

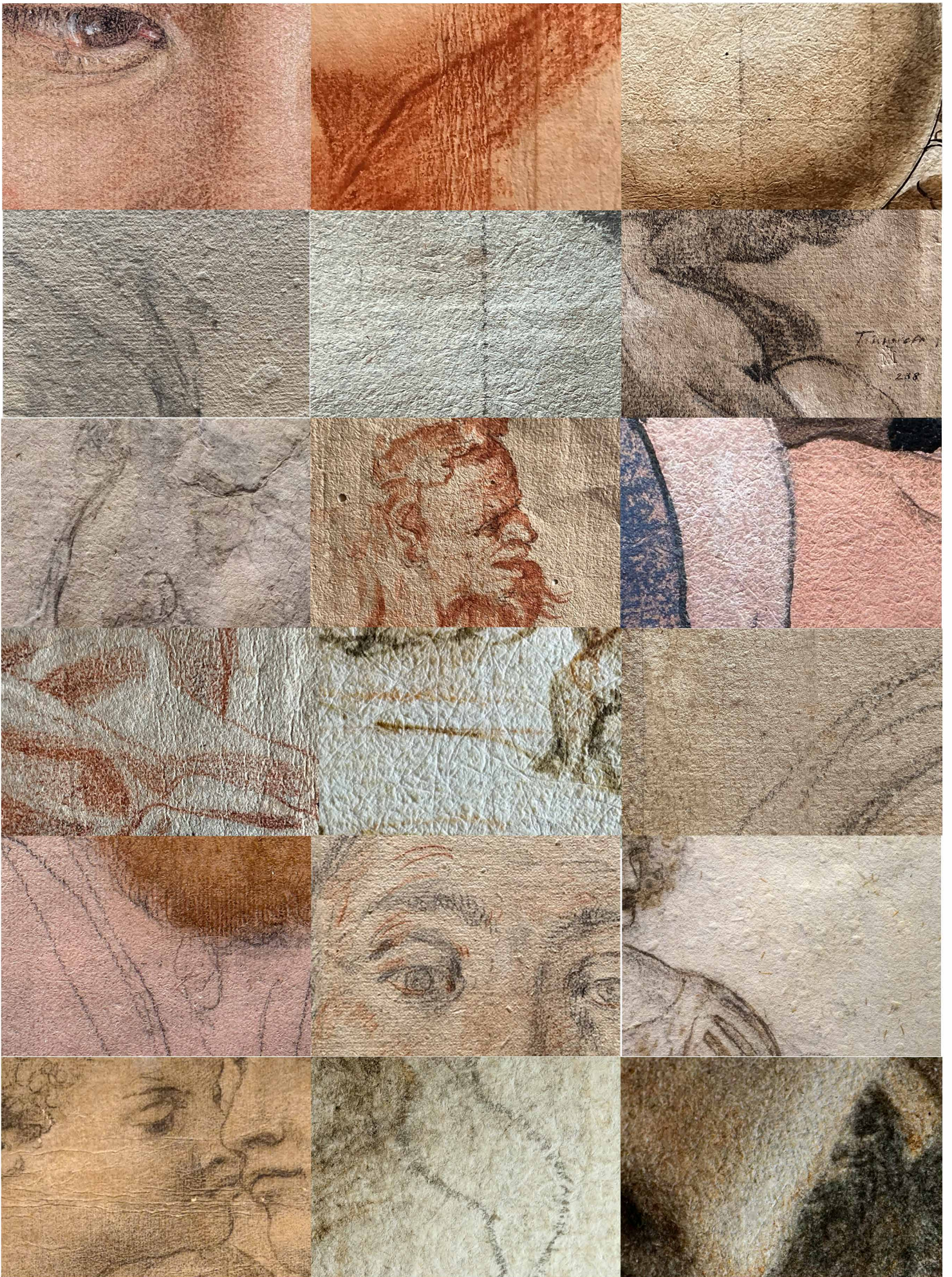
A Paper Journey:
Embracing the Coarse Papers
of the Renaissance

By
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Edited by
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The experience of drawing on Renaissance-style paper is like no other. Each sheet has unique physical features, created during forming, draining on laid screen, couching, and pressing between coarse-haired felts. These features create a profound connection between the hand, eye, paper, and chalk. The entangled fibers of the cellulose, imprinted by the embossed nap of the coarse felt, never repeat, turning the act of drawing into a journey of discovery. The paper's surface bridges the tactile and the visual, enhancing and interacting with the subject matter, be it a portrait, landscape, abstraction, or still-life. This formerly common texture deserves our reverence and respect. The artistic process lives within its horizons.

At Magnolia Paper Studio in Oakland, California, we have made reams of 18 x 24-inch laid paper since 2016. These sheets are designed and formulated to mirror the 15th to 17th-century sheets we have studied over the last eight years. For us, the surface is foremost of all, but we do not discount the contribution of varied hues, flaws and artifacts. We hope these sheets can enable the mark of the Renaissance, which has become less accessible to artists as papers became smoother and less flawed, to reemerge from its dormancy. When we choose a sheet on which to draw, raking light from a window reveals the topography of the paper, just as it might for a Renaissance artist visiting a paper merchant. Thus lit, the soul of the paper emerges.

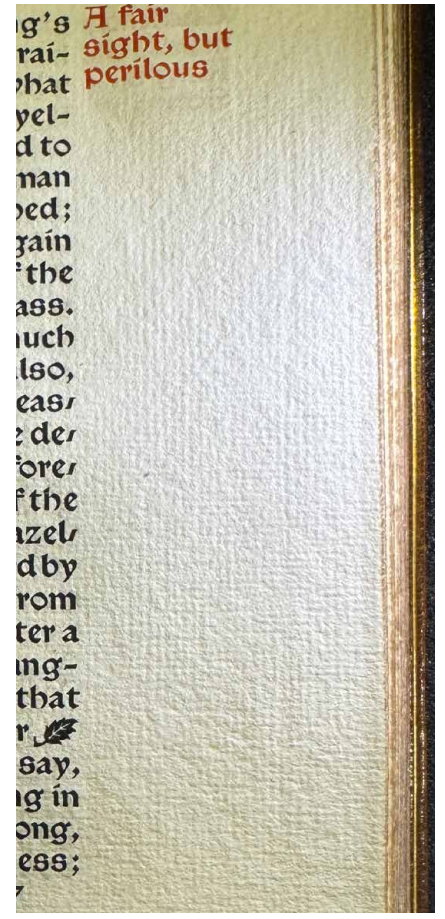
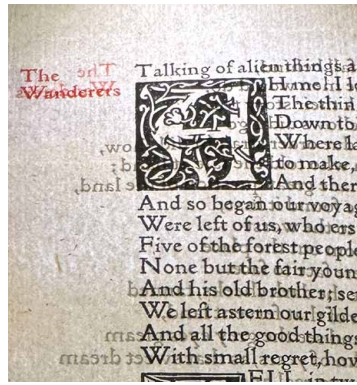
Handmade paper does not merely receive a drawing, it transforms it. The contribution of the hair marks, in collaboration with the hand of the artist, becomes evident as

the drawing progresses. The pigment blooms as it gradually builds up on the peaks of the paper's landscape. It is a subtle, creeping emergence that integrates the mark made by chalk or graphite with the intricate natural texture of the paper.

