

Transparent Paper as a Medium of Copying and Design in the Early Modern Architectural Workshop

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Abstract

This article explores the use and function of the *lucido* technique in architectural workshops from the Renaissance through the late eighteenth century. By examining evidence from written sources and key drawing collections, the study compares the copying practices of architects with those of artists. The findings reveal that transparent paper was not appreciated as a copying medium in Europe's architectural workshops until the mid-eighteenth century. When employed, transparent paper was primarily used for copying figure and ornamental drawings that were

challenging to transfer using the pricking technique. The paper argues that the marginalization of transparent paper in architectural practice was possibly due to the coating process and the characteristics of the substances employed – vegetable oils and resins – which were incompatible with the working environment of architects. It was only with the commercialization of machine-made wove transparent paper in the early nineteenth century that architects and engineers began to systematically adopt this medium.

Introduction

[1] The architectural treatises and manuals written in the sixteenth and early seventeenth centuries were conspicuously silent on the techniques employed by architects to copy drawings. The historiography of drawing often assumes that Renaissance architects painstakingly copied designs line by line using compasses and rulers – a time-consuming method. Yet several semi-mechanical copying methods, including pricking techniques, *calco* (stylus incisions), counterproofs, and *carta lucida* (transparent paper), had been described in artists' handbooks and practised in Italian and French workshops since the early fifteenth century.¹ Their primary purpose was to expedite the copying process and ensure fidelity to the original work, especially before a piece of art left the studio. They could also serve as tools for exploring compositions in reverse, incorporating additional details, and making other design changes, and so they were essential in the design of new artworks. Indeed, even if scant evidence of the use of semi-mechanical copying methods has been found in collections of architectural drawings, the close connection between artistic and architectural education in the Renaissance, and the frequent overlap between artistic and architectural practice, are reasons to believe that architects were well versed in the semi-mechanical copying methods favoured by painters and other practitioners such as engravers.

[2] The relative lack of interest in the material dimension of architectural drawing, which extends to its historical media and supports, is evident in the literature. Recent publications have begun to remedy this, emphasising the value of examining architectural drawings with a refined material lens.² As a contribution to the understanding of architects' working processes and of the materiality of their drawings, this study considers the evidence of the use and function of the *lucido* technique in architectural workshops from the Renaissance to the end of the eighteenth century.³ In this period transparent paper was not industrially produced and commercialised;

¹ Carmen Bambach, *Drawing and Painting in the Italian Renaissance Workshop: Theory and Practice 1300–1600*, Cambridge, UK 1999, 56-62 (pricking), 134 (*carta lucida*), 333-337 (*calco*), *et passim*.

² See, for example, Anthony Gerbino and Stephen Johnsson, *Compass and Rule: Architecture as Mathematical Practice in England 1500–1750*, New Haven 2009; Angelamaria Aceto, "From Building to Print: Giovanni Giacomo de' Rossi and the Making of Architectural Books", in: *The Burlington Magazine* 159 (2017), no. 1374, 697-705; Dario Donetti and Cara Rachele, eds., *Building with Paper: The Materiality of Renaissance Architectural Drawings*, Turnhout 2021; Basile Baudez, *Inessential Colors: Architecture on Paper in Early Modern Europe*, Princeton 2022; Fabio Colonnese, "Grids and Squared Paper in Renaissance Architecture", in: *Drawing Matter Journal–Architecture & Representation*, no. 2: *Drawing Instruments / Instrumental Drawings*, eds. Mark Dorrian and Paul Emmons, 14 Feb. 2024, 1-24, <https://drawingmatter.org/dmj-grids-and-squared-paper-in-renaissance-architecture/> (accessed June 2024).

³ Thus far, the only examination of architects' use of transparent paper in the Early Modern period is Basile Baudez, "De l'usage du calque d'architecture à la fin du XVIIIe siècle, outil de conception ou mémoire de représentation", in: Claude Mignot, ed., *Le dessin d'architecture dans tous ses états*, vol. 2: *Le dessin d'architecture, document ou monument?*, Paris 2015, 89-96.

architects had to prepare it themselves by coating sheets with vegetable oils and resins.⁴ Over time, paper treated with oils and resins becomes brittle, suggesting that numerous once-extant tracings may have perished from neglect or natural degradation. The scarcity of tracings from the Early Modern period in drawing collections may also have been compounded by their primarily utilitarian nature and the traditional undervaluation of copies.⁵

[3] Interestingly, with the introduction of machine-made transparent paper in the early nineteenth century, architects and engineers began to systematically employ this medium. Transparent paper allowed lines from one drawing to be selectively re-used in subsequent drawings. It offered the opportunity to compare solutions visually, to make the process reversible, and to see the architectural project as a pile of overlapping, interrelated layers, thus presenting architects with an unprecedentedly versatile design tool.⁶

Transparent paper and other semi-mechanical copying methods

[4] The earliest instructions for the use of transparent paper as a copying medium in architectural practice date back to 1750, when Louis-Charles Dupain de Montesson (1715–1790), a military engineer and geographer, included it in his drawing manual *La science des ombres*.⁷ An original placed under a transparent sheet of paper could be traced precisely and effortlessly, without any damage to the original. After having traced the desired image onto the transparent sheet, the copyist could either prick and pounce or trace it with a stylus onto a new working surface. Transparent copies could be also laid onto another sheet of paper. In Montesson's account, transparent paper (*papier huilé*) was a method to make an exact copy of a plan drawing, together with the techniques of pricking (*piquer*), tracing on a pane of glass (*contretirer*), and tracing with

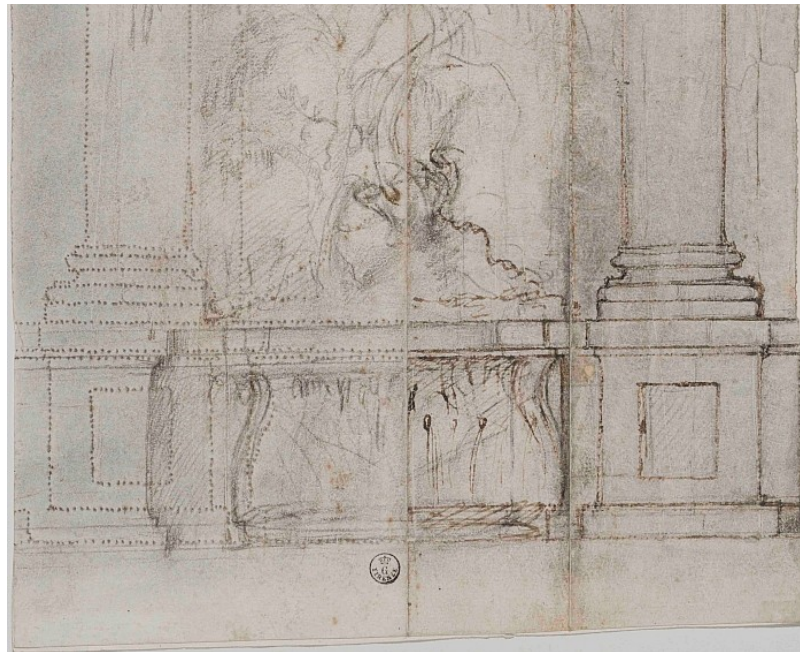
⁴ For coating media and the history of tracing paper until the early twentieth century, see Claude Laroque, "Transparent Papers: A Technological Outline and Conservation Review", in: *Reviews in Conservation* 1 (2000), 21-31; Claude Laroque, "History and Analysis of Transparent Papers", in: *Paper Conservator* 28 (2004), no. 1, 17-32.

⁵ Linda Freeman Bauer, "A Letter by Barocci and the Tracing of Finished Paintings", in: *The Burlington Magazine* 128 (1986), no. 998, 355-357; Linda Freeman Bauer, "More Evidence of Artists' Tracings", in: *The Burlington Magazine* 137 (1995), no. 1102, 38; Thomas Ketelsen and Carsten Wintermann, "'Drawn in the Air'. The Use of Tracings in Early Dutch Draftsmanship", in: *Journal of Paper Conservation* 14 (2013), no. 1, 10-15; Ashley E. Dunn, "'Only Artists Were Not Fooled': Delacroix's Preparatory Drawings on Tracing Paper", in: *Nineteenth-Century Art Worldwide* 21 (2022), no. 2, <https://doi.org/10.29411/ncaw.2022.21.2.3> (accessed December 2024).

⁶ Ray Lucas, "The Discipline of Tracing in Architectural Drawing", in: Christian M. Johannessen and Theo van Leeuwen, eds., *The Materiality of Writing: A Trace-Making Perspective*, London 2017, 116-137; Fabio Colonnese, "Between the Layers: Transparent Paper as a Modernist Architectural Design Environment", in: Cristiana Bartolomei, Alfonso Ippolito and Simone Helena Tanoue Vizioli, eds., *Digital Modernism Heritage Lexicon*, Cham, CH 2022, 57-80.

