Industrialized Bookmaking
An Exhibit Catalog for Industrialized Bookmaking

University of South Florida, Tampa Campus, Special Collections Department Reading Room.
October 12 – November 30, 2007

Organizer, James Ascher

Essays contributed by,
Anna Cianciara-Labourel
Eric Hughes

Additional assistance,
Arwen Main
David Pullen
Keli Rylance
Pat Tuttle
Paul Camp
Tomaro Taylor
One technical definition of a “book” is a non-periodical printed publication of at least 49 pages excluding covers. There are those, however, that believe this technical definition will soon no longer apply. The advent of digital information technologies has reshaped our relationship with texts. No longer bound to the physical medium of paper, much of our modern textual experience is digital: websites are now a common source for news. When we look for information we are more likely to turn to a search engine than an encyclopedia, and handwritten letters are an anomaly. So why study books and their history? What importance does print hold for us today? A complete understanding of the present is only possible with an understanding of the past, and the history of books and printing are, in fact, part of the larger story of the evolution of human thought and communications. While advances in medicine, warfare, and engineering have quite possibly changed the organic human experience beyond recognition, none of these would have been possible without the foundation of knowledge and mass transmission of ideas made possible by printing technology.

The advent of the printing press lead to transformative changes not unlike those attributed to the arrival of digital technologies. Print made it possible to more easily achieve an education, spread ideas quickly over great distances, and record information in multiple copies. The invention of the printing press is commonly attributed to Johannes Gutenberg in the 15th century, however, for a comprehensive understanding of how print changed human history it is necessary to look back further still. The concept of a codex–our modern book format composed of pages bound together within some type of cover–existed long before the advent of printing. However, these books were in manuscript format, meaning that they were written or copied by hand. Differences in handwriting, the speed and accuracy with which the text was written or copied, the extent of the illumination in the copy all affected the legibility of the text. As a result, manuscript reading was often slow and laborious, as a reader was often required to decipher imprecise penmanship or wade through inaccuracies due to mistakes made in haste. Moreover, due to the fact that manuscripts were copied by hand, the text would differ from copy to copy, as copyists mistook one word for another or changed passages with which they disagreed. The necessity of copying texts by hand also made the process of creating manuscript books long and expensive, making the cost of book prohibitive.

The advent of the printing press not only contributed to the rapid proliferation of reading material, but gave the text a sense of authority and fixity never before present in written material. The printing press itself, by modern standards, was still relatively time-
consuming and inefficient. Presses were still operated by hand, paper was still made by hand, books were still bound by hand, all leading to a process that was only slightly faster than the process of copying manuscripts by hand. However, the fact that multiple copies could be produced that were identical (or nearly so) contributed to the solidification of scholarship and the creation of the industry now known as the book trade. As mass production of texts became reality, mistakes and inaccuracies in text could be identified and addressed: since the texts were essentially duplicates, authors could be relatively assured that their ideas would be accurately conveyed and eventually, that they would receive credit for their work. This element of mass production also lead to an increase in literacy as well as easier, more rapid reading. Printed texts were, in general, easier to read and more uniform in terms of content. When a mistake was made by the compositor (who assembled the type before it went to press), the same mistake was usually made in many copies and so corrections were warranted and could be easily distributed to the mass audience that received the text.

While 18th and 19th centuries saw significant progress in the areas of mechanization, the basic processes established by Gutenberg generally held true until the electronic revolution of the mid-twentieth century. Nevertheless, the Industrial Age was not without impact on print. The same steam power that had just begun to speed people and cargo across countries and continents with what was, at that time, amazing speed, also powered printing presses that turned out printed information with the same speed. The steam-powered press and mechanical typecasting in addition to innovations in stereotyping and illustration processes combined to lower costs and increase output. In combination with the increased breadth and efficiency of education and new regulations on labor practices, the availability and affordability of reading materials caused literacy and reading rates to escalate. At the same time, the publishing industry, which had been developing rapidly since the invention of the printing press, solidified as a body of specialized professionals, capitalizing on the sensationalism created by a popular author with a mass readership.
Few things have changed the course of human history the way the invention of printing has done. Yet, for all its impact, the technology of printing has changed at a relatively slow pace. Printing technology changed only minimally over the three centuries after Gutenberg. Therefore, even though the invention of printing allowed for wide dissemination of knowledge, books themselves would remain too costly for most average people to afford. This would all change in the mid-nineteenth century, when printing technology would once again make a large impact on society. It was at this time that industrialized printing presses would make possible the fast, high-volume production of low cost publications, ranging from newspapers to dime novels and more.

