

Magdalena Bushart and Friedrich Steinle
Colour Histories

Colour Histories

Science, Art, and Technology in the 17th and
18th Centuries

Edited by
Magdalena Bushart and Friedrich Steinle

DE GRUYTER

ISBN 978-3-11-033573-6

Library of Congress Cataloging-in-Publication Data

A CIP catalog record for this book has been applied for at the Library of Congress.

Bibliographic information published by the Deutsche Nationalbibliothek

The Deutsche Nationalbibliothek lists this publication in the Deutsche Nationalbibliografie; detailed bibliographic data are available on the Internet at <http://dnb.dnb.de>.

© 2015 Walter De Gruyter GmbH Berlin/Boston

Cover illustration: Lambert's Colour Pyramid. In: Johann Heinrich Lambert, Beschreibung einer mit dem Calaischen Wachse ausgemalte Farbenpyramide, 1772.

Typesetting:: LVD GmbH, Berlin

Printing and binding: Beltz Bad Langensalza GmbH, Bad Langensalza

♻️ Printed on acid-free paper

Printed in Germany

www.degruyter.com

Table of Content

Introduction — V

Systems

Sachiko Kusukawa

Richard Waller's Table of Colours (1686) — 3

Fokko Jan Dijksterhuis

Perceptions of Colours by Different Eyes — 23

Friedrich Steinle

Colour Knowledge in the Eighteenth Century: Practice, Systematisation, and Natural Philosophy — 43

Bruno Belhoste

Dyeing at the Gobelins in the Eighteenth Century: The Challenge of Quémizet — 67

Practices

Ad Stijnman and Elizabeth Savage (Upper)

“Material Colours”: The Heritage of Colour Knowledge in Seventeenth- and Eighteenth-Century Printshops — 95

Susan M. Wager

“Almost an original”: Eighteenth-Century French Porcelain and the Materiality of Reproduction — 115

Olaf Müller

Border Spectra in the Skies of Hokusai and Hiroshige: Japanese Traces of Newton or Goethe? A Colour Mystery — 129

Aida Yuen Wong

Kingfisher Blue in Ming Arts: Status Symbol, Material Invention and Intercultural Connections — 145

Concepts

Tawrin Baker

Colour in Three Seventeenth-Century Scholastic Textbooks — 161

Romana Sammern

“Painting upon the Life”: Colour Knowledge and Colour Practice in English Art Writing and Cosmetic Treatises of the Sixteenth and Seventeenth Centuries — 179

Ulrike Boskamp

Primary Colours in Eighteenth-Century France: Concepts and Uses — 199

Robin Rehm

On the “Beauty and Perfection” of Yellow, Red, and Blue: Anton Raphael Mengs and the Origin of Colours — 223

Theories

David Brafman

The Putrid and the Pure: Colour-Theory of a Baroque Neapolitan Alchemist — 243

Karin Leonhard

Flowering Colour – Still Life Painting and Baroque Colour Theory — 261

Ioana Măgureanu

Colour: from Condemnation in the Scientific Discourse to Rehabilitation in Art Theory — 295

Theresa M. Kelley

Colour Trouble — 317

Picture Credits — 335

Index — 339

Plates — 347



Practices

Ad Stijnman and Elizabeth Savage (Upper)

“Material Colours”: The Heritage of Colour Knowledge in Seventeenth- and Eighteenth-Century Printshops

In the history of graphic art, colour histories often begin around 1700 with the convergence of two breakthroughs: the publication of Isaac Newton’s *Opticks* in 1704¹ and Jacob Christof Le Blon’s invention of a way to reproduce all natural tints in prints c. 1705–1710.² His method involved superimposing one impression each of the primary colours blue, yellow and red, in that order, and the novelty, precision and quantity of the resulting surge of colour-printed material had profound ramifications from the fine arts to medical education. The significance of Le Blon’s breakthrough was appreciated immediately, and scholarship since that point has positioned it as the start of real colour printing. But rather than coming out of nothing, it built on centuries of experiments, precedents and earlier breakthroughs. Many of them, in turn, must also be understood as continuations of or derivations from earlier techniques.

The few earlier episodes of colour printing that are well known are considered as isolated and, with rare exceptions, experimental. But early modern print culture did not make for a black-and-white world. As digital photography and digitisation initiatives make available reproductions of early modern prints in accurate colour, they reveal that these vibrant prints have been hiding in plain sight for centuries. At the same time, they are triggering a new research trend to re-examine colour in early modern printmaking specifically and visual culture more generally.³ It is now emerging that many hundreds, if not thousands, more early modern colour prints survive than were thought and that colour printmaking techniques developed and enabled new ways of communicating visual information continuously from the fifteenth century. This still-emerging corpus indicates that the development of colour printing had a significant impact on early modern visual culture. Ongoing initial research into colour printing techniques in the fifteenth, sixteenth, seventeenth and eighteenth centuries is already revealing that print-specific colour knowledge and technical knowledge was shared, repeatedly and independently re-invented, and deeply embedded within the print trade across Europe during the handpress period.

This paper presents new evidence that many of the so-called breakthroughs in early colour printmaking were instead refinements or re-inventions of much older tech-

1 Newton 1704.

2 In *Coloritto* (1725), Le Blon made a clear distinction between his printing with “Material Colours” and the behaviour of light or “impalpable Colours” as Newton had discussed twenty-one years earlier in his *Opticks*; Le Blon 1725, 6–7; Lilien 1985, 188–189.

3 Stijnman and Savage 2015 (forthcoming).

nologies. It is derived from preliminary results of our independent research projects into the history of intaglio and relief colour printing, respectively. It summarises new research that establishes that intaglio and relief colour printing were very common throughout Europe in the early modern period, even in countries and in centuries where it was previously unknown to print research. By demonstrating that many of the apparent outliers and dead-end experiments instead express a forgotten but rich culture of colour printmaking, it argues that many celebrated innovations in colour printmaking followed directly from medieval or early modern methods. By focusing on techniques, rather than the artistic styles that they enabled, it demonstrates that the study of colour printing can shed light on the development, dissemination, styles and functions of colour practices within early modern print communities. It concludes with suggestions of why this vast amount of material has so far been overlooked and how it can transform the understanding of colour in seventeenth and eighteenth-century Europe.

The assessment concerns both main categories of early modern printmaking: relief (in which the design is raised, as in woodcuts)⁴ and intaglio (in which it is sunken, including engraving and etching on metal plates).⁵ Because they involve different materials, production techniques, specialised skills and printing presses, their histories are intertwined but separate.⁶ ‘Early modern’ has many definitions, and in graphic art it is often thought to end in 1700 (which coincides with the invention of the approach that we still use today; blue-yellow-red, which eventually became the CMYK colour system) or 1830 (when the automation of printing allowed the mass production of (colour) printed matter). This chronological assessment adopts the former to survey developments in colour printmaking techniques in the seventeenth and eighteenth century, indicating their historical (fifteenth-century) roots and later applications.