⁷ Louis Charles Dupain de Montesson, *La science des ombres, par rapport au dessein. Ouvrage nécessaire à ceux qui veulent dessiner l'Architecture Civile & Militaire, ou qui se destinent à la Peinture*, Paris 1750, 148. A second revised edition of Montesson's drawing manual was published in Paris in 1786.

an intermediate sheet of paper rubbed on the back with chalk (*calquer*).⁸ Of the four semi-mechanical copying methods described by Montesson, surviving collections indicate that since the Renaissance the pricking technique was the one most practised by architects. Pricking involved placing the original on top of the paper intended to receive the copy and transferring the principal points by pricking through the original with a very fine needle (Fig. 1).⁹ The draughtsman would then outline the copy with chalk, pen, and straight edge. Nicolas Buchotte (1673–1757), a French military engineer and contemporary of Montesson's, said the method was suitable for orthogonal drawings such as plans, elevations and sections, but not for topographic maps or perspective and decorative drawings.¹⁰



1 Bernardo Buontalenti (1531–1608), *Wall fountain with aquatic plants*, detail. The sheet has been folded and pricked to transfer the drawing on the right-hand side to the left-hand side. Black chalk, pen and brown ink on white laid paper, 431 × 224 mm. Le Gallerie degli Uffizi, Florence, GDSU 2325A (photo: © Gabinetto Fotografico delle Gallerie degli Uffizi)

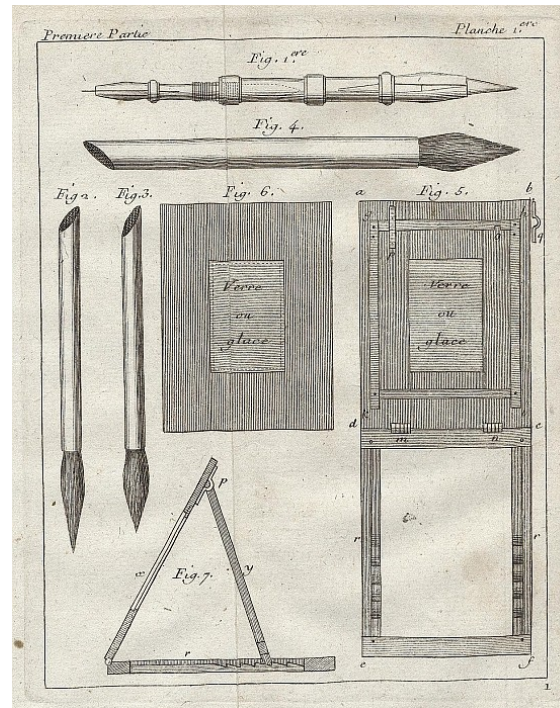
[5] The *contretirer* method, also known as *tirer à la vitre*, involved placing the drawing to be copied on a pane of glass with a sheet of paper on top of it. The light passing through the glass ensured the original drawing was fully visible, making it easier to copy. The first author who advised architects to use glass for copying a drawing "line by line" was Augustin Charles D'Aviler in

⁸ Dupain de Montesson (1786), 144-149.

⁹ For pricking, see Bambach (1999), 57-62. By "semi-mechanically aided copying" Bambach means the practice of transferring designs with the help of pouncing, square grids, and transparent paper.

¹⁰ Nicolas Buchotte, *Les règles du dessin et du lavis*, Paris 1722 [revised and enlarged editions 1743 and 1754], 48: "Cette seconde methode est très juste pour les plans, profils, coupes, etc. mais elle n'est pas propre pour les Cartes, ni pour le Paisage, non plus que pour l'ornement de l'Architecture & autres, comme la figure."

his 1691 *Cours d'architecture*.¹¹ In the 1754 edition of his *Les règles du dessin et du lavis*, Buchotte reproduced the image of a wooden frame containing a pane of glass used for tracing drawings "à la vître" (Fig. 2).



2 A wooden-framed pane of glass for tracing "à la vître". Nicolas Buchotte, *Les règles du dessein et du lavis*, Paris 1754 [first pub. 1722], pl. 1 (photo: Universitäts-Bibliothek Heidelberg, DOI: <https://doi.org/10.11588/diglit.37119#0239>)

According to Buchotte, this method was useful for copying perspective drawings, architectural ornaments, garden parterres, and figure drawings with asymmetrical, organic lines that were difficult to copy using pricking.¹² He also noted that *tirer à la vître* could not be used with thick paper of the type generally favoured by architects – "grand Aigle", "grand Colombier", "Nom de Jesus" – because the lines of the original would not be visible.¹³ These three qualities of paper corresponded to the three largest sizes of sheets available at the time in France, measuring 24 × 35 *pouces* (c.610 × 890 mm), 21 × 31 *pouces* (c.530 × 790 mm), and 18 × 25 *pouces* (460 × 630 mm) respectively.¹⁴ To address this limitation, a thin type of paper called "à la Serpente" or "à la Serpente" that was coated with oil of turpentine was recommended for tracing drawings that could not be pricked.¹⁵

¹¹ Augustin Charles D'Aviler, *Cours d'architecture*, 2 vols., Paris 1691, vol. 2, 442.

¹² Buchotte (1754), 55.

¹³ Thick paper was essential for drawing with brush and ink wash to avoid the paper disintegrating, see the instructions by Giovan Battista Armenini in his *De veri precetti della pittura [...] libri tre*, Ravenna 1587, lib. 1, 55.

¹⁴ The different paper sizes are listed in Buchotte (1722), 13, and Buchotte (1754), 16-17.

¹⁵ Buchotte (1754), 17.

[6] The last method mentioned by Montesson, known as *calco*, involved incising the original drawing with a stylus after rubbing the back of the sheet with chalk (Fig. 3a-b).¹⁶ To avoid colouring the original, a sheet of paper rubbed with chalk could be inserted between it and the copy. Montesson said *calco* was a less commonly method because of the potential damage it could cause to the original drawing.¹⁷ If tracing was necessary, he recommended making an exact copy of the original on transparent paper and then tracing the copy with a stylus instead of the original.¹⁸ The hesitancy about the *calco* technique seems to have been general among architects, as little evidence of its use can be found.¹⁹



3a-b Pierre Bullet (1639–1716), *Study for a "Colonne Ludovise"*, a monument to Louis XIV in the form of a victory column, c.1680–1690: (left) detail of the recto under raking light with the indented lines made by the stylus used to transfer the design onto another sheet; (right) detail of the verso rubbed with black chalk. Graphite, pen and brown ink, brush and brown wash on three joined sheets of white laid paper, 1.239 × 300 mm. Nationalmuseum, Stockholm, NMH THC 6858 (photo: Cecilia Heisser / Nationalmuseum, Stockholm)

¹⁶ The *Encyclopédie, ou Dictionnaire raisonné des sciences, des arts et des métiers*, eds. Denis Diderot and Jean-Baptiste Le Rond D'Alembert, *Texte*, vol. 2, Paris 1751 (facsimile ed. Stuttgart 1967), 565, s.v. "Calquer" said the technique was to rub the back of the original drawing with black or red chalk powder, lay it on a blank sheet, and trace over the main lines using a metal point (*pointe à calquer*). The technique was visualised in *Encyclopédie, ou Dictionnaire raisonné, Planches*, vol. 3, Neuchâtel 1765, s.v. "Gravure", pl. III, fig. 1-3.

¹⁷ Montesson (1786), 148-149.

¹⁸ *Ibid.*

¹⁹ Stockholm, Nationalmuseum, NM H THC 6858, is a rare example of an architectural drawing rubbed with black chalk on the verso and incised on the recto. It is a project by Pierre Bullet from c.1680–1690 for a monument to Louis XIV known as *Colonne Ludovise*, modelled on Trajan's Column. The preference for *calco* instead of the more common pricking technique reflects the need to transfer the column's elaborate sculptural frieze.

[7] From the eighteenth-century sources, it would seem the choice of the copying method depended on the size of the sheet (large versus small), the subject matter (plans and elevations versus perspectival and decorative drawings), the drawing technique (straight edge versus free-hand), and on the desired level of accuracy and speed of the copying process. The material characteristics of both original and copy also played a role in the choice. Additionally, the preference for a specific transfer process was influenced by the value attached to the original and the need to preserve it. Ultimately, the novelty of Montesson's instructions was not his description of the *lucido* technique per se, but his sanctioning of it as a suitable method for copying orthographic representations – then the most common convention in architectural drawing.²⁰

Tracing in the workshops of Renaissance artists

[8] While architects' and engineers' drawing manuals were significantly late to acknowledge the use of transparent paper as a copying medium, artists' handbooks described the technique as early as the fifteenth century. Artists' handbooks also provided various recipes for making paper transparent, using common substances found in artists' workshops, such as vegetable oils for binding colours and turpentine for varnishing.²¹ Cennino Cennini (*Trattato della pittura*, c.1400) said to coat paper with linseed oil, and recommended it be left to dry for several days.²² Raffaello Borghini (*Il Riposo*, 1584) found walnut oil superior to linseed oil because of its smoothness.²³ From the seventeenth century, art manuals suggested either warm oil of turpentine (known as Venetian turpentine), a natural balsam made by distilling the resin of larch trees,²⁴ or a mixture of

²⁰ For the systematization of orthographic projections and the triad of plan, section, and elevation as a convention in architectural representation, see Wolfgang Lotz, "The Representation of the Interior in Renaissance Architectural Drawings" [first pub. in German in 1956], in: *idem, Studies in Italian Renaissance Architecture*, Cambridge, MA 1977, 1-65; Christoph Luitpold Frommel, "Reflections on the Early Architectural Drawings", in: Henry A. Millon and Vittorio Magnago Lampugnani, eds., *Renaissance from Brunelleschi to Michelangelo: The Representation of Architecture*, London 1994, 101-121; James Ackerman, "Introduction: The Conventions and Rhetoric of Architectural Drawing", in: James Ackerman and Wolfgang Jung, eds., *Conventions of Architectural Drawing: Representation and Misrepresentation*, Cambridge, MA 2000, 9-36.

²¹ Laroque (2004), 20.