The most significant change in print production that has allowed for high speed printing today, was the change from flat presses to cylinder presses. On flat presses, paper is literally pressed between two flat surfaces, one of which contains the inked type or printing plate. A rolling or cylinder press, however, has a design where paper passes between two cylinders, one of which contains the type plate, and another which enacts pressure onto the print medium. This idea had been under development since the latter half of the 18th century, but did not come into wide-spread industrial use until closer to the mid-19th century. The use of cylinders allows for the development of an unhindered workflow, which, when later coupled with steam power, was capable of producing a dramatically higher output. Under optimum conditions, flat presses could only produce about 250 sheets an hour, printed on one side only. Rolling presses, which were often still man-powered before 1912, could produce 8,000 prints an hour. Modern presses are fully automated.

The most common industrial printing technique today is known as lithographic offset printing. This process begins with the preparation of the printing plates. When a manuscript is submitted in digital form for printing, it is converted into a photograph image of the final print, in negative, through a complicated process known as photo typesetting. This image is transferred to a surface that has been photochemically treated, and which is often made out of zinc or aluminum, but can also be made from paper. The chemicals are then exposed to the photo image of the printed page, which then causes the print plate to develop the image the way photographic film would. This final exposure is then treated with a sticky oil which sticks to the areas of the image that will receive ink. The non-ink areas will be treated with water. This is the basic premise of lithography: the concept that water and oil do not mix.

The print plate is then wrapped around a cylinder, and that cylinder is installed into the printing press. Above the printing plate cylinder will be a series of smaller rollers which
will apply both water and ink to the plate. The ink will stick only to the portion of the plate that has been pre-treated with oil, and the water will wet the remainder of the plate where no ink will transfer to the final print. The inability of water to wash away the treated, oily surface, and the inability of ink to stick to water is what ensures the fidelity of the prints through numerous copies.

Directly beneath the print plate (known as the lithoplate) is another cylinder that has a rubber surface. This is called the offset blanket cylinder, and it is the defining characteristic of offset lithography because it is on this cylinder where the plate cylinder actually transfers the inked image. In other words, the print is offset from the plate onto the blanket cylinder before being applied to the print medium. The reason for this is because the rubber around the blanket cylinder is soft enough to obtain an even and crisp image from the print plate, then apply the same image to a surface with a different texture, which includes paper, but also fabrics and plastics. It is at this point that the paper passes beneath the blanket cylinder and on top of another cylinder which has the sole purpose of applying sufficient pressure to the print medium to get a good print. It is called the impression cylinder.

That is the complete process of offset lithography, yet the print production process does not normally end here, unless the printed product is in one color. The full color process requires that the print medium pass through four separate lithographs: the first with black ink, and the remaining three which apply different mixes of colors to create any color. This process is called CMYK, which actually refers to the four colors being used. Y stands for Yellow, and K for black (or Key), however, since mixed inks result in colors that are darker than the original, close stand-in colors are used. C stands for Cyan, lighter blue, and M stands for Magenta, a lighter red. When magenta and yellow mix for example, the result is true red, a darker color than both base colors.

After inking, the product is run through a hot oven-like chamber for rapid drying and setting of the ink, then, the paper is cut into shorter lengths and shipped to the bindery to be turned into books and magazines.

Did you know: The terms uppercase and lowercase letters refer to the way typesetters store type pieces of fonts in cases? Capitol letters are used less frequently, and are therefore stored in the upper section of a case whereas lowercase letters, since they are more frequently used, are literally stored in the lower section of the case where they can be accessed more easily.
Edition Binding and Casing

James Ascher, MLIS Student, University of South Florida, Tampa

Prior to the 19th century, all printed book binding was done by hand with minimal mechanization. The printer would produce a book in sheets that would be gathered and stored until the time of purchase. An individual would purchase a book in sheets, or in a temporary binding, and send it to their favorite binder to have it bound in their selected style. This enabled small craft binders to flourish and develop various local markets. However, this meant that the publisher of the book was generally unrelated to the binder of the book. Thus, a complete book was a collaboration several people and the physical appearance might have little to do with the text, or methods of production. The craft process of binding continued undisturbed until the 19th century, when increasing demand for reading materials combined with new techniques, caused rapid industrialization in the binding of books. It was not until the early 20th century that the wholly automated book process was developed, but during the 19th century, one after another, each piece of equipment in the bindery was replaced by industrial machinery.

