UNIVERSIDADE DE LISBOA
FACULDADE DE BELAS-ARTES

THE TECHNIQUE OF BOOK ILLUMINATING IN THE 16th-CENTURY BOOK OF HOURS

A Multidisciplinary Study of the Materials, Technique and Artistic Influences in Hardouyns *incunabula* (1500-1540)

Silvia Bottura Scardina

Orientadores: Prof.ª Doutora Alice Nogueira Alves
Prof. Doutor Filipe Themudo Barata
Doutora Catarina Amélia Pereira Miguel de Sousa Cabral

Tese especialmente elaborada para a obtenção do grau de Doutor em Belas-Artes, na especialidade de Ciências da Arte e do Património

2022

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2022

DECLARAÇÃO DE AUTORIA

Eu, Silvia Bottura Scardina, declaro que a tese de doutoramento intitulada *The Technique of Illumination in the 16th-century Book of Hours: A Multidisciplinary Study of the Materials, Techniques and Artistic Influences in Hardouyns* Incunabula, é o resultado da minha investigação pessoal e independente. O conteúdo é original e todas as fontes consultadas estão devidamente mencionadas na bibliografia ou outras listagens de fontes documentais, tal como todas as citações diretas ou indiretas têm devida indicação ao longo do trabalho segundo as normas académicas.

A Candidata

_____

Silvia Bottura Scardina

Lisboa, 18 de julho 2022

RESUMO

Os *Livros de Horas* são conhecidos pelo seu charme e pelo mistério que os envolve. Nascidos como guias para a prática espiritual da Liturgia das Horas, estes objetos têm se tornado em itens de luxo por excelência já no século XIV, superando outros livros devocionais em importância e em número.

Com a introdução da técnica de impressão por Gutenberg (ca. 1455), verificou-se a chamada "revolução do livro", que marcou a transição do livro manuscrito para o tipográfico, à qual o Livro de Horas não foi alheio. Na verdade, este livro tornou-se num dos "protagonistas" deste processo, expressando da forma mais eficaz a fusão dos típicos livros manuscritos com os impressos, o que permitiu o nascimento de uma nova sensibilidade artística por detrás da indiscutível "democratização" do saber que então se vivenciou.

Neste contexto, este projeto selecionou como objeto de estudo a técnica artística da decoração de livros de uma tipografia renascentista gerida por Gillet e Germain Hardouyn, bem conhecida entre os especialistas da área. Estes dois irmãos geriram uma empresa de média escala dedicada exclusivamente à produção impressa de Livros de Horas, sediada em Paris, entre as décadas de 1500 e 1550.

Como objetivo de se realizar uma caraterização geral das técnicas de produção utilizadas por esta oficina, o projeto que aqui se apresenta foi dividido em três grandes áreas de interesse: a contextualização histórica e social da oficina, a definição da iconografia representada e a análise de influências artísticas na composição das imagens e a análise de materiais, técnicas e metodologias de produção. Para se alcançar esta visão global, foi adotada uma abordagem multidisciplinar que combina os métodos analíticos das ciências sociais com os métodos técnico-científicos da arqueometria.

Como casos de estudo, foram escolhidos três incunábulos que atualmente fazem parte do acervo da Biblioteca Nacional de Portugal (BNP, Res. 326.v, Res. 328.v e Res. 5781.p). Para uma melhor análise, e tendo em conta questões relacionadas com a representatividade, consideraram-se duas ilustrações dentro dos estudos de caso, uma de natureza profana, a *Marca do Editor* (Res. 326.v, fol. 1r, Res. 328.v, fol. 1r e Res. 5781.p, fol. 1r), e outra de conteúdo religioso e devocional, *A Adoração dos Magos* (Res. 326.v, fol. 46r, Res. 328.v, fol. 31r e Res. fol. 49v).

Depois de definidos alguns conceitos essenciais para a compreensão do trabalho apresentado, foi realizado um contexto histórico e social da época, em que se explica o enquadramento em que os Livres de Horas começaram a ser produzidos em Paris e a sua

disseminação pela Europa, melhor se compreendendo a história e importância da oficina dos irmãos Hardouyn e as suas vicissitudes.

Em seguida, realizou-se a identificação de uma coleção de matrizes gravadas adotadas pela oficina Hardouyn para a execução das ilustrações dos seus livros. Esta pesquisa identificou quinze séries, uma das quais, com seis conjuntos de gravuras, já era conhecida, enquanto cinco novos conjuntos são identificados pela primeira vez neste trabalho. Além disso, foi descoberto um novo uso para outros três conjuntos, incluindo a hipótese da existência de um possível processo de aquisição de duas séries que originalmente pertenciam a outras oficinas parisienses: Jean Barbier (1502-1515/1516) e Guillaume Eustace (1497-1535).

Esta análise também permitiu a reconstituição dos dois principais períodos de produção relacionados com a direção técnica da tipografia. O primeiro inclui as edições feitas por Gillet nos anos 1500-1521, sendo a apresentação destes *Livros das Horas* harmoniosa, elegante e revelando a influência da arte renascentista italiana e da escola de miniaturas de Tours. Para a sua realização, Gillet usou exclusivamente matrizes desenvolvidas por dois artistas locais, o miniaturista e designer Jean Pichore (*fl.* ca. 1501-1520) e o chamado "Mestre do Apocalipse" (*fl.* ca. 1480-1510), ativo na decoração de livros, mas também criador de rascunhos para vitrais, tapeçarias e pintor. Quanto às edições criadas por Germain no período entre 1518-1550, a sua apresentação é austera, errática, apresentando elementos da produção artística impressa alemã, com cenários feitos por vários artistas ativos em Paris, tanto franceses como estrangeiros: Jacob Faber (*fl.* 1516-1550), "Mestre de François de Rohan" (*fl.* ca. 1525-1546), Noël Bellamare (*fl.* ca. 1512-1546).

A terceira parte desta investigação subdivide-se em três áreas. A primeira consiste na análise de materiais de impressão, entendidos como o conjunto dos pigmentos, aglutinantes e aditivos utilizados na formulação das tintas de impressão. Através de uma abordagem multi-analítica, utilizando técnicas *in situ* e não destrutivas (h-EDXRF) e técnicas micro-invasivas e destrutivas (μ-FTIR, SEM-EDS, Py-GC-MS), foram identificados os seguintes materiais: grafite, negro de marfim, óleo de noz, carbonato de cálcio e secantes à base de Cu ou Pb. Para os materiais pictóricos, foi realizada uma abordagem exclusivamente *in situ* e não invasiva (p-XRF, UV-Vis-NIR FORS, HSI), tendo-se identificado os seguintes pigmentos, aglutinantes e aditivos: azurite, índigo, malaquite, ocre, zarcão, vermelhão, laca de garança, massicote, solda branca, alvaiade, gesso, ouro em pó e aglutinantes polissacarídeos e proteicos. Estes resultados foram comparados com livros de receitas do período medieval e pré-moderno dedicados a técnicas de impressão e a miniaturas, datados entre os séculos XII e XVII. Para a comparação com textos técnicos relacionados com a impressão artística, também se consultaram vários textos (*Libro dell'Arte*, *De secretis*, *De atramentis* e *Vocabolario dell'Arte e del Disegno*) que sugeriram que os materiais da impressão

são típicos do processo xilográfico ou de calcografia em relevo A análise dos tratados sobre pintura (*Schedula diversarum artium*, *De Arte illuminandi*, *Liber de Coloribus Illuminatorum sive Pictorum*, *Liber de coloribus faciendi*, *De coloribus diversis modis tractatur*, *De coloribus diversis* e a Ms. de Strasburgo) sugeriu que os materiais pictóricos são compatíveis com os usados em miniaturas, apesar de sugerirem uma evolução da técnica aplicada.

Para a análise da técnica de pintura, foram utilizadas técnicas de análise de área (imagem NIR, DM, fotografia de IR) e outras metodologias mais inovadoras, como simulações de Monte Carlo aliadas a h-EDXRF, pela primeira vez aplicadas na avaliação da estratigrafia das camadas pictóricas e da camada impressa. Além disso, foi desenvolvido um algoritmo para a reconstrução automatizada da composição do desenho subjacente. Os resultados da microscopia digital foram analisados com um *software* de processamento de imagem para a determinação do tamanho das partículas de uma classe de tintas (tintas azuis). Os efeitos óticos da granulometria foram semi-quantificados através de uma metodologia inovadora que combina dados microscópicos com os da análise do HSI nestas tintas. Depois de concluídos estes processos, os dados obtidos confirmaram a hipótese de que o desenho original foi impresso e posteriormente pintado. Além disso, a capacidade de produzir digitalmente reconstruções do desenho original permitiu identificar as gravuras que tinham sido usadas para fazer o desenho subjacente e propor uma hipótese de evolução histórica das imagens.

Por fim, as alterações do programa iconográfico foram avaliadas numa tentativa de se compreender a filosofia da produção, concluindo-se que são poucas as alterações que geralmente se encontram, caraterizadas pela remoção de alguns elementos originalmente presentes nas imagens ou apenas por ligeiras alterações, tendendo a ser respeitada a composição original. Estas alterações podem ter um caráter meramente estético, para simplificar a imagem, ou ter uma questão iconográfica subjacente.

No final deste estudo conclui-se que a produção revela elementos que sugerem uma abordagem "industrial" ao processo decorativo, sendo estes livros o resultado de uma produção em massa, contrariamente à produção individual que se realizava até então.

Palavras-Chave:

Livros litúrgicos; livros iluminados; caraterização material; gravura; iconografia.

ABSTRACT

This study focuses on the illuminated Book of Hours *incunabula* by the Parisian workshop of the Hardouyns (1500-1500).

To carry out a general characterization of the production techniques used by this workshop, the project was divided into three main areas of interest: the historical and social context of the workshop, the definition of the themes represented and the analysis of influences in the composition of the images and the analysis of materials, the techniques and production methodologies. To achieve this global vision, a multidisciplinary approach combining social sciences and technology was adopted.

After defining some essential concepts, a historical and social context was carried out, with the framework in which Books of Hours began to be produced in Paris to better understand the history and importance of the Hardouyn brothers' workshop and its changes over time.

To know the themes present in the illustrations, the second chapter identifies fifteen series of engravings designed by celebrated artists, applied across their editions. Most of these sets were known, but some were not, and are here present for the first time. Besides, this work yields new findings on the use and transmission of tools for decoration from other workshops.

In the third part, this study employed in-situ, non-invasive, micro-invasive and micro-destructive methods to investigate two images, *Adoration of the Magi* and *Printer's device* (UV-Vis-NIR FORS, h-EDXRF, HSI, DM, IR-photography, IRR, μ-FTIR, SEM-EDS, Py-GC-MS, XRMC, DM-IP and IP). The work highlighted that the materials adopted to formulate inks for printing are consistent with the materials referred to wood- and metal-cutting in documentary references. The coloured palette consisted of common pigments in either the French school of manuscript illuminating or the German school of print colouring, revealing a few unusual substances. In the end, the dissertation unveiled the "industrial" character of the Hardouyn editions.

Keywords:

Liturgical books; illuminated book; material characterization; engraving; iconography.

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The past four years of research have surely granted valuable insights into the artistic practices of sixteenth-century book production, yet scholar evidence was not their sole offering. Equally meaningful teachings that have come along were of a rather unique nature, more intimate. One of these is that no research work can be accomplished single-handed. Each research is a journey, always starting from a misty forest to proceed somewhere forward. Exceptionally rare are the situations where the travel runs in smooth or placid fashion; in most cases, that "somewhere" leads to a different destination than originally planned. Other times, one may even lose their path in between. As for my case, the simple fact that I am here now, compiling these lines, means that I am somehow approaching to an end. And it was the case because I happened not to have been alone.

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List of abbreviations

BCaN	Bibliothèque Carré d'art / Nîmes, Paris (France)
BL	British Library, London (United Kingdom)
BM	British Museum, London (United Kingdom)
BML	Bibliothèque municipale de Lyon
BMP	Bibliothèque municipale de Poitiers
BNE	Biblioteca Nacional de España, Madrid (Spain)
BnF	Bibliothèque nationale de France, Paris (France)
BNP	Biblioteca Nacional de Portugal, Lisbon (Portugal)
BPE	Biblioteca Pública de Évora (Portugal)
BStG	Bibliothèque Sainte-Geneviève, Paris (France)
DCL	Durham Dean and Chapter Library, University of Durham, Durham (United Kingdom)
UPenn	University Library of Pennsylvania, University Park, MA (USA)
MMA	Metropolitan Museum of Art, New York (United States)
PML	Pierpont Morgan Library, New York (United States)
SLUB	Saxon State and University Library, Dresden (Germany)
V&A	Victoria & Albert Museum, London (United Kingdom)

δ	Bending vibration
ν	Stretching vibration
$\mathbf{2}\nu$	First overtone of the stretching vibration
$\mathbf{3}\nu$	Second overtone of the stretching vibration
ν_a	Asymmetric stretching vibration

ν_s	Symmetric stretching vibration
a*	Coordinate on the Red-green axis in the CIELAB colour space (CIE 1976)
b*	Coordinate on the yellow-blue axis in the CIELAB colour space (CIE 1976)
L*	Coordinate of the lightness axis in the CIELAB colour space (CIE 1976)
wt	Weight
μ-FTIR	Micro-fourier transform infrared spectroscopy
2-D corr	Bi-dimensional correlation
DM	Digital microscopy
HSI	Hyperspectral imaging
IP	Image processing
IR	Infrared
IRR	Infrared reflectography
MSE	Mean square error
p-XRF	Portable X-ray spectroscopy
Py-GC-MS	Pyrolysis-gas chromatography coupled to mass spectrometry
ROI	Region of interest
SEM-EDS	Scanning electron microscopy coupled with energy-dispersive spectroscopy
SSIM	Structural similarity image measure
UV-Vis-NIR FORS	Ultraviolet-visible-near infrared fibre-optic reflectance spectroscopy
XRMC	X-ray spectroscopy coupled with Monte Carlo simulations
†	year of death
BCE	Before Common Era
CE	Common Era

c.	Around
fl.	*Fluorit* [be active around [...]]
fol.	*Folium*
r	Recto [of a leaf]
reg.	Reign
v	Verso [of a leaf]

Introduction

The principal aim of this doctoral work is to expand a piece of ambitious research, originally started as an international collaboration in fulfilment of a M.Sc.'s degree[1]. In that occasion, the primary goal was to study one member of a selection of illuminated books (both manuscript and early printed books) so to highlight the Manizola Fund of the historical Public Library of Évora, Portugal (Biblioteca Pública de Évora)[2]. However, the M.Sc.'s work did not arise as an independent project: it was framed within a larger, multi-institutional program of historical and scientific-technical characterisation focusing on some exceptionally rare items. That one was as an enlightened initiative of cultural promotion, which secured important scientific outcomes. Among these, the analysis of a tiny service-book, printed in a French sixteenth-century workshop, yielded some of the most intriguing findings, much more than originally expected. That book was a Book of Hours by one of the most celebrated printing activities of sixteenth-century Paris, the Hardouyn workshop.

The technical analysis of the *incunabulum* from Évora unfolded a curious artistic process: all miniatures hided crude prints beneath, and in most cases, their composition did not match the final colouring. Some compatibibility with the illuminated manuscript production appeared in the composition of the material of colouring; however, this research raised questions that the technical analysis of a single book could not meet. One matter at

[1] Silvia Bottura-Scardina. *The Technique of Illumination in the Transition from the Manuscript to the Incunabulum in Paris: A Case-Study on a Specimen from the Public Library of Évora*. M.Sc.'s thesis. Roma, 2016.

[2] The outcome from the work had been presented in the exhibition: "Lux Anima. *Um olhar sobre o acervo da Biblioteca de Évora*", Lisbon, Biblioteca Nacional de Portugal, September 1-Octover 7, 2016. Link at: http://www.bnportugal.gov.pt/index.php?option=com_content&view=article&id=1185%3Aexposicao-lux-anima-um-olhar-sobre-o-acervo-da-biblioteca-de-evora-1-set-16&catid=166%3A2016&Itemid=1206&lang=pt (Accessed February 18, 2022). The outcomes are also illustrated in the exhibition catalogue.

issue was whether other books could reveal details over the Hardouyn's *modus operandi* that the Évora Hours could not deduce; another, whether the technique employed to decorate that Hours was an exceptional case. In other words, the study left many details up to the researcher's curiosity. That M.Sc.'s final year's also revealed that at that time, there were not previous investigations exploring the Hardouyn Hours technically. Thus, it became apparent thatthe Hardouyn's workshop and its printed Books of Hours production required closer attention and study. To meet the purpose, undertaking a doctoral research seemed an appropriate choice.

The Hardouyn workshop was very dynamic in book production and retail in 1500s-1550s Paris. Two local brothers were at its head: the bookmaker-retailer Gillet and the illuminator-bookseller Germain. Together, they started a successful enterprise of luxury bookmaking and established their market in the city and beyond its boundaries. This workshop was particularly known for its small-sized, lavishly illuminated books, that continue to be considered exceptional because they are printed, in addition to the quality of their work of illumination, minimalistic presentation and the fascination they raise (fig. 1). Not too many decades ahead (*c.* 1455), a German goldsmith called Gutenberg had crafted an innovative technology, the press with movable types. The Parisian Hardouyns, like many others in their immediate surroundings, joined the widespread industry of the printed book. At that time, Paris was turning into a printing hub, in which the two Hardouyns chose to contribute exclusively a particular kind of book called *Book of Hours*.

Nowadays, their editions are kept in the Departments of Rare Books of the largest cultural institutes worldwide or widely sold at memorable auctions for their praised visual and technical quality.

The elaboration of decoration in the Hardouyn Hours and the scarcity of backgrounding information makes this work especially challenging, and their study entails many more matters. Thus, the first part of this section shall elaborate the purposes that this doctoral research aims to achieve in the first section (*Research objectives*). The next section illustrates the research design that the thesis adopted (*Research design*), that influenced the final presentation of findings from this doctoral research. Another section outlines the thesis' structure in the section *Structure of the thesis*. Finally, there is an

Figure 1: Representative image of an illustration from a Hardouyn Book of Hours (*c.* 90 mm x 60 mm, miniature dimensions). From Paris, BnF, Smith-Lésouef R.142, fol. 18^{r} ©Source BnF.

elaboration on the Hardouyn workshop. This overview considers both the information regarding specifically this workshop and the context of sixteenth-century Parisian typography and study of the coeval printed Books of Hours. All those subjects are the topic of the last section (*Research field on illuminated Books of Hours and the Hardouyn workshop*).

Work objectives

The Parisian printed Books of Hours are regarded as gems of the early printed culture. Despite the high consideration as artistic and historical objects, they suffer from neglect of their technical quality, which they share with the rest of the subject of the decorating practices in Parisian printing houses of Books of Hours.

This thesis has targeted exactly such inadequacy of information and focused on the Hardouyn Hours as the object of its undivided attention by pointing its research goals to three main matters: *materials*, *techniques* and *artist influences*. These are further broken down into smaller objects of study across this document. The first in line shall be contex-

tualising the historical and artistic setting in which the Hardouyns were active; the second, identifying the thematic sources for their printed production; the final, understanding the materials and techniques applied during the various phases of decoration of the Hardouyn Hours.

Looking at these points allowed addressing two main research objectives, namely providing a solid description of the artistic process and highlighting the connections between the decorating phases of the Hardouyn workshop and their coeval artistic and economic context. Thus, the first objective involves a thorough appreciation of the compositions employed in two moments: the illustration printing and its manual augmentation with colour. This purpose is not a simple identification of the pigments, binders, extenders or other modifiers in use in the Hardouyn workshop, rather a multi-scale work encompassing several subjects at the same time. By elaborating hypotheses on the technical specificity of this workshop, this doctoral work aims to draw the trends of technique over time and understand the position of the Hardouyn workshop in the Renaissance cultures of printing and book illuminating.

As for the second objective, the analysis of the relations between images and artistic practices of the Hardouyn workshop, this thesis strived to primarily understand the extent of the use of engravings within the decoration process. If either narrow or extensive, a given range of employment will suggest a hypothesis of the practical underpinning that affect their occurrence across editions. Finally, this second research objective includes identifying the connections between the Renaissance artistic trends and miniature production.

Research design

The research design that this thesis has adopted to accomplish its goals is a mixed scheme of descriptive-experimental approaches. Its descriptive component had the twofold aim of providing a full description of the artistic process of the Hardouyn workshop while framing it within the two coeval contexts of printing production and painted decorating with illuminated works. The experimental component consists of the scientific experimental component, which was undertaken to set a base for discussing the descrip-

tive results. Figure 2 outlines the approach adopted.

As the scheme illustrates, the research work was divided into two main parts accounting for the two possible phases of decoration: printed images and miniatures. For both components of the Hardouyn Hours' decoration, a systematic approach was undertaken, considering a set of selected images from a group of *incunabula* preserved in a Portuguese collection for technical evaluation. Chapter 3 provides a detailed description of the selected book and the criteria adopted for the choice of representative images. Also, the analytical results were compared with historical contemporary technical texts and the existing literature to discuss the affinity between the techniques adopted by the Hardouyn workshop with the coeval or semi-contemporary methods of printing and book-painting.

The characterisation of the printing inks involved a detailed historical recipes for two purposes. One was to create a base for discussing the data from the case studies; the other, to understand the technological function of the components to the overall formulation. As for the painted illustrations, the comparison with historical references not only had the goal of understanding the material affinity of the Hardouyn workshop to the contemporary production of other French illuminated books (generally manuscripts), but also to characterise their human modelling drawing, the techniques and sequence of painting.

The historical use of engravings entailed identifying the entire collection of suites of the engravings applied, the composition of each set and its use during the whole activity of the Hardouyns. This part of the work involved a direct inspection of physical copies and digital sources. Also, it attempted to attribute design authorship (whenever not previously available) and their artistic influences for each set.

In the end, the mechanisms that drove iconographic manipulations upon illuminating the crude prints were studied to understand the relationship between engravings and painted images.

Thesis structure

The broad interdisciplinarity of the thesis forced moving the best part of the historical introductory details to a dedicated section, Chapter 1. The rest of this thesis is structured for exploring a specific aspect of the research subject: the historical analysis of the sets

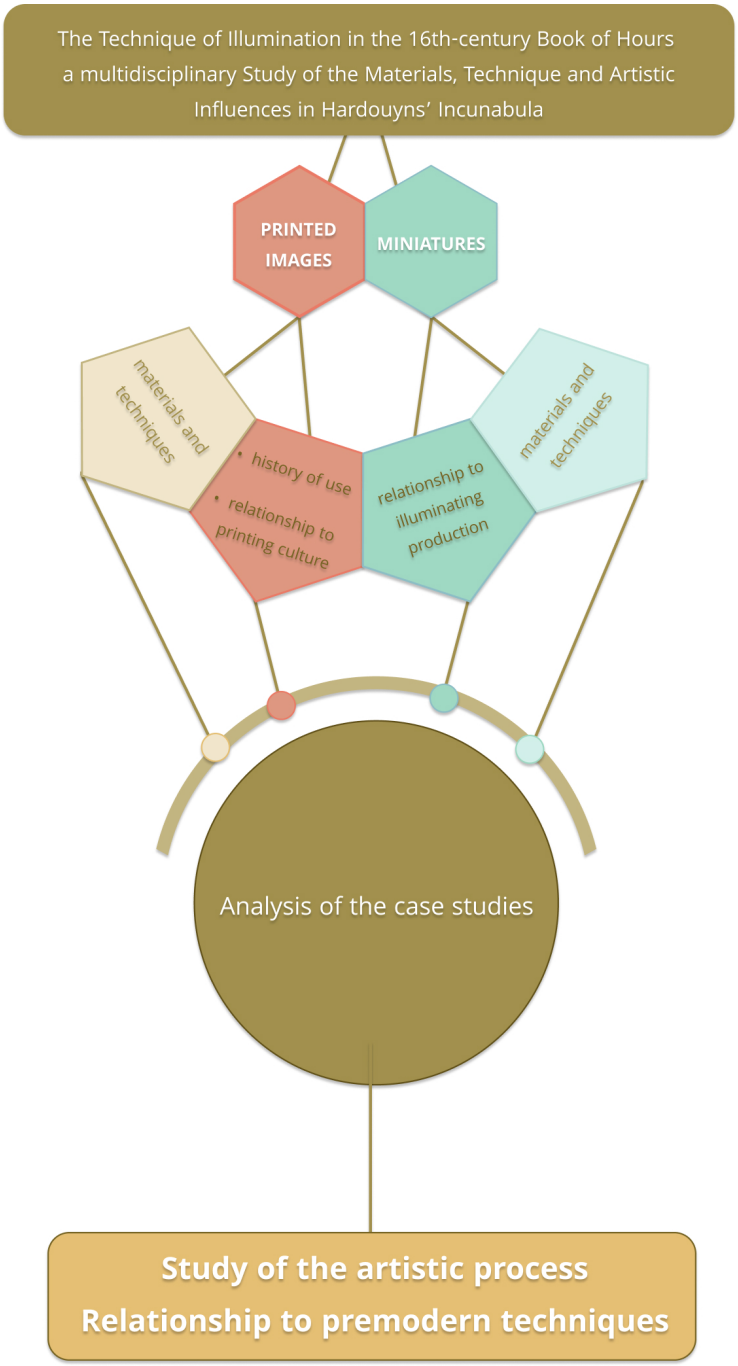


Figure 2: Scheme of the research design adopted in the doctoral work.

of engravings for illustrating, the technical of the printing technique and the material and technical analysis of the case studies. To better contextualize these parts, each chapter is introduced with a preamble, and the individual working approach for that section is always reiterated at its beginning.

Specifically, Chapter 1 covers a broad range of topics: the definition of a Book of Hours, the history of both its liturgy (the liturgy of the Hours) and production as a book. Later, the chapter outlines the differences between Books of Hours and other books of devotion; offers an overview of Parisian early typography with a major focus on the economic history of this market and the production of printed Books of Hours. Finally, it delineates the known history of the Hardouyn workshop.

Chapter 2 elaborates a possible database for the sets of engravings applied, traces for each of them a history of use across edition and establishes its artistic influences. Since several sets revealed shared authorship or subscribed to some artistic schools of engraving, they are listed by the period of earliest appearance and sorted by designing workshop and style.

The last chapter (Chapter 3) presents the results of the material characterisation of a selection of illustrations from books chosen as the case studies of the thesis.

Research field on illuminated Books of Hours and the Hardouyn workshop

As mentioned earlier, the research topics of this thesis encompass several subject areas: historical and artistic scholarship on Books of Hours and their decoration, the early-to-mid-sixteenth century printing culture and, of course, the historical-technical analysis of the Hardouyn editions.

In what concerns the Books of Hours, extensive historical work has been carried out to disclose their historical meaning. Those studies investigated the bottom-up, prominently lay movements inclining to individuality and withdrawal from congregate piety in the late Middle Ages and that promoted Books of Hours to a pervasive kind of book. One aspect that this historical inquiry has looked at closely was the spiritual experience of the late medieval Christian as it looked both the shift in the millennium-long practices of public

piety and the increasing "democratisation" of individual religious identities. Within this frame, the research by Bell, Dinis, Long and other scholars strived to understand the pious character of these books, especially concerning their tendency to privacy, isolation and connection to femininity[3]. Other studies allied with the former tendency and put their efforts into understanding the role of Books of Hours as boxes of material and immaterial records. Sometimes, this storing service of *horae* is quite literal: several books contain marginalia characterising family genealogies as well as souvenirs collected at the end of spiritual experiences, like *pilgrimage badges*[4], small illustrations of the Veronica or occasional pieces of devotional embroidery[5]. Such is the case of van Asperen, who provided insightful research on this subject through her extensive cataloguing work and identification of the connections to local forms of piety[6]. On the same account, Reinburg outlined the serviceable concept of the "archive of prayer" by retrieving numerous instances of Books of Hours serving as archives of family records, as well as religious and artistic sensibilities[7].

[3]Susan Groag Bell. "Medieval Women Book Owners: Arbiters of Lay Piety and Ambassadors of Culture". In: *Signs* 7.4 (1982), pp. 742–768. DOI: https://doi.org/10.1086/493920; Bruna Dinis. "Témoins de Dévotions dans les Livres d'Heures à la fin du Moyen Âge". In: *Revue Mabillon* 9.70 (1998), pp. 127–161. DOI: https://doi.org/10.1484/J.RM.2.305602; Laura Light. *'As if they had physically visited the holy places': Two Sixteenth-century Manuscripts Guide a Mental Journey through Jerusalem (Radboud University Library, Mss 205 and 233)*. Introduction by Anne Winston-Allen and Preface by Sandra Hindman. New York, NY: Les Enluminures, 2015; Sarah Ann Long. *The chanted mass in Parisian Ecclesiastical and civic communities, 14801540: Local liturgical practices in manuscripts and early printed service books*. Ph.D's dissertation. Urbana and Champaign, IL, 2015; Beth A. Williamson. "Sensory Experience in Medieval Devotion: Sound and Vision, Invisibility and Silence". In: *Speculum* 88.1 (2013), pp. 1–43. DOI: https://doi.org/10.1017/S0038713413.

[4]A *pilgrimage badge* is a wafer souvenir featuring images of saints and casted on inexpensive metals, like lead, tin, their alloys, silver-gilt, silver, brass, bronze, gold. Occasionally, they were made of leather or parchment. An extensive showcase of the phenomenon is outlined in Megan H. Foster-Campbell. *Pilgrimage through the Pages: Pilgrims' Badges in Late Medieval Devotional Manuscripts*. Ph.D's dissertation. Urbana and Champaign, IL, 2011. See also Bruna Dinis. "Les récentes acquisitions d'enseignes de pèlerinage et d'enseignes profanes au Musée national du Moyen Age". In: *Bulletin de la Société nationale des Antiquaires de France* 1 (1997), pp. 349–360. DOI: https://doi.org/10.3406/bsnaf.1997.11372.

[5]On a more exhaustive list, see Virginia Reinburg. "An Archive of Prayer. The Book of Hours in Manuscript and Print". In: *'Manuscripta Illuminata'. Approaches to Understanding Medieval and Renaissance Manuscripts*. Ed. by Colum Hourihane. New Jersey and Pennsylvania: Penn State University Press for the Index of Christian Art and Princeton University, 2014. Chap. 13, pp. 221–239.

[6]Hanneke van Asperen. "As if they had physically visited the holy places': Two Sixteenth-century Manuscripts Guide a Mental Journey through Jerusalem (Radboud University Library, Mss 205 and 233)". In: *The Imagined and Real Jerusalem in Art and Architecture*. Ed. by Jeroen Goudeau et al. Leiden: Brill, 2014. Chap. 8, pp. 190–214. DOI: https://doi.org/10.1163/9789004270855_010; Hanneke van Asperen. "The Book as Shrine, the Badge as Bookmark: Religious Badges and Pilgrims' Souvenirs in Devotional Manuscripts". In: *Domestic Devotions in the Early Modern World*. Ed. by Marco Faini et al. Leiden: Brill, 2019. Chap. 14, pp. 288–312. DOI: https://doi.org/10.1163/9789004375888_016.

[7]Virginia Reinburg. "'For the Use of Women': Women and Books of Hours". In: *Early Modern Women.*

Beside their historical values, Books of Hours often accommodate elaborate pictorial programmes. Sometimes, their possessors fastened objects long after their creation; other times, they conditioned their appearance at the moment of production. That explains why Books of Hours were often customised, becoming valuable objects under their lavish decoration. With such supplements, Books of Hours added considerable value to their original devotional service, becoming highly prized possessions and symbols of wealth accordingly. This process attracted the interest of scholars like Kumler, who devoted a sizeable interest to understanding the dynamics of customisation and their social implications[8]. Besides him, further art historians inspected the artistic quality of notable works, as was the case of French work of illumination are the early fifteenth-century Belles Heures, sponsored by the philanthropist Jean, Duke of Berry, that has been the object of the research attention of several scholars, such as Husband, Lawson and Plum-

An Interdisciplinary Journal 4 (2009), pp. 235–240; Reinburg, "An Archive of Prayer. The Book of Hours in Manuscript and Print"; Virginia Reinburg. "Oral Rites: Prayer and Talk in Early Modern France". In: *Spoken Word and Social Practice: Orality in Europe 1400-1700*. Ed. by Thomas V Cohen et al. Leiden and Boston: Brill, 2015. Chap. 13, pp. 373–392.

[8] Aden Kumler. *Translating Truth: Ambitious Images and Religious Knowledge in Late Medieval France and England*. New Haven, CT: Yale University Press, 2011. Although a robust customisation occurred, it must be clarified that pictorial programmes of Books of Hours tended to naturally filter down to a specific group of images. Over time, those illustration would become the standard decoration of Books of Hours (Roger S Wieck. *Painted Prayers: The Book of Hours in Medieval and Renaissance Art*. New York, NY: George Braziller, 1997; Virginia Reinburg. *French Books of Hours: Making an Archive of Prayer*. Cambridge: Cambridge University Press, 2012). Observing this process of canonisation, Leroquais developed a standard scheme for *horae* classification, but it finds application also outside an "exceptional" environment (Victor Leroquais. *Les livres d'heures manuscrits de la Bibliothèque nationale*. Paris: Maçon, Protat frères, 1927, vol. 1, pp.xv-xvi). In fact, the same methodology is also valid for the opening illustrations of the canonical hours, where the Hours of the Virgin always depict crucial moments of Mary's life, for instance (Roger S Wieck. *Time Sanctified: the Book of Hours in Medieval Art and Life*. New York, NY: George Braziller, 1988, p. 8; Wieck, *Painted Prayers: The Book of Hours in Medieval and Renaissance Art*; Reinburg, *French Books of Hours: Making an Archive of Prayer*, p. 17). At the core of the personalisation, there were always two figures: on the one side, an individual that sponsored the artistic project; on the other, a contracted artist. The two parts were bond by an economic contract that in turn set off a social phenomenon founded on personal appreciation of letters and arts (Karl Julius Holzknecht. *Literary Patronage in the Middle Ages*. Ebook edition. New York, NY and London: Routledge, 2019. DOI: https://doi.org/10.4324/9780429056871, p. 55). Thus, the role that the patron, as the initiator of each project, performed in the developing stage was important. The intentional incorporation of irregular iconology or atypical narrative structure occurred is a direct consequence of the situation. Such is the case of the very detailed illustrations in the Calendar to the *Très Riches Heures* that the Duke of Berry Jean assigned to the Limbourg; another instance is the *Mouth of Hell* theme in the *Hours of Catherine of Clèves* (PML, Ms. M. 945, see Millard Meiss. *French Painting in the Time of Jean de Berry: The Late Fourteenth Century and the Patronage of the Duke*. London: Phaidon, 1967; Margaret M. Manion. "Psalter Illustration in the Très Riches Heures of Jean de Berry". In: *Gesta* 34.2 (1995), pp. 147–161. DOI: https://doi.org/10.2307/767285; Marisa Mandabach. "Holy Shit: Bosch's Bluebird and the Junction of the Scatological and the Eschatological in Late Medieval Art". In: *Marginalia* 2 (2010), pp. 28–49).

mer[9].

Comprehensive work was also conducted to delineate the phases of the Paris school of illuminating, from its rise until it regained a leading status over the Tours school (between and after the Hundred Years' Wars had raged over the city). These dynamics and the structure of the renewed production of the Renaissance illuminated book have been articulated exhaustively by the art historian Orth[10]. Alongside them, Mr and Mrs Rouse brought essential expertise to the micro and macro-histories of the figures involved in Parisian book production and selling. With their meticulous archival research, they were able to establish the identity of key protagonists and the dynamics that bore on the local market[11].

On another perspective, illuminated French Books of Hours have also been inspected technically, taking into account their materiality and their state of conservation. In this area, we can refer to the works of a research group from the Universidade Nova de Lisboa, that conducted an extensive survey on a group of books conserved in the historical Palace of Mafra (Portugal)[12]. Aside from them, Dunlop compiled a careful archival and historical

[9]Timothy Husband. *The Art of Illumination: the Limbourg Brothers and the Belles Heures of Jean de France, Duc de Berry*. New York, NY: Metropolitan Museum of art, 2008; Margaret Lawson et al. "Examination and Conservation of the Fifteenth-century Parchment Manuscript the 'Belles Heures' of Jean, Duke of Berry". In: *Studies in Conservation* 47.sup:3 (2002), pp. 129–134. DOI: 10.1179/sic.2002.47.s3.027; John Plummer. "The beginnings of the Belles heures". In: *The Cloisters: Studies in Honor of the Fiftieth Anniversary*. Ed. by Elizabeth C. Parker. With the assistance of Mary B. Shepard. New York, NY: Metropolitan Museum of Art and International Center of Medieval Art, 1992.

[10]Myra Dickman Orth. "French Renaissance Manuscripts: The 1520s Hours Workshop and the Master of the Getty Epistles". In: *The J. Paul Getty Museum Journal* 16 (1988); Myra Dickman Orth. "Antwerp Mannerist Model Drawings in French Renaissance Books of Hours: A Case Study of the 1520s Hours Workshop". In: *The Journal of the Walters Art Gallery* 47.1 (1989); Myra Dickman Orth. "What Goes Around: Borders and Frames in French Manuscripts". In: *The Journal of the Walters Art Gallery: Essays in Honor of Lilian M. C. Randall* 54 (1996), pp. 189–201; Myra Dickman Orth. "The Master of François de Rohan, A Familiar French Renaissance Miniaturist with a New Name". In: *Illuminating the Book: Makers and Interpreters. Essays in Honour of Janet Backhouse*. Ed. by Janet Backhouse. London and Toronto: The British Library and University of Toronto Press, 1998.

[11]Richard H. Rouse et al. *Renaissance Illuminators in Paris: Artists & Artisans 1500-1715*. Leiden: Brepols, 2020. See also Martina Hacke. "The Messengers of the Nations of the University of Paris and the Book Trade (Late Fifteenth and Sixteenth Centuries)". In: *Early Modern Universities*. Ed. by Anja-Silvia Goeing et al. Leiden: Brill, 2020. Chap. 16, pp. 313–332. DOI: https://doi.org/10.1163/9789004444058_018; Christopher de Hamel. *A history of illuminated manuscripts*. London: Phaidon, 1986; Christopher de Hamel. *Scribes and Illuminators*. London: British Museum Press, 1992.

[12]Rita Araújo. *Os Livros de Horas (séc. XV) na colecção do Palácio Nacional de Mafra: estudo e conservação*. M.Sc.'s thesis. Lisboa, 2012; Isamara Carvalho et al. "Colour identification, degradation processes and findings in a fifteenth-century Book of Hours: the case study of Cofre no. 31 from Mafra National Palace". In: *Heritage Science* 6.9 (2018). DOI: https://doi.org/10.1186/s40494-018-0174-5; Ana Lemos et al. "O Cofre nž 24: Um Livro de Horas do Palácio Nacional de Mafra, caso de Estudo e de Intervenção". In: *Invenire: Revista de Bens Culturais da Igreja* esp:1 (2015), pp. 82–

review of the materials and techniques applied in illuminated French books (*c.* 1320-1420)[13].

Insofar, the above studies tackled the social, artistic, devotional complexity of Books of Hours, yet merely as manuscripts. The only work which bridged the gap between manuscript production and printed production is a comprehensive essay by Reinburg. This author draws a history of printed and manuscript production in this work, outlining interesting remarks on elements of the manuscript culture, print culture and devotional culture in fifteenth-to-sixteenth-century France. This study also keeps a weather eye on the case of Paris as a pivotal cultural hub of the time[14], but it lacks exploring the techniques applied to decorate Renaissance printed *horae*.

Studies on early typography have also been managed[15]. Since the turn between the nineteenth and the twentieth centenaries, specialists of *incunabula*[16] examined the early production of Parisian printed books[17]. One of them was the bibliophile Claudin (1833-

93; Maria J. Melo et al. "A spectroscopic study of brazilwood paints in medieval books of hours". In: *Applied spectroscopy* 68.4 (2014), pp. 434–443. DOI: https://doi.org/10.1366/13-07253; Tatiana Vitorino. "A Closer Look at Brazilwood and its Lake Pigments". In: (2012). M.Sc.'s thesis; Nancy Tumer. "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420". In: *Studies in Conservation* 43.sup1 (1998), pp. 45–50. DOI: https://doi.org/10.1179/sic.1998.43.Supplement-1.45.

[13]Louisa Jane Verrall Dunlop. *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*. Ph.D. dissertation. Faculty of Arts, 1988.

[14]Reinburg, *French Books of Hours: Making an Archive of Prayer*.

[15]Other interesting studies arose in of the same period, yet not exactly focused on the French area, were the general essays by Duff, Pollard and Cundall (Edward Gordon Duff. *Early printed books*. London: K Paul, Trench, Trubner, 1893, pp. 18-20, 80–87; Joseph Cundall. *A Brief History of Wood-Engraving from its Invention*. London: Sampson Low, Marston & Company, 1895, pp. 51-60; Alfred William Pollard. *Early Illustrated Books: a History of the Decoration and Illustration of Books in the 15th and 16th Centuries*. London: K Paul, Trench, Trübner & Company, Limited, 1893, pp. 142-173). Also, the catalogues of the major library added important pieces of bibliographic information on the Paris market and industry of printed books (Jacques-Charles Brunet. *Manuel du libraire et de l'amateur de livres, contenant 1o: Un nouveau dictionnaire bibliographique*. Paris, 1814; Jérôme Pichon et al. *Documents pour servir à l'histoire des libraires de Paris, 1486-1600*. Paris: Librairie Techener, 1895; Robert Proctor et al. *An index to the early printed books in the British Museum*. 4 vols. London: Kegan Paul, Trench, and Trübner, 1898). They are mentioned here rather than in the main body for the sake of completeness: they either offer meagre information or did not represent major contributions to the field.

[16]See Chapter 1, Section 1.2.3 on a definition of *incunabulum*.

[17]Other contemporary and later works that deserve mentioning are Elizabeth Armstrong. "English Purchases of Printed Books from the Continent 1465-1526". In: *The English Historical Review* 94.371 (1979), pp. 268–290. DOI: https://doi.org/10.1093/ehr/XCIV.CCCLXXI.268; André Blum. *The origins of Printing and Engraving*. Tanslated by Harry M. Lydenberg. New York, NY: C. Scribner's Sons, 2010, pp. 172-191; David C Greetham. *Textual scholarship: An introduction*. New York and London: Garland Publishing, 1994; John Macfarlane. *Antoine Vérard*. Vol. 7. London: Bibliographical society at the Chiswick Press, 1900; Margaret Meserve. "Patronage and Propaganda at the First Paris Press: Guillaume Fichet and the First Edition of Bessarion's *Orations against the Turks*". In: *The Papers of the Bibliograph-*

1906), who undertook the formidable task of outlining the early phases of typography of the major printing French centres (*c.* 1450s-*c.* 1510s). Among the places he considered for his analysis, Claudin also included Paris, devoting an entire volume to its dedicated analysis[18]. The collection is surely a work of great erudition, blending bibliographic studies, literary studies, art criticism and little archival inspection. As a result, he produced an outstanding contribution to the field, which, regrettably, covers its history only until the first years of the 1500s. Despite its noble intentions, this essay somehow fails in setting a specific methodology for the field of printing studies and does not establish clear connections between these professionals. Claudin often quoted other important sources that had contributed significantly to the field before him, such as the studies by Proctor, Caille, Chevillier and Marchand. The first in line is Proctor, a bibliophile and expert of early typography, who had initiated a few years before a catalogue of the collection of early printed books in the British Library (1898-1938)[19], but his death left the work unfinished. Despite the incomplete structure, this catalogue shares relevant details on the authorship of the British Library's collection of French early printed books[20]. The last three scholars, namely Caille, Chevillier and Marchand, had compiled historiographic monographies about the origins of printing between the seventeenth and the eighteenth centuries[21]. Thus, these essays represent a historical reference to the history of Parisian typography and its perceived importance.

Other studies attempted to reconstruct the history of individual printers and publish-

ical Society of America 97.4 (2003), pp. 521–588. DOI: https://doi.org/10.1086/pbsa.97.4.24295683; John Durham Peters. *Harold Innis's History of Communications: Paper and PrintingAntiquity to Early Modernity*. Lanham et al.: Rowman and Littlefield, 2014; Andrew Pettegree. *The Book in the Renaissance*. Yale: Yale University Press, 2010; Philippe Renouard. *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*. Ed. by Ursula Baurmeister et al. 3 Vols. (1965-1979). Paris: Service des travaux historiques de la Ville de Paris, 1965.

[18] Anatole Claudin. *Histoire de l'imprimerie en France au XVe et au XVIe siécle*. Four vols. Paris: Imprimerie nationale, 1901.

[19] Proctor et al., *An index to the early printed books in the British Museum.*

[20] This collection forms the original core of the British Library.

[21] Jean de La Caille. *Histoire de l'imprimerie et de la librairie, où l'on voit son origine & son progrès, jusqu'en 1689 : divisée en deux livres*. Online at: https://gallica.bnf.fr/ark:/12148/bpt6k108967w.image. Paris: Chez Jean de La Caille, 1689; André Chevillier. *L'origine de l'imprimerie de Paris. Dissertation historique, et critique. Divisée en quatre parties*. Online at: https://gallica.bnf.fr/ark:/12148/bpt6k9661335g.texteImage. Paris: Chez Jean de Laulne, 1694; Prosper Marchand. *Histoire de l'origine et des premiers progrès de l'imprimerie*. Online at: https://archive.org/details/bub_gb_2HAyM03MiioC/page/n7/mode/2up. La Haye: Veuve Le Vier and Pierre Paupie, 1740.

ers, especially of the printer-bookseller Thielman Kerver[22], Robert Estienne[23] and female entrepreneurs[24], like Yolande Bonhomme[25] and Charlotte Guillard[26]. Similarly, further historical work reconstructed the activity of artists who contributed to the market as designers of engraving, namely those by Nettekoven[27] and Zöhl[28]. These two works are of crucial importance in the field. In fact, not only they offer a detailed portrait of the activity of two outstanding protagonists of the Paris market and industry of the printed book (the so-called *Master of the Apocalypse Rose* and Jean Pichore)[29], but they also established a new line of historical studies in which they challenge the traditional art historical approaches. This new research perspective aims at understanding the connections between makers and designers of printing by grouping illustrations into sets[30], by establishing genealogies of design, influence, and professional networking. Among the heads of the printing workshop they mention, there is the Hardouyns' enterprise as well. Thus, they offered reference source, yet not exclusively dedicated to the Hardouyn workshop. Their attempts are the natural heir of the conception launched by the two historians Febvre and Martins. Together, they began (yet not completed since Febvre passed away before the joint close) a vast work of literature review and archival inspection on the economic history of printing and paper-making, which covered printers, sellers, publishers, authors, suppliers of the early modern book. In other words, their outlook was equally interested in the dynamics concerning manuscript and printed books, as two sides of coeval and

[22] Anna Majeski. *The printed Books of Hours of Thielman Kerver: Exploring Printer, Shop, Community and Book*. Master's thesis. 2012.

[23] Elizabeth Armstrong. *Robert Estienne, Royal Printer: An Historical Study of the Elder Stephanus*. Cambridge: Cambridge University Press, 1954.

[24] Susan Broomhall. *Women and the Book Trade in Sixteenth-Century France*. New York, NY and London: Routledge, 2002. DOI: https://doi.org/10.4324/9781315233833.

[25] Beatrice Beech. "Yolande Bonhomme: A Renaissance Printer". In: *Medieval Prosopography* 6.2 (1985), pp. 79–100. DOI: https://doi.org/10.2307/2862159.

[26] Beatrice Beech. "Charlotte Guillard: a sixteenth-century business woman". In: *Renaissance Quarterly* 36.3 (1983), pp. 345–367. DOI: https://doi.org/10.2307/2862159.

[27] Ina Nettekoven. *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*. Turnhout: Brepols, 2004.

[28] Caroline Zöhl. *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*. Vol. 8. Turnhout: Brepols, 2005.

[29] These two artists will be explored in greater detail on Chapter 2, Sections 2.1 and 2.2.

[30] These two historians did not pioneer this *modus operandi* (Zöhl especially). Before them, already Claudin grouped series of engravings into homogeneous suites (for instance, when he points out at the series of border plaquettes featuring the English sacraments in Pigouchet's Books of Hours; see Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 43). Thus, the difference is in the objectives of their engagement where they introduce clarity and a methodical structure. Also, the systematic architecture of their work allowed them to generate detailed historical information.

complementary markets[31].

Opposed to the richness of historical information, the studies on the materials and techniques of printing have not been enjoying equally careful attention. These few cases are the elemental profiling of inks for textual printing through non-invasive beam nuclear methods. However, these studies concerned the inks employed by Gutenberg or other printers, never the Hardouyns[32]. Additionally, other sporadic studies characterised inks adopted in block-printing[33] or artistic colour printing[34]. Among this last line of research, the print historian Stijnman deserves special notice. In fact, he understood the importance of technical studies of printing, so he surveyed intaglio printing in a broad period, including the activity of the Hardouyn workshop[35]. His work is highly involved in the working practices of engravers and establishes them as relevant historical factors as the more traditional economic and social aspects of printmaking. Thus, Stijnman's work represents an absolute novelty in printing studies, which regards technical details as another factor of art history.

Considering the above references, it is clear that the details on the Parisian market and some outstanding professionals are extensive, and the details of their professional ties are thoroughly understood for the French territory, and satisfactorily for the Parisian boundaries. Questions regarding the Hardouyn workshop found occasional interest in

[31] Lucien Febvre et al. *The coming of the Book: the Impact of Printing 1450-1800*. London and New York: Verso, 1976.

[32] Thomas A. Cahill et al. "Gutenberg's inks and papers: nondestructive composition analyses by proton milliprobe". In: *Archaeometry* 26.1 (2007), pp. 3–14. DOI: https://doi.org/10.1111/j.1475-4754.1984.tb00312.x; Hans Mommsen et al. "X-ray Fluorescence Analysis with Synchrotron Radiation on the Inks and Papers of Incunabula". In: *Archaeometry* 38.2 (1996), pp. 347–357. DOI: https://doi.org/10.1111/j.1475-4754.1996.tb00782.x; Werner Faubel et al. "Non-destructive analysis for the investigation of decomposition phenomena of historical manuscripts and prints". In: *Spectrochimica Acta Part B* 62.6–7 (2007), pp. 669–676. DOI: https://doi.org/10.1016/j.sab.2007.03.029.

[33] Federica Pozzi et al. "Color, collation, and curious creatures: a technical study of 15th-century block books at The Morgan Library & Museum". In: *European Physical Journal Plus* 136 (2021), p. 141. DOI: https://doi.org/10.1140/epjp/s13360-021-01335-w.

[34] Linda Stiber Morenus et al. "16th- AND 17th-Century Italian Chiaroscuro Woodcuts: Instrumental Analysis, Degradation, and Conservation". In: *Journal of the American Institute for Conservation* 54.4 (2015), pp. 238–271. DOI: https://doi.org/10.1179/1945233015Y.0000000008; Ad Stijnman. "The Colours of Black: Printing Inks for Blockbooks". In: *Bibliothek und Wissenschaft*. Ed. by Bettina Wagner. Beiträge der Fachtagungin der Bayerischen Staatsbibliothek Münchenam 16. und 17. Februar 2012. Wiesbaden: Harrassowitz Verlag, 2013. Chap. 3, pp. 59–80; "Printing Colour 1400-1700: History, Techniques, Functions and Receptions". In: ed. by Ad Stijnman et al. Leiden and Boston, MA: Brill, 2015; Ad Stijnman. "Colour Printing in Europe until 1700: An Overview". In: *Ricerche di storia dell'arte* 133.2 (2021), pp. 5–15.

[35] Ad Stijnman. *Engraving and Etching, 1400-2000: A History of the Development of Manual Intaglio Printmaking Processes*. London and Houten: Archetype Publications and Hes & De Graaf, 2012.

works embedded within collections of essays or individual pieces of historical research[36]. However, only one M.Sc.'s thesis and some scientific studies investigated occasionally the technique of decoration of the Hardouyn printshop. These studies characterised one Hardouyn edition in two phases of decoration: printing and illuminating[37], but focus only on a single book, disclosing relevant information on the artistic process, materials of printing and book illumination. However, as mentioned before, the analysis of a single item could not establish whether that *modus operandi* was a *unicum* or one instance of a routine. In default of this information, this research work points at addressing the shortcomings by devoting closer and more extensive attention to this workshop, and this document presents its findings.

[36] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*; Carol Steyn. "A luxury printed Book of Hours in the Grey Collection: The painting of metal and woodcut illuminations in the sixteenth century". In: *De arte* 49.90 (2014), pp. 42–59. DOI: https://doi.org/10.1080/00043389.2014.11877207; Maureen Warren. "Gillet and Germain Hardouyn's Print-Assisted Paintings: Prints as Underdrawings in SixteethCentury French Books of Hours". In: *The Reception of the Printed Image in the Fifteenth and Sixteenth Centuries*. Ed. by Grazyna Jurkowlaniec et al. New York, NY and London: Routledge, 2020. Chap. 4, pp. 81–96. DOI: https://doi.org/10.4324/9781003029199; Mary Beth Winn. "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*". In: *The Papers of the Bibliographical Society of America* 103.2 (2009), pp. 141–197.

[37] Bottura-Scardina, *The Technique of Illumination in the Transition from the Manuscript to the Incunabulum in Paris: A Case-Study on a Specimen from the Public Library of Évora*; Catarina Miguel et al. "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography". In: *Journal of Cultural Heritage* 40 (2019), pp. 34–42. DOI: https://doi.org/10.1016/j.culher.2019.05.014; Silvia Bottura-Scardina et al. "Image processing methods integrated to imaging and material characterisation for the study of incunabula illustrations: an innovative multi-analytical approach on a case-study". In: *Ge-Conservacion* 18.1 (2020), pp. 362–374. DOI: https://doi.org/10.37558/gec.v18i1.825; Silvia Bottura Scardina et al. "On the use of hand-held X-ray fluorescence spectroscopy coupled to Monte Carlo simulations for the depth assessment of painted objects: The case study of a sixteenth-century illuminated printed book". In: *European Physical Journal Plus* 136.3 (2021), p. 341. DOI: https://doi.org/10.1140/epjp/s13360-021-01326-x.

1. Printed Books of Hours at the time of the Hardouyns: A framework

As a vast topic, the study of the Hardouyn Hours requires specific knowledge of several fields of study. Such expertise must encompass many subjects, starting from the origins of its piety, the *Liturgy of the Hours* and touching on the early production of manuscript *horae*, their transition to printing and finally, the features of a printed book.

The intellectual range of those matters is surely comprehensive, thus hardly accessible to the average reader. In consideration of such a strict requirement, this chapter targets the construction of the fundamental intellectual grounds for the next chapters by elaborating an essential overview about the necessary notions. The bulk of this first chapter builds up a liturgical, codicological and historical framework for the object of study (the Book of Hours and the Hardouyn production); however, one particular section of the chapter contains some critical assessments. In fact, it elaborates clear, intellectual positions on specific topics embedded in the thesis, or the exact meaning of *incunabulum* and *illuminating* as for book decoration.

This choice arose from the simple consideration that tracing the roots of Book of Hours and the book production in Paris is needed to understand the typical structure of the Hardouyn Hours and identify their parent workshop's acclaimed inventiveness. Well before the Hardouyns launched out on printing, Books of Hours had enjoyed a long course of use as a means of devotion as guides of one extra-ecclesial piety, so this chapter shall brief the reader about the history of Books of Hours and their piety in Section 1.1. Besides, Books of Hours were not the sole book of liturgy available to medieval and Renaissance readers; as a matter of fact, the religious communities enjoyed a rich and diversified liturgical culture. Thus, many liturgical books had risen by the sixteenth century, each of

them adopting a textual structure arisen for a particular purpose or audience. Within such richness, a broad production of liturgical books came about. Thus, Section 1.2.1 shall outline the features of other liturgical books and show the differences between it and its next in kin, the Breviary (Section 1.2.2). Besides, the role of Books of Hours as private guides of piety prompted these books to normalise their prayers and, most importantly, their pictorial programmes. Thus, the same section shall outline the typical figurative cycles of manuscript Hours. This information will aid the following chapters in framing the pictorial programmes in the Hardouyn Hours as either innovative or traditional.

Another critical part of this chapter is the historical contextualisation of the Parisian markets of printed books (Section 1.3), printed Books of Hours (Section 1.4) as well as the phases of activity for the Hardouyn workshop (Section 1.5). This analysis elucidates historically the dynamics of printing at the time of the Hardouyns, while providing an explanation to the economic niche that the Hardouyns occupied within the local market. In other words, that section shall prepare to understand the Hardouyn management's specificity and uniqueness within the next chapters. As for Section 1.3, dedicated inspection and data interpretation were devoted to organising the existing data and creating new contents, given that the literary references on the subject of *incunabulum* bookmaking are numerous, yet very few of them have provided a systematic insight into the economic dynamics of the Parisian production or the connection between its classes of workers.

The last component of this chapter covers the terminology adopted throughout the dissertation, based on two observations. The first is that the community of scholars has not agreed on the definition of *incunabulum*. Because one basis of this research work is that the Hardouyn Hours are *incunabula*, Section 1.2.3 elaborates the position that this doctoral work takes on this subject. The second observation is about the definition of the decoration under investigation here as illumination. In other words, because the Hardouyn Hours reveal a mixed technique of textual printing and painted colouring, the reader may express serious doubts about the legitimacy of labelling the miniatures of the Hardouyn Hours as "illuminating". Section 1.2.4 addresses these (prospective) doubts by elaborating on a specific response.

1.1 From the rise of the *Divine Office* to the mass-production of printed books

Books of Hours are books of programmed worship. Each of these items, also called *horae*, is a structured collection of prayers, hymns, Gospels, responses, litanies and lessons, recited throughout the Liturgical Year to practise a certain spiritual discipline, the *Divine Office*. The Christian who celebrates the *Divine Office* performs a mandatory calendar and a sequence of prayer that is typically perpetual in Books of Hours. This means that the *Divine Office* can be performed every year; however, this is not the sole form of calendrical forms of piety available to the Christian. Other forms of liturgy may take place across shorter periods of time like the day, guiding a daily practice accordingly. As for *horae*, they are books for certain times of the day, the *canonical hours*. Because such liturgy has a distinct, systemic character based on time, this *Office* is also known as *Liturgy of the Hours*.

The *Liturgy of the Hours* counts eight daily moments of prayer: *Matins, Lauds, Prime, Terce, Sext, None, Vespers and Compline*[1]. The full liturgy that includes all the eight offices has always been the simplest form of the *Divine Office*, but abridged forms appeared occasionally. Sometimes, the *Office* keeps the longest services (Matins, Lauds, Vespers) and is called *major Hours*; other times, it singles out its shortest Hours (*Prime*, *Terce*, *Sext*, *None*) and is called *minor Hours*. Most likely, such differentiation of structure has arisen in response to practical reasons[2].

[1]The medieval canonical hours roughly correspond to the present-day 2 a.m. (*Matins*), 5 a.m. (*Lauds*), 6 a.m. (*Prime*), 9 a.m. (*Terce*), midday (*Sext*), 3 p.m. (*None*), 6 p.m. (*Vespers*) and 9 p.m. (*Compline*). However, Christianity did not set conventional hours because of practical reasons. In medieval Europe, units of time were a variable measure based on both the canonical hours' system and the Roman sundial system. However, this measure was not accurate and often dependent on weather, moon cycle, other seasonal factors, so the units of hours they marked were approximate. More reliable time-keeping devices like the mechanical clock were first made only in the fourteenth century but were a rarity in all Europe until the fifteenth century. However, the canonical hours do not count eight any longer: the Second Vatican Council (1963) suppressed *Prime*, and Pope Paul VI decreed that a reduced Liturgy of the Hours must be established. See Christopher St JH Daniel. *Sundials: instruments of time*. Risborough: Shire Publications, 2000, pp. 7-9; Christopher J Ferraro et al. *Guide for Celebrating the Liturgy of the Hours*. Chicago: Liturgy Training Publications, 2019, p. 115; James R Ginther. "Divine Office". In: *The Westminster Handbook to Medieval Theology*. Louisville and Westminster: John Knox Press, 2009, p. 54; William Rothwell. "The Hours of the Day in Medieval French". In: *French Studies* 13.3 (1959), pp. 240–251. DOI: https://doi.org/10.1093/fs/XIII.3.240, pp. 242-243, 686; Laura Sterponi. "Reading and Meditation in the Middle Ages: *Lectio Divina* and Books of Hours". In: *Text & Talk* 28.5 (2008), pp. 667–689. DOI: https://doi.org/10.1515/TEXT.2008.034, p. 686.

[2]Ferraro et al., *Guide for Celebrating the Liturgy of the Hours*, p. 115.

1. DEVOTIONAL, TECHNOLOGICAL AND HISTORICAL FRAMEWORK

The mere existence of variations on the *Liturgy of the Hours* may communicate that it has a long and complex course of use. And indeed, the Judaic discipline of the Talmud prescribed three daily prayers even before Christianity[3]. With the rise of the new biblical religion, the earliest communities derived their spiritual exercises from the Judaic tradition, and already before their religious emancipation (313)[4], Christians were equally encouraged in daily devotion.

The fundamentals of the Christian discipline had appeared almost immediately. The Doctors of the Church of the first centuries mandated to pray continuously: in his *Apostolic Tradition* (235), Hippolytus of Rome gave this direction and so did Cyprian (†*c.* 258), Tertullian (†*c.* 240), Origen of Alexandria (†*c.* 250) and Augustine of Hippo (*c.* 354-430)[5]. Slightly earlier, Clement of Alexandria (*c.* 150-215) was more specific as he prescribed "some fix hours for prayer, such as third, sixth and ninth"[6]. The Clementine recommendation of three daily exercises insisted on dogmatic reasons, because three is the number of the Trinity[7]. Despite the broad consensus on the importance of daily prayer, the unity was very little on its schedule. For instance, St. Peter prayed only once[8], while the Bible reports the ninth hour for praying[9]. As a result, the practice was originally inhomogeneous.

The attempts of a structuring agency to reform daily worship would appear at different times of history, depending on the Christian tradition. Eastern Churches canonised their piety early on, while western Christianity would introduce the devotional discipline to the secular groups many centuries after. Among the earliest eastern groups, there were the

[3] "Jewish Law makes it our duty to pray three times daily: in the morning, in the afternoon and at nightfall. These prayers are called morning prayer (*shacharit*), afternoon prayer (*minchah*) and evening prayer (*arvith* or *maariv*)." Nissan Mindel. “The three Daily Prayers”. In: (2013). Accessed: 2020-08-8. See Josef Lössl. *The early Church: History and Memory*. London and New York: T & T Clark, 2010, p. 135.

[4] The year of the Edit of Constantine.

[5] Paul F Bradshaw. *Daily prayer in the early church: a study of the origin and early development of the divine office*. Eugene: Wipf and Stock Publishers, 2008, p. 124; Henry Chadwick. *The Early Church*. London: Penguin, 1967, p. 272; Michael P Weitzman. *The Syriac Version of the Old Testament*. Cambridge (UK) and New York: Cambridge University Press, 2005, p. 213.

[6] Clement of Alexandria, *Stromata*, 7:7. See Chadwick, *The Early Church*, p. 272; Weitzman, *The Syriac Version of the Old Testament*, p. 213.

[7] Tertullian, *De Oratione*, 25. See Weitzman, *The Syriac Version of the Old Testament*, p. 213.

[8] *Acts* 10:9: "On the morrow, as they went on their journey, and drew nigh unto the city, Peter went up upon the housetop to pray about the sixth hour." This version is from the *King James Bible*, hereafter considered as the biblical English version for the whole thesis.

[9] *Acts* 3:1: "Now Peter and John went up together into the temple at the hour of prayer, being the ninth hour"; *Acts* 10:30 "and Cornelius said [...] at the ninth hour I prayed in my house."

hermits and monks of the Antiochian and Nicaean communities, who celebrated intensely and grew longer daily services than the biblical prescriptions. For instance, Basil of Caesarea's ethics (fourth century) directed eight offices[10] while John Cassian (fifth century) prescribed seven of them[11], based on biblical recommendations[12].

However, this does not mean that the West did not perform piety, but, to the contrary, that only a few communities engaged in it. The Roman Mass of the sixth century recommended six daily offices to its monastic communities, but this was no final instruction[13]. A major change would occur under St. Benedict (*c.* 500-550): adopting initially the six-office scheme of the Roman rite[14], soon he would introduce new moments of prayer to his Mass. One of the new offices was *Matins*. Because it concluded (or started) the spiritual day in the early morning, *Matins* was the longest moment of prayer, and sometimes it was combined with the existing Lauds. Along with this long office, the Benedictine tradition of liturgy would include one more canonical hour to its spiritual discipline, namely *Compline*[15]. In opposition to *Matins*, *Compline* was to recite at the end of the day.

Embedding *Matins* and *Compline* to its rite, the Benedictine order established a measure of uniformity in the number of prayers, that became eight. At the same time, it proposed an essential structure made of Psalms, hymns and calendar prayers. Among them, Psalms had the largest space in the Benedictine liturgy, so it was to recite the full books of Psalms in the round of a year[16]. Other prayers with a musical character such as hymns were frequently added in the middle or at the end of services[17].

[10] Basil of Caesarea, *Asketika*, Rule 37. See Chadwick, *The Early Church*, p. 272; Charles A Frazee. "Anatolian Asceticism in the fourth Century: Eustathios of Sebastea and Basil of Caesarea". In: *The Catholic Historical Review* 66.1 (1980), pp. 16–33, p. 29.

[11] In his *Institutiones*. See Chadwick, *The Early Church*, p. 272.

[12] *Psalm* 119: 164, "seven times a day do I praise Thee."

[13] Chadwick, *The Early Church*, p. 272.

[14] St. Benedict, *Rule*, Chapter 16: "that sacred number of seven will be fulfilled by us if we perform the Offices of our service at the time of the Morning Office [*Lauds*], of *Prime*, of *Terce*, of *Sext*, of *None*, of *Vespers* and of *Compline* since it was of these day Hours that [the Psalmist] said, ńSeven times a day do I praise theeż."

[15] Chadwick, *The Early Church*, p. 272.

[16] Joanne M Pierce. "Medieval Christian Liturgy". In: *Oxford Research Encyclopedia of Religion*. Oxford: Oxford University Press, 2016. DOI: https://doi.org/10.1093/acrefore/9780199340378.013.84, p. 13.

[17] One good instance are the Ambrosian hymns, of *Te Deum* for the vigil of the Lord's day and Benedictus, *Benedicite* in Lauds. Not just the content, but also the service duration was flexible: Benedict's rule indicated that the nightly total of prayers stretched to fewer or more abundant amounts over seasons and major festival vigils. See Mary W Helms. "Before the Dawn. Monks and the Night in Late Antiquity and Early Medieval Europe". In: *Anthropos* 99.1 (2004), pp. 177–191, p. 182.

Up to this point, the history of the *Divine Office* coincides with other forms of liturgy because, like other devotions, the *Office* had not grown into a fully formed exercise yet. However, with their harmonising and endorsing agency, the Benedictine communities would act as the catalyst for the evolution of the medieval spiritual exercises. For these monks, constant praying, or *opus Dei*, was a central component of the monastic life. Besides, the popularity of Benedict's Rule in western monasticism served a tremendous service in spreading their traditions, including the *Divine Office*.

The next centuries saw the Roman Curia and the religious reformations of the Franks (eight-ninth century), which had immense implications for the establishment of liturgical unity[18]. To enforce this attempt, the thirteenth-century Franciscans (*c.* 1209) and the Dominicans (*c.* 1216) movements prescribed that the medieval Christian shall commit to private recitation of the *Divine Office* for purposes of spiritual growth. The secular society of those years responded positively to this call to praying, maybe owing to the sympathy for the mendicant orders. In turn, the secular solidarity with the orders stirred the growth of individual spirituality. These orders showed individual practice as an accessible option of spiritual growth for everyone.

Surely, individual forms of devotion were becoming available, but they did not represent the only way of performing spiritual duties. The traditional *cathedral Office*[19] of the parochial system had been the most traditional rite until that moment. The role that the community served in such devotion was so crucial that some acts of the Mass were established with the clear aim of exciting the attention of the practising community. Reinburg portrays a perfect instance of the mismatching significance of the offertory procession to clerics and seculars[20]. According to her study, some secular congregations saw this act as

[18] David McKitterick. "Books as Objects". In: *The Invention of Rare Books: Private Interest and Public Memory, 1600–1840*. Cambridge: Cambridge University Press, 2018. Chap. 2, pp. 28–39. DOI: https://doi.org/10.1017/9781108584265.003; Yitzhak Hen. "Unity in Diversity: The Liturgy of Frankish Gaul before the Carolingians". In: *Studies in Church History* 32 (1996), pp. 19–30. DOI: https://doi.org/10.1017/S0424208400015308.

[19] Modern liturgical studies borrow this expression from Eusebius. See James W McKinnon. "The Origins of the Western Office". In: *The Divine Office in the Latin Middle Ages: Methodology and Source Studies, Regional Developments, Hagiography*. Oxford: Oxford University Press, 2000. Chap. 3, pp. 63–73. DOI: https://doi.org/10.1093/acprof:oso/9780195124538.001.0001, pp. 64-65.

[20] Reinburg refers to this exact instance to support the great distance of interpretation between laity and clergy. She stressed on the strong social value the lay attributed to the Mass, as opposed to the mystical content that the clergy secured in western Christianity. For a deeper elaboration on the concept, see John Bossy. "The Mass as a Social Institution 1200-1700". In: *Past & Present* 100 (1983), pp. 29–61. DOI: https://doi.org/10.1086/493920; Josef Andreas Jungmann. *The Mass of the Roman Rite: Its*

a central part of the service; the clerical congregation, as a mere ceremony of almsgiving. The spiritual implications of communal celebrations were perfectly clear to the celebrant. By contrast, the congregates were wholly unaware of its meaning. That moment became an edifying yet delusional experience, whose pomposity suggested unfounded solemnity, grandeur and mystery. Thus, the traditional Mass worked as an important component of medieval life. Yet, it could be loaded with demystified content, becoming a mere "social institution"[21].

Another part of the laity was not similarly unaware and, instead, grew important concerns over the growing demystification of the religious celebration. So deep was its apprehension that it started withdrawing itself from a public religious life in favour of other, independent forms of devotion. Because of the increasing malcontent, the laity's willingness to take part in the Mass hit a low point and the Roman Curia was forced to intervene. It is on this account that the Fourth Council of Lateran (1215) commanded parishioners to comply again with essential standards of participation, so that the centrality of the cathedral office would be restored[22].

These events did not pull back from a major upheaval of the devotional practices. Later Christians continued exploring their individual relationship with God while increasing the range of spiritual experiences they could enjoy. Along with a richer devotional life, fourteenth-century coenobitic and lay societies created a rift between their liturgical practices. A firm expression of this separation was the rise of the *Devotio Moderna* (= modern devotion, *c.* 1372) mystical movement. From the Low Countries to central and western Europe, the *Devotio Moderna* contributed a novel idea of spirituality (hence, *Moderna*),

Origins and Development. London: Bezinger, 1951, VI, pp. 1-26; Theodor Klauser. *A Short History of the Western liturgy*. London, 1969; Virginia Reinburg. "Liturgy and the Laity in Late Medieval and Reformation France". In: *The Sixteenth Century Journal* 23.3 (1992), pp. 526–547. DOI: https://doi.org/10.2307/2542493. As for the late medieval Eucharistic devotion, Dix stressed on the two elements of clerical isolation in the offertory and the reduction of the lay participation to mere observation. Because lay folk could "see" but not "hear" the celebration, minimised understanding followed limitations in active engagement. See Alan Clark. "The Function of the Offertory Rite in the Mass. A Study in History". In: *Ephemerides Liturgicae* 64 (1950), pp. 309–344; Dom Gregory Dix. *The shape of the liturgy*. London: Dacre, 1945, pp. 597-598.

[21] One of the first who planned the theory medieval Mass as an essentially social event was Bossy, and later Reinburg reinforced on the notion. For a fuller explanation of the notion, see Bossy, "The Mass as a Social Institution 1200-1700"; Reinburg, "Liturgy and the Laity in Late Medieval and Reformation France".

[22] Hermann Wedewer et al. *The Grove Encyclopedia of Materials and Techniques in Art*. St Louis and London: Herder, 1916, pp. 120-121.

as opposed to the traditional teachings from the Benedictine and mendicant orders[23]. The ancient positions on devotion (the *Devotio Antiqua*) can be typified in Eckhart's views. To him, spiritual practice was a full intellectual and contemplative immersion into the divine dimension, where the practitioner was to relinquish every earthly occupation and thought of individualism to fully embrace God. Another strong spokesperson of the ancient school of thought was Tauler, whose philosophy also rejected any individualism[24].

As for the *Devotio Moderna*, their views on devotions could not be more different from the ancient devotion. The "modern" movement proposed that the practice of selfless love, spiritual poverty and practice of virtues was the most perfect spiritual exercise[25]. At the same time, the simplicity of *Devotio Moderna*'s teachings made its contents universally accessible. Being so "democratic", this movement promoted the adoption of private rites.

This revitalised private holy call found a powerful tool of action in books, attracting new attention on this object. The renewed interest in the book was surely functional to many purposes, not limited to religious interest. In fact, other liturgical books had come along before this period[26]. Also, books with religious content were compiled long before this time, some of which intended to instruct the lay on the fundaments of Christianity[27]. Finally, the increasing schooling had made the medieval societies become familiar with the written word, bringing about literacy and book production.

In general, the thirteenth and fourteenth centuries are a period of cultural revival, where literacy rates would gradually increase until a peak in the fifteenth century[28]. In that

[23]David C Steinmetz. "Devotio Moderna". In: *The Westminster Dictionary of Christian Spirituality*. Ed. by Gordon S Wakefield. Westminster: John Knox Press, 1983, pp. 113-114.

[24]Louise Gnädinger. *Giovanni Taulero: ambiente di vita e dottrina mistica*. Torino: San Paolo, 1997, p. 70.

[25]This religious movement arose in the Netherlands from the local converting action of Geert Grote (or Gerald Groote). Those who joined this trend called for large-scale reforms, apostolic renewal through the rediscovery of genuine pious practices such as humility, obedience, and simplicity of life. See John H. van Engen. *Devotio Moderna: basic writings*. New York, NY: Paulist Press, 1988, pp. 7-12.

[26]This is the topic of the next sections.

[27]One of these cases is the *Biblia Pauperum*, a book illustrating typological correspondences between the Old and the New Testament. See Anke te Heesen. *The World in a Box. The Story of an Eighteenth-Century Picture Encyclopedia*. Chicago, IL: University of Chicago Press, 2002.

[28]The definition of literacy skills is cloudy, for it differs over a chronological period and place. To exemplify, fourteenth-century England identified Latin as the basis of literate skills, while the French society expressed a stressed preference for vernacular (Michael T Clanchy. *From memory to written record: England 1066-1307*. Cambridge: Harvard University Press, 1979, p. 184). However, a distinct preference for Latin in a generalised cultural context did not prohibit an active use of vernacular languages in written poetry or prose. This is the case for the fourteenth-century English clergy, or fifteenth-century English elites based in southern England (Devon) or in Paris under the English regency (1422-1438): the latter were keen

century, people became sufficiently proficient in writing and reading, so that they could employ those skills to set a well-structured economy. To provide a few instances of the impact of writing, the literate society could stipulate legal agreements, produce records of the financial capacity in trades or develop such diversified banking arrangements as the *lettre de change*[29]. Literary competence marked intellectual adequacy while helping to expand the business and social relations.

It is important to make a remark apropos. Mass literacy rates had surely increased; however, the literary ranges still marked considerable differences among individuals from different social levels. In other words, important differences in education endured[30].

on French books of religious and romantic content (Clanchy, *From memory to written record: England 1066-1307*, p. 185; Maryanne Kowaleski et al. "French Immigrants and the French Language in Late-Medieval England". In: *The French of Medieval England: Essays in Honour of Jocelyn Wogan-Browne*. Ed. by Jocelyn Wogan-Browne et al. Woodbridge: DS Brewer, 2017, pp. 206–224, pp. 208-223). In Italy, the Arthurian and Merlian literature conquered the attention of courts: Borso d'Este of Ferrara was one of the most enthusiastic Arthurian readers and had a *San Gradale* (Holy Grail), *Merlino*, *Meliadux*, a *Lanzaloto in franzexe* (Lancelot in French vernacular) (Eleonora Stoppino. "Arthur as Renaissance Epic". In: *The Arthur of the Italians: The Arthurian Legend in Medieval Italian Literature and Culture*. Ed. by Gloria Allaire et al. Cardiff: University of Wales Press, 2014. Chap. 7, pp. 121–132, p. 122). Not only Borso d'Este but also other Italian nobles and members of the intellectual Italian society shared the same fascination for texts in French, such as Francesco Accolti d'Arezzo, who borrowed books from Borso (Gloria Allaire. "The Arthur of the Italians: The Arthurian Legend in Medieval Italian Literature and Culture". In: *Arthurian Literature in the Middle Ages*. Ed. by Gloria Allaire et al. Cardiff: University of Wales Press, 2014. Chap. 7, pp. 190–204, p. 191). Aside from language preferences, other languages but Latin started to be used intentionally for artistic production: in the French-speaking area, *chansonniers*, *livres de ballades* were set into manuscripts, or restricted groups of femmes de lettres like Christine de Pizan (1364-*c.* 1430), wrote professionally in French on religious, moral, critical matter (Bell, "Medieval Women Book Owners: Arbiters of Lay Piety and Ambassadors of Culture", p. 756; Roberta L Krueger. "Female Voices in Convents, Courts and Households: the French Middle Ages". In: *A History of Women's Writing in France*. Ed. by Sonia Stephens. Cambridge: Cambridge University Press, 2000. Chap. 1, pp. 10–40, pp. 31-38). Therefore, providing sensible judgement of literacy skills or literacy rates for a society is not a straightforward task. To convolute the matter, lack of available educational records and methodical analysis are complicating factors (Rab Houston. "Literacy and Society in the West, 1500–1850". In: *Social History* 8.3 (1983), pp. 269–293. DOI: https://doi.org/10.1080/03071028308567568, p. 270). For a more elaborated insight into the matter, see Franz H Bäuml. "Varieties and Consequences of Medieval Literacy and Illiteracy". In: *Speculum* 55.2 (1980), pp. 237–265. DOI: https://doi.org/10.2307/2847287.

[29]On the system of the *lettres de change*, see Raymond de Roover. *L'Evolution de la lettre de change: XIVe-XVIIIe siécles*. Paris: A. Colin, 1953.

[30]Despite the improved access to schooling and education, literacy inequalities held strong in early modern Europe. Such differences depended on many factors, such as wealth, gender, personal history, transmission of professional obligations within the family, urbanisation of individuals' abode, notion of literacy. These factors, individually or altogether, could halt individuals from receiving essential education or facilitate them in the long path of instruction until the teaching professions or involvement with higher institutes of education, like universities. Participation to religious trends was equally important, meaning that the status of member or sympathiser of emerging heresies like Protestantism ensured a more or less sure grasp of dogmatic matters. On this account, politically established families or parties operated to merge the Reformation in north Europe and organising massive campaigns of instruction: this happened across Germany and Sweden (Richard Gawthrop et al. "Protestantism and literacy in early modern Germany". In: *Past & present* 104 (1984), pp. 31–55; HG Haile. "Luther and Literacy". In: *Publications of the Modern Lan-*

1. DEVOTIONAL, TECHNOLOGICAL AND HISTORICAL FRAMEWORK

Economic capitals and university hubs experienced the rise of the most complex cultural networks. One of the liveliest centres was Paris, where its economic and political influence as the capital of the French kingdom[31] paired with the dynamism of the city *studium*. Combined, these factors created sturdy grounds for a major book concentration. Here, private collections flourished: those who possessed relatively rich libraries[32] were a large group of royal courtiers, teachers, prelates, civil servants[33]. Most notable were the cases of the Royal Library of King Charles V of France (1338-1380)[34], the private library

guage Association of America 91.5 (1976), pp. 816–828. DOI: https://doi.org/10.2307/461557; Simon McKeown. "Reading and Writing the Swedish Renaissance". In: *Renaissance Studies* 23.2 (2009), pp. 141–150. DOI: https://doi.org/10.1111/j.1477-4658.2009.00556.x). Where the Catholic religion co-existed with Protestantism, like Low Countries, France and Ireland, literary awareness was still high (Mary E Daly et al. *The Origins of Popular Literacy in Ireland: Language Change and Educational Development 1700-1920*. Dublin: Trinity College, 1990; Adrianus Maria van der Woude. "De alfabetisering". In: *Algemene Geschiedenis der Nederlanden* 7 (1980), pp. 257–264, pp. 262-263).

[31] Paris prospered in the last phase of the fourteenth century while the later Hundred Years War and the Anglo-French regency caused the French market and book production to shrink considerably. The market declined mostly due to the many English sieges between 1429 and 1436 that added to the underlying economic distress from the Burgundian and Armagnac clashes and change of domination (Christopher Allmand. *Henry 5*. New Haven and London: Yale University Press, 2014, p. 161). It was only after the civil war that king Charles VII (1422-1461), son of Charles VI, could finally to set foot back in the capital. He and his successors, however (the kings Louis XI (1461-1483) and Charles VIII (1483-1498)), designated the Loire Valley as the favoured residence of the kings and the royal court. Then Paris lost temporarily its leading role as the political capital of France, and the production of illustrated manuscript suffered accordingly. Tours prevailed as the artistic capital, while Paris stayed by the wayside (Thomas Kren. *French illuminated manuscripts in the J. Paul Getty Museum*. Los Angeles: Getty Publications, 2007, p. xx).

[32] In the late Middle Ages (fifteenth century) those who possessed over ten books were significant book owners. See Bell, "Medieval Women Book Owners: Arbiters of Lay Piety and Ambassadors of Culture".

[33] Wayne A Wiegand et al. *Encyclopedia of Library History*. New York and London: Garland Publishing, 1994, p. 209.

[34] Charles V of France inherited around 1367 a small collection from his father John II and transferred it from the *Palais de la Cité* on the *Île-de-la-cité* to the royal palace Louvre on the Right Bank, in Château du Louvre. This group was the original core of the Bibliothèque du Roi, that expanded under the energetic initiative of this philanthropic king. Charles V hired a dedicate librarian to manage and organise the collection, Gilles Mallet, who made a first catalogue of the collection. Later, the king implemented his library with many titles: he ordered the transcription in French of some classic authors-only Ovid and Lucan as for Latin poetry, other prose-, the creation of richly bound and illuminated psalters, that made up the bulk of the original collection (Henry Hallam. *Introduction to the literature of Europe in the fifteenth, sixteenth and seventeenth Centuries*. Vol. 2. New York, NY: Harper & Brothers, 1842, p. 61). He might have also ordered the compilation of an updated catalogue to Jean Blanchet, secretary of Philip of Valois, in 1380 (Janet Backhouse. *The Making of the* Bibles Moralisées. *The Manuscripts*. Vol. 1. University Park: Pennsylvania University State Press, 2000, p. 247). However, the collection would be broken up after Charles V's death when John of Lancaster, duke of Bedford and reagent of France bought the whole of the Bibliothèque and had it shipped to England in 1424. During this time, the collection further increased or changes, and the licentiate in law and notary Jehan Le Bègue (Mary Philadelphia Merrifield. *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*. Two volumes. London: William Clowes & Sons, 1849, vol. 1) made two more inventories of the collection in 1411 and 1413 [Geoffrey, 1988: xc]. It was in 1485, when the French captured Naples, that a substantial part of the royal collection got lost (Wiegand et al., *Encyclopedia of Library History*, p. 209). The collection was re-established and housed in Fontainebleau only in 1544, under king Francis I (1494-1547) (Paul M Priebe. "From Bibliothèque du Roi to Bibliothèque Nationale:

of the influential courtly art patroness Marie de Brabant[35] and the library of the local University[36]. However, the ecclesiastic collections were the most long-lived and respected: among these, there were the libraries housed in the church of St. Denis, the monastery of St. Geneviève and the Cathedral Library[37]. Therefore, Paris expressed a strong literary vocation.

The instance of Paris is especially powerful. One reason for its peculiarity is that it provides a glimpse into the literary preferences of distinct social groups, mostly university academics. This implies that the best part of the domestic book retail revolved around the city university: local retailers offered for sale many university texts, like commentaries, classics, books of theology, law and the other arts taught in the faculties. Besides, university books were not the sole product: wealthy individual patrons often sponsored artistic and literary productions to establish personal prestige[38]. A less high-ranking class of urban readers alongside them expressed similar literary interests, yet concerning less luxurious objects. Both classes of philanthropists contracted bookmakers at least once to create a manuscript for them, and often those patrons had their copy complemented with painted decoration. For their manufacturing, several stages of intensive labour involved the collaboration of workshops of bookmakers and illuminators[39]. However, the levels of production depended largely on the financial availability of the sponsor, their artistic sensibility, and a convenient political framework. All those conditions were met in early fifteenth-century Paris, which lived a golden age of book illumination under the cultural action of notable local bibliophiles. One of them was Jean, Duke of Berry (1340-1416): he ordered some of the most lavish extant manuscripts, all service books: the *Grandes*

The Creation of a State Library, 1789–1793". In: *The Journal of Library History (1974–1987)* 17.4 (1982), pp. 389–408, p. 389).

[35]She was the wife of Philip III. See Jane H M Taylor et al. *Women and the Book: Assessing the Visual Evidence*. London and Toronto: British Library and University of Toronto, 1997, pp.. 198-200.

[36]The massive collection of the university library that counted 2,500 books, and which had increased by 1,000 books in only one century (Wiegand et al., *Encyclopedia of Library History*, p. 140; LM Fidler. "Sorbonne Library". In: *Encyclopedia of Library History*. Ed. by WA Wiegand et al. New York and London: Garland Publishing, 1994, pp. 585–586). Part of this collection was also available for everybody for partial loan or partial in-situ reading (Wiegand et al., *Encyclopedia of Library History*, p. 429).

[37]They counted no fewer than 300 books by the fifteenth century each (James Westfall. *The Medieval Library*. New York, NY: Hafner, 1923, pp. 252-253).

[38]Hamel, *A history of illuminated manuscripts*.

[39]Hamel, *Scribes and Illuminators*; Otto Pächt et al. *Book Illumination in the Middle Ages: an Introduction*. Oxford: Oxford University Press, 1986; Wieck, *Time Sanctified: the Book of Hours in Medieval Art and Life*.

Heures[40], *Petites Heures*[41] and *Belles Heures*[42]. The extravagant Duke was not alone in his desire to possess a book of prayer, for there are records of a similar course of ownership for most of the private collections of the time, were they luxury or less prestigious[43].

The complex yet tight entanglement of luxury- and mass-book retail touched the devotional tradition[44]. Lay devotees, mostly women[45], were frequent possessors of Books of Hours. To them, Hours were not only spiritual guides but also boxes of religious beliefs, artistic and personal records. It is on this account that those possessors turned their copies into "archives of prayer"[46]. So fluid was the role of Books of Hours, that those books

[40]Also called *Grandes Heures de Jean de Berry* (Bibliothèque nationale de France, Paris, Ms. Latin 919), this manuscript is a Book of Hours with Parisian Mass rite compiled between 1400 and 1409 and originally illuminated by hand of some of the most eminent illuminators of the time: the Boucicaut Master, the workshop of the Bedford Master. Further additions and illumination might have added later to the next possessors, Charles V.

[41]Also called *Petites heures de Jean de Berry* (Bibliothèque nationale de France, Paris, Ms. Latin 18014), this manuscript is a Book of Hours with Parisian Mass rite written in Paris (*c.* 1375) and illuminated in Bruges (1385-1390) that Jean of Berry commissioned to Jean Le Noir, a pupil of Jean Pucelle. Unfortunately, Le Noir could complete only few ordered miniatures, while the rest was completed by Jacquemard de Hasdin, that Jean contracted in 1384 (Husband, *The Art of Illumination: the Limbourg Brothers and the Belles Heures of Jean de France, Duc de Berry*, p. 43).

[42]The *Belles Heures* (New York, Metropolitan Museum of Arts, no. 54.1.1 (a, b) was originally a single Book of Hours that was probably created in Paris between 1405 and 1408/1409 for Jean of France, duke of Berry. For the entire illumination, the duke Jean contracted the Limbourg brothers (South Netherlands). See Léopold Delisle. *Mélanges de paléographie et de bibliographie*. Paris: Imprimerie Champion, 1880, pp. 283-293; Paul Durrieu. 1906; Margaret B Freeman. "A Book of Hours Made for the Duke of Berry". In: *The Metropolitan Museum of Art Bulletin* 15.4 (1956), pp. 93–104; Jean Porcher. *Les* Belles Heures *de Jean de France, duc de Berry*. Paris: Bibliothéque nationale de France, 1953.

[43]Bell, "Medieval Women Book Owners: Arbiters of Lay Piety and Ambassadors of Culture".

[44]The historical combination of material media and intangible practices is not new to manuscript studies. Reinburg explored widely the connection between liturgical practices in the late medieval French society (Reinburg, "Liturgy and the Laity in Late Medieval and Reformation France"; Reinburg, "'For the Use of Women': Women and Books of Hours"; Reinburg, *French Books of Hours: Making an Archive of Prayer*; Reinburg, "Oral Rites: Prayer and Talk in Early Modern France", p. 373). Ong, Chartier and Cochrane had already enunciated such connection, while Lemaître and Barnes provided historical instances for the modern period. Sluhovsky drew an elaborate account for the celebration of the patron saint of Paris, Saint Geneviève, which is woven from the many public and semi-private expressions of her devotion. See Andrew E. Barnes. "From Ritual to Meditative Piety: Devotional Change in French Penitential Confraternities from the 16th to the 18th Century". In: *Journal of Ritual Studies* (1987), pp. 1–26; Roger Chartier et al. *The cultural uses of print in early modern France*. Princeton: Princeton University Press, 1987; Nicole Lemaître. *Le scribe et le mage: Notaires et société rurale en Bas-Limousin aux XVIe et XVIIe siècles*. Ussel, 2000; Walter J Ong. *Orality and Literacy: The Technologizing of the Word*. London and New York: Methuen, 1982; Moshe Sluhovsky. *Patroness of Paris: Rituals of Devotion in Early Modern France*. Vol. 3. Leiden, New York, and Köln: Brill, 1998.

[45]Reinburg, "'For the Use of Women': Women and Books of Hours"; Wieck, *Painted Prayers: The Book of Hours in Medieval and Renaissance Art*, pp. 1-3.

[46]The scholar Reinburg long enunciated this fitting formulation and explained its meaning throughout her research (Reinburg, "'For the Use of Women': Women and Books of Hours"; Reinburg, "An Archive of Prayer. The Book of Hours in Manuscript and Print"). However, the most complete expression is in Reinburg, *French Books of Hours: Making an Archive of Prayer*, that stays the most complete interdisciplinary work on French Books of Hours to date.

could be indifferently liturgical guides, primers of education[47] or inventories of spiritual experiences[48]; other times, *horae* became gifts to exchange on special occasions[49].

In Paris, the market of Books of Hours attracted an obvious target. Although the readers of Hours belonged to many social ranks, this book became exceptionally popular among female readers[50]. This natural association to femininity roots in the medieval belief that Hours were a powerful instrument for practising modesty, a sheltered life and inspiring meditation. Because medieval societies suggested strongly that women should engage in these occupations[51], Books of Hours would be highly beneficial in achieving modesty and feminine virtues. Thus, this class of books gathered a large reading agency, especially from women.

To meet a large demand for books, the printing industry became an effective response. Until that moment, the production of service books had involved two major figures, namely a contracting sponsor and a specialised team of professionals[52]. Books were

[47] Reinburg illustrates the case of the *horae* bearing the image of the book peddler and the above line referring "*beauler a b c belles heures*" (= "beautiful ABCs and Hours", translation from vernacular French) from *Le cris de Paris*, Bibliothèque de l'Arsenal, Res-Est-264, fol. 1. The original book was printed in Paris around 1500, and a short alphabetic section published in Paris towards the end of the century (1581 or 1591) was appended at the back of the book. See Reinburg, "An Archive of Prayer. The Book of Hours in Manuscript and Print", pp. 221, 224.

[48] Appending religious objects like pilgrimage medals, votive images, embroideries are one instance of transforming Books of Hours into inventories of past spiritual experiences such as journeys to shrines, miraculous sites or just special affection towards single patron saints.

[49] The Book of Hours of Catherine of Cleves, Duchess of Guelders and Countess of Zutphen (1417-1479), now divided into multiple parts (New York, Morgan Library Ms. M. 945a,b) is a good instance of a book that was commissioned as a wedding gift: this sumptuous manuscript seems to be commissioned around 1440 and illuminated in Utrecht (Netherlands) upon the occasion of the marriage of the Countess to Arnold, Duke of Guelders. See Henri L M Defoer et al. *The Golden Age of Dutch Manuscript Painting*. London: Braziller, 1990, no. 96; John Plummer. *The Hours of Catherine of Cleves*. London: Barrie & Jenkins, 1966; Wieck, *Painted Prayers: The Book of Hours in Medieval and Renaissance Art*, no. 78, p.107.

[50] Bell, "Medieval Women Book Owners: Arbiters of Lay Piety and Ambassadors of Culture".

[51] Reinburg, "'For the Use of Women': Women and Books of Hours"; Wieck, *Painted Prayers: The Book of Hours in Medieval and Renaissance Art*.

[52] In this respect, it is stressed that service books came into existence largely as individual projects. These contracts of services were agreed between sponsors and teams of artists and copyists, either under mediation of a book-dealer or unmediated. However, there are reasons to believe that mass-produced books, also Books of Hours, could be additionally compiled for the use of academics or university affiliates because this market was in Paris equally significant. The academic industry generated books through a method developed from the *pecia* system, a quick, productive method capable of supplying a fair number of similar manuscripts in use in many university cities (Aleksander Gieysztor. "Management and Resources". In: *A History of the University in Europe*. Ed. by H de Rydder-Symoens. Cambridge et al.: Cambridge University Press, 2003, pp. 108–143, pp. 128-129). Despite being ordered largely by university scholars and undergraduates, *pecias* seem to be occasionally produced for some ecclesiastics like preachers working outside the academia: Ray suggested that this was the origin of some sermon manuscripts for sale back in the fourteenth century (Alison Joan Ray. "The *pecia* System and its Use in the Cultural Milieu of Paris *c.* 1250 to 1330". PhD thesis. London: University College London, Department of History, 2016, p. 11).

tailored for the sponsor, while the crafting was managed by book workshops or *ateliers*[53]. Besides, manual bookmaking was a lengthy and expensive process that only affluent patrons could afford. As the printing press rooted in Europe, it successfully penetrated the fabric of the Parisian market in a quick and pervasive fashion, thanks to the enormous potential of the printing technology[54]. In fact, the printing technology allowed securing stocks of nearly identical items for sale[55], so books became readily available and economically accessible.

In the rapid transition from handcrafting to pressing, printers diversified the book market. They both issued popular books[56] and sponsored vernacular literary works to create novel, exclusive material[57]. At the same time, printers and publishers polished their techniques to fashion long-established books, like Books of Hours.

The system pulled in a considerable number of books with standardised features so that it was helpful in a mentality dominated by fully handmade craftmanship. Because of this reason, other books like the *Paris pocket Bibles* were also produces similarly, resulting in numerous items standardised in content and format (Kathryn M Rudy. *The Modular Method*. Cambridge: Open Book Publishers, 2016. Chap. 1, pp. 15–50). However, this detail is neglected in the text for the sake of the overall fluidity.

[53] Hamel, *A history of illuminated manuscripts*, pp. 168-200; Reinburg, *French Books of Hours: Making an Archive of Prayer*, pp. 31-52.

[54] Another specification must be appointed here: attempts of establishing the press in Paris are earlier than Fichet and Heynlyn (*c.* 1470). Before this time, the local book-dealers and the German printer Fust already sought business in Paris, but the local resistance of manuscripts sellers was stronger than their attempts (Peters, *Harold Innis's History of Communications: Paper and PrintingAntiquity to Early Modernity*, p. 73). Only the University was an authoritative enough party to allow invited printers to produce printed books for the local commerce. Once these masters left the Sorbonne spaces to start a separate activity, the press formally rooted in Paris as a new commerce. See Anatole Claudin. *The First Paris Press: An Account of the Books Printed for G. Fichet and J. Heynlin in the Sorbonne, 1470-1472*. Vol. 6. London: Bibliographical society at the Chiswick Press, 1898; Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 168-169.

[55] Joerg Baten et al. "Book production and the onset of modern economic growth". In: *Journal of Economic Growth* 13 (2008), pp. 217–235. DOI: https://doi.org/10.1007/s10887-008-9031-9.

[56] A good instance of such deluge were the editions of the *Danse Macabre*. The *Danse* is a popular theme in the late Middle Ages and that probably first appearing as an illustrated theme on the *charnel* walls of the Church of the Innocents in Paris (Sandra Hindman. "The Theme and its Public". In: *The Danse Macabre of Women: Ms. Fr. 995 of the Bibliothéque Nationale*. Kent: Kent State University Press, 1994, pp. 7–18, p. 15). The French printer and publisher Guy Marchant (*fl.* 1483-*c.* 1505), issued editions of the Danse repeatedly between 1485-1486 and 1491, followed by the editions that the partnership Gillet Couteau-Jean Ménard-Petit Laurens produced in 1492 and 1494 respectively (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.126-127).

[57] This is the case for Vérard's *Mer des hystoires*, a universal history of France in two parts. The first book covers all historical facts occurred between its origins until the death of King Louis XI, and it is an adaptation to vernacular French of a Latin text. The text is also supplemented with other information, such as a geographical dictionary, a description of the Holy Land, Aesop's *Fables*, and a genealogy of kings of France until the death of King Louis I. A second part entitled *Le Martirologe des sainctz* followed the first volume one year later (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.451-455). Vérard, one of the most acclaimed publishers in Paris, issued the first edition of this monumental book in the two mentioned volumes, the first one in 1487 and the second in 1488/1489.

Even if the printed media made up a valid alternative to the manuscript, the manuscript production of Books of Hours was not discontinued immediately. Several individuals still enjoyed both the presentation of handmade *horae* and the art of illuminating masters, so that they would maintain the illuminated manuscript alive. This brought Renaissance Paris to live a unique historical moment when a society with multiple levels of literacy owned Books of Hours, the great majority of which appreciated decorated books, while only a small part of it could afford decorated items. The combination of these facts with the coexistence of the two manufacturing systems (printing and traditional bookmaking) brought about a harsh rivalry between makers of manuscripts and *incunabula*. Some *incunabulum* makers, especially the most refined publishers, devised to promote the presentation of their editions, turning austere early printed books into items for everyone. Those professionals understood the importance of the editing process, so they spent sizeable efforts in upgrading the page presentation. Additionally, those efforts resulted in elaborate *mise-en-page* and created a luxury market of printed books by augmenting them with illustrations, illuminated rubrics and miniature by the hand of the finest artists in the city. The 1490-*Grandes Heures royales* illustrated a good instance of this marketing strategy: the Parisian editor Antoine Vérard (*fl.* 1485-1512) edited and had this designed for the special use of King Charles VIII of France[58]. Making those Hours involved a tremendous deal of skill, which made this edition a historical, technical and artistic gem[59]. Soon, other Parisian publishers would follow Vérard's model, and they used their crafts to produce more and more beautiful editions. Another printer-publisher who worked himself into a frenzy of editing was Philippe Pigouchet (*fl.* 1483-*c.* 1500), who elaborated historiated borders in a peculiar style[60]; similarly, the engraver Geoffroy Tory (*fl. c.* 1500-1533) designed elegant editions with highly philosophical imagery[61].

[58] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*; Mary Beth Winn. *Anthoine Vérard: Parisian Publisher 1485–1512: Prologues, Poems, and Presentations*. Genève: Librairie Droz, 1997.

[59] See Section 1.4 on this subject.

[60] Mary Beth Winn. "Guillaume Tardif's Hours for Charles VIII and Vérard's *Grandes heures royales*". In: *Bibliothèque d'Humanisme et Renaissance* 56.2 (1994), pp. 347–383; Mary Beth Winn. "Printing and Reading the Book of Hours: Lessons from the Borders". In: *Bulletin of the John Rylands Library* 81.3 (1999), pp. 177–204.

[61] William M Jr Ivins. "Geoffroy Tory". In: *The Metropolitan Museum of Art Bulletin* 15.4 (1920), pp. 79–86. DOI: https://doi.org/10.2307/3253359.

1.2 Liturgical and technical features of printed Books of Hours

1.2.1 Books of Hours compared to other medieval liturgical books

The previous section has explored the *Divine Office* historically while elucidating its intimate connection to the Book of Hours. However, *horae* were not the only liturgical book available to medieval Christianity but, to the contrary, only one among a broad class. Within this group, the diversity of devotional books was as wide as the forms of religious celebrations. As for liturgical books, their distinction into several classes draws as much from their liturgical range as their literary specificity. Their themes were generally biblical, seldom being created on purpose. The broad category of liturgical books shall be, therefore, broken down into two groups: those that embrace solely biblical teachings (like Psalms, Gospels, portions of the Book of Revelations, etc.)[62], and those that contain non-biblical readings. The first group includes *biblical* books; the second, *liturgical* books.

The distinction between liturgical and biblical books is not always manifest. For instance, a book may use one as its primary core and later expand it with additional parts, altering the original intents accordingly. Furthermore, rites could be designed especially for certain religious groups, with the result that certain Masses arose for celebration in a diocese[63], a religious order, or special celebrations of the Roman Church. One instance

[62]It is important to stress that the condition of containing biblical reading is not sufficient to classify a book as liturgical: medieval copyists compiled Apocalypses, Beautus, Pentateuchs, *Biblés moralisée*, Gospel lectionaries, to mention some. However, it is possible that the boundary between liturgical biblical books and merely biblical books is the purpose that each book fulfils. Liturgical books guide a rite, while other books are for education. For instance, a *Beautus* is a commentary to the Book of Revelation by John the Evangelist, while the *Biblia Pauperum* (mentioned before) establishes connections between the two Testaments. However, this specification is not crucial for a full grasp of the significant differences among the liturgical books that contributed to the Books of Hours, so this section will not further discuss the subject.

[63]Like Paris, Utrecht or Canterbury. These rites can be roughly be defined as "uses" even if they vary significantly by the extent of difference: in some cases, individual rites adopt a textual range that does not overlap others. This first case represents regions that developed a distinct religious identity, like the English church or the French area. The English church expressed a pronounced preference for the use of *Sarum* (= of Canterbury) over other available, like the use of York. In its original form (late eleventh century) the *Sarum* rite bore a striking similarity with northern French liturgies such as the use of Rouen (in use in Normandy; see Harford A Pearson. *The Sarum Missal: Done into English*. London: The Church Printing Company, 1884, p. xxiii). However having distinctive features from the *Sarum* rite, the use of York was not as widely accepted as the other, and it was doomed to supplantation by the Book of Common Prayer from the

is in the difference between the so-called *low Mass*, a simple celebration of the Eucharist in which the celebrant was typically assisted by only one server, and the *high Mass* or *Missa solemni*, the presbyterian rite celebrated on solemn occasions[64] Bearing in mind the breadth of medieval devotion allows grasping that the *Divine Office* was only one form of piety. As this chapter illustrates, the reader will also see its characteristic architecture as a system of prayer based on time, both with seasonal variety and an invariable core.

Some kinds of *liturgical* and *biblical* books influenced the rise of the medieval Book of Hours more than others, specifically the Psalters, Antiphonaries, Evangeliaries, Missals and Breviaries[65], so this section shall illustrate their liturgical and codicological features.

Major liturgical books

Psalters A Psalter is a *biblical* book that simply contains the *Book of Psalms* (the full collection of 150 Psalms of the Old Testament)[66]. Occasionally, Psalters added to its core such ancillary texts as calendars, the *Litany of Saints*, hymns or other prayers. This book appeared at the beginning of the seventh century in the Insular area[67]. Continental Europe would adopt it a century after. Most of the extant Psalters had been produced between the eighth and ninth centuries, yet seldom further copies would appear throughout the following medieval periods to finally disappear in the early modern period. A small,

English Reformation (*c.* 1549) - which shares a good deal of the *Sarum* rite indeed (Charles Herbermann. "Use of York". In: *Catholic Encyclopedia*. New York, NY: Robert Appleton Company, 1913). As for the French semi-independent liturgies, there was a broad group of local rites (Paris, Tours, Rouen, etc.) that went under the comprehensive definition of Gallican rites (R.E. Balfour. "Note on the History of the Breviary in France". In: *The Journal of Theological Studies* 33.132 (1932), pp. 365–371). In other cases, than those presented, minimal variations such as the devotion of a special patron saint are seen. Other rites from dioceses or religious orders (Dominicans, Carthusians, Carmelites), the independent Ambrosian and Mozarabic Rites, were regarded of special weight so they could survive the massive Reformation action of reform by Pius V (*c.* 1566-1580; Herbermann, "Use of York"). However, the main office that served as a model for the Latin liturgies was the Mass of Rome; others display slight variations and are seldom regarded as minor variations on the Roman rite.

[64] See Jungmann, *The Mass of the Roman Rite: Its Origins and Development*.

[65] The fact that this section does not present other significant liturgical books does not deplete the historical meaning of the latter, books that contained important texts like scripture readings such as the *Lectionary*, or like the *Hymnal*, that gathered metrical hymns sung in the *Divine Office* and arranged according to the liturgical year (Michelle P. Brown. *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*. Los Angeles: Getty Publications, 2018, pp. 57, 63).

[66] Ingo F Walther et al. Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*. Köln: Taschen, 2001, p. 25; Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 88.

[67] Great Britain and Ireland.

sixteenth-century production of English Psalters represent an exceptional case: in the Tudor period, King Henry VIII of England and his consort had two exquisite copies made for personal use, the so-called *Psalter of Henry VIII* and the *Queen Mary Psalter*.

Until the Book of Hours, Psalters were the most frequent possession among high-ranking lay patrons, who used these objects for both private devotion and to mark their wealth[68]. As luxury products, Psalters were supplemented with sundry illumination: their decoration could be as intellectually rich and extravagant as the full-page illustration of the *Crucifixion* of Figure 1.1.

[68] A short list of remarkable Psalters must include the *Utrecht Psalter* (*c.* 820-840), *Lothair Psalter* (*c.* 840-855) and *Psalter of Blanche de Castille* (*c.* 1230). The *Utrecht Psalter* (Utrecht Universiteitsbibliotheek, Ms. Bibl. Rhenotraiectinae I Nr 32) was made in a Benedictine abbey in Hautervillers (near Reims). It has the Book of Psalters as its core to which it adds hymns from both Testaments and the Apostles' Creed (Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 90). The *Lothair Psalter* (BL, Add. Ms. 37768) was made in Germany, Aachen or Northern France, Tours for the use of a member of the court of the Emperor Lothar at Aachen, probably a sister of the Emperor himself (Scot McKendrick et al. *The Art of the Bible: Illuminated Manuscripts from the Medieval World*. London: Thames & Hudson and British Library, 2016, pp. 68-73. The *Psalter of Blanche de Castille* (Bibliothèque de l'Arsenal, Ms. Lat. 1186) was created in Paris and sponsored by Louis VIII of France and probably his queen, Blanche of Castille (Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 162).

Figure 1.1: Double-page view of the *Ramsey Psalter*, England, *c.* 1310 (268 mm x 165 mm single leaf dimensions). In New York, PML, Ms. M.302, fols. 17^{v} -18^{r} © Morgan Library, New York.

Illuminated decorations are typically found at the opening of Psalters, like the above mentioned case. Alternatively, colourful miniatures were placed within the text. As for their themes, the illustrative cycles of Psalters are a visual rendering of psalmodies; they bear no reference to Christ.

Antiphonaries An *Antiphonary* (or *Antiphonal* or *Antiphoner*), is a *liturgical* book of musical texts, the *antiphons*. Antiphons are song formulations that the Catholic Church has adopted to celebrate their rites. Sung throughout the year, universally, in special occasions or certain areas, antiphons are an important component of the liturgical traditions[69]. The books collecting antiphons differ from another called *Gradal* in their function: the Antiphonary contains long chants to articulate in choir, whereas a Gradal collects musical sequences of versicles and responses[70].

The origins of the Antiphonary are still unclear, but not because of the scarcity of information. Instead, their production has been so extensive and pervading that tracing its history is a challenging task. It would be necessary to study nearly all monasteries in the West, for it was an invariable accessory of the congregate Mass. Besides, the antiphonary contains the text of the monastic musical liturgy, that were intended for the exclusive use of canons.

The decoration in this type of books arranges the contents in hierarchical order, considering size and artistic quality of decoration (which consists almost only of decorated initials[71], fig. 1.2).

[69] Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 3.

[70] Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 25.

[71] For a more elaborate classification of the typologies of decorated initials, see Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*. Two good instances of antiphonaries are the Antiphonary Cenni Di Francesco Di Ser Cenni (*c.* 1390), from the Chapel of Saint Nicholas of Bari of San Pier Maggiore (Florence), and the Codex 116c of Manizola from the Biblioteca Pública de Évora (sixteenth century). Little is known on BPE, Codex 116c of Manizola: its provenance is uncertain but its inclusion in a Cistercian library and the peculiar iconography suggests a possible connection or derivation from a female monastery belonging to the order of St. Bernard of Claîrvaux (Ant(́o)nia Fialho Conde et al. "The Choir Books of the Monastery of St. Benedict of Cástris: Codicological Analyses of an Antiphonarium". In: *Mirabilia Ars* 2.1 (2015), pp. 58–83; Whitney Jacobs. "The Fingerprinting of the Materials used in Portuguese Illuminated Manuscripts: Origin, Production and Specificities of the 16th century Antiphonary Paints from the Biblioteca Pública de évora". MA thesis. Évora, Roma, and Thessaloniki: Universidade de évora, Dec. 2016, p. 18).

Figure 1.2: Full-page view of a fragment of Antiphonary, Italy, *c.* 1450 (370 mm x 255 mm leaf dimensions). In Dallas, Bridwell Library, Ms. 39 © 2006 Southern Methodist University.

Evangeliaries An *Evangeliary*, also called *Gospels*, is a *biblical* volume containing the full *Book of the Gospels* (the evangelical stories of the life of Christ). When it contains only portions of Gospels, this book is called *Book of pericopes*[72].

The core of an Evangeliary is a collection of Gospels, although prefatory commentaries might be attached at the front. Most commonly, such supplements were St. Jerome's *Prefaces* or Eusebius' *Canon Tables*. The Eusebian *Canon* is a Late Antiquity system that Eusebius of Caesarea (265-340) articulated to arrange the entire collection of Gospels into ten tables (*kanons*). Its system was for assisting evangelic studies, as well as establishing thematic correspondences between pericopes, as typical of the Middle Ages.

Medieval theologians believed that studying the Gospels was a major spiritual exercise[73]. So, it was considered essential for the spiritual building that evangelic readings became a stable component of the *lectio continua* and came to open every daily service. Put differently, medieval piety gave special consideration to evangelic teachings and, by extension, to the books which included them. Gospel books became symbols of holiness accordingly, and among the finest and sumptuous books until the High Middle Ages[74].

Thus, Evangeliaries appear with Christianity and were crafted throughout the medieval period. These books also marked the transition between the Late Antiquity and the early Middle Ages: monks dispatched pocketbooks of Gospels to the surviving outposts of the Latin society[75] and used them to spread the word of Christ. Additionally, aristocrats and other men in power exchanged large-sized Evangeliaries as gifts. The *scriptoria* and *ateliers* of Insular monasteries rivalled to design the most daring techniques of illumination

[72] Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 3; Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 25.

[73] Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 25.

[74] Good instances for this class of books are *Book of Lindisfarne*, the *Book of Kells* and the *Book of Durrow*. The *Book of Lindisfarne* or the *Lindisfarne Gospels* (before 698), (London, BL, Cotton Nero D. IV) was produced under request of the bishop of Lindisfarne (Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 70). The phase of creation of the *Book of Kells* (Dublin, Trinity College Library, Ms. A. I 6(58)) seems to date back to the ninth century (*c.* 800) but the original circumstances of production and use are currently unknown. The book was stolen from the monastery of Kells in 1007, after which it was named, and shortly recovered (Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 80). The *Book of Durrow* (Dublin, Trinity College Library, Ms. A. 4.5(57)) is the earliest of the group (c. 675), and the circumstances of its birth are as obscure as the *Books of Kells*. Partial information on the Evangeliary of Durrow refers the monastery library had owned it until its dissolution (sixteenth century). See Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 78.

[75] Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 70.

of the Middle Ages[76]. Irrespective of their format, Evangeliaries played a strategic role in the massive conversion to Christianism. Their golden age falls in the eighth and ninth centuries. After this period, their production depleted but never disappeared completely.

The universality of this book found its foundations in the breadth of its reading audiences: Evangeliary readers ranged from high-ranking seculars and clerics to monastery collections.

Speaking of their decoration, Gospels frequently contained full-page miniatures representing Christian iconographies. A good instance of such decoration is a Christ in Majesty on Figure 1.3. Nevertheless, Insular monasteries (*c.* 550-900) hosted the most prolific ateliers of the Middle Ages, whose books represent a unique case of artistic style[77], as Walther and Wolff expressed: "[Evangeliaries, n.d.a.] outstrip all other similar European works of the same period when it comes to artistic distinction and sheer exuberance of the decoration"[78]. This peculiar style of illumination relinquishes all decorations but title pages. Here, a compact integration of decoration and text, almost obsessed with elaborating the tiniest geometric patterns, that extends to the whole surface of a leaf. Canon Tables are another frequent prefacing artistic and practical supplement at front of the pericopes.

[76] Among these techniques, there were use of lead point and lightboxes. See Michelle P. Brown. *The Lindisfarne Gospels: Society, Spirituality and the Scribe*. Toronto: University of Toronto Press, 2003, pp. 213-226, 275–299.

[77] Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 61.

[78] Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 80.

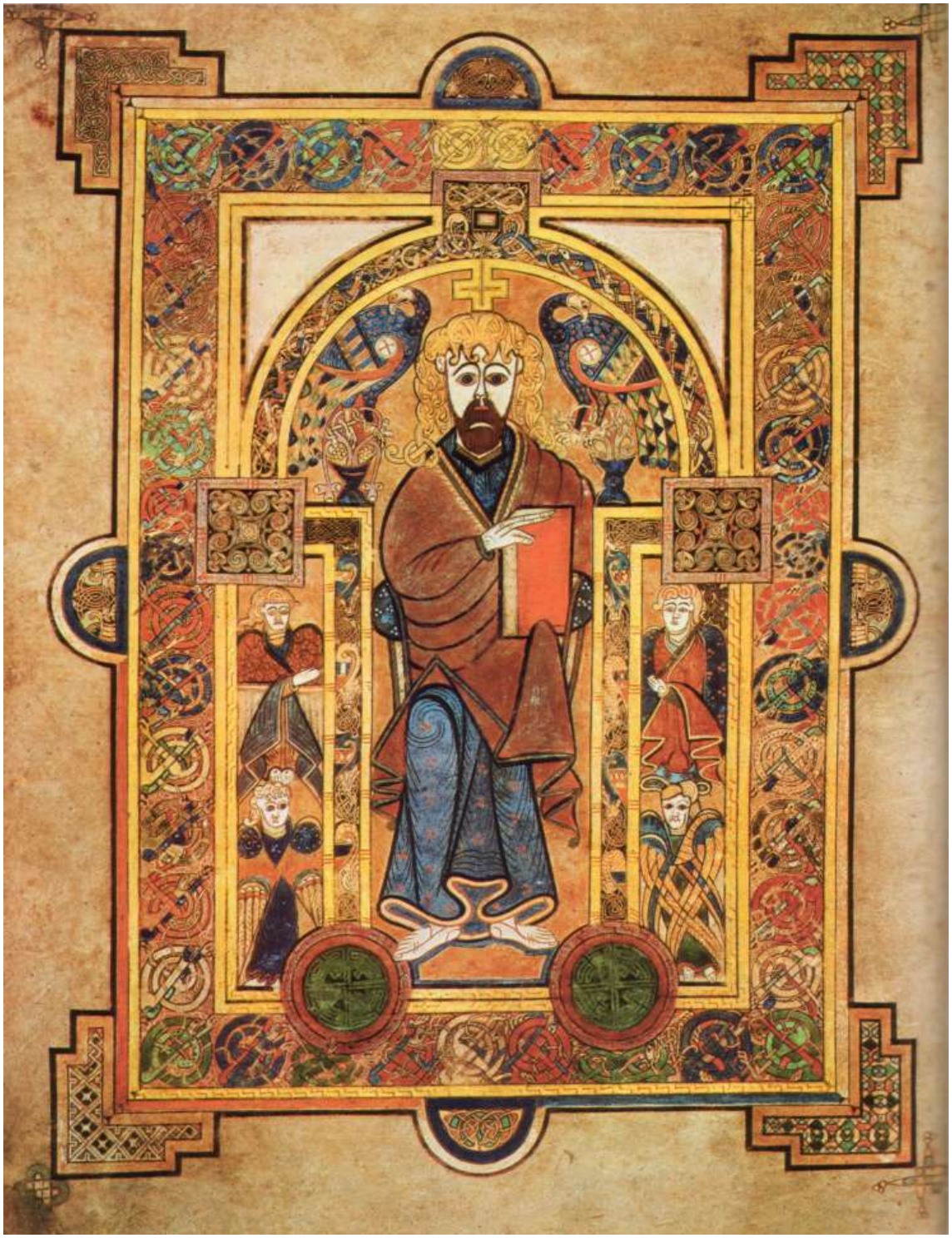


Figure 1.3: *Christ enthroned*, full-page miniature from the *Book of Kells*, Ireland, Scotland and England (?), ninth century (330 mm x 255 mm leaf dimensions). In Dublin, Trinity College Library, Ms. A. I. [58]), fol. 32^{v} © 2022, Trinity College Dublin, The University of Dublin.

Missals Missals are *biblical* books. They contain the texts and rubrics necessary for the celebration and guidance of the Ordinary of Mass, comprising the original core of the *Sacramentary* to which it added the Gradual, Evangeliary and Epistolary[79]. Sometimes, calendars are at their end. The Latin Missal appeared first in the Carolingian period (eight to ninth century) to replace completely the previous Sacramentary by the end of the High Middle Ages (thirteenth century).

Different from the other types, Missals circulated only among priests because of the selectivity of the rite. The illumination a feature that singles this class of books out from the other books presented insofar. Its decoration is, indeed, mandatory and strictly regulated with a canon[80] (fig. 1.4).

[79] Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 71.

[80] Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 25.

Figure 1.4: Full-page of a leaf from the *Sherborne Missal*, England, *c.* 1399-1407 (535 mm x 380 mm single leaf dimensions). In London, BL, Add Ms. 74236, fol. 31^{r} © The British Library Board.

Breviaries A Breviary is a *biblical* book that contains the *Divine Office*. Since the High Middle Ages until the present day, its core has been including Psalms, hymns, readings, prayers, antiphons, not necessarily in this order. This essential core has undergone considerable changes in response to the function that the book itself played over the centuries: originally, a Breviary was a collection of prayers (mostly Psalms)[81]; later, it drove private piety. With such a shift of intents, the structure changed accordingly, and adopted the Benedictine liturgy.

In its later form, the Breviary guides the recital *Divine Office* to absolve daily and arranges its contents into *Temporale*, *Sanctorale*, *Common of Saints*[82] and *Ordinary*. The Temporale is the section of service books containing the readings used to celebrate feast days, including the major Christological feasts (Christmas, Easter, Ascension, Pentecost) and the Sundays of the years. This section further includes the formularies used to celebrate the saints' feast day falling in late December (St. Stephen and John the Evangelist)[83]. The Sanctorale is the set of formularies (prayers and chants) with special Offices performed to celebrate other saints' feasts than those included in the Temporale. The duration of the Sanctorale covers the period of the year comprised between January 13 and December 24[84]. Similarly to the Sanctorale, the Common of Saints celebrates saints' feasts. However, it does not accord individual services to each saint and organises them into categories (martyr saints, virgin saints and so forth)[85]. Finally, the Ordinary or Proprium contains the parts of the liturgy to perform at all celebrations of the week but the Sundays. The Ordinary of the *Divine Office* differs from the Order of Mass by its changeable structure according to the canonical hour[86] and assembles various liturgical volumes for private use (*Psalter*, *Lectionary*, *Antiphonal*, *Collectar*, *Martyrology*).

Two devotional books stemmed from the Breviary: the *Diurnal* and the *Nocturnal*. Also called journals, these two books discern respectively only the daytime (hence, "diurnal") and nightly services of the *Divine Office* (hence, "nocturnal"). So the Diurnal comprises

[81] Walther et al., Codices illustres*: The World's Most Famous Illuminated Manuscripts: 400 to 1600*, p. 25.
[82] Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 16.
[83] *Ibid.*, p. 105.
[84] *Ibid.*, p. 98.
[85] *Ibid.*, p. 32; Fernand Cabrol. "Proprium". In: *Catholic Encyclopedia*. Ed. by Charles Herbermann. New York, NY: Robert Appleton Company, 1913.
[86] Cabrol, "Proprium".

Lauds, *Prime*, *Terce*, *Sext*, *None*, *Vespers* and *Compline*. Conversely, the Nocturnal offers only the night office or *Matins*[87].

Going back to the more traditional Breviary, it came to light in the West under the action of the early monasticism and accommodated additional readings in the eleventh century. Although several reforms sanctioned many Breviaries over the Middle Ages[88], the Tridentine reforms abolished all other breviaries but the Roman, which is still in use. Monks were initially the exclusive owners of this book before the Franciscans popularised it in a condensed form. With the Mendicant orders, Breviaries became widely available, so they lost their original affiliation to the clergy in the late Middle Ages[89].

As for decoration, Breviaries contain initials grading the text, figurative illuminations of various iconography, *bas-de-page*[90], border decoration in local styles of illumination (fig. 1.5).

[87] Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 38.

[88] Pope Nicholas III approved the Franciscan Breviary (1270-1280) in the Middle Ages, but this sanction did not spare it from later extinction. See Eric Palazzo. *A History of Liturgical Books from the Beginning to the Thirteenth Century*. Rome: Liturgical Press, 1998, p. 169.

[89] Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 16.

[90] *Bas-de-page* (= "bottom of the page") scenes are usually unframed images that may or may not refer to the text or image above. They are found in Gothic illumination from the thirteenth century on. See *ibid.*, p. 16.

Figure 1.5: Full-page view of a leaf with an historiated initial D, from a Breviary depicting St. Nicholas (Bishop), France or Flanders, 1450-1499 (104 mm x 140 mm leaf dimensions). In Philadelphia, UPenn Library, Lewis E M 28.21b, fol. 215^{r} © Free Library of Philadelphia.

1.2.2 Comparison between Breviaries and Books of Hours

The above description of the Breviary unveiled several similarities between this book and the Book of Hours, both liturgically and structurally. The two of them guide the daily prayer, and both books were meant only for individual worship. Contrary to the Breviary, the Book of Hours does not adopt the full *Divine Office*, but rather a section, the *Office of the Blessed Virgin Mary*.

Little is known about the origins of the *Office of the Blessed Virgin Mary* but two possible historical traditions. The first one derives from Peter the Deacon's writings (twelfth century): he reports that in the eighth century, the Benedictine monastery of Monte Cassino (Italy) elaborated a supplementary Marian Office as a secondary form of devotion within the *Divine Office*, to perform sporadically at the end of rites[91]. According to the second historical tradition, the liturgical master of Charlemagne's court, Alcuin (†804), elaborated a series of Votive Masses to popularise Saturday as Our Lady's Day[92]. A couple of centuries after, St. Peter Damian (†1072) remodelled the rite to give it the final shape. Regardless of the exact origin, both customs agree on a single point: that Marian piety was already strong. The devotion of Mary was already popular among medieval monks, who promoted an archaic form of the *Office of the Blessed Virgin Mary* Office to several monastic communities, especially the Cistercians[93]. Later, the Marian Office reached the secular, which adapted its original structure to the *Divine Office*. This later shape would be known as the *Common of the Blessed Virgin Mary*.

Starting from the twelfth century, the laity would adopt an abridged form of this *Common*, taking the name of *Little Office of the Blessed Virgin Mary*, or simply *Hours of the Virgin*[94]. Along with dissociation from the *Divine Office*, the *Hours of the Virgin* became closely intertwined with a specific class of readers. So the Breviary matured an increasing

[91] It was, according to him: "[Another office, supplementary to the Divine Office,] which [...] is customary to perform in honour of the Holy Mother of God, which Zachary the Pope [†752] commanded under strict precept to the Cassinese Monastery." See Little Office of Our Lady. "The Medieval Library". In: *The Catholic Encyclopedia*. Ed. by Charles George Herbermann. New York, NY: Robert Appleton Company, 1923.

[92] However, it is not clear whether Alcuin intended to celebrate this votive Mass as part of the daily office or as part of Easter devotion preparing the Christian in the Saturday to the forthcoming resurrection of Christ. See Eleanor Shipley Duckett. *Alcuin: Friend of Charlemagne, His World and His Work*. New York, NY: Macmillan, 1951, p. 273.

[93] The General Chapter sanctioned the *Little Office of Our Lady* as a community prayer in 1185. Later, it canonised her votive Mass celebrated on Saturdays from 1220.

[94] Wieck, *Painted Prayers: The Book of Hours in Medieval and Renaissance Art*, pp. 1-2.

affinity to the clergy, whereas the Books of Hours became the book of the laity. Clearly, this is a rough separation, for situations when lay folk ordered a personal Breviary made exist as well: such is the case of the *Isabella Breviary*[95], that was commissioned by Isabelle of Castille to a Dominican monastery of Bruges.

Aside from a historical differentiation, Books of Hours are distinct from Breviaries also by their liturgical other features. Breviaries embed, indeed, full-fledged Propers and Ordinaries, whereas these sections are not immediately recognisable in Books of Hours. Only in the late Middle Ages, calendars would be added to Hours, but their sequence of devotion remains ambiguous: not all calendars clearly mark the difference between major saints' feasts and minor saints' feasts. Additionally, each Office contained both standard liturgy and special readings, yet no instruction on when to say one or the other. Next to the calendar, Books of Hours were added earlier to their core further sections: the Hours of the Cross, Hours of the Holy Spirit, Hours of the Dead and the Penitential Psalms[96]. The Roman Curia would integrate them into its standard Breviary much later[97].

Not only the internal structure but also its decoration separates Hours from other kinds of books. Books of Hours developed standard sets of illustrations which they placed at the opening of each liturgical hour. Their compositions were thematically connected to the Office they illustrated. Accordingly, the Hours of the Virgin developed two standard figurative series of decoration, with scenes of the life of the Virgin[98]; the Hours of the Cross

[95] London, BL, Ms. 18851. The manuscript was produced in *c.* 1497 and includes a Breviary of Dominican use, known as the *Breviary of Isabella of Castile* after its owner. See Appendix A, Ms. 2 for a digital version of the manuscript.

[96] The *Penitential Psalms* is a group of seven compositions (Psalms 6, 31, 37, 50, 101, 129 and 142) that made up a whole ever since Cassiodorus (*c.* 485-585) presented them as a group in his *Exposition in the Psalms*. They were recited with the Litany of the Saints as a customary act of repentance during the festive days of the Lent since customary of the Papal court, also known as the Ordinal of Innocent III (1198-1216) sanctioned this practise. See Aurelian van Dijk. "The Litany of the Saints in the Breviary of the Roman Curia and the Friars Minor before Haymo of Faversham". In: *Franciscan Studies* 7.4 (1947), pp. 426–438. DOI: https://doi.org/10.1353/frc.1947.0036, p. 426.

[97] For instance, the *Penitential Psalms* appears in it only in 1614 (cfr. *Roman Ritual*, 1614, Title V, Ch. 3). Another Office, the *Hours of the Dead*, had an equally long and complicated course of sanction. The Reformation rejected this Office because connected to the Requiem Mass, but it was restored in 1560, under the Lutheran revision of the Breviary. It was only in the twentieth century that Pope St. Pius V finally assigned to the first free day of the month (1911). See Edwin Burton et al. *The New Psalter and its Use*. London and New York: Longmans, Green, 1912; Frank C Senn. "Requiem". In: *The encyclopedia of Christianity*. Ed. by E. Fahlbusch et al. Vol. 4. Grand Rapids et al.: Eerdmans and Brill, 1999, pp. 647–649, p. 649; John L Ubel. "*Septem psalmi poenitentiales*: History, Demise, and Rebirth of an Ascetical Tradition". In: *Logos: A Journal of Catholic Thought and Culture* 17.4 (2014), pp. 155–168. DOI: https://doi.org/10.1353/log.2014.0036, p. 163.

[98] The Infancy cycle and the Passion cycle.

also adopted a few scenes from the Passion cycle; the Penitential Psalms, biblical stories of king David and Bathsheba. Aside from these prevailing themes, Books of Hours were susceptible to customisation, in the sense that art patrons occasionally slipped customised imagery within the text (personal portraits or stories of their cherished saints).

The figurative scheme of a regular Book of Hours is presented below (tab. 1.1):

Office	Hour	Scene	Altenative cycle
Pericopes	-	John in Patmos Miracle of St. John and the poisoned cup St. John boils in oil	-
Office of the Virgin	Matin	Annunciation	Agony
	Lauds	Visitation	Betrayal
	Prime	Nativity	Christ before Pilate
	Terce	Annunciation to the Shepherds	Flagellation
	Sext	Adoration of the Magi	Christ carrying the Cross
	None	Flight into Egypt	Crucifixion
	Vespers	Presentation in the Temple	Deposition of Christ
		Massacre of the Innocents	Descent from the Cross
		Coronation of the Virgin	Entombment
	Compline	Death of the Virgin	
		Flight into Egypt	
Office of the Cross	Sext	Crucifixion	-
Office of the Holy Spirit	Sext	Pentecost	-
Little Office of the Immaculate Conception	*Matins*	Mary with her emblems	-
Marian prayers	*Obsecro Te*	Mary with Jesus Child	-
		Pentecost	
	O Intemerata	Lamentation	-
Penitential Psalms	-	Bathsheba at the Fountain	-
		King David summons Uriah	
		Death of Uriah	
Office of the Dead	-	Job on the dung heap	-
		Last Judgement	
		Personification of Death	
		Three Living Man and Three Dead	
		Rise of Lazarus	
		Lazarus and Dives	

Table 1.1: List of the most common illustration for each Office and section in Books of Hours

Finally, there is the fact that Books of Hours grew as distinct from breviaries, having a remarked character of popular book. It was not uncommon for Books of Hours to pour beliefs, artistic taste, social status among the leaves of their copy.

1.2.3 Definition of *incunabulum*

Insofar, this chapter has summed up a broad range of subjects: the history of the Book of Hours' liturgy as well as the differences between the *Divine Office* and the *Office of the Blessed Virgin Mary*. Additionally, it evaluated comparatively the pictorial structure of Books of Hours and other liturgical books, especially regarding Breviaries. For all the breadth of topics, Books of Hours have been presented essentially as *manuscripts*.

Instead, this thesis is exclusively concerned with *printed books*.

The topics of this chapter have intentionally neglected printed Books of Hours, aside from a brief mention at the bottom of Section 1.1. This was intentional because it is vital to establish some grounding notions about printing before venturing into further discussion.

The first of these notions is about the definition of *incunabulum*, that is to say, what marks the difference between it and an early printed book. To address the issue, this section introduces the topic historically by presenting an overview of the influential definitions. Later, it shall determine our own position on this delicate matter.

The accepted definition of *incunabulum* is "book made at the pioneering period of printing", setting this time from Gutenberg's Bible (*c.* 1455) until the year 1500[99]. "*Incunabulum*" comes from the Latin "*in*"(=in) and "*cunae*" (=cradle), which may translate to "object that resides in a cradle" or "precursor". The earliest use of this word is older than the Renaissance since documentary evidence of its use dates back to the Roman Antiquity. Already in the third century BCE[100], the Roman playwright Plautus used this word to mean "cradle fittings of diapers"[101], while Cicero (106-43 BCE) and Ovid (43 BCE-18 CE) stretched its usage to hold metaphorical and metonymical connotations. In Cicero's view, *incunabulum* signified "origin"[102], while Ovid intended it as "place of birth"[103]. Aside from them, this expression was alien to the common Latin vocabulary, for it appears only in a few pieces of literature.

After many centuries of disuse, the Dutch scholar Adriaan de Jonghe[104] (*c.* 1511-1575) resumed this word in his *Batavia* (1588)[105], employing it as a neologism. This word appears, in fact, in a section devoted to the history of the oldest cities in the Netherlands and the arise of the printing industry[106]. Speaking about Haarlem printing, Adriaan refers that:

[99] Some scholars also debate on this year because of the uncertainty of chronology for the objects produce between January and April prior to the Gregorian reformation of the calendar.

[100] This dissertation adopts the standard BCE/CE calendar ("Before Common Era" and "Common Era") throughout the text.

[101] Plautus, *Truculentus*, Act V, Sc 1, 905.

[102] Cicero, *Orator*, 42; *id.*, *De oratore*, I-23; Livy, IV-36.

[103] Ovid, Metamorphoses, III-317; *ibid.*, VIII-99 [*Thesaurus Linguae Latinae*: VII-1077-8]. On both cases, see Yann Sordet. "Le baptême inconscient de l'incunable: non pas 1640 mais 1569 au plus tard". In: *Gutenberg Jahrbuch, Harrassowitz Verlag* 84 (2009), pp. 102–105, p. 104.

[104] Also called Junius Hadrianus.

[105] The work was issued as a posthumous publication.

[106] De Jonghe, *De Hollandiae primaris urbibus deque oppidis & municipiis*.

> *Their* [of Haarlem, n.d.a.] incunabula *of the earliest phases were made by gluing two pages together on the blank side (because it was never printed on both sides).* [*They did so*] *having the care of producing neither void* [*between the glued sheets*] *nor aesthetic irregularity.*[107]

Therefore, de Jonghe used the expression "*incunabula*" technically. In his view, it served to characterise the unpolished technique of pioneering printers, who glued together two different sheets to make two-sided prints, for instance[108]. This becomes even more clear as he referred to further attempts of self-making such tools as wooden movable types of other, local printers[109]. For all the evidence, more clues suggest that the Dutch intellectual might not refer to *incunabulum* simply as a "printing prototype". Farther in the text, de Jonghe referred to "*incunabulum*" as a craft ("*artis*") with the expression "*prima artis incunabula*". Doing so, he apparently proposed a separation from the *incunabulum*-making and other forms of typography (being given as "*artis typographicae*"). Within this formal separation, the historian Sordet has yielded an interesting interpretation, as he proposes that the correct expression should be "[*typographicae*] *incunabula*"[110]. In doing so, Sordet's phrasing suggests new ways to penetrate Batavia's account: on the one hand, the sixteenth-century essay contextualised the notion of *incunabulum* as a phase of printing that deserves special attention; on the other hand, it suggested that already back in 1588[111], intellectuals acknowledged a historical separation between manuscripts and printed books. Because de Jonghe referred specifically to the *typographical craft*[112] rather than *bookmaking*, he admitted a technological transition from one system of production to the other. Or else, he yielded a strong, qualitative comment on the history of bookmaking.

[107] Translation by the author from the original in Latin: "*id observatum fuerat inter prima artis incunabula* (*ut nunquam ulla simul & reperta & absoluta est*) *uti paginae aversae glutine commissae cohaerescerent, not illae ipsae vacuae deformitatem adferrent*." From Hadrianus Junius. *Batavia*. Plantin: Leiden, 1588, p. 256.

[108] Those types were cut from beech wood ("*faginos cortices*") and were employed to print a couple of vernacular *Speculum humanae salvationis*. See Sordet, "Le baptême inconscient de l'incunable: non pas 1640 mais 1569 au plus tard", p. 103.

[109] These editions were print in vernacular Dutch ("*vernaculo sermone*"). See Sordet, "Le baptême inconscient de l'incunable: non pas 1640 mais 1569 au plus tard", p. 103.

[110] Sordet adds the word "*typographicae*" to the expression, proposing that the correct formulation should be "*prima artis* [*typographicae*] *incunabula*". See Sordet, "Le baptême inconscient de l'incunable: non pas 1640 mais 1569 au plus tard", p. 104.

[111] The year of issue of *Batavia* (see earlier).

[112] The art of writing through types (from "*typo*" and "*graphia*").

Even if de Jonghe pointed out some peculiarities of the early printed book, his focus on this matter is chiefly historical. Thus, it is not enough to regard him as an expert in printing technology, and looking at the writings of other scholars is necessary to find a more suitable definition.

Less than a century after him, the German scholar Bernard von Mallinckrodt (1591-1664)[113] also spoke about *incunabula*. In the essay he devoted to the history of typography[114], he gave large space for illustrating the early phases of printing too. However, the intellectual's primary objective was to celebrate the bicentenary of Gutenberg's first edition[115] and, by extension, the role of Gutenberg, Mainz and Fust as the driving forces of the primitive western press. For all of that, Mallinckrodt's secondary aim was to support German printers as the true creators of the technique.

Unlike Adriaan's historical outlook, Mallinckrodt's approach to the debate is classificatory. In fact, the German intellectual clearly discerned early printed books from modern typographical objects, saying that all items printed before the year 1500 are "*incunabula*"[116]. After proposing a definition based on chronological bases, Mallinckrodt went further and worked actively to establish the word in this subject field[117]. Indeed, he repeats the name *incunabulum* consistently throughout his work, remarkably as the association of the adjective "*typographicus,-a, -um*" (= typographic) and the word "*incunabulum, -i*": "*incunabula typographica*"[118] and "*typographicis incunalibus*"[119] get repeated along the text. To summarise, Mallickrodt did not undertake a merely linguistic task, but rather, he attempted a direct influence to set a glossary of printing.

The German's intellectual attempts were blessed with success, for other scholars finally adopted the word *incunabula* on a large scale. Not much later, the Dutch bookseller Cornelius van Beughem compiled an ambitious catalogue of all editions printed from the

[113] He was an intellectual, philologist and dean of the cathedral chapter of Münster.

[114] *De ortu e progressu artis typographycae* (1640).

[115] It corresponds to year of issue for the *Bible on 42 lines* (abbreviated as B-42).

[116] "*Pre-annus saecularis 1500*." See Sordet, "Le baptême inconscient de l'incunable: non pas 1640 mais 1569 au plus tard", p. 104.

[117] Mallinckrodt's "political" usage of the word to deny the entirety of Adriaan's vocabulary and ideas is not here explored. See Sordet, "Le baptême inconscient de l'incunable: non pas 1640 mais 1569 au plus tard", pp. 103-104 on the subject.

[118] Bernhard von Mallinckrodt. *De ortu et progressu artis typographicae*. Cologne, 1639, p. 49.

[119] *Sic* for "*typographicis incunabulis*" (Mallinckrodt, *De ortu et progressu artis typographicae*, p. 71).

beginning of the typographic era until 1688[120] (fig. 1.15). In this archive, van Beughem gathered the book entries as "*incunabula*" or "printed books" depending on the period of production or technical features of production. After him, Sebastian Semiller also made an inventory of the printed sources in the collection of the University Library of Ingolstadt (1787)[121]. Ever since, the number of inventories of *incunabula* escalated. To provide a short list of the most remarkable, those by Maittaire (1733)[122] and its supplement (1789)[123], or Panzer's (1793)[124] must be cited. This list also includes a critical historical essay on *incunabula* (1722)[125].

From this point onward, the interest in the early printed book branches into two main courses of research: on the one hand, it evolved into the bibliographic studies which have built an increasingly detailed database of all known editions printed in the West, yielding essential details for each of them and their printers/publishers[126]; on the other hand, there were those who continued their debate over the most appropriate definition of *incunabulum*. One of the most talkative expressions is Mumey's. She identified some recurring features in transitory printed books: presence or either *colophons*[127] or *title-pages*[128], illustrations made through woodcuts. Speaking in more detail, she observed that

[120]Full title: *Incunabula typographiae sive Catalogus librorum scriptorumque proximis ab inventione typographiae annis, usque ad annum Christi M.D.*, issued in 1688. The original manuscript is in Amsterdam, Johann Wolters collection (1688, in-12).

[121]Sebastian Semiller (1752-1798), *Bibliothecæ academicæ Ingolstadiensis incunabula typographica seu libri ante annum 1500 impressi*, Ingolstadt (Germany): Universitattbibliothek (1787).

[122]Michael Mattaire (1668-1747), *Annales Typographici: ab artis inventae origine ad annum 1664*, Amsterdam (1733).

[123]Michael Denis (1729-1800), *Annalium typographicorum v. cl. Michaelis Mattaire supplementum Adornavit Michael Denis Aug. a Conf. et Biblioth. Palat. Custos*, Vienna (1789).

[124]Georg Wolfgang Panzer (1729-1805), *Annales Typographici*, Nürnberg (1793).

[125]Carmelite Pellegrino Antonio Orlandi (1660-1727), *Origine e progressi della stampa O Sia Dell'Arte Impressoria E Notizie Dell'Opere Stampate Dall'Anno M.CCCC.LVII. Sino All'Anno M.D.*, Bologna (1722).

[126]Namely, the catalogues previusly mentioned together with many other that cannot be fully enlisted here because of variety and complexity in the adopted classifying method. This list includes historical registers, like those by Hain and Copinger's (nineteenth century) or the more modern *Gesamtkatalog der Wiegendrucke* (also known as *GW*), the *Indice generale degli incunaboli delle biblioteche d'Italia* (1943-81), Goof's *Incunabula in American libraries* (1964), Pellechet's *Catalogue général des incunables des bibliothèques de France* (1897-1909), the contemporary *Incunabula Short-Title Catalogue* (abbreviated in *ISTC*) that the BL created with the collaboration of other library institutions in worldwide. Next to these catalogues, there are countless union and private inventories of incunabula collections.

[127]In printed books, it is an inscription located at the beginning, ending or both part of an item bearing details on its content, the names and capacity of the people involved in its production, the place of production and the date, in a few cases. Starting from the last quarter of the fifteenth century, it includes the mark or device of the publishing party (Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 43.

[128]A *title-page* is the page in a book that bears the title, author's name, publisher's imprints and other

true incunabula bear colophons and woodcuts until 1520 and after 1461/1462 respectively, as well as title-pages that can be found only after 1520[129] in the great majority of cases. Frequency of occurrence is not a stringent parameter, she warns: Mumey also noticed that her observations had to be treated with caution, for colophons or woodcuts were occasionally employed beyond the proposed boundaries of time. Therefore, the definition of *incunabulum* could be more flexible than originally proposed, insisting on technical evidence rather than merely chronological facts.

After synthesising the most relevant views of the definition of "*incunabulum*", it is possible to derive the position according to this dissertation. Aside from the goodness of any position on the true nature of the early printed book, the extraordinary interest that a book made in such a limited range of time arose must be acknowledged. In the round of a few decades, printed books could, indeed, evolve in structural, technical, regional and literary specificity. Along with these qualities, the early printed book influence the coeval literary and technological setting. On one side, printed books played the role of lively instruments of culture; on the other, they absorbed the Renaissance's practical effervescence that affected all domains of art[130].

Because of their participation in this moment of cultural restructuration, *incunabulum* editions were caused to be easily devoid of physical regularity. Limited editions were printed as publications tailored for powerful individuals, so individual copies bespeak individual agreements between publishers and clients and so forth. Hence, *incunabula* occur frequently as unique books.

This quality of being unique contributed significantly to the later widespread celebra-

essential information.

[129] Nolie Mumey. *A Study of Rare Books: With Special Reference to Colophons, Press Devices and Title Pages of Interest to the Bibliophile and the Student of Literature*. Denver: Clason Publishing Company, 1930, pp. xv-xvi.

[130] In this perspective, *incunabula* can be appraised as innovative products generated in a period of general revision of the importance of crafts, and the reconsideration of the social dimension of technical workers. Some of these technical activities like painting collected dignification until they were promoted to intellectually, socially, politically relevant occupations. Because of the arising sympathy towards artists, they were increasingly encouraged to transfer their long-lasting practices and patenting through written technical treatises, like Cennini's *Libro dell'Arte*. Other, less intellectual crafts inclined towards tentative experiments, that are unveiled by the many *Books of Secrets* circulating at that time (Lèopold-Auguste Constantin. *Bibliothèconomie ou Nouveau manuel complet pour l'arrangement, la conservation et l'administration des bibliothèques*. Paris: Roret, 1841, p. 170; William Eamon. "How to Read a Book of Secrets". In: *Secrets and Knowledge in Medicine and Science„ 1500–1800*. New York, NY and London: Routledge, 2011, pp. 35–58.

tion of these books as memorable and "rare" items. Or, in the words of McKitterick, the idea of rarity is not related to its "scarcity" nor its "expense" or "goodness", "noticeability": appearance, content, etc., but their uniqueness. As for *incunabula*, the concept of their rarity could have been affected from generalisations over their value insisting sometimes on their content or on their external appearance. Lavished exteriority could be a possible reason for notability and would influence the early classification of some of these items. The result was that "information [...] included in bibliographical guides may be very misleading, especially when titles and editions were described as rare or unusual but were, in fact, common"[131].

Therefore, it is here believed that the interpretation of *incunabula* cannot fit a rigid box based purely on chronological grounds: early printed books are much diverse from each other and, as explained above, susceptible of having their original value misunderstood. Accordingly, if books issued in the fifteenth century are more likely to meet the requirements of experimentalism and transitory character, the same condition applies with less frequency to books printed in the next century. It is perhaps on this account that Maitter, Panzer, Kaiser rediscussed the cut-off date for *incunabula*: 1520, 1523, 1536, and so forth[132]. Surely, chronological boundaries allow the bibliographic research to neglect the great diversity of genre of these items, considering that printing masters issued bibles, missals, Psalters, books of chivalry, religious treatises, classics in the original language or translated into the local vernaculars, and so forth. At the same time, they would sacrifice other distinctive features and reveal important flaws.

The techniques, materials and equipment of this early stage are highly variable, both chronologically and geographically. Speaking of the chronological variability, during this phase of production, the book decoration was initially less refined and applied a mix of techniques. In fact some *incunabula* display crude woodcuts, other coloured illustrations, other illuminated miniatures. As for the latter batch, illuminated printed books displayed several qualities of illumination, ranging from the exquisite miniatures of some editions, like an early-sixteenth century Book of Hours in the Arquivo da Torre do Tombo[133], to

[131] McKitterick, “Books as Objects”, p. 30.

[132] Other experts of early typographical studies proposed further dates (Constantin, *Bibliothèconomie ou Nouveau manuel complet pour l’arrangement, la conservation et l’administration des bibliothèques*, p. 165).

[133] ANTT, CF-136. Book of Hours for the use of Rome, printed in Paris by Gillet and Germain Hardouyn,

the rushed decoration of other books of devotion, such as an Hours of the University of Yale[134]. As a result of technical diversity, each early printed book have a unique presentation; owing to their inherent diversity, this class of book had not found a unique classification to date[135]. Besides visual quality, further differences appear with reference to the areas that saw the spread of the printing technology. In fact the printing press spread gradually and steadily from Germany to the rest of Europe: Italy was the first country in line to install a press (1464) and was followed by France (1470), Spain (1473) and finally Portugal (1487)[136]. Thus early sixteenth-century France was at a more advanced stage of technical development than other areas.

Speaking specifically on the Hardouyn Hours, it should be considered that they share the features of a manuscript and a printed book at the same time. Like manuscripts, those books are made with vellum instead of paper; they are illuminated instead of being painted with water-colouring. At the same time, their decoration is created with woodcuts, like illustrated *incunabula*. Therefore, there is too much of a manuscript to be easily dismissed. At the same time, these books are printed books and such shared features were a distinctive mark of their trade, that held constant over half a century (*c.* 1490-1560). By delivering quality books for the entirety of this long period of activity, they exceed the boundaries of time that are generally established for *incunabula*. Then, the discussion would be too confusing if we would speak of *incunabula* and *cinquecentine*[137] in the text to refer to the pre-1500 and post-1500 *horae*, respectively. To conclude, the word *incunabulum* is adopted for the entirety of the dissertation both on technical grounds and to avoid ambiguous terminology.

c. 1513. A partial digital source for the book is available at: http://digitarq.arquivos.pt/viewer?id=3909701 (last access: October 29, 2021).

[134] Book of Hours, use of Paris, Paris and Rouen, printed by Thielman Kerver for Guillaume Eustace, 20 VI 1500 (with inserts from a manuscript dated 1475-1500). Book from the collection of Yale University Library, Beinecke Ms. 664. A full digital source is available at: https://collections.library.yale.edu/catalog/9998938 (last access: October 29, 2021).

[135] Mommsen et al., "X-ray Fluorescence Analysis with Synchrotron Radiation on the Inks and Papers of Incunabula".

[136] Arthur M Hind. *An introduction to a history of woodcut*. New York, NY: Dover Publishing, 1963; Salvatore Fugaldi et al. *Il manuale degli incunaboli*. Trapani: Biblioteca Fardelliana, 1985.

[137] Books printed in the sixteenth century.

1.2.4 Definition of *illuminating*

According to the Marriam-Webster vocabulary, the word *illumination* means "lighting up"[138] or "[set of] decorative features used in the art of illuminating"[139]. In arts, illuminating is the craft of augmenting books with coloured and metal-based substances.

According to the art historian Thompson (†1980), only those volumes that display metallic applications are "illuminated". His view was that metallic foils are a necessary requirement for illuminated books because of the unique behaviour that metals (especially gold) offer to artistic manipulation[140]. Rubbed, golden sheets gain a mirror-like glare; the deeper the treatment, the more the metallic material would shine, thus get "lightened"[141].

However, this definition cannot be adequate for several reasons. Firstly, books which are decorated with metals do not necessarily include them in form of *foils*. Resuming the instance of golden applications, not always do they occur as such among books: starting from the twelfth century, they were given to books in form of powder[142], and they would be in use as such ever since. Secondly, not all books that have been classified as "illuminated" have metal foils: several manuscript do contain painted decoration, yet no metal. Finally, illuminated books are from Europe and outside its boundaries: for instance, the major cultural institutions may include departments of *Islamic* illuminated manuscripts. Similarly, the accepted opinion is that manuscript decorated by Old-Slavonic[143], Byzantine[144] or Hebrew schools of painting [145] are equally "illuminated". Thus, Thompson's criterion is insufficient for the purposes of this dissertation.

Another important remark is that Western book production does not encompass only

[138] From the after the Latin word *illuminare* (= to enlighten). See *Merriam-Webster's dictionary*, v. *illumination*; Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 69.

[139] Merriam-Webster's dictionary, 2019: v. *illumination*.

[140] Silver foils offer a similar behaviour. See Brown, *The Lindisfarne Gospels: Society, Spirituality and the Scribe*, p. 69; Gerald WR Ward. *The Grove Encyclopedia of Materials and Techniques in Art*. New York, NY: Oxford University Press, 2008, p. 357.

[141] Daniel Varney Thompson. *The Materials and Techniques of Medieval Painting*. New York, NY: Courier Dover Corporation, 1956, pp. 196-198.

[142] This technique is called *shell gold*. See also Chapter 3, Section *Yellow paint*.

[143] Eastern manuscripts made between the sixteenth and the seventeenth centuries.

[144] Eastern manuscripts made in the period comprised between the tenth and the fifteenth century.

[145] Irena Nastova et al. "Spectroscopic Analysis of Pigments and Inks in Manuscripts: I. Byzantine and Post-Byzantine Manuscripts (1018th century)". In: *Vibrational Spectroscopy* 68 (2013), pp. 11–19. DOI: https://doi.org/10.1016/j.vibspec.2013.05.006; Irena Nastova et al. "Spectroscopic Analysis of Pigments and Inks in Manuscripts. III. Old-Slavonic Manuscripts with Multicolored Rubication". In: *Vibrational Spectroscopy* 78 (2015), pp. 39–48. DOI: https://doi.org/10.1016/j.vibspec.2015.03.005.

the traditional manuscript. What is referred to as "book" is only a certain format, the *codex*, which has been in use only since the sixth century CE. Before this time, the West appreciated other book items, rolls mostly, that were decorated in a similar fashion to the *codex*[146]. Besides, several styles of decoration have arisen within the medieval tradition of illuminating: Late Antique, Insular, Carolingian, Ottonian, Romanesque, Gothic or pre-Renaissance decorations. The consequence of the above considerations is that the notion of illuminated book cannot insist on the shape of decoration, and neither on the format nor provenance of an illuminated book. Thus, one ought look for other criteria for classifying illuminating as such.

Illuminated images occur in innumerate forms: they may be full-paints, incipit pages, small illustrations, *bas-de-page*, inhabited initials or drollery, just to cite some. Still, they all are instances of "illuminating". Thus, they must bear some common attribute. In fact, all those forms of decoration reveal a similar creative workflow, which includes a comparable series of steps. In fact, every illumination requires the application of consecutive layers of paint, from a masstone, to glazes, shadings, brightening, contouring and finishing. Because those sequences are comparable, illuminators must have a shared technical preparation, maybe gained after dedicated training. Indeed, medieval artists attended long apprenticeships in the studios of illuminating masters (called *ateliers*) to be trained as illuminators.

Although the creative process was maintained generally constant until the seventeenth century[147], technical differences arose locally. For instance, some central European artistic schools, like the German and the Flemish, would lay golden leaves on a brownish gesso primer instead of the "traditional" Armenian bole ground[148]. Another instance is *grisaille* painting: this illuminating technique is executed by applying thin layers of white paint to a gray background until reaching the desired shade of white. It is a techique which creates a strong illusion of relief, and it found wider use among fifteenth-century French

[146] A good instance are the painted rolls containing *Exultet* prayers. See Maria Luisa Agati. *Il libro manoscritto da Oriente a Occidente: Per una codicologia comparata*. Roma: L'Erma di Bretschneider, 2009, p. 135.

[147] Only then, such innovative materials as organic dye would find wider use. See Thomas Primeau. "The Materials and Technology of Renaissance and Baroque Hand-Coloured Prints". In: *Painted Prints. The Revelation of Color in Northern Renaissance and Baroque Engravings, Etchings, and Woodcuts*. Ed. by Susan Dackermann. University Park: Baltimore Museum of Arts and Pennsylvania State University Press, 2003. Chap. 3, pp. 49–76, p. 52.

[148] Hamel, *Scribes and Illuminators*.

and German illuminators[149]. Not only the techniques, but also the applied may be typical of a school of illuminating. Two common minerals of medieval art offer a good instance: vermilion was widely prepared as a synthetic red pigment, but the natural variety sourced from Almaden (Spain), was praised for its excellent quality[150]. Similarly, the blue mineral azurite was extracted from many European mines, yet that from Germany was regarded as the most perfect[151]. Therefore, the core of illuminating painting is eminently technical, yet it can be ascribed to neither a certain place nor time[152].

A final remark about the notion of *illuminating*, especially in relation to the Hardouyn Hours, is about the social impact of the artists who mastered this technique. In the past, the rigid control of the Catholic Church of the Middle Ages had influenced the artistic output, both profoundly and materially. On the one hand, the derogatory views of the Christian theology over the process of image making had conditioned the way in which artists were seen: mere artisans, reproducers of icons, even deceivers who confused the observers with illusory sights[153]. Only the later mediaeval phases saw a change, where artists could finally enjoy creative freedom maybe owing to a structural weakening of the Church's dominant agency of artistic sponsor. Finally, Renaissance patrons prized technical skills in art making, and artists were entitled to express their inventiveness. It was in this context of creative revival that such artists as Jean Poyet, Jean Bourdichon or the Limbourg brothers could express their full potential, bestowing upon the future generations with decorated manuscripts that are still regarded among the finest artworks

[149] Ward, *The Grove Encyclopedia of Materials and Techniques in Art*, p. 360.

[150] Cornelis Klein. *Manual of Mineral Science*. Hoboken: Wiley & Sons, 2003, pp. 360-361.

[151] At the beginning of the sixteenth century, it was extracted from the area comprised between Goldberg, in Saxony, and Schwarz, in Tyrol-see Andreas Burmester et al. "The Relationship between Albrecht Dürer's Palette and fifteenth/sixteenth-Century Pharmacy Price Lists: the Use of Azurite and Ultramarine". In: *Studies in Conservation* 43.101.1 (1998). DOI: https://doi.org/10.1179/sic.1998.43.Supplement-1.101, p. 104. Another area could be in France, mostly Chessy-seeKlein, *Manual of Mineral Science*, p. 398.

[152] This is also the opinion of David Diringer. *The Illuminated Book: Its History and Production*. London: Faber & Faber, 1958; 1982; Rowan Watson. *Illuminated Manuscripts and their Makers: An Account Based on the Collection of the Victoria and Albert Museum*. London: Victoria & Albert Museum, 2003.

[153] Depicting was impregnated with long-lived questions about the legitimacy of reproducing reality, and how observing an image could contribute to positive spiritual building and to which extent observing images could be recommended. In this context, artistic creativity of the mentioned workshops or *ateliers*. See Brown, *The Lindisfarne Gospels: Society, Spirituality and the Scribe*, p. 125. The legitimacy of those artists was limited to the mere reproduction of visual standards under the clerical approval. Having his power limited, the early medieval artist was much of the *artifex practicus*, whose philosophy on the represented themes and even their identification was completely dismissed. See also Joan Sureda. *La Edad Media, Románico & Gótico*. Madrid: Planeta, 1986, p. 28.

of all times.

Because the role of the artist was entering a phase of change, illuminated books would adjust their presentation in proportion to the degree of freedom and craft of the producing workshop. This became especially apparent as printmaking became a driving force of change: the printing technology gained rapidly momentum as more and more bookmaking centres converted to it, until it started questioning the social role of manuscripts within this process. In the past, *manuscripts* had been a universal mark of wealth and prestige. With *illuminating*, a copy gained in prestige. So *illuminated manuscripts* were bound to be prized goods, by virtue of a new gleam of power. The gained prestige, combined with a highly organised market[154], allowed the manuscript culture not to be immediately threatened. Thus, printmaking had to adjust to the pressure of the manuscript market.

The above remarks finally allow proposing a position on whether ranking the painted decorations of the Hardouyn Hours as "illuminating". The first observation about the Hardouyn Hours is about their presentation: those books are coloured with opaque, bright paint and lavish gilding (fig. 1.6.a). Their presentation is considerably different from other Books of Hours printed in Paris a few decades before, like that presented on Figure 1.6.b.

Also, illuminating was not the sole colouring technique available to Renaissance artists. In fact, engravings were supplemented with colour elsewhere, particularly in northern Europe (Netherlands[155]). The Flemish schools of print colouring made a wide use of organic pigments, maybe as a consequence of the vitality of the local market of dyestuff[156]. When little alchemy was applied, these organic sources could derive organic pigments (i.e. dye lakes), that rendered excellent service as artistic materials. For all their quality, their hiding power was not nearly as strong as mineral pigments. As a result, engraving colouring appears as gouaches[157], while traditional illuminating yielded brilliant, vivid images.

[154] In fact, the cultural-social movement of artistic remained strong at that time. See Janet Wolff. "The social production of art". In: *The Social Production of Art*. New York, NY: St Martin's Press, 1981. Chap. 1, pp. 26–48.

[155] Susan Dackermann. "Rediscovering Painted Prints". In: *Painted Prints: The Revelation of Color in Northern Renaissance & Baroque Engravings, Etchings & Woodcuts*. Ed. by Susan Dackermann. University Park: Baltimore Museum of Arts and Pennsylvania State University Press, 2003. Chap. 1, pp. 1–8, p. 3.

[156] A possible cause may be the strength of the local commerce of textile and textile dyeing. See also Franco Brunello. *The Art of Dyeing in the History of Mankind*. Vicenza: Neri Pozza, 1973; Primeau, "The Materials and Technology of Renaissance and Baroque Hand-Coloured Prints", p. 55.

[157] This does not mean that print colouring employed organic lake exclusively, but rather, that this class of materials was an important component of it. See those accounts of technical characterisation as a reference:

Figure 1.6: *Annunciation* colouring in two *incunabulum* Books of Hours made in Paris. To the left (a): the Hardouyn workshop (Germain Hardouyn), 1530-1540 (170 mm Œ 103 mm leaf dimensions). In Évora, Biblioteca Pública, Inc. 438, fol. 58^{v}; to the right (b), by Philippe Pigouchet, *c.* 1494 (180 mm Œ 110 mm). In Évora, Biblioteca Pública, Inc. 14, fol. 16^{r} © HERCULES Laboratory.

Going back to the main issue, the Hardouyn Hours are closer to illuminated books, at a comparison of it with other coloured prints.

The second observation about illuminating in the Hardouyn Hours is about their role: comparably to manuscript, their function seem to raise their rank to become as prestigious as an illuminated manuscript.