²² Cennino Cennini, *Trattato della pittura*, c.1400, ed. Giuseppe Tambroni, Rome 1821, ch. xxiii, 18; ch. xxiv-xxvi, 19-20; from the same period, Bibliothèque nationale de France (BnF), Paris, Ms. 6741, Jehan Le Begue, c.1432, transcribed in: Mary P. Merrifield, *Original Treatises on the Arts of Painting*, ed. S. M. Alexander, 2 vols., New York, NY 1967 [first pub. as *Original Treatises, Dating from the XIIIth to XVIIIth Centuries, on the Arts of Painting*, London 1849], vol. 1, 1-111; Biblioteca dei Canonici Regolari di San Salvatore, Bologna, Bolognese manuscript, anon., 15th century, transcribed in: Merrifield (1967), vol. 2, 325-602: 492 n. 214.

²³ Raffaello Borghini, *Il Riposo*, Florence 1584, 144-146.

²⁴ Biblioteca universitaria di Padova, Padua, no. 992, "Ricette per far ogni sorta di colori", anon., 17th century with earlier recipes, transcribed in: Merrifield (1967), vol. 2, 641-717: 681; BnF, Paris, Ms. Fr. 640, anon., Toulouse, c.1580, fol. 51r, s.v. "Contretirer", see digital critical edition by The Making and Knowing Project, DOI: <https://doi.org/10.7916/78yt-2v41> (accessed March 2023); Buchotte (1754), 18.

oil of turpentine and plant oils.²⁵ In order to take a correct outline, whether the original was on paper, panel, or wall, Cennino Cennini's instructions were to put transparent paper over the figure or design, fastening it lightly at the four corners with a piece of red or green wax. The figure or design would be immediately visible through the transparent paper. Cennini said to trace the outlines and extremities of the original design in ink with a fine nibbed pen or a small miniver brush, and then, having removed the transparent paper from the original, add the highlights and rilievis.²⁶ The copyist could then either prick and pounce (*spolverare*) the transparent sheet or trace it with a stylus onto a new working surface (*calcare*), if necessary with the aid of an intermediate sheet rubbed on the back with chalk.

[9] Tracings served a variety of purposes in artistic practice. They were used to consider compositions in reverse, sometimes with details added or with other changes; to create records of artworks before they left the studio; and to replicate works when required.²⁷ Despite the abundance of written sources about the use of transparent paper in artists' workshops, few tracings from the Early Modern period have survived.²⁸ The earliest preserved examples of artists' tracings in drawing collections are known from the early sixteenth-century Netherlands. Among them are two notable pieces. One is a compilation sheet featuring studies of "houses and castle formations".²⁹ It seems to have been done for training purposes and involved tracing selected models from the *Errera Sketchbook* by Herri met de Bles (c.1500–1560). The other depicts the *Descent from the Cross* and derived from a painting by the workshop of Gérard David (c.1460–1523), with the composition reversed.³⁰ In the sixteenth century, the practice of replicating

²⁵ *Secrets concernant les arts et les métiers*, Caen 1786, 111; *Encyclopédie, ou Dictionnaire raisonné, Texte*, vol. 7, Paris 1757 (facsimile ed. Stuttgart 1967), 880, s.v. "Gravure".

²⁶ "Di che modo puoi fare la sustanza di una buona figura o disegno in carta lucida, una carta, la quale ti può essere molto utile per ritrarre una testa o una figura o una mezza figura, secondo che uomo truova di man di grandi maestri. E per avere bene i contorni, o dichiarata ogni tavola o muro, che proprio la vogli tor su, metti questa carta lucida in su la figura, o ver disegno, attaccata gentilmente in quattro canti con un poco di cera rossa o verde. Di subito per lo lustro della carta lucida trasparrà la figura, o ver disegno, di sotto, in forma e in modo che lo vedi chiaro. Allora togli o penna temperata ben sottile, o pennello sottile di vajo sottile; e con inchiostro puoi andare ricercando i contorni e la stremità del disegno di sotto; e così genialmente toccando alcuna ombra, siccome a te è possibile poter vedere e fare." Cennini [ed. Tambroni 1821], ch. xxiii, 18. The English translation is from *The Book of the Art of Cennino Cennini*, tr. Christiana J. Powell Herringham, London 1899.

²⁷ Karl Eric Maison, "Further Daumier Studies. I: The Tracings", in: *The Burlington Magazine* 98 (1956), no. 638, 162-168.

²⁸ Maria Clelia Galassi, "Visual Evidence for the Use of *carta lucida* in the Italian Renaissance Workshop", in: David Saunders, Marik Spring and Andrew Meek, eds., *The Renaissance Workshop*, London 2013, 130-137; Laroque (2000); Dunn (2022).

²⁹ Staatliche Kunstsammlungen Dresden, Kupferstich-Kabinett, inv. no. C3664, unknown artist after Herri met de Bles, pen and black ink, 113 × 203 mm. Published in Ketelsen and Wintermann (2013), 10, fig. 1.

³⁰ British Museum, London, SL 5218.216, unknown artist after Gerard David, brush drawing in black and some brown ink, heightened with white (oxidised), on a sheet of cast gelatine, coated with linseed oil (?), laid down, 262 × 186 mm.

paintings using *lucidi* became widespread in artist's studios and beyond.³¹ Historical sources indicate that even low-skilled artisans, copyists, and amateurs used this technique to make fraudulent copies of famous artists' works.³² Unfortunately, this sometimes resulted in severe damage to the original paintings.

[10] In the same period, engravers frequently used oils or resins to impregnate drawings before etching them – an alternative method to the *counterproof* for transferring a design, reversed, onto the plate.³³ Because of the pressure made by the stylus to indent the lines of the drawings, sheets were severely damaged or more often than not destroyed. The 19 transparent papers made by the French artist and engraver Étienne du Pérac (c.1520–1604) for the series of etchings issued in 1575 as *I vestigi dell'antichità di Roma* are rare examples of drawings that survived the process.³⁴ In his 1645 treatise on the art of intaglio printmaking, the French engraver, painter, and architect Abraham Bosse (1602–1676) expressed concern for the preservation of the original and advised the alternative method of making a traced copy to transfer the design onto the plate.³⁵ Tracings surviving from printers' workshops show that paper was often treated after the drawing was done, not before – this is hinted at when only the surface of the sheet with the tracing was coated, while edges remained untreated. Drawings by the Italian draughtsman and architect Francesco Antonio Bufalini for *Insignium Romae templorum prospectus exteriores interioresque* (Rome, 1684) and by the Swedish draughtsman and military architect Erik Dahlberg for *Suecia antiqua et hodierna* (Stockholm, 1690–1714) are examples of this practice.³⁶

³¹ Joseph Meder, *The Mastery of Drawing*, tr. Winslow Ames, 2 vols., New York, NY 1978 [first pub. as *Die Handzeichnung. Ihre Technik und Entwicklung*, Vienna 1919], vol. 1: *Text*, 397–399.

³² Bauer (1986); Bauer (1995).

³³ Ad Stijnman, *Engraving and Etching 1400–2000: A History of the Development of Manual Intaglio Printmaking Processes*, London 2012, 155–156; Michael Bury, *The Print in Italy: 1550–1620*, London 2001, 13–16.

³⁴ Fabio Fiorani, "Etienne Du Pérac", in: Simonetta Prosperi Valenti Rodinò, ed., *I disegni del Codice Resta di Palermo*, Cinisello Balsamo 2007, 202–214; Fabio Fiorani and Gabriella Pace, "I disegni di Étienne du Perac per i *Vestigi dell'antichità di Roma*: Le prime carte traslucide", in: *Mitteilungen des Kunsthistorischen Institutes in Florenz* 52 (2010), no. 2/3, 240–251.

³⁵ Abraham Bosse, *Traicté des manières de graver en taille douce sur l'airin*, Paris 1645, 19: "Maniere de contretirer ou calquer la dessein sur le verni".

³⁶ Ashmolean Museum (AshM), Oxford, WA2003.Douce.4805, WA2003.Douce4806, Francesco Antonio Bufalini, longitudinal section and south side of the Basilica of St Peter's in Rome. See Angelamaria Aceto, "Rare Drawings for Prints by Francesco Antonio Bufalini", in: *Print Quarterly* 31 (2014), no. 2, 167–174. – Kungliga Biblioteket (National Library of Sweden), Stockholm, Erik Dahlberg, perspectival views of Swedish castles and palaces for *Suecia antiqua et hodierna*, Dahlb. Handt. 1:16, 2:6, 4:2, 4:27, 4:30, 4:32, 4:56, 4:58, 4:59, 6:22a, 7:3, 7:26a, 8:14, 8:15. On Dahlberg's preparatory drawings, see Börje Magnusson and Jonas Nordin, *Drömmen om stormakten: Erik Dahlberghs Sverige*, Stockholm 2015, 85 et passim; Kristoffer Neville, "Suecia antiqua et hodierna: An Architectural Viewbook in the Eighteenth Century", in: *Print Quarterly* 30 (2013), no. 4, 395–408.

Tracing in the studios of Renaissance architects

[11] The first examples of drawings on oiled paper that can be tied to architectural practice date to the 1490s. In this group are some 50 tracings in the Houfe Album³⁷ and a handful of other tracings in the Metropolitan Museum of Art (Fig. 4)³⁸, the Uffizi (Fig. 5)³⁹, and the Ashmolean Museum⁴⁰. What all these traced copies had in common was that they were taken from drawings by the architect and engineer Francesco di Giorgio Martini (1439–1501) and his circle. Measuring c.300 × 250 mm, they featured ancient monuments, architectural details (including classical capitals, bases, and entablatures), and classical sculpture. Their different drawing styles, however, indicated they were the product of at least three different hands. Useful elements of comparison are offered by the drawings in the Houfe Album depicting triumphal arches, especially alongside the corresponding motifs in the drawings of the Metropolitan Museum and the Uffizi.