Colour Relief Printing

In book illustrations, broadsides, single-sheet woodcuts and the decorative arts, colour prints in relief were produced in many techniques and styles. They were made

⁴ This is based on Upper 2012 and *Ibid.*, (as Elizabeth Savage), forthcoming, 2016.

⁵ This is based on Stijnman 2012, 45, 276–280, 341–372.

⁶ In relief printmaking, the blockcutter uses knives and gouges to cut a design (often supplied by an artist) into a block of wood; a viscous oil-based printing ink is then applied to the raised surface with inking balls; the inked block is covered by a sheet of damp paper and run through a flatbed printing press in the same way as a typographic forme. In intaglio printmaking, the engraver cuts lines from a metal plate using a burin or draws lines through an acid-resistant ground with a needle and etches the plate, fills the grooves with a viscous oil-based printing ink (of a different recipe), and cleans the plate’s surface, leaving ink in the sunken areas; the inked plate is covered by a sheet of damp paper and run through the two rollers of a roller press. The first reference work on colour printmaking during the hand-press period, which the authors are preparing, is forthcoming: Stijnman/Savage 2015.

over a much wider area than was thought, by many more printers, for many more purposes, to reach many more markets. The contexts of production are only starting to be understood because research on earlier colour prints is so new, but it is already clear that seventeenth-century colour woodcuts cannot be understood without reference to the earlier techniques and trends in production.

Book Illustrations: Adjacent Colours, 1457–1500

Colour printing was introduced with relief printing itself. Like many manuscript and printed liturgical documents, some copies of the first printed book, the Gutenberg Bible,⁷ included pages of text printed in black and red. Text and images (including individual letters and decorated initials) printed in more than one colour soon became common. They are either one-pull (in which only one run through the press was required) or two-pull (one run per colour, usually black and red), but some particularly colourful images required up to five pulls. This is generally easy to determine: if there is any overlap of printed matter or if the forme (the “page” of moveable type) or matrices (printed surfaces) are mis-registered (poorly aligned), more than one run was involved. All known fifteenth-century colour relief prints are in incunabula (books printed before 1501, roughly fifty years after the invention of the printing press); no single-sheet colour relief prints from this period are known.⁸ Unsurprisingly, the same colour-printing techniques were used for both text and images.

The first items printed in more than one colour are in the Mainz Psalter, printed by Johann Fust and Peter Schöffer in Mainz in 1457. All known impressions have a number of large bi-colour decorated initials with the body in red and marginal penwork in blue, or vice versa (see Plate 1). The ink squash (beaded edges caused by excess ink being pushed over the edge of the block in the press) around the red areas and the surface texture of the blue make it clear that they were printed, not painted, as does the absolute consistency and perfection of the registration of the blocks across surviving impressions. They are still occasionally described as woodcut because they are printed in relief, but it has long been established that the thinness and circularity of the lines in the penwork and the denting of these lines over time indicate that they were cut from metal blocks. The absolute uniformity of the registration (the alignment of the printed elements) and the minute space between adjacent areas of colour indi-

⁷ Mainz: Printer of the 42-line Bible (Johann Gutenberg) and Johannes Fust, c. 1455.

⁸ However, some intaglio single-sheet prints (see below), fabric that was block-printed (i. e. stamped by hand with woodblocks) with colour ink, colour flock prints, and a single red pasteprint survive; Stijnman/Savage 2015 (forthcoming). So far, the technical examination of single-sheet prints that appear to have been printed in brown ink has consistently shown that it is browned iron gall ink that originally was black; Stijnman 2013.

cate that the different pieces were inked separately, fitted together like a jigsaw puzzle, and then printed in one run; the colours would have strayed onto nearby lines if each element had been inked separately while locked in the forme. The 1457 jigsaw printing is often called a one-off experiment, but the printers issued what they called “venustate capitaliu[m]” (attractive capitals) for decades, in both later editions and other books.⁹

Only two known fifteenth-century instances of what became later known as *à la poupée* printing have recently been identified.¹⁰ This technique of inking elements of one matrix in different colours for a one-pull impression is indicated by the absolute consistency of registration, stray areas of colour inks, the blending of colour inks, and the printing of non-divisible elements (e. g. a single line) in multiple colours. It is thought to have emerged in the late seventeenth century in the workshop of Johannes Teyler, and in intaglio but not relief (see below). However, the John Rylands Library copy of the 1457 Mainz Psalter has one large initial ‘D’ whose body was inked in both blue and red. This metal plate was then set inside a metal “frame” block into which a penwork design had been cut, and it was inked in red. The two matrices were printed together as a single element, called a jigsaw print.¹¹

Another early kind of multiple-colour jigsaw printing was used for printing formes (not single matrices) with adjacent but not overlapping colours throughout the seventeenth and eighteenth centuries. But it is also attested in fifteenth- and sixteenth-century books. Images (especially printers’ devices) printed with adjacent but not overlapping areas of black and red became increasingly common, and the printer’s device in the 1495 *Officium Beatae Mariae Virginis*¹² is typical. In all of the examples, the consistency and precision of the registration suggests that it was a one-pull job, and the large gap between the central red area and the black border would have facilitated this. The forme would have been set and then inked; alternatively, the centre element would have been removed from the forme, inked in red while the rest of the forme was inked in black, and then returned to the forme so that it could be printed in one run. It was also used for text. The first page of some copies of Ammonius Hermiae, *Commentarii in quinque voces Porphyrii*¹³ has text in black and a border, heading and initial in gold (from gold leaf, not gold printing ink).¹⁴ The elements to be in gold were dabbed with plain varnish while the text was inked in black, the whole

⁹ Smith 2007, 49.

¹⁰ Masson 1954, 50.

¹¹ Manchester, John Rylands Library, S9784, p. 188; see Savage 2015b.

¹² In: *Horae: ad usum Romanum*, Turin: Jacobinus Suigus and Nicolaus de Benedictis, 1495.

¹³ Venice: Zacharias Callierges for Nicolaos Blastos, 1500.

¹⁴ Close inspection of areas where the gold leaf has flaked off reveals an unpigmented, browned printed substrate, presumably varnish, to which it had been adhered. Some gold strayed onto the outermost edges of the black text, inciting that this substance and the black ink were viscous (i. e., wet) at the same time and thus that they had been printed in the same pull.

was printed in one run, gold leaf was laid on top of the still-wet varnish, the sheet was presumably covered with a protective sheet, and the forme was finally run through the press a second time to make the gold leaf adhere to the varnish.¹⁵

Book Illustrations and Broadsides: Overlapping Colours, from 1485

Neither the historical context nor the continuity of production of colour relief printing techniques used in books in the seventeenth century has been understood previously, but both are evident from the surviving material. Seventeenth-century book printers issued colour woodcuts whose techniques followed a sixteenth-century innovation that tweaked a fifteenth-century technique, and the role of colour printing in the seventeenth-century book market is not new but an extension of what was established as early as the beginning of the sixteenth century.