Given the above discussion, it is here proposed that the painted illustrations in Hardouyn *horae* are illuminated.

Shelley Fletcher et al. "The Pigments on Hand-Colored Fifteenth-Century Relief Prints from the Collections of the National Gallery of Art and the Germanisches Nationalmuseum". In: *Studies in the History of Art* 75 (2009). Symposium Papers LII: The Woodcut in Fifteenth-Century Europe, pp. 276–297; Oliver Hahn et al. "Coloured Prints of the 16th Century: Non-Destructive Analyses on Coloured Engravings from Albrecht Dürer and Contemporary Artists". In: *Archaeometry* 46.2 (2004), pp. 273–282. DOI: https://doi.org/10.1111/j.1475-4754.2004.00157.x.

1.3 Printed book production in Paris

Until now, the chapter has illustrated the history of *horae* liturgy and their course as manuscripts; also, it has established that the Hardouyn Hours are *illuminated incunabula*. Now, this section shall delineate the organisation of the Parisian printmaking.

In 1470, Johann Heynlin and Guillaume Fichet, respectively Rector and librarian in chief of the Paris *studium*, invited three printing masters from abroad to install an academic press in Sorbonne college[158]. The two *studium* scholars regarded a local press as a profitable business, based on the observations on the upward trend in the printed-book purchase. In fact, the Parisian undergraduates and scholars were purchasing books by printing enterprises based in Mainz, Strasburg, Venice, Milan, Cologne and Bruges[159], so to Heynlin and Fichet's view, promoting an academic press would have brought about a sizeable profit. Their meditation drove them to extend an invitation to skilled professionals from a leading printing hub to launch a business in France, under the academic protection. This event has a tremendous historical significance, for it corresponds to an historical moment for the printing era in Paris. Previously, some attempts of establishing printing in Paris occurred, but none of them succeeded: the past local book-dealers and the German printer Fust[160] already sought business here[161], but they all failed to defeat the local resistance of manuscripts sellers[162]. Only with the partnership of the University, invited printers to produce this new type of books for the local commerce. When

[158]Claudin, *The First Paris Press: An Account of the Books Printed for G. Fichet and J. Heynlin in the Sorbonne, 1470-1472*.

[159]Peters, *Harold Innis's History of Communications: Paper and PrintingAntiquity to Early Modernity*, p. 72.

[160]A collaborator of Johann Gutenberg, the creator of the printing press. Fust came to Paris between 1466 and 1468 to retail books printed in Mainz, Germany. As a travelling trader, Fust hired a representant, Herman de Stadborn, alias Herman from Germany (Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 176-177).

[161]A short list of these traders includes the bookdealer and illuminator André Le Musnier (*fl.* 1451-1475), the bookdealer Jean Robinet (*fl.* 1460-1472), the bookdealer Arnoul Clotin (*fl.* 1464-1496), the bookdealer and binder Geoffroy I Le Roux (*fl.* 1465-1488/1492), the Jean Fust (*fl.* 1466) (Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*). Another retailer, Pasquier Bonhomme (*fl.* 1468-1501) ventured in the press in a stage successive to the arrival of the group invited by Ficher and Heynlin (Ulrich Gering, Michael Friburger and Martin Crantz) (Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 168-169). His contact with the university was strong, and he was indeed an appointed *grande libraire-juré*-for the meaning of this title, see later.

[162]Peters, *Harold Innis's History of Communications: Paper and PrintingAntiquity to Early Modernity*, p. 73.

these masters left the Sorbonne spaces to start a separate activity, the press was formally established in Paris.

The start of the academic press does not mark the official beginning of the Parisian typography. That exact moment correspond to these masters' departure from Sorbonne college to land outside, in an independent activity located in the immediate vicinity of the original venue.

The independent print-house engaged its activity in the immediate proximity of the college under the lead of a member of the original group, Ulrich Gering[163], who created readily a competitive large-scaled activity. Beside Gering and his shop, other French and non-French printers contributed business to develop a leading market already by the end of the century[164]. However, the press only thrived in Paris because of the agile class of workers who produced, traded and managed manuscripts and book collections even before the printing press creation, that were able to adapt to this new business.

Although the prior manuscript trade explains the fast affirmation of the succeeding press, there were also other facts of socio-religious identity, cultural and economic upheaval that raised the late fifteenth-century system of book production in Paris, related to the religious transformations of the Religious Wars, Protestant reformation and the Tridentine counter-reformation[165], the Humanistic enthusiasm for the traditional literature and Classic works, the horizontal and the vertical increase of literacy and the post-civil war political restoration.

The rationale behind the print's greater success than manuscript-making is not only socio-cultural, but also technical. On the one hand, one edition could quickly yield a stock of nearly-identical copies. On the other hand, the technical skills required to iterate mechanically the process of prototype composition and replication cost less time and effort than hand-made production. As the supply of items increased, the print market turned increasingly fluid and cost-effective to the point of becoming an easier offer than

[163]Claudin, *The First Paris Press: An Account of the Books Printed for G. Fichet and J. Heynlin in the Sorbonne, 1470-1472*.

[164]Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 168-169.

[165]Pamphlets and critical texts supportive or opposed to the Protestant, Huguenot contrasting views on the orthodox beliefs and increasing secularisation of the Church were written, spread and read locally. To further excite the enduring strife, the Gallican opinions sympathetic to the German assault on the papacy added to the conservative behaviours of Sorbonne's scholars, which disagreed on the reforming movements (Pettegree, *The Book in the Renaissance*, p. 118).

manuscripts. Because of improving in quantity, budget books could find a large audience of eager readers through the same factors as the antecedent manuscripts book-trade.

At the same time, early printed books are puzzling items technically. These books have (or try to emulate) the features of manuscripts, often applying great skill for the purpose[166]. Due to this fact, books issued in this early phase of typography deserved the specific denotation of *incunabula*. Being so chimeric, the study of printed books calls several holistic approaches[167], especially to unveil their economic history. As a matter of fact, those professionals employed the skills of those who had been active in manuscript making until that date. At the same time, the new market called for creating new professional classes that the city had not observed before, above all printers.

Thus, the next sections shall list these old and new figures as well as their relations.

1.3.1 The profession of printing master and printing skills

The introduction showed the press' role in the start of a self-empowering economic course. Shortly, all kinds of books were issued: popular literature, technical treatises, books of secrets, and so forth. A good instance of such deluge were the referred editions of the *Danse Macabre*[168] by the French printer and publisher Guy Marchant (*fl.*1483-1505/1506)[169], followed by the editions that the partnership Gillet Couteau-Jean Ménard, and Petit Laurens made between 1492 and 1494[170], and Vérard's *Mer des Histoires*[171].

[166] Sordet, "Le baptême inconscient de l'incunable: non pas 1640 mais 1569 au plus tard".

[167] Mary A Rouse et al. *Manuscripts and their Makers: Commercial Book Producers in Medieval Paris, 1200–1500*. Turnhout: Brepols, 2000.

[168] The *Danse Macabre* is a popular theme in the late Middle Ages and that probably first appearing as the illustrated theme *Danse Macabre des Hommes*, followed by a few verses attributed to Jean Gerson in 1424, on the charnel walls of the Church of the Innocents in Paris (Hindman, "The Theme and its Public", p. 15). For further details on the attribution to the verses to Gerson and the later evolution into the final dialogic form and popularity under the Middle-English poet and monk John Lydgate, see Lesley M Smith et al. *Women and the Book: Assessing the Visual Evidence*. Vol. 3. London and Toronto: British Library and University of Toronto Press, 1997.

[169] He issued several *Danses Macabre* between 1485-1486: the first edition dates back to 1485 (*Short Title Catalogue* or STC 22407); another edition with extended contents in two volumes is of 1486 (STC 22408). A final edition is a Latin re-print of 1491, made in partnership with the Parisian *libraire* Geoffroy de Marnef.

[170] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*.

[171] *Le Mer des Histoires* is a universal history of France in two parts. The first book covers all the historical facts occurred between its origins until the death of King Louis XI, and it is an adaptation to vernacular French of a Latin text. The text is also supplemented with other information, such as a geographical dictionary, a description of the Holy Land, Aesop's Fables, and a genealogy of kings of France until the death of King Louis I. A second part entitled *Le Martirologe des sainctz* followed the first volume one year later

Service books like pocket Books of Hours, also rushed into print. The earliest Book of Hours is an edition by the publisher Antoine Vérard , bearing 1486 as its year of issue[172]. Quite soon, Jean Dupré would imitate Véard producing a series of illustrated editions between 1488 and 1497[173]. Perhaps, the increasing varieties and kinds of *incunabula* that appeared in those years was a direct consequence of the advantageous conditions of production, which yielded deluges of items readily for sale and increased affordability of each editorial project.

Notwithstanding commercial advantage, the printing business called for specialised technical staff and literate partners. Jérôme Hornschuch in his *Orthotypographia* (1608) provided a substantial picture of the print-house framework: he characterised it as an organisation of printers, inkers, storemen and general workers, along with correctors who checked the composition of matrices before printing (fig. 1.7). Regarding such checking, the presence of the university had another positive influence in the market: in fact, it contributed a large group of university graduates, masters and scholars constituted as potential employees within the expanding market or printing[174].

Next to technical and grammatical competence, a printing master required layout building capability. A part of such technical knowledge was the skill of spreading text on a page and among the overall book-length. Given a determined format, a master calculated accordingly the extent of the editorial project so to quantify the resources required to complete it, considering the amount of paper, supplies necessary to formulate inks, time to print the planned number of copies, number of presses to devote to a project and number of editions to run at once.

(Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 451-455). The first edition was issued in 1487; the second in 1488-1489. Concerning the last edition, the uncertainty around the exact date (1488/1499) is because of the different calendar adopted in the medieval France and the different beginning of the year. Indeed, although France was one of the first countries to adopt the Gregorian calendar instituted with the papal bull *Inter gravissimas* of February 24, 1582, and the beginning of the year was fixed to January 1 only since 1564. Therefore, the months occurring between January and March are of unclear attribution in bibliographic studies.

[172] Vérard started a very prolific business of printed Book of Hours (Pollard, *Early Illustrated Books: a History of the Decoration and Illustration of Books in the 15th and 16th Centuries*, p. 181). More than two hundred of his editions are known (Greetham, *Textual scholarship: An introduction*, pp. 99-100; Sigfrid Henry Steinberg. *Five Hundred Years of Printing*. Mineola and New York: Courier Dover Publications, 2017, p. 60).

[173] The year of Marchant's death.

[174] Cristina Dondi. "The European Printing Revolution". In: *The Book: A Global History*. Oxford: Oxford University Press, 2013, pp. 80–92, p. 82.

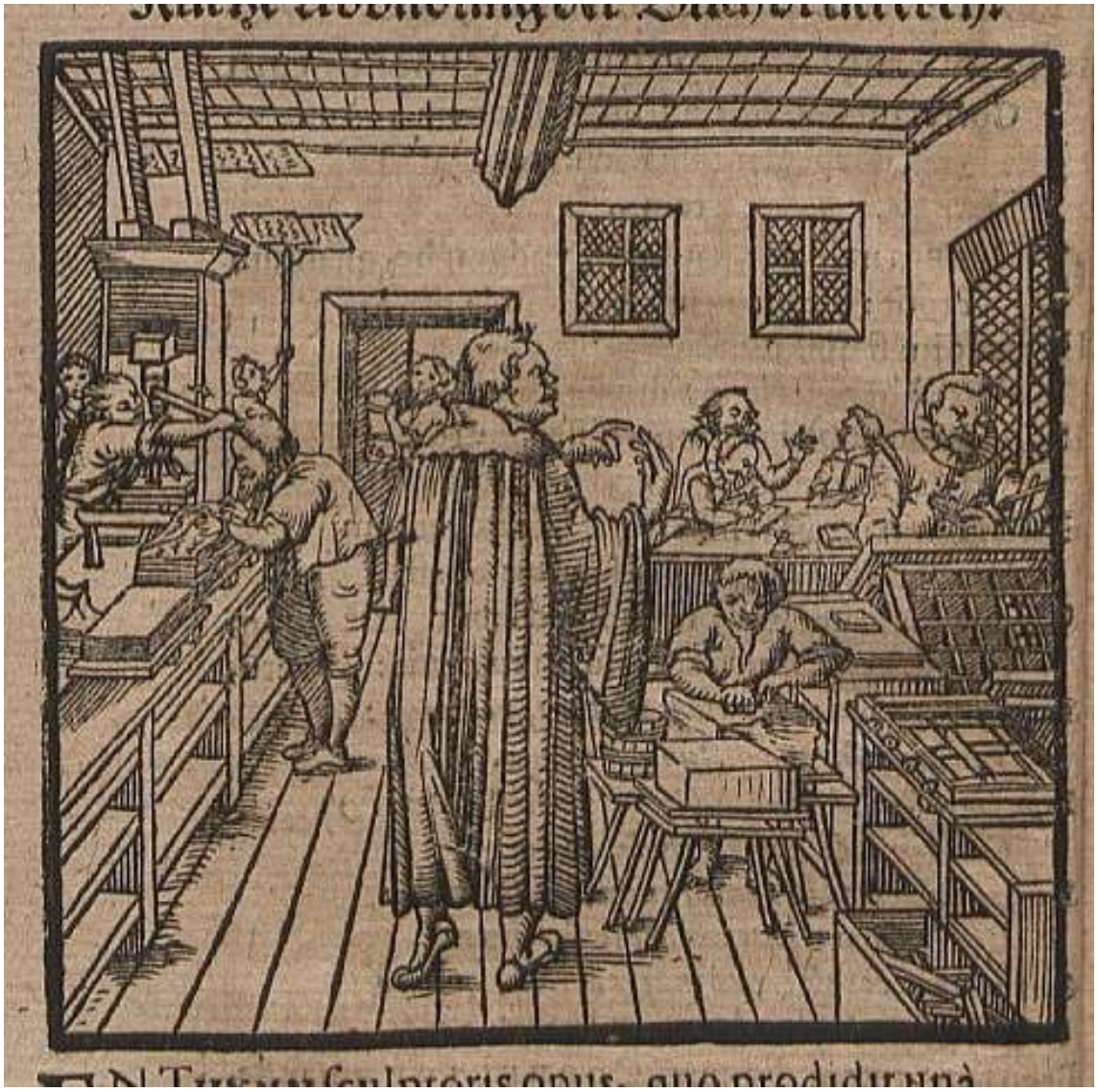


Figure 1.7: Organisation of a print-house, from a leaf of *Orthotypographia*, German copy translated by Tobias Heidenreich, printed in Leipzig, 1634 (original image size unknown). Now in Dresden, SLUB, inventory no. Technol.B.658.Th, fol. A3^{v} © SLUB.

Besides practical expertise, a printing master defined objectives and strategies for achieving a commercial niche, and the appropriate book format. If the prospective buyer were middlemen or travellers, the printing master would design an edition as a pocket-book, for instance[175].

To produce imprints varying in format, length and address, a printshop required specialised tools. Because the whole of the book-making was mechanised, any modification

[175]On this taken, the Hardouyn brothers printed an edition of agenda Books of Hours and service books in general were printed as *quarto* or *octavo* editions to be portable books for daily read. One of these books is a Book of Hours for the use of Rome now in the British Library (BL), inventory no. C.29.k.24, Paris, 19 I 1504, *Quarto*-format and that the printer Antoine Chappiel realised for Gillet Hardouyn.

on either the writing or illustrating style was equally automated. When analysing the sets of types integrated to the plates to create the various sections of the text, we can identify several aspects, such as the chapter summaries displayed in italic types[176], the page title or sections that appeared huger than the rest of the text, the letters capitalised or represented in regular size, the punctuation and spaces separating the phrases of a sentence, the break lines interrupting the length of the words to push the remaining part to the next line and fit the whole span, among others aspects.

The wealth of symbols that scribes duplicated manually to set in page letters, words, or sentences, to separate each phrase or to add emphasis, was replaced with individual types instead in the print production (fig. 1.8). And similarly, to reproduce pieces of texts in another writing system but Latin required bespoke sets of fonts. Due to this reason, the first Greek and Hebrew books were printed in 1507[177], and the earliest books of music appeared on the Parisian market only in 1538[178]. Therefore, to print a book many tools were needed, sets of types in various fonts, matrices, punches and moulds.

To know such details, a master needed printing experience so to act in a print-house as either the printer in chief or the supervisor for the overall process. This is the reason why the career of a printing master included clerkship at other print-houses[179]. Such expertise suggested a printing master proper formal arrangement to fit the content, layout, and format of a printed book.

The initial flaw of printed books was its lack of visuals: manuscripts were supplemented with hand-made images, but the matrices for the press initially hosted only types, supplying books in plain, full-text layout. However, since 1485 some printers with previous experience in calligraphy or illumination bridged the gap and included engraving dec-

[176] A sort or type is the smallest element of a typesetting set representing a particular letter or symbol, cast from a matrix mold and assembled with other sorts bearing additional letters into lines of type to make up a form from which a page is printed.

[177] Allen Kent et al. *Encyclopedia of Library and Information Science: Calligraphy to Church Libraries*. Vol. 4. New York and Basel: Marcel Dekker, 1970, p. 384.

[178] Marie Christine Vila. *Paris musique: de l'école de Notre-Dame à la Cité de la musique: huit siècles d'histoire*. Paris: Parigramme, 2007, p. 31.

[179] Such as the cases of the French printer Philippe Pigouchet, who worked at the Caillaut-Martineau printshop until 1483 and became a partner after this date, working independently since 1488 (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 13); or the other printed George Wolff from Baden (modern Switzerland), that was at Gering's payroll at the *Soleil d'Or* workshop for twelve years, and became independent only in 1490 (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, pp. 95-96).

Figure 1.8: A set of metallic types for the printing press © Willi Heidelbach.

orations to promote their editions. First on this fashion were the two printers-publishers Pasquier Bonhomme and Jean Dupré, who complemented a vernacular edition of Boccaccio's *Decameron* with a series of woodcut illustrations[180]. Afterwards, other printers created similarly magnificent editions, like the mentioned *Mer des histoires* originally printed by Pierre La Rouge in 1487 and re-issued by Jean Du Pré, Guy Marchant or Antoine Vérard[181]. A part of those printers used illustrations consistently until turning visuals into a major structural component of the pocket Books of Hours as specified in colophons. Next to essential details on the content, place and date of publication, statements at front or end of printed books also informed on the novelties of a production[182].

[180]Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, p. 120.

[181]Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*.

[182]To demonstrate this point, an edition of Books of Hours by Simon Vostre affirms that the edition us supplemented "with certain miracles, one Office bearing scenes from the cycle of the Apocalypse put at end of the Bible". Similar details are found in the colophons of the Hours issued by the Hardouyns, for they hail: "with images of the destruction of Jerusalem", "with images of the Apocalypse of Saint John the Evangelist". Original text from fol. 1: "*avec les figures de la destruction de Hierusale*[*m*]", Book of Hours with Roman Mass rite, printed by Germain Hardouyn, [1518], Paris. Current whereabouts: Lisbon, Biblioteca Nacional de Portugal, inv. no BNP, Res.326.v; Original text from fol. 1: "*cum mults suffragijs & orationibus de nouo additis. Etiam cum figuris apocalipsis beati Iohannis euangeliste*" (early printed source no. 13 of *Appendix A*). Book of Hours with Roman Mass rite, by Germain Hardouyn, [1534], Paris. Current whereabouts: Lisbon, Biblioteca Nacional de Portugal (BNP), inv. no Res.328.v. (see Appendix A,

Supplementing books with illustrations was only one of the applied strategies for enhancing the appeal of the printed book, increasing the number of editions of comparable attraction and aesthetic quality to manuscripts (fig. 1.9).

Figure 1.9: Comparison of invidual pages from a sample manuscript and a printed book. To the left: *Grandes Heures d'Anne de Bretagne*, 1505-1510, Tours, illuminating by Jean Bourdichon (300 mm x 190 mm leaf dimensions). In Paris, BnF, Ms. Lat. 9474, fol. 5^{r}. To the right: Book of Hours, printed by Yolande Bonhomme, 1522. In Paris, BnF, Res. 4-T-942, fol. 3^{r} © Source BnF.

Because a minority of editors adopted illustrations initially while others worked along the lines of these pioneering entrepreneurs afterwards, Parisian printers did not depend on a previous, dedicated working scheme. No internal organisation, professional setting or working methodology or even audiences existed. Indeed, the fifteenth-century Parisian printing masters were pioneers in the field of printing while this technology had not stretched to the rest of Europe yet. So, these masters built the local market regarding both the labour organisation and the book format. To build up their enterprises and keep them alive, they needed to be focused on their potential audiences and on providing a reasonable offer, which mirrored on the book size, presentation, value or format. It follows

Inc. no. 14).

that the producing system was beforehand.

1.3.2 Professional profiles

Material suppliers

We can see how the place of printed book production took shape within the circles of the material suppliers[183]. The printing masters depended on vendors of paper and parchment to get supplies required to print, cover the produced books and get the tools for printing. The next explanation follows the order from the paper-dealers (*papeleurs*) to the parchment-makers (*parcheminiers*), until the crafters of types, the goldsmiths.

Papeleurs Paper was in great use among book-makers as a support of printing, especially in university book production. The origins of paper in France are uncertain, but it seems that it had been already regularly imported in Paris since the mid-fourteenth century. In this period, King Charles V issued two Letters (1354 and 1368) to grant the Paris *studium* the right to select two sworn paper-makers of Troyes and Essonne as the official suppliers[184].

In Paris, the internal consumption of this material was larger than the local offer so local book-makers depended largely on external suppliers. The Parisian paper-makers or *papeleurs* were few, as it can be seen in another Letters Patent from Charles VIII (1498) that enlists the official suppliers of paper. Among the eleven official dealers mentioned, only four of which were from Paris, the other seven were from Troyes or Corbeil-Essonnes[185]. For this reason, it can be assumed that the paper was predominantly an outside resource at that time, and the large part of reams supply travelled from Troyes, whose papermills produced and distributed nearby and through the Seine and its tributaries for northern France, including Paris[186]. Next to this place, other important vendors were from Champagne and Lorraine[187].

[183] This section does not account for the suppliers for the materials of printing inks for two reasons: firstly, the study on ink formulations are still under development and secondly because they were sold mostly from local apothecaries, whose sources varied greatly in geographic provenance and regularity in the supply.

[184] William A Churchill. *Watermarks in Paper in Holland, England, France, etc. in the XVII and XVIII Centuries and their Interconnection*. Amsterdam: M Hertzberger, 1935, pp. 55-57.

[185] Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, p. 38.

[186] Especially during 1460 and 1470.

[187] Adolph S Cavallo. *Medieval Tapestries in the Metropolitan Museum of Art*. New York, NY: Metropoli-

The number of paper suppliers increased within the century: Febvre and Martin[188] specified the extent of the consumption. A printing master could easily employ three reams a day per press. This number becomes considerable when it includes a full-capacity activity throughout the year as well as the overall number of prolific printers. In an early study, Duff[189] enumerated no fewer than eighty-five printers active in the city by the year 1500 yielding around 800 books per year.

As shown, the origins of the Paris paper trade were academic and ecclesiastic because these institutions worked actively to ease the local supply at the beginning of the fifteenth century. So the referred Paris *studium* had its own suppliers, which were entitled as "Official Papermaker to the University"[190]. When included in the academic lists, official retailers were regarded as full members of the academic community and accordingly, they enjoyed the same privileges: fiscal and jurisdictional immunity and exemption from some civil obligations[191]. Through this privileged status, the members of the academic community and its provisioners were very joyfully exempted from the payment of the *taille*, that the royal administration originally levied in Paris under King Philip the Fair between 1292 and 1300[192]. Favier's analysis on the Paris *taille* tax rolls for the years 1421, 1423 and 1438 proved that the academic community as well as those who revolved commercially around it (that is to say, those involved in the book market), always maintained the fiscal exemption[193]. These individuals also benefited from the *privilegium fori* or the *Committimus*, namely the secular legal immunity and the right to be judged only by an academic tribunal[194]. At the basis of both rights was a Letter Patent that King Philip the

tan Museum of art, 1993, p. 242; Lothar Müller. *White Magic: The Age of Paper*. Cambridge: Polity, 2015, p. 28.

[188] Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, p. 40.

[189] Duff, *Early printed books*, p. 85.

[190] One case is the paper-maker Jean Le Bon of Troyes, who was entitled to start his own factories in Paris and in Essones, and the other are two Parisian citizens that were authorised to lease the bishop's mill in St. Claude to produce paper (Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, p. 38).

[191] For a full list of the rights of academic members, see Section *The academic membership of the* libraires-juré.

[192] Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, p. 38.

[193] Jean Favier. *Les Contribuables parisiens à la fin de la guerre de Cent Ans: les rô les d'impôt de 1421, 1423 et 1438*. Vol. 11. Géneve: Librairie Droz, 1970, p. 43.

[194] Paul Kibre. *Scholarly Privileges in the Middle Ages: The Rights, Privileges, and Immunities, of Scholars and Universities at Bologna, Padua, Paris, and Oxford*. Cambridge, MA: Mediaeval Academy of America, 1962, pp. 88-101; David S Clark. "The Medieval Origins of Modern Legal Education: Between Church and State". In: *The American Journal of Comparative Law* 35.4 (1987), pp. 653–719, p. 702; Godfried Croenen et al. "Patrons, Authors and Workshops: Books and Book Production in Paris around 1400". In: *Patrons, authors and workshops: books and book production in Paris around 1400*. Vol. 4.

Fair issued in 1309 for the university and its associates[195], which were confirmed successively in 1369 under King Charles V[196] and in 1498 with Charles VIII, as mentioned[197]. Such exemption as economical significance: as described in the section "Location of the shops", the bulk of the paper shops was located on the Left Bank, in the fiscal parishes that corresponded to *St. Séverin* and *St. Benoît* fiscal units[198], which later would correspond a middle-range taxation ranging between twenty-four and thirty-nine *sous*, that was a considerable sum at that time[199]. The protection of the academic community allowed a significant relief from fiscal burden and an easier business.

Despite their privilege, the provisioners associated with the university were subjected to the control of the Rector. Those who joined the academic community had to swear an oath and respect the university code. The academic arbitrage existed for a specific purpose, namely to enforce reasonable prices in the book market[200]. In this way, unfair competition among suppliers would be avoided whereas labour and expense would be maintained at acceptable levels.

Belonging to the university was not the sole form of economic association for the market of paper. Some paper-makers might have joined the Confraternity of St. John l'*Evageliste*, which included parchment-makers, while others appear to have formed their

Louvain: Peeters Publishers, 2006, pp. 1–20, p. 3; Paul A Delalain. *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*. New York, NY: Cambridge University Press, 2012, pp. xxiii-xxv.

[195]George H Putnam. *Books and their Makers during the Middle Ages: A Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century*. London, 1898, p. 262; Mary A Rouse et al. *Authentic Witnesses: Approaches to Medieval Texts and Manuscripts*. Notre Dame: University of Notre Dame Press, 1991, p. 272; Croenen et al., "Patrons, Authors and Workshops: Books and Book Production in Paris around 1400", p. 3.

[196]Churchill, *Watermarks in Paper in Holland, England, France, etc. in the XVII and XVIII Centuries and their Interconnection*, p. 57.

[197]Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, p. 38.

[198]Al Slivinski et al. "Taxation Mechanisms and Growth in Medieval Paris". In: *European Economic History Association Conference*. Geneva, 2009, p. 24.

[199]The basis for the mentioned fiscal impositions is not known, but we assume that it was a monthly calculation. But the possibility that the collegial activities fell in mid-level range of taxation can be better understood if the range twenty-four to thirty-nine sous is compared to the price of a daily commodity. In this regard, it is possible to say that in 1394 ten sous corresponded to the price of sixty loaves of bread of the weight of eighteen ounces each (Deborah Youngs et al. "Demonizing the Night in Medieval Europe: A Temporal Monstrosity?" In: Toronto and Buffalo: University of Toronto Press Toronto, 2003. Chap. 7, pp. 134–154, p. 143). However, the activities on the Left Bank were not the most heavily taxed and this area was not the richest. The Right Bank was more mercantile and richer (Simone Roux. *Paris in the Middle Ages*. Philadelphia: University of Pennsylvania Press, 2009, p. 222.

[200]Croenen et al., "Patrons, Authors and Workshops: Books and Book Production in Paris around 1400", pp. 2-3.

own craft guild back in 1398. The guild might have monitored the links between its members and external parties or act as an intermediate body. To illustrate the hypothesis, when the entrepreneur Charlotte Guillard went on a court case in front of the *Parlement* to discuss the bad quality of the paper available on commerce, she called up the guild of paper to urge tighter import control[201].

Parcheminiers Parchment was the second material used in print, although scarcely. In printing, its main function was as a covering material for bindings[202], whereas it found little use as a printing ground. This was because primarily for its huger fare than paper: in this regard, Le Goff referred that a sheet of paper was as much as thirteen times cheaper than one of parchment[203]. Combined to high expense, parchment needs high technical expertise if used as a ground for printing. In fact, the tight, strong and tick fibres of collagen do not allow the printing ink to reach the depth of an animal skin sheet as easily as the paper fibre, if not through the application of high pressure. For this reason, only a specific part of the printed books market employed it profusely, as is the case of the printed Books of Hours production.

Although parchment-makers[204] were not important vendors for printed book-makers, they had forms of structured professional organisation from their history of main suppliers of the manuscript trade. They were part of the comprehensive network of group traders that gathered in the Confraternity of St. Jean l'*Evangeliste* already in 1401[205]. This guild had St. John the Evangelist as the protecting patron since the evangelist was the protector of writing. By extension, he came to protect and represent all who were connected to the world of book-making[206]. Not many details are known for the activity of the confraternity in Paris, besides its aim for the spiritual edification of its members

[201] Beech, "Charlotte Guillard: a sixteenth-century business woman", p. 352.

[202] Colum P Hourihane. *The Grove Encyclopedia of Medieval Art and Architecture*. Vol. 2. New York, NY: Oxford University Press, 2012.

[203] Jacques Le Goff. *The birth of Europe*. Oxford: Blackwell Publishing, 2009, p. 127.

[204] Other names: *pergamenarii*, *parcheminieres* (Keith Busby. *Codex and Context: reading old French verse narrative in manuscript*. Vol. 1. Amsterdam and New York: Rodopi, 2002, p. 30).

[205] Charles Ouin-Lacroix. *Histoire des anciennes corporations d'arts et métiers et des confréries religieuses de la capitale de la Normandie*. Rouen: Libraires de Rouen, 1850, p. 145; Rouse et al., *Manuscripts and their Makers: Commercial Book Producers in Medieval Paris, 1200–1500*, p. 290; Diane E Booton. "Notes on manuscript production and valuation in late-medieval Brittany". In: *The Library* 7.2 (2006), pp. 127–153. DOI: https://doi.org/10.1093/library/7.2.127, p. 130.

[206] Robert W Berger. *Public access to art in Paris: a documentary history from the Middle Ages to 1800*. University Park: Penn State Press, 1999, p. 228.

and the accomplishment of charitable works[207]. In most likelihood, the confraternity also governed the relations of its members with the external economic parties.

Belonging to the guild was one of the forms of commercial associations in which these artisans joined, but it was not the only one. Other parchment-makers marketed with the university on a regular basis to produce university books, and they were enlisted in official records: four parchment-makers were mentioned in the Letters Patent of King Charles VIII of 1498. These professionals were officially appointed and licensed by the university and enjoyed the same juridical and fiscal privileges as the Masters of the university[208].

Goldsmiths Parchment-makers, paper-makers and dealers were not the sole suppliers. As mentioned previously, the system for printing consisted ultimately of metallic types cast so to fill a bespoke frame. To fabricate types, printers and publishers contacted goldsmiths to cast types for their use, initially in Gothic font. This happened before type-foundry and type-designing emerged in the mid-sixteenth century and were finally established towards the end of that century[209].

The period in which type-design gained momentum was delayed until the France exposure to the Italian late-Renaissance culture and the Italian Humanistic-classical view, gaining a Mannerist artistic approach. The vibrant evolution of the most important cultural environments influenced French phonetics and eventually penetrated the press. Then all kinds of literature here produced, not only Latin but also Greek and Hebrew, made use of special types as well as others emulating the Roman and Italic fonts. Those who initiated the evolution of typefaces would be Robert Estienne, Simon de Colines and Antoine Augereau and Garamond's *grecs du roi*[210] from 1541.

[207] Douglas Brine. "Image, Text and Prayer: The Indulgenced Memorial Tablet of Jean de Libourc (d. 1470), Canon of Saint-Omer". In: *Church Monuments* 23 (2008), pp. 45–61, pp. 49-50.

[208] Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, p. 38; Edith Diehl. *Bookbinding: its Background and Technique*. New York, NY: Dover, 1980, p. 50.

[209] Hendrik DL Vervliet. *The Palaeotypography of the French Renaissance: Selected Papers on Sixteenth-century Typefaces*. Boston and Leiden: Brill, 2008, p. 10.

[210] I.e. the Royal Greek Types. On the Greek printing types of French Renaissance see Vervliet, *The Palaeotypography of the French Renaissance: Selected Papers on Sixteenth-century Typefaces*, pp. 383-400.

Bookmakers and bookdealers

Once purchased the necessary supplies, the masters could engage in the printing phase, finish the product and make it available on the market. The many stages required one or more specialised workers who oversaw dedicated workshops: printers (*imprimeurs*), bookdealers (*libraires*) and binders (forwarders). The explanation of the tasks and relations among these workers follows in the next three sections. Since the *libraires* affiliated with the university enjoyed special privileges, a section is dedicated to the description of their status together with the ensuing rights and obligations. The last paragraph of this section is devoted to travelling book sellers (peddlers).

Imprimeurs, libraires, libraires-juré, forwarders The Parisian *imprimeurs* were printers while *libraires* acted as either publishers or book-dealers. But the three capacities together (printing, publishing, trading) were adjoined within the printing activity of the first decade and a half (1470-1485).

As Wijnekus remarks[211], the earliest publishers, printers, book-sellers were true entrepreneurs, literate people capable of differentiating their products. Also, they tended to create dynasties of publishers and booksellers. That is probably why Michael Friburguer, one member of the group that Fichet and Heylin, was invited to Sorbonne after a previous activity as a Master of arts from the Basel *studium*. When he and Gering moved out of the university premises in 1473, they started together the *Au Soleil d'Or* workshop, which relied on his intellectual support. Another example is the concurring workshop *Au Soufflet Vert*[212], where Kaysere was the editor and project director. As a former long-term procurator of the German Nation[213], he had economic management skills and was able to relate to the public.

The tendency to create families of book-makers and dealers, Pasquier Bonhomme (*fl.* 1475-1501) was the first Bonhomme to venture into the printed book-making business, and would later be followed by his brother Jean and his daughter Yolande (*fl.*1522-

[211] Franciscus JM Wijnekus et al. *Dictionary of the Printing and Allied Industries: In English (with Definitions), French, German, Dutch, Spanish and Italian*. Amsterdam, London, and New York-Tokyo: Elsevier, 2013, p. xvi.

[212] It was the second press established in Paris and started in partnership with Stoll in 1473.

[213] Kent et al., *Encyclopedia of Library and Information Science: Calligraphy to Church Libraries*, pp. 342-343.

1557)[214]. Once the business was on the way, these families created a compact society. So Yolande Bonhomme married the other important printer Thielman Kerver[215] and the female entrepreneur Charlotte Guillard married two professionals of the market, first the printer-publisher Berthold Rembolt (†1518/1519) and after Claude Chevallon (†1537)[216].

After 1485, some main tasks related to printed book-making emerge: edition, press, publication and trade. To speak in greater detail, *design* is here meant as the organisation of both text and format of an edition while *press* is the mechanical production. *Publication* is the organisation and marketing of a book project and trade the act of selling to a suitable clientele. Such a net of connections can be reconstructed via colophon inspections, whose inscriptions offer details about the circumstances of the production of a printed book, starting from the place of issue, until the people involved and date. In short, colophons provide substantial documentation to complement with other sources like accounting records or personal diaries. Those statements inform on who was involved in those projects through the formula "*sob signo* [...]" and the characterising symbol of the shop's, i.e. its *sign*[217]. However unnecessary, printers would use this set expression already in the press' infancy which resulted on the institution of this custom over time. This set of details from the book statement and additional records allow building a scheme of connections among professionals.

The first identified pattern is that in which professionals edited, printed and sold books on their own, running themselves the whole production and trade. Such masters kept accordingly equipment, material, personnel for correcting, editing, producing, and selling printed books. The instance of the pattern of the all-inclusive economy is the market of service-books of the Hardouyn brothers and Thielman Kerver, where they oversaw the edition and production of their editions, including customisation for sale to individual clients[218]. But administering multiple tasks and sizeable producing facility required accountancy and retailing staff, as we learn from the registers of the mentioned Charlotte

[214]These years correspond the period of activity of Yolande as an independent entrepreneur, following the death of her husband, the German Thielman Kerver (*c.* 1522).

[215]Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 186.

[216]Béatrice Craig. *Women and Business Since 1500: Invisible Presences in Europe and North America?* London: Palgrave and Macmillan International Higher Education, 2016, p. 58.

[217]They were mythological beasts, saints, depiction of phytomorphic, zoomorphic and anthropomorphic elements.

[218]Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography".

Guillard. Indeed, she owned various presses, and at least one accountant in her shop to sell books[219]. Printshops that involved both printing and selling were under the lead of printer-publishers, who generally owned the largest enterprises.

Other patterns of marketing involved collaborations among shops where publishers prepared shared projects. The cases of participation of multiple parties in an editorial project are numerous, such as the service-books that the printer-publisher Thielman Kerver issued in partnership with the book-seller Gillet Remacle[220] or the humanistic works with the university *libraire* Jean Petit[221]. In these projects, Kerver offered the presses while Remacle might have provided the economic support. In the second case, Jean Petit was the editor and proof-reader of the text. Although Kerver had an artistic background as an engraver and printer before his activity in Paris, he needed the cultural support of a university graduate to accomplish the publication of schooled texts like the works of Mantuano. Because Jean Petit was closely related to the University of Paris, he had a valuable place in this purpose[222]. Similarly, the printer-publisher Philippe Pigouchet issued theological books with the *libraire-juré* Durand Gerlier[223] and occasionally with Nicolas Vaultier[224]. Hence, the collaborative framework among publishers was fluid. On the one hand, they could act as sponsors in chief while on the other as the printer-booksellers contributing with the facility. But there were also occasions when the support was not economical nor technical, rather intellectual or bureaucratic. In those cases in which the printer-publisher did not master the content to publish, he rather asked the support of a learned *libraire* or a *libraire* integrated into the academic network, as in Kerver's case.

Beyond this collaborations among publishers, between publishers and printers this also existed, with the propose of creating an extended working area. In the event in which a

[219]Beech, "Charlotte Guillard: a sixteenth-century business woman", p. 351.

[220]Some cases are Hours for the use of Rome, issued in 1503, part of the collection of the Biblioteca Nacional de Portugal in Lisbon (inv. no BNP, Res.322.v, Appendix A, Inc. 11.) and in 1514, now in Madris, BNE (inv. no R.5098, see Appendix A, Inc. 19); use of Paris, issued in 1500, now in Paris, BnF (Inv. no. Velins.1633, Inc. no. 32); use of Cambrai, issued in 1500/1501, now in Oxford, Bodleian Library (inv. no Inc. H-152).

[221]Editions of the Baptista Mantuano's *oeuvre* printed in collaboration with his co-worker George Wolff: *De suorum temporum calamitatibus* (1499/1500), In *Robertum Severinatem panegyricum carmen* (*c.* 1499), *Parthenice prima* (1499) and *Secunda* (*c.* 1499).

[222]Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 536.

[223]For instance, Flores by Bernardus Claravallensis (1499), in Bod. Inc. B-179.

[224]For instance, *Summa aurea in IV libros Sententiarum* (ed. Guilelmus de Quercu), by Guilelmus Altissiodorensis (1500/1501), in Bod. Inc. G-295.

shop owner issued and sold books, but did not prepare them, that vendor could outsource the production to a printer. One of these was the publisher Claude Jaumar, who did not possess presses, so he contracted frequently the two local printers Pierre Le Dru and Felix Béligault, since 1493. He also initiated the pattern of single workers that organised other specialists to accomplish each book project as a teamwork[225]. The other publisher Antoine Vérard expanded this course of action slightly later and coordinated the finest network of print men of the city: Jean Du Pré, Pierre La Rouge, Pierre Levet, Pierre Laurent, Jean Maubanel, Gillet Coustiau, Pierre Le Caron, Jean Ménard, Jean Trepperel[226].

Another aspect of this collaboration was related to the updating of old professionals, like it was the case of Vérard, mentioned previously, that had a history of calligrapher and illuminator, or another important publisher, Guillaume Eustace, that was a book-dealer[227]. Both Vérard and Eustace were formerly part of the manuscript-making community and decided at a later stage of their activity to turn to the press. However, initiating a career as a printer required a taxing path of apprenticeship or collaboration with people already engaged in the printing technology. Through the second path, these professionals that did not own presses, could upgrade their business with a larger output. For those who were involved in the production of deluxe manuscripts, the conversion to the printed media translated to new trade opportunities. Calligraphers were trained in layout composition while illuminators supplemented books with astounding visuals. And when luxury book-makers applied their former experience with manuscript production to printed book-making, they could adjust old formats and techniques to printed books with a view to aesthetical promotion. To inflate their trade, these businessmen relied on a sturdy professional network: Vérard worked as a royal illuminator and Eustace was the personal book-dealer of the king. In short, the starters of the publisher-printer connection were generally people involved previously in high-ranking book-making and who decided to turn to the press without apprenticeship.

As the industry of book-making grew, a class of small printers arose with a setup of mutual collaboration with other printers engaged in larger projects. Such is the case of

[225] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, pp. 60, 198.

[226] Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, pp. 120-121.

[227] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 385; Elizabeth Armstrong. *Before copyright: the French book-privilege system 1498-1526*. Cambridge et al.: Cambridge University Press, 2002, p. 23.

Touissant de Montiay, who printed for the more well-known Philippe Pigouchet a 1495 (edition of printed Hours for the use of Lyon[228]). Or else, the small entrepreneur Gilles de Gourmont who produced for the major printer Felix Béligault the philosophical oeuvre of Andrea Limos[229].

To summarise, three major types of network among printed book-makers and dealers arose: publisher-publisher, publisher-printer, printer-printer. Also, it seems that a publisher sponsored the creation of printed books for sale in his shop so the title of *libraire* could be interpreted indifferently as "book-dealer" and "publisher"[230]. Together with the laid-out information, a close inspection of colophons can tell us more details.

Book statements always mention the main responsible of the workshop and seldom the workers. In differentiating masters, publishers and collaborators, a standard construction was used in colophons: "imprimée par" identifying the printing agent, while "pour" indicates the publishing agent, next to their capacity. As for the colophon of a reference Book of Hours, they say: "*Par Thielman Keruer imprimetur* [*et*] *librarie iure de luniversite de Paris*: *Pour Gillet Remacle, ausi librarie iure*"[231]. This means that Thielman Kerver was *libraire-juré* and printer in chief of his enterprise. Gillet Remacle was equally *libraire-juré*, but he was principally acting as the sponsor in the project. Hence, colophons teach relationships and connections, but they also offer a drawback. The only cited names are those of the main collaborators next to the printing master while other workers stay anonymous.

To assess the size of a print-house, comparative studies of great quantities of editions are required next to a thorough analysis of ancillary documentary sources like accounting records. Then a recurring pattern arise where individual printers initially appear as the partners of a publication and finally as independent entrepreneurs. Accordingly, the presented scheme suggests a possible story of apprenticeship, assistant-ship and independent

[228]Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 550.

[229]Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 547.

[230]To avoid confusion between bookdealers of manuscripts and of printed books, "publisher" is used hereafter to mean the latter group of sellers.

[231]Original text of the colophon: "*Hore intemerate Virginis marie secondu*[*m*] *Usum Romanum cum pluribus oratio*[*n*]*ibus tam in gallico q*[*uam*] *in latino. Ces presentes heures a lusaige de Rom*[*m*]*e fure*[*n*]*t acheuees le x iour de Ian Milcinqcen*[*n*]*t et troys. Par Thielman Keruer imprimetur [et] librarie iure de luniversite de Paris*: *Pour Gillet Remacle, ausi librarie iure: demourant sur le pont saint Michel a lenseigne de la Licorne*". From Biblioteca Nacional de España, inv. no R.41830. See Appendix A, Inc. 18 for further information on this item.

activity in the described order.

Apprenticeship was not the sole prerequisite for pursuing the printer profession. A formal authorisation of a licensing authority was the final step to start printing professionally. In fact, for reproducing book through press, masters needed to be granted the permission of a suitable authority. In this regard, Peters[232] affirms that previous attempts of establishing a local press date to an earlier time than the initial university press (1469/1470). Although the royal chancellery authorised a French printer to make business, the firm hostility of the affirmed class of manuscript-makers discouraged it, as referred previously. Only a community that was already deeply involved in book-making had enough power and authority to import the technology, so the press began effectively in Paris only when the academic community took action in that direction. And as the invited first printers worked within the university premises, they were under the direct control of Fichet and published the titles he commanded. On that account, the first Parisian editions are books of Latin classics and religious titles, such as the cardinal Bessarion's speeches, or the Cicero and Virgil's classics[233].

Forwarders were the creators of bindings, as Ward mentions[234]. Not much is known about them so it is merely suppositional that they might have worked in independent shops.

The academic membership of the *libraires-juré* The condition of subscribing to the University rule was not a mandatory requirement for seeking business in Paris. However, the local printing masters and publishers initially preferred to be academic agents, so a consistent number of the new printers swore the oath to the rector similarly to manuscript producers and dealers[235]. Accepting the academic patronage allowed publishers to secure

[232]Peters, *Harold Innis's History of Communications: Paper and PrintingAntiquity to Early Modernity*, p. 73.

[233]Meserve, "Patronage and Propaganda at the First Paris Press: Guillaume Fichet and the First Edition of Bessarion's *Orations against the Turks*", p. 527.

[234]Ward, *The Grove Encyclopedia of Materials and Techniques in Art*, p. 47.

[235]Chevillier, *L'origine de l'imprimerie de Paris. Dissertation historique, et critique. Divisée en quatre parties*, p. 327; Samuel Palmer. *General History of Printing: From the First Invention of it in the City of Mentz, to Its Propagation & Progress Thro'Most of the Kingdoms of Europe; Particularly the Introduction & Success of it Here in England; with the Characters of the Most Celebrated Printers from the First Inventors of this Art to the Years 1520 & 1550, Also an Account of Their Works...* London: Bettesworth, Hitch, Davis, 1733, p. 169.

the same privileges as the *libraires-juré*[236] of manuscripts. Unfortunately, no record exists with reference to *imprimeurs-juré*.

Because they were accredited by the university, stationers were subjected to obligations. One of this kind was the economic and administrative control: those who were admitted in the academic lists had to swear an oath to the Rector to follow the imposed charter, as mentioned previously (this fact explain why they were named as "*juré*" or *sworn*)[237]. The pronunciation was not a merely contractual requirement, for the enlisted professionals attended a formal ceremony in full regalia that took place in the convent of Saint-Mathurin, in front of the Rector, the whole academic staff and the general academic assembly[238]. Through the ceremony, the swore stationers were admitted to the academic community. From the university's official recognition, the same privileges as the Master of arts ensued: the mentioned *Committimus*, exemption from the fiscal burden of the *taille* and the duties of watch and door guard. These privileges were developed over time through the numerous royal Letters patent issued by the Kings Philip Auguste (1200), Louis IX (1229), Philip IV the Fair (1307), Philip of Valois (1330/1334), Charles V (1368, 1369)[239].

Besides the privileges, the academic community also governed some ranking among

[236]However, there is a difference between *libraires-juré* of manuscripts and of printed books. The former acted as both stationers and bookdealers, namely they were incumbent keepers of *exempla*-models of university books for reproduction-and dealers of their ready-made copies. As such, the mechanism came in existence between the fourteen and fifteenth century while before this time, the statutes admitted two professional figures with separate competencies: the *stationnaire* and the *libraire*. The stationnaire corresponded to the later stationer, having the sole difference that he was forbidden to hire clerks and his sole responsibility was to keep *exemplia* whereas, by contrast, a *libraire* could hire scribes, correctors, editors at their discretion (Delalain, *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*, pp.xix-xx). The rule would change around 1300, and Parisian stationers were then permitted to distribute copies for sale. Probably this was a consequence of repeated negligence to comply such dictates (Putnam, *Books and their Makers during the Middle Ages: A Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century*, p. 259). Then, the fifteenth-century stationer was both a keeper and a book vendor who hired copyists, organised manuscript production for sale, yet other *libraires-juré* existed contemporaneously. On this regard, Delalain suggested that the main difference between both professionals relied on the kind of book traded, where the first worker-the stationer-was responsible for the market of university books, or book for study; the other *libraire*-the book-dealer-could market also books not related to academic studies but academically approved. See Delalain, *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*, pp. xx-xxi.

[237]In Latin, *librarii iuratii.*

[238]Delalain, *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*, p. xxx.

[239]Delalain, *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*, pp. xxiii-xxvii.

the admitted professionals. The fifteenth-century organisation was that the stationers or *libraires* accredited by the university named "*libraires-juré*" and were ranked as main librarians ("*grandes libraires*")[240], librarians ("*libraires*"), minor librarians ("*petites libraires*"). The list of the major and minor *libraries-juré* was revised periodically, and four new major librarians were appointed yearly. Once installed, the major librarians had administrative duties, namely the control of book prices and ruling obligations towards the minor librarians[241].

The number of *libraire-juré* active in a year seems to have a limit, because the printer André Bocard was also recognised as a university associate only after Vérard relinquished in his favour[242] and the printer Gillet Hardouyn ceased his title to the brother Germain in 1519[243]. Because these masters swore the oath, they could also obtain the economic advantage of easing the budgetary burden. Indeed, this seems one of the major reasons for advancing a petition of printing privileges, as found in the statistical study of Ginsburg on the course of submission for a privilege[244]. The state of belonging to the academic community was beneficial also since the Paris *studium* was the chief agent of book-making[245]. Academic arbiters did not simply administer content approval but also solved contentions among book-makers and suppliers for both manuscripts and printed books. So when the woman entrepreneur Charlotte Guillard sued the guild of paper-dealers to claim paper of better quality, she filed the petition to a jury of the University of Paris that acted as the negotiator with suppliers[246].

Initially, the university of Paris acted towards printed book-making only as an inspect-

[240] One of those is Michel Du Riez, a well-educated *libraire* that licensed as a Master of Arts and graduated in law (Delalain, *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*).

[241] Chevillier, *L'origine de l'imprimerie de Paris. Dissertation historique, et critique. Divisée en quatre parties*, pp. 345-347; Delalain, *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*, pp. xxxvii-xl.

[242] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 40, 424.

[243] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 171-172.

[244] Armstrong, *Before copyright: the French book-privilege system 1498-1526*, pp. 78-91; Jane C Ginsburg. "Proto-property in Literary and Artistic Works: Sixteenth Century Papal Printing Privileges". In: *Research Handbook on the History of Copyright Law*. Ed. by H. Tomá Gómez-Arostegui et al. Cheltenham: Edward Elgar Publishing, 2016. Chap. 12, pp. 237–267, p. 259.

[245] David T Pottinger. *The French Book Trade in the* Ancient Régime*, 1500-1791*. Harvard: Harvard University Press, 1958, p. 55.

[246] Beech, "Charlotte Guillard: a sixteenth-century business woman", p. 352.

ing proxy of fairness to ease business rather than content evaluation, the first act of censorship was enforced in 1521, when King François I imposed *a priori* authorisations from the University on all religious books to publish[247]. A second act occurred in 1527, the year when also all Bible translations unapproved by the University were regarded as prosecutable[248]. Institutional patronage was advantageous because it guaranteed juridical and commercial insurance, but it was not a unique form of business protection.

Other forms of protection were sought shortly after the beginning of the sixteenth century. Various printers and publishers submitted frequent requests for special privileges to the royal chancery, so a comparable number of special privileges were issued under the ruling kings[249]. So there are records of twenty-five Letters issued under King Louis XIII (1507-1514) and a huger amount (eighty-one) under the next monarch, Francis I (1515-1516). Though privileges, Vérard secured nineteen titles as his exclusive right between 1508 and 1512 as the first publisher. Eustace protected similarly sixteen titles[250]. Printers and book-dealers applied for the concession through a petition for single titles or "packages" like the case of Le Noir, who submitted four petitions at once in 1517[251]. The requests, however, were not granted at any time of the year. By contrast, the course of their approval is not linear, because of its non-regularly functioning system. It largely depended on the personal proximity to the issuing agent as well as the movements of the royal court. For this reason, a few printers or their agents tracked the court to place their request. Alternatively, peaks in the number of requests granted in Paris are observed for the periods when the court was abiding here, that fact explains why the largest quantity of submitted requests dates to the period between the winter 1521 and the following spring[252]. Another sovereign court that released privileges was the *Parlement* of Paris, which granted 102 privileges throughout the period 1507-1526[253].

For these reasons, we can observe the following professional categories in the early

[247] Michael F Suarez. *The Book: a Global History*. New York, NY: Oxford University Press, 2013, p. 173.

[248] Henry. "Typography: Its Rise and Progress". In: *The Inventors' Advocate, and Journal of Industry: A British and Foreign Miscellany of Inventions, Discoveries and the Fine Arts* (1839), p. 209, p. 274.

[249] A part of these requests was submitted by the authors of literary works. In this thesis, only the privileges conceded to printers are under scrutiny. On the history of French copyright, see Armstrong, *Before copyright: the French book-privilege system 1498-1526*.

[250] Armstrong, *Before copyright: the French book-privilege system 1498-1526*, pp. 22-24.

[251] *Ibid.*, p. 31.

[252] *Ibid.*, p. 32.

[253] *Ibid.*, p. 33.

typography: in the period 1470-1485, only printers-publishers, after this date, printers, publishers-booksellers, and printers-publishers arose. After 1490, Claudin[254] presents another emerging group, those which he denotes as the "*petit ateliers*". These shops were owned by minor printers that either did not survive long or whose business never reached the same magnitude as the earliest printers-publishers.

Claudin's remark on the business size introduces the existence of a business scale including major and minor printers, publishers, and printers-publishers. To secure a part of the market and increase their income, some print-houses or book-stores specialised in the production or trade of a specific kind of book, like was the case of the mentioned brothers Hardouyn. Creating a single kind of books established a reputation as a reference for a given genre among the clientele, but also ensured constancy of production. Then the process of correcting and composing books would be simplified after the custom to a format and content standard. In this context, the printer Jean de la Barre occupied the niche of small editions of theology, Latin poetry, grammar and dialectics in use among students from 1500 onward[255].

Next to sectorisation, the other strategy for building business was to produce fine editions for the appeal of distinguished clients. On this account, Antoine Vérard assembled in 1498 an edition with rich detail of engraved silhouettes, Gothic architectures and *drôlleries* for the special use of King Charles VIII, which are known as the *Grandes Heures royales*[256].

Unlicensed book-sellers: peddlers and stall-keepers Documentary sources also record the existence of street vendors of books: peddlers and stall-keepers[257]. Those dealers could be another by-product of the increasing negligence of academic control. They sold in stands and had no university privilege; besides, they were subjected to the supervision of some inspecting authorities, which made sure that peddlers would not settle in

[254] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.303.
[255] *Ibid.*, p. 297.
[256] Macfarlane, *Antoine Vérard*; Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, pp. 409-415.
[257] Putnam, *Books and their Makers during the Middle Ages: A Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century*, pp. 260-261; Henry Curwen. *A History of Booksellers, the Old and the New*. New York, NY: Cambridge University Press, 2010, p. 4.

stores and exercise price control[258]. As for the former condition, In the case peddlers were found to annex to authorised *libraires*, they would lose the right of conducting business.

Book decorators

Another branch of book production consisted in the creation of the artistic book. With this aim, printers-publishers and publishers employed artistic media in their editions. One branch of those techniques is *intaglio* engraving, which is observed already in fifteenth-century book illustration.

On the application of engraving to early printed books, Claudin[259] provided extensive descriptions of the sets used among the Parisian masters. He gives substance to its explanation by providing a generous breadth of instances from Denis Meslier, Etienne Jehannot, Jean de Coulonce, Robin Charlot, Nicolas Desperex, just to refer some. In early printed books, plates were carved and applied in the press to surround texts in decorative *drôllerie* borders, historiated initials and figurative representations, complementing the text and printer's devices just as importantly. Duplessis[260] expressed further in this point by advocating woodcutting as the main illustrating media. However, although Duplessis' essay argued an extensive use of woodcuts and Claudin[261] endorsed this position, their conclusions are not fully convincing.

In addition to wood, copper was another material actively used in book illustration. In fact, relief metallic plates were used a lot for illustration in Jean Dupré's *Heures à l'usage de Rome*[262] as stated by a note to his book: "Collection of biblical stories and vignettes, both from the Old Testament and the New Testament, cut from copper for this Book of Hours."[263]. Additional records, however, are unknown. So even if Tenschert, Nettekoven and Zöhl[264] admitted metal-cutting in the early sixteenth-century Parisian industry, the

[258] Putnan refers that were forbaded from trading books at a price higher than the specified amount of ten *sous* of Paris. See Putnam, *Books and their Makers during the Middle Ages: A Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century*, pp. 260-261.

[259] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*.

[260] Georges Duplessis. *Histoire de la gravure en France*. Paris: Rapilly, 1861, p. 2.

[261] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*.

[262] In 1488.

[263] "*C'est le répertoire des histoires et figures de la bible tant du vieilz testame*[*n*]*tq*[*ue*] *du nouveau contenues dedens le*[*s*] *vignettes de ces presentes heures imprimées en cuyvre* [...]." Translation by the author from the original in Middle French.

[264] Heribert Tenschert et al. *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*.

attributions of individual sets are still cautious.

Nettekoven raised awareness[265] on the supposed overly dominant identification of woodcutting as the main technique for book-illustration, which could be historically inaccurate. She enforced on this point by observing that woodcuts can be hardly integrated to the press. Before applying pressure, the composed plates were heated to improve the flowing and sliding properties of the ink while offsetting, and sustained use may leave wooden plates worn. Considering that metal is a ductile material, and the relief section of metal plates deforms or cracks more frequently than wood plates, metal plates should be more brittle than wood and result in an accordingly likely damage[266]. Then the characteristic damage of old plates may suggest the nature of the source used. Such distinctive mark of use, however, appears seldom so technical observations do not always reveal the artistic technique applied.

Books were mostly decorated in black-and-white engraved illustrations, but also in colour. Many deluxe editions for private use, especially religious books, were further decorated with illuminated illustrations.

In the next three sections we will describe the artists identified as "Engravings designers, illuminators", "Engravers" and "Finishers". The first of which sections discusses the function of painters as designers of the engravings while the second illustrates the issues related to engravers' identification and their relations to the publishers and printers using the sets so carved. The last section briefly explains the activity of book-binding decorators, that were also called "finishers".

Engraving designers, illuminators Starting from the end of the Hundred Years' War through the first decades of the sixteenth century, book illumination lived a golden age with Renaissance illuminators like the Coëtivy Master (*fl. c.* 1450-1485), (*dit*) Jean d'Ypres (*fl. c.* 1480-1510), (*dit*) Guérard Louf (*fl.* Paris *c.* 1480-1500), Master of the Chronique Scandaleuse (*fl. c.* 1493-1510) or the Master of Jacques de Besançon (*fl. c.*

Ramsen and Rotthalmünster: Antiquariat Bibermühle AG and Antiquariat Heribert Tenschert, 2015, I, no. 5.

[265] Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, p. 70.

[266] Max Julius Friedlaender. "Handbücher der staatlichen Museen zu Berlin". In: *Der Holzschnitt. Dritte Auflage*. Berlin: De Gruyter, 1921, p. 5; Wilhelm Ludwig Schreiber. *Handbuch der Holz- und Metallschnitte des XV. Jahrhunderts*. Eight vols. Leipzig: Verlag Karl W. Hiersemann, 1926, p. 5.

1480-1500). These masters' workshops could reach large extents in volume and diversification: such is the case of Jean Pichore, who was the master of a large commercial enterprise that illuminated numerous books, both sacred and secular. Over time, Pichore also made a brief foray into book production in partnership with the printer Remy de Lastre, along with whom he designed miniatures for their use and local printers and publishers. But Pichore was essentially a miniaturist, mostly at the service of Cardinal Georges d'Amboise (1460-1510). As an enthusiastic of the Italian Renaissance and amateur of books and humanistic literature, the Cardinal gathered a large library, a portion of which was illuminated by Pichore.

This brief account about this artist sets an instance of the collaborative interaction between artists and makers of commercial books. Another expression of this close contact was the typical workflow of an artist's contract.

Illuminators were not exclusively active as book painters but also as sketchers for other artistic media. To substantiate the scheme of artistic fluidity, there are the two instances of Jean d'Ypres and Jean Pichore (see the next chapter, Sections 2.1 and 2.2). This maître-juré is known under a variety of aliases, namely "Master of the Apocalypse Rose of Sainte-Chapelle, Master of the Hunt of the Unicorn", "Master of the Très Petites Heures de Anne de Bretagne", "Master of the Life of St. John the Baptist"[267]. After this long list of titles, there was a history of multifaceted business in manuscript illumination, polychromy painting, stained glass art and tapestry design. As an illuminator, Jean d'Ypres worked on the decoration of the so-called *Hours of Anne of Brittany*[268]. As a painter of altarpieces, he made the polychromy for the retable of the high altar of the Sé Velha de Coimbra[269]. As a stained glass designer, he sketched the scenes from St. John's Book of Revelation of the large rose window in Flamboyant style of the Sainte-Chapelle around 1490[270]. As a designer of tapestries, he made the design of a set of tapestries depicting the hunt of the fabled unicorn[271].

[267] François Avril et al. *Les manuscrits à peintures en France: 1440-1520*. Paris: Flammarion and Bibliothèque Nationale, 1993, pp. 268-270; Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*.

[268] Paris, BnF, Ms. Nal. 3120.

[269] Susie Nash. *Northern Renaissance Art*. Oxford: Oxford University Press, 2008, p. 109.

[270] Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*.

[271] Majeski, *The printed Books of Hours of Thielman Kerver: Exploring Printer, Shop, Community and Book*, pp. 51-53.

The experience with objects varying in size, shape or address, made these flexible artists capable of adapting to the press as designers of engravings for book illustration. Furthermore, these artists found a welcoming class of printers and publishers eager to create extravagant book designs. Book-makers contracted artists to elaborate the model of engravings to use as a staple for marginal and textual decorations, but they were not obliged to create original composition and could find inspiration in the production of other illuminators or in another printer's imagery. On the grounds of the assimilation, there was the absence of formal reciprocal agreements among publishers and illustration designers, so artists had room to rework projects from other patrons and were even encouraged to pursue assimilation of popular imagery. This is the case of the mentioned artist Jean Pichore, that slightly readjusted the sketches of a personal set of engravings to respond to the needs of Simon Vostre and Thielman Kerver first, then Gillet and Germain Hardouyn, Guillaume Anabat and Guillaume Eustace[272]. Another representative case is of Jean d'Ypres, who further engaged in a long-lasting collaboration with the partnership Philippe Pigouchet-Simon Vostre and other Parisian printers and publishers[273].

At the same time, the visual composition of part of the production was standardised, particularly in religious books. The many centuries of manuscript illumination crystallised these pictorial series into defined cycles and, as a reault, the range of allowed variations was finite[274]. Despite that, secular books accommodated more elaborate illustrations (fig. 1.10)[275]. So in his artistic process, an artist could rely on his keen attentiveness to assimilate existing images for replication or original creation.

[272] Abbs. 1-3 of *Metallschnitte in Oktav der Pichore-Werkstatt für Simon Vostre, 1504-06*; Abbs. 1,2 of *Metallschnitte der Pichore-Werkstatt für Thielman Kerver, 1504-06*; Abbs. 1-2,4 of *Metallschnitte in Oktav der Pichore-Werkstatt für Gillet und Germain Hardouin, 1505-09*; Abbs. 1-3 of *Metallschnitte der Pichore-Werkstatt für Guillaume Anabat in Oktav*, *c.* 1508; Abbs. 1-3 of *Metallschnitte der Pichore-Werkstatt für Guillaume Eustace*, *c.* 1508 (Caroline Zöhl et al. "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens". In: *Horae B.M.V. Horae B.M.V. 365 Stundenbücher Aus Der Sammlung Bibermühle*. Ramsen: Antiquariat Bibermühle, 2015, p. 72-90].

[273] Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*.

[274] Majeski, *The printed Books of Hours of Thielman Kerver: Exploring Printer, Shop, Community and Book*, pp. 51-53.

[275] For a full digital source of the item, see Appendix A, Inc. 3.

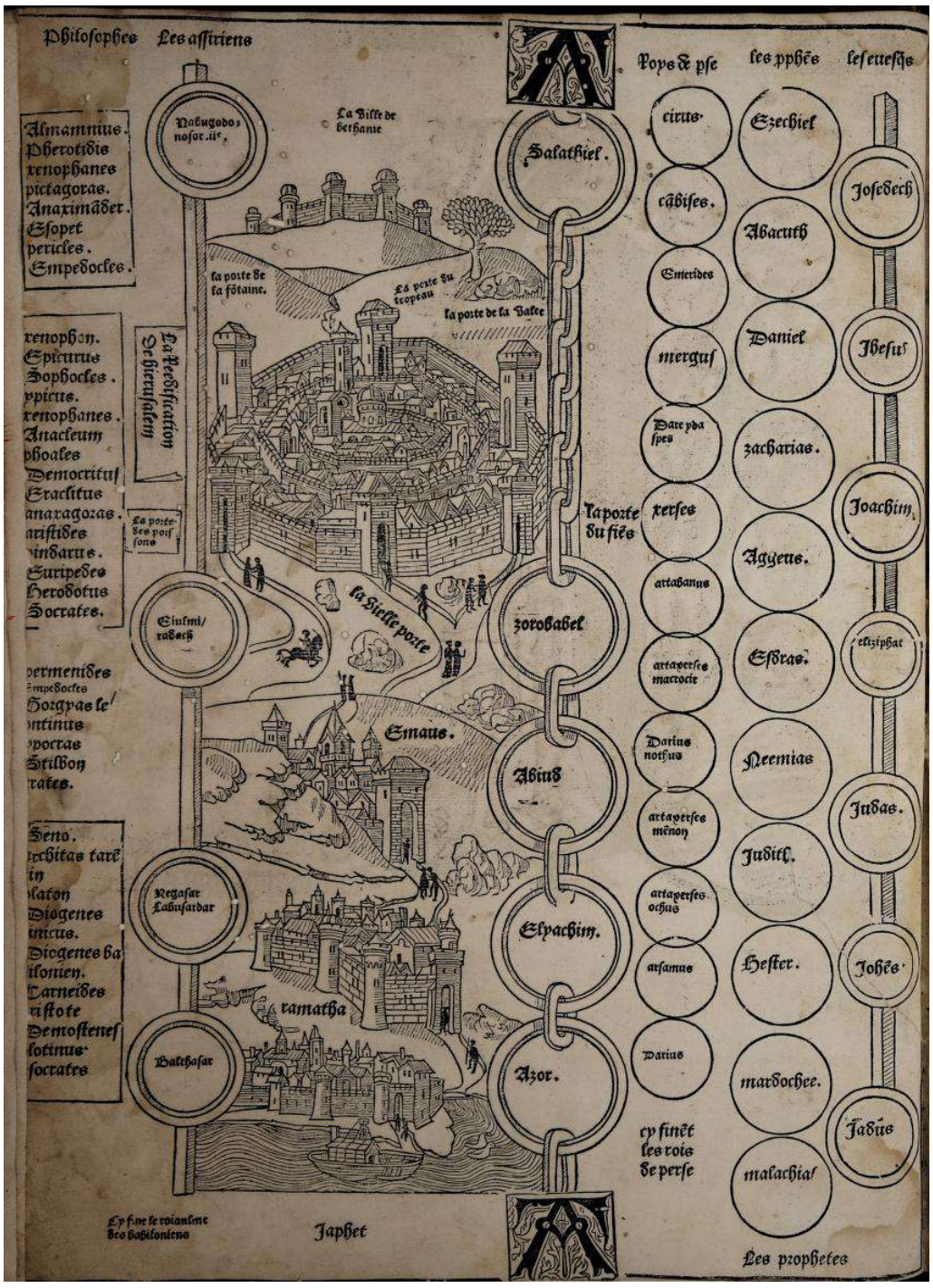


Figure 1.10: Leaf of *Rudimentum novitiorum: La Mer des hystoire*, volume I. Printed in Paris, VII 1488, by Pierre Le Rouge for Vincent Commin, illustrated with unpainted woodcuts (313 mm x 185 mm full leaf dimensions). In Boston, Public Library, (Rare Books Department) copy Q.402.51 pf v.2, fol. 1[v] © Boston Public Library.

Book artists were active in the innovative business of engraving design but also in traditional book painting. The printing masters that sought high-ranking clientele of admirers of illuminated books gathered illuminators for commercial partnership, either long-

lasting or occasional. This collaboration between illuminators and publishers depended largely on the book to decorate, especially religious books, that demanded most frequently exquisite garnishing in colour, so print-houses of service-books developed a personalisation process for each individual customer. On this trail, the Hardouyn brothers rendered in illumination according to the clientele preferences[276]. The bulk of the workshops assigned the works to specialised ateliers[277] while the Hardouyns' workshop is known for having his own illuminating staff, but this was an exception[278].

Despite the magnitude of the commercial exchanges, the names of these artists are rarely known. Aside from the cases of noted artists like Pichore or d'Ypres, there is a large class of minor artists whose hands cannot be distinguished and who stay anonymous.

Engravers Engravers crafted sets of book illustrations after the design by other artists. However, the identity of these engraving masters is as cloudy as the nature of their relationship to printing masters. As an example, the *Danse Macabre* series of illustrations were typical to Jean Du Pré and influenced parallel use among other publishers like Antoine Vérard, who imported the composition into other kinds of books[279]. Another is the grotesque L in the *Vie des ancient sainz Pères* was noticeably re-styled in numerous variants by Pierre la Rouge[280], Pierre Le Caron[281] and Vérard[282] (fig. 1.11). But besides the lineage, not much can be told about the origin of these engravings.

There are also complicating factors to authorship attributions. One of which is that printers would make alterations to woodcuts on single details or they cut the carved plate into smaller pieces: Bonicoli and Fabry-Tehranchi appointed the case of the crown of the bishop in the *Bataille judaïque* by Flavius Josephus (post-1492), which Vérard adjusted

[276] Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography".

[277] Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*.

[278] Germain Hardouyn was a registered illuminator (Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198).

[279] Especially service-books. See on this account the Books of Hours by Philippe Pigouchet, Antoine Vérard and the early Hours by Hardouyns.

[280] As the initial L at front of La mer des hystoires, edition of 1488 of Pierre Le Rouge for Vincent Commin. A copy of this book is now in Boston Public Library (Rare Books Department), inv. no Q.402.51. See Appendix A for a digital version of the item (early printed source no. 3).

[281] *Fois Moistre Alain Chartier, notaire et secrètoire du Roy Charles Vie*, edition of 1489 of Pierre Le Caron (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, p. 475).

[282] As the initial of the *Livre du facon* (Pollard, *Early Illustrated Books: a History of the Decoration and Illustration of Books in the 15th and 16th Centuries*, pp. 153–155).

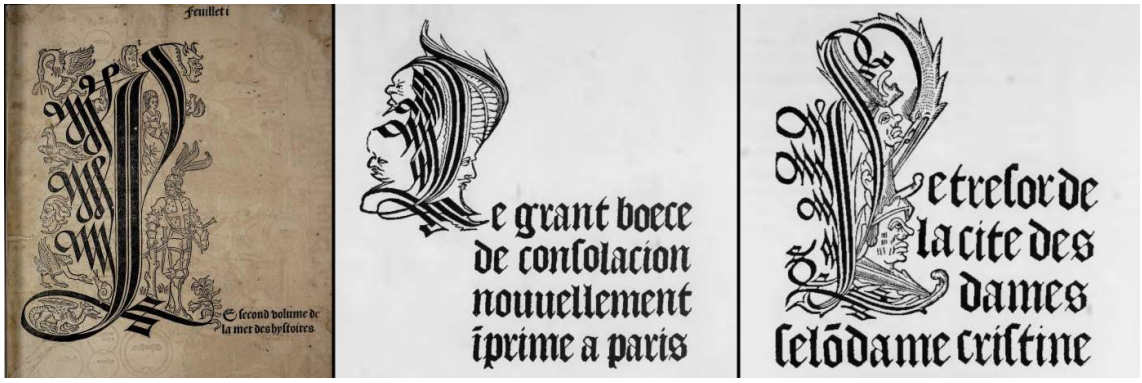


Figure 1.11: Initial grotesque L, from three printed editions. On the right: leaf of *Rudimentum novitiorum: La Mer des hystoire*, vol. I. Printed in Paris, VII 1488, by Pierre Le Rouge for Vincent Commin, illustrated with crude engravings (185 mm x 185 mm illustration dimensions). In Boston, Public Library, Q.402.51 pf, fol. 2^{v}. On the center: leaf from *Le Grand Boece de Consolation*. Printed in Paris, 19 VIII 1494, for Antoine Vérard, illustrated with unpainted engravings. From Claudin (1901, 469). On the right: leaf of *Le Tresor de la cité des dames* (original size unknown). Printed in Paris, 20 V 1497, by Pierre Le Caron. From Claudin (1901), p. 475. © Boston Public Library; Images in the Public Domain (centre, right).

to a royal crown before (1493) and to the customary hat (*c.* 1502) to make it a better fit to new editions[283]. Another fact is that publishers may sell worn sets to other masters, or they rented them out to other professionals, especially Vérard[284].

Due to the above facts, engravings are classified as the product of a print-house or a designer.

Finishers

Finishers or *relieurs* were decorators of book-bindings. Because their workshops were affiliated with the university, Sorbonne clerks or university undergraduates run these activities[285]. Alternatively, a few libraries also worked as "*relieurs de livres*", especially towards the end of the fourteenth century[286]. But bookbinding became a form of art only under King Henry II (*reg.* 1547-1559), when items were bound with rich decoration featuring linear frames, arabesque, interlacing strapworks combined with hatched tools and

[283] Louis-Gabriel Bonicoli et al. *Antoine Vérard's Early Printed Books in the British Library*. 2018. URL: %5Curl%7Bhttps://blogs.bl.uk/european/2018/07/antoine-v%5C'%7Be%7D%20rards-early-printed-books-in-the-british-library.html%20%7D (visited on 05/30/2020).

[284] Irène Fabry-Tehranchi. "Les imprimés sur vélin d'Antoine Vérard: d'Ogier le Danois au Merlin de la bibliothèque d'Henry VII enluminé par le maître de Jacques de Besanccon (1498)". In: *Mémoires du livre/Studies in Book Culture* 7.1 (2015). DOI: https://doi.org/10.7202/1035768.

[285] Delalain, *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*, p. xi.

[286] Delalain, *étude sur le libraire parisien du XIIIe au XVe siècle: d'après les documents publiés dans le cartulaire de l'Université de Paris*, pp. 41.

gold-tooled bindings aplenty[287]

1.3.3 Location of the shops

The locations of all phases of the book market-production, decoration, trade-were highly centralised[288]. This working environment originally spread from the vicinity of Sorbonne college, in Rue Saint-Jacques (fig. 1.12). So the first generation of post-Sorbonne masters set the two earliest print-shops here, *Soleil d'Or* (1475) and *Soufflet Vert* (1473). Among both, the *Soleil d'Or* evolved as a large family enterprise that survived through many generations of printers and booksellers. Initially. it was under the leadership of Ulrich Gering, then of his first associate Berthold Rembolt, the second associate Georges Maynial, Rembolt's widow Charlotte Guillard and Guillard's second husband Claude Chevallon, until 1557.

Close to this print-house, many other printing ateliers and the largest bookstores appeared in the following three decades. Among the group of print-houses, the enterprises *Clef d'Argent*[289], *Image Sainte-Barbe*[290], *Tres Pigeous*[291], *Lion enferré*[292], *Corne de Cerf*[293], Etienne Jehannot's[294] were the most important in this street, but also the book-

[287] Ward, *The Grove Encyclopedia of Materials and Techniques in Art*, p. 47.

[288] This section will not consider the whereabouts of the living quarters, only the position of the working areas.

[289] Shop of the printer-bookseller and *libraire-juré* from The Hague Wolfgang Hopyl (*fl.* Paris 1488-1522) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.67-74; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 206-207).

[290] Shop of the printer-publisher Denis Meslier (*fl.* 1490-1495) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.105-116; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 305).

[291] Shop of the printer-bookseller and *libraire-juré* from Poitiers André Bocard (*fl.* Paris 1491-1500) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, [vol. 2, pp.141-150; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 40).

[292] Shop of the printer-publisher from the Champagne Félix Beligault (or Baligault) (*fl.* Paris *c.* 1492-1506) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.193-208; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 16).

[293] He was printer-publisher and Master of Arts and he owned either the shop *Chevalier croisé* or *Pèlerin* (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.241-260; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 218).

[294] Shop of the *libraire-juré* Claude Jaumar (*fl.* 1493-1500) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.527-529; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*.

stores called *Image Saint-Claude*[295], *Pelican*[296], *Lion d'argent*[297], *Estrille Faulxveau*[298].

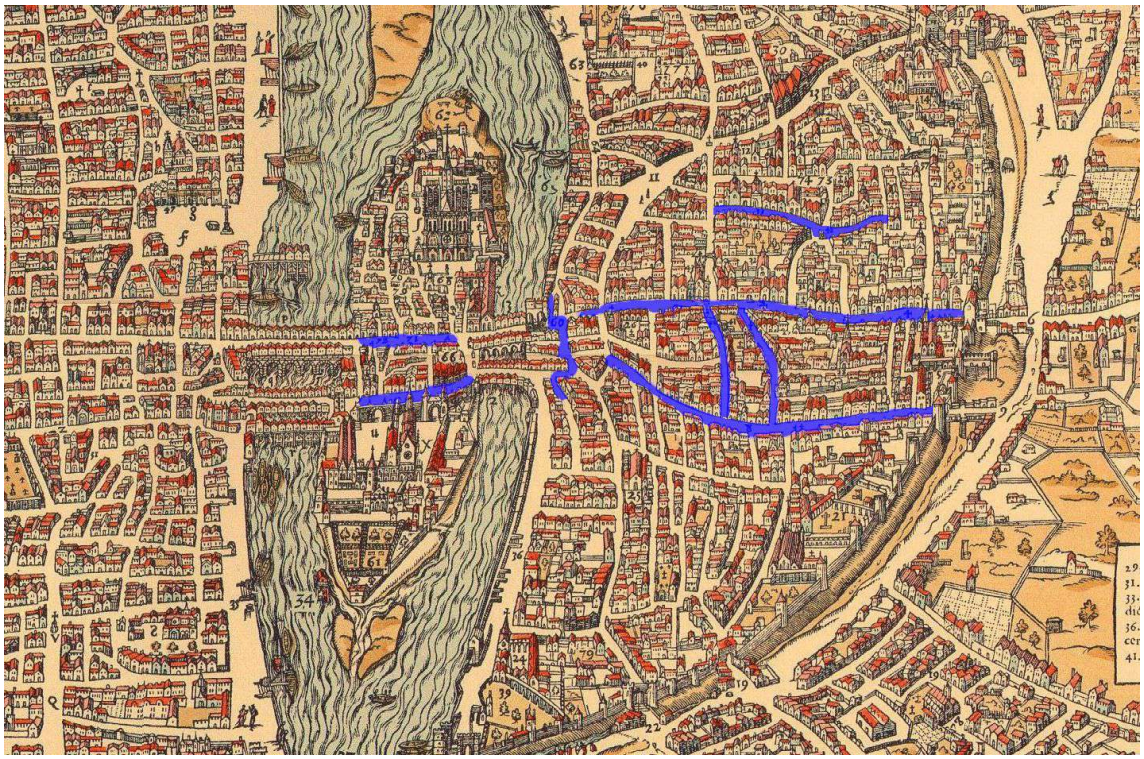


Figure 1.12: Map of Paris, with the main streets emphasized in blue. From *La Cosmographie universelle de tout le monde*, by François de Belleforest, tome 1, volume 1, plate [9], 1575. Engraving by Pierre Eskrich © Image in the Public Domain.

Nevertheless, these stores for the printed-book trade were not alone. The fourteenth and fifteenth centuries sworn and non-sworn *libraires* had previously created the book-trading neighbourhood here, for the records frequently mention the streets touching Sorbonne college[299]: *Rue Saint-Jacques* (4), *Rue Neuve Notre-Dame* (3), *Rue des Noyeres* (3), *Rue*

[295] Shop of the brothers Marnef Enguilbert (*libraire-juré*, *fl.* 1491-1533) and Geoffroy (*libraire-juré*, *fl.* 1489-1518). Enguilbert's offspring would continue the business outside Paris, in Poitiers, Agers, Bourges (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 296-297).

[296] Shop of the *grand libraire-juré* Jean Petit I (*fl.* 1492-1530) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.533-543; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 339-341).

[297] Shop of the Master of Arts and *libraire-juré* Durand Gerlier (*fl.* 1499-1529) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.521-523; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 169).

[298] Shop of the printer-publisher from Strasbourg George Mittelhus (*fl.* 1488-1500) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.5-12; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 310).

[299] The numbers between brackets record the number of *libraires* and *libraires-juré* as found in Delalain essay on university charters (2012). This list reveals scarcity of information on the actual locations occupied by the fifteenth century generations since the last address that Delalain reported dates 1385.

de la Parcheminerie (2), *Rue de Boutebrie* (2)[300]. The next generation of print books traders created a continuity of workers and techniques from the medieval tradition but also of places.

Additionally, on the mentioned *Rue de la Parcheminerie* also located the dealers of parchment and paper[301] and illuminators, after which the street was also called *Rue des enlumineurs*[302]. Other parchment-makers were in *Rue de Saint-Séverin*[303].

The shops were near one another on parallel streets interconnected to each other, which resulted in a clustered commerce. The trading aggregate was based on the Left Bank of the Seine, in two different fiscal parishes[304], the first one was called *St. Benoît* parish while the second was *St. Séverin* parish (fig. 1.13). The first district was named after the sixth-century church *Saint-Benoît-le-Bétourné* in *Rue Saint-Jacques*, dedicated to the martyr saints Sergius and Bacchus[305]. The second district was denoted after the other church Saint-Séverin. Both parishes were part of the area that sheltered the Sorbonne and several noble houses and corresponded to a district traditionally devoted to the book market.

Over time, more shops opened in the proximity of the bridges connecting the *Île de la Cité* to the two Banks in between of the bridges *Pont Nôtre Dame*, *Pont Saint-Michel*, *Petit*

[300] Putnam, *Books and their Makers during the Middle Ages: A Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century*, p. 262; Rouse et al., *Manuscripts and their Makers: Commercial Book Producers in Medieval Paris, 1200–1500*, I, p. 17-49.

[301] Rouse et al., *Manuscripts and their Makers: Commercial Book Producers in Medieval Paris, 1200–1500*, I, pp. 17-49.

[302] Rouse et al., *Manuscripts and their Makers: Commercial Book Producers in Medieval Paris, 1200–1500*, I, pp. 17-49.

[303] Putnam, *Books and their Makers during the Middle Ages: A Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century*, p. 262.

[304] With reference to the fiscal divisions from the *Livre des tailles* made under King Philip the Good and based on the study by Slivinski et al., "Taxation Mechanisms and Growth in Medieval Paris".

[305] The church existed until the early nineteenth century, after which period it was demolished. In the 1874 map *Le vieux Paris. Plan topographique de la montagne Ste-Geneviève à Paris du XVIe au XIXe siècle avec texte explicatif* by Verniquet, the church had already disappeared from the urban plan.

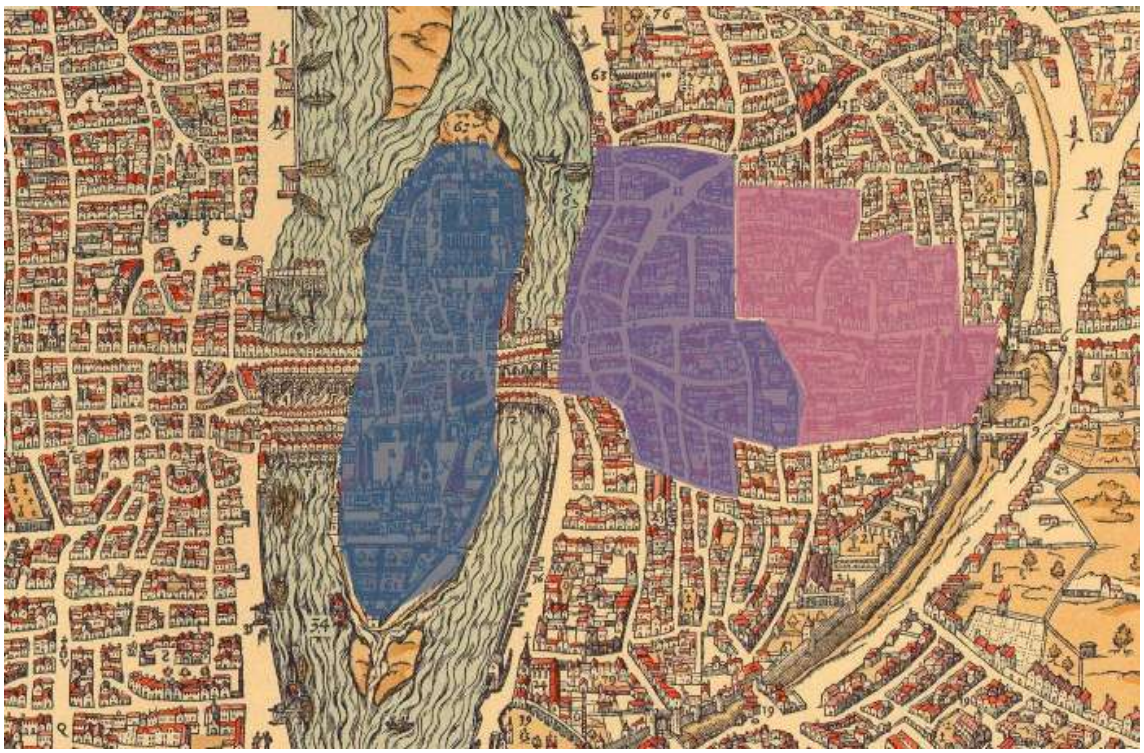


Figure 1.13: Map of Paris, with the fiscal division to parishes based on the records of the Taille as found from Slivinski et al., 2009, p. 24. Adapted from Figure 1.12.

Pont, *Pont au Change* (where the shops *Image Saint-Laurent*[306], *Chantres*[307], *Licorne*[308] settled). Other shops were on the same *Île de la Cité*, like the *Image saicte Margarete*[309]. Despite the fact, a general trend of abandoning the *Pont Nostre Dame* is observed around 1499, the year when the fragile wooden bridge collapsed .

Apart this information, no exact information is known on the whereabouts of

[306]Shop of the printer-bookseller Jean Trepperel (*fl.* 1491-1511), where he stayed until 1504, when he moved to *Rue Neufve Notre Dame* (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.174; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 413-414).

[307]Shop of the small printer-bookseller Jeans de Coulonce (*fl.* 1492-1505) (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.549-550; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 97-98).

[308]Shop of the printer-publisher of Coblentz Thielman Kerver (*fl.* Paris 1497-1522). The first shop located in *Rue des Mathurins*, close to the Hôtel de Cluny. In 1499 he opened the shop in the whereabouts of the *pont Saint-Michel* (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, [vol. 2; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 223-225).

[309]Initially the shop was named *Rose dor* and located between pont au change and Pont Notre Dame (1499-1509). It was moved to "*deuant saint denis de la chartre*" in 1509 (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 197-198). About the shop *Image saincte Margarete*, it could be the activity of book-selling that Germain run as Gillet was alive. Later, Germain could have maintained his own shop transforming it into a print-house.

goldsmiths nor book-binders (*relieurs*) while peddlers hovered in the whereabouts of churches[310].

1.3.4 Patterns of early printed book production

As seen, the market of manuscripts was a well-structured business coordinated mostly by *libraires*, which were initially University affiliates (*libraire-juré*). The few non-affiliates (*libraires*) worked as members of the crafts guild of St. John, which encompassed all professions related to book-making and material supply of the city: illuminators, parchment-makers, paper-dealers and book-binders.

The University controlled the best part of the book production because of the magnitude of the undergraduates and for the fiscal advantages of its membership. The fact is also proved by the geographic centralisation of the book-making enterprises to the Sorbonne colleges, which was critical to the methods developed for producing books. Indeed, most of the related activities of making and decoration were not only located on the same bank of the Seine river but also streets surrounding the Sorbonne college.

Since the producers of the printed books were either masters who completed their training as printers in print-houses, or manuscript-makers who turned to the press, those who previously were active in the deluxe production re-used their experience to promote quality in printed books by acting as sponsors of their production. In these projects, they would apply their knowledge on page layout, embellishment, or simply their own network to place market quality books in the market. Next to those coordinators, further professionals oversaw only the process of printing. As mentioned previously, this class of professionals was originally imported from Germany and the Low Countries to set up the working class of this production line. Only later French printers pursued apprenticeship and entrepreneurship locally.

Accordingly, the printing class structured a broad market where portions of book projects were created by professionals with specialisation. So publishers increasingly placed themselves in the market as the responsible for the design and trade of the produced books while printers were the producers and artists were the decorators and finish-

[310]Putnam, *Books and their Makers during the Middle Ages: A Study of the Conditions of the Production and Distribution of Literature from the Fall of the Roman Empire to the Close of the Seventeenth Century*, p. 262.

ers. The arising specialisation became a structuring condition for the book production, resulting in a decentralisation of the working area.

Considering these facts, book production appears to be product of a plurality of sites commercially interconnected rather than a single location. To support mutual connections, the makers started their activities in the proximity of their business partners. The result was that each book project was a network task divided into smaller phases realised by specialised workers in their own studios and that the neighbourhood contributed to its accomplishment.

1.4 Brief history of the printers of Books of Hours in Paris (*c.* 1485-1550)

On the basis of the above information, the first printed Book of Hours appeared as part of a 1485-edition by Antoine Vérard[311]. Though the decoration of these books is quite severe (it consists of hardly ten woodcuts) this project was overall ambitious. Only in the year before, Pasquier Bonhomme issued an edition that supplemented the printed text with one engraving as its illustration[312], not without great technical difficulty (for the reasons specified earlier). Engravings existed mostly as independent artworks when Paris lived the infancy of its printing industry, so Vérard's ambition of marrying the classic technique with textual print presented practical perils. One of these difficulties was the local lack of a professional category with training in shrinking cutting plates to suit the relatively small format of book editions. Another was to choose the most fitting materials

[311] Macfarlane, *Antoine Vérard*, p. xxviii dates the earliest publication of this kind back to 1486 based on the calendar of an in-16.ř Book of Hours in the BnF which bears 21 August 1486 (Vélins 2868, see Appendix A), Inc. 32). Another instance occurred during the research was a *Horae ad usum Romanum* [Paris: Jean Du Pré or Chablis: Jean Le Rouge] for Antoine Vérard, 12 September 1485 sold by Sotheby's to the Morgan Library and Museum (New York) as a gift of the B. H. Breslauer Foundation and on the B. H. Breslauer Foundation Fund, the Curt F. Bühler Fund, the Lathrop*c.*Harper Fund, and the Gordon N. Ray Fund (2007) (Winn, *Anthoine Vérard: Parisian Publisher 1485–1512: Prologues, Poems, and Presentations*, no. H-2; GW 13143; Schäfer 160; ChL1447C) (not in Macfarlane, Lacombe or Bohatta). Now the book is known under the accession number PML 129974. However, this last reference agrees with the most recent scholarship on Vérard (Mary Beth Winn. "Illustrations in Parisian Books of Hours". In: Incunabula *and their readers*. Ed. by Kristian Jensen. London: British Library, 2003. Chap. 3, pp. 31–52; Cristina Dondi. "Books of Hours: The Development of the Texts in Printed Form". In: *Incunabula and their readers*. Ed. by Kristian Jensen. London: British Library, 2003, pp. 53–70).

[312] See Section 1.3.1.

to match presses' hardness. Therefore, both Vérard and Pasquier must have experienced the same troubles: as a matter of fact, Vérard's Decameron edition of the same year (*c.* 1485) employed only one illustration[313]. Next to technical limitations, another likely factor that governed the shape of the pioneering project must have been Vérard's seeming shortage of sources.

The details around the origins of Vérard as a publisher are still uncertain. The few details in possession of the printing scholarship consist of the knowledge of a modest start, as he issued few small projects that do not date earlier than 1485[314] (figs. 1.14 and 1.15). The result of relatively limited financial and technical means could be the major cause for the rough appearance of these primordial editions, but also other factual parameters may have come into play. Differently from other professionals of the printed book, Vérard was a mere publisher, which fact made him rely heavily on other printers for making and patrons for sponsorship. This hypothesis finds historical support in the fact that as a fresh publisher, Vérard outsourced the local printer Pierre Levet[315] to press projects and found in Nicole Gilles, attorney and royal secretary (1475-onward), a stable patron[316]. The details around neither of the two collaborations, Levet-Vérard and Gillet-Vérard, have been historically resolved yet. However, it is possible to guess that the aforementioned professional network of printers[317] was not fully in place yet.

It is well known that the printing industry was officially introduced in Paris a decade and a half before (1470), and as they became increasingly independent from the Paris *studium*, printers generated other products than university texts or university-related literature. Not only the literary range of book production was in a phase of expansion, but also printed books were in a phase of evolution from mere books produced through the printing press to visually distinct products, especially after their coupling to engravings. The first illustrated books appeared in Europe in 1481; slightly later (1484), in Albi (Langue-

[313](Duff, *Early printed books*, p. 84). However, it is questioned whether this edition might be regarded as the first illustrated edition by him: another view proposes that the 1485-edition of Book of Hours is the earliest edition by Vérard. See Section 1.4.

[314]Duff, *Early printed books*, p. 84; Pollard, *Early Illustrated Books: a History of the Decoration and Illustration of Books in the 15th and 16th Centuries*, p. 149.

[315]Rémy Scheurer. "Nicole Gilles et Antoine Vérard". In: *Bibliothèque de l'école des Chartes* 128.2 (1970), pp. 415–419, p. 416.

[316]He exerted under the French Kings Louis XI, Charles VIII and Louis XII: see Scheurer, "Nicole Gilles et Antoine Vérard", p. 415.

[317]See Section 1.3.4.

Figure 1.14: Double-leaf view of a *Horae ad usum Romanum* (Roman Mass rite), [Paris: Jean Du Pré or Chablis: Jean Le Rouge] for Antoine Vérard, 12 September 1485 (120 mm x 84 mm copy leaf dimensions). In New York, PML 129974, fols. [2]-8^{v}, a1^{r} © The Morgan Library & Museum.

doc) a Tucremata's edition of *Meditationes* was printed including text and illustrations, while Pierre Bellesculée and Josses issued *Coutomes de Bretagne* and *Floret en francoys* (Renne), and Schenck pressed an illustrated edition of *L'Abuzé en court* (Vienne)[318]. Therefore, the Paris printing industry started mingling such carving techniques as engraving and regular press in a decade where it was still quite new to the craft, so Bonhomme and Vérard's early inclusion of cuts into the text-block frame was ground-breaking.

Vérard's initiative of venturing into the production of Books of Hours in the press was successful because of his design of pouring the appeal of art objects into these books while understanding the potential of such business[319]. In partnership with the printer Jean Du Pré, also called Jean Dupré, Vérard produced two editions in 1488 and 1489 with much

[318] Pollard, *Early Illustrated Books: a History of the Decoration and Illustration of Books in the 15th and 16th Centuries*, pp. 146-147.

[319] Vérard's activity of patron of printed Book of Hours was also innovative in the rest of Europe. The first Book of Hours was released as a print in 1481 in Italy

Figure 1.15: Double-leaf view of a *Horae ad usum Romanum* (Roman Mass rite), Paris, Jean Du Pré for Antoine Vérard, 21 August 1486. In Paris, BnF, Velins 2868, fols. 20^{v}-21^{r} © Source BnF.

finer cuts than the early editions of 1485 and 1486[320]. The individual illustrations from these two editions were surely in a more elaborate style than before, but the true innovation was in the whole set of decoration: illustrations framing the text had the shape of figurative side borders located on the top, bottom and side margins of each leaf throughout the entirety of these books. Also, these books have a distinctive graphic design with consistent hierarchy of decorated bordures: the top engravings display moral mottoes from the Book of Psalms-"the Earth has given its fruit"[321], "heavens are marked by the Lord's Word"[322], while the internal-side illustrations refer to ancient biblical passages-"may the sky be in between of waters; and may it divide waters [...] "the Lord named the sky heaven"[323]. Part of the books could be further lavishly coloured at the taste of individual patronage, as in the case of the *horae* below (fig. 1.16).

Vérard also significantly pushed *horae* business by designing the mentioned bespoke editions for individuals like the mentioned "royal Hours" (*Heures royales*). In accom-

[320] It is unclear whether these two editions were produced independently or under the patronage of Vérard: Tenschert claims that two copies listed in his catalogue (Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, I–IX, no. 50-75) were the product of the Dupré-Vérard partnership. Part of the material for illustration of the *Petites Heures royales* seems to be supplied by Etienne Jehannot. See Leon Techener. *Bulletin du bibliophile*. Vol. 7. Paris: Henri Leclerc, 1901, p. 321.

[321] "*Terra dedit fructum suum*" (Vulgata, Psalm 66: 7).

[322] "*Verbo Domini coeli firmati sunt*" (Vulgata, Psalm 32: 6).

[323] "*Fiat firmamentum in medio aquarum. Et dividat acquae ab aquis*" (Vulgata, Genesis 1: 6-7).

Figure 1.16: Double-page view of a Book of Hours lavishly decorated with figurative borders with scenes of the Genesis (120 mm x 84 mm copy leaf dimensions): on the left, *Creation of the firmament and division of water (second day)*; on the right, *Creation of dry lands and seas, grass, herbs and trees (third day)*. From a *Horae ad usum Romanum* (Roman Mass rite) [Jean Du Pré (printer of Paris)], for Antoine Vérard, 1488/89, hand-coloured. Book from a private collection.

plishing this purpose, he appealed to his impressive network of dukes, duchesses, kings. Among his contacts were King Charles VIII of France, Louise de Savoie, François d'Angoulême[324], King Henry VII of England[325]. As a result, printed Books of Hours became renowned and appealing also for other printers to produce.

After Vérard's input, a large group of publishers launched on a large-scale production of Books of Hours[326] in the next decade, the 1490s: Philippe Pigouchet (both alone

[324]Mary Beth Winn. "Books for a Princess and her Son: Louise de Savoie, François d'Angoulême, and the Parisian *Libraire* Antoine Vérard". In: *Bibliothèque d'Humanisme et Renaissance* 46.3 (1984), pp. 603–617.

[325]Fabry-Tehranchi, "Les imprimés sur vélin d'Antoine Vérard: d'Ogier le Danois au Merlin de la bibliothèque d'Henry VII enluminé par le maître de Jacques de Besanccon (1498)"; Gordon Kipling. "Henry VII and the Origins". In: *Patronage in the Renaissance; Princeton; Princeton University Press Henry VII and the Origins of Tudor Patronage*. Ed. by Guy Fitch Lytle et al. Princeton: Princeton University Press, 1981, pp. 117–164.

[326]Febvre et al., *The coming of the Book: the Impact of Printing 1450-1800*, p. 186.

and in partnership with Simon Vostre), Thielman Kerver, Geoffroy de Marnef, Guillaume Eustace, Guillaume Godard and François Regnault[327], just to mention the noteworthy. Most of these workers were librarians and publishers, but there were also publishers-booksellers. A smaller cluster was represented by occasional printers who joined or ventured into small editorial projects: such is the case of Robin Chalot and Jean de Coulonce, that produced and sponsored small editions of Books of Hours at the end of the fifteenth century[328]. Similarly to Vérard, these printers structured largely visual designs in which many engraved illustrations regularly complemented texts. This fact becomes clear when representative pages from printers are compared stylistically (fig. 1.17).

Figure 1.17: Two full-pages of Books of Hours printed in Paris at the beginning of the sixteenth century. On the left, *Horae ad usum Romanum* (Roman Mass rite), Philippe Pigouchet for Simon Vostre, *c.* 1502 (230 mm x 164 mm single leaf dimensions). In Lisbon, BNP, Res.329.v, fol. c3^{v}). On the right, *Horae ad usum Romanum* (Roman Mass rite), Guillaume Anabat for Gillet and Germain Hardouyn, *c.* 1508 (245 mm x 160 mm). In Paris, BnF, Rés. 8-T-2520, fol. B1^{r} © Duarte Belo and the Biblioteca Nacional de Portugal, Source BnF.

Looking at the figure above, it is clear that the two pages from Anabat and Pigouchet's

[327] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2.
[328] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.549.

horae replicate the same layout as Vérard, only with slight differences. The major dissimilarity is that, from one side, the two printers-booksellers included diverse illustrations in their Hours across editions. For instance, Pigouchet created some *Hours ad usum Sarum* with figurate bordures in Gothic style portraying the sacraments of the English Church, specifically-carved scenes of the life of Christ, zodiacal signs, precursor signs of the Apocalypse and Last Judgement or the celebrated *Danse macabre des Hommes et des Femmes*[329] (fig. 1.18). On the other side, these editors made use of technically more mature artists such as designers of engravings or cutters of metal- and wood-blocks (engravers). Among the first class of masters, the most active in Paris and beyond[330] was Jean d'Ypres, *dit* Apocalypse Master[331]. The second great difference between these Hours and Vérard's was the promotion of engravings to chief artistic technique to such a fine extent that Pigouchet's Hours set themselves free from illumination. As refined as well-balanced in black and white, these illustrations peak in elegance into a new mode than the traditional illumination[332]. Indeed, further embellishment in colour is hardly necessary since any paint supplement must outstand to live up to the engravings' gracefulness.

Another important progress of Pigouchet in the history of printed Books of Hours is his establishment of the custom of referring to a specific artist for engraving design, in this case Jean d'Ypres. Excluding Pigouchet[333], the same style is found in other printers. The

[329]The full set included sixty-six dancers and was probably owned a Vostre's possession (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.42-54), for more info on the sets, see Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, vol. 1, no.16. The set was also copied by Guillaume Godard-see *Appendix A* for the full digital version of an item that displays this set (Saumur, Château-Musée, inc. 0041, early printed source no. 38.

[330]Not only in Paris, also outside: Zöhl & Nettekoven cite other professionals outside Paris within Ypres' clientele, which also included Gerard Leeu, printer in Antwep, Jacques Le Forestier, printer in Rouen. See Ursula Baurmeister. "Was Jacques Le Forestier the Printer of The Horae ad usum Sarum of 1495?" In: *The British Library Journal* 9.1 (1983), pp. 66–75. DOI: https://doi.org/10.23636/673; Koen Goudriaan et al. *Een drukker zoekt publiek: Gheraert Leeu te Gouda, 1477-1484*. Delft: Eburon, 1993; Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, pp. 47-48; Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", pp. 36-38.

[331]See Section 1.3.2.1.

[332]Indeed, some technical innovations like the *manière criblée* appears in this period. One of these engraving masters might be Pigouchet himself. A good part of the full-page set of metalcuts that Pigouchet might have engraved himself is in a printed book now in the Staatsbibliothek of Berlin, L.impr.membr. 38. See *Appendix A* early printed source no. 23 for a link to its full digital version.

[333]This master designed several sets of metal-cuts for Simon Vostre and the same Pigouchet: one is the 1495-1498 21-piece set for Vostre (see Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 49-52). Historical instances of this set are listed in (Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der*

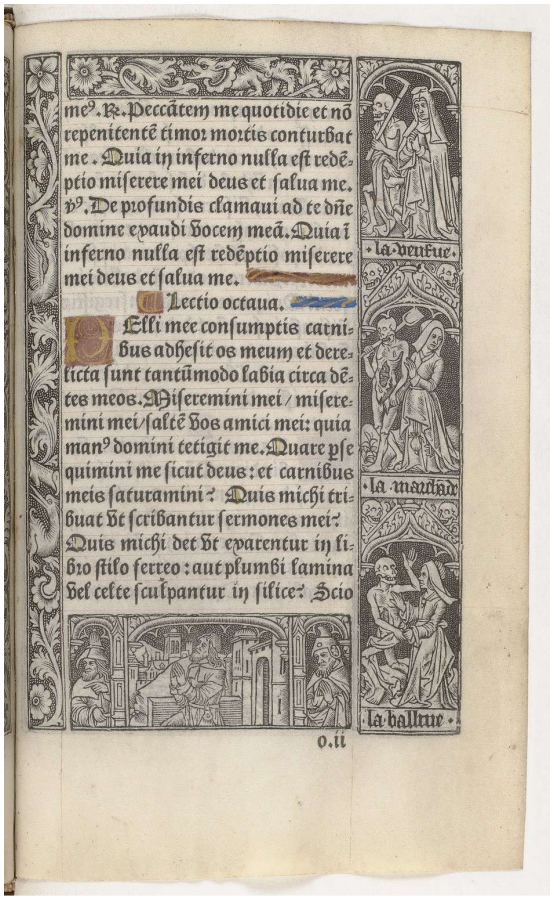


Figure 1.18: Full-page of a *Horae ad usum Romanum* (Roman Mass rite), Paris, [1502], Philippe Pigouchet for Simon Vostre, printed on parchment with uncovered engraved borders (leaf dimensions unknown): on the external margin, Vostre's borders from the sixty-six set of the *Danse macabre des hommes et des femmes*. From top to down, the following dancers are featured: *The widow* ("*la veuve*"), *The merchant's wife* ("*la marchande*") and *Baillif's wife* ("*la balline*"). In Paris, BnF, Rés. 8-T-2526, fol. O2^{r}. On the top and internal margin, there is a narrower border in *manière-criblée* displaying Gothic *drôllerie*; on the bottom margin, two prophets flank a praying man © Source BnF.

peculiar design of the well-rounded artist clearly emerges in some editions of Hours by Antoine Chappiel for Gillet Hardouyn[334], by Jean Dupré after 1489[335], or by the Thielman Kerver- Georg Wolff association[336] (fig. 1.19).

Sammlung Bibermühle 1490–1550, vol.1, no. 14.1-14.5, 15, 15a, 15b, 15.1, 16, 17, 17a, 17.1, 18, 18.1, 18.2, 18.3, 19, 20, 40, 41, 42, 43, 44, 45, 45.1, 45.2, 45.3, 45.4, 45.5, 46, 47, 47.1, 48, 48a, 49, 50, 50.1, 50.2, 51, 51.1, 52, 89.1, 93, 94, 94a, 95, 95a, 96, 96a, 96.1, 96.2, 97, 98, 98a, 98b, 99, 99a, 99.1, 100, 101, 101a, 101.1, 101.2, 102, 102a, 103, 103.1, 103.2, 103.3).

[334] A personal survey at the British Library (London) provided instances of copies of this edition: BL, C.29.k.24, a Horae ad usum Rotomagensem printed in Paris, 19 I 1504, *Quarto*-format (agenda format), by Antoine Chappiel for Gillet Hardouyn.

[335] (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", pp. 25-28)-historical instances of this set are listed in (Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, I, no. 11.6, 38, 39, 39.1, 39.2).

[336] This set dates 1497 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit

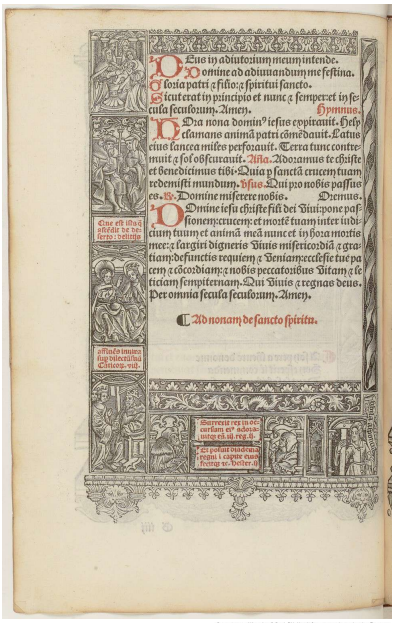


Figure 1.19: Full-page view of a *Horae ad usum Romanum* (Roman Mass rite), Paris, 1525, printed by Thielman Kerver (leaf dimensions unknown). The engraved borders are carved in a style quite close to the German school of engraving. In Paris, BnF, 4-T-943, fol. G4^{v} © Source BnF.

Thus, Vérard set initially put the business of service-books into place, at a much earlier time than the rest of Europe. Such a market grew interlaced to a given pattern of decoration. Regarding the late-fifteenth century book, its design was predominantly Gothic. The combination of harmony, balanced compositions, naturalism and attention to the beauty of the Renaissance would arise in printed books only at the turn of the sixteenth century, which marked the transition to another phase of production. The novel style found its most eloquent agent in the mentioned Jean Pichore[337], who elaborated the bulk of exquisite full-page illustrations of the martyrdom of St. John the Baptist[338], the Infancy

Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 53] and it can be found in several instances of the Tenschert catalogue (Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, I, no. 25.2, 26, 27, 28, 32, 86).

[337] See Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*.

[338] They represent two scenes of the martyrdom of St. John the Evangelist according to the *Golden Legend*, namely *St. John boiling in oil*: 1504-1506-Pichore set for Thielman Kerver, no. 1 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 76), 1504-1506-Pichore set for Simon Vostre, no. 1 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 72), *c.* 1508-Pichore set for Guillaume Anabat, no. 1 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 86), *c.* 1508-Pichore set for Guillaume Eustace, no. 1 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 90), *c.* 1509-Pichore set for Gillet and Germain Hardouyn, no. 1 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 104). The second image is

cycle[339], Passion cycle[340], stories of David and Uriah[341], *Last Judgement*[342] and other representations connected with the notion of death[343] that differentiate the Office of the Virgin, Office of the Cross, Office of the Holy Spirit, Penitential Psalms and Office of the Dead of these years. The Renaissance vigour began with Pichore, as he ventured briefly

John drinking the poisoned cup, 1505-1509-Pichore set for Gillet and Germain Hardouyn, no. 1 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 82).

[339] All sets include *Annunciation*, *Visitation*, *Nativity*, *Adoration of the Magi*, *Annunciation to the Shepherds*, *Presentation to the Temple*, *Flight into Egypt*, *Coronation of the Virgin / Death of the Virgin* may be defective in the *c.* 1509-Pichore set for Gillet and Germain Hardouyn (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", pp. 104-106, all the series). A limited number of sets include the rare images of *Augustus and the Sybille Tiburtine* (1504-1506-Pichore set for Simon Vostre, cuts 4 and 4b (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", pp. 72-73) and *Church and the virtues* (1505-1509 Pichore set for Gillet and Germain Hardouyn, no. 3 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 82).

[340] It included *Jesus seized in Gethsemane* (a), *Flagellation* (b), *Jesus before Pilates* (c) *Crucifixion* (d), *Massacre of the Innocents* (e), *Christ carrying the Cross* (f) in the 1504-1506-Pichore set for Thielman Kerver (d: no. 10), 1504-1506-Pichore set for Simon Vostre (a: no. 2; e: no. 9; f: no. 11) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", pp. 72, 76), *c.* 1508-Pichore set for Guillaume Anabat (a: no. 2) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 86), *c.* 1508-Pichore set for Guillaume Eustace (a: no. 2; b: no. 11) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", pp. 90, 92), 1509-Pichore set for Gillet and Germain Hardouyn (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 104), 1505-1509-Pichore set for Gillet and Germain Hardouyn, (d: no. 12) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 84), 1509-Pichore set for Gillet and Germain Hardouyn (a: no. 2; d: no. 5; e: no. 7) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", pp. 104-105), *c.* 1509-Pichore for Barbier set (b: no. 27; c: no. 26; d: no. 24; f: no. 28) (see Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", pp. 97-98). The *c.* 1509 set of Pichore for Barbier is the most complete, for it includes the whole Passion cycle.

[341] *King David ordering the death of Uriah* (a), *Death of Uriah* (b), *Bathsheba bathing at the fountain* (c), *Solomon in judgement* (d), *David enthroned with court* (e) are found in the following sets: 1505-1509-Pichore set for Gillet and Germain Hardouyn, (a, b: no. 14-15) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 84), *c.* 1508-Pichore set for Guillaume Anabat (c: no. 14; d: no. 13; e: no. 15) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 88), *c.* 1508-Pichore set for Guillaume Eustace (a: no. 13) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 92), 1509-Pichore set for Gillet and Germain Hardouyn (c: no. 9) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 105).

[342] *c.* 1508-Pichore set for Guillaume Anabat (a: no. 16) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 89).

[343] *Raise of Lazarus* (a), *Job on the dung heap* (b), *Lazarus and Dives* (c) are found in the following

into the printing activity in association to Rémy de Laistre around 1503. Slightly later (*c.* 1508), he tried his hand at mass-production of tools for illustration by designing sets of wood and metal cuts for several printers-booksellers and booksellers[344], and pursued in this trade until the middle of the following decade (mid-1510's).

The result of his rich activity of designer was that the local market was flooded with the novel imagery. Differently from d'Ypres, Pichore elaborated his figurative patterns under the strong influence of the Italian style of painting, which was in vogue among the cultural elites in this age.

The *Flagellation* below (fig. 1.20) illustrates wonderfully such transition in design: the marble tiles of the floor are regularly placed and drawn in perspective so that the observer can assess at a glance the size of the room in which Jesus is scourged by the Roman soldiers, designed in the classic style of architecture. Also, the artist was extremely careful in sketching and shading the body parts. A good part of the Italian Renaissance is here in place: linear perspective, realism, awareness of anatomy, figure composition and classicism.

Through his attention to Italian influences, Jean Pichore also paved the way to new ways of crafting visual content. Following this fashion, other Parisian artists expressed this "*art noveau*" like the anonymous master in the style of Dürer, who designed a small set for the Hardouyns (*c.* 1516)[345], or Noël Bellemare and the Master of François de Rohan[346] and the printer-publisher Geoffroy Tory, the latter creating (and probably carving)

sets: 1505-1509-Pichore set for Gillet and Germain Hardouyn, (a: no. 16) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 85), *c.* 1508-Pichore set for Guillaume Anabat (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 86), *c.* 1508-Pichore set for Guillaume Eustace (a: no. 14) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 92), 1504-1506-Pichore set for Simon Vostre (b: no. 14) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 74), 1504-1508-Pichore set for Simon Vostre (b: no. 14) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 81),1505-1509-Pichore set for Gillet and Germain Hardouyn (a: no. 16; c: no. 17) (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 85).

[344] In this case, they might borrow the illustrations as working materials to the printers working on joint collaborations.

[345] See the next Chapter.

[346] (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 141).

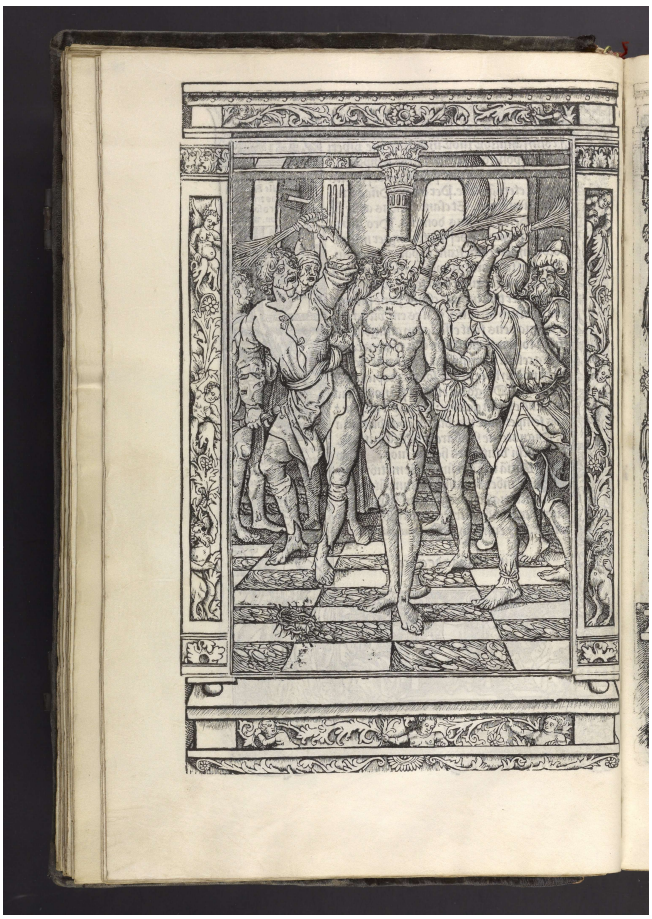


Figure 1.20: Metalcut representing the Flagellation of Christ, piece no. 10 from the *c.* 1509, *Quarto*-format series in the style of Jean Pichore for Gillet and Germain Hardouy (245 mm x 160 mm single leaf dimensions). From *Horae ad usum Romanum* (Roman Mass rite), Paris, [after 1509?], Guillaume Anabat for Gillet and Germain Hardouyn, UPenn, Ms. Codex 1531, fol. 24^{r} © University of Pennsylvania.

exquisite Italian Renaissance illustrations for his own use[347] (fig. 1.21). It follows that other artistic movements than the long-lived Gothic became appealing, but there were also other consequences of the early sixteenth -century vigour.

As the local artists became more skilled and capable of morphing the elaborate designs of multi-talented artists into useful tools, they also devised a combination of engravings. The most intriguing of the elaborated strategies is the Italian Renaissance tabernacle frame, also called "molded frame"[348], added to encase the full-page illustrations of the main offices. Printers mounted illustrations into such frames because across the different

[347]He carved several sets: one in *c.* 1525 (Zöhl et al., "Chronologische Beschreibung der wichtigsten Hauptbilderserien mit Auflistung und Abbildung der Einzelbilder und Nachweis ihres Vorkommens", p. 129).

[348]On the architectural frames in illuminated books, see Orth, "What Goes Around: Borders and Frames in French Manuscripts".

Figure 1.21: Full-page illustration in the Italian school of engraving featuring the *Adoration of the Magi*, from a *Horae ad usum Romanum* (Roman Mass rite), Paris, 1525, Geoffroy Tory, partially coloured (*c.* 240 mm x 157 mm single leaf size). In Paris, BnF, Rés. 4-RE-28, fol. 43^{r} © Source BnF.

edition, the shape of the surrounding decoration changes accordingly (fig. 1.22).

Technical innovation, expansion of the market and the impact of other artistic influences caused the development of print houses styles. Therefore, starting from the 1510's, two major forms of books arose: on one side, the book design inherited from Vérard shifted gradually to the Renaissance book, yet maintaining an alike assemblage of images, as is the case for Pigouchet, Eustace, Chappiel, Anabat. On the other side, individual workshops created their own style of decoration. Among this last class, there was Thielman Kerver and his German style of decoration, with engraving reminding Dürer's woodcuts, the refined and Italian Renaissance Geoffroy Tory and the lavishly illuminated books of the Hardouyns, that are studied in this thesis.

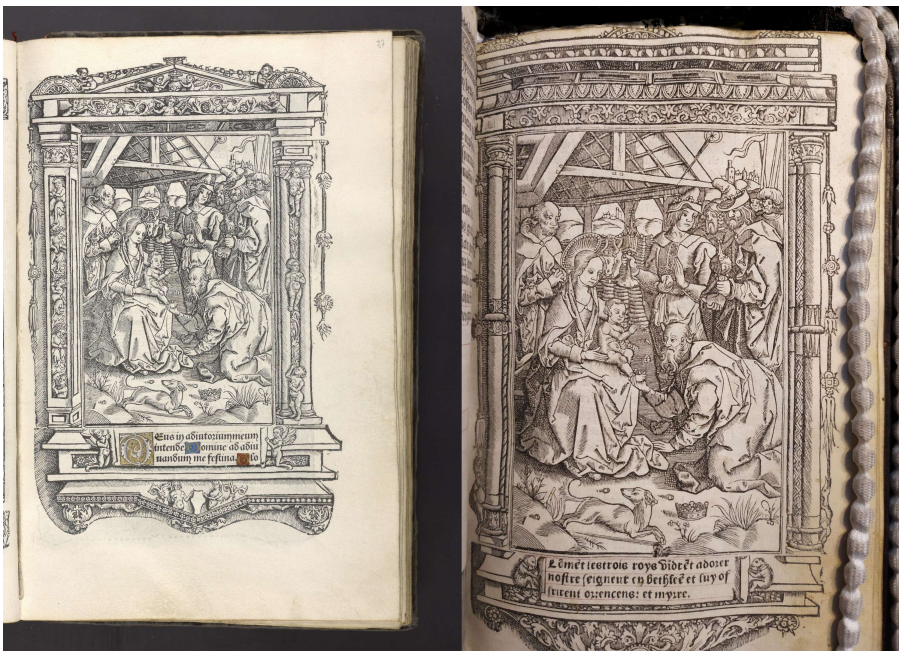


Figure 1.22: Full-pages of the same metal-cut of the Adoration of the Magi from two *Horae ad usum Romanum* (Roman Mass rite) made by Guillaume Anabat for the Hardouyn workshop framed with different Italian Renaissance tabernacle frames (245 mm x 160 mm single leaf size). On the left, UPenn, Ms. Codex 1531, fol. 37^{r}; on the right, C.29.h.11, fol. E6^{r} © University of Pennsylvania, British Library Board.

1.5 The Hardouyns' workshop

The history of the print house run by the Hardouyn brothers, Gillet[349] and Germain, can be ideally divided into five phases of activity: 1491-1509 (first), 1509-1521/3 (second), 1521/3-1525/6 (third), 1525/6-1541 (fourth) and 1541-1550 (fifth and last).

This workshop was one of the most celebrated as for the production of printed books of devotion. Its success reflected on a long-lived activity, which in fact covered a spell of several decades.

1.5.1 First phase: from 1491 to 1509

In the earlier 1490s, Gillet opened a bookshop in the proximity of the cathedral of Notre-Dame[350]. Judging from the colophons of the period, the earliest venue was located in the vicinity of the *Pont au Change*[351], on the *Île de la Cité*. Not much is known on this

[349] Also called *Gilles*

[350] Müller, *White Magic: The Age of Paper*, p. 76; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 197-198.

[351] "*Sur le pont au change aupres de la belle Ymaige nostre Dame.*". The statement has been found in the following editions: BL, C.29.c.14 (Bohatta, 1924: no. 898, 40; Moreau 1972: I, 112; Tenschert et al.,

business activity and its owner, aside from the fact that Gillet already had the status of *libraire-juré* at that time, and that the enterprise was denoted with an emblematic symbol, following the custom of the Parisian printers. In this case, Gillet's logo featured a rose[352].

The earliest Hardouyn shop had the structure of a bookstore where Gillet traded items made through the presses of contracted workers: the printers that appear most frequently among the earliest records were Antoine Chappiel and Guillaume Anabat[353], then Etienne Jehannot[354], and maybe Higman[355]. A good deal of the editions of this period confirm this edition, for they refer to this exact detail[356]. However, the fact of being a sworn librarian of the University of Paris did not force him to publish such university-related titles as pieces of theological, classic Latin literature and so forth. On the contrary, there are only Books of Hours bear with his name[357]. This is one of the signs that reveal the corrosion of Sorbonne's authority as the steward of book production in the city to pass the mantle to the royal licensing system[358].

Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550, III, no. 143, 1184–1191.

[352] "*A lenseigne de la Rose*", as referred in the colophons.

[353] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 197. Brunet also referred of an edition made by Philippe Pigouchet for him but there is no trace of it in the ISTC nor elsewhere. See Brunet, *Manuel du libraire et de l'amateur de livres, contenant 1o: Un nouveau dictionnaire bibliographique*, p. 587.

[354] He printed a *Horae ad usum Romanum* (Roman Mass rite) for Gillet in Paris, 31 August 1498 [ISCT ih00394400; GW 13162]. According to ISCT, a copy of this edition could be in the National Library of Gütenberg Museum (Mainz), GM/StB imperfect, Ink.2248a.

[355] Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*", p. 143.

[356] In the colophons, it is written indeed "*par Guillaume Anabat* [...] *pour Gillet Hardouyn*" (= by Guillaume Anabat [...] for Gillet Hardouyn), or "*Anthoine Chappiel* [...] *pour Gilles Hardouyn*" (= by Anthoine Chappiel [...] for Gillet Hardouyn). Among the edition that bear such statements, there are BL, C.29.h.11, C.29.i.11, Newberry Vault Wing As ZP 539.A.54, Penn Ms. C.1531 and BnF. Inc.159.6, A-K8, L4.

[357] Catalogues of printed books seldom mention a printer called Jean Hardouyn, that seems to be active only in 1499 and 1500 and working in association with the two Parisian publishers Pierre Levet and Raoul Cousturier. Through this association, they printed some religion books: Bernardus Claravallensis' *Floretus* (1499) (ISTC ib00395300; C 2540; Pell 2177; Hillard 339; Pr 8071; BMC VIII 104; GW 4012], Guillermus' *Postilla super epistolas et evangelia* (13 November 1499) (ISTC ig00705600; H 8295; Madsen 1860; GW 12020], *Regulae cancellariae apostolicae cum glosa* (1499/1500) (ISCT ii00154200; H 638; Cl II 540 & tab. 149; Pell Ms. 10069-10070 [9853]; CIBN I-52; GW 926); and Latin classic books-Guido Juvenalis' *Interpretatio in Laurentii Vallae Elegantias latinae linguae* (1500) (ISTC ij00671200; C 3418; Pr 8072; BMC VIII 104; GW M15850). The similarities in chronology of publication and place of edition allow this comparison, although there are several differences between the two individuals. Firstly, the two names Gillet/Gilles and Jean are quite different and do not share the same linguistic roots. Secondly, Gillet usually addresses himself as a *libraire-juré* while none of the presented editions mention such detail (Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198). Finally, Jean Hardouyn is presented as an *imprimeur* or printer whereas the first records of Gillet as a printer do not date earlier than 1509 (see also Section 1.5.2 on this aspect). Given the reasons above, the hypothesis of the shared identity of Jean Hardouy and Gillet Hardouyn is tentative and extremely cautious.

[358] On this topic, see the extensive Armstrong, *Before copyright: the French book-privilege system 1498-*

The activity was run exclusively by Gillet, who entrusted the overall preparation of the volumes to these professionals but retained few details on their design process. As a matter of fact, he established a repeat business of designs for illustration with Jean Pichore since 1504 or 1505[359]. Starting from an *Octavo*-format set of engravings that the artist designed for Gillet, Pichore created a complete set of illustrations to decorate the Office of the Virgin, pericopes of John, Penitential Psalms, Hours of the Dead. Additionally, he devised small representations of patron saints (seventeen in total), most of which were drafted specifically for Hardouyn[360]. Another set that reveals the unique craftsmanship of Pichore is another set he drew in 1507[361]. From this initial set appearing in the chronological range *c.* 1505-1509, Gillet established a sturdy economic relationship that endured after the decade[362]. As for the meaning of these facts, a proof of the importance of the material for decoration to the eye of Gillet might be the fact that editions that bear the name of contracted printers do not display the illustrations in possession of the latter. This is the case of a fine edition that Anabat printed in *c.* 1507 on behalf of the two brothers Hardouyn: though the printer owned his workshop equipment for decoration, this edition displays of Gillet's equipment instead. Although the original firm was not technically independent, it might possess a certain good economic areal if the fact of imprinting a visual hallmark can be regarded a sign of business maturity.

It seems that in Gillet's prosperity, the other Hardouyn brother, Germain, played a limited role as an occasional printer or illuminator[363]. Aside from Gillet, Germain was active as a printer elsewhere. In this period, he had more important contacts with the Parisian printer Guillaume Eustache instead, as their printer's devices reveal. Indeed, both Germain Hardouyn and Eustache were associated with the printer mark that was last used by the second bookseller until March or June 1500. That mark is very likely to be

1526 as well as Rouse et al., *Manuscripts and their Makers: Commercial Book Producers in Medieval Paris, 1200–1500*, p. 330 and Hilary Maddocks. "Art and Text: A Sixteenth-century Printed Parisian Book of Hours". In: *The La Trobe Journal* 77 (2006), pp. 23–36, p. 28.

[359]Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, II, no. 535.

[360]Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 170, 174–175.

[361]It is an in-4ř set consisting of eleven pieces (Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 170, 176–177).

[362]Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, II, no. 534-538.

[363]Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 196.

originally designed by Jean d'Ypres[364] (fig. 1.23) and was kept later on[365] (fig. 1.24). At the same time, the fact that Germain was collaborating with his brother could have led him to share the Gillet's business contacts and produce his own *horae* editions. This is the case of a *horae* for the use of Rome made in October 1505 by Guillaume Anabat for Germain, for instance[366].

Already in this period, Gillet expanded his business out of Paris, by creating a partnership with some booksellers in Rouen, namely Philippe Coste, Louis Bouvet and Renault Gaultier[367].

Figure 1.23: *Printer's device* of Guillaume Eustace, *c.* 1517 (102 mm Œ 74 mm). From Renouard, 1926, nos. 0308, 0434 © University of Tours.

[364]Renouard, 1926-1928: nr. 0308, 0434].

[365]Philippe Renouard. *Les marques typographiques parisiennes des XVe et XVIe siècles*. Paris: Imprimerie Champion, 1926, no. 0435, 0436, 0439. They were first used in a 1524-*Horae* for the use of Rome, *Octavo*-format, 1528-*Horae* for the use of Rome, *Octavo*-format (almanach: 1528 to 1545), the device is covered in an illumination probably altering its original features-and other devices used respectively starting from (a) 1524, (b) 1526 and (c) 1528 to 1545 (Renouard, *Les marques typographiques parisiennes des XVe et XVIe siècles*).

[366]Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, II, no. 67, 554–60; Bohatta, 1924: no. 807; Brunet, 1860: no. 225; Hoe, 1907: no. 239; Lacombe, 1907: no. 148/149; Moreau, 1972: I (1505), no. 85; Pollard et al., 1907: no. 586.

[367]The British Library is in possession of three of these editions. They are all Horae ad usum Rothomagensem (Rouen): BL, C.52.cc.10 (*c.* 1507, for Gillet Hardouyn, Philippe Coste and Louis Bouvet); BL, C.29.d.11 (*c.* 1508, for Gillet Hardouyn, Philippe Coste and Louis Bouvet); BL, C.65.g.16 (*c.* 1511, for Gillet Hardouyn, Philippe Coste, Louis Bouvet and Renaul Gaultier). The printer of these editions is unknown.

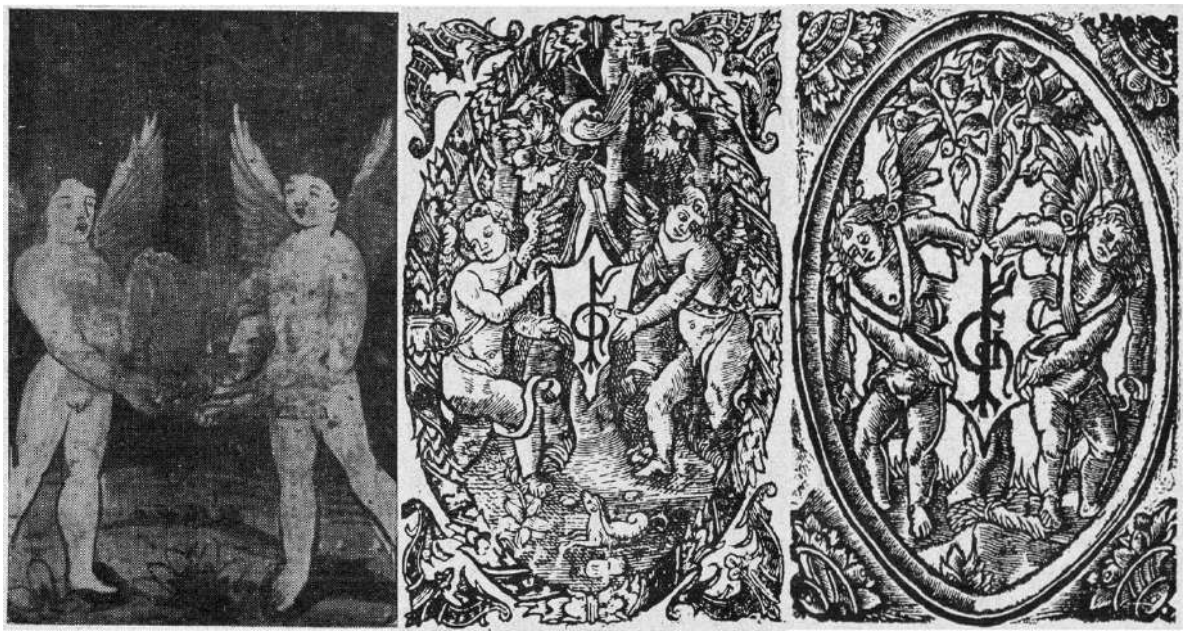


Figure 1.24: *Printer's device* of Germain Hardouyn. On left: used on 1524; on the centre: used on 1526; on right: used from 1528 to 1545. From Renouard, 1926, nos. 0435 (71 mm x 45 mm ill. dimensions), 0436 (92 mm x 61 mm), 0439 (65 mm x 47 mm). They have first appeared respectively: (left-centre devices) since 1524 for a *Horae for the use of Rome*, *Octavo*-format; (right device) since 1528 for a *Horae for the use of Rome*, *Octavo*-format (almanac 1528-1545). The left device is covered in an illumination probably altering its original features © University of Tours.

1.5.2 Second phase: from 1509 to 1521-3

The year 1509 marked a turning point for the Hardouyn enterprise: Gillet ceased the previous system of production based on an external printer to finally install his own press in a new location between the close Pont Nostre Dame and Saint Denis church[368]. Gillet's new status of printer is illustrated with these statements, where he frequently reported himself as a printer[369], as well as the renewed collaborations with the brother Germain. The two brothers worked more closely together until Germain was semi-officially integrated as the print house illuminator, so Germain's gilded frames turned into a distinctive mark of Hardouyn's production[370]. Gillet maintained his status of *libraire-juré*, until he relinquished the title in 1512 in favour of another less known brother, Guillaume[371].

[368] "*Confinio pontis Nostrae Dominae, ainte ecclesiam sancti Dionisii de carcere, ad intersignium Rosae deauratae*" (= at the border of the bridge of Notre-Dame, in front of St. Dionise in Prison church, under the sign of the golden Rose"), colophons refer.

[369] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198.

[370] Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, I, no. 20.

[371] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198.

Gillet, Germain and Guillaume seem to work closely in this period: Gillet was the head of the shop and incumbent for the bulk of the production chain and design sector. Germain somehow contributed, in some cases as an ancillary worker and in other as an active editor, and Guillaume is absent from any workshop record until 1519[372]. Concerning Gillet as a book designer, he prolonged the supply chain of graphic models for engravings under Jean Pichore, who designed new sets for Gillet in this period[373]. Not just due to the elegant designs in the Italian Renaissance style of Pichore, but also a consistent style of illumination promoted Hardouyns' pattern of the book widely enough that it is still known under the label "style of Hardouyn workshop"[374]. In this phenomenon of the Hardouyn-book, Germain played a part through his artistic skills. On the trails of his brother, Germain ordered further sets of illustration to Jean Pichore accompanied by other artists whose identities are still obscure[375]. Regarding Guillaume, his history bears the vaguest details[376]. He is known to be a bookseller affiliated with Sorbonne University. Maybe he had some printing and painting duties; however, the last detail is hard to track because the only book cited with his name might be of Germain instead[377].

The combination of strive for excellence and rigorous care for such decoration in colour as either illumination or black-and-white as fine carvings, made books in the Hardouyn style much treasured in Paris and beyond. In fact, there times when the Hardouyns' print house received requests for editions not only from Rouen booksellers as before[378] but also from other countries. Good examples are the Books of Hours in possession of Anne Boleyn, that were produced by the Paris workshop.

[372] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198.

[373] Such as the *quartserie* or in-4ř set as described in [Zöhl, 2004: 170].

[374] Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, vols. II-III.

[375] It is in this period that he ordered an anonymous artist with a medallion series that seems to be first used next to Gillet's death, after 1526 (Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, III, no. 1025-1026.

[376] The fact that Gillet and Germain are documented as the son of another Guillaume Hardouyn who also was bookseller significantly complicates the interpretation.

[377] This book has been cited by Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198, but there is no edition done by Guillaume that has an historical match.

[378] Brunet, *Manuel du libraire et de l'amateur de livres, contenant 1o: Un nouveau dictionnaire bibliographique*, p. 588.

1.5.3 Third phase: from 1521 to 1525

Gillet died in 1521, and Germain became a printer afterwards. However, the transition from Gillet's stewardship to Germain's is historically vague, owing to some reasons. The odds are that at the time of Gillet's death, Germain might have not met the formal criteria to work as an independent printer. Alternatively, another chance is that Germain's personal network might have not been strong enough to fill safely the power void brought about with Gillet's death. Thus, it might be on this account that all books printed in 1522 are still marked under both names of Germain and Gillet.

The archival material from the years right behind (1523-1525) shows that Germain rebranded the activity through a new name and location. Indeed, the designation of the shop is changed to *Saint Margaret*[379], and the location is moved towards the core of the *Île de la Cité*-in front of the Royal Palace[380]. Also, he established a few-year partnership with Pierre Vidoue (*fl.* 1510-1543)[381]. From his side, the bookseller Vidoue had important reasons for engaging in business with Germain. Maître es-arts[382] and bookseller[383], Vidoue also owned one shop in Paris and another in Rouen[384] so that the association with Germain guaranteed him supplies for both venues. Unfortunately, the exact destination of the editions that were made in this period can be hardly addressed since the usual statement from colophons refers the universally-adopted Roman rite as the service for devotion; therefore, these books bear no exact reference of geographic destination.

This bookseller issued numerous titles of classic Latin literature acting as a proof-reader

[379] "*Ad intersignium divae Margarete*".

[380] "*Inter duas portas Palatii*" / "*ante Palatium regis*".

[381] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 428.

[382] He obtained the title of *maître* at the Faculty of Arts in Paris and was one of the twenty-four *libraire-juré* of the University of Paris since 1523. See David J Shaw. "Book Trade Practices in Early Sixteenth-Century Paris: Pierre Vidoue (1516–1543)". In: *The Book Triumphant*. Ed. by Malcolm Walsby et al. Leiden: Brill, 2011, pp. 334–346. DOI: https://doi.org/10.1163/9789004221604$_$016, p. 339.

[383] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 428 refer to him also as a printer, but Malcolm Walsby. *Booksellers, Printers, and Bookbinders of Provincial France, 1470–1600*. Leiden: Brill, 2020, p. 780 rejects such claims to propose that the books sold in his shops in Paris and Rouen were instead produced by local presses.

[384] See also Shaw, "Book Trade Practices in Early Sixteenth-Century Paris: Pierre Vidoue (1516–1543)".

and publisher[385], but he was also involved in the market of religious texts[386]. Vidoue also had some interest in producing devotional books too: in fact, the name of Vidoue appears not only next to Germain's, but also other printers in other editions. In 1523, Vidoue issued Hours with the Roman Mass rite together with another printer, Guillaume Godard[387] and 1528-Hours with Greek typefaces with Guillaume Gourmont, that should be the most ancient of this kind in Paris[388]. With Germain, Pierre created a few editions of service-books probably with the manufacture overviewed by the Hardouyn, while Vidoue may have served as the final retailer[389]. Less clear is the ownership of the material for illustration: the 1523-edition made with Godard bears similar cuts resembling those of Germain (fig. 1.25), but both professionals keep their material later[390].

The last edition that the joint venture Germain-Pierre produced bears the year 1525[391].

1.5.4 Fourth phase: from 1525/6 to 1541

Germain was finally an independent printer after 1526. Before this time, he had worked closely to Guillaume Eustace, maybe grasping from him some rudiments of binding and trade of books, besides the ones form the perished brother, Gillet. Eustace had a prominent place among the Parisian market, because he was the royal librarian[392], a binder sworn

[385]Documentary material survives on at least one edition of the Iliad having his text correction Shaw, "Book Trade Practices in Early Sixteenth-Century Paris: Pierre Vidoue (1516–1543)", p. 342. He also issued Ovid's *Heroides* together with Simon Du Bois David J Shaw. "New Dates in the Career of Simon du Bois, Reformation Printer, Paris, 1523–1529". In: *The Yale University Library Gazette* 67.1/2 (1992), pp. 32–36.

[386]He also traded in Psalteries: for instance, he issued with Jean Petit an edition of Cathena aurea super Psalmos (BnF, A-4464 and BnF, A-44276, both dating *c.* 1521) as well as sermons such as *Sermones religiosissimi F. Jo. Tisserandi*, printed in 1517 with Pierre Gromors (*fl. c.* 14.. -1545) and Roger de Launay, (*fl.* 14..-15..) (BnF, D-10276 and D-10277). Brigitte Moreau et al. *Inventaire chronologique des éditions parisiennes du XVIe siècle*. Vol. I. 1501-1510. Paris: Service des travaux historiques de la ville de Paris, 1972, vol. 2, no. 1715.

[387]Edition described in (Lacombe, 1907: 332-333, Brunet, 1818: pp. 309, 573; Praet, 1822-28: no. 140). However, in this edition Vidoue seems to act more as a printer rather than a bookseller since the colophon refers "*Pierre Vidoue* [*imprimé*] *par Guillaume Godard*."

[388]Records on Vidoue using the Greek typeset survive in the mentioned 1528-edition he made with Gourmont as well as other works: a 1529-edition with Du Pré and a 1522-edition with Resch (Vervliet, *The Palaeotypography of the French Renaissance: Selected Papers on Sixteenth-century Typefaces*, p. 32).

[389]On the structure of Germain's collaborations see Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*", p. 143.

[390]See **Chapter 3**.

[391]Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198.

[392]I.e. *libraire du roi*. See Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 146.

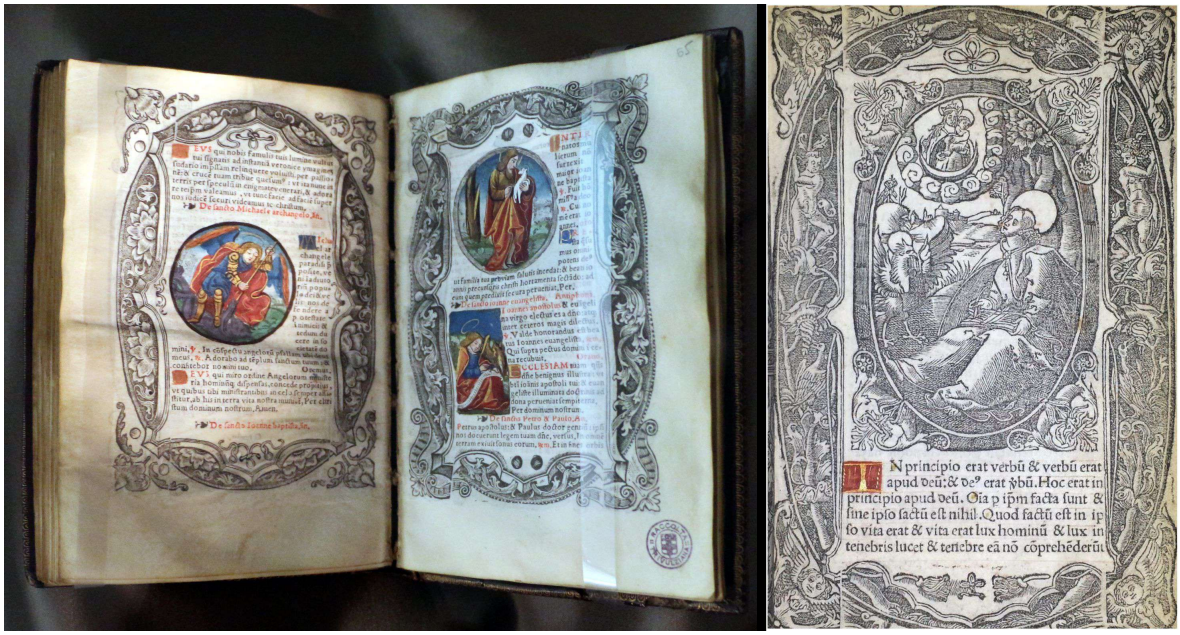


Figure 1.25: Two *Horae ad usum Romanum* (Roman Mass rite) printed for Pierre Vidoue. On the left: Guillaume Godard for Pierre Vidoue, 1523, from Biblioteca Trivulziana, Milan, fols. 64^{v}-65^{r}; on the right, Germain Hardouyn for Pierre Vidoue, 1524, from a book in a private collection © Sailko, INK LDN.

by the university[393] and that engaged in frequent contacts with the royal, at least since 1497[394]. A decade later (1509), Eustace finally ventured into typography through his own printing house until his death (1535), proving to be a compelling protagonist of making due to his proximity to king Louis XII and his many connections with other printers in Paris. Among these, there were Nicolas Higman (or Hyngman)[395] and the same Germain as well. Therefore, working with Eustace might have reinforced a well-rounded, business-oriented mentality of book production not as a mere printing technician but rather as the chief of an elaborate production of a large supply chain inherited from Gillet.

The similarities to Gillet did not express only in the form of management but also in the professional network. Indeed, Germain maintained the business connection with Pichore alive, as can be proved by some bespoke metal-cuts produced for Germain in 1526[396]. He also ordered the same year another *duodez-Serie*, according to the features that could

[393] He was one of the few *relieur-juré* known.

[394] Despite the archival records of a dense activity as a binder, very little evidence of covers produced by him have outlasted. See William Salt Brassington et al. *A History of the Art of Bookbinding: With Some Account of the Books of the Ancients*. London: Elliot Stock, 1894, p. 186.

[395] On the second decade of the sixteenth century. See Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 204; Pettegree, *The Book in the Renaissance*.

[396] Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, II, no. 545.

be recognised from the paints, for these books are nearly always painted. As a result, Germain's activity kept a careful eye on design and style.

The intelligent combination of elegance and efficiency turned Germain's workshop into an ergonomic industry yielding service-books of a narrow wealth of Mass rites (Sarum[397] and Rome[398]), yet with a rich choice of decoration and a flexible, client-oriented organisation. Books of Hours were edited, printed, embellished and maybe also bound[399] in the same shop. As a result, books within the same edition might appear utterly different from each other: some of them may display a lavish, bright palette while other may have been left in grayscale; other contain rare compositions which are unmatched by any other book or display equally rare prayers in vernacular, for instance. Therefore, Germain's activity gave a valuable assistance in refining the reputation of Hardouyn's workshop as an enterprise specialised in luxury books of devotion to be largely used by French readers.

Other factors contributed to Germain's foundation of massive success. Antoine Vérard died in 1512 and his son Barthélemy retired from the trade of print prayer books ever since[400]. The other leading publisher Simon Vostre died in 1521, and the direction of his workshop was taken by his sister Nicole without any luck. Only Yolande Bonhomme, Kerver's widow, managed to keep the shop in the 1520's, but she was not as consistent as Germain Hardouyn for the number of editions and stylistic variety and preferred to diversify her book production into other religious titles.

However, the workshop organisation changed over time: Guillaume Hardouyn died in 1537 and he was replaced by Guillaume Merlin in the same year. Germain also died a few years after, in 1541[401].

[397] Andrew Pettegree et al. *French Books. Books published in France before 1601 in Latin and Languages other than French*. Vol. 3. Leiden: Brill, 2011, vol.1, no. 67622, 67626.

[398] Pettegree et al., *French Books. Books published in France before 1601 in Latin and Languages other than French*, vol.1, no. 67453-67461, 67465–67468, 67471–67473, 67475–67477, 67480, 67481, 67484–67485, 67488, 67490–67494, 67496, 67501–67502, 67504–67507.

[399] There are no clear records of this stage of production in the Hardouyn shop, so this claim is merely hypothetical.

[400] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 424.

[401] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198.

1.5.5 Fifth phase: from 1541 to *c.* 1550

In this decade, Germain's widow (Catherine of Paris) took over the activity[402] later succeeded by his son Jean II[403]. Books made during this late stage are not significant nor bear any remarkable difference from the previous times.

[402] Doc. Arch. Nat. X I A 1543, fol. 427^{v}.
[403] Doc. Arch. Nat. X I A 1550, fol. 281^{v}.

2. Sets of engravings used in the Hardouyn workshop

The general opinion on the Hardouyn Hours is that they are extremely fine editions of early printed books. While inspecting those volumes, the charms of their ornamentation strike one's sight immediately. The richness of the half- and full-page illustrations topping the initial statements echoes the lavishness of decoration at the front, the end and between the prayers within those books. Besides, these items attract lasting gazes of the average observer while making an expert of *incunabula* appreciate both their technical quality and wealth of the visual range. In some editions, like Gillet's *Grandes Heures*, such is the illustrative deluge that the figurative depictions form parallel readings rivalling with textual piety. Thus, a profuse and elaborated embellishment is the heart of the Hardouyn Hours' allure. The figurative share is so lavish in these editions that it forced a material selection in view of a detailed art historical analysis. This chapter focuses exclusively on the major illustrations or the decoration at the opening at the canonical hours and Offices.

Before delving into a detailed analysis, it is important to make some introductory remarks regarding the iconography of the illustrations selected. The full series of pictorial contents found in the Hardouyns' Hours[1] is in Table 2.1, which compares their figurative programme with the traditional programme in manuscripts, both sorted by Office[2].

On a close inspection of the two schemes from Table 2.1, two important facts emerge. In the first place, the scenes for the Hours of the Virgin reveal iconographic consistency,

[1]The illustrations listed in the table are all those from the identified set of engraving, also including a few from the unrecognised sets. A table including a full list of the printed books analysed and another with the description of their illustrations are on Appendix C.

[2]This scheme was adapted from the comprehensive atlas by Wieck, who provided a useful commentary of the most common and usual representations for each section in late medieval Hours. See Wieck, *Time Sanctified: the Book of Hours in Medieval Art and Life*.

Table 2.1: Comparison of the typical figurative cycles in manuscript Books of Hours and printed Hours by the Hardouyn workshop.

	Illustration		**Kind of book**	
Office	***Hour / Section***	***Scene***	***Manuscripts***	***Hardouyn Hours***
Pericopes	Gospel of John	John in Patmos	•	•
		Miracle of St. John and the Poisoned Cup	•	•
		St. John boils in oil	•	•
Office of the Virgin	Matins	Annunciation	•	•
		Ego sum	•	•
	Lauds	Visitation	•	•
		Capture of Jesus in Gethsemane	•	•
	Prime	Nativity	•	•
		Christ before Pilate	•	
	Terce	Annunciation to the Shepherds	•	•
		Flagellation	•	•
	Sext	Adoration of the Magi	•	•
		Christ carrying the Cross	•	
	None	Flight into Egypt	•	•
		Crucifixion	•	
	Vespers	Presentation in the Temple	•	•
		Deposition of Christ	•	
	Compline	Coronation of the Virgin	•	•
		Death of the Virgin	•	•
		Descent from the Cross	•	
		Flight into Egypt	•	
Office of the Cross	Sext	Crucifixion	•	•
Office of the Holy Spirit	Sext	Pentecost	•	•
Little Office of the Immaculate Conception	Matins	Mary with her emblems	•	
Marian prayers	*Obsecro te*	Madonna with Jesus Child	•	•
		Pentecost	•	•
	O intemerata	Lamentation / Pietà	•	•
Penitential Psalms	-	Bathsheba at the Fountain	•	•
		King David summons Uriah	•	•
		Death of Uriah	•	•
Hours of the Dead	-	Job on the dung heap	•	•
		Last Judgement	•	
		Personification of Death	•	
		Three Living and three Dead(men)	•	
		Rise of Lazarus	•	•
		Lazarus and Dives	•	•

unlike the general flexibility of the remaining Offices. In addition, these representations feature specifically the stories about Jesus' birth and childhood[3]. It follows that the Hardouyn workshop's figurative arrangement is compatible with an established tradition[4]. However, the "orthodox" character of the Hardouyns' imagery may not be the original expression of alignment to manuscript Books of Hours. As Chapter 1 illustrates extensively, the Hardouyn workshop arose and lived during the settling phase of Paris typography. In fact, the first generation of Parisian printers had established the grounds of the printing industry in the second half of the fifteenth century[5]. The Hardouyn brothers created their enterprise slightly later, in the era of the major printing-publishing houses[6]. Being posterior to the pioneering phase of printed Hours, the workshop of these two brothers had the opportunity of selecting aesthetic choices from the past generation of publishers. When the influential Vérard made conscious choices, his philosophy about editing the internal liturgical and figurative structure set immediately a model[7]. This determined the two-fold outcome of introducing very little or no variation from the liturgy of an "ordinary" Book of Hours[8] and canonising the traditional set of images as a constitutive element of printed Hours. In most likelihood, the regularity of the adopted cycles of illustrations must have depended largely on the iconographic affinities and visual culture of the desired audiences. Then, the choice must have fallen on the only known model of illustrated service book: the manuscript Books of Hours. The consequent option for the earliest printers must have been to draw from the manuscript production.

[3]It is also called "infancy cycle".

[4]On the pericopes and religious texts on which the representations are based, see Appendix C.

[5]It is illustrated in Chapter 1, Section 1.3.

[6]It is illustrated in Chapter 1, Sections 1.4 and 1.5, which deal respectively on the production of printed Books of Hours in Paris and the history of the Hardouyn workshop.

[7]Antoine Vérard set a pictorial programme with his *Horae ad usum Romanum*, [Chablis: Jean du Pré or Paris: Jean Rouge] for Antoine Vérard, 12 September 1485. In New York, Pierpont Morgan Library and Museum. This book has been mentioned in Chapter 1, beginning of Section 1.4. An extensive overview of the compatibility of the early printed Hours in relation to the manuscript production had been explored contextually to a work presented in the conference EnIAD: Encontro de Investigação —Arte e Design, *Understanding the Decoration to the Renaissance French Printed Book of Hours: A Multidisciplinary Study from Engravings to Illuminations in Hardouyns' Incunabula* (Lisbon, October 1-3, 2019, Faculty of Fine Arts, University of Lisbon, post prints awaiting for publication). During the work, it appeared an overall regularity of the figurative cycles in Parisian Books of Hours.

[8]On further details in this regard, see the complete descriptions of the sets of illustrations of two catalogues of Bibermühle collection: Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*; Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. These two directories represent the largest and most complete documents of early printed Books of Hours from 1487 to 1586.

2. SETS OF ENGRAVINGS USED IN THE HARDOUYN WORKSHOP

Back to the figurative patterns of the major illustrations, their schemes are familiar but lack a systematic analysis. Catalogues and library descriptions classify these illustrations as crude wood- or metal-cuts or over-paints of engravings whereas further extensive research revealed the critical importance of individual personalities in Renaissance Paris[9]. However, this relative richness faces a shortage of essays that trace the activity of the Hardouyn workshop.

To compensate for the dearth in publication, the present chapter challenges historical and artistic findings, involving only the first stage of book embellishment (namely the application of printed illustrations). To meet its purposes, this chapter adopts a multidisciplinary approach based on historical analysis and artistic evaluation to set three primary objectives. The first goal is identifying most of the suited of engravings that the Hardouyn workshop employed; the other, reconstructing the history of use over editions and finally, tracing the history of use across the entire activity of this workshop.

As for the first aim, this chapter organises the entire collection of sets of cuts by chronological order of appearance in the Hardouyn editions. Such a classification lies on either the existing information or year of appearance in the considered books. All representations which form a set are sorted by the increasing canonical hour and Office where they appear, from Matins to Compline and Office of the Virgin to Office of the Dead, respectively. This layout adheres to the general structure of Book of Hours, proceeding from the Office of the Virgin to the Office of the Cross, Office of the Holy Spirit, Penitential Psalms to culminate with the Office of the Dead.

The second aim pursues the evaluation of the artistic quality of the suites of engravings. Evaluating formally these features had required in most cases a brief description of each image and the study of each set as a whole, without producing an individual final judgement (and such task would fall out of the scopes of this doctoral work). With the formal identification of the stylistic and iconographical elements typical of certain artistic production, it became possible to trace the extent to which a suite of engraving reveals

[9] See Geneviève Souchal. "Un Grand peintre français de la fin du XVe siècle, le Maître de la Chasse à la Licorne'". In: *Revue de l'Art* 22 (1973), pp. 22–50; Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*; Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*. The only exception seems to be the most recent survey of the Rouse, which extends their previous monograph of the Parisian manuscript with the activity of book illuminators until *c.* the eighteenth century. See Rouse et al., *Manuscripts and their Makers: Commercial Book Producers in Medieval Paris, 1200–1500*; Rouse et al., *Renaissance Illuminators in Paris: Artists & Artisans 1500-1715*.

its adherence to coeval an artistic movement, or the impact that other artworks had on its design (from illuminated manuscripts to national and international prints, paintings or sculptures from the late Middle Ages until the year of production). Thus, the discussion sheds light on the connection between the production of printed books and other artworks.

The ending task, namely the reconstruction of the history of use, is met by identifying each set retrieved and proposing a possible chronological range, based on their year of printing. However, this relatively straightforward task requires the consideration of two further points, one about the actual date of production and the second the visual quality of the illustrations. As for the first point, in only a few cases the time of production is fixed. In most instances, it is a mere suggestion from the first year of book almanacks. Accordingly, the bibliographic details of the editions emerged as the main chronological reference. Touching on the second point, illustrations were mostly found as over-paints. As such, on average, they bear a close resemblance to a parent image, and their affiliation to a set could only rely on a comparison with all possible recognised variants and the closest resemblance to a likely archetype. This choice implies that the discussion indifferently treats over-paints and bare engravings, and to this end it neglects iconographic and compositional divergences from the corresponding model. In the eventuality of an excessive divergence or impossibility to identify a template, that image falls in the class of unrecognised images.

In agreement with the above three requirements, five major groups were identified:

1. Sets designed by the Apocalypse Masters workshop, hereby referred to as *Sets in the style of the Apocalypse Masters*;
2. Sets designed by the Pichore workshop, hereby *Sets by the Pichore workshop*;
3. Sets produced in a stylistically transitional period, hereby *Transitional sets*;
4. Sets that reveal the influence of the German school of engraving, hereby *Sets in German style*;
5. *Additional sets*, one of which reveals the style of the Noël Bellemare circle (Flemish, *fl. c.* 1512-1546) other is a set commissioned by Guillaume Eustace (bookseller in Paris, *fl.* 1497-1535) and another by Jean Barbier (printer in Paris, 1502-1515/1516). This set is referred to as *Additional sets*.

2.1 Sets in the style of the Apocalypse Masters (1503-1533)

Two sets of comparable style appear within the earliest Hours produced by the Hardouyn workshop. One of which was brought out in *Octavo*-format editions since *c.* 1503, while the other is first seen one year after (*c.* 1504), in another edition of similar format.

While the authorship of the second set is not yet been confirmed, the design of the first series of engravings has been already attributed to the Parisian workshop of the *Apocalypse Master*[10]. Also referred to as *Master of the Apocalypse rose of Saint-Chapelle*, the leader of this atelier owes the name to the decoration of the rose window of the Sainte-Chapelle church in Flamboyant style, for which he sketched the scenes from the Book of Revelation around 1490[11]. However, the Apocalypse Master did not work solely as a stained glass designer.

Aside from this field, he could have also been personally involved in projects of manuscript illumination, polychromy painting, stained glass art and tapestry design. As an illuminator, this artist seems to have been employed to illustrate the so-called *Très Petites Heures* of Anne of Brittany[12]. One of his works as a painter of altarpieces was the polychromy for the retable of the high altar of the Sé Velha de Coimbra[13]. This master was active in embroideries design as well, for his hand has been identified in a set of tapestries depicting the hunt of the fabled unicorn[14]. This is the reason why this artist is also known as *Master of the Very Small Hours of Anne of Brittany*, *Master of the Life of St.*

[10] See Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, pp. 69-71.

[11] On the activity of the Apocalypse Master, see Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*.

[12] Paris, BnF, Ms. Nouv. Acqu. Lat. 3120, Ms source no. 8 in *Appendix A*. Notice of this item is in Avril et al., *Les manuscrits à peintures en France: 1440-1520*, no.143; Elizabeth L'Estrange. "Le mécénat d'Anne de Bretagne". In: *Patronnes et mécènes en France à la Renaissance*. Ed. by Kathleen Wilson-Chevalier. Presse universitaire de Saint-Etienne: Saint-Etienne, 2007, pp. 177-179. For further literature, see Diane E. Booton. *Manuscripts, Market and the Transition to Print in Late Medieval Brittany*. New York, NY and London: Routledge, 2010, p. 255.

[13] Nash, *Northern Renaissance Art*, p. 109.