³⁷ The Houfe Album was previously owned by Simon Houfe of Ampthill in England, who inherited it from his grandfather Sir Albert E. Richardson (1880–1964), and is in private hands. It consists of 51 sheets onto which are pasted tracings on paper coated with a vegetable oil. See Arnold Nesselrath, "I libri di disegni di antichità: Tentativo di una tipologia", in: Salvatore Settis, ed., *Memoria dell'antico nell'arte italiana*, vol. 3: *Dalla tradizione all'archeologia*, Turin 1986, 89-153: 103-104; Gustina Scaglia, "Drawings of Roman Antiquities in the Metropolitan Museum of Art and in the Album Houfe, Ampthill", in: *Annali di Architettura* 4-5 (1993), 9-21; Arnold Nesselrath, "Disegni di Francesco di Giorgio Martini", in: Francesco Paolo Fiore, ed., *Francesco di Giorgio Martini alla corte di Federico da Montefeltro*, Atti del Convegno Internazionale di Studi, Urbino, Monastero di S. Chiara, 11–13 ottobre 2001, Florence 2004, 337-367.

³⁸ Metropolitan Museum of Art, New York, anon. copyist after Francesco di Giorgio Martini, *Arch of Constantine*, inv. 80.03.585, pen and ink, brush and brown wash on oiled paper, 303 × 255 mm; *ibid.*, *Arch of Septimius Severus*, inv. 80.03.632, pen and ink, brush and brown wash on oiled paper, 281 × 257 mm, both c.1501. See also the catalogue entries by Giorgio Ortolani, "II.9.2" and "II.9.3" in: Francesco Paolo Fiore, ed., *La Roma di Leon Battista Alberti: Umanisti, architetti e artisti alla scoperta dell'antico nella città del Quattrocento*, Milan 2005, 256-257.

³⁹ Le Gallerie degli Uffizi, Florence, inv. 6711A, anon. copyist after Francesco di Giorgio Martini, *Arch of Janus* (left half) and *Arch of Septimius Severus* (right half), c.1501, with an attribution to Aristotele da Sangallo in Pasquale Nerino Ferri, *Indice geografico-analitico dei disegni di architettura civile e militare esistenti nella R. Galleria degli Uffizi di Firenze*, Florence 1885, 126; see also Giorgio Ortolani, "II.9.4", in: Fiore (2005), 257.

⁴⁰ Ashmolean Museum, Oxford, WA2003.Douce.4840, 359 × 277 mm; *ibid.* WA2003.Douce.4041, 355 × 264 mm. The two drawings, drawn with pen and brown ink with brown wash on oiled paper, feature ancient statues with their inscriptions. Michael J. Waters ("Francesco di Giorgio and the Reconstruction of Antiquity. Epigraphy, Archaeology, and Newly Discovered Drawings", in: *Pegasus: Berliner Beiträge zum Nachleben der Antike* 16 (2014), 9-102: 46-47; 79, fig. A.1; 80, fig. A.2) argues they were originally in the Houfe Album. I am grateful to Angelamaria Aceto for having made her curatorial reports on the two drawings available.



4 (left) Anon. after Francesco di Giorgio Martini, *Arch of Septimius Severus*, c.1501. Pen and ink, brush and brown wash on tracing paper, 281 × 257 mm. The Metropolitan Museum of Art, New York, inv. 80.3.632, Gift of Cornelius Vanderbilt, 1880 (photo: The Metropolitan Museum of Art, New York) | 5 (right) Aristotile da Sangallo (attr.) after Francesco di Giorgio Martini, *Arch of Janus* (left) and *Arch of Septimius Severus* (right), c.1501. Pen and brown ink on tracing paper laid onto another sheet, 370 × 280 mm. Le Gallerie degli Uffizi, Florence, GDSU 6711A (photo: © Gabinetto Fotografico delle Gallerie degli Uffizi)

The Houfe draughtsman used a straight edge and brown wash technique, while the Metropolitan Museum's and Uffizi's copyists drew free-hand using pen and ink only. The Uffizi's copyist omitted the inscription from the attic of the Arch of Septimius Severus, which was present in the Houfe drawing, and used etched lines instead of ink wash to convey the sculptural value of the bas-reliefs. The Metropolitan Museum's copyist accurately reproduced the inscriptions on the attics (incorporating additional inscriptions from the lower part of the arch), but his rendering of the sculptural elements of the arches was coarse. The Uffizi tracing, which combined half of the Arch of Janus and half of the Arch of Septimius Severus on the same sheet, stood out from the group in terms of composition: not only did it allow for an immediate visual comparison of the two arches, but it may also have been a deliberate choice by the draughtsman to save time and effort when copying.

[12] The extent of this set of tracings is not known, but it should be noted that they do not differ from other contemporaneous copies made on laid paper. Because the paper was treated with oil, Arnold Nesselrath suggests the Houfe Album drawings were made in anticipation of a never-finalised architectural treatise by Francesco di Giorgio Martini.⁴¹ Yet the lack of indentations on the Houfe tracings suggests at least another equally compelling hypothesis: the various sets of

⁴¹ Arnold Nesselrath, "II.9.5", in: Fiore (2005), 256-257. Being in private ownership, it is currently not possible to inspect the Houfe Album tracings.

copies of Francesco di Giorgio Martini were executed as model drawings for the workshop or for collecting purposes.⁴² The popularity of Francesco di Giorgio's drawings of antiquities in the first decades of the fifteenth century is borne out by the numerous copies scattered in other collections.⁴³ Significantly, several of the copies were done using transparent paper, a medium that facilitated the production of series of copies from one prototype. Traced copies were often then transferred to laid paper and finalised with ink wash to give them the appearance of finished drawings.⁴⁴

[13] Other examples of early sixteenth-century traced copies from model books of antiquities can be found in the Larger Talman Album in the Ashmolean Museum (Fig. 6).⁴⁵ The work of an anonymous draughtsman between c.1520 and 1550, the tracings feature a composite capital, two highly ornamented Corinthian capitals with putti, and two bases. The two Corinthian capitals appear to be exact copies of two prototypes in a model book of antiquities by the Master of the Oxford Album, a collaborator of Jacopo Ripanda (c.1465–1516?).⁴⁶ In the eighteenth century, the five traced copies were trimmed and pasted into an album of drawings owned by the collector John Talman (1677–1726).

⁴² On the making of multiple sets of copies to sell, see Carolyn Yorke Yerkes, *Drawing after Architecture: Renaissance Architectural Drawings and Their Reception*, Venice 2017, 20-21 et passim.

⁴³ On this corpus of copies, see Elizabeth M. Merrill, "Pocket-Size Architectural Notebooks and the Codification of Practical Knowledge", in: Matteo Valleriani, ed., *The Structures of Practical Knowledge*, Cham, CH 2017, 21-54; Elizabeth M. Merrill, "Fifteenth-Century Sienese Model Books and the Origins of Francesco di Giorgio's Codicetto", in: *Journal of the Warburg and Courtauld Institutes* 83 (2020), 37-80.

⁴⁴ It should be remembered that the oils used to coat paper darkened in time, giving tracings the characteristic yellow or brownish colour we see today; originally, oiled papers looked almost colourless, not effecting the reading of the drawing.

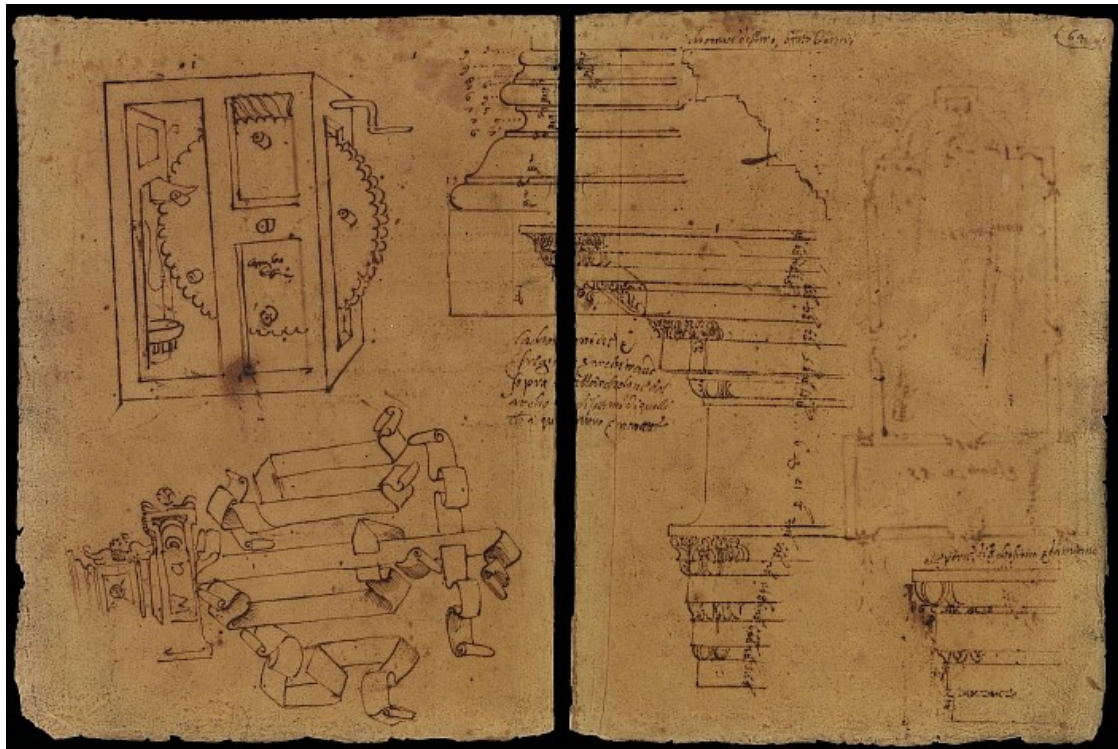
⁴⁵ Ashmolean Museum, Oxford, WA1942.55.157.2, anon. draughtsman, pen and brown ink on three pieces of laid paper joined together and oiled for tracing, 320 × 205 mm.