The earliest industrial machine to be introduced to the binder was the rolling press, which replaced the manual beating of sheets. Early binders would beat the printed sheets with a large hammer to flatten out the puckering that was caused by printing on wet paper. This helped to form the sheets into a solid text block, however, it was hard work. The hammer used for beating was around fourteen pounds and the work was strenuous enough to cause a hernia. In the 1920s the beating of paper was automated by putting the sheets through steel rollers. This new process was faster and required less effort. Around 1827 William Burn developed a rolling machine and demonstrated it at an exhibition by having a boy flatten a bible in a minute. The visitors were impressed because it would have taken a large man significantly longer to do the same work. Within a few years nearly every large bookbinder would use this device which purportedly reduced the labor by a factor of six, although some still used hand beating for special works, notably, the eminent binder, Joseph Zaehnsdorf.

Other industrial machines followed quickly, however, few had as visually dramatic an impact as the ones for working with book cloth. The Englishman Archibald Leighton Jr. created several devices for preparing cloth for the covering of books. In 1823 he designed a devices for calendaring cloth with starch, to render textiles suitable for pasting; in 1830 he created a device for embossing cloth, and by 1832 he had a substance for sizing the cloth which enabled the cloth to have the sort of gold tooling which had been previously restricted to leather. This enabled binders of the 19th century to use the great variety of colors and textures that were becoming available from the textile industry. This changed the appearance
of books dramatically. A shelf of 19th century books is usually a cornucopia of bright, flamboyant, colors and designs. While a shelf of earlier books were often subdued browns and creams, with occasional greens, reds, or other austere colors.

Industrialization did not stop at book cloth and rolling presses. Steam powered folding machines, rounding, backing, paper cutting, and sewing machines followed in the 1850s. These eliminated many operations that had been accomplished meticulously by hand previously. However, the most substantial change in book manufacture came about as a change in workflow, enabled by these machines. Previously, books had been bound by attaching the text block to cords which were attached to boards, and the structure of the text block in boards was covered with leather. In the 1820s, this process was revised. By attaching the cover, usually cloth, to the boards first and then attaching the cover to the completed text block, a book’s case could be prepared on machines, or by hand, at the same time as the book’s text was being prepared. This helped separate the jobs in the bindery into parts that could be automated with industrial techniques. With the increased mechanization in the bindery, publishers could now design and construct their own bindings, rather than leaving that work to a craft binder. Thus, the binding of the book had become part of the object created by the publisher, and so began the age of the publisher’s cased binding. These bindings, unlike earlier craft bindings, give some indication of the publisher’s intention for the book. A fancy, or pretentious, book would often be bound very decoratively, while a more humble book would have a simpler appearance.

Ultimately, the economic impact of the publisher’s binding was substantial. The mass production of books changed how people related to the book. During the hand-binding period, there was no advantage to working in bulk, one thousand bound books cost as much as binding one book one thousand times. However, the publisher’s cloth binding could be produced cheaper by unit in larger editions, one thousand cloth cases could be made significantly cheaper per item through industrialization. This made it desirable for publishers to produce larger and larger editions of books. The large publishing houses could afford the capital outlay for giant editions and large machinery, knowing that their costs would be recouped later. However, smaller publishing houses did not produce books of such great demand and could not afford the initial capital outlay for the machinery and materials to create a large edition. Thus, the larger publishing houses became larger and more centralized, taking work from the smaller houses. By 1855 Harper and Brothers’ employed over three hundred people to tend the machines in their seven story book factory. A small publisher could not compete with such an economy of scale and so many of them disappeared, moving book binding from a craft industry to professionalization.
Additional Resources

Catalog of Items

The industrialization of the book production process consists of a number of improvements in different areas. The exhibition was split into three major areas of improvement: paper making, printing, and binding. Each part of the exhibit showcases some materials that exemplify the changes in the industrialization of the process covered.

