rhine and the Mainz Cathedral.

After Mainz came Berlin, a fascinating city of dynamic contrasts, even more so after the fall of the infamous Wall. Our preparation for this dichotomy came after we crossed the former border of East and West Germany, lingering at the abandoned border crossing. A number of people in our group had traveled this same path years before, now reliving the tension and fear associated with the searches and encounters with the border guards. The same cold rooms they were stripped-searched in remain standing, empty shells of a recent era.

Our group had the fortunate pleasure of staying in Alexanderplatz while in Berlin, the hub of activity for the former East Berlin—fortunate because all of the historical sights and buildings are on the Eastern side within walking distance of our hotel, which was plush by Eastern standards.

With a young East German lady as our guide, we toured the city in our busses, beginning with what remains of the Wall. As people who make our living in communications, this was a fascinating visual experience, striking graphics painted on the cold concrete surfaces, images of the diverse tensions felt by the people and of their new hopes and frustrations.

A highlight of the Berlin tour was a visit to the old Berlin State Library, located in view of the Brandenburg gate. The director of the library brought us into a large room for a warm, though formal, welcome. We could barely stay seated through her talk out of anticipation—behind her on three tables were some of the rarest treasures of the library, brought out especially for our group to enjoy and
admire. Apart from specially arranged visits such as ours, these were treasures few tourists have the opportunity to view, let alone handle.

Under the watchful eye of the directors assistants we were allowed to peruse the contents of the tables, asking a myriad of detailed questions as we went. There was something for each person in the group to take interest in: an example of block printing dating before Gutenberg, the first music book to be printed, beautifully illuminated books, early children’s literature, and my favorite, a copy of Martin Luther’s 95 Theses. After this private session, we were escorted on tours of the old library building, viewing the largest book in the world along the way (measuring 3 1/2 feet by 6 feet) and their extensive collection of early newspapers.

Just a few blocks away from the State Library is a famous town square, the sight of the famous Jewish book burning, where Hitler piled all the books confiscated from the Jews and ignited them in a public ceremony, a horrific event in marked contrast to the collected treasures contained in the State Library. The memorial to this tragedy is as striking as the memory of the event: peering through glass at your feet, you view a room below the street with rows of empty library shelves.

A tour of the Berlin Technology Museum was a real highlig for those who wanted to marvel at antique machinery. Hosted by the museum curator, Dr. Rolf Stimpel, our group was shown the process of making paper by hand at an old wooden vat from 1830, contrasted to its manufacture by a modern Fourdrinier papermaking machine. Included in this extensive display was a laboratory-size version of this machine, 14 feet long and operational (in real life these machines measure 1,000 to 4,000 feet). I know of no museum in the United States with such as working Fourdrinier machine model on display.

We were allowed to print a keepsake on the 250-year old wooden press and marvel at the collection of old linecasting machines and the early presses. With great pride, Dr. Stimpel showed off one of the world’s first computers, measuring 4 feet by 6 feet and capable of performing a basic calculation such as 2+2 in about a half hour, or so they told us!

An occurrence my wife is beginning to expect whenever she travels with me happened again while I was walking around the Technology Museum: out of the blue, an American tourist walked up to me and introduced himself, asking “Aren’t you Mark Barbour from the Printing Museum in California?” As it turns out, this gentleman is a hobby printer who just happened to be touring in Berlin at the same time, and hearing that I was escorting a group to this museum that day decided to meet with me. Such strange events still amaze me though their impact on my wife is dwindling! Fame is fleeting!

On the roadtrip to Prague we made a stop at Hannover in Eastern Germany for a lunch visit at the Koenig & Bauer press manufacturing plant. We were each presented with a handsome book detailing the impressive 175-year history of the firm, now the second largest press manufacturer in the world. As we toured the facility, we were able to see large multi-color offset presses in various stages of production. As a curator, I again searched for some of their early machines since this is the company that invented and introduced the first cylinder press to the world back in 1814 to print the London Times, replacing slow wooden and metal hand presses of the day. In the lobby, off to the side I managed to catch a glimpse of a few turn-of-the-century pieces, though I was told they have a full museum somewhere else in Germany. Another trip!