⁴⁶ The two capitals with putti are taken from the Ripanda sketchbook, fols. 5r (b) and (d); for the sketchbook, see Valeria Cafà, "I disegni di architettura del taccuino KP668 all'Ashmolean Museum di Oxford", in: *Annali di Architettura* 14 (2002), 129-161.



6 Anon., *Three capitals and two column bases*, c.1520–1550. Pen and dark brown ink on three pieces of tracing paper joined together, 320 × 205 mm. Ashmolean Museum, Oxford, WA1942.55.157.2 (photo: © Ashmolean Museum, University of Oxford)

[14] The last of these sets of traced copies, originally a bound volume, is held by the Drawing Matter Collections in London.⁴⁷ Dating to the mid sixteenth century and consisting of 64 oiled sheets drawn on both sides in pen and brown ink, the volume had traced copies of plans of contemporaneous churches, classical buildings, tombs and mausolea, classical fragments, capitals and entablatures, machines, anatomical studies, trophies, and other subjects, often with inscriptions (Fig. 7).



7 Studio of Giovanni Antonio Dosio (attr.), *Sketch of milling machine, measured ornmented cornice, ribbon/label ornament*, c.1550. Pen and ink on tracing paper, 300 × 200 mm. Drawing Matter Collections, London, inv. 2159.63 and inv. 2159.6364 (photo: © Drawing Matter Collections)

Similar designs for machines can be found among the drawings of Francesco di Giorgio Martini; the sources of the other tracings remain unknown. The style suggests that at least two people had a hand in the book, arguably the architect Giovanni Antonio Dosio (1533–1610) and a mid-sixteenth-century draughtsman associated with Antonio da Sangallo the Younger's studio.⁴⁸ The accumulative character of several of the sheets and the lack of alignment of the drawings with the edges suggest the book was created as a compilation of models for the workshop and not for commercial purposes.

⁴⁷ Drawing Matter Collections, London, inv. 2159, 300 × 190-200 mm, originally leather-bound, c.1550.

⁴⁸ Initially attributed to Antonio da Sangallo the Younger's studio, Arnold Nesselrath has subsequently attributed the model book to Giovanni Antonio Dosio. Kept in the Drawing Matter Collections in London, the model book has not yet been a subject of systematic study. I would like to thank Elizabeth M. Merrill for bringing it to my attention.

Tracing in the eighteenth century

[15] Almost no architectural tracings are known from the seventeenth century. In this period copy drawings of ancient and modern architecture continued to be made and collected, but not on transparent paper.⁴⁹ Instead, it was in the eighteenth century that transparent paper appears to have resurfaced as the copying medium of choice, not only in architectural practice, but also in the pursuit of scholarly work and publications. This resurgence was likely driven by a renewed interest in the study of antiquities and the subsequent demand for copies from untapped collections of manuscripts and drawings. In a letter dated 1726, Francesco Scipione Maffei, a writer and historian, declared his intention to copy an ancient papyrus preserved in Geneva by soaking a thin sheet of paper with "olio di sasso", the petroleum found in the Sassuolo district near Modena.⁵⁰ Maffei also explained that at the time the practice of tracing manuscripts using transparent paper "was granted as a favour in all royal libraries".⁵¹ Maffei's antiquarian interests resulted in a series of 58 tracings of ancient buildings, now preserved in the Bibliothèque Carré d'Art in Nîmes.⁵² The tracings were likely purchased or commissioned around 1750 by Maffei's pupil and secretary, Jean-François Séguier, from Renaissance manuscripts preserved in Rome, including Giuliano da Sangallo's Barberini Codex and Pirro Ligorio's *Antichità*.⁵³ Included in the same series were three tracings of contemporaneous buildings, including Bernini's Roman church Sant'Andrea al Quirinale and the Jardins de la Fontaine in Nîmes.⁵⁴

[16] Maffei was not the only eighteenth-century antiquarian to commission copies of Giuliano da Sangallo's drawings of antiquities on transparent paper. In the 1780s, in anticipation of his *Histoire de l'art par les monumens* (1810–1823), Jean-Baptiste Séroux d'Agincourt asked the architect Léon Dufourny to make tracings from the Codice Barberiniano Latino 4424 in the Vatican Library, the so-called Sienese sketchbook in the Biblioteca comunale degli Intronati in Siena, and the Codice Resta in the Biblioteca Comunale in Palermo.⁵⁵ Séroux d'Agincourt appreciated

⁴⁹ For the diffusion of model copies see Cammy Brothers, "Drawing in the Void: The Space between the Sketchbook and the Treatise", in: Maria Beltramini and Caroline Elam, eds., *Some Degree of Happiness: Studi di Storia dell'Architettura in onore di Howard Burns*, Pisa 2010, 93-105 and 667-683.

⁵⁰ Scipione Maffei to Francesco D'Aguirre, 13 June 1726, quoted in: Eleonora Pistis, "'Farò con la copia': Una raccolta inedita di disegni d'architettura nella Bibliothèque Carré d'Art di Nîmes", in: *Pegasus: Berliner Beiträge zum Nachleben der Antike* 11 (2009), 93-207: 95.

⁵¹ "Farò con la copia, la qual si fa in tal forma: si bagna d'olio di sasso carta sottile, rendendosi con ciò trasparente ed atta a ritener l'inchiostro. Posta sopra il Papiro, persona non inesperta del disegno dee andarvi sopra con la penna, e rappresentarne tutt'i tratti, come appunto sta nell'originale. Questo è favore, che si concede in tutte le Biblioteche Regie"; quoted according to Pistis (2009), 95.

⁵² Bibliothèque Carré d'Art, Nîmes, Ms. 106. The sheets are c.480 × 360 mm and c.430 × 310 mm. The inscriptions are in Italian and French. The watermarks are of two types, suggesting the tracings were made at much the same time. The identities of the draughtsmen are difficult to determine.

⁵³ For a complete transcription of the manuscript, see Pistis (2009), 117-207.

⁵⁴ Pistis (2009), cat. 59-61.

⁵⁵ For Duforny's tracings see Antonio Bruculeri, *Les Français et la Renaissance. Idées et représentations de l'architecture, 1760–1880*, Berlin/Boston 2024, 189-203.

Renaissance drawings as objects of study and historical documents that could help him to recall the image of post-classical monuments. Transparent paper was therefore recognised by him as the most suitable medium for making exact copies of the originals.⁵⁶ A number of Dufourny's tracings are preserved in the collection of the École nationale supérieure des Beaux-Arts in Paris, while a large corpus of tracings by other artists is preserved in the fourteen volumes of preparatory material for the *Histoire de l'art par les monumens*, donated by Séroux d'Agincourt to the Vatican Library.⁵⁷

[17] Another series of tracings of a similar date that drew on historic sources was a volume titled "Modern and Antique Ceilings Coloured", now in the RIBA Collections in London.⁵⁸ Produced in the office of the architect Robert Adam (1728–1792), the volume has 60 tracings of different sizes (ranging from c.270 × 270 mm to c.550 × 320 mm) depicting Roman stucco ceilings discovered on the Esquiline and Palatine hills, wall decorations and grotesque works, and plans of ancient mausolea (Fig. 8).



8 Agostino Brunias (c.1730–1796) after Francesco Bartoli (1675–1730), *Antique lunette from the Palatine*, 1760. Pen and brown ink and watercolour on tracing paper. RIBA Collections, London, vol. 54 (formerly vol. 78), "Album of copy drawings, maybe from published sources, by Pietro Santi Bartoli, Francesco Bartoli and others, by the office of Robert Adam", fol. 20 (photo: © RIBA Collections)

Their prototypes can be found in drawings and prints issued by Pietro Santi Bartoli (1635–1700), Francesco Bartoli (1670–1733), Francesco Contini (1599–1669), and Anne Claude Count de Caylus

⁵⁶ Ilaria Miarelli Mariani and Simona Moretti, eds., *Seroux d'Agincourt e la documentazione grafica del Medioevo. I disegni della Biblioteca Apostolica Vaticana*, Vatican City 2017, 26–27.

⁵⁷ For the tracings after drawings by Giuliano da Sangallo and other Renaissance architects see in particular Vat. lat. 9839.

⁵⁸ RIBA (Royal Institute of British Architects), London, vol. 54 (formerly vol. 78), 620 × 490 mm, bound in red cloth.

(1692–1765). Notably, several of the tracings depicting ceilings were coloured with blue, red, yellow, and green watercolour, faithfully reproducing the original drawings by Pietro and Francesco Bartoli.⁵⁹ The close resemblance between the traced copies and the exquisite neoclassical ceilings designed by the Adam's office leaves no doubts about their function as models.⁶⁰

[18] Transparent paper's growing popularity in the later eighteenth century as a medium for multiple sets of copies of classical motifs is further demonstrated by the numerous tracings made by Jacques-Louis David (1748–1825) and his pupils.⁶¹ The Louvre holds three albums of tracings by David from his study period in Italy and Rome between c.1775 and 1780.⁶² Drawn with different media, including pen and brown ink, black chalk, and grey wash, David's tracings were copies of contemporaneous print works devoted to antiquities, including Pierre d'Hancarville's *Antiquités étrusques, grecques et romaines tirées du cabinet de Hamilton* (1806) and Johann Joachim Winckelmann's *Monumenti antichi inediti* (1767), as well as other untraced sources.