A third early innovation is printing in register, which involves superimposing impressions of each colour in a separate run through the press. For instance, all of the yellow areas could be printed from one block, then the red areas from another, and finally the black outline from the key block. The most famous polychrome relief print, the three-colour *Theorica eclipsis lnaris* (Diagram of a Lunar Eclipse) in Johannes de Sacro Bosco, *Sphaera mundi*,¹⁶ is in register. It is universally celebrated as the first three-colour print, a significant breakthrough in the communication of visual information, although an earlier example has been identified.¹⁷ Ratdolt, a great innovator and the first master colour printer, produced this process shortly before he left Venice to return to Augsburg. He issued many colour-printed woodcuts in his books over the next two decades with up to five colours (i. e., from up to five blocks; see Plate 2).

The limited literature on early colour printmaking generally holds that simple images with flat areas of colour were printed in books in Ratdolt’s workshop in Augsburg in the 1480s–1490s. Once single-sheet (“fine art”) woodcuts achieved a three-dimensional effect by matching highlight lines cut from the tone block to hatching (shading lines) in the keyblock (the outline, often printed in black), the narrative flows from Germany (from 1507 until the death of the great print patron Holy Roman Emperor Maximilian I in 1519) to Italy (from 1516), to France (from 1544),¹⁸ and finally to the Netherlands – specifically the workshops of Frans Floris (1517–1570) around 1555 and Hendrick Goltzius (1558–1617) from 1588.

¹⁵ Stijnman/Kleine-Tebbe 2009.

¹⁶ Venice: Erhard Ratdolt, 1485.

¹⁷ Stijnman/Savage 2015.

¹⁸ This was first demonstrated in Jenkins 2013; the three other steps in this narrative have long been established in the literature.

But this distinction is conceptual, not technical, and this history is wholly inaccurate. The single standard survey of early modern German colour printing¹⁹ identifies one colour woodcut book illustration, but hundreds upon hundreds survive, often in many individual colour impressions.²⁰ They are effectively unknown to art historians because they are in books, and they are often overlooked in bibliographical catalogues because they are images.²¹ This gap in the literature means that the rapid diffusion of colour-printing technologies throughout Europe and their prominence in the early modern book market have not been documented. Colour relief printing in register was actually very common in images in books (especially on title pages and in the German-speaking lands) until intaglio superseded woodcut c. 1600. The majority were printed from two blocks, so in two runs (for black and red), but the most complex had seven (including gold).²²

Woodcuts can have a long productive life, and it is not uncommon for colour woodcuts in seventeenth-century editions to have been first printed in the sixteenth century. The title vignette on five editions of Georg Rollenhagen's *Froschmeuseler*, printed in Magdeburg by various printers in 1595, 1600, 1608, 1616, 1618, 1621 and 1627, employs the same keyblock and tone block (which is always printed in red). The same late sixteenth-century design was printed from the same blocks through the first three decades of the seventeenth century until they were replaced by another specially printed version of the same image: a copperplate engraving (which was always printed in black).²³ It is a representative example; in many other types of publications, especially almanacs, what seem to be seventeenth-century colour woodcuts are actually later issues of sixteenth-century colour woodcuts.

The same applies to other colour-printing techniques used to illustrate books, such as masking with the frisket sheet. Here the keyblock was superimposed on itself in two runs, once in black and once in red, with holes cut into customised frisket sheets (masks that protect the unprinted area of the sheet in the press) to determine which areas would be printed in black, red, and both black and red. This technique is being researched from an art historical perspective for the first time,²⁴ and there is not yet a standard cataloguing term to describe it.

19 Strauss 1973.

20 Upper 2012, 112–140.

21 On the “neglect” of visual culture in bibliography, see Gaskell 2004.

22 On the *Arms of Matthäus Lang von Wellenberg*, frontispiece to the *Liber selectarum cantionum*, ed. Ludwig Senfl (Augsburg: Sigmund Grimm & Marx Wirsung, 1520) and the book in which it was printed, see Giselbrecht/Upper 2012.

23 To see all title pages, search <http://www.virtuelles-kupferstichkabinett.de/> with the term “Froschmeuseler”.

24 On the technique of their production, see Upper 2014, *Ibid.* (as Savage 2015a).

“Fine Art”: Single-Sheet (*Chiaroscuro*) Woodcuts, from 1507/1516

This section provides just a brief hint of the richness of seventeenth-century single-sheet colour printmaking in relief, which is marked by endless technical variations and combinations. The prints’ attributions can be extraordinarily complex. Because colour-printing technologies were used by artists to design collectable prints and by later printers to “improve” old woodcuts, these prints index both artists’ technical knowledge of printmaking and printers’ artistic decisions (and thus perhaps the market’s tastes).

The best known form of colour printing is the *chiaroscuro* woodcut. The term generally refers to the superimposition of two or more tones of the same colour to create a voluminous effect in imitation of Italian *chiaroscuro* drawing (wash drawing, comparable to modern watercolour). The terminology is a delicate issue; in reference to colour printmaking, “chiaroscuro” is first recorded in manuscript in an appeal for an Italian privilege in 1516²⁵ and in print in 1550.²⁶ Early references to *chiaroscuro* woodcut often specify that it is in imitation of the *chiaroscuro* style of drawing, and the term later came to mean an exaggerated contrast of light and shade in any medium (notably including late sixteenth- and early seventeenth-century paintings that are characterised by a reduced and near-monochromatic palette to emphasise the tonal contrast). However, because *chiaroscuro* is the only standard cataloguing term related to early modern colour printmaking, it is often used by default to indicate any kind of early colour printmaking, regardless of the print style, the brightness of the colours, the approach to tonal contrast or the relationship to *chiaroscuro* drawing. *Chiaroscuro* woodcuts immediately became popular, and many of the finest sixteenth-century German, Italian and Netherlandish artists created them. They have continued to be held in high esteem, and as less sophisticated work suggests, there was prolonged demand from both extremes of the market.

The first single-sheet colour prints, which were issued by Lucas Cranach (c. 1472–1553) in 1507 and Hans Burgkmair (1473–1531) in 1508, combined a black key block with a highlight block that was printed in gold and/or silver.²⁷ In 1508, Burgkmair replaced his two highlight blocks with the opposite, tone blocks from which highlight lines were cut out to complement the hatching and create a three-dimensional effect. In 1510, he issued the first single-sheet, three-colour woodcut, which was also the first from interdependent blocks (i. e. without a keyblock; all blocks must be printed for the design to be legible). Production was sporadic in the German-speaking lands, and the last single-sheet colour woodcut was printed c. 1572.

²⁵ Da Carpi 1516.