[14] This collection of thirteen tapestries represents the theme of the fabulous hunt of the unicorn and was created in the Netherlands around 1495 and 1505. Now it is in New York as part of the part of the Cloister Museum, Metropolitan Museum of Arts. See (Adolph S Cavallo. *The unicorn tapestries at the Metropolitan Museum of Art*. New York, NY: Metropolitan Museum of art, 1998).

John the Baptist or *Master of the Unicorn Hunt* respectively, as mentioned before. As for his true identity, several scholars are positive that he is Jean d'Ypres (*fl. c.* 1480-1510). Jean was an illuminator and printmaker active in Paris and was best known for his relation to the *coffret à estampe* production[15], as well as a series of framed, coloured devotional engravings[16].

The Apocalypse Master's involvement in artistic print-making seems to be deeper than single-sheet production. Nettekoven's special interest in the inherently collaborative nature of this Old Master unveiled a net of ongoing connections with the Parisian printers and publishers, for whom he might have designed several suites of engravings[17]. Moreover, within this broad production, Nettekoven could single out several series that the Apocalypse Master designed specifically for the illustration of printed Book of Hours in the period 1489-1500[18] for several workshops, such as Jean Dupré's, Pierre La Rouge's[19], Anthoine Vérard's[20], Simon Vostre's[21] and Thielman Kerver's[22]. Likewise, Davies identified numerous permutations of images whose common element is the hand of the master, whose engravings were in use among Parisian workshops in competition[23].

[15] A *coffret à estampe* is a wooden coffin made (generally) of beech and is covered with and iron strips, having a devotional illustration (a coloured woodcut) glued to the internal face. This production seems not to be exclusive to Paris since other coffrets are from elsewhere, like Antwerp Sandra Hindman. *Gothic Traveling: Coffers Revisited*. Exhibition catalogue, 3-28 November. Les Enluminures Gallery, New York. New York, NY, 2015, p. 2. A good instance of extant *coffret* is in the Art Institute of Chicago, *c.* 1490, acc. no. 2009.49. On this subject, see Michel Huynh et al. "When Assemblage Makes Sense: An Example of a Coffret à Estampe". In: *Art in Print* 2.4 (2012), pp. 9–14.

[16] An instance of this production is a woodcut of the Flagellation dating *c.* 1490-1500, now in the British Museum, London, inv. no. 1902,0212.3. On it, see Séverine Lepape. "La gravure en France au début du XVIe siècle: un champ à explorer". In: *France 1500: entre Moyen âge et Renaissance*. Ed. by Geneviève Bresc-Bautier. Paris: Grand Palais, 2010, p. 161.

[17] Nettekoven identified several series: histories from the *Dance Macabre*, *L'Art de bien vivre*, *Les Vigiles de la mort du feu Roy Charles septiesme*, *La Nef Des Folz/Stultifere Naves*, *Le Compost et Kalendrier des Bergères*, *Le Chasteau de Labour*, *La Mystère de la conception* are just some instances. On it, see Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, pp. 76-86.

[18] See Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, pp. 76-86.

[19] Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, pp. 87-88.

[20] *Ibid.*, pp. 88-91.

[21] *Ibid.*, pp. 89-90.

[22] Kerver seems to have engaged in a long-lasting collaboration with the Apocalypse Master, as described in *ibid.*, pp. 91-94, as well as Majeski, *The printed Books of Hours of Thielman Kerver: Exploring Printer, Shop, Community and Book*, pp. 54-60.

[23] See Hugh Davies. *Catalogue of a collection of early French Books in the Library of C. Fairfax Murray*. London: Holland Press, 1965, I, p. 165. For a detailed illustration for the articulation of the relationship, especially with regard to the Kerver workshop, see Majeski, *The printed Books of Hours of Thielman*

2. SETS OF ENGRAVINGS USED IN THE HARDOUYN WORKSHOP

One of those workshops that reveals the style of the Apocalypse Master was Hardouyn's, at the earliest of the sixteenth century. More specifically, Gillet Hardouyn seems to have whipped themselves into the same frenzy of commissions for the Apocalypse Master.

In the past, Nettekoven identified the hand of the *Apocalypse Master* in a set made specifically for the Hardouyns (here called Octavo-format set of *c.* 1503)[24]. As for the present chapter, it reports one unprecedented set by this Master[25], being comparable in style to the one already known. Then, the next sections articulate the description of the two sets and discuss the attribution of authorship of the second unpublished suite.

Kerver: Exploring Printer, Shop, Community and Book.

[24]The set is mentioned in her monography on the *Apocalypse Master*, but it is fully listed in Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, vol. 1, nos. 233-234; Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, pp. 69-71. See also Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, p. 94.

[25]In other words, is has not been discussed by Nettekoven.

2.1.1 Formal description of the sets

Octavo-format set of *c.* 1503 (1503-1533), *c.* 83 mm x 57 mm

(a) Piece 1 (b) Piece 2 (c) Piece 3

(d) Piece 4 (e) Piece 5 (f) Piece 6

Figure 2.1: The first six pieces of the *Octavo*-set in the style of the Apocalypse Master workshop of *c.* 1503 (*c.* 83 mm x 57 mm illustration dimensions): a) London, BL, C.29.k.24, fol. 1^{r}; b) (*id.*), fol. 17^{r}; c) (*id.*), fol. 22^{r}; d) (*id.*), fol. 24^{r}; e) (*id.*), fol. 25^{v}; f) (*id.*), fol. 27^{r}; g) (*id.*), fol. 28^{v} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 7 (b) Piece 8 (c) Piece 9

(d) Piece 10 (e) Piece 11 (f) Piece 12

Figure 2.2: The last six pieces of the *Octavo*-set in the style of the Apocalypse Master workshop of *c.* 1503 (*c.* 83 mm x 57 mm illustration dimensions): a) (*id.*), fol. 31^{r}; b) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, pp. 70, nos.9; c) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, pp. 70-71, nos.9-10; b) London, BL, C.29.k.24, fol. 38^{r}; c) (*id.*), fol. 43^{r} © Silvia Bottura-Scardina, the British Library Board and Antiquariat Bibermühle.

The *Octavo*-format set consists of twelve pieces for the illustration of the Office of the Virgin, Office of the Cross, Office of the Holy Spirit, Penitential Psalms and Office of the Dead (figs. 2.1 and 2.2)[26].

[26]The pericopes and the other biblical texts on which the scene are bases, are in Appendix C

- *Piece 1, Annunciation*[27] (illustration for the Office of the Virgin [Matins], fig. 2.1a). Mary stands on the left side of the image, apparently interrupted in her pious duties by the visit of archangel Gabriel, who appears from the right. One of Mary's hands is still on the pages of a volume, left open facing her, while the other one responds the request of the divine messenger with a humble gesture of acceptance. The archangel Gabriel holds a sceptre with the right hand while pointing Mary with a finger of the other. Upon the woman's approval, the Holy Spirit appears in the image of a dove surrounded in downward rays, directed toward her. In addition, a flag bearing no message hovers between the two characters. The scene has its most likely set in an interior, as revealed by a rear wall and a piece of furniture slightly to the front, despite the flora clustered on the bottom edge of the frame. In the foreground, there is a city.
- *Piece 2, Visitation*[28] (illustration for the Office of the Virgin [Lauds], fig. 2.1b). Mary and her old cousin Elizabeth meet in a flowery meadow, just outside the city of Jerusalem, that stands out from the dark background. The two relatives warmly embrace and touch the womb of the other, as a sign of the double miraculous conception. The meeting happens under the gaze of a couple of angels behind, who witness the event while a light shines upon them.
- *Piece 3, Nativity*[29] (illustration for the Office of the Virgin [Prime], fig. 2.1c). St. Joseph and Mary are in a wooden, stable manger and celebrate the birth of Jesus, under the overlooking sight of an ox and a donkey from the rear. On the right, Mary joints her hands in a sign of prayer, while St. Joseph kneels to the Child and breaks one extremity of the crook on which he leans[30]. Child Jesus lays on a cloth

[27] The scriptural records for this scene are Luke 1:26-38 and (text in Ref. no. C.2.1.1.2).

[28] From Luke 1: 39-56 (text in Ref. no. C.2.1.2.1).

[29] From Matthew 1:18-25 and Luke 2:1-7 (text in Ref. no. C.2.1.3).

[30] The fact that St. Joseph is not hidden, removed from the scene nor ridiculed suggests that the artist did not spotlight him in an uncomplimentary fashion. This choice is not an oddity for the French visual culture, that did not neglect him: as Williams discussed extensively in a dedicated study, the figure of St. Joseph was theologically debated, although his cult touched the majority of Central Europe, from France to Germany, until the Low Countries (Anne L. Williams. "Satirizing the Sacred: Humor in Saint Joseph's Veneration and Early Modern Art". In: *Journal of Historians of Netherladish Art* 10.1 (2018). DOI: https://doi.org/10.5092/jhna.2018.10.1.3). In the most respectful treatment, St. Joseph was portrayed as the *nutritor Domini*, especially in the thirteenth-to-fifteenth century religious devotion. As Wilson reminds, the pre-Tridentine Europe already saw signs of an increased awareness towards him, the most notable for which was the decision of pope Sixtus VI to incorporate St. Joseph's feast into the Roman 1479 (Carolyn C. Wilson. "textit/Sanctus Joseph Nutritor Domini: A Tryptych Attributed to Jan Gossaert

adjusted on the ground, apparently an extension of Mary's garment[31]. The baby is fully naked, and his head is surrounded by a three-radiant *nimbus*. The stable in which the three characters abide resembles a wooden hut with a hay rooftop, architectonically independent of any surrounding building. Between St. Joseph and Mary, an aperture in the side wall reveals a sight to the city of Bethlehem, which is styled as a Gothic urban centre.

- *Piece 4, Annunciation to the Shepherds*[32] (illustration for the Office of the Virgin [Terce], fig. 2.1d). In a rural area, the angel of God looms from the sky to bring a message of good news to three shepherds, out as they are to tend to pasture their flocks in the grazing land. The three shepherds express graded reactions to the appearance: the one on the right stares at the sky in wonder and points a finger to it in surprise. Next to him, another shepherd goes backwards and tumbles from stupefied astonishment. A third shepherd stares at the scene on the left and maintains a property of behaviour. Two watchdogs complete the scene: one flanks the shepherd on the earth while the other stands on the other side of the field. Like the images of before, an urban settlement peeks from the distance.
- *Piece 5, Adoration of the Magi*[33] (illustration for the Office of the Virgin [Sext], fig. 2.1e). The three Wise Men are placed on two levels. The oldest of them pays his homage to a Child Jesus kneeling toward him to offer a sumptuous gift, while the other two Wise Men stand behind the front group. As the two Men await, they engage in a delighted exchange of impressions: the youngest on the left points his finger to the glowing star that has appeared on the right since the Nativity. Mary sits

Considered as Evidence of Early Hapsburg Embrace of St. Joseph's Cult". In: *Saint Joseph: Patron for Our Times*. September 27-October 4. Kalisz (Poland), 2009, p. 500). This act seems to have boasted Josephian devotion in Southern Europe: after the papal decree, the number of books that mention this feast increased dramatically Pacifico Maria Branchesi. "Una chiesa bolognese dedicata a S. Giuseppe dal sec. XII". in: *Cahiers de Joséphologie* 19 (1971), pp. 576–590; "Chiese e conventi di Parma". In: ed. by Felice da Mareto. Parma: Deputazione di storia patria per le provincie parmensi, 1978, p. 156; Carolyn C. Wilson. "St. Joseph in the Early Cinquecento: New 'Readings' of Two Parmigianino Drawings and a Recently Rediscovered Bedoli". In: *New Studies on Old Masters: Essays in Honour of Colin Eisler*. Ed. by John Garton et al. Toronto: Centre for Reformation and Renaissance Studies, 2011, p. 331.

[31] It could be to emulate a shroud, as the premonition on the divine task Jesus to fulfil. In this sense, it resembles the *Mystical Nativity* [oil on canvas], Sandro Botticelli, *c.* 1500-1501. London, National Gallery, inv. no. NG1034. Retrieved from: https://www.nationalgallery.org.uk/paintings/sandro-botticelli-mystic-nativity (Accessed September 23, 2021).

[32] From Luke 2: 8-10 (text in Ref. no. C2.1.4).

[33] From Matthew 2: 7-11 and other sources (all referred in Ref. no. C2.1.5).

with the naked Jesus on her lap and oversees the scene. The setting is the same as the Nativity, except for St. Joseph, who has been excluded from this representation.

- *Piece 6, Presentation of Jesus in the Temple*[34] (illustration for the Office of the Virgin [None], fig. 2.1f). The scene takes place in the interior of Jerusalem's synagogue, which is rendered in a Gothic church. The apertures of the exterior of the building are featured as Gothic windows with a diamond pattern—seemingly through metallic ribs and smaller parts defined with stonework. The altar on the centre features a quatrefoil relief pattern. Mary presents Jesus to the High Priest of the Temple forty days after the Childbirth to complete the ritual of purification[35]. The High Priest-St. Simeon[36] receives the Child by the offering mother and holds him over the altar. St. Joseph stands on the left, behind Mary, and removes his hat in a sign of humility and respect. Next to him, a maidservant holds a candle and a bucket of doves to offer for the rite[37].
- *Piece 7, Flight into Egypt*[38] (illustration for the Office of the Virgin [Vespers], fig.

[34]From Luke 2: 22-39 (text in Ref. no. C2.1.6).

[35]The Torah mandated all Jewish new-borns to fulfil this religious and legal obligation, as referred in Lev 12 and Ex 13:12-15.

[36]St. Simeon was the Jerusalemite who first recognised the infant Jesus as "the Lord's Christ", or the *Hypaphante* Gertrud Schiller. *Iconography of Christian Art*. Vol. 1. New York, NY and Greenwich, UK: Graphic Society, 1971, p. 90: "And he came by the Spirit to do for him after the custom of the law, then took him up in his arms, and blessed God, and said: Lord, now lettest Thou Thy servant depart in peace, according to Thy word" (Luke 2:27-29). In Western depictions of the theme, the meeting of Simeon while entering the temple is frequently merged with the two scenes of the Circumcision and the competition of the purification. The "merging" of the High Priest and St. Simeon into a single character occurred no earlier than the thirteenth century Schiller, *Iconography of Christian Art*, p. 93; Dorothy C. Shorr. "The Iconographic Development of the Presentation in the Temple". In: *The Art Bulletin* 28.1 (1946). DOI: https://doi.org/10.1080/00043079.1946.11407736, p. 30, and here I endorse the opinion based on the number of cases in which St. Simeon appears as the High Priest. The same association occurs in central European paintings, like Stefan Lochner's altarpiece, *c.* 1447, Church of St. Katherine, now in Hessisches Landesmuseum, Darmstadt (inv. no. WGA13347).

[37]The maidservant is also traditionally represented in German depictions. For instance, she appears in an engraving by Dürer and another by Wolfgang Huber, a print from Dürer's *Life of the Virgin* cycle, 1503-1505 (one is in London, V&A Museum, acc. no. E.698-1940) and the other appears as a single-sheet work, *c.* 1515-1530 (in London, British Museum, inv. no. 1858 0626.296). A maid can be also be found in Stefan Lochner's altarpiece, *c.* 1447, Church of St. Katherine, now in Hessisches Landesmuseum, Darmstadt (inv. no. WGA13347). The candle the woman carries with one hand could refer to the Candlemas, the *festum luminis* or *candelabrum*, the ceremony of blessing of candles that the Christiendom celebrated from the tenth century onwards and one of the main Marian feasts. See Charles Caspers. "Leviticus 12, Mary and Wax: Purification and Churching in Late Medieval Christianity". In: *Purity and Holiness*. Leiden: Brill, 2000. Chap. 12, pp. 295–309. DOI: https://doi.org/10.1163/9789004421394_020; Alistair James MacGregor. "Candlemas: a festival of Roman origin". In: *Maria* 2.1 (2001); Christian Roy. "Candlemas". In: *Traditional festivals: A multicultural encyclopedia*. Vol. 1. Santa Barbara, CA, Denver, CO, and Oxford, UK: ABC-Clio, 2005, pp.41-43; Schiller, *Iconography of Christian Art*, p. 90.

[38]From Matthew 2: 12-23 (text in Ref. no. C2.1.7).

2.2a). Mary rides side-saddle a horse and carries a Child Jesus in swaddling clothes, while St. Joseph follows the group on foot. The family travels in the countryside, as revealed by the wilderness of the surroundings. In the background, the hills and a city form a dramatic backdrop, only disrupted by a gigantic statue on the top of a tower which is disproportionate to the size of the urban view. This sculpture could be a representation of the pagan idols, also called *Fall of Idols*[39].

- *Piece 8, Coronation of the Virgin*[40] (illustration for the Office of the Virgin [Compline], fig. 2.2b). Mary kneels before God the Father, with the hands joined in prayer. Behind her, a hovering angel brings a tiara, ready to place it on the Virgin's head. Not too far, there is a bed and beyond, a series of angels proceeds from left

[39]The *Fall of Idols* theme is extracted by the apocryphal Gospel of Pseudo-Matthew (21-23,3, C2.1.7), that says in this regard: "And rejoicing and exulting, they came into the regions of Hermopolis, and entered into a certain city of Egypt which is called Sotinen; and because they knew no one there from whom they could ask hospitality, they went into a temple which was called the Capitol of Egypt. And in this temple there had been set up three hundred and fifty-five idols, to each of which on its own day divine honours and sacred rites were paid. For the Egyptians belonging to the same city entered the Capitol, in which the priests told them how many sacrifices were offered each day, according to the honour in which the god was held. And it came to pass, when the most blessed Mary went into the temple with the little child, that all the idols prostrated themselves on the ground, so that all of them were lying on their faces shattered and broken to pieces; and thus they plainly showed that they were nothing. Then was fulfilled that which was said by the prophet Isaiah: Behold, the Lord will come upon a swift cloud, and will enter Egypt, and all the of the Egyptians shall be moved at His presence." Source in Alexander Roberts et al., eds. *The Gospel of Pseudo-Matthew*. Vol. 8. Revised and Chronologically arranged with brief prefaces and occasional notes by A. Cleveland Coxe. New York, NY: Christian Literature Publishing Co., 1885, p. 377. In medieval times, Pseudo-Bonaventura resumes the story in his *Meditationes Christi*: "When they entered Egypt all the idols of that province fell and broke [...]." Pseudo-Bonaventure. *Meditations on the Life of Christ*. Ed. by Isa Ragusa et al. Translation and edition from MS Ital. 115, Bibliothèque Nationale, Paris. Princeton, NJ: Princeton University, 1977, p. 68; Ralph Dekoninck. "Falling Idols, Rising Icons: Bruegel's Flight into Egypt and the Embeddedness of Sacred Images in Nature". In: *Pieter Bruegel the Elder and Religion*. Ed. by Bertram Kaschek et al. Leiden: Brill, 2018. Chap. 8. DOI: https://doi.org/10.1163/9789004367579_009, p. 227. However, the Fall of Idols became more common in thirteenth-century representations related to the infancy of Jesus, Mâle remarks: "[the fall of idols] is found in almost all carved or painted series of scenes of the childhood of Christ. The thirteenth-century version of this legend is so condensed as to become almost a hieroglyph", in Emile Mâle. *The Gothic image: Religious art in France of the thirteenth century*. Translated by Dora Nussey. New York, NY et al.: Icon editions and Harper & Row, 1972, p. 217. Also see Michael Camille. *The Gothic idol: Ideology and image-making in medieval art*. Cambridge, MA et al.: Cambridge University Press, 1989, pp.xxviii-xxix. According to Schiller, the fall of the idols is a fulfilment of Is 19, 1 and Jer 43, 13: "The apocryphal story of the arrival in Sotina indicates that the Flight from the land of Judea into heathen Egypt[...] was in earlier times regarded as Christ's triumph over hostile powers and as a revelation of his divinity to the heathen", in Schiller, *Iconography of Christian Art*, p. 118. Late medieval Christianity was duly instructed on the fall of idolatry while the Holy Family journeyed from Israel through Jacobus' *Legenda Aurea*, one of the most read books of the time. See section 10, "The Holy innocents", Jacobus de Voragine. *The Golden Legend: Readings into the Saints*. Translated by William Granger Ryan; with an introduction by Eamon Duffy. Princeton, NJ and Oxford, MA: Princeton University Press, 2012, p. 57.

[40]According to Harthan, no biblical source refers the episode of the Coronation of the Virgin but interpretations of St. Gregory of Tours' writings. Among the sources that may indirectly refer to the theme, there is Kings 2: 19 (text in Ref. no. C2.1.8.1).

to right, from Mary to the Almighty. Mary looks at the Father in pious attitude and awaits being crowned. She dresses a simple garment of cloth and gown, and her hair is free, consistently with the iconography of her marriage. God the Father is treated as an old man dressing in rich garments, namely a cloth with a pin securing its ends and a long robe. His head carries a *triregnum*, the tiara of the popes. Three fingers of his right hand are raised in blessing, while the other covers a *globus cruciger*. He sits on a throne with a topping canopy, with the sides richly decorated in foliage.

- *Piece 9, Crucifixion*[41] (illustration for the Office of the Cross [Matins], fig. 2.2c). In this Crucifixion, Christ is the sole that is nailed to the Cross. On the left and the right, a large crowd assist the scene. Among them, an inconsolable Mary stands out from the left. Behind her, St. John supports Mary. On the right, there is a group of Gentiles.
- *Piece 10, Pentecost*[42] (illustration for the Office of the Holy Spirit [Matins], fig. 2.2d). Mary, the Apostles and other women are gathered in prayer. While reciting the service, the Holy Spirit appears from the top in form of a dove. As the dove approaches Mary, it emanates tongues of fire toward the attendant. Mary is on the centre facing an open book with the hands joined in prayer.
- *Piece 11, Samuel anoints King David*[43] (illustration for the Penitential Psalms [First Psalm], fig. 2.2e). The prophet Samuel pours oil from a flask over the head of a young David, who had been hurriedly summoned through his father Jesse while other spectators on the left attend the ceremony. Even if David should be a shepherd, he already dresses like a king. The scene takes place on a meadow of Jesse's mason and in the background, a Gothic cityscape stands out.
- *Piece 12, Feast of Dives*[44] (illustration for the Office of the Dead [Matins], fig. 2.2f). The scene is divided into two parts, one occupies the biggest part of the engraving, while the second occupies a thin portion of it, visible from a narrow window located on the top left side. In the main scene, Dives dines along with a woman at a richly

[41] From Matthew 27: 33-55; Mark 15: 24-39; Luke 23: 32-49 and John 15: 24-39 (text in Ref. no. C.3.1).
[42] From Acts 1: 14; 2:1-4 (text in Ref. no. C.4).
[43] From 1 Samuel 16: 1-13 and Psalm 89: 20 (text in Ref. no. C.5.1.1).
[44] From Luke 16: 19-31 (text in Ref. no. C.6.1.1).

laid table, which is on the centre of the engraving. Both he and the woman dress richly[45] and contrast with a proceeding Lazarus in rags and misery[46] begging for some food. In the secondary scene, Lazarus lays on the ground in a completely abandoned state, dead.

[45]Dives' hair is long, following the post-1460s Flemish fashion Herbert Norris. *Medieval Costume and Fashion*. Mineola, NY: Dover publications, 1999, p. 433, and his headgear is a nobleman's hat in the 1450-1500 fashion (with two jewels, one set on the front, the other on the side to hold a quill Norris, *Medieval Costume and Fashion*, pp.434-435). The woman could be Dives' wife, based on the fact that her garment is not styled as those of young women. As a matter of fact, it appears as a plain robe with no girdle at the waist Norris, *Medieval Costume and Fashion*, p. 397 (a "girdle" is a belt in use among medieval women. It was an article of particular attire for high-class woman, and the degree of decoration, material, technique applied to produce a girdle communicated the social status of that woman. See Norris, *Medieval Costume and Fashion*, p. 23 on the origin of girdles). Her hair is not tied, as expected for a noble woman, and she may be wearing a shorter version of *hennin*, a female hairgear in use in France before 1470 Norris, *Medieval Costume and Fashion*, p. 448. Dives and his wife's wealth contrasts with the clothing of their servant, which follows the costume vogue among common citizen of late 1480s-1490s (i.e. lower station than common citizens). Indeed, they dress a tunic secured on the front (no visible buttoning),low collar, hat without universal hood beneath, heavy leather shoes and a sword hanging on one side. This outfit corresponds to that typical between the "Man of the People"; see Norris, *Medieval Costume and Fashion*, pp. 422-423.

[46]The poverty of Lazarus is clear from the sores all over his face and feet, beside his simple garments. As for the dressing, Lazarus wears a plain bonnet, similar to that in use among farmers. Compare his clothing with that of worker in the October calendar illustration from the *Très riches heures du duc de Berry*, fol. 10^{r}. The digital source for this manuscript is indicated in Appendix A—See Appendix A, Ms.1.

Alternative set (1504-1508), *c.* 60 mm x 40 mm

(a) Piece 1

(b) Piece 2

(c) Piece 3

(d) Piece 4

Figure 2.3: All pieces of the *Alternative octavo* set in the style of the Apocalypse Master workshop of *c.* 1504 (*c.* 60 mm x 40 mm illustration dimensions). The illustrations are from: a) London, BL, C.29.d.11, fol. 14^{r}; b) London, BL, C.29.k.24, fol. 20^{v}; c) (*id.*), fol. 21^{v}; d) London, BL, C.29.d.11, fol. 48^{v} © Silvia Bottura-Scardina and the British Library Board.

- *Piece 1, Annunciation* (illustration for the Office of the Virgin [Matins], fig. 2.3a). Like the version in Figure 2.1a, Mary is initially intending to read and turns her head to the archangel, as if she receives a sudden visit. Along with an overall similar composition, the style of this Annunciation is comparable with the previous: the stance of the archangel, partially bent toward Mary and proceeding to her. The Holy

Spirit as a dove hovers between the two figures and finally, the clothing of this Mary is similar to the Mary in Figure 2.1a. Differently from the previous version, this Mary stands below a canopy. Additionally, the backdrop features only an interior with two windows in Gothic style placed on the top half of the illustration.

- *Piece 2, Crucifixion* (illustration for the Office of the Cross [Matins], fig. 2.3b). This representation is also comparable to its counterpart (fig. 2.2c). In both images, the crucified Christ divides the scene into two parts: the group of followers on the right-wing and the Gentiles on the other side. Another similarity between this version and that from the previous *Octavo-format set* is the fact that the pain shatters strongly Mary's serenity, and she almost falls on the ground for the commotion. Likewise, the landscape behind the pierced Christ is shaped triangularly and the frame surrounding the scene draws a decorative feature resembling a Gothic tracery element.
- *Piece 3, Pentecost* (illustration for the Office of the Holy Spirit [Matins], fig. 2.3c). The Mary from this scene is depicted with the hands clasped in prayer and facing an open book. Like most of the depictions of this subject, she occupies the centre of the image with the ensemble of Apostles surrounding her. Surely, these elements are comparable with the corresponding illustration from the previous set. However, other features reveal closeness to Figure 2.2d. Mary's clothing is exceptionally similar to the other image. Besides, the graphic rendering of all characters of this image as well as the usual frame surrounding are the same as the Pentecost from the *Octavo*-set of the year before. The major dissimilarity is that this image appears mirrored when compared to Figure 2.2d; also, Mary has the book adjusted on her lap rather than a lectern.
- *Piece 4, Bathsheba bathing at the fountain*[47] (illustration for the Penitential Psalms [first Psalm], fig. 2.3d). This illustration is the first one to introduce iconographic novelty: this scene features Bathsheba having her toilet in a large basin of a semi-public fountain. She seems wholly unaware of the lustful gaze that King David sets on her nudity, from a window behind. In the meanwhile, she plays with the water gushing from the top, and holds one towel with one hand, probably to dry her

[47] From 2 Samuel 11: 2-3 (text in Ref. no. C.5.1.2).

body afterwards. Far from the two figures, the top right corner opens in a Gothic cityscape.

2.1.2 Differences between the two sets

The two variants on this set may have reached the Hardouyn workshop in the years 1503-1504. In 1503, the Hardouyns contracted the *Apocalypse Masters* workshop[48] to craft a suite of engravings inspired from the one elaborated a few years before for the Kerver-Wolff enterprise (*c.* 1497)[49]. Already in one year, a few additional illustrations flanked the initial group.

Stylistically speaking, substantial differences separate the parent set from those for the Hardouyn workshop. There are even more discrepancies are between the 1503 and 1504-sets for the Hardouyns, as well as between individual blocks of the 1504-set. As for the differences between the parent model and the Hardouyns sets, three are most noticeable. The first of those variations is a mirroring of the original composition, which occurs in a few illustrations (*Annunciation to the Shepherds*, *Flight into Egypt* and *Adoration of the Magi*). The second element of dissimilarity is overall darkening through a profuse *manière criblée* across all illustrations, as opposed to the relatively low-contrast impression in their archetypes[50]. Every illustration of the 1503 and 1504-set displays frequent use of this technique: in the sky of all images and small selections of the backdrop, like in *Presentation of Jesus in the Temple* and *Feast of Dives* (respectively, figs. 2.1f and 2.13). As an effect of this stylistic choice, the characters project out over the observer's sight. The last remark is about the lower artistic quality of this set. Although its lines

[48]This section credits both the workshop works and those that this Master accomplished individually to the *Apocalypse Masters*, instead of distinguishing them. The reasons for this definition are illustrated later.

[49]It is not clear whether the order came from Gillet or Germain. Because the inaugural editions for this set bear sometimes the name of Gillet and other times the name of Germain, the hypothesis of this section it that this order from the two brothers rather than only one of them. Nettekoven also speaks generally of the Hardouyn workshop rather than only one of the two brothers. See Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, p. 92. Tenschert catalogue bears reproductions of the whole set Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, pp. 53-55.

[50]The throughout application of manière criblée deserves further remarks. Based on the above information, the reader could believe that the set for the Hardouyn workshop is stylistically unique, but this is not the case. On the contrary, another set the Apocalypse Master for Kerver made around 1497-1502 displays dotted sections carved in comparable fashion—see Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, pp. 56-59. This fact suggests that darkening extended areas of the illustration was an aesthetic choice already typical of the Apocalypse Masters workshop.

keep clarity and the unique sketch of the Apocalypse Master, they lack the precision of the parent suite. This becomes especially clear in *Presentation of Jesus in the Temple* (fig. 2.1f). While comparing the two background Gothic windows, the rails should start from the same level, but one of them is slightly elevated than the other. Further instances of imprecision appear elsewhere: slightly below, the parallel lines of the side of the altar point towards discordant vanishing points, causing a faulty three-dimensionality. To enhance those inaccuracies, the fake relief-patten on it follows a likewise independent set of vector lines.

Further differences drive away from the two sets for the Hardouyn workshop. The first feature is the block dimensions, where in the original set of 1503, the pieces typically measure 83 mm x 57 mm; another, the size of the latter set, which is noticeably inferior, ranging about 60 mm x 40 mm. The second variation is on the overall artistic quality. This *Additional set* appears more unpolished and shallower than the other. Its illustrations display a lesser abundance of detail, and the design prefers coarse, straight lines over the curvy decoration of the 1503-set. Another important variation is the absence of the flowery theme that runs over the base of nearly every illustration of the 1503-set. In fact, the ground of *Crucifixion* (fig. 2.3c) is bare, described through mere line gridding.

Within the 1504-set, *Crucifixion* and *Pentecost* (figs. 2.3b and 2.3c) constitute a technically distinct group from the remaining two illustrations—*Annunciation* and *Bathsheba baths at the fountain* (figs. 2.3a and fig. 2.3d). In the first cluster, the frames to the illustrations in Gothic style feature arches with a three-centred trefoil pattern, as the *Crucifixion* of fig. 2.3b exemplifies; in the second cluster, a moulded keystone interrupts its length into two equal parts, like in *Pentecost*. Both cases also display two slender pillars topped with carved abaci, on the left and the right, as a support of a segmental arch. The arches of the second group are more regular and feature two consecutive three-centred trefoil arches connected through a tracery element, made of carved leaves. Similarly to the previous group, the two sides of the images have pillars drawn in a comparable fashion. On top of that, the Holy Spirit as a dove (in *Annunciation* and *Pentecost*) does not resemble the model of the 1503-set (fig. 2.4), and the first cluster gives an overall impression of harmony and balance between all elements of the image, as opposed to the packed arrangement of the other. For the above reason, the two groups evoke mismatching

compositional and stylistic qualities.

(a) 1503-set (b) 1504-set (1st delivery) (c) 1504-set (2nd delivery)

Figure 2.4: The Holy Spirit as a dove compared across the three deliveries (*c.* 20 mm x 20 mm illustration dimensions), details from: a) London, BL, C.29.k.24, fol. 1^{r}; b) London, BL, C.29.k.24, fol. 1^{r}; b) (*id.*), fol. 21^{v}; c) London, BL, C.29.d.11, fol. 14^{r} © Silvia Bottura-Scardina and the British Library Board.

After measuring the two sets in terms of their visual incompatibility, we wonder about their mutual relations. The catalogue Tenschert already found that the 1503-set was complete, including one illustration for each Office, and classified it as a product of the Apocalypse Masters workshop. In the description of the catalogue, it makes no mention of the illustrations from the *Alternative set*. The 1504-set comes only by inspecting two unpainted Hours in the British Library[51] whose sets, as they appear, are likely to imply a direct participation of the Apocalypse Masters workshop in the production. We believe that that attributing both sets to the circle of of his atelier should be relatively safe not only because their style and composition resembles the 1497-set for the Kerver workshop, but also for other reasons. Indeed, Nettekoven concludes his essay by stating that the Apocalypse Master established a hierarchical regime in his lively workshop[52] and applies this line of reasoning to the 1503-set for the Hardouyn workshop[53]. Nettekoven's hypothesis

[51]London, BL, C.29.k.24 (*Horae ad usum Romanum*, Paris, printed by Anthoine Chappiel for Gillet Hardouyn, 19 I 1504. See Hans Bohatta. *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*. Wien: Verlag von Gilhofer & Ranschburg, 1924, no. 785; Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.349-351) and London, BL, C.29.d.11 (*Horae ad usum Romanum*, Paris, printed by Guillaume Anabat for Germain Hardouyn, *c.* 1508. See Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 872; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, I, 1508, no. 108; Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, I, p. 75).

[52]Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, p. 56.

[53]Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, p. 92.

is sensible for both the capacity of this master and the fact that Paris was not new to a cooperative organisation of artistic atelier[54].

Admitting the existence of a circle of the Apocalypse Master would also clarify the relationship between the two clusters within the *Alternative set*. One of which groups includes the illustrations for the Hours of the Cross and Hours of the Holy Spirit—namely *Crucifixion* and *Pentecost*. Concerning these two Offices, two possible structures of liturgy appear among Books of Hours[55]. One of them consists in a set of prayers following the Office of the Virgin. The other, as a set put among the Main Office[56]. Those Hours that follow the latter devotional arrangement take the name of *mixed Hours* and generally adopt an abridged rite[57]. In such books, the introductory illustrations to the Hours of the Cross and the Hours of the Holy Spirit can occur within the textual area, in a similarly reduced format. One of the books analysed for this chapter, BL, C.29.k.24, is indeed a *mixed Hours*[58] with illustrations from the *Alternative set*. This book includes only *Crucifixion* and *Pentecost*, not the remaining images. The remaining illustrations, *Annunciation* and *Bathsheba bathing at the fountain*, finally complete the figurative cycle in another *mixed Hours*, BL, C.29.d.11[59]. In addition, it is worth mentioning that BL, C.29.k.24 was issued at the beginning of 1504[60] while the other edition dates roughly 1508. Considering simultaneously the liturgical structure and circumstances of production of the two editions[61], it can be suggested two possible facts: that this set was created specifically for *mixed Hours*, and that the two clusters came around 1504 and 1504-1508 respectively.

[54] A similar organisation had been already suspected in relation to the Boucicaut Masters (Paris, *fl.* 1400-1430). See Christine Geisler Andrews. "The Boucicaut Masters". In: *Gesta* 41.1 (2002), pp. 29–38. DOI: https://doi.org/10.2307/767203.

[55] In both manuscript Hours and printed Hours. See Reinburg, *French Books of Hours: Making an Archive of Prayer*, pp. 31-52; Hamel, *A history of illuminated manuscripts*, pp. 168-200.

[56] Reinburg, *French Books of Hours: Making an Archive of Prayer*, p. 17.

[57] In this form, they included only the prayers for the Matins Wieck, *Time Sanctified: the Book of Hours in Medieval Art and Life*.

[58] The Hours of the Cross and of the Holy Spirit start on fol. C4^{v} and fol. C5^{v}, and they locate between Lauds and Prime of the Hours of the Virgin—beginning on fol. C1^{r} and fol. C6^{r} in turn.

[59] This edition bears no exact date of production, so the year is inferred from the beginning of the almanac. In it, the Hours of the Cross and Hours of the Holy Spirit are placed in between of Lauds and Prime.

[60] The colophon refers apropos the date of edition: "*acheuees le .xix. iour de Ianuier. Lan mil cinq cens & quattre*", which translates to January 19, 1504.

[61] The discussion treats the date of edition as the date of production.

2.1.3 Artistic influences

The previous section assigned the authorship of the *Alternative set* to the Apocalypse Masters workshop, based on stylistic features and historical facts. Next to these factors, the illustrations of the Hardouyn's sets show throughout resemblances with miniatures in the style of this painting master. The personal Hours for Anne de Bretagne provides a perfect representation for the similarities[62]: its *Annunciation* is quite comparable in composition to those from the 1503-set and the *Alternative set* (fig. 2.5). The same goes also for *Visitation*, *Nativity* and *Flight into Egypt* from the same book (figs. 2.6-2.8). Further similarities arise in another devotional book, also illuminated by this artist over the late 1490s[63] (fig. 2.9).

[62] *Horae ad usum Romanum*, also called *Très petites Heures de Anne de Bretagne*, [Low Countries], 1497-1498, illuminated by Jean d'Ypres. On the attribution of the miniatures to Jean d'Ypres / Apocalypse Master, see Avril et al., *Les manuscrits à peintures en France: 1440-1520*, no. 143; L'Estrange, "Le mécénat d'Anne de Bretagne", pp. 177-179; Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, pp. 47, 113–115; Booton, *Manuscripts, Market and the Transition to Print in Late Medieval Brittany*, p. 255. The digital source for this manuscript is indicated in Appendix A (see Appendix A, Ms. 8).

[63] Book of *Horae ad usum Romanum*, written and illuminated in Paris, 1495-1499, miniatures by Jean d'Ypres. On the attribution of the decoration to Jean d'Ypres, see Avril et al., *Les manuscrits à peintures en France: 1440-1520*, no. 267; Wieck, *Painted Prayers: The Book of Hours in Medieval and Renaissance Art*, ill. 38bis; Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, pp. 54-55, 112. The digital source for this manuscript is indicated in Appendix A (see Appendix A, Ms. 22).

(a) BnF, NAL 3120, 1497-1498 (b) Hardouyn, *c.* 1504 (c) Hardouyn, *c.* 1504

Figure 2.5: *Annunciation* compared across miniatures of Jean d'Ypres and the Hardouyn sets in the style of the Apocalypse master: a) Paris, BnF, N.A.L. 3120, fol. 28^{r} (*c.* 30 mm x 10 mm illustration dimensions); b) London, BL, C.29.k.24, fol. 1^{r} (*c.* 83 mm x 57 mm); c) London, BL, C.29.d.11, fol. 14^{r} (*c.* 60 mm x 40 mm) © Source BnF, Silvia Bottura-Scardina and the British Library Board.

(a) BnF, NAL 3120, 1497-1498 (b) Hardouyn, *c.* 1504

Figure 2.6: *Visitation* compared across miniatures of Jean d'Ypres and the Hardouyn sets in the style of the Apocalypse master: a) Paris, BnF, N.A.L. 3120, fol. 40^{v} (*c.* 30 mm x 10 mm illustration dimensions); b) London, BL, C.29.k.24, fol. 17^{r} (*c.* 83 mm x 57 mm) © Source BnF, Silvia Bottura-Scardina and the British Library Board.

(a) BnF, NAL 3120, 1497-1498 (b) Hardouyn, *c.* 1504

Figure 2.7: *Nativity* compared across miniatures of Jean d'Ypres and the Hardouyn sets in the style of the Apocalypse master: a) Paris, BnF, N.A.L. 3120, fol. 50^{v} (*c.* 30 mm x 10 mm illustration dimensions); b) London, BL, C.29.k.24, fol. 22^{r} (*c.* 83 mm x 57 mm) © Source BnF, Silvia Bottura-Scardina and the British Library Board.

(a) BnF, NAL 3120, 1497-1498 (b) Hardouyn, *c.* 1504

Figure 2.8: *Flight into Egypt* compared across miniatures of Jean d'Ypres and the Hardouyn sets in the style of the Apocalypse master: a) Paris, BnF, N.A.L. 3120, fol. 66^{v} (*c.* 30 mm x 10 mm illustration dimensions); b) London, BL, C.29.k.24, fol. 24^{r} (*c.* 83 mm x 57 mm) © Source BnF, Silvia Bottura-Scardina and the British Library Board.

(a) PML, Ms. M.1110, 1495-1500

(b) Hardouyn, *c.* 1504

Figure 2.9: *Crucifixion* compared across miniatures of Jean d'Ypres and the Hardouyn sets in the style of the Apocalypse master: a) New York, PML, Ms. M.1110, fol. 148^{r} (*c.* 70 mm x 45 mm illustration dimensions); b) Teschert catalogue (2015), ill. no. 9; (*c.* 83 mm x 57 mm) © The Morgan Library & Museum, Antiquariat Bibermühle.

These instances reveal the compatibility with the Apocalypse Master's oeuvre, but further traces communicate broader artistic interest influences. Several illustrations of the Hardouyn set show the traces of the French artistic tradition. A good illustrative example is the setting of the *Annunciation*. The French fourteenth-century conceived the space where the Virgin receives the visit of the archangel specifically as an interior, as observed in the elegant *Petites Heures* of Jean, Duke of Berry[64] and the Breviary of Charles V[65] (fig. 2.10). The only difference was that the interior was originally ecclesiastic, and later it evolved into a private bedroom[66]. Another expression of the French identity is the refusal to render the stable of the *Adoration of the Magi* scene into classical ruins or the three Wise Man as individuals from three different parts of the world. As a matter of

[64]Hours for the use of Paris, Paris, 1375-1390, illuminated by Jean Pucelle. In Paris, BnF, Ms. Lat. 18014, fol. 141^{v}. The digital source for this manuscript is indicated in Appendix A, Ms. 14.

[65]Breviary for the use of Paris, Paris, 1340-1380, illuminated by Jean Pucelle and Jean Le Noir. In Paris, BnF, Ms. 1052, fol. 392^{r}. The digital source for this manuscript is indicated in Appendix A (see Appendix A, Ms. 13).

[66]The French tradition is very different from other schools of representation, like the Italian. In the Italian peninsula, the 1410-1420 Florentine school of painting placed the Virgin in a garden or in the doorway to a backyard rendered this space (John R. Spencer. "Spatial Imagery of the Annunciation in Fifteenth Century Florence". In: *The Art Bulletin* 37.4 (1955), p. 274). Most likely, this treatment meant was a reference to the *hortus conclusus* theme, emblematic of Mary. The image appreciated her as a space "within the cultivated, safe world of divine order" (Nancy Miwa. *The hortus conclusus: Marian iconography in the late Middle Ages*. Ph.D.'s dissertation. Casperen School of Graduate Studies, 2011, p. 6).

fact, the late fifteenth-century Netherlandish school of painting tended to insert classical ruins in this image, or to represent one different phase of life in each Magus—youth, maturity, old age—or a different geographic provenance. About this last point, we can mention one painting by Hieronymus Bosch (*c.* 1475) and another by Geertgen tot Sint Jans (1480-1485) as two general cases in point (fig. 2.11). In them, King Balthasar has the appearance of a dark-skinned king[67].

(a) PML, Ms. M.1110, 1495-1500

(b) BnF, Ms. 1052, 1375-1390

Figure 2.10: *Annunciation*, in: a) New York, PML, Ms. M.1110, fol. 37^{r} (*c.* 70 mm x 45 mm illustration dimensions); b) Paris, BnF, Ms. Lat. 18014, fol. 141^{v} (*c.* 35 mm x 25 mm) © Source BnF.

[67]The same choice is in another variant on the theme also by Geertgen tot Sint Jans and now in Amsterdam, Rijksmuseum—Harleem, 1480-1485, oil on panel. Retrieved from: https://www.rijksmuseum.nl/nl/collectie/SK-A-2150/catalogus-entry (Accessed September 18, 2021).

(a) Bosch's version

(b) Sint Jans's version

Figure 2.11: *Adoration of the Magi*, by: a) Hieronymus Bosch, *c.* 1475, oil on panel (711 mm x 565 mm painting dimensions). In New York, MET; b) Geertgen tot Sint Jans, 1480-1485, central piece of a tryptic, oil on wood (1110 mm x 690 mm). In Prague, National Gallery © 2021 Metropolitan Museum of Art, New York; Web Gallery of Art.

In addition to these observations, the two Wise Men on the rear seem to engage in a conversation. This model is absent in the above paintings but seems to appear in early fifteenth-century miniatures. In fact, two manuscript Hours share the same composition, one being illuminated by the Boucicaut Masters workshop and another by a follower (fig. 2.12).

(a) Boucicaut Masters

(b) follower of the Bocicaut Masters

Figure 2.12: *Adoration of the Magi*, in: a) the Boucicaut Masters workshop, from Book of Hours (Use of Paris). In Los Angeles, Getty Museum, Ms. 22 (86.ML.571), fol. 72^{r} (*c.* 70 mm x 70 mm illustration dimensions); b) follower of the Bocicaut Master. In Cleveland, Cleveland Museum of Art, 1410-1425, inv. no. 1942.169.89.a (*c.* 100 mm x 60 mm) © J. Paul Getty Trust, Cleveland Museum of Art.

Another point of relevance is the relative centrality of St. Joseph, which is revealing of French religious beliefs. St. Joseph's presence is quite central in the *Nativity*, where he appears along Mary's side rather than on the rear of the scene. Also, he is not portrayed as small as her in size. The two features indicate a highlight of his figure which, in turn, persuades on a sympathetic view on it. In this regard, large areas of fifteenth-century Central Europe gave some affectionate expression to the Josephian perspective. This region touched France, Germany, and the Low Countries. In one of the most respectful forms, the cult of St. Joseph promoted him as the *nutritor Domini*, the educator or guardian of the Lord[68].

[68] See Wilson, "textit/Sanctus Joseph Nutritor Domini: A Tryptych Attributed to Jan Gossaert Considered as Evidence of Early Hapsburg Embrace of St. Joseph's Cult", on this subject. However, the above lines were to stress that the Josephian affection of these areas was ahead of schedule in comparison to the rest of the pre-Tridentine Europe. Only the later decades of the fifteenth century could observed the signs of an increased awareness of his religious input to the Holy Family, until pope Sixtus VI mandated the official integration of his feast to the Roman calendar in 1479 Wilson, "textit/Sanctus Joseph Nutritor Domini: A Tryptych Attributed to Jan Gossaert Considered as Evidence of Early Hapsburg Embrace of St. Joseph's Cult", p. 500. With the papal decree, the Josephian devotion boasted also in Southern Europe, and the number of books that mention this feast increased dramatically Wilson, "St. Joseph in the Early Cinquecento: New 'Readings' of Two Parmigianino Drawings and a Recently Rediscovered Bedoli", p. 331; Mareto, "Chiese e conventi di Parma", p. 156; Branchesi, "Una chiesa bolognese dedicata a S. Giuseppe dal sec. XII".

2. SETS OF ENGRAVINGS USED IN THE HARDOUYN WORKSHOP

Although the two sets for the Hardouyns reveal a strong French identity, they have small traces of central European iconographic traditions. A particular one is the depiction of the maidservant carrying a candle in *Presentation of Jesus in the Temple*, characteristic of some German treatments of the theme[69] (fig. 2.13). On top of these features, maybe the most outstanding aspect is the parallel narrative of two stories in the same image, which can be seen in *Feast of Dives*. Such descriptive device appears in two series of prints by the German engraver Israhel van Meckenem (*fl. c.* 1445-1503). In partnership with Hans Holbein the Elder[70], van Meckenem carved one twelve-sheet suite with stories of the Passion of Jesus, called accordingly *Passion Series* (1475-1485)[71], and another for the life of the Virgin (1490-1500)[72]. Both series include secondary representations in background slices, generally corresponding to convenient apertures within walls (fig. 2.14). Only in the following years, this narrative trend would extend to pictorial forms[73], as it is seen in paintings by Jan Baegert (like an *Adoration of the Child* now in Warsaw, National Museum, *c.* 1490[74]). Regardless of the rightful parent of such descriptive technique, its use in French engraving is outstanding because it was unseen until that point.

[69] Schiller, *Iconography of Christian Art*, p. 93.

[70] This thesis does not intend to side Plassman's theory on the major van Meckelem contribute as to innovation of narrative structures in paint. Instead, stating that the two series are the product of a partnership, the present discussion will take the intentional stance of a direct action of Hans Holbein the Elder as the chief of a fruitful workshop where he, as the leader, provided models for van Meckelem to process Fritz Koreny. "Israhel van Meckenem". In: *Print Quarterly* 18.4 (2001). Review article. See also Otmar Plassmann. *Israhel van Meckenem: Kupferstiche des späten Mittelalters aus Westfalen*. Schmallenberg, Grafschaft Abbey Museum, 2 June-13 August 2000. Exhibition catalogue; Martin Sonnabend. *Kupferstiche des Israhel van Meckenem*. Frankfurt, Städel Museum, 21 January-22 April 2001. Exhibition catalogue.

[71] A complete collection of this work is in New York, MET (inv. no. 2003.476) and another in London, BM (L.143-153).

[72] A few instances of this series are in New York, MET: *Birth of Mary*, *Annunciation* and *Coronation of the Virgin*, inv. nos. 52.522.1, 28.97.106 and 22.51.2. The British Museum holds a more complete version of it: inv. nos. 1842,0806.60-1842,0806.67 and 1842,0806.69.

[73] Koreny measures the parallels between the engraver Israhel van Meckenem with the German painter Jan Baegert (1465-*c.*1535) and supports a lack of originality of the former with reference to the other Koreny, "Israhel van Meckenem", p. 472. However, the double storytelling in the mentioned series of engraving may be an original element of the van Meckelen-Holbein partnership in this period.

[74] *Adoration of the Child*, by Jan Baegert, *c.* 1490, oil on panel. In Warsaw, National Museum, acc. no. M.Ob.585.

(a) Albrecht Dürer, *c.* 1511

(b) Wolfgang Huber, 1515-1530

Figure 2.13: *Presentation in the Temple*, as represented in the German school of engraving: a) Albrecht Dürer, *c.* 1511. In London, V&A Museum, London, acc. no. E.698-1940 (299 mm x 210 mm print dimensions); b) Wolfgang Huber, 1515-1530. In London, BM, inv. no. 1858 0626.26 (118 mm x 94 mm) © Victoria and Albert Museum, London, 2021; the Trustees of the British Museum.

(a) Nativity

(b) Deposition of Jesus

Figure 2.14: Two prints by the Israhel van Meckenem-Hans Holbein the Elder partnership: a) *Nativity*, 1490-1500. In London, BM, inv. no. 1842,0806.64 (257 mm x 183 mm print dimensions); b) *Deposition of Jesus*, 1475-1485 (257 mm x 183 mm). In New York, MET, inv. no. DP167213 (208 mm Œ 145 mm) © The Trustees of the British Museum; The Elisha Whittelsey Collection, The Elisha Whittelsey Fund, 1929.

Overall, the two sets in the style of the Apocalypse Master reveal the influence of the

French school of illumination and the German school of engraving.

2.1.4 Use of the sets among the Hardouyn editions

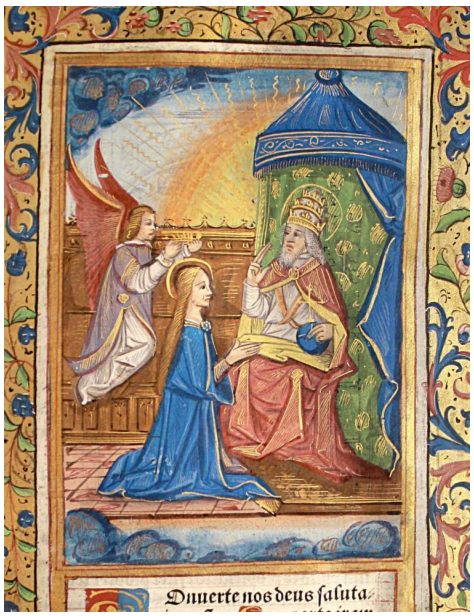
The use of the sets in the style of the Apocalypse Masters can be divided into two major periods of use. The first of which terms falls in the years 1504-1505 and corresponds to the years in which these suites found the most coherent employment. It is in this period that Gillet and Germain contracted two Parisian printers, Anthoine Chappiel (Paris, *fl.* 1500-1504) and Guillaume Anabat (Paris, *fl.* 1500-1510), to print Hours on their behalf. As for Chappiel, he produced two editions for Gillet and one more for Germain, all of them throughout the year 1504[75]. We were able to realise a direct inspection for one item in London of the editions for Gillet (BL, C.29.k.24) and the digital source of another exemplar of Germain's edition in the Vatican State (BAV, Stamp. Ross. 1522)[76] of the edition for Germain. All these items are *Octavo*-editions, some of which occur in the exceptionally rare *agenda* format[77]. Additionally, these images were meant to be left unpainted or with overpaints, but when the set is covered with colour, the overpaints stick to the original outlines. For the two situations, the parallel inspection of a book decorated with crude paint (BL, C.29.k.24) and another volume from a private library offers a perfect instance of affinity (fig. 2.15).

[75]London, BL, C.41.e.4 (notice in Paul Lacombe. *Livres d'heures imprimés au XVe et au XVIe siècle conservés dans les bibliothèques publiques de Paris: catalogue*. Paris: Imprimerie nationale, 1907, no. 146; Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 784; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, I, 1504, no. 45); C.29.k.24 (notice in Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.349-351; Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 785; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, vol.1, 1504, no. 46); C.29.i.11 (notice in Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, nos. 426, 614; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, I, 1504, no. 49).

[76]BAV, Stamp. Ross. 1522, *Horae ad usum Romanum*, Paris, 5 X 1504, Anthoine Chappiel for Germain Hardouyn. The digital source for this printed book is indicated in Appendix A, Inc. 41. London, C.29.i.11 (see before) and BAV, Stamp. Ross. 1522 have a common ISTC identification number (ih00412500). See https://data.cerl.org/istc/ih00412500 (Accessed September 13, 2021).

[77]It is an *Octavo*-edition with elongated shape.

(a) Reference impression



(b) Private collection

Figure 2.15: *Coronation of the Virgin* compared across two Books of Hours from the Hardouyn workshop (83 mm x 57 mm illustration dimensions): a) London, BL, C.29.k.24; b) private collection © Libraire Camille Sourget, Silvia Bottura-Scardina and the British Library Board.

Starting from 1505, the use of the sets becomes more inconsistent. The years 1518-1521 correspond to a new development in use, when the images employed are nearly exclusively those from the 1503-set, and, among them, a good part of the scenes illustrates the Office of the Virgin, the Penitential Psalms and the Hours of the Dead. The images for the remaining offices are supplied with other sets, especially the *Set in "Linear" style of c. 1515* and the *Set in "German" style of c. 1516* and (see Sections 2.3.1 and 2.4.1). The set survived until 1533, when Germain mixed the sole images of the Hours of the Virgin with the illustrations from three sets for the decoration of two editions (at least)[78].

[78]Two books that still display the series from the Apocalypse Masters combined with other sets are in Avignon (Avignon, BMC, Rés. 203, *Horae ad usum Romanum*, Paris, *c.* 1533, Germain Hardouyn) and in Poitiers (Poitiers, BM, DR.38. *Horae ad usum Romanum*, Paris, *c.* 1533, Germain Hardouyn). See Appendix A, Incs. 1 and 38.

2.2 Sets in the style of Jean Pichore (1505-1526)

In 1505, the Hardouyns commissioned the artist Jean Pichore (Paris, *fl.* 1502-1521) to craft the first of a long series of suites of engravings that would find long employment as figurative decoration. Jean Pichore was a versatile artist whose style has been identified in illuminated manuscripts, printed books and, most importantly, in the design of sets of engravings for publishers and printers. As for the first of the above activities, his involvement in the production of illuminated manuscripts seems to date back to the turn of the sixteenth century, with a sure record of activity in *c.* 1502[79]. As an illuminator, Jean Pichore worked alone and in collaboration with other fellow master of painting[80]. As for printing, Jean Pichore made a brief foray into print-making with the publisher Rémy de Laistre in *c.* 1501-1504[81]. After his period, Pichore seems to engage in designing (and maybe even crafting) numerous sets of engravings for Parisian publishers and printers of Books of Hours, like Simon Vostre, Thielman Kerver, Jean Barbier, Guillaume Le Rouge and Jean De Brie[82]. Among this large group, some of the sets that Pichore designed were for the Hardouyn workshop[83].

Pichore had a very busy schedule, so he often structured his assignments as collaborative works with other fellow illuminators. Among the artists who collaborated with Pichore, scholars identified the *Master of the Chronique scandaleuse* (France, *fl. c.* 1493-1510), the Master of Cardinal Bourbon (France, *fl. c.* 1480-1500), the *Master of Jacques de Besançon* (France, *fl. c.* 1480-1500) and Jean Coene IV. Together, they decorated

[79] This earliest trace of Pichore's work corresponds to a commission for the production of miniatures in a *Civitas Dei* for the Cardinal Georges d'Amboise (see note 46 of Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 15-16). Zöhl reconstructed this detail of Pichore's activity based on a document now in Archives Départementales de la Seine-Maritime (G.614, quoted from Achille Deville. *Comptes de dépenses de la construction du château de Gaillon publiés d'après les registres manuscrits des trésoriers du Cardinal d'Amboise*. Paris, 1850, p. 437).

[80] On this point, see Section 2.2.1.1.

[81] Renouard et al. mention the De Laistre-Pichore enterprise, without clarifying their roles (Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 23, 357). De Laistre was a publisher while Pichore was an illuminator that also had contacts with other booksellers and publishers; however, the involvement of each of them is still unclear.

[82] See Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 127-155.

[83] Zöhl labels them "*Oktavserie für Gillet und Germain Hardouin*" and "*Quartserie für Gillet und Germain Hardouin*." See Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 138-141, 144–146, 176–177.

the so-called *Poncher Hours*[84], a copy of Lactantius' *Divinae Institutiones*[85] and another book of private devotion[86] in the early sixteenth century. Pichore was synergetic at times. In addition, his co-operative nature might have trained him to keep an open eye on the work of his contemporaries. As elucidated in the next sections[87], Pichore's work leaks off the traces of influence of another important illuminator of the Tours school of illuminating, Jean Poyer (*fl. c.* 1483-1503). Back to the sets illustrated in this sections, some of these prints already received attention. Zöhl explored Jean Pichore's *oeuvre* thoroughly, especially concerning his designing activity at the service of Parisian printers of Hours[88]. Later, she integrated this information while collaborating on the creation of Tenschert's catalogues[89]. Concerning the case of the Hardouyn workshop, Zöhl has identified four complete series of engravings, two of which would decorate the Offices, the other were border decorations. The major sets from her inspection are here described as the *Octavo-set for Gillet and Hardouyn of c. 1505-1509* and *Quarto-set for Gillet and Hardouyn of c. 1509*[90]; a part of the engravings for the historiated marginalia also finds some space here. In fact, another collection explored in this thesis (*Octavo-agenda set for Gillet Hardouyn of c. 1506*) includes two pieces that were originally part of a unit inspired by the *Danse Macabre* narratives[91]. The Hardouyns titled that cycle *Accidents de l'homme*[92], and the

[84]Paris, *c.* 1500. Los Angeles, J. Paul Getty Institute, Ms. 109 (see Klaus Waldmann. "Dannazione e salvezza: Immagini dell'Aldilà al Getty Museum di Los Angeles". In: *'Alumina' pagine miniate* 10.37 (2012); Elizabeth Morrison. "Marriage, Death, and the Power of Prayer: The Hours of Denise Poncher". In: *The Getty Research Journal* 6 (2014). DOI: https://doi.org/10.1086/675797). See Appendix A, Ms. 4 for more illustration for the Penitential Psalms [first Psalm] bibliographic info and a partial digital source for the item.

[85]Paris, c. 1500-1505. In Paris, BnF, Lat. 1671; see Avril et al., *Les manuscrits à peintures en France: 1440-1520*, pp .274-275, no. 150; Marie-Pierre Laffitte. "La librairie de Georges d'Amboise à Gaillon". In: *Léonard de Vinci entre France et Italie miroir profond et sombre*. Ed. by Silvia Fabrizio-Costa et al. Proceedings of the International Conference of the University of Caen (3-4 October 1996). Caen: Presses universitaires de Caen, 1999, p. 273; Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 19, 44, 59, 190). See Appendix A, Ms. 20 for bibliographic info and a partial digital source for the item.

[86]Paris, c. 1500-1520. In London, BL, Ms. Sloane 2418. See Appendix A, Ms. 3 for more illustrations and bibliographic info on the item.

[87]See the last parts of Section 2.2.3.

[88]See Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*.

[89]Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*;Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*.

[90]The present thesis adopted these titles to conform to the terminology that Zöhl employed to designate the series in her monography. She originally named them in German, so this manuscript translated them into English especially for creating a uniform nomenclature.

[91]This series would find large employment in the Hardouyn *Grandes Heures*. See Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*.

[92]On the *Accidents de l'homme* theme, see later in the Section 2.2.3 for more details and the history of

two pieces at issue are *Death with Adam and Eve in Paradise* (Piece 1) and *One man strangles another, Death observes* (Piece 12). This thesis explores their use as a complement to other unpublished illustrations to decorate exclusive items in agenda-format. No previous study has detected the best part of the pieces that constitute it, namely those featuring scenes of the Life of the Virgin. Thus, this thesis presents for the first time a formal description of these pieces and attributes them to the group of figurative borders that the Pichore workshop realised around 1508. The second discovery is of an entire series of engravings that is first seen in *c.* 1512, the *Duodecimo-series*. This latter group of engravings is here presented and discussed for the first time also, so it follows a tentative attribution of authorship to the Pichore workshop, based on stylistic analysis.

use.

2.2.1 Formal description of the sets

Octavo-agenda set for Gillet Hardouyn of *c.* 1506 (1506), 42 mm x 22 mm

(a) Piece 1 (b) Piece 2 (c) Piece 3

(d) Piece 4 (e) Piece 5 (f) Piece 6

Figure 2.16: First six pieces of the *Octavo-agenda* set in the style of the Pichore workshop of *c.* 1508 (42 mm x 22 mm illustration dimensions). The illustrations are from: a) London, BL, C.29.d.11, fol. 13^{v}; b) UPenn, Ms. Codex 1531, fol. 97^{r}; c) BL, C.29.d.11, fol. 17^{v}; d) (*id.*), fol. 22^{v}; e) (*id.*), fol. 24^{v}; f) (*id.*), fol. 26^{v} © The British Library Board, Kislak Center for Special Collections, Rare Books and Manuscripts, University of Pennsylvania.

(a) Piece 7 (b) Piece 8 (c) Piece 9

(d) Piece 10 (e) Piece 11 (f) Piece 12

Figure 2.17: Six pieces more of the *Octavo-agenda* set in the style of the Pichore workshop of *c.* 1508. The illustrations are from London, BL, C.29.d.11 (42 mm x 22 mm illustration dimensions): a) fol. 28^{v}; b) (*id.*), fol. 29^{v}; c) (*id.*), fol. 9v; d) (*id.*), fol. 22r; e) (*id.*), fol. 42^{r}; f) (*id.*), fol. 49^{v} © The British Library Board.

Figure 2.18: Piece 13 of the *Octavo-agenda* set in the style of the Pichore workshop of *c.* 1508 (42 mm x 22 mm illustration dimensions). From London, London, BL, C.29.d.11, fol. 50^{r} © The British Library Board.

- *Piece 1, Death with Adam and Eve in Paradise* (illustration for the Office of the Virgin [Matins], fig. 2.16a). Adam and Eve are in the garden of Eden, facing the Tree of Knowledge. The evil in half-serpentine form, peeks the scene from the top of the tree. On the left, Death drags a reluctant Adam by the arm. Adam and Eve cover their nudity with one hand. The background shows the gate of Heaven, and the fence framing it.
- *Piece 2, Annunciation* (illustration for the Office of the Virgin [Matins], fig. 2.16b). Mary stands below a canopy, reading a book. Her lecture is interrupted by the visit of archangel Gabriel. She waives to him as a sign of acceptance, while the other hand stays on the book. The angel leans towards her and indicates the fact that the Divine Plan is directly emanated by God the Father with one finger raised to the top. The Holy Spirit descends in form of a dove towards her, from the indicated direction.
- *Piece 3, Visitation* (illustration for the Office of the Virgin [Lauds], fig. 2.16c). Mary and Elizabeth meet in the countryside, as shown by the surrounding hills and a tree far away. Mary stays with a straight back while the old cousin bends in the Virgin's direction. The two women touch each other's wombs to communicate their

double pregnancy.

- *Piece 4, Nativity* (illustration for the Office of the Virgin [Prime], fig. 2.16d). Mary and St. Joseph celebrate the birth of Jesus. The Child is adjusted on Mary's cloak, on the ground and is completely naked. Mary joins her hands in prayer and St. Joseph observes. Beyond, an ox and a donkey are peeking from an open-air stable, just behind the Holy Family.
- *Piece 5, Annunciation to the Shepherds* (illustration for the Office of the Virgin [Terce], fig. 2.16e). Two shepherds receive the Good News from the Angel of God, who appears from the top.
- *Piece 6, Adoration of the Magi* (illustration for the Office of the Virgin [Sext], fig. 2.16f). The three Wise Men visit Mary and the Child Jesus to homage the new King. The old king kneels before Jesus and offers his gift, with his head uncovered. The other two kings stay behind, wearing their crowns. They are represented as three men in three different phases of life. The scene takes place in an open-air stable and does does not display St. Joseph.
- *Piece 7, Presentation in the Temple* (illustration for the Office of the Virgin [None], fig. 2.17a). Mary presents Child Jesus to the High Priest / Simeon in the Temple of Jerusalem. The High Priest / Simeon adjusts Jesus on the altar, below a canopy, a maidservant and St. Joseph observe the scene.
- *Piece 8, Flight into Egypt* (illustration for the Office of the Virgin [Vespers], fig. 2.17b). The image is a moment of the travel of the Holy Family from Israel. They are in the countryside, in disguise: Jesus is in swaddling clothes and Mary's hair is covered with a veil.
- *Piece 9, Jesus carries the Cross* (illustration for the Office of the Cross [Matins], fig. 2.17c). During the procession to Golgotha, Christ almost falls under the weight of the Cross[93] under the sight of Mary and a dense crowd. Christ looks backwards.
- *Piece 10, Pentecost* (illustration for the Office of the Holy Spirit [Matins], fig. 2.17d). Amazed and astonished, Mary and the apostles look at the miraculous ap-

[93] This compositional model reminds a Schongauer's print, possibly inspired by a (now lost) painting by Van Eyck. See Schongauer, Martin (1475-1480). *Christ carrying the Cross* [print on paper]. New York, MET, Inv. no. 35.27. Retrieved from: https://www.metmuseum.org/art/collection/search/336162 (Accessed September 18, 2021).

parition of the Holy Spirit as a dove, that comes from the left corner of the image.

- *Piece 11, King David in penitence* (illustration for the Penitential Psalms [first Psalm], fig. 2.17e). King David is in the courtyard of his palace and kneels in the middle of a meadow in penance, directing this gaze to above. God opens the sky to answer David's call. A lyra, the sign of David's . A lyra, the sign of David's natural disposition to music, is left on the ground.
- *Piece 12, One man strangles another, Death observes* (illustration for the Office of the Dead [Vespers], fig. 2.17f)[94]. Death observes the violent scene where a man strangles another. Probably, that man has already killed another one, that lays dead on the front.
- *Piece 13, Job on the dung heap*[95] (illustration for the Office of the Dead [Vespers], fig. 2.18). The ailing Job, having suffered many afflictions, including the loss of his children, his riches, and even his health, is reduced to resting on a reeking heap of dung. Satan, in the form of two friends, visits Job to persuade him to give up his faith.

[94]This illustration is the only one from this series with no biblical origin. Its meaning is understood while reading the verses of the *Accidents the l'homme* poem, that is a dance of death. In relation to this piece of the *Octavo-agenda* series, the poem reads: "Then these robbers, murderers, iniquitous, / Friends of death and evil serfs: / For, by their hands, many have been restored to me. / Their fact approves and holds as authentic; / But notwithstanding, I agree, as a matter of practice, / Let the thieves hang on the gallows." Translation by the author from the original in Middle French: "*Puis ces brigands larrons*, *meurtriers*, *iniques*, / *Amis de mort et serfs diaboliques*: / *Car*, *par leurs mains*, *plusieurs me sont rendus*. / *Leur fait approuve et tiens pour authentique*; / *Mais nonobstant*, *je consens*, *par pratique*, / *Que les larrons soient au gibet pendus*." These lines describe Death's punishment for the most immoral members of the society, namely the termination of their lives. As such, the theme has some intrinsic connections to the imagery traditionally employed as a figurative opening to the Office of the Dead. Firstly, it is a dialogue spoken by Death itself, so it is an appropriate choice to portray her in this Office. Besides, Wieck proposed that the medieval man recited the prayers of this Office to shorten the permanence of the departed souls of their relatives in the Purgatory (Wieck, *Painted Prayers: The Book of Hours in Medieval and Renaissance Art*, p. 117). Reciting these lines, the torments of their relatives would be shortened. Thus, this illustration may have forced the Christian to meditate on the importance of well-conducting their life before it would be taken away by the heinous Death. In other words, this illustration may be an instance of *memento mori*.

[95]From Job 2: 8-13 (text in Ref. no. C.6.1.3).

Octavo-set for Gillet and Germain of *c.* 1505-1509 (1505-1526), *c.* 121-125 mm x 80 mm

This set and the next one represent different themes that the *Octavo-agenda* suite. If the previous series gave large space to monstrous representations related with the death, those one gave larger space to other themes, such as typological representations. Despite their differences all those set share a common ground in regards of their designer: the Pichore workshop. Thus, the next suites are classified as members of this section.

(a) Piece 1 (b) Piece 2 (c) Piece 3

(d) Piece 4 (e) Piece 5 (f) Piece 6

Figure 2.19: The first twelve pieces of the *Octavo*-set in the style of the Pichore workshop of 1505-1509 (*c.* 121-125 mm x 80 mm illustration dimensions). The illustrations are from Paris, BnF, Rés 8.T.2520: a) fol. 24^{r}; b) (*id.*), fol. 30^{r}; c) (*id.*), fol. 40^{r}; d) (*id.*), fol. 41^{r}; e) (*id.*), fol. 56^{r}; f) (*id.*), fol. 71^{r} © Source BnF.

(a) Piece 7 (b) Piece 8 (c) Piece 9

(d) Piece 10 (e) Piece 11 (f) Piece 12

Figure 2.20: More twelve pieces of the *Octavo*-set in the style of the Pichore workshop of 1505-1509 (*c.* 121-125 mm x 80 mm illustration dimensions). The illustrations are from Paris, BnF, Rés 8.T.2520: a) (*id.*), fol. 76^{r}; b) (*id.*), fol. 81^{r}; c) (*id.*), fol. 86r; d) (*id.*), fol. 92r; e) (*id.*), fol. 100^{r}; f) (*id.*), fol. 67^{r} © Source BnF.

(a) Piece 13 (b) Piece 14 (c) Piece 15

(d) Piece 16 (e) Piece 17 (f) Piece 18

Figure 2.21: The last six pieces of the *Octavo*-set in the style of the Pichore workshop of 1505-1509 (*c.* 121-125 mm x 80 mm illustration dimensions). The illustrations are from Paris, BnF, Rés 8.T.2520: a) (*id.*), fol. 69^{r}; b) (*id.*), fol. 116^{r}; c) (*id.*), fol. 117^{r}; d) (*id.*), fol. 135^{r}; e) (*id.*), fol. 134^{r}; f) Poitiers, BM, DR.38, fol. 1^{r} © Source BnF and Poitiers, Bibliothèque municipale.

Figure 2.22: Piece 19 of the *Octavo*-set in the style of the Pichore workshop of 1505-1509 (118 mm x 78 mm illustration dimensions). From London, BL, C.29.i.18, fol. L8^{v} © Silvia Bottura-Scardina and The British Library Board.

- *Piece 1, St. John and the poisoned chalice*[96] (illustration for the Gospels [Gospel of John], fig. 2.19a). St. John is in a courtyard, in front of a large crowd of spectators, astonished by the miracle. The Apostle stands between the two corpses of the prisoners that were forced to drink from the poisoned cup and now lay dead before him. St. John's holds the chalice that previously contained the venom and now lodges a snake.
- *Piece 2, Jesus is arrested in the garden of Gethsemane*[97] (illustration for the Gospels [Passion Gospel of John], fig. 2.19b). Jesus and Judah stand in the middle of a dense crowd in the garden of Gethsemane, away from Jerusalem. Judah kisses Jesus on the face, as the signal arranged to distinguish him and a Roman soldier immediately drags Jesus away from his people.
- *Piece 3, Dispute and reconciliation between the daughters of God*[98] (illustration for

[96]From Leucian Acts, XX and the *Golden Legend* (text in Ref. no. C.1.1.1). For bibliographic info and a full digital source of the item, see Appendix A, Inc. 26.

[97]From John 18: 3-6 (text in Ref. no. C.1.2.1).

[98]The Dispute in Heaven was one of the most widespread allegories of the medieval folklore. It described a debate between the four daughters of God, Justice, Truth, Mercy and Peace, about whether it was sensible for God to create mankind. In the allegory, each of them had their reasons to favour or oppose the plan and a debate set up. In the end, the four daughters come to common solution and consent to God's plan to give birth to the man. The image developed from various sources but, among these, Pseudo-Bonaventure's *Meditationes* were the most influential in the Christianity (also see Hope Traver. "The Four Daughters of God: A Mirror of Changing Doctrine". In: *PMLA* 40.1 (1925). DOI: https://doi.org/10.2307/457268

the Office of the Virgin [Matins], fig. 2.19c). The image presents the reconciliation between the four Daughters of God, where Justice brandished a sword and Peace protects her with her body. Mercy brings a bag, and Truth carries a rose. Two groups interact: Justice and Peace kiss, while Mercy and Truth hug.

- *Piece 4, Annunciation* (illustration for the Office of the Virgin [Matins], fig. 2.19d). Mary faces the archangel Gabriel facing him and sitting on a throne. She has a book on her lap. The scene takes place in a large interior richly styled in Renaissance fashion.
- *Piece 5, Vision of Augustus and the Tiburtine sibyl*[99] (illustration for the Office of the Virgin [Lauds], fig. 2.19e). Augustus and the Tiburtine sibyl are in a courtyard. She shows him a vision of Mary with the Child, which appear from the sky, on the left corner. Augustus observed the apparition, astonished.
- *Piece 6, Nativity*[100] (illustration for the Office of the Virgin [Lauds], fig. 2.19f). Mary and St. Joseph kneel before Jesus, in a stable that has the shape of a wooden hut. A wooden element of the stable divides the scene, leaving Mary alone on one side and St. Joseph with the Child on the other side. Far away, a group of peasants, maybe shepherds, observe the scene. The ox and the donkey pay no attention to the Holy Family and keep on feeding.
- *Piece 7, Annunciation to the Shepherds* (illustration for the Office of the Virgin [Prime], fig. 2.20a).A group of three shepherds received the angel's visit. Two of them are on the front, one stays slightly aside. The shepherd in the centre was

and Raplh A. Klinefelter. "The Four Daughters of God: A New Version". In: *The Journal of English and Germanic Philology* 52.1 (1953)). The order of placement of the Four Daughter is after Ps 85:10, that says: "Mercy and truth are met together; righteousness and peace have kissed each other". In the scene Justice / Righteousness indeed kisses Peace while Mercy and Truth hug. However, the order in which the two groups are placed in the image is inverted to the traditional order: Justice-Peace are first in order (left) and Mercy-Truth follow (right).

[99] At the order of the Senate to worship Augustus as a god, the Roman emperor wondered on the rightfulness of this decree. Thus, he interrogates a powerful female prophet, the Tiburtine Sibyl. She revealed to Emperor Augustus a vision of the Virgin and Christ Child, who would eclipse all the Roman gods. This popular tale connected Ancient and Christian Rome, implying foreknowledge of the coming of Christ by the greatest of Roman emperors. This tale is told in Vincent of Beauvais' *Speculum naturale*, together with *Golden Legend*, chapter 6 (*De nativitate Domini*, a compilation of myths related to the birth and anticipation of Jesus' birth). See Anthony Cutler. "Octavian and the Sibyl in Christian hands". In: *Vergilius* 11.1 (1965)

[100] Technically speaking, this piece sets apart from the rest of the suite. However clear, the way the characters are sketched does not respect the standard of Jean Pichore. Also, the wooden pillar in the centre splits unusually the scene into two parts, pushing Mary to the left and St. Joseph to the right. Zöhl supposed that this piece is the work of a workshop clerk, and that it is a reversed copy of a 1504-piece (see also Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 138-140).

probably playing the hornpipe before the angel makes his appearance. Two dogs on the front retract, scared.

- *Piece 8, Adoration of the Magi* (illustration for the Office of the Virgin [Terce], fig. 2.20b). The three Wise Man stand slightly outside the stable where the Holy Family abides. The older Wise Man kneels before Jesus, bowing his head and touches one little foot of the child. Behind the old Wise Man, the other two engage in a conversation, waiting for their turn to pay their respects to the new King. Behind the three Wise Man, a procession herds to see the child[101].
- *Piece 9, Presentation in the Temple* (illustration for the Office of the Virgin [Sext], fig. 2.20c). The Holy Family visits the Temple of Jerusalem for Jesus' rites of purification and expiation. Mary has just passed the ChildJesus to the High Priest/Simeon, who, in turn, adjusts the baby on the altar. Amidst the backgrounding crowd of spectators, St. Joseph carries the offers for the rite, namely a chest of doves and a candle. The Priest stands beneath a round canopy, and the interior of the Temple shows the influence of Ancient Roman architecture in Renaissance Italian style.
- *Piece 10, Flight into Egypt* (illustration for the Office of the Virgin [Vespers], fig. 2.20d). The scene captures a moment of the flight of the Holy Family to Egypt, as the group passes through a countryside landscape. Mary and the Child, in disguise, ride a donkey; St. Joseph and a maid servant follow on the side and the rear, respectively. A couple of angels observe the scene.
- *Piece 11, Death of the Virgin* (illustration for the Office of the Virgin [Compline], fig. 2.20e). The body of Mary lays on her deathbed, in the middle of a wide room. Surrounding her, a large group of bystanders pay their respects to the mother of Jesus. As they wait for their turn to give offerings, or maybe the final farewell, the soul of Mary rises from her dead body and hovers above the crowd.
- *Piece 12, Crucifixion* (illustration for the Office of the Cross [Matins], fig. 2.20f). Jesus and the two thieves are on the Cross, but only the former is nailed to the wood

[101]The "procession" version of *Adoration of the Magi* was popular in Italian painting between the late fourteenth- and the early fifteenth century. A good case in point is a painting from Gentile da Fabriano: (1423), Florence [paint on wood]. Florenze, Uffizi Gallery, inv. no. 1890,8364. Retrieved from: https://www.uffizi.it/en/artworks/adoration-of-the-magi (Accessed September 18, 2021).

bars. Jesus is already dead, and a large crowd of spectators is present at the scene. They express mixed feelings: Mary is heartbroken; Mary Magdalene embraces the Cross, lamenting the loss of her Master and St. John sides Mary, to assist her. On the right, the Roman soldier Longinus pierces the dead body of Jesus, under the gaze of his fellow soldiers and citizens of Jerusalem.

- *Piece 13, Pentecost* (illustration for the Office of the Holy Spirit [Matins], fig. 2.21a). Mary and the apostles are gathered in prayer. As the members of the gathering perform their duties, the Holy Spirits descends to them from the centre top. The divine epiphany leaves all those who are present speechless, but Mary. She stays in the centre, joining her hands as a sign of humble reception of the gift. Two of the apostles sit on benches placed in front, on both sides.
- *Piece 14, King David sends Uriah to die*[102] (illustration for the Penitential Psalms [first Psalm], fig. 2.21b). King David summons the soldier Uriah in his palace to hand him the order that will send the latter to sure death. The king gives the letter with the instructions directly to a kneeling Uriah, who accepts humbly the task. Witnessing the scene, several members of David's court stand on the rear and everywhere in the background. The scene is set in a sixteenth-century context: the room where the event takes place is styled as an Italianate Renaissance building. Additionally, the characters are shown wearing sixteenth-century garments, in particular King David and his courtiers.
- *Piece 15, Death of Uriah*[103] (illustration for the Penitential Psalms [first Psalm], fig. 2.21c). On a crowded battlefield, a soldier pierces Uriah the Hittite to death with a spear. Hit on the flank, the Hittite soldier falls from the horse to the ground. A violent battle rages around the main scene: two rear knights engage in single combat, many flags hover on the fighters, people lie dead on the ground. The scene takes place at the doors of Jerusalem, as shown by the cityscape.
- *Piece 16, Rise of Lazarus*[104] (illustration for the Office of the Dead [Vespers], fig. 2.21d). Just outside the city of Jerusalem, Jesus visits the tomb of Lazarus with

[102] From 2 Samuel, 11: 12-15 (text in Ref. no. C.5.1.3).
[103] From 2 Samuel, 11: 16-17 (text in Ref. no. C.5.1.4).
[104] From John 11: 38-44 (text in Ref. no. C.6.1.2).

his disciples. Here he raises his three fingers in a sign of blessing[105] and performs the miracle of resurrection. To everyone's surprise, Lazarus arises alive from his sepulchre: some open their arms, others look at each other, one woman falls to her knees.

- *Piece 17, Feast of Dives* (illustration for the Office of the Dead [Vespers], fig. 2.21e). Splendidly dressed in furs and jewels that indicate his great wealth, Dives sits at a table with his wife. Around the couple, dishes with food swirl around, carried by many attendants. Far back, Lazarus approaches the house to beg for some scraps, while his dogs beat each other to lick the sores on Lazarus's wretched body.
- *Piece 18, Printer's device, first version* (fig. 2.21f). This image is the only classical scene of the set. Its subject is the rescue of Deianira by the demigod Hercules'. She has just fallen in the clutches of the centaur Nessus, who heads toward the other side of a nearby river in the attempt of fleeing away from Hercules' reach. Hercules stands on the left, tending his arc and ready to shoot at the creature. The scene takes place in the middle of a deep forest, which is revealed by the lavish vegetation surrounding the figures. On the top of the image stands a blank escutcheon.
- *Piece 19, Printer's device, second version*[106] (fig. 2.22). This second device of the Hardouyn workshop features the Portuguese coat of arms. The centre of the image is entirely filled with the heraldic symbol of D. Manuel I of Portugal (*reg.* 1495-1523), with the five small blue shields filled with an equal number of bezants[107].

[105] This is the traditional sign of blessing of the Trinity; see Adolphe Napoléon Didron. *Christian iconography ; or, the history of Christian art in the Middle Ages*. Vol. 1. Translated from the French by E.Y. Mellington, and completed with additions and appendices by Margaret Strokes. London: George Bell & Sons, 1886, p. 406.

[106] This illustration is both discussed by Zöhl and presented in the Tenschert catalogues as the "*Engel mit Wappen und Sphaira*" piece (="Angel with Coat of Arms and Sphere"). According to Zöhl, its first appearance dates back to c. 1510. See Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, p. 174; Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, vol. 1, nos.534-538; Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, p. 82.

[107] The five shields or escutcheons underwent major changes already under King D. João II of Portugal (in 1481-1485). The Portuguese King undertook a reform of the royal coat of arms, whose new order (Arms of D. João II of Portugal) touched both the number of shield and their orientation. These changes were elucidated in the writings of the royal chronist Garcia de Resende (1470-1536), on which regard he stated: "Concerning the five escutcheons in the centre of the shield and forming a cross, the two on the sides [originally] were part of its grounds and directed their points toward the cross [centre]. This [order] was contrary to the right rule of the coat of arms and seemed to disregard greatly those who anguished on the battlefield, which was not the case. Thus, the King, to avoid any suspicion and unrest, ordered that all the escutcheons would be placed upright, with their points downwards, as they were to present themselves

Around the major shield, there is a bordure with twelve small castles inside[108]. Besides, the illustration comprises also a crown over the major escutcheon[109] and an armillary sphere[110] on the lower half. Two angels support the central shield, one

duly and naturally. This is how they present themselves henceforth". Translation from the original text in French in Miguel Metelo de Seixas. "Overseas Elements in Portuguese Armorials from the Modern Era". In: *e.Journal of Portuguese History* 15.2 (2017), pp. 1–29 (see also Miguel Metelo de Seixas. "Art et héraldique au service de la représentation du pouvoir sous Jean II de Portugal (1481-1495)". In: *L'arme segreta: Araldica e storia dell'arte nel Medioevo (secoli XIII-XV)*. ed. by Matteo Ferrari. Introduzione di Alessandro Savorelli. Firenze: Le Lettere, 2015. Chap. 20, pp. 258–309). On the perceived meaning on the five bezant, the Portuguese poet Luís de Camões (1524-1579/1580) suggested they represented the coins that Judah received when he sold Christ to the Jews: "In these five shields [he] paints the thirty / coins that were paid when God was sold. / This memory is paint in various colours, / by those who were favoured. / Five [beazers] [go] in each of these [shields], / so that [the arms] contain the entire number []. (*Os Lusiadas*, III, 54) Translated by the original in Old Portuguese (*E nestes cinco escudos pinta os trinta* / *Dinheiros, por que Deos fòra vendido*, / *Escrevendo a memoria em varia tinta*, / *Daquele quem foi favorecido*: / *E cada hum dos cinco, cinco pinta*; / *Porque assi fica o numero comprido* []). Another opinion is that the beazers symbolised the Five Holy Wounds of Christ. On it, see Katherine Ward Parmelee. "The Flag of Portugal in History and Legend". In: *Romanic Review* (1918). Online at: https://www.proquest.com/docview/1290852680/fulltextPDF/245BD6DAE8A94ED3PQ/1?accountid=14777, pp. 291–303. Later, King D. Manuel I of Portugal maintained these changes.

[108]The castles in the bordure typically symbolise the Reconquista of the Algarve region (southern Portugal) to the Moors. Like the other elements of the royal coat of arms, it was subject to changes. Initially, it included fourteen castles which would be limited to only seven with the reforming activity of King D. João II. On the use that King D. Duarte made of this element to communicate public support to his allies, see Seixas, "Overseas Elements in Portuguese Armorials from the Modern Era". However, there are elements suggesting that the royal efforts were to unify the use of this symbol in the nation. In fact, Seixas made an extensive overview of the municipal variations of arms in Miguel Metelo de Seixas. "As insígnias municipais e os primeiros armoriais portugueses: razões de uma ausência". In: *Ler História* 58 (2010). DOI: https://doi.org/10.4000/lerhistoria.1218. This fact would explain the number of castles in the image: the reforming efforts of the Portuguese king tried fixing its number to seven. However, the Parisian rendering of the illustration for the Hardouyn workshop augments its number to twelve. Thus, it is possible that the engraving designed by the Pichore workshop represents one of those instances in which the canonisation was escaped or could be an instance of ignorance of the full content of the recent reform. Alternatively, there might be further reasons behind those changes. To address them, further historical analysis is necessary and will be covered in future with additional work.

[109]The crown topping the escutcheons adopts the fifteenth- and sixteenth-century heraldic model. One good instance appears in a manuscript in Manchester (John Rylands Library, Lat. Ms. 28, fol. 81^{r}. Online at: http://enriqueta.man.ac.uk/. Accessed February 13, 2022); another is in Livro do Armeiro-Mor, a Portuguese armorial made in 1509 by the Portuguese herald João de Cró. In this case, the Arms of King D. João II and his queen appear on fol. 42^{r} (Lisbon, Torre do Tombo, *Cartório da Nobreza*, liv. 19, online at: http://digitarq.arquivos.pt/viewer?id=4162406. Accessed February 13, 2022). Sometimes, the representation with the crown above the shield was adopted in illuminated Manueline Charters: for instance, it appears in the reforming Charters of Alcochete (17 January 1515), Alandroal (15 January 1515), Évora (1 September 1501) and Terena (16 January 1515). See Catarina Miguel et al. "The comparative study of four Portuguese sixteenth-century illuminated Manueline Charters based on spectroscopy and chemometrics analysis". In: *Applied Physics A* 123 (2017), p. 72. DOI: https://doi.org/10.1007/s00339-016-0659-6; Catarina Miguel et al. "The Power of Combining MA-XRF, Infrared Reflectography and Digital Microscopy to Unveil the Production of the 16th Century Illuminated Charter of Évora: What May Be Hidden under a Painted Surface?" In: *Heritage* 5.1 (2022), pp. 286–296. DOI: https://doi.org/10.3390/heritage5010015.

[110]The armillary sphere represents a tool that mariners and seafarers employed frequently to navigate

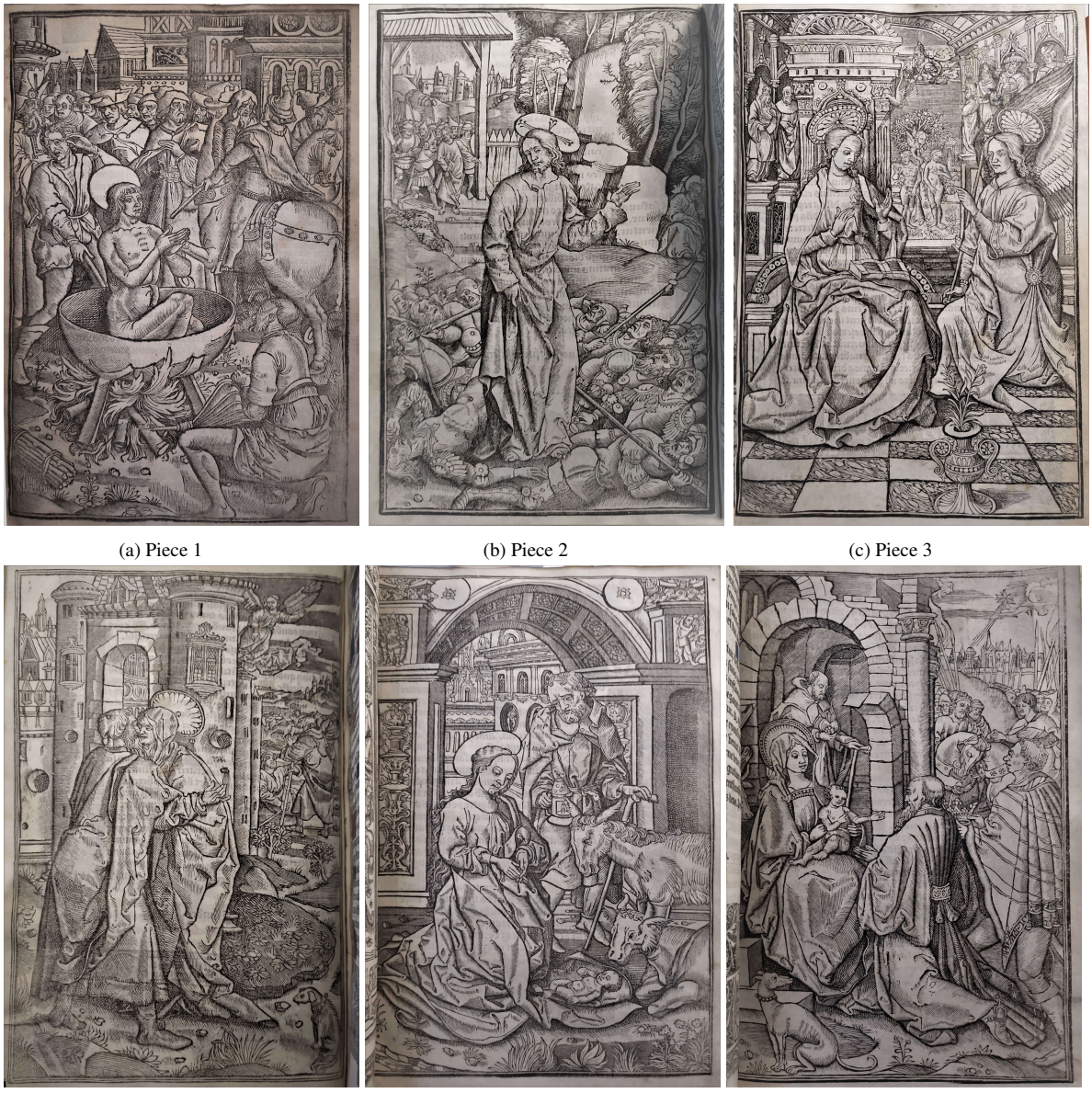
on the left and the other on the right[111]. They dress in a long vest, and their wings are fully open, as if they are hovering on the rest of the image. Finally, flowers are all around the image: above the angels, below them, around the sphere and on the bottom[112].

their way while travelling across seas and oceans. In the Portuguese coat of arms, this tool became the representation of the role that the Portuguese Kings of the fifteenth century perceived to their empire, namely a maritime power. See also Seixas, "Overseas Elements in Portuguese Armorials from the Modern Era".

[111]The two angels may be a symbol employed in some heraldic versions: for instance, it appears in the Arms of King D. Manuel I of Portugal in the mentioned Manueline Charter of Évora (1501).

[112]The presence of the flowers may be explained either as a Marian reference or as an homage to the Portuguese royal family. As for the first case, roses are another attribute of Mary, being in connection to her title of *hortus conclusus* (see Piece 11 of the *Quarto-series for Gillet and Germain Hardouyn of c. 1509*). In the second case, it is possible that this illustration could have been elaborated to celebrate the birth of Luis of Portugal. The fact that these Arms feature the entire achievement of the Arms of D. Manuel I would lead to the hypothesis that this symbol intends to celebrate the royal family in all its majesty. The complete Arms are found in documents in which the Portuguese King exerted his full power, like city Charters, leads to the hypothesis that the Arms as designed by Pichore intends to relate to this display of power. However, the presence of the floral pattern suggests another fascinating hypothesis. Flowers were not only a Marian symbol, but also of femininity. In this regard, Maria of Aragon, second wife of King D. Manuel I, gave birth to her second child in 1506 (Luis of Portugal). Thus, the symbol may have been designed to celebrate this event. However, future work will clarify the exact historical role of this illustration.

Quarto-set for Gillet and Germain of *c.* 1509 (1506-1515), *c.* 193 mm x 123 mm



(a) Piece 1 (b) Piece 2 (c) Piece 3

(d) Piece 4 (e) Piece 5 (f) Piece 6

Figure 2.23: The first six pieces of the *Quarto*-set in the style of the Pichore workshop of *c.* 1508 (*c.* 193 mm x 123 mm illustration dimensions). The illustrations are from Poitiers, BM, CR 46, London, BL, C.29.i.17 and C.29.i.18 © Poitiers, Bibliothéque municipale; Silvia Bottura-Scardina and the British Library Board.

(a) Piece 7 (b) Piece 8 (c) Piece 9

(d) Piece 10 (e) Piece 11

Figure 2.24: The last five pieces of the *Quarto*-set in the style of the Pichore workshop of *c.* 1508 (*c.* 193 mm x 123 mm illustration dimensions). The illustrations are from London, BL, C.29.i.17 and C.29.i.18 © Silvia Bottura-Scardina and the British Library Board.

- *Piece 1, St. John boiled in the oil cauldron*[113] (illustration for the Gospels [Gospel of John], fig. 2.23a). John crouches within a large cauldron, seemingly unharmed by the martyrdom he endures. Beneath the large vessel, a man keeps the fire at the behest of the Proconsul of Ephesus, who rides a horse and points at the saint. All around, the group of bystanders expresses mixed feelings of surprise, astonishment and fear.

[113]From *Golden Legend*, 9 (text in Ref. no. C.1.1.2).

- *Piece 2, "Ego sum" & Arrest of Jesus in the garden of Gethsemane* (illustration for the Gospels [Passion Gospel of John], fig. 2.23b). Jesus towers over a crowd of soldiers that lie all on the ground unorderly as if they have just fallen. A mix of surprise and horror is written all over their face while gazing at Jesus, as if he is the cause of their distress. Contrarily to their reaction, Jesus does not communicate any ominous intention against them. In fact, his posture is slightly bent, putting most of his weight on one leg only and raising one hand in a mannerism resembling closely the way he bestows benediction. Another scene takes place in the background: the same Jesus is dragged off the garden by Roman soldiers while the crowd of Jews incites the soldiers to drag Jesus away.
- *Piece 3, Annunciation & Fall of Men* (illustration for the Office of the Virgin [Matins], fig. 2.23c). During the observation of her religious duties, Mary receives the visit of Archangel Gabriel. She leaves her book of pious readings open on the lap, where it was placed before the divine meeting. The great abashment of Mary is all over her face: so strong is the feeling of being overwhelmed by the visitor's glory, that she bends the head, lowers the sight before him and raises the hands both to complement her embarrassment and awkwardly welcomes the announced message. Her slight ungracefulness is juxtaposed with the richness of the throne where she sits, which reminds of the Renaissance Italian architectural style. Furthermore, the scene takes place in a spacious room of a magnificent Renaissance palace, decorated on the bottom by large, squared marble tiles and on the top by some statues placed in special niches, maybe featuring prophets. The room opens to a rear garden, where Adam and Eve are being tempted to eat the fruit.
- *Piece 4, Meeting at the Golden Gate*[114] (illustration for the Office of the Virgin [Lauds], fig. 2.23d). Ste. Anne and Joachim rush to the gates of the city of Jerusalem (the *Golden Gate*) to meet and share the good news on the divine blessing with a son, despite their old age. The Gate appears as a medieval-to-Gothic city gate, with an arch opening between two round towers. The upper storeys of both of them open in glassed windows in quasi-Flamboyant style. At an overall look, the gate marks the beginning point of the urban settlement, which occupies the remain-

[114]From *Golden Legend*, 131 and *Gospel of the birth of Mary*, 3 (text in Ref. no. C.2.1.2.2).

ing left half of the image. The right portion features a rural landscape, where some shepherds get informed on Jesus' birthplace.

- *Piece 5, Nativity* (illustration for the Office of the Virgin [Prime], fig. 2.23e). The Holy Family is caught in a moment of tender intimacy. St. Joseph watches over his spouse, making light for her with a lamp that he carries with his only free hand, for the other is engaged in supporting his weight with a crook. Mary knees before her baby, offering a special prayer for the blessing with the new-born Jesus. The pious task and her motherly nature take up all her attention; thus, she misses the affectionate attempt of St. Joseph of comforting his wife. The baby is adjusted on the ground, having only the protection of his mother's garment, a bull and donkey's breath from the discomfort that the bare earth's irregularities and cold would have caused without. Finally, the scene has a strong Italian Renaissance feeling, which is expressed by the surrounding architectural setting.
- *Piece 6, Adoration of the Magi* (illustration for the Office of the Virgin [Terce], fig. 2.23f). In the scene, the Wise Men reach the Holy Family to bestow their blessing to them and gifts to honour the new-born King. Jesus sits on Mary's lap; in turn, she already changed her clothing style since the previous image. Now, she covers her head with a veil as a sign of respect and of her new condition as mother, probably. Before her, a Wise Man knees and pay his respects to the Child; behind him, another younger Wise Man impatiently awaits his turn. The backdrop is divided into two parts. On the left side, St. Joseph stays asides and carries one of the rich offerings from the visitors; on the right side, the large entourage of servants and backing soldiers crowd the area. Like the previous scene, this image takes place in a Classical setting which, differently from the previous illustration, appears in shambles and ruin.
- *Piece 7, Flagellation* (illustration for the Office of the Virgin [Terce, Passion Cycle], fig. 2.24a). Jesus is tied up to a central pillar to be scourged by a lynch mob of punishers, who strike all his body with whips and brunches. Herod sits behind the group, observing the events.
- *Piece 8, Massacre of the Innocents*[115] (illustration for the Office of the Virgin [Ves-

[115] From Matthew 2: 15-17 (text in Ref. no. C.2.2.1).

pers, Passion cycle], fig. 2.24b). Sitting from his magnificent throne, Herod dominates the results of the terrible order. Many babies are dragged out of their mother's catch, abducted and tortured, and their lives wiped out in deadly mob violence. The most pitiful and vulnerable figure is a woman on the front, that is grabbed by her hair during her attempts of shielding an older woman and a baby with her own body. To her distress, her attempts are unsuccessful. Another soldier threatens the older woman from behind and fulfils Herod's command. That story gets tangled with other martyrdoms everywhere in the scene, resulting in disarray and a shocking perception of the scene.

- *Piece 9, Crucifixion* (illustration for the Office of the Cross [Matins], fig. 2.24c). The scene depicts the moment of Jesus' death on the Cross and the following miracles: the skies above the crowd open, a strong wind blows the figures off. The Good Thief crucified to Jesus' right inclines his head as a sign of respect. The other observes the events with astonishment. Below, the first Mary (the mother) is destroyed by the emotion and supported by St. John. The second Mary (Magdalene) holds the Cross, in desperation. A third anonymous Mary blends into the rest of the multitude of spectators.
- *Piece 10, Bathsheba baths at the fountain* (illustration for the Penitential Psalms [first Psalm], fig. 2.24d). The scene portrays a moment of rest for Bathsheba in a fountain. She raises her gown and steps into the basin to enjoy the contact with the water. A maidservant attends her, keeping watch on anyone in the surroundings that may observe the scene. And indeed, King David stares at this moment in company with his entourage from a balcony nearby. The entire scene evokes richness and lavishness, starting from Bathsheba clothing, her maid's garments and the exuberant ornament of the palace, even the fountain where the bathing happens.
- *Piece 11, Mary with her emblems* (illustration for the Little Office of the Immaculate Conception [Matins], fig. 2.24e). The scene depicts Mary surrounded by the attributes and symbols typically associated with her: desired as the sunlight ("*electa ut sol*"), beautiful as the moon ("*pulchra ut luna*"), cedar tree ("*cedrus exaltatum*"), Gate of Heaven ("*porta coeli*"), well of living waters ("*puteus aquarum viventium*"), enclosed garden ("[*h*]*ortus conclusus*"), city of God ("*civitas dei*"),

fountain sealed up ("*fons signatus*") , tower of David ("*turris David*"), luxuriant olive ("*oliva speciosa*") and star ("*stella*"). These attributes are described by a banderole and a figurative representation of her allegorical titles[116].

[116]Most of these attributes are from the Biblical Canticle of Canticles: the titles *hortus conclusus*, *fons signatus* and *puteus aquarum viventium* are adapted from 4:12 versicle: "A garden enclosed is my sister, my spouse; a garden enclosed, a fountain sealed up" (= the text is taken from the Vulgate "*Hortus conclusus soror mea, sponsa, hortus conclusus, fons signatus*"). The "tower of David", from 4:4: See also BE Daley. "The 'Closed Garden' and the 'Sealed Fountain': Song of Songs 4: 12 in the Late Medieval Iconography of Mary in Medieval Gardens". In: *Medieval Gardens*. Ed. by Elizabeth Blair MacDougall. Vol. 9. Dumbarton Oaks Colloquium on the History of Landscape Architecture. Washington DC, WA: Dumbarton Oaks Research Library and Collection, 1986, pp. 253–278; Rachel M. Delman. "Enclosed Gardens, Female Networks, and Spiritual Kinship in Late Medieval Northern Europe". In: *Viator* 51.1 (2020), pp. 437–464. DOI: https://doi.org/10.1484/J.VIATOR.5.127054; Victoria Larson. "A Rose Blooms in the Winter: The Tradition of the Hortus Conclusus and its Significance as a Devotional Emblem". In: *Dialog: A Journal of Theology* 52.4 (2013), pp. 303–312. DOI: https://doi.org/10.1111/dial.12066.

Duodecimo-set for Gillet Hardouyn of *c.* 1512 (1512-1514), *c.* 41 mm x 26 mm

(a) Piece 1 (b) Piece 2 (c) Piece 3

(d) Piece 4 (e) Piece 5 (f) Piece 6

Figure 2.25: The first six pieces of the *Duodecimo*-set in the style of the Pichore workshop of *c.* 1512 (*c.* 41 mm x 26 mm illustration dimensions). The illustrations are from:a) Portugal, BNP, Res.325.v, fol. 9^{r}; b) (*id.*), fol. 21^{r}; c) (*id.*), fol. 25^{v}; d) (*id.*), fol. 32^{r}; e) (*id.*), fol. 40^{v}; f) (*id.*), fol. 34^{v} © Duarte Belo and the BNP.

(a) Piece 7 (b) Piece 8 (c) Piece 9

(d) Piece 10 (e) Piece 11 (f) Piece 12

Figure 2.26: Six more pieces of the *Duodecimo*-set in the style of the Pichore workshop of *c.* 1512 (*c.* 41 mm x 26 mm illustration dimensions). The illustrations are from: a) ortugal, BNP, Res.325.v, fol. 37^{r}; b) (*id.*), fol. 42^{r}; c) (*id.*), fol. 46^{r}; d) (*id.*), fol. 30^{v}; e) (*id.*), fol. 31^{r}; f) (*id.*), fol. 55^{r} © Duarte Belo and the BNP.

Figure 2.27: Last piece (no. 13) of the *Duodecimo*-set in the style of the Pichore workshop of *c.* 1512 (*c.* 41 mm x 26 mm illustration dimensions). From Lisbon, BNP, Res. 325.v, fol. 63^{r} © Duarte Belo and the BNP.

- *Piece 1, St. John in Patmos* (illustration for the Gospels [Gospel of John], fig. 2.25a). Situated in the isolation of Patmos island, the evangelist St. John seats under a tree and receives the divine inspiration to compile the Book of Revelation, as it is revealed by an incoming ray. His attributes are a book that he keeps on his lap, a pen to write and an eagle peeping from behind. The saint evangelist is clothed in a beautiful, rich red garment.
- *Piece 2, Annunciation* (illustration for the Hours of the Virgin [Lauds], fig. 2.25b). Mary is intended to read her book of prayers and to recite her daily devotion when the archangel Gabriel comes to tell her joyous news. Mary dresses in a simple garment made of blue cloth and a plain brown vest and occupies the entire left side of the image whereas the angel stands on the opposite side, arms crossed. Finally, the Holy Spirit descend as a dove from the heavens, carried by a golden ray. Differently from the other version from the previous sets, the scene is quite essential and made entirely of the three figures.
- *Piece 3, Visitation* (illustration for the Hours of the Virgin [Matins], fig. 2.25c). Mary and her cousin Elizabeth meet to inform the other of their pregnancy. The scene seems to take place in a rural setting, as revealed by trees on the left, a green hill and a vague cityscape in the background. Elizabeth, standing on the left, wears

a blue-red headgear with a white veil, over a red dress, while Mary, on the right side of the image, is dressed in a blue mantle and has her head uncovered. Elizabeth reaches her hands out towards the belly of Mary.

- *Piece 4, Nativity* (illustration for the Hours of the Virgin [Prime], fig. 2.25d). The new-born Christ Child lies naked among the straw of a manger of a stable. Mary and St. Joseph are at his watch, the mother on the left side near her husband. Mary is clothed in an elaborate blue mantle, folds her hands in prayer and sees down to the Child. Next to Mary stands Joseph, who is featured as an old, warped man with grey hair who leans on a stick. Above the figures is the wooden roof of the stable, a simple structure supported by wooden beams. In the background, on the left side next to Mary, an ox and donkey observe the scene.
- *Piece 5, Annunciation to the Shepherds* (illustration for the Hours of the Virgin [Terce], fig. 2.25e). An angel appears from the sky to a group of three shepherds. The cattlemen are caught in different emotions and shown in different attitudes, alluding to the unexpected appearance of the heavenly messenger. The first one, on the left, is cut at the border of the image, but we can observe his amazement as he points his finger at the angel above. Another shepherd, prominently visible in the central foreground, is afraid instead. He gazes at the angels with his hands already folded. A third one, on the right, is partly visible behind the middle one and is facing the viewer, about to turn around. In the central image, the white sheep are grazing in the grass.
- *Piece 6, Adoration of the Magi* (illustration for the Hours of the Virgin [Sext], fig. 2.25f). This scene is as essential as the previous: is features exclusively the three Magi around Mary with the Christ child. The image is populated by the figures, yet we see a glimpse of the structure which abodes them. They stand under the roof of the stable where the Child was just born. Mary, wearing a long blue mantle, holds the Child who sits fully unclothed on her lap. In a dynamic movement, the Child is reaching out to king Melchior, who kneels before him. We see this old, bearded king with grey hair sitting in the foreground on the right without his crown, that he must have removed as a sign of humility. Behind him, in the central part of the upper part of the image, stands king Balthasar. This bearded man has a crown on

his head and supports his gift to the new-born Child in his left hand. Probably, is it monstrance containing myrrh. At the same time, he turns his head to the neighbour to his left and third king, the young Caspar. Like his fellows, this last Magus holds a present for the child.

- *Piece 7, Presentation in the Temple* (illustration for the Hours of the Virgin [None], fig. 2.26a). In this illustration, the focal point is the Christ child, who is seated on the lap of the priest, most likely to identify the latter with Simeon. Mary and Joseph are on the right, after having handed the Child to the priest. On the left, we see the naked Child kicking delicately over the altar. Behind the group stands Joseph holding a little basket with two pigeons, awaiting to offer them to the priest as a gift. In the background another face of a bystander appears.
- *Piece 8, Flight into Egypt* (illustration for the Hours of the Virgin [Vespers], fig. 2.26b). This scene of the traveling family is set in a landscape. The background consists of a forest on the left and a cityscape on the right, while the Holy family stays in the foreground. From left to right, the figures overlap: to the right, Mary proceeds by foot and is fully covered in a blue cloak; a *nimbus* hovers above her head. Next to Mary is Joseph walking, carrying the Christ Child in a bandage that he conveniently put across his chest and over his shoulder. The kid, dressed in a red garment and also having a *nimbus*, tenderly reaches to his mother. Directly behind them walks their pack mule.
- *Piece 9, Coronation of the Virgin*, illustration for the Hours of the Virgin [Compline], fig. 2.26c). This scene is set in heaven, where Mary receives the crown as the *Queen of Heaven* (or *Regina Coeli*) from a rear angel. from a rear angle. The event is duly observed by the careful eye of God the Father, that is depicted as an old, grey-haired and bearded man, who dresses in an elaborate brown cloak and wears a gold-and-white, three-layered tiara. He stands before Mary as he moves his right arm upward to make the typical blessing sign of the members of the Trinity. Mary, richly dressed to symbolise her status of *Regina Coeli*, kneels before God and holds her hands in devout humility.
- *Piece 10, Christ carries the Cross* (illustration for the Hours of the Cross [Matins], fig. 2.26d). This touching illustration is about the relationship between the son and

the mother. While Christ carries the cross through the street, he bows and dynamically turns his head towards Mary who stands behind him at the right edge of the image. Mary, dressed in blue and thereby standing out in the monochrome colour of the city, looks in his direction, thereby creating a visual connection between the two. Christ, who is the central figure in this image, is further accompanied by a soldier who walks behind him and who is visible to his left. This soldier wears a harness and a blue tunic. The background shows glimpses of Jerusalem, including a gate and other buildings in greyish stone recalling the model of *Meeting at the Golden Gate* (fig. 2.23d).

- *Piece 11, Pentecost*, illustration for the Hours of the Holy Spirit [Matins], fig. 2.26e). The scene captures a crowded gathering of people close together, with two people seen on their back and one in the middle who is visible at half-length. Aside from them, only the faces of the remaining features are visible. The apostles and Mary have all gathered in a house: the ensemble of apostles surrounds Mary. In turn, she is the central figure to whom the others direct their gaze. She stands amidst the men, hands folded in prayer and dressed in the traditional blue cloak. To the right above a white dove, the symbol of the Holy Spirit hovers on her. The backdrop features an arch within a wall.
- *Piece 12, King David in repentance* (illustration for the Penitential Psalms [First Psalm], fig. 2.26f). One single figure stands out: King David. He is depicted in the foreground, in a three-quarter profile from the back, kneeling in desperation for God the Father. David wears a royal, luxurious red tunic with a white collar, a crown, a belt and a sword on a chain over his shoulder. In addition, there is his harp, which is both his attribute and symbol, next to him for the purpose of identification. Furthermore, he is surrounded by richly decorated architectural edifices of a castle, of which there is a doorway, a wall and a tower in the background. David is a brown-haired, bearded man, who kneels in prayer, facing upward to the sky, where the face of God appears to him as an answer to his prayer of repent.
- *Piece 13, Job on the dung heap* (illustration for the Hours of the Dead [Vespers], fig. 2.27). Job is depicted in rags and misery because he accepted the future of suffering and distress that God has held for him. The Devil disguised as Job's

friend approaches the man to convince him to refrain from his pious decision. Job refuses: he joins his hands in prayer and bends his head to welcome the divine will, despite being only clothed in a white loincloth and sitting on a heap of dung.

Identification of Jean Pichore's hand The entire set from the National Library of Portugal is published here for the first time[117]. Regrettably, the two most respected indexing references in our possession make no mention of it: no trace of it is in Zöhl's essay, and neither the two Tenschert catalogues report it. Because of this fact, this eccentric set needed compensation for the shortage of literature about it. Thus, our doctoral work included a tentative attribution of authorship of the mysterious *Duodecimo-series*. At a first inspection, the characters of some illustrations reveal close resemblances with sets of engravings: taking the archangel Gabriel of *Annunciation* as a case in point (fig. 2.28), his features represent a first match with the same subject as treated in the *Octavo series* for Vostre (1504-1508). Just as the angel reveals some likeness across the two versions, so do his garment and Mary's, together with the two characters' stance and the shape of the Holy Spirit as a dove. In the same way, the inclination of Mary in *Coronation of the Virgin*, together with the frontal attitude of the crowning angel in this *Duodecimo set* conforms once again to that from the *Octavo series* for Vostre. However, this series does not show the same degree of elaboration and fineness of design as the *Octavo-* and *Quarto-series*. Thus, it could be possible that the author of this series may be a less refined artist, maybe a follower of the Pichore workshop. However, other elements suggest closer proximity to this artistic workshop than initially supposed. Looking at a set directly crafted for the Hardouyns, the *Octavo-agenda* series, the points of contact increase. First of all, Mary's facial features are close to that of Vostre's set, as observed in the two *Visitation*. Secondly, the composition of most of the images (*Nativity, Annunciation to the Shepherds, Adoration of the Magi, Presentation in the Temple, Job on the dung heap*) appears as a magnified view of the illustrations from past sets (figs. 2.29-2.31).

[117] Retrieved from Lisbon, BNP, Res. 325.v. For bibliographic info and a full online source of this item, see Appendix A, Inc. 12.

(a) BNP, Res.325.v

(b) Simon Vostre's *Quarto set*

Figure 2.28: *Annunciation* compared across two books: a) Reference illustration, from Zöhl's essay (180 mm x 123 illustration dimensions); b) Lisbon, BNP, Res.325.v, fol. 21^{r} (*c.* 41 mm x 26 mm) © Caroline Zöhl; Duarte Belo and the BNP.

(a) BNP, Res.325.v

(b) BL, C.29.d.11

(c) BNP, Res.325.v

(d) BL, C.29.d.11

Figure 2.29: Several illustrations from the *Duodecimo-series* (*c.* 41 mm x 26 mm illustration dimensions) and the *Octavo-agenda series* compared (*c.* 42 mm x 22 mm): a) *Nativity*, from Lisbon, BNP, Res.325.v, fol. 32^{r}; b) (*id.*), London, BL, C.29.d.11, fol. 17^{v}; c) *Annunciation to the Shepherds*, from Lisbon, BNP, Res.325.v, fol. 34^{v}; d) (*id.*), London, BL, C.29.d.11, fol. 24^{v} © Silvia Bottura-Scardina, the British Library Board, Duarte Belo and the BNP.

(a) BNP, Res.325.v

(b) BL, C.29.d.11

(c) BNP, Res.325.v

(d) BL, C.29.d.11

Figure 2.30: Several illustrations from the *Duodecimo-series* (*c.* 41 mm x 26 mm illustration dimensions) and the *Octavo-agenda series* compared (*c.* 42 mm x 22 mm): a) *Adoration of the Magi*, from Lisbon, BNP, Res.325.v, fol. 37^{r}; b) (*id.*), London, BL, C.29.d.11, fol. 26^{v}; d) *Presentation in the Temple*, from Lisbon, BNP, Res.325.v, fol. 40^{v}; d) (*id.*), London, BL, C.29.d.11, fol. 28^{v} © Duarte Belo and the BNP.

(a) BNP, Res.325.v

(b) BL, C.29.d.11

Figure 2.31: Further illustrations from the *Duodecimo-series* (*c.* 41 mm x 26 mm illustration dimensions) and the *Octavo-agenda series* compared (*c.* 42 mm x 22 mm): a) *Job on the dung heap*, from Lisbon, BNP, Res.325.v, fol. 63^{r}; b) (*id.*), London, BL, C.29.d.11, fol. 50^{r} © Silvia Bottura-Scardina, the British Library Board, Duarte Belo and the BNP.

As little as these similarities may appear, the history of Pichores activity for the period of creation of the set supports the possibility of his involvement. The earliest date of appearance for the set is *c.* 1512, which still falls during Pichores Parisian residency. Generally in the 1510s, the artist continues operating on multiple commissions for several parties, in Paris and outside. Some of the Parisian patrons required his services for the decoration of other books, especially for Antoine, Duke of Lorraine (France, 1489-1544) and Louise of Savoy (1476-1531)[118]. Outside Paris, Pichore entered a strong partnership with the Le Roux family[119], which had business with branches between Paris and Rouen. Particularly in Rouen, they drove their market into the direction of luxury book-selling. Because Pichore had quite a lively involvement in the Le Roux's market, he would include members of the Rouen elites in his professional network. In fact, he appears to be responsible for the embellishment of personal books of devotion made in Rouen[120]. Although

[118] Pichore is recorded as the responsible for the decoration of *Vies de Démosthène, Cicéron et de Caton l'Ancien*, Rouen, *c.* 1500-1520 (Vienna, OS, Ms. Cod. 256511); *Vies de Scipion et Pompée*, Rouen, *c.* 1508, illuminated with the Master of Philippe de Gueldre and (poss.) François Bourcier (London, RCT, Ms. RCIN 104755213. Retrieved from: https://www.rct.uk/collection/1047552/lives-of-scipio-and-pompey, Accessed September 18, 2021) and *Vie d'Hannibal*, *c.* 1500-1520 (Vienna, OS, Cod. 258714).

[119] Zöhl elaborates on this connections, based on personal documentary research and the Rouse's research (Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 27-28; Rouse et al., *Manuscripts and their Makers: Commercial Book Producers in Medieval Paris, 1200–1500*).

[120] Vatican State, BAV, Barb. Lat. 487 (see later); the so-called *Cardinal York's Book of Hours* (London,

this seems extraneous information, it actually supports the single point that Pichore never stopped working on the decoration of books of devotion, not even in the 1510s.

As mentioned before at the opening of the section dedicated to the set in the style of Jean Pichore[121], he frequently engaged in collaborative projects, so the idea of a workshop work may not be an oddity. The hypothesis of a Pichore workshop had been already proposed by Zöhl: she suggested this after observing the stylistic inconsistencies of the *Navitity* piece from the *Octavo-series* (Piece 6, fig. 2.19f) with the other engravings from the same group[122]. At the same time, Pichore may have instructed his clerks to design this set after the influence of an artist from the school of Tours, Jean Poyer, with whom he had worked a few years before. Thus, this set may reveal the Tours influence in the close-up scale, as the next section elucidates.

2.2.2 Artistic influences

Across the described groups, a trained eye would detect frequent manifestations of several artistic backgrounds.

A primary source of such it would recognise would be internal, namely the suites that the Pichore workshop had realised beforehand, as the *Octavo-series* illustrates. This suite for the Hardouyns dating back to 1505-1509 reveals in the compositional choices of some illustrations a close similarities with two suites of an earlier Pichore, specifically those of the time of his partnership with De Laistre. This becomes even more evident as one compares the *Octavo Annunciation*, *Pentecost* and *Death of the Virgin* for the Hardouyn workshop with other sets, all being inspired from the De Laistre-Pichore edition of 1503[123] (fig. 2.32). Similarly, *Augustus and the Tiburtine sybil* and *Flight into Egypt* could have drawn on a later Pichore-De Laistre set, namely that of 1504[124]. These cases could reflect

RCT, Ms. RCIN 1005087. Retrieved from: https://www.rct.uk/collection/1005087/cardinal-yorks-book-of-hours, Accessed September 18, 2021).

[121] Section 2.2.

[122] Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, p. 139.

[123] The reference edition is a book in the Lyon, PL, Rés. A.490330 (see Appendix A, Inc. 16 for further details and the digital source).

[124] A direct inspection of the Pichore-De Laistre Hours of 1504 was impossible; however, there are grounds to believe that the 1504-set could be the parent model for that of the Hardouyns (1505-1508). In proving the connection, the *Octavo-set* for the Hardouyns had been compared with those for Thielman Kerver (1504-1506) and Simon Vostre (1504-1508), which operation allowed identifying a common model for Pentecost and Flight into Egypt. The descriptive statements of the latter suites of the Tenschert catalogue predicated

an intentional creative process, in which an essential component was the re-use of past sketches. As a confirmation of the supposed circumstances, the Hardouyn series echoes in composition those made for two fellow enterprises, the Kerver and the Vostre workshops (respectively, 1504-1506 and 1504-1508). Compared to the set for Kerver, specifically equivalent features are in five pieces in that of the Hardouyns, or those narrating the *Adoration of the Magi*, *Massacre of the Innocents* and *Pentecost* (figs. 2.33-2.34). Similarly, the series for Vostre is comparable with the one for the Hardouyns, as emerges from the inspection of *Annunciation*, *Presentation of Jesus in the Temple*, *Flight into Egypt*, *Crucifixion* and *Pentecost* (figs. 2.35-2.36)[125]. The arising pattern from these observations is that the *modus operandi* of the Pichore workshop as a designing firm iterated past arrangements with reference to engraving production.

(a) The Hardouyns (b) Pichore-De Laistre

Figure 2.32: *Death of the Virgin* compared across one Pichore-De Laistre edition (*c.* 125 mm x 80 mm illustration dimensions) and one Hardouyn edition (*c.* 125 mm x 80 mm). From: a) Lyon, BM, Rés.490330, fol. E7^{r} (from a microfilmed version); b) Paris, BnF, Rés 8.T.2520, fol. 100^{r} © Lyon, Bibliothèque municipale and Source BnF.

matches with those illustrations and the 1504-set of Pichore-De Laistre (Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, pp. 76, 79).

[125]The number of instances is greater than listed here and extends also to the *Quarto-series of c. 1509*. However, for the sake of argument, it was considered preferable to put only the instances from the earlier series.

(a) Hardouyn's version

(b) Kerver's version

(c) Hardouyn's version

(d) Kerver's version

Figure 2.33: Illustrations from the 1504-1508 suite for Kerver and the 1505-1509 suite for the Hardouyns compared (125 mm x 80 mm illustration dimensions). From Paris, BnF, Rés 8.T.2520: a) fol. 81^{r}; c) fol. 86^{r}. From Madrid, BNE, R.5098, b) fol. 66^{v}; d) fol. 68^{v} © Source BnF, Biblioteca Nacional de España.

(a) Hardouyn's version

(b) Kerver's version

(c) Hardouyn's version

(d) Kerver's version

Figure 2.34: Illustrations from the 1504-1508 suite for Kerver and the 1505-1509 suite for the Hardouyns compared (125 mm x 80 mm illustration dimensions). From Paris, BnF, Rés 8.T.2520: a) fol. 92^{r}; c) fol. 69^{r}. From Madrid, BNE, R.5098: b) fol. 70^{v}; d) fol. 121^{v} © Source BnF, Biblioteca Nacional de España.

(a) Hardouyn's version

(b) Vostre's version

(c) Hardouyn's version

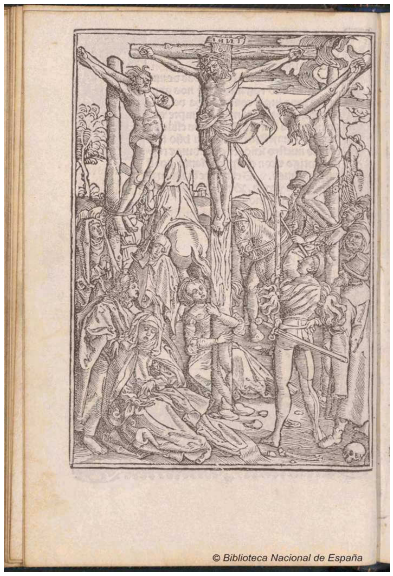
(d) Vostre's version

Figure 2.35: Illustrations from the 1504-1508 suite for Vostre and the 1505-1509 suite for the Hardouyns compared (125 mm x 80 mm illustration dimensions). From Paris, BnF, Rés 8.T.2520: a) fol. 41^{r}; c) fol. 81^{r}. From Madrid, R.31496: b) fol. 32^{r}; d) fol. 49^{r} © Source BnF, Biblioteca Nacional de España.

(a) Hardouyn's version

(b) Vostre's version

(c) Hardouyn's version



(d) Vostre's version

Figure 2.36: Illustrations from the 1504-1508 suite for Vostre and the 1505-1509 suite for the Hardouyns compared (125 mm x 80 mm illustration dimensions). From Paris, BnF, Rés 8.T.2520: a) fol. 67^{r}; c) from London, BL, C.29.i.17. From Madrid, R.31496: b) fol. 53^{v}; d) fol. 73^{r} © Silvia Bottura-Scardina, the British Library Board, Source BnF, Biblioteca Nacional de España.

Besides, there are indications that Pichore applied this routine also to other book forms. The same models as the sets for the Hardouyns, for Simon Vostre and Thielman Kerver were later replicated in, at least, two manuscript Books of Hours that Pichore illuminated personally afterwards. One of those books is in the Vatican Library (Barb. Lat. 487), where there is every likelihood that the models after which he sketched *Dispute among the Daughters of God*, *Arrest of Jesus*, *Pentecost*, *Nativity* and *King David sends Uriah*

to die[126] are the same. Equally, the illustrations from two more manuscripts of personal devotion in the Pierpont Morgan Library display a close resemblance (Ms. M.85[127] and M.291[128], see Figures 2.37-2.40). Thus, Pichore transferred indifferently his past patterns of composition to printed books and manuscripts.

(a) Hardouyns Hours

(b) PML, Ms. M.85

(c) Hardouyns Hours

(d) PML, Ms. M.85

Figure 2.37: Devotional illustrations by the Pichore workshop compared across a reference printed *horae* by the Hardouyn workshop (121-125 mm x 80 mm illustration dimensions) and a reference manuscript *horae* made Paris or Tours (1490-1510, 140 mm x 87 mm): a) BnF, Rés 8.T.2520, fol. 41^{r}; b) PML, Ms. M.85, fol. 23^{v}; c) BnF, Rés 8.T.2520, fol. 81^{r}; d) PML, Ms. M.85, fol. 50^{v} © Source BnF and Morgan Library, New York.

[126] Boof of Hours, use of Rome, Tours or Paris, 1490-1510, illuminated by Jean Pichore. The leaves presenting the mentioned miniatures are in order: 23^{v}, 15^{v}, 43^{r}, 44^{r}, 67^{r}. See Appendix A, Ms. 23 for further details and a complete digital source of this item.

[127] *Horae ad usum Romanum*, 1510-1520, France, illumination by the Pichore workshop. See Appendix A, Ms.12 for further details and a complete digital source of this item.

[128] *Horae ad usum Romanum*, 1490-1510, Paris or Tours, illuminated by Jean Pichore. See Appendix A, Ms.9 for further details and a complete digital source of this item.

(a) Hardouyns Hours

(b) PML, Ms. M.85

(c) Hardouyns Hours

(d) PML, Ms. M.85

Figure 2.38: Devotional illustrations by the Pichore workshop compared across a reference printed *horae* by the Hardouyn workshop (121-125 mm x 80 mm illustration dimensions) and a reference manuscript *horae* made Paris or Tours (1490-1510, 140 mm x 87 mm): a) BnF, Rés 8.T.2520, fol. 92^{r}; b) PML, Ms. M.85, fol. 56^{v}; c) BnF, Rés 8.T.2520, fol. 135^{r}; d) PML, Ms. M.85, fol. 89^{r} © Source BnF and Morgan Library, New York.

(a) Hardouyns Hours

(b) PML, Ms. M.85

(c) Hardouyns Hours

(d) PML, Ms. M.85

Figure 2.39: Devotional illustrations by the Pichore workshop compared across a reference printed *horae* by the Hardouyn workshop (121-125 mm x 80 mm illustration dimensions) and a reference manuscript *horae* made Paris or Tours (1490-1510, 140 mm x 87 mm): a) BnF, Rés 8.T.2520, fol. 67^{r}; b) PML, Ms. M.85, fol. 40^{v}; c) BnF, Rés 8.T.2520, fol. 69^{r}; d) PML, Ms. M.85, fol. 42^{v} © Source BnF and Morgan Library, New York.

(a) Hardouyns Hours

(b) PML, Ms. M.291

(c) Hardouyns Hours

(d) PML, Ms. M.291

Figure 2.40: Devotional illustrations by the Pichore workshop compared across a reference printed *horae* by the Hardouyn workshop (*c.* 1508, 121-125 mm x 80 mm illustration dimensions) and a reference manuscript *horae* made Paris or Tours (1490-1510, 87 mm x 54 mm): a) BnF, Rés 8.T.2520, fol. 67^{r}; b) PML, Ms. M.291, fol. 66^{r}; c) BnF, Rés 8.T.2520, fol. 69^{r}; d) PML, Ms. M.291, fol. 68^{r} © Source BnF and Morgan Library, New York.

A second hypothesis is that Pichore may have also used his previous activity as a master of illumination as a source of inspiration to design the Hardouyn workshop's series. As one meets the question, instances of similarities indeed arise. One detail that discloses such connection is the throne chair on which Mary sits as she receives the divine visit of archangel Gabriel, in the *Annunciation* scene (fig. 2.41a). The back of the seat is tall and finely carved, ending with a shell semi-dome on the top, and its arms are styled like

those of Renaissance X-chairs[129]. The same pattern of a chair is seen continuously across the allegorical miniatures of a manuscript that Jean Pichore decorated slightly earlier, *Des Remedes de fortune*[130]. Fortune, represented as a woman, rests on a royal seat to distribute her gifts or to spin her wheel, irrespective of the earthly preoccupations of the men (figs. 2.41b and 2.41c). In all cases, Fortune's throne appears likewise, as an X-chair. Among all illustrations, there is even one that repeats the shell-dome sided on the left and the right with classical pillars (fol. 135^{v}, fig. 2.41d). The instances from the above paragraphs prove that Pichore transferred indifferently the models of his compositions to printed books and manuscripts.

(a) Version 1 (b) Version 2 (c) Version 3 (d) Version 4

Figure 2.41: Patterns of chair compared across Pichore's *oeuvre*: a) *Annunciation*, from Paris, BnF, Rés 8-T-2520, fol. 41^{r} (size area, 121 mm x 60 mm); b) *Allegory of Fortune*, from Paris, BnF, Ms. Français 225, fol. 78^{v} (240 mm x 120 mm); c) (*id.*), fol. 151^{r} (240 mm x 200 mm); d) (*id.*), fol. 135^{v} (240 mm x 160 mm) © Source BnF.

Besides his past works, Pichore looked at the artistic experiences of other Old Masters. This fact is particularly clear while inspecting *Augustus and the Tiburtine sybil* and *Dispute among the Daughters of God* (figs. 2.19c and 2.19e). Like figurative themes, their earliest occurrence in Parisian illustrated *incunabula* seems to happen, indeed, with Pichore[131]. However, these images saw other artistic treatments, previously and elsewhere.

[129] This kind of seat gained popularity in the Renaissance.

[130] *Des Remedes de fortune*, illuminated by Jean Pichore, *c.* 1503. See Appendix A, Ms. 19 for further detail and the digital source of this item.

[131] Another theme that is relatively rare in printed books is *John and the miracle of the poisonous chalice*. This iconography of St. John is relatively rare as an illumination of devotional books, and it was observed

As for *Vision of Augustus and the Tiburtine Sibyl*, the Flemish Old Master Dieric Bouts the Elder (*c.* 1415-1475) and an anonymous master painted a large panel featuring this popular legend in 1473-1477[132] (fig. 2.42b). Elsewhere, images of Augustus' vision appear in rare, late fifteenth-century engravings by the Monogrammist ES workshop (*fl. c.* 1450-1467, fig. 2.42a and 2.42c)[133] and by Michel Wolgemut (*c.* 1493, fig. 2.42d)[134]. Speaking of *Dispute among the Daughters of God*, it appears in Parisian manuscripts illuminated by the hand of several masters, which stayed anonymous in some cases (figs. 2.43a[135], 2.43b[136] and 2.43e[137]) while it could be identified in other books as works by the Master François or the Master of Philippe of Guelders (figs. 2.43d[138] and 2.43c[139]). Pichore emulated foreign prints and paintings in unusual themes, as well as mainstream

in a small group of French manuscripts (Books of Hours). For instance, Golan reports PML, Ms. M.815, a Book of Hours made in Paris, 1471-1485 (Tamara Golan. "'ut experiri et scire posset': Pictorial Evidence and Judicial Inquiry in Hans Fries' Kleiner Johannes Altar". In: *The Art of Law: Artistic Representations and Iconography of Law and Justice in Context, from the Middle Ages to the First World War*. Ed. by Stefan Huygebaert et al. Cham, Switzerland: Springer, 2018. Chap. 16, p. 322).

[132]Bouts the Elder, Dieric and Master of the Tibirtine sibyl. (*c.* 1473-1477). *Vision of Augustus and the Tiburtine Sibyl* [painting on oak wood]. Städel Museum, Frankfurt. Retrieved from: https://sammlung.staedelmuseum.de/en/work/the-prophecy-of-the-tiburtine-sibyl (Accessed September 16, 2021). According to Friedlander, Dieric Bouts the Elder started the painting but left it unfinished, and the work was taken over by this homonymous Master, that could have been an apprentice of Bouts the Elder (Max J. Friedländer. *Die altniederländische Malerei*. Berlin: P. Cassirer, 1924, vol.3, pp. 70-sff.). See also Godfridus J. Hoogewerff. *De Noord-Nederlandsche Schilderkunst*. The Hague: Nijhoff, 1936, vol.2, p. 80 and James E. Snyder. "The Early Haarlem School of Painting: I. Ouwater and the Master of the Tiburtine Sibyl". In: *The Art Bulletin* 42.1 (1960). DOI: https://doi.org/10.2307/3047874, pp. 49-50.

[133]Monogrammist ES (1450-1467). *The Tiburtine Sibyl and the Emperor Augustus* [print on paper]. British Museum, London, Inv. nos. E,1.3 and E,1.21. Retrieved from: https://www.britishmuseum.org/collection/object/P_E-1-3 and https://www.britishmuseum.org/collection/object/P_E-1-21 (Accessed September 16, 2021).

[134]Wolgemut, Michel (designer); Pleydenwurff, Wilhelm (engraver) and Korberger, Anton (publisher) (*c.* 1493). *The Tiburtine Sibyl and the Emperor Augustus* [engraved illustration on book]. From *Liber Chronicarum*, also called "Nuremberg Chronicle". Rijksmuseum, Amsterdam, Inv. no. RP-P-2016-49-22-10. Retrieved from: https://www.rijksmuseum.nl/en/collection/RP-P-2016-49-22-10 (Accessed September 16, 2021).

[135]Book of Hours, Eastern France or Paris, *c.* 1465, illuminated by an anonymous painting master. From New York, PML, Ms. M.1207. Retrieved from: https://www.themorgan.org/manuscript/410891 (Accessed September 22, 2021).

[136]Book of Hours, Paris, *c.* 1480-1500, illuminated by an anonymous painting master. From New York, PML, Ms. M.179. Retrieved from: https://www.themorgan.org/manuscript/77093 (Accessed September 22, 2021).

[137]Book of Hours, France (prob. Paris), *c.* 1490, illuminated by an anonymous painting master. From New York, PML, MS. M.1080. Retrieved from: https://www.themorgan.org/manuscript/145175 (Accessed September 22, 2021).

[138]Book of Hours, Paris, *c.* 1475, illuminated by Maître François. From New York, PML, Ms. M.73. Retrieved from: https://www.themorgan.org/manuscript/77002 (Accessed September 22, 2021).

[139]Book of Hours, Paris, early sixteenth century, (partly) illuminated by the Master of Philippe of Guelders (*fl. c.* 1495-1510). From Huntington Library, San Marino, CA, Ms. M.H.1101. Retrieved from: https://dpg.lib.berkeley.edu/webdb/dsheh/heh_brf?CallNumber=HM+1101 (Accessed September 22, 2021).

depictions. For instance, in *Adoration of the Magi* (fig. 2.44a), Mary presents Jesus in the environment of classical ruins. Beneath her, a (supposedly) round arch has long collapsed and opened the view to open skies. To the front, picturesque solitary stone pillars stand out without doing any real architectural service. In general, the sole reason for the ruins to exist seems to be driving the observer's imagination to fill up the empty spaces and ruptured backbones. In other words, the function of the classical ruins seems to add a psychological effect of timelessness. Such an effect was common to central European depictions[140], like the prints of the German school of engraving (figs. 2.44b[141], 2.44c[142] and 2.44d[143]). The prints illustrated in the above figures share the ruin theme, the difference being the fashion of the architectonical rendering. In Dürer's print (fig. 2.44d), the "classic" building has no feature that addresses the Roman Antiquity. In the background, stands a tall tower, which could belong to a medieval castle instead. Only Schongauer's version encloses the scenes with pillars topped with carved abaci (fig. 2.44b). However, even the style of the latter diverges from the most-common Roman or Greek orders or the southern-European Gothic. Compared to all the mentioned versions, Pichore makes a different choice of style. In fact, their style is actually Ancient Roman.

[140] A recent essay by Hui presented a compelling hypothesis that the framing of the Holy Family amidst ruins can be interpreted as a typified rupture between the Jewish religion and the Christian tradition (Andrew Hui. "The Birth of Ruins in Quattrocento Adoration Paintings". In: *I Tatti Studies in the Italian Renaissance* 18.2 (2018). DOI: https://doi.org/10.1086/683137). Because Jesus' birth brought the Christianity with him, and because the Jews refused him as the Messiah, an irreparable fracture between the two spiritualities occurred. In this theological interpretation, classical buildings must represent the old beliefs and their wreck becomes physically tangible as ruins. In addition, the same fact that a Child Jesus abides in this desolation could signify his triumph.

[141] Schongauer, Martin (1470-1474). *Adoration of the Magi* [print on paper]. London, British Museum, inv. no. 1845,0809.239. Retrieved from: https://www.britishmuseum.org/collection/object/P_1845-0809-239 (Accessed September 17, 2021).

[142] Monogrammist L (1500-1525). *Adoration of the Magi* [print on paper]. London, British Museum, inv. no. 1929,0516.9. Retrieved from: https://www.britishmuseum.org/collection/object/P_1929-0516-9 (Accessed September 17, 2021).

[143] Dürer, Albrecht (1501-1502). *Adoration of the Magi* [print on paper]. Washington DC (NY), National Gallery of Art, inv. no. 1941.1.35. Retrieved from: https://www.nga.gov/collection/art-object-page.613.html (Accessed September 17, 2021). See also Louis Marchesano. "Prints by Albrecht Dürer in the Getty Research Institute's Special Collections". In: *Getty Research Journal* 5 (2013). DOI: https://doi.org/10.1086/grj.5.41825356, p. 177.

(a) Monogrammist ES, 1450-1463

(b) Dieric Bouts the Elder, 1473-1477

(c) Monogrammist ES, 1450-1463

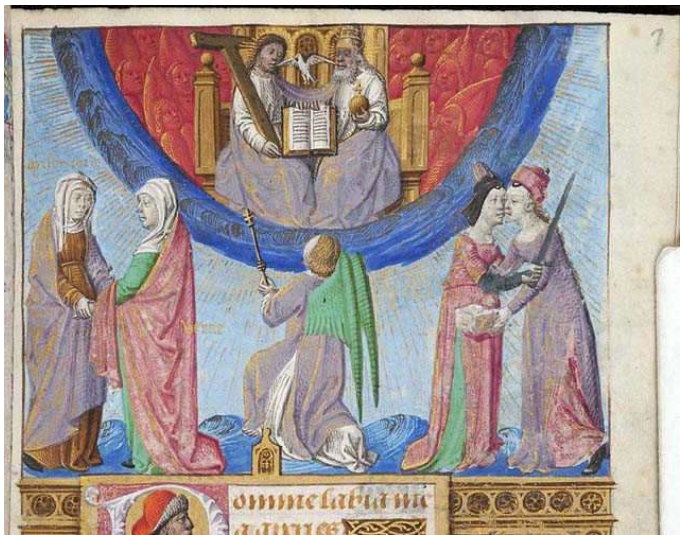
(d) Wolgemut (workshop of), *c.* 1493

Figure 2.42: *The Prophecy of the Tiburtine sibyl*, from: a) Monogrammist ES, (1450-1467). In London, British Museum, E,1.3 (219 mm x 146 mm); b) Dieric Bouts the Elder and Master of the Tiburtine sibyl (689 mm x 857 mm painting dimensions), oil on wood, 1473-1477. In Städel Museum, Frankfurt, Inv. no. 1068; c) Monogrammist ES (1450-1467). In London, British Museum, E,1.21 (269 mm x 199 mm); d) Wolgemut (workshop of), from Nuremberg Chronicle, (*c.* 1493). In Amsterdam, Rijksmuseum, RP-P-2016-49-22-10 (143 mm Œ 107 mm) © 2021 Städel Museum, the Trustees of the British Library, Rijkmuseum.

(a) Anonymous master, *c.* 1465

(b) Anonymous master, *c.* 1480-1500

(c) Master of Philippe of Guelders, *c.* 1495-1510



(d) Master François, *c.* 1475

(e) Anonymous master, *c.* 1490

Figure 2.43: *Dispute and Reconciliation of the four Daughters of God*, from illuminated manuscripts of the Parisian school of painting: a) New York, PML, Ms. M.1207, single sheet (*c.* 213 x 155 mm illustration dimensions); b) New York, PML, Ms. M.179, fol. 38^{r} (*c.* 140 mm x 110 mm); c) Huntington Library, San Marino, Ms. M.H.1101, fol. 19^{v} (*c.* 197 mm x 136 mm); d) New York, PML, Ms. M.73, fol. 7^{r} (*c.* 63 mm x 94 mm); e) New York, PML, MS. M.1080, fol. 25^{r} (*c.* 88 mm x 82 mm) © Morgan Library, New York and 2006 The Regents of the University of California.

(a) Reference (Pichore)

(b) Martin Schongauer

(c) Monogrammist L

(d) Albrecht Dürer

Figure 2.44: Ancient classical ruins compared across Pichore's *Quarto-series* and German prints. *Adoration of the Magi*, from: a) London, BL, C.29.i.17 (196 mm x 118 mm illustration dimensions); b) Martin Schongauer, 1470-1474 (255 mm x 170 mm); c) Monogrammist L, 1500-1525 (72 mm diameter); d) Albrecht Dürer, 1501-1502 (302 mm x 211 mm) © Trustees of the British Museum; National Gallery of Art.

Aside from this instance, there are other places where Pichore expresses a fascination for the Italianate style. Across the *Quarto-series*, the sight catches additional reminders to Ancient Roman monuments. The architectural language reaches its peak of eloquence in the *Annunciation* scene (fig. 2.45a), whose stone pavement recalls the ancient marbles

alternating on the floors of ancient monuments, like the Roman Forum, or such Christian monuments as the Arch-basilica of St. John Lateran in Rome (figs. 2.45b-2.45c). The same stone decoration is in the *Quarto Flagellation*, as well as *octavo Augustus and the Tiburtine sibyl*, *Presentation in the Temple*, *Death of the Virgin*, *Pentecost* and *King David sends Uriah to die* (figs. 2.46a-2.46e). In other words, such rendering covers nearly every interior space within the two sets, the *Octavo* one and the *Quarto* one. The references finally evolve into a full-fledged level of representation with the *Quarto Nativity*. Here, looking behind the group of the Holy Family, an elaborate architecture appears. The building consists of two corners whose sides are fully carved in Italianate *drôllerie*. Slightly above, a barrel caisson vault with an inner floral pattern, typical of Renaissance Rome and Florence[144], has the function of joining the two sides.

On top of that, all images from this set are framed in a specific border decoration which has been called *Italianate tabernacle frame*[145]. This aesthetic machine is a moulded frame that encapsulates an illustration to set it apart from the rest of the page, and its patterns reveal several degrees of elaboration. In some cases, these fake niches feature richly decorated miniature houses, topped off with pediments and classical sculptural reliefs like that on Figure 2.47a. Otherwise, they have the shape of relatively simplified niches surrounded with slender pillars and such Italianate Renaissance stringcourse decoration as an egg-and-dart pattern (figs. 2.47b).

All above instances, taken together, could reveal a connection between the Pichore workshop and the schools of painting of engraving of central-to-western Europe (Netherlandish area and Germany).

Although a direct relationship between Pichore and the Flemish and Italian artistic schools has not been fully elucidated, Zöhl referred to similar instances of the artist's attention to Netherlandish works[146] and predicates on several occasions that his style is profoundly "Italianate"[147]. Moreover, the behaviour of Pichore corroborates the established notion in illuminated manuscripts' studies that since the early fifteenth century,

[144] A short list of those decorative patterns includes: the Giuliano da Sangallo's flat caisson ceiling from Basilica di Santa Maria Maggiore, Rome; the coffered ceiling of the Sala dell'Udienza, in the Palazzo Vecchio, Florence and Barren vault decoration of entrance arch of Basilica of Sant'Andrea, Mantua.

[145] See Orth, "What Goes Around: Borders and Frames in French Manuscripts".

[146] See Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 18, 26–27, 42.

[147] See *ibid.* pp. 102-103.

French painters looked closely at central European artworks for inspiration[148].

(a) Reference (Hardouyn) (b) Roman Forum

(c) St. John Lateran, Rome

Figure 2.45: Stone pattern of the floor compared across Pichore's design and ancient Roman instances: a) reference floor, detail from London, BL, C.29.i.17; b) a *marmor iassense* slab, Roman Forum; c) detail of the top of *Porta Santa*, Archbasilica of St. John Lateran, Rome.

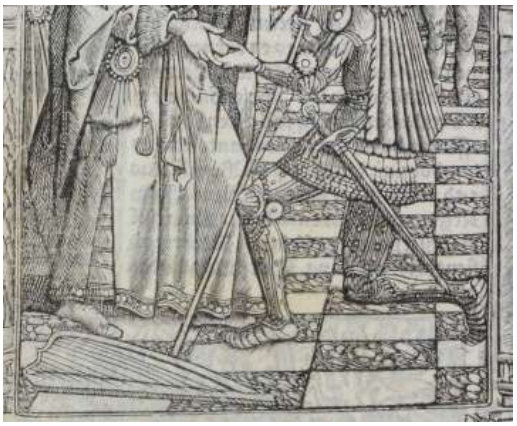
[148]We refer here to Panofsky's observations about the international character of the Bocicaut Masters' workshop (early 15th century) (Erwin Panofsky. *Early Netherlandish painting: Its origins and character*. Cambridge, MA: Harvard University Press, 1958, I, pp. 57-61), but a further elaboration on this point is out of this chapter's scope.

(a) Piece 5, in-*Octavo* set

(b) Piece 9, in-*Octavo* set

(c) Piece 11, in-*Octavo* set

(d) Piece 13, in-*Octavo* set



(e) Piece 14, in-*Octavo* set

Figure 2.46: Floor rendering compared across illustrations from both sets in the style of Jean Pichore for the Hardouyns (80 mm x 80 mm max illustration dimensions). Details from: a) Paris, BnF, Rés 8.T.2520, fol. 56^{r}; b) (*id.*), fol. 86^{r}; c) (*id.*), fol. 100^{r}; d) (*id.*), fol. 69^{r}; e) (*id.*), fol. 116^{r} © Source BnF.

(a) Elaborate tabernacle frame

(b) Simplified tabernacle frame

Figure 2.47: Italianate tabernacle frames from two illustrations of the *Octavo series* (122 mm x 78 mm leaf dimensions). From: a) London, BL, C.29.i.18; b) Paris, BnF, RéS 8.T.2520, fol. 116^{r} © Source BnF.

Some influences were surely from Central European and Italian artworks. However, Pichore was even more aware of the work of his fellow illuminators. The latter artistic background leaves a distinctive mark on the *Quarto-series of c. 1509* made for the Hardouyn. More specifically, Pichore articulated his affiliation to a French school of illumination in two ways: by adopting themes otherwise unknown to the printed-book producers and affiliating his style to the decorative patterns of illuminated manuscripts. Speaking of the first point, the above paragraphs elucidated the artistic basis of two unusual themes, the *Vision of Augustus* and *Dispute among the daughters of God*. Pichore imported these images into book-printing directly from the tradition of some contemporaries in Paris, although not integrally (figs. 2.43a-2.43c). This instance was not an isolated case, because two more images unite stories which were originally unrelated: in the *Quarto Annunciation*, the door between Gabriel and Mary reveals a peaceful garden, where a parallel scene takes place. At a closer look, the scene reveals itself as the Fall of Men. This arrangement repeats that from a private book of devotion, the so-called *Heures de Louis de Laval*[149] (fig. 2.48). In another case from the *Quarto-series*, the leading theme of the illustration is

[149]Paris, BnF, Ms. 920, *Horae ad usum Romanum*, also called *Heures de Louis de Laval* (Roman Mass rite), Paris, 1400-1501, illuminated. See Appendix A, Ms.17 for further bibliographic details and a complete source of this item.

purposely pushed to a corner to serve as a merely secondary scene. Finally, the front features the "*Ego sum*" episode. Here, the possible influence does not consist exactly in the double-narrative structure, but rather in the stress of a limited image in book decoration. As a matter of fact, only two past instances could be traced: one from the *Hours of Henry VIII*[150] and another from the *Très riches Heures* of Jean of Berry[151] (fig. 2.49).

(a) Hardouyn's version

(b) *Heures de Louis de Laval*

Figure 2.48: *Annunciation*, from: a) a crude engraving of a Book of Hours from the Hardouyn workshop (London, BL, C.29.i.17, *c.* 193 mm x 123 mm illustration dimensions); b) from the so-called *Heures de Louis de Laval* (Paris, BnF, Ms. Lat. 920, fol. 51^{v}, 245 mm Œ 175 mm) © Silvia Bottura-Scardina, the British Library Board and Source BnF.

[150]New York, PML, Ms. H.8, *Horae ad usum Romanum*, also called *Heures de Louis de Laval* (Roman Mass rite), Paris, *c.* 1500, illuminated by Jean Poyer. See Appendix A, Ms.8 for further bibliographic details and a complete source of this item.

[151]Chantilly, Musée Condé, Ms. 65, also called *Très riches Heures du duc de Berry*, 1412-1414, Paris, illuminated by the Limbourg brothers. See Appendix A, Ms.1 for further bibliographic details and a complete source of this item.

(a) Hours of Henry VIII

(b) *Très riches Heures*

Figure 2.49: *Ego sum*, from two manuscript illuminated by artists of the Tour school of illumination: a) *Hours of Henry VIII*, fol. 13^{r} (256 mm x 180 mm leaf dimensions); b) *Très riches Heures*, Ms. 65, fol. 142^{v} (290 mm Œ 210 mm) © New York, Morgan Library and Web Gallery of Art.

The second relationship with the French illumination is in the deliberate emulation of the Tours style, as in *Bathsheba bathing at the fountain*. The standard interpretation of the biblical story insisted on an uncomplimentary narrative that treated her as a despicable seductress. To accentuate her tempting suggestion, artists expose her invitingly, making her stand out in all her sovereign nudity while glancing in the direction of a hypnotised King David (fig. 2.50b)[152]. However, Pichore follows another school here. For the Hardouyns, he sketches her in the "dressed" version, where she raises her clothing and sits on the edge of the fountain in her undergarments. However immodest an attitude, Bathsheba's behaviour is also less reprehensible than other images. Pichore's choice appears in a small batch of manuscript, one of which belongs to the Tours school of illumination (Jean Colombe, fig. 2.7[153]). Differently than Jean Colombe, Pichore retains little criticism against Bathsheba, so that the observer would be indecisive to interpret her cryptic smile

[152]Bourdichon, Jean (1498-1499), Tours, *Bathsheba bathing* [Tempera and gold on parchment]. Los Angeles, J. Paul Getty Museum, Ms. 79 (2003.105). Retrieved from: https://www.getty.edu/art/collection/objects/223147/jean-bourdichon-bathsheba-bathing-french-1498-1499/ (Accessed September 17, 2021).

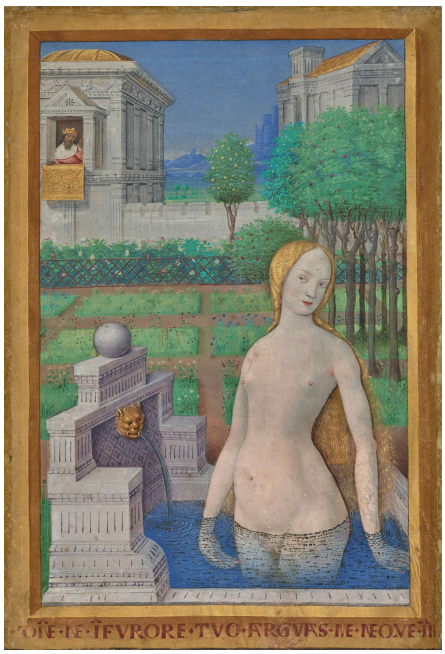
[153]PML, Ms. M.677, *Horae ad usum Romanum* (Roman Mass rite), *c.* 1473, Bourges, illuminated by Jean Colombe. See Appendix A, Ms.11 for further bibliographic details and a complete source of this item.

as an attempt of seduction or relief for the moment of alleviation. Aside from the specific story of the sinful romance of Bathsheba and King David, more echoes to the Tours painters are in the uncommon, cropped format of the *Duodecimo-series*. Two Hours illuminated by Jean Poyer are decorated with close-up illustrations that resemble that of the *Duodecimo*-set[154] (figs. 2.51-2.53), especially the volume of the Pierpont Morgan Library. In addition to the visual affinities, the most compelling argument in support of a direct influence of Jean Poyer are illustrated in the curatorial notes for the item:

> *This manuscript may have been started in the 1490s in Tours where Bourdichon had his workshop, but it was finished in Paris where Pichore worked from about 1502. The Raising of Lazarus (fol. 70r), one of the three illustrations by Pichore, is based on a composition by the Touraine artist Jean Poyer in the Briçonnet Hours (Teylers Museum, Haarlem, Ms. 78, fol. 83^{r}) illustrated between 1483 and 1491 in Tours. Pichore's other two illustrations, the Crucifixion (fol. 66^{r}, and Pentecost (fol. 68^{r}) are close to his compositions for these subjects in Morgan M. 85 and a Book of Hours printed after his designs by Gillet Hardouin in 1509-10*[155]

[154] Walters Art Museum, Ms. W. 295 and PML, Ms. M.291.

[155] Notes available at: https://www.themorgan.org/manuscript/77411 (Accessed September 17, 2021).



(a) by Jean Poyer

(b) by Jean Colombe

Figure 2.50: *Bathsheba bathing at the fountain*, two versions from two illuminated manuscripts compared. From: a) Los Angeles, J. Paul Getty Museum, Ms. 79 (2003.105), illuminated by Jean Poyer, 1488-1489, Tours (243 mm Œ 170 mm leaf dimensions); b) New York, PML, Ms. M.677, fol. 211^{r}, illuminated by Jean Colombe, *c.* 1473, Bourges (147 mm x 109 mm) © New York, Morgan Library and (2021) The J. Paul Getty Trust.

(a) BNP, Res.325.v (b) PML, Ms. M.291 (c) Walters Art Museum, Ms. W.295

(d) BNP, Res.325.v (e) PML, Ms. M.291 (f) Walters Art Museum, Ms. W.295

Figure 2.51: Several close-ups of the *Duodecimo-series* compared to two manuscripts in the style of Jean Poyer (*Annunciation* and *Visitation*). From Lisbon, BNP, Res. 325.v (*c.* 41 mm x 26 mm illustration dimensions): a) fol. 21^{r}; d) fol. 25^{v}. From New York, PML, Ms. M.291 (*c.* 87 mm x 54 mm): b) fol. 14^{r}; e) fol. 25^{r}. From Baltimore, Walters Art Museum, Ms. W.295 (98 mm x 77 mm): c) 9^{r}; f) fol. 16^{r} © Duarte Belo and the BNP; New York, Morgan Library and 2011 Walters Art Museum.

(a) BNP, Res.325.v (b) PML, Ms. M.291 (c) Walters Art Museum, Ms. W.295

(d) BNP, Res.325.v (e) PML, Ms. M.291 (f) Walters Art Museum, Ms. W.295

Figure 2.52: Other close-ups of the *Duodecimo-series* compared to two manuscripts in the style of Jean Poyer (*Nativity* and *Annunciation to the Shepherds*). From Lisbon, BNP, Res. 325.v (*c.* 41 mm x 26 mm illustration dimensions): a) fol. 32^{r}; d) fol. 34^{v}. From New York, PML, Ms. M.291 (*c.* 87 mm x 54 mm): b) fol. 32^{r}; e) fol. 35^{r}. From Baltimore, Walters Art Museum, Ms. W.295 (98 mm x 77 mm): c) fol. 20^{v}; f) fol. 22^{r} © Duarte Belo and the BNP; New York, Morgan Library and 2011 Walters Art Museum © Duarte Belo and the BNP; New York, Morgan Library and 2011 Walters Art Museum.

(a) BNP, Res.325.v (b) PML, Ms. M.291 (c) Walters Art Museum, Ms. W.295

(d) BNP, Res.325.v (e) PML, Ms. M.291 (f) Walters Art Museum, Ms. W.295

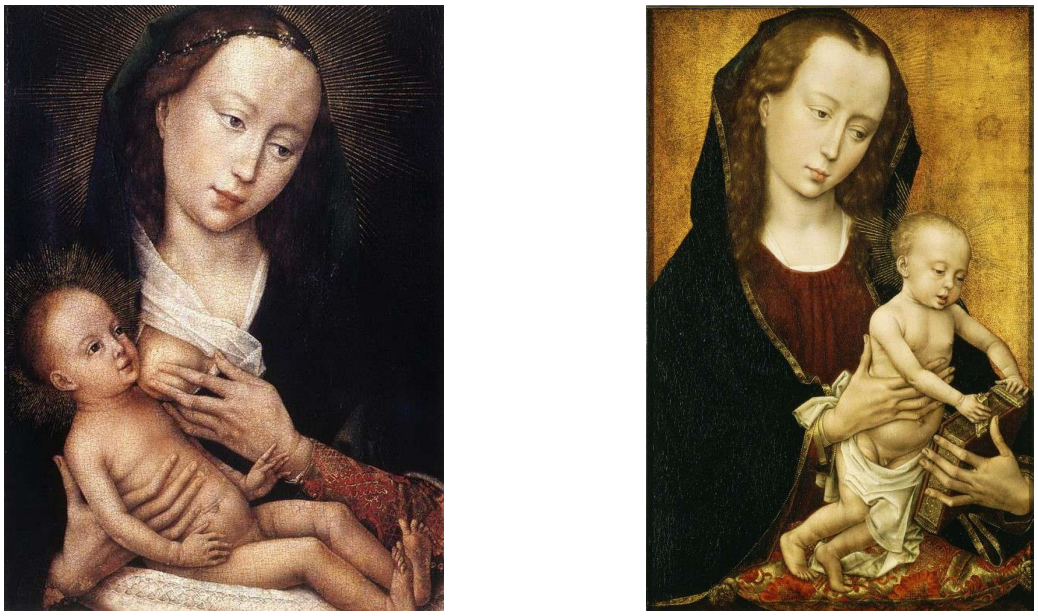
Figure 2.53: Further close-ups of the *Duodecimo-series* compared to two manuscripts in the style of Jean Poyer (*Nativity* and *Annunciation to the Shepherds*). From Lisbon, BNP, Res. 325.v (*c.* 41 mm x 26 mm illustration dimensions): a) fol. 37^{r}; d) fol. 40^{v}. From New York, PML, Ms. M.291 (*c.* 87 mm x 54 mm): b) fol. 38^{r}; e) fol. 40^{v}. From Baltimore, Walters Art Museum, Ms. W.295 (98 mm x 77 mm): c) fol. 24^{r}; f) fol. 25^{v} © Duarte Belo and the BNP; New York, Morgan Library and 2011 Walters Art Museum.