Paper Making:

Experiments in wood paper production were done by Christian Schäffer as early as 1765, but commercially wood paper appeared in the 1840s and by 1880 was being widely used for inexpensive publications in the United States. *Analog* (1962) and *Frank Rede Jr., and his electric prairie schooner* (1894) are two examples of materials printed on wood paper.
One of the earliest uses of woven paper in America is by Isaiah Thomas in 1795. This copy of *Sermons on various subjects* (1806) by Joseph Lathrop was printed by Isaiah Thomas on both handmade woven and laid paper. The page on the left is handmade laid paper, while the one on the right is handmade wove paper.
If the materials to make paper were not sufficiently broken-up, knots of material would be in the finished product. An appliance called a knotter came into general use about 1819 which eliminated filtered out knots. This copy of *De los nombres de Christo* (1603) clearly predates the invention of the knotter and is on handmade paper that has highly visible knots.
[Samples of modern machine made papers]

After the introduction of Foundriner paper making machine, most paper was made with a woven finish since the belts on this device were wire mesh, although a small amount of paper was still made on cylinder machines that have a laid surface. The sheet of this modern machine made stationary is deliberately marked with laid lines, and this sample book of artist’s papers is open to some bearing the same anachronistic laid texture.

This is an illustration of a complete Foundriner paper making machine made by B. Donkin and Company (1847). The paper pulp would be loaded into the stuff chest on the far right, travel down the wire mesh to the drying cylinders in the middle, and receive a smooth calendar finish from the rolls on the left, before being rolled up to be shipped or used.
Machine Printing:

Stereotype is a process of casting a raised metal printing surface in plaster or flexible laminated paper. This process was the only method of plate making until the 1830s when electrotype plates were developed that used the electro-deposition of metal on a mold. This large plate is an example of what these processes might produce. The three books, although one has a different title, were likely printed from plates like these.
The Linotype machine, introduced in the 1890s, cast a solid slug of type for each line typed in by an operator. Due to the way the lines were cast, letters could not be spaced as closely as in other ways of casting type. The ‘j’s in this copy of Studies in Bibliography (1996) have the short, cropped, look characteristic to the Linotype slugs that were used to print it. The Linotype slugs show how the text was composed in a solid block.
The Monotype machine, produced in bulk first in 1901, cast individual pieces of type based on instructions punched into paper tape. Monotype was not as inexpensive as Linotype, but was preferred by some book printers because the letters could be spaced as in hand-set type and individual letters could be swapped out. The pieces of type are foundry type produced in a casting machine in much the same way as Monotype and almost identical in appearance. This copy of Printer’s ornaments by Frederic Warde is an example of Monotype printing.
This is a scale facsimile of half-sheet imposition printing on a common press. This sheet would take a pressman two pulls for each side to complete. Notice the small holes in the middle that were used to insure accurate alignment when the back side was printed. Sheets could not be printed much larger than this until the nineteenth century.
This is the approximate size and layout of a single sheet of paper as it left the printing press. The work represented is the first sixty-four pages of James Branch Cabell’s *Gallantry* (1907). After the sheet was printed on both sides, it would be cut in half with the first page on the lower left, backed by a copy of the second page in the lower right. Thus, the single printed sheet represents two copies of the first sixty-four pages of *Gallantry*. 
Binding and casing:

This copy of Cicero’s *De Finibus Bonorum et Malorum* (reprinted 1718) is an example of a hand bound book sewn on cords. The raised bands are the leather that is formed around the cords that the pages are sewn onto. The blank, uncovered, book in boards is a modern reproduction of a book sewn on cords mid-production. Notice that the cords are sewn through the cover and then hammered flat. The next step in the completion of this book would be to plough the boards and pages, sew endbands, cover with leather, and finish the leather with decoration.
In the nineteenth century, books were cased rather than bound. Casing consists of completing the text block of the book and then attaching the covers and boards at the same time. This process allowed the covers to be mass produced and decorated. The blank book here is a modern hand made book and case. The next step would be to glue the cover and boards to the endpapers of the book and press it until it is dry.
These are examples of nineteenth century publisher’s cloth cased bindings. These books show the great variety of textures and colors that could be achieved using textiles on cased books. The text and large patterns were stamped separately from the cloth texture, which was created when the cloth was manufactured.
This is an image of the Smyth No. 1 book sewing machine. It first appeared in the Spring of 1880 and could sew the text block of a book quickly using curved needles through pre-sawn holes. It could handle eight sheets per section up to 7 ½ x 10 inches. This machine replaced some of most time consuming, meticulous, work of a bindery.