This article describes this consequential surface in three parts. The first will trace the trajectory of my life as a papermaker. This will lead us back to the paper of William Morris and the Kelmscott press, the history of which deserves a deep dive. Finally I will return to the Renaissance paper I love so dearly, and will attempt to describe in detail those qualities that make it incomparable, followed by the process necessary to create such a handmade paper in today's environment, tainted as it is by modern chemicals. Although this article includes significant portions of historical analysis, it is important to emphasize at the outset that the singular experience of drawing on Renaissance style paper is what brings the history of papermaking into focus as something relevant and worthy of extensive study.

My Journey as a Papermaker

I fell in love with early European handmade paper in the mid-1970s while working at Daedalus Paper Conservation in Berkeley, performing papermaking experiments with conservator Keiko Keyes, attending chemistry night classes at Laney College, and earning my undergraduate degree at the San Francisco Art Institute. In handling a wide variety of papers, I was surprised to learn that a five-hundred-year-old sheet, in addition to being more beautiful, was often in strikingly better condition than a sheet made in my lifetime. By the time I was 22 years old in 1974, I had



These examples from William Morris' *The Wood Beyond the World*, a Kelmscott Press publication of 1894, show woodcuts, laid lines, minor woodcut show-through, and felt texture. Note that the felt texture (far right) is in a grid pattern, meaning the sheet was pressed between a woven felt. In my investigations, I have not encountered woven felt textures in Renaissance sheets. The sheets usually have a non-woven felt texture, or are too smooth to detect any felt texture, woven or non-woven, as in the Bologna editions. This edition is housed at the Bancroft Library, at UC Berkeley.

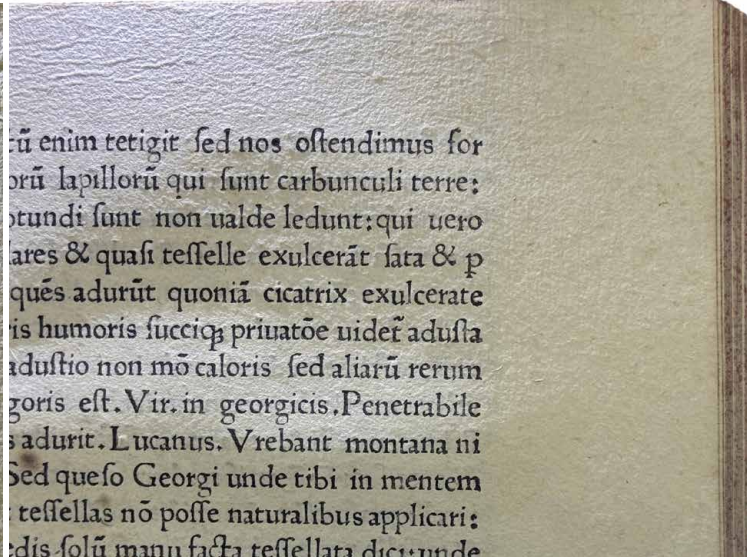
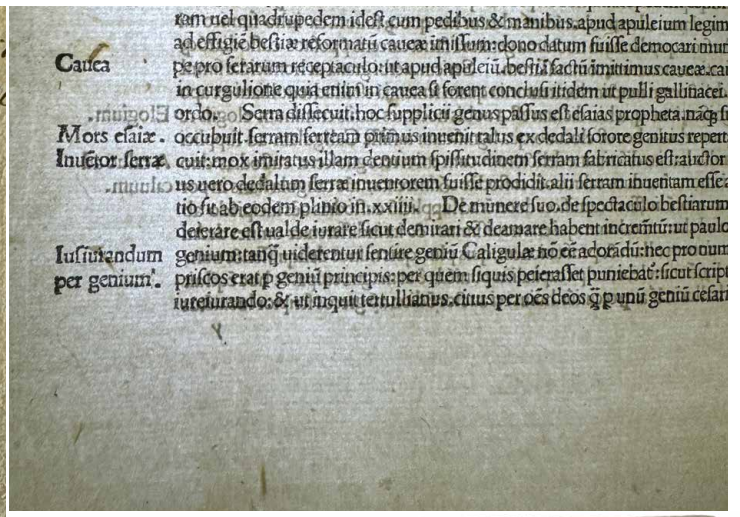
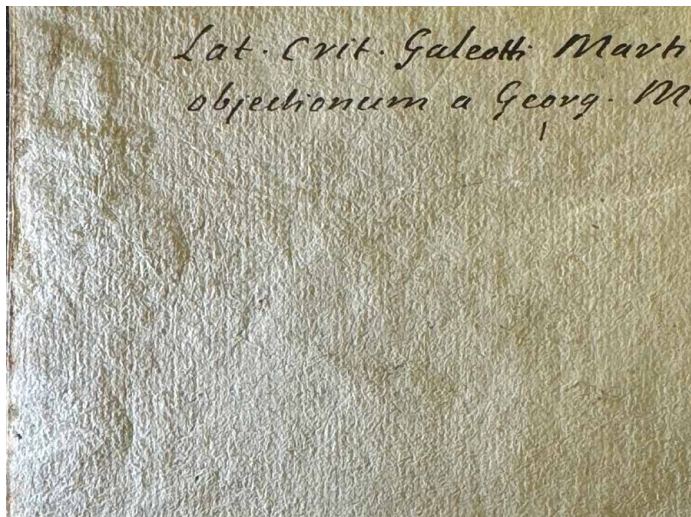
acquired laid and wove paper moulds, a Noble and Wood Hollander beater, woven felts (discarded from a Fourdrinier paper machine), and a metal screw press I found in a junkyard on my commute to Editions Press in San Francisco, where I had taken a job in stone lithography producing limited edition prints. I started producing handmade paper with hopes of making sheets as magnificent as the ones I saw as a conservator.

I was participating in a broader American craft revival. Papermaking, letterpress printing, bookbinding, furniture making, ceramics, art glass, textiles, metal casting, and more were all being revitalized. I taught papermaking at the California College of Arts and Crafts in the 1980s, where there were classes in all these disciplines. The College was founded in 1907 in direct participation with the broader Arts and Crafts Movement that had been spearheaded by William Morris. He had an outsized influence on me and numerous others in my milieu. Many of us took inspiration from the fine letterpress editions of Morris' Kelmscott Press, and sought to emulate him. Among his many goals was to replicate the highest quality papers

of 15th-century artisans, which meant smooth paper free of flaws. He and his papermaker, Joseph Batchelor, achieved this goal beautifully. Their paper was the pinnacle for their purpose, letterpress printing. But no standard can be universal in papermaking.

Joseph Batchelor and I take the same era of papermaking as our model. But because our intentions are different, we are attuned to different features of Renaissance papermaking. My intention, today, is to make drawing paper that recreates the surface available to the master draftsmen of the Renaissance, a surface created by pressing couched sheets between non-woven coarse wool felts. This surface was rejected as too rough by many, and according to a survey by paper historian J.N. Balston, it was virtually eliminated by the mid-1700s as paper was improved for general use.