Moreover, the mentioned floor pattern and the Italianate design are not exclusive of Pichore since they are found in previous works of Jean Poyer: the mentioned *Hours of Henry VIII*, as well as the *Hours of Anne de Bretagne*.

Tours artists have surely left their mark on Pichore's art, especially in the compositional choices he took to design the sets of engraving for Parisian artists; however, the range of Pichore's artistic interests may be broader than outlined.

Looking more closely, the half-length view from the *Duodecimo*-set close-ups bears

striking similarities to the Virgin and Child prototype of a production of small-scaled devotional diptychs. Having enjoyed great popularity in early fifteenth-century northern Europe, this model reached the Netherlands through the Flemish artist Rogier van der Weyden (1400-1464), getting revived in the 1450s[156]. Wyeden's work of dissemination took form in a series of such small-scale diptychs as the *Portrait Diptych of Jean de Gros* (fig. 2.54a)[157] and the *Diptych of Philip de Croÿ with The Virgin and Child* (fig. 2.54b)[158] (1450-1464) and (at least) one gouache on cloth portraying a *Virgin and Child Sleeping*[159].



(a) Diptych of Jean de Gros

(b) Diptych of Philip de Croÿ

Figure 2.54: Two versions of *Madonna with Child* from two diptychs by Rogier van der Weyden: a) (Originally left wing of the) *Diptych of Jean de Gros*, 1460-1464 (365 mm Œ 270 mm painted surface), Tournai, Museée de Beaux-Arts Faux; b) (Originally left wing of the) *Diptych of Philip de Croÿ*, *c.* 1460 (522 mm Œ 346 mm painted surface), San Marino (CA), The Huntington Museum © 2022 Public Domain (a) and The Huntington Library, Art Museum, and Botanical Garden (b).

Weyden's initiative was successful. In fact, artists and followers replicated his proto-

[156] Guy Bauman. "Early Flemish Portraits 1425-1525". In: *The Metropolitan Museum of Art Bulletin* 43.4 (1986), pp. 4–64, p. 49; Panofsky, *Early Netherlandish painting: Its origins and character*, p. 297.

[157] Weyden, Rogier van der (1450-1460), *Portrait Diptych of Jean de Gros* (left wing) [oil on oak panel]. Tournai, Musée des Beaux-Arts. This model would be repeated in later paintings: see the *Virgin with Child* in Chicago from the Weyden workshop (*c.* 1460, Art Institute of Chicago, inv. no. 1933.1052) or another by an anonymous follower (1450-1499, private collection. Online at: https://rkd.nl/nl/explore/images/54901, Accessed August 4, 2022).

[158] Weyden, Rogier van der (*c.* 1460), *Virgin and Child*, originally left wing of *Diptych of Philip de Croÿ with The Virgin and Child* [oil on panel]. San Marino (CA), Hungtington Library. Retrieved from https://www.huntington.org/grid-detail/virgin-and-child (Accessed August 5, 2022).

[159] Weyden, Rogier van der (140..-1464), *Virgin and Child Sleeping* [gouache on cloth]. Besancon, Musee des Beaux-Arts et d'Archeologie.

types in 1480s-1490s artworks like those portrayed in Figure 2.55—two *Virgin and Child*, *c.* 1480-1499[160]. Besides, this model was not new to Europe: even before the Flemish dissemination, this composition belonged to Byzantine icons[161], and not only Wyeden tied to this tradition indirectly, but may also have exerted a direct influence in France through a series of works he accomplished in the kingdom, such as the *Beaune Altarpiece* (*c.* 1445-1450) in the Hôtel-Dieu de Beaune.

(a) Version 1

(b) Version 2

Figure 2.55: Two later versions of *Madonna with Child* from two followers of Rogier van der Weyden: a) left wing of the panel (*c.* 1480), now in Harvard Art Museums (550 mm x 355 mm painted surface); b) single panel, *14..-1499*, now part of Upton House, Warwickshire collection © 2022 President and Fellows of Harvard College (a) and Upton House, National Trust (b).

Alongside those instances, more traces of Pichore's awareness of his contemporary artistic production appear in more than one piece of the *Quarto*-set, starting from the *Annunciation*.

In this representation, the background behind the Virgin and the Archangel Gabriel reveals a set of illusory high reliefs (fig. 2.56), leaving the impression that the scene

[160]The painting in Figure reffig.3.36b.1 is by a [follower of] Weyden, Rogier van der, *c.* 1480, *Virgin and Child* [oil on redwood panel]. Cambridge (MA), Harvard Art Museums/Fogg Museum, inv. no. 1906.6.A. Retrieved from https://harvardartmuseums.org/collections/object/231968 (Accessed August 5, 2022). The painting in Figure reffig.3.36b.2 is by a [follower of] Weyden, Rogier van der, 1400-1499, *Virgin and Child* [oil on oak panel]. Edge Hill (MA), Upton House, The Bearsted Collection (National Trust), inv. no. NT 446745. Retrieved from https://www.nationaltrustcollections.org.uk/object/446745 (Accessed August 5, 2022).

[161]Panofsky, *Early Netherlandish painting: Its origins and character*, p. 297.

takes place in a church rather than a private room. Furthermore, the coloured version of this particular piece (fig. 2.57)[162] is stylistically close to a traditional execution named *grisaille*. Grisaille was not new to French miniaturists since fourteenth-century miniatures of their art school had already elected it for a luxury production of manuscripts for royal and Burgundian patrons[163]. Despite the traditional acquaintance with the technique, some facts persuade on an artistic parentage to foreign styles and media, both for the chronology and type of use.

(a) Original (b) Detail 1 (c) Detail 2

Figure 2.56: Faux-architectural figures within the *Annunciation* piece of the *Quarto*-set by the Pichore workshop, from BL, C.29.i.17: a) Original image with the details labeled with a red frame (193 mm x 123 mm illustration dimensions); b) magnified image of the left detail (64 mm x 41 mm illustration dimensions); c) magnified image of the left detail (42 mm x 42 mm illustration dimensions) © The British Library Board and Silvia Bottura Scardina.

[162] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed for Gillet Hardouyn, *c.* 1512. Now in Versailles, Bibliothéque municipale, Inc. G 306.

[163] See Sophia Rochmes. "Philip the Good's Grisaille Book of Hours and the Origins of a New Court Style". In: *Simiolus: Netherlands Quarterly for the History of Art* 38.1-2 (2016), pp. 17–30 and the bibliographic sources here referred: Barbara D. Boehm. "Grisaille". In: *The hours of Jeanne d'Evreux : Acc. No. 54.I.2, the Metropolitan Museum of Art, the Cloisters Collection, New York*. Ed. by Barbara D. Boehm et al. Luzern and New York (NY): Faksimile Verlag and Metropolitan Museum of Art, 2000, pp. 330–374; Michaela Krieger. *Grisaille als Metapher : zum Entstehen der Peinture en Camaieu im frühen 14. Jahrhundert*. Wien: Holzhausen, 1995. Instances of books of this period are of the Parisian Jean Pucelle (1300-1355) and the Dutch Willem Vrelant (†1481/1483), while the Master of the Blank Backgrounds, as Rochmes baptised him (Rochmes, "Philip the Good's Grisaille Book of Hours and the Origins of a New Court Style", pp. 25-26), had even it his device for a personal, unique style. For an instance of the early fourteenth-century grisaille, the so-called *Hours of Jeanne d'Evreux* constitute a powerful instance (New York, Metropolitan Museum of Arts, inv. no. Ms. 54.1.2, Ms source no. 5 in *Appendix A*).

(a) Crude engraving

(b) Coloured version

Figure 2.57: Coloured versions of the *Annunciation* piece from the *Quarto*-set by the Pichore workshop: a) Original image; b) coloured version © Silvia Bottura Scardina and The British Library Board, Bibliothèque de Versailles.

As for the chronology of use, the Italian painter Andrea Mantegna (*c.* 1430/1431-1506) had employed this technique towards the end of his career (late fifteenth-early sixteenth century). To provide a sense of the volume and strategic use of this technique, it is enough to recall the classical-style frieze by himself and his circle[164], some biblical scenes[165] and his *bronzi finti*[166]. Raphael (1483-1520) also employed it for the faux-relief decoration in the wall base of the four consecutive reception rooms in the Apostolic Palace, which he decorated with his workshop in the early sixteenth century (1508-1524).

[164]The decorations were originally planned as a series of four decorations for Francesco Cornaro, a Venetial nobleman, but only two of them were completed. The first one is by Mantegna's hand, an *Introduction of the Cult of Cybele at Rome* (*c.* 1505-1506) now in the National Gallery, London (online at: https://www.nationalgallery.org.uk/paintings/andrea-mantegna-the-introduction-of-the-cult-of-cybele-at-rome, accessed August 5, 2022). The second is *An Episode from the Life of Publius Cornelius Scipio*, executed after Mantegna's death, in *c.* 1506, by the hand of his brother-in-law, Giovanni Bellini (*c.* 1427/1430-1516). This second work is now part of the National Gallery of Art, Washington DC (online at: https://www.nga.gov/collection/art-object-page.41589.html, accessed August 5, 2022).

[165]Two instances are *Samson and Delilah* (now in London, National Gallery) and *Judith with the Head of Holofernes* (Dublin, National Gallery of Ireland).

[166]The National Gallery of London has two remarkable instances of this production: *The Vestal Virgin Tuccia with a Sieve* (1495-1506) and *A Woman Drinking* (1495-1506). These two works are small temperas painted as bronze-like figures against a pink-and-white marble backdrop for the d'Este, a family of noblemen in Mantua. See also https://www.nationalgallery.org.uk/paintings/andrea-mantegna-a-woman-drinking (Accessed August 5, 2022).

Italian art could have been a major source for two reasons. One is the irresistable fascination that Renaissance France felt for Italian art; another is that in the year 1500, countless French pilgrims and artists had flocked to Rome to celebrate the Jubilee. Proffering a direct connection between Roman art and French artists/personalities may also be admissible for historical reasons. For instance, cardinal Jean de Bilhères de Lagraulas (1434/1439 -1499)—diplomat for the French interests in Rome—originally commissioned the Vatican *Pietà* (1498-1499) to be part of his funerary monument in Santa Petronilla Rotonda church, Rome[167]. This church had strong ties with the French political identity for its traditional association to the French royal class[168]. Considering this option, it becomes plausible that the cardinal may have originally commissioned this statue for display to the eye of French travellers (and artists) in Rome, and becoming a cultural reference accordingly.

On the type of use, other facts persuade that a broader range of influences might have acted, especially in the creative use of grisaille. Italian painters seem to use this technique by way of a pictorial imitation of the Roman relief decorations (like sarcophagi, friezes or tympani), while the illusory statues in Pichore's *Quarto*-piece represent prophets. This leads to the observation that Pichore's interpretation is quite different from the Italian.

Looking at other artistic styles, more traces of grisaille appear in fifteenth-century Flemish paintings. One frequent use is to decorate the outer folding of Jan van Eyck's polyptych panels. In fact, this painter employed this technique in the central-bottom back wing of the *Ghent Altarpiece*[169], the small-scaled *Annunciation Diptych*[170] and the outer panels of the *Dresden Triptych*—which show another version of the *Annunciation*[171]. Almost contemporaneously, other Netherlandish artists employed pictorial grisaille to represent faux-sculpted portals. One of them is Rogier van der Weyden (1400-1464), who adopted it in every panel of the *Miraflores Altarpiece* (fig. 2.58a)[172] as well as the inner

[167] A church that was originally adjacent to the Vatican, before its demolition in 1516.

[168] Emily A. Fenichel. "Michelangelo's *Pietá* as Tomb Monument". In: *Renaissance Quarterly* 70.3 (2017), pp. 862–896. DOI: https://doi.org/10.1086/693883, p. 863.

[169] Eyck, Jan and Hubert van (mid-1420s-1432), *Adoration of the Mystic Lamb*, also called *Ghent Altarpiece* [oil on panels]. Ghent, St Bavo's Cathedral.

[170] Eyck, Jan van (1433-1435), *Annunciation Diptych* [oil on panels]. Madrid, Thyssen-Bornemisza, inv. no. 137.b (1933.11.2). Available at: https://www.museothyssen.org/en/collection/artists/eyck-jan-van/annunciation-diptych (Accessed August 6, 2022).

[171] Eyck, Jan van (1437), *Dresden Triptych* [oil on oak panels]. Dresden, Staatliche Kunstsammlungen, Gemäldegalerie Alte Meister, inv. no. 799.

[172] Weyden, Rogier van der (1435-1445), *Miraflores Altarpiece* [oil on oak panels]. Berlin, Staatliche

boards of his *St. John Altarpiece*[173]; Dirk Bouts (1415-1475) also used it in all inner panels of his *Triptych of the Virgin's Life*[174]; finally, Petrus Christus (1410-1475) joined this trend too with his *Nativity* (fig. 2.58b)[175].

(a) Rogier van der Weyden

(b) Petrus Christus

Figure 2.58: Use of grisaille in Flemish art: a) *The Annunciation Diptych* by Rogier van der Weyden (388 mm x 232 mm, left panel; 390 mm x 240 mm, right panel); b) *The Nativity* by Petrus Christus (1276 mm x 949 mm painted surface) © 2022 Thyssen-Bornemisza National Museum and National Gallery of Art.

The above considerations may suggest the parallel influence of the Italian and Flemish styles in the compositional choices of the *Annunciation*, which are reinforced in another pieces of the same *Quarto*-set. In the *Adoration of the Magi*, the way in which the Pichore workshop designed this Virgin recalls the prototype of the Vatican *Pietà* by Michelangelo (fig. 2.59).

Museen, Gemäldegalerie , inv. no. 534A. Available at: https://recherche.smb.museum/detail/871481 (Accessed August 6, 2022).

[173]Weyden, Rogier van der (1450-1464), *St. John Altarpiece* [oil on oak panels]. Berlin, Staatliche Museen, Gemäldegalerie , inv. no. 534B. Available at: https://recherche.smb.museum/detail/866581 (Accessed August 6, 2022).

[174]Bouts, Dirk (*c.* 1445), *Triptych of the Life of the Virgin* [oil on oak panels]. Madrid, Museo del Prado, inv. no. P001461. Available at: https://www.museodelprado.es/en/the-collection/art-work/triptych-of-the-life-of-the-virgin/ed28d5db-1f03-441e-bbc4-010786805dde (Accessed August 6, 2022).

[175]Christus, Petrus (*c.* 1450), *Nativity* [oil on oak panels]. Washington, National Gallery of Art, Gemäldegalerie Alte Meister, inv. no. 1937.1.40. Available at: https://www.nga.gov/collection/art-object-page.47.html (Accessed August 6, 2022).

(a) Hardouyn Hours

(b) Vatican *Pietà*

Figure 2.59: Styling in the Virgin's facial features compared in a piece of the *Quarto*-set (from the *Adoration of the Magi*)and Michelagelo's Vatican *Pietà*: a) Hardouyn Hours; b) Vatican *Pietà* © Silvia Bottura Scardina and the British Library Board, Public Domain.

For all those influences, it is also important to remark that the adoption of this scene view in engraving was an absolute novelty. No previous illustration had adopted this compositional choice: not in the previous set by the Apocalypse Master, not in any other set by Pichore's hand and not even in any piece of next sets. Thus, it could be stated that this suite is quite unique, both in Pichore's production and as the history of the illustrated *incunabulum* as well.

Pichore surely appears to have been a keen connoisseur of French miniature illuminating as well as Flemish easel painting; however, other signs suggest more details about his art. More specifically, this Parisian artist might have used iconographic elements to subscribe to forms of devotion like the Immaculate Conception, based on the informed use of specific iconographical choices.

It becomes clear while inspecting the *Quarto*-set: Piece 11 shows the Virgin Mary as a young woman in the centre, girdled with allegorical representations. Also known (inappropriately) as the *Virgin of the Litany*, this particular image relates Mary with the emblems drawn from her fifteen titles or *litanies*[176]. Having made its first appearance a

[176]In Books of Hours, "litanies" *stictu sensu* is the list of saints with each name followed by a particular invocation, all arranged in an order that reflects the heavenly hierarchy. The "inappropriate" reference to Litanies in this Marian image is because her titles are drawn from several biblical sources (Song of Songs, Book of Proverbs, Book of Wisdom, Ecclesiasticus) rather than prayers. On this position, see also Françoise Baron. "L'Iconographie de l'Immaculée Conception dans la sculpture médiévale et moderne en

few years earlier (*c.* 1484) in the St Etienne cathedral in Cahors, southern France[177], it soared almost simultaneously in books: first in manuscripts, soon after in printed books.

The Virgin of the Litany appears iconographically accomplished already in the manuscript production, as illustrated by a French miniature of an early sixteenth-century-*horae* (fig. 2.60a)[178]. Two reasons make this illustration particularly interesting: firstly, the composition bears striking similarities to the Hardouyn piece; secondly, it contains specific elements sealing its ties with the Immaculate Conception doctrine. Just below this miniature, it reads: "Hours of the Immaculate Conception,"[179] denoting that it serves as the opening illustration to the Office indeed. Moreover, a ribbon unfurls at the top of the image with the script: "you are fair, my friend, and have no stain."[180] According to the historian Abby Mcghee, this versicle was taken as a support to the views of Mary as the *Inviolata intacta*[181], so that it can act as theological support to her original purity.

Upon the transition to printed books, this image grew as the custom illustration to the Office of the Immaculate Conception among Parisian printers and publishers. In fact, Antoine Vérard[182], Thielman Kerver(*c.* 1503-1525)[183] and the partnership Simon Vostre-Philippe Pigouchet[184] adopted it since *c.* 1503 (fig. 2.60b). Jean Pichore fitted directly into this territory, only differing in a slight detail: that his Mary emanates light.

Normandie". In: *Marie et la Fête aux Normands: évotion, images, poésie*. Mont-Saint-Aignan: Presses universitaires de Rouen et du Havre, 2011. Chap. 10, pp. 163–178. DOI: https://doi.org/10.4000/books.purh.10926.

[177] Baron, "L'Iconographie de l'Immaculée Conception dans la sculpture médiévale et moderne en Normandie".

[178] Baltimore (MD), Walters Art Museum, Ms W.282, fol. 7^{r}. It is a Book of Hours produced in Bruges, *c.* 1440-1450, with visual and textual supplements dating around 1500, probably commissioned by Christophe of Ricaumez. Because the prayers are in Rouennais and the artistic style recalls this production, this Marian image can have a special connection to Rouen.

[179] Translated from the original in High French: "*heures de la conception de n*[*ot*]*re-dame*".

[180] "*Tota pulchra es amica mea et macula et macula non est in te*" (Song of Songs 4:7).

[181] Abby Mcgehee. "The Virgin Chapel at Saint-Gervais-Saint-Protais: Embellishment and Devotion in Late Gothic Paris". In: *Journal of the Society of Architectural Historians* 63.3 (2008), pp. 262–287. DOI: https://doi.org/10.1525/jsah.2008.67.3.362, pp. 372-373.

[182] Two versions appeared: one is in a 1503-edition of Book of Hours mentioned in Mcgehee, "The Virgin Chapel at Saint-Gervais-Saint-Protais: Embellishment and Devotion in Late Gothic Paris", p. 372. The other version is in a 1525-edition of Book of Hours, use of Paris, now in Paris (BnF, Res. 4-T-943, fol. p4^{r}).

[183] This version was retrieved in a (partially) digitised source available at: https://cepuckett.com/inventory/index.php?no_cache=20220808042055&main_page=product_info&products_id=894 (Accessed August 8, 2022).

[184] Kathryn M. Rudy. In: *Rubrics, Images and Indulgences in late Medieval Netherlandish Manuscripts*. Ed. by Kathryn M. Rudy. Leiden: Brill, 2017. Chap. 7, pp. 161–180. DOI: https://doi.org/10.1163/9789004326965_008, p. 161.

(a) Manuscript

(b) *Incunabulum*

Figure 2.60: Representation of the *Virgin of the Litany* in books: a) Baltimore, Walters Art Museum, Ms W.282, fol. 7^{r} (152 mm x 101 mm illuminated image); b) Paris, BnF, fol. P4^{r} (*c.* 104 mm x 72 mm printed image) © The Walters Art Museum, Source BnF.

Through this alteration, he bolstered the relationship to the origins of the Office of the Immaculate Conception. The image of the Virgin and Child surrounded in rays of light is, in fact, a less frequent Marian iconography called *Virgo in sole*. According to the historian Kathryn Rudy, this iconography ultimately stems from the second-century legend of the *Ara coeli*, according to which the Roman emperor Augustus received the prophecy on the top of Campidoglio hill about the arrival of a greater king than him, namely Christ. This legend refers that the Tiburtine Sybil, gave the emperor a glimpse of her extraordinary vision showing the Virgin and the Child appearing in the sky, "radiating beams of sunlight"—as the historian says[185]. Somehow, the model of the Virgin and Child emanating light developed a special connection to the rosary devotion[186] and the Immaculate Conception doctrine[187]. As for this second devotion, it is a tradition that pope Sixtus IV should have fostered his relationship with a putative indulgence based on the statement found in an illuminated manuscript of the British Library: "Pope Sixtus granted an 11,000-year indulgence upon reciting this prayer before an image of the Virgin *in sole*."[188]

[185] *Ibid.*

[186] *Ibid.*, p. 162.

[187] *Ibid.* and Sixten Ringbom. "*Maria in Sole* and the Virgin of the Rosary". In: *Journal of the Warburg and Courtauld Institutes* 25.3-4 (1962), pp. 326–330.

[188] Original from the Latin: "*Papa Sixtus concessit dicentibus hanc orationem ante ymaginem marie virginis in sole xi milia annorum indulgentie. Oratio*," from BL, Add. Ms 35313, fol. (also known as the *London Rothschild Hours*), fol. 237^{r}. It is a Book of Hours produced around 1500 in the Netherland0, for a member of the Spanish court here. This inscription is the most traditional among those who support the indulgence prayer connection to pope Sixtus IV (Bonnie J. Blackburn. "The Virgin in the Sun: Music and Image for a Prayer Attributed to Sixtus IV". in: *Journal of the Royal Musical Association* 124.2 (1986),

The above illustration shows, indeed, Mary and Christ glaring rays of light and a pope, probably to identify as the same Sixtus IV[189]. He was a fervent supporter of the Marian original purity and energetically fostered the cult of the Immaculate Conception: initially, with two Bulls (1476 and 1477) promising a sizeable indulgence for the celebration of the Office for the Feast of the Immaculate Conception[190]; later (1480), with another Office dedicated to the Immaculate Conception. As to Pichore and his *Quarto*-set, it is possible that adding the attribute of the Virgin *in sole* could be an artistic strategy to reinforce the connection between the same illustration and the Office.

What convinces in Pichore's familiarity with the legend and the Virgin *in sole* is also the presence of a piece of the *Octavo*-set portraying the episode of Augustus vision (Piece 5). This other Mary respects the traditional representation of the Virgin in the Sun as retrieved from indulgence prints (fig. 2.61a)[191] and a few northern paintings (fig. 2.61b)[192]: half-length view, Virgin and Child directing their gaze to the side and with a glare directly emanating from them.

(a) Jean Pichore (b) Indulgence print (c) Geertgen tot Sint Jans

Figure 2.61: The Virgin *in sole* compared across artistic media: a) *Virgin and Child*, detail of *Octavo*-set, Piece 5 by the Pichore workshop; b) printed indulgence prayer (Oxford, Bodleian Library, Ms Bodl. 113, fol. 13^{v}, 152 mm x 101 mm printed image); c) *The Glorification of the Virgin*, Geertgen tot Sint Jans (1490-1495, 245 mm x 205 mm), Rotterdam, Boijmans Museum © The Walters Art Museum, Source BnF.

pp. 157–195. DOI: https://doi.org/10.1093/jrma/124.2.157; Rudy,).

[189] Blackburn, "The Virgin in the Sun: Music and Image for a Prayer Attributed to Sixtus IV", p. 159.

[190] Ringbom, "*Maria in Sole* and the Virgin of the Rosary", p. 326.

[191] From University of Oxford, Bodleian Library MS. Bodl. 113, fol. 13^{v}. A partial digital source is available at https://digital.bodleian.ox.ac.uk/objects/f19af247-602d-47e2-b7df-abb28bc5cbc1/surfaces/d48a57a1-aa91-4cd1-99b5-93fbcffa3ae1/ (Accessed August 8, 2022).

[192] Jans, Geertgen tot Sint (1480-1489), *Glorification of the Virgin* [oil on panel]. Rotterdam, Museum Boijmans Van Beuningen, inv. no. 2450. Available at: https://www.boijmans.nl/en/collection/artworks/3730/the-glorification-of-the-virgin (Accessed August 9, 2022).

To conclude, the illustrations reveal strong influences of several artistic forms surrounding Jean Pichore, both in his immediate vicinity and in regions geographically (yet not culturally) away from Paris, as well as controversial doctrines. For all the similarities, Pichore seems to express an original artistic identity as well as a marked self-referential character.

2.2.3 Use of the sets among the Hardouyn editions

The first set in line for this section (the *Octavo-agenda* one) discloses an interesting history of use. The first cut from the series belongs to a collection of historiated wood- or metal-cuts for border decoration that the Hardouyns labelled as *Figures de la vie de l'homme*[193], while the rest coincides with a suite featuring stories of the life of the Virgin.

Concerning the first group of engravings, it is a twenty-six piece collection (originally, each one was coupled to underlying lines of text) which describe a story of Death tormenting mankind, alone and together with three comrades-in-arms, *Guerre* (war), *Famine* and *Mortalité* (mortality or disease)[194].

In turn, the sources of inspiration for the set of Figures were the "*Danse Macabre*" theme[195] next to its first adaption to an independent, illustrated publication with the editions printed by Guy Marchant two decades before the Hardouyns (in 1485)[196]. The third

[193]By way of illustration, the colophon of Pennsylvania, UPenn, Ms. Codex 1531 recites on fol. 1^{r}: "*Avec les figures de la | vie de l*[']*hom*[*m*]*e*". For the digital source of this book, see Appendix A, Inc. 33.

[194]The three companions of Death allude to the horsemen of the Apocalypse as to Rev 6:8.

[195]This theme had been widely spread for centuries before its appearance in textual version. In this form, the earliest trace of *Danse Macabre* occurs as a short poem written of a wall of the *Cimitièère des Innocents* in Paris, during the early fifteenth century (*c.* 1424). Later, John Lydgate would translate this poem into English, and a female version on the theme was elaborated soon after. See Hindman, "The Theme and its Public", p. 15.

[196]In 1485/1486, the Parisian printer Guy Marchant (*fl.* 1483-*c.* 1505) produced a handful of editions of the ballad of both versions—for instance, in the year 1485, the edition Kommission fur den Gesamtkatalog der Wiegendrucke et al. *Gesamtkatalog der Wiegendrucke*. Leipzig and Stuttgart: K.W. Hiersemann and Anton Hiersemann, 1925, no. 7943; on c. 1485-1486, the edition Gesamtkatalog der Wiegendrucke et al., *Gesamtkatalog der Wiegendrucke*, no. 7944 and on 1499, the edition Gesamtkatalog der Wiegendrucke et al., *Gesamtkatalog der Wiegendrucke*, no. 5915. Other printers that produced *Danse Macabre* editions were Gillet Couteau in partnership with Jean Mènard, and Petit Laurens-respectively, in 1492 and 1494 (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, pp. 126-127). Mary Beth Winn delineated a complete history for the set and its application in borders to the Hardouyns Hours Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*". It is worth mentioning here that the Hardouyns were not the only ones to adopt illustrations on this theme. Before them, Simon Vostre applied it in a Books of Hours in Spanish (one case is in Madrid, BNE, R.31496; see Appendix A, Inc. 20 for further details and the digital source). Soon after, another contemporary, Guillaume Godard (Paris, *fl.* 1510-1539), would replicate the Hardouyn's version in his editions (this, at least, is Winn's

reservoir of inspiration was a collection of historiated cut for lateral borders made for Simon Vostre, a few years after Marchant's works[197]. The version of the Hardouyn workshop displays Jean Pichore's style, and it was created in the period falling between 1506 and 1508, as Zöhl infers[198]. The remaining illustrations belong to a Life of the Virgin series hitherto unpublished, even in Zöhl's essay. However, an unrevised series managed as a marginalia decoration appears in one book from the Library of Pennsylvania University[199].

The period of production that Zöhl proposed for the creation of the *Le vie de l'homme* series agrees with the date of issue of the books inspected for this section which include this set. Indeed, two books now in the Public Library of Poitiers (BR.87[200] and CR.49[201]), one in Pennsylvania (Ms. Codex 1531) and another one in the British Library (C.29.d.11[202]) seem to be made precisely between 1505 and 1512 (the set was designed around 1506). However, only one of them employs two historiated cuts from it, *Death with Adam and Eve in Paradise* and *A man strangling another, Death observes* (figs. 2.16a and 2.17f), with the specific purpose of illustrating individual canonical hours. That image in the *Danse Macabre*-theme is used in association with a canonical *Annunciation* for the decoration of Lauds. Because they are used together, the fig. 2.16a could be used typologically, to mean that because Mary is"blessed among all women"[203], she is the fe-

opinion Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*", p. 151)

[197]This set is a full cycle of the *Danse Macabre des hommes et des femmes of c. 1508*, by the Parisian engraver and printer Philippe Pigouchet (see Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*", p. 147). A full reproduction of the set can be found in Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.52-53. Based on Claudin, it seems that the earliest Hours with this set dates back to the 1490s; also Winn does not refer a specific date (Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*"). After this first version for Spanish Hours, two later versions were tailored for French texts, namely *Les Accidens de l'homme* (*c.* 1512) and *Vie de l'homme* (*c.* 1507). The major difference between the two of them seems to be the text, but the images of these two latter versions are comparable.

[198]See Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, p. 155.

[199]Pennsylvania University Library, Ms. Codex 1531. *Horae ad usum Romanum* (Roman Mass rite), Paris, Guillaume Anabat (printer) for Gillet and Germain Hardouyn (publishers), *c.* 1507. See Appendix A, Inc. 33 for further details and the digital source.

[200]*Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Guillaume Anabat (printer) for Gillet and Germain Hardouyn (publishers), *c.* 1505. For further details and its digital source, see Appendix A, Inc. 34.

[201]*Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Gillet Hardouyn, *c.* 1512. For further details and its digital source, see Appendix A, Inc. 36.

[202]*Horae ad usum Romanum* (Roman Mass rite), Paris, Guillaume Anabat (printer) for Gillet Hardouyn (publishers), *c.* 1508, in-*Octavo*.

[203]See source C.2.1.1.1 from Appendix C

male counterpart of Jesus as the Saviour of women[204]. Coming back to the use of the illustration of *Death with Adam and Eve*, the single book that sees this use of the volume from the British Library. The rest of the mentioned books employ the *Vie de l'homme* cuts as lateral border decoration, according to their original purpose.

This instance of use calls attention to a couple of points. The first is the fact that originally, the set served as lateral finishing[205] to then find development as an independent illustration. In this view, C.29.d.11 can represent a case for intentional reinventing the workshop equipment, although it is not an isolated case. Other expressions of similar flexibility appeared in the previous chapter, where book decorators offered instances of severe alterations to woodcuts as seen in the Vérard workshop[206]. In that case, a detail was continuously adjusted to accommodate other book contents (the headgear of one figure[207]). In other circumstances, the material for printed *horae* decoration proved comparable fluidity between the workshops of Denis Meslier and Jean Dupré[208]. In addition to the above observation, C.29.d.11 is a book in a rare agenda format. The catalogues describing copies of this edition do not unfortunately disclose details about the size format of other instances[209], so that the relationship C.29.d.11 and other copies is not fully clear. However, it would be sensible to assume that these books would be similarly sized as agendas. In addition to this discovery, another interesting use for the *Le vie de l'homme* appears in other two editions by Gillet Hardouyn[210], one in *Octavo*- and another in *Quarto*

[204]This capacity of Mary would soon find an updated version in the *Quarto set by Jean Pichore* (see below).

[205]This line of production corresponds to the so-called *Grandes Heures* of Gillet Hardouyn, titled after the lavishly vibrant Books of Hours by Anthoine Vérard that he published in 1489/1490 (Mary Beth Winn. "Vérard's Hours of 8 February 1489/90: Prologue, Table, and Typological Borders". In: *The Papers of the Bibliographical Society of America* 87.3 (1993)).

[206]See section 1.3.2.2.

[207]Bonicoli reports the alterations to the woodcut for the period (post) 1492-*c.* 1502, as seen in three books: Paris, BnF, Rés. H.10, fol. A8^{v}; Paris, BnF, Rés. H.10, fol. A8^{v} (Louis-Gabriel Bonicoli. "La production du libraire-éditeur parisien Antoine Vérard (1485-1512) : nature, fonctions et circulation des images dans les premiers livres imprimés illustrés". PhD thesis. Paris: Paris Nanterre University, 2015).

[208]For instance, Claudin was positive that the historiated border blocks of the earliest Hours by Jean Dupré (Paris, *fl.*) were either a property of the contemporary Denis Meslier (Paris, *fl.*) or were borrowed by the latter (Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.106).

[209]See Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, I, 1508, no. 108; Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 872.

[210]The text consists in a dialogue between Death ("La Mort") and individuals, representing members of various stations of the society. The attribution to Gillet insists exclusively on the combination of the "centaur" device (at front of the book) with the two angels supporting the shield with the globe (at the end), that is seen in his editions. See Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de*

format. These two editions contain an extremely rare four-leaf booklet which is appended at the end of the editions and called "*Dis des estas*"[211]. These two cases repeat a shared attitude of creating innovative editorial operations for the years 1507-1512, only in the editions by Gillet Hardouyn. After 1508, no later edition bears these illustrations at the openings of Offices.

The octavo set for Gillet and Germain is the most perfectly represented, among all observed sets[212]. Concerning it, Zöhl subdivided it into four consecutive deliveries:

- first delivery (*c.* 1505): it includes one *Printer's device* (Hercules aiming at Nessus with Deianira), *St. John with the Poisoned Cup*, *Capture of Jesus in Gethsemane* and *Dispute and Reconciliation of the Four Daughters of God*[213];
- second delivery (*c.* 1506): it includes the complete cycle of illustrations for the Office of the Virgin, as well as the images for the Hours of the Cross, Hours of the Holy Spirit, Penitential Psalms and Hours of the Dead;
- third delivery (*c.* 1508): it includes the second illustration for the Penitential Psalms (*Death of Uriah*) and an alternative version for the Hours of the Dead (*Feast of Dives*)[214];
- third delivery (*c.* 1509: it consists of the sole second mark for Gillet Hardouyn (the two angels supporting the shield with a globe)[215].

The direct observation of books supports Zöhl's classification. Among the earliest editions, the books dating until 1506 bear the first two deliveries: Library of Congress,

l'homme to the *Dis des Estas*", p. 145.

[211] The *Dis des estas* was originally discussed by Winn (see Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*").

[212] It appears in twenty books in the collection gathered for the discussion. See Appendix B for a comparison.

[213] Zöhl proposes the year 1505 after two editions bearing the date "1 X 1505" (Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 174-175); compare with Lacombe, *Livres d'heures imprimés au XVe et au XVIe siècle conservés dans les bibliothèques publiques de Paris: catalogue*, nos. 148-149 and Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, nos. 65-67.

[214] Zöhl derived this particular from Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, no. 69, edition of 28 V 1508 (Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 139, 175).

[215] Printer's device in Renouard, *Les marques typographiques parisiennes des XVe et XVIe siècles*, no.431, pp. 132-133.

Rosenwald 923[216]; BL, C.52.cc.10[217] and two books from the Public Library of Poitiers, BR.87[218] and CR.46[219] (respective dates of production: *c.* 1505, *c.* 1506, *c.* 1505 and *c.* 1505). Similarly, other books dating until 1509 bear up to the third delivery among others[220]: UPenn, Ms. Codex 1531; BL, C.29.h.11[221]; two from the Bibliothèque nationale de France (Rés 8.T.2520[222] and Rés 8.T.2521[223]) and another from the Library of Geneviève collection, Ms. OEXV365[224] (possible dates of production: *c.* 1508, *c.* 1506-1508, *c.* 1508, *c.* 1509 and *c.* 1508). The fourth delivery first appears in a book in Poitiers seen before, CR. 49, and an additional book from the British Library, C.29.i.18[225] (possibly produced in *c.* 1512 and *c.* 1514).

Besides, the sets of this *Octavo* series for the Hardouyns can be chiefly associated with the period of activity of Gillet. Most of these books were issued in the period 1505-1522 and bear the name of Gillet in the colophon. Based on the initial (or final) statements for the edition, it may be inferred that the producer is either Gillet alone or the Gillet-Germain partnership. In other words, Gillet was always somehow involved in the editorial process for these works. After Gillet's death, the set almost disappeared in the Hours edited by Germain, and only very few pieces (*Dispute and Reconciliation of the Four Daughters*

[216] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Guillaume Anabat (printer) for Gillet Hardouyn (publisher), *c.* 1505. In New York, Library of Congress, Ms. Rosenwald 923 (for further details and the digital source, see Appendix A, Inc. 42).

[217] *Horae ad usum Rotomagensis* (Rouen Mass rite), Paris, printed by Guillaume Anabat (printer) for Philippe Coste and Louis Bouvet (publishers in Rouen); with the printer's device of Gillet Hardouyn, *c.* 1506. In London, BL, C.52.cc.10.

[218] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Guillaume Anabat (printer) for Gillet and Germain Hardouyn (publishers), *c.* 1505. In Poitiers, BM, BR.87 (for further details and its digital source, see Appendix A, Inc. 34).

[219] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Guillaume Anabat (printer) for Gillet and Germain Hardouyn (publishers), *c.* 1505. In Poitiers, BM, CR.46 (Inc. 35).

[220] The number of books is greater than listed here. For a full list of the books, see Appendices A and B.

[221] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Guillaume Anabat (printer) for Gillet and Germain Hardouyn (publishers), 1506-1508. In London, BL, C.29.h.11.

[222] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Guillaume Anabat (printer) for Gillet and Germain Hardouyn (publishers), *c.* 1508. In Paris, BnF, Rés 8.T.2520 (see Inc. 27 for further details and the digital source).

[223] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Gillet Hardouyn, *c.* 1509. In Paris, BnF, Rés 8.T.2521 (see Inc. 27 for further details and the digital source).

[224] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Guillaume Anabat (printer) for Gillet and Germain Hardouyn (publishers), *c.* 1508. In Library of Geneviève, Ms. OEXV365. Retrieved from: https://archive.org/details/OEXV365 (Accessed on September 22, 2021).

[225] *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Gillet Hardouyn, *c.* 1514. In London, British Library, C.29.i.18 (notice on Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, nos. 972-974; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, II, 1514, no. 869).

of God, *Nativity* and *Death of the Virgin*) were combined[226] with those from the *Octavo* set of Pichore for the printer Jean Barbier[227]. Because the referred span sees a significant involvement of Gillet in the workshop, it is possible to infer that he might be the sponsor of this set.

In Gillet's plan, the *Octavo*-suite was for use in combination with the *Quarto* series. For instance, this combination is found in a good number of books: two books in the British Library (C.29.h.11 and C.29.i.18), one from the Bibliothèque nationale de France (Rés 8.T.2521), one book from the Public Library of Blois (Inc. G.306[228]), three from Poitiers, PL (BR.87, CR.46 and CR.49) and finally, the book from the University Library of Pennsylvania (Ms. Codex 1531). Their date of production also falls in the same chronological span seen before: 1506-1515. After these years, the *Quarto*-series disappears from the output of the Hardouyn workshop.

Further comment can be made regarding the use of the *Quarto* set for Gillet by the Hardouyn workshop. First of all, although the number of books bearing it is relatively broad, three illustrations from it generally appear in *Octavo*-format books: *Flagellation* and *Mary with her emblems*. In the rest of the texts, the *Quarto* set is mixed with the *Octavo*. Another remark is also that the two sets offer similar compositional patterns (as seen in the previous section), and the final appearance of editions bearing them is of stylistic unity. That feeling of harmony is stressed with further visual supplements, like the aforementioned Italianate tabernacle frames (in Section 2.2.2). What was left out from their previous presentation are some technical considerations. In all books without over-paints of the *Octavo* and *Quarto* sets, an architectonically elaborated frame encompasses every image. However, such decoration seems to be a supplement added at the moment of composing the frame rather than being carved contextually to the rest of an image. A single image left as a crude engraving was analysed in several volumes belonging to different editions, and seven leaves were found[229]. In each of them, the frame shows differing features (fig. 2.62). However, at a close inspection, one can notice that the apparent diversity

[226] For instance, in Paris, *Horae ad usum Romanum* (Roman Mass rite), Paris, printed by Germain Hardouyn, *c.* 1526. In Paris, BnF, Rés 8.T.2546 (see Inc. 29 for further details and the digital source).

[227] See Sections 2.5.1 and 2.5.3.

[228] Horae ad usum Romanum (Roman Mass rite), Paris, *c.* 1515, printed by [Gillet Hardouyn]. In Blois, BM, Inc. 119 (see Inc. 2 for further details and the digital source).

[229] BnF, Rés 8.T.2520, fol.81^{r}; Poitiers, BM, BR.87, fol.38^{r}; Poitiers, BM, CR.46, fol.31^{r}; UPenn, Ms. Codex 1531, fol.37^{r}; BStG, OEXV365, fol.119^{r}; Library of Congress, Rosenwald, fol. 89^{r}.

of these elaborate frames can be reduced to a smaller number of components, or the side pillars, the top and the bottom. Each of them displays multiple variations, and the column even occur under a different pattern with reference to the position, one for the left side and another for the right side[230].

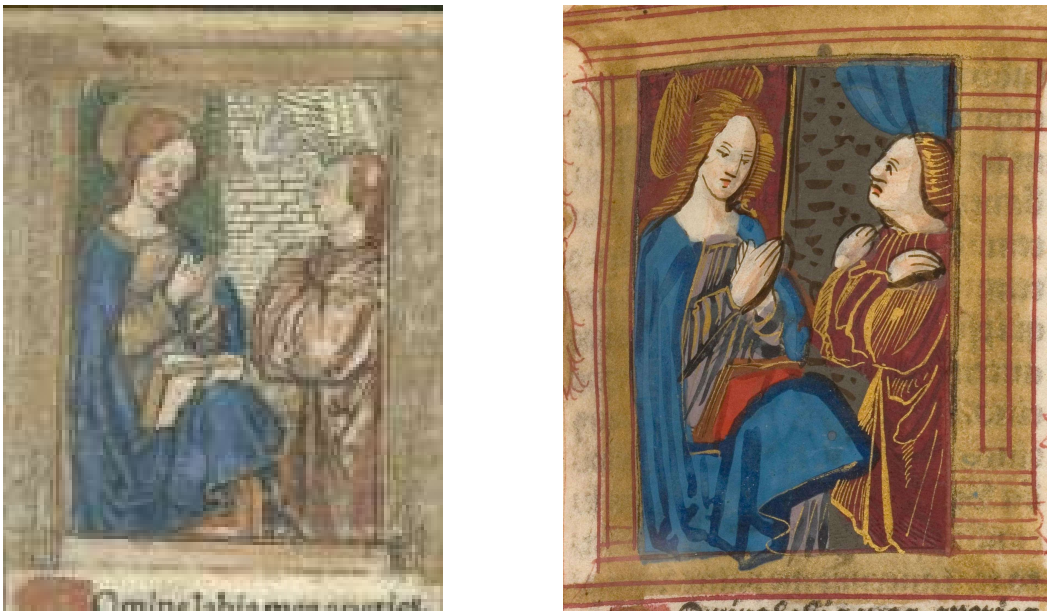
(a) Variant 1 (b) Variant 2 (c) Variant 3

(d) Variant 4 (e) Variant 5 (f) Variant 6

Figure 2.62: A reference image framed into seven different version of *Italianate tabernacle frame* (*c.* 160 mm x 107 mm area dimensions). From: a) Paris, BnF, RES 8-T- 2520, fol. 81^{r}; b) Paris, BSG, OEXV365, fol. 119^{r}, c) Washington, LC, Rosenwald 923, fol. 45^{v}; d) Poitiers, BM, BR.87, fol. 38^{r}; e) Poitiers, BM, BR.46, fol. 31^{r}; f) Pennsylvania, UPEnn, Ms. Codex 1531, fol. 37^{r} © Silvia Bottura-Scardina, the British Library Board, Source BnF, Kislak Center for Special Collections, Rare Books and Manuscripts (University of Pennsylvania).

[230]On closer inspection, seven differing patterns appear for the bottom component along with eight possible couples of columns and six different top elements, all presented in Figure 2.62. The fact that these number do not match leaves to the interpretation that this list is non-exhaustive.

To contrast the rich information of above, only a few details can be told about the *Duodecimo-series*. It was possible to retrieve a (hopefully) complete version of this set from an *Agenda*-format book of the Biblioteca National de Portugal (BNP, Res.325.v), and probably, the set was used for the decoration of another Hours with the same format in Chantilly (Impr. XIV.C.003, see fig. 2.63b)[231]. Because both books bear the year 1512 as the approximate date of edition 1512, this set is likely to have been applied in an extremely limited number of agenda editions of the early 1510s.



(a) BNP, Res.325.v

(b) MC, Impr. XIV-C-003

Figure 2.63: *Annunciation* compared across two Hours by Gillet Hardouyn decorated with the *Duodecimo set* (*c.* 41 mm x 26 mm illustration dimensions): a) Lisbon, BNP, Res.325.v, fol. 21^{r}; b) Chantilly, Musée Condé, Impr. XIV-C-003, fol. c2^{r} © Duarte Belo and the BNP; Musée Condé, Chantilly.

That combination of an almost obsessive attention to the visual and their technical characteristic in Gillet's editions leave a sturdy feeling of harmony and elegance. Later, Germain took utterly dissimilar aesthetic choices.

[231] For full bibliographic info and a partial digital source of the item, see Appendix ap:1, Inc. 7.

2.3 Transitional set (1515-1533)

2.3.1 Formal description of the set: Set in "Linear" style

Set in "Linear" style (*c.* 1515), *c.* 95 mm x 63 mm

(a) Piece 1 (b) Piece 2 (c) Piece 3

Figure 2.64: All pieces of the *"Linear" style* set of *c.* 1515 (*c.* 95 mm x 63 mm illustration dimensions). The illustrations are from: a) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 1, p.113; b) *ibid.*, no. 2, p. 113; c) *ibid.*, no. 3, p. 113 © Antiquariat Bibermühle.

- *Piece 1, Crucifixion* (illustration for the Office of the Cross [Matins], fig. 2.64a) Mary and John assist the crucifixion and Jesus' death on the Cross. On the top of it, the label says "INRI". On the bottom, there are some bones. Mary laments her son's death by crossing her hands on the chest; a second Mary, maybe Magdalene, falls to the ground and mourns her master's demise. St. John stands on the right, equally in pain.
- *Piece 2, Bathsheba baths at the fountain* (illustration for the Penitential Psalms [first Psalm], fig. 2.64b) Bathsheba baths at an octagonal fountain with the assistance of a maidservant. The maid hands her a soap bar and holds her garment. King David observes the scene from the terrace of his palace, not too far from her. The scene takes place in a courtyard.
- *Piece 3, Job on the dung heap* (illustration for the Office of the Dead [Vespers], fig.

2.64c) After a long series of unfortunate events and misery, Job can only wait for his destiny, sitting on a heap of dung. He expresses his complete submission to the divine will by relinquishing his earthly goods, exposing his body to the inclement weather and waiting for God to express his will. A group of wealthy friends visit him to convince him, unsuccessfully, to abandon his pious lifestyle and return to earthly life.

2.3.2 Artistic influences

During the second decade of the sixteenth century, the artistic panorama of Paris lived a phase of transition. While the manuscript production remained an influential source of its inspiration, the local artists started looking with increasing attention to foreign sources, especially from Germany. The ongoing artistic evolution also invested in the production of illustrations of printed Hours, resulting in a new class of visuals.

One set produced in the middle of this decade of change shares the same innovative character. Around 1515, Germain Hardouyn commissioned an anonymous artist to craft an unusual collection of illustrations for the decoration of three Offices, namely this *"Linear" set*[232]. The three illustrations neither form a complete cycle by themselves nor are they thematically coherent. For all their extraneity of content, the set reveals an internal relationship in design.

The first illustration from the series, *Crucifixion*, relinquishes the group pattern of two previous series, namely the *Octavo series* and *Quarto-series* by the Pichore workshop. As a matter of fact, this new series of engravings compresses the burbling crowd of spectators of the above versions into a smaller group including only two Mary and John. This new model seems to follow the pattern adopted for one print by the Monogrammist AG (1450-1500)[233] and Martin Schongauer (1470-1482)[234] first (figs. 2.65b and 2.65c), and by Lucas Cranach the Elder (1500-1503)[235] after (fig. 2.65d). The Mary Magdalene from the *"Linear" series* performs comparably on (almost) all the prints illustrate her embracing the Cross. Likewise, the arrangement places John preferably to the right side of the illustration and the virgin Mary to the other side. However, the only two features that this piece from the *"Linear" series* and the print of Lucas Cranach the Elder share, is the structure of the background cityscape and the crossed position of Mary's arms, on her

[232]The name of this set is an adaptation to English of the homonymous from the Tenschert catalogue. See Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*.

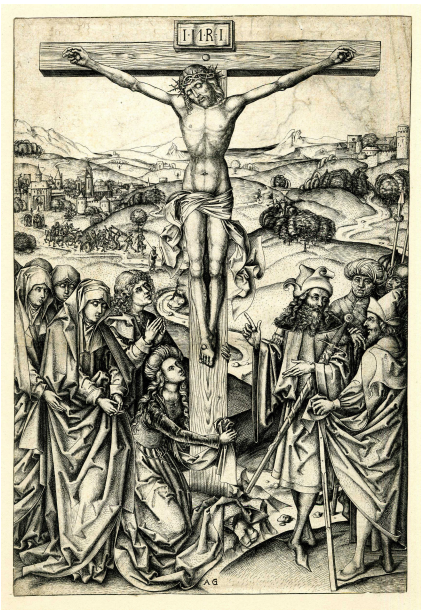
[233]Monogrammist AG (1450-1500) *The Crucifixion* [print on paper]. London, British Museum, inv. no. E,1.31. Retrieved from: https://www.britishmuseum.org/collection/object/P_E-1-31 (Accessed onSeptember 19, 2021).

[234]Schongauer, Martin (1470-1482) *The Crucifixion* [print on paper]. London, British Museum, inv. no. E,1.52. Retrieved from: https://www.britishmuseum.org/collection/object/P_E-1-52 (Accessed on September 19, 2021).

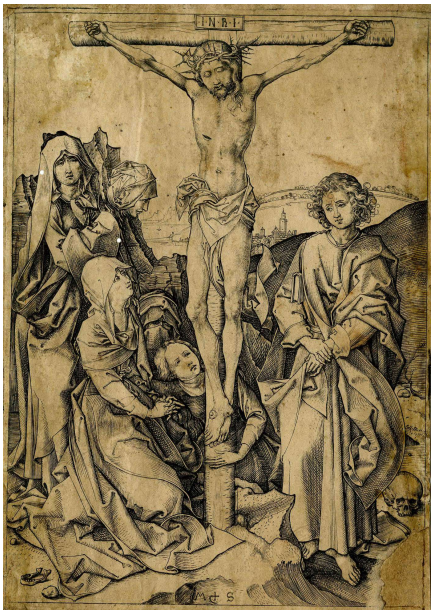
[235]Cranach, Lucas [the Elder] (1500-1503) *The Crucifixion* [print on paper]. London, British Museum, inv. no. 1928,0714.4. Retrieved from: https://www.britishmuseum.org/collection/object/P_1928-0714-4 (Accessed September 19, 2021).

chest.

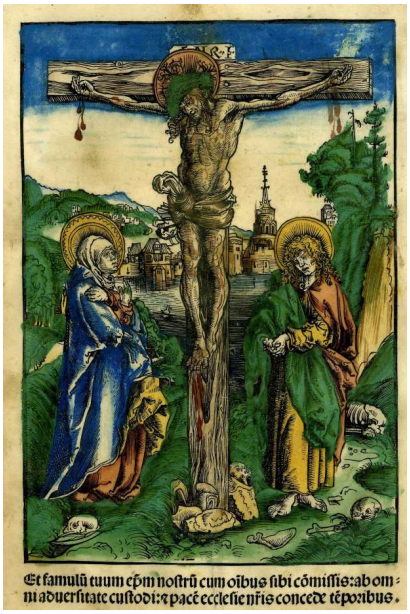
(a) *Linear* series



(b) Monogrammist AG



(c) Martin Schongauer



(d) L. Cranach the Elder

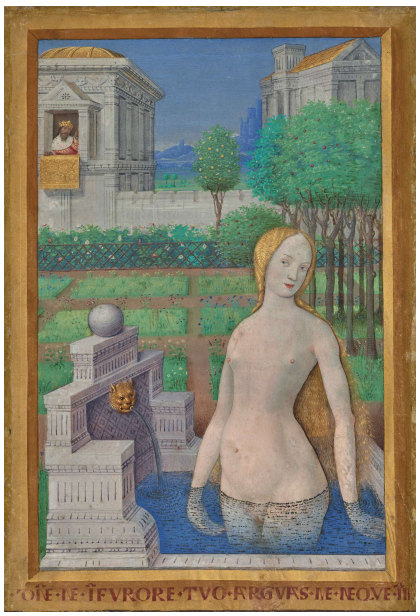
Figure 2.65: *Crucifixion* compared across the *"Linear" series* of *c.* 1515 and three works of the German school of engraving: a) reference image (*c.* 95 mm x 63 mm print dimensions), from Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, p. 113, no.1; b) Monogrammist AG, *c.* 1450-1500 (277 mm x 190 mm), from London, BM, inv. no. E,1.31; c) Martin Schongauer, *c.* 1470-1482 (166 mm x 114 mm), from London, BM, inv. no. E,1.52; d) Lucas Cranach the Elder, 1500-1503 (216 mm x 150 mm), from London, BM, inv. no. 1928,0714.4 © Antiquariat Bibermühle and the Trustees of the British Museum.

(a) *"Linear" series*

(b) *Quarto-series*

Figure 2.66: *Bathsheba baths at the fountain* compared across the *"Linear" series* (*c.* 95 mm x 63 mm print dimensions) and the *Quarto-series* (*c.* 193 mm x 123 mm). From: a) London, BL, C.29.i.18; b) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, p. 113, no.2 © Antiquariat Bibermühle, Silvia Bottura-Scardina and the British Library Board.

(a) Jean Poyer



(b) Jean Colombe

(c) Master de Claude de France

(d) Monogrammist S

Figure 2.67: *Bathsheba baths at the fountain* compared across various works: a) New York, PML, Ms. M.677, fol. 211^{r} (147 mm x 109 mm miniature dimensions); b) J. Paul Getty Museum, Ms. 79 (2003.105) (243 mm Œ 177 mm); c) Paris, BnF, Ms. 291.réserve, fol. 74^{v} (137 mm Œ 87 mm); d) London, British Museum, inv. no. 1837,0616.241 (55 mm diameter) © Morgan Library, New York; (2021) the J. Paul Getty Trust; Source BnF and the Trustees of the British Museum.

Bathsheba baths at the fountain retains a German influence as well, albeit not equally profound. The compositional scheme of this version is comparable to the version of the *Quarto-series* (figs. 2.66a and 2.66b); however, elements of dissimilarity arise. The first observation is that the novel version undergoes heavy simplification of forms as compared

to the previous. Maybe a good reason is the extremely reduced size of the *"Linear"* piece, which measures half as the *Quarto* piece (95 mm x 63 mm against 193 mm x 123 mm)[236], but other elements suggest an intentional aesthetic choice. At Bathsheba's back, the fountain is decorated on the side with a tall, slender spire in Gothic fashion. That decorative element appears in German prints, not before. The previous illustrations from the miniatures by Jean Colombe and Jean Poyer followed a different choice of style (figs. 2.67a and 2.67b), and so did the *Master de Claude de France* in Tours (fig. 2.67c)[237]. However, this choice appears, again, in German prints, like one by the Monogrammist S in fig. 2.67d[238].

Beside the stylistic meaning, *Crucifixion* and *Bathsheba baths at the fountain* reveal another inner choice. As for the former illustration, the fact that the *Crucifixion* scene removes a great majority of the bystanders can imply a choice of meaning of the image itself. Cutting on the crowd translates to reducing the whole *pathos* of the image to a limited number of psychological components: the grieve of a mother who lost a child; the sorrows of losing the mentor and a close friend. Add to this the fact that none of the condemners and cynics who actively cooperated for the death of Jesus participates in this new version, and the necessary atonement for mankind's misdeeds is completely absent. Considering all these aspects, this *Crucifixion* renounces its cathartic service to absolve the viewer of any responsibility in Jesus' death. Given this, the version of the *"Linear" set* expresses a different direction than later versions, like a painting by Lucas Cranach the Elder of 1538[239].

The last image of the series, *Job on the dung heap*, tells a different story than the other two pieces. Unfortunately, the sources of its inspiration are obscure, and its connection to

[236]Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, pp. 104, 113.

[237]Book of Hours, 1510-1515, Tours, illuminated by the *Master de Claude de France*. In Paris, BnF, Ms. 291.réserve, fol. 47^{v}. See Appendix A, Ms.15 for bibliographic info and a partial digital source for the item.

[238]Monogrammist S (1500-1525). *Bathsheba baths at the fountain* [print on paper]. London, British Museum, inv. no. 1837,0616.241. Retrieved from: https://www.britishmuseum.org/collection/object/P_1837-0616-241 (Accessed September 19, 2021).

[239]Cranach, Lucas [the Elder] (1538). *The Crucifixion* [oil on panel]. Chicago, The Art Institute of Chicago, inv. no. 1947.62. Retrieved from: https://www.artic.edu/artworks/59856/the-crucifixion (Accessed September 19, 2021). On the theological views of this painting and the influence of Luther, see Bonnie Noble. *Lucas Cranach the Elder: Art and Devotion of the German Reformation*. Lanham et al.: University Press of America, 2009; Nicole Adams. "The Evolution of Protestant Art: Works by Lucas Cranach the Elder and Albrecht Dürer". In: *The Humanities Review* 1 (2017), pp. 71–88.

other artistic works remains unclear.

2.3.3 Use of the set among the Hardouyn editions

Contrarily to the previous sets, the observations of the *"Linear" series* suggest that this group was meant for neither exclusive nor frequent use. With reference to this set, the catalogue Tenschert states that its plates were not meant to be a series of their own, and that they appear in luxury editions[240]. This hypothesis may be sensible, for more than one reason. Speaking of the possibility of forming a complete set, the illustrations of the series are for decoration of secondary offices only, as illustrated in Section 2.3.1. Because no image for the main office, namely the Office of the Virgin, seems to be part of this set, they necessary call for supplementary illustrations. The second reason is the empirical analysis: a direct inspection of the editions by the Hardouyn workshop that bear this set readily confirms the guess. In fact, all eight books from this group include illustrations from other series as well[241].

Those illustrations belong to three main groups: the *Set in "German" style* (Section 2.4.1), the *Set for Guillaume Eustace* (Section 2.5.1) and the *Set for Jean Barbier* (Section 2.5.1). The illustrations from the first set in *"German" style* provide a supplement to the initial section of Hours, from the Gospels to Terce of the Office of the Virgin. The rest of the set is generally completed with either one or the last two sets above mentioned, the one for Guillaume Eustace and another for Jean Barbier.

The only drawback of the inspection here is of chronological order. The Tenschert catalogue specifies the year 1515 as the approximate date of appearance for this collection. Unfortunately, no inspected book from this year contained this set, or other editions date back to a later time. The earliest date of production here found is 1518, when other sets already entered the Hardouyn workshop. Following this dating, the observation cannot cover the earliest period of use, *c.* 1515-1517.

[240] Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, p. 113.

[241] See Appendix B.

2.4 Sets in German style (1518-1534)

In 1521, Gillet Hardouyn passes away. A few years before, Gillet had managed the enterprise toward a managerial transition favouring the brother Germain as the emerging chief of the workshop. The landmark in the Hardouyn workshop transition of this period could be the official relocation of his privileges. In 1519, Gillet passes his title of *libraire-juré* to another brother, the less known [242]. In the years 1514-1520, Gillet and Germain produced several editions in association[243]. Thus, at the death of Gillet, the major responsibility of the workshop had to be handed over to either Germain or Guillaume. Among the two of them, Germain proved the strong stewardship, based on its strong editorial identity. The books printed in the years overlapping with Gillet's demise reflect indeed major aesthetic differences. The most apparent is the fact that Germain elects to tear the parallel figurative readings from borders, leaving them generally unfilled. As a result, the overall page layout of those Hours is typically meagre in comparison to the mighty *Grandes Heures* of Gillet. In addition, Germain relinquishes the Italianate style of Jean Pichore and looks to Germany for inspiration.

To decorate the Hours of this period, Germain contracts other designers and engravers

[242] Renouard mentions this fact in his Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198. Unfortunately, other details about these circumstances are unknown, and the history of this third Hardouyn brother, Guillaume, are still vague. For instance, it seems that Guillaume Hardouyn acquired a personal device from a Parisian printer, Guillaume Eustace, based on the bibliographic info of a recent sale of *Les Enluminures* gallery of New York (TM 1076, *Horae ad usum Romanum*, Paris, *c.* 1526, illuminated by Germain Hardouyn).However, nothing much is known about this third brother. Probably, Gillet handed his title of *libraire-juré* over to provide a powerful connection with the University of Paris, as a marketing strategy. However, future work will clarify these doubts.

[243] Two *Octavo*-editions for the year 1514 (see on no. 1 Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 959; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1514, no. 865 and on no. 2 Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 970; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1514, no. 867); two *Octavo*-editions for the year 1518: (see on no. 1: Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 1029; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1518, no. 1848 and on no. 2 Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 1030; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1518, no. 1849); for the year 1520, one *Octavo*-edition (see Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 1044 (?), 1045; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1520, no. 2355) and a *Quarto* edition (see Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 1051; Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1520, no. 2360).

than the Pichore workshop. This new group of artists adopts the stylistic traits and the motifs of German printers, particularly of Albrecht Dürer and Hans Holbein the Younger. Because these dominant influences are common to a group of sets used between 1518 and 1534, these suites are grouped in an overarching class.

Looking at the list of the sets, the careful reader may notice apparent incongruities. If German prints are a common source of inspiration for all the presented suites, they would wonder why only a particular one is labelled as "German". To address the inquiry, it must be known that this set was first classified in the Tenschert catalogue (2015) as the "Elongated, octavo set of woodcuts in German style for Gillet and Germain Hardouyn"[244]. In order to avoid disambiguation, this thesis preferred to render the name in English. Similarly, this section adopted the English rendering of several series of engravings encapsulated in an oval frame. Accordingly, they are here referred to as *Medallion* sets[245].

The second collection of illustrations from this section, the *Medallion group*, deserves a second specification. The two Tenschert catalogues (2003 and 2015) do not break it into smaller groups, although the illustrations are formally inconsistent. In this incoherence, three styles emerge. Thus, the *Medallion set* is further divided into three parts here.

Finally, it is worth mentioning that the remaining series of the group are published here for the first time.

[244] Originally, "*Hochoktav-Holzschnitte im deutschen Stil für Gillet und Germain Hardouin, c. 1516*" (Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, p. 114).

[245] This choice shares the same labelling strategy as the sets by the Apocalypse Masters workshop and the Pichore workshop (see Sections 2.1 and 2.2).

2.4.1 Formal description of the sets

Elongated set in "German" style of *c.* 1516 (1516-1533), *c.* 120 mm x 60 mm

(a) Piece 1 (b) Piece 2 (c) Piece 3

(d) Piece 4 (e) Piece 5 (f) Piece 6

Figure 2.68: All pieces of the *Elongated set in "German" style* of *c.* 1516 for Gillet and Germain Hardouyn (*c.* 120 mm x 60 mm illustration dimensions). The illustrations are from: a) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, p. 114, no.1; b) Madrid, BNE, Res. 175, fol. 15^{r}; c) London, BL, C.29.f.10, fol. 18^{v}; d) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, p. 115, no.4; e) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 5, p.115; f) London, BL, C.29.f.10, fol. 33^{r} © Antiquariat Bibermühle, Biblioteca Nacional de España, Silvia Bottura-Scardina and the British Library Board.

- *Piece 1, John in Patmos*[246] (illustration for the Gospels [Gospel of John], fig. 2.68a). The apostle John in the Greek island of Patmos is writing the Book of Revelation and having a vision of God. He occurs in the shape of a Mary on a crescent moon with Child Jesus. Next to John, an eagle stands with open wings.
- *Piece 2, Arrest of Jesus in the garden of Gethsemane* (illustration for the Gospels [Passion Gospel of John], fig. 2.68b). The scene contains two episodes, or the "*Ego Sum*" on the top right corner and the arrest in the garden of Gethsemane in the first scene. Judah tries to kiss Jesus, from behind. At the same time, Jesus prevents Paul from killing a Jew while a Roman soldier pulls his left arm.
- *Piece 3, Annunciation* (illustration for the Office of the Virgin [Matins], fig. 2.68c). The scene takes place in an ample room with two series of columns that draw a nave. In the middle stands Mary to read her pious lectures. From the top, the archangel Gabriel carries the divine message and the Holy Spirit as a dove (that appears from the top left corner). Her election is indicated in a flying *banderole*[247], which says the traditional words: "*Ave gratia plena*"[248]. At the end of the nave, a door shows a garden with the Tree of Knowledge, Adam and Eve, just after their Fall.
- *Piece 4, Visitation* (illustration for the Office of the Virgin [Lauds], fig. 2.68d). Mary and Elizabeth meet at the doors of Jerusalem, in a rural area. Next to them, there is a door with Joaquim coming by to meet the two women and on the back, shepherds flock their livestock.
- *Piece 5, Nativity* (illustration for the Office of the Virgin [Prime], fig. 2.68e). Mary stands in contemplation of Child Jesus. The baby is placed on a manger, directly on the floor, and is heated up by the breath of a nearby ox and a donkey. The scene takes place in a ruined stable. At the centre, the wall in brickwork collapses and reveals the moment of the revelation of the birth of Jesus to the shepherds. A rising star glares on the top right corner of the image.

[246] The biblical record for this image is indicated in Source C.1.1.3 of Appendix C

[247] The definition is from Anne I. Lockhart. “Four Engravings by the Master with the Banderoles”. In: *The Bulletin of the Cleveland Museum of Art* 60.8 (1973), p. 247: "billowing banners with inscriptions".

[248] Abbreviation of the longer formula: "*Ave Maria gratia plena Dominus tecum benedicta tu in mulieribus fructus ventris tui, Jesus*" (=Hail Mary, full of grace! The Lord is with you, blessed are you among women the fruit of your womb, Jesus).

- *Piece 6, Annunciation to the shepherds* (illustration for the Office of the Virgin [Terce], fig. 2.68f). The shepherds are intent on their bucolic celebrations as a group of angels make their appearance to announce the celebration of Jesus. In the background, a small group of shepherds continues their lively dances. Only the figures on the front show marvel at the miraculous apparition: one shepherd falls, and the shepherdess on the right expresses is also astonished.

Medallion sets (1527-1534)

From here, the description of the pieces of the series illustrates only their number, content and relation to an Office. This was chosen based on the fact that the essential iconographic elements have been already described, so the reader is sufficiently informed to identify the elements of certain iconographies. The only exception is the entire *Third Medallion set*: both it is unpublished and its contents reveal a connection to the popular genre *Ars Moriendi*. However, its complexity and iconographic elaboration would require a detailed attention and iconographic analysis that would go beyond the present scopes of this dissertation. It is our conviction that the identification and listing of the illustration and the use among the Hardouyn edition meets the purposes of the doctoral work. However, future work will delve into this fascinating topic.

(a) Piece 1

(b) Piece 2

(c) Piece 3

(d) Piece 4

Figure 2.69: First four pieces of the *Medallion set, part 1* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.29.f.10: a) fol. 9^{v}; b) fol. 50^{r}; c) fol. 26^{r}; fol. 26^{r}; d) fol. 31^{v} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 5

(b) Piece 6

(c) Piece 7

(d) Piece 8

Figure 2.70: Last four pieces of the *Medallion set, part 1* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.29.f.10: a) fol. 12^{r}; b) fol. 49^{r}; c) fol. 56^{r}; d) fol. 62^{r} © Silvia Bottura-Scardina and the British Library Board.

First Medallion set (1527-1534), *c.* 90 mm x 60 mm

- *Piece 1, John in Patmos* (illustration for the Gospels [Gospel of John], fig. 2.69a).
- *Piece 2, Annunciation* (illustration for the Office of the Virgin [Lauds], fig. 2.69b).
- *Piece 3, Visitation* (illustration for the Office of the Virgin [Prime], fig. 2.69c).
- *Piece 4, Nativity* (illustration for the Office of the Virgin [Terce], fig. 2.69d).
- *Piece 5, Crucifixion* (illustration for the Office of the Cross [Matins], fig. 2.70a).

- *Piece 6, Pentecost* (illustration for the Office of the Holy Spirit [Matins], fig. 2.70b).
- *Piece 7, Bathsheba at the fountain* (illustration for the Penitential Psalms [first Psalm], fig. 2.70c).
- *Piece 8, Job on the dung heap* (illustration for Office of the Dead [Matins], fig. 2.70d).

(a) Piece 1

(b) Piece 2

(c) Piece 3

(d) Piece 4

Figure 2.71: The first four pieces of the *Medallion set, part 2* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from: a) London, BL, C.35.f.11, fol. e8^{v}; b) London, BL, C.29.f.10, fol. 35^{r}; c) (*id.*), fol. 37^{r}; d) (*id.*), fol. 39^{r} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 5

(b) Piece 6

Figure 2.72: The last two pieces of the *Medallion set, part 2* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from: a) London, BL, C.29.f.10, fol. 42^{r}; f) London, BL, C.29.g.5, fol. g4^{v} © Silvia Bottura-Scardina and the British Library Board.

Second Medallion set (1527-1534), *c.* 90 mm x 60 mm

- *Piece 1, Annunciation to the shepherds* (illustration for the Office of the Virgin [Terce], fig. 2.71a).
- *Piece 2, Adoration of the Magi* (illustration for the Office of the Virgin [Sext], fig. 2.71b).
- *Piece 3, Presentation in the Temple* (illustration for the Office of the Virgin [None], fig. 2.71c).
- *Piece 4, Flight into Egypt* (illustration for the Office of the Virgin [Vespers], fig. 2.71d).
- *Piece 5, Coronation of the Virgin* (illustration for the Office of the Virgin [Compline], fig. 2.72a).
- *Piece 6, Mary with her emblems* (illustration for the Little Office of the Immaculate Conception [Matins], fig. 2.72b).

(a) Piece 1

(b) Piece 2

(c) Piece 3

(d) Piece 4

Figure 2.73: [First part] *Medallion set, part 3* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.35.f.11: a) fol. e1^{r}; b) (*id.*), fol. e4^{v}; c) (*id.*), fol. f2^{v}; d) (*id.*), fol. f5^{v} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 5

(b) Piece 6

(c) Piece 7

(d) Piece 8

Figure 2.74: [Second part] *Medallion set, part 3* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.35.f.11: a) fol. g1^{r}; b) (*id.*), fol. g4^{r}; c) (*id.*), fol. e1^{r}; d) (*id.*), fol. e4^{v} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 9

(b) Piece 10

(c) Piece 11

(d) Piece 12

Figure 2.75: [Third part] *Medallion set, part 3* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.35.f.11: a) fol. f2^{v}; b) fol. f5^{v}; c) fol. g1^{r}; d) fol. g4^{r} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 13

(b) Piece 14

(c) Piece 15

(d) Piece 16

Figure 2.76: [Fourth part] *Medallion set, part 3* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.35.f.11: a) fol. i2^{v}; b) fol. 48^{r}; c) fol. 49^{r}; d) fol. 50^{v} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 17

(b) Piece 18

(c) Piece 19

(d) Piece 20

Figure 2.77: [Fifth part] *Medallion set, part 3* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.35.f.11: a) fol. 51^{v}; b) fol. 81^{v}; c) fol. 82^{r}; d) fol. l8^{r} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 21

(b) Piece 22

(c) Piece 23

(d) Piece 24

Figure 2.78: [Sixth part] *Medallion set, part 3* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.35.f.11: a) fol. m1^{r}; b) fol. m2^{v}; c) fol. m3^{v}; d) fol. m4^{v} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 25

(b) Piece 26

(c) Piece 27

Figure 2.79: [Seventh part] *Medallion set, part 3* for Germain Hardouyn (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.35.f.11: a) fol. m5^{v}; b) fol. m8^{v}; c) fol. n1^{v} © Silvia Bottura-Scardina and the British Library Board.

Third Medallion set (1530-1534), *c.* 90 mm x 60 mm

- *Piece 1, Arrest of Jesus on Mount of Olives* (illustration for the Office of the Cross [Matins], fig. 2.73a)[249].

[249]This class is the richest of all sets of engraving used by the Hardouyn workshop. Because each image would require dedicated exceeding inspection to provide an adequate iconographic and artistic profile, this section will provide a mere listing of the illustrations.

- *Piece 2, Jesus before Pilate/Herod* (illustration for the Office of the Cross [Prime], fig. 2.73b).
- *Piece 3, Jesus carries the Cross* (illustration for the Office of the Cross [Terce], fig. 2.73c).
- *Piece 4, Crucifixion* (illustration for the Office of the Cross [Sext], fig. 2.73d).
- *Piece 5, Deposition from the Cross* (illustration for the Office of the Cross [Vespers], fig. 2.74a).
- *Piece 6, Entombment of Jesus* (illustration for the Office of the Cross [Compline], fig. 2.74b).
- *Piece 7, Nathan admonishes David* (illustration for the Office of the Virgin [Terce], fig. 2.74c).
- *Piece 8, David's repentance before the angel* (illustration for the Penitential Psalms [Psalm 10], fig. 2.74d).
- *Piece 9, David kneels in front of the sacrificial altar* (illustration for the Penitential Psalms [Psalm 101], fig. 2.75a).
- *Piece 10, David is made king* (illustration for the Penitential Psalms [Psalm 129], fig. 2.75b).
- *Piece 11, Salomon hands David the ruler's insignia* (illustration for the Penitential Psalms [Psalm 142], fig. 2.75c).
- *Piece 12, The three dead* (illustration for the Office of the Dead [Vespers], fig. 2.75d).
- *Piece 13, The three living* (illustration for the Office of the Dead [Vespers], fig. 2.76a).
- *Piece 14, Expulsion from the garden of Eden* (illustration for the Office of the Dead [First lesson], fig. 2.76b).
- *Piece 15, Adam and Eve in the earthly world* (illustration for the Office of the Dead [Second lesson], fig. 2.76c).
- *Piece 16, Adam kneels before God* (illustration for the Office of the Dead [Third lesson], fig. 2.76d).
- *Piece 17, The funeral mass of Raymond Diocres* (illustration for the Office of the Dead [Fourth lesson], fig. 2.77a).

- *Piece 18, Birth, Old age and Death* (illustration for the Office of the Dead [Fifth lesson], fig. 2.77b).
- *Piece 19, Souls in Purgatory* (illustration for the Office of the Dead [Sixth lesson], fig. 2.77c).
- *Piece 20, Last unction on deathbed, struggle for the soul* (illustration for the Office of the Dead [Seventh lesson], fig. 2.77d).
- *Piece 21, Job on the dung heap* (illustration for the Office of the Dead [Eight lesson], fig. 2.78a).
- *Piece 22, World, body and demons at childbed (the three enemies of man)* (illustration for the Office of the Dead [Ninth lesson], fig. 2.78b).
- *Piece 23, Harrowing of Hell* (illustration for the Office of the Holy Spirit [Matins], fig. 2.78c).
- *Piece 24, Resurrection of Christ* (illustration for the Office of the Holy Spirit [Prime], fig. 2.78d).
- *Piece 25, The risen Jesus appears to his mother, "Regina coeli letare"* (illustration for the Office of the Holy Spirit [Terce], fig. 2.79a).
- *Piece 26, The risen Jesus appears to Mary Madgalene, "Noli me tangere"* (illustration for the Office of the Holy Spirit [Sext], fig. 2.79b).
- *Piece 27, Supper at Emmaus* (illustration for the Office of the Holy Spirit [None], fig. 2.79c).

Set by Jacob Faber for Germain Hardouyn of *c.* 1528 (1528-1534), 90 mm x 60 mm

(a) Piece 1

(b) Piece 2

(c) Piece 3

(d) Piece 4

Figure 2.80: [First part] *Set by Jacob Faber* for Germain Hardouyn of 1528 (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from: a) London, BL, C.29.b.25, fol. 9^{v}; b) (*id.*), fol. 11^{v}; c) London, BL, C.29.g.5, fol. 17^{v}; d) London, BL, C.29.b.25, fol. 19^{r} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 5

(b) Piece 6

(c) Piece 7

(d) Piece 8

Figure 2.81: [Second part] *Set by Jacob Faber* for Germain Hardouyn of 1528 (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.29.b.25: a) fol. 33^{r}; b) (*id.*), fol. 27^{r}; c) (*id.*), fol. 39^{v}; d) (*id.*), fol. 41^{r} © Silvia Bottura-Scardina and the British Library Board.

(a) Piece 9

(b) Piece 10

(c) Piece 11

(d) Piece 12

Figure 2.82: [Third part] *Set by Jacob Faber* for Germain Hardouyn of 1528 (*c.* 90 mm x 60 mm illustration dimensions). The illustrations are from London, BL, C.29.b.25: a) fol. 43^{v}; b) (*id.*), fol. 47^{v}; c) (*id.*), fol. 32^{v}; d) (*id.*), fol. 52^{r} © Silvia Bottura-Scardina and the British Library Board.

Figure 2.83: Piece 13 of the *Set by Jacob Faber* for Germain Hardouyn of 1528 (*c.* 90 mm x 60 mm illustration dimensions). The illustration is from a) London, BL, C.29.b.25, fol. 63^{r} © Silvia Bottura-Scardina and the British Library Board.

- *Piece 1, John in Patmos* (illustration for the Gospels [Gospel of John], fig. 2.80a).
- *Piece 2, Agony in the garden of Gethsemane* (illustration for the Gospels [Passion Gospel of John], fig. 2.80b).
- *Piece 3, Creation of Adam and Eve* (illustration for the Office of the Virgin [Matins], fig. 2.80c).
- *Piece 4, Annunciation* (illustration for the Office of the Virgin [Lauds], fig. 2.80d).
- *Piece 5, Visitation* (illustration for the Office of the Virgin [Prime], fig. 2.81a).
- *Piece 6, Adoration of the shepherds* (illustration for the Office of the Virgin [Terce], fig. 2.81b).
- *Piece 7, Adoration of the Magi* (illustration for the Office of the Virgin [Sext], fig. 2.81c).
- *Piece 8, Presentation in the Temple* (illustration for the Office of the Virgin [None], fig. 2.81d).
- *Piece 9, Flight into Egypt* (illustration for the Office of the Virgin [Vespers], fig. 2.82a).
- *Piece 10, Coronation of the Virgin* (illustration for the Office of the Virgin [Compline], fig. 2.82b).

- *Piece 11, Pentecost* (illustration for the Office of the Holy Spirit [Matins], fig. 2.82c).
- *Piece 12, Bathsheba at the fountain* (illustration for the Penitential Psalms [first Psalm], fig. 2.82d).
- *Piece 13, Job on the dung heap* (illustration for Office of the Dead [Matins], fig. 2.83).

2.4.2 Artistic influences and hypotheses on the authorship

The introductory lines of this section stated that the common element to all pieces of the above sets is a general proximity to German prints. In particular, the sets for the Hardouyn workshop imitated in composition a selection of prints from Dürer's *Life of the Virgin* cycle (1500-1510), as several images can prove. Within the *Elongated set in "German" style*, *Visitation* appropriates the same image from Dürer's collection (1503)[250] (fig. 2.84); similarly, certain illustrations from the *Set by Jacob Faber* borrow somehow from Dürer as well (figs. 2.85[251] and 2.86[252]). Together with a general fascination for Dürer, the suite discloses other details.

(a) Hardouyn's set

(b) Albrecht Dürer

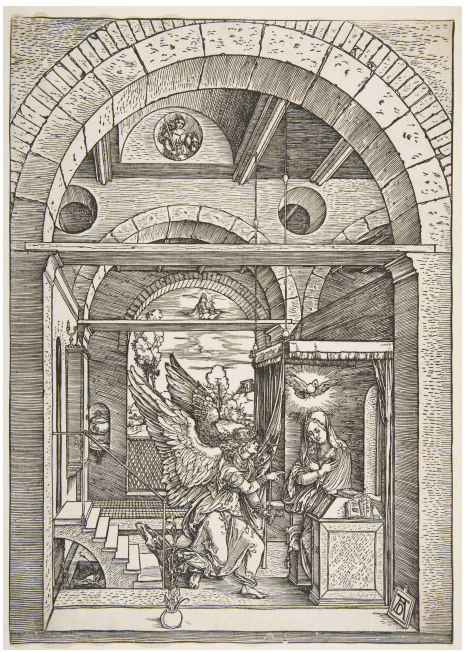
Figure 2.84: *Visitation* compared across the *Elongated set in "German style"* for the Hardouyns (*c.* 120 mm x 60 mm print dimensions) and the same image from Dürer's *Life of the Virgin* cycle (*c.* 1503, 303 mm x 211 mm): a) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 1, p.117; b) New York, MET, inv. no. 18.65.15 © Antiquariat Bibermühle; 2021 Metropolitan Museum of Arts.

[250]Dürer, Albrecht (1503-1504). *Visitation* [print on paper]. New York, MET, inv. no. 18.65.15. Retrieved from: https://www.metmuseum.org/art/collection/search/347405 (Accessed September 20, 2021).

[251]Dürer, Albrecht (1503-1504). *Annunciation* [print on paper]. New York, MET, inv. no. 18.65.16. Retrieved from: https://www.metmuseum.org/art/collection/search/387879 (Accessed September 20, 2021).

[252]Dürer, Albrecht (1511). *Flight into Egypt* [print on paper]. New York, MET, inv. no. 57.531.9. Retrieved from: https://www.metmuseum.org/art/collection/search/386307 (Accessed September 20, 2021).

(a) Hardouyn's set



(b) Albrecht Dürer

Figure 2.85: *Annunciation* compared across the *Set by Jacob Faber* for Germain Hardouyn (*c.* 90 mm x 60 mm print dimensions) and the same image from the *Life of the Virgin* cycle (*c.* 1503, 297 mm x 211 mm): a) London, C.29.b.25, fol. 19^{r}; b) New York, MET, inv. no. 18.65.16 © Silvia Bottura-Scardina, the British Library Board, 2021 Metropolitan Museum of Arts.

(a) Hardouyn's set

(b) Albrecht Dürer

Figure 2.86: *Flight into Egypt* compared across the *Set by Jacob Faber* for Germain Hardouyn (*c.* 90 mm x 60 mm print dimensions) and the same image from the *Life of the Virgin* cycle (1511, 298 mm x 222 mm): a) London, BL, C.29.b.25, fol. 43^{v}; b) New York, MET, inv. no. 57.531.9 © Silvia Bottura-Scardina, the British Library Board, 2021 Metropolitan Museum of Arts.

The *Set by Jacob Faber* reveals itself closer proximity to the works of another German artist, Hans Holbein the Younger (1497/98-1543). The most perfect instance is the image *Creation of Adam and Eve*: the impression from an Hardouyn Hours reveals a near relationship with a particular woodcut by Holbein (fig. 2.87b)[253]. Both versions describe the birth of Eve from Adam's flank, contextually to the rest of the created orders. From the top glaring clouds (first day of creation: light), three faces of men emerge to spread gusts of wind (second day of creation: the sky). Among the clouds, Sun and Moon peek out (fourth day of creation), and the surrounding lush nature embraces the other fruits of the remaining days of work: vegetation, the beings of the land and the sea (days three and five). The descriptive character of the two prints, from Holbein's version and that from the Hardouyn workshop, is the same. Not only the way of narrating the biblical episode is analogous, but also the style of the two images is the equivalent, as if they were from the same workshop. Aside from this specific case, the design of the engraver Holbein dominates this set, as Figure 2.88 illustrates. The similarities are striking while posing a chronological issue. Holbein elaborated this version of *Creation* in 1526[254], but he published it only in 1538. Given so, a contact of this image with the Hardouyn seems to be highly unlikely. Nevertheless, history can prove this first impression wrong.

At the beginning of the 1520s, Holbein collaborated with a French engraver, Jacob Faber (*fl.* 1516-1550). Together, Holbein and Faber created a stable association in the years 1521-1525 to produce a series of cuts for book illustration, generally in form of stripes and blocks (among which there are those reproduced in Figure 2.88). The foray of Holbein and Faber into book illustration provided both the artists with adequate familiarity to output such technically elaborate works as the title-pages for Andreas Cratander's editions[255]. This fact is especially remarkable for Faber: from being a mere metal-

[253] Holbein, Hans [the Younger] (1538). *Creation* [print on paper]. New York, MET, inv. no. 19.57.1. Retrieved from: https://www.metmuseum.org/art/collection/search/365180 (Accessed September 20, 2021).

[254] As for the notice on this item from the MMA website (see previous note).

[255] Andreas Cratander was printer from Strassburg, active in Basel during the years 1518-1536. With Holbein, he published some works like Theophylactos' *Evangelia Ennarationes* (= "Commentaries on the Four Gospels"). Two extant cases of illustrated title pages to the *Ennarationes* are London, BM, inv. no. 1895,0122.1072 [1523-1524] and 1874,0711.1808 [1522-1528], among others). See also further prints in the British Museum of London: inv. nos. 1875,0710.904; 1900,1019.168; 1904,0206.60.1-19 (notice from the online catalogue of the British Museum. Retrieved from: https://www.britishmuseum.org/collection/term/BIOG142658 (Accessed September 20, 2021).

cutter[256], he would become a professional crafter of book illustrations and grow the technical refinement already in a decade. Yet, the two artists ended their partnership and left off two different directions no later than 1525, Holbein heading to England[257], Faber to Paris.

(a) Hardouyn's set

(b) Hans Holbein the Elder

Figure 2.87: *Creation of Eve* compared across the *Set by Jacob Faber* for Germain Hardouyn (*c.* 90 mm x 60 mm print dimensions) and the same image from Hans Holbein the Younger's *Danse Macabre* cycle (1526, 66 mm x 49 mm): a) London, BL, C.29.g.5, fol. 17^{v}; b) New York, MET, inv. no. 19.57.1 © Silvia Bottura-Scardina, the British Library Board and 2021 Metropolitan Museum of Arts.

[256]Notice from the catalogue of the British Museum. Retrieved from: https://www.britishmuseum.org/collection/term/BIOG142651 (Accessed September 20, 2021).

[257]See John Fletcher et al. "Hans Holbein the Younger at Antwerp and in England, 1526-28". In: *Apollo: The international magazine of arts* 252 (1983) and Oskar Batschmann et al. *Hans Holbein*. London: Reaktion Books, 1997.

(a) 1521

(b) 1523-1524

(c) 1523

Figure 2.88: Showcase of works by the Holbein the Younger-Faber partnership (1521-1524): a) bottom segment of title-page (detail). In London, BM, inv. no. 1875,0710.904 (38 mm x 124 mm area dimensions); b) bottom segment of title-page (detail). In London, BM, inv. no. 1895,0122.1072 (42 mm x 172 mm); c) impression of individual segment of page border, London, BM, 1871,1209.492 (27 mm x 131 mm) © The Trustees of the British Museum.

In Paris, Faber continues his activity related to bookmaking. Although he cuts devices for the Parisian printers and booksellers initially[258], Faber continues to be celebrated rather more regarding book decoration than single-sheet production. It is in these circumstances that he instituted a solid French network, which included an established family

[258]One of the products of this period is the device of Conrad Resch, book-seller and *libraire-juré* of the University of Paris (Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 368). An extant exemplum of Resch's device is in London, BM, inv. no. 1929,0416.143. Retrieved from: https://www.britishmuseum.org/collection/object/P_1929-0416-143 (Accessed September 20, 2021).

of book-sellers in Caen and Rouen, the Regnault[259]. One member of the family, Pierre II Regnault, elected Faber to elaborate an edition of the *Biblia picturis illustrata* (=illustrated Bible)[260]. An illustration for this latter work, *Adoration of the Magi* is perfectly compatible with the version from the set for the Hardouyns (fig. 2.89)[261].

(a) Hardouyn's version

(b) Regnault's version

Figure 2.89: *Adoration of the Magi* compared across two illustrated books: a) Book of Hours by Germain Hardouyn (BL, C.25.b.25, fol. 39^{v}, *c.* 90 mm x 60 mm print dimensions); b) *Biblia pictvris illvstrata* by Pierre Regnault (Bibliothèque universitaire de l'Arsenal, inv. no. 601011, fol. [sec.2], 2^{v}, *c.* 64 mm x 52 mm) © Silvia Bottura-Scardina; the British Library Board; Toulouse, Bibliothèque universitaire de l'Arsenal.

The above piece of information is eligible to represent the missing part for the solution of the tangled connection between Holbein and the Hardouyn. Above, the section mentioned that Faber worked in close collaboration with Holbein; however, cooperating with the German artists may have left a stylistic mark on Faber's *oeuvre*. As a matter of fact, Holbein's trace endured for decades, as Figure 2.90 exemplifies[262]. Thus, Faber could have imported this style into the city of Paris, and directly into the rooms of the Hardouyn

[259] See Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 362-365 on the history of the Regnault until the late 1540s.

[260] Regnault, Pierre II and Faber, Jacob (1540). *Biblia pictvris illvstrata*. Toulouse, Bibliothèque de l'Arsenal. See Appendix A, Inc. 40 for bibliographic info and a partial digital source for the item.

[261] For bibliographic info and the digital source of Paris, Bibliothèque universitaire de l'Arsenal, inv. no. 601011, see Appendix A, Inc. 39.

[262] Faber, Jacob (1530-1550). *Initial S*, illustrating an unidentified Latin publication [print on paper]. From London, BM, inv. no. 1900,1019.55. Retrieved from: https://www.britishmuseum.org/collection/object/P_1900-1019-55 (Accessed September 20, 2021).

workshop.

Figure 2.90: Faber, Jacob (1530-1550), initial S illustrating an unidentified Latin publication. From London, BM, inv. no. 1900,1019.55 © The Trustees of the British Museum.

The remaining cluster of this section, the *Medallion* sets, reveals mixed pictorial intake, starting from the outer set up. The images of the first *Medallion* suite (Sec. 2.4.1) are constantly enclosed with a written frame. For most devices, the respective band contains a scriptural reference:

- Annunciation: "*In nobis verbum caro factum est et habitavit*" (= "and the Word was made flesh and dwelt among us"), from John 1:14 (cfr. with fig. 2.69b);
- Visitation: "*Magnificat anima mea dominum et exultavit spiritus meus in salutari meo*" (= "My soul magnifies the Lord, and my spirit rejoices in my salvation"), from Luke 1:46-55 (cfr. with fig. 2.69c);
- Nativity: "*Puer natus est nobis et filius datus est nobis*" (= "A Child is born for us and a son is given to us"), from Is 9:6 (cfr. with fig. 2.69d);
- Crucifixion: "*Adoramus te Criste et benedicimus tibi quia per sanctam crucem tuam*" (= "We adore you, Christ, and we bless you because of your Holy Cross"), from the text for the Seventh Station of the Cross (cfr. with fig. 2.70a);
- Pentecost: "*Veni sancte spiritus reple tuorum corda fidelium et tui amoris in eis ignem*" (= "Come, Holy Spirit, fill the hearts of your faithful and fill them with the

fire of your love"), from Ps 30 (cfr. with fig. 2.70b);

- Job on the dung heap: "*Miseremini mei saltem vos amici mei quia manus [do]mini tetigit me*" (= "Have pity on me at least you my friends, because the hand of the Lord has touched me"), from Job 19:21 (cfr. with fig. 2.70d).

The scriptural references are thematically connected to the respective image. As for the *Annunciation* scene, the brief pericope calls the majestic opening of the Gospel of John, and the mighty of God's creative power; in the Visitation, there is a line from *Magnificat*[263]; a Gregorian introit for the Christmas Day in the Nativity[264], and finally, the lines related to the Pentecost are an excerpt from the Hallelujah of the Pentecost Mass[265]. Any theological involvement is completely eliminated from the other sets. The later structures abdicate any interest in participating in the image contents they encapsulate to develop a variety of shapes. In particular, those of the second *Medallion set* are slim, while those of the third *Medallion* are heavier and thicker. However, this is not the only difference between the three sets.

More pronounced divergences arise as for their design. The first *Medallion* set exhibits a similar style to a renowned Parisian illuminator in its time, the so-called *Master François de Rohan* (1525-1546).

This French master is recorded to have a significant involvement in the market of books. His prime occupation was as an illuminator of manuscripts for high-ranking patrons. As a matter of fact, his name is linked to several luxury manuscripts[266], still admired for their

[263] It is also called "Song of Mary" (David R. Breed. *The History and Use of Hymns and Hymn-Tunes*. Nabu Press, 2009, p. 17).

[264] Timothy J. Roden et al. *Chants Beginning the Mass on Christmas Day. Anthology for Music in Western Civilization*. Vol. I. Belmont: Thomson & Schirmer, 2006, pp.8-9.

[265] Antônio Coelho. *Curso de liturgia romana*. Negrelos: Mosteiro de Singeverga, 1950.

[266] The list of these books includes the personal book of devotions of king François I of France, now in New York (MMA, inv. no. 2011.353). Jane Backhouse gave the first notice on the book with the illuminations from this artist when it was placed on deposit at the British Library, under the number Loan Ms. 58 (Janet Backhouse. "Two Books of Hours of Francis I". in: *British Museum Quarterly* 31.3/4 (1967)). Another important book is *Fleur de vertu* (Paris, BnF, Ms. Français 1877). François Avril identified the hand of this master of illumination in this book, and decided to baptise this book after his patron, the archbishop of Lyon François of Rohan (see NAF 28635 [4]. Retrieved from: https://gallica.bnf.fr/ark:/12148/btv1b10000507p/f1415, Accessed September 20, 2021). See also Kay Sutton. "Sources and the Sarum Hours Illuminated by the Master of François de Rohan". In: *Quand la peinture était dans les livres: Mélanges en l'honneur de François Avril*. Ed. by Mara Hofmann et al. Turnhout: Brepols, 2007. Chap. 25. DOI: https://doi.org/10.1484/M.ARS-EB.3.43, p. 331 and Orth, "The Master of François de Rohan, A Familiar French Renaissance Miniaturist with a New Name", pp. 84-85 for a list of miniatures attributed to the *Master François de Rohan*.

imaginative subject matter and originality[267]. The *Master François* was surely celebrated as an illuminator, but book-painting was not his sole activity. Myra Orth credited the design of several engravings to him[268]. One is the title-page for a *Commentarii Linguae Graecae* printed by Josse Badé (1529)[269]. Additionally, she traced the hand of *Master François* in a suit of engravings for Nicolas Couteau (used in *Le Premier volume du triumphant mystere des Actes des Apostres*, 1538)[270] as well as the frontispiece of a *Byble in Englyshe* by the Renaults (1539)[271] and the best part of the miniatures for the decoration of *De Praxis criminis persequendi* by the Colines workshop (1541)[272]. Thus, the *Master of François* was an active designer of illustrations for printed books.

The period of activity of this master is compatible with the creation of the *Medallion* sets. The scholarship on the *Master François* places his activity in the period 1525-1549[273], and the earliest retrieved Hours with the *first Medallion* set dates to 1527, indeed[274]. Besides, this fact agrees with the information provided by the Tenschert catalogues regarding this suite[275], in which they proposed the year 1526. Provided the historical compatibility, we observe the similarities of style.

Comparing the images from this set with an Hours in New York (Metropolitan Museum of Arts, Ms. 2011.353), the traits of the *Master François* appear distinctively across the

[267] Orth, "The Master of François de Rohan, A Familiar French Renaissance Miniaturist with a New Name", p. 77.

[268] Orth, "French Renaissance Manuscripts: The 1520s Hours Workshop and the Master of the Getty Epistles", pp. 84-85.

[269] Budé, Guillaume [printer] (1529), *Commentarii Linguae Graecae* [single sheet on paper]. Churchill Ave, Library of Christ College (University of Tasmania) [no accession number]. Retrieved from: https://eprints.utas.edu.au/8600/ (Accessed September 21, 2020).

[270] Couteau, Nicolas [printer](1538), *Mystere des Actes des Apostres*. Bourges, BM, Bya 30042 t. I. See Appendix A, Inc. 4 for bibliographic info and a partial digital source for the item.

[271] See Myra Dickman Orth. "The English Great Bible of 1539 and the French connection". In: *Tributes to Jonathan J.G. Alexander. Making and Meaning in the Middle Ages and the Renaissance*. Ed. by Susan L'Engle et al. London: Harvey Miller, 2006.

[272] One copy is Orléans, BM, Rés. B.3281. See Appendix A, Inc. 25 forbibliographic info and a partial digital source for the item.

[273] Orth, "The Master of François de Rohan, A Familiar French Renaissance Miniaturist with a New Name"; Yassana Croizat-Glazer. "Sin and Redemption in the Hours of François I (1539–40) by the Master of François de Rohan". In: *Metropolitan Museum Journal* 48.1 (2013). DOI: https://doi.org/10.1086/675317.

[274] Madrid, BNE, Res. 175, *c.* 1527 (Inc. 22 of Appendix A).

[275] The catalogues report two different pieces of information. The first version from the edition of 2003 says that this set must be crafted somewhere around 1516, and that it was first used in 1526 Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, I, pp. 1025-1026. The newer version does not treat this information and states only that the earliest appearance of the suite occurs around 1526 Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, p. 135.

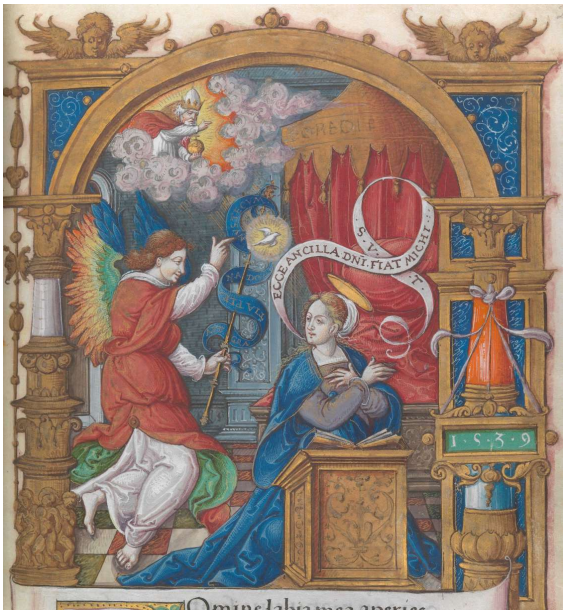
series for Germain Hardouyn (figs. 2.91-2.93). This comparison leaves no doubt that this master was a source of inspiration for the first two suites.

(a) Hardouyn's version

(b) Hours of king François I

Figure 2.91: [First part] One Book of Hours printed by Germain Hardouyn with the *First Medallion set* (*c.* 1527, *c.* 90 mm x 60 mm print dimensions) compared with a manuscript illuminated by the *Master François de Rohan* (*c.* 1541, *c.* 110 mm x 73 mm miniature dimensions): a) *John in Patmos*, London, BL, C.29.f.10, fol. 9^{v}; b) *id.*, *Hours of king Francis I*, New York, MET, inv. no. 2011.353, fol. 5^{r} © Silvia Bottura-Scardina, the British Library Board, 2021 Metropolitan Museum of Arts.

(a) Hardouyn's version



(b) Hours of king François I

(c) Hardouyn's version

(d) Hours of king François I

Figure 2.92: [Second part] One Book of Hours printed by Germain Hardouyn with the *First Medallion set* (*c.* 1527, *c.* 90 mm x 60 mm print dimensions) compared with a manuscript illuminated by the *Master François de Rohan* (*c.* 1541, *c.* 110 mm x 73 mm miniature dimensions): a) *Annunciation*, London, BL, C.29.f.10, fol. 50^{r}; b) *id.*, New York, MET, inv. no. 2011.353, fol. 21^{r}; c) *Pentecost*, London, BL, C.29.f.10, fol. 49^{r}; d) *id.*, New York, MET, inv. no. 2011.353, fol. 37^{r} © Silvia Bottura-Scardina, the British Library Board, 2021 Metropolitan Museum of Arts.

(a) Hardouyn's version

(b) Hours of king François I

(c) Hardouyn's version

(d) Hours of king François I

Figure 2.93: One Book of Hours printed by Germain Hardouyn with the *Second Medallion set* (*c.* 1527, *c.* 90 mm x 60 mm print dimensions) compared with a manuscript illuminated by the *Master François de Rohan* (*c.* 1541, *c.* 110 mm x 73 mm max miniature dimensions): a) *Flight into Egypt*, BL, C.29.f.10, fol. 39^{r}; b) *id.*, *Hours of king Francis I*, New York, MET, inv. no. 2011.353, fol. 55^{r}; c) *Coronation of the Virgin*, London, BL, C.29.f.10, fol. 42^{r}; d) *id.*, New York, MET, inv. no. 2011.353, fol. 61^{r} © Silvia Bottura-Scardina, the British Library Board, 2021 Metropolitan Museum of Arts.

Needless to say, each of the three suites expresses its own specificity of design. Within the first two sets, the first series is darker, and prefers cross-hatching over parallel hatching for shading (fig. 2.94); additionally, the way of rendering the characters is slightly different (fig. 2.95). However, the similarities increase within the *Second Medallion set*: *Presentation in the Temple* and *Flight into Egypt* that are technically different from the rest of the series, as if they were from two different hands (cfr. figs. 2.93a and 2.93c).

At the same time, there is a particular sign suggesting that these two sets were from the same workshop. Two scenes from the two sets, *Nativity* (first set) and *Adoration of the Magi*, feature a secondary scene in the background. In both cases, it may always be an *Annunciation to the shepherds*; regardless, their treatment is the same (fig. 2.96). This fact is a suggestion that the artist made the intentional choice of conforming to the style of the first set. Finally, the third set Finally, the third set adopts the same graphic choices as the others, despite the general stiffness of its figures (cfr. figs. 2.69, 2.70, 2.73-2.79).

(a) First Medallion set (b) Second Medallion set

Figure 2.94: Differences of style compared across two reference impressions of the *First Medallion set* and the *Second Medallion set* (*c.* 45 mm x 45 mm area dimensions): a) detail from London, BL, C.29.f.10, fol. 50^{r}; b) London, BL, C.29.f.10, fol. 42^{r} © Silvia Bottura-Scardina and the British Library Board.

(a) First Medallion set (b) Second Medallion set

Figure 2.95: Different hatching across two reference impressions of the *First Medallion set* and the *Second Medallion set* (*c.* 45 mm x 30 mm area dimensions): a) detail from *Crucifixion*, London, BL, C.29.f.10, fol. 12^{r}; b) detail from *Annunciation to the shepherds*, London, BL, C.29.f.10, fol. 40^{v} © Silvia Bottura-Scardina and the British Library Board.

(a) First Medallion set (b) Second Medallion set

Figure 2.96: Similarities between two reference impressions of the *First Medallion set* and the *Second Medallion set* (*c.* 30 mm x 30 mm area dimensions): a) detail from London, BL, C.29.f.10, fol. 31^{v}; b) London, BL, C.29.f.10, fol. 35^{r} © Silvia Bottura-Scardina and the British Library Board.

(a) Medallion set for Germain (b) *Master François de Rohan*

Figure 2.97: Similarities between two reference impressions of the *First Medallion set* and another by the workshop of the Master François (45 mm x 30 mm area dimensions). Detail of Mary from: a) *Crucifixion*, London, BL, C.29.f.10, fol. 12^{r}; b) Bourges, BM, Bya 30042 t. I, fol. a6^{r} © The British Library Board; Bourges, Bibliothèque municipale.

The above observations lead to two possible conclusions: that several hands produced the three sets, and that their crafters may belong to the same workshop. A lasting uncertainty only attaches to the identity of the workshop.

Finally, to solve the original issue of the authorship of this series of engravings, Orth provides a decisive clue. Among the work she identifies as part of the *Master François*'s work, the *First Medallion set* appears to be after one the earliest identified works by the anonymous master (*c.* 1538, fig. 2.97). Thus, the authors may be the same or part of the

workshop that designed the two sets.

2.4.3 Use of the sets among the Hardouyn editions

The use of the suites in German-style is not as coherent as its influences. The *Elongated set* found ample use across Germain's activity, describing two major periods of use, 1516-1520 and 1526-1534. Seven books were found for the earlier period and an almost equal number for the later term. Within the first group, the Hardouyn workshop completed the pictorial programmes by adding the mentioned *"Linear"* suite, as well as two suites for Guillaume Eustace (*c.* 1508) and Jean Barbier (1509)[276]. In the later cluster, the illustrations from the first two *Medallion* suites complemented the other Offices and the Penitential Psalms[277].

Two *Medallion* sets were meant to be used together, and they are indeed complementary. Occasionally, they were used with other engravings: the set by Jacob Faber in one case (BL, C.29.g.5, *c.* 1534) and with the elongated series in another (BL, C.29.f.10, *c.* 1528). The third *Medallion* suite is the rarest: it is observed only in two cases (BL, C.29.g.5, *c.* 1534; and BL, C.35.f.11, 1530). Among these, C.29.g.5 adopts the Roman Mass rite, while the second is a Book of Hours with Salisbury rite—for the English Mass.

The adoption of the English rite fact could explain the greater complexity of this set as seen in one book in the British Library (C.35.f.11)[278]. This example bears an exceptionally rare and rich programme for four Offices: the Hours of the Cross, the Hours of the Holy Spirit, the Hours of the Dead and the Penitential Psalms. Their iconography describes the entire Passion of Jesus, from his arrest until the entombment in relation to the Hours of the Cross (cfr. figs. 2.73a-2.74b). The Hours of the Holy Spirit describe an unusual series of images connected with the resurrection of Jesus and his epiphany to his strict circle, including the rare images of his Triumph over Death, the Descent into Limbo

[276] Lisbon, BNP, Res. 326.v (*c.* 1516, see Inc. 13) and Res. 5781.p (1518-1521, see Inc. 15); Madrid, BNE, R.41820 (*c.* 1520, see Inc. 21); New York, MET, 89.27.4 (1518-1521, see Inc. 24); New York, PML 128883 (*c.* 1520); Lyon, BM, Res. A.491956 (*c.* 1520, see Inc. 17).

[277] Paris, BnF, Smith Lesouéf R.142 (*c.* 1528, see Inc. 30); Madrid, BNE, Res. 175 (*c.* 1527, see Inc. 22) and Res. 180 (*c.* 1526, see Inc. 23); London, BL, C.29.f.10 (*c.* 1528). Two cases aside are Avignon, BMC, Rés. 203 (*c.* 1533, see Inc. 1 and Poitiers, BM, DR.38 (*c.* 1533, see Inc. 37), for they include the sets for Eustace and Barbier.

[278] *Heures ad usum Sarum* (Salisbury Mass rite), printed in Paris, 11 V 1530, by Germain Hardouyn, in-*Octavo*.

and the visits to the two Marys in "*Regina coeli laetare*" and "*Noli me tangere*" on Figures 2.78c-2.79c. The Penitential Psalms explore the story of David, from this ascent to the throne of Israel to his sincere repentance for the sins committed (cfr. figs. 2.74c-2.75c).

The analysis of the Hours of the Dead was left for last, intentionally. This particular theme gathered greater notice in comparison to the other themes comprised in this collection for a couple of reasons. As Zöhl elucidated in a dedicated essay[279], the manuscript produced in Paris for the English church tended to develop several rich figurative programmes. Zöhl explored some of these cycles in the perspective of supporting a connection to the Pichore workshop. Indeed, the Pichore workshop produced a series for the Parisian printer Jean Barbier in 1509 (*c.* 1502-1515/1516) for use in his Hours with English Mass rite[280]. Later, the two printer-publishers Thielmann Kerver and Yolande Bonhomme ordered a set of their own[281], later followed by the Regnault family. Similarly to the *Third Medallion* suite, the figurative programme of the blocks for Kerver included the same, full cycle of images for the Hours of the Cross, of the Holy Spirit, the Penitential Psalms and Hours of the Dead. Also, the style of the suite for the Kerver workshop and the one for the Hardouyn workshop are comparable (fig. 2.98)[282].

The lines above offer enough pieces of information to form a hypothesis of creation for this set. Based on that, Germain Hardouyn may have contracted an atelier to craft a set of illustrations specifically for the decoration of Hours with English rite. For this purpose, he may have employed a group of artists with specialisation in this regard. Less certain is the actual course of use among editions since the number of retrieved books that contained this Office was insufficient to form a strong analysis.

[279] Caroline Zöhl. "A Phenomenon of Parallel Reading in the Office of the Dead". In: *Mixed metaphors: the Danse Macabre in medieval and early modern Europe*. Ed. by Stefanie Knöll et al. Cambridge Scholars Publishing: Newcastle-upon-Tyne, 2011.

[280] Retrieving the records only for one of them was possible. The found instance is [Paris : Jean Barbier, *c.* 1510] (Gesamtkatalog der Wiegendrucke et al., *Gesamtkatalog der Wiegendrucke*, no. XI Sp.612bP. However, the odds are that this number could be huger than already encountered.

[281] One is the "*Bilderreiche Metallschnitt-Serie im Dürer-Stil für Thielman Kerver, 1519-1521*", see Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, I, pp. 660-666; Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*; Zöhl, "A Phenomenon of Parallel Reading in the Office of the Dead"; Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, pp. 116-125.

[282] For bibliographic info and a full digital source of Lisbon, BNP, Res. 2984.p, see Appendix A, Inc. 10.

(a) Instance 1

(b) Instance 2

Figure 2.98: Reference images for the set in "Medallion" style for the Kerver workshop, 1519-1521, from Lisbon, BNP, Res. 2984.p (*c.* 90 mm x 60 mm illustration dimensions): a) fol. 10^{v}; b) 14^{v} © Duarte Belo and the BNP.

2.5 Additional sets

The remaining sets are stylistically incompatible and cannot form a group of their own. Because of that, they fall in the general group of the "Additional sets". The first two suites for this section, the *Set for Guillaume Eustace of c. 1508* and the *Set for Jean Barbier of 1509*, were crafted by the Pichore workshop[283]. Iconographically speaking, the illustrations do not introduce much novelty, for they are styled after the previous suites of Vostre (1504-1508), Kerver (1504-1506) and those for the Hardouyn workshop (1505-1509). The greater interest of these two series is their appearance in itself among the Hardouyn Hours. Indeed, individual pieces from these two series occurs by the late 1510s to last until the late 1530s.

The last series that this chapter explores is a group that the artist Noël Bellemare designed especially for Germain Hardouyn around 1527.

Originally from the Low Countries, Noël Bellemare was an illuminator. After spending his apprenticeship in Anvers or at the family workshop until 1512/1515[284], Noël moved to Paris[285]. Here, he practised his craft to produce manuscripts after both the Italian design as well as the style of contemporary German prints during the period 1512-1546/1549[286]. One of the most popular books with his hand is the so-called *Getty Epistles*[287], after which manuscript he took the alternative name of *Master of the Getty Epistles*. Bellemare's fascination for early sixteenth-century Paris may have arisen from the vibrant climate of cultural inspiration, maybe favoured by the royal stewardship of the time[288]. In these cir-

[283] Zöhl described these sets in her monograph devoted to Jean Pichore (Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 148-151).

[284] Kren, *French illuminated manuscripts in the J. Paul Getty Museum*, p. xxvi; Guy-Michel Leproux. "Une oeuvre importante de Noël Bellemare retrouvée au Kunstmuseum de Bâle: le retable de Philippe de Villiers de L'Isle-Adam, grand maitre de l'ordre de Saint-Jean de Jérusalem". In: *Zeitschrift für Kunstgeschichte* 77.H.4 (2014).

[285] This is the most credited opinion; however, Orth suggested that he was located either in Tours, Bourges or Paris. See Marie-Blanche Cousseau et al. "Étienne Colaud: Et l'enluminure parisienne sous le régne de François Ier". In: Tours: Presses universitaires François-Rabelais, 2016, p. 68; Orth, "French Renaissance Manuscripts: The 1520s Hours Workshop and the Master of the Getty Epistles", p. 59.

[286] Leproux, "Une oeuvre importante de Noël Bellemare retrouvée au Kunstmuseum de Bâle: le retable de Philippe de Villiers de L'Isle-Adam, grand maitre de l'ordre de Saint-Jean de Jérusalem", p. 481.

[287] Master of the Getty Epistles (1528-1530), *Epistles of St. Peter*, France. J. Paul Getty Museum, inv. no. Ms. Ludwig I 15 (83.MA.64). Available on: https://www.getty.edu/art/collection/objects/1352/master-of-the-getty-epistles-getty-epistles-french-about-1528-1530/ (Accessed September 21, 201).

[288] Several scholars are positive that the promotion of the arts in Paris by King François I was pivotal in this period. Illuminated monarch and philanthropist, the king invited directly certain artists to establish their

cumstances, Noël had his atelier by the Pont Notre-Dame, in an area surrounded by publishers and printers of printed books[289]. Next, another workshop engaged similarly in the production of illuminated manuscripts, which Orth designated *1520 Hours workshop*[290]. This place gathered numerous artists oriented towards the exclusive production of illuminated Book of Hours. This place seems not to be extraneous to Noël, because there are grounds to believe in his direct involvement in the Hours workshop's activities[291], among others. Aside from the production of luxury books, Bellemare was a member of the University of Paris, that appointed him "*peintre-enlumineur juré*"[292]. In other words, Bellemare co-operated closely with various partners.

residency in Paris, as Scaillierez remarks: "There is an important difference between "attraction" and direct invitation. Some artists came indeed to France after royal invitation: such is the case for Joos van Cleve, that worked at the royal court between 1529 and 1535. Noël de Bellemare arrived before this time, in a period where the sensitivity towards the northern European influences as well as the Italian style of painting and classicism was already thriving" (Cécile Scailliérez, ed. *François Ier et l'art des Pays-Bas*. Catalogue exhibition. France, Musée du Louvre, Paris. October 2017-October 2018. Paris, 2017, p. 32). The same Bellemare could be one of those artists who attracted the royal interest. As a proof of his tight connection with the royal court, Orth proposes that the 1527 illuminated peace treaty between Francis I of France and Henry VIII could by the hand of a major workshop, the so-called *the 1520s Hours workshop* (Orth, "French Renaissance Manuscripts: The 1520s Hours Workshop and the Master of the Getty Epistles").

[289] Guy-Michel Leproux. *La peinture à Paris sous le règne de François Ier*. Vol. 4. Paris: Corpus Vitearum Presses de l'Université de Paris-Sorbonne, 2001, p. 117.

[290] Orth, "The Master of François de Rohan, A Familiar French Renaissance Miniaturist with a New Name".

[291] Orth, "The Master of François de Rohan, A Familiar French Renaissance Miniaturist with a New Name".

[292] Cousseau et al., "Étienne Colaud: Et l'enluminure parisienne sous le régne de François Ier", p. 68).

2.5.1 Presentation of the sets

Set by the Pichore workshop for Guillaume Eustace of *c.* 1508 (1518-1530), *c.* 123 mm x 78 mm

(a) Piece 1 (b) Piece 2 (c) Piece 3

(d) Piece 4 (e) Piece 5 (f) Piece 6

Figure 2.99: [First part] *Set of the Pichore workshop* for Guillaume Eustace of *c.* 1508 (*c.* 123 mm x 78 mm illustration dimensions). The illustrations are from: a) London, BL, C.35.f.11, fol. 22^{r}; b) (*id.*), fol. 24^{r}; c) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 9, p.91; d) London, BL, C.35.f.11, fol. 40^{v}; e) (*ibid.*), fol. 43^{v}; f) (*ibid.*), fol. 46^{v} © Silvia Bottura-Scardina, the British Library Board and Antiquariat Bibermühle.

(a) Piece 7

(b) Piece 8

(c) Piece 9

(d) Piece 10

Figure 2.100: [Second part] *Set of the Pichore workshop* for Guillaume Eustace of *c.* 1508 (*c.* 123 mm x 78 mm illustration dimensions). The illustrations are from: a) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 11, p.92; b) (*ibid.*), no. 12, p. 92; i) (*ibid.*), no. 13, p. 92; c) (*ibid.*), no. 14, p. 92 © Silvia Bottura-Scardina, the British Library Board and Antiquariat Bibermühle.

- *Piece 1, Annunciation* (illustration for the Office of the Virgin [Matins], fig. 2.99a).
- *Piece 2, Vision of Augustus* (illustration for the Office of the Virgin [Matins], fig. 2.99b).
- *Piece 3, Annunciation to the shepherds* (illustration for the Office of the Virgin [Terce], fig. 2.99c).
- *Piece 4, Adoration of the Magi* (illustration for the Office of the Virgin [Sext], fig.

2.99d).

- *Piece 5, Presentation in the Temple* (illustration for the Office of the Virgin [None], fig. 2.99e).
- *Piece 6, Flight into Egypt* (illustration for the Office of the Virgin [Vespers], fig. 2.99f).
- *Piece 7, Crucifixion* (illustration for the Office of the Cross [Matins], fig. 2.100a).
- *Piece 8, Pentecost* (illustration for the Office of the Holy Spirit [Matins], fig. 2.100b).
- *Piece 9, King David sends Uriah to die* (illustration for the Penitential Psalms [first Psalm], fig. 2.100c).
- *Piece 10, Rise of Lazarus* (illustration for the Office of the Dead [Vespers], fig. 2.100d).

Set by the Pichore workshop for Jean Barbier of 1509 (1518-1533), *c.* 88 mm x 55mm

(a) Piece 1

(b) Piece 2

(c) Piece 3

(d) Piece 4

Figure 2.101: [First part] *Set of the Pichore workshop* for Jean Barbier of 1509 (*c.* 88 mm x 55 mm illustration dimensions). The illustrations are from: a) London, BL, C.41.a.23, fol. c7^{r} (*c.* 88 mm x 60 mm); b) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, p. 98, no.25; c) (*ibid.*), no. 29, p. 98; d) (*ibid.*), no. 30, p. 98 © Antiquariat Bibermühle.

(a) Piece 5 (b) Piece 6 (c) Piece 7

Figure 2.102: [Second part] *Set of the Pichore workshop* for Jean Barbier of 1509 (*c.* 88 mm x 55 mm illustration dimensions). The illustrations are from: a) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 31, p.99; b) (*ibid.*), no. 42, p. 100; c) London, BL, C.41.a.23, fol. c6^{v} © Silvia Bottura-Scardina, the British Library Board and Antiquariat Bibermühle.

- *Piece 1, Annunciation* (illustration for the Office of the Virgin [Matins], fig. 2.101a).
- *Piece 2, Coronation of the Virgin* (illustration for the Office of the Virgin [Compline], fig. 2.101b).
- *Piece 3, Crucifixion* (illustration for the Office of the Cross [Sext], fig. 2.101c).
- *Piece 4, Deposition* (illustration for the Office of the Cross [Vespers], fig. 2.101d).
- *Piece 5, Entombment* (illustration for the Office of the Cross [Compline], fig. 2.102a).
- *Piece 6, Repentance of King David to the angel* (illustration for the Penitential Psalms [first Psalm], fig. 2.102b).
- *Piece 7, Expulsion from Paradise* (illustration for the Office of the Dead [Vespers], fig. 2.102c).

Set by the Bellemare workshop and Master François de Rohan for Germain of *c.* 1527 (1527-1538), *c.* 50 mm x 35 mm

(a) Piece 1 (b) Piece 2 (c) Piece 3

(d) Piece 4 (e) Piece 5 (f) Piece 6

Figure 2.103: [First part] *Set by Noël Bellemare and the Master François of Rohan* for Germain Hardouyn of *c.* 1527 (*c.* 50 mm x 35 mm). The illustrations are from: a) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 1, p.141; b) (*ibid.*), no. 2, p. 141; c) (*ibid.*), no. 3, p. 141; d) (*ibid.*), no. 4, p. 142; e) (*ibid.*), no. 5, p. 142; f) (*ibid.*), no. 6, p. 142 © Antiquariat Bibermühle.

(a) Piece 7 (b) Piece 8 (c) Piece 9

(d) Piece 10 (e) Piece 11 (f) Piece 12

Figure 2.104: [Second part] *Set by Noël Bellemare and the Master François of Rohan* for Germain Hardouyn of *c.* 1527 (*c.* 50 mm x 35 mm). The illustrations are from: a) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 7, p.142; b) (*ibid.*), no. 8, p. 142; c) (*ibid.*), no. 9, p. 142; d) (*ibid.*), no. 10, p. 143; e) (*ibid.*), no. 11, p. 143; f) (*ibid.*), no. 12, p. 144 © Antiquariat Bibermühle.

(a) Piece 13

(b) Piece 14

Figure 2.105: [Third part] *Set by Noël Bellemare and the Master François of Rohan* for Germain Hardouyn of *c.* 1527 (*c.* 50 mm x 35 mm). The illustrations are from: a) Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, no. 13, p.144; e) (*ibid.*), no. 14, p. 144 © Antiquariat Bibermühle.

- *Piece 1, John in Patmos* (illustration for the Gospels [Gospel of John], fig. 2.103a).
- *Piece 2, Arrest of Jesus* (illustration for the Gospels [Passion Gospel of John], fig. 2.103b).
- *Piece 3, Annunciation* (illustration for the Office of the Virgin [Matins], fig. 2.103c).
- *Piece 4, Visitation* (illustration for the Office of the Virgin [Lauds], fig. 2.103d).
- *Piece 5, Nativity* (illustration for the Office of the Virgin [Prime], fig. 2.103e).
- *Piece 6, Annunciation to the shepherds* (illustration for the Office of the Virgin [Terce], fig. 2.103f).
- *Piece 7, Adoration of the Magi* (illustration for the Office of the Virgin [Sext], fig. 2.104a).
- *Piece 8, Presentation in the Temple* (illustration for the Office of the Virgin [None], fig. 2.104b).
- *Piece 9, Flight into Egypt* (illustration for the Office of the Virgin [Vespers], fig. 2.104c).
- *Piece 10, Coronation of the Virgin* (illustration for the Office of the Virgin [Compline], fig. 2.104d).

- *Piece 11, Crucifixion* (illustration for the Office of the Cross [Matins], fig. 2.104e).
- *Piece 12, Pentecost* (illustration for the Office of the Holy Spirit [Matins], fig. 2.104f).
- *Piece 13, Bathsheba baths at the fountain* (illustration for the Penitential Psalms [Matins], fig. 2.105a).
- *Piece 14, Job on the dung heap* (illustration for the Office of the Dead [Vespers], fig. 2.105b).

2.5.2 Artistic influences

The first two sets of this last group, the one in *Octavo*-format for Guillaume Eustace (*c.* 1508) and the other for Jean Barbier (1509), were created in the environment of the Pichore workshop[293]. Like other suites with this provenance, the style of these illustrations corresponds largely to previous assignments, which is more notorious in those made for Simon Vostre (1504-1508) and Kerver (1504-1506)[294]. Differently from the past work, the two collections of images express significantly inferior technical quality, in comparison to the previous sets.

Finally, the suite designed by Noël de Bellemare and the *Master François de Rohan* is mainly aligned to previous suites, like the *Medallion* series and that by Jacob Faber.

2.5.3 Use of the sets among the Hardouyn editions

The two sets by the Pichore workshop of this section represent a unique case of use in relation to the Hardouyns' activity. In fact, neither of them was originally crafted for Germain nor Gillet, but rather for other printers. More specifically, one of the original possessors of one suite was Guillaume Eustace, a *libraire-juré* based in Paris between 1497 and 1535[295]. Eustace used his set to adorn a small production of books in the years 1509-1513, when he financed the production of few editions of Hours with several

[293] Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, pp. 146-148; Tenschert et al., *Horae BMV: 158 Stundenbuchdrucke der Sammlung Bibermühle 1490–1550*, II, pp. 660-666.

[294] *Id.*. For a direct comparison, see Tenschert et al., *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*, pp. 76-81.

[295] He was also appointed *Libraire du roi* and *relieur juré* (Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 146-147).

rites. These items were practically yielded by the presses of various local printers (Gillet Couteau[296], Jean Barbier[297], Nicolas Higman[298] and Jean de La Roche[299], but Eustace supplied the graphic tools for decoration. After this date, the available bibliographic data suggest that he withdrew from the market of service books, and these illustrations seem to disappear along with him from the next editions. Instead, another workshop issued Hours with certain illustrations that resemble closely Eustace's set. That enterprise was the Hardouyn workshop when Germain was already the incumbent chief editor. Several Hardouyn Hours issued from 1518-1521 carry a selection of illustrations with a strong affinity to Eustace's set (one is Lisbon, BNP, Res. 5781.p[300]); however, all those editions are lavishly augmented with colour. Thus, inferring the adoption of Eustace's set requires a thorough inspection.

[296]Two *Octavo*-editions, one in 1512 (Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1513, no. 598) and another in 1513 (Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1513, no. 590).

[297]One *Octavo*-edition in collaboration with Nicolas Vivien, *c.* 1508: Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1508, no. 110; Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, nos. 852, 853.

[298]Two *Octavo*-editions in 1516: one is represented exclusively by London, BL, C.41.a.30; the other is cited in Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, nos. 993-994, 996, 1000 and Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1516, no. 1384.

[299]Two *Octavo*-editions in 1514: see Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, nos. 960 and Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1514, no. 858 on the first of them; see Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1514, no. 877.

[300]*Heures ad usum Romanum* (*Horae ad usum Romanum*), Paris, 1518-1520, Gillet Hardouyn for Germain Hardouyn. See Appendix A, Inc. 15 for bibliographic details and a full digital source.

(a) BNP, Res. 5781.p (b) Eustace's set (c) Hardouyn's set, 1505-1509

Figure 2.106: Over-paint of the *Presentation in the Temple* scene compared with the crude engraving from the set for Eustace (*c.* 1508) and the 1505-1509 set for the Hardouyn workshop: a) reference image, from Lisbon, BNP, Res. 5781.p, fol. c8^{r} (*c.* 85 mm x 80 mm miniature size-gilding excl.); b) Eustace's set, from London, BL, C.35.f.11, fol. f3^{v} (*c.* 123 mm x 78 mm); c) Paris, BnF, Rés. 8.T.2520, fol. 86^{r} (*c.* 125 mm x 80 mm) © Duarte Belo and the BNP, Silvia Bottura-Scardina, the British Library Board and Source BnF.

Two details of the over-painted Presentation in the Temple from an Hours in Lisbon (BNP, Res. 5781.p) disclose a relation to Eustace's set (fig. 2.106). One of those clues is the position of the hands of Mary after handing the baby to the High Priest; the other, the baby's stance. The two elements are compatible both in composition and style with the illustration from the Octavo-set from Eustace (fig. 2.106a and 2.106b) yet not with any recognised Presentation in the Temple from the Hardouyns sets (fig. 2.106c).

(a) BNP, Res. 5781.p (b) Eustace's set (c) Hardouyn's set, 1505-1509

Figure 2.107: Over-paint of the *Pentecost* scene compared with the crude engraving from the set for Eustace (*c.* 1508) and the 1505-1509 set for the Hardouyn workshop: a) reference image, from Lisbon, BNP, Res. 5781.p, fol. c8^{r} (*c.* 85 mm x 80 mm miniature size-gilding excl.); b) Eustace's set, from Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, p. 92, no.12 (*c.* 123 mm x 78 mm); c) Paris, BnF, Rés. 8.T.2520, fol. 69^{r} (*c.* 125 mm x 80 mm) © Duarte Belo and the BNP; Antiquariat Bibermühle; Source BnF.

The same book bears a second instance of remarkable similarity in another miniature, *Pentecost* (fig. 2.107). Like the illustration of Figure 2.106a, a careful inspection of this Pentecost suggests that its closest reference could only be the set for Eustace (fig. 2.107b) and not any for the Hardouyns (fig. 2.107c). Furthermore, other books, issued even later than the Hours in Lisbon, seem to include other pieces from the same suite (London, BL, C.35.f.11[301]. Because these Hours are issued after Eustace discontinued his production of printed Hours, it is realistic that the Hardouyns (precisely Germain) may have come into their possession after Eustace himself.

Another second set that which reaches enters the Hardouyn workshop at in a later phase time is thate one specially crafted for the Parisian printer Jean Barbier (*fl.* 1502-*c.* 1515). Inversely from Eustace, this worker had his own presses, which he employed to produce large projects in collaboration with other firms[302]. In 1509, Barbier contracted the Pichore workshop to realise a collection of blocks to decorate Books of Hours with an exception-

[301] *Heures ad usum Sarum* (Hours for the use of Salisbury), Paris, 11 V 1530, in-*Octavo*, printed by Germain Hardouyn.

[302] Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, pp. 19-20.

ally rich pictorial cycle: it includes illustrations for the full calendar, Gospels, stories of the Passion and Resurrection of Jesus, of King David's repentance and lessons related to the Hours of the Dead[303]. Speaking of its history of use, this set appears only in 1508- and 1509-editions by Barbier[304], but would enter the Hardouyn workshop around 1518. In fact, the same copy of Hours in Lisbon carries another image that could have its parent model could in a block from Barbier's set representing the *Coronation of the Virgin* (fig. 2.108). In this case, the shared features are weaker in comparison to the previous images (Eustace set vs Hardouyn set). However, the sole image that the Hardouyn workshop possessed at that time was from the *Set in the style of the Apocalypse Masters*, and this one is utterly incompatible with the reference in Figure 2.108.

Three more books made afterwards bear illustrations from these two sets (all from 1520, one in Madrid[305] and another now in a private collection) may contain part of Barbier's set (fig. 2.109a-2.110a). Especially one image from one Hours in Lyon bears a genuine likeness of this set (fig. 2.110b). However, it also finds little use towards the end of Germain's stewardship, in the 1530s[306].

[303] This set was already mentioned in Section 2.4.3.

[304] Notice for the editions made with Guillaume Le Rouge: one *Octavo*-edition, August 1509 (Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1509, no. 103) and another *Octavo* of the same year (Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 893, copy in Paris, BnF, Velins 2943); one *Octavo* edition of 1509 (Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1509, no. 98). With Guillaume Eustace and Nicolas Vivien, one *Octavo*-edition of 1508 (Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1508, no. 110, copy in Paris, BnF, 8.T.2544).

[305] Madrid, BNE, R.41820, *Heures ad usum Romanum* (Hours for use of Rome), Paris, *c.* 1520, printed by Gillet and Germain Hardouyn. See Appendix A, Inc. 20 for a detailed bibliographic description and a link to a digital source of this item.

[306] Madrid, BNE, Res. 180 (1526) and Poitiers, BM, DR.38 (1533). See Appendix A, Incs. 23 and 37 for more details and their digital sources.

(a) BNP, Res. 5781.p (b) Eustace's set

Figure 2.108: Over-paint of the *Coronation of the Virgin* scene compared with the crude engraving from the set for Eustace (*c.* 1508): a) reference image, from Lisbon, BNP, Res. 5781.p, fol. c6^{r} (*c.* 85 mm x 80 mm miniature size-gilding excl.); b) Eustace's set (*c.* 123 mm x 78 mm), from Heribert Tenschert et al. *Horae B.M.V.: 365 gedruckte Stundenbücher aus der Sammlung Bibermühle, 1487-1586*. Ramsen: Heribert Tenschert, 2015, p. 98, no.25 © Duarte Belo and the BNP; Antiquariat Bibermühle.

(a) BNP, Res. 5781.p (b) Eustace's set (c) Eustace's set

Figure 2.109: [First part] Illustrations from the set for Jean Barbier in the Hours printed by the Hardouyn workshop (*c.* 128 x 80 mm max. miniature dimensions): a) from Madrid, BNE, R.41820, fol. 38^{r}; b-c) book in a private collection © Biblioteca Nacional de España.

(a) Eustace's set

(b) Eustace's set

Figure 2.110: [Second part] Illustrations from the set for Jean Barbier in the Hours printed by the Hardouyn workshop (*c.* 128 x 80 mm max. miniature dimensions): a) book in a private collection; b) Lyon, BM, Rés. A.491956, fol. 27^{r} © Bibliothèque municipale de Lyon.

Finally, the set by Noël Bellemare the *Master François de Rohan* appears in a limited selection of editions which, comparably to the other cases, date back to the latest phases of the Hardouyn workshop. More remarkable is the difference of use: this last set is mostly used not mixed to other series[307].

[307] Compare with Appendix B, Table B.1.

2.6 Final remarks

This section brings forth the systematic classification of the engravings applied in the Hardouyn workshop in the view of organising into coherent series. Historical evidence, together with literature review and a direct inspection of the Hours credited to the Hardouyn workshop, proved that as much as fifteen series of wood- and metal-cuts have been applied throughout the operation of this printing house.

The two earliest series were designed by the workshop of the so-called *Apocalypse Master*, a local artist that concentrated on the production of the illustrating elements for publishers and printing masters. Six more sets were crafted by another celebrated artist, Jean Pichore. Through the inspection, this chapter could add three pieces of information to the sets by Pichore. Firstly, it found a previously unpublished collection of engravings, the *Duodecimo set for Gillet Hardouyn*. Secondly, it proved that a selection of illustrations from two other sets, originally designated for marginal decoration, was used as the opening illustrations in a group of rare *agenda* editions. Finally, two sets that originally belonged to two contemporaries of Gillet and Germain (Guillaume Eustace and Jean Barbier) entered the Hardouyn workshop in the late 1510s or the early 1520s. However, it was not possible to discover if the sets were ceded or sold to the Hardouyns. Speaking of the latter case, even even larger is the class of engravings in the style of German (quasi-) contemporary prints. This group encompasses four more sets, two of those with the direct or indirect influence of two painting masters, the *Master François de Rohan* and another one in collaboration with the Flemish artist Noël Bellemare. Finally, this chapter disclosed another unpublished set, proposing an attribution of its authorship to the French engraver Jacob Faber. One more set was produced in a "transitional" phase between the time of most extensive use of the series designed by two leading Renaissance artists (Jean Pichore and the Apocalypse Masters) and the time when the Hardouyn Hours reveal a clear influence of German prints (here called *Sets in German style*).

The major division into a Pichore-period and a German-school period follows a clear distinction of style. During the earliest phase of activity of the Hardouyn workshop, the combination of late-Gothic patterns, Renaissance Italianate style and the Tours school of illumination (1490-1510) dominate the Hours edited by Gillet. During the second period,

the prints by Albrecht Dürer and Hans Holbein the Younger becomes the novel source of inspiration. Besides, this shift of artistic preferences coincides with a shift in stewardship in favour of Germain Hardouyn. In turn, Germain established solid connections with celebrated members of the second generation of artists who operated indifferently on manuscript or printed commodities, namely Noël Bellemare and the *Master François of Rohan*. Besides, the findings from this section allow suggesting a fascinating hypothesis on the latter, anonymous master. In fact, the pieces of evidence that this chapter gathered suggest that his workshop developed a hierarchical organisation, in which he could have included a number of engravers, concentrating on the exclusive production of religious images. Among those collaborators, there could be Jacob Faber. Looking closely, one may notice that Figures 2.103c and 2.103e of the *Set by Bellemare and the Master François* reflect the unique sketch of Jacob Faber. However fascinating, this observation could not generate a formed hypothesis. In fact this possibility requires deeper inspection and an attention that goes beyond the scopes of this chapter.

Coming back to the Hardouyns, the above differences in style mark clear editorial choices for each of the two main personalities of the Hardouyn workshop, Gillet and Germain. So remarked is the aesthetic dissonance that defines two distinct periods of activity. The first of which occupies the earliest years of the sixteenth century until approximately 1516, while the other covers the years from 1526 to the end of the Hardouyn workshop. Besides, the first term sees Gillet as the head of the workshop while in the second period, Germain takes over the business.

Together with the style, another element of dissonance between the "Gillet-phase" and the "Germain-phase" lies in their iconographical choices. Under Gillet, the pictorial programmes are in their fullest form and tend towards formal unity. Germain relinquishes this purpose, and orders very small-scale sets like the *Linear set*. Alternatively, he requires such narrow suites with lacking programmes as the *Elongated set in "German" style*. Germain's choice seems to be justified by his intention of adding visual diversity to the editions in the section of the Office of the Virgin. For instance, Germain supplements two-page *Annunciations* and *Adoration of the Magis*[308]. Another instance is a crude metal-cut impression (fig. 2.111). Indeed, it is after the *Master François de Rohan*,

[308] See Appendix B.

but it cannot be quite associated with a set.

Figure 2.111: London, BL, C.29.g.5, fol. 18^{r} (*c.* 90 mm x 60 mm illustration dimensions) © Silvia Bottura-Scardina and the British Library Board.

Speaking of the themes, Gillet adheres to the *Danse Macabre* fascination of late-fifteenth/early-sixteenth century Paris. On this point, he absorbs the theme with reference to the Hours of the Dead.However, Germain prefers the sixteenth-century themes celebrating the importance of pious living before the soul's departure by adopting allegorical representations of angels and demons competing for the human souls, the snares and temptations of evil, the grievous harms of eternal damnation in the *third Medallion set*. This preference could be related to the increasing fame that such books of popular literature as the *Ars Moriendi* and prints disseminated through collections of woodcut block-book since the mid-sixteenth century. One good case in point is a collection of engravings by the mentioned Monogrammist ES[309].

For all the findings, this chapter suffered two central limitations. On the one hand, an overall number of fourty-five books proved to be insufficient to fully represent all the identified sets. On the other hand, the inspection retrieved over-paints that did not correspond to any parent model. This class of illustrations includes a small selection of

[309] Alan Shestack. *Master E.S. Exhibition catalogue*. Philadelphia: Philadelphia Museum of Art, 1967, nos. 4-15.

images of Mary (fig. 2.112)[310], *Annunciation to the shepherds* (fig. 2.113), *King David sends Uriah to die* (fig. 2.114), *Job on the dung heap* (fig. 2.115)[311] and *Death riding a bull* (fig. 2.116). Thus, there might be other illustrations still to unravel.

(a) Poitiers, BM, DR.38

(b) Avignon, BM, Rés. 203

(c) Lyon, BM, Rés. A.491956

(d) Château Library, Impr. XII.F.006

Figure 2.112: Images of Mary without a parent model (*c.* 125 mm x 80 mm miniature dimensions), from: a) Poitiers, BM, DR.38, fol. 69^{r}; b) Avignon, BM, Rés. 203, fol. i5^{r}; c) Lyon, BM, Rés. A.491956, fol. 65^{r}; d) Chantilly, Château Library, Impr. XII.F.006, fol. l5^{v} © Bibliothèque municipale de Poitiers, Avignon, Lyon and Bibliothèque de Château.

[310]For bibliographic info and a partial digital source of Chantilly, Château Library, Impr. XII.F.006, see Appendix A, Inc. 6.

[311]For bibliographic info and a partial digital source of Troyes, Cathedral Library, no. num. [2], see Appendix A, Inc. 40.

Figure 2.113: Image of *Annunciation to the shepherds* without a parent model, from BPE, Inc. 438, fol. 9^{r} (*c.* 90 mm x 60 mm miniature dimensions)© Duarte Belo and the BNP.

(a) BNP, Res. 326.v (b) Poitiers, BM, DR.38 (c) Avignon, BM, Rés. 203

Figure 2.114: Images of *King David sends Uriah to die* without a parent model (*c.* 110 mm x 80 mm av. miniature dimensions), from: a) Lisbon, BNP, Res. 326.v, fol. 68^{v}; b) Poitiers, BM, DR.38, fol. 44^{v}; b) Avignon, BM, Rés. 203, fol. f4^{v} © Duarte Belo and the BNP; Bibliothèque municipale de Poitiers, Avignon.

(a) BNP, Res. 326.v

(b) Cathedral Library, no. num. [2]

Figure 2.115: Images of *Job on the dung heap* without a parent model (*c.* 110 mm x 80 mm av. miniature dimensions), from: a) Lisbon, BNP, Res. 326.v, fol. 78^{r}; b) Troyes, Cathedral Library, no. num. [2], fol. 56^{r} © Duarte Belo and the BNP; Bibliothèque da Catedral de Troyes.

Figure 2.116: Image of *Death riding a bull* without a parent model (*c.* 90 mm x 6 mm miniature dimensions), from Avignon, BM, Rés. 203, fol. g3^{v} © Bibliothèque municipale de Avignon.

3. Analysis of the case studies

The previous chapter explained the worth of the figurative configuration to the Hardouyn Hours. After delving into the sets of engravings with Chapter 2, it becomes apparent that the two Hardouyn brothers (Gillet and Germain) were intensely aware of the coeval artistic trends, especially about printmaking. They tended towards expressing certain styles in their visuals for decoration[1], becoming themselves an expression of the powerful influence of foreign arts. Chapter 2 presents various cases of Hours decorated with crude engravings, although this seems the favoured routine of production in the earliest phase of the Hardouyn workshop. This period corresponds to Gillet's stewardship within it[2], so it is reasonable to believe that such an aesthetic paradigm discloses his own editorial office.

Gillet's image edition included some overpaints; however, the number of coloured Hours escalates only after his death. This falls into place with Appendix B, which lists a considerable number of cases for the period for the early 1500s and the late 1510s. In addition, the few Hours from the earliest phase of activity reveal the hand of specialised illuminators who did not belong to the Hardouyn workshop. Three perfect instances are two early Hours, as the first of them shows the hand of a private illuminator (Arquivo Nacional Torre do Tombo[3]); another one of the Gotha Master (the Walters Art Museum,

[1]The richness of the visual quality of the Hardouyn Hours has been already expressed at the beginning of Chapter 2, and it was the meditation that has made necessary to select the object of study. However, the Hours by their workshop employed a considerable number of marginal decorations. An essential list of the typology of these illustrations includes figurative cycles for marginalia located on the side, at the bottom or top of the page the major office illustrations, frames for the major illustrations, medium-sized illustrations of secondary religious themes, small-sized illustrations of the evangelists, male martyr saints, female virgin saints, other saints. On these, see Winn, "Gathering the Borders in Hardouyn's Hours: From the *Accidents de l'homme* to the *Dis des Estas*"; Zöhl, *Jean Pichore: Buchmaler, Graphiker und Verleger in Paris um 1500*, Zöhl, "A Phenomenon of Parallel Reading in the Office of the Dead".

[2]See Chapter 2, Section 2.6.

[3]Book of Hours, use of the Rome, *c.* 1513, Paris, printed by Gillet and Germain Hardouyn. In Lisbon, ANTT; shelfmark PT/TT/CF/136. See Arquivo Nacional Torre do Tombo et al. *Relações Portugal-França*

Baltimore[4]); the last one, the Pichore workshop (Falvey Memorial Library[5]). Since the late 1510s, the Hardouyn workshop started embellishing its Hours.

Thus, this chapter intends to study the technique applied from this phase onward. For this purpose, three case studies preserved in the state library of Portugal based in Lisbon (the Biblioteca Nacional de Portugal) were selected: Res. 326.v, Res. 328.v and Res. 5781.p. The first part of the chapter provides an essential description of the case studies and the illustrations selected for a detailed characterisation; additionally, it elucidates the reasons for picking the exactly those compositions among their entire pictorial programmes.

A second part illustrates the results of material characterisation for the two stages of decoration, that are printing and final colouring. Later on, the section compares the past findings collected while inspecting another Hardouyn Hours (with the M.Sc.'s research work). This work has the precise intention of reconstructing a technical timeline of production for the Hardouyn workshop.

Another part characterises the iconographic alterations to the original arrangement, which the artists of the Hardouyn workshop applied upon colouring. As part of such characterisation, this analysis shall propose at last the possible reasons behind this phenomenon.

The last section is devoted to the locate the printing and colouring techniques of the Hardouyn workshop within the technical settings of late-medieval and Renaissance manuscript production and printmaking. For these purposes, it discusses technically and historically the previous results with artistic treatises and recipe books discussing the recommended materials and practices to formulate paints for colouring and printing, to give them to the supports and the strategies to achieve the desired visual outcome.

: documentos e ilustrações séculos XIII a XIX: guia da exposição. Lisboa: ANTT, 1992, no. 4, p.5. The partial digital source of this item is available at: http://digitarq.arquivos.pt/viewer?id=3909701 (Accessed January 9, 2022).

[4]Book of Hours, *c.* 1505, Paris, printed by Guillaume Anabat for Gillet and Germain Hardouyn. In Baltimore (MD), The Walters Art Museum; shelfmark 91.614. The partial digital source of this item is available at: https://art.thewalters.org/detail/25539/book-of-hours/ (Accessed January 9, 2022).

[5]Book of Hours, use of Rome, *c.* 1516, Paris, printed by Gillet Hardouyn. In Texas City (TX), Falvey Memorial Library, Villanova University; BX2080.A2. The full online source of this item is available at: https://digital.library.villanova.edu/Item/vudl:57694#?c=&m=&s=&cv=8&xywh=-2022%2C-1%2C5807%2C2994 (Accessed January 9, 2022).

3.1 Description of the case studies

3.1.1 The case-studies: Res. 326.v, Res. 328.v and Res. 5781.p

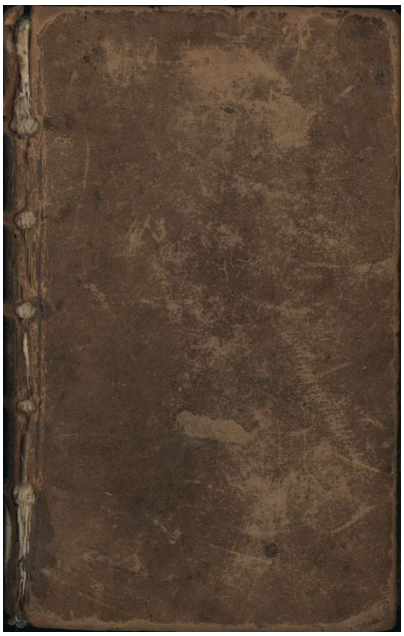


Figure 3.1: First case study: BNP, Res. 326.v © Duarte Belo and the BNP.

Res. 326.v Res. 326.v is a Book of Hours in *Octavo*-format that belongs to the National Library of Portugal (Biblioteca Nacional de Portugal or BNP). It adopts the Roman office (fig. 3.1)[6] and was printed by Germain Hardouyn in 1518-1523[7]. This book has small

[6] As stated in the initial and final colophons: "These Hours follow the Roman Mass rite for long use, with no exception. With visuals featuring [...] Jerusalem and [...]" (text missing due to severe deterioration of the area, fol. 1r); "These Hours [follow] the Roman rite for long use, with no exception. With the Hours of the Immaculate Conception and several other suffrages recently composed (?). Printed in Paris by Germain Hardouyn, based between the two doors of the Palace [of Justice, ed.], under the sign of Ste. Margaret" (fol. 105^{v}). The two statements are by this thesis' author from the original in Middle French: "*Ces p*[*rese*]*ntes heures sont a lusaige de Rôme* | [,] *tout au long sans* [*riens*] *requerir. Auec les* | *figures* [...] *hierusalem / e* [...]"; "*Ces presentes heures a lusaige de* | *Ro*[*m*]*me/au long sans riens req*[*ue*]*rir*"*/auec* | *loffice de la* [*con*]*ceptio*[*ne de*] *n*[*ost*]*re Dame/*[*et*] *plusi*|*eurs aultres suffraiges nouellement* | *adioustres:ont este imprimees a Paris* | *pour Germain hardouyn/demoura* [*n*]*t* | *entre les deux portes du palays/a len* | *seigne saicte Marguerite*."

[7] The book does not bear any date so that only assumptions can be proposed in this regard. The first year for the proposed range is the first year of Res. 326.v's almanack (1518-1525). This dating was also accepted by Brigitte Moreau et al. *Inventaire chronologique des éditions parisiennes du XVIe siècle*. Vol. 2. 1511-1520. Paris: Service des travaux historiques de la ville de Paris, 1972, 1518, no.1848. However, Renouard claims that Germain signed his editions under his name and location ("the sign of Ste. Margaret") only after 1523. Based on this statement, it is sensible to maintain 1518 as the year of production whereas the year of issue shall be pushed forward by a few years, to 1522. This can be only a hypothesis; therefore, this dissertation adopts the precautionary approach of dating the item for the period 1518-1523 (max 1518-1525, considering the final year of the almanack). See Renouard, *Imprimeurs e libraires parisiens du XVIe siècle: ouvrage publié d'après les manuscrits de Philippe Renoard*, p. 198.

dimensions, measuring 180 mm x 118 mm (157 mm x 105 mm single leaf dimensions) and 120 *folia*. Externally, its book binding consists of undecorated, full leather; internally, of a block sewed to five single raised bands. Its boards are secured to the book block, which consists of parchment quires, with two end-sheets of marbled papers pasted to the boards. Decorated in red, blue and yellow patterns, the end-sheets are pasted to the boards, one at the front and the other at the end of the book[8]. Finally, the binding retains its headbands.

At a general inspection, the binding seems to date back to the twentieth century rather than the Renaissance, because both its state of conservation is overall acceptable and its presentation modern. The only sign betraying some use is a thinning of the leather jacket in the area where the bands attach to the boards. While opening the book, it is possible to notice that the centre of the front past-leaf has a pasted heraldic ex-libris reading: "Livraria de J.C. Mazziotti Salema Garção." Thus, the book was in this patron's possession for some time, during a period when he presumably rebound his collection.

José Caetano Mazziotti Salema Garção of Porto (1886-1961) was a Portuguese collector and wolfram magnate. Being dearly fascinated with books, he gathered one of the vastest collections of manuscripts, rare books, printed books and other documentary sources in Portugal[9]. His collection started dispersing as he was still alive: Salema Garção himself donated a generous fund to the University of Coimbra[10] in 1949-1951[11]. Since his death, the rest of the collection was sold in private sales[12], and so has been given away[13] in favour of several holders, including cultural institutions. The National Library of Portugal is one of these institutes, and it possesses a large fund with such provenance[14],

[8]The marbled leaves have a comparable pattern.

[9]Pablo A. I. Magalhães. "Um códice perdido de José de Santa Rita Durão A tradução portuguesa do Ensaio Sobre a Poesia Épica, de Voltaire (Lisboa, 1783)". In: *Varia história* 37.75 (2021). DOI: https://doi.org/10.1590/0104-87752021000300007.

[10]Accessory number PT/AUC/COL/SG. On a description of the fund contents, see Zélia Maria Cruz Pereira. *O universo dos arquivos pessoais em Portugal: identificação e valorização*. Ph.D's dissertation. Évora, 2018, vol. 2, p.396.

[11]Source AUC (Arquivo da Universidade de Coimbra) at: https://pesquisa.auc.uc.pt/details?id=134942&ht=coimbra&detailsType=Description (Accessed January 6, 2022).

[12]One instance is https://www.zvab.com/OS-CRIST%C3%83OS-NOVOS-EM-PORTUGAL-S%C3%89CULO-XX/30432433236/bd (Accessed January 6, 2022).

[13]Magalhães, "Um códice perdido de José de Santa Rita Durão A tradução portuguesa do Ensaio Sobre a Poesia Épica, de Voltaire (Lisboa, 1783)".

[14]It is a fund comprising more than sixty books. See BNP Catalogue https://catalogo.bnportugal.gov.pt/ipac20/ipac.jsp?session=16S149P78N046.12033&profile=bn&uri=link=3100018~!30169~!3100024~!3100022&aspect=basic_search&menu=search&ri=2&

the best part of which consists of public donations[15], whereas the rest was acquired after his death[16]. The Res. 326.v may belong to the latter group: in fact, the BNP Catalogue does not label it as a donation.

Concerning Res. 326.v's pictorial programme, this book contains thirty-eight painted illustrations of different sizes: fourteen major miniatures (full-page, rectangular format), twenty-three smaller illustrations (20 mm x 15 mm max print dimensions) and one full-page illustration of an *Anatomic man*[17]. The major illustrations open each section of the book, or the Offices: Gospels of John (two images), Hours of the Virgin (eight images), Hours of the Holy Spirit (one), Penitential Psalms (one) and Hours of the Dead (one). The remaining illustration is the publisher's mark, also called *Printer's device*. The small illustrations represent the evangelists Matthew, Mark and Luke as well as individual saints and are part of the Suffrages[18].

source=~!bnp&term=Gar%C3%A7%C3%A3o%2C+Jos%C3%A9+Caetano+Mazziotti+Salema%2C+1886-1961&index=AUTHOR (Accessed January 6, 2022).

[15] In all likelihood, the book became public property after Salema Garção's death. Later, when the BNP became the official holder of the national legal deposit law (Decree-Law 71/1982), the books which were previously in possession of the Portuguese Ministry of Culture and Fine-Arts (the *Direcção Geral do Ensino Superior e das Belas-Artes*) passed to the BNP. Part of these books may have included the Salema Garção fund.

[16] In that case, the BNP catalogue only refers to Salema Garção as a mere possessor rather than a donor. Unfortunately, this fact remains a mere guess due to the absence of detailed documentary evidence.

[17] An *Anatomic man* is a skeletal or visceral representation of the human body illustrating the influence of celestial bodies on the well-being of the human body. According to the mediaeval beliefs, the position of a certain celestial body within the astronomic system governs a particular humor or temperament (i.e. a fluid of the human body among black bile, yellow bile, phlegm, and blood). If a mediaeval man wished to mantain good health, he had to perform specific medical operations in order to compensate for the celestial imbalances. In fact, a humoral imbalance would lay in the increased strength of one fluid in relation to the others; as the humors become uneven, maladies arise. An Anatomic man offers concise medical advice to follow during certain periods of the year, both in visual and written form. It becomes clear at a close inspection of Res. 326.v's Anatomic man, for instance (fol. 2^{r}). On the top right corner, it reads: "As the Moon is in the third house [Gemini, ed.], the seventh [Libra, ed.] or the eleventh [Aquarius, ed.], it is good to have a bloodletting carrying out." Translation by this thesis' author from the original in Middle French: "*Qua*[*n*]*t la lune est* | *en gemini* [,] *libra* [*et*] | *aq*[*ua*]*ri*[*um*] (the text reports an erroneous "aquarius" that has been here corrected, ed.) : *il fait bom* | *saigner au san*|*guin*." (for a full online source of the item, see Appendix A, Inc. 12)

[18] A *suffrage* is an invocation or prayer addressed to a certain patron saint, performed with the specific aim of imploring for some kind of protection or assistance. Considered all together, groups of such prayers form Masses or acts of piety that a Christian devotee offers for the repose of the departed souls (Brown, *Understanding Illuminated Manuscripts, revised: A Guide to Technical Terms*, p. 119).

Figure 3.2: Second case study: BNP, Res. 328.v © Duarte Belo and the BNP.

Res. 328.v The Res. 328.v is also part of the BNP collection of rare books. Like the previous case study, the Res. 328.v is an *Octavo*-printed Book of Hours following the Roman office[19] (fig. 3.2), produced around 1534[20]. The dimensions of this case study are 170 mm x 118 mm (157 mm x 105 mm single leaf dimensions), and the main block counts eighty-five leaves with another one sewed to it for good measure. The supplementary leaf contains prayers in Middle French addressed to Jesus[21], whose form of writing seems

[19] As expressed in two statements, the initial and final: "Hours in praise of the Blessed Virgin Mary, pursuant the Roman Mass rite for long use, with no exception. With several new suffrages and prayers, and numerous illustrations of the Apocalypse of St. John. Newly printed by the *libraire juré* Germain Hardouyn, based between the two doors of the Palace [of Justice, ed.], under the sign of Ste. Margaret" (fol. 1^{r}); "This is the end of these Hours pursuant the Roman Mass rite for long use, with no exception. They were recently printed in Paris, by Germain Hardouyn, sworn librarian of the University of Paris, based between the two doors of the Palace [of Justice, ed.], under the sign of Ste. Margaret" (fol. 84^{v}). The two statements are by this thesis' author from the original in Latin and Middle French: "*Hore in laude gloriosissime virginis marie secu*[*n*]|*dum vsum Romanu*[*m*] *totaliter ad longu*[*m*] *sine require* : | *cum multis suffragijs & orationibus de nouo additis.* | *Etiam cum multis figuris apocalipsis beati Iohannis euan*|*geliste nouiter Impresse Parisius Per Germanu*[*m*] *har*|*douyn bibliopole Iurati : commorantem inter duas Ianuas Palatij : ad interfignium diue Margarete.*"; "*Cy finissent ces presented heures a lusaige de* | *Romme toutes au long sans riens requerir : ont* | *este noiielleme*[*n*]*t Imprimees a Paris par Ger*|*main hardouyn Imprimeur & Libraire iure de* | *Luniversite de Paris demoura*[*n*]*t entre les deux* | *portes du Palais a le*[*n*]*seigne saincte marguerite*".

[20] Res. 328.v bears no date, so its date of issue/production adopts the first year of its almanack (1534-1553). The bibliographic info is compatible with Brigitte Moreau et al. *Inventaire chronologique des éditions parisiennes du XVIe siècle*. Vol. 4. 1531-1535. Paris: Service des travaux historiques de la ville de Paris, 1972, 1534, no.1025 (see later), but the end date of the calendar is not correct (Moreau refers 1552 instead).

[21] In fact, the compiler addresses them to "Lord Jesus, the Christ" (= "*seuygneur Jesu o* | *crist*", fol. 85^{r}).

compatible with the book's period of production[22].

This item's binding consists of a full-leather black jacket decorated with stamped, gilded patterns[23], and the book comes with a two-piece, protective box covered in brown leather. The jacket's look matches the French production of the mid-sixteenth century in its small format, use of cardboard in lieu of wood, harmonious appearance and gold tooling; however, its decoration is hardly compatible with the sixteenth or seventeenth *fanfaire* style of decoration[24]. Moreover, the leather colour does not resemble the coeval material quality of the period[25], nor does it show the signs of wearing that an extant five-century binding should have. Showing a good state of conservation, the external cover does not allow appreciating the binding architecture of this book. Moreover, the front past-leaf uniting the boards to the block looks equally modern. The combination of all these facts suggests that the manufacture of the binding is modern yet crafted by an artisan who had a vague familiarity with Renaissance bindings.

The book itself indicates no further information about its history of use and, related to the acquisition by the Biblioteca Nacional of Lisbon, the signs are even lesser in number. One of these is the Moreau catalogue[26]that includes one entry, most likely referring to the Res. 328.v[27]. Thus, this item must be part of the library collection ever since the catalogue's date of issue (1992).

The Res. 328.v contains thirty-nine painted images of different proportions and destinations: eighteen major illustrations (half-page, rectangular format), twenty small-sized images (semi-square format) and one Anatomical man. The major images are used to represent the printing workshop (*Printer's device*), the Gospel of John (two images), ; the

[22]At a rough palaeographic inspection, the writing seems to adopt a Renaissance script due to the typical module of letters "d", "p" and "f" of 1500-1550 writings, which they share. Also, the regularity and harmony of the calligraphy suggests that the writer was rather familiar with the writing setting, or at least someone who possessed some calligraphy or cultural literacy. Thus, chances are high this final *folium* may have been affixed to a freshly purchased Hours, on account of its position. In other books, supplementary leaves are incorporated at the front of a Book of Hours (like in BnF, Rés 8.T.2521, fols. 1-2; see Appendix A, Inc. 28) for the full digital source of this item) whereas this one is based at its end. This is relevant since the ending part of Hours was of the suffrages and other prayers, some of them were customisable.

[23]Owing to the gilding, it is not possible to discriminate visually the working method for applying the pattern. However, an initial, visual examination suggested that it may involve modern heat stamping.

[24]For several instances of Renaissance French binding, see the dedicated database of the British Library available at: https://www.bl.uk/catalogues/bookbindings/Results.aspx?SearchType=AlphabeticSearch&ListType=Style&Value=237 (Accessed January 7, 2021).

[25]Like red morocco, light or dark brown goatskin.

[26]Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*.

[27]Moreau et al., *Inventaire chronologique des éditions parisiennes du XVIe siècle*, 1534, no.1025.

Hours of the Virgin (nine), the Hours of the Cross (one), the Hours of the Holy Spirit (one), the Hours of the Conception of Mary (one), the Penitential Psalms (one), the Hours of the Dead (one) and the Trinity at last. The small illustrations represent three evangelists (Matthew, Mark and Luke) and seventeen patron saints. The remaining illustration is a representation of the *Anatomic Man*.