²⁶ Vasari 1550, 659.

²⁷ One copy has the highlight block inked *à la poupée* in gold and silver; Berlin, Kupferstichkabinett, 3–1924.

The main centre of production was sixteenth-century Italy. Vast numbers were produced soon after the artist Ugo da Carpi applied for a privilege for his invention of a way to print woodcuts in the style of *chiaroscuro* drawings in 1516 in Venice, and many were reprinted in the next decades. In the seventeenth century, it was independently revived by several printmakers, the most prominent of whom used sixteenth-century blocks and models. Andrea Andreani (1540–1623) was particularly prolific and specialised in reprinting earlier colour woodcuts, such as his 1610 reissue of *Virgin and Child with Saints* by Alessandro Gandini, after Girolamo da Treviso, designed c. 1570. Bartolomeo Coriolano (1590 or 1599–1676) reproduced works after his master Guido Reni (1575–1642), including the three-block *St Jerome*, dated 1637. A two-block woodcut of a *Sybil*, after Coriolano after Reni, printed by Giuseppe Maria Moretti 1700–1746 (see Plate 3) embodies the historical indebtedness of this approach: here, an eighteenth-century print is after a seventeenth-century printmaker after an early seventeenth-century artist, using a sixteenth-century adaptation of a technique developed for fifteenth-century book illustrations.

Outside Italy, *chiaroscuro* woodcuts were most often issued in the Netherlands in the sixteenth and seventeenth centuries. Goltzius was the most prolific designer, but it must be remembered that *printers*, not necessarily *artists*, controlled this visual effect. *Chiaroscuro* woodcuts “by” Albrecht Dürer (1471–1528), who never issued a colour print, illustrate this point. About a century after Dürer’s woodcuts *Rhinoceros* (dated 1515) and the portrait of *Ulrich Varnbüler* (dated 1522) were first printed (in black only), the Amsterdam printer Willem Jansz. Blaeu acquired the keyblocks, had tone blocks added, and reprinted them as two- and three-colour woodcuts during the so-called Dürer Renaissance of the early seventeenth century. From the origins of the academic study of the history of graphic art in the eighteenth century, the addition of colour was considered to reduce the value of prints, cheapening them aesthetically and on the market. However, these reissues show that printed colour could be added as an integral part of the artwork to make woodcuts more appealing. The production of these prints parallels the extensive reissuing of *chiaroscuro* woodcuts in Italy and the “brightening” of old and worn woodcuts in book illustrations through the addition of a new tone block. They must also have been commissioned by the printer rather than the original artist or designer – especially editions produced after the death of the artist or printer. By applying a sixteenth-century Italian visual idiom to earlier sixteenth-century German prints for the seventeenth-century Dutch art market, they also epitomise the international foothold of *chiaroscuro* printmaking.

Many other approaches to *chiaroscuro* printmaking were used in single-sheet prints, but they are not widely known because they have not been subject to academic enquiry. Some, such as the two-block woodcut by Jan Christoffel Jegher (1618–1667) of *The Head of Christ*, printed in Antwerp in the mid-seventeenth century,²⁸ seems to

²⁸ Hollstein German, vol. 9, 193, no. 94.

follow a local (but non-Italian) style of *chiaroscuro* drawing. Others, like an etching with two woodcut tone blocks of *Aaron* by Frederick Bloemaert after Abraham Bloemaert, c. 1650, combine a design in intaglio printed in black with woodcut tone blocks printed in different colours, using different presses.²⁹

Decorative Art: Imitation Wooden Panels, c. 1550–c. 1650

Besides single-sheet (“fine art”) and book illustrations, colour relief prints were produced for a third function in the seventeenth century, if not the eighteenth: the decorative arts. Unlike the use of colour relief techniques in book illustrations and single-sheet prints, it has no parallel in intaglio printmaking. The few texts that refer to these faux “panels” of intarsia or wood grain, printed in two or three browns to imitate wood, consider them as outliers that allowed for the cheap alternative of intarsia or marquetry. However, new research has uncovered a much larger market, if not an industry, and suggested that seventeenth-century production follows directly from a sixteenth-century precedent.³⁰ Like the other uses of colour woodcuts in the seventeenth century, the production and market seems to have been international (examples survive across Europe, and archival documents refer to a network of trade representatives), well established (some practitioners had legal trouble for broaching others’ privilege), and vastly more common than has been recognised. The development and function of these seventeenth-century colour woodcuts cannot be fully understood until their earlier counterparts have been more fully explored.

Conclusions: Early Modern Colour Relief Printing, 1485–c. 1700

While much remains to be done, this ocean of new material is already pointing to largely unrecognised demands for colour in the early modern print and book markets as well as for affordable alternatives to intarsia and marquetry. It also indicates that, in some cases, the artistic role of printers has not been recognised; in cases where the printer must have commissioned the tone blocks and/or chosen the colours of the printing inks, the printer, not the artist or designer, was responsible for the visual effect of the artwork.

²⁹ Hollstein Dutch & Flemish, vol. 2, 86, no. 6 (after Abraham Bloemaert).

³⁰ Upper 2012, 174–195. This will be briefly presented in Stijnman/Savage 2015 and discussed in detail in Savage 2016.

Colour Intaglio Printing

On the whole the introduction of colour in intaglio printing is parallel to that in relief printing, although its heyday was from the late seventeenth to the early nineteenth century, not in the sixteenth century. The surviving sixteenth- and seventeenth-century colour-printed engravings and etchings indicate the continuous and gradually increasing production of (and presumably market demand for) this kind of print.

The Beginning of Monochrome Intaglio Colour Printing, from c. 1465

Engraved copper plates were first printed in intaglio in the 1430s. Engraved images printed in colours other than black appeared shortly after Fust and Schöffer's red-and-blue initials of 1457 (see above). Stylistic evidence suggests that impressions of an engraving of the *Virgin and Child* by Master E. S. in white ink on black prepared paper were printed c. 1465–1467; this is generally considered the first colour (non-black) intaglio print.³¹ Close examination of an impression shows that the white of the eyes and the highlights of the skin and drapery are printed and thus engraved. This experiment seems to have been a one-off because the rest of his oeuvre is printed with black ink on white paper. Printing in white or in pale yellow ink on dark paper remained a rarity, and the next known examples come from the print oeuvre of Hercules Segers in the 1620s–1630s (see also below). Experimental as Segers works may have been, printing in white on a dark background occasionally appeared in scholarly illustrations from the seventeenth century, starting with an etching of a magnification of a cross-section of the stem of “The Lesser Common Thistle” in 1675.³²

From the 1470s until c. 1515, a small number of anonymous engravings that were printed monochrome in blue, green, brown or red ink have survived (see Plate 4). The majority are Italian, several are German, and all are undated. Most of them depict designs for the decoration of metal objects; those printed in blue may have been specifically intended for silver, and later prints in red and yellow-brown may have been made for goldsmiths.³³ A small but significant number of colour-printed engravings from this period illustrate scholarly publications. The two earliest known colour-printed engravings, which may also be the earliest known intaglio book illustrations, are paper instruments – a quadrant and a volvelle – in an astronomical publication of c. 1476.³⁴ In some copies, the quadrant is printed monochrome red and/or

³¹ Stijnman 2012, 45, fig. 44.