In my journey as a papermaker, I have had to reckon again and again with this question: What is paper for? There can be no single answer. Which paper is best always depends on its telos—its final intended purpose.



Left and bottom right: *Refutatio Objectorum in Librum de Homine*, a 1474 edition by Dominicus de Lapis. Top right: Petrarch's *Trionfi*, published 1475 by Hannibal Malpiglius. These books are from the collection of the Bancroft Library, and were all originally published in Bologna. The images on the left depict texture from non-woven felts. The top right shows some inclusions from the paper's formation. The bottom right shows a back mark along the top of the sheet, the result of drying the sheet over a horse-hair rope.

In our American paper revival of the 1970s, '80s, and '90s, we strayed away from the tradition of Western paper in favor of invention and experimentation in the pursuit of contemporary fine art, with many successes.

Reflecting on my papermaking journey, I can now see what I missed in my early attempts. The ability to understand the various qualities of a material requires an attunement that comes about through use and is nearly impossible to achieve by contemplation alone. I failed to recognize many aspects of the ancient paper I loved, particularly paper texture and its role in shaping the artist's mark.

William Morris, James Batchelor, and Bologna, 1473

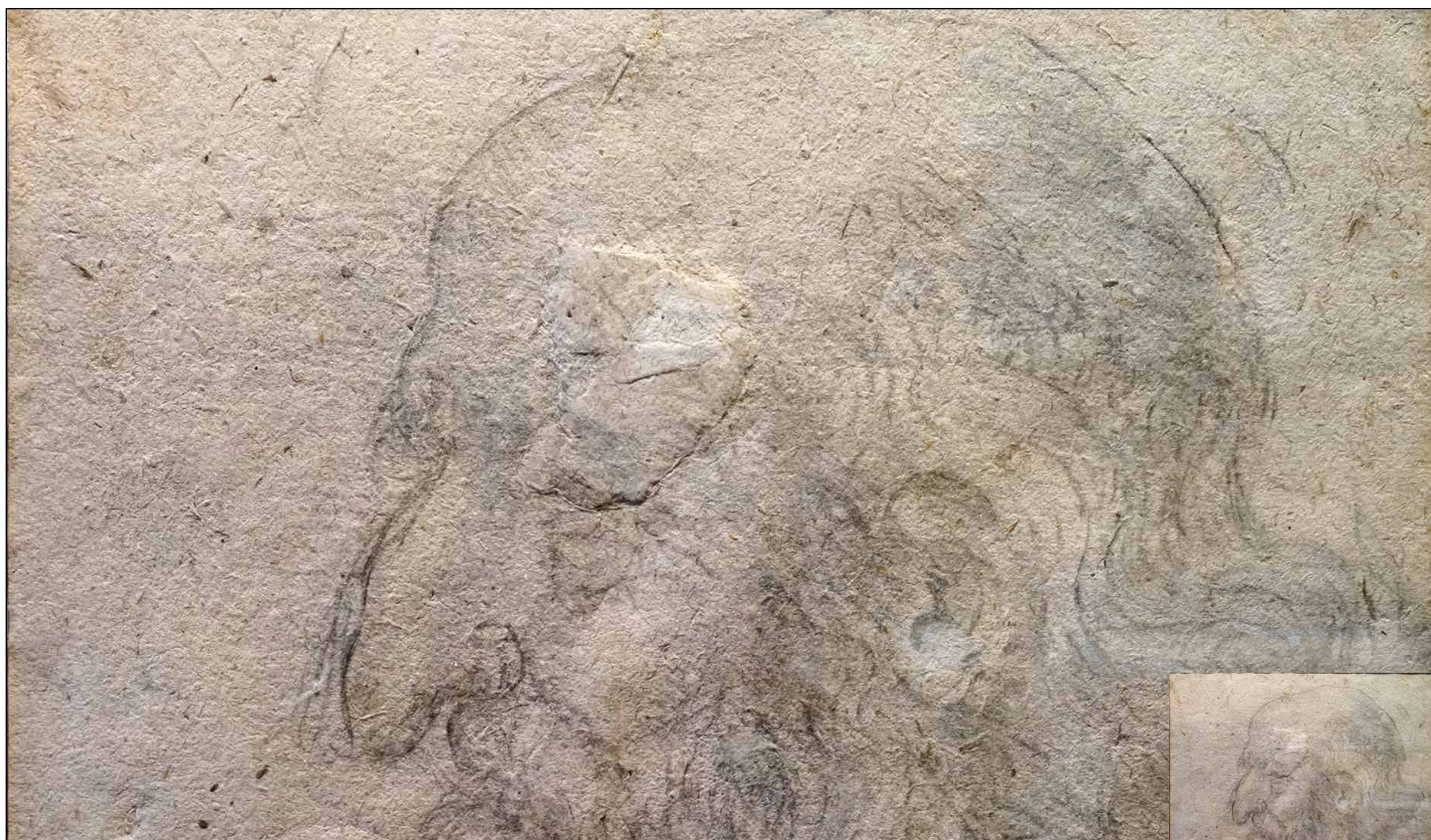
In addition to being edifying from a historical perspective, researching the historical record surrounding the Kelmscott Press has caused me to consider how and why

a papermaker chooses to focus on certain features of their paper over others.

In *A Note by William Morris on His Aims in Founding The Kelmscott Press*, he describes his model paper:

The paper should be hand-made, both for the sake of durability and appearance. [...] 1st, th[e] the paper must be wholly of linen (most hand-made papers are of cotton today, and must be quite 'hard,' i.e., thoroughly well sized; and 2nd [...] it must be 'laid' and not 'wove' [...] I took as my model a Bolognese paper of about 1473. My friend Mr. Batchelor, of Little Chart, Kent, carried out my views very satisfactorily, & produced from the first the excellent paper which I still use.

A trip to the Bancroft Library in June of 2024 confirmed that Batchelor's "Kelmscott Handmade" was a faithful recreation



Leonardo da Vinci, *The Head of an Old Bearded Man in Profile*, (c.1519) The Royal Collection Trust, Windsor. Far from avoiding flaws, Leonardo incorporated the large inclusion above the eye (~4 cm) into his drawing.



of his Bolognese models. Max Thill, Guy Diehl, and I studied several Kelmscott books, along with three incunabula published in Bologna in the 1400s¹. All three Bolognese books were printed on fine white paper of staggering beauty and quality. I was surprised and a little dismayed at how regular and smooth the antique Bolognese sheets were. In my research and recreation of Renaissance drawing paper, I am accustomed to seeing sheets with significant felt hair marks, among many other features and flaws that tell the story of their creation. The only sheets that had felt hair marks in the Bolognese incunabula were the paste-downs and endpapers. Clearly there was coarse paper around, but they chose not to use it for fine printing.