[19] David's use of transparent paper as a copying medium seems to have been embraced by his pupils, as confirmed by two large albums of tracings by the Swedish artist Per Krafft the Younger (1777–1863), now held by the Royal Swedish Academy of Fine Arts in Stockholm.⁶³ The method of tracing by means of transparent paper was also soon an established practice at the École des Beaux-Arts in Paris, where students in the third year were required to produce traced copies of classical monuments and other antiquities.⁶⁴

⁵⁹ Helen Whitehouse, "Pietro Santi Bartoli's 'pitture antiche miniate': Drawings of Roman Paintings and Mosaics in Paris, London and Windsor", in: *Papers of the British School at Rome* 82 (2014), 265–313; Erminia Gentile Ortona and Mirco Modolo, *Caylus e la riscoperta della pittura antica: Attraverso gli acquarelli di Pietro Santi Bartoli per Luigi XIV: Genesi del primo libro di storia dell'arte a colori*, Rome 2016.

⁶⁰ For Robert Adam's drawings of classical-inspired stucco ceilings, see Frances Sands, *Robert Adam's London*, Oxford 2016.

⁶¹ Clemency Coggins, "Tracings in the Work of Jacques-Louis David", in: *Gazette des Beaux-Arts* 72 (1968), 259–264.

⁶² Musée du Louvre, Paris, Département des Arts graphiques, Album David Jacques-Louis, nos. 9–11. The tracings, of different sizes, are pasted into the albums but have individual inventory numbers. See Arlette Sérullaz, *Dessins de Jacques-Louis David: 1748–1825*, Paris 1991 (= Musée du Louvre, Cabinet des Dessins, *Inventaire général des dessins. École française*); Pierre Rosenberg and Benjamin Peronnet, "Un album inédit de David", in: *Revue de l'Art* no. 142 (2003), 45–83.

⁶³ Konstakademien (Royal Swedish Academy of Fine Arts), Stockholm, A 64 and B 64, neither of which has been published. Per Krafft the Younger (1777–1863) entered the Academy in Stockholm in 1783 at the age of six and studied under Lorens Pasch the Younger. In 1796 he received a travel grant to study fresco painting in Italy, but decided to visit Paris first, where he spent two years in the workshop of Jacques-Louis David, entranced by neoclassicism. Krafft's traced copies from David were likely made in Paris between 1796 and 1798. The Stockholm albums also contain Krafft's tracings from other graphic sources, probably from his stay in Rome in 1802–1803.

⁶⁴ For this practice, see the 599 traced drawings in the Louvre, inv. RFML.AG.2020.30.1, album of Jacques-Édouard Gatteaux (1788–1881); Basile Baudez, "Usage du calque dans le voyage de Naples, architectes et peintres au tournant des XVIIIe et XIXe siècles", in: Cristina Cuneo and Antonio Bruccheri, eds., *À travers l'Italie / Attraverso l'Italia: Edifici, ville, paesaggi nei viaggi degli architetti francesi, 1750–1850*, Cinisello Balsamo 2020, 166–173: 172.

Transparent paper and architectural practice in the eighteenth century

[20] The surviving evidence suggests it was in the first half of the eighteenth century that architects began to use transparent paper in their ordinary practice. This would be consistent with the historical sources, which acknowledged transparent paper for the first time as an alternative copying medium in 1750.⁶⁵ Unlike the Renaissance architects before them, though, eighteenth-century architects did not limit their use of transparent paper to copying classical prototypes: they used it to trace original project drawings by contemporary architects and to trace their own project drawings.

[21] One of the earliest substantial groups of architectural tracings from the period is held by the Nationalmuseum in Stockholm.⁶⁶ The some 600 sheets of tracings were made between c.1720 and 1780 in the studios of the Swedish architects – and successive Superintendents of the Public Works – Carl Hårleman (1700–1753) and Carl Johan Cronstedt (1709–1777), and were subsequently incorporated in the collections of drawings gathered by the two architects, now known as the Tessin-Hårleman Collection and the Cronstedt Collection.⁶⁷ Hårleman and Cronstedt used transparent paper to copy drawings by French and Italian masters during their educational travels

⁶⁵ Montesson (1750), 148 n. 3.

⁶⁶ For the Nationalmuseum's tracings, see the digital exhibition curated by Anna Bortolozzi, "Transparent Designs: Copies and Tracings in Eighteenth-Century Architectural Practice", 15 May 2023, <https://www.nationalmuseum.se/en/explore-art-and-design/more-to-discover/transparent-design-copies-and-tracings>. See also Helen Evans, "A Condition Survey of the Architectural Drawings Collections", in: *Art Bulletin of the Nationalmuseum* 16 (2009), 127-130.

⁶⁷ For Carl Hårleman, see Åke Stavenow, *Carl Hårleman: En studie i frihetstidens arkitekturhistoria*, Uppsala 1927; Göran Alm, *Carl Hårleman och den svenska rokokon*, Lund 1993; Göran Alm, ed., *Carl Hårleman: Människan och verket*, Stockholm 2000. – For Tessin, see Martin Olin, "Introduction: Nicodemus Tessin the Younger's Collection of Architectural Drawings", in: Martin Olin and Linda Henriksson, *Nicodemus Tessin the Younger: Sources, Works, Collections: Architectural Drawings*, Stockholm 2004, 9-27; Nicodemus Tessin the Younger, *Catalogue des livres, estampes & desseins du cabinet des beaux arts, & des sciences appartenant au Baron Tessin* [Stockholm 1712], ed. and commented by Per Bjurström and Mårten Snickare, Stockholm 2000; Mårten Snickare and Martin Olin, "Collector and Organiser", in: Mårten Snickare, ed., *Tessin. Nicodemus Tessin the Younger, Royal Architect and Visionary*, Stockholm 2002, 61-80; Merit Laine, "The Tessin Collection of Architectural Drawings during the Eighteenth Century (1728–1772)", in: *Konsthistorisk Tidskrift / Journal of Art History* 72 (2003), no. 1-2, 91-102. – For Carl Johan Cronstedt, see Linnéa Rollenhagen Tilly, *Carl Johan Cronstedt arkitekt och organisatör*, Stockholm 2017; Linnéa Rollenhagen Tilly, "Carl-Johan Cronstedt in Paris (1732–35): Instruction, Contacts and Purchases", in: *Art Bulletin of Nationalmuseum Stockholm* 15 (2008), 101-108; Anna Bortolozzi, "La biblioteca di Carl Johan Cronstedt (1709–1777), architetto reale di Svezia", in: Giovanna Curcio, Marco Rosario Nobile and Aurora Scotti Tosini, eds., *Il libri e l'ingegno: studi sulla biblioteca dell'architetto (XV–XX sec.)*, Palermo 2010, 177-184. For the Swedish Nationalmuseum's Cronstedt Collection, see Eric Langenskiöld and Carl David Moselius, *Arkitekturritningar, planer och teckningar ur Carl Johan Cronstedts Fullerösamling*, exh. cat., Stockholm 1942; Carl David Moselius, "Carl Johan och F.A.U. Cronstedts samlingar på det Gamla Fullerö", in: *Nationalmusei Årsbok* (1942–1943), 39-105; Carl David Moselius, "The Carl Johan Cronstedt Collection of Drawings by Claude Audran", in: *Gazette des Beaux-Arts*, 6. Pér., no. 28 (1945), 237-256; *Dessins du Nationalmuseum de Stockholm: Collections Tessin et Cronstedt*, exh. cat., Paris 1950.

on the Continent in the 1720s and 1730s (Fig. 9).⁶⁸ They also used it to copy drawings by other Swedish architects stored in the Superintendent's office or in private collections such as Carl Gustaf Tessin's. Hårleman's and Cronstedt's tracings feature a range of subjects, including plans, elevations and sections of residential and religious buildings, architectural elements, interior decoration, sculpture, antiquities, furniture, garden designs, fountains, infrastructure, coaches, and theatrical sets and costumes. However, as large part of the sheets depicted interior decoration, it would seem Hårleman deliberately chose transparent paper over pricking, the better to copy the extravagant, asymmetrical designs of the French Rococo style (Fig. 10).



9 (left) Carl Johan Cronstedt (1709–1777), *Santi Ambrogio e Carlo al Corso, Rome, plan, two levels*. Inscribed "Le 30 Dec[ember] 1735" (lower left corner), it dates to Cronstedt's educational trip to Rome. Pen and black ink, brush and black wash on tracing paper, 633 × 344 mm. Nationalmuseum, Stockholm, NMH A CC 292 (photo: Cecilia Heisser / Nationalmuseum) | 10 (right) Carl Hårleman (1700–1753), *Ornamental design for a trophy*. Black chalk on tracing paper, 345 × 197 mm. Nationalmuseum, Stockholm, NMH THC 7080 (photo: Cecilia Heisser / Nationalmuseum)

[22] Transparent paper not only helped Hårleman to make accurate copies of the work of the French masters of interior decoration, such as François-Antoine Vassé and Gilles-Marie Oppenord, but it seems probable it facilitated the rapid transfer and popularisation of French models in

⁶⁸ For Hårleman's grand tour, see Magnus Olausson, "I Paris och Rom", in: Göran Alm, ed., *Carl Hårleman: Människan och verket*, Stockholm 2000, 42-53; for Cronstedt's grand tour, see Rollenhagen Tilly (2017), 20-53.