³² Grew 1675, fig. 26.

³³ Grimm/Kleine-Tebbe/Stijnman 2011, 86–91, nos. 28–30.

³⁴ Beham 1476, fol. 45r and 46v.

the three-layer volvelle is composed of two layers in red and one in black or vice versa.³⁵ The volvelle may be called a “composite print”, and the manner of combining monochrome elements of a single image is not known again until the nineteenth century. The *De nola opusculum distinctum (etc.)* by Ambrogio Leone³⁶ has four maps engraved by Girolamo Mocet(t)o (c. 1458–c.1531), of which two are printed in black and two either in red or in blue. Other colour prints would have been printed in blue, green or red for aesthetic purposes, including engravings by established artists such as Giovanni Antonio da Brescia (fl. 1490–1519), Domenico Campagnola (c. 1500–1564) and Andrea Mantegna (1431–1506).

Etchings produced by Italian, French and Dutch artists working on the decoration of the French royal palace at Fontainebleau form a school of their own. Between 1542 and 1547 they produced some 420 prints, of which approximately 60 etchings were printed in red or brown.³⁷ The subjects were related to the sophisticated iconography of the decoration of the palace, and the plates may have been printed in these colours to give the prints the appearance of designs for this project. This large, coherent group of works, with its high percentage of colour prints, attests to the interest in colour printmaking among leading artists and courtly patrons in this important moment for the history of art in France.

These are just some of the many episodes, but they are sufficient to indicate that colour intaglio printing developed from the very start of intaglio printing, and was produced in multiple locations across Western Europe (even if in small pockets). It also demonstrates that the earliest function of printed colour was often instructive and practical, and their special appearance, which distinguished them from normal impressions in black, would have been of interest to craftsmen, print collectors and scholars.

A la poupée Printing, c. 1525–c. 1700

Multiple-colour intaglio printing procedures also developed far earlier than has been realised. In 2007, a *Madonna Adored by Saints of the Dominican Order* engraved by Domenico Veneziano (1490–1540) appeared on the Berlin art market.³⁸ All other recorded impressions (dated c. 1525) are in black, except this, which has the Virgin and Child inked in red with the saints and the background in blue. The lack of wear of the engraved lines, the unsophisticated colour division, and evidence from the scientific examination of the inks and the watermark in the paper suggest that it was

³⁵ Stijnman/Upper 2014.

³⁶ Venice: Vercellani, 1514.

³⁷ Jenkins 2013, 131 and 138.

³⁸ *Ausgewählte Druckgraphik* 2007, 50–53, no. 20

printed during the artist's lifetime, if not also c. 1525.³⁹ The engraved plate was inked with two colours and printed in one run. This approach is known as *à la poupée* printing (each colour is applied to the plate separately with a small inking ball that is stuffed like a rag doll, or *poupée* in French). The literature holds that this manner appeared only in the late seventeenth century in Holland, mainly in the workshop of Johannes Teyler (1648–c. 1709), which produced hundreds of *à la poupée* prints from 1688 until its closure in 1697 (see Plate 5).⁴⁰ However, there are a number of earlier examples of this printing method from throughout the sixteenth and the seventeenth centuries, the first of which seems to be this early sixteenth-century Italian example.

With Teyler begins the first production of intaglio colour printing on a large scale. Amsterdam publishers issued series of etchings in his manner from 1695 onward, and the *à la poupée* manner spread to England, Germany, France and Italy in the eighteenth century. This first great wave of colour intaglio printing ebbed in the early nineteenth century. Teyler's output probably inspired Jacob Christof Le Blon (1667–1741) to develop his trichromatic printing process (blue, yellow and red) from c. 1705.⁴¹

Jigsaw Printing, 1572–c. 1650

Further colour-printing methods were invented or derived from colour relief printing simultaneously with the spread of *à la poupée* printing. The printing (in black) of two engravings next to each other on one sheet is found from the mid-fifteenth century. In the early sixteenth century, plates were cut into two or more pieces that were inked separately, joined on the bed of the press and printed together in one run to create one coherent image. The method is called jigsaw-plate printing, and it was commonly used for images surrounded by a separate decorated border. It allowed a number of images to be printed with the same border, which saved work. The earliest print series produced in this manner, such as those by Lucas van Leyden (1489 or 1494–1533), Theodor de Bry (1528–1598), Abraham de Bruyn (c. 1538–1590) and Dominicus Custos (1560–1612), come from the sixteenth century and are printed in black, but it is one step removed from inking the different plates in different colours.

In 1572 Konrad Saldörffer (fl. 1563–1583) produced a bi-coloured title page for the German translation of Nicolas de Nicolay's journey through Turkey (see Plate 6).⁴² The title page shows a simple but effective manner of an etching printed in the jigsaw manner: the border plate was inked in black, the text plate inked in red and inserted

³⁹ For a reproduction, see Stijnman 2012, 345, fig. 277.

⁴⁰ For the oeuvre catalogue of Teyler's printshop, see Stijnman 2016.

⁴¹ Stijnman 2012, 359–361.

⁴² Nicolas de Nicolay, *Der Erst Theyl von der Schiffart und Rayss in die Türkei*, Nuremberg: Gerlatz, 1572.

into the black plate, and the whole was printed in one run. It is the earliest example of its kind that has been identified.

The pamphlet *Peristromata Turcica*⁴³ goes further because it has not only the title page printed from a bi-coloured jigsaw-plate, but also its six illustrations. All plates are inked red-black or black-red, depending on the copy. In one case the title page is inked in blue and red.⁴⁴

Shortly before 1600 Wendelin Dietterlin (fl. 1550/51–1599) started issuing his *Architectura*, a series of etchings with architectural designs. The title pages of the two volumes of the first edition (Strasbourg 1593, 1595) developed the jigsaw method and combined it with *à la poupée* printing.⁴⁵ Both have a small plate cut out in the top, inked in either black or red and inserted again, and a small cut out plate in the middle printed *à la poupée* in red and black. The same plates were used for the title pages of volumes 3–5 in the second edition of 1598, whereby different text plates were inserted into the larger plates. This bi-coloured printing, but not necessarily the *à la poupée* printing, is used in all copies that have been consulted so far.