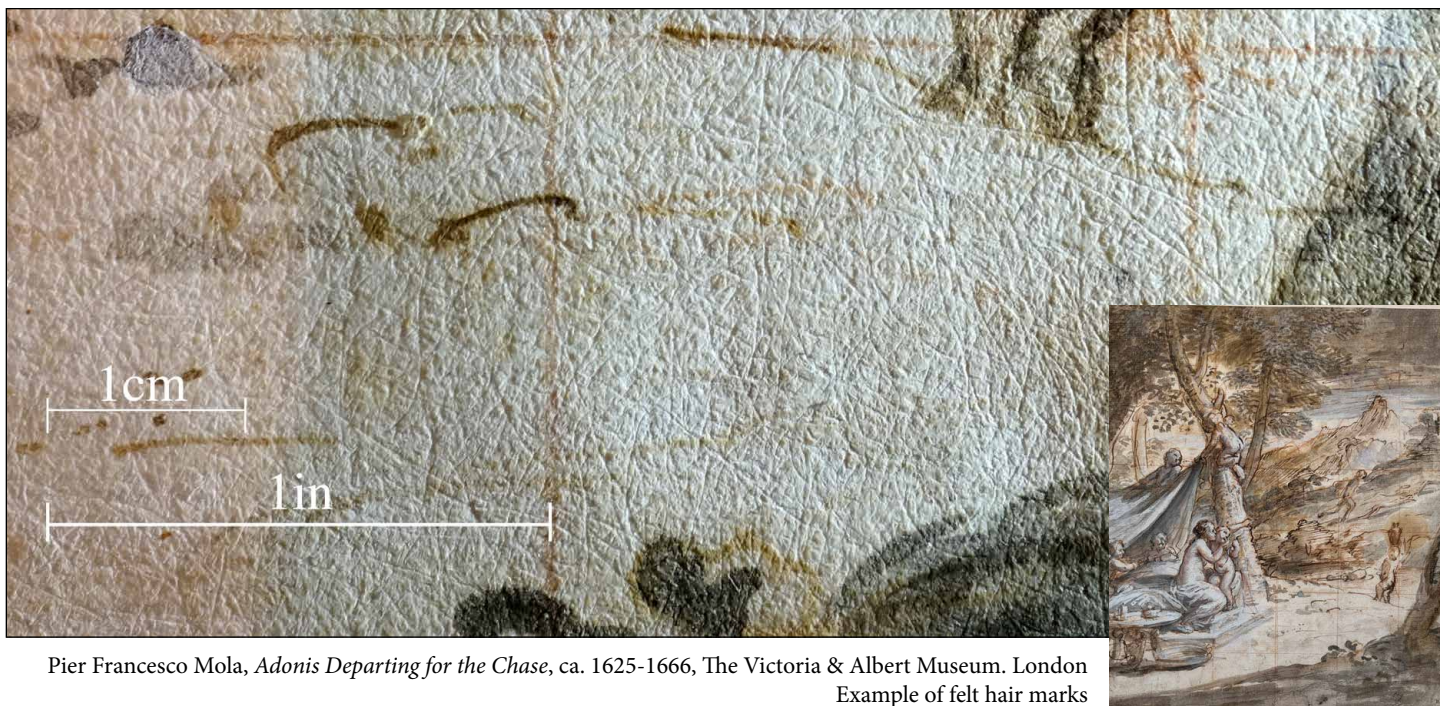
Flawed, uneven paper damages type because it requires soft packing during make-ready, the process of ensuring that each part of the form receives sufficient ink and pressure. Soft packing allows the inked type to crush the paper, compensating for uneven paper. This makes the type's indent visible on the verso and the verso text visible on the recto (show-through). By contrast, uniform, smooth paper

allows for a precise impression of the type on the paper. This enables the use of hard packing, which requires only light pressure to achieve an ideal impression, preventing excessive wear on the type and alleviating show-through. Early printers often had to use soft packing. The Bolognese editions I viewed in the Bancroft library are exceptional in this regard in that they exhibit almost no show-through.

Batchelor deviated from his Bolognese examples in only a few minor ways. Some of his felts were too coarsely woven, which imparted a gridded woven felt pattern (see p.3). His sheets had no knots, debris inclusions, or back marks (created when 15th-century papermakers hung paper to dry on ropes). None of his sheets had felt-hair marks, but, defying my expectations, neither did his predecessors' sheets.

I wonder why Morris chose to use laid paper at all, since wove paper, being less uneven in thickness than laid paper, is more suited to letterpress printing. When laid paper is held to the light, one sees the screen pattern from which it was created, and a surface texture from the mould is often visible as well. The look-through of wove paper, by contrast, shows no pattern. Perhaps Morris favored laid paper

¹ The codices studied were a 1475 edition of Petrarch's *Trionfi*, published by Hannibal Malpighius, and *Refutatio Objectionum in Librum de Homine*, a 1474 edition by Dominicus de Lapis, and *Vitae XII Caesarum*, published by Benedictus Hectoris in 1493



Pier Francesco Mola, *Adonis Departing for the Chase*, ca. 1625-1666, The Victoria & Albert Museum, London
Example of felt hair marks

because, bearing marks from the paper mould, it subtly shows evidence of the craft that created it rather than disappearing from view as wove paper often can.

Nevertheless, Morris was pragmatic and did not wholly reject mechanization. Batchelor used machine-made woven felts (as evidenced by their surface texture), mechanized Hollander beaters, knotters (machines that filter out debris from pulp), mechanized sizing tubs, drum dryers, “sails” (tarps for drying “spurs” of sheets pressed together, to avoid the wrinkled lines of a back mark caused by hanging spurs on horsehair rope), and other industrial machines.

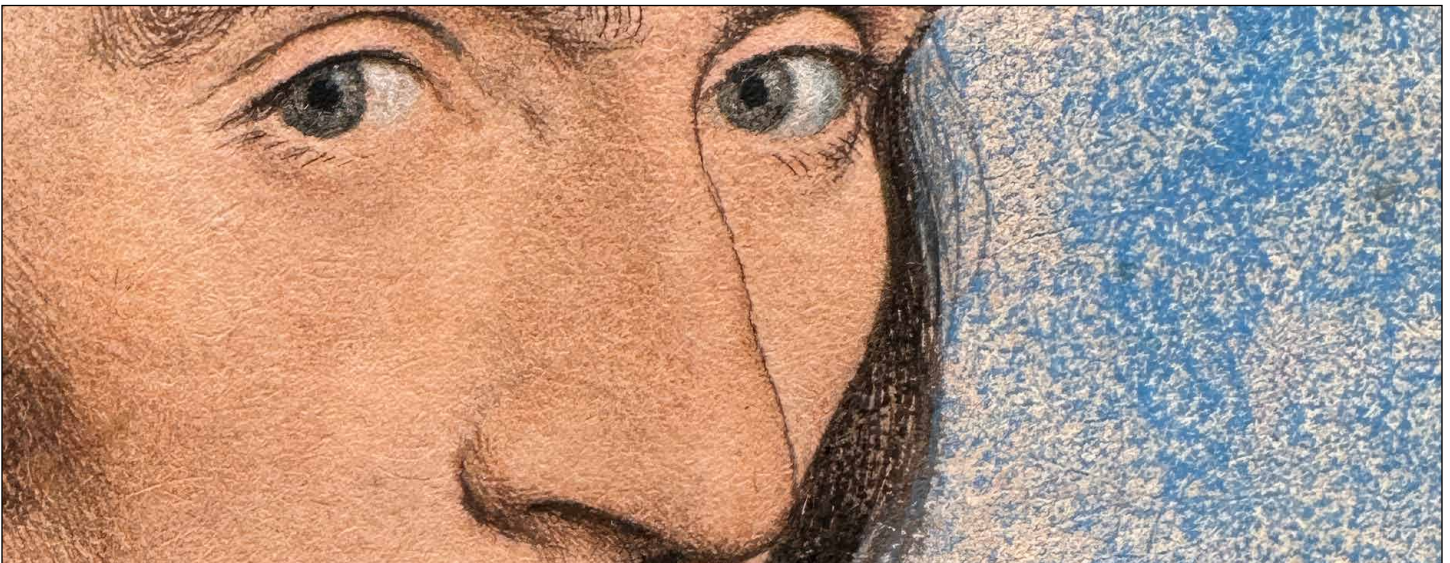
In my early papermaking attempts, despite being inspired by the Arts and Crafts Movement and Italian Renaissance, I never captured the essence of the paper they used. I was not doing letterpress printing, so the evenness of my sheets never arose as a problem, as it would have if I were attempting to do hard packing. In other words I did not use my paper in the same way that my predecessors did, making it easy to drift into other practices.