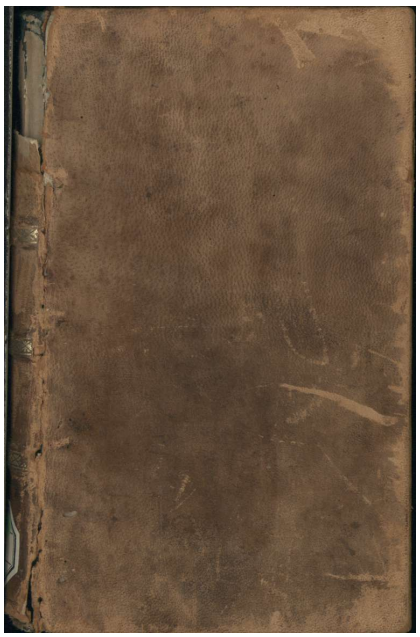


Figure 3.3: Third case study: BNP, Res. 5781.p © Duarte Belo and the BNP.

Res. 5781.p The Res. 5781.p is the last case study, an *Octavo*-Book of Hours adopting the Roman office of 1518-1522[28] conserved in the BNP (fig. 3.3)[29]. It is a small-sized book of 184 x 100 mm (95 mm x 87 mm single leaf dimensions) made of eighty *folia*

[28]The book bears no date, so it is generally dated with the first year of its almanack (running 1518-1528). However, it is possible that 1518 may be the year of production, while 1522 may be the year of issue.

[29]"These Hours follow the Roman Mass rite for long use, with no exception. With visuals featuring the destruction of Jerusalem. Latest edition printed in Paris by Germain Hardouyn, publisher based between the two doors of the Palace [of Justice, ed.], under the sign of Ste. Margaret" (fol. 1^{r}); "These Hours follow the Roman Rite for long use, with no exception. They were printed in Paris, by Gillet Hardouyn, publisher based near *pont Notre Dame*, in front of the church St. Denis de Chartre under the sign of the golden rose. [Printed, ed.] for Germain Hardouyn, publisher based between the two doors of the Palace [of Justice, ed.], under the sign of Ste. Margaret" (fol. 80^{v}). The two statements are by this thesis' author from the original in Middle French: "*Ces p*[*rese*]*ntes heures so*[*n*]*t a lusage de Ro*[*m*]*me | tout au long sans viens requerir. Avec les | figures de la destruction de Hierusale*[*m*]. *Nou|uelleme*[*n*]*t imprimees. A Paris* : *pour germain | hardouyn librayre demoura*[*n*]*t entre les deux| portes du Palays enlenseigne saincte mar|guerite*"; "*Ces presentes heures sont a lusage de | Ro*[*m*]*me tout au long sans viens requerir ont |* [*et*] *ste i*[*m*]*primees a Paris par Gilles hardouyn | libraire demora*[*n*]*t au bout du po*[*n*]*t n*[*ot*]*re dame | dena*[*n*]*t saint denis de la chartre / a lenseigne | de la rose dor* [.] *Pour germain hardouyn librai|re de demora*[*n*]*t entre les deux portes du Palays | enlenseigne saincte mar|guerite.*"

and supplemented with two blank leaves (one at the front, the other at the end of the book). Its binding is plain: externally, it consists of a brown full-leather jacket covering two cardboard plates; internally, the parchment block is sewn to cardboard plates through five cord band, as revealed by some gaps in the joint between the boards and the spline. Even though the external binding reveals fragility in the mentioned area, the block is in a good state of conservation.

On the front past-leaf, there is an out-of-date inventory number and a name, reading: "Vitor Perez". Vitor Ávira Perez (1830s-before 1938) was a Portuguese passionate bibliophile who collected throughout his life a vast collection of manuscripts, *incunabula* and other printed books. In 1939-1941, this vast collection was auctioned off[30], and a good part of it was acquired by the BNP[31], maybe including Res. 5781.p[32]. Another note scripted on the front free-paper also refers "1517"[33]: maybe it was by the same Perez, who may have appointed this year as the most likely date of production.

The pictorial programme of the Res. 5781.p includes thirty-seven miniatures, sixteen of which are major illustrations; sixteen, small images; one, the Anatomic man and the remaining four, historiated borders. The major illustrations are half-page illustrations decorating the Gospel of John (two illustrations), the Hours of the Virgin (nine), the Hours of the Cross (one), the Hours of the Holy Spirit (one), the Penitential Psalms (one) and the Hours of the Dead (one). The smaller images represent the evangelists Matthew, Mark and Luke along with thirteen patron saints.

3.1.2 Selection of the images for the case studies

Printer's device and *Adoration of the Magi* were the subjects selected as the best case studies for the multi-disciplinary investigation of this chapter for two reasons. The first is the function that the *Printer's device* and *Adoration of the Magi* serve within their own

[30]The action of the Perez collection was one of the largest ever occurred in Portugal: a total of 8,962 lots was sold off from October 1939 through April 1940, leaving only the auction catalogue as the extant record for the Perez collection. See Arnaldo Henriques de Oliveira. *Catálogo da riquíssima Biblioteca Victor Marat de Ávila Perez*. Lisboa: A.H. Oliveira, 1939.

[31]Thus, the number written with a pencil could date just before being sold.

[32]Unfortunately, no purchasing record could be retrieved. However, fol. 1^{v} shows a number on the top, being probably an old shelfmark (by the BNP). This supports the idea that the book has been part of the library for a long time, sufficiently prolonged to get its inventory number altered.

[33]The rest of the writing is undecipherable.

pictorial programmes. The former image, *Printer's device*, does not recall biblical or other religious events; in fact, it is a purely allegorical representation. Renaissance printers and booksellers adopted figurative allegories as unique emblems of their products. Otherwise, this kind of image represents one of the earliest forms of commercial logo design. The fashion of these images varied significantly over time, and those of early sixteenth-century Paris expressed a strong heraldic vocation. As images derived from armorial compositions, their achievement picked a limited number of components among the entire ensemble available in heraldic design: lateral supporters, a crest, compartment, a slogan and an escutcheon. Differently from regular coat of arms, the canonical programme in a *Printer's device* was rather essential because printers and booksellers took hold of its components as a way to push customisation. Specifically, the name of the printer or bookseller replaces mottoes in a *Printer's device*; the central shield contains the monogram of the printing master or publisher rather than family crests. Based on the above facts, it becomes clear that a *Printer's device* serves only the personal promotion of book makers instead of being instrumental to pious contemplation.

In what concerns the second parameter that drove to the selection of those two compositions, especially *Adoration of the Magi*, is of technical order. In particular, this parameter is the niche that an illustration occupies within its own pictorial programme: that is to say, how often the *Adoration of the Magi* theme is employed to illustrate one hour of the *Office of the Virgin* (since a Printer's device is an independent representation). In this regard, the previous chapters have developed the story of this illustration across the Hardouyn production in detail[34]. As it is inspected closely, this decoration for the Sext hour reveals immediately that few or no iconographic variation appears across the Hardouyn production, and that *Adoration of the Magi* is an invariable component of the Hardouyn's graphic setting. This becomes apparent while weighting the incidence of *Adoration of the Magi* along with Sext, and the rate of appearance of other themes within other canonical hours. Therefore, in what concerns to None and Compline, various composition appear: either *Flight into Egypt* or *Presentation in the Temple* in relation to None; *Coronation of the Virgin* or *Death of the Virgin* along with Compline. Consequently, the distribution of this illustration across the *corpus* of the Hardouyn Hours is rather high.

[34] See Chapter 2.

A second reason for preferring the *Adoration of the Magi* over such standard illustrations as the *Annunciation* lays in its inherent complexity of execution. The scene of the visit to an infant Jesus involves necessarily a large number of characters, five at least: Jesus, Mary and the three Kings. Besides, the architectural outline includes a fair diversity of natural and artificial features, such as classical ruins, stables, cityscapes. The double necessity of picturing large number of participants and a diversified landscape requires a broad chromatic and technical range. Given such richness of elements, this illustration was one of the most eligible to represent the technique of decoration applied throughout the book.

The final interest for studying Adoration of the Magi is the comparability with previous studies: the Inc. 438 from the Biblioteca Pública de Évora (*c.* 1532)[35], a book crafted in the Hardouyn workshop, already studied both considering the iconography as the material characterization of its colour paints. Studying the same kind of images in comparable spots of analysis allows establishing arising patterns in both the materials and technique of production. Otherwise stated, analysing these images allows establishing a timeline of production.

Therefore, the two images chosen from each book are representative of several purposes: relation to the reader, to its meaning and the techniques applied for its realisation.

3.1.2.1 *Printer's device*

The *Printer's device* of the Res. 326.v measures 122 mm x 78 mm (miniature dimensions)[36] and is an extensively coloured miniature (fol. 1^{r}, fig. 3.4). Its subject is a classical scene, namely the demigod Hercules' rescue of an abducted Deanira (by the centaur Nessus). On the right, the centaur grabs Deanira and tries to flee away from Hercules' reach and heads toward the other side of a nearby river. Hercules stands on the left, tending his arc and ready to shoot to the creature. The scene takes place in a naturalistic setting: together with the mentioned river, on the rear a vegetation indicates the presence of a forest.

[35]Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography"; Bottura-Scardina et al., "Image processing methods integrated to imaging and material characterisation for the study of incunabula illustrations: an innovative multi-analytical approach on a case-study"; Bottura Scardina et al., "On the use of hand-held X-ray fluorescence spectroscopy coupled to Monte Carlo simulations for the depth assessment of painted objects: The case study of a sixteenth-century illuminated printed book".

[36]The measure of all miniatures for this section does not include the gilded frame.

On the top of the image stands a blank, unpainted escutcheon.

The second *Printer's device* is from the Res. 328.v (fol. 1^{r}, fig. 3.4.2). This illustration is smaller than the previous, being 100 mm x 80 mm in size. Along with the dimensions, this version of the theme differs from the previous by the subject: in this case, the illustration is a purely symbolical representation, while the previous was an illustration with a clear Classical mythological reference. The version at issue in the Res. 328.v includes three *putti*. Two of them occupy the centre of the image, whereas the last one is on the top; as for the lower angels, they support the two sides of a large shield bearing a monogrammed decoration inside. Behind the pair, there is a tree with dense foliage filling the entire half of the scene. Amidst the leaves, a third *putto* sits and holds some bridles to further support the shield. Below the group, a wide meadow covers the bottom of the scene with lush vegetation.

The final *Printer's device* for this section is from the third case study, the Res. 5781.p (fol. 1^{r}, fig. 3.4.3). This last version share several features with the previous. One of these are the overall dimensions, where this illustration is 95 mm x 78 mm in size (miniature dimensions), being slightly smaller than the other by few millimetres; besides, its composition also includes angels bearing a shield in a naturalistic setting. Differently than the previous version, the device in the Res. 5781.p features only two angels, both dressed in yellow garments; the background of this version consists of a backdrop in plain red; the tree is slimmer and has no fruits.

(a) Res. 326.v (b) Res. 328.v (c) Res. 5781.p

Figure 3.4: Full page views of the leaves with the *Printer's device* across the case studies: a) BNP, Res. 326.v, fol. 1^{r} (122 mm x 78 mm miniature dimensions); b) BNP, Res. 328.v, fol. 1^{r} (100 mm x 80 mm); c) BNP, Res. 5781.p, fol. 1^{r} (95 mm x 78 mm) © Silvia Bottura-Scardina.

3.1.2.2 *Adoration of the Magi*

The *Adoration of the Magi* of the Res. 326.v measures 122 mm x 77 mm (miniature dimensions) and is vividly coloured (fol. 46^{r}, fig. 3.5a). The illustration shows the scene of the Magi's arrival to the place where the Holy Family abides, a humble stable in the countryside. The visiting kings come to pay their respects to Jesus as the Christ, guided by the ray of the glaring star (appearing on the top left corner). Upon arrival, one king kneels before Jesus to touch the baby's foot while the other two wait patiently for their turn, with their offers in the hand. As for the Holy Family, Mary sits in the foreground with Jesus on her lap. Joseph stands behind the couple of them, observing the scene.

Compared to the previous, the second version Adoration of the Magi in the Res. 328.v (fol. 31^{r}, fig. 3.5b) reveals an important dissimilitude in many aspects. One is the size, being this version significantly smaller since it measures 90 mm x 60 mm (miniature dimensions). Another difference is this architectural setting: unlike the other version, the organisation of the architectural spaces features Classic buildings in ruin rather than a humble stable. Nearly all the members of the traditional representation are present: the kings, Mary with the Child, St. Joseph, yet not the star nor the ox and the donkey.

The final *Adoration of the Magi* of this section is from the Res. 5781.p (fol. 49^{v},

fig. 3.5c). This last version of the theme is also the smallest, measuring 85 mm x 80 mm (miniature dimensions). The scene it depicts is extremely essential. The three kings pay their respect to Jesus: the older one kneels before the Child and waits to receive a blessing; the other two stay slightly aside, waiting for their turn to offer the rich gifts that they hold aloft. Mary secures the baby on the lap while observing the scene. It appears that the scene takes place in an interior, but the pictorial features of the settings do not bear enough descriptive elements to provide further details on the surrounding environment.

(a) Res. 326.v (b) Res. 328.v (c) Res. 5781.p

Figure 3.5: Full page views of the leaves with the *Adoration of the Magi* across the case studies: a) BNP, Res. 326.v, fol. 1^{r} (122 mm x 77 mm miniature dimensions); b) BNP, Res. 328.v, fol. 1^{r} (90 mm x 60 mm); c) BNP, Res. 5781.p, fol. 1^{r} (85 mm x 80 mm) © Silvia Bottura-Scardina.

3.2 Material characterisation

The preamble to this chapter promised to characterise technically the two stages of decoration for the Hardouyn Hours (printing and work of illuminating). Specifically, the aim branches into two parts, each corresponding to one exact step of decoration. Thus, for the printing phase, this section reports the results from the material identification of the components employed in the ink formulation. Additionally, it presents further studies conducted both to understand the features of the ink compounds and how these have given to produce illustrations. With reference to the technique of painting, this section determines the substances employed in the paint formulation (colourants, extenders, binders)

as well as their extent of use across the group of selected illustrations.

To such extents, this research work employed largely non-invasive and in-situ techniques, limiting the adoption of micro-invasive and destructive methods exclusively to the materials of printing. These material studies can be ideally divided into three components by the yielded information: spectroscopic methods of molecular characterisation, elemental characterisation and area analysis. For the first class, a non-invasive and in-situ spectroscopic method was used to characterise the materials of illuminating and printing: Ultraviolet-visible-near infrared reflectance spectroscopy on fibre-optic (UV-Vis-NIR FORS). One non-invasive and in-situ method of elemental analysis was used to characterise all materials (painting and printing), namely handheld X-ray fluorescence spectroscopy (p-XRF). Finally, imaging methods were used to determine the original design of the underlying prints (IR-photography and Infrared reflectography-or IRR), the extent of use of the chromophores (Vis-NIR hyperspectral imaging or Vis-NIR HSI) and the microscopic features of the pictorial and printing films (Digital microscopy or DM).

Micro-sampling of the printing inks was performed in a peripheral area of one incunabulum (Res. 5781.p, sample size in the 20-50 μm range), that was analysed with micro-invasive and micro-destructive techniques. Those methods characterised the micro-sample's molecular signature with Fourier-transformed infrared spectroscopy (μ-FTIR) and Pyrolysis-gas chromatography coupled with mass spectrometry (Py-GC-MS). The elemental profile and microscopic images of the sample were obtained with Scanning electron microscope coupled with energy-dispersive spectroscopy (SEM-EDS). The imaging from SEM was performed both in Back-scattered electrons mode (BSE) and Secondary electrons mode (SE) to achieve distinct qualities of information. The scheme of the multi-analytical approach is illustrated on Figure 3.6[37] Afterwards, the data from this multi-analytical approach was compared with those obtained from the study of the Hour in Évora (BPE, Inc. 438).

The results from the in-situ approach were further treated to gain supplementary information. This section shall illustrate a pioneering attempt of coupling the p-XRF data to a class of stochastic methods (Monte Carlo simulations) in order to make predictions about the thickness of the pictorial and printing film. Image processing (IP) techniques

[37] The analytical conditions of each methods and their spots are presented in Appendix F.

have also been applied to the data from the area analysis (IRR and DM). In particular, for this research work, an original algorithm has been developed in MATLAB environment to enhance the information from the IR-reflectographies and reconstruct the original design of the prints covered in the pictorial overlayers. Several techniques of spectral extraction and mapping were tested in relation to the Vis-NIR HSI data, in order to determine the best approach for the analysis of illuminated books. The last piece of research accomplished in this research work was another attempt of coupling IP methods and imaging data. Here, DM data was analysed with an IP software to evaluate grain size for a class of chromophores (blue pigments); later, the optical effects of grain size were semi-quantified by computing the changes in the colorimetric coordinates (in the CIELAB colour space) and spectroscopical alterations (band displacement, broadening and intensity increase) in the main reflectance band associated to the blue colour with and varying values of pigment size distribution.

The first part of this section shall illustrate the study of the printing technique (Subsection *Printing technique*), delving into the reconstruction of the original design first and later in the analysis of the materials employed for printing. Following, the other section presents the result from the characterisation of the works of illuminating (Subsection *Illuminating technique*).

3.2.1 Printing technique

3.2.1.1 Printed image

Elaboration of the automated software A part of the work aimed at improving the analytical outcome from the IR imaging analysis. To this end, the first part of the analysis aimed at elaborating an automated method of digital enhancement of the imaging data, with the larger purpose of achieving more accurate representations of the printed design beneath the pictorial films. This section illustrates the results of a test run on a simplified image, with the purpose of obtaining data sufficiently detailed to be employed for the later iconographical analysis on Section 3.3 (*Evaluation of the artistic process*).

For this task, IR reflectography was elected as the appropriate analytical method, because of the useful properties that light exhibits within its range of spectral sensitivity

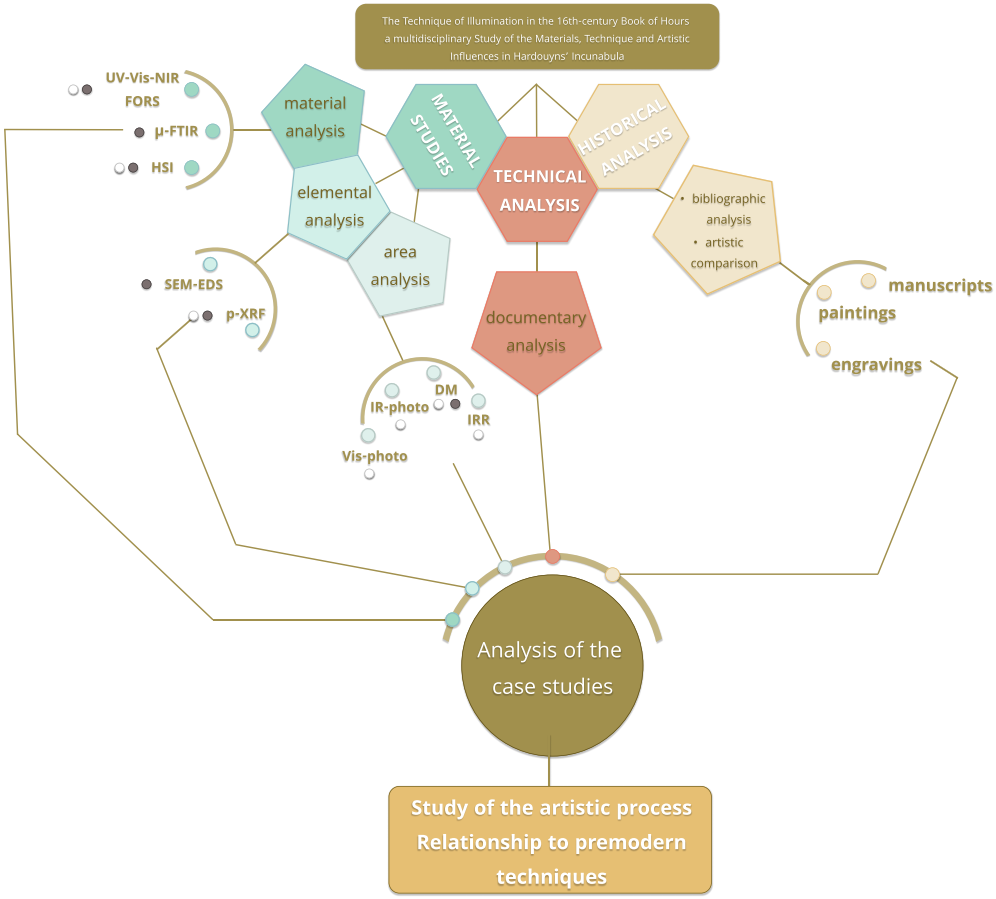


Figure 3.6: Scheme of the experimental design adopted for the chapter. List of abbreviations: UV-Vis-NIR FORS (Ultravisible-visible-nearinfrared fibre-optic reflectance spectroscopy; μ-FTIR = micro-Fourier transformed infrared spectroscopy; HSI = hyperspectral imaging; SEM-EDS = scanning electron microscope coupled with energy-dispersive spectroscopy; p-XRF = portable-X-radiation spectroscopy; Vis-photo = Visible photography; IR-photo = Infrared photography; DM = Digital microscopy; IRR = Infrared reflectography. The white dots mark the use of that technique to characterise a miniature; the black dots mark the use of that analytical method to study the printing materials.

(NIR-SWIR, 900-1700 nm). IR rays (800-12000 nm) display a linear increase of the penetration depth across the entire range[38], so pictorial materials become more transparent with increasing wavelengths. Being able to penetrate the outer layers of paint, IR radiation can reach the deepest levels of painted objects, differently than Visible light (400-800 nm). This property allows longer wavelengths to reach the sub-levels of such IR-absorbing materials as carbon-based black colourants (called black-backing), corresponding to those areas where artists handmade the sketch of an image to overpaint. With the Hardouyns, these materials correspond to the chromophores used in printing[39].

Among the multiplicity of IR imaging technologies, photographic devices equipped with solid state Si CCD detectors[40] and FPA InGaAs cameras (also known as *reflectographers*) are the most commonly employed in Heritage Studies[41]. Their main difference

[38] Other parameters determine the transparency of a material to IR rays, including the refractive index: the higher the index, the lower the capability of the radiation to pass through that material.

[39] See the discussion of the materials of printing later, in Section 3.2.1.1.

[40] These devices correspond to the most common photographic devices. Because these sensors are generally sensitive to wavelengths in the range 350-1050 nm, the extended sensibility until the end of the NIR range (750-1000 nm) affects the performance of Vis cameras in several ways. Among those effects, the most apparent is an overcharge of one colour channel over the others (the red) in RGB sensors. This phenomenon arises from the fact that solid state sensors typically respond to both Vis and NIR radiation; such a response does not correspond to the human eye, that has an average sensibility in the 400-800 nm range. As a result, solid state sensors "overcharge" the red component of the image. To avoid this effect, commercial cameras place an IR cut-off filter before the sensor to block the radiative fraction that the human eye does not perceive. See also Peter B. Catrysse. "Optics for Digital Imaging". In: *Handbook of Digital Imaging*. Ed. by Michael Kriss et al. Vol. 1. Image capture and storage. Chichester and West Sussex: John Wiley & Sons, 2015. Chap. 2, pp. 31–85, p. 33.

[41] For some instances of NIR scanning systems applied to book studies, see Jan Blaek et al. "Improvement of the visibility of concealed features in artwork NIR reflectograms by information separation". In: *Digital Signal Processing: A Review Journal* 60 (2017), pp. 140–151. DOI: https://doi.org/10.1016/j.dsp.2016.09.007; Douglas M. Chabries et al. "Imaging the past: Recent applications of multispectral imaging technology to deciphering manuscripts". In: *Antiquity* 77.296 (2003), pp. 359–372. DOI: https://doi.org/10.1017/S0003598X00092346; Giulia Doni et al. "Thermographic study of the illuminations of a 15th century antiphonary". In: *Journal of Cultural Heritage* 15.6 (2014), pp. 692–697. DOI: https://doi.org/10.1016/j.culher.2013.12.001; Marco Gargano et al. "A perceptual approach to the fusion of visible and NIR images in the examination of ancient documents". In: *Journal of Cultural Heritage* 16.4 (2014), pp. 518–525. DOI: https://doi.org/10.1016/j.culher.2014.09.006; Marco Gargano et al. "A new spherical scanning system for infrared reflectography of paintings". In: *Infrared Physics & Technology* 81 (2017), pp. 128–136. DOI: https://doi.org/10.1016/j.infrared.2016.12.011; Fulvio Mercuri et al. "A new spherical scanning system for infrared reflectography of paintings". In: *Journal of Cultural Heritage* 31 (2018), pp. 53–62. DOI: https://doi.org/10.1016/j.culher.2017.10.008; Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography"; Alessandra Sorbello Staub et al. "Near-Infrared Laser Scanning (NILS) to Differentiate Historical Inks, Deployed on a Stained and Faded Ninth-Century Fragment of Boethius Reused as Binding Material: Proving a Concept". In: *Restaurator* 37.1 (2016), pp. 1–13. DOI: https://doi.org/10.1515/res-2015-0005; Sara Valadas et al. "New insight on the underdrawing of 16th Flemish-Portuguese easel paintings by combined surface analysis and microanalytical techniques". In: *Micron* 85 (2016), pp. 15–25. DOI: https://doi.org/10.1016/j.micron.2016.03.004.

is their spectral sensibility, where photographic methods[42] can record light until the end of the NIR range (*c.* 800-1050 spectral sensibility), whereas reflectographers have an extended sensitivity in comparison since they can record light until the SWIR region[43] (900-1700 nm spectral sensibility)[44]. Because they can detect longer wavelengths, reflectographers are valid methods to detect sub-layers of sketches or, like in this case, of underprintings.

Owing to the above reasons, this NIR-SWIR data was used for the digital enhancement (that will hereafter be cited within the text as *digital reconstructing*). This digital building process comprises a multistep procedure involving a combination of a user's direct involvement and automation. It starts with the selection by the user of regions of interest (ROIs) containing the underprintings, for each of which the algorithm recalibrates automatically the levels of grey to remove the unnecessary information. In the end, the algorithm merges all ROIs to return a complete reconstruction.

Recalibrating each ROI proved to be the most critical and challenging task of the script because other materials add interference, and reflectograms[45] typically have poor contrast. Relating to the first point, the underprintings are not the sole layer which displays IR-sensitivity, but, to the contrary, the materials from the pictorial layers can substantially reflect or absorb incoming light. If a material from the outer levels is reflective, it prevents the light from reaching the underprintings; in the other case, it attenuates the radiation before it reaches the deepest levels. In both cases, they hamper diagnostic efforts, similar to the second point. It consists in the fact the substrate of printing does not reflect perfectly and diffusely the IR radiation, in either case its morphology is uneven or when its compo-

[42] This class of technique employs typically commercial cameras that are adapted to NIR imaging by removing the IR cut-off filter before the lens system to block the Vis radiation. In this way, diagnostic images are captured by employing only the peripheral area of solid state sensors (*c.* 800-1050 nm). Upon such modification, these photographic devices are then called "transformed" cameras. IR cameras are also available, but their use in Heritage Studies is more limited.

[43] The SWIR range, or Short-Wave-Infrared, is the 1000-2500 nm spectral region.

[44] Duilio Bertani et al. "A scanning device for infrared reflectography". In: *Studies in Conservation* 35.3 (1990), pp. 113–116. DOI: https://doi.org/10.1179/sic.1990.35.3.113; L. Consolandi et al. "A prototype for high resolution infrared reflectography of paintings". In: *Infrared Physics & Technology* 49.3 (2007), pp. 239–242. DOI: https://doi.org/10.1016/j.infrared.2006.06.031; Charles M. Falco. "High resolution digital camera for infrared reflectography". In: *Review of Scientific Instruments* 80 (2009), p. 071301. DOI: https://doi.org/10.1063/1.3174431; Marco Gargano et al. "A new methodology for comparing IR reflectographic systems". In: *Infrared Physics & Technology* 49.3 (2007), pp. 249–253. DOI: https://doi.org/10.1016/j.infrared.2006.06.013.

[45] A reflectogram is an image captured with an IR-reflectographer.

sition is such that it is partially IR-positive. As a result, the selection of the exact levels of grey for the digital reconstruction becomes taxing.

Despite those challenges, an algorithm was elaborated, and its accuracy tested on a small, minimalistic image. Employing an image of reduced size and simplified iconographic content was an important step for the quantitative testing phase, so that the next phase could be the application to more complex illustrations, such as those selected from the case studies.

The quantitative testing was an evaluation, with algorithms of image comparison, of the automated digital reconstruction against another one elaborated "manually" (made by highlighting the perceptual outline from the reflectography with an image manipulation software and a graphic tablet). Both reconstructions, the automated and the manual, were segmented into ROIs and evaluated with a pristine , namely a crude engraving from another Hardouyn Hour in London[46] that displayed a comparable composition. The segmentation into ROIs was performed following two criteria: random splitting (freehand regions) and a geometric splitting (rectangular regions). Later, each ROIs was tested against the pristine, that has been similarly segmented[47].

Figure 5.7 below presents the two digital reconstructions (automated and manual) and the pristine before their quantitative comparison with mathematical metrics.

[46]London, BL, C.29.f.10, fol. K4^{v}. It is a Horae ad usum Romanum (Hours for the use of Rome), printed in Paris, *c.* 1528, Germain Hardouyn.

[47]Before the comparison, the pristine had been conveniently pre-processed. The pre-processing included adapting the boundaries to the reflectography, removing the information related to neighbouring writing and the pattern of its substratum, converting to 8-bit greyscale and finally, to a black-and-white image.

(a) (b)

(c) (d)

Figure 3.7: Comparison of digital reconstructions of a test image from a Hardouyn Hour, originally reconstructed from a reflectography: a) pristine (original), from London, BL, C.29.f.10, fol. f4^{v}; b) pre-processed pristine; c) manual reconstruction; d) automated reconstruction © The British Library Board, Silvia Bottura-Scardina.

Three methods of image comparison were used:

Mean squared error (MSE): cumulative squared difference between the two pixel values at the same location of arrays A (pristine) and B (reconstruction to assess) of common size M x N through the formula:

$$MSE_{m,n} = \frac{\sum_{m,n} (A_{m,n} - B_{m,n})^2}{m \cdot n}$$

with $A_{m,n}$ the intensity value of matrix A at the m,n location (pristine);

$B_{m,n}$ the intensity value of matrix B at the m,n location (pristine);

m the position in the column vector;

n the position in the row vector.

2-D correlation coefficient: 2-D correlation coefficient R between arrays A and B of common size M x N through the formula:

$$2Dcorr_{A,B} = \frac{\sum_m \sum n(A_{m,n} - \bar{A})(B_{m,n} - \bar{B})}{\sqrt{(\sum_m \sum n(A_{m,n} - \bar{A}))^2 (\sum_m \sum n(B_{m,n} - \bar{B}))^2}}$$

with $A_{m,n}$ the intensity value of matrix A at the m,n location (pristine);

$\bar{A}$ the average value of the entire set of intensity values for array A (pristine);

$B_{m,n}$ the intensity value of matrix B at the m,n location (pristine);

$\bar{B}$ the average value of the entire set of intensity values for array B (pristine);

m the position in the column vector;

n the position in the row vector.

Structural similarity index measure (SSIM): index of the mathematical relationship of the perceived similarity between arrays A (pristine) and B (reconstruction to assess) of common size M x N, based on the comparison of their values of luminance, contrast and structure[48]. It is calculated through the formula::

$$SSIM_{A,B} = \frac{(2\mu_A\mu_B + c_1)(2\sigma_{A,B} + c_2)}{(\mu_A^2 + \mu_B^2 + c_1)(\sigma_A^2 + \sigma_B^2 + c_2)}$$

with σ_A^2 the variance of array A;

σ_B^2 the variance of array B;

μ_A the mean intensity of array A;

μ_B the mean intensity of array B;

c_1 the product $(k_1 \cdot L)^2$;

c_2 the product $(k_2 \cdot L)^2$;

[48]This metric has been implemented on the basis of the previous Universal Quality Index (UQI). Nowadays, MSE and SSIM are the common methods in image comparison. The elaboration of the version of SSIM that has been adopted for this research work (first version), see Zhou Wang et al. "Image quality assessment: from error visibility to structural similarity". In: *IEEE Transactions on Image Processing* 13.4 (2004), pp. 600–612. DOI: https://doi.org/10.1109/TIP.2003.819861.

L the dynamic range (bit depth);

k_1 the constant coefficient 0.01 (default);

k_2 the constant coefficient 0.03 (default).

The table with the results from the assessment are presented as follows[49]:

Table 3.1: Comparison of the quality assessment of freehand ROIs of the manual reconstructions and the automated reconstruction for one illustration in BPE, Inc. 438, fol. 8^{r}. The quality metrics are Mean Squared Error (MSE); 2-D correlation (2-D corr.); Structural Similarity Index Measure (SSIM). The *Result* column gives which method performed best for individual ROIs (value in cell), averaging all results (*Average*) and comparing the unsegmented reconstruction (*Whole image*). |Δ| refers the absolute difference of value between the manual reconstruction and the automated reconstruction. Best values of comparing metrics are (av. ROIs): MSE, 1647 (± 71); 2D corr, 0.560 (± 0.020); SSIM, 0.950 (± 0.010). The full sets of results is given in Appendix F, Section F.4.2.

	METHOD					
ROI	**MSE**		**2-D corr**		**SSIM**	
	Result	**|Δ|**	***Result***	**|Δ|**	***Result***	**|Δ|**
1	manual	127.30	manual	0.005	manual	0.005
2	manual	129.200	manual	0.080	manual	0.080
3	manual	58.830	manual	0.020	manual	0.020
4	manual	10.370	manual	0.040	manual	0.040
5	manual	15.800	**autom.**	0.024	manual	0.024
6	**autom.**	28.850	manual	0.000	**autom.**	0.000
7	**autom.**	69.000	**autom.**	0.015	**autom.**	0.015
8	**autom.**	30.110	manual	0.121	**autom.**	0.121
9	manual	68.370	manual	0.089	manual	0.089
10	manual	63.300	manual	0.029	manual	0.029
11	manual	138.100	manual	0.033	manual	0.033
12	**autom.**	185.300	**autom.**	0.032	manual	0.032
Average	manual	24.834	manual	0.029	manual	0.029
Whole image	**autom.**	20.900	manual	0.010	manual	0.010

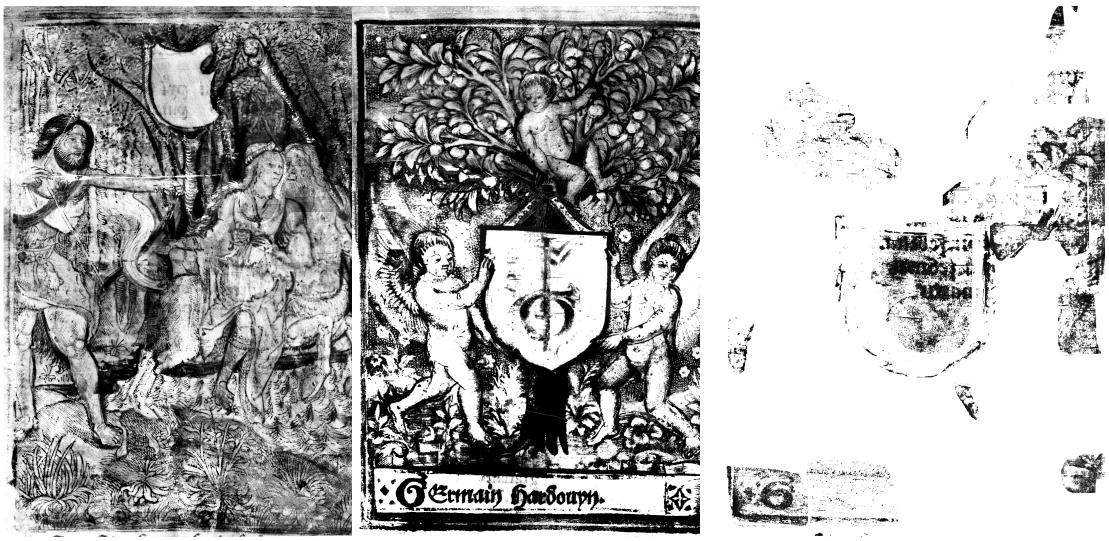
[49]The table below displays which reconstruction performed the best in individual comparisons. The full list of results is in Appendix F, Section F.

Table 3.2: Comparison of the quality assessment of geometric (rectangular) ROIs of the manual reconstructions and the automated reconstruction for one illustration in BPE, Inc. 438, fol. 8^{r}. The quality metrics are Mean Squared Error (MSE); 2-D correlation (2-D corr.); Structural Similarity Index Measure (SSIM). The *Result* column gives which method performed best for individual ROIs (value in cell), averaging all results (*Average*) and comparing the unsegmented reconstruction (*Whole image*). |Δ| refers the absolute difference of value between the manual reconstruction and the automated reconstruction. MSE, 1906 (± 82); 2D corr, 0.55 (± 0.02); SSIM, 0.95 (± 0.01). The full sets of results is given in Appendix F, Section F.4.2

	METHOD					
ROI	**MSE**		**2-D corr**		**SSIM**	
	Result	**|Δ|**	***Result***	**|Δ|**	***Result***	**|Δ|**
1	manual	0.000	**autom.**	0.009	manual	0.005
2	manual	10.000	manual	0.017	manual	0.080
3	manual	0.000	manual	0.067	manual	0.020
4	manual	0.000	manual	0.036	manual	0.040
5	manual	0.000	**autom.**	0.003	**autom.**	0.024
6	manual	0.000	manual	0.010	manual	0.000
7	manual	0.000	manual	0.016	manual	0.015
8	manual	0.000	**autom.**	0.031	**autom.**	0.121
9	manual	0.000	manual	0.016	manual	0.089
Average	manual	1.111	manual	0.013	manual	0.029
Whole image	**autom.**	20.900	manual	0.010	manual	0.010

At a close observation, Tables 3.1 and 3.2 extrapolate that the automated reconstructions are approximately as accurate as manual reconstructions, performing slightly better in some cases. The real difference between the two processes is the time it took to create each of them: the manual reconstruction took six hours for its creation, whereas the digital reconstruction was complete in only 0.5 hours. Thus, the algorithm yields a great gain in time efficiency.

Identification of the underprints The IR imaging data detected some compositions which differ significantly from the painted miniatures. Specifically, the automated software allowed reconstructing the outline of these underlying images, that are presented on Figure 3.8.



(a) Res. 326.v (b) Res. 328.v (c) Res. 5781.p

Figure 3.8: Automated digital reconstructions of the *Printer's device* obtained with the algorithm elaborated for the three case studies: a) Res. 326.v, fol. 1^{r}, b) Res. 328.v, fol. 1^{r}; Res. 5781.p, fol. 1^{r} © Silvia Bottura-Scardina.

Such a response is understood with a general look at the Kubelka-Munk model (often simplified as K-M model), a mathematical formalism that the physicist van Asperen de Boer adapted to study the interaction between IR light and the pictorial layers of painted objects while detecting any underlying drawing[50].

The model works on four initial assumptions: the first is that no specular reflective interaction occurs at each interphase. The second assumption is that the entire pictorial stratigraphy can be approximated to three main layers, namely a reflective ground, a back-backing and a single pictorial layer. All three levels are assumed to be homogeneous in composition, to have pigment grains of spherical shape, distributed randomly within a layer and with a grain size ranging much smaller than the thickness in which they are dispersed. The third assumption is that the surface morphology of each layer (ground, black-backing and pictorial layers) is ideally plain; in other words, every layer shows no roughness[51]. The final premise is that the ground reflects the entire amount of incoming

[50] See J.R.J. van Asperen de Boer. "Infrared Reflectography: a Method for the Examination of Paintings". In: *Applied Optics* 7.9 (1968), pp. 1711–1714. DOI: https://doi.org/10.1364/AO.7.001711. This section shall not perform a rigorous calculation of the K-M equations with reference to the three reflectographies from the three case studies. On the contrary, it aims at elucidating briefly the macroscopic interactions between a light beam and a painted object.

[51] These assumptions are to simplify the model and to make it empirically serviceable. The assumption that no specular reflection occurs at every interphase (atmosphere/pictorial layer, pictorial layer/black-backing and black-backing/ground) is to consider only the effects of isotropic reflection and extinction. The

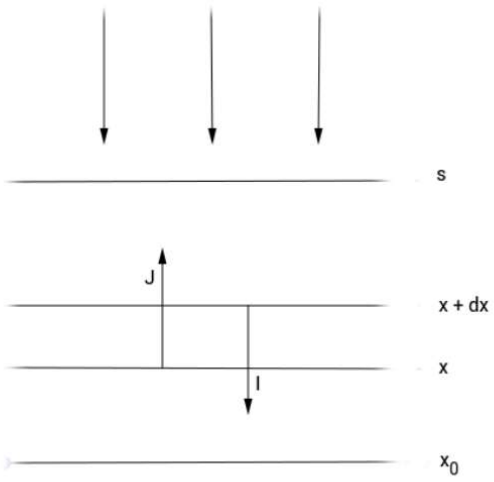


Figure 3.9: Representation of the simplified model for the interaction between an incident IR radiation on a general painted artwork and the artwork: I is the transmitted radiation, J the reflected radiation, x_0 the ground level, x the absorption level, x+dx is a level in the painted layer above x and s the surface level © Silvia Bottura-Scardina.

radiation, without interacting with it.

Under these assumptions, the simplified K-M model proposes that an incoming beam of IR rays toward a painted object undergoes several interaction at the painted surface, within the pictorial layer or beneath the paint. During its travel, the IR radiation is attenuated mostly by IR-absorbing materials, while it is fully reflected by a reflective ground. Figure 3.9 elucidates the phenomenon visually.

Where the diffuse reflectance R_∞ is given with the formula[52]:

$$R_\infty = 1 + \frac{k}{s} - \sqrt{\frac{k}{s}\left(2 + \frac{k}{s}\right)}$$

Also written as:

$$\frac{k}{s} \quad \frac{(1 - R_\infty)^2}{R_\infty}$$

assumption that the pictorial layers can be approximated to a sole, homogeneous layer is both to simplify the formalism and to neglect individual interactions at the interphase of every layer. Additionally, shape of a pigment is assumed to be spherical to neglect the directional interactions of a radiative source with a pigment; and the morphology of a layer to be plain to avoid calculating the preferential orientation of the light toward a certain direction. If the surface was not ideal, the first assumption that only isotropic reflection occurs would not be respected. Finally, this model is to consider as empirical and educational because of the high number of assumptions.

[52]From Asperen de Boer, "Infrared Reflectography: a Method for the Examination of Paintings".

with k as the absorption coefficient of the sample and s the scattering coefficient of the sample. In other words, the amount of radiation reflected is inversely proportional to the capability of the materials to attenuate the IR radiation, and directly proportional to the property of back-scattering the IR radiation to a recording device (like IR reflectographers). In most cases, the materials of the back-backing consist of amorphous or poorly crystalline elemental carbon, forming spherical particles in the 0.1 nm - 1 μ range, coalesced into aggregates of various shapes[53]. Because those materials absorb most or all NIR radiation, they produce a local attenuation of the incoming radiation when a preparation layer contains them.

Generally, artists employed C-based substances to sketch manually the outline of an artistic project to paint on—for instance, charred softwood was used in easel painting underdrawings[54]. Based on similar assumptions, the underprintings may include similar materials. Thus, the next section shall elucidate this point.

3.2.1.2 Printing materials

The printing materials have been characterised with p-XRF, μ-FTIR, Py-GC-MS and SEM-EDS. With these techniques, it was possible to advance a hypothesis about the composition of the materials employed to formulate the ink (binder, additives, chromophores). The results from p-XRF have been deconvoluted, and their Cu/Pb ratio been calculated and compared with the characterisation of printing inks of one page of the Hardouyn Hours in Évora (the BPE, Inc. 438, fol. 1^{r}). The second part of this section presents an experimental approach to perform semi-quantitative quantification and assess the thickness of the sub-level of printing inks with a non-invasive and in-situ approach. This methods employs the p-XRF data from the three Lisbon Hours with the item in Évora. For the latter, data was acquired from areas where the printing ink was exposed (hereafter unpainted areas). The unpainted areas correspond to regions where the printing ink of the initial engraving directly covers parts of the parchment ground while the coloured layers are superimposed to the engraved image. The reliability of each assay for the MC sim-

[53] John Winter. "The Characterization of Pigments Based on Carbon". In: *Studies in Conservation* 28.2 (1983), pp. 49–66. DOI: https://doi.org/10.1179/sic.1983.28.2.49.

[54] Helena Pinheiro de Melo et al. "Charcoal or Black Stone? Reconstructions as a Tool to Study the Behaviour of Dry Underdrawing Katerials within the Paint Structure of Sixteenth Century Panel Paintings". In: *Heritage* 10 (2022), p. 23. DOI: https://doi.org/10.1186/s40494-022-00649-x.

ulation was determined with MATLAB software, which extracted and colour-filtered the images of the XRF spot of analysis to express each as percentages of the overall analytical areas. The XRMC (X-ray coupled to Monte Carlo simulations) program was employed to build simulations of the XRF spectra. The comparison of the similarity between the measurements and the simulation was achieved visually.

The last part compares the information to elaborate final remarks for this section.

Identification of the components of the printing inks The μ-FTIR data of the micro-sample of the printing ink, collected from the Res. 5781.p (fol. 1^{r}), revealed several levels of information with reference to both its binding agent and extender (fig. 3.10).

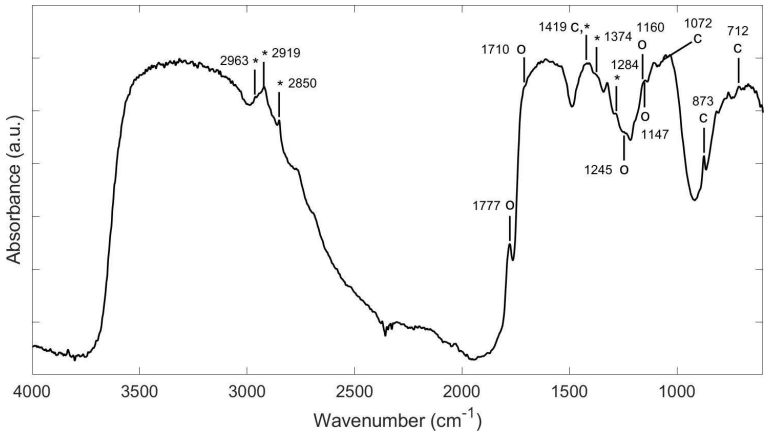


Figure 3.10: μ-FTIR spectrum of the printing ink from BPN, Res. 5781.p, fol. 1^{r}. The bands labelled with the asterisk marker (*) are those associated with aliphatic compounds; those labelled with circle marker (o) are those associated with oxidised species; those labelled with a c marker (c) are those associated with the the carbonate extender.

Concerning the binder, several features are consistent with the vibrational response of an aliphatic compound, as revealed by bands associated to residual methyl and methylene moieties. They appear at 2963, 2919, 2850, 1419, 1374, 1284 cm^{-1} , corresponding respectively to the stretching vibrations of the methyl [$\nu(CH_3)$], symmetric stretching vibrations of the methylene [$\nu_s(CH_2)$], asymmetric stretching vibrations of the methylene [$\nu_a(CH_2)$], bending vibration of the methylene δ(CH2) and the methyl $\delta(CH_3)$ and deformation of the methyl[55].

[55] Anna Schönemann et al. "Raman and FTIR microspectroscopic study of the alteration of Chinese tung oil and related drying oils during ageing". In: *Analytical and Bioanalytical Chemistry* 400.4 (2011), pp. 1173–1180. DOI: https://doi.org/10.1007/s00216-011-4855-0; Laurence de Viguerie et al. "The drying of linseed oil investigated by Fourier transform infrared spectroscopy: Historical recipes and

Furthermore, the substance may be at an advanced state of oxidation, given the presence of bands unveiling the formation of several oxidation products: esters (1777 [ν(C=O)], 1245 [ν(C-O)], 1160 cm^{-1} [ν(C-O), triglycerides ester linkage])[56]; acids (1710 [ν(C=O)], 1322 cm^{-1} [ν_s(C-O)]); ethers (1147 [ν_s(C-O), of C-O-C in ethers])[57]. Additionally, a strong, broad band appears in the region 1590-1640 cm^{-1}, being possibly related to conjugated double bonds, along with a global increase of the baseline in the 1300-1000 cm^{-1} range. Combined with the previous observations, all these features suggest the presence of fatty compounds at an advanced state of oxidation, like drying oils. This hypothesis finds further support in the presence of a very strong and broad band in the 3400-3100 cm^{-1} region: being related to the hydroxyl groups, it could be a marker of alcoholic species, which are a common intermediate and terminal primary and secondary product of autoxidation reactions[58].

Further bands from the μ-FTIR analysis indicate that other compounds were added to the binding agent. Some weak bands appear in the region 700-1400 cm^{-1}: 712, 873, 1072 and 1419 cm^{-1}. Traditionally, these features are associated to vibrations specific to certain carbonates, like chalk ($CaCO_3$): in-plane bending (ν4, 712 cm^{-1}), out-of-plane bending (ν2, 873 cm^{-1}), symmetric stretching (ν1, 1072 cm^{-1}) and asymmetric stretching modes (ν1, 1419 cm^{-1})[59]. A weak shoulder at 1798 cm^{-1} (ν1 + ν4)[60] seems to confirm the initial guess. However, the identification is not immediate: in fact, the vibration at 1419 cm^{-1} may be hampered by the dominant response of the binder (i.e. $\delta(CH_2)$), so this initial attribution awaits confirmation with other data. As for the first piece of evidence deduced

influence of lead compounds". In: *Progress in Organic Coatings* 93.2 (2016), pp. 46–60. DOI: https://doi.org/10.1016/j.porgcoat.2015.12.010.

[56] *Ibid.*

[57] Viguerie et al., "The drying of linseed oil investigated by Fourier transform infrared spectroscopy: Historical recipes and influence of lead compounds".

[58] The word *autoxidation* describes a complex series oxidative, cross-linking and cleavage of reactions between the unsaturated species of drying oils from a radical precursor. The reactions continue until evolving a fresh oil into an extended network. The literature about this chemical process is extensive; on a good review of this research, see Juita et al. "Low temperature oxidation of linseed oil: a review". In: *Fire Science Reviews* 1 (2012), p. 3. DOI: https://doi.org/10.1186/2193-0414-1-3.

[59] Martin P. Andersson et al. "Infrared Spectroscopy and Density Functional Theory Investigation of Calcite, Chalk, and CoccolithsDo We Observe the Mineral Surface?" In: *The Journal of Physical Chemistry A* 118.45 (2014), pp. 10720–10729. DOI: https://doi.org/10.1021/jp5053858; Xiang Wang et al. "High-temperature Raman and FTIR study of aragonite-group carbonates". In: *Physics and Chemistry of Minerals* 46 (2019), pp. 51–62. DOI: https://doi.org/10.1007/s00269-018-0986-6.

[60] Luca Nodari et al. "Non-invasive identification of paint binders in illuminated manuscripts by ER-FTIR spectroscopy: a systematic study of the infuence of diferent pigments on the binders' characteristic spectral features". In: *Heritage Science* 7 (2019), p. 7. DOI: https://doi.org/10.1186/s40494-019-0249-y.

from the μ-FTIR results, namely the presence of a drying oil, the Py-GC-MS results provided a substantial support to the initial guess (fig. 3.11)[61]. Here, three main peaks appeared at three retention times: 12.05, 13.53 and 13.72 min, and their characterisation with MS suggested that they could be interpreted as methyl esters of palmitic (P), oleic (O) and stearic acids (S)[62]. All these compounds are typical of drying oils, and their ratio are important clues of their composition and aging: in fact, the P/S ratio is typically employed to discriminate between the oils (linseed, walnut, poppyseed, etc.); being saturated, these monocarboxylic acids are less likely to be involved in the reaction of autoxidation, so their amounts stay unaltered upon aging. Additionally, the O/S ratio is another indicator of the ageing degree. As for the micro-sample from the Res. 5781.p, its P/S value is 2.54 while the O/S ratio is 0.36. According to the chemists Bonaduce and Andreotti, typical P/S values for linseed oil are around 1; for walnut oil, between 2.2 and 2.8[63]. Additionally, in aged paintings the O/S values are approximately 0.1-0.2. Thus, the medium could be either walnut oil or a blend of linseed oil and walnut oil; additionally, the O/S value is slightly higher than the suggested range. Thus, the sample contains more unsaturated moieties than expected from a mature oil, suggesting than its source could be a walnut oil.

[61] The analytical conditions of the Py-GC-MS analysis are described in Appendix F, Section F.2.1

[62] A *palmitic acid* is a monocarboxylic fatty acid with a backbone of sixteen carbon atom, and zero degree of unsaturation (C16:0); a *stearic acid* is another saturated fatty acid which counts eighteen carbon atoms (18:0). Finally, an *oleic acid* is a monocarboxylic fatty acid a backbone of eighteen carbon atoms and single degree of unsaturation (C18:1). The double bond of an oleic acid is located at C9, and the two aliphatic residuals are arranged to form a cis isomer in fresh oils. See also Juita et al., "Low temperature oxidation of linseed oil: a review".

[63] *Ibid.*

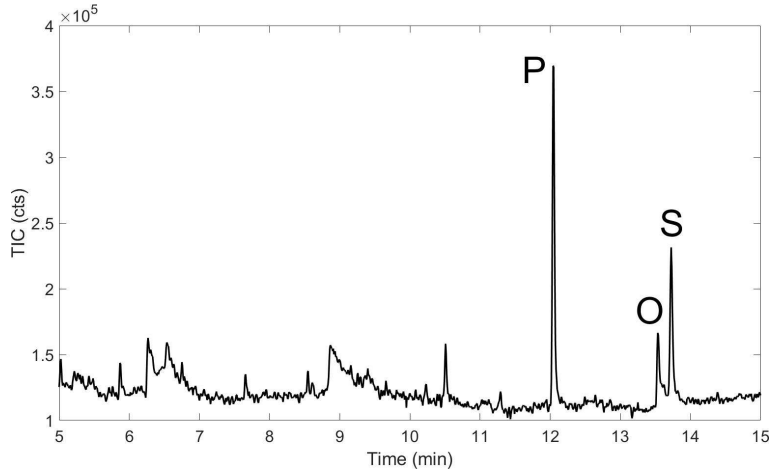


Figure 3.11: Py-GC-MS analysis of the printing ink from BPN, Res. 5781.p, fol. 1[r]. The bands labelled with the capital letter correspond to the species identified: *S*, stearic acid; *P*, palmitic acid, *O*, oleic acid.

The p-XRF and SEM-EDS data provided further information about the composition of the chromophore and the ink additives[64]. The elemental data from p-XRF was acquired from an unpainted area; later, it was deconvoluted and normalised[65] (fig. 3.12).

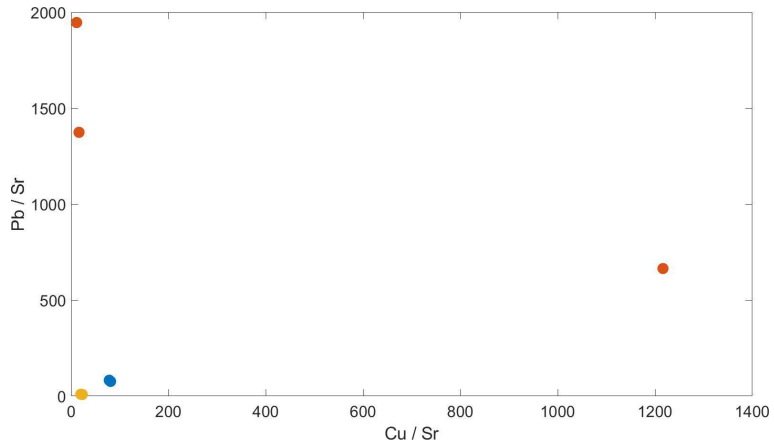


Figure 3.12: Sr-deconvolution of the p-XRF results of printing inks of BNP, Res. 5781.p and BPE, Inc. 438 to show the Cu/Pb ratio. In all cases, the analysis were taken by areas with crude ink. The blue dots represent the values for the parchment (reference), the yellow dots BNP, Re. 5781.p and the red ones BPE, Inc. 438.

Comparing those results with the parchment ground, both Cu and Pb occur at a significantly lower amount than the parchment ground, making it likely that they were not

[64]The analytical conditions of the p-XRF and SEM-EDS analysis are described in Appendix F, Section F.1.2.

[65]Conditions of acquisition included the signal from the atmosphere. Additionally, the following corrections have been applied upon deconvolution: escape peaks, shelf and background. The method applied was Bayes, calculating the net concentration of these elements: Al, Si, S, Cl, Ar, K, Ca, Mn, Fe, Ni, Cu, Sr, Rh, Sn, Ba, Au, Hg, Pb.

supplied to the binding agent[66]. This information is quite crucial: some scientific studies on the printing inks from leaves printed by several printing masters across Europe highlighted the common patterns of detecting high amounts of Cu and Pb[67]. This made the research team headed by Mommsen establishing a connection between the early printing tradition and the Renaissance tradition of painting, supposing that those printers actively supplemented lead compounds to vegetable oils. Renaissance artists knew from empirical knowledge that processing oils with lead compounds reduced the drying time[68], and early printers may have applied the same reasoning to printing inks. However, this may not be the case for the ink adopted to print the Res. 5781.p, because neither Cu nor Pb occur at substantial quantities.

However, some slight amounts of Cu appear in the elemental analysis of the micro-sample with SEM-EDS (0.13-1.44 at. wt %). However, no Pb was detected. Thus, it is possible that some Cu-based substance may have been supplied, yet not at the same proportions detected in relation to other workshops[69].

. The SEM-EDS results of the micro-sample allowed discriminating the pigment used to give the black colour: the elemental composition indicated some amounts of N, Na, Mg, Al, Si, S, Cl, K, Ca and Fe (tab. 3.3).

[66] The p-XRF analysis were acquired by placing a Sn sheet below the miniatures in the view of performing future work of non-destructive and in-situ semi-quantification based on the same approach adopted in the p-XRF/Monte Carlo studies in the next section.

[67] Cahill et al., "Gutenberg's inks and papers: nondestructive composition analyses by proton milliprobe"; Mommsen et al., "X-ray Fluorescence Analysis with Synchrotron Radiation on the Inks and Papers of Incunabula"; Peter Zahn. "Printer's inks and papers in early incunabula under synchrotron light (SYXRF) [article] A project in progress". In: *Gazette du livre médiéval* 21 (1992), pp. 18–29.

[68] Artists developed the practice of pre-processing oils before applying them as binding agents as early as the twelfth century. The team headed by Viguerie reminds that Eraclius advised to prepare the oil for "tempering colours" by boiling it with lime, supplement lead white and thicken it by exposure to sunlight. See Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*; Viguerie et al., "The drying of linseed oil investigated by Fourier transform infrared spectroscopy: Historical recipes and influence of lead compounds". In the Renaissance, oils were treated thermally with either litharge, lead white, red lead (Pb_3O_4) or zinc sulfate ($ZnSO_4$). Viguerie et al., "The drying of linseed oil investigated by Fourier transform infrared spectroscopy: Historical recipes and influence of lead compounds"; Charles S. Tumosa et al. "The influence of lead ions on the drying of oils". In: *Studies in Conservation* 50.sup. 1 (2005), pp. 39–47. DOI: https://doi.org/10.1179/sic.2005.50.Supplement-1.39. This fact finds support in the frequent efflorescences of lead aggregates (Zn in the contemporary) in fifteenth- and sixteenth-century easel paintings. Conservators and scientists proposed that source of widespread lead were compounds being intentionally supplemented to the binder rather than degradation products of those paints. Accordingly, these scholars proposed that Renaissance artists were aware of the property of lead to promote the reactions of autoxidation and cross-polymerisation of alkyd media.

[69] Cahill et al., "Gutenberg's inks and papers: nondestructive composition analyses by proton milliprobe"; Mommsen et al., "X-ray Fluorescence Analysis with Synchrotron Radiation on the Inks and Papers of Incunabula".

Table 3.3: EDS results of the ink from Res. 5781.p. The values of the sample area compared with the EDS analyis on a commecial graphite refence. The right column gives the EDS data uses the data reported by Tomasini et al., 2012. https://doi.org/10.1016/j.microc.2011.11.005.

Element	Amount (at. %)	
	Res. 5781.p	*Reference*
C	46.01	*47.46*
O	30.86	*41.53*
N	10.95	-
Ca	3.31	-
Na	2.56	-
Si	2.07	*7.98*
Al	1.91	*1.52*
Cu	0.74	-
Fe	0.46	*1.57*
K	0.3	-
S	0.35	-
Cl	0.3	-
Mg	0.18	*0.23*

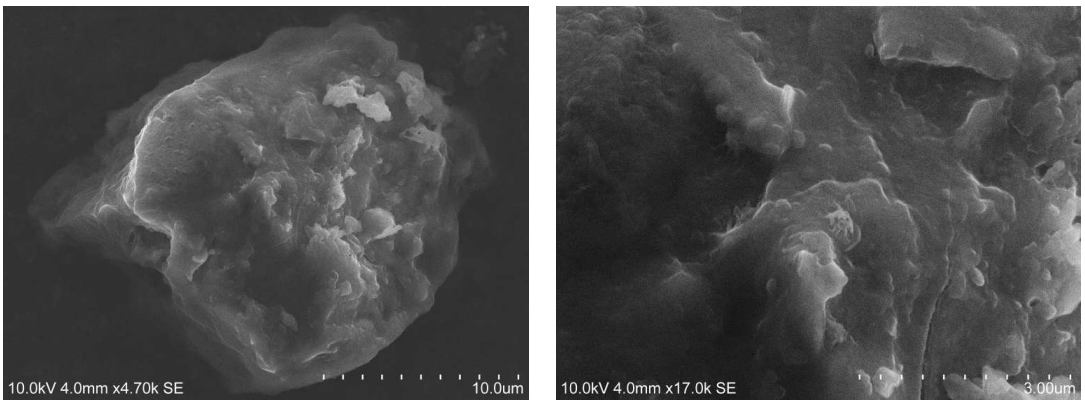
As Table 3.3 illustrates[70], the amounts as calculated with SEM-EDS semi-quantification[71] are in good agreement with literature data on graphite, a crystalline form of carbon[72]. Among these elements, high amounts of Si, Fe, Al and Mg have typically observed in association with this carbon-based material as residual clays or oxides[73]. Another feature that the black pigment shares with graphite, is its morphological pattern: the SEM micrographs of the micro-sample from the Res. 5781.p (fol. 1^{r}) show a highly disordered structure with a massive grain, on whose surface grow nanoscopic, quasi-globular accretions in cluttered fashion (150-300 nm average diameter, fig. 3.13b).

[70]The values indicated in the as the reference for graphite are from Eugenia Tomasini et al. "Spectroscopic, morphological and chemical characterization of historic pigments based on carbon. Paths for the identification of an artistic pigment". In: *Microchemical Journal* 102 (2012), pp. 28–37. DOI: https://doi.org/10.1016/j.microc.2011.11.005.

[71]The evaluation of the quantities from SEM-EDS is to consider as semi-quantitative because the concentrations have been calculated with the standardless method.

[72]This section adopts the classification of carbon-based pigments proposed by Winter, "The Characterization of Pigments Based on Carbon".

[73]Tomasini et al., "Spectroscopic, morphological and chemical characterization of historic pigments based on carbon. Paths for the identification of an artistic pigment".

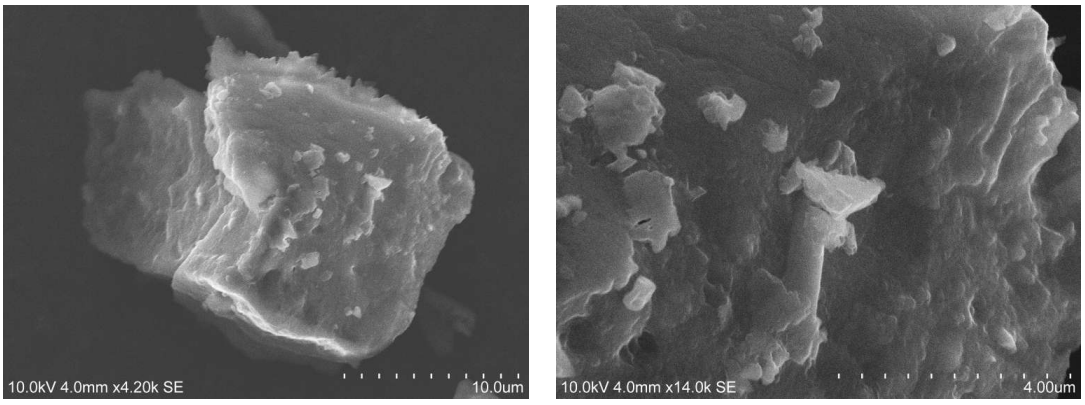


(a) (b)

Figure 3.13: SEM micrographs of the ink micro-sample from Res. 5781.p taken in SE mode: a) entire grain analised; b) detail of the micro-topography © HERCULES Laboratory.

Given so, the microscopic images do not show any spherical structure with smooth surface, which would be typically found in non-crystalline carbons like carbonisation products. This fact persuades on the use of a mineral form of carbon, like graphite.

Regarding the plausibility of the presence of chalk as an additive, the SEM-EDS results show indeed that some microscopic particles (2 μm width, fig. 3.14) contain slightly higher amounts of Ca (2.67-7.53 at. wt. %) and Mg (0.6-1.38 at. wt. %, see tab. 3.4)[74].



(a) (b)

Figure 3.14: SEM micrographs of an ink micro-sample with possible traces of the extender visible in the acquisitions at higher magnification, from Res. 5781.p taken in SE mode: a) entire grain analised; b) detail of the extender © HERCULES Laboratory.

[74]The Mg should be associated to these particles since its amount in other areas is significantly lower (0.38 at. wt. %).

Table 3.4: Semi-quantitative EDS analysis of the printing ink from BNP, Res. 5781.p, fol. 1^{r}, expressed in normalised counts (left column), with quantification based on the K-series of the elements, except for Cu and Hg, for which the L-series and the M-series were used respectively. Confidence interval is expressed as standard deviation (1σ) of the atomic weight (wt%).

Element	**Norm. counts (at. %)**	**Error (wt%**
C	51.09	0.01
O	20.47	0.01
N	19.44	0.01
Cu	1.44	0.01
Na	2.94	0.01
Ca	1.24	0.01
Al	0.97	0.01
S	0.63	0.01
Cl	0.37	0.01
Fe	0.22	0.01
K	0.32	0.01
Mg	0.38	0.01
Si	0.27	0.01
P	0.19	0.01

SEM micrographs show that these structures lack a clear crystalline form, impeding to deduce a conclusive argument about their presence or source.

The results of this study were compared with the SEM-EDS and μ-FTIR results from micro-samples of the printing inks of other leaves (fols. 11^{r}, 47^{v}) collected from the BPE, Inc. 438 during the M.Sc.'s research work[75]. According to EDS analysis on these other samples (tab. 3.4), two distinct areas appear, one enriched in copper and lead while the other is intensive in phosphorus, calcium and other light elements-Na, Si, Al. SEM analysis showed that the specific micro-structure of the P and Ca-rich area consisted of amorphous crystals with lamellar-to-angular shape of microscopic size, with round nano-metric particles clustered on the surface of the larger crystals (fig. 3.15).

[75] Bottura-Scardina, *The Technique of Illumination in the Transition from the Manuscript to the Incunabulum in Paris: A Case-Study on a Specimen from the Public Library of Évora*.

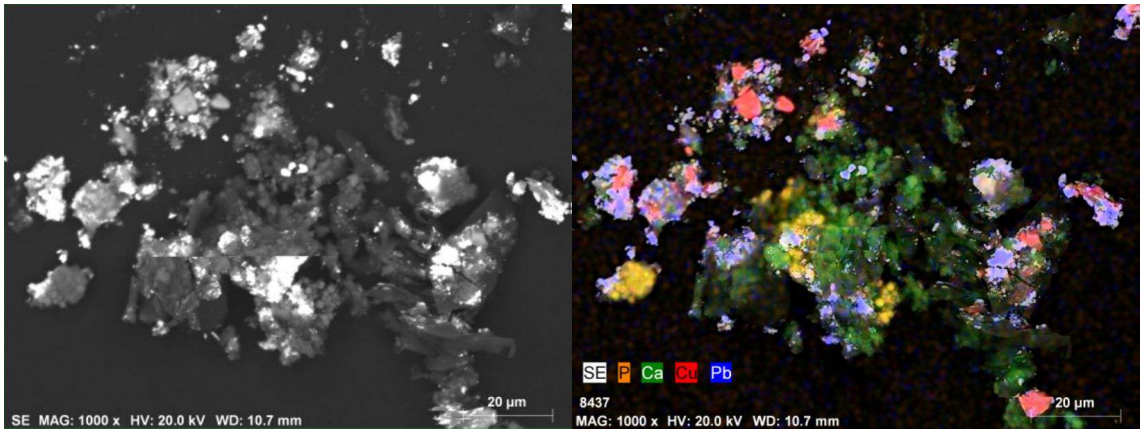


Figure 3.15: SEM micrographs of the printing inks at x1.0k magnification. From left to right: image in SE mode of a micro-sample from a leaf of Inc. 438, SE-EDS image of the micro-sample with mappig superimposed for the following elements: P, Ca, Cu and Pb © HERCULES Laboratory.

The two conditions of abundance of calcium and phosphorus and the specific micro-configuration are compatible with hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$), the inorganic component of bone black pigment[76]. The IR spectrum of representative micro-samples displays bands at 1450, 1417 and 875 cm^{-1} (fig. 3.16), which also belong to carbonated hydroxyapatite[77]. However, three strong bands centred at 1658, 1550, 1230 cm^{-1}, respectively attributed to the amide I (peptide C=O stretching vibration, weakly coupled with C-N stretch and N-H bending), amide II (combination of the C-N stretch strongly coupled to N-H in-plane bending modes) and amide III vibrations (N-H in-plane bending coupled to C-N stretch with C-H and N-H deformations)[78], may belong to residual collagen. Some studies on bone tissue and bone-based materials assign it to bone tissue residuals surviving the combustion[79] and would further support the identification of this carbon-based pig-

[76]Tomasini et al., "Spectroscopic, morphological and chemical characterization of historic pigments based on carbon. Paths for the identification of an artistic pigment".

[77]Michael E. Fleet. "Infrared spectra of carbonate apatites: 2-Region bands". In: *Biomaterials* 30.8 (2009), pp. 1473–1481. DOI: https://doi.org/10.1016/j.biomaterials.2008.12.007.

[78]Vera Balan et al. "Vibrational Spectroscopy Fingerprinting in Medicine: from Molecular to Clinical Practice". In: *Materials* 12.18 (2019), p. 2884. DOI: https://doi.org/10.3390/ma12182884113-116; Bal R. Singh et al. "Fourier transform infrared analysis of amide III bands of proteins for the secondary structure estimation". In: *Biomolecular Spectroscopy III*. vol. 1890. OE/LASE'93: Optics, Electro-Optics, and Laser Applications in Scienceand Engineering. Los Angeles, CA: SPIE, 1993. DOI: https://doi.org/10.1117/12.145242. Balan et al., "Vibrational Spectroscopy Fingerprinting in Medicine: from Molecular to Clinical Practice"; Singh et al., "Fourier transform infrared analysis of amide III bands of proteins for the secondary structure estimation".

[79]Nikolaos Kourkoumelis et al. "Fourier Transform Infrared Spectroscopy of Bone Tissue: Bone Quality Assessment in Preclinical and Clinical Applications of Osteoporosis and Fragility Fracture". In: *Clinical Reviews in Bone and Mineral Metabolism* 17 (2019), pp. 24–39. DOI: https://doi.org/10.1007/s12018-018-9255-y; Tomasini et al., "Spectroscopic, morphological and chemical characterization of historic pigments based on carbon. Paths for the identification of an artistic pigment".

ment. However, it is also equally probable that collagen might not belong to the pigment. In the process of separating a small portion of ink from the ground as the micro-sample, extreme attention was paid in ensuring to remove only the desired material. Nevertheless, a minimal portion of collagen from the parchment sheet may have been collected as well. As the result, this minimal parchment portion could act as a contaminant to the IR spectrum, reinforcing the amide vibrations of the collagen moieties.

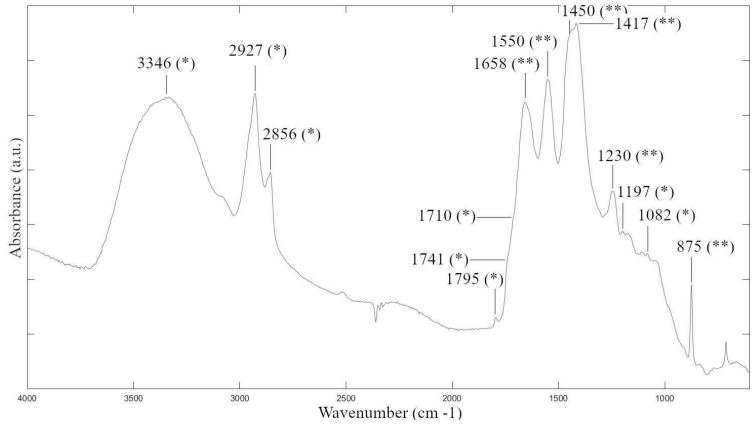


Figure 3.16: μ-FTIR spectrum of the printing ink in BPE, Inc. 438, evidencing the IR bands characteristic of the oil binder (*) and of the bone pigment (**).

Although sharp, the three IR bands of the amides can also bring information of further components. The broad peak at 3346 cm^{-1} belongs to the stretching vibration of hydroperoxides[80]; together with the very weak vibrations at 2965 cm^{-1} [$\nu(CH_3)$], the peaks at 2927 and 2856 cm^{-1} [$\nu_s(CH_2)$ and $\nu_a(CH_2)$][81]. In the region between 1800-1680 cm^{-1}, a series of complicated, weak vibrations broaden the base of the next peak centred at

[80] Schönemann et al., "Raman and FTIR microspectroscopic study of the alteration of Chinese tung oil and related drying oils during ageing".

[81] Massimo Lazzari et al. "Drying and oxidative degradation of linseed oil". In: *Polymer Degradation and Stability* 65.2 (1999), pp. 303–313. DOI: https://doi.org/10.1016/S0141-3910(99)00020-8; Jacky Mallégol et al. "Long-term behavior of oil-based varnishes and paints I. Spectroscopic analysis of curing drying oils". In: *Journal of the American Oil Chemists' Society* 76.8 (1999), pp. 967–976. DOI: https://doi.org/10.1007/s11746-999-0114-3; Raymond J. Meilunas et al. "Analysis of aged paint binders by FTIR spectroscopy". In: *Studies in Conservation* 35.1 (1990), pp. 33–51. DOI: https://doi.org/10.1179/sic.1990.35.1.33; Jorrit D.J. van den Berg et al. "Effects of traditional processing methods of linseed oil on the composition of its triacylglycerols". In: *Journal of Separation Science* 27.3 (2004), pp. 181–199. DOI: https://doi.org/10.1002/jssc.200301610.

1658 cm^{-1} (1795[82], 1741[83] and 1710 cm^{-1}[84]) are stretching of C=O functional group. At lower wavenumbers, a series of vibrations, namely 1197[85], 1170[86], 1082 cm^{-1} [87], are the stretching modes of C-O. All these vibrations have been observed to belong to drying oil binder IR spectra, where the last two groups falling in the regions 1800-1680 cm^{-1} and 1200-1080 cm^{-1} is related to the formation of secondary oxidation products, ester and triglyceride ester linkage as part of the curing reaction of drying oils[88].

Being triacylglycerides employed as the vehicle, the printing ink of Inc. 438 could be an oil-based medium, in agreement which result agrees with the information reported in other 16th-century recipes and documents[89]. A part of the historical recipes recommends adding rosin to the compound; unfortunately, the area that fingerprints its presence(the region falling in the range 1800-1680 cm^{-1}[90]) offers no visible trace.

Copper and lead from EDS analysis (tab. 3.5) could not be detected from the IR spectrum. Nonetheless, their presence is compatible with previous observations on early typographic inks[91]. Some of these studies on the preparation of historical drying oils for paint-

[82] Meilunas et al., "Analysis of aged paint binders by FTIR spectroscopy".

[83] S. Boyatzis et al. "UV exposure and temperature effects on curing mechanisms in thin linseed oil films: Spectroscopic and chromatographic studies". In: *Journal of Applied Polymer Science* 84.5 (2002), pp. 936–949. DOI: https://doi.org/10.1002/app.10117; Lazzari et al., "Drying and oxidative degradation of linseed oil"; Meilunas et al., "Analysis of aged paint binders by FTIR spectroscopy"; Schönemann et al., "Raman and FTIR microspectroscopic study of the alteration of Chinese tung oil and related drying oils during ageing"; Berg et al., "Effects of traditional processing methods of linseed oil on the composition of its triacylglycerols".

[84] Meilunas et al., "Analysis of aged paint binders by FTIR spectroscopy".

[85] Mallégol et al., "Long-term behavior of oil-based varnishes and paints I. Spectroscopic analysis of curing drying oils".

[86] Zahit O. Oyman et al. "Oxidation of drying oils containing non-conjugated and conjugated double bonds catalyzed by a cobalt catalyst". In: *Progress in Organic Coatings* 54.3 (2005), pp. 198–204. DOI: https://doi.org/10.1016/j.porgcoat.2005.06.004.

[87] Mallégol et al., "Long-term behavior of oil-based varnishes and paints I. Spectroscopic analysis of curing drying oils".

[88] Viguerie et al., "The drying of linseed oil investigated by Fourier transform infrared spectroscopy: Historical recipes and influence of lead compounds".

[89] Girolamo Ruscelli. *Secreti del Reverendo Donno Alessio Piemontese: Nuovamente posti in luce. Opera vtile, et necessaria universalmente à ciascuno.* Available at: https://www.digitale-sammlungen.de/en/view/bsb10202339?page=4,5 (Accessed January 27, 2022). Venezia: Sigismondo Bordogna, 1555; Stijnman, *Engraving and Etching, 1400-2000: A History of the Development of Manual Intaglio Printmaking Processes*.

[90] Dominique Scalarone et al. "Ageing behaviour and pyrolytic characterisation of diterpenic resins used as art materials: colophony and Venice turpentine". In: *Journal of Analytical and Applied Pyrolysis* 64.2 (2002), pp. 345–361. DOI: https://doi.org/10.1016/S0165-2370(02)00046-3.

[91] Cahill et al., "Gutenberg's inks and papers: nondestructive composition analyses by proton milliprobe"; Mommsen et al., "X-ray Fluorescence Analysis with Synchrotron Radiation on the Inks and Papers of Incunabula".

Table 3.5: Semi-quantitative EDS analysis of the printing ink in BPE, Inc. 438, fol. 65^{v} expressed in normalized counts (left column), with quantification based on the K-series lines of the mentioned elements (except for Pb, for which the L-series lines were used). Confidence interval is expressed as standard deviation (1σ) of the atomic weight (wt%).

Element	Norm. counts (%)	Error (wt%)
Na	3.4	0.1
Al	2.3	0.1
Si	2.1	0.1
P	2.4	0.1
Ca	38.1	0.5
Cu	11.8	0.2
Pb	40.0	0.7

ing described the intentional supplementing of metal compounds either as solubilised in boiling oils or added to cold oils[92]: transition metals act as catalysing agents of the cross-polymerisation process that enables a liquid oil to evolve into a semi-solid, flexible film (curing process) at a much enhanced rate than without[93]. Early workers found that in the range 1.0-2.0% metal per oil (wt), lead compounds performed the best[94].

Combining together the results from the BNP, Res. 5781.p and BPE, Inc. 438, it appears that the Hardouyn workshop employed two different kinds of formulations: on the one side, an ink with no drier, graphite and possibly a carbonate extender; on the other side, a compound with ivory black and important amounts of drier.

Monte Carlo simulations for thickness assessment (printing inks) XRMC modelled a pattern of MC simulation for the unpainted areas of BPE, Inc. 438, fol. 1^{r} (fig. 3.17), being a two-layer model: layer one, parchment ground; layer two, ink layer.

The reference model used as initial guess model for XRMC was calibrated on a 1:1 P/B ratio for the printing ink (50% black pigment in drying oil) and a thickness of 1 mm for the parchment. The choice for the proposed amount of black pigment in the alkyd binder was set to the maximum limit of the accepted concentrations of an oil-based carrier phase,

[92] Tumosa et al., "The influence of lead ions on the drying of oils".
[93] Juita et al., "Low temperature oxidation of linseed oil: a review".
[94] *ibid.*.

namely 30-50%[95]. XRMC determined initially an average level of 20 μm thickness for the first layer and 40 μm for the second on the simulated spectra. Each layer was assumed as homogeneous and even for the calculation.

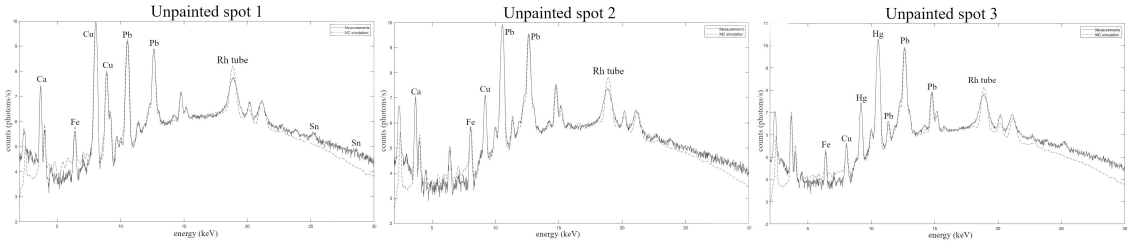


Figure 3.17: P-XRF spectra vs Monte Carlo simulations, presented against real measurements.

The simulated spectra background could not provide a good fitting with the background of the measured spectrum at low energies. This is mainly due to the influence of the electronic noise of the detector which produce a background that cannot be attributed to the excitation spectrum emitted from the X-ray tube[96]. Despite the limitation, the peaks of the major elements - such as Ca, Fe, Cu, Hg, Pb - and the background from 5 keV onward generally conformed to the real measurements. In addition, MC simulations provided a better fit when lead and copper were assigned to the printing ink layer as well as calcium. Little mercury had to be assigned to the ink layer of point 1 simulation too.

The same level of thickness was calculated in the remaining assays. The XRMC spectra could simulate for the blue and green spots spectra matching the simulations in a similar way as the red one.

All unpainted areas show a similar profile: Cu, Pb, Fe appear in the spectrum with the difference being their proportion. In one unpainted spot, the quantity of copper is bigger than lead, while in the rest the trend is the opposite. However, XRMC also allowed to provide some compositional data (table 3.6).

[95] Sanna M. Rousu et al. "Influence of Coating Pigment Chemistry and Morphology on the Chromatographic Separation of Offset Ink Constituents". In: *The science of papermaking*. 12th Fundamental Research Symposium, Oxford, September 2001. Manchester: FRC, 2018, pp. 1115–1147. DOI: https://doi.org/10.15376/frc.2001.2.1115

[96] Bruno Lemière. "A review of pXRF (field portable X-ray fluorescence) applications for applied geochemistry". In: *Journal of Geochemical Exploration* 188 (2018), pp. 350–363. DOI: https://doi.org/10.1016/j.gexplo.2018.02.006.

Table 3.6: Quantitative layer composition with the statistical error evaluated through Monte Carlo simulations, with confidence interval for the measures on BPE, Inc. 438 expressed as the previously proposed margin of uncertainty (10% of the atomic weight), 1σ for the reference values; only elements significantly detected as part of each layer (= value > limit of detection) are quoted. The considered values for the ink layers are devoid of the outliers (Cu for spot 1; Pb for spot 2 and 3).

Source	**Amount (wt %)**					
	Ca	*Ti*	*Fe*	*Cu*	*Pb*	*Cu/Pb*
Inc. 438, ink layers	-	-	0.06 ± 0.01	0.06 ± 0.01	0.06 ± 0.01	0.10 ± 0.01
Inc. 438, P in Red	2.50 ± 0.25	-	-	0.60 ± 0.06	0.60 ± 0.06	1.0 ± 0.1
Inc. 438, P in Green	3.50 ± 0.35	-	-	0.40 ± 0.04	0.60 ± 0.06	0.67 ± 0.07
Inc. 438, P in Blue	3.50 ± 0.36	-	-	0.40 ± 0.04	0.60 ± 0.06	0.67 ± 0.07

Table 3.7: Quantitative layer composition with the statistical error and value of thickness evaluated through Monte Carlo simulations of the p-XRF analysis spots. Confidence interval is calculated as the margin of uncertainty presented in the section of p-XRF and Monte Carlo methods (10% of the atomic weight); only elements significantly detected as part of each layer (= value > limit of detection) are quoted. The value of thickness of the simulation is presented against the calculated thickness from micro-samples from several leaves of Inc. 438. List of abbreviations: NoP = No paint p-XRF analysis spot, P.I = p-XRF-MC simulation of the printing ink layer, E.T. = thickness of the layer assessed through XRMC (μm), M.T. = thickness of the micro-sample (minimum value-maximum value, both in μm), Fol. = folium from which the micro-sample was collected.

Spot	**Layer**	**E.T.**	**M.T.**	**Fol.**	**Amount (wt %)**									
					S	*Ca*	*Ti*	*Fe*	*Cu*	*Sn*	*Br*	*Au*	*Hg*	*Pb*
NoP 1	P.I.	30 μm			-	-	-	0.080 ± 0.008	4.9 ± 0.5	0.30 ± 0.03	-	-	-	0.62 ± 0.06
NoP 2	P.I.	40 μm	32-38 μm	47v	-	-	-	0.050 ± 0.005	0.050 ± 0.005	-	-	-	0.050 ± 0.005	5.5 ± 0.6
NoP 3	P.I.	20 μm			-	-	-	0.050 ± 0.005	0.070 ± 0.007	-	-	-	0.08 ± 0.01	10 ± 1

As for the calculated level of thickness (Table 3.7), the XRMC software computed various levels comprised in the range 20-40 μm for all layers: coloured paints, printing inks below the paints (of the three-layer model) and uncovered inks (of the two-layer model). Therefore, these results are comparable, they consistently fall in a similar range and are supported by the analysis on micro-samples from the other leaves. The SEM images of small samples of printing inks, as well as green and red paints (fols. 11^{r} and 47^{v}) reveal indeed a range of 32-38 μm for the uncovered ink layer, 23-34 μm for the green paint and 32-47 μm for the red paint (no good reference for the sample for the blue paint was available). At an overall consideration, the extreme range for all pictorial layers from the SEM images is 23-47 μm, which is consistent with the range proposed through the MC simulations. The range obtained through the MC simulations is slightly broadened when the large uncertainty is considered and extends to 10-50 μm, but it is still

compatible with the reference values (23-47 μm, SEM images).

In conclusion, the 10-50 μm range for the thickness of the printing inks in BPE, Inc. 438 seems to be uniform across the entire books. Hopefully, this value could be an indicator of the inking precision of the Hardouyn work[97].

3.2.2 Illuminating technique

The materials employed for the painting phase of decoration of the Hardouyn Hours were characterised with a multi-analytical approach of non-destructive and in-situ techniques: UV-Vis-NIR FORS for the characterisation of the molecular palette, p-XRF for the elemental determination and Vis-NIR HSI for the assessment of the extent of use of the proposed chromophores. Additionally, the blue pigments showed the highest degree of crystallinity among all colourants detected. Thus, the optical effects of their grain size were studies only for this class of paints with an innovative approach elaborated specifically for this research work (DM-IP[98]).

3.2.2.1 Materials of painting

Blue paints Analytical data were acquired from the blue paints across all illustrations under investigation[99]. Diffuse reflectance spectra in the visible range (Vis range, 380-780 nm) showed a major band of reflectance centred around *c.* 400-500 nm in all cases but one (Res. 5781.p, fol. 29^{v}, spot 1, fig. 3.18a).

In the darkest paints, the position of the band falls at shorter wavelengths (*c.* 460 nm) while the lighter spots exhibit the same feature at longer wavelengths, being it shifted to *c.* 500 nm (Table 3.1)[100]. Besides, those data further display a max of absorbance in the region 570-670 nm, which precede an absorbance plateau located the 740-880 nm range.

[97] Future work on other Hardouyn Hours will study the thickness of other inks in the view of confirming this hypothesis.

[98] Digital Microscopy coupled with Image Processing for the assessment of the particle size distribution.

[99] The spots of analysis for the blue paints are indicated in Appendix F, Section F.3.

[100] See later in Table 3.9

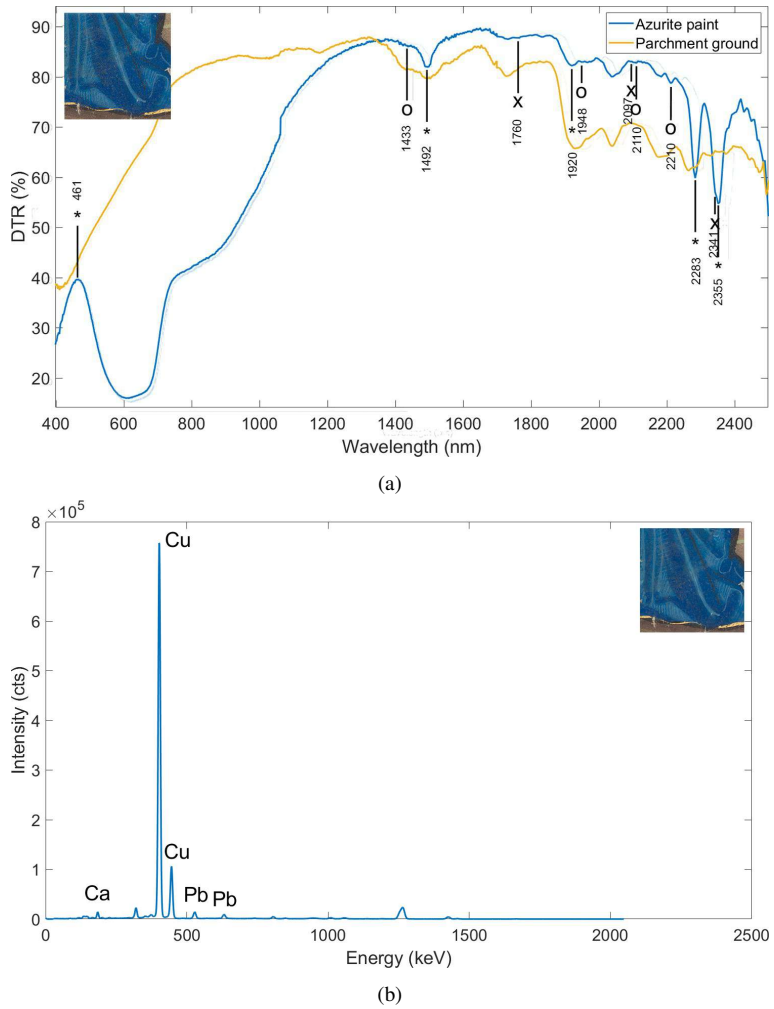


Figure 3.18: Sample spectra for azurite paints across the case studies: a) UV-Vis-NIR FORS spectrum (blue solid line) compared with the parchment ground (yellow solid line; Res. 326.v, fol. 46^{r}, spot shown on the top). The bands associated to the pigment are labelled with an asterisk marker (*); for the extender(s), the circle marker (o). Data expressed as Diffuse Reflectance Factor (DRF, %) and wavelength (nm). b) XRF reference spectrum (spot 1, Res. 326.v, fol. 46^{r}, shown on the top).

These features are compatible with the visible (Vis) spectrum of azurite. Azurite ($2CuCO_3{\cdot}Cu(OH)_2$), also known as *azure ore*, is a blue mineral used for colouring purposes in art. This mineral occurs in association with weathered copper ores in which acidic aqueous solutions meet copper at its native state (as a metal)[101]. One of the locations for its widest distribution for medieval Europe was Chessy, near Lyon, France[102]. Mineralogically speaking, azurite is an idiochromatic mineral[103]. In fact, it is commonly

[101] Cornelis Klein. *Manual of mineralogy*. After James D. Dana. New York, NY: Wiley, 1993, pp. 417-418.

[102] See Klein, *Manual of mineralogy*, p. 417. The ore deposit of Chessy-les-Mines was mined for copper from the Middle Ages until 1875 (Guedes De Ascenção. *Mines et minéraux de Chessy (Rhône)*. Monistrol-sur-Loire: Edition du Piat, 2003, pp. 46–85).

[103] Namely, its colour is a constant property which does not change among its several crystallographic

identified through a characteristic reflectance peak in the blue region (440-490 nm), sometimes through an additional absorption band in the red region (more precisely, around 640 nm). Both those features are related to the 3d electronic transitions of of Cu^{2+} in square planar coordination with O and OH ions[104]. More absorption bands occur in the 600-840 nm range, corresponding to $^2B_1 \rightarrow {}^2A_1$ and $^2B_1 \rightarrow {}^2E$ transitions[105].

Further spectral features arise in the NIR region (780-2500 nm), which reveal the vibrational absorption bands arising from the overtones and combination bands of fundamental bands. In this range, azurite produces characteristic absorption bands related to the carboxyl groups (-CO_3) and hydroxyl groups (-OH) of the structural water of its crystalline lattice. Among these, the most notable is a duplet of very sharp absorption bands at 2283 nm and 2355 nm, which have been assigned respectively to the combination of stretching and bending modes of the hydroxyl group [(ν + δ)-OH] and to the second overtone of the stretching mode of carbonates [$3\nu(CO_3)$][106]. Another, less intense vibrational absorption feature appears at *c.* 1495 nm, which has been attributed to the first overtone of the hydroxyl group [2ν(OH)[107]].

The hypothesis on the use of azurite finds support in the X-ray Fluorescence Spectroscopy (XRF) results: all spectra acquired for the blue paints are strongly enriched in copper (fig. 3.18b) through the Kα and Kβ lines of Cu (8.04 keV and 8.09 keV).

Not only Diffuse reflectance (DR) spectra allowed to characterise the blue colourant applied to nearly all miniatures as azurite, but it also offered other pieces of information.

forms.

[104] Kurt Nassau. "The origin of color in minerals". In: *American Mineralogist* 63.3-4 (1978), pp. 219–229; B. Jagannadha Reddy et al. "Absorption spectra of Cu^{2+} in azurite". In: *Solid State Communications* 38.6 (1981), pp. 547–549. DOI: https://doi.org/10.1016/0038-1098(81)90434-8.

[105] Reddy et al., "Absorption spectra of Cu^{2+} in azurite".

[106] Kathryn A. Dooley et al. "Mapping of egg yolk and animal skin glue paint binders in Early Renaissance paintings using near infrared reflectance imaging spectroscopy". In: *Analyst* 138 (2013), pp. 4838–4848. DOI: https://doi.org/10.1039/c3an00926b; Ray L. Frost et al. "Identification of the rosasite group mineralsAn application of near infrared spectroscopy". In: *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy* 66.4 (2007), pp. 1075–1081. DOI: https://doi.org/10.1016/j.saa.2006.04.043; Costanza Miliani et al. "In situ noninvasive study of artworks: the MOLAB multitechnique approach". In: *Accounts of chemical research* 43.6 (2010), pp. 728–738. DOI: https://doi.org/10.1021/ar100010t; Costanza Miliani et al. "Reflection infrared spectroscopy for the non-invasive in situ study of artists' pigments". In: *Applied Physics A* 106 (2012), pp. 295–307. DOI: https://doi.org/10.1007/s00339-011-6708-2.

[107] Graham R. Hunt. "Spectral Signatures of Particulate Minerals in the Visible and near Infrared". In: *Geophysics* 42 (1977), pp. 501–513. DOI: https://doi.org/10.1190/1.1440721;Dooley et al., "Mapping of egg yolk and animal skin glue paint binders in Early Renaissance paintings using near infrared reflectance imaging spectroscopy".

One of these is a rough estimate of the particle size distribution (PSD) based on the band of the blue region. Its sharpness mirrors in a higher elevation (peak height) and the greater area of the above peak[108]. If those values are relatively large, they should follow a higher frequency of coarser grains. To validate the hypothesis, these three values (PSD, peak height and peak area) are studied for the blue paints across the case studies, and their values are presented in Table 3.7. While analysing the vibrational response of two different qualities of laboratory mock-ups of azurite paints (with fine grain and coarse grain) mixed to several binders, all mixtures display slightly different vibrational responses (fig. 3.19). Indeed, those paints that are mulled with coarser grains exhibit more intense bands than the variety with finer grains.

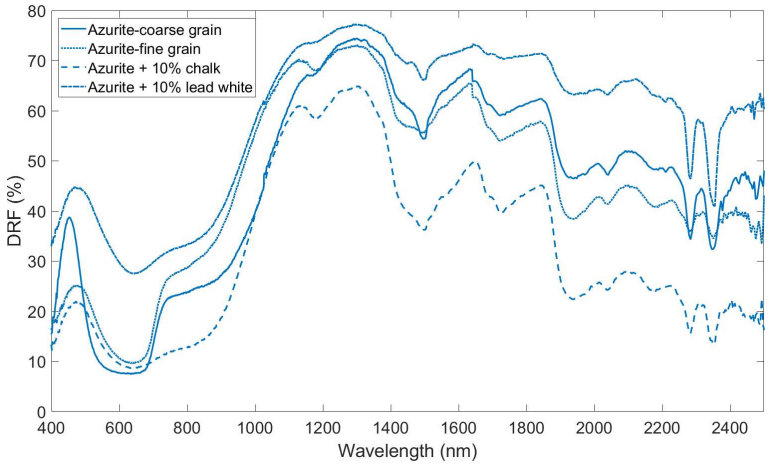


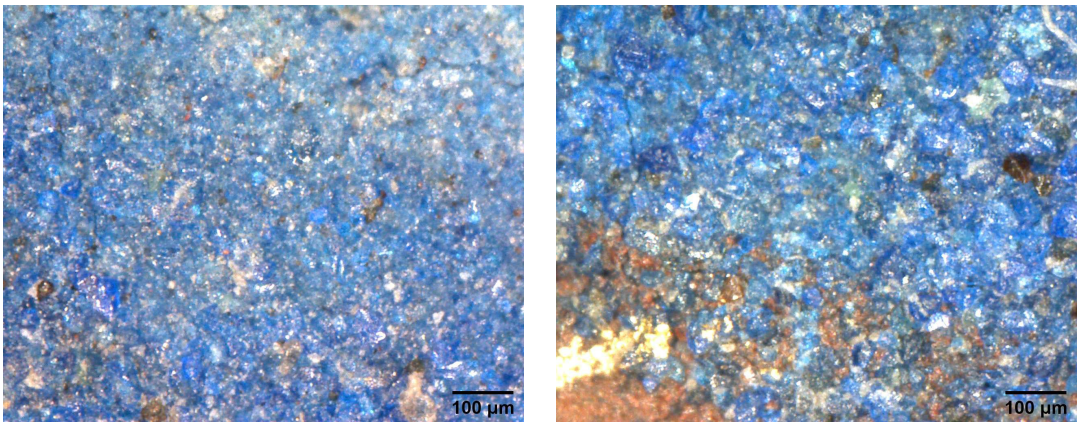
Figure 3.19: UV-Vis-NIR FORS spectra of laboratory mock-ups of several qualities of azurite: coarse grain (solid line); fine grain (dot line); azurite mixed to chalk (dash line) and azurite mixed to lead white (dash-dot line). All mixtures are bound with the same agent (parchment glue).

As white pigments are added to the mixture, they can affect the spectral response across the entire range of analysis, as inspected with laboratory reproductions of this pigment mixed to white extenders. The DR curve corresponding to the reproductions with the genuine pigment (solid and dot lines in Figure 3.19). Upon supplement with chalk ($CaCO_3$) at already 10% (wt., dash line), the bands around 1495 nm and 2355 nm become stronger than mixtures devoid of an extender; with lead white (basic lead carbonate, $2PbCO_3 \cdot Pb(OH)_2$, dash-and-dot line), the absorption around 1495 nm and 1920-1950 nm is comparatively stronger than seen in a pure-pigment mixture. However, such extenders also

[108]The peak area is calculated through the formula: A = H x FWHM, where A is the peak area, and FWHM is the full-width at half-maximum, or the bandwidth at half of a peak height.

affect the Vis-initial NIR response (380-1000 nm), with the two-fold effect of depressing the reflectance at the longest wavelengths (from 700 nm) while shifting the centre of the reflectance peak to longer wavelengths.

Speaking of the reflectance spectra of the analysed miniatures, they all retain the sharp increase of reflectance at the end of the Vis range. Besides, stronger vibrations (those at 1495, 2283 and 2355 nm) appear in the dark spot of Res. 326.v, fol. 46^{r} (*Adoration of the Magi*). This observation allows inferring a higher distribution of larger grains for those spots where the signal is most intense. Digital microscopy (DM) images revealed indeed that this illustration contains the coarsest grains for that area (fig. 3.20).



(a) (b)

Figure 3.20: Two sample digital microscope (DM) images of azurite paints, 435x (0.68 mm x 0.91 mm field of view), Res. 326.v, fol. 46^{r} © HERCULES Laboratory.

Analysing the grain size of those mixtures, the analysed images describe, on average, the higher amounts of coarse particles for the darkest spots (see tab. 3.8)[109].

[109]The present granulometry estimation for blue paints studies must be considered only semi-quantitatively, for the reasons that are illustrated in Appendix F, Section F.

Table 3.8: Results of the Particle Size Distribution assessment (PSD) expressed as percentage of all particles retrieved for the blue spots of analysis. The size range for the granulometry is: E. fine (Extra fine) = <38 μm; Medium = 38-63 μm; Coarse = 63-80 μm; E. coarse (Extra coarse) = >80 μm.

Book	**Leaf**	**Spot**	**Brightness**	**PSD** (%)			
				E. fine	***Fine***	***Coarse***	***E. coarse***
Res. 326.v	1^{r}	1	Dark	78.10	15.45	3.42	3.03
		2	Light	77.03	18.09	2.87	2.01
	46^{r}	1	Dark	0	21.67	41.67	36.66
		2	Dark	0	18.18	18.18	63.94
		3	Light	89.65	9.35	0.75	0.25
Res. 328.v	1^{r}	1	Light	86.28	11.69	1.52	0.51
		2	Dark	0.99	33.66	36.63	26.73
	31^{r}	1	Dark	42.76	20.34	15.52	21.38
Res. 5781.p	1^{r}	*— not possible to compute —*					
	29^{v}	1	Dark	1.96	19.61	41.18	37.25
		2	Dark	1.94	19.42	29.13	49.51

Finally, the influence of different values of grain size was related to the perceptual features of blue paints in Table 3.8. Expressly, this table illustrates the perceptual features of blue paints as colorimetric coordinates compared to the spectral variation of the reflectance band in the blue region. The presented values are relative to the case studies (the colorimetric reference values of the mock-ups are given in the legend).

Table 3.9: Colorimetry coordinates against the assessment of the reflectance peak in the blue-violet region (400-500 nm) for the blue paint spots of the case studies. The color is expressed as coordinates of the CIELAB color space (CIE1976) and is the average of three values, each being converted to a CIELAB set of values from single-pixel apparent reflectance spectra of hypercubes (see Appendix F, Section F.1.6 for a detailed description of the reflectance spectrum-to-color coordinate conversion). Position = location of the maximum of reflectance for the blue peak (nm); Height (%) = Apparent Reflectance Factor$_{max}$ (%) - Apparent Reflectance Factor$_{peak\ base}$ (%); Area (a.u.) = Height * FWHL (Full Width at Half Length).

Book	**Leaf**	**Spot**	**Brightness**	**CIELAB values**			**Spectral assessment**		
				L*	***a****	***b****	***Pos. (nm)***	***Area (a.u.)***	***Height (a.u.)***
Res. 326.v	1^{r}	1	Dark	31	-16	-23	470	40.43	3.15
		2	Light	50	-14	4	507.56	40.53	1.55
	46^{r}	1	Dark	20	-10	-31	463.87	35.81	3.55
		2	Dark	36	-17	-27	472.59	36.15	2.39
		3	Light	54	-15	-6	490.06	46.71	2.61
Res. 328.v	1^{r}	1	Light	49	-5	4	504.64	23.64	0.53
		2	Dark	29	-12	-24	466.77	33.96	2.30
	31^{r}	1	Dark	25	-12	-27	460.96	0.62	0.01
Res. 5781.p	1^{r}	*— not possible to compute —*							
	29^{v}	1	Dark	41	-13	-16	472.59	38.36	1.91
		2	Dark	34	-11	-26	458.06	30.64	2.12

On a close look at Table 3.9, the relationship between greater distributions of coarse particle size with the darker macroscopical appearance becomes clear. Employing pigments of various grain size qualities seems to affect more the brightness than other components of the Vis spectrum of the paints to which they belong. The colorimetry coordinates of the analysed spectra (in the range 380-780 nm) elucidate the effects of pigment size on the Vis radiation (Tab. 3.9)[110]. As the below table indicates, the sole coordinate which shifts with greater frequency of the coarser size is ΔL* (brightness). Among the darker spots, the greater the size, the smaller the ΔL*, while the other two components remain mostly unaffected (only Δb* is shifted to -b*). Spectroscopically, the fact translates to larger areas and heights for the characteristic band of the blue region and a position of its centre to shorter wavelengths (around 460 nm) (*Spectral assessment*, Tab. 3.8). In other

[110] Also in this case, the colorimetric coordinates are to be considered semi-quantitatively because they were not produced by a regular colorimeter. Instead, they are computed from the RS spectra of HSI data with a procedure described in Appendix F, Section F.1.6.

words, the blue peak of areas with lower L* are associated to sharper and more intense blue bands, while the minimum of reflectance stays unaltered, resulting perceptually in a greater degree of saturation. This allows making the rough estimate of saturation for those darker paints, being substantially greater than light blue paints[111]. Similar effects have been already appreciated and already related to the size of pigments in other[112].

Other perceptual influences are seen in lighter pigments, where they exhibit higher ΔL* values (toward whiteness) and a shift toward positive values of Δb* (toward yellowness). Spectrally speaking, ΔL* towards higher levels affect their reflectance curve by affecting the peak in the blue region and the plateau in the orange-red region (600-880 nm). As for the first, the peak base becomes broader while its centre gets shifted to longer wavelengths (until *c.* 500 nm); as for the second feature, the plateau starting from *c.* 780 nm experiences an increased elevation of its average reflectance levels. The two facts increase the overall reflectance of the spectrum and minimise the differences between the minimum and maximum of reflectance, resulting in reduced colour saturation. Such effects are appreciated in the light spot of Res. 328.v, fol. 1^{r} (spot 1).

The last observation to draw while observing Tables 3.8 and 3.9 is the utter difference of granulometry and spectral behaviour between the lighter and darker spots, as well as a certain regularity of their cumulative frequencies or particle size distribution (PSD). The existence of arising patterns (comparable values of the extra fine class for the lighter spots; coarse to extra-coarse varieties) supports the hypothesis of an intentional use of the material.

At a close inspection of the spectra, further pieces of information concerning the formulation of blue mixtures. Two more clusters of absorption bands can be appreciated in the lightest spots: the first group includes one band centred between 1433 nm and 1445 nm as well as a duplet around 2206 and 2169 nm, the second group sees a weak band around 1540-1550 nm, a sharp one falling in the range 1938-1948 nm and another, less intense at 2210-2244 nm. The first vibrational feature (at *c.* 1445 nm) could be the first overtone of the asymmetric vibrations of hydroxyl groups [2ν(OH)][113], a possible marker

[111] Ruth Johnston-Feller. *Color Science in the Examination of Museum Objects: Nondestructive procedures*. Los Angeles, CA: The Getty Conservation Institute, 2001, pp. 13-14.

[112] Anna M. Gueli et al. "Effect of particle size on pigments colour". In: *Colour Research and Applications* 42.2 (2017), pp. 236–243. DOI: https://doi.org/10.1002/col.22062.

[113] Some authors are careful in the interpretation of this band because it may overlap with the 3ν(OH) of

of a Pb-based pigment like lead white (basic carbonate, $2PbCO_3 \cdot Pb(OH)_2$)[114]. A duplet appears at 2206 nm and 2169 nm in most cases; it can be observed in AR specta of Pb-based carbonates [115]; however, they have found no attribution yet. Also, the sharp absorption around 1938-1948 nm is significantly weaker in those spots where the features of lead white seems stronger. The remaining vibrations (1938-1948 nm and 2210-2224 nm) can be related to the bands arising from the combination of stretching and bending modes of the hydroxyl group of water (respectively ($\nu_a + \delta$(OH))-OH and ($\nu_s + \delta$)-OH) of gypsum crystals ($CaSO_4 \cdot 2H_2O$)[116]. The vibrations of lead white and gypsum are found across all *folia* but are stronger in some cases. As for gypsum, its identification is limited by the fact that the same vibrations are also found in the spectra of bare parchment. Therefore, the signal could belong to the parchment rather than the paints. What allow proposing the possible presence of lead white is the presence of the Pb-fluorescence lines in the p-XRF spectra of those spots.

As for the media used to disperse the pigments, the vibrations for detecting their composition are not very strong. However, it is possible to exclude the use of whole egg or egg yolk due to the absence of the bands at 2309 and 2347 nm (($\nu_s + \delta$)-CH_2) and ($\nu_a + \delta$)-CH_2) of fatty acid chains). In some cases, a few bands centred near 1570-1580 nm, 1770 nm, 2100 nm and 2323 nm arise, assigned to 2ν(OH), ν(CH)+δ(CH_2) and δ(OH)+ν(CO) of the polysaccharidic fraction of natural gums. From this information, it is possible to

gypsum (calcium sulfate diihydrate, $CaSO_4 \cdot 2H_2O$), that falls approximately in the same range (*c.* 1498 nm). See Marcello Picollo et al. *Modern white pigments: their identification by means of noninvasive ultraviolet, visible, and infrared fiber optic reflectance spectroscopy*. Conference of May 16-19, 2006, Tate Modern, London. Los Angeles, CA, 2007.

[114]Chemically, *lead white* is similar to a class of Pb-based carbonates, among which the most common is hydrocerussite (chemical formula $Pb_3CO_3(OH)_2$). The major difference between lead white and mineral hydrocerussite is the fact that the first one is a synthetic pigment, while the other is a material with natural distribution (Oleg Siidra et al. "Hydrocerussite-related minerals and materials: structural principles, chemical variations and infrared spectroscopy". In: *Acta Crystallographica B* 74.2 (2018), pp. 182–195. DOI: https://doi.org/10.1107/S2052520618000768). On lead white, see Manuela Vagnini et al. "FT-NIR spectroscopy for non-invasive identification of natural polymers and resins in easel paintings". In: *Analytical and Bioanalytical Chemistry* 395.7 (2009), pp. 2107–2118. DOI: https://doi.org/10.1007/s00216-009-3145-6; John K. Delaney et al. "Mapping the pigment distribution of Vermeer's Girl with a Pearl Earring". In: *Heritage Science* 8.4 (2020). DOI: https://doi.org/10.1186/s40494-019-0348-9.

[115]At at a comparison with the ASTER spectral library of natural and man-made materials. See also Alice M. Baldridge et al. "The ASTER Spectral Library Version 2.0". In: *Remote Sensing of Environment* 113.4 (2009), pp. 711–715. DOI: https://doi.org/10.1016/j.rse.2008.11.007.

[116]Vagnini et al., "FT-NIR spectroscopy for non-invasive identification of natural polymers and resins in easel paintings";Dooley et al., "Mapping of egg yolk and animal skin glue paint binders in Early Renaissance paintings using near infrared reflectance imaging spectroscopy".

establish that these paints could have been mixed to water-soluble components, as typical of the late-medieval technique of illumination[117].

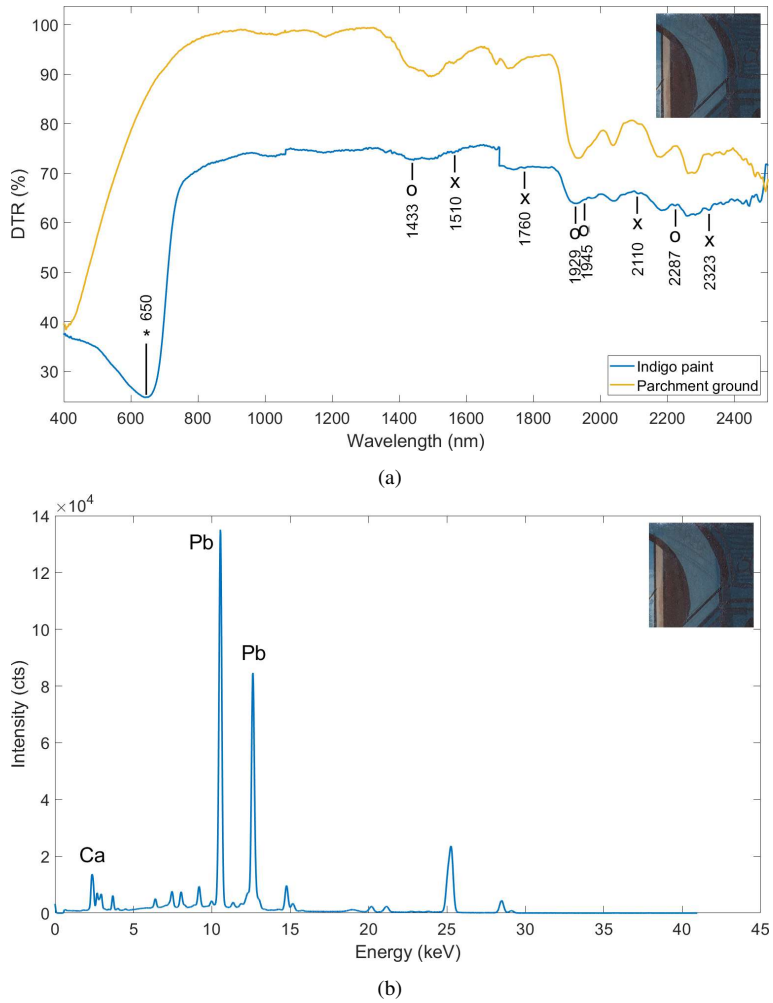


Figure 3.21: Sample spectra for indigo paints across the case studies: a) UV-Vis-NIR FORS spectrum (blue solid line) compared with the parchment ground (yellow solid line; from Res. 326.v, fol. 46^{r}, spot shown on the top). The bands associated to the pigment are labelled with an asterisk marker (*); for the extender(s), the circle marker (o). b) XRF reference spectrum (spot 1, Res. 326.v, fol. 46^{r}, shown on the top).

Finally, the illustrations for *Adoration of the Magi* contain another blue colourant than azurite. Especially concerning the illustration of Res. 328.v, XRF analysis does not highlight any substantial difference from the spectra of parchment but enrichment in Pb. This fact is ascertained through the Pb-Lα and Pb-Lβ peaks (respectively centred around c. 10.55 keV and 12.60 keV, see fig. 3.21b)[118], which leads to infer that that blue colourant

[117] Stefanos Kroustallis. "Binding media in medieval manuscript illumination: a source of research". In: *Revista de História da Arte* 1.série W (2011), pp. 105–117.

[118] The other XRF spectrum allows inferring only a major presence of Cu, which could either come from a neighbouring spot.

was dispersed in a Pb-based compound. Since the DM images indicate the presence of white particles (fig. 3.22), those grains could explain the Pb enrichment. The FORS-NIR spectrum for the spot supports the hypothesis and reveals the vibration of Pb-based carbonates (maybe lead white used as an inert material).

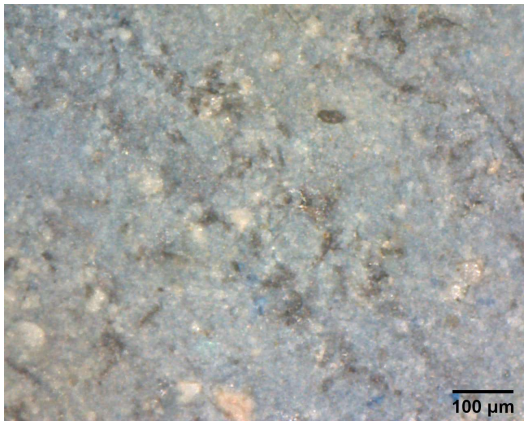


Figure 3.22: DM image of indigo paints, 435x (0.68 mm x 0.91 mm field of view), Res.328.v, fol. 31^{r} © HERCULES Laboratory.

The reflectance spectra proved to provide more conclusive information (fig. 3.21a): in the Vis region, it is possible to observe in the blue region a very broad curve peak approximately around 472 nm (446-498 nm) and a steep increase of the reflectance curve after the absorption maximum at 660 nm. After this level, the reflectance curve describes a plateau that is stable until the end of the Vis region. In the NIR region, the curve is devoid of the two bands at 2283 and 2355 nm characteristic of azurite [$(\nu + \delta)$-OH and $3\nu(CO_3)$]. These two facts suggest that azurite was not applied to colour those areas. Instead, the absence of any major element from the XRF spectra suggests that the applied colourant could be organic[119]. However, the described profile of the reflectance curve in the Vis region is compatible with low concentrations of indigo, an organic dye[120]. Indigo dye

[119]The elements with atomic weight between 12 and 16 (from Mg to S) exhibit a weak response to the X-ray radiation so they are hardly or poorly detectable.

[120]Indigo is a vegetal dyestuff, naturally sourced from two plants, *Indigofera tinctoria* L. and *Isatis tinctoria* L. *Indigofera tinctoria* L. (also called *true indigo*) is a deciduous tropical shrub from the *Fabeaceae* family while *Isatis tinctoria* (or *woad*) is a flowering plant from the *Brassicaceae* family (Carmine Guarino et al. "Cultivation and Use of Isatis tinctoria L. (Brassicaceae) in Southern Italy". In: *Economic Botany* 54.3 (2000), pp. 395–400. DOI: https://doi.org/10.1007/BF02864789). The colourant was prepared from the juices of those plants by hydrolysing the indigo precursors (indican for Indigofera plants, indican and isatan B for Isatis plants, see R.B. Chavan. "Indigo dye and reduction techniques". In: *Denim: Manufacture, Finishing and Applications*. Ed. by Roshan Paul. Woodhead Publishing Series in Textiles. Amsterdam and Paris: Woodhead and Elsevier, 2015. Chap. 3, pp. 37–67. DOI: https://doi.org/10.1016/B978-0-85709-843-6.00003-2) through fermentation of crushed leaves in a vat. The vat solution extracted

was known in the Egyptian and was in fair use in the Roman and Greek Antiquity[121]. The Middle Ages inherited indigo and applied it for several artistic purposes, including the illumination technique[122]. Speaking of the spectral response of the dye chromophores[123], the above absorption maximum arises as to the $\pi \rightarrow \pi^*$ electronic transition of its molecular orbitals[124]. Previous research evaluated the sharpness and position of the absorption between 540 nm and 730 nm regarding the aggregation state of the pigment[125], revealing a slight shift from 660 nm toward longer wavelengths in compounds with a higher aggregation state[126]. Because this shift does not appear in the spectra of Res. 328.v, it is not possible to propose this piece of information. As for the binder, indigo paints contain the vibrational bands of a polysaccharide media. The results of the analysis of the blue paints

the colourless, water-soluble precursors while the fermentation hydrolysed those compounds to release the indoxyl, and a yellow liquid called indigo white salt or yellow vat was prepared (Alois G. Püntener et al. "Natural Dyes". In: *colourants for Non-Textile Applications*. Ed. by H.S. Freeman et al. Amsterdam: Elsevier Science, 2000. Chap. 9, pp. 382–455. DOI: https://doi.org/10.1016/B978-044482888-0/50040-4). The indoxyl from the vat was readily converted to a blue-coloured, water-soluble compound (indigotin) with oxidation by exposure to the atmosphere. A blue dye was precipitated to indigo by the addition of an alkalising agent (such as lye). Finally, the water-insoluble paste was drained and pressed into cakes, also called *indigo block* or *indigo rocks*). Those blocks were sold directly to be applied either as colourants for textile dyeing or materials for painting (Thompson, *The Materials and Techniques of Medieval Painting*, pp. 139-140). About the spectral response of indigo at low concentrations (below 9%), see Marco Leona et al. "Identification of the pre-columbian pigment mayablue on works of art by noninvasive UV-Vis and raman spectroscopic techniques". In: *Journal of the American Institute for Conservation* 43.1 (2004), pp. 39–54. DOI: https://doi.org/10.1179/019713604806112632.

[121] Guarino et al., "Cultivation and Use of Isatis tinctoria L. (Brassicaceae) in Southern Italy".

[122] For instance, Heraclius recommended in the eight-tenth century to give indigo for painting backgrounds (*Mappae Clavicula*). See Franco Brunello. *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*. Vicenza: Neri Pozza, 1975, p. 186.

[123] Namely, the part of a molecule responsible for its colour.

[124] This absorption has been explained as a $\pi \rightarrow \pi^*$ transition from the highest-occupied molecular orbital to the lowest-unoccupied molecular orbital (LUMO-HOMO) (Leona et al., "Identification of the pre-columbian pigment mayablue on works of art by noninvasive UV-Vis and raman spectroscopic techniques").

[125] Alan R Monahan et al. "Spectroscopic differences between crystalline and amorphous phases of indigo". In: *The Journal of Organic Chemistry* 37.25 (1972), pp. 4182–4184; Luis Serrano-Andrés et al. "A theoretical study of the indigoid dyes and their chromophore". In: *Chemistry: A European Journal* 3.5 (1997), pp. 717–725. DOI: https://doi.org/10.1002/CHEM.19970030511.

[126] The aggregation has been related to the engagement of H-bonds between indigo dimers (M.D. Cohen et al. "Topochemistry I. The Phototropy of Anils". In: *Hydrogen Bonding*. Ed. by D. Hadzi. Papers Presented at the Symposium on Hydrogen Bonding Held at Ljubljana, 29 July3 August 1957. New York, NY et al.: Pergamon Press, 1959. Chap. 31, pp. 293–300;Costanza Miliani et al. "A spectrophotometric and fluorimetric study of some anthraquinoid and indigoid colourants used in artistic paintings". In: *Spectrochimica Acta Part A* 54.4 (1998), pp. 581–588. DOI: https://doi.org/10.1016/S1386-1425(97)00240-0.), with the effect of redistributing the electronic charge from the electronegative pole around N to the rest of the molecule. The redistribution reduces the distance between the HOMO and the LUMO, resulting in transition of lower energy (hence the batochromic shift, see Miliani et al., "A spectrophotometric and fluorimetric study of some anthraquinoid and indigoid colourants used in artistic paintings"; Leona et al., "Identification of the pre-columbian pigment mayablue on works of art by noninvasive UV-Vis and raman spectroscopic techniques").

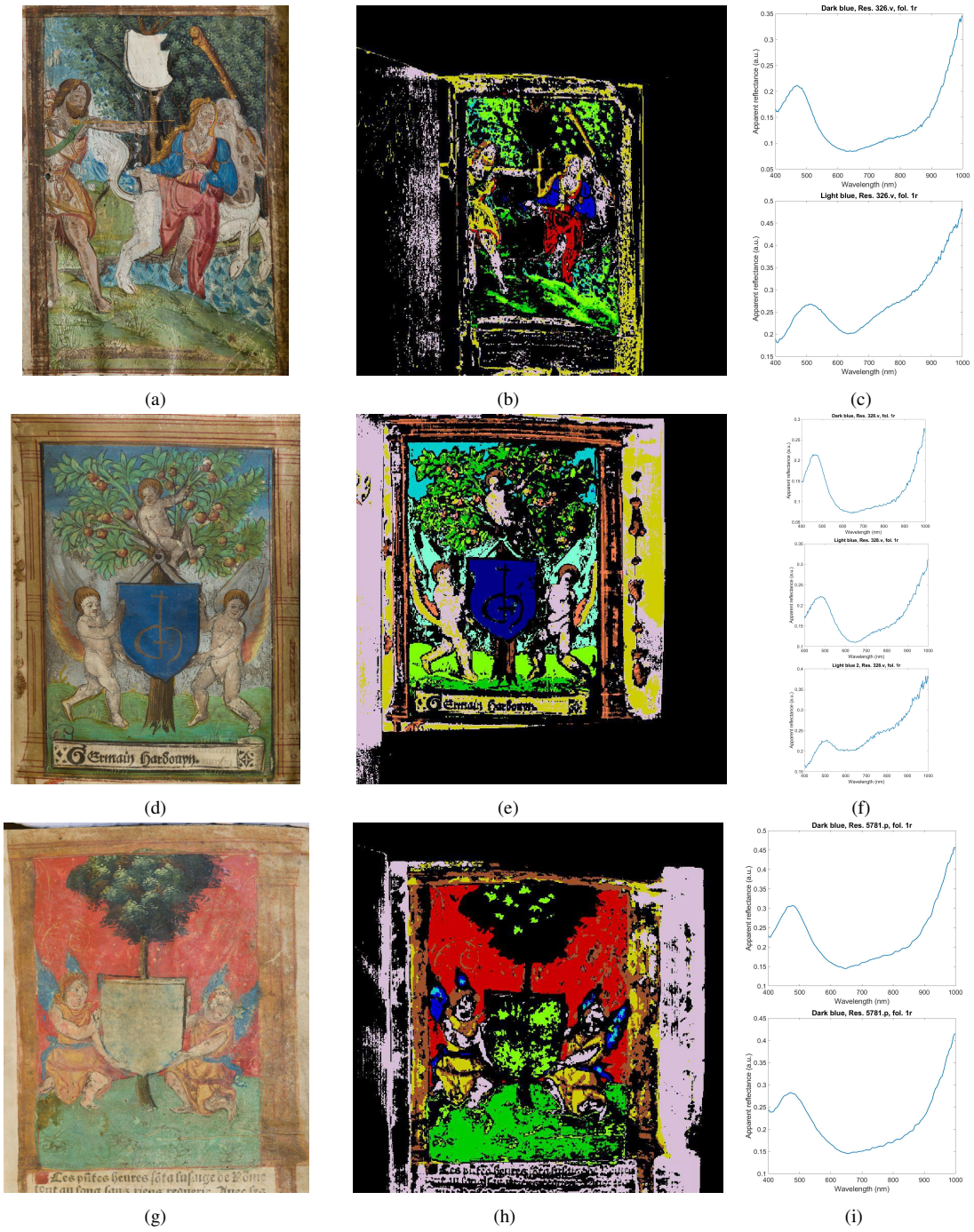
are presented in Table 3.10.

Table 3.10: Results of the tentative identification of the components for the blue paints: colourants, extenders and binders.

Book	Leaf	Spot	Colourant	Extender	Binder
Res. 326.v	1^{r}	1	azurite	gypsum	polysaccharide
		2	azurite	gypsum, lead white	polysaccharide
	46^{r}	1	azurite	none / not identif.	polysaccharide
		2	azurite	none / not identif.	polysaccharide
Res. 328.v	1^{r}	1	azurite	lead white	polysaccharide
		2	azurite	lead white	polysaccharide
	31^{r}	1	azurite	lead white	polysaccharide
		2	azurite	lead white	polysaccharide
		3	indigo	lead white	polysaccharide
Res. 5781.p	1^{r}	1	azurite	gypsum	polysaccharide
		2	azurite	(gypsum)	polysaccharide
	29^{v}	1	azurite	lead white	polysaccharide
		2	azurite	lead white	polysaccharide
		3	indigo	lead white	polysaccharide

Based on HSI mapping (solid dark, light and baby blue areas, figs. 3.23 and 3.24), the composition of these mixtures is rather regular, showing differences only concerning the size of the blue grains and amount of white supplemented[127].

[127] Compare with Section 3.2.1.1.



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 3.23: HSI maps of all paints (b, e, h) compared with the Vis images of all *Printer's device* across the case studies (a, d, g). The blue solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) dark blue: 0.020, light blue: 0.030; f) 0.020 in all cases; i) 0.020 in all cases. The endmembers (hereafter EM) are shown in (c), (f), (i).

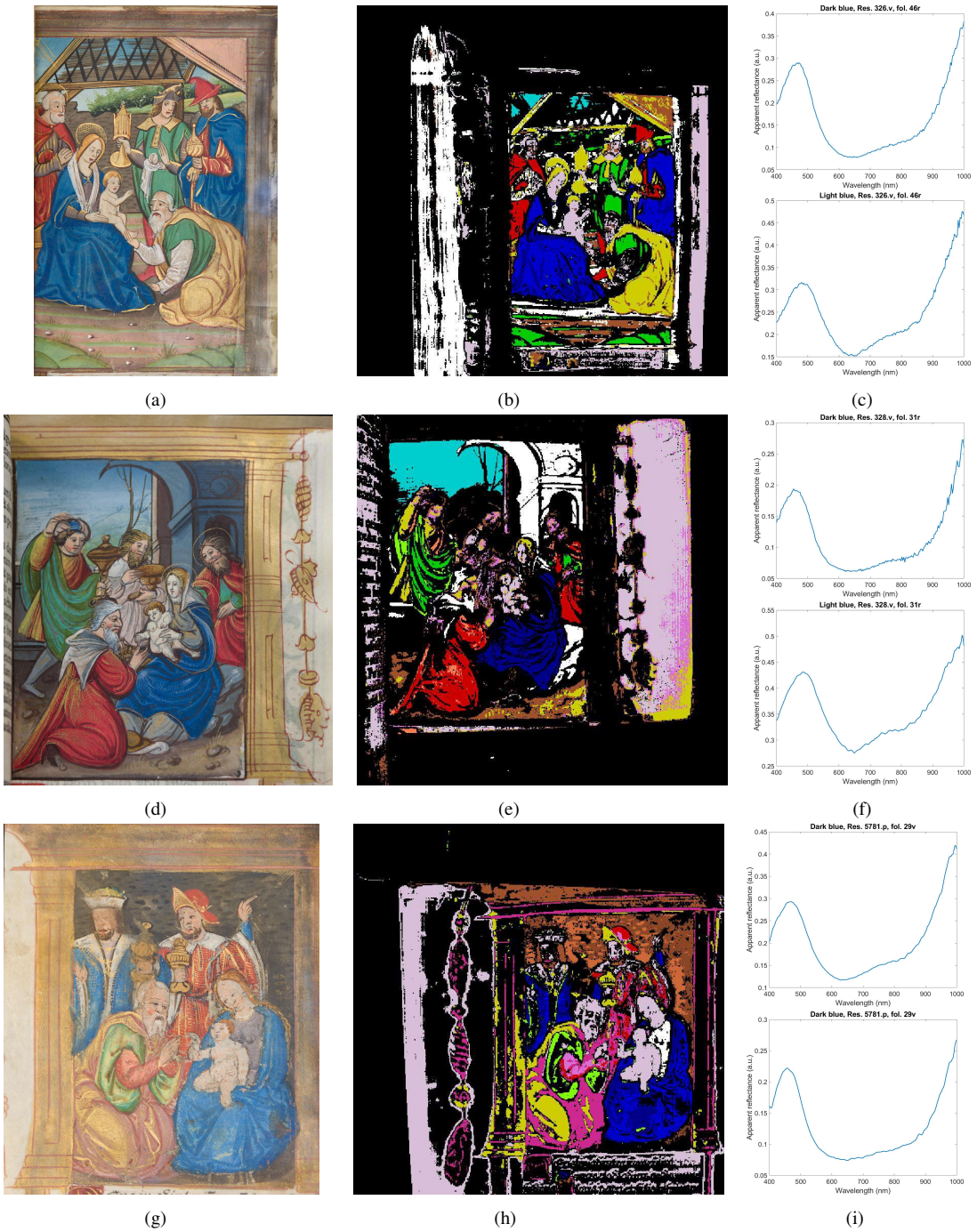


Figure 3.24: HSI maps of all paints (b, e, h) compared with the Vis images of all *Adoration of the Magi* across the case studies (a, d, g). The blue solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.010 in all cases; f) 0.020 in all cases; i) 0.020 in all cases. The EM are shown in (c), (f), (i).

Paints based on crude azurite prevail among the representations of Mary's mantle (fig. 3.24). In other figurative elements (like the sky), azurite is enfeebled with lead white. Alternatively, other colourants may appear, like indigo. This colourant is found in the paints

for the ruined wall beyond Mary, the hair of the oldest Magi, as well as some adjacent rocks in Res. 328.v's *Adoration of the Magi* (figs. 3.24d-3.24e). More indigo may have been mixed to another blue colourant for Mary's garment in Res. 5781.p's *Adoration of the Magi* (figs. 3.32a-3.32b). Therefore, azurite-based mixtures find a special place in paints for cloaks and the sky, while non-azurite mixtures were employed indifferently for elements of the landscape, parts of modelling and drapery, either alone or mixed to other blue colourants. Among these materials, no trace of ultramarine pigment has been detected.

Green paints Green paints appear in all *folia*, and the molecular and elemental profile was investigated for at least one spot across all miniatures[128]. Table 3.11 summarises the results from their evaluation and details the tentative characterisation of the components dispersed for each mixture.

Table 3.11: Results of the tentative identification of the components for the green paints: colourants, extenders and binders.

Book	Leaf	Spot	Colourant	Extender	Binder
Res. 326.v	1^{r}	1	azurite + (Pb-oxide)	gypsum	protein, polysaccharide
	46^{r}	1	malachite	chalk, gypsum	polysaccharide
		2	malachite	chalk, gypsum	polysaccharide
		3	malachite	gypsum	protein, polysaccharide
Res. 328.v	1^{r}	1	azurite, malachite, yellow pig. (inorg. / org.) yellow	not identif.	protein, polysaccharide
		2	azurite, malachite	not identif.	protein, polysaccharide
	31^{r}	1	malachite	chalk	polysaccharide
Res. 5781.p	1^{r}	1	(malachite)	gypsum	protein, polysaccharide
		2	azurite, malachite	gypsum	polysaccharide
	29^{v}	1	malachite	not identif.	polysaccharide

As shown, there are two major differences between the mixtures applied over *Printer's device* illustrations and *Adoration of the Magi* miniatures. The first is that the blend of

[128]The spots of analysis for the green paints are indicated in Appendix F, Section F.3.

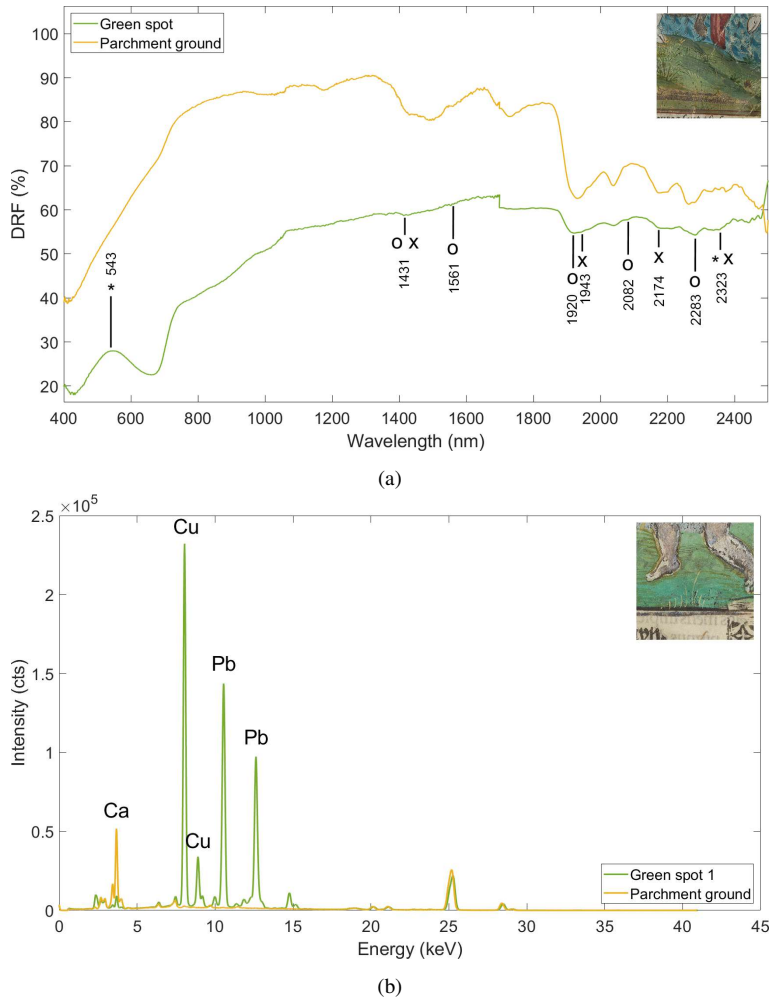
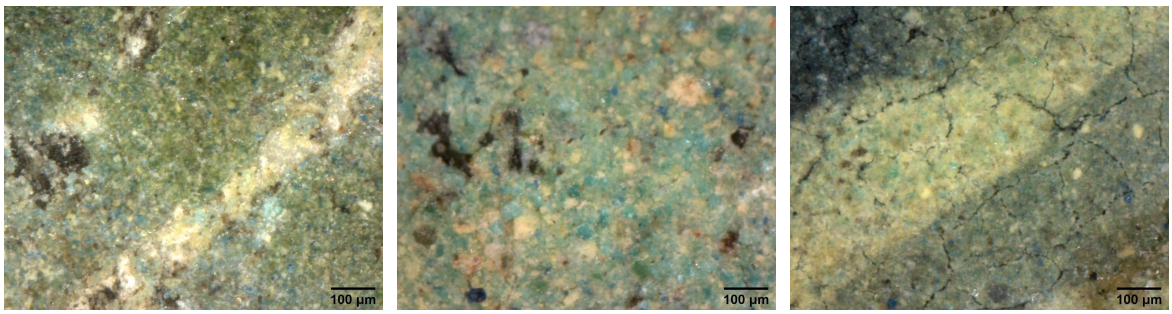


Figure 3.25: Sample spectra of green paints made by mixing blue and yellow pigments: a) UV-Vis-NIR spectrum (green solid line) of a reference paint compared with the parchment ground (yellow solid line; from Res. 326.v, fol. 1^{r}, spot shown on the top). The bands associated to the pigment are labelled with an asterisk marker (*); for the extender(s), the circle marker (o); b) XRF reference spectrum (green solid line) compared to the parchment ground (yellow solid line; from Res. 328.v, fol. 1^{r}, shown on the top).

the opening leaves of the case studies is never a pure green pigment. In fact, it consists essentially of malachite ($CuCO_3 \cdot Cu(OH)_2$)[129] adulterated with varying amounts of azurite and yellow colourants (organic or inorganic). Several data support this hypothesis: their DR-NIR signal shows two weak absorption bands which are likely to be the stretching vibration of carbonate groups of malachite (2222 nm [$3\nu_s$(CO),CO_3] and 2278 nm [$3\nu_a$(CO),CO_3, $3\nu_a$(CO)][130]. Additionally, the NIR region of the reflectance spectra al-

[129]Malachite has a crystalline structure almost equal to azurite, with the sole difference that is contains one atom of Cu less than azurite. The results of the deprivation of Cu in the crystalline structure is that the diamond-shaped planar chains are less distorted, and the energy levels at the excited state are closer. In this way, the crystal field transitions require less energy to happen, with the result of falling at longer wavelengths.

[130]Dooley et al., "Mapping of egg yolk and animal skin glue paint binders in Early Renaissance paint-



(a) (b) (c)

Figure 3.26: DM images of green paints, 435x (0.68 mm x 0.91 mm field of view): a) Res. 326.v, fol. 1^{r}; b) Res. 328.v, fol. 1^{r}; c) Res. 5781.p, fol. 1^{r} © HERCULES Laboratory.

ways uncovers the vibrations previously described for azurite (2283 nm and 2350 nm, (ν + δ)-OH and 3ν(CO), CO_3), see Figure 3.25a), and DM images display the presence of small blue particles scattered everywhere (fig. 3.26).

The remaining spots contained other colourants. Based on the p-XRF spectra, their major element is Cu; as for the UV-Vis-NIR DR spectra, the spectral response is quite different from the previous areas. In the Vis-NIR range (480-1300 nm), it exhibits a sharp reflectance maximum centred around 530 nm. This value is quite similar to malachite, which displays this band at ~ 530 nm in its coarse grade[131], while that of other pigments based on copper like Cu(II)-acetates (verdigris, $Cu(CH_3COO)_2]_x \cdot [Cu(OH)_2]_y \cdot zH_2O$[132]) or proteinates ($Cu(C_{19}H_{29}COO)_2$), it moves to shorter wavelenghts (~400-490 nm, see Figure 3.27a); in Cu(II)-hydroxychlorides, this band locates at 510-520 nm[133]. Also similarly to malachite, the DR spectrum of the green paint in Res. 326.v, fol. 46^{r} shows a maximum of absorbance around 640 nm and a slow rise until 1600 nm, yet it lacks the characteristic duplet of absorptions around 894 nm and 1194 nm of more Cu(II) transitions. This particular feature is more similar to verdigris, which displays a steeper rise in reflectance until ~1300 nm and an absorption band around 1430 nm; differently that standard verdigris, the 1430 nm-band of the green paint in Res. 326.v, fol. 46^{r} is quite sharp. Looking closely at the NIR region of the spectrum, it shows a series of three absorptions

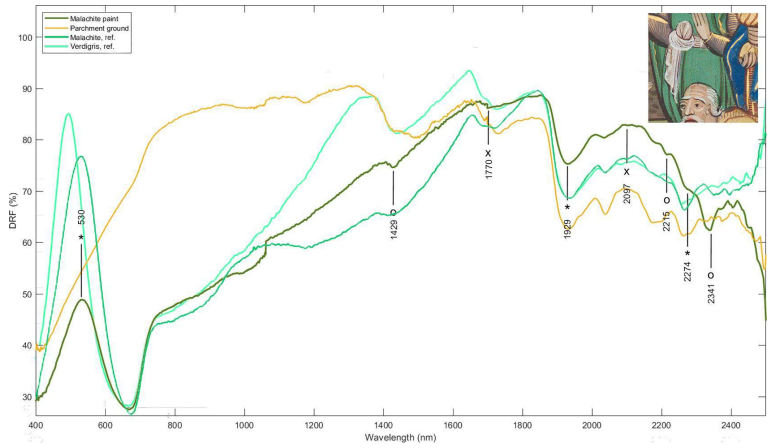
ings using near infrared reflectance imaging spectroscopy";Frost et al., "Identification of the rosasite group mineralsAn application of near infrared spectroscopy".

[131] See also Rutherford J. Gettens et al. "Malachite and Green Verditer". In: *Studies in Conservation* 19.1 (1974), pp. 2–23. DOI: https://doi.org/10.1179/sic.1974.001.

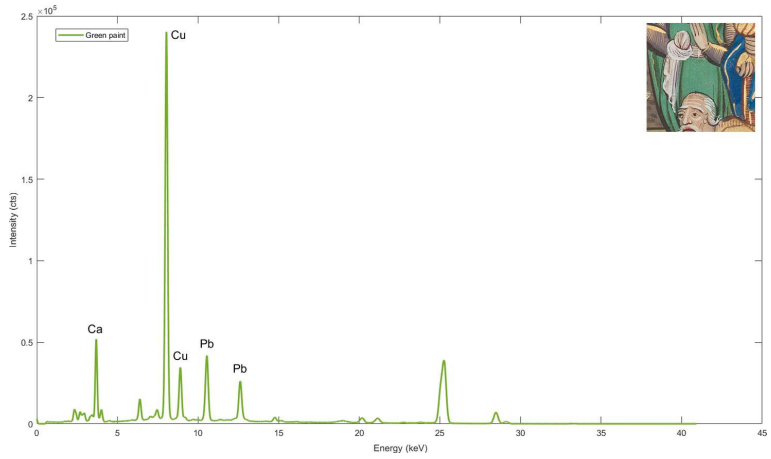
[132] Where $x = 1$, $y = 3$ and $z = 2$. See also Nicholas Eastaugh et al. *The Pigment Compendium A Dictionary of Historical Pigments*. Linacre House: Elsevier Butterworth-Heinemann, 2004, pp. 385-386.

[133] At a comparison with the spectrum of atacamite from the ASTER spectral library. See also Baldridge et al., "The ASTER Spectral Library Version 2.0".

at 2215, 2274 and 2341 nm: the first two may be admitted as the stretching modes of carbonate groups as the previous spectra; the presence of the last, stronger band suggests the presence of another material. For instance, the spectrum of natural chalk shows a similar band between 2336 and 2350 nm arising from the stretching modes of carbonates $[3\nu CO_3]$[134].



(a)



(b)

Figure 3.27: Sample spectra of Cu-based paints: a) UV-Vis-NIR FORS spectrum (dark green solid line) of a paint in Res. 326.v, fol. 46^r compared with a mock-up paint containing modern malachite and verdigris (standard pigments mixed with gum Arabic, blue-green solid line and green-yellow solid line) and the parchment ground (yellow solid line; from Res. 326.v, fol. 46^r, spot shown on the top). The bands associated to the pigment are labelled with an asterisk marker (*); for the extender(s), the circle marker (o); b) XRF reference spectrum (green solid line) compared to the parchment ground (yellow solid line; from Res. 326.v, fol. 46^r, shown on the top). The reference pigments are by Kremer Pigmente.

Another typical calcite feature is that this mineral does not exhibit significant absorp-

[134] Dooley et al., "Mapping of egg yolk and animal skin glue paint binders in Early Renaissance paintings using near infrared reflectance imaging spectroscopy"; Sungchan Oh et al. "Near-Infrared Spectroscopy of Limestone Ore for CaO Estimation under Dry and Wet Conditions". In: *Minerals* 7 (2017), p. 193. DOI: https://doi.org/10.3390/min7100193 and at a comparison with the spectrum of coarse calcite from the ASTER spectral library.

tion of Vis-NIR radiation until ~ 1360 nm, making it likely that it obscures the characteristic absorption of malachite in the 800-1300 nm region.

Additionally, the p-XRF spectrum displays the spectral line of Ca (Kα, 3.7 keV, see Figure 3.27b), and the DM images show that the green pigment is mixed to yellowish grains. The same microscopic images also show that the green pigment consists of coarse grains with a developed crystalline shape, making it more likely to have been sourced naturally, like malachite pigment[135].

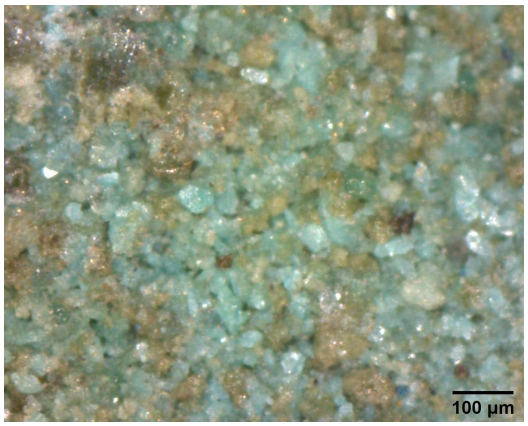


Figure 3.28: DM image of malachite paints, 435x (0.68 mm x 0.91 mm field of view), Res. 326.v, fol. 46^{r} © HERCULES Laboratory.

Other times, the remaining green paints can be a green pigment mixed to a yellow colourant. In this latter case, the yellow material has been applied either as a transparent layer over a blue film (Res. 326.v, fol. 1^{r} and Res. 328.v, fol. 1^{r}) or was mixed with a green pigment (Res. 326.v, fol. 1^{r} and Res. 5781.p, fol. 1^{r})[136]. As for the yellow glaze (Res. 326.v and Res. 328.v), it was impossible to establish its composition because of the limitation of XRF data to interpret the composition of organic substances and the fact that DM images did not show distinct yellow particles. The two facts combined suggests that this material could have an organic nature. Concerning the yellow pigment of the other two books (Res. 326.v and Res. 5781.p), the enforced peaks of Pb in XRF spectra of Res. 326.v and Res. 5781.p (fig. 3.28) lead to the possibility of the dispersion of a Pb-based pigment, like lead yellow oxides[137].

[135]The identification of this green pigment as malachite is tentative; more spectral data is necessary to support this hypothesis

[136]Because the DM images did not allow to perform granulometry analyses, this section will not explore the effects of the grain size to the perceptual effects of those mixtures.

[137]Lead forms two yellow Pb(II)oxides with different mineralogy. The two mineral phases differ only in

Table 3.12: Colorimetry coordinates against the assessment of the reflectance peak in the green region (500-570 nm) for the green paint spots of the case studies. The color is expressed as coordinates of the CIELAB color space (CIE1976) and is the average of three values, each being converted to a CIELAB set of values from single-pixel apparent reflectance spectra of hypercubes (see Appendix F, Section F.1.6 for a detailed description of the reflectance spectrum-to-color coordinate conversion). Position = location of the maximum of reflectance for the blue peak (nm); Height (%) = Apparent Reflectance Factor$_{max}$ (%) - Apparent Reflectance Factor$_{peak\ base}$ (%); Area (a.u.) = Height * FWHL (Full Width at Half Length).

Book	**Leaf**	**Spot**	**Brightness**	**CIELAB values**			**Spectral assessment**		
				L*	***a****	***b****	***Pos. (nm)***	***Area (a.u.)***	***Height (a.u.)***
Res. 326.v	1^{r}	1	Sl. Dark	43	-14	20	530	1.21	0.06
	46^{r}	1	Light	66	-10	39	565	0.41	0.03
		2	Dark	52	-26	12	530	6.24	0.22
		3	Sl. dark	54	-14	27	550	3.18	0.13
Res. 328.v	1^{r}	1	Dark	45	-26	12	525	3.58	0.15
		2	Dark	51	-23	14	530	4.35	0.17
	31^{r}	1	Dark	50	-24	6	515	5.41	0.20
Res. 5781.p	1^{r}	1	Sl. dark	57	-18	10	530	5.01	0.18
		2	Very dark	53	-13	24	545	1.74	0.08
	29^{v}	1	Light	44	-23	14	530	3.32	0.14

The perceptual features of green paints were also investigated, and Table 3.12 lists the colorimetry coordinates of all the spots of analysis. The sharp band centred around 530 nm (green region) could explain the green colour of the analysed areas and the arising differences. Colorimetry analysis allows drawing a broad cluster encompassing all Adoration of the Magi as well as the paints of *Printer's device* of Res. 326.v. Because no neat difference separates those paints given to *Adoration of the Magi* from those of the *Printer's device*, it is safe to say that no regularity of production exists across the case studies.

DR-NIR spectra also offered pieces of information regarding the nature of the applied extenders and binders. The yellow transparent overlayers or glazes to *Printer's device* throughout the case studies expose common spectral features in overtones and combination bands of aminic, methylene and carboxyl groups associated with amino acids. The great majority of those bands might be associated with the proteic components of the substrate, being it the collagen fraction of parchment sheets (1498 nm [2ν(NH)], 1930-

their crystal structure, where one is tetragonal (α-PbO) and is known as *litharge*; the other is orthorombic (β-PbO) and is called *massicot* (Georges Trinquier et al. "Lead monoxide. Electronic structure and bonding". In: *The Journal of Physical Chemistry* 88.26 (1984), pp. 6696–6711. DOI: https://doi.org/10.1021/j150670a038).

1940 nm and 2036-2041 nm [(ν + δ)-OH], 2174-2183 nm [(ν_a + δ)-NH], 2ν(CO), amideI + amideII] and 2287 nm [ν_a + δ)-CH_2][138], although they appear stronger in the leaf of Res. 326.v. Thus, these compounds could be proteinaceous, and the presence of a band around 1510 nm may identify it as egg white [2ν(NH)][139]. Retrieving a compound from this class is not an oddity. Although egg-based binders were the most frequent adhesives for illumination of the Middle Ages[140], and the few existing fifteenth-century recipes still instructed on their use. The later applications prescribed to apply egg-white binders with vegetal and animal dyestuff for translucent overlayers or to mix these media with opaque pigments for achieving secondary hues[141]. Besides, egg-based binders have been retrieved on some late fifteenth-century illuminated books[142].

[138] Vagnini et al., "FT-NIR spectroscopy for non-invasive identification of natural polymers and resins in easel paintings"; Dooley et al., "Mapping of egg yolk and animal skin glue paint binders in Early Renaissance paintings using near infrared reflectance imaging spectroscopy".

[139] Vagnini et al., "FT-NIR spectroscopy for non-invasive identification of natural polymers and resins in easel paintings". If such was the case, it could be glair. Glair was produced by the mechanical denaturation of egg whites through beating, whipping or squeezing; size was created by heating small pieces of parchment in water to extract its collagen. The absence of vibrations related to a lipidic fractions at 2310 nm and 2352 nm in the RS-NIR spectra of the case studies [(ν + δ)-CH_2] allows excluding the use of whole egg or egg yolk.

[140] For instance, Thompson defined glair as the "standard medium for illumination" and even an entire booklet was devoted specifically to the description of this medium and the methods for its preparation (*De Clarea*). Between the twelfth and the thirteenth century, Theophilus' *Schedula diversarium artium* (= On various arts) described a recipe which included whipping the white of eggs, while Heraclius' treatise recommended multiple filtering through a linen cloth (Merrifield found a recipe for this method in a book from the BnF with Jean Le Begue's writings. However, the denaturation method would change since the thirteenth century to adopt squeezing through a sponge. See Mark Clarke. "Reworking Theophilus: adaptation and use in workshop texts". In: *Zwischen Kunsthandwerk und Kunst: Die 'Schedula diversarum artium'*. Berlin and New York, NY: De Gruyter, 2013. Chap. 5, pp. 72–90. DOI: https://doi.org/10.1515/9783110334821.72); John G. Hawthorne et al. *Theophilus: On Divers Arts*. Chicago, IL: University of Chicago Press, 1963; Kroustallis, "Binding media in medieval manuscript illumination: a source of research"; Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, p. 232, no.31; Thompson, *The Materials and Techniques of Medieval Painting*, pp. 50-53; Salvador Muñoz Viñas. "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts". In: *Studies in conservation* 43.2 (1998), pp. 114–124. DOI: https://doi.org/10.1179/sic.1998.43.2.114.

[141] One of these treatises was by Jacob Cohene (Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, I, nos. 293, 294, 295, pp. 270-274); other were by an anonymous textile dyer (*ibid.*, vol. 1, nos. 89-99, pp. 84-90). The last group describes the use of organic reds such as kermes, brazilwood and lac; plant greens such as parsley and rue; yellows from weld and buckthorn berry; blues from turnsole and indigo (either woad or true indigo). These recipes were initially given by Johannes Alcherius (*fl. c.* 1380-1420) and were transcribed by Jean Le Bégue (1368-1457) later in his Bolognese manuscript. See also Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420"; Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts".

[142] Laurie found evidence found evidence of a madder lake in a book dated from *c.* 1465-1489; further instances of use have been seen in fifteenth-century French Book of Hours from the collection of Palácio Nacional de Mafra, Portugal. See Carvalho et al., "Colour identification, degradation processes and findings

A final clue for the identification of proteinaceous materials as the media for glazes may come from DM. Microscopic images of a green spot in Res. 326.v (fig. 3.29) show a boundary between the blue-yellow ground and a yellowish overlayer. Besides, the image also displays craquelure, an alteration that is commonly seen in proteinaceous media[143]. The reason for applying a thin yellowish glaze may lay in an underlying intention of obtaining a deeper green hue through a subtractive mixture: adding a yellow translucent coating produces a moderate shift of Vis-reflected radiation from blue to green[144].

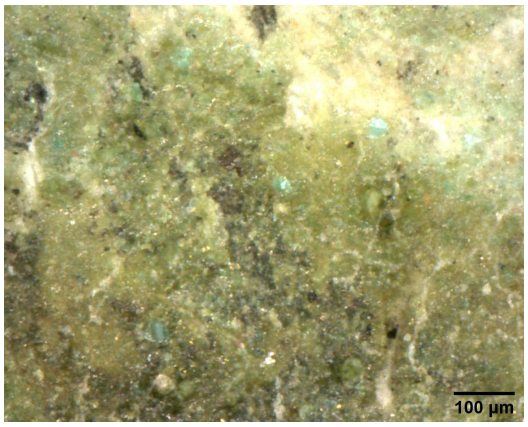


Figure 3.29: DM image of a green paint with a marked craquelure, 435x (0.68 mm x 0.91 mm field of view), from Res. 328.v, fol. 1^{r}.

RS spectra do not reveal only protein-related vibrations and show further vibrations that could be related to another adhesive. Some weak features at 2110 and 1760 nm can be related to the functional groups of a polysaccharide [δ(CO)+ν(OH); 2ν(CH$_2$)][145], the major binding agent for late medieval illumination[146]. Finally, the presence of Pb in all

in a fifteenth-century Book of Hours: the case study of Cofre no. 31 from Mafra National Palace"; Melo et al., "A spectroscopic study of brazilwood paints in medieval books of hours"; Helmut Schweppe et al. *Madder and Alizarin*. Ed. by Elizabeth West Fitzhugh. Vol. 3. Washington, CO and London: National Gallery of Arts and Archetype Publications, 1997. Chap. 4, pp. 109–142, p. 111; Vitorino, "A Closer Look at Brazilwood and its Lake Pigments".

[143] Spike Bucklow. "The Description of Craquelure Patterns". In: *Studies in Conservation* 42.3 (1997), pp. 129–140. DOI: https://doi.org/10.2307/1506709; Ludovic Pauchard et al. "Craquelures and pictorial matter". In: *Journal of Cultural Heritage* 46.1 (2020), pp. 361–373. DOI: https://doi.org/10.1016/j.culher.2020.08.007.

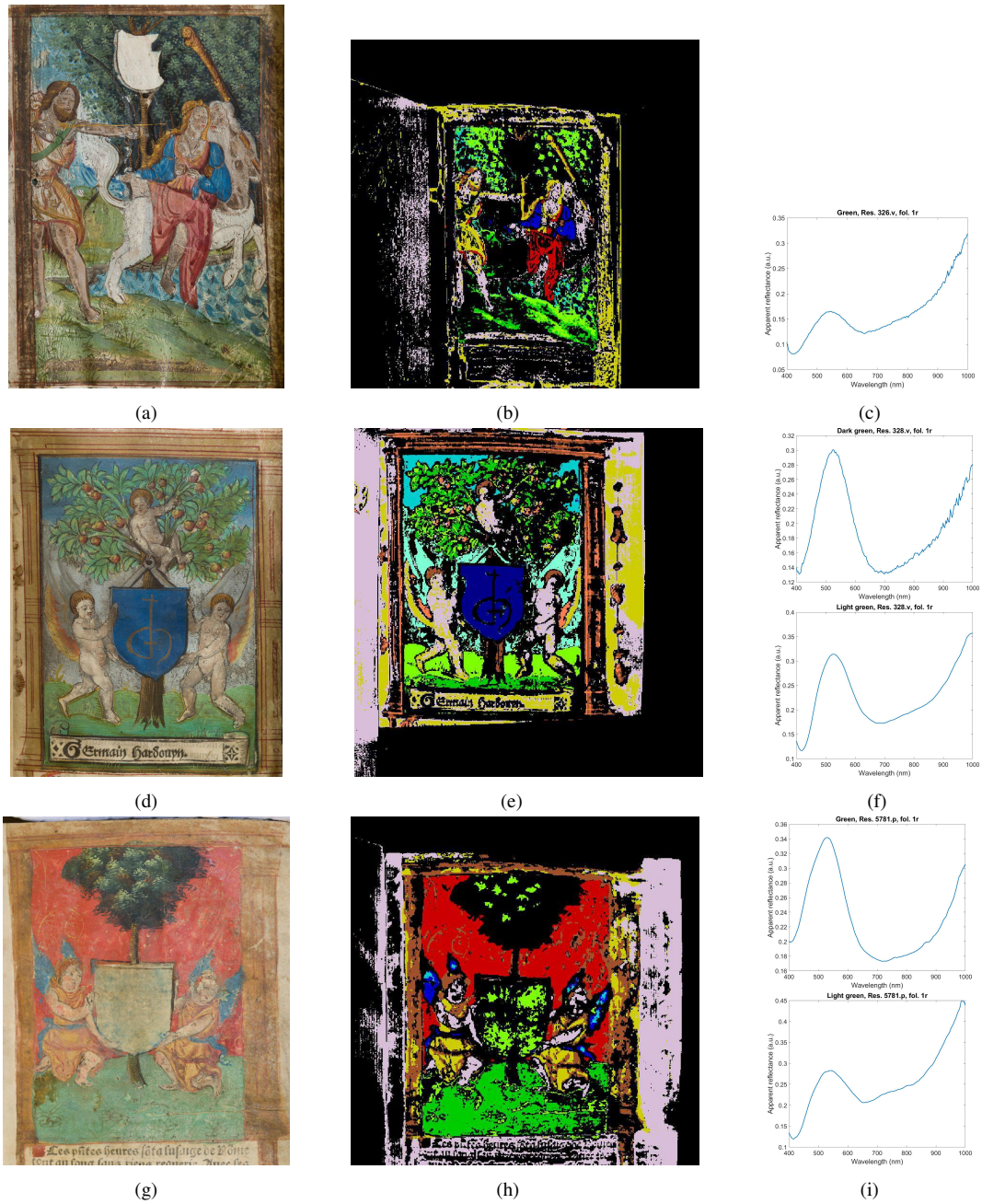
[144] Johnston-Feller, *Color Science in the Examination of Museum Objects: Nondestructive procedures*, pp. 16-17; Pauchard et al., "Craquelures and pictorial matter".