Printing in Register

The German engineer Heinrich Zeising(k) (d. 1613) produced a book on mechanics in five parts from 1607 to 1613, each with its own title page.⁴⁶ He apparently used these title pages to display his ingenuity and make the works more commercially attractive. The first title page is an etching printed *à la poupée* in green (top), black, and violet (below). The title pages of the second and fifth parts are etchings printed in black only. The title page of the third part of the book has the text typographically printed in red and black surrounded by an etched border decoration printed in black. The title page of the fourth part shows the application of the printing in register that was common with bi-coloured woodcuts on title pages and single leaf *chiaroscuro* woodcuts in the sixteenth century (see above). Here the red is printed on top of the black impression. Printing in register started in typography in the fifteenth century and was used to combine intaglio designs with woodcut tone blocks in the sixteenth century, but this is the earliest known totally intaglio print in register. It is a typical example of how existing techniques were combined in a new way, thereby creating a new print-making method.

⁴³ Nuremberg: Endter, 1641.

⁴⁴ Stijnman 2012, 354, fig. 286.

⁴⁵ Stijnman 2012, 13, fig. 13 and 346, fig. 278.

⁴⁶ For reproductions of all five title pages search <http://www.virtuelles-kupferstichkabinett.de/> with the term “Zeisingk”.

The prints by the Dutch artist Hercules Segers (1589/90–1638?) were obscure in his lifetime, and his many printing experiments are not yet well understood. Some of his surviving etchings are printed in black, but the majority are printed monochrome in blue, brown, green or grey – often combined with hand-colouring – and some are in white or pale yellow ink on a dark background. One or two impressions of landscapes might also be printed *à la poupée*; they are currently undergoing scientific analysis.⁴⁷ The unique impression at the Rijksmuseum, Amsterdam, of his *Rocky Landscape with a Road, a River in the Distance*, c. 1620–29,⁴⁸ was printed in register in black and white from two plates on blue coated paper.

Segers' French contemporary François Perrier (1590–1650) used the same principles to make a series of etchings in black with highlights printed in white from a second plate on greyish-brown paper in the 1630s. Perrier's works were fairly well known in his day, as they are mentioned in seventeenth-century literature.⁴⁹ The same method of printing intaglio in register, this time with red over black, was also used in both surviving copies of one portrait of an unidentified old man by the Dutch silversmith Jan van de Velde IV (fl. 1650–1680) a few decades later. Although he only occasionally produced engravings and etchings and the rest of his known oeuvre is printed in black,⁵⁰ it is clear that he was in control of his working manner because the portrait is so well executed. The difference between Segers and Van de Velde, on the one hand, and Perrier, on the other, may clarify that the first two were more involved in experimentation, while Perrier had passed that phase and was working for a market. The number of his works that survive indicate that he employed an effective and commercially viable printing method.

The next crucial development in intaglio colour printing was Jacob Christof Le Blon's invention of trichromatic printing in Amsterdam c. 1705–1710. He printed images in register from three (mezzotint) plates, using transparent blue, yellow and red inks (respectively and in that order). The likes had never before been seen: rather than lines and dots, the superimposition of the colours created an infinite number of hues. From the late 1720s, he began enhancing the shades to work more efficiently by first printing an impression of an extra plate inked in blue or black. This resulted in a completely new visual effect in prints: realistic colour gradations. The implications were wide-ranging. For instance, the decorative applications made Le Blon's manner fashionable in France, and the realism transformed medical education by allowing the production of anatomical illustrations in natural colours. Its use died out c. 1800,

⁴⁷ Haverkamp Begemann 1973, nos. 16 and 22 'b'; Stijnman 2012, 356. Results will be published in the catalogue coinciding with the Segers exhibition in the Rijksmuseum, Amsterdam, which is planned for September 2016.

⁴⁸ Haverkamp Begemann 25 'b'.

⁴⁹ Abraham Bosse explained in his manual on etching how he thought Perrier's works were printed; Bosse 1645, 74–75.

⁵⁰ For a reproduction see Stijnman 2012, 359, fig. 290.

but trichromatic printing was reintroduced in lithography in 1837⁵¹ and eventually developed into the CMYK system (cyan, magenta, yellow + keyplate in black) still used today.

Other Colour Methods

Other manners of introducing colour in intaglio printing include the combination of an engraving or etching printed in black with woodcut tone blocks; examples are discussed above. Woodcuts, engravings and etchings were not uncommonly printed in black ink on blue paper; coloured satin or silk was also used in this way.

Another option involved making colour prints without a printing press, as the engraved plate could also be cast in gelatine, plaster, sulphur or wax.⁵² Gelatine casting, for example, involved pouring isinglass (liquid fish glue) onto an inked plate and pulling it off when dry, lifting the ink and effectively making a cast of the plate. This form of “printing” without a press resulted in a transparent sheet with an image on it. It allowed for colours to be used in different ways because the gelatine could have been coloured by hand and colour printing inks could have been applied. A series of six casts of plates of the design of an equestrian statue of Herzog August the Younger, now held at the Herzog August Bibliothek, Wolfenbüttel, was produced in Nuremberg in 1646 with red printing ink and green gelatine.⁵³ This technique was used especially in Augsburg, where some estimated four million casts were produced from 1640 until the late nineteenth century. Little remains because such material is fragile, sensitive to mould and insects, and was consumed in a literal sense – sheets of gelatine with religious imagery were fed to animals during epidemics or dissolved in a cup of soup for a sick child.

Conclusions

To summarise, intaglio colour printmaking methods of the seventeenth century did not come out of the blue. Most techniques described here were first used in the fifteenth and sixteenth centuries, and these works show the continuous use of colour in intaglio printing from the fifteenth century into the sixteenth and recontextualise the further development of polychrome intaglio printing in the seventeenth and eight-

⁵¹ French privilege granted to Godefroy Engelmann on 31 July 1837, no. 8848, with an addition for changing ‘Lithocolore’ to ‘Chromolithographie’ on 27 March 1838; Lilien 1985, 124–27.

⁵² Stijnman 2012, 40–41, 328–331.

⁵³ For the complete series, search <http://www.virtuelles-kupferstichkabinett.de/> with the term “gelatine”.

eenth. A case could be made for the continuity of monochrome colour printing because a colour other than black was chosen now and again. However, particular multiple-colour methods, such as *à la poupée* printing, must have been re-invented independently several times over the centuries because they require more technical insight and there seem to be isolated, workshop-specific pockets of production. Given time and advances in the digitisation of print collections and libraries, more colour prints will emerge, making it possible to shape a more homogeneous chronology.

Introducing Colour in Eighteenth-Century Print Studies

It is unquestionable that the overwhelming majority of print production was in black, but the historical continuity of printed colour in both relief and in intaglio printing must be acknowledged. Surviving colour prints indicate that it was vastly more common than has ever been suggested. So why has the history of colour printmaking in early modern Europe not been written?