American papermakers in the 1970s primarily used cotton rag half-stuff and cotton linter, since linen rags were not readily available. Having little use for it, I avoided the difficult process of hot gelatin sizing of waterleaf sheets. We used abaca and kozo when applicable to a specific art-oriented application. We employed both wove and laid moulds, dipping and pouring pulp directly on moulds, again for specific art pieces. I purchased an industrial knot-

ter but never put it into operation. I continued my drift towards fine art, relying on chemical internal sizing, mixing Japanese papermaking with Western papermaking, casting paper sculpture, and generally leaving fine papermaking behind.

Forty years later, I am on the path to rediscovering traditional European papermaking—not the Extra Superfine quality produced by Morris and Batchelor, but the lower-grade paper commonly used by artists for drawing. Because I am drawing on my paper, the qualities of materials I once overlooked have become essential. For example, the hardness of a linen bast fiber, in contrast to a soft cotton spiral, is readily felt by the hand when drawing with chalk or graphite. Likewise for a hard-surfaced gelatin-sized sheet. I was not alerted to the need for these qualities until drawing became my focus. Indeed, I did not need them.

Surface texture, created by coarse felts, is the quality par excellence that I overlooked. Since making this realization, I have studied Old Master drawings, tested hypotheses, drawn countless portraits on the textured and flawed paper we make, and copied the marks of masters in their medium of quarried chalk. By contacting sheep geneticists, we found the heritage Churro breed, preserved by the Navajo Nation. The DNA of these sheep has not changed for half a millennium, and can be traced directly to Italy and Spain. The felts made from these coarse-haired sheep have been my most irreplaceable tool on the path to recreating Renaissance drawing paper.



Hans Holbein the Younger, *Sir John Godsall* (c. 1505-1556) 6.2 x 29.2 cm, The Royal Collection Trust, Windsor

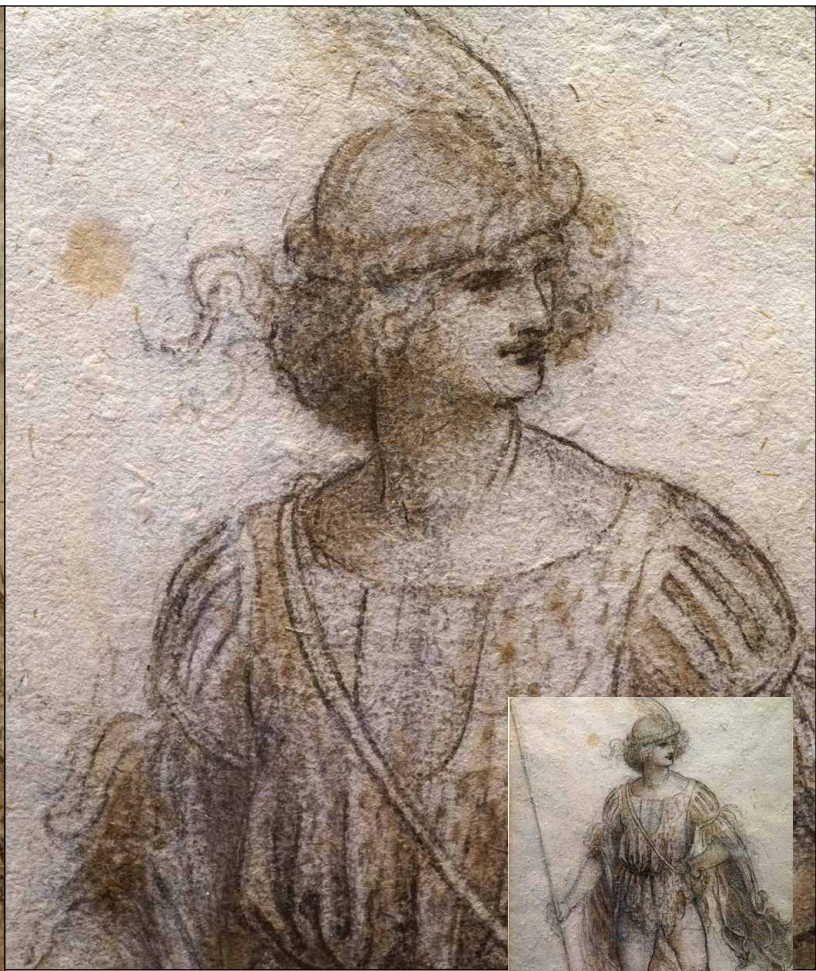
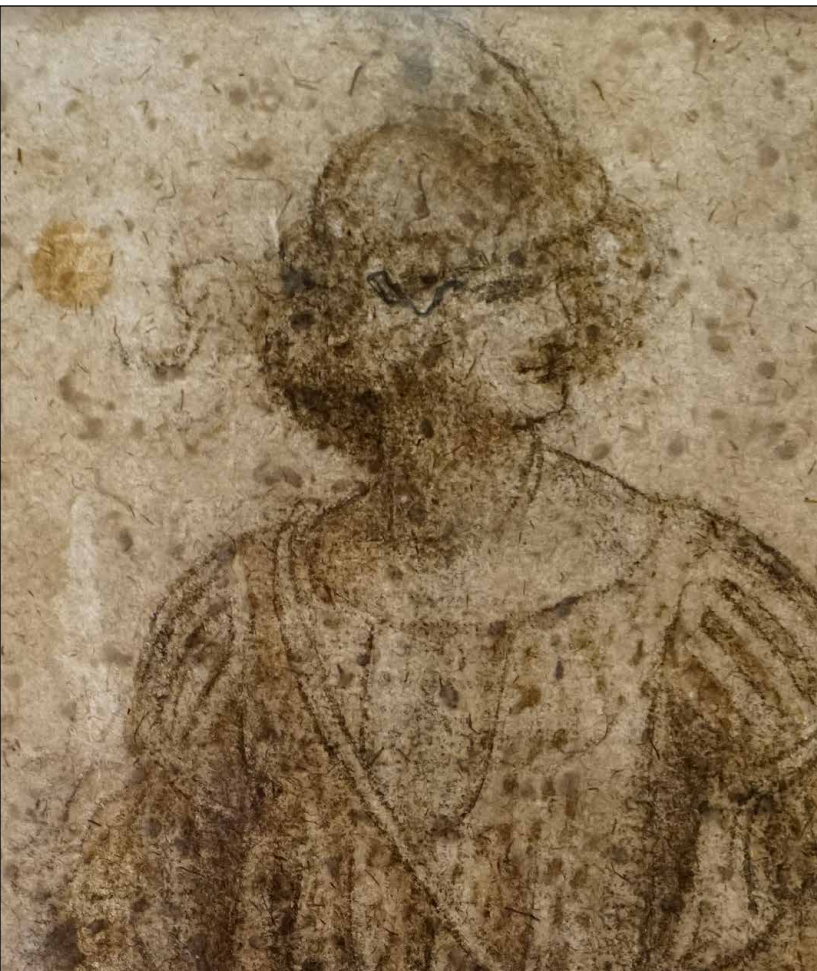
Transition to Renaissance Papermaking

