Chancery Papermaking at the University of Iowa's Center for the Book

https://www.youtube.com/watch?v=e-PmfdV_cZU

Scrolling text on film with the sound of water from the papermaking-process in the background:

Paper has been the primary substrate for the development and transmission of human culture since the year 1000. But many do not realize that prior to the invention of the paper machine around 1800, every piece of paper in the world was made by hand.

In Europe, skilled artisans, working in teams of 3, were able to make 1500 or more sheets in a day or about 200 sheets in an hour.

The following short film documents the work of Tim Barrett and his graduate student co-workers at the University of Iowa Center for the Book as they attempt to replicate some of these historical production methods.

The goals of the research are to learn more about how early workers achieved these impressive pre-industrial rates of production, and to produce papers that are ideal for the repair and conservation of rare books.

The film is intended to be of interest to Iowa public school art and history educators, home school coalitions, local and statewide arts organizations, public libraries, museum curators, conservators, archivists, historian, and anyone else with an interest in the important role of paper in human history.

Chancery Papermaking at The University of Iowa Center for the Book, 2013

Audio – Narrator: All the paper used in Europe between the 14th and 18th century was made by hand, one sheet at a time. Until the paper machine was invented around 1800, a team of three people accomplished this work. The roles of these three artisans and those of supporting co-workers are documented in detail in 18th-century French papermaking manuals. The team included the vatman, who formed the sheets using a rectangular sieve-like mold, the coucher who inverted the mold and pushed it against a wet felt leaving the

fresh sheet on the felt, and the layer who removed the press sheets from the felts. It is an impressive fact of papermaking history that one of these three-person teams could produce 1500 or more sheets in a day or roughly 200 sheets of paper in an hour. A film documenting the work routine as it was still practiced at Hayle Mill in England in 1976 is available on YouTube.

At the University of Iowa Center for the Book Research and Production Paper Facility, we have set up workstations for a three-person team in an attempt to reach these historical production rates. The purpose of this project is to learn more about how paper was actually made as a utilitarian commodity for five centuries. More important, we hope discover how such production rates impact the aesthetic properties of the finished paper. We are making 12½ by 18-inch size sheets often called "chancery." This size sheet accounted for 90% of the paper made after 1500. These paper dimensions were undoubtedly common, because equipment and supplies for making smaller sheets were cheaper, and expenses were a major concern for anyone wanting to establish a paper mill. In addition, the smaller sheet size was easier to work with at all stages of the papermaking process, a great help when training younger workers.

The historical raw material for paper was old rags made of linen, hempen and sometimes cotton fiber. Due to the introduction of synthetic fibers which can complicate processing, we began with new textile-quality hemp and cotton fiber and making most of our paper. The fiber, as it is drawn out ready for spinning in the textile industry, is laid out into hanks of about 40 strands and then cross cut into 2½ mm lengths on a German-made flock cutter.

Ten pounds of the fiber is soaked in the water and later drained and cooked in a lime solution to swell the fiber and leave it more receptive to beating. The cooked fiber is loaded into a beater where it is washed with a drum-typed washer to remove excess lime and then beaten to fibrillate and macerate the fiber so they will form strong bonds with each other during sheet forming, pressing, and drying.

Enough beaten fiber is added to the vat to make 50 sheets. The thicker pulp is allowed to settle lower in the vat and then drawn up as papermaking continues in order to

make sheets of uniform thickness. The person at the vat needs to take up just the right amount of pulp and then shake the mold, so the pulp settles evenly before the excess water drains through the porous surface. From the vat, the mold goes to the coucher who transfers the freshly formed sheet to a damp felt in one continuous motion, returning the empty mold to the vat. While the vat person and the coucher are at work, the layer is parting the damp paper from the felts in a previously pressed stack or post of 50 sheets. She lays the damp paper in an accumulating pile and passes the felts to the coucher.

We learned two things very quickly. First, we could indeed make a 100 to 200 sheets an hour and second, ten pounds of pulp was used up in about 3 hours. As of 2013 we have not actually made 1500 or more sheets in a day, but we are now confident it is possible given enough pulp on hand. When 50 sheets are accumulated, the post goes into the press. 50 tons of pressure is applied over a 3- to 4-minute period. During this work the vat is recharged so that when the layer goes back to work at the end of pressing, the other two workers are ready to join in making a new post of 50 sheets.

At the end of the day the accumulated stack or pack of damp paper is gradually squeezed in a screw press over a 30-minute period to expel more water. The pressed pack is then parted and separated into loose groupings or “spurs” of four sheets. The paper is then hung to dry in a sheet-plastic enclosed area designed to slow the drying rate. Traditionally, this work would have been accomplished in a loft in the upper floors of the paper mill, and the humidity in the loft was controlled with sliding shutters which let in more or less air from outside. When the paper is initially hung to dry, it is flat and even but a day or two later, after drying, all of the paper is wavy and cockled. This is avoided in much contemporary hand papermaking by drying each sheet between blotters or other absorbent media under restraint. But one ten-pound beater load gives us about 350 sheets, which is too much to dry using this method. We imagined the historical work routine and wondered if perhaps the humidity given off by the damp paper coming up to the loft from today’s papermaking was used to humidify and soften the paper in the loft from yesterday’s papermaking. So, we tried humidifying the drying space to simulate all the moist air that might come from the sudden arrival of a lot of damp paper, and indeed we found that after 4 to 5 hours in a very damp space, the paper will soften enough to be stacked, exchanged

and then taken to the screw press for flattening. Subsequent exchanges and returns to the dry press can be used to get the paper eventually flat and dry. If the finished paper will be used in calligraphy or with other aqueous media, we size it in a warm gelatin solution. Sizing takes place in a stainless-steel double boiler tray. Typically, the warm gelatin is a 3% solution; the sheets are added to the solution in groups of about 12 sheets, allowed to thoroughly absorb the size and moved to an accumulating stack. A felt is used to work out any air between the sheets. When all the sheets are sized, they pressed in the screw press to expel excess gelatin solution. The warm sheets are then parted, stacked loosely and hung to dry. Humidification and flattening follows later.

Burnishing is an optional final step following gelatin sizing and is usually done with a polished agate stone like this one from India. Burnishing leaves the sheets with a much smoother feel and a shinier surface. The final step in the process is grading the sheets for thickness and quality.

We're not yet satisfied with the results of this experiment. We are still perfecting the process of sheet flattening; the surface of the paper doesn't always have the active grainy surface we see in the historical sheets; and the sheet formation and overall quality is not as good as it should be. Nevertheless, the effort has already been revealing. Our respect for earlier artisans and the high-production skilled work they accomplished has only deepened. Students in our papermaking classes can read about historical processes or watch a video but actually working at each of the three vat workstations brings a new level of appreciation for the crafts people who made 1500 or more sheets a day, probably six days a week for most of their lives. And aesthetically, we are gradually getting closer to something that looks like a quickly- but professionally-made utilitarian commodity.

End of narration

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Papermakers: Tim Barrett, Katharina Siedler, Mary Louise Sullivan, Elizabeth Boyne

Direction and Narration: Tim Barrett

Video Content Production
Avi Michael, Play Right Productions

To purchase a High Definition copy of this film, contact center-for-the-book@uiowa.edu

For more on hand papermaking history and technique see
Dard Hunter, Papermaking – History and Technique of an Ancient Craft

For information on papermaking with kids see
Gloria Zmolek Smith, Teaching Hand Papermaking – A Classroom Guide

The UI Center for the Book is a graduate program committed to the study of the book arts, and the role of paper and books in our culture – past, present, and future.