Sweden before the first series of Rococo prints became available in the 1730s and 1740s (Fig. 11).⁶⁹



11 Carl Hårleman (1700–1753) after François-Antoine Vassé, *Hôtel de Toulouse, Paris, study for a chimney piece at the far end of the Galerie Dorée, upper part*. Traces of graphite, pen and black ink, brush and grey wash on tracing paper, 345 × 555 mm. Nationalmuseum, Stockholm, NMH THC 7103 (photo: Cecilia Heisser / Nationalmuseum)

[23] The tracings in the Nationalmuseum collections are often large (c.550 × 350 mm), even if tracings on smaller pieces of paper or on two or more sheets glued or sewn together are not unknown. An examination of the watermarks shows Cronstedt's studio preferred a white laid paper produced by the Dutch manufacturer Cornelis & Jan Honig.⁷⁰ The exceptional thinness and uniformity of this paper, once coated, helped achieve a high degree of transparency. To be able to handle the tracings and avoid tears, several of them had larger sheets of thick, rough paper as backing paper.

[24] It is possible Hårleman introduced Carl Johan Cronstedt to the practice of copying with transparent paper. Cronstedt joined Hårleman's workshop in 1730 and accompanied his master to Paris the following year, where Hårleman wanted to recruit French stuccoists for the decoration of the Royal Palace of Stockholm. The number of tracings in the Cronstedt Collection – some 400, twice as many as in the Tessin-Hårleman Collection – is a sign that Cronstedt not only used transparent paper more effectively than his master, but also to a greater extent. In tracing symmetrical plans and elevations, Carl Johan Cronstedt deliberately copied only half or a quarter of the original design, since, if needed, the missing part could be obtained by flipping the sheet.

⁶⁹ For Hårleman's designs for the Rococo interior of the Royal Palace in Stockholm, see Bo Vahlne, *Frihetstidens inredningar på Stockholms Slott: Om bekvämlighetens och skönhetens nivåer*, Stockholm 2012.

⁷⁰ The paper mill C & J Honig was founded in 1709 by the brothers Cornelis (1683–1755) and Jan Honig (1688–1757) in the Dutch city of Zaandijk. In 1738 the son of Cornelius joined the company, which became J Honig & Zoon(en).

He also combined copies from different prototypes on the same sheet to obtain an immediate visual comparison between two buildings or elements of the same building. The presence of tracings of projects conceived in Cronstedt's own workshop suggests that transparent paper was also being used as a design tool (Fig. 12).



12 Carl Johan Cronstedt (1709–1777), *Church of Adolf Frederick, Stockholm, half elevation, section*. Pen and black ink on tracing paper, 388 × 486 mm. Nationalmuseum, Stockholm, NMH A CC 234 (photo: Cecilia Heisser / Nationalmuseum)

[25] By the mid eighteenth century, Swedish architects were not alone in using transparent paper systematically in the studio. French and British collections too have tracings for projected buildings and interior decoration executed in the period, even if they cannot compare in size to the Nationalmuseum's holdings. The Louvre's Cabinet de dessins has thirteen tracings of projects for Rococo interior decoration and wall panels from about 1750, assigned to the workshops of Juste-Aurèle Meissonnier, Charles-Germain de Saint-Aubin, and Nicholas Pineau.⁷¹ Seven of the tracings are of designs for a salon in the Czartoryski Palace in Warsaw (Fig. 13).⁷² The project was commissioned in 1748 from Juste-Aurèle Meissonnier by Marie Sophie Denhoff, Princess Czartoryska.⁷³ Following Meissonnier's death in 1750, the salon's wainscoting and ceiling were apparently completed in his workshop and sent to Poland in 1753 by his widow. Three plates of

⁷¹ Musée du Louvre, Cabinet de dessins, inv. 22428.2r, 22329, 14055, 35144, 35146, 35147, 35153, 30844 BIS, 22329 TER recto, 35144, 35146, 35147, 35153, 52270.

⁷² Musée du Louvre, Cabinet de dessins, inv. 14055v, 22428.2r, 22329, 35144, 35146, 35147, 35153; for a complete survey of the commission and four of the Louvre's tracings, see Peter Fuhling, *Juste-Aurèle Meissonnier: Un genio del rococò: 1695–1750*, Turin 1999, cat. no. 64, figs. 124-127.

⁷³ Peter Fuhling, "Juste-Aurèle Meissonnier and His Patrons", in: Sarah D. Coffin et al., *Rococo: The Continuing Curve, 1730–2008*, exh. cat., New York 2008, 23-40: 39-40.

the longitudinal section of the Salon Czartoryski were etched in 1748 by Pierre-Edmé Babel and published in the edition of Meisssonnier's *Oeuvre* the same year.⁷⁴ The tracings in the Louvre do not correspond to the etchings, which documented Meisssonnier's earlier design for the salon, or to the finished project, documented by a set of drawings by Johann Sigmund Deybel the Younger in 1760. This indicates that they documented an intermediate stage in the design process and were instrumental to the realisation of Meisssonnier's project.



13 Anon., *Ornement de porte d'un salon, dans un palais*, 1748. The interior decoration of the Salon of the Czartoryski Palace in Warsaw is attributed to the workshop of Juste-Aurèle Meisssonnier. Pen and black ink on tracing paper, 220 × 263 mm. Musée du Louvre, Paris, Département des Arts graphiques, inv. 35144, recto (photo: © Réunion des musées nationaux-Grand Palais)

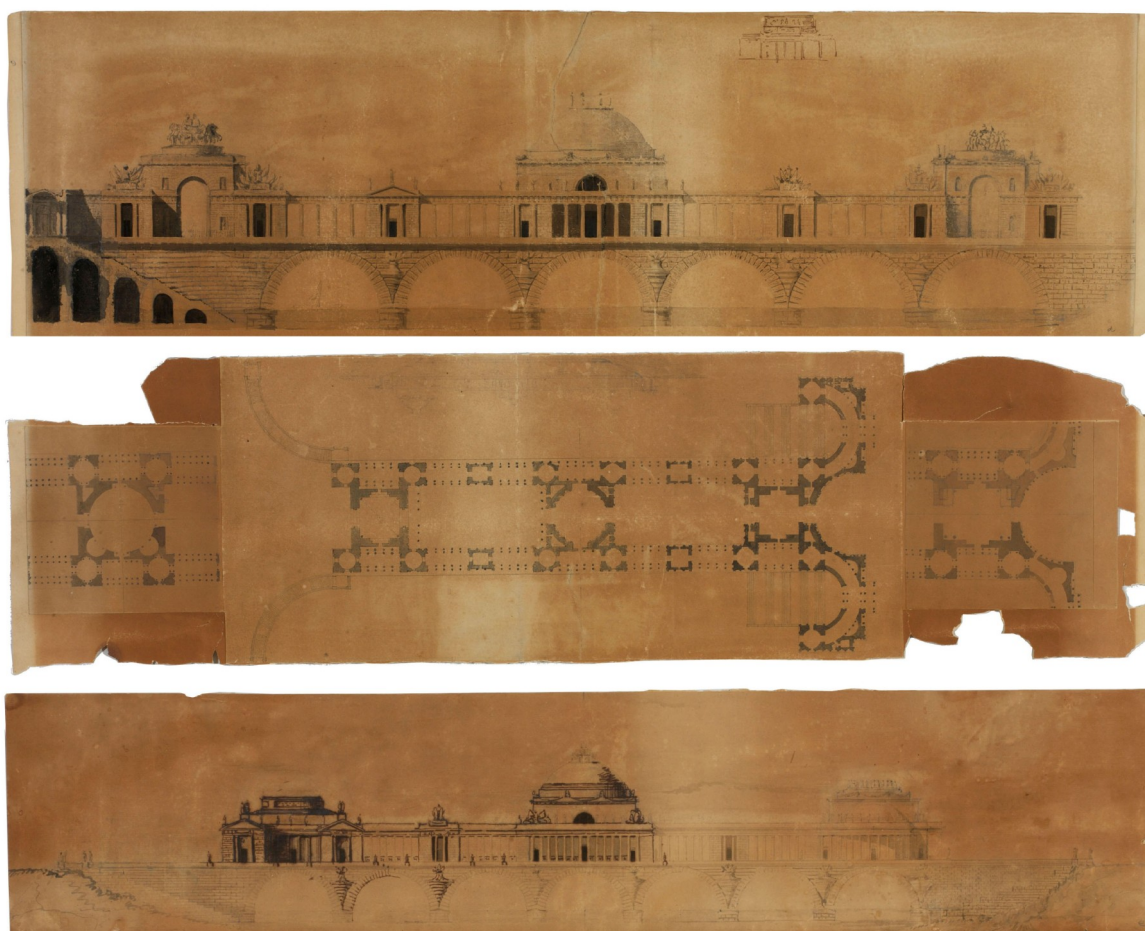
[26] From the last quarter of the eighteenth century, one can also find numerous tracings of perspectival views and landscapes, which were executed by French architects on their Italian tours. Among them are a number of drawings on transparent paper by Louis-François Cassas, Stanislas Lépine, Alexandre-Théodore Brongniart, Prosper Barbot, Achille Etna Michallon, Antoine-Alphonse Monfort, and Édouard-Henri-Théophile Pingret, the majority of them pasted into albums.⁷⁵

[27] Examples of architectural tracings dating from the later eighteenth century are also found in British collections. The Sir John Soane's Museum in London has several dozen tracings made in Soane's office, often backed with wove paper or pasted into albums. The earliest appear to be traced copies made by Soane when he was an assistant in Henry Holland's office between 1772

⁷⁴ *Oeuvre de Juste-Aurèle Meisssonnier, peintre, sculpteur, architecte & dessinateur de la chambre et cabinet du roy*, Paris 1748, pl. 85.