In 2016, my quest to recreate Renaissance paper intensified. My wife, Era, and I visited various museums, such as the California Legion of Honor, Morgan Library, and the Queen's Collection at Buckingham Palace. We made appointments to study specific works at Windsor (the Royal Collection), The Ashmolean, The V&A, The Met, The British Library. We also started collecting early letters, manuscripts, blank papers, and books for direct comparison. In study rooms, we examined works of art on paper using backlighting, magnification, and raking light. The surface textures varied: some sheets had more pronounced laid texture, others more defined felt hair marks, and some presented both.

Today, early European papers are found and studied in museums' prints and drawing collections, library rare book

rooms, and private collections. Old Master graphic and rare book dealers regularly offer chalk drawings, etchings, woodcuts, letters, manuscripts, and bound volumes containing well-made and well-preserved sheets. Additionally, paper conservators collect sheets and fragments of early paper for mending and infilling purposes, making examples readily available for study. It is a testament to the methods of the Renaissance that so much paper, a material commonly thought of as ephemeral, survives in excellent condition.

No single sheet can embody all the variations created by European papermakers from the 15th to 17th centuries. A substantial number have survived among the millions of sheets produced primarily for writing, books, and wrapping papers. This durability is attributed to the papermakers' practices, the resilient flax and hemp bast fibers used, and the naturally alkaline water (calcium carbonate) from



Leonardo da Vinci, *A Masquerader as a Lansquenete*, circa 1513, Example of drawing on "Brown" paper

The Royal Collection Trust, Windsor

Left: transmitted light.

Right: mild raking light



rivers and streams powering the mills.

The textured, second-tier sheets of the 15th century exhibit a unique embossment of entangled fiber, in addition to the laid lines from the wire surface of the paper mould. Both textures—entangled hair and laid-pattern—vary based on numerous factors within the papermaking process. Although hair-marks and laid-patterns are common in Old Master drawings, the highest grade papers of the 15th century used for fine letterpress book publications were almost hair-mark-free. Were these flawless papers less desirable or too expensive for an artist?

It appears artists had their preferences; Hans Holbein the Younger favored (selected) coarse felt hair-marked paper. His mixed-media portrait drawing of Sir John Godslove (p.8), which I viewed at the Royal Collection at Windsor, was made on a highly textured sheet, and incorporates the texture of the sheet in both the dry media of the face and the wet media in the background. Other Holbein drawings I viewed (ink and chalk) were made on similarly coarse sheets, which I believe contribute to the Holbein's exqui-

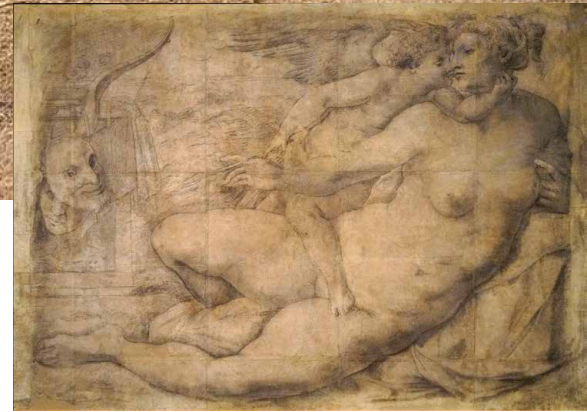
sitely delicate and complex mark marking

Michelangelo seemed to prefer papers with fewer felt hair marks, especially for his presentation drawings. A comparison of the dimensions of his drawings with available paper dimensions at the time indicates that he trimmed his sheets to avoid back-marks.

Leonardo da Vinci was perhaps the most experimental of all. He drew on wrapping paper loaded with bits of partially beaten rags and containing numerous flaws and inclusions, and he even incorporated these flaws into his drawings (see p. 6 & 9).

After eight years of recreating and working on Renaissance-style paper, fellow artists Guy Diehl, Max Thill, and I have come to appreciate and enjoy painting and drawing on Magnolia's linen and hemp, gelatin-sized paper. The paper's imprinted surface, featuring a strong presence of intertwined, coarse felt fibers, has become a preferred choice for our art.





Attributed to: Michelangelo and Workshop, Italian. *Cartoon of Venus Kissed by Cupid*, 1532–34.
Charcoal on nineteen sheets of paper mounted on canvas. 51.6 in x 72.5 in.
Museo Nazionale di Capodimonte, Gabinetto Disegni, Naples

Format choices that avoid the back mark



Examples of Michelangelo's format choices that suggest an avoidance the back mark found running down the middle of a Royal [realle] sheet.

Left: Michelangelo Buonarroti, *Studies for the Libyan Sibyl* (Italian, Caprese 1475–1564 Rome), ca. 1510–11, Red chalk with small accents of white chalk.

Metropolitan Museum of Art, New York. Right: Michelangelo Buonarroti, *Study for the drapery of the Erythraean Sibyl, seated to right with legs crossed*. 1508–12. Brown wash and pen and dark brown ink over a black chalk under-drawing, The British Museum, London.

The materials and methods that succeeded in recreating 15th-century paper:

The above article has traced my intellectual and aesthetic evolution. But without craft, there is no ground to stand on. As such, I want to share, in detail, the materials and methods that have succeeded thus far in making this paper-making project possible. If I die and am reincarnated, these are the notes I would want to help me begin anew. They are listed in roughly the order in which they appear in the papermaking process.

The first three years of my efforts were dedicated to modifying my equipment and assembling additional tools and equipment of early European papermakers. I also learned what not to do, experimenting with various retting, beating, forming, pressing, drying, and sizing strategies. I made hundreds of sheets, most of which were not viable. My early attempts, such as pressing sheets to 40 tons overnight to imprint felt hair marks, and drying sheets stuck on felts, were unsuccessful; contact time does not intensify the felt hair mark. In fact, these early tests seemed to diminish my sought after hair mark. Most early sheets were cloudy with poor look-through and indistinct laid lines. Despite this, our Artist in Residence, Guy Diehl, attempted drawings on these inferior sheets with a positive attitude. His feedback and encouragement spurred me on.