[145] Yongjiang Dong et al. "Gum Arabic authentication and mixture quantification by near infrared spectroscopy". In: *Food Control* 78 (2017), pp. 144–149. DOI: https://doi.org/10.1016/j.foodcont.2017.02.002.

[146] Kroustallis, "Binding media in medieval manuscript illumination: a source of research"; Carvalho et al., "Colour identification, degradation processes and findings in a fifteenth-century Book of Hours: the case study of Cofre no. 31 from Mafra National Palace"; Melo et al., "A spectroscopic study of brazilwood paints in medieval books of hours".

samples, combined with its vibrations in the NIR (DR), leads to infer the presence of lead white as the extender in most paints, and gypsum was supplemented too to some *Printer's device* illustrations.

HSI mapping on the green paints (solid areas in green hues, figs. 3.30 and 3.31) showed an interesting use of the green paints.



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 3.30: HSI maps of all paints (b, e, h) compared with the Vis images of all *Printer's device* across the case studies (a, d, g). The dark and light green solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.025; f) 0.020 in all cases; i) 0.020 in all cases. The EM are shown in (c), (f), (i).

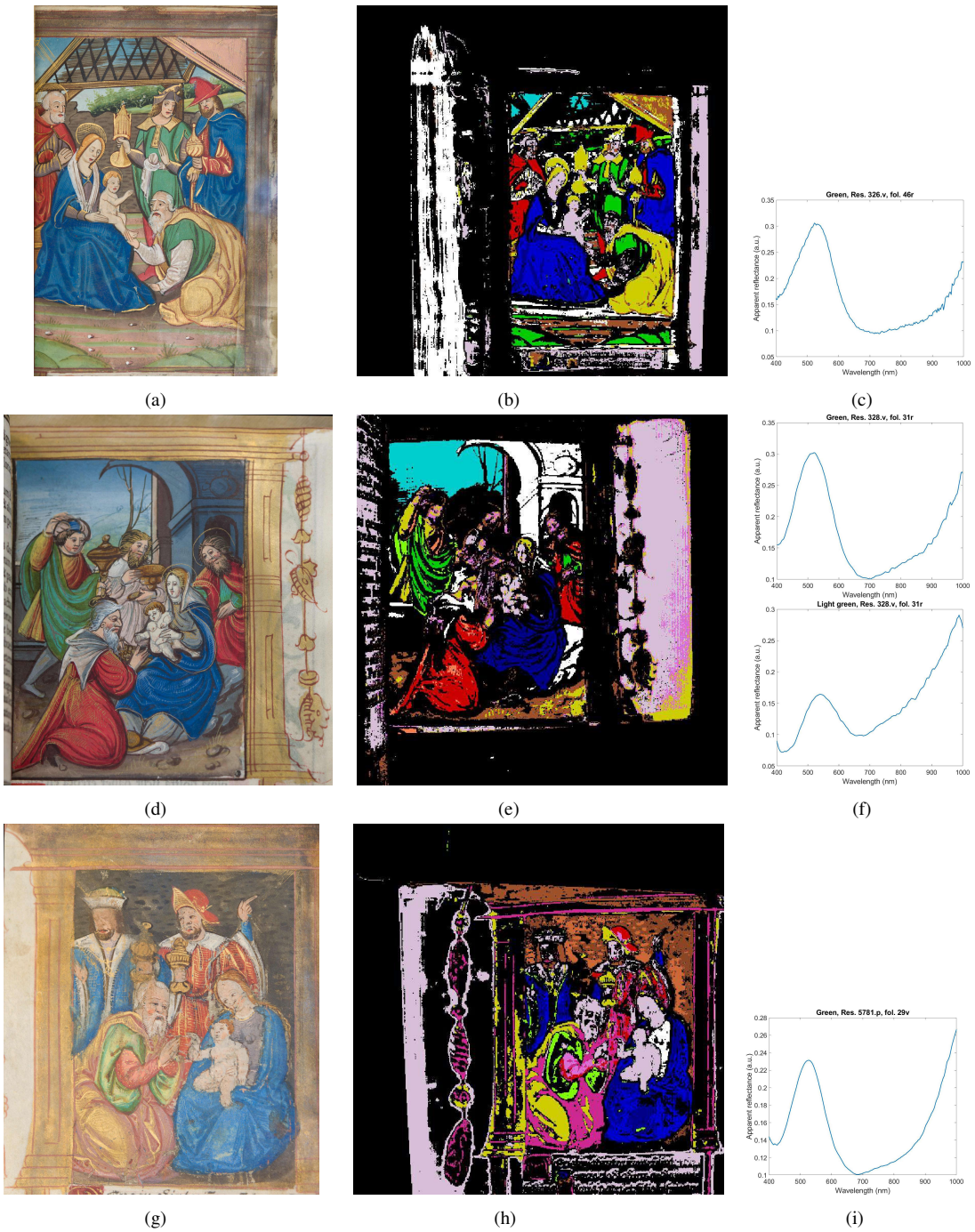


Figure 3.31: HSI maps of all paints (b, e, h) compared with the Vis images of all *Adoration of the Magi* across the case studies (a, d, g). The dark and light green solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.020; f) dark green, 0.005; light green, 0.030; i) 0.160. The EM are shown in (c), (f), (i).

Those mixtures display the largest variability. In fact, the endmembers employed for the mapping within one hypercube hardly represented the entire pictorial area for that mixture (solid dark and light green areas, figs. 3.30a-3.30b), or more than one endmember

had to be extracted to represent broader areas (figs. 3.30d-3.30e)[147]. Those variations may arise as either the effect of differing amounts of their pigments or a set of pigments applied. As a result, large portions of the hyper-cubes stay unclassified. A likely reason for the taxing difficulty of classifying these mixtures is the fact that yellow colourants exhibit a poor spectral response to RS in the visible range. Thus, these colourants do not possess a fingerprinting mark that would allow a conclusive identification.

Red paints Red paints were also applied in all cases but in *Printer's device* of Res. 328.v, where orange appears instead[148]. The results from their evaluation are illustrated on Table 3.13. Observing Table 3.13 allows drawing two remarks based on the compositional information. The first of which comments is that the artists employed essentially two colourants for colouring, one mineral and the other organic; the second is that no distinct difference emerges about the formulation of the mixtures. In fact, paint mixtures of comparable formulation seem to be given indifferently across the leaves.

Table 3.13: Results of the tentative identification of the components for the red and orange paints: colourants, extenders and binders.

Book	Leaf	Spot	Colourant	Extender	Binder
Res. 326.v	1^{r}	1	madder lake	gypsum	protein, polysaccharide
	46^{r}	1	vermilion	lead white	polysaccharide
Res. 328.v	1^{r}	1	red lake over Pb-based yellow	none / not identif.	protein, polysaccharide
	31^{r}	1	vermilion	lead white	polysaccharide
		2	vermilion red lake	lead white polysaccharide	
Res. 5781.p	1^{r}	1	vermilion	gypsum	protein, polysaccharide
	29^{v}	1	vermilion red lead ochres	not identif.	polysaccharide
		2	vermilion red lake	lead white	polysaccharide
		1	not identif. (org?)	lead white	polysaccharide

[147]The endmembers employed for the mapping are given in Appendix F, Section F.3.

[148]The spots of analysis for the red and orange paints are indicated in Appendix F, Section F.3.

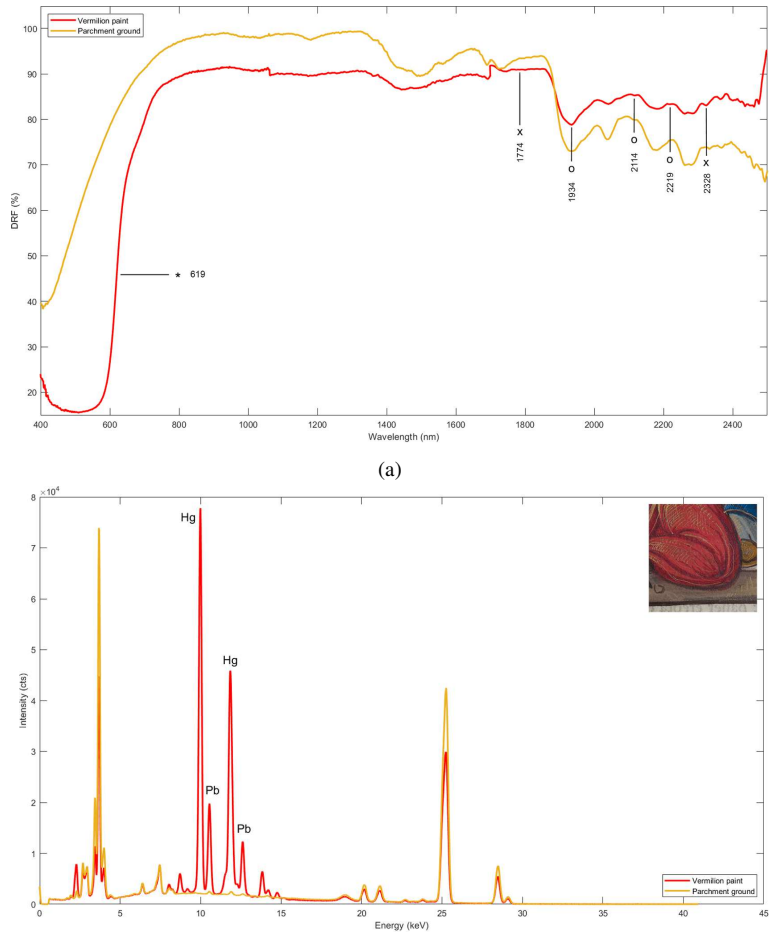


Figure 3.32: Sample spectra of vermilion paints: a) UV-Vis-NIR FORS spectrum (red solid line) of a reference paint compared with the parchment ground (yellow solid line; from Res. 328.v, fol. 31^{r}, same spot as b)). The bands associated to the pigment are labelled with an asterisk marker (*); for the extender(s), the circle marker (o); b) XRF reference spectrum (red solid line) compared to the parchment ground (yellow solid line; from Res. 328.v, fol. 31^{r}, shown on the top).

From the spectroscopic point of view, the spots with vermilion[149] are characterised by a steep curve that draws an inflection point at c. 600 nm to end in a well-defined plateau until the end of the Vis range (fig. 3.32a). Sharp reflectance curves are the typical electrical response (Vis range) of semiconducting pigments. In vermilion, its red colour comes from a bandgap absorbing all radiations with wavelengths shorter than 600 nm (after the red) while allowing those with longer wavelengths to get reflected (it covers all

[149] Some confusion may arise around the nomenclature of the red HgS. In fact, this mineral exists in two forms. The natural phase is called cinnabar (α-HgS), while the synthetic pigment is called vermilion (Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*). For an extensive description of vermilion and cinnabar, see Rutherford J. Gettens et al. *Vermilion and Cinnabar*. Ed. by Ashok Roy. Vol. 2. Washington, CO and London: National Gallery of Arts and Archetype Publications, 1993. Chap. 7, pp. 159–182.

the red region since it ranges from 610 to 780 nm). This phenomenon arises because of the crystalline structure of this mineral, which contains tiny sulfide ions (S^{2-}) in the interstitial positions of the Hg lattice, with the result of doping it[150]. However, in almost all cases, position of the inflection does not fall exactly at 600 nm as the pure pigment but near 610 nm, shifting by 10 nm. A possible reason for the shift could be due to the presence of lead white: the study of the pigment behaviour on laboratory mock-ups showed that the presence of the white pigment affects the position of the band (fig. 3.33).

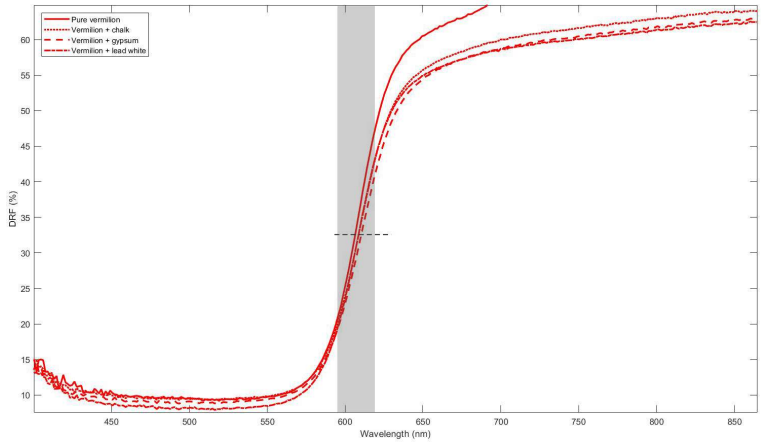


Figure 3.33: Vis-FORS spectra of laboratory mock-ups of vermilion mixed to various pigments and extenders: pure vermilion (solid line); vermilion + chalk (dot line); vermilion + gypsum (dash line); vermilion + lead white (dash-dot line). The level of the inflection point is indicated with a horizontal dash line; all mixtures contain 10% of extender (% w/w) and are bound with the same agent (gum Arabic).

In relation to other kinds of colourant, medieval artists employed natural dyestuff extensively for pictorial use. The most popular red colourants for illumination were dyestuff of the anthraquinone family (madder, kermes, cochineal, lac dye, for instance)[151] or neoflavanoids (brazilwood)[152]. These colourants exhibit in the Vis range a steady increase in reflectance around 600 nm with a plateau around 800 nm. Strong absorption bands (λ_{abs1} and λ_{abs2}) are seen before the rise of reflectance, and they are assigned to the n →

[150] J.O. Akinlami et al. "Electronic and optical properties of β-HgS". in: *Semiconductor physics* 22.2 (2019), pp. 150–155. DOI: https://doi.org/10.15407/spqeo22.02.150PACS42.79.Pw.

[151] Schweppe et al., *Madder and Alizarin*; Paula Nabais et al. "Microspectrofluorimetry and chemometrics for the identification of medieval lake pigments". In: *Heritage Science* 6.13 (2018). DOI: https://doi.org/10.1186/s40494-018-0178-1.

[152] Vitorino, "A Closer Look at Brazilwood and its Lake Pigments"; Tatiana Vitorino et al. "New insights into brazilwood lake pigments manufacture through the use of historically accurate reconstructions". In: *Studies in Conservation* 61.5 (2016), pp. 255–273. DOI: https://doi.org/10.1179/2047058415Y.0000000006; Melo et al., "A spectroscopic study of brazilwood paints in medieval books of hours"; Raquel Rondão et al. "Brazilwood Reds: The (Photo)Chemistry of Brazilin and Brazilein". In: *Journal of Physical Chemistry* 117.41 (2013), pp. 10650–10660. DOI: https://doi.org/10.1021/jp404789f.

π^* transitions of the carbonyl in the anthraquinone core[153]. The position of the transitions is observed to single out its composition, and in madder[154], λ_{abs1} λ_{abs2} fall at 510 and 540 nm respectively[155]. The red colourants used for the decoration of Res. 326.v, fol. 1^r, Res. 328.v, fol. 31^r (spot 2) and Res. 5781.p, fol. 29^v (spot 2) reveal the two bands at the above position.

The XRF signal of the red spot in Res. 326.v confirms the suspicion that this colourant may be organic through the absence of a marker element. Additionally, the XRF spectrum of this red contains a weak Kα transition of Al, an element commonly used as the complexing agent for the preparation of lakes[156].

At a close inspection with DM, madder lake paints appear as quasi-opaque glazes (fig. 3.34). However, the execution of the technique varies across the leaves: in *Printer's de-*

[153]Mario R. Reta et al. "Solvatochromism of anthraquinone and symmetrical dihydroxy derivatives. Local interactions". In: *Spectrochimica Acta Part A: Molecular Spectroscopy* 49.7 (1993), pp. 903–912. DOI: https://doi.org/10.1016/0584-8539(93)80209-S; Beatriz Fonseca et al. "Seeing red: towards an improved protocol for the identification of madder- and cochineal-based pigments by fiber optics reflectance spectroscopy (FORS)". in: *Heritage Science* 7 (2019), p. 92. DOI: https://doi.org/10.1186/s40494-019-0335-1.

[154]Madder is a dyestuff derived from the roots of numerous plants of the *Rubiaceae* family, especially *Rubia*, *Galium*, *Morinda* and *Rebulnium* plants: *R. tinctorum* L., *Odenlandia*, *Morinda* and a variety from East, *R. peregrina* L. are among the most common. Such plants have a wide geographical distribution, ranging from Central Europe, Middle East and South America. The European varieties are *Rubia* and *Galium* plants; *Morinda* and *Rebulnium* grow in the American continent. An orangish-red dye was extracted by crushing the roots (and sometimes the bark) of these plants and leaving them in an aqueous liquor to macerate. This process was performed until a satisfactory amount of its dyes was extracted, namely molecules from the anthraquinone family: alizarin, purpurin and anthragallol are the most common in plants from the *Rubia* and *Galium* plants; munjistin is found more frequently in *Morinda* and *Rebulnium*. Each of those colorant has got its own stability, solubility in aqueous media and lightfastness; among all of them, alizarin displays the greatest stability to chemical and luminous degradation. On it, see Eastaugh et al., *The Pigment Compendium A Dictionary of Historical Pigments*, p. 244; Schweppe et al., *Madder and Alizarin*.

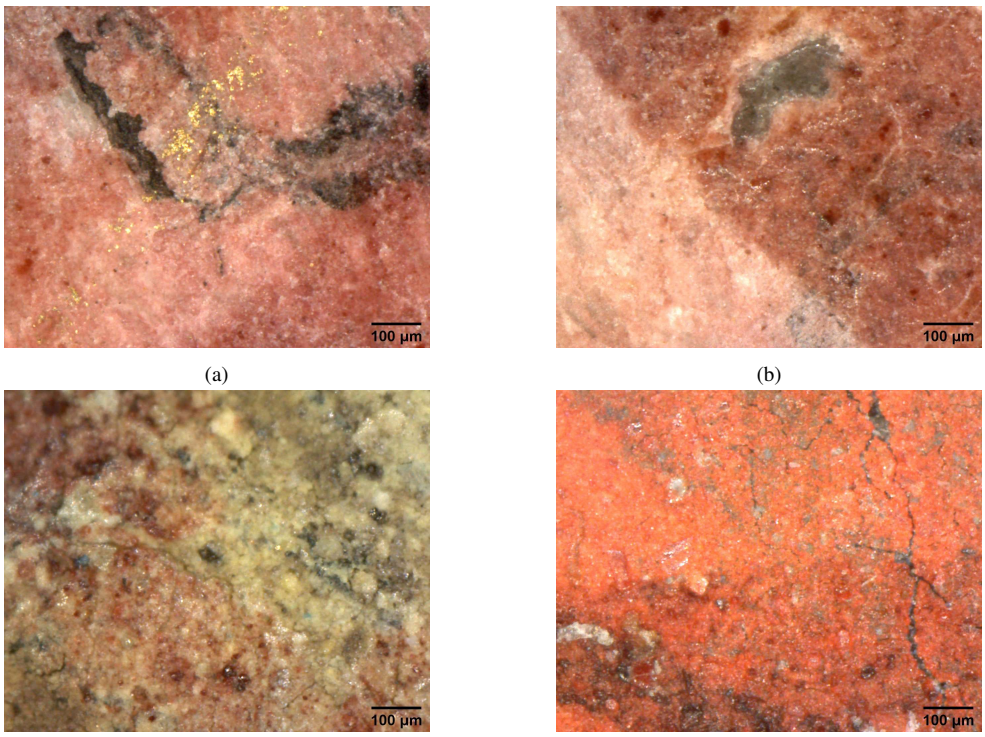
[155]This kind of analysis must be considered as tentative since previous investigations highlighted that both the intensity of the absorption bands and their position are affected by a number of factors. For lake pigments, the most important are the applied synthesis methodology, nature of the metallic compound used to precipitate the dyestuff, substrate on which they are applied, number of consecutive layers of application and so forth (Vitorino, "A Closer Look at Brazilwood and its Lake Pigments"; Lucilla Pronti et al. "Intrinsic limits of reflectance spectroscopy in identifying pigments in paint layers". In: *IOP Conference Series: Materials Science and Engineering* 364 (2018), p. 012061. DOI: https://doi.org/10.1088/1757-899x/364/1/012061; Fonseca et al., "Seeing red: towards an improved protocol for the identification of madder- and cochineal-based pigments by fiber optics reflectance spectroscopy (FORS)"; Jacobs, "The Fingerprinting of the Materials used in Portuguese Illuminated Manuscripts: Origin, Production and Specificities of the 16th century Antiphonary Paints from the Biblioteca Pública de évora").

[156]Vitorino, "A Closer Look at Brazilwood and its Lake Pigments"; Jacobs, "The Fingerprinting of the Materials used in Portuguese Illuminated Manuscripts: Origin, Production and Specificities of the 16th century Antiphonary Paints from the Biblioteca Pública de évora", p. 11; Jo Kirby et al. "The Technology of Red Lake Pigment Manufacture: Study of the Dyestuff Substrate". In: *National Gallery Technical Bulletin* 26 (2005), pp. 71–87.

vice of Res. 326.v, a white ground is visible through the craquelure of the transparent red glaze (figs. 3.34a and 3.34b); in the other leaves, the thin organic coating is layered over coloured films (fig. 3.34c). In the first case (Res. 326.v), the white ground may be used with the two-fold purpose of masking the underprinted outline as well as the preparatory layer for the red application. In turn, the red lake could be purposedly formulated as incomplete hiding to control darkening. To reduce print brightness, an artist can indeed choose to supplement a small amount of black pigment or increase colourant concentration or the layer thickness to increase the overall absorption rate of the visible radiation[157]. If artists followed the latter pathway, they could quench paint brightness while retaining glossiness. Such could have been the technical choice that the artist of the case studies adopted to decorate Res. 326.v, fol. 1^{r}. This fact emerges in Figure 3.34b: the image shows an area where the paint flaked away to unravel the underlaying black ink: the underlayer of the lighter red glaze appears at the boundaries of the damage while a darker overglaze seems to be applied directly over it since it can be viewed through the craquelure. The scattering pigment applied for the purpose (i.e. the white pigment) could be gypsum, as the combination of RD-NIR and XRF spectra suggest. All the vibrations of gypsum are seen in the NIR region, and Ca and S appear as the major elements of the spots of analysis for the area (fig. 3.35).

Returning to the remaining red glazes, the behaviour and formulation of the glaze appears comparable to the illustrated case of Res. 326.v, fol. 1^{r}, with the only difference that these mixtures are applied over either a yellow coating to achieve an orangish hue (fig. 3.34c) or on opaque red paints for shading (fig. 3.34d).

[157] Daniela R. Leonard. "An Exercise in Fugitivity: Investigating the fading of red lake pigments". In: *E-conservation Journal* 5 (2017). DOI: https://doi.org/10.18236/econs5.201702.

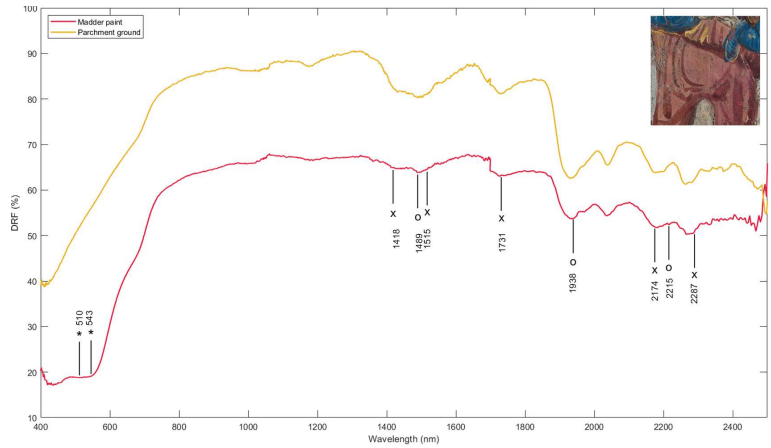


(a) (b)

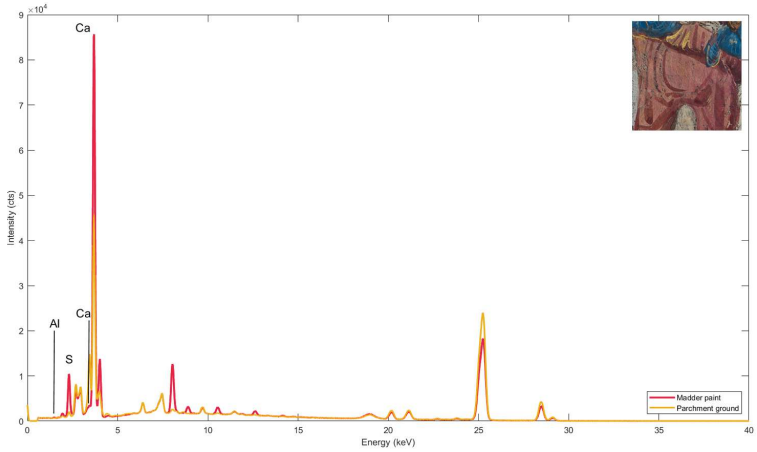
(c) (d)

Figure 3.34: DM images of red lakes across the case studies, 435x (0.68 mm x 0.91 mm field of view): a) and b) Res. 326.v, fol. 1^{r}; c) Res. 328.v, fol. 1^{r}; d) Res. 328.v, fol. 31^{r} © HERCULES Laboratory.

Lead white might have been used as an extender, dispersed in all mixtures but the organic glazes as based on the DR-NIR and XRF analysis results (fig. 3.35). Besides, the adhesive employed might have been a polysaccharidic adhesive. In the organic glazes, proteinaceous binders could have been applied instead.



(a)



(b)

Figure 3.35: Sample spectra of the red glazing: a) UV-Vis-NIR FORS spectrum (red solid line) of a reference paint compared with the parchment ground (yellow solid line; from Res. 326.v, fol. 1^{r}, spot shown on top). The bands associated to the pigment are labelled with an asterisk marker (*); for the extender(s), the circle marker (o); b) XRF reference spectrum (red solid line) compared to the parchment ground (yellow solid line; from Res. 326.v, fol. 1^{r}, shown on the top).

Finally, the colorimetric coordinates for the paints are presented numerically in Table 3.14 and projected in the Cartesian coordinate system illustrated in fig. 3.36. Figure 3.36 reveals two major cluster in connection to the a* and b* coordinates: one of these is situated in an area at higher values of +a* and +b* (yellowness and redness), while the other falls on the other side of the plane, towards slightly toward -a* and -b* (blueness and greenness). As a result of the clustering, the first cluster describes paints at higher values of saturation while the second reveals a consistent production of darker and duller paints.

Table 3.14: Colorimetry coordinates for the red and orange paint spots of the case studies. The color is expressed as coordinates of the CIELAB color space (CIE1976) and is the average of three values, each being converted to a CIELAB set of values from single-pixel apparent reflectance spectra of hypercubes (see Appendix F, Section F.1.6 for a detailed description of the reflectance spectrum-to-color coordinate conversion).

Book	Leaf	Spot	Brightness	CIELAB values		
				*L**	*a**	*b**
Res. 326.v	1^{r}	1	Sl. Dark	44	19	21
	46^{r}	1	Light	36	46	34
Res. 328.v	1^{r}	1	Dark	37	19	22
	31^{r}	1	Dark	34	42	31
		2	Dark	22	46	39
Res. 5781.p	1^{r}	1	Sl. dark	45	35	27
	29^{v}	1	Light	36	37	40
		2	Light	59	23	26
		3	Light	47	12	15

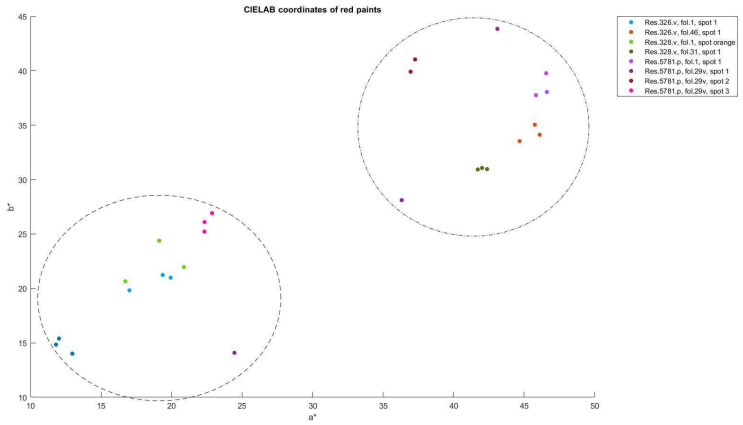
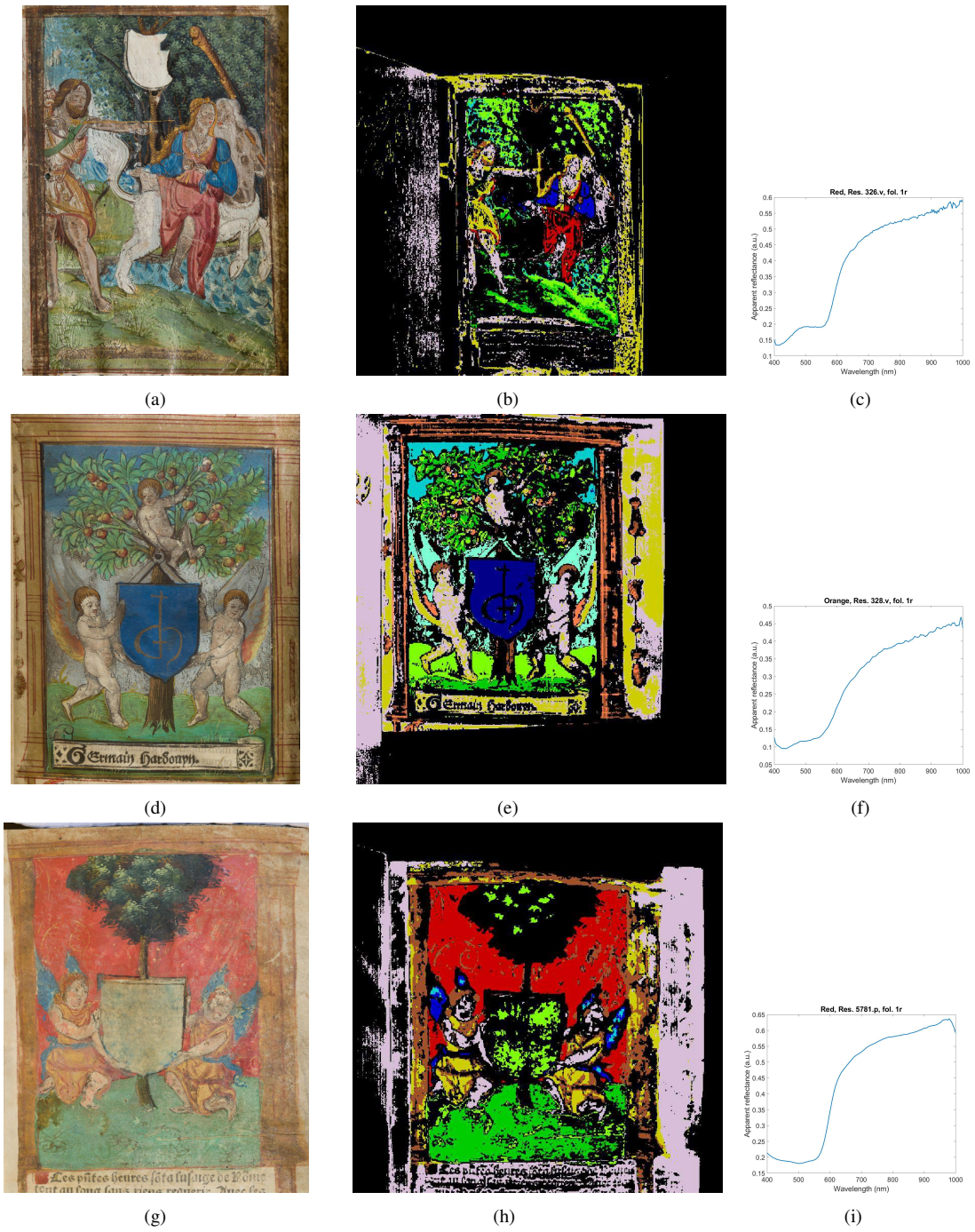


Figure 3.36: CIELAB coordinates of the red paints across the case studies (coordinates represented in a 2-D plot).

The HSI maps revealed that generally, individual red mixtures were given to a miniature (solid red, magenta and thistle areas, figs. 3.37 and 3.38). The only exception is represented by the Adoration of the Magi in the Res. 5781.p, fol. 49^{v}, where three different mixtures were given (figs. 3.38g - 3.38h).



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 3.37: HSI maps of all paints (b, e, h) compared with the Vis images of all *Printer's device* across the case studies (a, d, g). The red and orange solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.008; f) 0.010; i) 0.008. The EM are shown in (c), (f), (i).

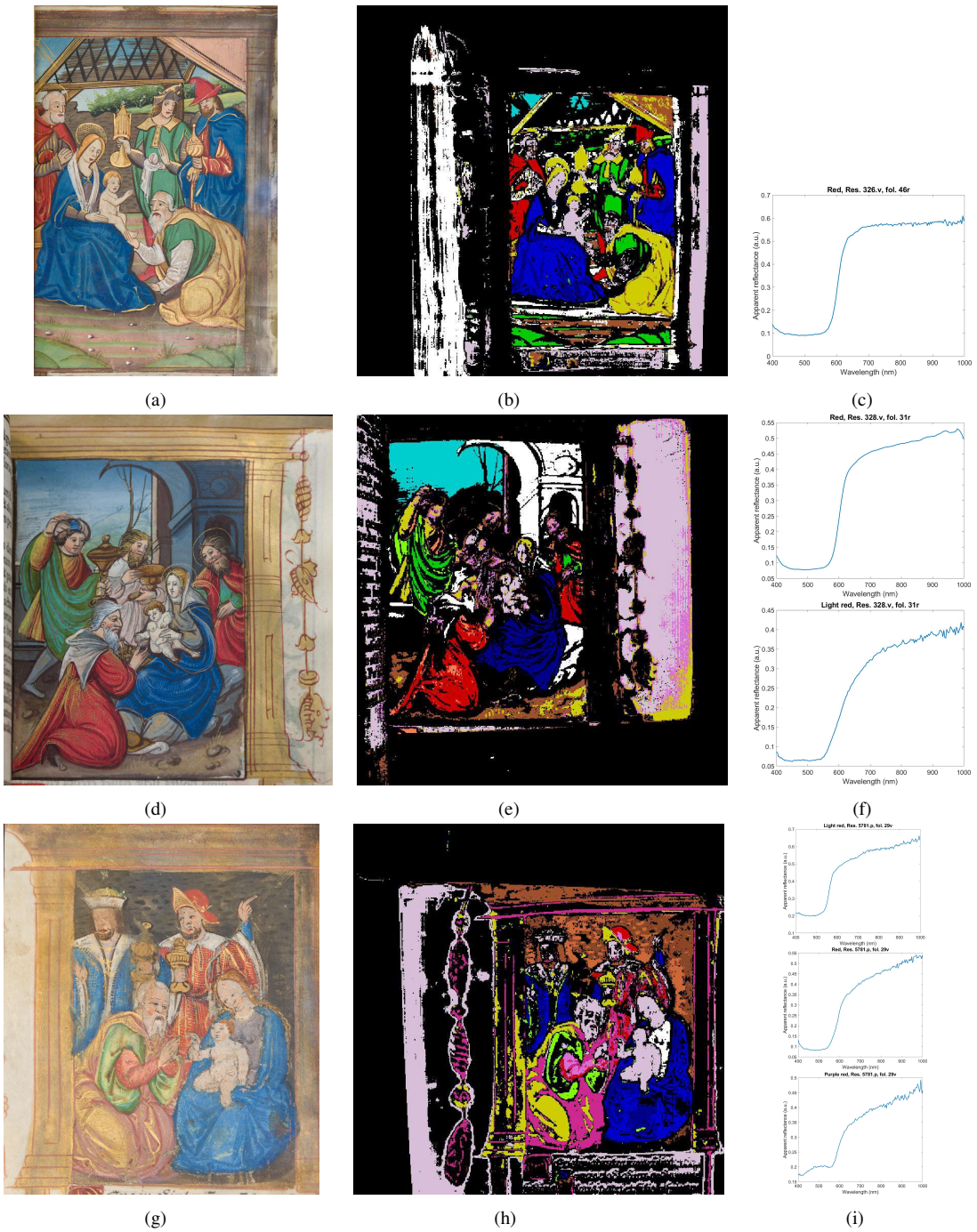


Figure 3.38: HSI maps of all paints (b, e, h) compared with the Vis images of all *Adoration of the Magi* across the case studies (a, d, g). The red solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.010; f) 0.005 in all cases; i) 0.008 in all cases. The EM are shown in (c), (f), (i).

Brown and pink paints Both brown and pink paints were analysed in all *folia* of the case studies[158]. Similarly to the previous paragraphs, their results are in Table 3.15. This table characterises the brown and pink mixtures as somehow comparable, compositionally speaking. They include ochres dispersed in polysaccharidic media.

Table 3.15: Results of the tentative identification of the components for the pink and brown paints: colourants, extenders and binders.

Book	Leaf	Spot	Hue	Colourant	Extender	Binder
Res. 326.v	1^{r}	Brown	1	red ochres + black pigments	lead white	polysaccharide
		Pink	1	Fe, Pb, Cu, Ca, S	not identif.	not identif.
	46^{r}	Brown	1	red ochres, red lead	lead white	polysaccharide
			2	orange ochres	lead white	polysaccharide
Res. 328.v	1^{r}	Pink	1	ochres + impurit.	lead white	polysaccharide
	31^{r}	Brown	1	not identif.	lead white	polysaccharide
		Pink	1	not identif.	lead white	polysaccharide
Res. 5781.p	1^{r}	Pink	1	red lake + impurit.	lead white, gypsum	protein, polysaccharide
	29^{v}	Pink	1	orange ochres	lead white, gypsum	polysaccharide

The word *ochre* is used among natural sciences and heritage science to label a mixture of earthy mineral phases comprising fine-grained oxides, hydroxides and oxo/hydroxides of iron. The profile of the minerals seen in natural ochres is highly heterogeneous, and it includes amorphous Fe-III-oxides (octahedral α-Fe_2O_3, trigonal Fe_2O_3) or Fe-III-oxo-hydroxides (α-FeOOH), among others[159]. Additionally, ochres include varying amounts of other compounds, most commonly quartz (SiO_2), various phases of calcite ($CaCO_3$) or alumino-silicates (like kaolinite or illite)[160]. The colour of ochres originates from charge transfers between the Fe^{3+} of the crystalline core and its ligands (O^{2-} or OH^{-}).

Because of the great heterogeneity among the species from this class, the colour of

[158]The spots of analysis for the brown and pink paints are indicated in Appendix F, Section F.3.

[159]For a more complete mineralogical list of natural ochres, see Mady Elias et al. "The colour of ochres explained by their composition". In: *Materials Science and Engineering: B* 127.1 (2006), pp. 70–80. DOI: https://doi.org/10.1016/j.mseb.2005.09.061;José Torrent et al. *Diffuse Reflectance Spectroscopy of Iron Oxides*. Ed. by Arthur T. Hubbard. Vol. 1. New York, NY: Marcel Dekker, 2002, pp. 1438–1446. See also Rochelle M. Cornell et al. *The Iron Oxides: Structure, Properties, Reactions, Occurrences and Uses*. Second, Completely revised and Extended Edition. Weinheim: Wiley-VHC, 2003 on their occurrence and diagenesis.

[160]Elias et al., "The colour of ochres explained by their composition"

ochres is not a constant property. In fact, ochres are broadly classified as red, yellow, orange or brown by their colour[161]. Their Vis-NIR reflectance spectra is characterised by a series of four transitions, three being single-electron transitions[162] and one an electron-pair transition[163].

According to Scheinost et al.[164], the electron-pair transition at *c.* 500 nm[165] determines the absorption edge of the mineral; in DR spectroscopy, its coupling with the next single-pair transition (650-750 nm) may create a first, marked inflection point (λ_m) in the region comprised between the two (520-590 nm). Thus the position of λ_m may be observed to determine the composition of an ochre.

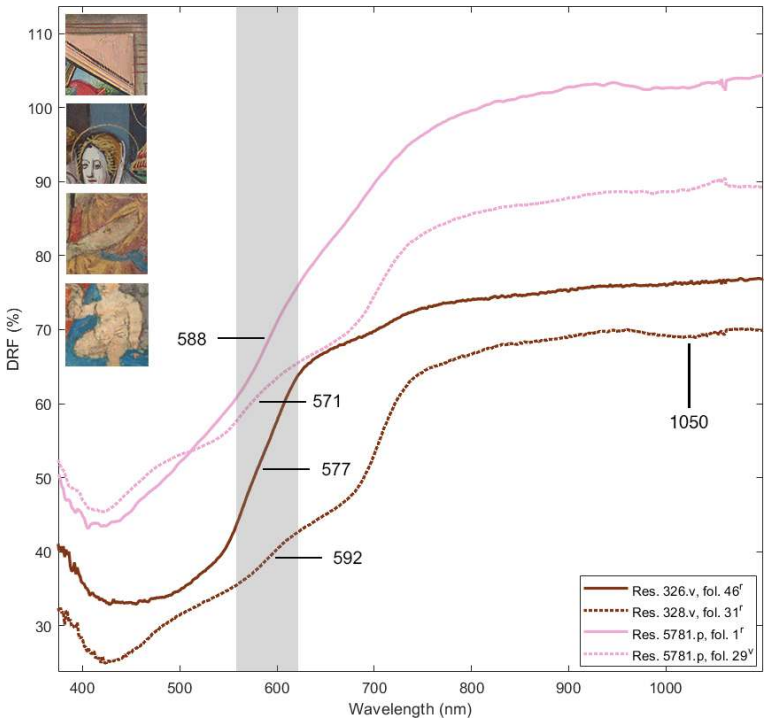
[161] Depending on the class, ochres can show higher amounts of hematite (red ochres), goethite (yellow ochres) or equal amounts of them (orange ochres). Nevertheless, to support the hypothesis of a significant abundance of one of the mentioned mineral phases or anyone else, X-ray diffraction results are required. Such analytical data is not given for the present work, so the classification of ochres will limit its attention to discriminate between red, yellow, brown or orange ochres based on their reflectance response (DR) and elemental profile (XRF).

[162] From the shortest to the longest wavelength, ^4E; $^4A_1 \leftarrow {}^6A_1$, $^4T_2 \leftarrow {}^6A_1$ and $^4T_1 \leftarrow {}^6A_1$. See also A.C. Scheinost et al. "Use and Limitations of Second-Derivative Diffuse Reflectance Spectroscopy in the Visible to Near-Infrared Range to Identify and Quantify Fe Oxide Minerals in Soils". In: *Clays and Clay Minerals* 46.5 (1998), pp. 528–536. DOI: https://doi.org/10.1346/CCMN.1998.0460506.

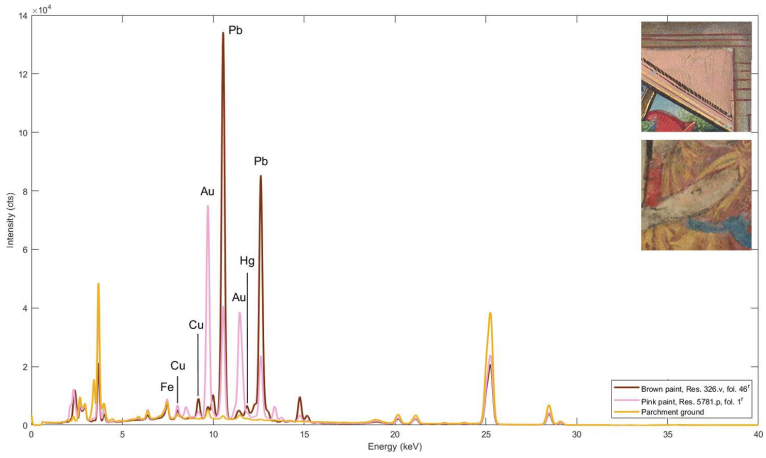
[163] ($^4T_1$ + $^4T_1$) *leftarrow* ($^6A_1$ + $^6A_1$). See also Scheinost et al., "Use and Limitations of Second-Derivative Diffuse Reflectance Spectroscopy in the Visible to Near-Infrared Range to Identify and Quantify Fe Oxide Minerals in Soils".

[164] Scheinost et al., "Use and Limitations of Second-Derivative Diffuse Reflectance Spectroscopy in the Visible to Near-Infrared Range to Identify and Quantify Fe Oxide Minerals in Soils".

[165] But for hematite, for which it is observed at *c.* 520-580 nm.



(a)



(b)

Figure 3.39: Sample spectra for pink and brown paints: a) UV-Vis FORS spectra of brown and pink paints, 375-1100 nm spectral range (brown in Res. 326.v, fol. 46^{r}; brown in Res. 328.v, fol. 31^{r}; pink in Res. 5781.p, fol. 1^{r}; pink in Res. 5781.p, fol. 29^{v}, spots shown on top left). The area where the characteristic λ_m falls is indicated with a transparent grey band. b) XRF spectrum of brown and pink paints (brown in Res. 326.v, fol. 46^{r}; pink in Res. 5781.p, fol. 1^{r}; spots shown on top left).

As for the paints in the case studies, their spectral response reveal features that are compatible with ochres, such as a double series of sharp slopes with a marked inflection point (λ_m). In brown paints, λ_m is seen at 578 nm (Res. 328.v, fol. 1^{r} and Res. 5781.p, fol. 29^{v}) and 583 nm (Res. 328.v, fol. 31^{r}); therefore, they lie approximately within the given

range for red ochres (575-580 nm, fig. 3.39a)[166]. In pink paints, λ_m is slightly shifted to shorter wavelengths: 572 nm (Res. 5781.p, fol. 29^v), 574 nm (Res. 328.v, fol. 1^r, spot 1), 578 nm (Res. 328.v, fol. 1^r, spot 2) and 585 nm (Res. 5781.p, fol. 1^r). Most spots across the case studies fall in the range given for orange ochres (565-580 nm). Only in one case, red lead seems to be supplemented to ochres (Pb_3O_4, in Res. 326.v, fol. 46^r)[167]. Another broad—yet weaker—transition falls at 1050 for brown ochres, which may label the presence of some goethite[168]. The last single-electron transition generates another series of characteristic transitions of the crystal field in the range 850-1050[169].

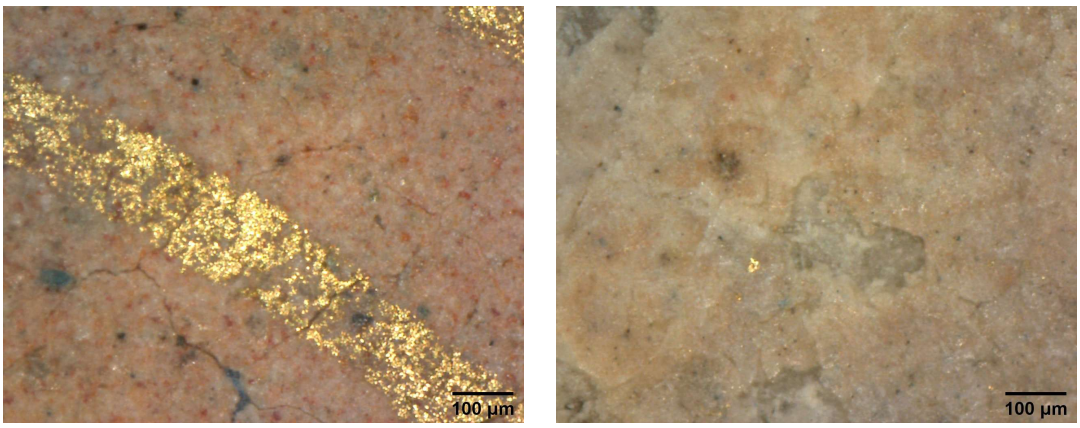
Although Vis-DR spectra allow ready identification of the applied ochres, their elemental profile does not communicate equally clear information. Only the spectra of the brown paint on Res. 326.v, fol. 1^r expresses a distinct presence of Fe (Kα and Kβ peaks respectively at 6.40 and 7.06 keV). In the remaining spectra of brown spots, the fluorescence lines of Fe are too weak to assign ochres to the spot of analysis only by the elemental profile. On the contrary, XRF data suggest the presence of extenders with a thorough, fair enrichment in Pb, of Ca and S in a portion of them (especially in Res. 326.v and Res. 5781.p). The observation matches the information from DR-NIR spectra, where the absorption bands for gypsum and lead white arise (fig. 3.39b).

[166] Elias et al., "The colour of ochres explained by their composition".

[167] The colour of red lead arises from transitions of the bandgap; therefore, it is a semiconductor (Svyatoslav Petrovich Gabuda et al. "XANES Pb LIII spectra of mixed-valence compound: minium, Pb3O4". In: *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 543.1 (2005). Proceedings of the XV International Synchrotron Radiation Conference, pp. 184–187. DOI: https://doi.org/10.1016/j.nima.2005.01.168). Its inflection point lies at 580 nm.

[168] Scheinost et al., "Use and Limitations of Second-Derivative Diffuse Reflectance Spectroscopy in the Visible to Near-Infrared Range to Identify and Quantify Fe Oxide Minerals in Soils".

[169] They have been assigned to the $^4T_1 \leftarrow {}^6A_1$. See Scheinost et al., "Use and Limitations of Second-Derivative Diffuse Reflectance Spectroscopy in the Visible to Near-Infrared Range to Identify and Quantify Fe Oxide Minerals in Soils".



(a) (b)

Figure 3.40: DM images of brown and pink mixtures: a) Res. 326.v, fol. 46^{r}; b) Res. 5781.p, fol. 1^{r} © HERCULES Laboratory.

DM images describe different technical executions, both in brown and pink paints. About brown mixtures, one kind consists of red pigments mixed brown and black grains, with a low amount of extender (fig. 3.40a). Another formulation includes small red grains incorporated into a compact matrix of white pigment, whereas another one is achieved by shading through yellow, transparent glazes[170]. Regarding pink mixtures, they also exhibit consecutive overlayers from a white substrate (fig. 3.40b) or dispersion of several pigments (prevalently red grains, small amounts of blue particles) within a white matrix.

Finally, the HSI maps for the brown and pink areas (solid brown and pink areas, figs. 3.41 and 3.42) reveal that generally, the areas characterised spectroscopically represented the entire pictorial area of a miniature.

[170] Other vibrational techniques may better help identify the nature of this compound.

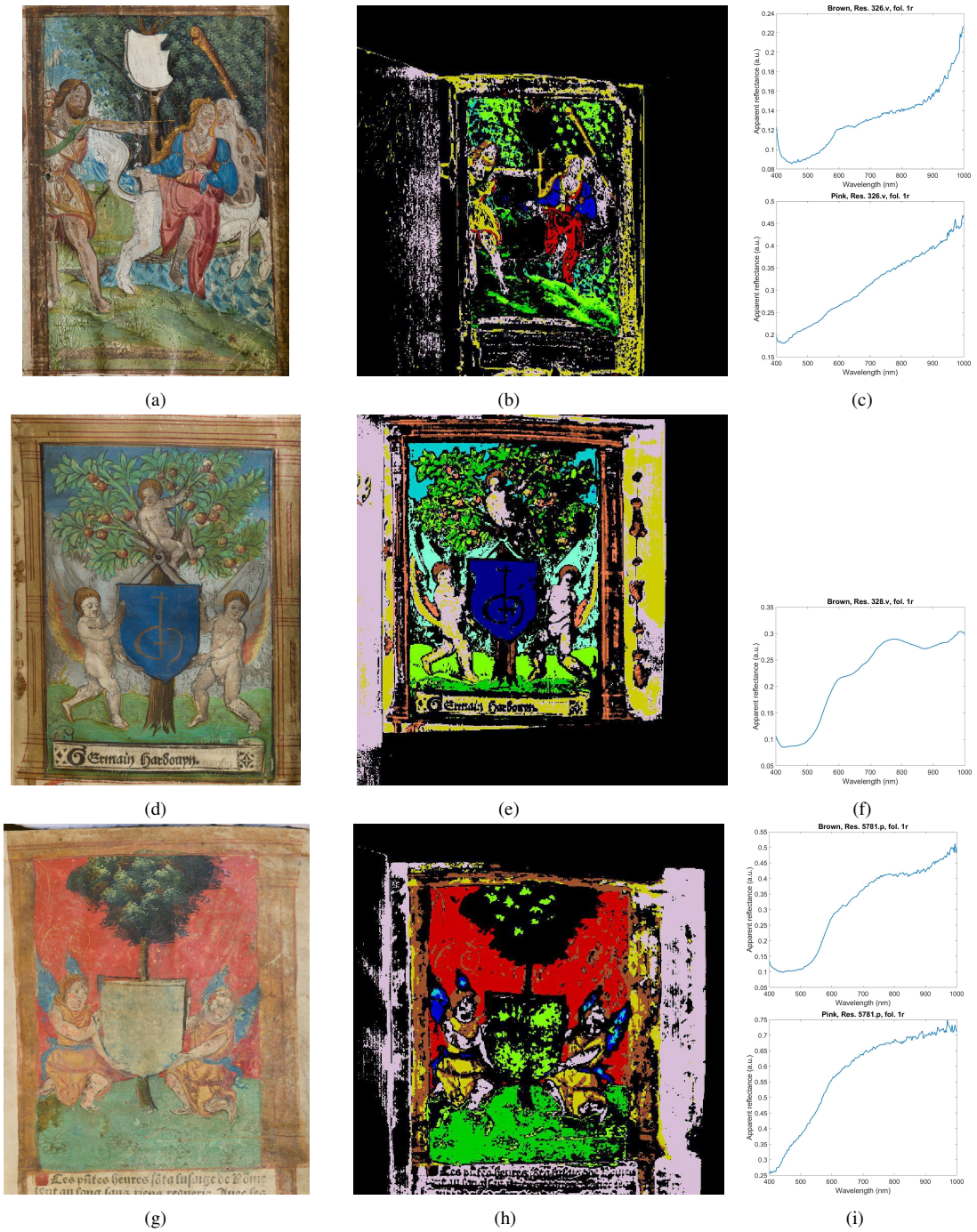


Figure 3.41: HSI maps of all paints (b, e, h) compared with the Vis images of all *Printer's device* across the case studies (a, d, g). The pink and brown solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.008 in all cases; f) 0.005 in all cases; i) 0.008 in all cases. The EM are shown in (c), (f), (i).

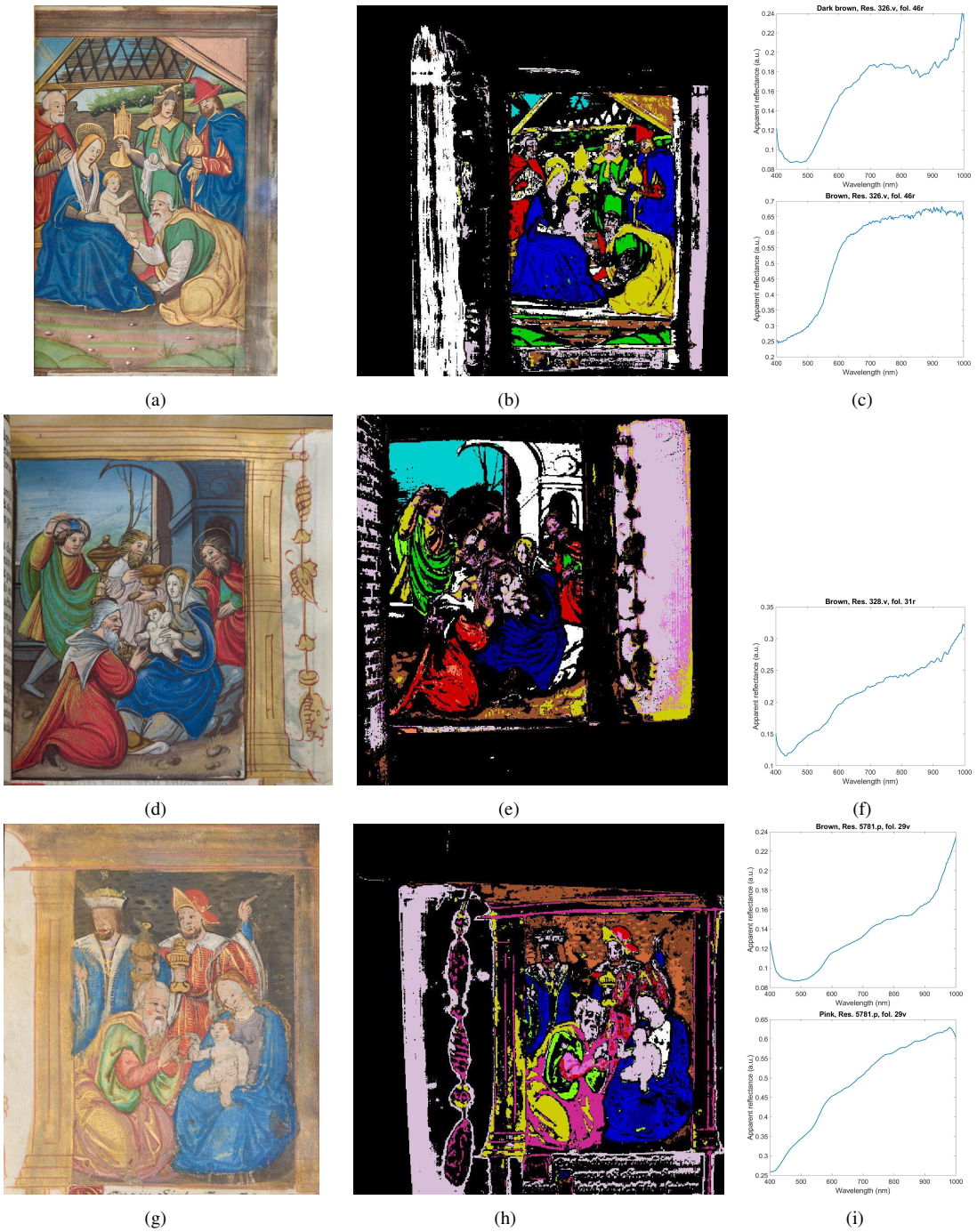


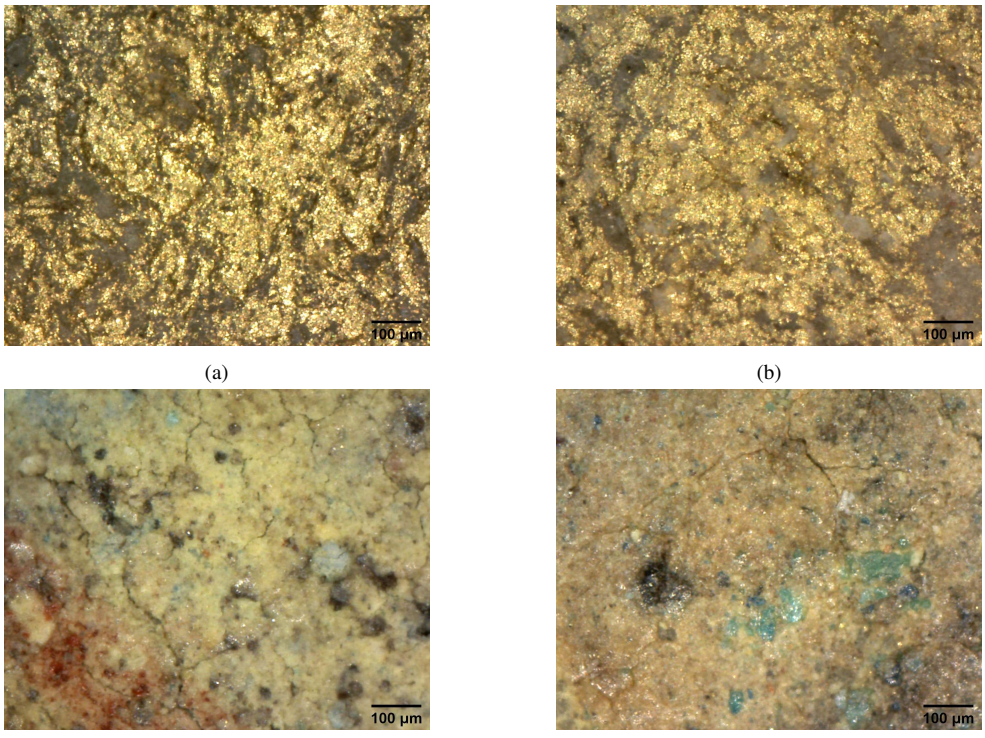
Figure 3.42: HSI maps of all paints (b, e, h) compared with the Vis images of all *Adoration of the Magi* across the case studies (a, d, g). The pink and brown solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.006 in all cases; f) 0.006; i) 0.008 in all cases. The EM are shown in (c), (f), (i).

Yellow paints Yellow paints appear seldom in the books here studied[171]. Because of the limited use, one spot only was studied per case study, and the results from their analysis

[171] The spots of analysis for the yellow paints are indicated in Appendix F, Section F.3.

are presented in Table 3.17 at the end of this section.

As with brown and pink paints, the composition of this class of mixtures draws two clusters by technical routine. The first group includes the sole spot of Res. 326.v, fol. 46^{r}[172]: its DM images display a powdery layer with golden glare laid on a dark film (fig. 3.43). With XRF, the top layer is identified as gold powder (9.7 and 11.4 keV, Au Lα and Lβ lines), while the presence of fluorescence of iron atoms (spectral lines at 6.4 and 7.1 keV, Fe Kα and Kβ, fig. 3.44b) implies the possible use of ochres for the bottom dark ground. RD-UV-Vis spectrometry supports the identification of gold through a broad absorption at the beginning of the Vis region (480-500 nm) as well as a steady increase of reflectance until the end of the Vis region and throughout the NIR region (fig. 3.44a). This behaviour is typical of gold-based materials[173].



(a) (b) (c) (d)

Figure 3.43: DM images of yellow mixtures (two clusters by composition): a) instance of the first cluster, Res. 326.v, fol. 46^{r}; b) first cluster, Res. 5781.p, fol. 1^{r}; c) second cluster, Res. 328.v, fol. 1^{r}; d) second cluster, Res. 326.v, fol. 46^{r} © HERCULES Laboratory.

[172]The spectral data obtained for this cluster of data include only the mentioned spot of analysis. However, the DM images indicate that a similar mixture was also given to Res. 5781.p, fol. 1^{r}. See figure 3.43.

[173]Errol F.I. Roberts et al. "The colour characteristics of gold alloys". In: *Gold bulletin* 12.1 (1979), pp. 9–19. DOI: https://doi.org/10.1007/BF03215099.

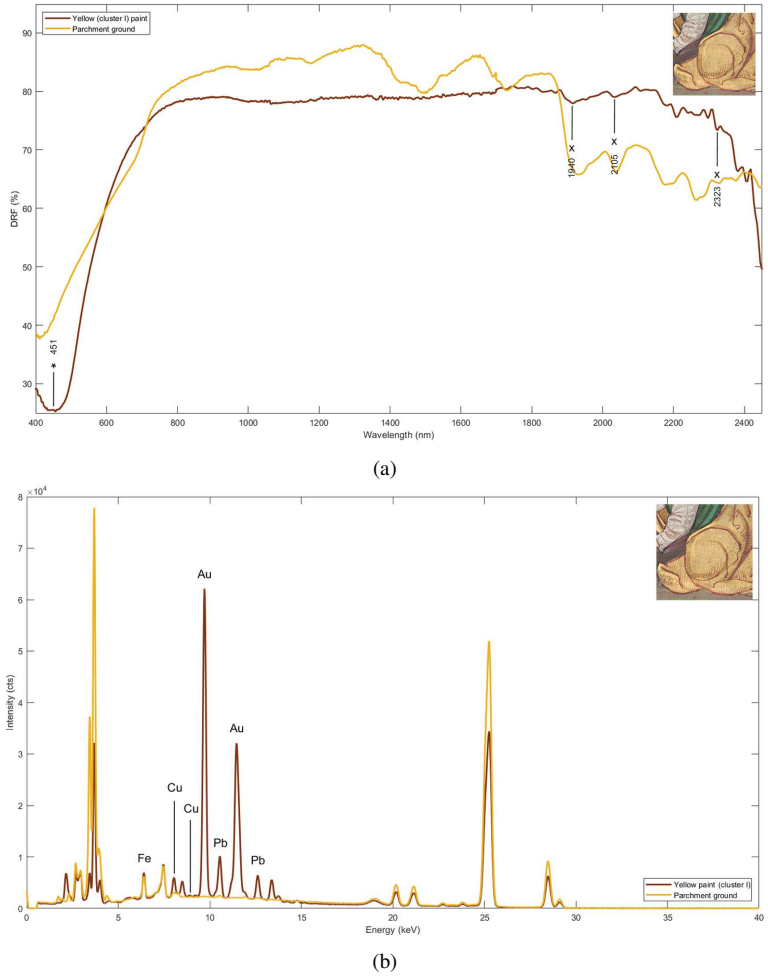


Figure 3.44: Sample spectra of yellow spot, cluster I (gold-based paints): a) UV-Vis-NIR FORS spectrum (brown solid line) compared with the spectrum of the parchment ground (yellow solid line, from Res. 326.v, fol. 46^{r}, spot shown on the top); b) XRF spectrum (brown solid line) compared with the parchment ground (yellow solid line, from Res. 326.v, fol. 46^{r}, spot shown on the top).

Other than these details, the remaining findings from DR spectrometry for this spot is the appearance of polysaccharide fingerprints, probably used as the adhesive of the paints. Thus, it is relatively safe to believe that the top layer is given with powdered gold mixed with a polysaccharide, like a vegetable gum (*shell gold*[174]). Besides, the radiative interaction of the gold particles and the excitation source of DR spectrometry could explain

[174]The technique of reducing gold to a powder was already known in the third century CE (Leyden papyrus X, recipe 53; see Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, pp. 169-170). Much later, Theophilus Presbyter (*fl.* twelfth century) reports a Flemish recipe to prepare gold powder by association with mercury (*Schedula diversarum artium*, recipe 33); the fifteenth-century *Bolognese manuscript* (Biblioteca della Università di Bologna, Ms. Lat. 2861) describes a similar method showing only little difference from Theophilus' technique (see Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, p. 170). Also in the fifteenth century the Italian Cennino Cennini describes a procedure to give powdered gold to various surfaces, including those for illumination (*Libro dell'Arte*, recipe 160).

the failure to identify the ochres as well as the extender. In fact, gold reflectivity keeps steady across all the NIR region, where it can exceed 96% of the reflected radiation[175]. Therefore, the gold particles could bounce off all the radiation, preventing it from reaching the lower depths. As a result, this property of the gilding may frustrate the efforts of identifying the below level of the suspected ochres.

The second cluster of paints comprises mixtures of a yellow pigment in a polysaccharide binder. Only a major enrichment in Pb in the XRF spectra suggests that this element could be the major component of the pigment (10.50, 12.61 and 14.76 keV, Lα, Lβ and Lγ fluorescence lines, fig. 3.45b[176]. In Res. 5781.p, weak peaks of the Sn spectral lines appear at the end of the spectrum (25.27, 25.04, 28.49 keV, Kα1, Kα2 and Kβ), but not those relative to Si[177] while in the spot of Res. 328.v, these lines do not appear. This fact suggests that the yellow pigment could be Pb- and Sn-based, like a lead-tin yellow (type I, due to the absence of Si)[178]. The relative weakness of the Sn spectral line does not allow inferring whether the pigment was used alone or mixed to another Pb-based yellow. As for Res. 328.v, the absence of these lines in its DR spot implies the exclusive use of another pigment, like a Pb-based yellow (massicot or litharge). In fact, the reflectance

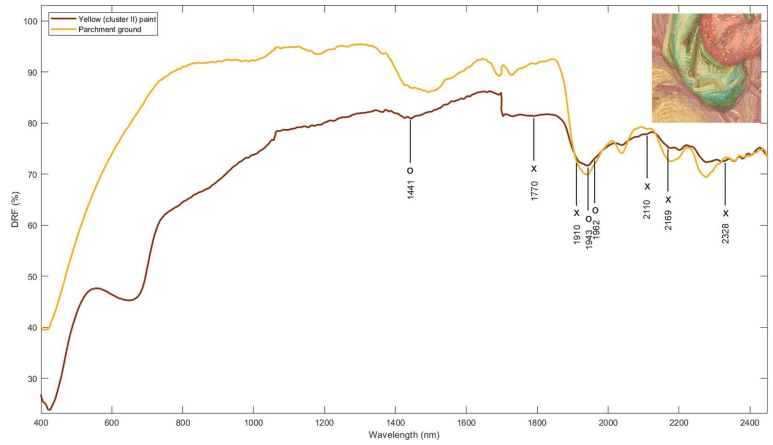
[175]This observation applies to gold coatings and gold layers, used widely in NIR spectroscopy as standard reflectors (Akifumi Ikehata. *NIR Optics and Measurement Methods*. Ed. by Yukihiro Ozaki et al. Singapore: Springer, 2021. Chap. 9, pp. 211–234, p. 224). The coefficients of optical and vibrational absorption for golden nanoparticles of different size and shapes have also been investigated extensively and proved a dependence exsisting between particle size, particle shape and radiation wavelength (Mas Ira Syafila Mohd Hilmi Tan et al. "VIS-NIR spectral and particles distribution of Au, Ag, Cu, Al and Ni nanoparticles synthesized in distilled water using laser ablation". In: *Results in Physics* 14 (2019), p. 102497. DOI: https://doi.org/10.1016/j.rinp.2019.102497; Mazen Alrahili et al. "Absorption cross section of gold nanoparticles based on NIR laser heating and thermodynamic calculations". In: *Scientific Reports* 10 (2020), p. 18790. DOI: https://doi.org/10.1038/s41598-020-75895-9).

[176]This visual does not show the parchment ground because this XRF assay was not taken with the Sn-sheet placed below the leaf. The adoption of this choice was based on the fact that the Sn content of the sheet would have given an overestimate of this element in the final spectrum; in turn, this excessive amount of Sn would have made these results' interpretation ambiguous. Removing the Sn sheet, the actual presence of this element in the spot of analysis was possible. However, the reference for the parchment was performed only with the Sn sheet below, so this reference for the comparison was excluded in this case.

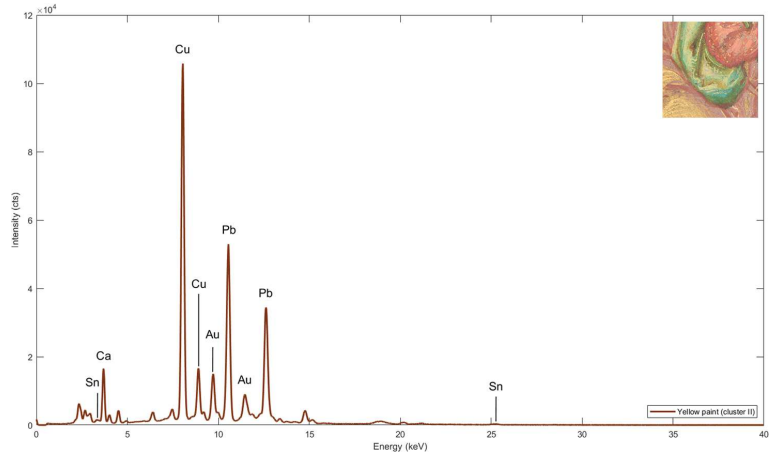
[177]Sn also emits photons with lower energies in the 3-4.5 keV range related to the L-shell. However, these fluorescence lines are hindered by those of other elements, like Ca or Pb, so they are not considered for identification.

[178]There are two varieties of lead-tin yellow, one referred to as type I and the other type II. The first variety is a lead-tin oxide of the composition Pb_2SnO_4; the other is obtained by heating a portion of type I pigment in presence of silica at temperatures in the range 800-900řC to give a compound with formula ranging from $PbSnO_3$ to $Pb(Sn,Si)O_3$ (Hermann Kühn. "Lead-Tin Yellow". In: *Studies in Conservation* 13.1 (1968), pp. 7–33. DOI: https://doi.org/10.1179/sic.1968.002; Hermann Kühn. *Lead-Tin Yellow*. Ed. by Ashok Roy. Washington, CO and London: National Gallery of Arts and Archetype Publications, 1993. Chap. 4, pp. 83–112, p. 85).

spectra for the two yellow mixtures of Res. 5781.p and Res. 328.v are quite different in the Vis region (figs. 3.45a and 3.46)[179]. The spectrum in Res. 328.v is compatible with the reflectance response of massicot, while the other is more similar to a lead-tin yellow.



(a)



(b)

Figure 3.45: Sample spectra of yellow spot, cluster II (Pb-based yellow): a) UV-Vis-NIR FORS spectrum (brown solid line) compared with the spectrum of the parchment ground (yellow solid line, from Res. 5781.p, fol. 29^{v}, spot shown on the top); b) XRF spectrum (brown solid line, from Res. 5781.p, fol. 29^{v}, spot shown on the top).

[179]The spectra given for the Vis-NIR region are not those from UV-Vis-NIR DR spectroscopy because the results from the technique suffered heavily from the contamination of neighbouring paints. HSI allowed to obtain data at higher resolution (*c.* 0.3 mm spatial resolution in both cases), so such data was used for the study of the second cluster.

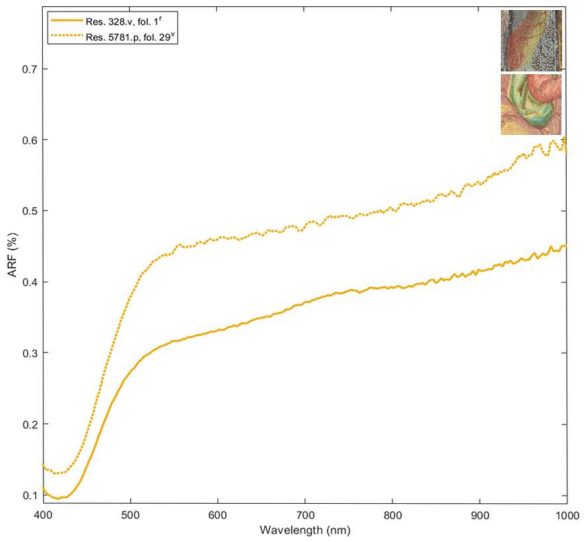


Figure 3.46: AR-Vis spectra of the yellow spots: a) massicot, Res. 328.v, fol. 1^{r} (yellow solid line); b) lead-tin yellow, Res. 5781.p, fol. 29^{v} (yellow dot line; spectra extracted from the HC of the two images).

Concerning the perceptual features of the second cluster, the two mixtures are colorimetrically different (their ΔE* is 16.23 ± 1.26). Table 3.16 illustrates the CIELAB coordinates obtained from the conversion of their reflectance spectra into colorimetric coordinates. Based on the results, the two mixtures are perceptually different: indeed, their average ΔL*[180] denotes a difference perceptible by the human eye (≥ 2). Additionally, the two pigments (lead-tin yellow and massicot) have high tinting strength [181]. Supplementing only one variety of yellow seems to be an intentional choice. However, it is possible that at the basis of the use there was a variation in the local supply: in fact probably related to an artistic trend for the two period when they were applied (Res. 326.v, c. 1534; Res.5781-p, c. 1522). Kühn described the confusing terminology around massicot, stating that northern countries used the word *masticot* to refer to lead-tin yellow while some old pharmacies labelled as *massicot* the admixtures of lead-tin oxide with lead oxide[182]. Given the ambiguity, it is possible that the actual composition of the pigment may vary over the period as well as the suppliers. Unfortunately, the analytical data is not sufficient

[180]This is a parameter that measures the Euclidean distance between two coordinates of colour in the CIELAB colour space (*Technical report: Colorimetry*. Standard. Third edition. Commission Internationale de l'Eclairage, 2004).

[181]The average refractive indices reported for massicot are: nα = 2.510 nβ = 2.610 nγ = 2.710 (it is a birifrangent mineral, see A.E. Ennos. "Optical Properties of Evaporated Lead Monoxide Films". In: *Journal of the Optical Society of America* 52.3 (1962), pp. 261–264. DOI: https://doi.org/10.1364/JOSA.52.000261), while for lead-tin yellow type II are nα = 2.29 and nβ = 2.31 (Kühn, *Lead-Tin Yellow*, p. 91).

[182]Kühn, "Lead-Tin Yellow".

to validate this fascinating hypothesis.

Table 3.16: Colorimetry coordinates for the yellow paint spots of the case studies. The color is expressed as coordinates of the CIELAB color space (CIE1976) and is the average of three values, each being converted to a CIELAB set of values from single-pixel apparent reflectance spectra of hypercubes (see Appendix Appendix F, Section F.1.6 for a detailed description of the reflectance spectrum-to-color coordinate conversion).

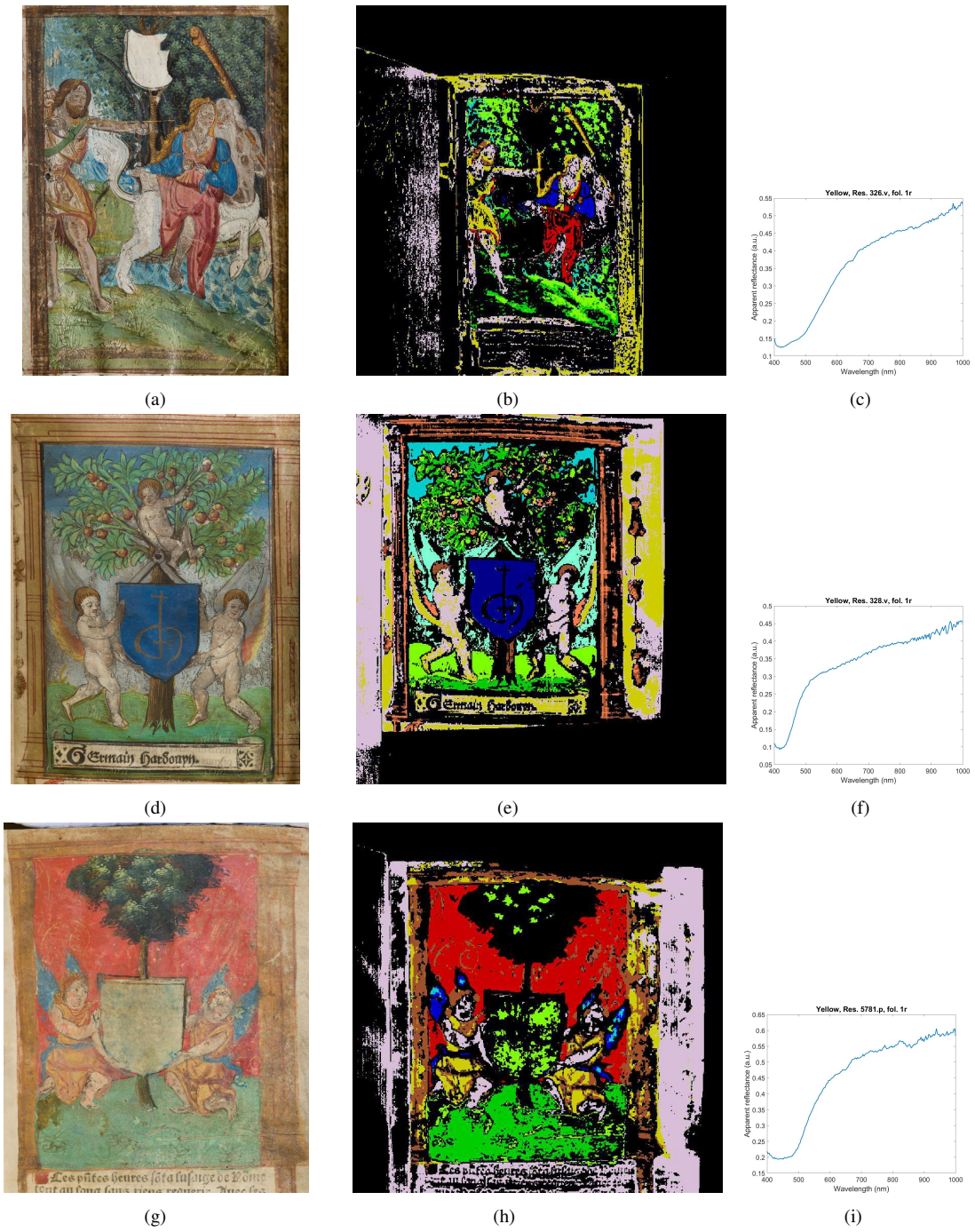
Book	**Leaf**	**Spot**	**Brightness**	**CIELAB values**		
				L*	***a****	***b****
Res. 326.v	46^{r}	1	Light	63	9	41
Res. 328.v	1^{r}	1	Dark	55	-6	30
Res. 5781.p	1^{r}	1	Light	68	-9	40

Finally, Table 3.17 illustrates the results from the inspection of the yellow paints.

Table 3.17: Results of the tentative identification of the components for the yellow paints: colourants, extenders and binders.

Book	**Leaf**	**Spot**	**Colourant**	**Extender**	**Binder**
Res. 326.v	46^{r}	1	shell gold, ochres	not identif.	polysaccharide
Res. 328.v	1^{r}	1	(yellow PbO)	lead white	polysaccharide
Res. 5781.p	1^{r}	1	shell gold	not identif.	polysaccharide
	29^{v}	1	(lead-tin yellow)	lead white	polysaccharide

The HSI mapping for all miniatures (yellow solid areas, figs. 3.47-3.48) indicate that the yellow mixture identified was applied throughout that miniature. The only exception is the Adoration of the Magi in the Res. 5781.p, fol. 49^{v}, where more than one yellow mixture was used.

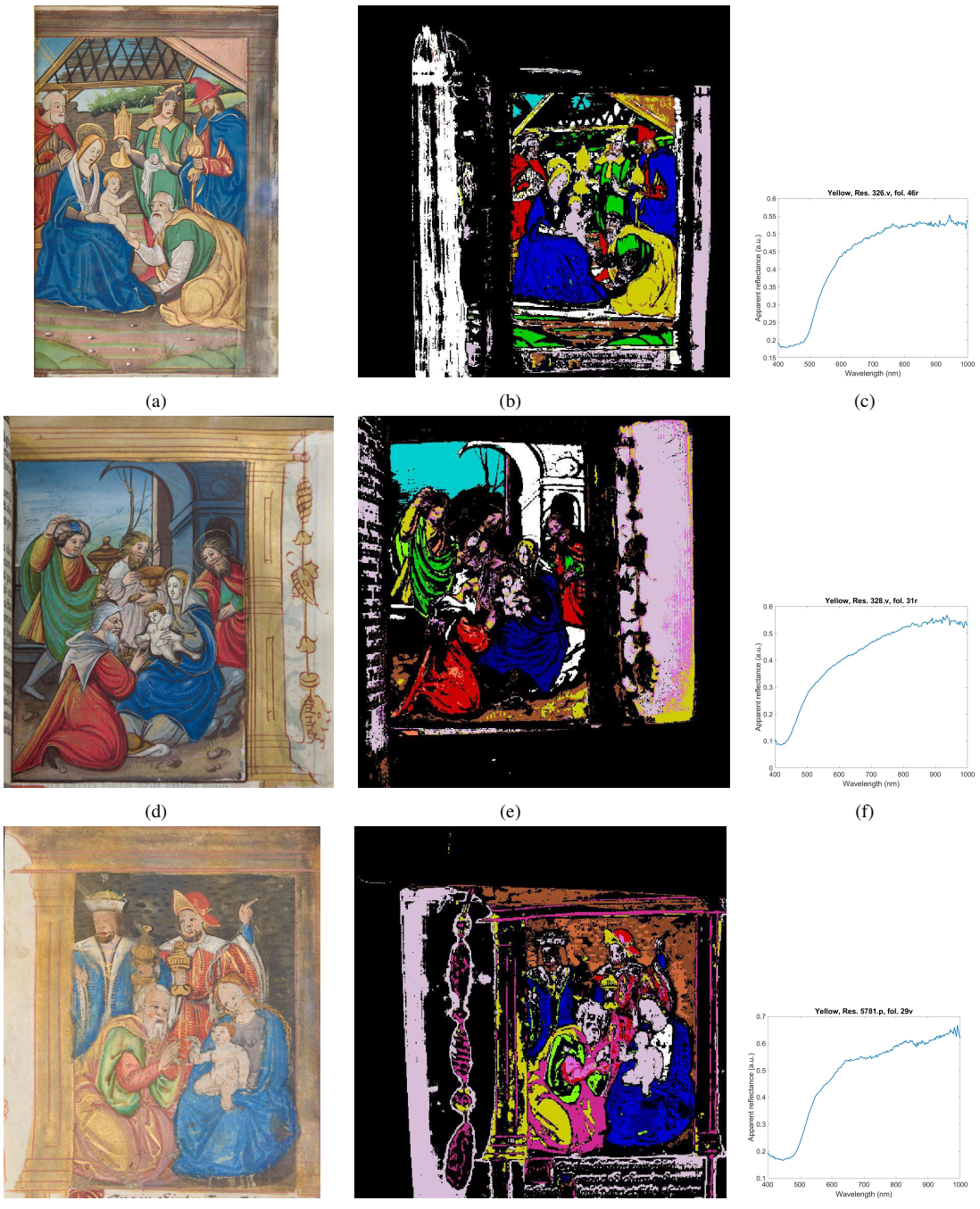


(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

Figure 3.47: HSI maps of all paints (b, e, h) compared with the Vis images of all *Printer's device* across the case studies (a, d, g). The yellow solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.008; f) 0.010; i) 0.008. The EM are shown in (c), (f), (i).



(a) (b) (c)

(d) (e) (f)

(g) (h) (i)

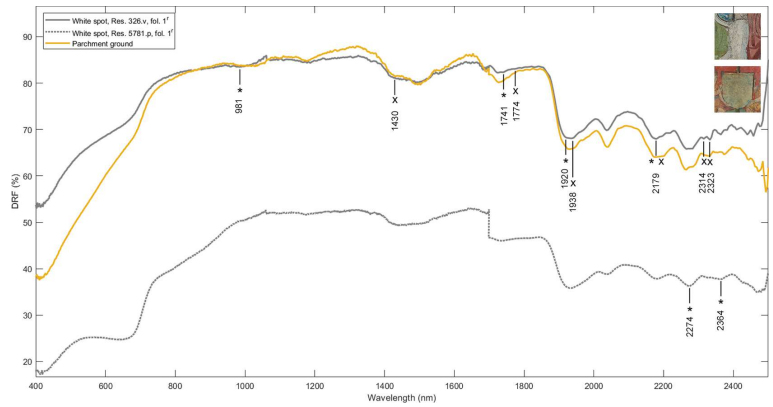
Figure 3.48: HSI maps of all paints (b, e, h) compared with the Vis images of all *Adoration of the Magi* across the case studies (a, d, g). The yellow solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.010; f) 0.008; i) 0.008. The EM are shown in (c), (f), (i).

White, grey and black paints The last section for the colourants given to the case studies discusses the formulation of white, grey and black mixtures. The results of their material characterisation are given in Table 3.18[183]. This table illustrates that among the white spots, genuine white was given only to Res. 326.v (fol. 1^{r}, see figs. 3.49b and 3.50); the other spot contains only traces of blue paint, probably scraped away at a later date than the execution (Res. 5781.p, fol. 1^{r}).

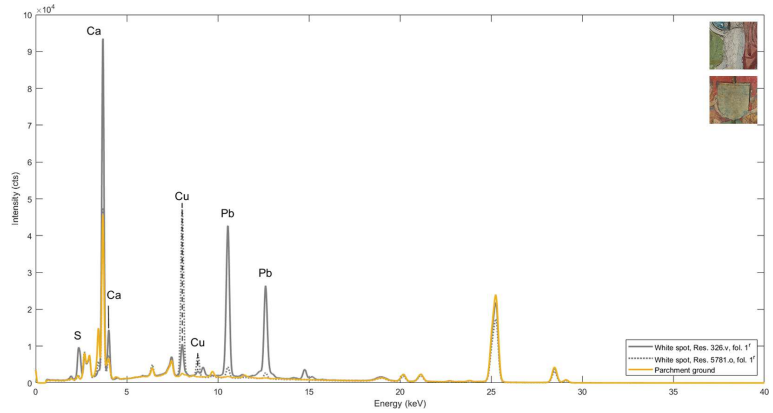
Table 3.18: Results of the tentative identification of the components for the white, grey and black paints: colourants, extenders and binders.

Book	Leaf	Spot	Hue	Colourant	Extender	Binder
Res. 326.v	1^{r}	White	1	lead white	chalk	not identif.
Res. 328.v	31^{r}	grey	1	indigo	lead white	polysaccharide
Res. 5781.p	1^{r}	White	1	(azurite)	not detect.	not detect.
	29^{v}	grey	1	not. identif.	Pb-based	not identif.
		Black	1	ochres, [C-based black]	lead white, gypsum	not identif.
			2	ochres, [C-based black]	lead white, gypsum	not identif.

[183]The spots of analysis for the white, grey and black paints are indicated in Appendix F, Section F.3.

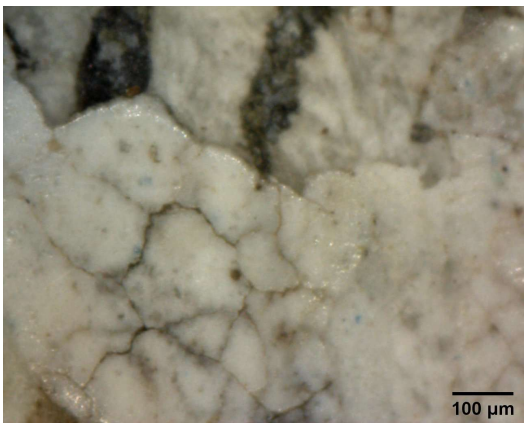


(a)

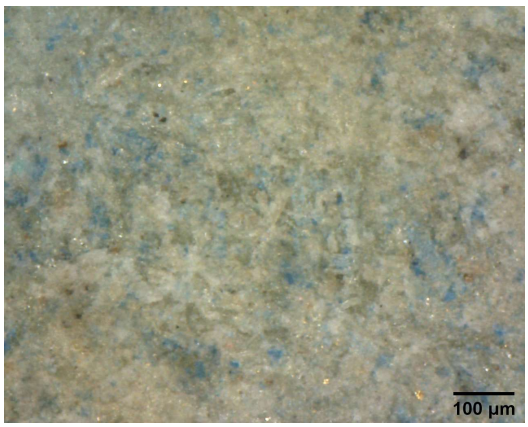


(b)

Figure 3.49: Sample spectra of white paints: a) UV-Vis-NIR FORS spectrum of the paints (grey solid line, Res. 326.v, fol. 1r; grey dot line, Res. 5781.p, fol. 1r) compared with the parchment (yellow solid line, from 326.v, fol. 1r, spots shown on the top); b) XRF spectrum of the paint (grey solid line, Res. 326.v, fol. 1r; grey dot line, Res. 5781.p, fol. 1r) compared to the parchment (yellow solid line, from 326.v, fol. 1r, spots shown on the top).



(a)



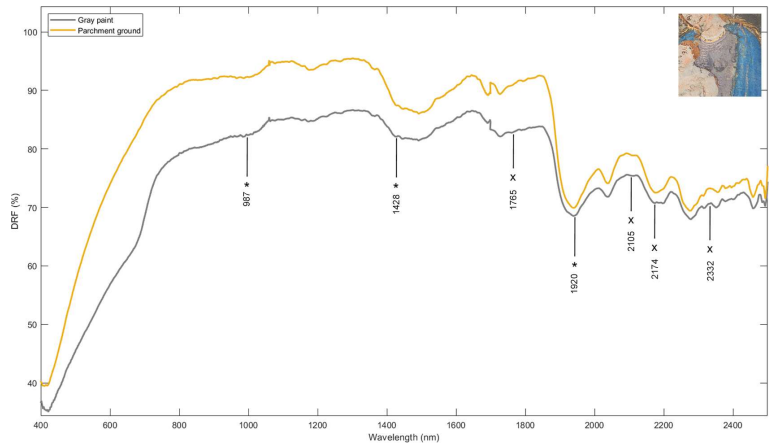
(b)

Figure 3.50: DM images of white mixtures, 435x (0.68 mm x 0.91 mm field of view): a) Res. 326.v, fol. 1r; b) Res. 5781.p, fol. 1r © HERCULES Laboratory.

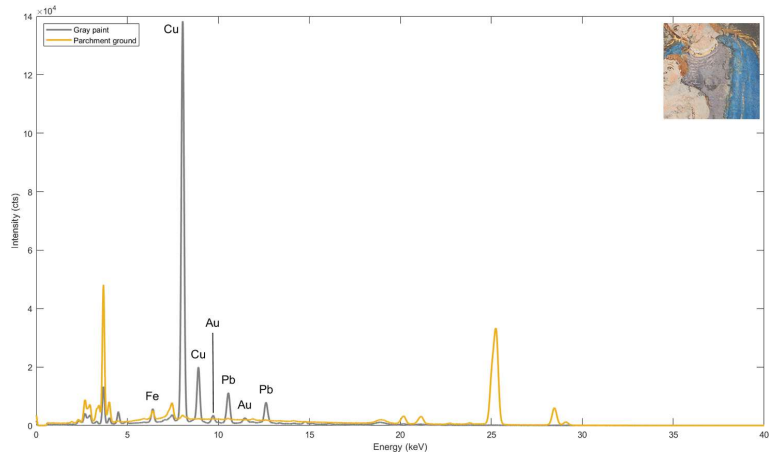
In fact, the DR and XRF spectra unravel the two different natures of the spots (fig.

3.49b): the one in Res. 326.v contains the vibrations and the spectral lines associated to lead white and Pb respectively, but the data for the other spot only reveals surviving traces of Cu and the characteristic duplet of azurite (2285 and 2353 nm).

Grey paints' composition appears quite heterogeneous. In Res. 328.v, fol. 31^{r}, indigo could be used to achieve duller hues (fig. 3.56c)—as seen in the section dedicated to the blue paints—; the paint applied to Res. 5781.p, fol. 29^{v} does not reveal any remarkable spectral feature in its DR spectrum (fig. 3.51), but that the average reflectance in the Vis range (400-780 nm) is relatively high (*c.* 60%), much more than the blue mixtures seen in the case studies —where it ranged 30-50% —; however, its p-XRF spectrum exhibits the lines of copper and lead, making it likely that some Pb-based, maybe an extender, and Cu-based pigments may have been given to the paint (fig. 3.52). Only the AR spectrum in Figure 3.56f reveals two possible clues to indigo and azurite: a broad absorption at 550 nm and another at *c.* 660-670. The first could be explained as the d-d transitions of Cu(II) in azurite, the second with the transitions of delocalised orbitals of indigo; however, the analytical data is insufficient to uniquely identify the grey mixture in that spot as either a mixture of azurite and indigo nor to confirm the presence of lead white.



(a)



(b)

Figure 3.51: Sample spectra of grey paints: a) UV-Vis-NIR FORS spectrum of the paint (grey solid line) compared with the parchment (yellow solid line, from 5781.p, fol. 29^{v}, spot shown on the top); b) XRF spectrum of the paint (grey solid line) compared to the parchment (yellow solid line, from 5781.p, fol. 29^{v}, spot shown on the top).

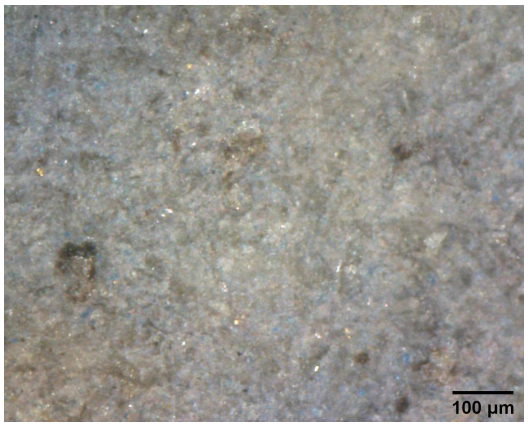


Figure 3.52: DM image of a grey paint, 435x (0.68 mm x 0.91 mm field of view): Res. 5781.p, fol. 29^{v} © HERCULES Laboratory.

The different composition is also reflected by unmatching colorimetry coordinates, that

highlight a higher degree of unsaturation for the mixture of Res. 5781.p (values pushed to near 0 values on the a* and b* coordinate; see tab. 3.19 and fig. 3.53).

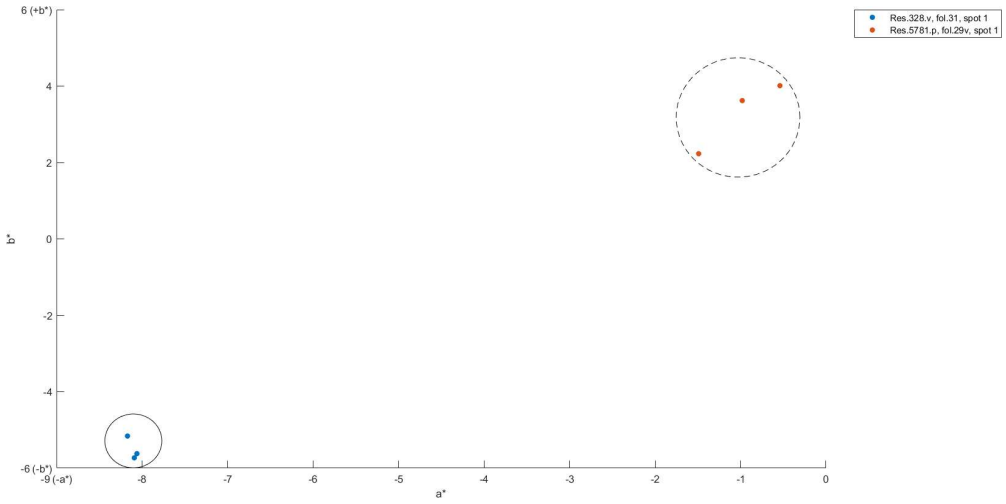


Figure 3.53: CIELAB coordinates of the grey paints across the case studies (coordinates represented in a 2-D plot).

The two black areas analysed were formulated with a mix of ochres and a black pigment, as detected only with Fe lines in the XRF spectra because the RD information is completely obscured in the Vis range, very weak in the NIR (fig. 3.54a).

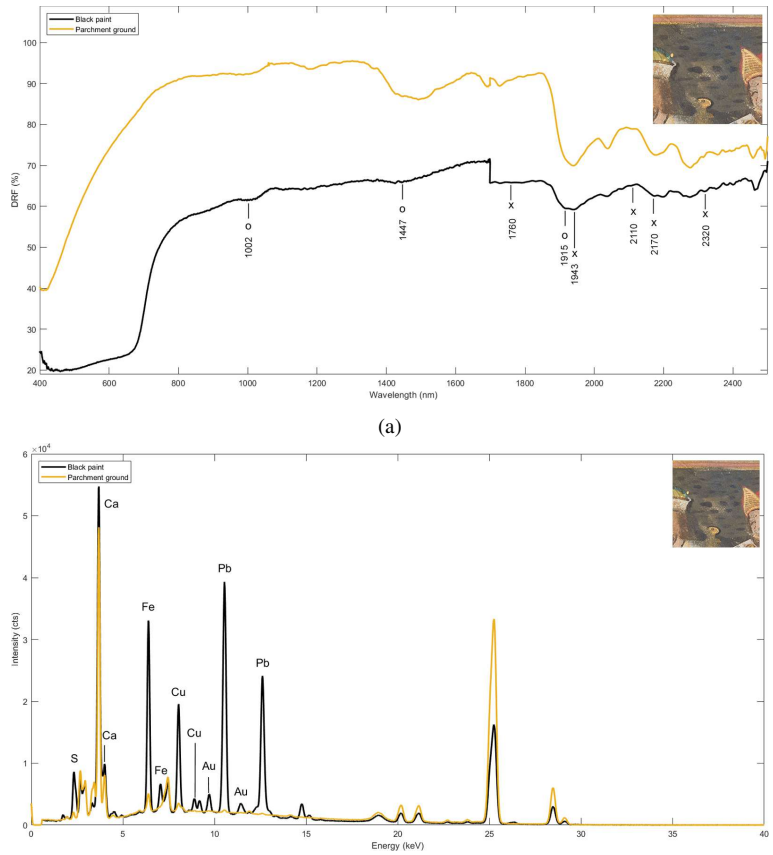


Figure 3.54: Sample spectra of black paints: a) UV-Vis-NIR FORS spectrum of a black paint (spot 2, black solid line) compared with the parchment (yellow solid line, from 5781.p, fol. 29^{v}, spot shown on the top); b) XRF spectrum of the paint (spot 2, black solid line) compared to the parchment (yellow solid line, from 5781.p, fol. 29^{v}, spot shown on the top).

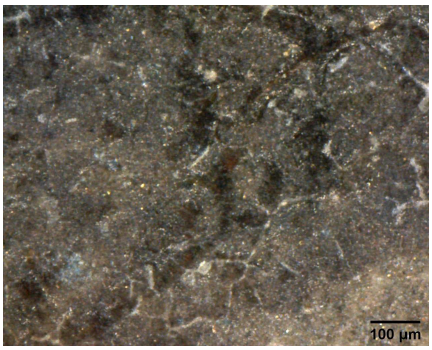


Figure 3.55: DM image of a black paint, 435x (0.68 mm x 0.91 mm field of view): Res. 5781.p, fol. 29^{v} © HERCULES Laboratory.

Probably, the cause for the poor responsiveness of the spot is the black chromophore mixed generously to the binder (fig. 3.55). Thus, no chemical element that could be associated with a mineral black appears (like Mn, see fig. 3.54b); even if the spectrum is

Table 3.19: Results of the tentative identification of the components for the white, black and grey paints: colourants, extenders and binders.

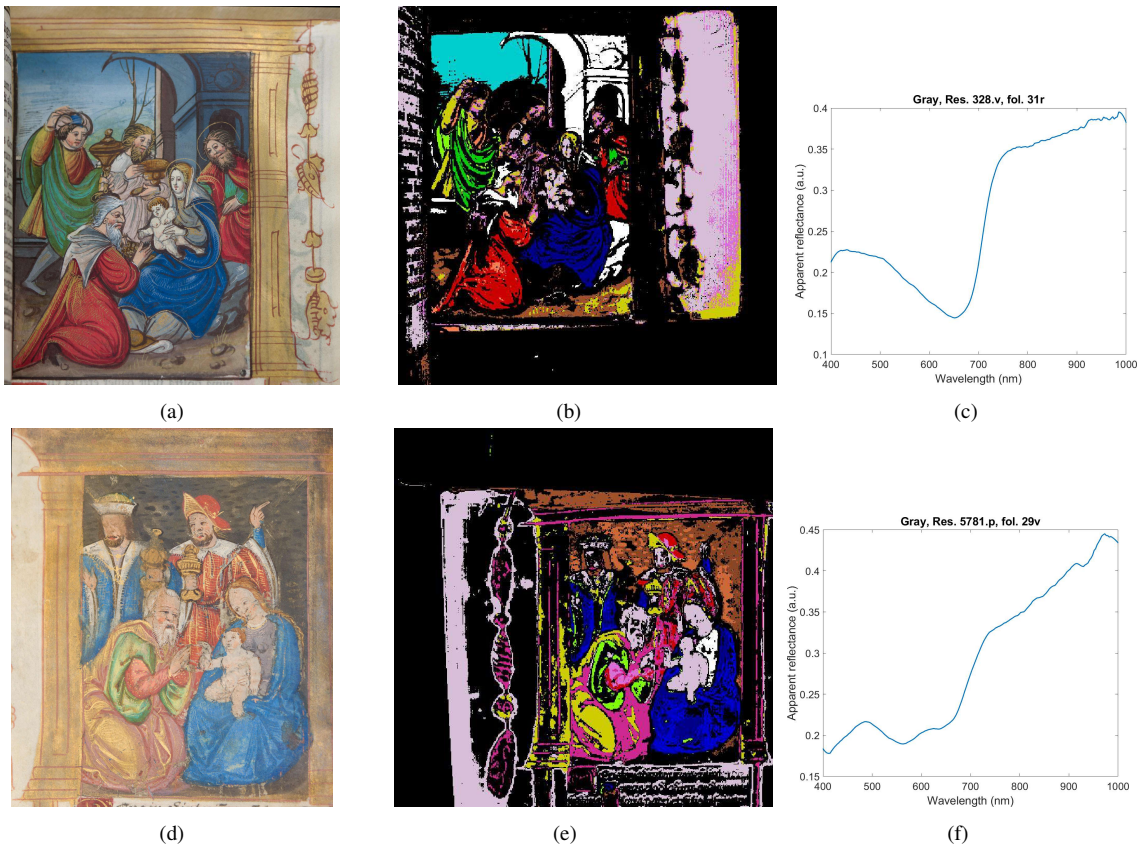
Book	Leaf	Spot	Brightness	CIELAB values		
				*L**	*a**	*b**
Res. 328.v	1^{r}	grey	1	46	-8	-6
Res. 5781.p	29^{v}	grey	1	49	-1	3
		Black	1	30	0	10
			2	22	2	9

quite weak throughout the region, the spectral features in the NIR do not provide a clear identification of a C-based pigment.

Finally, the HSI mapping could be performed only for the miniatures featuring the Adoration of the Magi (fig. 3.56). This reveal an interesting piece of information, namely that grey paints were used indifferently to feature elements of the landscape and human figures, as shown in the version in the Res. 328.v, fol. 31^{r} (figs. 3.56a-3.56b).Here, the grey is used as much to render the Classical ruin behind the Holy Family as to portray the undergarment of Mary and the hair of the oldest Magus. This is especially important in relation to the clothing of Mary. In fact, the medieval tradition preferred giving ultramarine to Mary's mantle, owing to the intrinsic sanctity and royalty of its stone source, i.e. the lapis lazuli[184]. However, the Hardouyn made a different choice that did not discriminate

[184]The Italian school of painting expressed affection, yet cautious, toward this pigment. Not only it was costly as it was shipped from a remote region of overseas (hence the word ultramarine: "ultra" and "marine" mean respectively "over" and "sea"), but it was also hard to manipulate for preparing pigments of satisfying quality. Mere grinding and washing lapis lazuli yield dull, greyish ashes in most cases, unless the raw stone is of exceptional quality (Eastaugh et al., *The Pigment Compendium A Dictionary of Historical Pigments*, p. 219). Only twelfth century artists could successfully improve the yield from individual stones, adding a process of calcination to remove the fine carbonates. Because of its high expense, ultramarine-based applications were generally reserved to final overlayers covering azurite and lead white grounds (Leonardo Da Vinci placed a good examples with the Virgin of the Rocks or The Virgin with Child and St. Anne; see Larry Keith et al. "Leonardo da Vinci's 'Virgin of the Rocks': Treatment, Technique and Display". In: *National Gallery Technical Bulletin* 32 (2011), pp. 32–56 and Victor Gonzalez et al. "Microchemical analysis of Leonardo da Vinci's lead white paints reveals knowledge and control over pigment scattering properties". In: *Scientific Reports* 10 (2020), p. 21715. DOI: https://doi.org/10.1038/s41598-020-78623-5). Such high expense may be presumably why Renaissance artists were asked to stipulate formal agreements defining the exact amount of pigment employed demanded that ultramarine would be subject to rigid agreements, especially concerning the extent of the areas employing it (Benno A. Zuiddam. "The spiritual value of contrast, black, white, blue and red in Renaissance paintings. Biblical colour symbolism and interpretation of Christian art". In: *South African Journal of Art History* 33.1 (), pp. 67–91, p. 78). At the same time, Renaissance artists praised this pigment, maintaining that it is "a colour noble, beautiful, and perfect beyond all other colours, and there is nothing that could be said of it but it will still exceed this (praise)" (translation by Christiana J. Herringham. *The Book of the Art of Cennino Cennini: A Contemporary Practical Treatise on Wuattrocento Painting*. Translated from the Italian, with Notes on Mediæval Art Methods by Christiana J. Herringham. London: G. Allen & Unwin, 1899, p. 47).

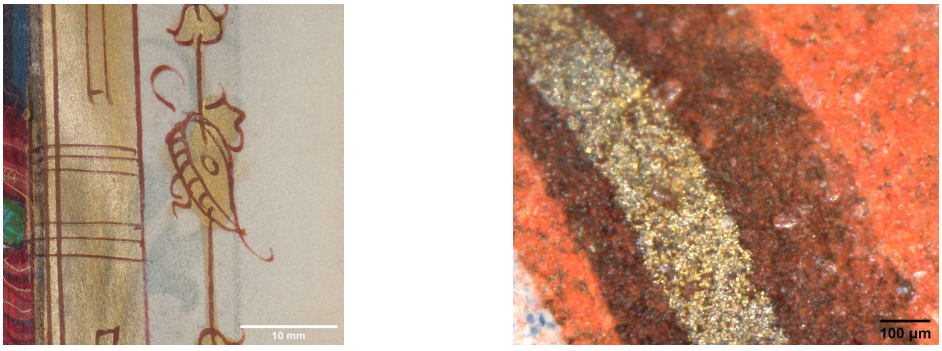
among the compositional elements.



(a) (b) (c)

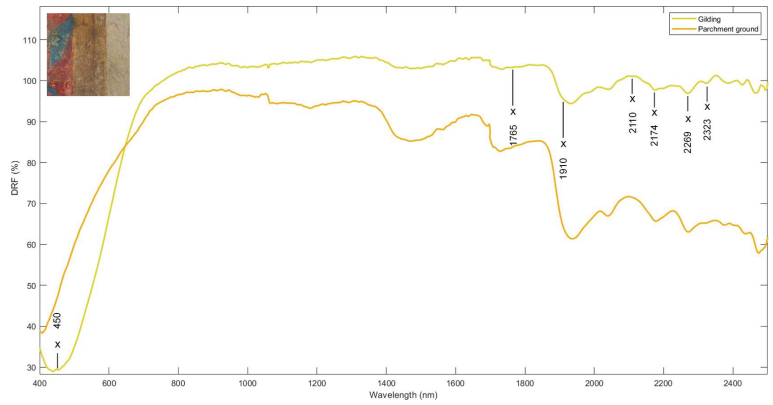
(d) (e) (f)

Figure 3.56: HSI maps of all paints (b, e, h) compared with the Vis images of all *Adoration of the Magi* in Res. 328.v, fol. 31^{r} and Res. 5781.p, fol. 29^{v} (a, d). The white solid areas are calibrated on the spots of analysis of UV-Vis-NIR FORS and p-XRF (extracted from a 3x3 kernel on the HC). The used pixel-matching algorithm was SID in all cases, with the following values of cosine angle (tolerance): c) 0.070; f) 0.008. The EM are shown in (c), (f).

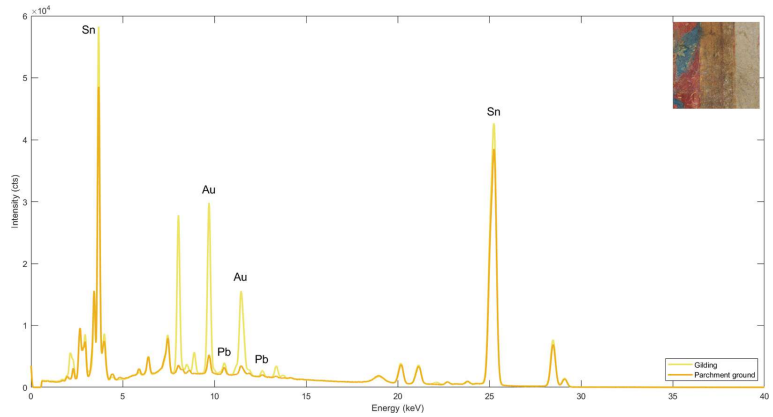


(a) (b)

Figure 3.57: Gildings applied to the case studies: a) border gilding (detail from Vis image, Res. 328.v, fol. 31^{r}); b) architecture of a gilded finishing (DM image, 435x, 0.68 mm x 0.91 mm field of view) from Res. 328.v, fol. 31^{r}) © HERCULES Laboratory.



(a)



(b)

Figure 3.58: Sample spectra of Au-based gildings: a) UV-Vis-NIR DR spectrum (light yellow solid line) compared to the parchment (dark yellow solid line, from Res. 5781.p, fol. 1^{r}, spot shown on the top); b) XRF spectrum of the paint (light yellow solid line) compared to the parchment (dark yellow solid line, from Res. 5781.p, fol. 1^{r}, spot shown on the top).

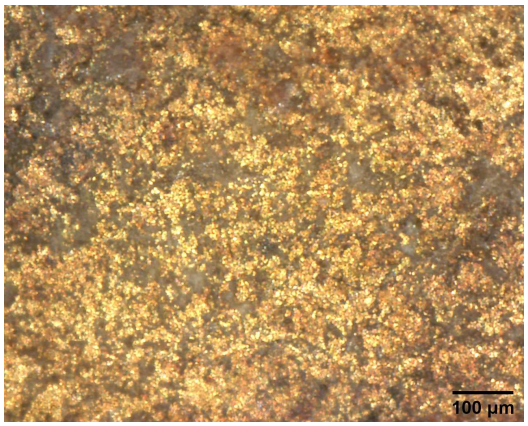


Figure 3.59: DM image of a Au-based gilding, 435x (0.68 mm x 0.91 mm field of view): Res. 5781.p, fol. 1^{r} © HERCULES Laboratory.

Gildings The finishing applied to the miniatures involved some amounts of gildings[185]. These applications were largely given to the borders (fig. 3.57a); little amounts were also laid as a finishing golden lines above the other pictorial layers (fig. 3.57b)[186]. Whereas XRF detected Au in all spots of analysis (fig. 3.58b[187]), the UV-Vis-NIR results showed equal compatibility with gold through the mentioned broad absorption in the 480-500 nm region (fig. 3.58a)[188]. Additionally, DM images revealed tiny gold-like particles (fig. 3.59). These three facts lead to the assumption that powdered gold was employed. DR results also reveal a polysaccharide across all spectra, maybe a natural gum employed as a binding agent. Altogether, the observations are compatible with a certain late mediaeval gilding technique, namely *shell gold*. Said in more specific terms, shell gold is a pictorial finishing consisting of powdered gold, indeed mixed to gum water[189]. The particles of shell applications give a metallic colour, golden in this case, and their combination to a binder allows the treatment of gold as a regular material of painting[190].

[185] The spots of analysis for the gildings are indicated in Appendix F, Section F.3.

[186] See Section 3.2.1.2.

[187] The presence of Cu arises from a neighbouring paint which, unfortunately, enters the spot of analysis. Owing to this fact, its peaks are not labelled in the figure.

[188] See Section 3.2.2.1.5.

[189] A weak aqueous solution of natural gums.

[190] On shell gold, see Thompson, *The Materials and Techniques of Medieval Painting*, pp. 191-193.

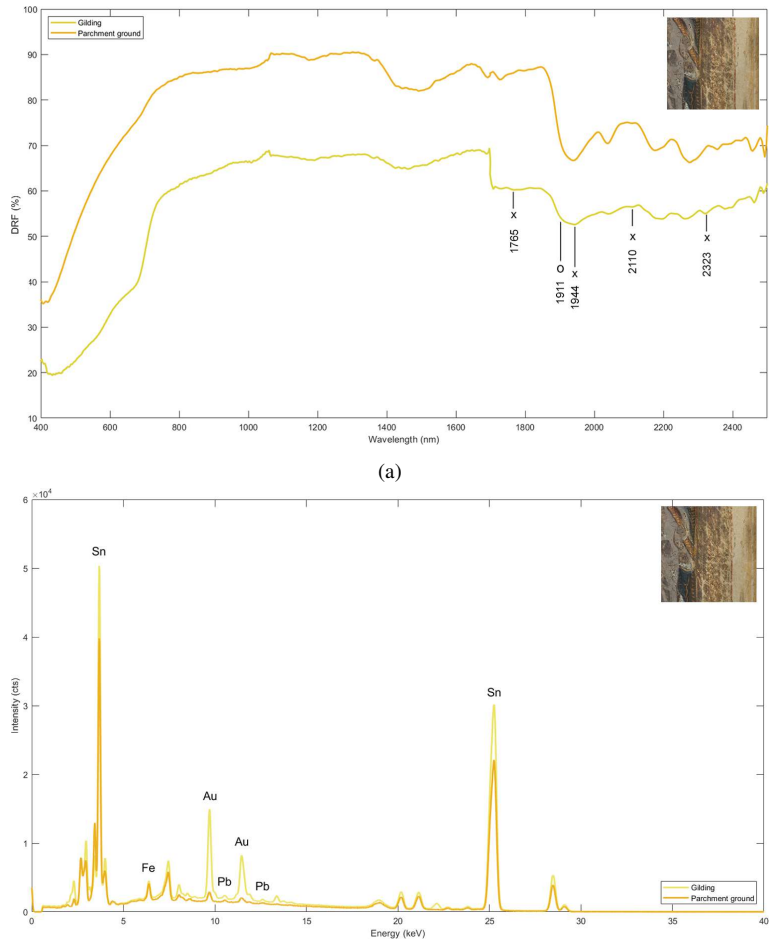


Figure 3.60: Sample spectra of gildings containing mosaic gold: a) UV-Vis-NIR DR spectrum (light yellow solid line) compared to the parchment (dark yellow solid line, from Res. 326.v, fol. 1^{r}, spot shown on the top); b) XRF spectrum of the paint (light yellow solid line) compared to the parchment (dark yellow solid line, from Res. 326.v, fol. 1^{r}, spot shown on the top).

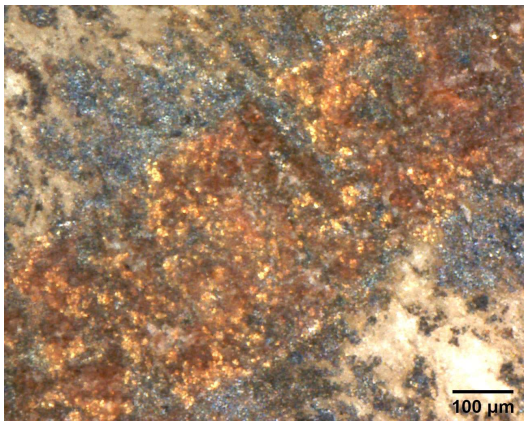


Figure 3.61: DM image of a gilding containing mosaic gold, 435x (0.68 mm x 0.91 mm field of view): Res. 326.v, fol. 1^{r} © HERCULES Laboratory.

Shell gold may have not been used alone across the case-studies, for there are signs of

other compounds. The XRF analysis of the gildings in Res. 326.v, fol. 1^{r} detected Sn and S along with Au (fig. 3.60b), and their DR curves differ greatly from that of an entirely-golden spot (fig. 3.60a). The presence of these two elements may denote supplementing the analysis area with another substance such the tin(IV) sulfide *mosaic gold*, a common substitute for gold of the late Middle Ages[191]. Previous studies characterised the UV-Vis-NIR diffuse reflectance response of mosaic gold, reporting a characteristic inflection point

[191] *Mosaic gold* or *purpurinus* is the name of a class of tin(IV) compounds (on the origin of this pigment's nomenclature, see Janet L. Ross. "A Note on the Use of Mosaic Gold". In: *Studies in Conservation* 18.4 (1973), pp. 174–176. DOI: https://doi.org/10.2307/1505713; Paula Nabais et al. "Singing with light: an interdisciplinary study on the medieval Ajuda Songbook". In: *Journal of Medieval Iberian Studies* 8.2 (2016), pp. 283–312. DOI: https://doi.org/10.1080/17546559.2016.1234061, note 52). While it is general opinion that this pigment is the mineral berndtite (chemical formula SnS_2, see Srebrenka Bogovi-Zeskoski. "Gold and not so real gold in Medieval treatises". In: *Conservar Património* 22 (2012), pp. 51–58; Eastaugh et al., *The Pigment Compendium A Dictionary of Historical Pigments*, p. 268; Maria J. Melo et al. *'O livro de como se fazem as cores': Medieval Colours for Practitioners*. Online edition. https://www.dcr.fct.unl.pt/LivComoFazemCores. Accessed on December 18, 2021. 2016, ch. 1), some investigations proposed that other phases can come along: a mixture of the black tin(IV) sulfide or oxide, or the tin(II) sulfide (Howell G.M. Edwards et al. "Raman spectroscopic studies of a 13th century polychrome statue: identification of a 'forgotten' pigment". In: *Journal of Raman Spectroscopy* 31.5 (2000), pp. 407–413. DOI: https://doi.org/10.1002/1097-4555(200005)31:5<407::AID-JRS530>3.0.CO;2-Y). SnS_2 occurs as two polytypes (i.e. crystalline forms with minor structural variations), a natural one (stacking polytype 2T of high pressure) and a synthetic one (stacking polytype 4H of high pressure; see R.M. Hazen et al. "The crystal structures and compressibilities of layer minerals at high pressure. I. SnS2, berndtite". In: *American Mineralogist* 63.3–4 (1978), pp. 289–292). The synthetic form seems to be the most likely in an artistic context, because both the low-pressure crystal is the reported polytype in association to art objects (Eastaugh et al., *The Pigment Compendium A Dictionary of Historical Pigments*, p. 268; Alistair Smith et al. "Francesco del Cossa's 'S. Vincent Ferrer'". In: *National Gallery Technical Bulletin* 5 (1981), pp. 44–57) and mediaeval documentary sources describe its preparation. The oldest instance of preparation remains a chapter of fourteenth-century technical treatise *De Arte illuminandi* (ch. 9, see Table 3.15 of Section 3.3.1); another case is in Alcherius' *corpus* (fifteenth century), that reports the instructions to prepare it (rec. 22, see Table 3.15 of Section 3.3.1); further mediaeval instances are also found in the Ms. Bolognese (rec. 168), *Livro de Komo se Fazen as Kores* (ch. 1). These recipes show slightly dissimilar pathways for the mosaic gold's preparation; a different preparation may be the cause for the varying material qualities of its artistic occurrences, especially in relation to its byproducts and degradation products (Edwards et al., "Raman spectroscopic studies of a 13th century polychrome statue: identification of a 'forgotten' pigment"). The period of use of this pigment stretches from the thirteenth century until the seventeenth century (Bogovi-Zeskoski, "Gold and not so real gold in Medieval treatises"; Thompson, *The Materials and Techniques of Medieval Painting*, pp. 182-183), when it was applied mostly to illuminated manuscript (Debbie Lauwers et al. "Pigment identification of an illuminated mediaeval manuscript De Civitate Dei by means of a portable Raman equipment". In: *Journal of Raman Spectroscopy* 45.11–12 (2013), pp. 1266–1271. DOI: https://doi.org/10.1002/jrs.4500; Paola Ricciardi et al. "Use of Visible and Infrared Reflectance and Luminescence Imaging Spectroscopy to Study Illuminated Manuscripts: Pigment Identification and Visualization of Underdrawings". In: *Proceedings of SPIE - The International Society for Optical Engineering* 7391 (2009). SPIE Europe Optical Metrology - Munich, Germany (Monday 15 June 2009), O3A: Optics for Arts, Architecture, and Archaeology II, p. 739106. DOI: https://doi.org/10.1117/12.827415; Paola Ricciardi et al. "The Choir Books of San Giorgio Maggiore in Venice: Results of in Depth Non-Invasive Analyses". In: *Heritage* 2.2 (2019), pp. 1684–1701. DOI: https://doi.org/10.3390/heritage2020103) and in some cases, to easel paintings (Smith et al., "Francesco del Cossa's 'S. Vincent Ferrer'").

at 530 nm[192]. However, this spectral feature is not clearly detectable in all the DR spectra for the case studies[193]. At its place, a sinusoidal curve with two shoulders at 570 nm and 680 nm appear, so the mosaic gold presence cannot be fully ascertained. The two shoulders suggest that the compositional nature of the spot of analysis is richer than described. Inspecting visually the spot discloses an extensive phenomenon of darkening which has a mirror-like lustre on a microscopic level (fig. 3.61), as if it was some phenomenon of metallisation. Mosaic gold blackening had been proposed in the past, either as an effect of the conversion of SnS_2 to a black mixture of oxides and mono-sulfides[194] or the reduction process of tin(IV) to tin(0)[195]. Another valid option is that the lower layer may contain a layer of specular hematite (Fe_2O_3). Also known as *specularite*, this pigment seems to have found some use in the miniatures by the hand of the Bourdichon workshop (Paris, early fifteenth century). In this regard, the chemist Burgio reported the use of this pigment, which also appears black with the naked eye, but microscopically, it shows a lustrous, mirror-like surface[196]. Admitting specularite in the spot would justify the previous observations: the S-shape of the reflectance curve and the high luminary quality of the pigment under the a microscope. The relatively low content of Fe in the XRF results can similarly be explained by the fact that Au and Sn have a relatively large photoelectric cross-section[197], resulting in a higher tendency to absorb the incoming X-ray radiation

[192]Maurizio Aceto et al. "Characterisation of colourants on illuminated manuscripts by portable fibre optic UV-visible-NIR reflectance spectrophotometry". In: *Analytical Methods* 6.5 (2014), p. 1488. DOI: https://doi.org/10.1039/c3ay41904e.

[193]It does not appear in Res. 5781.p, fol. 1^r.

[194]This may happen if the precursors for the preparation of mosaic gold did not involve ammonium chloride, but rather sole heating of tin and hydrogen sulfide. Heating the mixture gives the desired product initially, but it tends to convert to the mentioned products upon drying (Edwards et al., "Raman spectroscopic studies of a 13th century polychrome statue: identification of a 'forgotten' pigment").

[195]This mechanism has been described by Howell G.M. Edwards et al. "Leadtin mirror formation from mixtures of red lead and tin sulphide ". In: *Spectrochimica Acta A: Molecular and Biomolecular Spectroscopy* 59.10 (2003), pp. 2291–2299. DOI: https://doi.org/10.1016/S1386-1425(03)00072-6. He proposed a double pathway in which participate mosaic gold and such Pb-based Pb_3O_4 or PbO: SnS_2 can undergo reduction to native tin Sn(0) to give lead oxide PbO_2. Alternatively, native tin(0) and lead(0) are formed along with the lead sulfide (PbS). See Lucia Burgio et al. "Spectroscopic Investigations of Bourdichon Miniatures: Masterpieces of Light and Color". In: *Applied Spectroscopy* 63.6 (2009), pp. 611–620. DOI: https://doi.org/10.1366/000370209788559593.

[196]Burgio et al., "Spectroscopic Investigations of Bourdichon Miniatures: Masterpieces of Light and Color".

[197]The photoelectric cross-section σ^{pe} describes the probability for an inner atomic electron to be expelled, following the absorption of an incoming X-ray excitation source. The cross-section changes over the amount of incoming energy (X-ray) along with the described curve with sabertoothed edges characteristic for each element; these edges (called absorption edges) correspod to the fluorescence line of each sub-shell (M. Mantler. "Basic Fundamental Parameter Equations". In: *Handbook of Practical X-Ray Flu-*

rather than being transparent to it. Unfortunately, these results remain mere hypotheses, without the supplementary support of such analytical methods as Raman spectroscopy[198].

The final observation for this section is that the gilding technique applied across the case studies is not constant. Table 3.19 compares their composition, revealing important differences across the books analysed. In fact, the technique of Res. 326.v does match neither Res. 326.v nor Res. 5781.p. In Res. 326.v, the spots of analysis may contain the tentative specularite and mosaic gold, covered with shell gold; in Res. 328.v (both *folia*), sole shell gold; in Res. 5781.p (only fol. 29^{v}), shell gold covering specularite.

Table 3.20: Results of the tentative identification of the components for the gildings: colourants, extenders and binders.

Book	Leaf	Spot	Hue	Colourant	Extender	Binder
Res. 326.v	1^{r}	Darkened gold	1, 2	shell gold, (mosaic gold), (hematite)	not identif.	polysaccharide
Res. 328.v	31^{r}	Golden	1, 2	shell gold	not identif.	polysaccharide
		Golden	1, 2	shell gold	not identif.	polysaccharide
Res. 5781.p	1^{r}	Golden	1, 2	shell gold	not identif.	polysaccharide
	29^{v}	Golden	1, 2	shell gold, (hematite)	not identif.	polysaccharide

3.2.2.2 Monte Carlo simulation for thickness assessment (pictorial layers)

XRMC modelled one patterns of MC simulation for the coloured paints of Inc.438 (fig. 3.62). One of which is a two-layer model for the unpainted areas, the other is a three-layer model for the painted areas. Through MATLAB mappings[199], one red paint (red paint 1) was chosen as the reference to calibrate all simulations because it offered the broadest region of coloured paint without the influence from neighbouring areas. Despite of realising two acquisitions for each colour paints, only one spot for each colour paint

orescence Analysis. Ed. by Burkhard Beckhoff et al. Berlin and New York, NY: Springer, 2006. Chap. 5, pp. 311–326. DOI: https://doi.org/10.1007/978-3-540-36722-2, pp. 311-324; Luís de Souto Martins. *X-ray fluorescence analysis using a standardless method*. Ph.D's dissertation. Lisboa, 2019, pp. 7-8).

[198]The hypotheses for the presence of mosaic gold will be the object of future investigation, considering its deterioration and the presence of specularite disclose further interesting matches between the illuminated manuscript production and decorated printed production of fifteenth/sixteenth-century Paris, that will be the object of future investigation.

[199]The paint coverage for all the spots of analysis are given in Appendix F, Section F.2.3.

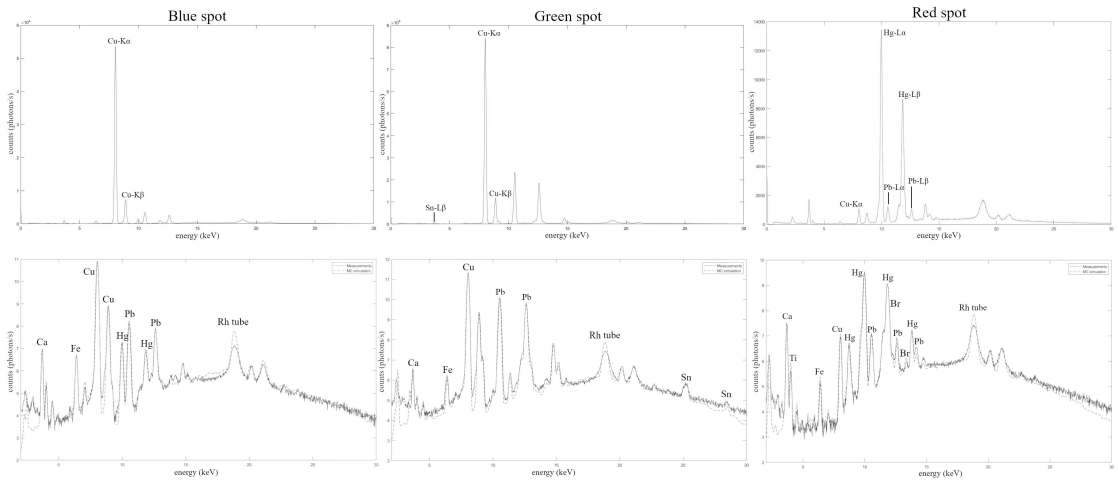


Figure 3.62: p-XRF spectra vs Monte Carlo simulations with representative spectra for each coloured area are presented in linear scale of ordinate (first row) and logarithmic scale of ordinate (second row) with the main peaks marked with labels. On the second row, the same p-XRF spectra (solid line) are presented against the respective Monte Carlo simulations (dotted line) in logarithmic scale of ordinate.

could serve satisfactorily the present study by overall coverage of the paint within. As a result, a total of three simulations is presented, one for each colour (one for the red paint, one for the blue paint and another one for the green paint); Monte Carlo simulations were built for all the unpainted spots under investigation (for a total of three spot of analysiss).

The reference model used as initial guess model for XRMC was calibrated on a 1:6 pigment-to-binder (P/B) ratio (20 % HgS in polysaccharide binder, dry % wt) for the outer layer (red paint), and a given thickness of 1 mm for the parchment. The choice for the proposed concentration of red pigment in the binder was based on previous studies of illumination paints composition[200], while the amount of black pigment in the alkyd binder was set to the limit of the accepted concentrations of an oil-based carrier phase, 30-50 %[201]. XRMC determined initially an average level of 20 μm thickness for the first layer and 40 μm for the second on the simulated spectra. Each layer was assumed as homogeneous and even for the calculation.

The simulated spectra background could not provide a good fitting with the background of the measured spectrum at low energies. This is mainly due to the influence of the electronic noise of the detector which produce a background cannot be attributed to the exci-

[200] Catarina Miguel. *Le vert et le rouge: a study on the materials, techniques and meaning of the green and red colours in medieval portuguese illuminations*. Ph.D.'s dissertation. Lisboa, 2012.

[201] Rousu et al., "Influence of Coating Pigment Chemistry and Morphology on the Chromatographic Separation of Offset Ink Constituents".

tation spectrum emitted from the X-ray tube[202]. Despite the limitation, the peaks of the major elements (such as Ca, Fe, Cu, Hg and Pb) and the background from 5 keV onward generally conformed to the real measurements. In addition, MC simulations provided a better fit when lead and copper were assigned to the printing ink layer beneath together. Calcium had to be assigned to all ink layers in the three-layer models for the paints; little mercury had to be assigned to the ink layer of point 1 of the simulation.

The same level of thickness was calculated in the remaining assays. The XRMC spectra could simulate for the blue and green spots spectra matching the simulations in a similar way as the red one.

All unpainted areas show a similar profile: Cu, Pb, Fe appear in the spectrum with the difference being their proportion. In one unpainted spot, the quantity of copper is bigger than lead, while in the rest the trend is the opposite. However, XRMC also allowed to provide some compositional data (tab. 3.20).

Table 3.21: Quantitative layer composition with the statistical error and value of thickness evaluated through Monte Carlo simulations of the p-XRF analysis spots. Confidence interval is calculated as the margin of uncertainty presented in the section of p-XRF and Monte Carlo methods (10% of the atomic weight); only elements significantly detected as part of each layer (= value > limit of detection) are quoted. The value of thickness of the simulation is presented against the calculated thickness from micro-samples from several leaves of Inc. 438. List of abbreviations: P.I = p-XRF-MC simulation of the printing ink layer, C.P. = p-XRF-MC simulation of the colour paint layer, E.T. = thickness of the layer assessed through XRMC (μm), M.T. = thickness of the micro-sample (minimum value-maximum value, both in μm), Fol. = folium from which the micro-sample was collected.

Spot	Layer	E.T.	M.T.	Fol.	Amount (wt %)									
					S	*Ca*	*Ti*	*Fe*	*Cu*	*Sn*	*Br*	*Au*	*Hg*	*Pb*
Red	P.I.	30 μm	-	-	-	2.50 ± 0.25	-	-	0.60 ± 0.06	-	-	-	-	0.60 ± 0.06
	C.P.	40 μm	32-47 μm	11r	1.0 ± 0.1	3.40 ± 0.34	0.050 ± 0.005	0.10 ± 0.01	-	-	0.20 ± 0.02	0.60 ± 0.06	6.8 ± 0.7	-
Green	P.I.	30 μm	-	-	-	3.50 ± 0.35	-	-	0.40 ± 0.04	-	-	-	-	0.60 ± 0.06
	C.P.	30 μm	23-34 μm	11r	0.50 ± 0.05	0.70 ± 0.07	0.070 ± 0.007	0.140 ± 0.014	18 ± 2	1.50 ± 0.15	-	0.010 ± 0.001	8.0 ± 0.8	
Blue	P.I.	30 μm	-	-	-	3.5 ± 0.4	-	-	0.40 ± 0.04	-	-	-	-	0.60 ± 0.06
	C.P.	30 μm	-	-	-	0.50 ± 0.05	0.070 ± 0.007	0.35 ± 0.04	18 ± 2	-	-	-	0.70 ± 0.07	1.50 ± 0.15

Noteworthy is also the fact that through the MC simulation, little bromine was detected in the red spot. The fact could be explained as a possible clue to methyl bromide, that was said to be used in the past as fumigant pesticides[203] (fig. 3.62).

As for the calculated level of thickness (Table 3.22), the XRMC software computed various levels comprised in the range 20-40 μm for all layers: coloured paints, printing

[202] Lemière, "A review of pXRF (field portable X-ray fluorescence) applications for applied geochemistry".

[203] Hanna M. Szczepanowska. *Conservation of Cultural Heritage: Key Principles and Approaches*. New York, NY and London: Routledge, 2016.

inks below the paints (of the three-layer model) and uncovered inks (of the two-layer model). Therefore, these results are comparable, they consistently fall in a similar range and are supported by the analysis on micro-samples from the other leaves. The SEM images of small samples of printing inks, as well as green and red paints (fols. 11r and 47v) reveal indeed a range of 32-38 μm for the uncovered ink layer, 23-34 μm for the green paint and 32-47 μm for the red paint (no good reference for the sample for the blue paint was available). At an overall consideration, the extreme range for all pictorial layers from the SEM images is 23-47 μm, which is consistent with the range proposed through the MC simulations[204]. The range obtained through the MC simulations is slightly broadened when the large uncertainty is considered and extends to 10-50 μm, but it is still compatible with the reference values (23-47 μm, SEM images).

Table 3.22: Quantitative evaluation of the pictorial layers with the XRMC method. Values from table above, only singling out the values of thickness for the paints.

Spot	Layer	E.T.	M.T.	Fol.
Red	P.I.	30 μm	-	-
	P.I.	40 μm	32-47 μm	11^{r}
Green	P.I.	30 μm	-	-
	C.I.	30 μm	23-34 μm	11^{r}
Blue	P.I.	30 μm μm	-	-
	C.I.	30 μm	-	-

In conclusion, the 20-50 μm range for the thickness of the painting mixtures in BPE, Inc. 438 seems to be uniform across the entire books. Hopefully, this value could be an indicator of the painting precision of the Hardouyn work[205].

3.2.2.3 Evaluation of the pictorial sequence

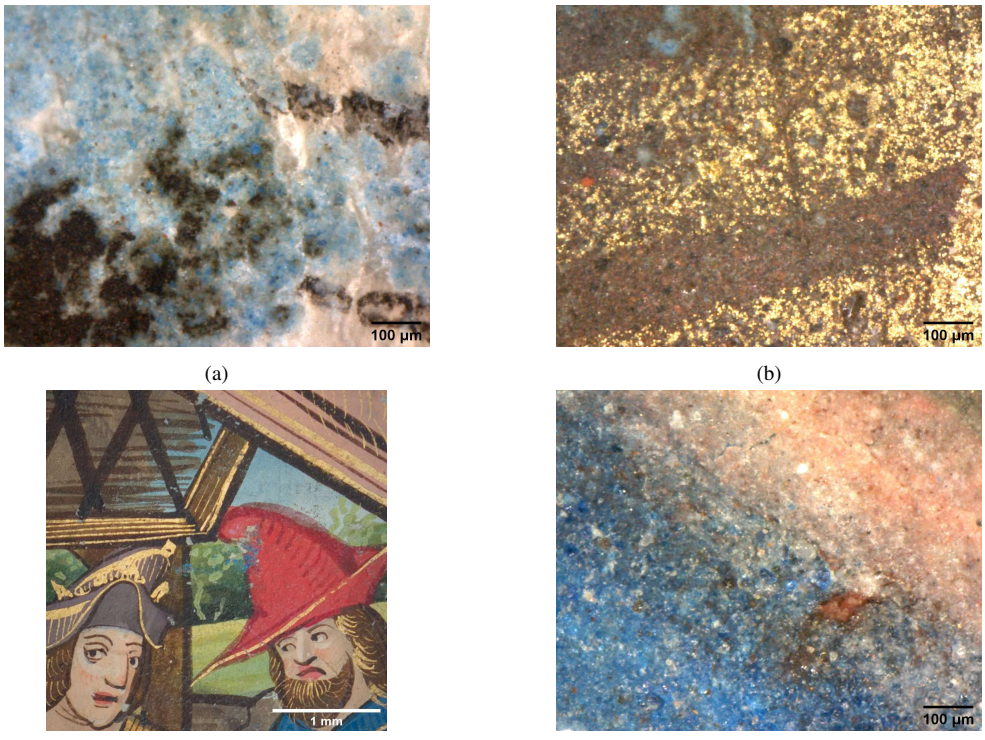
The series of complex practices which craftsmen observe for creating artistic objects goes under the term "artistic process". As for the books here inspected, such a process calls for observing two elements of their decoration, one being the underlying printed de-

[204] See also Section 3.2.2.2

[205] Future work on other Hardouyn Hours will study the thickness of other inks in the view of confirming this hypothesis.

sign; the other, the sequence of painting. The former element, or the printed design, corresponds to the original visual quality of the images at issue, or their figurative archetypes. They are all covered by layers of paint, so their exact patterns cannot be immediately appreciated. The exact recognition of these prints' composition calls for appropriate analytical methods, which also allow evaluating the extent of compositional affinity to the respective model. The latter element of analysis is the sequence of painting; like the previous subject, its technical appraisal calls for dedicated inspection. In fact, it takes some discriminating the order of painting for the miniatures under consideration.

The sequence of painting for the books is constant and consists of a mono- or bilayers. In all cases the pictorial film is given directly to the underdrawing in order to cover it. Generally, the initial layer is of blue paint, used to represent the sky in most cases (fig. 3.63a)[206]. A few layers are laid on it, like the brown, green or red paint of a few cases (figs. 3.63b-3.63d); for the most part, the pictorial films are applied directly on the lower level (figs. 3.63a-3.63c).

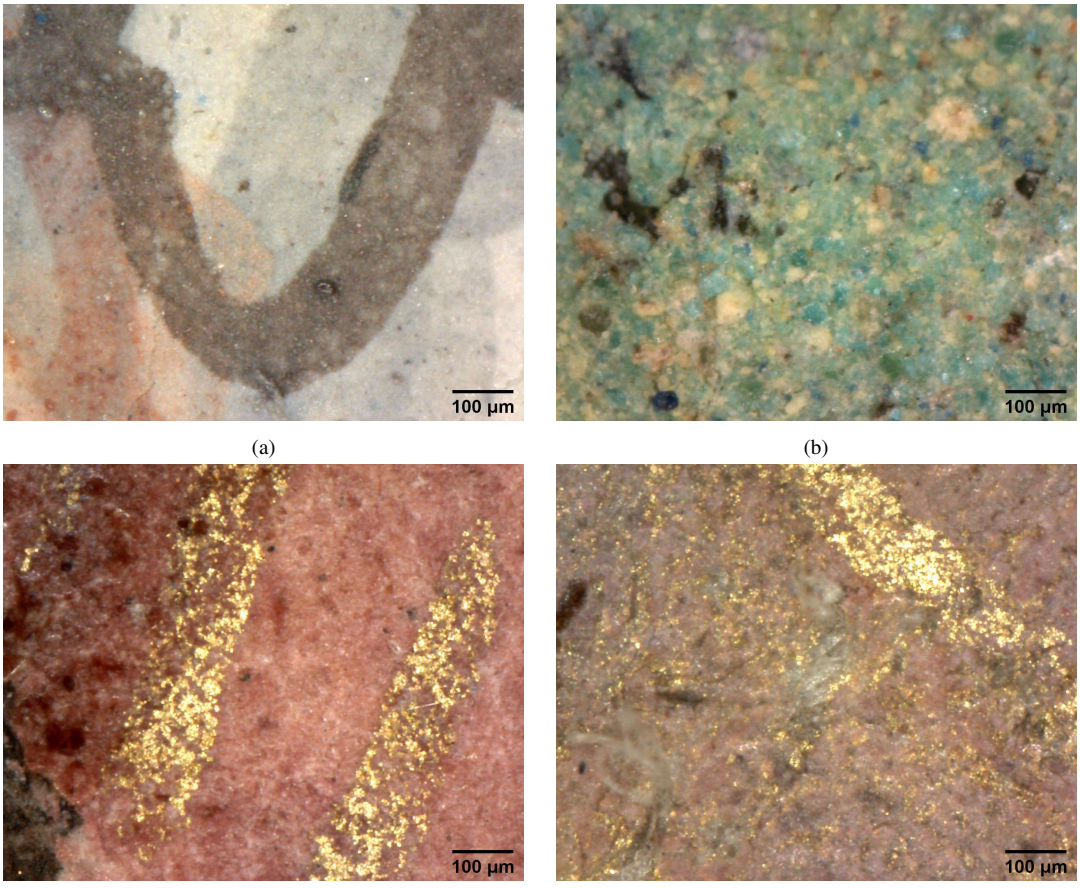


(a) (b) (c) (d)

Figure 3.63: Details of the paints for the first layers of paint across the case studies: a) Res. 326.v, fol. 1^{r}, blue spot (1, DM image); b) Res. 326.v, fol. 1^{r}, brown spot (DM image); c) Res. 326.v, fol. 1^{r}, green spot (magnification of the Vis image); d) Res. 326.v, fol. 1^{r}, red spot (DM image) © HERCULES Laboratory.

[206] In all miniatures, except for Res. 5781.p.

Other finishing traceries are applied on the first film, for either shading or highlighting. Figures 3.63a and 3.63c shows that shadings are created before the rest: the grey area appears to lay underneath the red and pink layers, as well as the dark brown finishing. In the end, contouring is made and the final gilding (figs. 3.63b-3.64d).



(a) (b)

(c) (d)

Figure 3.64: Microscopic details of shadings, highlightings and gildings across the case studies: a) highlightings and shadings in a pink spot (Res. 328.v, fol. 31^{r}); b) highlightings and shadings in a green spot (Res. 328.v, fol. 31^{r}); c) gilding over red spot (Res. 326.v, fol. 1^{r}); d) gilding over red spot, 3 (Res. 5781.p, fol. 29^{v}) © HERCULES Laboratory.

3.2.2.4 Timeline of the illuminating technique for the Hardouyn workshop

The technique of decoration of the Hardouyn *horae* has been widely detailed so far. The present chapter has discussed the largest part the technical characterisation of three Hours printed by the Hardouyn workshop, and which are now part of the BNP collection. Now, this section shall relate the results gained insofar to the past research on the other Hardouyn Hour book from the BPE (Inc. 438). This other item is part of the public

collection of Évora since 1955[207], and it is an Octavo-Book of Hours of small dimensions (cover size 170 mm x 103 mm) and adopts the Salisbury Mass rite[208].

Like the other case studies, this item was printed by Germain Hardouyn[209], in this case, between 1528 and the mid-1530s[210] on 124 *folia* extensively decorated[211]. As for the scientific investigations involving Inc. 438, it consisted in a M.Sc.'s final year's research work, which characterised the book's technique of illuminating[212], printing[213] as

[207] As stated in two legal records conserved in the library (*Ata de cessão e entrega* nos. 1 and 2 from the catalogue of the Manizola fund). The book was originally presented as a gift to the *Visconde* of Esperança in August 1901, as read in an initial statement: "Bestowed upon the Visconde of Esperança, August 1901. By Ex. Francisco Ribeiro da Cunha" (second free-paper^{r}). Translated from the modern Portuguese: "*Oferecido pelo Ex*[*celentís*]*s*[*i*]*mo Senhor Francisco Ribeiro da Cunha em agosto de 1901.* | *Visconde da Esperança*"). More exactly, Francisco Ribeiro da Cunha gave the book to José Bernardo da Baraona Fragoso Cordovil Gama Lobo, who was the second Visconde of Esperança. Along with belonging to the local nobility, Gama Lobo was a dedicated bibliophile and created a personal library in own estate (Manizola). Following his death (1925), the Visconde arranged formally to bequeath his own collection to the local library of Évora; however, his heirs disputed this will. The heirs summoned the national court for the settlement of the dispute, and the solution to the complicated issue was reached only in 1953. In this year, the entire collection was acquired by the National Treasury of Portugal (*Ata de cessão e entrega* no. 1) to be conceded to the BPE in 1955 (*Ata de cessão e entrega* no. 2).

[208] In Latin, *ad usum Sarum*. For full bibliographic info and a complete digital source of the item, see Appendix A, Inc. 9.

[209] As expressed in the initial and final colophons: "Hours of the Virgin for the prestigious and excellent Canterbury Office, complete and for long usage, without exceptions. With several suffrages [and] prayers. New edition printed in Paris by Germain Hardouyn, [printer] based between the two doors of the Royal Palace [Palace of Justice, ed.], under the sign of Ste. Margaret" (fol. 1^{r}); "This is the end of the Hours of the Blessed Virgin Mary pursuant the Salisbury Mass rite, complete and for long usage. With several suffrages [and] prayers. New edition printed in Paris by Germain Hardouyn, [printer] based between the two doors of the Royal Palace [Palace of Justice, ed.], under the sign of Ste. Margaret" (fol. 119^{v}). The two statements are by this thesis' author from the original in Latin: "*Hore beatae Mariae Virginis ad vsum* | *insignis ac preclare ecclesie Sarum* / *tota*|*liter ad Longum sine require. Cum plu*|*ribus suffragiis* [*et*] *orationibus* / *Nouiter* | *impressis parisius* : *per Germanum har*|*douyn* / *co*[*m*]*morantem inter duas portas* | *Palatii Regis, ad inter signium diue* | *Margarete*"; "*Expliciunt hore beatissime virginis* | *Marie secundum vsum Sarum totali*|*ter ad longum. Cum pluribus suffragiis* | [*et*] *Orationibus denouo additis Nouiter* | *impressis Parisius per Germanum har*|*douyn* / *Co*[*m*]*morantem inter duas portas* | *Palatii Regis* / *ad inter signium Sancte* | *Margarete*."

[210] Also in this case, no clear reference of dating appears throughout the item, so its dating is a mere guess. For this purpose, the first year of the almanack is adopted as the year of production, but its decoration/issue must have occurred at a later time, owing to considerable iconographic differences between the crude engravings and their colouring (Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography").

[211] It contains thirty miniatures altogether: thirteen big for the decoration of the major offices, twelve for the decoration of the Gospel and suffrages and five more for the decoration of supplementary prayers (Bottura-Scardina, *The Technique of Illumination in the Transition from the Manuscript to the Incunabulum in Paris: A Case-Study on a Specimen from the Public Library of Évora*).

[212] Bottura-Scardina, *The Technique of Illumination in the Transition from the Manuscript to the Incunabulum in Paris: A Case-Study on a Specimen from the Public Library of Évora*; Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography".

[213] Bottura Scardina et al., "On the use of hand-held X-ray fluorescence spectroscopy coupled to Monte Carlo simulations for the depth assessment of painted objects: The case study of a sixteenth-century illuminated printed book".

well as the iconographical variations that occurred between the phases of printing and colouring[214] of several miniatures.

Among the studied images, close attention was dedicated to its coloured versions of the *Printer's device* and *Adoration of the Magi*. Thus, this section compares the results from the past technical inspection on the BPE's book with those from the BNP's items. Their global comparative analysis touches on three topics: pigments, binders and extenders employed for the coloured paints; materials of printing and iconographical manipulation of the original engravings.

The overall period of decoration (including both printing and colouring) falls across the years *c.* 1522-1534 and touches only the production under Germain's stewardship. In fact, it is important to remember that Res. 326.v has been dated at *c.* 1522[215]; Res. 5781.p *c.* 1518-1523 (*ante*-1525)[216]; Inc. 438, 1528-*c.* 1535[217]; Res. 328.v, *c.* 1534[218].

Concerning the first part of the analysis, Figure 3.65 compares the materials of paintings throughout the four books under consideration (BNP, Res. 326.v, Res. 328.v and Res. 5781.p; BPE, Inc. 438). Its observation suggests that the blue, green, red and brown inorganic pigments show no trend of use. Their direction of employment appears regularly throughout the case studies and, hopefully, may be the same for the entire printing activity of the Hardouyns[219]. Diametrically different are the cases of the red lakes and yellow colourants. On the one hand, the most widely employed organic pigments could be the lakes of brazilwood and madder. However, their exact nature is either to confirm or was not clear in all cases. Thus, this subject remains open for future research. On the other hand, the most interesting piece of evidence are the tenors of occurrence in yellow colourants. Such mixtures show the first period of use until *c.* 1522-1525, within which

[214] Bottura-Scardina et al., "Image processing methods integrated to imaging and material characterisation for the study of incunabula illustrations: an innovative multi-analytical approach on a case-study".

[215] See Section 3.1.1.

[216] The year 1525 is the ending date of Res. 5781.p's almanack and accordingly, the most likely *terminus ante quem* for its retail. See Section 3.1.1.

[217] Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography".

[218] See Section 3.1.1.

[219] Considering that Gillet and Germain were both registered as "illuminators" in the Paris Book guild register (Campardon, Émile [1889], Civil register in Paris of April 10, 1539-October 31, 1539. In *Répertoire numérique des archives du Parlement de Paris*. Série X, doc. no. X/1a/1543). It is possible that the Hardouyn workshop may have developed his own working method over time since Hindman refers that this fact was quite unusual for printers and publishers. See link at: https://www.textmanuscripts.com/medieval/germain-hardouyn-printed-book-of-hours-141447 (Accessed January 9, 2022).

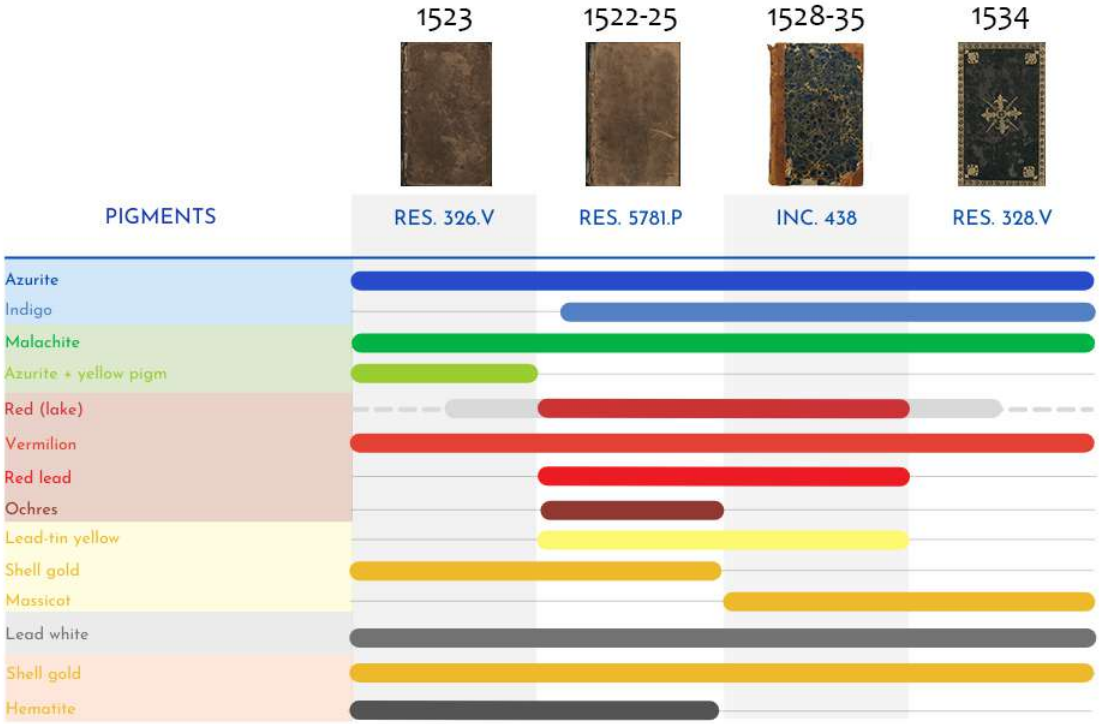


Figure 3.65: Timeline chart for the analysed pigments in the Hardouyn books.

term the preferred method of giving yellow is applying a layer of gold over ochres, or a mosaic-gold / shell gold layer over ochres[220]. Later (in the mid-1530s), this method was abandoned in favour of Pb-based yellows. The same course seen in the yellow paints may have also affected the technique of gilding, which shifts to sole shell gilding, as seen in Inc. 438[221]. The remaining materials of colour paints, namely binders and extenders, seem constant: proteinaceous agents could be the prevalent choice to mix organic pigments; for the remaining materials, polysaccharide agents (like natural gums). Moreover, lead white found the largest use as an extender, whereas gypsum and chalk[222] could have found some use too.

[220] Regardless of their position within the book.

[221] The material quality of the gildings in Inc. 438 is at high purity, for the SEM-EDS results ascertained comparable values of Au:Ag:Cu ratio over four samples: sample 1, 96.24 ± 2.63 %, 1.93 ± 0.09 %, 2.04 ± 0.10 % (Au, Ag, Cu); sample 2, 97.21 ± 2.87 %, 0.83 ± 0.07 %, 1.97 ± 0.10 %; sample 3, 95.48 ± 2.69 %, 2.06 ± 0.10 %; 2.47 ± 0.11 %; sample 4, 97.03 ± 2.65 %, 1.50 ± 0.08 %, 1.48 ± 0.09 % (Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography"; Bottura-Scardina, *The Technique of Illumination in the Transition from the Manuscript to the Incunabulum in Paris: A Case-Study on a Specimen from the Public Library of Évora*).

[222] Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography".

3.3 Evaluation of the artistic process

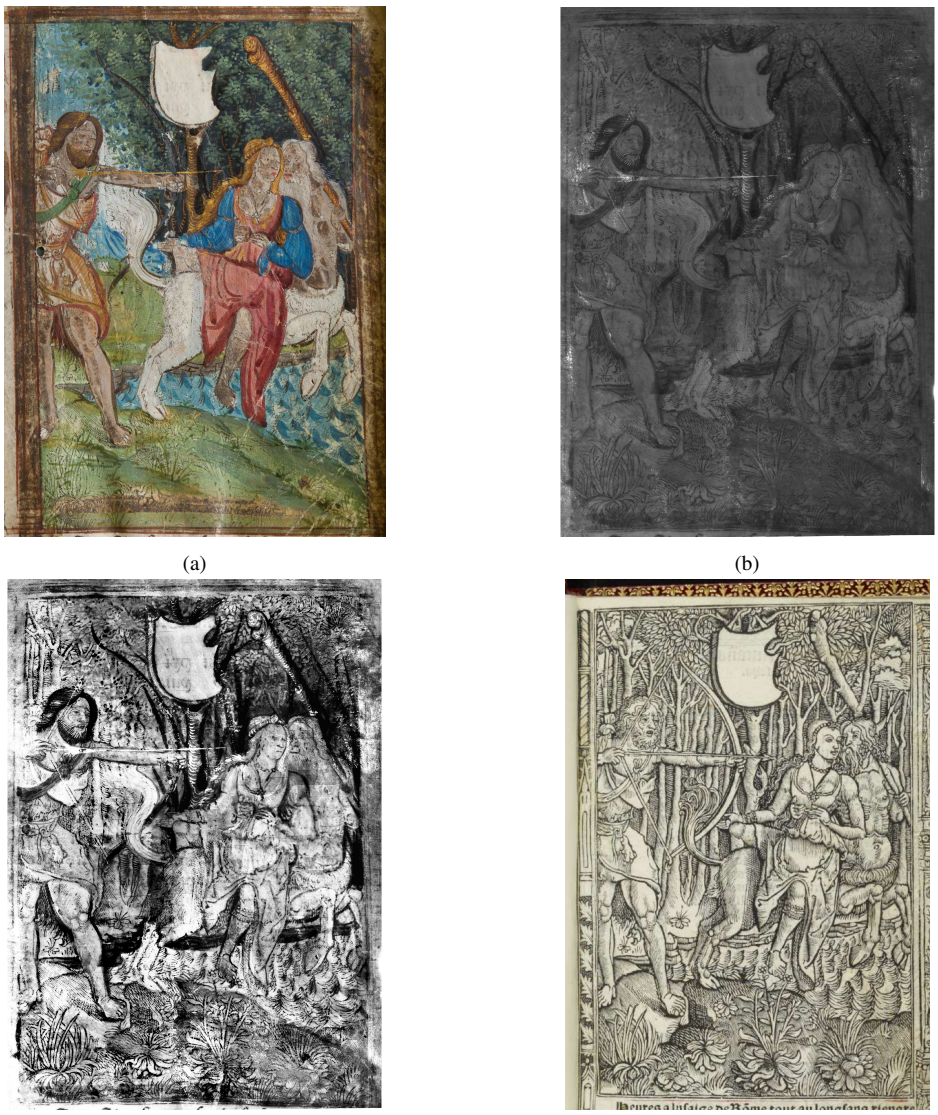
The tentative matching of the selected case studies with illustrations from the sets identified in Chapter 2 employed the method illustrated in the previous section (automated enhancement of reflectograms) for the iconography of the *Printer's device* across the three case studies. IR images were employed instead to study the *Adoration of the Magi*, without employing the same method[223].