We expected our passage through the Czech border to go smoothly, considering the changed political climate of recent years. It became apparent to us this wasn’t going to be a quick process after the second guard who looked like he was having a bad day boarded the bus to check our passports (maybe they knew we were printers with the inherent ability to alter documents in the span of five minutes?!). After a forty-five minute wait during which they escorted our bus driver off to one of those famous rooms and extorted about $200 from him, they seemed to feel we were genuinely harmless and permission was granted for us to pass. Maybe they should distribute more newspapers to the border areas since I am not convinced those border guards know the Wall has fallen.

Prague is certainly one of the most beautiful cities of all of Europe, a mixture of art and architecture from eleven centuries. Everywhere I turned in the old city I found another historic building or monument. The tight streets and winding alleyways made me feel as if I was actually experiencing Europe as it was many years ago. But for all its beauty, it is also a dangerous city with an abundance of crime, particularly pickpockets. On our group’s first ride on the subway, four or five of us were accosted in the course of twenty minutes beginning with one lady having $800 and her passports stolen from her secured purse before she even realized what was happening.

We really felt closer to home when we stumbled across the Prague K-Mart store with its brightly il-
lumined red letter. A block or so after we had passed this bastion of discount, I stopped my wife in amazement as I saw the bust of Alois Senefelder on the side of a building. As I explained to my dismayed wife (who never doubts I can find some of importance to printing history wherever I go, requiring similar delays), Senefelder is the inventor of lithography. Though the inscription was in Czech, I assumed this was a place of great importance so I proceeded to have numerous pictures taken (she's very patient!). One of the members of the Santa Monica Bay Club of Printing House Craftsmen, Vic Donath, has since translated the text and I was proven right: Senefelder was born in that building, just down the street from K-Mart!

To the envy of the rest of the tour group, Dave Jacobson purchased an old magazine in Czech about Senefelder at a local bookstore. Printed in 1921 in Prague, it seems to be a memorial to Senefelder and his family, complete with numerous lithographs in black and white and color. Plenty of offers to buy the magazine were made on the bus as it was passed around from one lithographer to another. Its home, however, is now at the Printing Museum in Buena Park where we are in the process of having Vic Donath translate the text. If you are in the area, stop by and ask to see this beautiful old book.

From Prague we headed into the famous of all cities, Vienna, Austria. By this time on our 2 1/2 week trip we were a little inundated with historic architecture and old churches, though we still had room to appreciate all that we saw. A group of us did tour the National Library, an experience which changed our understanding of the word “beautiful.” Many of us agreed that this was the most beautiful library we had ever seen, gilt in gold and decorated with magnificent paintings and sculptures on the walls and ceilings. One member of our group could even be seen lying on his back just to take in the detail of the paintings on the dome ceiling!

An exhibit of the life of the Copts was on display, taken from the library’s extensive papyrus collection. But rather than simply a display of old papyrus with descriptions of their age, the exhibit and our energetic young Coptic guide told us what these fragile 2,000 year old documents said—they spoke of the daily life and business transactions of Coptic people, or Egyptians as we know them. One was a shopping list for a husband with a reminder to buy some wine for his boss! Another was about an alimony case of a wife kicked out by her husband for a younger honey. The exhibit really helped us to identify with a people from the distant past, to know that though our technology might be different we all experience life as humans.

Though the group continued on to Hungary, my wife and I departed by rental car to Frankfurt. Traveling with my wife who was 8 months pregnant required our travels to be on an airline which would accept us, and that airline didn’t fly out of eastern Europe!

With our DRUPA 95 Trip behind us, we are now planning for the next one. Whether you are involved in the printing industry or not, these trips can be a unique experience and we welcome any of the Friends of the Printing Museum to participate. Drop me a line at the Printing Museum if you would like to receive information on our next international tour—it'll be a trip you will really enjoy with many new friendships as a result.

And as a side note, my wife and I celebrated the birth of our son two weeks after returning. An adventure to the end!

---

THE WAYZGOOSE GAZETTE
is issued quarterly or thereabouts for the Friends of the Printing Museum. Annual membership to the Friends is $25.00 and helps to support the efforts of the Museum to preserve the history of printing.

The term "wayzgoose" dates to the early 17th century, being a printer's festival held about the time of the feast of St. Bartholomew in August.

The International Printing Museum is a non-profit museum founded by David Jacobson and featuring the Ernest A. Lindner Collection of Antique Printing Machinery
8469 Kass Drive, Buena Park, CA 90621
(714) 523-2070

Mark Barbour, curator and editor
Copyright 1995—The International Printing Museum