Linen rags and half stuff

The use of old linen rags, like old Irish linen tablecloths listed on eBay, is problematic due to the use of optical brightening agents, chlorine bleach, and other chemicals used in modern textile production and laundering. Therefore, we purchased cuttings (called “cabbage” or “cabbage”) from textile companies that manufacture natural linen products without OBAs. However, new cuttings are more challenging to break down than old worn-out rags. Processing them into paper is more labor and time-intensive, a problem shared by Renaissance papermakers, who preferred to use old rags for higher quality papers. New textile remnants were historically used to make wrapping paper.

We air freighted bales of flax and hemp half-stuff from Celesa in Spain. This partially-prepared fiber must be beaten hard and fast to keep the freeness high.

Decomposing rags prior to physical processing

We successfully tested composting or “retting” our new

linen rag cuttings using three processes. First we cultivating mycelium with rags mixed with growing media in sterilized and inoculated mushroom grow bags. Second, we decomposed rags in worm farms, interspersed with kitchen compost. Finally, we retted cuttings soaked in water with slaked lime for 7 years. The intention of retting is to reduce the amount of beating and therefore the amount of hydration. For this purpose, all three systems were viable.

With the advent of the Hollander beating engine around 1640, retting was no longer necessary as papermakers relied on breakers and beaters to process their rags. More physical processing and less microbial degradation of cellulose fiber increases hydration, which causes shrinkage when newly made sheets dry, and can result in the loss of felt-mark fidelity.

Shredding rags

We found it extremely difficult to cut the rags into smaller pieces using a scythe-blade, as is described in Volume II of Diderot’s *Encyclopédie*. Instead, we purchased a FilaMaker shredder, which pulls the woven fibers of the rags apart without excessive cutting. Shredding keeps the cellulose fibers more intact before beating, preserving the tapered ends of the bast fibers and avoiding exposing oxidation sites, which can contribute to degradation.

Hollander Beaters

We use two Hollander beaters, a Noble and Wood ten-pound laboratory cycle beater (which we seldom fill with more than three pounds of dry fiber) and a two-pound brass Valley Iron Works beater purchased from papermaker Timothy Barrett, with a bedplate rebuilt by David Reina. I visited Jacques Brejoux at Le Moulin du Verger, where water driven stamper mills (the predecessor to the Hollander beater) are still in use. They were of extreme historical interest but I deemed them not practical.

Achieving a Free Furnish

After several years, I concluded that an unconstrained, air-dried sheet made with a free furnish was necessary in order to permanently articulate the felt’s fingerprint in the paper surface. Freeness measures the rate of dewatering—a freer furnish will drain faster, which results in a more dimensionally stable sheet. This means the sheet shrinks less during drying and the felt hair marks will be retained.



(Detail) Max Thill, *Life cycle Still Life?* 2024
oil on Magnolia 18 x 24-inch linen and hemp paper



An overprocessed (i.e. “wet” or “greasy”) furnish will shrink and bond internally to such a degree that the once articulated felt hair marks will no longer be visible when the sheet has dried. The conclusion that Renaissance pulp was very free was supported by a study at the University of Iowa Center for the Book, where Professor Timothy Barrett and his students demonstrated that a vat man and coucher could produce 2000 sheets in a ten-hour day, matching the pace described in Lalande’s 1761 *The Art of Papermaking*.

Beating and Formation

We soak the shredded linen and aggressively beat the fibers to create a “free” pulp, which helps with drainage and contributes to a good look-through. We combine this processed rag pulp with other batches of source fiber. Separately, we process Spanish flax and hemp half-stuff by soaking

the fibers overnight and then beating and blending batches of longer and shorter processing times. This mixing and combining of processed pulp produces a strong paper with a good look-through and free furnish. Our target freeness is between 300 and 400 CSF (Canadian Standard Freeness), and we blend these pulp batches with calcium and magnesium carbonate.

A hot vat of furnish increases freeness and speeds up the sheet formation process. Using two moulds and one deckle, the vatman forms sheets as the coucher deposits them on a stack of alternating felt and paper, building a post. The post is pressed to 50 tons within minutes.

Laid and wove paper moulds

Our 20 x 29-inch and 19 x 25-inch laid paper mould sets

were made by Serge Pirard. 18 x 24-inch mould set made by Britt Quinlan, smaller moulds printed on our 3D printer by Nicholas Price who modified designs by Brian Queen.

Vat bridge and other furniture

The vat we use is a re-purposed polyethylene water tank with an exoskeleton of aluminum tubing. I designed and fabricated the bridge, stay and ass, loosely based both on the designs of J. Barcham Green, found in his publication *Paper Making by Hand* and on a bridge I saw at Iowa Center for the Book built by Timothy Barrett. These essential elements of the vat were built by Miguel and Gamiel Mendoza in their cabinet shop M² located across the street from Magnolia Paper Studio. Miguel also constructed the oak “slice” used for lifting wet sheets, the “T” used for hanging wet sheets on the treble lines, and our marine-grade pressing boards.

Short, stainless steel couching tables were fabricated by a local restaurant supply company, where I also purchased a rolling muffin rack. After some modification, it holds twenty 25 x 34-inch robust aluminum frame and nylon screens we purchased from a screen printing supplier. These screens allow us to lay our paper flat during air drying.

Renaissance style woolen felts

Finding heritage wool hair sheep with DNA tracing back to Spain and Italy during the Renaissance was surprisingly straight forward. My research journey led me to some remarkable individuals, such as Minna White of Lana Dura, a Navajo-Churro felt maker in Taos, New Mexico. I reached out to her with a request for large, 3 x 4 ft. coarse Churro felts, and she not only fulfilled my request but also introduced me to Connie Taylor, the current registrar for the Navajo-Churro Sheep Association. Connie is a specialist in wool color and genetics, and her insights have been invaluable to my research. The Churro breed felts I received from Minna were large, coarse, and felted with no woven underlayment; paper couches nicely on these felts, and they spring back easily from 50 tons (230 psi in our 32”x42” hydraulic press) of pressure. The outer coat hairs of this felt measure 50 to 65 microns in diameter (0.050 to 0.065 mm) – similar to my measurements of the marks in Renaissance paper, and a far cry from the 10 to 24-micron diameter measurements found in delicate wool garments and contemporary papermaking felts. To mimic a 16th century felt more precisely, Minna White is making felts with a finer nap on one side and coarser on the verso.

Hydraulic Press

Our 50 ton Hydraulic press (34 x 44-inch), was built by David Reina.

Second Pressing (pack-pressing) and the exchange process

After the first pressing between felts, the sheets are stacked one on another without felts and pressed gently to stick them together temporarily. For smoother paper, early papermakers repeated this process, parting, shuffling, and re-pressing the sheets in a procedure called “the exchange process.” Pack pressed sheets were separated into “spurs” of four to eight sheets, which gently clung to one another.

We purchase colored pigments and Hercon 100 from his associated company run by his wife, Carriage House Paper-making Supplies

Treble lines

Finding horsehair rope on which to hang and dry paper (traditionally called treble lines) was relatively easy since horse hair is used to make mecate rope for equestrian uses, since it is not generally irritating to horses, unlike sisal and other vegetable fiber rope which can agitate a horse on contact. We strung these lines in rows above our work area and on which we hang spurs and wet animal sized sheets.