The presentation of the results and their discussion are organised by iconographical content in the next two subsections, and it is as follows.

3.3.1 First case: *Printer's device*

The results of the enhancement of the first *Printer's device* (Res. 326.v, fol. 1[r]) are summarised on Figure 3.66. Through the digital reconstruction, some differences arise between the overpainted miniature (fig. 3.66a) and the underprinting (fig. 3.66c), regarding the landscape alone. One is a detail appearing in the top left corner, revealing to be originally a woodland backdrop; another, the meadow in the lower half of the image. In this case, the plain grass at Hercules' feet proves to have originally been a lavish vegetation. In turn, the reconstruction bears a close resemblance to a piece explored in the previous chapters.

[223]The analytical conditions adopted to capture reflectograms and IR images are in Appendix F, Section F.1.4.



(a) (b) (c) (d)

Figure 3.66: Imaging characterisation of *Printer's device*, Res. 326.v, fol. 1[r]: a) Vis image; b) IR-reflectography; c) Digital reconstruction; d) Reference engraving (from BnF, Rés 8.T.2520, fol. 1[r]) © HERCULES Laboratory, Source BnF.

Within the *Octavo*-format set by the Pichore workshop, one piece bears a striking resemblance to the digital reconstruction. This piece corresponds to an early commercial mark of the Hardouyn workshop (fig. 3.66d)[224]. To be more exact, Renouard proposed that this engraved piece first appeared with the series of Quarto editions that Guillaume Anabat printed chiefly for Gillet Hardouyn (not earlier than 1505)[225]. Following this hypothesis, Zöhl classified this image as part of the first delivery of the Octavo-series that the Pichore workshop designed (and maybe also crafted) for the Hardouyn workshop dates

[224] Compare with Figure 2.23a and the information on Chapter 2, Section 2.2.1.

[225] Renouard, *Les marques typographiques parisiennes des XVe et XVIe siècles*, p. 131, no. 429.

back to sometime around the proposed date, or 1505[226].

(a) (b)

(c)

Figure 3.67: Imaging characterisation of *Printer's device*, Res. 328.v, fol. 1[r]: a) Vis image; b) IR-reflectography; c) Digital reconstruction © HERCULES Laboratory.

On a close look at the imaging results of the second Printer's device (Res. 328.v, fol. 1[r]), the digital reconstruction (fig. 3.67c) unravels a high degree of similarity with the painted version (fig. 3.67a). This miniature is located above the edition's colophon and represents the emblematic image of Germain Hardouyn's editions, despite not being his original creation. Before Germain, another Parisian printer carved it in *c.* 1497 as the personal trademark of a printing workshop, namely that of Guillaume Eustace (fig. 3.68)[227]. In light of that, it is possible to address the chronologic relationship between

[226] See Chapter 2, Section 2.2.3 for further details.
[227] Renouard, *Les marques typographiques parisiennes des XVe et XVIe siècles*, pp. 92-93, no.308.

Figure 3.68: Original version of the first *printer's device* of Germain Hardouyn, as originally designed by Guillaume Eustace (*c.* 1497). From Renouard et al., 1926, no. 308 © BaTyR.

the original logo by Eustace and the one as it appears in the digital reconstruction of Res. 328.v.

Germain Hardouyn started sharing this plate with Eustace sometime after 1500, maybe around 1505[228]. After getting full possession of the engraving, Germain would apply multiple adjustments to it over time (fig. 3.69). The first version observed under Germain's possession is the one in which the letter "E" and the bottom banderole were carved out (fig. 3.69a). Probably, these two alterations were not too severe to continue a course of shared use with Eustace. The altered version still retained the original monogram and one of Eustace's initials, so applying it as an identifying mark across the two workshops would still be rather safe. In fact, this version appeared once a few years later, in an edition of Hours by Eustace[229]. As either a painted miniature or a crude engraving, this version of the logo may have endured until the mid-1520s since it is found in some Book of Hours made in the 1510s and the early 1520s[230].

[228]It is possible that the initial course of use may be partially shared, owing to the fact that this plate appears one again across Eustace's edition (see later). As for Germain, the estimated date of issue for the earliest edition bearing Germain's new mark is 1505 (Renouard, *Les marques typographiques parisiennes des XVe et XVIe siècles*, no. 308, pp.92-93).

[229]Namely, a 1508-edition of Hours. See also Renouard, *Les marques typographiques parisiennes des XVe et XVIe siècles*, p. 92.

[230]One is a book in New York, MMA 89.27.4, 1518-1521 (see Appendix 1, Inc. 25 for more bibliographic info and a partial online source of the item); another is a book in Madrid, BNE, Res. 41820, c. 1520. In

(a) (b) (c)

(d) (e)

Figure 3.69: All versions of Germain Hardouyn's early typographical device: a) earliest version, textitc. 1505 (Renouard et al., 1926, no. 434, pp. 134-135); b) second modification: supplement of Germain's name inside the bottom *banderole*, 1520-1525 (Poitiers, BM, DR.38, fol. 1^{r}, 1533); c) third modification: initial "G" removed and monogram altered, *c.* 1526 (Paris, BnF, Rés. 8.T.2546, fol. 1^{r}, *c.* 1526); d) fourth modification: supplement of Germain's name inside the bottom banderole, 1527-1530 (London, BL, C.29.f.10, fol. 1^{r}); e) fifth modification: alteration of Germain's name in the *banderole*, 1528- (Lisbon, BNP, Res. 328.v, fol. 1^{r}) © Source BnF, 2022 The Metropolitan Museum of Art, Bibliothèque municipale de Poitiers, The British Library Board, HERCULES Laboratory, Silvia Bottura-Scardina.

During the 1520s, the logo underwent a new series of changes. Initially (1520-1525)[231],

both cases, the date of production of issue remains unclear. On the one hand, the New York Hours seem to be a joint collaboration between Gillet and Germain. Because Gillet died in 1521, the period of production of this book may date between the first date of its calendar (1518) until Gillet's demise (1521). On the other hand, the Madrid Hours is also dated through its calendar (date referred in the online calendar: see http://catalogo.bne.es/uhtbin/cgisirsi/x/0/0/57/20/R\unhbox\voidb@x\bgroup\let\unhbox\voidb@x\setbox\@tempboxa\hbox{2\global\mathchardef\accent@spacefactor\spacefactor}\let\begingroup\endgroup\relax\let\ignorespaces\relax\accent22\egroup\spacefactor\accent@spacefactorF41820/0/X1001211191?user_id=WEBSERVER, [Accessed November 24, 2021]).

[231] This position relies on the comparative analysis of the book bearing this logo in the context of alteration

the bottom banderole was filled with Germain's full name in Roman square script[232] (fig. 3.69b); later (*c.* 1526)[233], the monogram counter[234] was simplified while the remaining initial letter ("G") got cut away too (fig. 3.69c); finally (1528-1530)[235], the name within the banderole assumed the Gothic script (fig. 3.69d).

However, further changes were seen also regarding the composition of this late script. One version contains the full name of Germain along with the extant "G" from the initial composition. As the result, the full name spells "GGermain hardouyn"(fig 3.69d). Instead,

of the others. Among these, Poitiers, BM, DR.38 (issued in 1533; see Appendix A, Inc. 38 for more info), bears a sure date of publication, stated in the rear colophon ("*Anno d*[*omi*]*ni Mcccccxxxiij*", = [made in the] year 1533). However, a number of elements lead to believe that the date of issue (1533) may not correspond to the year of production. Firstly, the Roman script in BMP, DR.38's device resembles closely the so-called Romans typefonts (series of compositions of movable types in Roman square capital letters and lowercase letters). Given so, it is possible that the adoption of Roman square types in the design of Printer's devices may date to an earlier period than 1533. This hypothesis is also seen in a similar typeface which appears in earlier Hardouyn editions: Lisbon, BNP, Res. 325.v, *c.* 1512 (for a full digital source of the item, see http://purl.pt/24632/3/#/1 [Accessed January 3, 2021]) and Paris, BnF, Rés. 8.T.2521, pre-1509 (for a full digital source of the item, see http://catalogue.bnf.fr/ark:/12148/cb368280436, [Accessed January 3, 2021]). Secondly, the version of the monogram as seen in Figure 3.5b is the same as the earliest version under Germain's adoption, so that the logo in BMP, DR.38 may be earlier than the other versions on Figure 3.52. Additionally, the calendar of the 1533-edition calendar runs through the years 1522-1533. This allows to believe that that book may have been printed around or before 1522 for sale throughout the period indicated in the calendar (1533 at the latest). Finally, the elegant model of this edition is incompatible with the austere presentation of the 1530s aesthetics of Germain's editions (compare with Chapter 2, Section 2.6). These facts along with those previously illustrated, derive two possible conclusions. The first of which options is that only the initial leaf containing the Printer's device (on the front), and the *Anatomical man* (on the rear) may have been printed before the rest of the body; the other, that the entire book has actually been printed earlier than the date of issue. This second possibility seems to be more sensitive than the other, due to the basics of the printing technique. Printing a book entails that individual units of printing are to contain several portions of text (across the two sides), each corresponding to individual page of a quire. The final arrangement of the text becomes clear only after folding the printed leaf for a number of times equal to the book format: for instance, "*Quarto*" units of printing are to fold four times, giving a quire of eight leaves each; or "*Octavo*" units of printing are to fold eight times, giving a quire of sixteen leaves each. This remark clarifies the choice of printing only the first leaf (fol. 1^{r} and 1^{v}) as impractical, indeed improbable. Thus, it is more likely that the book was printed at been printed at a much earlier time, maybe the early 1520s, and would be officially published only in 1533. In consideration of this broad remark, the given dating of the earliest alteration in Figure 3.52 could be placed at an undefined moment before 1527 (the date of issue of the next alteration).

[232] Like those designed by Simon de Colines in the 1520s and the other by Claude Garamond of the 1530s (see Armstrong, *Robert Estienne, Royal Printer: An Historical Study of the Elder Stephanus*, pp. 47-48; Vervliet, *The Palaeotypography of the French Renaissance: Selected Papers on Sixteenth-century Typefaces*, vol. 1, pp.77-78).

[233] This period of alteration is proposed on the basis of the edition displayed on Figure 3.52: Paris, BnF, Rés. 8.T.2521 (*c.* 1526), but is also seen in Madrid, BNE, Res. 180 (*c.* 1526) and Res. 175 (*c.* 1527). In all cases, the only chronological reference is the first year of their almanack.

[234] In typography design, the area of a letter that is entirely or partially enclosed by a letter form or a symbol is its *counter*.

[235] It is not clear whether the third and fourth interventions to the logo happen contemporaneously or in different periods; because no crude version from 1526 could be retrieved, this position is taken as a precautionary measure.

the version in BNP, Res. 326.v contains a reduced version, resulting in the correct spelling "GErmain hardouyn" (fig. 3.69e).

Analysing the logo in the case study allows completing the history of this *Printer's device*. The device in Res. 328.v shows the pristine monogram in neither its reflectography nor the digital reconstruction. This agrees with the fact that the symbol inside the escutcheon would undergo alterations only in the late 1520s as proposed, and not around 1533. Therefore, the first outcome of the technical examination of this logo is to add a slight piece of history to the production of the Hardouyn workshop, for it supports the above sequence of modifications. Additionally, this image may reveal two more interesting pieces of information. The first of which may involve the bottom banderole, the other the history of use of the Printer's devices within the Hardouyn workshop. As for the first point, it is possible to notice that the position of the writing "Germain hardouyn" in the ribbon concerning the extant *G* (referring to "*Guillaume Eustace*") appears exceptionally regular across all versions. That fact may suggest that this part of the device was not printed afterwards, but rather contextually to the device's printing. Speaking of the history of use of this logo, the analysis of the IR images in the context of the proposed history of use provides a chronological reference for this book, which lacks a clear reference of date. Aside from the almanack (running for the period 1534-1552), nothing in the book suggests either the actual year of production or issue. Through the analysis of this section, it is possible to support the early 1530s as the possible date of production of Res. 328.v.

A final relationship for the *Printer's device* of Res. 328.v can be drawn concerning its painted version and the pristine. The two versions match evenly in their outlines, showing only slight differences in the convolution of the lavish meadow (of the engraving) and in the design adopted for the escutcheon. Those differences lead to a substantial compositional simplification in the painted version's drawing.

(a) (b) (c)

Figure 3.70: Imaging characterisation of *Printer's device*, Res. 5781.p, fol. 1^{r}: a) Vis image; b) IR-reflectography; c) Digital reconstruction. From Res. 5781.p, fol. 1^{r} © HERCULES Laboratory.

The last image in the Res. 5781.p, fol. 1^{r} was the hardest to analyse: neither the reflectography nor the digital reconstruction could unscramble much information concerning the Printer's device of Res. 5781.p (fig. 3.70). The only useful detail is the foliage from the reconstruction, which suggests that this image may belong to the class of variants seen in the previous paragraph, without being able to single the exact one out.

3.3.2 Second case: *Adoration of the Magi*

(a) (b) (c)

Figure 3.71: Imaging characterisation of *Adoration of the Magi*, Res. 326.v, fol. 46[r]: a) Vis image; b) IR-reflectography; c) Reference engraving (Paris, BnF, Rés. 8.T.2520, fol. 81[r]) © HERCULES Laboratory, Source BnF.

The use of IR photography unravelled some elements of the genuine print of the *Adoration of the Magi* in the Res. 326.v, fol. 46[r] (fig. 3.71b)[236], which are absent in its pictorial treatment (fig. 3.71a). An instance of these elements is the design in the top right corner; at the bottom half of the image, a hound, a crown and naturalistic elements of the landscape appear. The former features can be identified through a piece previously described (fig. 3.71c), in which the indistinct top design is disclosed as the banners of the visiting Magi combined with the profile of a far-off Nazareth. The latter wrapped up elements, or the low group of the dog, the laid down crown and surrounding vegetation, also belong to the mentioned reference. This archetype is a piece of an Octavo suite that the Pichore workshop crafted specifically for the Hardouyns (*c.* 1505-1509)[237], used between the years 1505-1522. This period of use agrees with the proposed dating of Res. 326.v, confirming its date of issue.

Despite of the considerable closeness of the pictorial version and the pristine of this *Adoration of the Magi*, this pair differs in two aspects[238] Firstly, there are the mentioned

[236]The analytical conditions adopted for the analysis of this image are described in Appendix F, Section F.1.4.

[237]On this set, see Chapter 2, Sections 2.2.1, 2.2.2 and 2.2.3.

[238]See Chapter 2, Section 2.2.3.

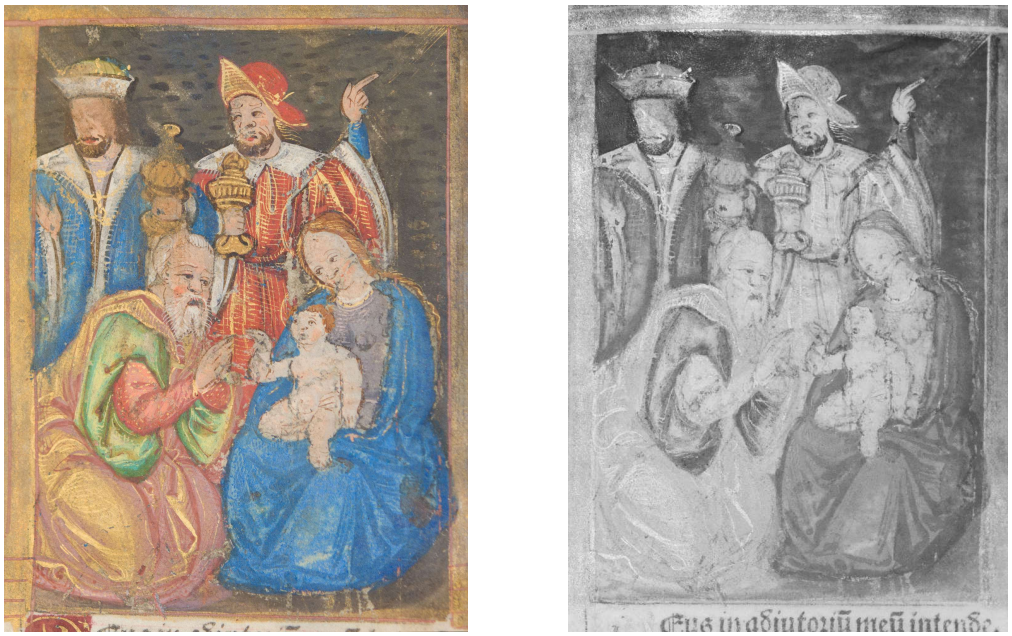
elements of the image, which disappear, thus this image's outline becomes overall plainer. The second remark is that the pictorial version interprets the image's iconographic differently: the stable becomes a ruined place; the scene, completely isolated from any form of civilisation; the three Magi, three powerful men who pays their respects to Jesus and not kings like before. Therefore, Jesus is the only spiritual King of the scene, as well as the visual focal point of the miniature.

(a) (b) (c)

Figure 3.72: Imaging characterisation of *Adoration of the Magi*, Res. 328.v, fol. 46^{r}: a) Vis image; b) IR-photography; c) Reference engraving (London, BL, C.29.f.10, fol. 35^{r}) © HERCULES Laboratory, The British Library Board and Silvia Bottura-Scardina.

The Adoration of the Magi from the second book (the Res. 328.v, fol. 31r) unveils major changes in its pictorial rendering. This becomes clear by comparing the final version (fig. 3.72a) with its IR photography (fig. 3.72b), which allows appreciating some original components of the image later removed. The first of them is an elaborate oval frame originally enclosing the scene. The artist who decorated the image removed it completely and altered the image format, shifting its shape from oval to rectangular. The second set of alterations involved the elements of the landscape: a parallel Annunciation to the Shepherds in the backdrop and the buildings behind the Magi are either erased or considerably altered. The third series of modifications touches the Magi, namely their garments become unsophisticated and ordinary and their gift humble, compared to their original appearance.

Like the first case study, these alterations could address a doctrinal choice. The Magi in Figure 3.72a have the look of travellers from distant countries (the youngest Magus wears on his head a turban, a symbol of the Asian regions), yet do not appear as kings. The combination of Magi's moderation, outline simplification and white colour of Jesus and Mary's flesh tone, attract the observer's attention to the two of them. Probably, this was to stress the higher spiritual order of Mary and Jesus as well.



(a) (b)

Figure 3.73: Imaging characterisation of *Adoration of the Magi*, Res. 5781.p, fol. 29^{v}: a) Vis image; b) IR-photography © HERCULES Laboratory.

This last version of the *Adoration of the Magi* (Res. 5781.p, fol. 49^{v}) could not be compared to an original engraved, for the IR photography does not bear sufficiently detailed elements to attempt a digital reconstruction (fig. 3.73b).

3.3.3 Patterns of iconographical alterations

The comparative analysis of the illuminations from Sections 3.3.1 and 3.3.2 showed that alterations of the iconographic programme occurred every time an engraving underwent full colouring. There are two likely explanations for such a process, based on the severity of their manipulation. The changes occurring between the printed and painted Printer's devices, generally consist in a visual simplification of the outline. Specifically,

the one in Res. 326.v (fol. 1^{r}), sees the thick forest, where the centaur Nessus sets foot, morphing into a harmless far-off grove (fig. 3.74a); Inc. 438 replaces similarly lavish vegetation with a red backdrop, which cuts away a significant portion of the original pattern (fig. 3.74b). Despite the apparent loss, the visual simplification may hide a careful aesthetic choice. In fact, if the artist did not operate a selection of the elements to include in the final colour rendering, these images would appear excessively crowded and violently unpleasant to the eye. If refined, the presentation of these images becomes harmonious and elegant. On another perspective, it is also possible that colouring could be used intentionally with the opposite aim, that is a simplification of the original outline. However, the two possibilities have the same outcome.

(a) (b) (c) (d)

Figure 3.74: Comparison between underprintings and pictorial versions: a) final miniature, Res. 326.v, fol. 1^{r}; b) engraved reference of (a); c) final miniature, Inc. 438, fol. 1^{r}; d) engraved reference of (c) (Renouard et al., 1936, no. 435, pp. 134-135 © Silvia Bottura-Scardina, Source BnF, BatyR.

The same tendency of clearing the iconography of its unnecessary elements also appears in coloured *Adoration of the Magi*. Res. 326.v, Res. 328.v and Inc. 438 offer a perfect instance of this choice: in the former, the pictorial version of this theme has eliminated the large retinue of aides and attorneys, being unnecessary to its spiritual appreciation. In both Res. 328.v and Inc. 438, the background narration of the rural *An-*

nunciation to the shepherds disappears too. At the same time, the *Adoration of the Magi* theme underlies more profound transformations. One constant element of exclusion is St. Joseph. In fact, later versions of the image (1530s-) never include him (Inc. 438). The odds are that it may have happened to focus its attention on the Marian content of the depiction, that was debated since the high Middle Ages. One Marian dogma that was under discussion between the mid-fifteenth century and the late sixteenth (ending with the Council of Trent, 1546) was the state of Mary's sin at the moment of birth. In 1439, the Council of Basel decreed that Mary was born free of the original sin under God's grace rather than her personal merit. Thus, distancing Joseph from the position was a means of affirming the immaculate state of her chastity after the conception and Jesus' birth. To summarise the remarks on iconographical divergences, all the case studies may express two comparable modes of treating the final miniature.

3.4 Contextualisation of the techniques

3.4.1 Printing technique

The previous chapter has been exploring extensively one component of the decoration of the Hardouyn Hours: their printed illustrations. Focused on the Hardouyn working process as a system involving printing in both the textual portion and the visual component of these editions, the fact is that Chapter 2 has not appointed neither the exact technique nor the materials employed for decoration. For this, these two matters are the primary focus of this section.

Much has been told in relation to the history of printed production[239], yet textual typography was not the sole printing process available in late medieval Europe. A class of methods for producing a series of identical images was in use even before Gutenberg created his press with movable types, namely the *engraving* process. Engraving methods were applied already a century and a half before Hardouyn's activity, both industrially and artistically. *Engraving* is the craft of cutting designs, figures or letters into a flat surface which is called plate or matrix, in order to make it suitable for printing[240]. Depending on

[239] In Chapter 1.

[240] The major difference between *engraving* and another common printmaking process, *etching*, is that

both the cutting and offsetting method, fifteenth-to-sixteenth-century engraving processes fall into the classes of *relief* techniques or *intaglio* techniques. A *relief* process involves cutting material away from a plate, creating depressions and allowing only raising areas to remain. Such asperities are later covered in a dense, opaque substance (an *ink*), and an appropriate medium to print is placed in contact with the carved plate[241]. Finally, a pressing agent transfers the ink from the plate to the medium. In an *intaglio* process, an engraver gouges only the parts that will be filled up with ink. The entire plate is covered in ink, filling the gouges created with the incision. Then the plate is wiped, removing the layer of ink only from the exposed areas and leaving ink in the parts previously hollowed. In the end, a medium to print is placed and pressed as described above. Figure 3.75 compares the two techniques, showing that the relief process cuts only the bright portions of the desired subject and leaves the dark parts, while the intaglio process works the other way around. Otherwise stated, relief techniques work similarly to modern-day photographic negatives; intaglio techniques, to positives.

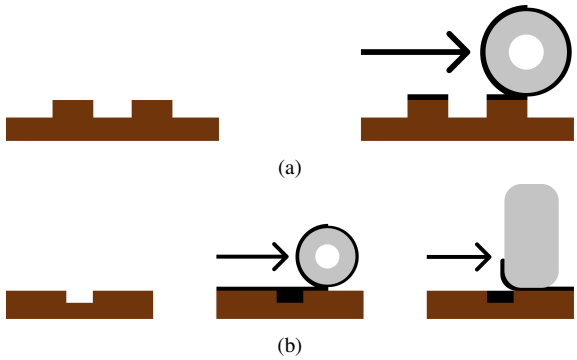


Figure 3.75: Illustration of two classes of engraving techniques: a) a relief plate carved and inking process; b) an intaglio plate carved, its inking and removal of exceeding ink with a sponge © Silvia Bottura-Scardina.

Already in the Renaissance, printmaking processes were numerous and very different from one another; thus, singling out the exact class of techniques is a crucial step to analyse the Hardouyn Hours technically. In this respect, documentary sources and practical evidence suggest that the relief processes may be the best candidates[242]. This class com-

in the first class of techniques, lines are cut directly onto the surface. In *etching*, depressions are created chemically with an acid solution (called *etching agent*). The solution is applied homogeneously to the entire plate, leaving unaffected those areas which are protected by a mask while corroding those left exposed. Because of the use of a chemical agent, etching techniques are also known as "chemical etching", while those from the other class are labelled as "traditional etching".

[241] That substrate can be placed over the plate or vice versa, depending on the desired effect.

[242] See later, Section 3.4.1.1.

prises two possible techniques: *woodcutting* and *metalcutting*. The former is a printing process in which the matrix to cut is a wood plate, whereas in metalcutting, the matrix to cut is a metal slab.

Based on the above information, the first part of this section offers a historical overview of fifteenth-sixteenth century engraving, focusing on the case of Paris (Section 3.4.1.1). That section outlines the rise of woodcutting, mentioning the engraving hubs until the years of the Hardouyns' activity and the historical records on image printmaking in the Parisian book illustration. The second part (Section 3.4.1.2) compares the composition of the printing inks used in the Hardouyn workshop with the recipes from technical texts to contextualise the formulations.

3.4.1.1 Renaissance engraving and the Hardouyn workshop

Relief printmaking is an ancient craft, much older than textual typography. In Europe[243], the earliest forms of such class of techniques employed wood blocks as matrices since the fourteenth century. In fact, Cennino Cennini (*c.* 1360-before 1427) offers a mention of printing already in the early years of this century, when he outlines one method in his *Libro dell'Arte*[244]. Despite their antiquity, these earliest forms of woodcutting were not originally to decorate parchment. Cennini's method was, in fact, referring to cloths[245], specifically fustian gowns for children and hangings for reading-desks. Also, the original designs reproduced patterns; occasional figurative representations appeared only in mid- to late-fourteenth century printing. One block dating back to these years is a fragment of a *Crucifixion* made in Burgundy in *c.* 1370-1390[246]. Nevertheless, academic scholarship proposed an analogous use for textile decoration[247].

[243]The specific designation of "European printing" owes to the fact that the technique originated in China (tenth-century). Later, the printing method would be imported to Europe through Egypt, during the period of the Crusades. See Hind, *An introduction to a history of woodcut*, vol. 1, p.65; Thomas Francis Carter. *The invention of printing in China and its spread westward*. New York, NY: Columbia University Press, 1931, pp. 23-28, 133–139.

[244]On the *Libro dell'Arte* (= "Book on Arts"), see Appendix E, Section E.3.

[245]Rec. 173, "The way to work on cloth by printing from a shape in colour" (= "*Il modo di lavorare colla forma dipinti in panno*"). See a translated version of the recipe in Herringham, *The Book of the Art of Cennino Cennini: A Contemporary Practical Treatise on Wuattrocento Painting* and in Appendix D, Recipe D.1.1.

[246]A. Hyatt Mayor. *Prints and People: A Social History of Printed Pictures*. Chicago, IL: Metropolitan Museum of Art, 1971, p. 8.

[247]About this case, Mayor suggests that it might have used to flock print a banner, an altar front or a lectern, owing to the wide popularity of these religious items during the late fourteenth century (see Mayor,

The earliest forms of paper printing arose a little later, but still, they were not for illustrating books. Instead of these items, card games and single-sheet prints of saints gave a tremendous impetus to woodcutting. In the late fourteenth century, card games enjoyed escalating and widespread popularity: their earliest references date back to modern-day Switzerland in 1367[248]; 1377 in Germany and Spain; 1379 in Luxemburg and Italy and 1392 in France[249]. French cities were particularly involved: in this regard, Carter states that by 1397, card-playing had become so common in Paris that the provost emitted an edict to refrain workingmen from indulging in this activity on working days[250]. Some card stocks were handmade and illuminated manually[251]. However, these decks were luxury sets; most of these were produced with engraving instead. The 1397-edict of the Parisian provost would suggest that printed cards could come from massive import or produced locally. In fact, some woodcut blocks from Lyon[252] and Rouen[253] have survived. About the second instance of paper printing, easel paintings suggest that individual prints of saints acted as another important catalyst for the diffusion of small prints. One instance is offered by the earliest version of the Annunciation from the Mé rode Altarpiece (1422-pre-1427)[254]: here, a *St. Christopher with Child* appears in the depiction as a print nailed to the rear fireplace (fig. 3.76). Another case is a painting by Petrus Christus, *Portrait of a Feminine Donor* (*c.* 1455)[255]: backward to the kneeling woman, a small icon of

Prints and People: A Social History of Printed Pictures, p. 8). Brunello supports this theory, observing that not a single print on paper or parchment from these decades has survived and that the design of these plates resembles closely the decoration of coeval textiles (Brunello, *The Art of Dyeing in the History of Mankind*).

[248]Timothy B. Husband. *The World in Play: Luxury Cards 14301540*. New York, NY and New Haven, CT: The Metropolitan Museum of Art and Yale University Press, 2015, pp. 13, 128.

[249]Carter, *The invention of printing in China and its spread westward*, p. 141.

[250]Carter, *The invention of printing in China and its spread westward*, p. 141. Also, one century after, special French suit insignia arose in 1480, deriving from German suits (see Michael A.E. Dummett et al. *The game of Tarot: from Ferrara to Salt Lake City*. London: Duckworth, 1980, pp. 14-16).

[251]One instance is the *Courtly Hunt Cards*. See Husband, *The World in Play: Luxury Cards 14301540*, pp. 26-41.

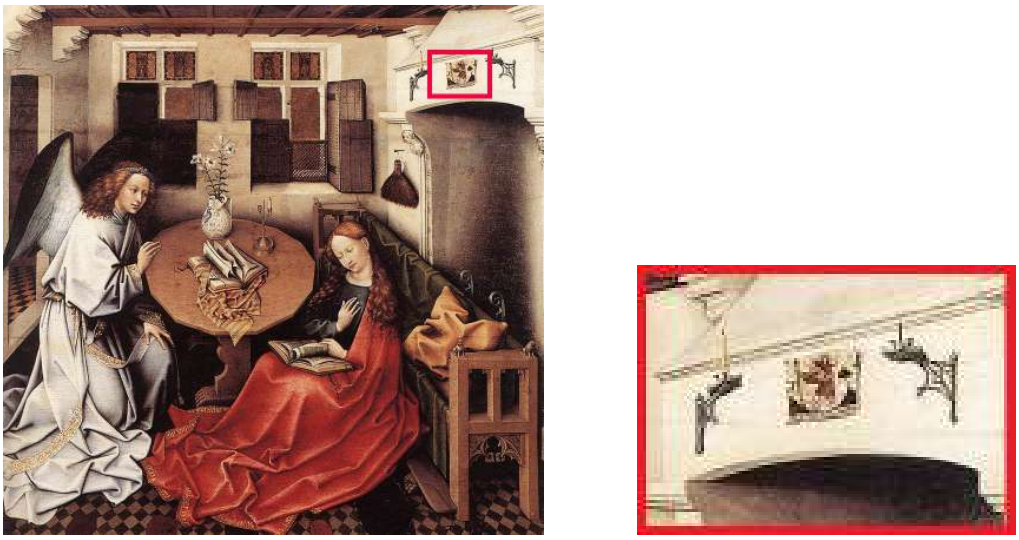
[252]Marjorie G. Wynne et al. "The Art of the Playing Card". In: *The Yale University Library Gazette* 47.3 (1973), pp. 137–184. DOI: http://www.jstor.org/stable/40859489, nos. 8-9, pp.153-154.

[253]Rouen was an important printing centre that produced cards for export in Britain (N. B. Tosney. *Gaming in England, c. 1540-1760*. Ph.D's dissertation. York, 2008, pp. 29-30).

[254]Campin, Robert (workshop of) [1422-1427], oil on panel; central panel of *Mé rode Altarpiece*, Netherlands (first version). In Brussels, Musé e des Beaux-Arts. Available at: https://www.wga.hu/frames-e.html?/html/m/master/flemalle/2/annuncia.html (Accessed January 24, 2022).

[255]Petrus Christus, *Portrait of a Feminine Donor*, oil on panel, 1455, Netherlands. In New York (NY), National Gallery of Art, 1961.9.11 (Samuel H. Kreiss Collection). Available at: https://www.nga.gov/collection/art-object-page.46110.html (Accessed January 25, 2021). Originally, it was the right-wing panel of a triptych (Lynn F. Jacobs. *Opening Doors: The Netherlandish Triptych Reinterpreted*. Pennsylvania State University: University Park, PA, 2012, pp. 122-125).

Saint Elisabeth of Hungary appears on the wall (fig. 3.77)[256]. The above instances of a large diffusion of these religious illustrations find support in material evidence: a woodblock from Bohemia of the *Flight into Egypt* dates back to the early fifteenth century (*c.* 1410). The oldest instances of paper prints date a few years ahead: among the most popular in printing studies, one is a German *St. Christopher* (South Germany, hand-coloured woodcut, 1423) ; another, the *Madonna of the Fire* of Forlì (Italy, *c.* 1425)[257]. Thus, at the beginning of the fifteenth century, the examples of paper printing were numerous, especially images of saints, which circulated as single-leaf prints.

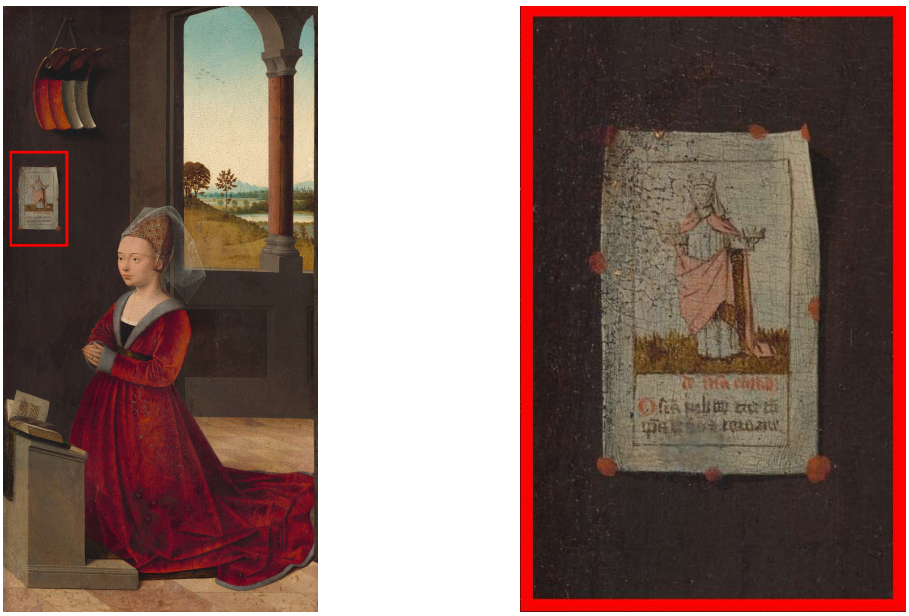


(a) (b)

Figure 3.76: Robert Campin's workshop, *Annunciation*. Central panel of *Mérode Altarpiece*, 1422-1427, Netherlands [first version]. In Brussels, Musée des Beaux-Arts: a) entire painting; b) detail of an engraving of Saint Christopher with Child (section indicated with a red square, top left corner) © Web Gallery of Art.

[256] A notice of these cases is also in David S. Areford. *The Viewer and the Printed Image in Late Medieval Europe*. Farnham and Burlington, VT: Ashgate, 2010, p. 1.

[257] Areford, *The Viewer and the Printed Image in Late Medieval Europe*, pp. 10-13; Sergio Fabbri. *La Madonna del fuoco di Forlì fra storia, arte e devozione*. Con un saggio introduttivo di Fabrizio Lollini. Cesena: Società di studi romagnoli, 2003; Lisa Pon. "Place, print and miracle: ForlÍ's Madonna of the Fire as functional site". In: *Art History* 31.3 (2008), pp. 303–321. DOI: https://doi.org/10.1111/j.1467-8365.2008.00608.x.



(a) (b)

Figure 3.77: Petrus Christus, *Portrait of a Feminine Donor*, 1455, Netherlands. In New York, National Gallery of Art, 1961.9.11 (Samuel H. Kreiss Collection): a) entire painting; b) detail of an engraving of Saint Elisabeth of Hungary (section specified with the square in the illustration of the left) © National Gallery of Art.

Another important causative factor in the development of woodcutting was the spread of blockbooks. A *blockbook* is a text which is entirely cut into wood matrices; each plate corresponds to an individual page, so a single blockbook requires as many plates as the total number of its pages. In the fifteenth century, a large assortment of popular literature circulated as blockbooks: *Biblia Pauperum*[258], *Apocalypses*[259], *Ars Memorandi*

[258] See also Chapter 1, Section 1.2.1. Two good instances are a *Biblia pauperum* made in Netherlands, *c.* 1470 (New York, Pierpont Morgan Library, PML 1.2) and another in Wolfenbüttel, Herzog August Bibliothek (*c.* 1470-1475). The latter is available at: http://diglib.hab.de/wdb.php?dir=inkunabeln/1-xylogr&pointer=0 (Accessed January 24, 2022).

[259] Some instances of [*Apocalypsis Sancti Johannis cum figuris*] may be found as digital copies: one from Germany, printed *c.* 1478-1480 is in Cambridge, University Library, Inc.3 [4245]. Available at: https://cudl.lib.cam.ac.uk/view/PR-INC-00003-04245/4 (Accessed January 25, 2022). Three more copies are in Munich, Bavarian State Library: Cim. 45a, [Netherlands], [*c.* 1465/1470] (available at: https://daten.digitale-sammlungen.de/~db/0003/bsb00039962/images/index.html. Accessed January 25, 2022); Cim. 45, [Germany], [c. 1468/70] (available at: https://daten.digitale-sammlungen.de/~db/0003/bsb00039962/images/index.html. Accessed January 25, 2022); Cgm 5448 [East Germany], [after 1465] (available at: https://daten.digitale-sammlungen.de/~db/0003/bsb00038187/images/index.html. Accessed January 25, 2022).

per figuram evangeliarium[260], *Ars Moriendi*[261], *Canticum Canticorum*[262]. Most of these books were created in Flanders and Germany but may have appeared in other markets outside these areas.

It is perhaps on this account that Parisian artists considered engravings as creative tools. One case of the artistry revolving around engraving was the creation of *coffrets à estampe*, small wooden coffins with a coloured wood-cut illustration glued to the internal face (1490s-1530s) (fig. 3.78)[263]. Even if this object was not unique to Paris[264], the fact of being crafted here is a sign of a possible artistic affinity to this technique.

(a) (b)

Figure 3.78: *Coffret à estampe à saint Cristophe*, Paris, *c.*1 490-1500. In Paris, Bibliothèque nationale de France, Departement of Rare books and photohraphie, MUSEE OBJ-187-Pt FT © Source BnF.

Contemporaneously, etching techniques grew associated with book decoration. Outside

[260] See Hind, *An introduction to a history of woodcut*, vol. 1, pp.243-45. A good instance of an *Ars memorandi notabilis p*[*er*] *figuras ewangelistar*[*um*], [South Germany], [*c.* 1470] is in Munich, Bavarian State Library: Xylogr. 10 (available at: https://daten.digitale-sammlungen.de/~db/0003/bsb00039962/images/index.html. Accessed January 25, 2022). Another is in Washington, DC, Library of Congress, Incun. X .A88, from Germany, [*c.* 1470]. Available at: https://www.loc.gov/item/49039040/ (Accessed January 25, 2022).

[261] See also Adrian Wilson et al. *A medieval mirror, Speculum humanae salvationis, 1324-1500*. Berkeley, CA: University of California Press, 1985, p. 98. An instance of this item is in Munich, Bavarian State Library, from South Germany (Ulm?), [*c.* 1475?]. Available at: https://daten.digitale-sammlungen.de/~db/0003/bsb00039966/images/index.html (Accessed January 25, 2022).

[262] Hind, *An introduction to a history of woodcut*, vol. 1, pp.243-45.

[263] The case presented in Figure 4.4 is a *Coffret à estampe à saint Cristophe*, Paris, *c.* 1490-1500, print designed by the Apocalypse Master. In Paris, Bibliothéque nationale de France, Department of Prints and Photography, Acc. no. MUSEE OBJ-187-Pt FT. Available at: https://gallica.bnf.fr/ark:/12148/btv1b550110279.item (Accessed January 25, 2022).

[264] Another centre of production was Antwerp. See Hindman, *Gothic Traveling: Coffers Revisited*.

Paris, the Dutch-German artist Israel Van Meckenen (*fl. c.* 1445-1503)[265] was ruling the market of burin stamps, which he designed either to be single-leaf prints or illustrations within books. Also, this artist was highly influential outside his boundaries[266]. Aside from him, another German artist mastered the craft until near perfection, Albrecht Dürer. Dürer would serve his apprenticeship at the Korberger workshop during Meckenem's golden age. It is in these years that he worked on his celebrated *Nuremberg Chronicle*[267]. As for France, Lyon was another printing hub, which produced illustrated books even before Paris. Its school of engraving was nourished and admired[268]. These cases prove that image printmaking had gained a certain artistic maturity.

As for the techniques applied in Paris, the opinions are diverging. In his extensive historical review of fifteenth- and sixteenth-century Parisian typography, Claudin is convinced about the use of engraved illustrations. As for the exact technique, he only brings up that woodcuts and engravings made "on a metal plate" were employed[269], without mentioning their preparation as either intaglio or relief carving. Claudin claims several publishers adopted woodcuts for illustration, such as Denis Meslier[270], Etienne Jehannot[271], Jean de Coulonce[272], Robin Charlot[273] and Nicolas Desperex[274]. Another eminent scholar of Parisian printing, Renouvier, was similarly positive about the active use of woodcutting. According to him, this technique found its most extensive use between 1484 and 1498, under the reign of kings Charles VIII (1483-1498) and Louis XII (1498-1515) in the intentional attempt of replacing miniatures. According to him, woodcuts offered a model for overpaints[275]. These two scholars agree on the potential use of either woodcutting or metalcutting but did not establish criteria for their use or discrimination.

Insofar, this section has been exploring woodcutting techniques, but metalcutting seems

[265] On him, see also Chapter 2, Section 2.1.3.

[266] Jules Renouvier. *Des gravures sur bois dans le livres de Simon Vostre: Libraire d'Heures*. Paris: Chez Auguste Aubry, 1862, p. 2.

[267] Giulia Bartrum. *Albrecht Dürer and his Legacy*. London: British Museum Press, 2002, p. 3.

[268] Blum, *The origins of Printing and Engraving*, p. 2.

[269] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2.

[270] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, pp.106, 116; Brunet, *Manuel du libraire et de l'amateur de livres, contenant 1o: Un nouveau dictionnaire bibliographique*, no. 335.

[271] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.248.

[272] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.243.

[273] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.308.

[274] Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.357.

[275] Renouvier, *Des gravures sur bois dans le livres de Simon Vostre: Libraire d'Heures*, p. 2.

another likely choice. In his *Le vite de' piv eccellenti pittori, scvltori, et architettori* (or *Le Vite*), Giorgio Vasari (1511-1574) credited the Florentine goldsmith Maso di Fininguerra with the creation of metal relief printing (*c.* 1460)[276]. Almost one century after, Evelyn wrote a non-technical treatise about the history of printmaking[277], where he refuted Vasari's opinion. This scholar affirmed that the metal used to prepare the plates was copper and that the birth of the copper-cutting was to move forward by thirty years than Vasari's account, namely to the 1490s.

Unfortunately, it is hard to agree with one or the other author. The only engraver who dates his works is Albrecht Dürer, and only at the beginning of the sixteenth century. In Paris, the only historical record about Paris is a colophon of a 1488-edition by Dupré , which reads: "This series of figurative representations and biblical stories [...] were cut on a copper [plate]"[278]. Aside from these facts, historical findings cannot offer sturdy support to the hypothesis for two reasons. One is that metal plates scarcely survived until today[279]; the other, that the work of Parisian engravers remains obscure, so it is not possible to be assertive about the techniques they employed[280]. Relief metal engraving seems to exist already during the period of activity of the Hardouyns workshop[281], even

[276]Giorgio Vasari. *Le vite de' piv eccellenti pittori, scvltori, et architettori*. Firenze: I Giunti, 1568, p. 466. Available at: https://archive.org/details/levitedepiveccel03vasa (Accessed January 25, 2022).

[277]John Evelyn. *Sculptura, or the History, and Art of Calchography and Engraving in Copper*. London: J. Payne, 1662, pp. 43-44. A 1765-edition is available at: https://books.google.com.bn/books?id=SU1iAAAAcAAJ&pg=PP7&hl=it&source=gbs_selected_pages&cad=2#v=onepage&q&f=false (Accessed January 25, 2022).

[278]From the original in Middle French: "*C'est le répertoire des histoires et figures de la bible tant du vieilz testame*[*n*]*tq*[*ue*] *du nouveau contenues dedens le*[*s*] *vignettes de ces presentes heures imprimées en cuyvre*". This statement is part of the colophon of a Book of Hours, use of Rome, printed by Jean Dupré, Paris, [1488]. Reference raised during a conversation of Nettekoven; also, she explored the topic in the context of her historical-technical analysis of the Apocalypse Master (Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, p. 71). On this reference, see also Claudin, *Histoire de l'imprimerie en France au XVe et au XVIe siécle*, vol. 2, p.241; Hind, *An introduction to a history of woodcut*, vol. 1, p.479. On further bibliographic details on Dupré edition and reference, see Bohatta, *Bibliographie der livres d'heures Horae B.M.V officia, hortuli animae, coronae B.M.V., rosaria und cursus B.M.V. des XV. und XVI. Jahrhunderts*, no. 489; Brunet, *Manuel du libraire et de l'amateur de livres, contenant 1o: Un nouveau dictionnaire bibliographique*, vol. 5, no.156; Léopold Delisle. *Chantilly le cabinet des livres ; imprimés antérieurs au milieu du XVIe siècle*. Paris: Plon-Nourrit, 1905, no. 909; Lacombe, *Livres d'heures imprimés au XVe et au XVIe siècle conservés dans les bibliothèques publiques de Paris: catalogue*, nos. 3, 41; cite[no. 5899/5885]pellechet1897; Renouvier, *Des gravures sur bois dans le livres de Simon Vostre: Libraire d'Heures*, p. 331; ISTC no. ih00359640.

[279]Blum, *The origins of Printing and Engraving*, p. 191; Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, p. 72.

[280]As specified in Chapter 1, Section 1.3.2.1.

[281]Mayor supports this theory in Mayor, *Prints and People: A Social History of Printed Pictures*, p. 19.

if there are further remarks to make.

Metal plates would be more common in later intaglio techniques (burin, aquatint, *maniera nera*, etc.). Also, metal plates should be more brittle than wood, so they undergo wearing more easily. Because of its ductility, the relief section of metal plates would develop deformations or cracks more frequently than wood plates[282]. Besides, metal ductility allows a more effortless shaping of intricate patterns than wood plates. As they are combined, these facts make both relief metalcutting and woodcutting two suitable candidates for the image printmaking routine of the Hardouyn workshop.

3.4.1.2 Comparison with technical treatises

Based on the aforementioned technical trends in early sixteenth-century printmaking, this section surveys technically two methods of relief printing as applied in the period 1470s-1550s , wood- and metalcutting. Limited documentary evidence apropos had survived, favourably to the contemporary scholars who wish to appreciate it historically and technologically. To this end, some instructions have been singled out from the following texts:

- *Libro dell'Arte*, by Cennino Cennini (*c.* 1300s-1330s)[283]: within his vast technical treatise on painting and drawing, Cennini occasionally reports details about other crafts. In this regard, he outline one instruction to print cloths[284];

[282] Such is the opinion of Schreiber, *Handbuch der Holz- und Metallschnitte des XV. Jahrhunderts*, vol. 1, p.5 and Max J. Friedländer et al. *Der Holzschnitt*. Handbücher der Staatlichen Museen zu Berlin. Berlin and Boston: De Gruyter, 1970, p. 5, also shared by Nettekoven Nettekoven, *Der Meister der Apokalypsenrose der Saint Chapelle und die Pariser Buchkunst um 1500*, pp. 70-71. The first two authors remarked that defects in the impression may be a clue of the material used for the plate: metal plates should show more clear signs of weariness and brittleness than wood. As a result, metal plates may damage more easily than wood plates. In addition to that, metal is a ductile material, resulting in the fact that the relief sections of such plates would get deformed or cracked more frequently than wood plates.

[283] On more info on Cennini, see Appendix E, Section E.

[284] The materials mentioned in *Libro dell'Arte* are listed in Table 3.21. Additionally, the text of the recipe can be found in Appendix D, Recipe D (Translation in English and original text in Italian vernacular).

- *De secretis*, by Alessio Piemontese[285] (1557): this text includes two recipes for printing, one delineated a complicated mixture, the other with some materials observed in the inks for the Hardouyn workshop[286];

[285] Alessio Piemontese or *Alexis Piedmont* is believed nowadays to be a pseudonym of a sixteenth-century physician, alchemist, whose real name might be Girolamo Ruscelli (1500-1566). Ruscelli-Piemontese wrote a vast treatise in six books covering a broad range of craft, titled *De' Secreti del Reverendo Donno Alessio Piemontese, Prima parte, diuisa in sei libri*. The *De' Secreti* was originally printed in Venice in 1557 among three different publishers. Later, Ruscelli's handbook would gain significant weight in the field of "book of secrets" studies, being the first, the most complete and with interesting information about several artisanal forms at the mid-sixteenth century. See also William Eamon. *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture*. Princeton, NJ: Princeton University Press, 1994, p. 134.

[286] The materials mentioned in *De' Secretis* are listed in Table 3.21. Additionally, the text of the recipe can be found in Appendix D, Recipe D (Translation in English and original text in Old Italian).

- *De atramentis*, by Petro Maria Canepario[287] (1619): he wrote a comprehensive work on inks for many purposes, including artistic printing. Among these, there is one recipe for typographic and relief printing[288];
- *Vocabolario Toscano dell'Arte e del bel disegno*, by Filippo Baldinucci[289] (1681): this treatise deals widely with seveal artistic techniques, including printing. Among these, one seems to describe particularly the methods of French printing[290].

[287] Very little information is known about him. The only record available is that Pietro Canepario was the son of Domenico Canepario, and that he had his birthplace in Crema around 1563. Later, Pietro would move to Venice to study medicine; here, he delved into several sciences, but particularly chemistry and natural sciences (Francesco Arisi. *Cremona Litterata*. Vol. 2. Online at: https://archive.org/details/cremonaliteratas02aris. Parma: Pauli Monti, 1706, p. 292) It must have been in this context that Petrus wrote his *De Atramentis*. In fact, the historian De Ferrari observed that the work has been dedicated to Antonio Priuli, whom had been doge in Venice between 1618 and 1623, making 1619 a plausible date of issue. See also De Ferrari, Augusto. "Canepari, Pietro Martire". In *Dizionario Biografico degli Italiani*, vol. 18. Online at: https://www.treccani.it/enciclopedia/pietro-martire-canepari_%28Dizionario-Biografico%29/ (Accessed February 4, 2022).

[288] The materials mentioned in *De Atramentis* are listed in Table 3.21. Additionally, the text of the recipe can be found in Appendix D, Recipe D (Translation in English and original text Latin).

[289] Filippo Baldinucci (1625-1696) was an Italian art historian and biographer based in Florence and who was celebrated for his extensive biographical work on his contemporary Baroque painters, *Notizie de' professori del disegno da Cimabue in qua* (started in 1681).

[290] The materials mentioned in *Vocabolario Toscano* are listed in Table 3.21. Additionally, the text of the recipe can be found in Appendix D, Recipe D (Translation in English and original text in Old Italian).

Table 3.23: Components of printing ink according to 15th- to 17th historical technical texts.

Author	Source	Period	Recipe	Original text	Components *Binder*	*Pigment*	*Additive*
Cennino Cennini	*Libro dell'Arte*	14th cent.	Ch. 173	Ap. 4, no.	Liquid varnish	Vine black	*none*
Alessio Piemontese	*De secretis libri septem*	1557	*A far inchiostro da scrivere* [...]	Ap. 4, no.	Cephalopod ink, linseed oil	Carbon black, irongall ink	Natural gum
				Ap. 4, no.	Liquid varnish	Lampblack	Linseed oil, walnut oil
Pietro Maria Canepario	*De atramentis*	1618	*Typographucum*, *Chalcographorumve Atramentum*	Ap. 4, no.	Linseed oil	Charred pitch, lampblack	Liquid varnish (linseed- or walnut oil-based)
Alessio Baldinucci	*Vocabolario Toscano dell'arte e del disegno*	1681	*Inchiostro da Stampatori*	Ap. 4, no.	Liquid varnish	Lampblack	*none*
			Inchiostro da Stampatori in rame	Ap. 4, no.	Linseed oil	*Terra da Stampatori*	*none*
			[French variant]		Walnut oil	barrel tartrate	*none*

Based on the table, the identified components are the following:

Black pigments: The pigments used in both text and image printing seem to be organic compounds derived from incomplete combustion of vegetal or animal matter, either in absence of air or in presence of little atmosphere. These pigments give the best performances as artistic materials because of their high hiding power[291] and lightfastness[292]. However, they display varying oil number and affect variously the drying period[293]:

- *Lampblack*: it consists of oil lamp flamed in contact with a cold surface and in presence of little oxygen. To prepare a perfect pigment, the organic precursors must undergo a consecutive series of charring and washing stages until reaching the desired material quality. Also called *soot*, the pigment so processed consists largely of amorphous carbon and may contain varying degrees of abundance of contaminants as residuals of compounds added during the preparation. Additionally, lampblack is a stable pigment with high lightfastness, very fine grain and high hiding power; unfortunately, this black pigment tends to slower down the drying rate of fatty films. Generally used as the main black colourant, in the past it was preferred to other carbon blacks because of its aforesaid excellent hiding power and lightfastness. Unfortunately, the procedure to produce it was long, thus it was quite expensive[294].
- *Ivory black*: it is a pigment obtained by burning bone material. If produced from ivory, the pigment is ivory black; if made from animal bones, it is called bone black. However, the two pigments are named indifferently bone black or ivory black nowadays. Due to its lower amount of carbon, ivory black gives a weaker black colour than lampblack, having lower hiding power accordingly. Besides, this pigment has coarser granulometry, low oil number and excellent lightfastness. It tends to slower the drying rate of the oil film, yet not as much as lampblack.
- *Vine black*: it is the pigment produced by charring vine wood (*Vitis sp.*) and other

[291] The the capability for a mixture of hiding the substrate. See also Johnston-Feller, *Color Science in the Examination of Museum Objects: Nondestructive procedures*, p. 115.

[292] The power of a compound of not shifting colour after exposure to light.

[293] The amount of time necessary to a mixture to develop a solid film.

[294] Together with Piemontese, other authors who mention the use of lampblack for printing are Vincenzo Fineschi. See Vincenzo Fineschi. *Notizie storiche sopra la stamperia di Ripoli*. Firenze: Francesco Moicke, 1781. A private conversation with the artist Vladimiro Elvieri also highted the use of this pigment in sixteenth-century recipes used contemporaneously to Dürer. See also Mommsen et al., "X-ray Fluorescence Analysis with Synchrotron Radiation on the Inks and Papers of Incunabula".

parts of vine plants, like stalks, twigs or vine lees , while other times, it was made with sediments of dead yeast and other residue obtained in the process of wine making[295]. It is a stable pigment with excellent lightfastness, used only secondarily in paints preparation due to its lower hiding power, tendency to give a greyish paint and slowing down the drying rate of oil films. Generally, artists regarded it as a secondary black pigment to use in addition to darker materials such as lampblack or ivory black. Probably, it was used probably in early printing or later, to make inks more transparent or improve the film thickness.

Binding media: The above table (tab. 3.21) shows that the main component of the media is a drying oil or a mix of drying oil and vegetable resin, namely:

- *Linseed oil*: it is the vegetable oil extracted from flaxseed (*Linus usitatissimus* L.)[296]. Usually, this oil was treated thermally, by boiling it in presence of air or in absence of air for several hours or days. With the boiling process, the substance is converted to a viscous medium quick to dry. In promoting filming reactions (to reduce the time of polymerisation), drying catalysts (metal salts) were added to the boiling oil. Without these compounds, the medium would dry slower. The main drawback of adding these substances is that over time, the oil boiled with driers tends to become yellowish. This effect is serious in paints, but negligible in black inks for engraving and printing. Being the black pigments employed quite stable to light, significant colour shifts do not occur nor affect visual appreciation. Oil was also boiled to favour removal of the impurities due to extraction from the seed[297], of residual water and later, to thicken the binder. Linseed oil is generally recommended as the main binder, because of its capability of drying faster than other oils[298]. item*Walnut oil*: it is the vegetable oil extracted from the seeds of *Juglans*

[295] Tomasini et al., "Spectroscopic, morphological and chemical characterization of historic pigments based on carbon. Paths for the identification of an artistic pigment".

[296] Viguerie et al., "The drying of linseed oil investigated by Fourier transform infrared spectroscopy: Historical recipes and influence of lead compounds".

[297] Mostly the mucilage. See D.K. Dev et al. "Preparation and Functional Properties of Linseed Protein Products Containing Differing Levels of Mucilage". In: *Journal of Food Science* 53.6 (1988), pp. 1834–1837. DOI: https://doi.org/10.1111/j.1365-2621.1988.tb07854.x; Ricky W. Fedeniuk et al. "Composition and Physicochemical Properties of Linseed (Linum usitatissimum L.) Mucilage". In: *Journal of Agricultural and Food Chemistry* 42.2 (1994), pp. 240–247. DOI: https://doi.org/10.1021/jf00038a003.

[298] Schönemann et al., "Raman and FTIR microspectroscopic study of the alteration of Chinese tung oil and related drying oils during ageing"; Viguerie et al., "The drying of linseed oil investigated by Fourier

regia. This oil was another important binding medium employed in Renaissance painting, because of his relatively fast drying rates and lower tendency to yellowish in comparison to other drying oils. However, the oxygen uptake and the filming rate of this oil are weaker than linseed oil, thus it creates a weaker and more brittle film in comparison to the oil described just before. Walnut oil was used alone or mixed to linseed oil as bodied oil by boiling, although Baldinuccis recipe suggests a preferential use in French printing.

- *Liquid varnish*: the composition of *liquid varnish* is still unclear; however, it seems that its preparations suggest boiling sandarac resin[299] with linseed oil in slow fire[300].

Additives: the main additives seem to be pitches and resins. The first could be sourced from local pine trees added as whole to improve the medium features (viscosity, stickiness, etc.). In relation to the second material, it could correspond to the so-called *black pitch*[301].

After describing the composition of the identified materials, Table 3.23 below compares them to the compounds retrieved among the Hardouyn Hours.

transform infrared spectroscopy: Historical recipes and influence of lead compounds".

[299] Several studies identified this resin as the exudate of *Tetraclinis articulata*. See Clara Azémard et al. "On the tracks of sandarac, review and chemical analysis". In: *Environmental Science and Pollution Research* 24 (2017), pp. 27746–27754. DOI: https://doi.org/10.1007/s11356-017-0522-0; Jacques Savary des Brûlons. *Dictionnaire portatif de commerce*. Vol. 4. Online at: https://archive.org/details/dictionnairepor01plomgoog/page/n8/mode/2up. Bouillon: Société typographique, 1770.

[300] See also Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, Ms. Bolognese, rec. 206. It was also studied by Johannes A. van de Graaf. *Het De Mayerne manuscript als bron voor de schildertechniek van de Barok: British Museum, Slcane 2052*. Ph.D's dissertation. Utrecht, 1958.

[301] The preparation of black pitch was described by a number of authors of Medieval treatises, but Eastlake clarified the matter by distinguishing two varieties, or the so-called *pece nera* and *pece navale*. The first of which could be the compound extracted by pine woods by firing processes and that later was used as waterproofing material for ships. Chemically, black pitch could be made with the most solid part of pine tar and pine resin. Its colour is brown-black, and it has solid appearance. In paints, it might be used serve as additive, black agent and modifier of viscosity or other aesthetical properties. The use of this material is mentioned among the materials for printing in the list published by the Ripoli workshop. See Appendix D, Section D and Angela Cerasuolo. *Literature and Artistic Practice in Sixteenth-Century Italy*. Translated by Helen Glanville. Leiden: Brill, 2017, p. 255.

Table 3.24: Comparison of the materials identified in the Hardouyn Hours with historical treatises.

Material		Presence in Hardouyn Hous	Mention in historical recipes
Class	***Substance***		
Black pigment	Ivory black	•	•
	Graphite	•	-
Binder	Walnut oil	•	•
Additive	Calcium carbonate	•	
Siccative	Cu- or Pb-based	•	

Based on Table 3.23, all the materials retrieved but graphite belong to the tradition of sixteenth-century woodcut or metal-cutting. Thus, the Hardouyn workshop adopt a shared technical ground with the coeval engravers.

3.4.1.3 Observations on the ink formulation

Adopting oil-based media has practical effects concerning printing, starting from the dynamics of transferring an inking substance onto a suitable surface. Because processed oils are viscous and sticky, they adhere tenaciously to the surface of the metallic- or wood matrix on which are spread, without dripping nor expanding excessively. At the same time, oil binders retain the necessary fluidity to penetrate the first microns of the substratum thickness as being pushed through the fibres of the material printed.

This interaction between an oil-based ink and its substratum diverges entirely from inks that use water as a solvent base to carry the pigment. This type of ink is represented by iron gall inks: in this class of compounds, the pigment is carried by gum water emulsions. Iron gall pigments precipitate afterwards within the fibres of a written material[302], following the application of the inking substance to the desired area with a pen tool. Thus, traditional iron gall inks reach deep levels of the thickness of written material, while oil-based inks form a superficial, homogeneous layer.

Another substantial property of viscous, oil-based media is their capability of reproducing the desired outline faithfully. Those mixtures tend to stay where they are deposited,

[302] The literature on this process is extensive, and Rafael J.D. Hidalgo et al. "New insights into iron-gall inks through the use of historically accurate reconstructions". In: *Heritage Science* 6 (2018), p. 63. DOI: https://doi.org/10.1186/s40494-018-0228-8 offers a good review of the chemical process.

with the result that they describe composition as sketched, rendering a neat pattern. Additionally, oil media give a film with body and strong colour vibrancy, in comparison to water-based inks that appear much more transparent.

Finally, fatty media typically evolve into solid yet flexible films with sufficient strength to resist the continuous mechanical stress induced by the substrate deformation. The book pages are folded continuously as one reader flips one page, touches it, or merely as they adjust to variable environmental conditions. In such a process, the ink film deposited on top of those materials must possess enough plasticity to adapt to the deformation and have a certain rigidity to appear solid and stay in place. And indeed, these are all features that oil media meet adequately.

3.4.2 Illuminating technique

3.4.2.1 Materials of painting: comparison with the traditional palette

The technique of painting, both in terms of the pigments employed and the methods for building up layers, is compared against medieval and late medieval technical text. The list of those considered is as follows[303]:

- *Schedula diversarum artium* (= On Diverse Arts), by Theophilus Presbyter (Germany, *c.* early twelfth century);
- *De Arte illuminandi* (= On the Art of Illuminating), anonymous (Italy, fourteenth century);
- *Liber de Coloribus Illuminatorum sive Pictorum* (= Book on Colours for Illuminators or Painters), anonymous (France, fourteenth century);
- *Liber de coloribus faciendis* (= Book on How to Make Colours), Peter of St. Audemar (northern France, late thirteenth-early fourteenth century);
- *De coloribus diversis modis tractatur and De coloribus diversis modis tractatur* (= On Diverse Ways of Preparing Colours; On Diverse Colours), by Johannes Alcherius (France, early fifteenth century);
- *Strasbourg tradition* (Germany, early fourteenth-late sixteenth century).

[303]The reasons for their selection and the exclusion of other treatises from the present consideration are outlined in Appendix E. This appendix also contains a table with a full list of the pigments retrieved during the inspection and the number of the recipe/chapter mentioning them (Table E.1).

Based on the above treatise, the list of most likely pigments in the French technique of illumination is illustrated in Table 3.24 below. Also, the table compares the pigments suggested from the treatises against the findings of the case studies.

Table 3.25: Comparison of the colourants retrieved across the Hardouyn Hours and their occurrence in historical references as materials recommended for miniature painting.

Chromophore		**Occurrence**	
Hue	***Material***	***Hardouyn Hours***	***Historical references***
Blue	Azurite	•	•
	Indigo	•	•
Green	Malachite	•	
Red	Madder (lake)	•	•
	Ochres	•	•
	Red lead	•	•
	Vermilion	•	•
Yellow	Lead-tin yellow	•	
	Massicot	•	
White	Lead white	•	•
	Gypsum	•	
	Chalk	•	

Part of the pigments retrieved in the case studies (azurite, indigo, vermilion, red lead, earths, madder, lead white) also appear in Table 3.15 except for malachite and lead yellows. Comparing the pigments found across the case study and the above table also allows drawing some observations in comparison with manuscript illuminating:

- *blue colourants*: Ultramarine blue is regularly mentioned among several sources (Theophilus' *Schedula*; the *corpus* of Alcherius' writings; *Strasbourg tradition*) as one of the most perfect and beautiful blue substances. In spite of its traditional praise, ultramarine is completely absent in the Hardouyn workshop. This fact draws a first difference from the manuscript luxury production, that still made large use of the precious blue from lapis lazuli in the second quarter of the fifteenth century and only sometimes employed azurite as a supplementary blue colourant[304]. A

[304] See the technical study of late fourteenth-fifteenth century French illuminated manuscripts: Tumer,

possible reason for the ultramarine's scarcity in the Hardouyns' editions may not be connected to a lack within the Parisian market, but to an intentional choice. This gemstone still appeared on the Parisian market stalls, easily finding its way from Badakhshan (in present-day Afghanistan) to Europe via the greatest trade centres of Venice[305], Genoa[306] or Antwerp[307]. As for azurite, it was sometimes mentioned in the above sources and the hypothesis of its use is historically possible. In fact, the Parisian azurite[308] was sourced from close regions: Germany, Hungary[309], Austria and Central Europe, maybe the Low Countries[310]. Speaking of the last blue pigment from the case studies, indigo, it was largely known to the Parisian market since the previous centuries; in fact, the Parisian *taille*[311] of 1349 already mentions it[312].

"The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420"; Carvalho et al., "Colour identification, degradation processes and findings in a fifteenth-century Book of Hours: the case study of Cofre no. 31 from Mafra National Palace".

[305] Venice is mentioned as a large port by the Florentine merchant Pegolotti (Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, p. 31). Also, Dunlop assigns all the documentary particulars as referred to ultramarine owing to the common interpretation of *azure* with "blue from lapis lazuli". In any case, the interpretation of *azur* or *azure* could differ over place and time. On this topic, see also Adam Raft. "About Theophilus' Blue Colour, 'Lazur'". In: *Studies in Conservation* 13.1 (1968), pp. 1–6. DOI: https://doi.org/10.2307/1505385; Inès Villela-Petit. "Copies, reworkings and renewals in late medieval recipe books". In: *Medieval Painting in Northern Europe. Techniques, analysis, art history*. Ed. by Jilleen Nadolny. Translated by Jilleen Nadolny. London: Archetype Publications, 2006. Chap. 14, pp. 167–181, p. 172; Eastaugh et al., *The Pigment Compendium A Dictionary of Historical Pigments*, pp. 32-33.

[306] Barbara H. Berrie. "Mining for color: new blues, yellows, and translucent paint". In: *Early science and medicine* 20.4–6 (2015), pp. 308–334. DOI: https://doi.org/10.1163/15733823-02046p02.

[307] Antwerp may not have been already a major retailer, for its economical weight has been observed since the mid-sixteenth century (Filip Vermeylen. "The colour of money: dealing in pigments in sixteenth-century Antwerp". In: *Trade in Artists' Materials: Markets and Commerce in Europe to 1700*. Ed. by Jo Kirby et al. London: Archetype Publications, 2010. Chap. 20, pp. 356–365, p. 357).

[308] The identification of azurite in documentary sources is not a straighforward task. In some cases, it is referred to as "*azzurro della Magna*" (Eastaugh et al., *The Pigment Compendium A Dictionary of Historical Pigments*, p. 33), probably with reference to the German provenance (from the mines of Goldberg in Saxony; Schwartz in Tirol, or Wallerfangen in Saarland; see Eastaugh et al., *The Pigment Compendium A Dictionary of Historical Pigments*, p. 33). Rutherford J. Gettens et al. "Azurite and Blue Verditer". In: *Artists' Pigments: A Handbook to Their History and Characteristics*. Ed. by Ashok Roy. Vol. 2. Washington, CO and London: National Gallery of Arts and Archetype Publications, 1993. Chap. 1, pp. 23–36 refer that the mines in France (see Section 3.2.1.1) became economically important only in the modern period.

[309] Berrie, "Mining for color: new blues, yellows, and translucent paint", p. 313. For azurite, Antwerp would become one of the largest Parisian retailers since the 1570s (Vermeylen, "The colour of money: dealing in pigments in sixteenth-century Antwerp", p. 361); however, it is unclear the exact role of the city in the period 1500s-1550s.

[310] Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, p. 37.

[311] The "*taille*" is the tariff system. The books describing the fiscal introit became an important documentary source for the study of the labour structure in late medieval and modern city. On Paris, see Slivinski et al., "Taxation Mechanisms and Growth in Medieval Paris".

[312] For instance, Toulouse was a large retailer of woad for the period 1450s-1561 (Gillet Caster. *Le com-*

Depending on the plant source (woad or true indigo), this dye's cost and suppliers would change[313]. Some major suppliers of woad were based in southern France, in the valley of Ariège (Toulouse)[314], or Amiens in the North; since the fifteenth century, large quantities of indigo also came from Lombardy and Tuscany[315]. As a material for illuminating, indigo was generally prescribed for shading[316] or as a secondary colourant[317], never as a main one. Thus, using indigo as a major pigment draws a second difference from the manuscript production.

- *Green colourants*: Based on the above results, it seems that the Hardouyn workshop applied no pigment from the class of copper acetates[318], which were strongly advised for illuminating, using copper carbonate green at their place. The history of copper carbonates in the French artistic practices is not entirely clear: technical assessments of late medieval French manuscripts, especially Books of Hours, commonly detected its presence[319], and some German artists applied malachite to colour prints[320]. In spite of the colourant's familiarity to the Parisian art, including

merce du pastel et de lépicerie à Toulouse de 1450 environ à 1561. Toulouse: Eduard Privat, 1962; Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, p. 76).

[313]During the Middle Ages, true indigo was shipped from the Indian subcontinent to Italy, which distributed the dye to Europe (Robin J.H Clark et al. "Indigo, woad, and Tyrian Purple: important vat dyes from antiquity to the present". In: *Icarus* 17.4 (1993), pp. 191–199. DOI: https://doi.org/10.1016/0160-9327(93)90062-8).

[314]Louis Félix Bourquelot. *Études sur les foires de Champagne, sur la nature, l'étendue et les règles du commerce qui s'y faisait aux XIIe, XIIIe et XIVe siècles*. Paris: Imprimerie Impériale, 1865, vol. 1, pp.221-222; Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, p. 76.

[315]Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, pp. 76-77. Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, p. 102, note 139 mentions that the plant cultivates in France was qualitatively inferior to other places, probably as a result of the cold weather (Jamieson B. Hurry et al. *The woad plant and its dye*. London: Oxford University Press and H. Milford, 1930, pp. 103-104), which could cause the plant to develop lower amounts of dye precursors (see Section 3.2.1.1).

[316]Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, p. 186.

[317]Like in *De Arte illuminandi* (ch. 9).

[318]Namely, verdigris.

[319]See Araújo, *Os Livros de Horas (séc. XV) na colecção do Palácio Nacional de Mafra: estudo e conservação*; Carvalho et al., "Colour identification, degradation processes and findings in a fifteenth-century Book of Hours: the case study of Cofre no. 31 from Mafra National Palace"; Maria J. Melo et al. "Colour degradation in medieval manuscripts". In: *Microchemical Journal* 124 (2016), pp. 837–844. DOI: https://doi.org/10.1016/j.microc.2015.10.014.

[320]Fletcher et al. refer finding only copper acetates in a technical inspection of a group of sixteenth-century German coloured prints preserved at the National Gallery of Art, Washington; Hahn et al. are positive about the presence of malachite in the coloration of some Dürer's prints. See Fletcher et al., "The Pigments on Hand-Colored Fifteenth-Century Relief Prints from the Collections of the National Gallery

the Hardouyn workshop, no documentary record exists about its commerce[321].

- *Red colourants*: The list of the red pigments employed in the Hardouyn workshop is quite essential, especially if compared to the wide range of red materials employed in illuminating. The representative *par excellence* of organic lakes of manuscripts, brazilwood[322], seems to find no use in the case studies here. This workshop may have employed another one at its place, namely that of madder[323]. Madder dyestuff was traded in Europe; however, no clear record of it appears in French inventories[324]. Probably, it found some use, yet not exclusive, in print colouring[325]. The remaining colourants that are mentioned in the appointed technical sources (earth pigments, vermilion and red lead) are present in the Hardouyn production. These materials were inexpensive, readily accessible to the market or could be easily synthesised[326]. In light of that, their employment is not an oddity; what surprises the most is the relative scarcity of vermilion across the analysed miniatures.
- *Yellow colourants*: Their use throughout the case studies from the BNP is rare, where orpiment (As_2S_3), traditionally applied for early illuminated manuscripts, seems to be replaced with Pb-based yellows. The lack of orpiment across this

of Art and the Germanisches Nationalmuseum"; Hahn et al., "Coloured Prints of the 16th Century: Non-Destructive Analyses on Coloured Engravings from Albrecht Dürer and Contemporary Artists".

[321] On its use in fourteenth- and fifteenth-century Paris, see Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, pp. 42, 164, 192.

[322] For instance, Tumer proposes the (possible) use of madder lake in a fifteenth-century French Hours illuminated in the Bocicaut Masters workshop together with brazilwood lake (Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420"); Guineau refers finding only brazilwood in other books decorated by the same workshop (Bernard Guineau et al. "Painting techniques in the Boucicaut Hours, and in Jacques Coene's colour recipes as found in Jean Lebégue's *Libri Colorum*". In: *Studies in Conservation* 43.sup. 1 (1998), pp. 51–54. DOI: https://doi.org/10.1179/sic.1998.43.Supplement-1.51). See also Araújo, *Os Livros de Horas (séc. XV) na colecção do Palácio Nacional de Mafra: estudo e conservação*; Melo et al., "A spectroscopic study of brazilwood paints in medieval books of hours"; Vitorino, "A Closer Look at Brazilwood and its Lake Pigments"; Vitorino et al., "New insights into brazilwood lake pigments manufacture through the use of historically accurate reconstructions".

[323] On its nature and composition, see before.

[324] In fact, Dunlop sees its appearance exclusively in the 1402-Florentine *gabella* (another book of tariffs). See Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, p. 148.

[325] See Note 22 of Fletcher et al., "The Pigments on Hand-Colored Fifteenth-Century Relief Prints from the Collections of the National Gallery of Art and the Germanisches Nationalmuseum" for the case of the German school of printing.

[326] Dunlop refers that the Paris *taille* of 1349 already mentions vermilion as a traded commodity (Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, p. 37). However, the register does not mention whether the pigment was sourced naturally or obtained synthetically (maybe in the same apothecary houses).

dissertation's case studies may not be specific to the Hardouyn workshop; in Renaissance Europe, coeval artists commonly adopted other varieties of opaque yellow colourants. A group of these substances are the yellow phases of lead, such as oxides or stannates[327]; others were yellow earths[328] Those who coloured artistic prints would apply such materials, according to one technical inspection of German prints[329].

- *Gildings*: Three major pigments were detected throughout this Chapter's case studies: mosaic gold, shell gold and specularite. Mosaic gold is mentioned among the technical treatises: in fact, Alcherius incorporated one recipe for its preparation. This piece of information was initially treated cautiously since it is contained in *Experimenta de coloribus*. As previously mentioneed, this part of Alcherius' *corpus* contains Italian recipes, being among those from Fra Dionisio in this case. The other (presumably) Italian treatise from this section, *De Arte illuminandi*, also outlines one method to craft mosaic gold[330]. In opposition to an apparent incompatibility with the French artistic schools, previous investigations on late medieval manuscripts either decorated here[331] or in ancient Flanders[332] reported active uses of mosaic gold. The Strasbourg manuscripts mentions it as well, but only with reference to gold inks[333]. This notwithstanding, one scientific examination persuades of a more common use in central Europe. The technical analysis of German fifteenth-century playing cards by Richter[334] detected indeed mosaic gold. Holding this case

[327] On their composition, see bofore.

[328] On their composition, see Section 3.2.2.1.4.

[329] See Hahn et al., "Coloured Prints of the 16th Century: Non-Destructive Analyses on Coloured Engravings from Albrecht Dürer and Contemporary Artists".

[330] As previously stated; see also Section 3.2.2.1.5.

[331] Angelo Agostino et al. "On the Hierarchical Use of Colourants in a 15th Century Book of Hours". In: *Heritage* 4.3 (2021), pp. 1786–1806. DOI: https://doi.org/10.3390/heritage4030100; Burgio et al., "Spectroscopic Investigations of Bourdichon Miniatures: Masterpieces of Light and Color"; Carvalho et al., "Colour identification, degradation processes and findings in a fifteenth-century Book of Hours: the case study of Cofre no. 31 from Mafra National Palace"; Ricciardi et al., "Use of Visible and Infrared Reflectance and Luminescence Imaging Spectroscopy to Study Illuminated Manuscripts: Pigment Identification and Visualization of Underdrawings".

[332] Lauwers et al., "Pigment identification of an illuminated mediaeval manuscript De Civitate Dei by means of a portable Raman equipment".

[333] Sylvie Neven. *The Strasbourg manuscript : a medieval tradition of artists' recipe collections (1400-1570)*. London: Archetype Publications, 2016, p. 91-92, 164, 191.

[334] Ernst-Ludwig Richter et al. "The 'Stuttgarter Kartenspiel': Scientific Examination of the Pigments and Paint Layers of Medieval Playing Cards". In: *Studies in Conservation* 21.1 (1976), pp. 18–24. DOI: https://doi.org/10.1179/sic.1976.003.

in consideration allows crediting mosaic gold with greater weight than suggested in technical treatises or to assign it to some printed crafts. Speaking of the second pigment detected, shell gold, it is the most widely known gilding practise of the late Middle Ages, and widely reported in nearly every technical treatise dealing with miniature illuminating. Given so, its detection it quite compatible with the manuscript production. Few sources exist with reference to the last pigment, specularite. Owing to this dearth, its discussion can be very little.

3.4.2.2 Mixtures for modelling

This section shall investigate the combinations of pigments that the Hardouyn workshop's artists applied to render human figures pictorially. For this purpose, the first step of the evaluation was discriminating all features of the analysed representations (ground tone of flesh, lips, hair, beard, etc). Table 3.25 illustrates the results from the assessment of all the retrieved components of human figures in these miniatures.

Table 3.26: List of the features of human design in the analysed miniatures.

Treatise	**Recipe** *Number*	*Name*	**Use**	**Translated text**	**Mixture**	**Colour nuance**
Schedula Diversarum Artium, Theophilus Presbyter (12^{th} c.)	1	"The mixture of pigments for nude bodies"7	Any body part	Appx.G, Sec. G.1.1	1. Minium/massicot/ lead-tin yellow + lead white + cinnabar/red earths	Green
	2, 3	"The pigment *prasinus*", "The colour called *posc* "	Shadows	Appx.G, Secs. G.1.2 and G.1.3	2. Green earths + red earths + cinnabar	Pink-greenish
	4	"The first rose pigment"	Red parts	Appx.G, Sec. G.1.4	3. (Mixture no. 1) + cinnabar	Pink, ground flesh tone (*rosa prima*)
	5	"The first highlighting pigment"	Highlights	Appx.G, Sec. G.5	4. (Mixture no.1)+ lead white	Light pink (*lumina prima*)
	6	"*Veneda*,to be put on the eyes	Eyes contouring	Appx.G, Sec. G.1.6	5. Lead white + black pigment	greyish (*veneda*)
	7	"The second shadow pigment"	Shadows	Appx.G, Sec. G.1.7	6. Red earths + green earths	Dark pink-greenish
	8	"The second rose pigment"	Further red parts	Appx.G, Sec. G.1.8	7. (Mixture no. 3) + cinnabar	Pink-reddish (*rosa segunda*)
	9	"The second highlighting pigment"	Further highlights	Appx.G, Sec. G.9	8. (Mixture no.1) + lead white	First highlights (*lumina segunda*)
	10, 11, 12	"The hair of boys, adolescent and young men", "The beard of adolescent", "The hair and body of senile and old men"	Hair	Appx.G, Secs. G.10, G.1.11 and G.12	9. Black pigment + yellow earths	Brown/whitish/grey

Table 3.26 continued from previous page

Treatise	Recipe *Number*	*Name*	Use	Translated text	Mixture	Colour nuance
	13	"*Exudra* and the other pigments for the face"	Finishing	App.G, Sec. G.13	10. red earths + black pigment	Dark red (*exudra*)
					11. red earths	—
					13. red earths	—
De arte illuminandi (14^{th} c.)	Marginal note to section 11	"Annotation on how to made the flesh tone of faces and other parts of the body"	Any part	Appx. G, Sec. G.2.1	1. Green earths + lead white	Ground flesh tone
					2. Green earths + C-based black + yellow ochres + indigo + red pigment	Base flesh tone
					3. Green earths	Shading
					4. Lead white	Highlights
					5. Red pigment + lead white	Pink-reddish
					6. red pigment + C-based black + yellow ochre	Contouring
					7. indigo + C-based black	
De coloribus diversis, Johannes Alcherius (15^{th} c.)	317	"The flesh colour of images is thus made"	General flesh tone	Appx. G, Sec. G.3.1	1. Green earths + lac dye or madder + lead white	Pink (ground)

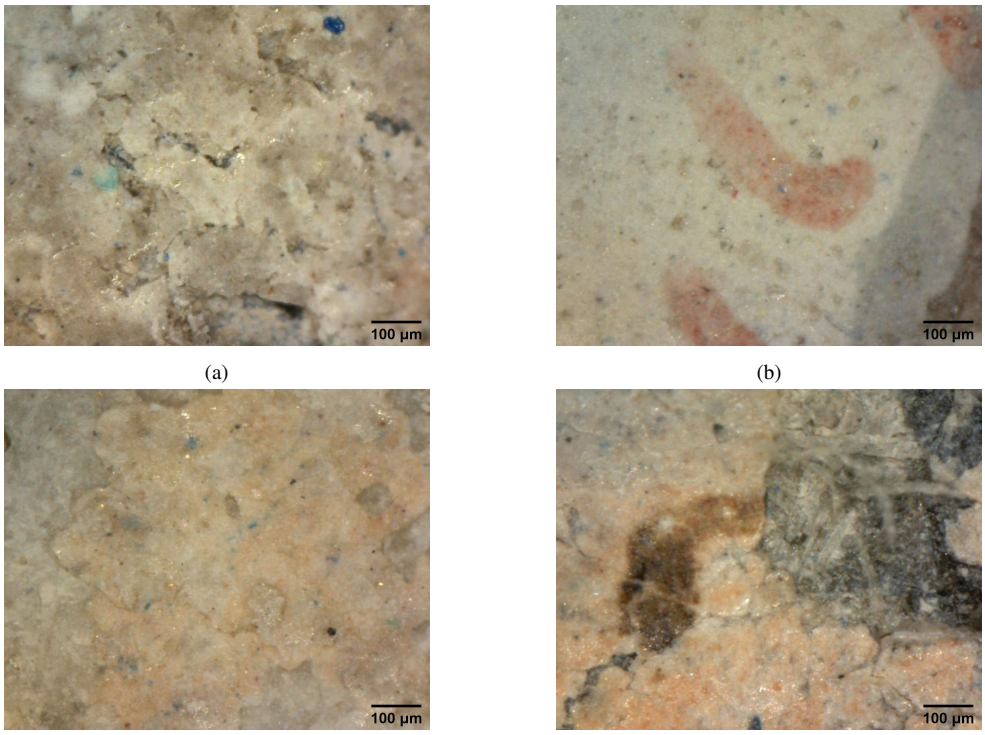
Table 3.26 continued from previous page

Treatise	Recipe *Number*	*Name*	Use	Translated text	Mixture	Colour nuance
De coloribus diversis, Johannes Alcherius (15^{th} c.)	317	"The flesh colour of images is thus made"	General flesh tone	Appx. G, Sec. G.3.1	2. Green earths + (brown or yellow) earths + lac dye(?) 3. Lead white + hematite-rich earths 4. (Brown or yellow) earths + hematite-rich earths + lead white 5. Lac dye or madder 6. Lead	Greenish (shading) Pink-reddish ("rose colour") Pink Red White (highlights)
	344	"To make a colour which is called *posc* for the undraped part of images"	General nude flesh	Appx. G, Sec. G.3.2	Cinnabar + minium + (green earths + lac dye or madder + lead white)	Red
	345	"To make two colours, one called *lumine*, and the other *cedre* or *excedre*, for the undraped parts of figures"	Shading highligths	App. G, Sec. G.3.3	1. (Green earths + lac dye or madder + lead white) + lead white + *vertbleu*	Light pink (*lumina*)
Strasbourg tradition (15^{th}-16^{th} c.)	*"Making of flesh colour"*	78	Young flesh tone	App. G, Sec. G.4.1	1. Cinnabar + minium + madder lake(?) + lead white 2. Cinnabar + earths + minium 3. Lead white	Light pink Shading Highlights

Table 3.26 continued from previous page

Treatise	Recipe *Number*	*Name*	Use	Translated text	Mixture	Colour nuance
					4. (Cinnabar + minium + madder lake(?) + lead white) + lamp black	Contouring
					5. Indigo + verdigris	Contouring
	79	"Another flesh colour"	Dark flesh tone	App. G, Sec. G.4.2	1. Burnt sienna(?) + minium + lead white	Brown flesh
					2. Red-brown earths + lamp black	Shading
					3. Cinnabar + brazilwood lake	Highlights
	79	"Another flesh colour"	Old flesh tone	App. G, Sec. G.4.3	1. Minium + ochres + fine azurite(?) + lead white	Pink
					2. Ochres + red-brown earths	Shading
					3. Lamp black + indigo	Shading

Through a close observation of Table 3.25, it appears that nearly all miniatures across the case studies feature infants. Thus, juvenile flesh tones became the object of special attention on the techniques applied in the Hardouyn workshop to represent human figures.



(a) (b) (c) (d)

Figure 3.79: DM images of mixtures applied for young flesh tone (infant) across the case studies (435x, 0.68 mm x 0.91 mm field of view): a) Res. 328.v, fol. 1^{r}; b) Res. 328.v, fol. 31^{r}; c) Res. 5781.p, fol. 1^{r}; d) Res. 5781.p, fol. 29^{v} © HERCULES Laboratory.

Microscopic images of the mixtures[335] applied for young flesh reveal the common use of tiny blue, red and black grains dispersed in a prevailing white matrix (fig. 3.79). Besides, the AR (Apparent Reflectance) spectra[336] of their hypercubes (hereafter HC) do not

[335]The analytical conditions of the HSI analysis are described in Appendix F, Section F.1.4.

[336]*Apparent reflectance* is a slightly different concept from the mentioned *diffuse reflectance*. "Apparent" reflectance is a definition used in remote sensing to describe the amount of radiation reflected by a surface (against a reference of white), differing from "true reflectance" in that shadows and directional effects of light are not dealt with. Because the spectra used for flesh tone comparisons are extracted from hypercubes, small divergences from true reflectance may arise as the result of the scattering interactions between Vis rays and uniquely uneven, irregular surfaces. The sum and degree of an object's three-dimensionality (divergence from perfect surface evenness), surface roughness (divergence from perfect surface smoothness) and other factors affects the amount of light reaching the sensor of HSI devices. In relation to the HSI sensing of the case studies, the tiny size of the analysed miniatures required short working distance from the books. The result of a reduced distance may be a minor deviation from true reflectance. However, it is sensible to suggest a likely inconsistency between the reflectance values as detected from the HSI camera and the FORS device. In FORS assays, the analysis area was in quasi-contact with the excitation source and the mechanism collecting the reflected radiation. As a result, the deviations from true diffuse reflectance

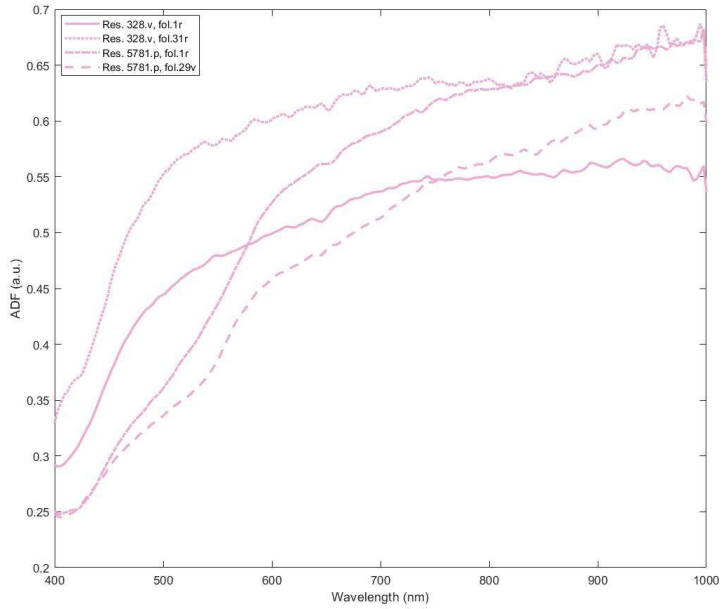


Figure 3.80: Vis-NIR AR spectra of the young flesh tones (infants) across the HC: *putto*, Res. 328.v, fol. 1^{r} (pink solid line); Jesus, Res. 328.v, fol. 1^{r} (pink dot line); Jesus, Res. 328.v, fol. 31^{r} (pink dash-dot line); Jesus, Res. 5781.p, fol. 29^{v} (pink dash line). The spectra are plotted as unit of AR (pure number ranging between 0.0 and 1.0).

offer a clear indication of the the use of coloured earths (i.e. ochres) (fig. 3.80). These data, thus, cannot fully support the tentative characterisation of the pink paints[337], where the principal red pigments appeared to be ochres and red lead[338]. Similarly, neither the hyperspectral imaging nor the combined results from the molecular and elemental characterisation could detect or identify the blue pigment. In light of that, it is possible to formulate mere guesses on its nature, relying on the available data. The XRF data expose Fe, Pb and Cu as the major elements. Among these, Cu can give blueish phases, used in art as pigments. On this basis, it is sensible that the blue grains observed are Cu-based minerals. Based on similar assumptions, the black grains seen in Figure 3.42 do not reveal the presence of Mn[339] or other elements traditionally associated with black colourants could be C-based pigments or dark ochres. Carbon-based materials remain undetected by XRF analysis, because their fluorescence lines fall outside the range of sensitivity of the most common detecting systems.

are negligible. Despite that, such may not be the case for the reflectance spectra from HSI analysis. In consideration of the fact, the values of reflectance from HSI assays will hereafter be cautiously given as values of "apparent reflectance".

[337] All spots of analysis corresponded to children's flesh tones.

[338] Compare with Table 3.15 of Section 3.2.2.1.4.

[339] Like black pyrolusite (MnO_2), a mineral of the rutile group.

Thus, the only information available is from the spot of analysis illustrated in the previous section *Materials of painting*, and looking at the distribution of the mixtures with HSI. Later, such information has been compared to the instructions retrieved in technical texts, that are presented in Table 3.27.

Table 3.27: Comparison between the mixtures indicated in the technical recipes for the production of the base flesh tone of young people ("young flesh tone") with the case studies. List of abbreviations: SDA = Schedula diversarum artium, book 1; LdC = *Liber de Coloribus*; DAi = *De Arte illuminandi*; Ms. PdA = Ms. of Peter of St. Audemar; Ms. A = *corpus* of Alcherius and Str. F. = *Strasbourg family*. The pigment present in each treatise are indicated with a bullet marker (•).

Pigment	**Recipe**				**Case studies**		
	SDA	***DAi***	***Ms. A***	***Str. F.***	***Res. 326.v***	***Res. 328.v***	***Res. 5781.p***
Cinnabar	•	•		•			
Minium	•	•		•	•	•	•
Madder lake			•	•			
Lac dye			•	•			
Lead white	•	•	•	•	•	•	•
Green earth	•	•	•				
Red ochres					•	•	•
Yellow ochres		•	•			•	
Brown ochres			•		•	•	•
(Fine) azurite				•	•	•	•
Indigo		•					
Massicot	•						
Lead-tin yellow	•						
Soot			•	(•)	(•)	(•)	

Based on the above table, important similarities arise concerning the central and northern European tradition, here represented by the *Strasbourg family*. In fact, Recipe no. 80 ("Another flesh colour [for old people]") instructs artists to use "little azure ashes"[340], probably to shade the red pigments and achieve the natural tone of flesh. This detail marks an utter deviation from the past tradition, which either laid a background layer of green earths (the so-called *verdaccio* of the Tuscan tradition[341] and *De Arte illuminandi*[342]), or

[340] Compare with the text in Appendix G, Section G.4.3.

[341] Compare with the instructions from the *Schedula diversarum artium* in Appendix G, Sections G.1.1-G.1.13.

[342] See the full text translated of the recipe in Appendix G, Section G.2.

green earths mixed to other pigments (like in the Ms. from Alcherius[343]). Additionally, the same recipe from the *Strasbourg family* teaches the use soot for shading. Considering this, it is possible that the black pigments detected with DM could be carbon-based.

Together with DM, HSI is a decisive tool for discriminating colour mixtures[344]. The Vis-NIR response collected (400-1000 nm) for a reference spectrum (also called endmember) has been compared to all spectra of the hyperspectral acquisition fusing appropriate algorithms, so that mono-indexed distributions maps could be computed[345]. These maps describe the areas where a certain mixture has been applied; as for the mentioned mixtures, the spectrum of an area with young flesh colour was used as the endmember for mapping.

The results of the colour mapping are presented in Figures 3.81 and 3.82. Based on such representations, the mixtures given to render the flesh colour of infants seem to be, on average, the same as women (figs. 3.81a-3.81c), but different for the other characters (figs. 3.82a-3.82b) or the redder parts of faces[346] (fig. 3.82c). The spectral reference for the HSI mapping was also analysed (fig. 3.83) but could not offer clear information about their composition as well[347]. The only way of using the data is by verifying the distribution of the mixtures previously identified in Section In this case, the evaluation would be compatible with the technical instructions referred to in Table 3.27. All the above technical instructions advise the use of red pigments mixed with abundant white pigments. The major difference among them consists in the fact that the earliest texts dictate a rigid sequence of painting (like in the case of the *Schedula diversarum artium*[348]), while in the following centuries, the technical instructions became lesser, shorter and intentionally less detailed (like those from the *Strasbourg manuscript*). Besides, these mixtures do not appear to be given by the figure gender. Instead, they are applied by the phase of life (young flesh colour, old flesh colour). This fact would agree with the content of the later

[343] See the full set of texts translated in Appendix G, Sections G.3.1-G.3.3.

[344] The analytical conditions of the HSI analysis are described in Appendix F, Section F.1.4.

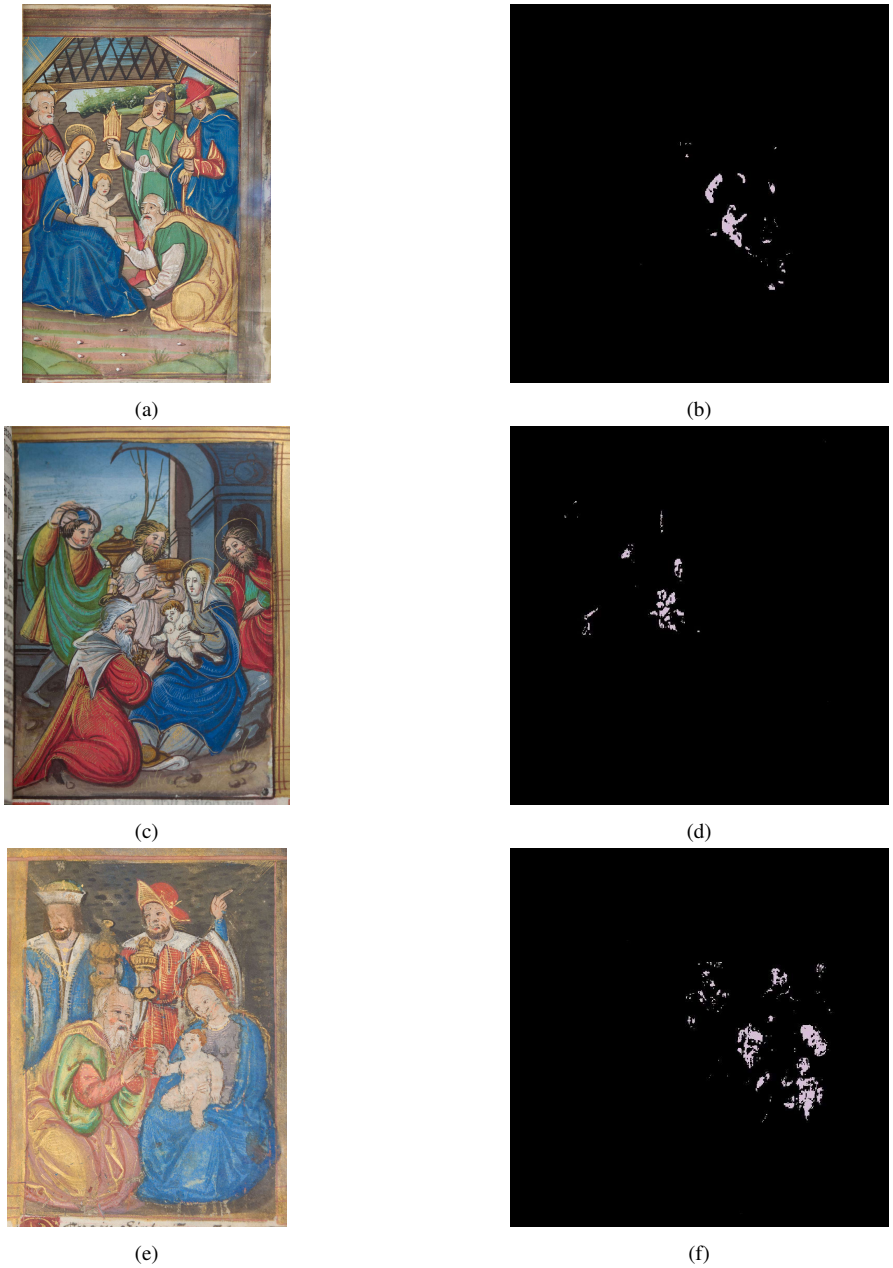
[345] A different endmember has been used for each computation. On the methods used for the HSI mapping, see Appendix F, Section F.1.5.

[346] Like for cheeks or lips.

[347] Further data from analytical instruments capable of performing chemical imaging would be necessary, such as macro X-ray fluorescence (MA-XRF) or portable Raman spectroscopy.

[348] The instructions appoint a sequence of thirteen steps having their own mixture. Brunello gave a summary on the process and appreciated the terminology specific for each phase of modelling. See Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, pp. 189-191.

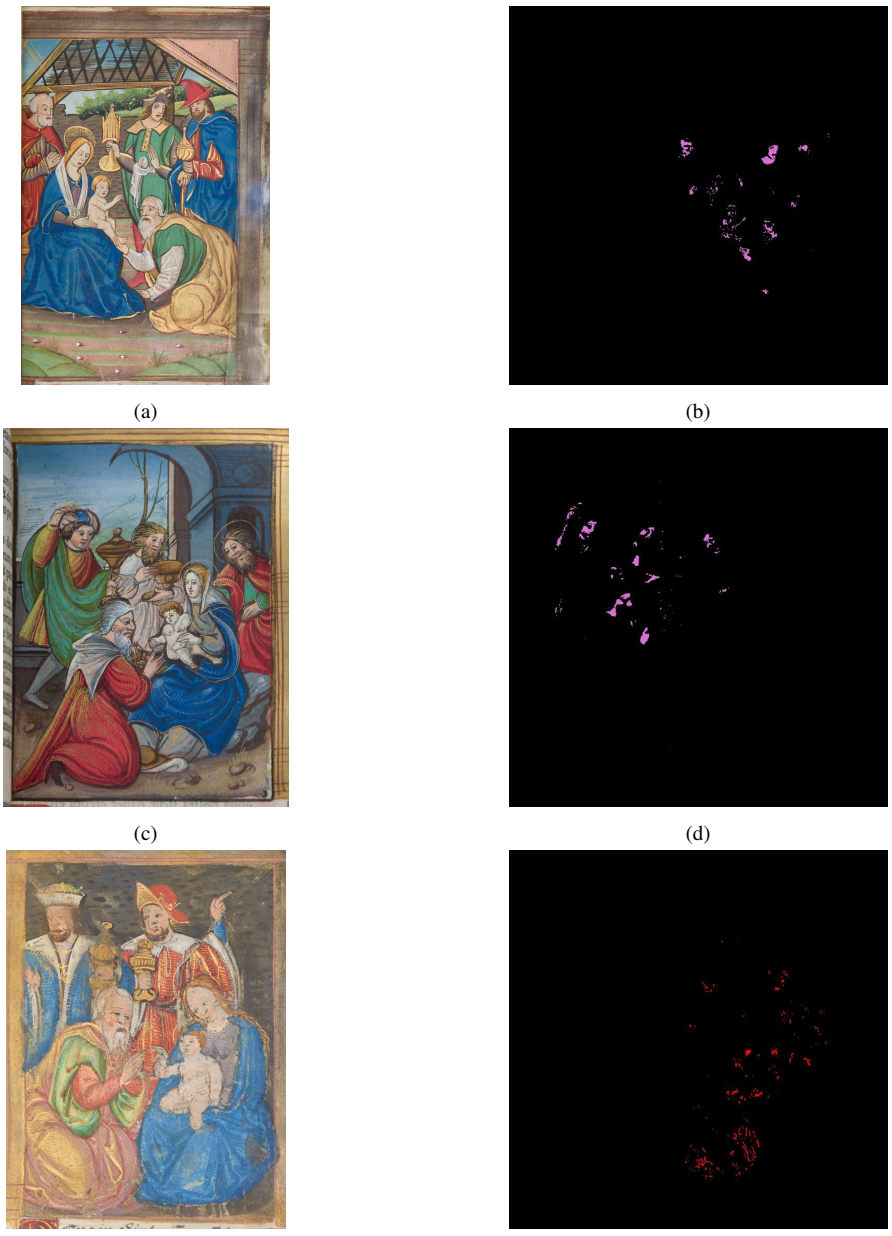
technical instructions, which only discriminates by age[349].



(a) (b) (c) (d) (e) (f)

Figure 3.81: SID UV-Vis-NIR chemical maps of the mixtures applied for young flesh tones (infants): a-b) Res. 326.v, fol. 46^{r}; c-d) Res. 328.v, fol. 31^{r}; e-f) Res. 5781.p, fol. 29^{v}. The black area corresponds to the unclassified parts of the HC, while the coloured areas corresponds to the pixel whose spectrum matches the given reference © HERCULES Laboratory.

[349] Among the corpus of Alcherius writings, no mention of differing mixtures by gender or age; in the *Strasbourg manuscript*, they only refer: "if you want to make a beautiful flesh colour for young people", "another flesh colour for brown people" or "another flesh colour for old people." Compare with Appendix G, Sections G and G.



(a) (b) (c) (d) (e) (f)

Figure 3.82: SID UV-Vis-NIR chemical maps of the mixtures applied for other kinds of flesh tone: mixtures for the flesh of the Magi: a-b) Res. 326.v, fol. 46^{r}; c-d) Res. 328.v, fol. 31^{r}. Mixtures applied for the redder parts of faces: e-f) Res. 5781.p, fol. 29^{v}.

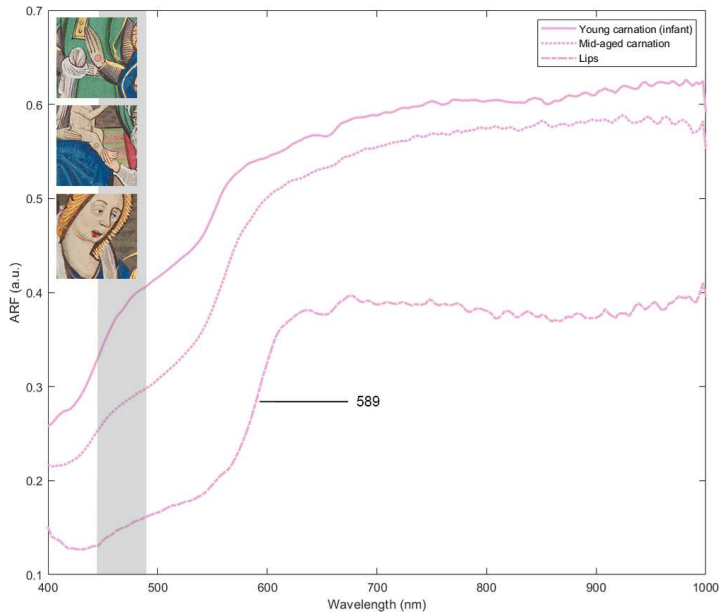


Figure 3.83: Vis-NIR AR reference spectra for the mapping: young flesh colour, Res. 326.v, fol.46^{r} (pink solid line); middle-aged flesh colour, Res. 326.v, fol.46^{r} (pink dot line); c) redder areas of the face, Res. 326.v, fol.46^{r} (pink dot-dash line; spots indicated on the top).

3.5 Final remarks

This chapter presents the scientific and technical study of three Hardouyn Hours of the Biblioteca Nacional de Portugal, Lisbon. Every case study from the BNP adopts the Roman rite, is printed and supplemented with colour. Additionally, their overall production falls in the years 1518-1538. After delving into their investigation, the chapter compares the results from the case studies with the previous research on another Hardouyn *horae*, namely Inc. 438 in the Biblioteca Pública of Évora.

This technical inspection considers two figurative subjects, one secular and the other religious (*Printer's device* and *Adoration of the Magi*), to address three main matters. The first in line is the molecular palette for the materials for painting and printing; the second, the consistency of these results both with coeval/semi-coeval treatises about illuminating, printing and scientific studies of French late-mediaeval Books of Hours and prints; the third, the underlying engravings. Meeting these three inquiries has the broader scope of reconstructing a technical history for the Hardouyn workshop and its technical specificity within the two contexts of the manuscript and print production of Renaissance France.

The material characterisation of the inks showed that their composition varies greatly

over books, where in one case it adopts a medium with high amounts of drying agents (either Cu- or Pb-based) to bind ivory black pigments (BPE, Inc. 438), while in another case, the oil media is almost devoid of those driers and the black colourant is graphite (BNP, Res. 5781.p). All the materials for printing seem to be typical for wood- and metalcutting. The only exception to this general trend is represented by graphite. Its scientific discussion highlights report an exceptional positive influence of this pigment to the drying reactions of oil media, and this behaviour was already reported by de Mayerne (Ms. Sloane 2052)[350]. However, the use of this pigment seems to be typical of the sixteenth century, making its supplement to the mixture a likely possibility[351].

The material characterisation of the colouring materials and their comparison with the research on BPE, Inc. 438, as well as textual and scientific references, allows making some deductions. On the one hand, the Hardouyn workshop has been applying consistently a limited range of materials, a fraction of which is uncommon to illuminated fifteenth-century manuscripts. Instead, the use of these rare materials in illuminating belongs to the palettes of print colourers. On the other hand, the artistic process for building up layers of paints strips off numerous steps, especially while modelling figures. This last observation may not imply that the Hardouyn pictorial technique is insufficient. On the contrary, the late mediaeval schools of painting were experiencing an increasing degree of crafting freedom. Also, the Hardouyn illuminating atelier follows all the appropriate phases for painting the human figure, yet only those necessary.

As for the last area of analysis, identifying the underprintings of the case studies, their technical imaging and digital processing revealed that the illustrations generally match the engraved outline. It is on the grounds of similar observations that Maureen Warren wrote recently[352]. Warren adopted a *positive* perspective, namely identifying the similarities between an underprinting and its colouring in the Hardouyn Hours. Through such an ap-

[350] De Mayerne mentions this pigment as black chalk

[351] See Eastaugh et al., *The Pigment Compendium A Dictionary of Historical Pigments*, p. 54 and the literature here cited.

[352] "I use 'painted prints' to describe graphic works of art that have been augmented with color, which I understand to be distinct from 'print-assisted paintings.' The images in Hardouyn *Horae* are not so much 'painted prints' as they are miniatures with prints underneath. Painted prints generally have transparent washes of color, which allow the printed lines beneath to show through, and occasionally areas of the paper or support are left unpainted. Colorists typically worked with inexpensive water-based paints, either freehand or more often with stencils". Warren, "Gillet and Germain Hardouyn's Print-Assisted Paintings: Prints as Underdrawings in SixteethCentury French Books of Hours", p. 83.

proach, she expressed an attentive meditation on the appropriate position of the Hardouyn Hours within their own print culture and artistic book production. Opposite, indeed *negative*, is the angle adopted in this section since it emphasises the iconographic discrepancies between the two treatments of the same illustration (printed and painted). The imaging characterisation of the case studies unveiled alterations of the original iconography. These changes are constant, sometimes stringent, yet contingent on the subject represented. In particular, the *Printer's device* reveals a softer revising impact, being the most significant (or sole) adjustment in the landscape simplification. On the contrary, the coloured version of *Adoration of the Magi* can eliminate major characters in the final pictorial treatment, like in Res. 5781.p[353]. Such contraction cannot be understood as an instance of artistic laziness: in fact, several cases of high technical competence can be singled out from the inspection of case studies here. It was clear, for example, while inspecting the impact of the grain size on the optical properties of the blue paints[354], or glazing in green[355] and red paints[356]. Thus, the observed alterations upon colouring of the Hardouyn *horae* are a crucial component of their research.

The end of Section 3.3.3 suggests two possible reasons for their occurrence: aesthetic value and accommodation of certain religious sensibilities. Now, the last remark is about the technical implications of their execution. While looking at other overpaints of *Printer's device*, their altered versions are comparable. A fine sample of this fact is the mark of two Gillet *horae* (*c.* 1516) compared with the one in Res. 326.v (fig. 3.84): in all cases, the left side of the corner becomes a blue sky. Similarly, three more Germain Hours reveal a shared pattern of decoration (fig. 3.85).

[353]The elimination of St. Joseph from the scene is a mere supposition, based on the fact that he is included in every engraved plate inspected in Chapter 2.

[354]See Section 3.2.2.1.

[355]Namely the green paints made with yellow glazing over blue grounds, Section 3.2.2.1.

[356]Namely the achievement of darker use through overlayers in the red of Res. 326.v's *Printer's device*; see Section 3.1.2.

(a) (b) (c)

Figure 3.84: A version of the same *Printer's device* compared across several Hardouyn Hours: a) Canterbury, Cathedral Library, H/L.3.1, fol. 1^{r}; b) Texas City, Falvey Memorial Library, BX2080.A2, fol. 1^{r}; c) Lisbon, BNP, Res. 326.v, fol. 1^{r} © Cantherbury Cathedral Library; Falvey Memorial Library; Silvia Bottura-Scardina.

Based on this analysis, it seems that Hardouyn prints "assist" their colourings to the extent that they include the full display of the available elements. Later, the graphic taste or a doctrinal stance would command which elements are to remove from one image.

Removing figurative elements from the final display is generally regarded as a strong expression of identity. Thus, such a phenomenon raises one question about the Hardouyn Hours: to what lengths could individual customers propose alterations to an image? According to the previous observations, the probable answer is that the clientele had little weight. Other instances could help arrange a fuller answer, like three versions of the same *Adoration of the Magi* found across an equal number of Hours[357]. Figure 3.62 compares them and their iconography, revealing several facts. As usual, all versions remove St. Joseph from the scene, yet each image interprets differently certain elements like the ruins and the landscape. Additionally, the colour palette is always different. Thus, the nature of the encountered alterations seems typically subtractive (figs. 3.86a-3.86c); occasionally, transformational (fig. 3.86c). But despite their differences, those illustrations still stick to the original outline[358].

[357] Évora, BPE, Inc. 438, fol. 11^{r}; Lisbon, BNP, Res. 328.v, fol. 31^{r}; Cambridge, Trinity College Library, C.30.9, fol. 35^{r} (for a full online source of the item, see Appendix A, Inc. 5).

[358] Second piece of the *Second Medallion set*: compare with Chapter 2, fig. 2.71b.

(a) (b)

(c) (d)

Figure 3.85: Another version of *Printer's device* compared across several Hardouyn Hours: a) Lisbon, BNP, Res. 5781.p, fol. 1^{r}; b) Liège University Library, R. 2334 A, fol. 1^{r}; c) Évora, BPE, Inc. 438, fol. fol. 1^{r}; d) Cambridge, Trinity College Library, C.30.9, fol. 1^{r} © Silvia Bottura-scardina, HERCULES Laboratory, Liège University Library; Cambridge, Trinity College.

(a) (b) (c)

Figure 3.86: Versions of *Adoration of the Magi* compared across several Hardouyn Hours: a) Évora, BPE, Inc. 438, fol. fol. 11^{r}; b) Lisbon, BNP, Res. 328.v, fol. 31^{r}; c) Cambridge, Trinity College Library, C.30.9, fol. 35^{r} © HERCULES Laboratory; Cambridge, Trinity College.

To conclude, the technical analysis of the major illustrations detected a clear pattern of production. The material quality and the technical execution reveal some traces of standardisation; the pictorial treatment of crude designs, further traces. When combined, the two facts may become the expression of a novel way to see the book colouring, distant from the past. The entire book embellishment of the Hardouyn Hours (at least the editions by Germain) may be part of a fixed routine as much as their textual component. The word "embellishment" comprises two phases: image creation and its final colouring.

Conclusions

Early printed Books of Hours provide their viewers with a sense of marvelled respect, commonly through abundant and vivid illuminated decoration. Deemed as impressive artworks, illuminated incunabula received coloured ornamentation in ways that are still uncertain. In default of adequate knowledge of such a production, this thesis was designed to address the subject by focusing on the artistic expression of a celebrated printing house of Book of Hours: the Hardouyn brothers' workshop (Germain and Gillet,*c.* 1500-1500), starting from their creative process, and proceeding to their procedures followed for engraving and illuminating. For this, a comprehensive technical account of the Hardouyns' creative activity was traced since the initial step, that it the conceptualisation, to look at the other stages: sketching and colouring, yet only for the major illustrations. Besides the impact of surrounding artworks in designing images, and to this end, the analysis of the Hardouyn workshop's attention to contemporary productions, a special attention was paid to book and documentary items with graphic vocation, like illuminated manuscripts and artistic prints. Finally, a contextualization of the Hardouyn illuminated production within the output of their generation of printers, engravers and producers of illuminated manuscripts was performed. The scepticism of encountering exceptions also relied on a meditation of the position of their techniques in the context of Renaissance printing and illuminating cultures. Probably, it would be more convenient for the Hardouyns to adhere to available styles of printing rather than establishing new artistic fashions. Neither Germain nor Gillet was a professional engraver, unlike other printers-publishers, so the engraved component was not likely to be the exclusive feature of these books. The leading aesthetical appeal of the Hardouyn editions seemed to stand out for chromatic allure and brilliance at the beginning of the research. Such a tendency could originate in the artistic inclinations of Germain, who received training in illuminating. Learning about its

education as a professional illuminator led to the starting guess of possible compatibility with the illuminating techniques, perhaps with severe simplifications. Satisfying a heavy demand for customised items could have driven the practical requirements of hastening the decorating process. From the analysis of the entire ensemble of engravings that the Hardouyns applied for illustration, fifteen series of cuts were appointed. For this, some historical facts about the creative process and use of these series were evaluated, reaching to interesting features, namely in the bulk of the collection (in six of the sets), where the hand of Jean Pichore - a local artist who expressed a strong involvement as a designer in the industry of prints for illustrated books - was revealed. Among this six sets, most of them were specially crafted for the Hardouyn workshop, while two of them entered the workshop afterwards, probably after being ceded or sold to Germain. Other sets were performed by other artistic studios based in Paris, namely that of the Apocalypse Masters (two sets) and of Jacob Faber (one set), while for one of the set a joint product of Noël Bellamere and the so-called Master of François of Rohan might be behind of its production. Few more suites were retrieved; however, it was not possible to establish the exact identity of their maker. Of these, one group labelled Medallion sets roused the suspicion of being by Jacob Faber. In this sense, it becomes evident that the Hardouyn workshop sourced its tools for illustrating locally. This notice suggested that Parisian artists were highly aware of the coeval tendencies in printmaking and book illuminating; otherwise, the city could attract foreign artists, adding substantial influences and skills to its market. Also, a natural division of the Hardouyn production by the aesthetic presentation of their editions was identified: the first class comprises the editions by Gillet, which are notable for their iconographical richness, strong awareness of popular themes (especially biblical folklore) and typological references. The editions produced under Gillet's editorial activity are harmonious and refined, with an exceptional faithfulness to the stylistic canon of the Italian Renaissance. Different are the editions by Germain: lavishly illuminated, with images containing frequent references to the German printing schools. Such marked differences may demonstrate two distinct personalities or approaches to the editing process between Gillet and Germain. Probably, Gillet was highly literate and refined, which would explain the unique choice of adopting a Classical myth, the Abduction of Deianira, as his mark of activity. Also, his taking a sizeable interest in the editing process might

unveil his initial and primary nature as a publisher rather than a printer. Instead, Germain was intimately an illuminator. It might be on this account that the editions made under him reveal an extensive illuminating; also, the dynamism implicit in his sourcing engraved suites from several artists might be the expression of a livelier character than his brother. In what concerns the illuminations procedure, two images (Printer's device and Adoration of the Magi) selected from three case studies were studied from the material, technical and iconographical perspectives, leading to new interesting results regarding the Hardouyn workshop. The first was the printing phase, for which the algorithm especially elaborated for this research illustrated the original outline of the prints used by Hardouyn. Moreover, and besides the printing designs, a description of the materials employed to formulate those inks (chromophores, binder, additives) were characterized, allowing a deeper knowledge of the working procedure of the printers. Despite an irregular formulation of the inks substances, the comparison of these results with documentary sources on late-medieval to Renaissance painting and printing, allowed to conclude two relief techniques, wood- and metal cutting, might have been used for the printing process.

Regarding the illuminations procedure, detailed results from its material characterisation and analysis of the extent of use identified, at the same time that both painting sequence and the technique for figure modelling were characterized. From the material characterization it was verified that the quality of the materials for illuminating was generally high. It became apparent in the general orientation toward mineral pigments than lakes; other examples of commitment to high material quality are the extensive use of gold instead of cheaper alternatives for gilding, the generous use of powdered gold as a yellow pigment and the preference of azurite over smalt. The coloured palette proved to be overall constant throughout the activity of the Hardouyns, with the only exception in the gilding techniques. Besides, the materials that the Hardouyn workshop employed for illuminating agree with the traditional production of illuminated manuscripts. However, their use also reveals either that the workshop adopted them slightly differently than the tradition (choice of malachite instead of other copper greens, azurite over lapis lazuli) or that they embraced the method of print colouring. Accordingly, this shifting tendency might be one instance of the large-scale transition from the illuminated manuscript to the coloured typographic book. Finally, from the comparative evaluation of the two outlines

of the iconographical alterations seen between the printed image and its colouring, some aspects came to the light: in all cases, few details were removed or altered upon illuminating. For these alterations, double pathway of explanation is proposed: on the one hand, the colouring proposed only a slight variation on the programme set by the underlying print; on the other hand, the alterations were to accommodate religious or aesthetic preferences through a mostly subtractive process. In other words, such elements as part of the landscape or a few characters (mostly St. Joseph for the Adoration of the Magi) were either eliminated or transformed. Thus, the original iconography was always maintained.

To conclude, and from the best of our knowledge, this manuscript represents the earliest, large-scale attempt to study miniature printed painting rather than colour printing or Renaissance manuscript illuminating. It is already well known that illuminators and printers coexisted in the same city and sometimes shared their working space. However, no past research has clarified the exact relationship between the two classes of professionals neither has attempted to characterise the printing process of an entire printing house, both from a historical and technical point of view. For this, the holistic approach followed in this dissertation both supported in social sciences and in archaeometric methodologies, was fundamental for the success of the results. Also, within the tools (algorithms) developed in the framework of this research, new studies may be performed in other case studies in future work. In fact, and despite the interesting and unique results reached under this dissertation, this research has left some questions open, namely:

- Regarding Chapter 2, the closing remark expressed the suspicion that more sets might be to find among other books. Thus, some work planned for the future is to complete this field of research.
- Additionally, other steps that the authors intend to take is to find further pieces of evidence about the existence of a Faber workshop, which has been only proposed based on the evidence collected so far.
- One more field that the authors are keen to cover is the study of a specific piece of the *Octavo*-set by the Pichore workshop of*c.* 1505-1509: Piece no. 19 (Printer's device, second version). The fact of containing the Arms of D. Manuel I of Portugal makes this cut exceptionally valuable to highlight the possible connections between the Parisian marked of the printed book and Portugal living its most dynamic phase

of expansion. However, such attention did not fall within the scope of this dissertation, so more analysis of this Piece was not possible. Despite that, the authors intend to commit further efforts to unravel this interesting case.

- Similarly, the Third Medallion set is a unique interpretation of the *Ars moriendi* for the "Germain"-phase of the Hardouyn workshop. A detailed inspection of every piece of its iconography was a challenge falling outside the scope of the present research, so it was not carried out. However, it excited curiosity to learn more; thus, its study is another work that the authors are keen to carry out.
- Finally, the compositional heterogeneity of the printing inks opened another question on whether they employed other formulations. Given the challenge, future work will consider more books from the Hardouyn workshop to improve our knowledge of their printing technique.

By presenting these new-open doors for future research, this dissertation reaches its two-folded intentions: to contribute to the advance of the state-of-the art on the study of early printed incunabula and contribute to open the field to new future works on this subject, that up to this research presented a deep lack on studies and knowledge.

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Appendices

A. Digital sources of cited artworks

A.1 Manuscript sources

1. **Chantilly, Musée Condé, Ms. 65** - *Horae ad usum Romanum*, also called *Très riches Heures du duc de Berry* (Roman Mass rite), Book of Hours, use of Rome, 1412-1414, Paris, https://www.overleaf.com/project/5f807f6fe40b8f0001506d9eilluminated by the Limbourg brothers, 300 mm x 215 mm, 206 leaves, illuminated, parchment. In Chantilly, Musée Condé. Partial digital coverage for the item is available at: https://www.wga.hu/frames-e.html?/html/l/limbourg/ (Accessed September 17, 2021) © Web Gallery of Art, created by Emil Krén and Daniel Marx.
2. **London, BL, Ms. 18851** Also called *Breviary of Queen Isabella of Castile*, breviary, use of the Dominican, *c.* 1497, compiled in the Dominican monastery of the Southern Netherlands (Bruges), 230 mm x 160 mm, ff. 523, illuminated, parchment. In British Library, Department of Illuminated Manuscripts. Digital coverage for the item is available at: https://www.bl.uk/manuscripts/Viewer.aspx?ref=add_ms_18851_fs001r (Accessed November 7, , 2020). © The British Library Board.
3. **London, BL, Ms. Sloane 2418** - *Horae ad usum Romanum* (Roman Mass rite), Book of Hours, use of Rome, [1500-1520], Paris, illuminated by Jean Pichore (himself and workshop of) and Jean Coene IV, 220 mm x 150 mm, 139 [+6] leaves, illuminated, parchment. In British Library, Department of Manuscripts. Partial digital coverage for the item is available at: https://www.bl.uk/catalogues/illuminatedmanuscripts/record.asp?MSID=6515&CollID=9&NStart=2418 (Accessed September 18, 2021) © The British Library Board.
4. **Los Angeles, Getty Institute, Ms. 109 (2011.40)**. *Horae ad usum Romanum* (Roman Mass rite), Book of Hours, use of Rome, [1500], Paris, illuminated by the *Master of the Chronique Scandaleuse*, Jean Pichore, *Master of Cardinal Bourbon* and *Master*

of Jacques de Besançon, 138 mm x 98 mm, illuminated, parchment. In J. Paul Getty Institute, Department of Manuscripts. Partial digital coverage for the item is available at: https://www.getty.edu/art/collection/objects/255028/master-of-the-chronique-scandaleuse-jean-pichore-master-of-cardinal-bourbon-et-al-poncher-hours-french-about-1500 (Accessed September 18, 2021) © The J. Paul Getty Institute, Los Angeles.

5. **New York, MMA, Ms. 54.1.2** Hours for the use of Paris, also called *Hours of Jeanne d'Evreux* , manuscript, *c.* 1324-1328, Paris, illuminated by Jean Pucelle, 99 mm x 72 mm, illuminated, vellum. In Metropolitan Museum of Arts, the Cloisters Collection. Digital coverage for the item is (partially) available at: https://www.metmuseum.org/art/collection/search/470309 (Accessed August 5, 2022). © 2022 The Metropolitan Museum of Art.
6. **New York, MMA, Ms. 2011.353** Hours for the use of Rome, also called *Hours of Francis I*, manuscript, 1539-1540, Paris, illuminated by the Master of François de Rohan, 292 mm x 241 mm, illuminated, vellum. In Metropolitan Museum of Arts, the Cloisters Collection. Digital coverage for the item is (partially) available at: https://www.metmuseum.org/art/collection/search/238581 (Accessed September 20, 2021). © 2021 The Metropolitan Museum of Art.
7. **New York, PML Ms. 1110** - *Horae ad usum Romanum* (Roman Mass rite), Book of Hours, use of Rome, 1495-1499, Paris, illuminated by Jean d'Ypres, 153 mm x 102 mm, 262 leaves, illuminated, parchment. In Pierpont Morgan Library, Department of Manuscripts. Partial digital coverage for the item is available at: http://ica.themorgan.org/manuscript/thumbs/160771 (Accessed September 12, 2021) © Morgan Library, New York.
8. **New York, PML Ms. H.8** - *Horae ad usum Romanum* (Roman Mass rite), Book of Hours, use of Rome, [1500], Tours, illuminated by Jean Poyer, 256 mm x 180 mm, 200 leaves, illuminated, parchment. In Pierpont Morgan Library, Department of Manuscripts. Partial digital coverage for the item is available at: http://ica.themorgan.org/manuscript/thumbs/77089 (Accessed September 17, 2021) © Morgan Library, New York.
9. **New York, PML Ms. M.291** - *Horae ad usum Romanum* (Roman Mass rite), Book of Hours, use of Rome, 1490-1510, Paris or Tours, illuminated by Jean Pichore, 185 mm x 123 mm, 112 leaves, illuminated, parchment. In Pierpont Morgan Library, Department of Manuscripts. Partial digital coverage for the item is available at: http:

//ica.themorgan.org/manuscript/thumbs/77411 (Accessed September 16, 2021) © Morgan Library, New York.

10. **New York, PML Ms. M.292** - *Horae ad usum Romanum* (Roman Mass rite), Book of Hours, use of Rome, 1511-1513, France (prob. Paris), illuminated by Pierre de Rohan and the atelier of Jean de Bourdichon, 159 mm, 112 leaves, illuminated, parchment. In Pierpont Morgan Library, Department of Manuscripts. Partial digital coverage for the item is available at: http://ica.themorgan.org/manuscript/thumbs/76872 (Accessed September 16, 2021) © Morgan Library, New York.
11. **New York, PML Ms. M.677** - *Horae ad usum Romanum* (Roman Mass rite), Book of Hours, use of Rome, [1473], Bourges, illuminated by Jean Colombe, 147 mm x 109 mm, 333 leaves, illuminated, parchment. In Pierpont Morgan Library, Department of Manuscripts. Full digital coverage for the item is available at: http://ica.themorgan.org/manuscript/thumbs/77067 (Accessed September 17, 2021) © Morgan Library, New York.
12. **New York, PML Ms. M.85** - *Horae ad usum Romanum* (Roman Mass rite), Book of Hours, use of Rome, 1510-1520, France (Rouen?), illuminated by Jean Pichore and another artist imitating the syle of Jean Bourdichon, 203 mm x 121 mm, 121 leaves, illuminated, parchment. In Pierpont Morgan Library, Department of Manuscripts. Partial digital coverage for the item is available at: http://ica.themorgan.org/manuscript/thumbs/77119 (Accessed September 16, 2021) © Morgan Library, New York.
13. **Paris, BnF, Ms. 1052** - *Breviarium ad usum Ecclesiae Parisiensis* (Parisian Mass rite), Breviary, use of Paris, also called *Breviary of Charles V*, 1340-1380, Paris, illuminated by Jean Pucelle and Jean Le Noir, 235 mm x 170 mm, 617 leaves, illuminated, parchment. In Bibliothèque nationale de France, Department of Manuscripts. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b84525491.image (Accessed September 12, 2021) © Source BnF.
14. **Paris, BnF, Ms. 18014** - *Horae ad usum Parisiensis* (Parisian Mass rite), Book of Hours, use of Paris, 1375-1390, Paris, illuminated by Jean Pucelle, 215 mm x 145 mm, 291 leaves (290 + fol. 98bis), illuminated, parchment. In Bibliothèque nationale de France, Department of Manuscripts. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b8449684q/f1 (Accessed September 12, 2021) © Source BnF.
15. **Paris, BnF, Ms. 291.réserve** - Book of Hours, use of Rome, 1510-1515, Tours, illuminated

by the Master de Claude de France, 137 mm Œ 87 mm, 122 leaves, parchment. In Bibliothèque nationale de France, Bibliothèque de lArsenal. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b550103847 (Accessed September 19, 2021) © Source BnF.

16. **Paris, BnF, Ms. 640-réserve** - *Horae ad usum Romanum*, also called *Heures de Saulx-Tavannes* (Roman Mass rite), Book of Hours, use of Rome, 1533, Paris, illuminated by the Master of François de Rohan, 222 mm Œ 153 mm, 107 leaves, illuminated, parchment. In Bibliothèque nationale de France, Bibliothèque de l'Arsenal. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b550057309 (Accessed September 20, 2021) © Source BnF.
17. **Paris, BnF, Ms. 920** - *Horae ad usum Romanum*, also called *Heures de Louis de Laval* (Roman Mass rite), Book of Hours, use of Rome, 1400-1501, Paris, richly illuminated, 245 mm Œ 175 mm, 342 leaves, parchment. In Bibliothèque nationale de France, Department of Manuscripts. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b52501620s (Accessed September 17, 2021) © Source BnF.
18. **Paris, BnF, Ms. Fr. 1877** - *Le Livre nommé Fleur de vertu, translaté d'italien en françoys, par Françoys de Rohan, archevesque de Lion, primat de France et evesque d'Angiers*, manuscript, translated by bishop François de Rohan, *c.* 1530, Paris, by the *maître* François de Rohan (artist), 300 mm Œ 190 mm, 84 leaves, parchment. In Biliothéque nationale de France, Department of manuscripts. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b105073318/f1.item. (Accessed November 2, 2021). © Source BnF.
19. **Paris, BnF, Ms. Français 225** - *Des Remedes de fortune*. French translation of Petrarch's *Remedies for Fortunes* by Jean Daudin, [1503], Rouen, illuminated by Jean Pichore, 222 leaves, illuminated, parchment. In Paris, Department of Manuscripts. Full digital coverage for this source is available at: https://gallica.bnf.fr/ark:/12148/btv1b60007782 (Accessed September 16, 2021) © Source BnF.
20. **Paris, BnF, Ms. Lat. 1671** - Lactantius *Divinae institutiones*, 1500-1505, Paris, illuminated by Jean Pichore and the *Master de la Chronique scandaleuse*, 310 mm x 210 mm, 277 leaves, illuminated, parchment. In Bibliothèque nationale de France, Department of Manuscripts. Full digital coverage for the item is available at: http://gallica.bnf.fr/ark:/12148/btv1b53184855p (Accessed September 18, 2021) © Source BnF.
21. **Paris, BnF, Ms. Lat. 9474** Book of Hours, use of Rome, also called *Grandes Heures*

dAnne de Bretagne, 1505-1510, Tours, illuminated by Jean Bourdichon, 300 mm Œ 190 mm, 238 leaves, illuminated, parchment. In Bibliothèque nationale de France, Department of Manuscripts. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b52500984v.image (Accessed April 27, 2020) © Source BnF.

22. **Paris, BnF, Ms. N.A.L. 3120** Horae ad usum Romanum (Roman Mass rite), also called *Heures of Anne de Bretagne*, Paris, decorated by Jean dYpres (14..?-1508), Paris, *c.* 1497-1498, 60 mm x 40 mm, 162 leaves, illuminated, parchment. In Bibliothèque nationale de France, Manuscripts Department. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b10515740c.image (Accessed April 2, 2020) © Source BnF.
23. **Vatican city, BAV, Barb. Lat. 487** [Horae ad usum Rotomagensis], also called *The Barberini Book of Hours* (Hours for the use of Rouen), Paris, illuminated by Jean Pichore, [1510], 106 leaves, illuminated, parchment. In Biblioteca Apostolica Vaticana, Department of Rare and Printed Books. Full digital coverage for the item is available at: https://digi.vatlib.it/view/MSS_Barb.lat.487 (Accessed September 22, 2021) © Biblioteca Apostolica Vaticana.

A.2 Early printed book sources

1. **Avignon, BMC, Rés. 203** [Horae ad usum Romanum] (Hours for the use of Rome), Paris, printed by Germain Hardouyn, [1533], *Octavo*-format, 170 mm x 105 mm, 96 leaves, decorated with unpainted engravings, parchment. In Bibliothèque municipale de Avignon, Ceccano Library. Partial digital coverage for the item is available at: https://bvmm.irht.cnrs.fr/consult/consult.php?REPRODUCTION_ID=15616 (Accessed September 22, 2021) © Bibliothèque municipale de Avignon.
2. **Blois, BM, Inc. 119** - *Heures a lusaige de Rom*[*m*]*e tout au long | sans rien requerir. Auec la destruction*[*n*] *de | Ierusale*[*m*] : *et les figures de la vie de ho*[*m*] *| me.et plusieurs aultres belles figures* Horae as usum Romanum (Roman Mass rite), [1515], printed by [Gillet Hardouyn], *Quarto*-format, illuminated, parchment. Partial digital source is available for the item at: https://bvmm.irht.cnrs.fr/resultRecherche/resultRecherche.php?COMPOSITION_ID=2740 (Accessed September 15, 2021)

©

Bibliothèque municipale de Blois.

3. **Boston, BM, Q.402.51** *Feuletti second volume de la mer des hystoires* and *Rudimentum novitiorum*. Paris, printed by Pierre La Rouge for Vincent Commin, book in two parts: (I) 1488, (II) 1488/1489, *Secundo*-format, 390 mm x 283 mm, [326] leaves, illustrated with unpainted engravings, paper. In Boston Public Library, Rare Books Department. Full digital coverage for the item is available at: https://archive.org/details/rudimentumnoviti00pari/mode/2up (Accessed 27 January 2021) © Public Library of Boston.
4. **Bourges, BM, Bya 30042 t. I.** - *Mystere des Actes des Apostres* Mysteries of the Acts of the Apostles, Paris, printed by Nicolas Couteau, [1538], *Secundo*-format, [10 ?], [1], II-CLXIX. (=CLVIIi), [1] leaves, decorated with unpainted engravings, paper. In Bourges, Bibliothèque municipale. Full digital coverage for the item is available at: http://www.bvh.univ-tours.fr/Consult/consult.asp?numtable=B180336101_BY030042_1a&numfiche=977&mode=1&index=27&ecran=0 (Accessed September 21, 2021) © Bibliothèque municipale de Bourges.
5. **Cambridge, Trinity College Library, C.30.9** *Hore Beate Marie Virginis ad Vsum | insignis ac preclare ecclesie Sarum / tota|liter ead Longum sine require. Cum plu|ribus suffragiis* [*et*] *orationibus / Nouiter | impressis parisius per Germanum Har|douyn co*[*m*]*morantem inter duas portas | Palatii Regis ad inter signium diue | Margarete.* Horae ad usum Sarum (Canterbury Mass rite), Paris, printed by Germain Hardouyn, [1528], *Octavo*-format, 170 mm x 103 mm, [119] leaves, illuminated, parchment. In Trinity College Library. Full digital coverage for the item is available at: https://mss-cat.trin.cam.ac.uk/manuscripts/uv/view.php?n=C.30.9#?c=0&m=0&s=0&cv=0&xywh=-2133%2C-256%2C8064%2C5102 (Accessed January 10, 2022) © Trinity College, Cambridge.
6. **Chantilly, Musée Condé, Impr. XII.F.006** [Heures a lusaige de Rome] (Hours for the use of Rome), Paris, printed by Germain Hardouyn, [1522], *Octavo*-format, illuminated, parchment. In Musée Condé, Library. Partial digital coverage for the item is available at: https://bvmm.irht.cnrs.fr/consult/consult.php?REPRODUCTION_ID=16467 (Accessed September 22, 2021) © Musée Condé de Chantilly.
7. **Chantilly, Musée Condé, Impr. XIV.C.003** [Heures a lusaige de Rome] (Hours for the use of Rome), Paris, printed by Gillet Hardouyn, [1515], *Octavo*-format, 170 mm x 70 mm, 84 leaves, illuminated, parchment. In Musée Condé, Library. Partial digital coverage

for the item is available at: https://bvmm.irht.cnrs.fr/consult/consult.php?REPRODUCTION_ID=16501 (Accessed September 22, 2021) © Musée Condé de Chantilly.

8. **Cherbourg, BM, Impr. Cat. 156** *Ces presentes heures a lusaige de | Rouen tout au long sans rie*[*n*] *s requerir : im*|*primes a Paris pour Philippe Coste* - Horae ad usum Rotomagensem (Hours for the use of Rouen), Paris, printed by [Gillet Hardouyn] for Philippe Coste, [1510], *Octavo*-format, 168 mm x 105 mm, decorated with unpainted engravings, parchment. In Musée Condé, Library. Partial digital coverage for the item is available at: https://portail.biblissima.fr/iiif/collection/ark:/43093/edatafebb58c4acbf6f38e2cc26d25b30b67883e9ce7d (Accessed September 22, 2021) © Bibliothèque municipale de Cherbourg.
9. **Évora, BPE, Inc. 438** *Hore Beate Marie Virginis ad Vsum insignis ac preclare ecclesie Sarum, totaliter ead Longum sine require. Cum pluribus suffragiis et orationibus. Nouiter impressis parisius per Germanum Hardouyn co*[*m*]*morantem inter duas portas Palatii Regis ad inter signium diue Margarete.* Horae ad usum Sarum (Canterbury Mass rite), Paris, printed by Germain Hardouyn, [1528], *Octavo*-format, 170 mm x 103 mm, [119] leaves, illuminated, parchment. In Biblioteca Pública de Portugal, Manizola Fund. Full digital coverage for the item is available at: http://purl.pt/29289 (Accessed April 2, 2020). © Duarte Belo e a Biblioteca Nacional de Portugal.
10. **Lisbon, BNP, Res. 2984.p** *Ces presentes heures a lusaige de Rome | toutes au long sans rien requerir | Nouuellement imprimees a Paris, auec plu*|*sieurs belles hystoires tant au kalendrier | aux heures nostre Dame, aux heures de la | Croix, aux heures du Saint esperit aux | sept pseaulmes que aux Vigiles.* Horae ad usum Romanum (Roman Mass rite), Paris, printed by Yolande Bonhomme, 1546, *Octavo*-format, 183 leaves, illustrated with unpainted engravings, parchment. In Biblioteca National de Portugal. Full digital coverage for the item is available at: http://purl.pt/24601/3 (Accessed September 21, 2021) © Duarte Belo e a BNP.
11. **Lisbon, BNP, Res. 322.v** *Hore intemerate Virginis marie secundu*[*m*] *usum Romanum cum pluribus oratio*[*n*]*ibus tam in gallico q*[*uam*] *in latino. - Paris : par Thielman keruer imprimeur deluniuersite de Paris : pour Gillet Remacle libraire demourant sur le pont Saint Michel a lenseigne de la Licorne.* Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Remacle (printer) for Thielman Kerver (publisher), 1503, *Octavo*-format, 190 mm, [96] leaves, illustrated with unpainted engravings, parchment. In Biblioteca Na-

cional de Portugal, Rare Books and Printed Books Department. Full digital coverage for the item is available at: http://purl.pt/24630 (Accessed April 2, 2020). © Duarte Belo e a Biblioteca Nacional de Portugal.

12. **Lisbon, BNP, Res. 325.v** *Hore intemerate dei genitricis Virginis Marie secu*[*n*]*dum vsum ecclesie Romane totaliter ad longum sine require una cum pluribus aliis suffragiis & orationibus. Nouiter impressis. Parisius : per Egidium Hardouyn in confinio pontis nostre Domine ante ecclesiam s*[*an*]*cti Dyonisii de carcere, ad intersignium Rose.* Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Hardouyn, [1512], in-12ř, 160 mm, [4 br., 95, 3 br.] leaves, illuminated, parchment. In Biblioteca Nacional de Portugal, Rare Books and Printed Books Department. Full digital coverage for the item is available at: http://purl.pt/24632 (Accessed April 2, 2020). © Duarte Belo e a Biblioteca Nacional de Portugal.
13. **Lisbon, BNP, Res. 326.v** *Ces p*[*rese*]*ntes heure sont a lusaige de Rôme tout au long sans riens requerir. Avec les figures de la destruction de Hierusale*[*m*]. Horae ad usum Romanum (Roman Mass rite), Paris, printed by Germain Hardouyn, [1518], *Octavo*-format, 180 mm, [120] leaves, illuminated, parchment. In Biblioteca Nacional de Portugal, Rare Books and Printed Books Department. Full digital coverage for the item is available at: http://purl.pt/24647 (Accessed April 2, 2020). © Duarte Belo e a Biblioteca Nacional de Portugal.
14. **Lisbon, BNP, Res. 328.v** *Hore in laudem gloriosissime virginis marie secu*[*n*]*dum vsum Romanu*[*m*] *totaliter ad longu*[*m*] *sine require: cum mults suffragijs & orationibus de nouo additis. Etiam cum figuris apocalipsis beati Iohannis euangeliste. Nouuelleme*[*n*]*t imprimees. - Á Paris : pour Germain Hardouyn librayre demoura*[*n*]*t entre les deux portes du palays alenseigne Saincte Marguerite.* Horae ad usum Romanum (Roman Mass rite), Paris, printed by Germain Hardouyn, [1534], *Octavo*-format, 170 mm, [85, 1 br.] leaves, illuminated, parchment. In Biblioteca Nacional de Portugal, Rare Books and Printed Books Department. Full digital coverage for the item is available at: http://purl.pt/24648 (Accessed April 2, 2020). © Duarte Belo e a Biblioteca Nacional de Portugal.
15. **Lisbon, BNP, Res. 5781.p** *Ces p*[*re*]*sentes heures so*[*n*]*t a lusage de Ro*[*m*]*me tout au long sans viens requerir. Avec les figures de la destruction de Hierusale*[*m*]. *Nouuelleme*[*n*]*t imprimees. A Paris : pour Germain Hardouyn librayre demoura[n]t entre les deux portes du Palays enlenseigne saincte marguerite.* Horae ad usum Romanum (Roman Mass rite), Paris, printed by Germain Hardouyn, [1518-1521], *Octavo*-format, 200 mm, [1 br., 80,

1 br.] leaves, illuminated, parchment. In Biblioteca Nacional de Portugal, Rare books and Printed Books Department. Full digital coverage for the item is available at: http://purl.pt/24631 (Accessed April 2, 2020). © Duarte Belo e a Biblioteca Nacional de Portugal.

16. **Lyon, BM, Rés. A.490330** - *Heures a lusaige de Rome* - Horae ad usum Romanum (Roman Mass rite), Paris, printed for Jean Pichore and Remy de Laistre, 5 IV 1503, *Quarto*-format, 112 leaves, decorated with unpainted engravings, parchment. In Lyon, Musée de limprimerie of the Public Library. Full digital coverage for the item is available at: shttp://numelyo.bm-lyon.fr/f_view/BML:BML_00GOO0100137001100981617 (Accessed September 16, 2021) © Bibliothèque Municipale de Lyon.
17. **Lyon, BM, Rés. A.491956** - *Horae diuine virginis Marie secundum | usum Romanum / cum multis folio se|quenti notatis : vna cum figuris Apocalipsis | & destruction Hierusalem & multis figuris | Biblie infertis* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Germain Hardouyn, [1520], *Octavo*-format, 96 leaves, illuminated, parchment. In Lyon, Musée de limprimerie of the Public Library. Full digital coverage for the item is available at: http://numelyo.bm-lyon.fr/f_view/BML:BML_00GOO0100137001100981617 (Accessed September 16, 2021) © Bibliothèque Municipale de Lyon.
18. **Madrid, BNE, R. 41830** *Hore intemerate Virginis marie secundu*[*m*] *Vsum Romanum cum pluribus oratio*[*n*]*ibus tam in gallico q*[*uam*] *in latino. Ces presentes heures a lusaige de Romme fure*[*n*]*t acheuees le x iour de Ian Milcinqcen*[*n*]*t et troys. Par Thielman Keruer imprimetur* [*et*] *librarie iure de luniversite de Paris : Pour Gillet Remacle, ausi librarie iure : demourant sur le pont saint Michel a lenseigne de la Licorne.* Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Remacle (publisher) and Thielman Kerver (printer), 10 I 1503, *Quarto*-format, [96] leaves, illustrated with unpainted engravings, parchment. In Biblioteca Nacional de España. Full digital coverage for the item is available at: http://bdh-rd.bne.es/viewer.vm?id=0000251277&page=1 (Accessed April 2, 2020) © Biblioteca Nacional de España.
19. **Madrid, BNE, R. 5098** *Hore intemerate dei genitricis virginis marie secundum vsum Romanae curie. Officia quotidiana sive horas b[ea]te marie brevi pulcherrimo q*[*uem*] *stilo at*[*que*] *ordine*[*m*] *positas s*[*e*]*c*[*un*]*d*[*u*]*m* [*u*]*sum Romane ecclesie : cum pluribus memorijs* [*et*] *deuotissimis orationibus illis annexis sine*[*m*] *sumpsisse cernens olecto*[*rum*], *deuotissime deo et suis* [*et*] *regnantibus gratias age : Impressoremos Thielmannum Keruer alme vniuersitatis parisiensis librariu*[*m*] *iuratum : in magno vico sancti Iacobi, ad signum cratis*

co[*m*]*morantem lauda : qui hoc opus Parisijs i*[*m*]*pressit.* Horae ad usum Romanum (Roman Mass rite), Paris, printed by Thielman Kerver, 27 XI 1514, *Octavo*-format, [151] leaves, illustrated with unpainted engravings, parchment. In Biblioteca Nacional de España. Full digital coverage for the item is available at: http://bdh-rd.bne.es/viewer.vm?id=0000015483&page=1 (Accessed April 2, 2020) © Biblioteca Nacional de España.

20. **Madrid, BNE, R.31496** - *Las horas de nuestra señora co*[*m*] *muchos otros | oficios y oraciones Impressas em Paris.*. Officium Parvum Beatae Mariae Virginis (Little Office of the Virgin), Paris, [1520], *Quarto*-format, printed by Nicolas Higman [for] Simon Vostre, [136] leaves, decorated with unpainted engravings, parchment. In Biblioteca Nacional de España. Full digital coverage for the item is available at: http://bdh-rd.bne.es/viewer.vm?id=0000010134&page=1 (Accessed September 18, 2021) © Biblioteca Nacional de España. -
21. **Madrid, BNE, R.41820** - *Ces presentes heures sont a lusaige de | Romme tout au long sans riens requerir. | Auec les figures de la destruction de Hieru|salem : Et plusieurs autres belles figures | de la pocalipse*. Horae ad usum Romanum (Roman Mass rite), Paris, [1520], printed by Gillet Hardouyn for Germain Hardouyn, [160] leaves, *Octavo*-format, decorated with painted illustrations, parchment. In Biblioteca Nacional de España. Full digital coverage for the item is available at: http://bdh-rd.bne.es/viewer.vm?id=0000251270&page=1 (Accessed September 21, 2021) © Biblioteca Nacional de España.
22. **Madrid, BNE, Res. 175** *Hore beate marie virginis secundu*[*m*] | *vsum Romanum totaliter ad longum | sine require* [.] *Cum multis suffragiis et | Orationibus de nouo additis* [.] *Nouiter | impressis Parisius per Germanum | Hardouyn : commorantem inter duas | portas Palatii ad intersinium San|cte Marguarete.* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Hardouyn, [1527], *Octavo*-format, [112] leaves, decorated with unpainted engravings, parchment. In Biblioteca Nacional de España. Full digital coverage for the item is available at: http://bdh-rd.bne.es/viewer.vm?id=0000196061&page=1 (Accessed September 22, 2021) © Biblioteca Nacional de España.
23. **Madrid, BNE, Res. 180** *Hore beate marie virginis secundum usum | Romanum totaliter ad longum sine require. Cu*[*m*] | *multis suffragiis & Orationib*[*us*] *de nouo additis | Sicut videbitis in tabula. Nouiter impressis Pa|risius : per Germanum Hardouyn commorante*[*m*] | *inter duas portas Palatii ad intersiniu*[*m*] *Sancte | Marguarete . Et ibi venundentur.* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Hardouyn, 1518-1521, *Octavo*-format, 206 mm x 121 mm, 77 leaves, decorated with unpainted engravings, parch-

ment. In Biblioteca Nacional de España. Full digital coverage for the item is available at: http://bdh-rd.bne.es/viewer.vm?id=0000081758&page=1 (Accessed September 22, 2021) © Biblioteca Nacional de España.

24. **New York, MMA, 89.27.4** *Ces p*[*rese*]*ntes herures so*[*n*]*t a lusaige de Ro*[*m*]*me | tout au long sans riens requierir. Auec les | figures de la destruction de Hierusale*[*m*]*. Nou|eleme*[*n*]*t imprimées a Paris pour germain | hardouynlibrayre demoura*[*n*]*t entre les deux | portes du Palays en lenseigne saincte mar|guerite* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Hardouyn, 1518-1521, *Octavo*-format, 206 mm x 121 mm, 77 leaves, illuminated, parchment. In Metropolitan Museum of Arts, Department of Manuscripts and Rare Books. Partial digital coverage for the item is available at: https://www.metmuseum.org/art/collection/search/468941 (Accessed September 22, 2021) © 2021 Metropolitan Museum of Arts.
25. **Orléans, BM, Rés. B.3281** - *De Praxis criminis persequendi* by Milles de Souvegny, printed in Paris, by Simones de Colines, 1541, [4], 1-85 leaves, *Secundo*-format, decorated with unpainted engravings, paper. In Orléans, Bibliothèque municipal. A full digital source is available for the item at: http://www.bvh.univ-tours.fr/Consult/consult.asp?numtable=B452346101_B3281&numfiche=773&mode=1&index=135&ecran=0 (Accessed September 21, 2021) © Bibliothèque municipale de Orléans.
26. **Paris, BnF, Rés. 8.T.2520** *Heures a lusaige de Rom*[*m*]*e tout au long | sans riens requerir avec plusieurs belles hy|stoires et figures de lapocalipse* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Hardouyn, 1508, *Octavo*-format, [85] + 1 leaves, decorated with unpainted engravings, parchment. In Bibliothèque nationale de France, Department of Manuscripts and Rare Books. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/bpt6k1510136m (Accessed September 22, 2021) © Source BnF.
27. **Paris, BnF, Rés. 8.T.2521** *Heures a lusaige de Romme tout au long sans rien requerir . Avec ung commun antiennes suffrages et oraisons de plusieurs sainctz et sainctes selon ledit usaige et plusieurs autres comme on verra en la table* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Hardouyn, 1509, *Octavo*-format, [85] + 1 leaves, illuminated, parchment. In Bibliothèque nationale de France, Department of Manuscripts and Rare Books. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/bpt6k15113749 (Accessed September 22, 2021) © Source BnF.

28. **Paris, BnF, Rés. 8.T.2525** *Ces presentes heures sont a lusai|ge de Romme . tout au long sans re|quierir . Imprimees a Paris par. G. | Hardouyn libraire iure de luniversite | de Paris . demourant audit lieu entre | les deux portes de Palais a limaige | saincte Marguerite.* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Germain Hardouyn, [1538], *Octavo*-format, 92 leaves, illuminated, parchment. In Bibliothèque nationale de France, Department of Manuscripts and Rare Books. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/bpt6k15112368 (Accessed September 22, 2021) © Source BnF.
29. **Paris, BnF, Rés. 8.T.2546** - *Hore Beate Marie Virginis secundum usum | Romanum totaliter ad longum sine require . Cu*[*m*] | *multis suffragiis & orationib*[*us*] *de novo additis | Sicut vebitis in tabula. Nouiter impressis Pa|risius* : *per Germanum Hardouyn commorante*[*m*] | *inter duas portas Palatii ad intersigniu*[*m*] *Sancte | Margarete. Et ibi venundentur* Horae ad usum Romanum (Roman Mass rite), Paris, printed by Germain Hardouyn, [1526], *Octavo*-format, 84 leaves, illuminated, parchment. - In Bibliothèque nationale de France, Arsenal Department. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/btv1b8626126j (Last access on: September 15, 2021) © Source BnF.
30. **Paris, BnF, Smith-Lésouef R.142** - [Officium beate Marie virginis secundum usum Romanum] - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Germain Hardouyn, [1528], *Octavo*-format, 88 leaves, illuminated, parchment. In Bibliothèque nationale de France, Department of Manuscripts and Rare Books. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/bpt6k9940953 (Accessed September 22, 2021) © Source BnF.
31. **Paris, BnF, Vélins 1633** *Ces presents heures a lusaige de Paris sont toutes au long sans rie*[*n*]*s requerir aueq les heures saincte geveuiesve et la co*[*m*]*memoration saint Marcel et de sainct Germain.* Horae ad usum Parisiensem (Paris Mass rite), Paris, printed by Gillet Remacle (printer) for Thielman Kerver (publisher), 20 VI 1500, *Quarto*-format, illustrated with unpainted engravings, parchment. In Bibliothèque nationale de France, Rare Books and Printed Books Department. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/bpt6k1057734x (Accessed April 2, 2020) © Source BnF.
32. **Paris, BNP, Vélins 2868** *Ces heures furent achevés le XXIe jour de aoust M. IIII. C. IIII. XX. et VI, pour Anthoine Verard, libraire demourant à Paris, à l'ymage saint Johan l'evangeliste, sur le pont Nostre Dame, ou au paloys du roy nostre sire, au premier pillier*

devant la chapelle o[*u*] *on chante la messe de mes seigneurs les presidens Horae ad usum* [*Romanum*] ([Roman] Mass rite), printed for Antoine Vérard, 21 VIII 1486, *Octavo*-format, 120 leaves, illustrated with unpainted engravings, parchment. In Bibliothèque nationale de France, Rare Books and Printed Books Department. Full digital coverage for the item is available at: https://gallica.bnf.fr/ark:/12148/bpt6k1057738k (Accessed 16 November, 2020) © Source BnF.

33. **Pennsylvania, UPenn, Ms. Codex 1531** *Heures a lusaige de Rom*[*m*]*e tout au long | sans rie*[*n*]*s requerir Auec les figures de la | vie de lho*[*m*]*me : & la destruction*[*n*] *de Hierusale*[*m*] *Horae ad usum* [*Romanum*] ([Roman] Mass rite), printed for Guillaume Anabat for Gillet and Germain Hardouyn, [1508], *Octavo*-format, 245 mm x 160 mm, 120 leaves, illustrated with (mostly) unpainted engravings, parchment. In University of Pennsylvania Library, Kislak Center for Special Collections. Full digital coverage for the item is available at: http://dla.library.upenn.edu/dla/medren/pageturn.html?id=MEDREN_9944959863503681&currentpage=3&rotation=0&size=2 (Accessed 16 November, 2020) © Kislak Center for Special Collections, Rare Books and Manuscripts, University of Pennsylvania.
34. **Poitiers, BM, BR.87** - *Heures a lusaige de Ro*[*m*]*me tout au long | sa*[*n*]*s requerir. Auec les figures de la | vie de l*[']*ho*[*m*]*me*: [*et*] *la destructio*[*n*] *de hierusale*[*m*] - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Guillaume Anabat for Gillet and Germain Hardouyn, [1505], *Quarto*-format, 116 leaves, decorated with unpainted engravings, parchment. In Poitiers, François-Mitterrand Library. Full digital coverage for the item is available at: https://patrimoine.bm-poitiers.fr/digital-viewer/c-1097555 (Accessed September 14, 2021).
35. **Poitiers, BM, CR.46** - *Heures a lusaige de Ro*[*m*]*me tout au long | sa*[*n*]*s riens requerir. Auec les figures de la|pocalipse.*] - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Hardouyn, [1505], *Octavo*-format, 116 leaves, decorated with unpainted engravings, parchment. In Poitiers, François-Mitterrand Library. Full digital coverage for the item is available at: https://patrimoine.bm-poitiers.fr/digital-viewer/c-1097618 (Accessed September 14, 2021).
36. **Poitiers, BM, CR.49** - *Heures a lusaige de Romme tout au | long sans riens requerir. Avec les figu| res de la vie de lhomme : et la destruction | de hierusalem|pocalipse* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Gillet Hardouyn, [1512], *Octavo*-format, 92 leaves, illuminated, parchment. In Poitiers, François-Mitterrand Library. Full

digital coverage for the item is available at: https://patrimoine.bm-poitiers.fr/digital-viewer/c-1097703 (Accessed September 14, 2021).

37. **Poitiers, BM, DR.38** - *Horae diuine virginis Marue | secundum vsum | Romanum | cum alijs multi folio seguenti notaris | vna cum figuris Apocalipsis* [*et*] *destructio Hierusa|lem* [*et*] *multis figuris Biblie infertis* - Horae ad usum Romanum (Roman Mass rite), Paris, printed by Germain Hardouyn, 1533, *Octavo*-format, 88 leaves, illuminated, parchment. In Poitiers, François-Mitterrand Library. Full digital coverage for the item is available at: https://patrimoine.bm-poitiers.fr/digital-viewer/c-1097027 (Accessed September 14, 2021).
38. **Saumur, Château-Musée, Inc. 0041** [*Ces présentes heures ont élé imprimées à Paris pour Guillaume Godard, libraire demourant sur le pont au change, à lenseigne de lhomme saivage*]. *Horae* [*ad usum Romanum* (Roman Mass rite)], Paris, printed by Guillaume Godard, [1500], *Quarto*-format, 95 leaves, illustrated with partly coloured engravings, parchment. In the Library of the Museum of Châ-teau-de-Saumur. Full digital coverage for the item is available at: https://bvmm.irht.cnrs.fr/iiif/1374/canvas/canvas-422300/view (Accessed 22 November, 2020). © 2013 Institut de recherche et dhistoire des textes (license CC-BY-NC 3.0).
39. **Toulouse, Bibliothèque universitaire de l'Arsenal, inv. no. 601011** - *Biblia pictvris illvstrata. Breves in eadem annotationes, ex doctiss. interpretationibus, & Hebraeorum commentariis. Interpretatio nominum Hebraicorum. Index Epistolarum & Euangeliorum totius anni*, Bible with engraved figurer, Paris, 1540, Pierre Regnault and Jakob Faber (engravers), [8]-482-128-[22] leaves, *Octavo*-format, illustrated with unpainted engravings, paper. In Bibliothèque universitaire de l'Arsenal. Full digital coverage for the source is available at: https://tolosana.univ-toulouse.fr/fr/notice/122531876 (Accessed September 20, 2021).
40. **Troyes, Cathedral Library, Troyes, No num.[2]** [Horae ad usum Romanum] (Hours for the use of Rome), Paris, printed by Germain Hardouyn, [1518], *Octavo*-format, 180 mm x 110 mm, 95 leaves, illuminated, parchment. In Troyes, Cathedral Library. Partial digital coverage for the item is available at: https://bvmm.irht.cnrs.fr/consult/consult.php?REPRODUCTION_ID=6245 (Accessed September 22, 2021) © Bibliothèque da Catedral de Troyes.
41. **Vatican city, BAV, Stamp. Ross. 1522** [Horae ad usum Romanum] (Hours for the use of Rome), Paris, printed by Anthoine Chappiel for Germain Hardouyn, [1504], *Oc-*

tavo-format, 41 leaves, illuminated, parchment. In Biblioteca Apostolica Vaticana, Department of Rare and Printed Books. Full digital coverage for the item is available at: http://digi.vatlib.it/view/Stamp.Ross.1522 (Accessed September 22, 2021) © Biblioteca Apostolica Vaticana.