One main reason is the pervasive bias against colour in early modern graphic art, which has been embedded in the field since it emerged as an academic discipline in the Neoclassical period. A comparison with classical statuary is revealing. Thoughts of ancient Greece or Rome call up mental images of white marble sculptures, even though it is widely known that traces of their vivid paint were systematically removed to meet Neoclassical market demands and academic expectations. The prized visual purity that underpinned research into the antique world for generations was based on the “white-washing” of the objects and, in a self-perpetuating cycle, of research itself; remnants of paint that survived the centuries and, more treacherously, eighteenth-century restoration workshop practices, were dismissed as incidental.

A parallel aversion to colour typifies approaches to early modern graphic art from its Neoclassical roots through the twentieth century. It was reinforced by limitations of mechanical reproduction: black-and-white images are best suited for black-and-white illustrations, and, until very recently, colour plates were prohibitively expensive and potentially inaccurate. Early modern colour prints were necessarily reproduced in greyscale, frustrating further research. This bias continues to shape scholarship and the market; some dealers still sell hand-painted impressions for less than unpainted (i. e. possibly unfinished) impressions because the paint is thought to be a later, unintended addition that covers up the “true art” of the print’s design.⁵⁴ More fundamentally, this printed colour is rarely described (there is still no standard descriptive vocabulary for recording colour in prints, colour-printing techniques, or

⁵⁴ The modern hand-colouring of old prints does indeed exist; Stijnman 2012, 374.

multi-block “states”), so it is nearly impossible to identify colour prints in library or print collection catalogues. This invisibility led to the assumption that colour-printing did not exist before c. 1700, apart from the few well-known exceptions.

Another tangle of reasons is that many of the examples presented here are in books, and some are text or textual elements like decorated initials. The literature on pre-eighteenth-century colour prints is small and focused on single-sheet prints, especially in the style of Italian *chiaroscuro*; for example, the sole dedicated study to early modern colour printmaking in the German-speaking lands,⁵⁵ which is called “Chiaroscuro” although only two of the prints imitate Italian chiaroscuro drawings, concerns sixteenth-century single-sheets printed in relief (woodcut). It includes only one book illustration from the German lands, but Elizabeth Savage has identified hundreds (see above). At the same time, this research is necessarily and deeply interdisciplinary. It calls on three fields that tend to be separate: the history of art/visual culture, bibliography and the technical examination of works of art. Book illustrations, title vignettes and title borders (which are largely the purview of bibliographers) are rarely *chiaroscuro* woodcuts (which fall within the remit of art historians), so they have fallen into the gap. Although they are often unsophisticated, they were made by the same producers and printers, with the same materials and techniques, and at the same presses as the “fine art” colour prints, and they are equally important in understanding early modern print culture.

A further restriction is the difficulty of identification. Colour-printing techniques are barely described in printmaking manuals before 1700, so it is not possible to rely on contemporary references and to identify contemporary terms. The colours themselves can be ambiguous; a reddish-brown block may be variously described as a dark orange, red or brown, while reproductions of colour prints may appear too pale, too bright, too dark, or even in sepiatone.⁵⁶ So even precise descriptions and illustrations must be interpreted cautiously. Few technical examinations of early colour printing inks (and non of red typographic printing inks) have been published. Descriptions rely on visual observation, making it difficult to define fugitive colourants and chemically changed pigments, and oily binding media may cause the browning of the inks. Few art historical programmes provide students of early modern graphic art with an introduction to historical production processes, the technical examination of early modern printed material or approaches to reconstructing printmaking techniques. The result is that the learning curve for researchers working on early colour printmaking tends to be steep, and the study of this topic requires an unusual combination of resources allowing for the close observation and comparison of prints, if not reconstructions on a printing press and scientific analysis. This research would not have

55 Strauss 1973.

56 For instance, Strauss 1973 is illustrated in sepiatone.

been possible before the spread of digital photography and the recent rapid increase in online databases of art collections.

General Conclusions

Although it has not been acknowledged, many techniques of colour printmaking were used across Europe for centuries before the invention of trichromatic (blue-yellow-red) colour printmaking shortly after 1700. These technologies generally developed from much older ones, and they have to be understood in that context rather than as breakthroughs in isolation from their historical precedents. As new technologies enable scholarship to identify and explore these prints, new chapters in the history of printmaking and in the history of the technologies of colour will be written.

Bibliography

- Ausgewählte Druckgraphik = Selected Prints III* (2007). Berlin: Teeuwisse.
- Beham, Lazarus (c. 1476), *Buch von der Astronomie*. Cologne: Nicolaus Götz.
- Bosse, Abraham (1645), *Traicté des manieres de graver en taille douce sur l'airin (etc.)*. Paris: Bosse.
- Da Carpi, Ugo (1516), "Appeal to the Senate of Venice". In: Michelangelo Gualandi (ed.), *Memorie originali italiane risguardanti le Belle Arti*. Bologna: Tipi di Jacopo Marsigli, 1840–1845, vol. II, 134–135, no. 65 and see http://commons.wikimedia.org/wiki/File:Ugo_da_carpi-patent_suppliation.png (accessed 26 November 2014).
- Dackerman, Susan (2002), *Painted Prints: The Revelation of Color in Northern Renaissance and Baroque Engravings, Etchings and Woodcuts*. University Park: Baltimore Museum of Art and Pennsylvania State University Press. Published in conjunction with an exhibition of the same name at the Baltimore Museum of Art (6 October 2002–5 January 2003) and the Saint Louis Museum of Art (14 February–18 May 2003).
- Giselbrecht, Elisabeth and Upper, Elizabeth (2012). "Glittering Woodcuts and Moveable Music: Decoding the Elaborate Printing Techniques, Purpose, and Patronage of the *Liber selectarum cantionum*." In: Stefan Gasch, Birget Lodes and Sonja Tröster (eds.), *Senfl Studien I* (Wiener Forum für ältere Musikgeschichte 4). Tutzing: Hans Schneider, 17–67.
- Grew, Nehemiah (1675), *The Comparative Anatomy of Trunks. Together with an Account of Their Vegetation*. London: Kettlby.
- Grimm, Melanie / Kleine-Tebbe, Claudia / Stijnman Ad (2011), *Lichtspiel und Farbenpracht: Entwicklungen des Farbdrucks 1500–1800*. Wiesbaden: Harrassowitz. Published in conjunction with an exhibition of the same name at the Herzog August Bibliothek, Wolfenbüttel (11 March–28 August 2011).
- Haverkamp Begemann, Egbert (1973), *Hercules Segers: The Complete Etchings*. Amsterdam: Scheltema & Holkema; The Hague: Nijhoff.
- Hollstein's Dutch & Flemish Etchings, Engravings and Woodcuts, ca. 1450–1700* (1949–2010). Originally ed. by F. W. H. Hollstein. 72 vols. Currently published by Rotterdam: Sound & Vision Interactive.
- Hollstein's German Engravings, Etchings and Woodcuts, 1400–1700* (1954– ...). Originally ed. by F. W. H. Hollstein. Currently published by Rotterdam: Sound & Vision Interactive.