Drying

The spurs mentioned above are dried draped over treble lines (horse hair rope) or flat on stretched canvases (sails) for different surface finishes. Those sheets draped over treble lines and left to dry, develop parallel ridges down the middle called “back marks.”

Appropriate hide glue

Hide glue crystals are readily available from woodworker/cabinet makers suppliers in various gram strengths, with higher values corresponding to stronger glues, which will gel faster and have less clarity. To keep peace at our art studio (foul odors to a minimum), we sourced deodorized 192 gram-strength hide glue that performs well and prevented a brewing rebellion contemplated by our master printers Nicholas and Tallulah.

We tub size our papers in 3% hide glue at approximately 130° F.

Stack Dryer and hot press

Our 36 x 48-inch stack dryer that constrain dries wet paper was built by Lee Scott McDonald, a creative force in hand-made papermaking equipment. We also use a modified Seal 500 T hot press for flattening.

Testing Equipment

Canadian Standard Freeness Tester, kilogram, gram, and



Donald Farnsworth, *Portrait of Atim* - 2023



milligram scales, tensile strength tester, Cobb tester, tear strength tester, motorized paper micrometer, microscope, Dennison wax pick tests, pH testing meters and papers

Other essential items

Standing press, plexi glass, Evolon, Pellon, 240 watt blender, laser thermometer

Associated Equipment for testing our paper's viability

French Tool etching press, trays and chemistry for copper-plate etching, drawing materials, including quarried chalk
A 3D printer for making small paper moulds.

15th, 16th and 17th-century paper samples

We have accumulated old letters, documents, blank sheets and books from conservators, book and manuscript dealers, and other sources, for study and comparison with the paper we make.

Determining paper quality and texture:

The raw materials, local conditions, routines, and traditions were very diverse: the women in mills in the Auvergne sorted rags into three grades: fine, medium, and coarse. But some mills, who took more care with the sorting used six grades of rag: superfine, fine, fine seams, medium, medium seams and coarse. So many different descriptions of paper types and qualities exist, depending on who is describing the paper – makers, sellers or users.

Peter Bower

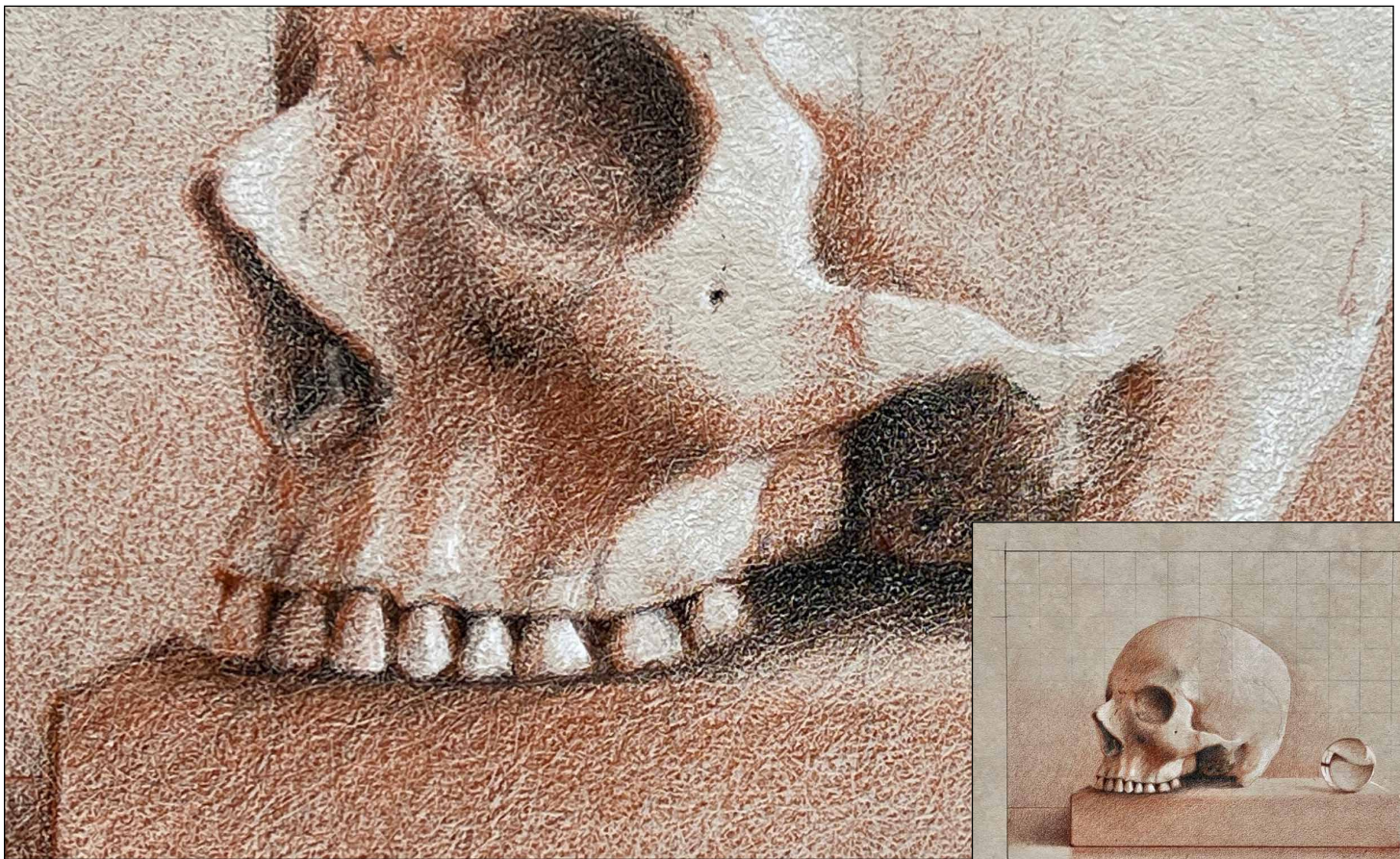
Categories describing the quality of paper is influenced by the rag sorters and classifications of linen:

- *Fine woven white linen rags*
- *Fine woven white linen rags with seams*
- *Medium linen rags*
- *Medium linen rags with seams*
- *Coarse woven linen rags*

Felts: The age, fiber length, and shaft diameter of felt fibers affect the texture of the paper. **New Felts** tend to impart a coarse texture to newly formed sheets, suitable for medium-grade papers like brown paper. **Old Felts:** With the loss of longer, coarser fibers, older used felts can be used for fine-grade, white paper imparting less texture. **Older worn out Felts:** Used for bookboard and wrapping paper. Excessive wear starts to reveal the warp and weft in the inner structure of woven felts. Non-woven felts develop holes. Excessive shedding of felt hair fragments start to disfigure the sheets.

Exchanges technique: Frequent exchanges after parting in the pack pressing lead to less textured paper.

Additionally, the beating, processing, and drying techniques play a significant role. With the introduction of the Beating engine, retting was no longer needed as papermakers used breakers and beaters to process their rags. This shift to more physical processing and less microbial processing of cellulose fiber caused shrinkage when the freshly made sheets dried, leading to a loss of the felt-mark fidelity.



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