⁷⁵ For this particular use of transparent paper, see Baudez (2020).

and 1778.⁷⁶ They are small-size tracings (c.270 × 150 mm) of designs for a chimneypiece, walls, and ceiling decorations at Claremont House by Henry Holland. The exceptional thinness of the sheets suggests that Soane initially coated silk paper. Also from Soane's early years are a series of tracings of ideal projects submitted to the Royal Academy's 1776 competition (Fig. 14).⁷⁷



14 Sir John Soane, *Design for a triumphal bridge submitted to the Royal Academy school's gold medal competition, 1780*. Pen and black ink, grey and black wash on five sheets of tracing paper laid on cardboard. Sir John Soane's Museum, London, SM P220 aka SM 86/2/1 a-e (photo: © Sir John Soane's Museum)

[28] The practice of tracing copies of academic studies seems to have been common since the mid eighteenth century, as indicated by a tracing of a building with porticos and apsidal pavilions found in a volume of drawings by Robert Adam, which Soane acquired at the Adam's office sale.⁷⁸ Later in Soane's own office, much larger sheets of transparent paper (c.555 × 330 mm) were used

⁷⁶ Sir John Soane's Museum, London, vol. 42/16, nos. 34, 42, 44, 46-48, 51-52, 54, 64-65, 67-69, 71, 73-75, 151. Soane's tracings are pasted into the album "Original Sketches, Miscellaneous Architectural Subjects" with 195 drawings by Soane, Dance, Holland and others, dated 1757-1818.

⁷⁷ Sir John Soane's Museum, SM 86/2/1 a-e (formerly SM P220).

⁷⁸ Sir John Soane's Museum, Adam vol. 9/58, c.1756.

by assistants to make copies of projects by other British architects kept in the studio, such as William Kent's designs for a new Parliament House.⁷⁹ Also in the Soane collection is a group of tracings of classical buildings in Italy by Charles Heathcote Tatham (1772–1842) from around 1797.⁸⁰ Significantly, from about 1820 Soane's office used a different kind of transparent paper, possibly machine-made,⁸¹ unlike the earlier tracings, the sheets are colourless and lack chain lines.

Conclusions

[29] A survey of some of the key collections of architectural drawings seems to confirm the scant treatment of the *lucido* technique in drawing manuals and other teaching literature, namely that transparent paper was not appreciated as a copying medium in architectural workshops before the mid eighteenth century. When transparent paper was used, it was to copy ornamental drawings with intricate, organic lines that were challenging to transfer using the pricking technique. Traced copies were often pasted onto paper and cardboard or into albums to facilitate handling and protect them from tears.

[30] The earlier use of transparent paper to copy drawings of antiquities was narrow in time and scope, being limited to the first half of the sixteenth century and to surveying and studying ancient monuments. The Renaissance architects' adoption of transparent paper as a copying medium is best explained as a transfer of techniques and media from artistic practice. It may have been prompted by two factors: the close connection between artistic and architectural education in the Renaissance; and the collaborative spirit among practitioners, including architects, artists, engravers, and scholars, in the study of Roman ruins.⁸² In the early seventeenth century, however, in conjunction with the organisation of architecture as an independent discipline, transparent paper seems to have been banned from architects' drawing tables, even though its use continued unabated among artists, engravers, and printers.

⁷⁹ Sir John Soane's Museum, SM 36/2/21, traced copy by Soane's office of a variant design for the first floor of a new Parliament House by William Kent, original dated 1738–1739, pen on tracing paper, backed with wove paper, 555 × 325 mm; SM 36/2/22, traced copy of a design for the first floor of the new Law Courts, pen on tracing paper, backed with wove paper, 553 × 329 mm. They are plain copies of the two drawings bought by Soane after 1820, SM 36/2/20 and SM 36/2/7.

⁸⁰ Sir John Soane's Museum, vol. 109/80-3, 90.

⁸¹ Sir John Soane's Museum, SM 37/1-4, 9, "Palace of Westminster: The New Law Courts", "The Stone Building", 2 October 1822.

⁸² On the connection between artistic and architectural education in the Renaissance, see Golo Maurer, *Michelangelos Architekturzeichnungen: Entwurfsprozeß und Planungspraxis*, Regensburg 2004; Caroline Elam, "Funzione, tipo e ricezione dei disegni di architettura di Michelangelo", in: Caroline Elam, ed., *Michelangelo e il disegno di architettura*, Venice 2006, 42-73; Cammy Brothers, *Michelangelo: Drawing and the Invention of Architecture*, New Haven, CT 2008; Alina Payne, "The Sculptor-Architect's Drawing and Exchanges between the Arts", in: Michael W. Cole, ed., *Donatello, Michelangelo, Cellini: Sculptor's Drawings from Renaissance Italy*, exh. cat., London 2014, 57-73. On the transfer of technical knowledge, see Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance*, Baltimore 2001, chap. 7 et passim; Pamela O. Long, *Artisan/Practitioners and the Rise of the New Sciences: 1400–1600*, Corvallis, OR 2011.

[31] The question that remains unanswered is why transparent paper, despite its undisputed qualities as a copying medium, was marginalised in architectural practice in the Early Modern period. One assumption is that architects, swayed by the views of art theorists, condemned tracing as deceptive.⁸³ Starting with Vasari, the primary argument against tracing was that it diminished the challenge of drawing (*disegnare*). Antonio Palomino, in his *Museo pictórico* (1715–1724), argued tracing was "harmful to those who wish to progress [...] because it impedes the practice of drawing".⁸⁴ Similarly, Francesco Milizia (*Dizionario delle belle arti del disegno*, 1771) cautioned that "he who traces without knowing how to draw, transcribes a foreign language which he does not understand. It is impossible that he shall not commit errors. Wherefore tracing is no good for anything, and of little use to him who knows."⁸⁵ However, the negative perception of tracing among art scholars from the late sixteenth century on did not seem to align with architectural practice. In architectural workshops, young apprentices were typically assigned the task of producing clean drawings from sketches and working drawings by the master. These clean drawings, often in a large format and embellished with ink washes, were valued for their quality and accuracy rather than their authorship. Furthermore, by the end of the seventeenth century, professional draughtsmen (*dessinateurs*) were on the payroll in the French Royal Office of Works (*Bâtiments du roi*) and in other similar offices.⁸⁶

[32] Another reason for the architects' hesitancy about transparent paper may be attributed to the coating process and the characteristics of the media. The vegetable oils and resins required to achieve the desired transparency of the copying sheets were sticky, greasy substances that had to be kept separate from the original drawings. After coating, each sheet had to dry for several days before it could be used. If there was an excess of unabsorbed oil, the paper risked leaving indelible stains on the original. The substances and processes necessary to produce tracing paper were thus not compatible with the architects' working environment. There is evidence of the damage that the preparation and handling of hand-coated tracing paper could do, with several original drawings in the Swedish Nationalmuseum's collections stained with oil (Fig. 15). The same collections, however, also show that from the 1750s the availability of a much thinner, uniformly laid rag paper produced by Dutch manufacturers not only improved transparency, but likely also facilitated the treatment of the sheets.

⁸³ See "The Censure of Copying Practices", in: Bambach (1999), 127-136.

⁸⁴ Antonio Palomino de Castro y Velasco, *El museo pictórico y escala óptica*, vol. 2: *Práctica de la pintura*, [Madrid 1724], ed. M. Aguilar, Madrid 1947, 518-519, quoted according to Bambach (1999), 128.

⁸⁵ Francesco Milizia, *Dizionario delle belle arti del disegno*, Bologna 1827 [first pub. Bassano 1797], vol. 2, 189, quoted according to Bambach (1999), 133.

⁸⁶ Alexandre Cojannot, "Architectes et 'dessinateurs': Mutation du dessin d'architecture en France au XVIII^e siècle", in: Alexandre Cojannot and Alexandre Gady, eds., *Architectes du Grand Siècle, du dessinateur au maître d'oeuvre*, Paris 2020, 131-161.



15 Anonymous French early 18th-century draughtsman, *Partial elevation of a two-storey panelled interior with two doors*. The oil stains on the sheet were likely caused by contact with a sheet of tracing paper that was not completely dry. Squared in graphite, black chalk on laid paper, 440 × 585 mm. Nationalmuseum, Stockholm, NMH THC 6628 (photo: Cecilia Heisser / Nationalmuseum)

[33] By the early nineteenth century, another technological advance – the production and commercialization of the first thin, machine-made wove tracing paper – significantly impacted architects' relationship with the medium.⁸⁷ Unlike its handmade counterpart, industrial tracing paper was not produced by coating of rug paper with oils or resins, but rather through an extended process, beating rag and cellulose pulp before making it into sheets of paper.⁸⁸ The process eliminated the laborious preparation of traditional transparent paper, and offered an affordable, efficient tool for generating multiple design copies. It was no coincidence that architects and engineers began to systematically use tracing paper as a copying aid and eventually as a design tool from the early nineteenth century on.

⁸⁷ John Krill, *English Artists' Paper*, London 1987, 95 argues the first tracing paper was produced by the English firm W. T. Reeves between 1768 and 1782. There is no consensus in the literature as to when the first machine-made tracing paper was produced and commercialised. Laroque (2004), 24 argues papermakers knew how to make transparent papers by beating the pulp before the first patents were granted in Europe and the US around 1850.

⁸⁸ Nineteenth-century drawings on tracing paper have been a particular focus of study in conservation science, see Susan Page, "Conservation of Nineteenth-Century Tracing Paper: A Quick Practical Approach", in: *The Book and Paper Group Annual* 16 (1997), 67-73; Lois Olcott Price, *Line, Shade and Shadow. The Fabrication and Preservation of Architectural Drawings*, New Castle, DE 2010; Laroque 2000; Laroque 2004.

About the Author

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