- Jenkins, Catherine (2013), “The Chiaroscuro Woodcuts of the Master ND at Fontainebleau”. In: *Print Quarterly* 30, 131–143.
- Le Blon, Jacob Christof (1725), *Coloritto; or the Harmony of Colouring in Painting: Reduced to Mechanical Practice under Easy Precepts, and Infallible Rules = L’Harmonie du coloris dans la peinture; reduite en pratique mecanique et à des regles sures & faciles*. [London: Le Blon].
- Lilien, Otto M. (1985), *Jacob Christoph Le Blon, 1667–1741, Inventor of Three- and Four Colour Printing*. Stuttgart: Hiersemann.
- Newton, Isaac (1704), *Opticks: or, A treatise of the reflexions, refractions, inflexions and colours of light. Also two treatises of the species and magnitude of curvilinear figures*, London: printed for Sam Smith, and Benj. Walford.
- Smith, Margaret (2007), “Printing Red Underlines in the Incunable Period: Sensenschmidt and Frisner’s 1475 Edition of Justinian’s Codex.” In: *Journal of the Printing Historical Society* 10, 45–57.
- Stijnman, Ad (2012), *Engraving and Etching 1400–2000: A History of the Development of Manual Intaglio Printmaking Processes*. London: Archetype; Houten: Hes & De Graaf.
- Stijnman, Ad (2013), “The Colours of Black: Printing Inks for Blockbooks.” In: *Blockbücher des 15. Jahrhunderts, eine Experimentierphase im frühen Buchdruck: Beiträge der Fachtagung in der Bayerischen Staatsbibliothek München am 16. und 17. Februar 2012*, ed. by Bettina Wagner (Bibliothek und Wissenschaft 46). Wiesbaden: Harrassowitz, 59–80.
- Stijnman, Ad (2016, forthcoming), *The New Hollstein Dutch & Flemish Etchings, Engravings and Woodcuts, 1450–1700: Johannes Teyler*. Ouderkerk aan den IJssel: Sound & Vision Interactive.
- Stijnman, Ad and Kleine-Tebbe, Claudia (2009), *Hochzeit von Bild und Buch: Anfänge der Druckgraphik 1420–1515 aus den Beständen der Herzog August Bibliothek*. Wiesbaden: Harrassowitz Verlag. Published in conjunction with an exhibition of the same name at the Herzog August Bibliothek, Wolfenbüttel (23 October 2009–31 January 2010).
- Stijnman, Ad and Upper, Elizabeth (2014), “Color Prints before Erhard Ratdolt: Engraved Paper Instruments in Lazarus Beham’s *Buch von der Astronomie* (Cologne: Nicolaus Götz, c. 1476).” In: *Gutenberg Jahrbuch* 89, 86–105.
- Stijnman, Ad and Savage, Elizabeth (2015, forthcoming), *Printing Colour 1400-1700: History, Techniques, Functions and Reception*. Leyden: Brill.
- Strauss, Walter Leopold (1973), *Chiaroscuro: The Clair-obscur Woodcuts by the German and Netherlandish Masters of the XVI and XVII Centuries: A Complete Catalogue with Commentary*. London: Thames and Hudson. Published simultaneously as *Clair-Obscur. Der Farbholschnitt in Deutschland und den Niederlanden im 16. und 17. Jahrhundert*. Nuremberg: Hans Carl Verlag.
- Upper, Elizabeth (unpublished PhD dissertation, 2012), *Printing Colour in the Age of Dürer: German “Chiaroscuro” Woodcuts, 1487–1572*. Cambridge: University of Cambridge.
- Upper, Elizabeth (2014) “Red Frisket Sheets, c. 1490-1700: The Earliest Artefacts of Colour Printing in the West.” In: *Papers of the Bibliographical Society of America*, <http://bibsocamer.org/bibsite-home/list-of-resources>.
- Savage (Upper), Elizabeth (2015a, forthcoming). “Erhard Ratdolt’s Workshop Practice: New Evidence for the Making of the 1505 *Missale Constantiense*”. In: *Journal of the Printing Historical Society*.
- Savage (Upper), Elizabeth (2015b, forthcoming), “Proto-à la poupée Printing in Relief: An Initial D in the Rylands Mainz Psalter, 1457”. In: *Der gegenwärtige Stand der materiellen Aspekte in der Inkunabelforschung*, ed. Christoph Reske and Wolfgang Schmitz, Wolfenbütteler Schriften zur Geschichte des Buchwesens. Wiesbaden: Harrassowitz.
- Savage (Upper), Elizabeth (2016, forthcoming), *Vivid Prints: Colour Printmaking and the Transformation of Visual Information in Early Modern Germany, 1485–c. 1600*. Leyden: Brill.
- Vasari, Giorgio (1550), *Le vite de’ più eccellenti architetti, pittori, et scultori italiani, da Cimabue insino a’ tempi nostri*. Florence: L. Torrentino.

Plates



Plate 1: Initial details. From *Psalterium* ([Mainz]: Johann Fust and Peter Schöffer, 14 August 1457). Leaf 49. Cambridge University Library, Cambridge, Inc.Fragments.0[7].



Plate 2: Attr. Hans Burgkmair. *Crucifixion with the Virgin and St John*. Colour woodcut from five blocks, with hand-colouring. 253 × 165 mm (borders). Removed from a copy of the *Missale Pataviense* (Augsburg: Erhard Ratdolt, 4 June 1493) or the *Missale Augustanum* (Augsburg: Erhard Ratdolt, 10 June 1496). Herzog Anton Ulrich-Museum, Braunschweig, V 6218.



Plate 3: After Bartolomeo Coriolano, after Guido Reni. *Sybil (Sitting in Profile)*. Colour woodcut from three blocks. 317 × 229 mm. Printed by Giuseppe Maria Moretti, 1700–1746. British Museum, London, 1918.0713.19. © The Trustees of the British Museum, London.



Plate 4: *Design for a Silver Dish or Deckel*, engraving, printed in blue ink, c. 1475, 23.6 cm in diameter. Wolfenbüttel, Herzog August Library, 15 Astron. 2^o (1): fol. 1lv^o.



Plate 5: *The IJ at Amsterdam, with the East-India House in the Background*, Johannes Teyler (workshop), engraving, printed *à la poupée* in various colours of ink, printed c. 1690–1700, 37.0 × 52.8 cm. Wolfenbüttel, Herzog August Library, Graph. C: 1736.25.



Plate 6: Title plate, Konrad Saldörffer, etching, jigsaw print from two plates in red and black ink, 26.0 × 16.9 cm. (N. de Nicolay, *Der Erst Theyl von der Schiffart und Rayss in die Türckey unnd gegen Oriennit*. Nürnberg: Gerlatz, 1572. Wolfenbüttel, Herzog August Library, QuN 30 (3)).