42. **Washington, Library of Congress, Rosenwald 923** *Heures a lusaige de Ro*[*m*]*me tout au long sans riensre|querir auecques plusieurs belles hystoires & figures de | la pocalipce a la mode dytalie nouuelleme*[*n*]*t imprimees.* (Hours for the use of Rome), Paris, printed by Anthoine Chappiel for Germain Hardouyn, [1505], *Octavo*-format, 104 leaves, decorated with unpainted engravings, parchment. In Library of Congress, Lessing J. Rosenwald collection. Full digital coverage for the item is available at: https://www.loc.gov/resource/rbc0001.2016rosen0923/?sp=11 (Accessed September 22, 2021) © National Library of Congress.
43. **Vendôme, BM, Rés. A.405** [Horae ad usum Romanum] (Hours for the use of Rome), Paris, printed by Germain Hardouyn, [?], *Octavo*-format, 180 mm x 110 mm, 100 leaves, decorated with unpainted engravings, parchment. In Musée Condé, Library. Partial digital coverage for the item is available at: https://bvmm.irht.cnrs.fr/consult/consult.php?REPRODUCTION_ID=8830 (Accessed September 22, 2021) © Bibliothèque municipale de Vendôme.

A.3 Other printed sources

1. Junius, Hadrianus. *Batauia. In qua praeter gentis & insulae antiquitatem, originem, decora, mores, aliàque ad eam historiam pertinentia, declaratur quae fuerit vetus Batauia, quae Plinio, Tacito, & Ptolemaeo cognita quae item genuina inclytae Francorum nationis fuerit sedes*. 1586, Leiden: ex officina Plantiniana. Full digital coverage for the item is available at: https://archive.org/details/bub$_$gb$_$P$_$TTscGTKYgC/page/n3/mode/2up (Accessed February 8, 2021). Source available in the Public Domain 1.0. The original copy belongs to the Alessandrina Library, Rome, Inv. No. T-RM0280.
2. von Mallinckrodt, Bernard. *De ortu et progressu artis typographicae dissertatio historica, in qua Præteralia Pleraque ad Calcographices Negocium Spectantia de Avctoribvs et Loco inuentionis præcipuè inquiritur, proqve mogvntinis contra Harlemenses concluditur*. 1640, Coloniae Agrippinensium: Apud Ioannem Kinchium. Full digital coverage for the item is available at: https://books.google.pt/books?id=ItZFAAAAcAAJ&

printsec=frontcover#v=onepage&q&f=false (Accessed February 8, 2021). Source available in the Public Domain 1.0.

3. Beughem, Cornelis. *Incunabula typographiae, sive, Catalogus librorum scriptorumque proximis ab inventione typographicae annis, usque ad annum Christi M.D. inclusive, in quavis linguâ editorum*. 1688, Amstelodami: Apud Joannem Wolters. Full digital coverage for the item is available at: https://babel.hathitrust.org/cgi/pt?id=gri.ark:/13960/t8pc7j63d&view=1up&seq=5 (Accessed February 9, 2021). Source available in the Public Domain 1.0. The original copy belongs to the J. Paul Getty Museum Library, Department of Special Collections, Inv. no. 88-B20798.
4. Orlandi, Pellegrino Antonio. *Origine e progressi della stampa o sia dell'arte impressoria e notizie dell'opere stampate dall'anno MCCCCLVII sino all'anno MD*. 1722, [Bononiæ]: [C. Pisari]. Full digital coverage for the item is available at: https://archive.org/details/b30520319 (Accessed February 9, 2021). Source available in the Public Domain 1.0.
5. Seemiller, Sebastian. *BibliothecæacademicæIngolstadiensis incunabula typographica seu libri ante annum 1500 impressi circiter mille et quadringenti*. 1787, Universität Ingolstad : Bibliothek. Full digital coverage for the item is available at: https://archive.org/details/bibliothecacade01seemgoog/page/n12/mode/2up (Accessed February 9, 2021). Source available in the Public Domain 1.0. The original copy belongs to the Morgan Library & Museum, Inv. no. PML 79763-65 (copy bound in three volumes).

B. Illustrations in the inspected books

Table B.1: List of books analysed for the elaboration of Chapter 2. List of abbreviations: BL = British Library; BM = Bibliothèque Municipale; BnF = Bibliothèque nationale de France; BNE = Biblioteca Nacional de España; Un. Lib. = University Library; UPenn. = Pennsylvania University Library. The bullet symbol • in each cell represents the presence of a set in the mentioned book.

Book	Year of issue	Apocalypse Master, *c.* 1503	Alternative set, Apocalypse Master, *c.* 1504	*Octavo agenda* set, Jean Pichore, *c.* 1506	*Octavo set* Jean Pichore, *c.* 1505-1509	*Quarto set* Jean Pichore, *c.* 1505-1508	*Duodecimo set* Jean Pichore, *c.* 1512	Linear set	"German" elongated set, *c.* 1516	Set by Jacob Faber	Medallion set-I	Medallion set-II	Medallion set-III	Guillaume Eustace's set, Jean Pichore, *c.* 1508	Jean Barbier's set, Jean Pichore, *c.* 1509	Set Nöel Bellemere-Master François of Rohan, *c.* 1527
Avignon, BM, Rés. 203	[1533]	•						•	•						•	
Blois, BM, Inc. 119	[1515]				•	•										
Binghamton Univ. Lib., BX 2080 H67	[1527]															•
Chantilly, Musée Condé, Impr. XII.F.006	[1530]				•											
Chantilly, Musée Condé, Impr. XIV.C.003	[1522]						•									
Évora, BPE, Inc. 438	[1528]										•	•				
Libraire Camille Sourget	[1503]	•														
Lisbon, BNP, Res. 325.v	[1512]						•									
Lisbon, BNP, Res. 326.v	[1518]				•				•						•	
Lisbon, BNP, Res. 328.v	[1534]									•	•	•				•
Lisbon, BNP, Res. 5781.p	1518-1521							•	•					•		
London, BL, 1471.de.7	[1530]															•
London, BL, C.29.b.250	[1528]									•						
London, BL, C.29.d.11	[1508]		•	•												
London, BL, C.29.f.10	[1528]										•	•				

Table B.1 continued from previous page

Book	Year of issue	Apocalypse Master, *c.* 1503	Alternative set, Apocalypse Master, *c.* 1504	*Octavo agenda* set, Jean Pichore, *c.* 1506	*Octavo set* Jean Pichore, *c.* 1505-1509	*Quarto set* Jean Pichore, *c.* 1505-1508	*Duodecimo set* Jean Pichore, *c.* 1512	Linear set	"German" elongated set, *c.* 1516	Set by Jacob Faber	Medallion set-I	Medallion set-II	Medallion set-III	Guillaume Eustace's set, Jean Pichore, *c.* 1508	Jean Barbier's set, Jean Pichore, *c.* 1509	Set Nöel Bellemere-Master François of Rohan, *c.* 1527
London, BL, C.29.f.14	[1513]				•											
London, BL, C.29.g.5	[1534]									•	•	•	•			
London, BL, C.29.h.11	1506-1508				•	•										
London, BL, C.29.i.17	[1510]					•										
London, BL, C.29.i.18	[1514]				•	•										
London, BL, C.29.k.24	1504	•	•													
London, BL, C.35.f.11	1530										•		•	•		•
London, BL, C.41.a.23	[1534]														•	
London, BL, C.52.cc.10	[1506]				•											
Lyon, BM, Inc. 691	[1514]				•											
Lyon, BM, Rés. A.419956	[1520]							•	•					•	•	
Madrid, BNE, R. 180	[1526]													•		
Madrid, BNE, R. 41820	[1520]	•						•	•							
Madrid, BNE, Res. 175	[1527]								•							
Madrid, BNE, Res. 180	[1526]				•				•							
New York, MET, 89.27.4	1518-1521	•						•	•							
New York, PML, 128883	[1520]							•	•							
Paris, BnF, Rés. 8. T. 2520	[1508]				•											
Paris, BnF, Rés. 8. T. 2521	[1509]				•	•										
Paris, BnF, Rés. 8. T. 2525	[1538]															•
Paris, BnF, Rés. 8. T. 2546	[1526]				•									•		
Paris, BnF, Smith Lésouef. R. 142	[1528]								•		•	•				
Paris, Bibl. Ste.-Geneviève, OEXV. 365	[1505]			•	•	•										
Pennsylvania, UPenn, Ms. Codex 1531	[1508]			•	•	•										
Poitiers, BM, BR.87	[1506]			•	•	•										
Poitiers, BM, CR.46	[1506]			•	•	•										
Poitiers, BM, CR.49	[1512]				•	•										
Poitiers, BM, DR.38	1533							•	•						•	
Troyes Cathedral Library, *cote no num* [2]	[1518]				•				•	•						
Vendôme, BM, Rés. A.405	-				•				•						•	

Table B.1 continued from previous page

Book	Year of issue	Apocalypse Master, *c.* 1503	Alternative set, Apocalypse Master, *c.* 1504	*Octavo agenda* set, Jean Pichore, *c.* 1506	*Octavo set* Jean Pichore, *c.* 1505-1509	*Quarto set* Jean Pichore, *c.* 1505-1508	*Duodecimo set* Jean Pichore, *c.* 1512	Linear set	"German" elongated set, *c.* 1516	Set by Jacob Faber	Medallion set-I	Medallion set-II	Medallion set-III	Guillaume Eustace's set, Jean Pichore, *c.* 1508	Jean Barbier's set, Jean Pichore, *c.* 1509	Set Nöel Bellemere-Master François of Rohan, *c.* 1527
Versailles Library, Inc. G.306	[1512]					•										
Washington DC, Library of Congress, Rosenwald 923	[1505]				•					•						

C. Biblical and hagiographic references

C.1 Gospels

Gospel of John

St. John and the poisoned Chalice

- *Source 1, Leucian Acts, XX*[1]: "Now when Aristodemus, who was chief priest of all those idols, saw this, filled with a wicked spirit, he stirred up sedition among the people, so that one people prepared themselves to fight against the other. And John turned to him and said: Tell me, Aristodemus, what can I do to take away the anger from thy soul? And Aristodemus said: If thou wilt have me believe in thy God, I will give thee poison to drink, and if thou drink it, and die not, it will appear that thy God is true. The apostle answered: If thou give me poison to drink, when I call on the name of my Lord, it will not be able to harm me. Aristodemus said again: I will that thou first see others drink it and die straightway that so thy heart may recoil from that cup. And the blessed John said: I have told thee already that I am prepared to drink it that thou mayest believe on the Lord Jesus Christ when thou seest me whole after the cup of poison. Aristodemus therefore went to the proconsul and asked of him two men who were to undergo the sentence of death. And when he had set them in the midst of the market-place before all the people, in the sight of the apostle he made them drink the poison: and as soon as they had drunk it, they gave up the ghost. Then Aristodemus turned to John and said: Hearken to me and depart from thy teaching wherewith thou callest away the

[1] J. K. Elliott. *The Apocryphal New Testament: A Collection of Apocryphal Christian Literature in an English Translation*. Oxford: Clarendon Press, 1993, pp. 434-344.

people from the worship of the gods; or take and drink this, that thou mayest show that thy God is almighty, if after thou hast drunk, thou canst remain whole. Then the blessed Jolm, as they lay dead which had drunk the poison, like a fearless and brave man took the cup, and making the sign of the cross, spake thus: My God, and the Father of our Lord Jesus Christ, by whose word the heavens were established, unto whom all things are subject, whom all creation serveth, whom all power obeyeth, feareth, and trembleth, when we call on thee for succour: whose name the serpent hearing is still, the dragon fleeth, the viper is quiet, the toad (which is called a frog) is still and strengthless, the scorpion is quenched, the basilisk vanquished, and the phalangia (spider) doth no hurt -in a word, all venomous things, and the fiercest reptiles and noisome beasts, are pierced (or covered with darkness)"

- *Source 2, Golden Legend, 9*[2]: "When Saint John had preached throughout the region of Asia, the idol-worshippers stirred up a riot among the populace, and they dragged him to the temple of Diana and tried to force him to sacrifice to the goddess. Then the saint proposed this alternative: if by invoking Diana they overturned the church of Christ, he would offer sacrifice to the idols; but if by invoking Christ he destroyed Diana's temple, they would believe in Christ. To this proposal the greater number of people gave their consent. When all had gone out of the building, the apostle prayed, the temple collapsed to the ground, and the statue of Diana was reduced to dust. Thereupon the High Priest Aristodemus incited a still greater commotion among the people, and two parties were at the point of coming to blows. The apostle asked the priest: "What do you want me to do to restore order?" He answered: "If you want me to believe in your God, I will give you poison to drink. If it does no harm, it will be clear that your master is the true God." John replied: "Do as you say!" "But first," came the answer, "I want you to see it kill some others, to make you fear its power the more." So Aristodemus hied himself to the proconsul, obtained the release of two criminals condemned to decapitation, and, in the presence of the crowd, gave them the poison. They drank it and fell dead. Then the apostle took the cup, armed himself with the sign of the cross, drained the drink, and suffered no harm; and all present began to praise God. Aristodemus, however,

[2]Text from the version by Ryan (Voragine, *The Golden Legend: Readings into the Saints*, p. 53).

was not yet convinced and said: "If you can bring the two dead men to life, I will not hesitate to believe." The apostle handed him his cloak. "Why do you give me your cloak?" the other asked. John's answer: "To make you think twice and give up your unbelief! No mantle of yours will ever make me believe!" the priest retorted. John said: "Go and spread this cloak over the corpses, and say, 'The apostle of Christ has sent me to you, that you may rise in the name of Christ.'" He did as he was bidden, and the dead men arose at once. Then the priest and the proconsul believed, and the apostle baptized them and their families. At a later time they built a church in honor of Saint John"

St. John boiled in the oil cauldron

- *Golden Legend, 9*[3]: "When, after Pentecost, the apostles separated, Gospel of John, apostle and evangelist, beloved of Christ and chosen as a virgin, went to Asia and there founded many churches. The emperor Domitian, hearing his fame, summoned him to Rome and had him plunged into a caldron of boiling oil outside the gate called the Porta Latina; but the blessed John came out untouched, just as he had avoided corruption of the flesh. Seeing that this treatment had not deterred him from preaching, the emperor exiled him to the island of Patmos, where, living alone, he wrote the Apocalypse, the Book of Revelation. That came the same year the emperor was murdered because of his cruelty, and the Senate revoked all his decrees. This it came about that John, who had been deported unjustly, returned to Ephesus with honor, and the crowds ran out to meet him crying: "Blessed is he who comes in the name of the Lord!"[4]

St. John in Patmos

- *Source 1, Apocalypse, 1: 9*[5]: "I John, who also am your brother, and companion in tribulation, and in the kingdom and patience of Jesus Christ, was in the isle that is called Patmos, for the word of God, and for the testimony of Jesus Christ."

[3]From Voragine, *The Golden Legend: Readings into the Saints*, p. 51. The chapel of San Giovanni in Olio should mark the place where the martyrdom of St. John took place (James Hall. *Dictionary of Subjects and Symbols in Art*. Second edition. New York, NY and London: Routledge, 2018, p. 180.).

[4]From Voragine, *The Golden Legend: Readings into the Saints*, p. 51.

[5]All the hereafter biblical text for this section are from the King James version.

- *Source 2, Golden Legend, 9*: "Seeing that this treatment had not deterred him from preaching, the emperor exiled him to the island of Patmos, where, living alone, he wrote the Apocalypse, the Book of Revelation. That came the same year the emperor was murdered because of his cruelty, and the Senate revoked all his decrees. This it came about that John, who had been deported unjustly, returned to Ephesus with honor, and the crowds ran out to meet him crying: "Blessed is he who comes in the name of the Lord!"

Passion Gospel of John

"Ego sum" and arrest of Christ in Mount of Olives

- *Gospel of John, 18: 3-6*: "Judas then, having received a band of men and officers from the chief priests and Pharisees, cometh thither with lanterns and torches and weapons. Jesus therefore, knowing all things that should come upon him, went forth, and said unto them, 'Whom seek ye?' They answered him, 'Jesus of Nazareth.' Jesus saith unto them, 'I am he.' And Judas also, which betrayed him, stood with them. As soon then as he had said unto them, I am he, they went backward, and fell to the ground."

Agony in the garden

- *Source 1, Gospel of Matthew, 26: 37-45*: And he [Jesus] took with him Peter and the two sons of Zebedee, and began to be sorrowful and very heavy. Then saith he unto them, My soul is exceeding sorrowful, even unto death: tarry ye here, and watch with me. And he went a little further, and fell on his face, and prayed, saying, O my Father, if it be possible, let this cup pass from me: nevertheless not as I will, but as thou wilt. And he cometh unto the disciples, and findeth them asleep, and saith unto Peter, What, could ye not watch with me one hour? Watch and pray, that ye enter not into temptation: the spirit indeed is willing, but the flesh is weak. He went away again the second time, and prayed, saying, O my Father, if this cup may not pass away from me, except I drink it, thy will be done. And he came and found them asleep again: for their eyes were heavy. And he left them, and went away

again, and prayed the third time, saying the same words. Then cometh he to his disciples, and saith unto them, Sleep on now, and take your rest: behold, the hour is at hand, and the Son of man is betrayed into the hands of sinners."

- *Source 2, Gospel of Luke, 22: 39-45*: "And he came out, and went, as he was wont, to the mount of Olives; and his disciples also followed him. And when he was at the place, he said unto them, Pray that ye enter not into temptation. And he was withdrawn from them about a stone's cast, and kneeled down, and prayed, Saying, Father, if thou be willing, remove this cup from me: nevertheless not my will, but thine, be done. And there appeared an angel unto him from heaven, strengthening him. And being in an agony he prayed more earnestly: and his sweat was as it were great drops of blood falling down to the ground. And when he rose up from prayer, and was come to his disciples, he found them sleeping for sorrow."

C.2A Office of the Virgin (Infancy cycle)

Matins

Scene 1: Fall of Men

- *Genesis, 1-3*

Scene 2: Annunciation

- *Source 1, Gospel of Luke, 1: 26-38*: "And in the sixth month the angel Gabriel was sent from God unto a city of Galilee, named Nazareth, to a virgin espoused to a man whose name was Joseph, of the house of David; and the virgin's name was Mary. And the angel came in unto her, and said, Hail, thou that art highly favoured, the Lord is with thee: blessed art thou among women. And when she saw him, she was troubled at his saying, and cast in her mind what manner of salutation this should be. And the angel said unto her, Fear not, Mary: for thou hast found favour with God. And, behold, thou shalt conceive in thy womb, and bring forth a son, and shalt call his name Jesus. He shall be great, and shall be called the Son of the Highest: and the Lord God shall give unto him the throne of his father David: And

he shall reign over the house of Jacob for ever; and of his kingdom there shall be no end. Then said Mary unto the angel, How shall this be, seeing I know not a man? And the angel answered and said unto her, The Holy Ghost shall come upon thee, and the power of the Highest shall overshadow thee: therefore also that holy thing which shall be born of thee shall be called the Son of God. And, behold, thy cousin Elisabeth, she hath also conceived a son in her old age: and this is the sixth month with her, who was called barren. For with God nothing shall be impossible." And Mary said, "Behold the handmaid of the Lord; be it unto me according to thy word." And the angel departed from her."

- *Source 2, Gospel of Matthew, 1: 18*: "This is how the birth of Jesus the Messiah came about: His mother Mary was pledged to be married to Joseph, but before they came together, she was found to be pregnant through the Holy Spirit."

Lauds

Scene 1: Visitation

- *Gospel of Luke, 1: 39-56*: "And Mary arose in those days, and went into the hill country with haste, into a city of Juda; and entered into the house of Zacharias, and saluted Elisabeth. And it came to pass, that, when Elisabeth heard the salutation of Mary, the babe leaped in her womb; and Elisabeth was filled with the Holy Ghost: And she spake out with a loud voice, and said, Blessed art thou among women, and blessed is the fruit of thy womb. And whence is this to me, that the mother of my Lord should come to me? For, lo, as soon as the voice of thy salutation sounded in mine ears, the babe leaped in my womb for joy. And blessed is she that believed: for there shall be a performance of those things which were told her from the Lord. And Mary said, My soul doth magnify the Lord, and my spirit hath rejoiced in God my Saviour. For he hath regarded the low estate of his handmaiden: for, behold, from henceforth all generations shall call me blessed. For he that is mighty hath done to me great things; and holy is his name. And his mercy is on them that fear him from generation to generation. He hath shewed strength with his arm; he hath scattered the proud in the imagination of their hearts. He hath put down the mighty

from their seats and exalted them of low degree. He hath filled the hungry with good things; and the rich he hath sent empty away. He hath holpen his servant Israel, in remembrance of his mercy. As he spake to our fathers, to Abraham, and to his seed for ever. And Mary abode with her about three months and returned to her own house."

Scene 2: Meeting at the Golden Gate

- *Source 1, Golden Legend, 131*[6]: "Meanwhile Anne was weeping bitterly, not knowing where her husband had gone, when the same angel appeared to her, revealing to her the same things he had told Joachim, and added that, for a sign, she should go to Jerusalem's Golden Gate, where he would meet her husband as he returned. So they met as the angel had predicted, and were happy to see each other and to be sure that they were to have a child. They went home, joyfully awaiting the fulfillment of the divine promise. Anna conceived and brought forth a daughter, and called her name Mary."
- *Source 2, Gospel of the birth of Mary, 3*[7]: "The angel appeared to Anna his wife saying : Fear not, neither think that which you see is a spirit. "For I am that angel who hath offered up your prayers and alms before God, and am now sent to you, that I may inform you, that a daughter will be born unto you, who shall be called Mary, and shall be blessed above all women. She shall be, immediately upon her birth, full of the grace of the Lord, and shall continue during the three years of her weaning in her father's house, and afterwards, being devoted to the service of the Lord, shall not depart from the temple, till she arrives to years of discretion. In a word, she shall there serve the Lord night and day in fasting and prayer, shall abstain from every unclean thing, and never know any man. But, being an unparalleled instance without any pollution or defilement, and a virgin not knowing any man, shall bring forth a son, and a maid shall bring forth the Lord, who both by his grace and name and works, shall be the Saviour of the world. Arise therefore, and go

[6]Jacobus de Voragine. *The Golden Legend: Readings into the Saints*. Vol. 2. Translated by William Granger Ryan. Princeton, NJ and Oxford, MA: Princeton University Press, 1995, p. 152.

[7]William Hone et al. *The Apocryphal New Testament: being all the gospels, epistles, and other pieces now extant, attributed in the first four centuries to Jesus Christ, His apostles and their companions*. Philadelphia, PA: Gebbie & co., 1880, pp. 19-20.

up to Jerusalem, and when you shall come to that which is called the golden gate (because it is gilt with gold), as a sign of what I have told you, you shall meet your husband, for whose safety you have been so much concerned. When therefore you find these things thus accomplished, believe that all the rest which I have told you, shall also undoubtedly be accomplished." According therefore to the command of the angel, both of them left the places where they were, and when they came to the place specified in the angel's prediction, they met each other. Then, rejoicing at each other's vision, and being fully satisfied in the promise of a child, they gave due thanks to the Lord, who exalts the humble. After having praised the Lord, they returned home, and lived in a cheerful and assured expectation of the promise of God. If So Anna conceived, and brought forth a daughter, and, according to the angel's command, the parents did call her name Mary."

Prime: Nativity

- *Source 1, Gospel of Matthew 1: 18-25*: "Now the birth of Jesus Christ was on this wise: When as his mother Mary was espoused to Joseph, before they came together, she was found with child of the Holy Ghost. Then Joseph her husband, being a just man, and not willing to make her a publick example, was minded to put her away privily. But while he thought on these things, behold, the angel of the Lord appeared unto him in a dream, saying, Joseph, thou son of David, fear not to take unto thee Mary thy wife: for that which is conceived in her is of the Holy Ghost. And she shall bring forth a son, and thou shalt call his name JESUS: for he shall save his people from their sins. Now all this was done, that it might be fulfilled which was spoken of the Lord by the prophet, saying, "Behold, a virgin shall be with child, and shall bring forth a son, and they shall call his name Emmanuel, which being interpreted is, God with us." Then Joseph being raised from sleep did as the angel of the Lord had bidden him and took unto him his wife and knew her not till she had brought forth her firstborn son: and he called his name Jesus."
- *Source 2, Luke 2: 1-7*: "And it came to pass in those days, that there went out a decree from Caesar Augustus, that all the world should be taxed. (And this taxing was first made when Cyrenius was governor of Syria.) And all went to be taxed,

every one into his own city. And Joseph also went up from Galilee, out of the city of Nazareth, into Judaea, unto the city of David, which is called Bethlehem; (because he was of the house and lineage of David:) To be taxed with Mary his espoused wife, being great with child. And so it was, that, while they were there, the days were accomplished that she should be delivered. And she brought forth her firstborn son, and wrapped him in swaddling clothes, and laid him in a manger; because there was no room for them in the inn."

Terce: Annunciation to the Shepherds

- *Gospel of Luke, 2: 8-10*: "And there were in the same country shepherds abiding in the field, keeping watch over their flock by night. And, lo, the angel of the Lord came upon them, and the glory of the Lord shone round about them: and they were sore afraid. And the angel said unto them, Fear not: for, behold, I bring you good tidings of great joy, which shall be to all people. For unto you is born this day in the city of David a Saviour, which is Christ the Lord. And this shall be a sign unto you; Ye shall find the babe wrapped in swaddling clothes, lying in a manger. And suddenly there was with the angel a multitude of the heavenly host praising God, and saying, Glory to God in the highest, and on earth peace, good will toward men. And it came to pass, as the angels were gone away from them into heaven, the shepherds said one to another, Let us now go even unto Bethlehem, and see this thing which is come to pass, which the Lord hath made known unto us. And they came with haste, and found Mary, and Joseph, and the babe lying in a manger. And when they had seen it, they made known abroad the saying which was told them concerning this child. And all they that heard it wondered at those things which were told them by the shepherds. But Mary kept all these things, and pondered them in her heart. And the shepherds returned, glorifying and praising God for all the things that they had heard and seen, as it was told unto them."

Sext: Adoration of the Magi

- *Gospel of Matthew, 2: 7-11*: "Then Herod, when he had privily called the wise men, enquired of them diligently what time the star appeared. And he sent them to Bethlehem, and said, Go and search diligently for the young child; and when ye have found him, bring me word again, that I may come and worship him also. When they had heard the king, they departed; and, lo, the star, which they saw in the east, went before them, till it came and stood over where the young child was. When they saw the star, they rejoiced with exceeding great joy. And when they were come into the house, they saw the young child with Mary his mother, and fell down, and worshipped him: and when they had opened their treasures, they presented unto him gifts; gold, and frankincense, and myrrh. And being warned of God in a dream that they should not return to Herod, they departed into their own country another way."

Schiller refers Isaiah 49, 8 ff.; 60, 1-6; Psalms 68, 32; 72, 9-11; John 1, 4 ff.; 8, 12 for comparison Schiller.[8]

None: Presentation in the Temple

- *Gospel of Luke 2: 22-39*: "And when the days of her purification according to the law of Moses were accomplished, they brought him to Jerusalem, to present him to the Lord; (As it is written in the law of the Lord, Every male that openeth the womb shall be called holy to the Lord;) And to offer a sacrifice according to that which is said in the law of the Lord, A pair of turtledoves, or two young pigeons. And, behold, there was a man in Jerusalem, whose name was Simeon; and the same man was just and devout, waiting for the consolation of Israel: and the Holy Ghost was upon him. And it was revealed unto him by the Holy Ghost, that he should not see death, before he had seen the Lord's Christ. And he came by the Spirit into the temple: and when the parents brought in the child Jesus, to do for him after the custom of the law, Then took he him up in his arms, and blessed God, and said, Lord, now lettest thou thy servant depart in peace, according to thy word:

[8] Schiller, *Iconography of Christian Art*, p. 94.

For mine eyes have seen thy salvation, Which thou hast prepared before the face of all people; A light to lighten the Gentiles, and the glory of thy people Israel. And Joseph and his mother marvelled at those things which were spoken of him. And Simeon blessed them, and said unto Mary his mother, Behold, this child is set for the fall and rising again of many in Israel; and for a sign which shall be spoken against; (Yea, a sword shall pierce through thy own soul also,) that the thoughts of many hearts may be revealed. And there was one Anna, a prophetess, the daughter of Phanuel, of the tribe of Aser: she was of a great age, and had lived with an husband seven years from her virginity; And she was a widow of about fourscore and four years, which departed not from the temple, but served God with fastings and prayers night and day. And she coming in that instant gave thanks likewise unto the Lord, and spake of him to all them that looked for redemption in Jerusalem. And when they had performed all things according to the law of the Lord, they returned into Galilee, to their own city Nazareth."

Vespers: Flight into Egypt

- *Source 1, Matthew 2: 12-23*: "And being warned of God in a dream that they should not return to Herod, they departed into their own country another way. And when they were departed, behold, the angel of the Lord appeareth to Joseph in a dream, saying, Arise, and take the young child and his mother, and flee into Egypt, and be thou there until I bring thee word: for Herod will seek the young child to destroy him. When he arose, he took the young child and his mother by night, and departed into Egypt: And was there until the death of Herod: that it might be fulfilled which was spoken of the Lord by the prophet, saying, Out of Egypt have I called my son. Then Herod, when he saw that he was mocked of the wise men, was exceeding wroth, and sent forth, and slew all the children that were in Bethlehem, and in all the coasts thereof, from two years old and under, according to the time which he had diligently enquired of the wise men. Then was fulfilled that which was spoken by Jeremy the prophet, saying, In Rama was there a voice heard, lamentation, and weeping, and great mourning, Rachel weeping for her children, and would not be comforted, because they are not. But when Herod was dead, behold, an angel of the

Lord appeareth in a dream to Joseph in Egypt, Saying, 'Arise, and take the young child and his mother, and go into the land of Israel: for they are dead which sought the young child's life.' And he arose, and took the young child and his mother, and came into the land of Israel. But when he heard that Archelaus did reign in Judaea in the room of his father Herod, he was afraid to go thither: notwithstanding, being warned of God in a dream, he turned aside into the parts of Galilee: And he came and dwelt in a city called Nazareth: that it might be fulfilled which was spoken by the prophets, He shall be called a Nazarene."

- *Source 2, Arabian Gospel of the Childhood of Christ/Syriac Infancy Gospel*, chapters 12-26.
- *Source 3, Evangelium of Pseudo Matthew, chapters 17-25*.

Compline

Scene 1: Coronation of the Virgin

- *(Indirect) source, Kings, 2: 19*: "Bathsheba therefore went unto king Solomon, to speak unto him for Adonijah. And the king rose up to meet her, and bowed himself unto her, and sat down on his throne, and caused a seat to be set for the king's mother; and she sat on his right hand."

Scene 2: Death of the Virgin

Mary's death is not recorded in the scriptures

C.2B Office of the Virgin (Passion cycle)

Matins: Massacre of the Innocents

- *Gospel of Matthew, 2: 15-17*: "And was there until the death of Herod: that it might be fulfilled which was spoken of the Lord by the prophet, saying, Out of Egypt have I called my son. Then Herod, when he saw that he was mocked of the wise men, was exceeding wroth, and sent forth, and slew all the children that were in Bethlehem, and in all the coasts thereof, from two years old and under, according

to the time which he had diligently enquired of the wise men. Then was fulfilled that which was spoken by Jeremy the prophet"

C.3 Office of the Cross

Matins: Crucifixion

- *Source 1, Gospel of Matthew, 27: 33-55*: "And when they came to a place called Gol'gotha (which means the place of a skull), they offered him wine to drink, mingled with gall; but when he tasted it, he would not drink it. And when they had crucified him, they divided his garments among them by casting lots; then they sat down and kept watch over him there. And over his head they put the charge against him, which read, 'This is Jesus the King of the Jews.' Then two robbers were crucified with him, one on the right and one on the left. And those who passed by derided him, wagging their heads and saying, 'You who would destroy the temple and build it in three days, save yourself! If you are the Son of God, come down from the cross.' So also the chief priests, with the scribes and elders, mocked him, saying, 'He saved others; he cannot save himself. He is the King of Israel; let him come down now from the cross, and we will believe in him. He trusts in God; let God deliver him now, if he desires him; for he said, ńI am the Son of God.ż' And the robbers who were crucified with him also reviled him in the same way. Now from the sixth hour there was darkness over all the land until the ninth hour. And about the ninth hour Jesus cried with a loud voice, 'Eli, Eli, la'ma sabach-tha'ni?' that is, 'My God, my God, why hast thou forsaken me?' And some of the bystanders hearing it said, 'This man is calling Eli'jah.' And one of them at once ran and took a sponge, filled it with vinegar, and put it on a reed, and gave it to him to drink. But the others said, 'Wait, let us see whether Eli'jah will come to save him.' And Jesus cried again with a loud voice and yielded up his spirit. And behold, the curtain of the temple was torn in two, from top to bottom; and the earth shook, and the rocks were split; the tombs also were opened, and many bodies of the saints who had fallen asleep were raised, and coming out of the tombs after his resurrection

they went into the holy city and appeared to many. When the centurion and those who were with him, keeping watch over Jesus, saw the earthquake and what took place, they were filled with awe, and said, 'Truly this was the Son of God!' There were also many women there, looking on from afar, who had followed Jesus from Galilee, ministering to him."

- *Source 2, Gospel of Mark, 15: 24-39*: "And they crucified him, and divided his garments among them, casting lots for them, to decide what each should take. And it was the third hour, when they crucified him. And the inscription of the charge against him read, 'The King of the Jews.' And with him they crucified two robbers, one on his right and one on his left. And those who passed by derided him, wagging their heads, and saying, 'Aha! You who would destroy the temple and build it in three days, save yourself, and come down from the cross!' So also the chief priests mocked him to one another with the scribes, saying, 'He saved others; he cannot save himself. Let the Christ, the King of Israel, come down now from the cross, that we may see and believe.' Those who were crucified with him also reviled him. And when the sixth hour had come, there was darkness over the whole land until the ninth hour. And at the ninth hour Jesus cried with a loud voice, 'E'lo-i, E'lo-i, la'ma sabach-tha'ni?' which means, 'My God, my God, why hast thou forsaken me?' And some of the bystanders hearing it said, 'Behold, he is calling Eli'jah.' And one ran and, filling a sponge full of vinegar, put it on a reed and gave it to him to drink, saying, 'Wait, let us see whether Eli'jah will come to take him down.' And Jesus uttered a loud cry, and breathed his last. And the curtain of the temple was torn in two, from top to bottom. And when the centurion, who stood facing him, saw that he thus breathed his last, he said, 'Truly this man was the Son of God!'"
- *Source 3, Gospel of Luke, 23: 32-49*: "Two others also, who were criminals, were led away to be put to death with him. And when they came to the place which is called The Skull, there they crucified him, and the criminals, one on the right and one on the left. And Jesus said, 'Father, forgive them; for they know not what they do.' And they cast lots to divide his garments. And the people stood by, watching; but the rulers scoffed at him, saying, 'He saved others; let him save himself, if he is the Christ of God, his Chosen One!' The soldiers also mocked him, coming up and

offering him vinegar, and saying, 'If you are the King of the Jews, save yourself!' There was also an inscription over him, 'This is the King of the Jews.' One of the criminals who were hanged railed at him, saying, 'Are you not the Christ? Save yourself and us!' But the other rebuked him, saying, 'Do you not fear God, since you are under the same sentence of condemnation? And we indeed justly; for we are receiving the due reward of our deeds; but this man has done nothing wrong.' And he said, 'Jesus, remember me when you come into your kingdom.' And he said to him, 'Truly, I say to you, today you will be with me in Paradise.' It was now about the sixth hour, and there was darkness over the whole land until the ninth hour, while the sun's light failed; and the curtain of the temple was torn in two. Then Jesus, crying with a loud voice, said, 'Father, into thy hands I commit my spirit!' And having said this he breathed his last. Now when the centurion saw what had taken place, he praised God, and said, 'Certainly this man was innocent!' And all the multitudes who assembled to see the sight, when they saw what had taken place, returned home beating their breasts. And all his acquaintances and the women who had followed him from Galilee stood at a distance and saw these things."

- *Source 4, Gospel of John, 15: 24-39*: "So they took Jesus, and he went out, bearing his own cross, to the place called the place of a skull, which is called in Hebrew Gol'gotha. There they crucified him, and with him two others, one on either side, and Jesus between them. Pilate also wrote a title and put it on the cross; it read, 'Jesus of Nazareth, the King of the Jews.' Many of the Jews read this title, for the place where Jesus was crucified was near the city; and it was written in Hebrew, in Latin, and in Greek. The chief priests of the Jews then said to Pilate, 'Do not write, ńThe King of the Jews,ż but, ńThis man said, I am King of the Jews.ż' Pilate answered, 'What I have written I have written.' Then the soldiers had crucified Jesus they took his garments and made four parts, one for each soldier; also his tunic. But the tunic was without seam, woven from top to bottom; so they said to one another, 'Let us not tear it, but cast lots for it to see whose it shall be.' This was to fulfil the scripture, 'They parted my garments among them, and for my clothing they cast lots.'"

C.4 Office of the Holy Spirit

Matins: Pentecost

- *Source 1, Acts, 1:14*: "These all continued with one accord in prayer and supplication, with the women, and Mary the mother of Jesus, and with his brethren"
- *Source 2, Acts, 2:1-4*: "And when the day of Pentecost was fully come, they were all with one accord in one place. And suddenly there came a sound from heaven as of a rushing mighty wind, and it filled all the house where they were sitting. And there appeared unto them cloven tongues like as of fire, and it sat upon each of them. And they were all filled with the Holy Ghost, and began to speak with other tongues, as the Spirit gave them utterance"

C.5 Penitential Psalms

First psalm, scene 1: Samuel anoints king David

- *Source 1, 1 Samuel, 16: 1-13*: "And the Lord said unto Samuel, How long wilt thou mourn for Saul, seeing I have rejected him from reigning over Israel? fill thine horn with oil, and go, I will send thee to Jesse the Bethlehemite: for I have provided me a king among his sons. And Samuel said, How can I go? if Saul hear it, he will kill me. And the Lord said, Take an heifer with thee, and say, I am come to sacrifice to the Lord. And call Jesse to the sacrifice, and I will shew thee what thou shalt do: and thou shalt anoint unto me him whom I name unto thee. And Samuel did that which the Lord spake, and came to Bethlehem. And the elders of the town trembled at his coming, and said, Comest thou peaceably? And he said, Peaceably: I am come to sacrifice unto the Lord: sanctify yourselves, and come with me to the sacrifice. And he sanctified Jesse and his sons, and called them to the sacrifice. And it came to pass, when they were come, that he looked on Eliab, and said, Surely the Lord's anointed is before him. But the Lord said unto Samuel, Look not on his countenance, or on the height of his stature; because I have refused him: for the Lord seeth not as man seeth; for man looketh on the outward appearance,

but the Lord looketh on the heart. Then Jesse called Abinadab, and made him pass before Samuel. And he said, Neither hath the Lord chosen this. Then Jesse made Shammah to pass by. And he said, Neither hath the Lord chosen this. Again, Jesse made seven of his sons to pass before Samuel. And Samuel said unto Jesse, The Lord hath not chosen these. And Samuel said unto Jesse, Are here all thy children? And he said, There remaineth yet the youngest, and, behold, he keepeth the sheep. And Samuel said unto Jesse, Send and fetch him: for we will not sit down till he come hither. And he sent, and brought him in. Now he was ruddy, and withal of a beautiful countenance, and goodly to look to. And the Lord said, Arise, anoint him: for this is he. Then Samuel took the horn of oil, and anointed him in the midst of his brethren: and the Spirit of the Lord came upon David from that day forward. So Samuel rose up, and went to Ramah."

- *Source 2, Psalm 89: 20*: "I have found David my servant; with my holy oil have I anointed him".

First psalm, scene 2: Bathsheba bathing at the fountain

- *2 Samuel, 11: 2-3*: "And it came to pass in an eveningtide, that David arose from off his bed, and walked upon the roof of the king's house: and from the roof he saw a woman washing herself; and the woman was very beautiful to look upon. And David sent and enquired after the woman. And one said, 'Is not this Bathsheba, the daughter of Eliam, the wife of Uriah the Hittite?'"

First psalm, scene 3: David sends Uriah to die

- *2 Samuel, 11: 12-15*: "And David said to Uriah, Tarry here to day also, and to morrow I will let thee depart. So Uriah abode in Jerusalem that day, and the morrow. And when David had called him, he did eat and drink before him; and he made him drunk: and at even he went out to lie on his bed with the servants of his lord, but went not down to his house. And it came to pass in the morning, that David wrote a letter to Joab, and sent it by the hand of Uriah. And he wrote in the letter, saying, Set ye Uriah in the forefront of the hottest battle, and retire ye from him, that he

may be smitten, and die.

First psalm, scene 4: Death of Uriah

- *2 Samuel, 11: 16-17*: "And it came to pass, when Joab observed the city, that he assigned Uriah unto a place where he knew that valiant men were. And the men of the city went out, and fought with Joab: and there fell some of the people of the servants of David; and Uriah the Hittite died also."

C.6 Hours of the Dead

Vespers, scene 1: Feast of dives

- *Gospel of Luke, 16: 19-31*: "There was a certain rich man, which was clothed in purple and fine linen, and fared sumptuously every day, And there was a certain beggar named Lazarus, which was laid at his gate, full of sores, and desiring to be fed with the crumbs which fell from the rich man's table: moreover the dogs came and licked his sores. It came to pass, that the beggar died, and was carried by the angels into Abraham's bosom: the rich man also died, and was buried. In hell he lift up his eyes, being in torments, and seeth Abraham afar off, and Lazarus in his bosom. He cried and said, Father Abraham, have mercy on me, and send Lazarus, that he may dip the tip of his finger in water, and cool my tongue; for I am tormented in this flame. But Abraham said, Son, remember that thou in thy lifetime receivedst thy good things, and likewise Lazarus evil things: but now he is comforted, and thou art tormented. Beside all this, between us and you there is a great gulf fixed: so that they which would pass from hence to you cannot; neither can they pass to us, that would come from thence. Then he said, I pray thee therefore, father, that thou wouldest send him to my father's house: 'For I have five brethren; that he may testify unto them, lest they also come into this place of torment.' Abraham saith unto him, 'They have Moses and the prophets; let them hear them'. And he said, 'Nay, father Abraham: but if one went unto them from the dead, they will repent.' And he said unto him, 'If they hear not Moses and the prophets, neither will they

be persuaded, though one rose from the dead.'"

Vespers, scene 2: Rise of Lazarus

- *Gospel of John, 11: 38-44*: "Jesus therefore again groaning in himself cometh to the grave. It was a cave, and a stone lay upon it. Jesus said, Take ye away the stone. Martha, the sister of him that was dead, saith unto him, 'Lord, by this time he stinketh: for he hath been dead four days.' Jesus saith unto her, 'Said I not unto thee, that, if thou wouldest believe, thou shouldest see the glory of God?' Then they took away the stone from the place where the dead was laid. And Jesus lifted up his eyes, and said, 'Father, I thank thee that thou hast heard me. And I knew that thou hearest me always: but because of the people which stand by I said it, that they may believe that thou hast sent me.' And when he thus had spoken, he cried with a loud voice, 'Lazarus, come forth.' And he that was dead came forth, bound hand and foot with graveclothes: and his face was bound about with a napkin. Jesus saith unto them, Loose him, and let him go."

Vespers, scene 3: Job on the dung heap

- *Job, 2: 8-13*: "Job sat in a dunghill, and he shaved away the quitter of him with a shell. (and then Job sat on a hill of dung, and scratched his sores with a shell.) Forsooth his wife said to him, Dwellest thou yet in thy simpleness, that is, fondness? Curse thou God, and die. (And his wife said to him, Remaineth thou yet in thy integrity, that is, in thy foolishness? Curse thou God, and die.) And Job said to her, Thou hast spoken as one of the fond women; if we have taken goods of the hand of the Lord, why forsooth suffer we not evils? In all these things Job sinned not in his lips. (And Job said to her, Thou hast spoken like the foolish woman that thou art; if we have received good from the Lord's hand, then why should we not also suffer evil? And so in all these things Job did not sin with his lips.) And then three friends of Job heard (of) all the evil that had befallen to him, and they came to him, each of them from his place, Eliphaz (the) Temanite, and Bildad (the) Shuhite, and Zophar (the) Naamathite; for they had said together to themselves, that they would

come together, and visit Job, and comfort him. And when they had raised afar their eyes, they knew not him; and they cried [out], and wept, and rent their clothes, and sprinkled dust on their head(s) into heaven. (And when they had raised up their eyes from afar, they did not know him, or they could not recognize him; and they cried out, and wept, and tore their clothes, and sprinkled dust on their heads toward the heavens.) And they sat with him in the earth seven days and seven nights, and no man spake a word to him; for they saw, that his sorrow was great. (And then they sat on the ground with him for seven days and seven nights, and no one spoke a word to him; for they saw, that his sorrow was great.)"

D. Historical recipes of printing inks

D.1 *Libro dell'Arte*, Cennino Cennini (14th c.)

Chapter 173: The way to work on cloth by printing from a shape in colour

Translated version in English: As to the art of the brush yet appertains certain painting on linen cloth used for skirts (*garnelli*) of boys and children, and for certain church adornments (*leggi*) this is the way to do them. Have a frame made, as if for a linen-covered window, two ells (*bracci*) long, and one ell wide, covered on the laths with linen, or canvas. When you want to paint your linen (*pannolino*), any quantity, six or twenty ells, roll it all up, and put the top end of the stuff upon the frame; also have a board of walnut or pearwood, any way of a strong kind of wood, the size of a brick, which tablet must have designed and hollowed on it a wide band, in which must be designed, in the manner of any sort of silk stuff you like, either leaves or animals; and let the design be so arranged and engraved on the block that all four faces may match together to make a complete and connected pattern, and there must be a handle to be able to lift it. Put it on the other surface which is not engraved (*intagliati*). When you want to work take a glove for the left hand/and first grind some pine charcoal, very finely, with water. Then having thoroughly dried it at the sun or fire, grind it again dry, and mix it with liquid varnish, as much as is needful; and with a small ladle (*mestoletta*) take some of this black and spread it out on the palm of the hand, that is, over the glove ; and so smear it on the board where it is engraved, carefully, so that the engraving is not choked. Now, begin putting it (the engraved tablet) regularly and equally upon the cloth stretched upon the frame, putting it underneath; take in the right hand a shield-shaped board (*scudella* or *scudellino*) and with the back of it rub hard over the part where the tablet is engraved; and when you have rubbed, till you are sure that the colour must be well incorporated with the cloth or linen, remove your block, put pigment on it again, and very methodically replace it, till the whole piece of stuff is quite full [...][1].

Original version in Italian Vernacular: *Perchè all'arte del pennello ancora s'appartiene di certi lavorii dipinti in panno lino che son buoni da guarnelli di putti o ver fanciulli, e per certi leggii da chiese, el modo del lavorarli si è questo. Abbi un telaio fatto sì come fusse una finestra impannata, lungo dua braccia, largo un braccio, confitto in su regoli pannolino o vuoi canovaccio. Quando vuoi dipignere il tuo*

[1] Translation from Herringham, *The Book of the Art of Cennino Cennini: A Contemporary Practical Treatise on Wuattrocento Painting*, pp. 158-159.

pannolino una quantità di sei o di venti braccia, avvolgilo tutto, e metti la testa del detto panno in sul detto telaio; e abbi una tavola di noce o di pero, pur che sia di legname ben forte, e sia di spazio come sarebbe una prieta cotta o vero mattone: la quale tavoletta sia disegnata e cavata una grossa corda; nella quale vuole essere disegnato d'ogni ragione drappo di seta che vuoi, o di foglie o d'animali; e fa' che sia in forma distagliata e disegnata, che le facce tra tutte e quattro vengano a riscontrarsi insieme e fare opera compiuta e legata; e vuole avere manico da poterla levare, e porre in su l'altra faccia che non è intagliata. Quando vuoi lavorare, togli un guanto in mano sinistra, e prima macina del negro di sermenti di vite, macinati sottilissimamente con acqua. Poi, asciutto perfettamente o con sole o con fuoco, puoi da capo macinarlo a secco, e mescolarlo con vernice liquida, tanto che sia bastevole; e con una mestoletta togli di questo negro, e spianatene su per la palma della mano, cioè sopra il guanto; e così ne va' imbrattando l'asse dove è intagliata, bellamente, che l'intaglio non si riempiesse. Comincia, e mettila ordinata e gualiva, e sopra la detta tela distesa in sul telaro, e di sotto dal telaro: togli in mano destra una scudella o scudellino di legno, e col dosso frega fortemente per quello spazio quanto l'asse intagliata tiene; e quando hai tanto fregato, che credi bene che 'l colore sia bene incarnato colla tela o ver pannolino, leva la tua forma su, rimettivi colore da capo, e per grande ordine rimetti al detto modo tanto che compiutamente fornisca tutta la pezza.

D.2 *De secretis libri septem*, Alessio Piemontese (1564)

How to make ink for writing which yields large amounts, in short time, at low expense, being still perfect

Translated version in English: How to make ink to write in huge quantity and fast, at low expense, and that will still be perfect. And how to make another one for printing. Take that pigment used by those who dye leather, for you will have it at a good price. Take then cuttlefish, or fish lees, that will cost you almost nothing, especially in coastal cities like Venice. Here, you will have a *cantolo*[2][3] of said fish for three or four *marcelli*[4], and eating the fish, you can take the matter from time to time. Then mix the soybeans of cuttlefish with the same dye for leather, which will certainly be perfect ink. And if you still wish to improve the texture, you can put on the aforementioned carbon powder, vitriol, and gall and rubber. That ink will still be good to print with copper prints adding a little bit of paint and a little bit of linseed oil. In this way, it can penetrate the thickness, or the carved holes of the print, and it is so tenacious that it can be put on top of the paper without spreading[5].

Original version in Italian Vernacular: *Piglia di quella tinta che avanza a coloro, che tingono corami, che ne averai molta per pochissimo prezzo, e piglia poi fele di seppie, o fecce pesci, che medesimamente*

[2] A *cantolo*

[3] Probably, it is a unit of measure.

[4] It is a currency used in 1473-4 under the doge Nicolò Marcello, after whom it was titled.

[5] From Ruscelli, *Secreti del Reverendo Donno Alessio Piemontese: Nuovamente posti in luce. Opera vtile, et necessaria universalmente à ciascuno.* pp. 188-189. Translation by this manuscript's author.

verrà a costarti quasi niente, e principalmente in terra di mare, come in Venezia, ove averai un cantaro di detto pesce per tre o quattro marcelli, e mangiando il pesce, potrai serbar da parte il fiele di volta in volta. Mescola poi detti fieli di seppie con la detta tinta di corameri, che senz'altro sarà inchiostro perfetto. E volendo ancor migliorare, mettivi della sopradetta polvere di carbone, di vetriolo, e di galla e gomma. E quello inchiostro sarà ancora ottimo a stampare con stampe di rame, aggiungendovi un poco di vernice, ed un poco d'olio di lino, di modo che venga corrente in se stesso da poter penetrar nello spessore, o intagli della stampa, e che sia poi tenace da rendersi sopra la carta senza spargersi, o diffondersi in largo e far lettera bavosa.

[Ink to print letters], second part of above

Translated version in English: Then, the ink used to print letters is made of smoke only, as above is said, and it is dissolved with liquid paint. You can make it more liquid or harder according to your need. The hardest is always the most black, clearest, and glossy. But in case, you must keep on mixing it very well. And to make it liquid, as it is called, put more linseed oil, or even walnut. To make it harder use less oil, more lampblack, and heat it up more.

Original version in Italian Vernacular: *L'inchiostro poi da stampar lettere, si fa di solo fumo di ràgia, come di sopra è detto, e si stempera con vernice liquida, e si cuo ce un poco facendolo più liquido e più duro secondo il bisogno, ed il verno bisogna che sia più liquido, e la state più duro, e sempre il più duro fa il più negro, più netto, e più lustro. Ma in qualunque modo vuol esser benissimo mescolato sempre. E per farlo liquido, com'è detto, si mette più olio di seme di lino, o ancor di noce della vernice. Per farlo duro si mette manco olio, e più fumo, e si scalda di più.*

D.3 *De Atramentis*, Petro Maria Canepario (1619)

Translated version in English: [there is also] another ink for printers that Antonius Musa Brasaolus described in his book, The Scroll of the Earth. He writes [that]: the ink of the Chalcographers, which is the same as that of Printers, is made from oil and the soot of pitch. Soon others made a kind of ink for types with smoke [pigment], or soot, and flax seed oil. When they are mixed in the same oil, they make an ink just like the one for printers. Besides that, it is the blackest of them all, and the stickiest. Nevertheless, those who print with types in more recent times, created a different ink, which is also used nowadays. Although in some respects it may seem nearest to others and almost of the same nature, yet it is quite different from them; in fact it is better than the others when used for printing. For that reason I will indicate the way in which it is made. As I said, it is ground thin. For that purpose they use one pound of common liquid varnish, which is made from the Arab sandarac, which is the gum of juniper and flax seed oil. Mixing them together, is they make a certain varnish, which is called liquid varnish.

Original version in Latin: *aliud Typographicum atramentum, quod recensuit Antonius Musa Brasauolus libro examinis terrarum, inquit, enim fieri hoc sequens atramentum Chalcographorum, quod & Typographo-*

rum est idem, & constabat ex picis fuligine, & oleo: mox vero alii composuerunt pro Typis atramentum ex fumo siue fuligine, dicas olei seminis Iini, & eum eodem oleo lini adinuicem permistis hoc atramentum fuligineum aequalius quidem est, nigerrimum praeterea atque maxime haeret: nihilominus omnium Recentiores, qui literas cudunt imprimuntque omissis reliquis atramentis aliud composuerunt; quo hodierno tempore vtuntur hoc quamuis aliis proximum atque eiusdem fere naturae in aliqua parte videatur attamen satis distat ab eis: verum hoc etiam melius aliorum pro Typorum vsu succedit, iccirco modum componendi eum referam: Qui magis prout dixi tritus est: Accipiunt ergo vernicem liquidam communem ad põdus vnius librae, haec autem constat ex sandaraca Arabum, quae est gumma iuniperi, & oleo seminis liui, ex his itaque ad inuicem mistis constituta est vernix, quae liquida appellatur.

D.4 *Vocabolario Toscano dell'arte e del bel disegno*, Filippo Baldinucci (1681)

Ink for printers

Translated version in English: [...] It is the ink in use among printers, [made] with lampblack and liquid varnish. Besides, they also employ other coloured inks: red, blue, green, yellow and other. To make these, the varnish must be clear, and they use turpentine instead of liquid varnish[6].

Original version in Italian Vernacular: *[...] Quello che adoprano li stampatori di caratteri: colla di nero di fumo, e di vernice liquida. Ne fanno ancora di diversi colori, come rosso, turchino, verde, giallo, e d'altri; ma per questi bisogna che la vernice sìa di quella che è chiara bene, & in luogo di essa si servono della trementina.*

Ink for printers on copper plates

Translated version in English: This is the ink used in intaglio copper engraving, namely, burin and aquatint. It is made with a black earth, or printers' pigment[7], that is reduced to finer particles on grinding slab and mixed to boiled linseed oil, similarly to pigments for painting. In France, they use another variety prepared with barrel tartar fired with boiled walnut oil. They start the fire and keep it burning as long as required, depending upon the desired texture, say, liquid or firm. This mixture is said to be termed ink after such processing, from the Greek word and Latin *Incaustum*, which means "burnt". The pigment is later reduced to finer grain by grinding is together with the oil. And you have to keep it warm, if you wish to spread on the copper plate. Paper is dampened during the process in that way, that is: they dampen two sheets, and between every two wet sheets they place one dry, leaving them crammed tightly there for

[6]Retrieved from: https://archive.org/details/vocabolariotosca00bald/page/74/mode/2up?q= (Accessed February 26, 2022). Translation by this manuscript's author.

[7]Original: *terra da stampatori*.

twelve hours and well packed. Then, they put them in place, dampening again before and inking the copper plate with the palm of the hand, and with the small bunch[8].

Original version in Italian Vernacular: *[...]* Quello che adoprano coloro, che stampano i rami intagliati, ossìa a bolino, e con acquaforte. È composto di una sorta di terra nera, che si chiama, terra da Stampatori, la quale si macina fu la pietra come tutti i colori de' Pittori, e ridotta in polvere s'incorpora sulla medesima pietra con olio di lino ben cotto. In Francia usano un'altra sorta d'inchiostro, che fanno con tartaro di botte arso con olio di noce cotto, con appiccami dentro la fiamma, tenendovela quanto occorre, secondo che l'inchiostro vorranno far liquido o sodo, dal qual' abbruciamento par che sia detto inchiostro, quasi , voce Greca, che è lo stesso che in Latino Incaustum, che vuol dire arso. Poi lo macinano sopra pietra insieme coll'olio in tal modo abbruciato; e volendolo dare sopra il rame, mantengon sempre esso rame caldo. L'impressione fanno sopra carta bagnata; e bagnano la carta in quello modo, cioè: bagnano due fogli, e fra ogni due fogli bagnati ne pongono uno non bagnato, lasciandoli stare così ammassati per dodici ore in circa e ben caricati, e poi gli mettono in opera, nettando prima bene il rame inchiostrato con la palma della mano, e col mazzo piccolo.

[8]Retrieved from: https://archive.org/details/vocabolariotosca00bald/page/74/mode/2up?q= (Accessed February 26, 2022). Translation by this manuscript's author.

D.5 List of materials from the dominican printshop of Ripoli (Italy, 1476-1484)

Table D.1: Table of the materials employed in the Ripoli printing office (1476-1484) Press established in Florence's Dominican nunnery. From Vincenzo Fineschi. *Notizie storiche sopra la stamperia di Ripoli*. Firenze: Francesco Moiicke, 1781, p. 49, and the English adaptation by Ad Stijnman.

Italian original	**Costs in lira**	**English translation**
Olio di lino	3.10 per lib.	Linseed oil
Trementina	-0.4 per lib.	Turpentine resin
Pece greca	-0.4 per lib.	Greek pitch (=resin)
Pece nera	- 0.18 per lib.	Black pitch (=resin)
Marcassita	3. - per lib.	Bismuth (Sb) or marchesita
Cinabro	-0.5 per lib.	Vermilion
Ragia	-0.3 per lib.	Resin
Vernice solida	-0.8 per lib.	Strong varnish
Vernice liquida	-0.12 per lib.	Liquid varnish
Galla	-0.4 per lib.	Gall nuts
Vetriolo	-0.4 per lib.	Vitriol [Fe(II) sulfate][9]
Lacca	-0.34 per lib.	Lake ([red]? dyestuff][10]

E. Historical info on the studied treatises on painting

E.1 Selected technical treatises

- *Schedula diversarum artium* (= On Diverse Arts), by Theophilus Presbyter (Germany, *c.* early twelfth century)[1]. It is a technical treatise on several artistic crafts, ranging from painting to glassmaking and metalworking. Divided into three books, the *Schedula* appears as an organic work rather than a collectanea, as evidenced by the structure of its contents. Each book covers a certain group of arts, and each book consists of a coherent series of chapters (instead of recipes). The first volume is dedicated exclusively to the preparation and use of painting materials: it outlines procedures for material selection, synthesis, grinding, mixing, building up layers of paint and gilding. Among the long list of chapters, the first part is devoted to the techniques for rendering figurative patterns[2], the rest to the materials of painting and writing[3]. The *Schedula diversarum artium*'s text has survived in a large number of manuscript copies[4]. About its contents, the original text has been published several times with English and German translations[5], but scholars placed its

[1] The work is widely known as Schedula diversarum artium (= List of various arts) or simply De diversis artibus (= On Diverse Arts).

[2] Chs. 1-16.

[3] Chs. 17-38.

[4] Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts" reports that three are the oldest and most complete copies: one in Vienna, Austria (National Bibliothek, MS 2527), another in Wölfenbiittel, Germany (Wölfenbiittel Herzogliche Bibliothek, Gudeanus Lat. 2o 69) and the last one in London, UK (British Museum, MS Harley 3915). The Thomas-Institut of the University of Cologne gives a complete list of the known copies for this source. See https://schedula.uni-koeln.de/, "Manuscripts" section (Accessed December 14, 2021).

[5] Among the former group, the most relevant are those by Dodwell and Hawthorne. See Charles Reginald Dodwell. *The Various Arts: De Diversis Artibus*. Oxford: Clarendon Press, 1961; Hawthorne et al.,

writing between 1100 and 1120[6]. Concerning its relationship to miniature painting, the *Schedula* includes a selection of chapters specifically devoted to it. For instance, Chapters 28-30, 32[7] refer specifically to methods for painting books. As for the preparations of pigments, no clear specification of destination is found in individual chapters of pigments; only Chapter 32 discourages from the use of certain pigments[8]

- *De Arte illuminandi* (= On the Art of Illuminating), anonymous (Italy, fourteenth century[9]). This treatise is a collection of headings, being exclusively dedicated to miniature painting. Its only known copy is untitled and part of a manuscript of the National Library of Naples, Italy (MS XII E 27)[10]. The copy in Naples contains recipes for the preparation of pigments, mixtures and their use for illuminated manuscripts. Like Theophilus' work, it contains recipes for the preparation of artificial inorganic pigments and for the synthesis of several organic lakes, plant extracts and for their mixing in binding media. Additionally, the manuscript contains a short note on how to paint human figures[11]. Although the copy in Naples is the only extant manuscript version, the strongest reason to believe that

Theophilus: On Divers Arts. More recently, the text underwent a major critical revision by Clarke based on a copy in Montpellier, France (Bibliothèque de la Faculté de Médecine MS H277, c. 1431, also known as "Montpellier manuscript"; see Mark Clarke. *Mediaeval painters' materials and techniques: the Montpellier Liber diversarum arcium*. London: Archetype, 2011).

[6]The exact period of creation has been disputed, but the paleographic inspection of the copies of Vienna and Wölfenbiittel suggested the early twelfth century as the most likely period of creation (see Dodwell, *The Various Arts: De Diversis Artibus*; Hawthorne et al., *Theophilus: On Divers Arts*; Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts").

[7]"Grinding gold and casting the mill"(ch. 28), "How [powdered] gold and silver are applied in books" (ch. 29), "How pictures in books are decorated with tin and saffron" (ch. 30), "How colours are prepared for books" (ch. 32).

[8]Namely salt green, but it recommends the use of Spanish green.

[9]The dating has been proposed by Salazaro Lecoy and was later confirmed by Lecoy. See Albert Lecoy de La Marche. *L'art d'enluminer : manuel technique du XIVe siècle*. Paris, 1887, p. 3; Demetrio Salazaro. *L'arte della miniatura nel secolo XIV. Codice della Biblioteca nazionale di Napoli messo a stampa*. Napoli: R. Cáccavo, 1877, p. xiii.

[10]According to Brunello, the name "*De Arte illuminandi*" only appears in the library catalogue. Later, this treatise has been inspected palaeographically by Salazaro, technically by Lecoy and Guareschi. Besides, this booklet has been translated into English and further studied by Thompson. See Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, p. 25; Icilio Guareschi. *Osservazioni sul 'De arte illuminandi' e sul manoscritto bolognese (Segreti per colori)*. Torino: Carlo Clausen, 1905; Lecoy de La Marche, *L'art d'enluminer : manuel technique du XIVe siècle*; Salazaro, *L'arte della miniatura nel secolo XIV. Codice della Biblioteca nazionale di Napoli messo a stampa*; Daniel Varney Thompson et al. *An Anonymous Fourteenth-Century Treatise: De Arte Illuminandi. The technique of manuscript illumination*. Translated from the Latin of the Naples ms. XII. E.27. New Haven, CT: Yale University Press, 1933.

[11]Marginal note to Heading 28. See Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, pp. 132-133.

the methods and techniques it describes were widely accepted is the fact that its contents match other literary sources. As two cases in point, the use of indigo for painting is also recommended by another major technical treatise of the same period, *Libro dell'Arte* (Cennino Cennini, early fourteenth century[12]); likewise, *De Arte illuminandi*'s preparation of folium, another natural colour, is compatible with Theophilus' *Schedula* and other later treatises[13]

- *Liber de Coloribus Illuminatorum sive Pictorum* (= Book on Colours for Illuminators or Painters), anonymous (France[14], fourteenth century[15]). Retrieved within Sloane Ms. 1754 (fols. 142^{v}-149^{r}), it was first published was as a journal article by Thompson . He provided a short introduction with essential information yet did not delve into a detailed analysis of the treatise's contents. Besides, the manuscript he transcribed and duly translated is structured into twenty chapters, describing the preparation of pigments, gilding, their grinding, mixing to vehicles and laying on a substrate. Additionally, the *Liber de Coloribus* contains several instructions specifically addressed to illuminators to indicate the most appropriate binders for certain pigments[16], or which mixtures to avoid[17].
- *Liber de coloribus faciendis* (= Book on How to Make Colours), Peter of St. Audemar (northern France, late thirteenth-early fourteenth century[18]). Very little or nothing is known about its author; the original hypothesis of Mrs. Merrifield is

[12] Two of these recipes are that to dye blue paper (ch. 19) and another to fake azurite pigment (ch. 61). See also Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, p. 27.

[13] See later.

[14] Such is the opinion of Thompson based on the mention of several French localities or French-related materials: *green of Rouen* (rec. 6), Tours and Paris (rec. 7) for the quality of pigments. See Daniel Varney Thompson. "Liber de Coloribus Illuminatorum Siue Pictorum from Sloane Ms. No. 1754". In: *Speculum* 1.3 (1926), pp. 280–307. DOI: https://doi.org/10.2307/2847412.

[15] According to Thompson, the date should fall in the beginning of the fourteenth century; according to Vinas, the date should be pushed to the end of the century. See Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts"; Thompson, "Liber de Coloribus Illuminatorum Siue Pictorum from Sloane Ms. No. 1754".

[16] For instance, as he strongly discourages from mixing red lead, lead white and "carmine" in natural gums (Ch. 14) or when he allows the use of any protein-based media for mixing natural ultramarine (Ch. 12).

[17] Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts".

[18] The sole chronological attribution is from Sir Charles Lock Eastlake. *Materials for a History of Oil Painting*. London: Longman, Brown, Green, & Longmans, 1847, p. 45, who dated it to the late thirteenth century-early fourteenth century (see also Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts"; Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms of Jean Le Begue, p.112).

that he was French. She claimed that the manuscript itself affords evidence of the author's provenance, owing to the mention of French-related material along it[19]. Other later authors supported that because of the interpretation of the author's name. "St. Audemar" could be interpreted as "St. Omar", a locality situated in northern France[20]; thus, the author could be native to the area or have compiled the collection while living there. Little information exists also in relation of the circumstances of writing for this collection, for it is known only in the collection compiled by Jean Le Bégue (1431) and a few contemporary publications[21]. The *Liber de Coloribus* includes a fairly wide number of recipes[22] describing the preparation of pigments and mixtures for several pictorial applications, along with recommendations on the proper ways to use materials according to each art. Thus, this treatise is not specifically devoted to illumination, yet it contains useful information for use on miniature painting[23]. The most important instructions on book painting come from Recipe no. 197 ("How and with which vehicles to temper colour for painting in books"[24]), because it suggests clearly which media are for use in illumination, and which pigments to avoid.

- *De coloribus diversis modis tractatur* and *De coloribus diversis modis tractatur* (= On Diverse Ways of Preparing Colours; On Diverse Colours), by Johannes Alcherius (France, early fifteenth century). Johannes Alcherius[25] lived between

[19]One case in point is the mentioned "*Rothomagensian green*" or "*Rouen green*" (a pigment which belongs to the class of verdigris); another proof is in the "*warancia*", an old French word standing for "madder" (Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms. of Jehan Le Begue, p.112).

[20]Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*, p. 16.

[21]Mrs. Merrifield gave the first notice and English translitteration of the collection, along with the other manuscripts from Le Bégue's collection (Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms. of Jehan Le Begue). Later, Thompson edited the manuscripts and made some correction to Merrifield's version (Daniel Varney Thompson. "The Liber magistri Petri de Sancto Audemaro de coloribus faciendis". In: *Technical Studies in the Field of the Fine Arts* 4 (1935), pp. 28–33).

[22]Over sixty.

[23]Explicit mentions to miniature painting occur sparingly, like in Recipe 172 ("How to make a black colour in various manners").

[24]"When mixing colours for painting in books, make a vehicle of the clearest gum Arabic and water, as before, and mix with it all colours except green and ceruse, minium, and carmine. Salt green is of no use in a book. Spanish green you must temper with wine, and if you wish to shade it, add a little of the juice of sword grass, or cabbage, or leak. You must mix minium and ceruse, and carminium, with white of egg. Grind azure with soap, and wash it, and mix it with white of egg." Edition and translation by Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms of Jean Le Begue, pp.156-157.

[25]Also called "Jean" or "Giovanni" "Alcerius", "Archerius" or "Alchero" (Hourihane, *The Grove Ency-*

northern Italy and Paris[26]. He is known for three collections of recipes which he gathered in two consecutive periods of traveling around Italy and France: one after a first arrival in Paris in 1382 (*De coloribus diversis modis tractatur*), the remaining two before a second return to the city in 1410 (*Experimenta de Coloribus* and *De coloribus diversis modis tractatur*)[27]. During his wandering, Alcherius made contact with several artists, craftsmen and clerics who shared with him technical recipes discussing a wide range of artistic crafts, including illuminating. Alcherius took the best part of the first original collection (*Experimenta de Coloribus*, recs. 1-99) from a book borrowed by an Italian monk, Fra Dionisio[28]; the rest of it (recs. 100-116) came from the Italian painter Giovanni da Modena[29]. The entire second original collection seems to be dictated by Jacques Coene, a Flemish illuminator ac-

clopedia of Medieval Art and Architecture, p. 29). Over time, a number of hypothesis were formulated regarding his identity: some authors have identified him as a painter (Charles Cailhol. "Sources bibliographiques pour l'étude des pigments utilisés en peinture jusqu'au XVe siècle". In: *Revue des Sociétés Savantes de Haute-Nonnandie* 20 (1960), pp. 23–53, p. 36); other proposed he could be an agent of Giangaleazzo Visconti, Duke of Milan (Otto Pächt. "Early Italian nature studies and the early calendar landscape". In: *Journal of the Warburg and Courtauld Institutes* 13.1/2 (1950), pp. 13–47. DOI: https://doi.org/10.2307/750141, p. 14, note 4;Colin Eisler et al. *The Prayerbook of Michelino da Besozzo*. Introduction by Colin Eisler, legends by Patricia Corbett and Colin Eisler. Reproduced from the illuminated manuscript (M 944) belonging to the Pierpont Morgan Library. New York, NY: The Pierpont Morgan Library and George Braziller, 1981, p. 14) or of Jean, Duke of Berry (Martin Warnke. *The Court Artist: On the Ancestry of the Modern Artist*. Cambridge and New York, NY: Cambridge University Press, 1993, p. 25). Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420" found evidence of a relationship with the Church from multiple associations with northern Italian clerics.

[26]According to Tumer, Alcherius remained in Milan until 1382, after which date he may have moved to Paris. Nearly a decade later (1398), he could have returned to northern Italy for some time; however, he returned to Paris in 1410. See Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420".

[27]Tumer assumed that the writings from Alcherius were meant to have a stratified nature starting from an original core (Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420"). In other words, Alcherius may have elected to add new collections to a main body instead of organising the recipes logically. In fact, the first collection, *Experimenta de coloribus*, is followed by several texts that maintain their own structure (Hourihane, *The Grove Encyclopedia of Medieval Art and Architecture*, p. 29). The closest succession of treatises is known from the copy that Mrs. Merrifield inspected (Paris, BnF, Ms. 6741, see Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms, of Jehan Le Begue). The opening collection is *Experimenta de coloribus*, followed by the corpus of Eraclius and Peter of St. Audemar, then by *De coloribus diversis modis tractatur* and *De diversis coloribus* as the conclusion of the series of Mss. from Alcherius as well as the manuscripts from Jean Le Bégue.

[28]This section seems to have been gathered around March 1408 (Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms of Jean Le Begue, pp.4-5; Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts").

[29]Probably before 1410, during his frequent economic relations across northern Italy (Genoa, Bologna, Milan and Bologna). See Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol.1, Ms, of Jehan Le Begue, p. 9.

tive in Paris[30]; the third and final original collection also contains instructions from a French illuminator, Antoine de Compiégne[31]. These recipes discuss exclusively the preparation of pigments and mixtures. Among them, the best part indicates instructions to synthesise lakes and organic colourant from various dyestuffs, some to prepare grounds for gold leaf, achieve metallic effects, to ground blue inorganic pigments, to produce corrosion products of metallic copper as green pigments and to prepare binding agents[32]. As Tumer noticed[33], the most relevant pigments used to illuminate manuscripts do not appear, probably because Alcherius meant the treatise as an appendix to the most known as a supplement to a main text[34] that already discussed extensively the preparation and use of more "traditional" materials. Also, the extensive description of organic colourants from Alcherius' text is exceptionally rich and more varied than any treatise touching miniature painting.

- *Strasbourg tradition* (Germany, early fourteenth-late sixteenth century). This line originates in the so-called *Strasbourg manuscript*. "Strasbourg manuscript" is a given name to a manuscript produced in the German area in the fifteenth century[35],

[30] Jacques Coene was a south Netherlandish painter originally from Bruges, probably based in Paris around 1398. Coene's identity has long being disputed, mostly because all records about him come from indirect sources (such as Alcherius' writings). On him, see Hourihane, *The Grove Encyclopedia of Medieval Art and Architecture*, p. 156.

[31] Hourihane, *The Grove Encyclopedia of Medieval Art and Architecture*, p. 29; Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420".

[32] Villela-Petit, "Copies, reworkings and renewals in late medieval recipe books"; Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420".

[33] Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420".

[34] In the manuscript to which Mrs. Merrifield referred for the translation (BnF, Ms. Lat. 6741), three literary works precede the collection of Alcherius. The first of which in line is an ancient technical treatise, *De coloribus et artibus Romanorum* (= On Roman Colours and Arts) by Eraclius, the second is the first book of Theophilus' *Schedula*; the last in order are the mentioned recipes by Peter of St. Audemar. Mrs Merrifield and Tumer's shared opinion is that the MS of Eraclius, and the accompanying writings of Peter of St. Audemar could constitute a block collected by the same Alcherius, and that this block represented the original text of his treatise. Also, their common opinion is that the joint text, namely the block and the supplement, may have been handed to Jean Le Bégue, who merely transcribed it. See Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms, of Jehan Le Begue; Tumer, "The recipe collection of Johannes Alcherius and the painting materials used in manuscript illumination in France and Northern Italy, c. 1380-1420".

[35] Estlake was positive that the manuscript was written in the last quarter of the fourteenth century, based on a palaeographic assessment (Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts"); the historian Berger disagreed, and dated its composition to the fifteenth century. The historian Neven's comprehensive analysis (see later) proposed a different opinion: she proposes that the oldest recipe should date earlier than 1412 (based on documentary evidence of

originally preserved at the Strassburger Stadtbibliothek (Ms. A VI 19). Unfortunately, in 1870, a fire in the library destroyed the original copy, which could partly survive through the handwritten notes made of Sir Charles Eastlake[36] (now preserved in the National Gallery, London)[37]. A century later, art-technical scholarship on German recipe books individuated important parallels across numerous items[38]. More specifically, the methodologies from these books were so comparable and numerous that the above corpus was specially designated as the "Strasbourg Family". Later, Sylvie Neven undertook the latest grammatical review of the *Strasbourg manuscript*, along with a comparative review of its contents with those from the "Strasbourg Family" in order to define its membership to a local artistic tradition, its patterns and evolution over time (which she calls "Strasbourg tradition")[39]. The Strasbourg manuscript, both according to the "traditional" critical perspective and the Neven's "renewed" outlook (including the "Strasbourg tradition"), exam-

Colmar's life) while the most recent should date back to the seventeenth century. See Neven, *The Strasbourg manuscript : a medieval tradition of artists' recipe collections (1400-1570)*, p. 59; Ernst Berger. "Quellen und Technik der Fresko- : Oel- und Tempera-Malerei des Mittelalters von der byzantinischen Zeit bis Einschliesslich der 'Erfindung der Oelmalerei' durch die Brüder Van Eyck". In: (1897).

[36] See Daniel Varney Thompson. "The Strasburg Manuscript, A Medieval Painter's Handbook Translated from the Old German. Viola Borradaile , Rosamund Borradaile". In: *Speculum* 43.1 (1968), pp. 125–126. DOI: https://doi.org/10.2307/2854806; Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts"; Sylvie Neven. "The Strasburg family texts: Originality and Survival. A survey of illuminating techniques in medieval South Germany". In: *Revista de História da Arte* 1 (2011). série W, pp. 75–85. A few decades after the fire, the German scholar Berger copied Eastlake's notes to publish them as a German translation in three volumes (Berger, "Quellen und Technik der Fresko- : Oel- und Tempera-Malerei des Mittelalters von der byzantinischen Zeit bis Einschliesslich der 'Erfindung der Oelmalerei' durch die Brüder Van Eyck"). A similar effort of translation was that of the Borradaile sisters, who endeavoured to render Sir Eastlake's notes into English in a dedicated monography (Viola Borradaile et al. *The Strasburg manuscript; a medieval painters' handbook*. Translated from the Old German. New York, NY: Transatlantic Arts, 1966). The Borradailes' edition was the only available in English before Neven's major revision. Sir Eastlake contributed much more than copying the reference manuscript. In fact, he also made a critical review of the comments of the manuscript within his monography on the pictorial materials applied to several pictorial crafts (Eastlake, *Materials for a History of Oil Painting*, pp. 126-141).

[37] Copy labelled under the access number 75,023 STR.

[38] Neven refers to the studies by Oltrogge and Ploss' teams. See Neven, "The Strasburg family texts: Originality and Survival. A survey of illuminating techniques in medieval South Germany"; Doris Oltrogge. "The Cologne database for painting materials and reconstructions". In: *Art of the Past: Sources and Reconstructions*. Ed. by Mark Clarke et al. London: Archetype Publications, 2005. Chap. 4, pp. 9–15; Emil Ernst Ploss. *Ein Buch von alten Farben - Technologie der Textilfarben im Mittelalter mit einem Ausblick auf die festen Farben*. Heidelberg and Berlin: Impuls Verlag Heinz, 1962.

[39] Based on a philological and codicological inspection, she selected a total of fifteen manuscripts (Neven, *The Strasbourg manuscript : a medieval tradition of artists' recipe collections (1400-1570)*, p. 29). Part of her findings produced a database presented in Neven, "The Strasburg family texts: Originality and Survival. A survey of illuminating techniques in medieval South Germany".

ines topics related to various crafts, ranging from illuminating to metalworking, with deep insights into such auxiliary arts as polychromy, mural painting, dyeing, preparation and colouring of parchment supports. Besides, the "traditional" structure (given in Berger's version) and the latest rearrangement (from Neven) of the *Strasbourg manuscript* agree to assign the instructions related to miniature painting to a first section[40]. This part of the Strasbourg manuscript should correspond to the recipes transmitted by Heinrich von Lübeck (on pigment grinding and preparation)[41] and by Andreas von Colmar (on miniature painting[42]). Most art-technical scholarship on medieval painting techniques has regarded the contents of the *Strasbourg manuscript* a work of considerable importance, for a major reason. In fact, this recipe is the oldest extant document written in German and accordingly, the oldest reference for the northern European technique of painting.

E.2 Reasons for selecting those technical texts

The list of the considered treatises is intentionally essential, for a two-fold rational. One the one hand, selecting was necessary, mostly due to the number of available sources. On the other hand, the number of selecting criteria was large: period of composition or use (as close it could get to the sixteenth century), a treatise's membership to the central and northern techniques of painting and obviously, a special dedication to miniature painting.

The *Schedula diversarum artium* meets those criteria for two main reasons. First of all, because of its early dating and area of reference (twelfth century, Germany). Despite the fact that the technical text's historical relevance until the eighteenth century has not fully clarified[43], the described materials and methods reflect the artistic practices of central and

[40]First book of Berger, "Quellen und Technik der Fresko- : Oel- und Tempera-Malerei des Mittelalters von der byzantinischen Zeit bis Einschliesslich der 'Erfindung der Oelmalerei' durch die Brüder Van Eyck", first section of Neven, *The Strasbourg manuscript : a medieval tradition of artists' recipe collections (1400-1570)*. See also Neven, "The Strasburg family texts: Originality and Survival. A survey of illuminating techniques in medieval South Germany".

[41]Neven, *The Strasbourg manuscript : a medieval tradition of artists' recipe collections (1400-1570)*, pp. Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts".

[42]Neven, *The Strasbourg manuscript : a medieval tradition of artists' recipe collections (1400-1570)*, p. 29; Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts".

[43]The *Schedula diversarum artium* gathered mixed opinions. One side is that of Ian Chilvers. *The*

northern Europe[44]. Also, the first book of the *Schedula* was assembled to the block of Le Bégue's manuscript[45], suggesting its relevance in the context of the fifteenth century artistic practices in France. Secondly, among all mentioned treatises, the first book of the *Schedula* contains the most detailed instructions on pigment mixing, layering and outlining. The book intends to be rather clear on the pigments to use and their amounts[46]; also, it sets a specific terminology for painting human figures[47].

The *De Arte illuminandi* is included here owing to the fact that it is a rare medieval documents explicitly devoted to miniature painting. Additionally, among the set of the considered treatises, it is the sole that could be composed outside France. Several authors proposed in this regard that the *De Arte illuminandi*'s author could be a central or southern Italian native[48]. Despite of the geographical incompatibility, the likely period of its composition does not exceed in time enough to fall out of consideration; also, the materials it recommends are compatible with the other selected sources[49].

Most of the remaining treatises bear a connection to France: the *Liber de Coloribus Illuminatorum sive Pictorum* and the *corpus* of Alcherius (copied in 1431). However, the latter deserved special attention. The above description gave a measure of its structural

Oxford Dictionary of Art and Artists. Fourth edition. DOI: 10.1093/acref/9780199532940.001.0001. Oxford: Oxford University Press, 2009, "Theophilus", who states that the text was not widely known until the modern period. On the other side, the large number of surviving copies could be the expression of some popularity. See also Clarke, *Mediaeval painters' materials and techniques: the Montpellier Liber diversarum arcium*, pp. 2-5 and Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts" a list of the numerous investigations on it.

[44]Clarke, *Mediaeval painters' materials and techniques: the Montpellier Liber diversarum arcium*, p. 4.

[45]Mrs. Merrifield made no mention of the first book of Theophilus' *Schedula* and she missed rendering it into English (Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol.1). However, the book is actually included in the manuscript of her reference (BnF, Ms. Lat. 6741, fols. 43^{r}-51^{r}. A full online source for the manuscript is available at: https://gallica.bnf.fr/ark:/12148/btv1b10525796f (Accessed on December 20, 2021).

[46]Theophilus' descriptions are so clear that Brunello could work such information into explanatory tables (see Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, pp. 181-195).

[47]For instance, the first layer of carnation goes under the definition "*rosa prima*"; light carnation as "*lumina prima*" or outlining as "*veneda*" (Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, pp. 193-195). Also, Alcherius adopts a comparable terminology in his "*Tabula de vocabulis synonymis et equivocis colorum*"(= Table of synonymes and ambiguous colours, 1431). See Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms, of Jehan Le Begue, p.30.

[48]Salazaro and Lecoy de la Marche supposed that the anonymous author of the *De Arte illuminandi* could be from Naples (Salazaro, *L'arte della miniatura nel secolo XIV. Codice della Biblioteca nazionale di Napoli messo a stampa*, p. xiii; Lecoy de La Marche, *L'art d'enluminer : manuel technique du XIVe siècle*, pp. 2-3); Brunello proposed that he could belong to the Tuscan school of painting (Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, pp. 31-32).

[49]See later.

complexity, wide range of subjects covered and the geographical reach of its sources. Several non-French craftsmen dictated part of the *corpus* (Fra Dionisio, Giovanni da Modena, Michelino da Besozzo, Giovanni il Normanno, Alberto Porzellus or Porcelli), and this fact poses a problem. That could either indicate that Paris was technically perceptive to the Italian painting, or just that Le Bégue copied faithfully the copy handed by Alcherius, without operating a selection of the material he was handed. The second hypothesis could be plausible, in light of Le Bégue's profession. In fact, he was a notary, with no artisanal education.

The doubt would require dedicated attention, and would go beyond the scope of the present chapter. It is important to remind, in fact, that this section intends only to appoint some likely references for the French tradition of miniature painting rather than being an exhaustive review of late mediaeval treatises. Therefore, only the recipes from French artists or craftsmen were taken into account for simplicity: *De coloribus diversis modis tractatur*, *De diversis coloribus* and the Ms. of Peter of St. Audemar. Finally, the *Strasbourg tradition* contains some of the latest recipes, and its consideration allows understanding the position of the technique as applied in the Hardouyn workshop in the context of the central European schools of painting. Whenever possible, the dissertation of the English scholar Dunlop was taken into consideration[50].

E.3 Treatises excluded from the historical analysis

Of course, the number of treatises devoted to illumination, or which speak about illumination techniques is greater than listed. One of the most popular in the field of technical studies is the *Livro de Komo de Fazen as Kores* (= Book on How to Make Colours, fifteenth century, hereafter called LKFK), a Portuguese technical text concerning the materials used in several painting crafts, including illumination[51]. It is part of a manuscript

[50] She wrote a dissertation on fourteenth- and fifteenth-century's use of colour in Parisian illuminations, where she also refers documentary sources in the commerce (Dunlop, *The use of colour in Parisian manuscript illumination c.1320-c.1420 with special reference to the availability of pigments and their commerce at that period*).

[51] It is the only documentary source available for the Sephardic technique of illumination and the oldest for the Portuguese area. See Luís U. Afonso. "New developments in the study of O livro de como se fazem as cores das tintas". In: *The Materials of the Image. As Matérias da Imagem*. Ed. by Luís U. Afonso. Lisboa: Campo da Comunicação, 2010. Chap. 1, pp. 3–27; D.S. Blondheim. "An old Portuguese work on manuscript illumination". In: *Jewish Quarterly Review* 19.2 (1928), pp. 97–135. DOI: https:

collectanea of Hebrew text preserved in Parma, Italy (Biblioteca Palatina, Ms. 1959, folios 1^r20^r). In the last two decades, the manuscript has received considerable attention both as an historically relevant document for the Portuguese technique of illumination[52] as well as a reliable source of technical teachings[53]. Along with its accuracy about miniature painting, some comparative studies traced parallelisms with other technical texts, such as the mentioned manuscripts of Jean Le Bégue and the so-called *Bolognese manuscript*[54]. However, the shared opinion of these studies is that the LKFK resembles more closely

//doi.org/10.2307/1451766; Devon L. Strolovich. *Old Portuguese in Hebrew Script: convention, contact, and convivência*. Ph.D.'s dissertation. Cornwell, NY, 2005; Inês Villela-Petit. "Les Recettes pour l'enluminure. Do Livro judaico-português de como se fazem as cores". In: *Medievalista* 9 (2011). Online publication. http://journals.openedition.org/medievalista/669. Accessed on December 18, 2021. DOI: https://doi.org/10.4000/medievalista.669.

[52] See Luís U. Afonso et al. "Tradition and modernity in Portuguese Hebrew book art of the late 15th century". In: *Portuguese Studies on Medieval Illuminated Manuscripts*. Ed. by Adelaide Miranda et al. Turnhout: Brepols, 2015. Chap. 8, pp. 169–189. DOI: https://doi.org/10.1484/M.TEMA-EB.4.000183; António João Cruz et al. "On the Date and Contents of a Portuguese Medieval Technical Book on Illumination. O livro de como se fazem as cores". In: *The Medieval History Journal* 11.1 (2008), pp. 1–28. DOI: https://doi.org/10.1177/097194580701100101; Débora Marques de Matos. *The Ms. Parma 1959 in the context of portuguese hebrew illumination*. M.A.'s thesis. Lisboa, 2011; Débora Marques Matos et al. *The Book of 'How to Make Colours' ('O livro de como se fazem as cores') and the 'Schedula diversarum artium'*. Ed. by Andreas Speer. Berlin and Boston, MA: De Gruyter, 2013. Chap. 17, pp. 305–318. DOI: https://doi,org/10.1515/9783110334821.305.

[53] See Rita Castro et al. "Interpreting lac dye in medieval written sources: new knowledge from the reconstruction of recipes relating to illuminations in Portuguese manuscripts". In: *Sources on Art Technology: Back to Basics*. Ed. by Sigrid Eyb-Green et al. Proceedings of the sixth symposium of the ICOM-CC Working Group Art Technological Source Research. London: Archetype Publications, 2016. Chap. 12, pp. 88–99; Maria J. Melo et al. "The making of vermilion in medieval Europe: historically accurate reconstructions from The book on how to make colours". In: *Fatto D'Archimia: history and identification of artificial pigments*. ICPE. Madrid, 2010; Melo et al., *'O livro de como se fazem as cores': Medieval Colours for Practitioners*; Maria J. Melo et al. "The book on how to make all the colour paints for illuminating books: unravelling a Portuguese Hebrew illuminators' manual". In: *Heritage Science* 6.44 (2018). DOI: https://doi.org/10.1186/s40494-018-0208-z; Catarina Miguel et al. "A study on red lead degradation in a medieval manuscript Lorvão Apocalypse (1189)". In: *Journal of Raman Spectroscopy* 40.12 (2008), pp. 1966–1973. DOI: https://doi.org/10.1002/jrs.2350; Miguel, *Le vert et le rouge: a study on the materials, techniques and meaning of the green and red colours in medieval portuguese illuminations*; Catarina Miguel et al. "The alchemy of red mercury sulphide: The production of vermilion for medieval art". In: *Dyes and Pigments* 102 (2014), pp. 210–217. DOI: https://doi.org/10.1016/j.dyepig.2013.10.041; Paula S.F. Nabais. *Identity and connections within medieval heritage: color in the illuminated manuscript through the eyes of the molecular sciences and humanities*. M.Sc.'s thesis. Lisboa, 2019; Vitorino, "A Closer Look at Brazilwood and its Lake Pigments"; Vitorino et al., "New insights into brazilwood lake pigments manufacture through the use of historically accurate reconstructions".

[54] See António João Cruz. "Em busca da origem das cores de 'O Livro de Como se Fazem as Cores': sobre as fontes de um receituário português medieval de materiais e técnicas de pintura". In: *The Materials of the Image. As Matérias da Imagem*. Ed. by Luís U. Afonso. Lisboa: Campo da Comunicação, 2010. Chap. 1, pp. 3–27; Matos et al., *The Book of 'How to Make Colours' ('O livro de como se fazem as cores') and the 'Schedula diversarum artium'*.

the Iberian tradition of illuminating[55] or the Italian tradition than French painting. For instance, greater similarities arise with reference to Alcherius' *Experimenta de Coloribus*, which has been dictated by the Italian monk Fra Dionisio[56]. Owing to the non-French influences, the *Livro de Komo se Fazen as Kores* was excluded from further consideration.

Another important technical text is the so-called *Bolognese Manuscript* (Italy, anonymous, second quarter of the fifteenth century[57]). This treatise takes its name from its place of conservation (University Library of Bologna, Ms. Lat. 2861) and, similarly to the LKFK, is widely known in the field of technical studies of paintings. However, it seems to source its knowledge from the Italian peninsula. This is revealed both by the language it adopts (both Latin and Italian vernacular) and its artistic influences: Merrifield and recent scholars are positive that the directions here contained appointed at the style of fifteenth-century Bologna[58]. Consequently, as with the LKCM, the present chapter does not consider the *Bolognese Manuscript*.

Finally, another celebrated reference for late medieval painting techniques, is Cennino Cennini's (*c.* 1370-*c.* 1440) *Libro dell'Arte* (= Book on Art, fifteenth century). Concerning this particular treatise, it is regarded as one of the most reliable references on fifteenth-century European techniques of painting. However, a recent line of investigation has questioned the considerable importance that Cennini's tratise has gathered, approaching philologically and technically the subject of its accuracy and historical relevance. On the one hands, such scholarship argued that the *Libro dell'Arte*'s reception in the context of fifteenth and sixteenth centuries artistic crafts was very different from the modern; secondly, that not all instructions of *Libro dell'Arte* are technically exact. Speaking on the former point, namely Cennini's early literary fortunes, Burns noticed that the number

[55] Villela-Petit, "Les Recettes pour l'enluminure. Do Livro judaico-português de como se fazem as cores".

[56] On Fra Dionisio, see before; on the comparative study, see Matos et al., *The Book of 'How to Make Colours' ('O livro de como se fazem as cores') and the 'Schedula diversarum artium'*.

[57] See Federica Ferla. *Il Manoscritto Bolognese. Segreti per colori del secolo XV (ms. 2861, Biblioteca Universitaria di Bologna)*. Ph.D's dissertation. Milan, 2006; Francesca Muzio. *Un trattato universale dei colori: Il ms. 2861 della Biblioteca Universitaria di Bologna*. Firenze: Olschki, 2012; Viñas, "Original written sources for the history of mediaeval painting techniques and materials: a list of published texts".

[58] Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol.2, Bolognese Manuscript, pp.328-330; Sandroa Baroni et al. "Formation, transmission and genres in the recipe books of art technology between the Middle Ages and the 18th century: new proposals for analysis and interpretation". In: *Contribution à une historie technologique de l'art*. Ed. by Claire Betelu et al. Actes des journées d'étude de la composante de recherche Préservation des Biens Culturels - HiCSA. Paris: HiCSA, Université de Paris 1 - Panthéon-Sorbonne, 2018. Chap. 1, p. 9, p. 17.

of extant copies is limited, and among Renaissance documentary sources, a few of them mentions Cennini[59]; only later scholars expressed interest on him[60]. About the other point, or the artist's technical faithfulness, Broecke proved that his instructions on drawing and painting proved to be workable[61], while those concerning pigment selection, or their material quality are not as precise as the other sections[62]. Such insights allow reducing the importance of Cennini *per se*; however, other factors were more decisive for Cennini's exclusion from the present chapter.

Along with accuracy restricted to certain artistic crafts, Cennini is a spokesperson of the fourteenth-century Italian painting. At the beginning of *Libro dell'Arte*, he avowed that he was "trained in [the artist's] profession for twelve years by my master, Agnolo di Taddeo of Florence" and that in order "to minister all of those who wish to enter the profession, I will make note of what has was taught me by the aforesaid Agnolo, my master, and of what I have tried of my own hand"[63]. The above statements suggest in repetition and content that Cennini's major concern are artistic techniques as applied in Florence or his own hands-on experience of painting. In both cases, his care covers essentially panel painting, or techniques in use among Italian schools of painting. To confirm the hypothesis, Broecke reports several cases of studies of northern Italian art that match

[59]Burns makes two remarks. The first of which observations is that only a limited number of *Libro dell'Arte*'s copies survived the late Middle Ages: three are in Florence (Biblioteca Mediceo-Laurenziana, Cod. P 7 [1437]; Biblioteca Riccardiana, MS 2190 [sixteenth century (?)] and Biblioteca Nazionale Centrale, Cod. Palatino 818 [eighteenth century]), another in the Vatican City (BAV, Ottonian MS 2974 [1737]). Her second comment is that the earliest reference to the *Libro dell'Arte* dates from 1568, when Giorgio Vasari (1511-1574) mentioned it in his *Lives*. However, the later fortunes of the treatise seem to be somehow bound to Vasari's monography; in fact, the Florentine intellectual Raffaele Borghini (1537-1588) ventured himself in elaborating a art-technical treatise, availing himself of Vasari's *Lives* (Thea Burns. "Cennino Cennini's Il Libro dell'Arte: A Historiographical Review". In: *Studies in Conservation* 56.1 (2011), pp. 1–13. DOI: https://doi.org/10.1080/01971360.2016.1215662). However, Borghini did not reference directly Cennini as his source, despite of copying large sections of his writings (Raffaele Borghini. *Il Riposo*. Ed. by Marco Rosci. (1964). Milan: Edizioni Labor, 1584, p. 129; Raffaele Borghini. *Il Riposo*. Translated by L.H. Ellis (2007). Toronto: University of Toronto Press, 1584, pp. xxv, 10, 14–16). Neither later writers mention Cennini, who was re-discovered only in the nineteenth century.

[60]Thompson drew an elaborate history on Cennini's studies. On it, see Cennino Cennini. *The Craftsman's Handbook. The Italian's 'Libro dell'Arte'*. Translated by Daniel V. Thompson. New York, NY: Dover Publications, 1954, pp. ix-xiii.

[61]Lara Broecke. *Cennino Cennini's 'Il Libro dell'Arte'. A New English Translation and Commentary with Italian Transcriptions*. London: Archetype, 2015; Lara Broecke. *Truth and Intention in the 'Libro dell'Arte'*. London: Archetype, 2015.

[62]Broecke's opinion on Cennini's low understanding of pigment's material quality could be related to the fact that he bought his own materials as ready-made compounds by apothecaries. See Broecke, *Truth and Intention in the 'Libro dell'Arte'*.

[63]Translation by Cennini, *The Craftsman's Handbook. The Italian's 'Libro dell'Arte'*, p. 2.

Cennini's suggestions on carnations, mixtures, layering and outlining, as well as drawing[64]. Therefore, Cennini's exclusive interest in Italian painting does not qualify him to represent French techniques.

On top of Cennini's area of interest, he expresses little interest in miniature painting. In fact, he devotes either slim chapters or swift information concerning book painting[65]. Moreover, his list of colours for illuminating is exceedingly meagre when compared to any treatise taken into active consideration[66].

E.4 List of the pigments mentioned in the treatises

[64] See note 2 of Broecke, *Truth and Intention in the 'Libro dell'Arte'*, p. 57.

[65] Chs. 157, 159-161 (based on Milanesi's critical edition; see Cennini, *The Craftsman's Handbook. The Italian's 'Libro dell'Arte'*).

[66] In ch. 161("Colours for use on parchment"), Cennini only mentions brazilwood while labelling the remaining of organic colours as "clothlet", or "certain colours which have no body". On an English translation of the chapter, see Cennini, *The Craftsman's Handbook. The Italian's 'Libro dell'Arte'*, pp. 102-103.

Table E.1: List of colourants mentioned in late medieval technical texts. List of abbreviations: SDA = Schedula diversarum artium, book 1; LdC = *Liber de Coloribus*; DAi = *De Arte illuminandi*; Ms. PdA = Ms. of Peter of St. Audemar; Ms. A = *corpus* of Alcherius and Str. F. = *Strasbourg family*. The number in each cell corresponds to the number of the recipe or chapter which mentions that colourant. When a colourants appear in contemporary study but did not correspond to a specific recipe, they were labelled with an "x" mark. Uncertain interpretations were marked with a question mark (?).

Pigments	**Recipes**					
	***SDA* 12th cent.**	***LdC* 13th-14th cent.**	***DAi* 14th cent.**	***Ms. PdA* 15th cent.**	***Ms. A* 15th cent.**	***Str. F.* 15th-16th cent.**
Blue colourants						
azurite		29	9, 21	170	x[67]	
(nat.) ultramarine	14, 15, 16[68]	1, 43	9	167, 168	117, 118	1, 4, 7, 8, 11
anthocyanin blue		30		171	314[69]	27-29, 38, 63, 64, 103-105, 108
silver blue		27, 28		167, 169		113, 114
indigo	14, 16	1	9		294	
folium (blue)	33	1, 4, 17	9	162, 166		
Red colourants						
vermilion	(37)[70]	1, 7	5, 22, 23	x[71]	311	3, 5, 6, 13, 43
cinnabar	34	7				
minium	(37)	1	5		311	
red ochre		1 (?)				
sinopia		1	13			
madder (lake)		1, 47[72], 7				
brazilwood (lake)		1	11, 12	181	293, 304, 309[73], 334	10, 30, 36
cochineal (lake)		1		1		
dragon's blood		1				
lac dye (lake)		47[74]	13		309	31
folium (red)				162, 166		
anthocyanin red						27-29, 38, 63-64, 103-105, 108
Green colourants						
salt green	(35)[75]			150, 151		
Rouen green		34		156		
vert-de-gris / verdigris		1, 33, 35, 36	11		301	2, 12
Spanish green	36					
green earth	2, 3, 7, 11, 14, 15					
sap green	14, 15, 16, 25					35
iris green	32		10	x[76]	361	
eldeberry juice	14			x[77]		
ivy green		41		184	332	
Yellow colourants						
(yellow) ochre	3, 10, 11, 14, 15, 16	7	8			
orpiment	14	1, 7	8			9, 58, 59
saffron	16	1	8, 26			40
weld (lake)			6			
mosaic gold			7		(22)[78]	21
buckthorn (lake)					(x)	
curcuma (lake)			5			
Brown and black colourants						
vine black			3			
brown earths		1				
lampblack			3			
charcoal				172		
sepia			3			
White colourants						
lead white	37	1	4	x[79]		
Apulian white		1				

F. Materials and methods

F.1 Characterisation of the case studies

F.1.1 Molecular characterisation

- *UV-Vis-NIR FORS*: Site-specific diffuse reflectance spectra of spot were collected using an UV-Vis-NIR FORS (Vis-Fiber optic-Reflectance Spectroscopy) instrument (i-Spec® 25) operating from 345-2500 nm with spectral sampling 1.4 nm (350-1060 nm, channel 1), 1.5 nm (1061-1700, channel 2) and 4.4 nm (1701-2500, channel 3). The collection spot at the surface was 5 mm in diameter and working distance ≤ 5 mm from the sample. Data acquisition was performed as follows: 95 ms integration time, single accumulation (channel 1); 60 μs integration time, 60 accumulations (channel 2); 80 μs integration time, 250 accumulations (channel 3). The spectra were calculated as ratios of the light incident on a Halon G-50 white reference with the iSpec® 4 software. All spectra were plotted with MATLAB® R2020b, and the further manipulation (addition of the analysis spot in the figure and the addition of number labels) were done with Adobe Photoshop CC 2019. RS was applied to inspect the colour palette and the printing ink across the hand-painted miniatures. The analysis spots are presented in Figure F.1 below.

F.1.2 Elemental characterisation

- *p-XRF*: The analyses were performed with a Tracer® III-SD handheld p-XRF spectrometer by Bruker (Billerica, MA, USA) equipped with a Rh tube and a peltier-cooled Si drift operating at 40 keV, and an internal VGA CMOS camera for photo acquisition of the analysis spot. The operating conditions were decided following those already applied in the analysis of illuminated books[1] and previous characterisations of Books of Hours by the Hardouyn workshop[2]: 11 μA, 40 keV,

[1] See Catarina Tibúrcio et al. "On the use of EDXRF, mapping-EDXRF and UV-Vis FORS to unveil the step by step production of two illuminated manuscripts from the fifteenth century Portuguese Royal Court". In: *Microchemical Journal* 153 (2020), p. 104455. DOI: https://doi.org/10.1016/j.microc.2019.104455; Miguel et al., "Unveiling the underprintings of a late-fifteenth-early-sixteenth century illuminated French incunabulum by infrared reflectography".

[2] Namely, BPE, Inc. 438: see Bottura-Scardina et al., "Image processing methods integrated to imaging and material characterisation for the study of incunabula illustrations: an innovative multi-analytical

no filter, 120 s acquisition time and acquiring spot 12 mm^2 (3 x 4 mm). A Sn sheet was placed below every analysis spot[3]. Both paints and the parchment primer were analysed under the same conditions. In all analyses the device was mounted on a tripod and placed at a working distance of semi-contact (maximum 2-3 mm away) with the analysed surface. The spectra acquisition was performed with S1PXRF software while shootings of the analysed spots were done with CyberLink YouCam software for the online view with the spectrometer built-in camera (400 x 400 pixels resolution). P-XRF was applied to inspect the colour palette and the printing ink across the hand-painted miniatures. The analysis spots are presented in Figure F.1 below.

F.1.3 Chemical imaging

- *Vis-NIR HSI*: Vis-NIR HSI hypercubes were acquired with a Specim IQ® Vis-NIR hyperspectral camera by Specim, Spectral Imaging LTD. (Oulu, Finland). The camera is equipped with a Si CMOS sensor serving as a photographic camera with resolution of 512 x 512 pixel (5 Mpixel) and a spectral detector (400-1000 nm spectral range). The radiation is allowed into the camera through two distinct objectives, one for the spectral analysis and the other to for the photographic recording, both having the same focal distance (21 mm) but a different diaphragm aperture each (f/1.7 at sensor and f/2.2 at the photographic slit). The illumination setup is described in the dedicated section (see later). All hypercubes were acquired by performing no spectral binning (204 channel/pixel, 2.11 nm spectral resolution) and with 34 ms as the integration time. The machine was operated in Default mode, placing the reference for white contextually to every acquisition. After selecting the appropriate acquisition time (i.e. the integration time), the device software guides the user through the step of data validation and the conversion from irradiance factor to reflectance factor (DV-to-irradiance factor is performed automatically by the device). This last step is done on the basis of the white reference: the software allows the user to choose the reference of white and recalculates every spectral value from every pixel as a ratio of the average of the selected area (this step is performed for every assay). Spectral extraction and mapping were performed with ENVI® 5.3 software by L3Harris Geospatial (Broomfield, CO, USA), as a single-pixel extraction. Hypercubes were recorded for all miniatures.
- *HSI Mapping*: The best HSI mapping and endmember extraction were initially tested on one HC (*Printer's device*, Res. 326.v, fol. 1^r). Several methods were tested: Savitzky-Golay filtering (3-19 nm window length, 2^{nd} polynomial, tab. F.1)[4], wavelet de-noising (level 2-7, tab. F.2)[5] and digital filtering (2-9 terms, tab. F.3[6] were applied on the spectrum extracted from the same area as the

approach on a case-study".

[3]This was done to perform future quantitative analysis on the materials of painting with the results obtained.

[4]With MATLAB® built-in function.

[5]With MATLAB® built-in function.

[6]MATLAB® built-in function.

FORS analysis (see later fig. F.1). Additionally, the mean spectrum from a user-defined ROI (UD-ROI) were processed with PCA denoising (2 iterations, tab. F.4)[7], MNF denoising (2 iterations, tab. F.5)[8], median filter on a kernel centered around the original spectrum (3 x 3, 5 x 5, 7 x 7, 9 pixel x 9 pixel kernel size, tab. F.6)[9], mean filter on a kernel centered around the original spectrum (3 x 3, 5 x 5, 7 x 7, 9 pixel x 9 pixel kernel size, tab. F.7)[10], Lee filtering (adaptive, multiplicative and mixed adaptive-multiplicative on 3 x 3, 5 x 5, 7 x 7, 9 x 9 kernels, tabs. F.8-F.10)[11]. The quality of the extracted spectra was calculated with two parameters: Signal-to-noise gain (SNG)[12] and Spectral distortion (SD)[13]. The spectra with the highest SNG and the lowest SD were selected for the second part of the testing. The best spectra from each class was used to perform the mapping with two methods: spectral angle mapper (SAM) and spectral information difference (SID). The coverage of each map was tested against the respective pictorial area, that was obtained by colour-thresholding the Vis reference of the HC with MATLAB (tabs. F.11-F.16)®[14]. Each map and the reference were binarised to obtain a black-and-white image with a pixel dynamic range of 2 (0, 1). Each map was compared to the reference with 4 algorithms of image comparison: MSE, Tanimoto index, Dice index and SSIM[15]. SID mapping on the mean spectrum extracted from UD-ROIs proved to be the most effective, so it was adapted throughout the thesis.

[7] With *wmspca* built-in function of MATLAB® on 204 x 203 arrays.

[8] It was a customised method performed by performing a white denoising of the input array with the *wnoise* built-in function. Later, the processed matrix was manipulated with the *wmspca* built-in function to perform the PCA routine like before.

[9] Performed with MATLAB. The script for the kernel selection was written for the purpose, while the calculation of the median spectrum was performed with a MATLAB® built-in function.

[10] Performed with MATLAB. The script for the kernel selection was written for the purpose, while the calculation of the median spectrum performed with a MATLAB® built-in function.

[11] Lee filtering was performed with ENVI® 5.3.

[12] It is the measure of the -Δ between the SNR of the original spectrum and the final SNR of the processed spectrum.

[13] A measure of mismatch between the |Δ| between the original spectrum and a spectrum with random noise introduced artificially and the |Δ| between the extracted spectrum and a ideally perfect spectrum for that spot.

[14] With the *Colour thresholder* app.

[15] For all these parameters but Tanimoto index were used MATLAB® built-in functions. The script for Tanimoto's index was written for the purposes of this research.

Table F.1: Values of the spectral evaluation for the HSI mapping on a test HC, Savitzky-Golay filter (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Window (nm)	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
3	1.0000	16.8019	1.8777	10.240	1.0000	16.188	1.8749	11.905	1.0000	11.999	1.0000	13.353
5	1.1306	13.0279	2.0806	5.479	1.2448	10.429	2.0793	8.609	1.1865	7.484	1.6039	7.901
7	1.4348	10.8723	2.1052	3.587	1.5090	7.755	2.2923	6.835	1.2280	5.736	1.6663	5.922
9	1.8904	8.9707	2.2588	2.336	1.4381	6.037	2.4428	5.675	1.1907	4.845	1.9016	5.045
11	3.8033	13.3303	**2.2670**	**2.226**	1.6520	4.531	**2.5443**	**4.722**	1.2365	3.689	1.9310	4.566
13	3.3360	6.3637	2.2582	2.851	1.7479	3.347	2.5220	4.322	1.2596	2.688	2.0988	3.698
15	**7.3271**	**3.3892**	2.2384	3.449	**1.9584**	**2.416**	2.5489	3.804	1.2604	1.860	2.1770	3.132
17	6.0370	3.5151	2.2208	4.205	2.0543	2.693	2.5294	3.391	**1.2266**	**1.626**	**2.2076**	**2.887**
19	6.6101	3.0247	2.2201	5.022	1.9644	3.013	2.4995	2.855	1.1682	1.721	2.2342	2.455

Table F.2: Values of the spectral evaluation for the HSI mapping on a test HC, Wavelet denoising (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Level	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
2	1.0365	11.9183	**1.8836**	**6.711**	**0.9832**	**10.688**	**1.8667**	**9.702**	**0.9911**	**8.460**	**1.0235**	**9.343**
3	**1.0255**	**11.0815**	1.8792	6.922	0.9818	10.102	1.8589	9.311	0.9779	7.135	1.0034	8.537
4	1.0004	11.2852	1.8685	7.057	0.9655	10.123	1.8593	9.118	0.9910	0.000	1.0119	8.195
5	0.9883	11.3574	1.8687	7.063	0.9709	10.214	1.8576	9.202	0.9931	7.444	1.0279	8.316
6	0.9888	11.3706	1.8686	7.063	0.9716	10.204	1.8574	9.205	0.9925	7.441	1.0302	8.292
7	0.9887	11.3689	1.8686	7.060	0.9716	10.202	1.8580	9.206	0.9922	7.464	1.0298	8.277

Table F.3: Values of the spectral evaluation for the HSI mapping on a test HC, Wavelet denoising (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Level	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
2	1.9980	14.7014	**2.6169**	**10.157**	1.8071	12.725	2.2242	9.539	1.0575	8.438	**1.8636**	**9.355**
3	**3.3683**	**16.2184**	3.3062	15.550	**2.3737**	**16.870**	**2.7356**	**9.374**	**1.2716**	**9.653**	2.4889	10.378
4	5.2266	19.6517	3.8623	22.276	2.7439	22.686	3.3968	10.527	1.5234	13.035	2.8776	13.415
5	7.1104	23.6096	4.3177	29.167	2.9395	29.225	4.0273	12.678	1.7290	16.999	3.1842	17.186
6	8.7905	27.7651	4.7552	36.016	3.1095	36.066	4.5366	15.100	1.9448	20.901	3.5225	20.867
7	10.6819	32.4128	5.1352	43.055	3.3300	42.698	5.1356	17.829	2.1889	24.684	3.8002	24.706
8	12.4580	36.9589	5.3647	50.011	3.5777	49.305	5.7082	20.517	2.4195	28.420	3.9887	28.539
9	13.3876	41.6735	5.5097	56.870	3.7624	55.956	6.2506	23.109	2.6253	0.027	4.1914	32.319

Table F.4: Values of the spectral evaluation for the HSI mapping on a test HC, PCA denoising (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Iteration	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
1	0.0657	53.4999	3.1776	27.8772	1.6207	42.1674	3.4704	6.4282	1.3113	15.5695	0.2276	39.0910
2	**0.8021**	**53.4999**	**3.1776**	**27.8772**	**1.6207**	**42.1674**	**3.4704**	**6.4282**	**1.3113**	**15.5695**	**0.2276**	**39.0910**

Table F.5: Values of the spectral evaluation for the HSI mapping on a test HC, MNF denoising (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Iteration	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
1	0.7795	52.7880	3.1929	27.3668	1.6168	42.2127	3.5146	6.6831	1.3178	16.0206	0.2227	39.0675
2	**0.7795**	**52.7880**	**3.1929**	**27.3668**	**1.6168**	**42.2127**	**3.5146**	**6.6831**	**1.3178**	**16.0206**	**0.2227**	**39.0675**

Table F.6: Values of the spectral evaluation for the HSI mapping on a test HC, median spectrum with varying kernel size (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Kernel	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
3 x 3	**1.1752**	**53.3735**	**1.9687**	**22.5324**	**1.7538**	**37.5648**	**2.7049**	**60.4945**	**1.4507**	**20.1461**	**1.8147**	**16.8197**
5 x 5	0.9108	33.5307	1.7385	410.4855	1.9914	47.7186	1.8702	44.2790	1.2150	20.8186	1.3013	31.2432
7 x 7	1.1531	33.7157	1.7159	31.6728	1.7742	80.8594	2.6166	22.4165	1.2278	22.4096	1.3761	60.2406
9 x 9	1.3208	24.6077	1.6125	33.0795	1.4194	119.9387	3.0270	17.7725	1.3321	24.0517	1.5856	90.0357

Table F.7: Values of the spectral evaluation for the HSI mapping on a test HC, mean spectrum with varying kernel size (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Kernel	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
3 x 3	**1.0577**	**31.5615**	**1.7212**	**38.0431**	**2.1293**	**48.6526**	**2.5592**	**55.6521**	**1.3449**	**18.6817**	**1.8597**	**19.3331**
5 x 5	0.9454	15.3568	1.4507	424.8379	1.8326	58.8842	2.5545	45.9448	1.4088	19.1599	1.6844	29.4755
7 x 7	1.0275	16.5673	1.4090	57.5965	1.5924	89.4823	2.7422	19.4597	1.4440	21.6028	1.6057	60.5131
9 x 9	0.9621	16.3621	1.3642	47.9876	1.4051	141.9127	2.6269	49.4290	1.4374	27.2034	1.5670	89.8517

Table F.8: Values of the spectral evaluation for the HSI mapping on a test HC, Lee filter (adaptive) with varying kernel size (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Kernel	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
3 x 3	**0.9982**	**41.9865**	**1.3718**	**15.3827**	**1.4683**	**19.7161**	**2.5113**	**8.7353**	**1.6752**	**12.4610**	**1.8470**	**20.4228**
5 x 5	1.0003	32.4746	1.1907	18.0387	1.3356	43.7461	2.1692	21.9852	1.2551	11.9007	1.3036	31.4683
7 x 7	1.0367	25.0446	1.2470	14.1659	1.3635	21.7375	2.1003	9.6096	1.2650	11.3221	1.4382	19.4396
9 x 9	1.0410	39.1685	1.1490	33.3551	1.2935	72.9731	2.2352	32.9722	1.2638	13.9271	1.2672	46.3157

Table F.9: Values of the spectral evaluation for the HSI mapping on a test HC, Lee filter (multiplicative) with varying kernel size (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Kernel	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
3 x 3	**1.0876**	**49.9327**	**1.2039**	**10.9968**	**1.2844**	**14.3559**	**1.9743**	**8.4310**	**1.3449**	**9.4821**	**1.4453**	**14.2539**
5 x 5	1.0367	25.0446	1.2470	14.1659	1.3635	21.7375	2.1003	9.6096	1.2650	11.3221	1.4382	19.4396
7 x 7	1.0003	32.4746	1.1907	18.0387	1.3356	43.7461	2.1692	21.9852	1.2551	11.9007	1.3036	31.4683
9 x 9	1.0410	39.1685	1.1490	33.3551	1.2935	72.9731	2.2352	32.9722	1.2638	13.9271	1.2664	46.3157

Table F.10: Values of the spectral evaluation for the HSI mapping on a test HC, Lee filter (multiplicative) with varying kernel size (*Printer's device*, Res. 326.v. fol. 1[r]). The values express the effects of several windows length (in nm) to the signal-to-noise ratio gain (SNG) and spectral distortion (SD). The SNG is expressed in arbitrary units (a.u.), the SD as a percentage value of the distortion with reference to the reference of "ideal" spectrum for each colour area. The values chosen for each colour spot are in bold.

PARAMETER	COLOUR SPOT											
Kernel	Red spot		Blue 1		Blue 2		Brown		Green 1		Green 2	
	SNG (a.u.)	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*	*SNG (a.u.)*	*SD (%)*
3 x 3	**0.7357**	**35.7670**	**0.9665**	**12.6465**	**0.7952**	**18.7235**	**1.3402**	**12.2842**	**0.9476**	**12.4940**	**0.8968**	**14.1773**
5 x 5	0.7027	55.4794	0.9626	12.7184	0.7661	19.6693	1.3331	12.3089	0.9631	12.5419	0.8897	14.2876
7 x 7	0.7025	47.4922	0.9730	12.7708	0.7632	20.8016	1.3289	12.4321	0.9627	12.5635	0.8936	14.3939
9 x 9	0.6934	41.9865	0.9852	13.0136	0.7647	22.1023	1.3222	12.5864	0.9629	12.5842	0.8863	14.5207

Table F.11: Comparison between the red testing area and the maps created based on the endmembers selected with several comparing metrics. The best mapping method and endmember extraction is given in the last row. List of abbreviations: Mean squared error (MSE), Structural similarity index of measure (SSIM), Tanimoto's index. Interpretation results: MSE = 0 (perfect pixel similarity) → +∞ (perfect dissimilarity); SSIM = 0 (perfect structural dissimilarity) → +1 (perfect structural similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Dice index = 0 (no image intersection) → +1 (perfect image intersection). Values for the maps building (threshold): SAM = 0.075 radiants; SID = 0.007 (max divergence) for all maps.

	SIMILARITY METRIC											
Endmember extraction	**MSE**			**SSIM**			**Tanimoto's index**			**Dice index**		
	SAM	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***
Original	0.0147	0.0114	SID	0.9135	0.9631	SID	0.3819	0.3718	SAM	0.5527	0.5421	SAM
SGolay	0.0149	0.0118	SID	0.9115	0.9642	SID	0.3788	0.3492	SAM	0.5495	0.5176	SAM
Wavelet	0.0149	0.0115	SID	0.9111	0.9644	SID	0.3812	0.3629	SAM	0.5519	0.5325	SAM
Dig Filter	0.0153	0.0122	SID	0.9090	0.9649	SID	0.3748	0.3205	SAM	0.5452	0.4855	SAM
PCA	0.0109	0.0105	SID	0.9305	0.9663	SID	0.4894	0.4071	SAM	0.6572	0.5786	SAM
MNF	0.0109	0.0105	SID	0.9305	0.9663	SID	0.4894	0.4071	SAM	0.6572	0.5786	SAM
Median	0.0104	0.0109	SAM	0.9386	0.9662	SID	0.4866	0.3880	SAM	0.6547	0.5591	SAM
Mean	0.0089	0.0112	SAM	0.9527	0.9653	SID	0.5377	0.3667	SAM	0.6993	0.5366	SAM
Mean ROI	0.0126	0.0103	SID	0.9107	0.9653	SID	0.4746	0.4266	SAM	0.6437	0.5981	SAM
LeeAdap	0.0101	0.0103	SAM	0.9345	0.9665	SID	0.5212	0.4235	SAM	0.6852	0.5950	SAM
LeeMulti	0.0112	0.0109	SID	0.9241	0.9659	SID	0.5004	0.3884	SAM	0.6670	0.5595	SAM
LeeBoth	0.0187	0.0110	SID	0.8954	0.9656	SID	0.3153	0.3868	SID	0.4795	0.5578	SID
Best method	***Mean, SAM***			***Lee Adaptive, SID***			***Mean, SAM***			***Mean, SAM***		

Table F.12: Comparison between the blue (spot 1) testing area and the maps created based on the endmembers selected with several comparing metrics. The best mapping method and endmember extraction is given in the last row. List of abbreviations: Mean squared error (MSE), Structural similarity index of measure (SSIM), Tanimoto's index. Interpretation results: MSE = 0 (perfect pixel similarity) → +∞ (perfect dissimilarity); SSIM = 0 (perfect structural dissimilarity) → +1 (perfect structural similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Dice index = 0 (no image intersection) → +1 (perfect image intersection). Values for the maps building (threshold): SAM = 0.100 radiants; SID = 0.050 (max divergence) for all maps.

	SIMILARITY METRIC											
Endmember extraction	**MSE**			**SSIM**			**Tanimoto's index**			**Dice index**		
	SAM	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***
Original	0.0076	0.0094	SAM	0.9742	0.9694	SAM	0.0231	0.0328	SID	0.0451	0.0636	SID
SGolay	0.0077	0.0094	SAM	0.9741	0.9700	SAM	0.0252	0.0327	SID	0.0492	0.0634	SID
Wavelet	0.0076	0.0094	SAM	0.9742	0.9700	SAM	0.0235	0.0331	SID	0.0459	0.0640	SID
Dig Filter	0.0074	0.0093	SAM	0.9743	0.9696	SAM	0.0231	0.0324	SID	0.0451	0.0627	SID
PCA	0.0085	0.0098	SAM	0.9726	0.9682	SAM	0.0284	0.0349	SID	0.0552	0.0674	SID
MNF	0.0085	0.0097	SAM	0.9726	0.9685	SAM	0.0284	0.0345	SID	0.0552	0.0667	SID
Median	0.0078	0.0098	SAM	0.9739	0.9678	SAM	0.0243	0.0317	SID	0.0474	0.0615	SID
Mean	0.0080	0.0096	SAM	0.9737	0.9686	SAM	0.0257	0.0319	SID	0.0500	0.0619	SID
Mean ROI	0.0086	0.0100	SAM	0.9737	0.9676	SAM	0.0289	0.0354	SID	0.0562	0.0683	SID
LeeAdap	0.0079	0.0095	SAM	0.9739	0.9690	SAM	0.0242	0.0327	SID	0.0472	0.0633	SID
LeeMulti	0.0078	0.0094	SAM	0.9740	0.9695	SAM	0.0244	0.0330	SID	0.0477	0.0639	SID
LeeBoth	0.0075	0.0094	SAM	0.9742	0.9694	SAM	0.0233	0.0328	SID	0.0455	0.0636	SID
Best method	***Dig. filter, SAM***			***Dig. filter, SAM***			***Mean ROI, SID***			***Mean ROI, SID***		

Table F.13: Comparison between the blue (spot 2) testing area and the maps created based on the endmembers selected with several comparing metrics. The best mapping method and endmember extraction is given in the last row. List of abbreviations: Mean squared error (MSE), Structural similarity index of measure (SSIM), Tanimoto's index. Interpretation results: MSE = 0 (perfect pixel similarity) → +∞ (perfect dissimilarity); SSIM = 0 (perfect structural dissimilarity) → +1 (perfect structural similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Dice index = 0 (no image intersection) → +1 (perfect image intersection). Values for the maps building (threshold): SAM = 0.080 radiants; SID = 0.040 (max divergence) for all maps.

	SIMILARITY METRIC											
Endmember extraction	**MSE**			**SSIM**			**Tanimoto's index**			**Dice index**		
	SAM	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***
Original	0.0303	0.3175	SAM	0.8220	0.4150	SAM	0.0058	0.012	SID	0.0115	0.0234	SID
SGolay	0.0323	0.3026	SAM	0.8109	0.4107	SAM	0.0063	0.011	SID	0.0126	0.0208	SID
Wavelet	0.0307	0.3272	SAM	0.8195	0.4271	SAM	0.0057	0.012	SID	0.0113	0.0237	SID
Dig Filter	0.0253	0.0756	SAM	0.8554	0.6512	SAM	0.0036	0.029	SID	0.0072	0.0565	SID
PCA	0.0335	0.0318	SID	0.8847	0.8925	SID	0.0079	0.005	SAM	0.0157	0.0095	SAM
MNF	0.0335	0.0306	SID	0.8848	0.8947	SID	0.0079	0.003	SAM	0.0157	0.0067	SAM
Median	0.0307	0.0385	SAM	0.8931	0.8819	SAM	0.0027	0.016	SID	0.0054	0.0320	SID
Mean	0.0320	0.0430	SAM	0.8867	0.8686	SAM	0.0047	0.027	SID	0.0094	0.0526	SID
Mean ROI	0.0358	0.0456	SAM	0.8730	0.8618	SAM	0.0162	0.037	SID	0.0318	0.0716	SID
LeeAdap	0.0293	0.0295	SAM	0.9045	0.9123	SID	0.0004	0.000	SAM	0.0008	0.0008	SAM
LeeMulti	0.0294	0.0292	SID	0.9025	0.9124	SID	0.0005	0.000	SAM	0.0010	0.0005	SAM
LeeBoth	0.0285	0.0300	SAM	0.9026	0.9101	SID	0.0004	0.001	SID	0.0008	0.0010	SID
Best method	***Dig. filter, SAM***			***LeeMulti, SID***			***Mean ROI, SID***			***Mean ROI, SID***		

Table F.14: Comparison between the brown testing area and the maps created based on the endmembers selected with several comparing metrics. The best mapping method and endmember extraction is given in the last row. List of abbreviations: Mean squared error (MSE), Structural similarity index of measure (SSIM), Tanimoto's index. Interpretation results: MSE = 0 (perfect pixel similarity) → +∞ (perfect dissimilarity); SSIM = 0 (perfect structural dissimilarity) → +1 (perfect structural similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Dice index = 0 (no image intersection) → +1 (perfect image intersection). Values for the maps building (threshold): SAM = 0.065 radiants; SID = 0.012 (max divergence) for all maps.

	SIMILARITY METRIC											
Endmember extraction	**MSE**			**SSIM**			**Tanimoto's index**			**Dice index**		
	SAM	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***
Original	0.0196	0.0200	SAM	0.8791	0.8907	SID	0.0027	0.0226	SID	0.0054	0.0442	SID
SGolay	0.0217	0.0209	SID	0.8602	0.8866	SID	0.0047	0.0307	SID	0.0094	0.0595	SID
Wavelet	0.0200	0.0204	SAM	0.8750	0.8912	SID	0.0030	0.0290	SID	0.0061	0.0564	SID
Dig Filter	0.0165	0.0151	SID	0.9106	0.9345	SID	0.0000	0.0000	SAM	0.0000	0.0000	SAM
PCA	0.0442	0.0375	SID	0.7634	0.7965	SID	0.0113	0.0307	SID	0.0224	0.0596	SID
MNF	0.0443	0.0364	SID	0.7634	0.8001	SID	0.0112	0.0315	SID	0.0222	0.0611	SID
Median	0.0186	0.0179	SID	0.8925	0.9163	SID	0.0027	0.0219	SID	0.0053	0.0429	SID
Mean	0.0202	0.0187	SID	0.8759	0.9103	SID	0.0043	0.0270	SID	0.0086	0.0526	SID
Mean ROI	0.0326	0.0260	SID	0.7990	0.8473	SID	0.0088	0.0336	SID	0.0175	0.0650	SID
LeeAdap	0.0222	0.0192	SID	0.8559	0.9063	SID	0.0056	0.0319	SID	0.0112	0.0618	SID
LeeMulti	0.0217	0.0203	SID	0.8603	0.8947	SID	0.0028	0.0307	SID	0.0101	0.0596	SID
LeeBoth	0.0193	0.0198	SAM	0.8818	0.8915	SID	0.0051	0.0224	SID	0.0055	0.0438	SID
Best method	***Dig. filter, SID***			***Dig. filter, SID***			***Mean ROI, SID***			***Mean ROI, SID***		

Table F.15: Comparison between the green (spot 1) testing area and the maps created based on the endmembers selected with several comparing metrics. The best mapping method and endmember extraction is given in the last row. List of abbreviations: Mean squared error (MSE), Structural similarity index of measure (SSIM), Tanimoto's index. Interpretation results: MSE = 0 (perfect pixel similarity) → +∞ (perfect dissimilarity); SSIM = 0 (perfect structural dissimilarity) → +1 (perfect structural similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Dice index = 0 (no image intersection) → +1 (perfect image intersection). Values for the maps building (threshold): SAM = 0.100 radiants; SID = 0.025 (max divergence) for all maps.

	SIMILARITY METRIC											
Endmember extraction	**MSE**			**SSIM**			**Tanimoto's index**			**Dice index**		
	SAM	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***
Original	0.0762	0.0814	SAM	0.7845	0.7748	SAM	0.0093	0.0100	SID	0.0185	0.0198	SID
SGolay	0.0784	0.0827	SAM	0.7808	0.7727	SAM	0.0099	0.0106	SID	0.0195	0.0210	SID
Wavelet	0.0770	0.0787	SAM	0.7835	0.7797	SAM	0.0098	0.0096	SAM	0.0194	0.0189	SAM
Dig Filter	0.0716	0.0591	SID	0.7941	0.7838	SAM	0.0073	0.0094	SID	0.0146	0.0186	SID
PCA	0.0827	0.0857	SAM	0.7746	0.7584	SAM	0.0128	0.0128	SID	0.0253	0.0253	SID
MNF	0.0827	0.0856	SAM	0.7745	0.7585	SAM	0.0128	0.0128	SID	0.0253	0.0253	SID
Median	0.0795	0.0853	SAM	0.7797	0.7654	SAM	0.0117	0.0118	SID	0.0231	0.0232	SID
Mean	0.0800	0.0848	SAM	0.7793	0.7662	SAM	0.0116	0.0114	SAM	0.0230	0.0226	SAM
Mean ROI	0.0805	0.0806	SAM	0.7766	0.7623	SAM	0.0132	0.0118	SAM	0.0260	0.0234	SAM
LeeAdap	0.0815	0.0839	SAM	0.7759	0.7696	SAM	0.0117	0.0109	SAM	0.0231	0.0215	SAM
LeeMulti	0.0799	0.0822	SAM	0.7785	0.7738	SAM	0.0106	0.0106	SAM	0.0210	0.0210	SAM
LeeBoth	0.0756	0.0811	SAM	0.7852	0.7752	SAM	0.0091	0.0100	SID	0.0180	0.0198	SID
Best method	***Dig. filter, SID***			***Dig. filter, SAM***			***Mean ROI, SID***			***Mean ROI, SID***		

Table F.16: Comparison between the green (spot 1) testing area and the maps created based on the endmembers selected with several comparing metrics. The best mapping method and endmember extraction is given in the last row. List of abbreviations: Mean squared error (MSE), Structural similarity index of measure (SSIM), Tanimoto's index. Interpretation results: MSE = 0 (perfect pixel similarity) → +∞ (perfect dissimilarity); SSIM = 0 (perfect structural dissimilarity) → +1 (perfect structural similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Tanimoto's index = -1 (perfect Euclidean dissimilarity) → +1 (perfect Euclidean similarity); Dice index = 0 (no image intersection) → +1 (perfect image intersection). Values for the maps building (threshold): SAM = 0.100 radiants; SID = 0.025 (max divergence) for all maps.

	SIMILARITY METRIC											
Endmember extraction	**MSE**			**SSIM**			**Tanimoto's index**			**Dice index**		
	SAM	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***	***SAM***	***SID***	***Best***
Original	0.0377	0.0683	SAM	0.8898	0.8032	SAM	0.0000	0.0017	SID	0.0000	0.0033	SID
SGolay	0.0395	0.0692	SAM	0.8794	0.8019	SAM	0.0000	0.0015	SID	0.0000	0.0031	SID
Wavelet	0.0382	0.0696	SAM	0.8866	0.8016	SAM	0.0000	0.0020	SID	0.0000	0.0039	SID
Dig Filter	0.0376	0.0481	SAM	0.8917	0.8118	SAM	0.0000	0.0008	SID	0.0000	0.0016	SID
PCA	0.0435	0.0635	SAM	0.8563	0.8196	SAM	0.0016	0.0055	SID	0.0031	0.0109	SID
MNF	0.0435	0.0639	SAM	0.8564	0.8187	SAM	0.0016	0.0057	SID	0.0031	0.0113	SID
Median	0.0400	0.0691	SAM	0.8754	0.7983	SAM	0.0001	0.0031	SID	0.0002	0.0062	SID
Mean	0.0415	0.0695	SAM	0.8674	0.7948	SAM	0.0005	0.0042	SID	0.0009	0.0084	SID
Mean ROI	0.0441	0.0630	SAM	0.8544	0.8206	SAM	0.0022	0.0061	SID	0.0043	0.0122	SID
LeeAdap	0.0406	0.0665	SAM	0.8724	0.8009	SAM	0.0002	0.0030	SID	0.0004	0.0059	SID
LeeMulti	0.0396	0.0678	SAM	0.8776	0.8008	SAM	0.0000	0.0024	SID	0.0000	0.0048	SID
LeeBoth	0.0373	0.0677	SAM	0.8924	0.8037	SAM	0.0000	0.0015	SID	0.0000	0.0029	SID
Best method	***LeeBoth, SAM***			***LeeBoth, SAM***			***Mean ROI, SID***			***Mean ROI, SID***		

F.1.4 Imaging methods

- *Digital Microscopy*: *Digital Microscopy*: All miniatures were observed under a Dino-lite® Pro AM4013MZT4 digital microscope. This microscope is equipped with an IR cut-filter (> 650 nm) and ensures images of spatial sampling 1280 x 1024 pixels (1.3 MP). All microscopic images were acquired at 435x magnifications, corresponding to a Field-of-View (FOV) of 0.91 mm x 0.68 mm (W x H), 0.1 mm Depth-of-Field (DOF) at a working distance (WD) of approximately 0.2 mm. The images were captured with DinoCapture® 2.0 (Windows).
- *IRR*: IR-reflectograms were acquired with an Osiris® camera by Opus Instruments LTD. (Norwich, UK). The camera is equipped with an InGaAs sensor sensitive between 900-1700 nm and the macro lenses system supplied by the company (78 mm, 1:4.5). To block the radiation with wavelength shorter than 850 nm, the lens system has a long-pass filter Schott RG850 placed before the aperture. The diaphragm aperture was left at f/8; the scale reading, at 35 across all acquisitions (camera-to-object distance: 29 cm). These conditions correspond to 55 mm x 55 mm FOV and 2 mm DOF. The average conditions of illuminations are described in *Lighting setup* Section. Slight adjustments were adopted to avoid exceeding levels of brightness in the capture area (namely > 90% of the value indicated by the software for the aquisition) Initially, fast-scan captures were taken to focus

the camera on the area of interest; later, each higher resolution reflectograms were acquired in slow scan mode (10 msec at 50Hz). Each illustration was divided into 4-6 tiles with 30-50 % percentage of overlapping with the neighbouring tiles to ensure a successful merging and obtain high-resolution recordings. Each tile had 4096 x 4096 pixel resolution, corresponding to a real-size dimension of 55 x 55 mm. The tiles were blended together with Adobe Photoshop CC 2019 to create bigger, high-res panoramas. The resolution of the final reflectograms is as follows: 7769 x 10987 pixel (Res. 326.v, fol. 1^{r}); 5844 x 8072 pixel (Res. 328.v, fol. 1^{r}); 5641 x 7390 pixel (Res. 5781.p, fol. 1^{r}). For the photomerging, the following corrections were applied: geometric distortion, vignette removal and HDR equalisation of the final image brightness.

- *Technical photography*: For the Technical photography (IR), a transformed Nikon D3100 camera with a Si CCD sensor (effective resolution of 14.2 Mpixel) equipped with an AF-S Micro objetive Nikkor 60mm 1:2.8 GED. Before the objective, a Xnite 1000b filter IR filter (2mm thickness) by LDP LLC - MaxMax was applied before the aperture to block the radiation with wavelength shorter than 1000 nm (45% efficiency). The diaphragm aperture was left at f/6.3; the ISO, at 100 and the exposure time was varied according to the luminosity of the object. Contextually to every shooting, an X-Rite, Colorchecker Passport Photo 2 was placed for the correction of white in post-processing. The conversion to grayscale and the calibration of white were performed in Adobe Lightroom CC 2019; additionally, the same software applied corrections for the effects of chromatic and optical aberrations.
- *Digital reconstructions*: The digital reconstructions were performed with a function build for the purpose. The function creates the digital reconstruction of undrawings or underprintings of 2-D painted objects based from their IRR images. The function uses the IR image as the starter for the creation of the reconstruction that employs a series of steps until returning a final contrasted image containing only the desired pattern.
- *Vis documentation*: For the visible (Vis) documentation, the miniatures under investigation were shooted with a Nikon D3400 camera, equipped with a Si CCD sensor (effective resolution of 24 Mpixel) and an AF-S Micro lens Nikkor 60mm 1:2.8 GED. The diaphragm aperture was left at f/5.6; the ISO, at 100 and the exposure time was varied according to the luminosity of the object. Contextually to every shooting, an X-Rite, Colorchecker Passport Photo 2 was placed for the correction of white in post-processing. Before the session, a custom colour profile of the camera was created at the same conditions of illuminations to calibrate the final colour rendering to the sensibility of the camera. The application of the purposely-created colour profile and the calibration of white were performed in Adobe Lightroom CC 2019; additionally, the same software applied corrections for the effects of chromatic and optical aberrations.
- *Lighting setup*: Two bulbs of Tungsten-Halogen VC1000Q Quartz light system (3200 K), 1000 W power, were positioned at the left and right at an angle of incidence of 50° (light-book-camera). These working settings were adopted to avoid mirror-like reflection. The lighting-object distance

was 2 m, and a lux-meter was adopted to ensure uniform illumination. For IRR analyses, it was not higher than ~ 50 W/m^2; in HSI analyses, the average value was 1300 lux, *c.* 110 W/m^2). A surface thermometer was adopted to make sure that no raise > 5% of the initial temperature would occur.

F.1.5 Analysis of granulometry

A series of reason make the granulometric assessment of the blue paints in Chapter 3, Section 3.2.1.1 a semi-quantitative assessment. The first lays in the recording technique: because the photographic method renders 3-D features into individual 2-D representations, this recording technique hampers the topographic information of the pictured areas. Every painted surface is a profile with unique topography rather than an ideally even surface. In other words, painted surfaces describe a series of valleys and heights of varying width, height and depth. Owing to profile imperfections, the pictorial materials of analysis areas may lay exactly on the focal plane of photographic devices, below or on top of it (respectively farther or closer to the observer). Thus, those visual features that fall in the analysis area may not fully correspond to the expectations from the ideal field of view (FOV) of the device with the effect of introducing slight underestimates or overestimates. However, previous experiences of topographic paint determination for one Hardouyn book (BPE, Inc. 438) allowed estimating surface roughness within the range comprised between 10 and 16 ţm[16]. In turn, this error applied to multiple features can affect the overall granulometry assessment.

The second reason for being cautious is the fact that 2-D images can portray particles from several angles of view. Should images represent a certain grain side, that side could correspond to the smaller or the broader. Highly crystalline azurite can occur can under many habits, but one side is found longer than the other across many morphological occurrences [17] On the contrary, a picture that portrays two sides of a crystal at the same time can introduce an unnatural elongation of the grain, resulting in exaggerations of its classification.

The third consideration to take into account concerns the serious shortage of state-of-the-art experiences which posed the problem of rigorous practices in granulometry evaluations for technical art studies. A limited selection of studies had employed this parameter purposedly[18]; other investigations discussed the importance of grain size to the visual effects of a pigment, yet do not pose a precise methodology for an accurate determination[19]. Specific protocols exist concerning soil studies, specifically to standardise sample

[16] See Bottura Scardina et al., “On the use of hand-held X-ray fluorescence spectroscopy coupled to Monte Carlo simulations for the depth assessment of painted objects: The case study of a sixteenth-century illuminated printed book”.

[17] Those from Chessy may be either semi-tabular or prismatic indeed. See Victor M. Goldschmidt. *Atlas der Krystallformen*. Heidelberg: C. Winters, 1913, "Kupferlasur" nos. 1, 301 for the two habits and https://www.mindat.org/min-447.html (Accessed November 28, 2021) for their 3-D digital treatment.

[18] J.R.J. Van Asperen De Boer. “An Examination of Particle Size Distributions of Azurite and Natural Ultramarine in Some Early Netherlandish Paintings”. In: *Studies in Conservation* 19.4 (1974), pp. 233–243.

[19] Gueli et al., “Effect of particle size on pigments colour”.

treatment, taxonomy and textural interpretation[20], as well as the World Reference Base for Soil Resources (WRB). Unfortunately, those approaches cannot find use in the technical assessment of art objects for a particular limitation. This constraint is that those methods do not limit their attention to the grain dimension but also evaluate its physical texture (like roundness, solidity, the eccentricity of the ideal ellipsoid). Artistic pigments appear as particles dispersed in organic media (a binder) with other inorganic and organic components (mostly extenders). Only a portion of their bulk emerges from the surface at a degree that varies upon the applied binder (fair for fatty binder and temperas, relatively poor for gouaches). Given so, the exposed portion of a pigment is the only part available for evaluation. However, it cannot offer the full range of information required for textural classification. Thus, an effective way to classify paints microscopically may be that of micro-analytical approaches applied for their qualitative and quantitative assessment, like X-ray diffraction studies (XRD). XRD considers mineral particles as systems consisting of several separated crystals (crystallites). Optical microscopes fail to detect or quantify such nanoscale features as crystallites due to the minimum resolution of visible light (0.2 μm, corresponding to half of the 0.4-0.7 μm spectral range). Yet digital microscopes can offer microscale information, namely of particles or grains. At this level, XRD evaluations approximate the shape of an assessed grain to a sphere with a homogeneous radius. That description offers the advantage of providing a uniform descriptive parameter for that grain, regardless of its degree of crystallinity (since not all grains may display the same level of geometrical regularity) at the expense of its textural features. In this case, the textural information was also neglected, and the maximum caliper or Feret's diameter (the longest distance between any two points along the selection boundary) was chosen as the descriptive parameter for the grain size.

The last limitation is the non-destructivity of the method and the image sample size. As for the first observation, the non-destructivity of the analytical approach due the impossibility of separating small portions of material from the case studies, hampered all the information related to the thickness of cross-sections and limited the attention exclusively to the surface. As for the second consideration, this study considered a minimum of three non-overlapping images to provide sufficient statistical representativity for the analysis spots. Despite that, not all pictures could permit ready identification of grains nor be crispy enough to be workable. Therefore, the values presented in the table were computed only based on one or two images for some spots (the number of images is referred to in the table). To compensate for the above uncertainties, the mentioned value of surface uncertainty is adopted as the base to express the confidence interval (16 μm). Besides, the classification employed for this section adopted the ranges provided by a common pigment retailer of natural powder pigment (Kremer Pigmente Gmbh & Co. Kg): fine-grain, below 38 μm; medium-grain, between 38 μm and 63 μm; coarse grain, between 63 μm and 80 μm; very coarse grain, above 80 μm. Careful quantification of those effects with laboratory reproductions, as well as a way to correct the effects of surface unevenness with 3-D calibration will be taken into consideration for future work.

Description of the assessment: The analysis of granulometry was performed by using the DM images

[20]ISO/TC 190/SC 3. *ISO 11277: 1998. Soil quality Determination of particle size distribution in mineral soil material Method by sieving and sedimentation*. Tech. rep. International Organization for Standardization, 1998.

on blue paints. The images were imported in the image processing software ImageJ 1.53e (released in the public domain by the National Institute of Health, USA). The images were pre-processed as follows: colour thresholding, contrast and brightness adjustment, conversion to grayscale (L) and final L-thresholding. Later, the images were converted to 8-bit, despeckled, their outliers removed and finally, watershed. This working method was done to identify only the grain of pigment of analytical interest and to remove outliers; in this process, not all steps were applied (only those necessary). The previous workflow was adopted only as images possessed good edges for the calculations; otherwise, the particles boundaries were identified manually (sixty grains were considered at least). Later, the scale of the image was imported (global set) and the "Analyse particles" function used. The dimension used for the calculation of the granulometry was Feret's diameter of each grain which was identified. Later, the results were imported into an Excel datasheet (Office 365 pack by Microsoft) and the values of Feret's diameter were classified into four classes of granulometry: *extra fine* (<38 μm); *medium* (38-63 μm); *coarse* (63-80 μm); *extra coarse* (>80 μm). Finally, the results were used to assess the Particle Size Distribution (PSD), being expressed as percentage of all particles retrieved for the analysis spots (blue paints). The granulometry range was chosen as the ranges given by the retailer Kremer Pigmente Gmbh & Co. KG (Aichstetten, Germany) for the purchase of azurite pigment. For each PSD assessment, the final values were averaged over 1-3 images.

F.1.6 Other imaging methods

- *Conversion of AR spectra to CIELAB coordinates*: Individual spectra (1 x 1 kernel) were extracted from the raw HC (lighting setup and recording conditions expressed before). For each HC, one additional spectra for the reference of white and another for the reference of black were taken: the reference of white was extracted from representative areas of the white target, whereas the reference of black was manually selected from the black frame of the target. In fact, the paint of the target is highly opaque, and rough to serve as a working standard of black. Each spectrum of irradiance for the paints under analysis was subtracted with the reference of black, and the reference of white was equally subtracted to obtain manually AR spectra. The dark pixel subtraction accounts for the effects of atmospheric haze, which may affect the final AR spectra. In fact, the results from the corrected spectra (those re-calculated) and uncorrected spectra (those which were extracted directly from each final HC) were compared, and the most reliable were those which had been corrected. Each corrected AR spectra derived a set of tristimulus values (XYZ) by multipling the spectrum for a colour-matching function (5 nm spectral resolution). Later, the XYZ coordinates were transformed into the CIE1976 colour space including the 10° Supplementary Standard Observer (CIELAB), by using the specific equations. For the conversion to XYZ values, the calculation adopted the Standard Illuminant D65. The output considers the white points of CIELAB colour space under the same illuminant (D65 Standard). The calculation was elaborated using the values and the practice reccomended in the ASTM Standard E 308-01, "Standard Practice for Computing the Colors of Objects by Using the CIE System". The values of the colour-matching functions and Illuminant

Sources are from *Technical report: Colorimetry*. Standard. Third edition. Commission Internationale de l'Eclairage, 2004, pp. 57-62.

F.2 Characterisation of the ink reproductions and ink micro-samples

F.2.1 Molecular characterisation

- *μ-FTIR*: An FT-IR Hyperion 3000 micro-spectrometer by Bruker (Billerica, MA, USA) equipped with a single-point MCT detector cooled with liquid nitrogen and a 15Œ objective lens was used. The spectra were collected in the transmission mode, in 50100 μm^2 areas, using a S.T. Japan diamond anvil compression cell. Infrared spectra were acquired with a spectral resolution of 4 cm^{-1}, 64 scans, in the 4000-650 cm^{-1} region (MIR). Before each measure, the interferogram of the background was taken. The spectra were acquired with the OPUS® 7.2 software by Bruker.
- *Py-GC/MS*: A system with a Frontier Lab PY-3030D double-shot pyrolyser was used. The interface was maintained at a temperature of 280 °C. The pyrolyser was coupled to a Shimadzu GC2010 gas chromatographer, coupled to a Shimadzu GCMS-QP2010 Plus mass spectrometer. A capillary column Phenomenex Zebron-ZB-5HT (30-m length, 0.25-mm internal diameter, 0.50-μm film thickness) was used for separation. Helium was the carrier gas at a flow rate of 1.5 mL/min. The split injector (15:1 ratio) operated at a temperature of 250 °C. GC temperature programme was as follows: 35 °C (1 min), followed by a series of temperature ramps: until 110 °C at 60 °C/min, until 240 °C at 14 °C/min, up to 280 °C at 6 °C/min, until 320 °C at 30 °C/min, and then an isothermal period of 6 min. Source temperature was placed at 240 °C, and the interface temperature was maintained at 280 °C. The mass spectrometer was programmed to acquire data between 40 and 1090 m/z. The sample (<100 μg) was previously derivatized with 3 μL of tetramethylammonium hydroxide (2.5% in methanol, v/v) and pyrolysed at 500 °C. Compound and material identification was performed using AMDIS software integrated with NIST-Wiley database (match factor >700).

F.2.2 Elemental characterisation

SEM-EDS: Scanning electron microscopy coupled with energy-dispersive X-ray spectroscopy (SEM-EDS) was used to characterize the elemental composition of gildings and its surface morphology with two different devices:

- *SE imaging*: Some microscopic images were taken with a Hitachi Variable Pressure SEM (VP-SEM) S-3700N. The uncoated micro-sample was observed in Secondary Electron mode (SE) at 10.0 keV, under vacuum, at acceleration voltage 10keV and 4 mm working distance from the sample (WD).

The imaging data achieved magnification in the range x4.0k-14.0k (FOV 6.8 μm x 8.8 μm at x14.0k, 22.6 μm x 29 μm at x4.2k) for three grains of the micro-sample, 2-3 magnified area for each grain.

- *BSE imaging and EDS analysis*: Other microscopic images were taken with a Phenom ProX G6 desktop scanning electron microscope to analyse the structure and elemental composition of the same micro-sample. Also uncoated, the micro-sample was analysed in low vaccum (under air pressure of 40 Pa). The back-scattering mode (BSE) was used at 15 keV for SEM imaging of three grains of the micro-sample, 2-3 magnified area for each grain. The resolution of the EDS detector is 123 eV at the Mn Kα line energy. To collect X-ray emissions from heavier elements like Pb, an acceleration voltage of 20 kV was chosen by adjusting the value manually. The EDS tasks and the quantification were achieved through the Phenom ProX G6 software.

F.2.3 Monte Carlo simulations

The current version of the code of the XRMC program for the elaboration of the MC simulations was developed in a collaboration between Ghent University, the European Synchrotron Radiation Facility and University of Sassari[21]. It is based on the database for X-ray interactions Xraylib[22] and has been implemented for the analysis of rough surfaces. The special version of XRMC used here has been developed for rough surfaces of corrosion layers of archaeological artifacts, this feature came in handy for the analysis of paints on manuscripts, which can be seriously affected by the geometric factor of local areas of undulation typical of animal skin sheets. XRMC simulates the detector response to the incoming X-ray radiation based on the model of the spectrum emitted by the X-ray source, the response of the detector and its efficiency, the convenient experimental setup and a user-defined quantification of the component of the analysed area at a given configuration[23].

The influence of the surface topography was studied under microscope and the obtained values were expressed as average height. The microscopical inspection allowed us to determine an overall roughness between 10 and 16 μm ($\pm$ 5 μm), meant as the average difference of the absolute difference of level between an ideal plane and the lowest/highest points of the cross profile. Also, during the same analyses, we could assess an average of valleys amplitude measuring around 1 mm. Based on these data, we performed several

[21] Ubaldo Bottigli et al. "Voxel-based Monte Carlo simulation of X-ray imaging and spectroscopy experiments". In: *Spectrochimica Acta Part B* 59.10–11 (2004), pp. 1747–1754. DOI: https://doi.org/10.1016/j.sab.2004.03.016; Bruno Golosio et al. "Monte Carlo simulation of X-ray imaging and spectroscopy experiments using quadric geometry and variance reduction techniques". In: *Computer Physics Communications* 185.3 (2014), pp. 1044–1052. DOI: https://doi.org/10.1016/j.cpc.2013.10.034.

[22] Antonio Brunetti et al. "A library for X-raymatter interaction cross sections for X-ray fluorescence applications". In: *Spectrochimica Acta Part B* 59.10–11 (2004), pp. 1725–1731. DOI: https://doi.org/10.1016/j.sab.2004.03.014; Tom Schoonjans et al. "The xraylib library for X-raymatter interactions. Recent developments". In: *Spectrochimica Acta Part B* 66.11–12 (2011), pp. 776–784. DOI: https://doi.org/10.1016/j.sab.2011.09.011.

[23] T. He et al. "An improved Si(Li) detector response function". In: *Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment* 299.1–3 (1990), pp. 354–366. DOI: https://doi.org/10.1016/0168-9002(90)90805-G

attempts to match the best fit for the simulation of the real surface using models simulating various distributions of surface irregularities - from sinusoidal models with spatial period corresponding to the assessed value of roughness and random noise - until flat surfaces. These attempts show that no observable differences between the simulated spectra. For this reason, a simple flat surface has been selected as the standard model for the simulated samples. In all likelihood, the design of the portable analyzer and the mounting setting were such that the intensities of X-ray radiation emerging from the rough surfaces of the analysis spot of BPE, Inc.438 were comparable to a flat surface's response. In addition, the large size of the spot of analysis (approx. 12 mm^2) had the effect of averaging the information about local irregularities. For these reasons, we considered adopting a flat plane for the simulations a sensible choice.

Margin of uncertainty for the chemical composition of these assays is 10% for all elements.

To evaluate the suitability of the spots for the MC simulations, shootings recorded with the internal camera of the p-XRF spectrometer were processed with MATLAB^{TM} R2019b software with Image Processing Toolbox^{TM} 11.0, Colour Threshold App to extract colour maps. A first map of the overall area of the spot was used as the first comparing quantity, while the areas corresponding to individual coloured areas or inked areas were mapped separately as the second comparing quantity. Both the overall area of the spot and the coloured areas were later converted to binary masks and percentages of the images were calculated and expressed as percentages of the overall area under analysis. The spots with the largest area of individual paints were used as the reference for the MC simulation for the colourant (table F.17).

Table F.17: Results of the evaluation of the coverage assessment for each pictorial layer. Confidence interval is expressed as standard deviation (1) of the binary image produced for each pictorial component

Spot		Component	Amount (%)	Error (%)
1	Red paint 1	Red paint	89.2	0.4
2	Red paint 2	Red paint	60.6	0.4
3	Blue paint 1	Blue paint	63.8	0.4
		Red paint	19.3	0.2
4	Blue paint 2	Blue paint	49.3	0.3
		Red paint	4.2	0.1
		Ink	6.6	0.1
5	Green paint 1	Green paint	77.6	0.4
		Ink	1.2	0.1
6	Green paint 2	Green paint	54.4	0.4
		Ink	17.8	0.2
No paint 1	Printing ink 1	-	-	-
No paint 2	Printing ink 2	Ink	43.9	0.3
No paint 3	Printing ink 3	Ink	30.2	0.3

F.3 List of the spots of analysis

The analyses were performed on the spots indicated in Figure F.1:

(a) Res. 326.v, fol. 1[r]

(b) Res. 328.v, fol. 1[r]

(c) Res. 5781.p, fol. 1[r]

(d) Res. 326.v, fol. 46[r]

(e) Res. 328.v, fol. 31[r]

(f) Res. 5781.p, fol. 49[v]

Figure F.1: Showcase of the spots of analysis for the three case studies: BNP, Res. 326.v, Res. 328.v, Res. 5781.p. The spots are the same for all the analytical methods.

Follows a table referring what techniques and how many spots have been used for each miniature:

SPOT		Res. 326.v						Res. 328.v						Res. 5781.p					
		Fol. 1r			*Fol. 46r*			*Fol. 1r*			*Fol. 31r*			*Fol. 1r*			*Fol. 49v*		
		XRF	FORS	HSI	XRF	FORS	HSI	XRF	FORS	HSI	XRF	FORS	HSI	XRF	FORS	HSI	XRF	FORS	HSI
Blue	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•
	2	•	•	•		•	•	•	•	•	•	•	•		•	•	•	•	•
	3										•		•						
Brown	1	•	•	•	•	•	•				•	•	•						
	2					•	•												
Green	1	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•		•
	2				•	•	•	•	•	•				•	•	•			
	3					•	•												
Pink	1	•		•				•	•	•	•	•	•	•	•	•	•	•	•
	2								•	•									
Red	1	•	•	•	•	•	•				•	•	•	•	•	•	•	•	•
	2										•	•	•					•	•
	3																	•	•
White	1	•	•	•										•		•			
	2																		
Yellow	1				•	•	•											•	•
Orange	1							•	•	•									
Gray	1																	•	•
Black	1							•		•							•	•	•
	2																•	•	•
Gilding	1	•	•	•				•	•	•	•	•	•	•	•	•	•	•	•
	2	•	•	•										•			•		

Table F.18

F.4 Digital reconstuctions

F.4.1 Description of the methods

Digital reconstructions MATLAB® R2019b software with Image Processing Toolbox™ 11.0 was applied. To create them, the reflectographies were segmented multiple times with thresholding algorithms based on L (levels of grey) values. Since the original bit depth of the reflectographies was 8, the magnitude of the dynamic range consisted of 256 levels. Thresholding filtering was done on single or multiple Ls chosen with local histograms extracted from representative regions of the image. Through this step, a series of binary masks representative of either individual or extensive underprinting features were extracted and combined until creation of an overall reconstruction. Upon completion, each mask was converted to 8-bit arrays and finally filtered with a Gaussian filter (1σ) to return visually appealing images.

F.4.2 Tests of BPE, Inc. 438

Table F.19: Comparison of the quality assessment of ROIs from the manual and automated reconstruction of BPE, Inc. 438, fol. 8r, measured with the quality metric Mean Squared Error (MSE). The *Result* column gives which method performed best for individual ROIs (value in cell), averaging all results (*Average*) and comparing the unsegmented reconstruction (*Whole image*). Δ refers the difference of value between the manual reconstruction and the automated reconstruction. The evaluation of the MSE index ranges from 0 (perfect pixel similarity) to +∞ (perfect dissimilarity).

MSE ASSESSMENT										
ROI	**Freehand ROIs**					**Geometric ROIs**				
	Autom.	***Manual***	*σ*	***Result***	Δ	***Autom.***	***Manual***	*σ*	***Result***	Δ
1	2125.7	1998.4	68.65	manual	127.3	1879.7	1879.7	60.93	manual	0.0
2	2456.9	2327.7	56.11	manual	129.2	2291.2	2281.2	79.38	manual	10.0
3	696.3	637.5	61.27	manual	58.8	1815.2	1815.2	85.89	manual	0.0
4	719.7	709.4	315.17	manual	10.4	1740.8	1740.8	72.68	manual	0.0
5	1414.0	1398.2	110.74	manual	15.8	2139.5	2139.5	111.60	manual	0.0
6	493.1	522.0	26.37	**autom.**	-28.9	1871.8	1871.8	74.97	manual	0.0
7	1474.9	1543.9	22.58	**autom.**	-69.0	1682.9	1682.9	72.90	manual	0.0
8	659.8	689.9	48.29	**autom.**	-30.1	1843.0	1843.0	104.97	manual	0.0
9	784.2	715.8	23.63	manual	68.4	1900.9	1900.9	74.60	manual	0.0
10	1456.9	1393.6	69.66	manual	63.3	-	-	-	-	-
11	1578.2	1440.1	25.35	manual	138.1	-	-	-	-	-
12	6200.0	6385.3	24.86	**autom.**	-185.3	-	-	-	-	-
Average	1671.6	1646.8	71.06	manual	24.8	1907.2	1906.1	81.99	manual	1.1
Whole	1631.6	1652.5	734.89	**autom.**	-20.9	1631.6	1652.5	734.89	**autom.**	-20.9

Table F.20: Comparison of the quality assessment of ROIs from the manual and automated reconstruction of BPE, Inc. 438, fol. 8r, measured with the quality metric 2D-correlation. The *Result* column gives which method performed best for individual ROIs (value in cell), averaging all results (*Average*) and comparing the unsegmented reconstruction (*Whole image*). Δ refers the difference of value between the manual reconstruction and the automated reconstruction. The evaluation of the 2D-correlation index ranges from -1 (perfect dissimilarity) to +1 (perfect similarity).

2D-correlation										
ROI	**Freehand ROIs**					**Geometric ROIs**				
	Autom.	***Manual***	***sigma***	***Result***	***Delta***	***Autom.***	***Manual***	***sigma***	***Result***	***Delta***
1	0.4828	0.4877	0.0183	manual	-0.0049	0.4849	0.4759	0.0186	**autom.**	0.009
2	0.5343	0.6141	0.0194	manual	-0.0798	0.4888	0.5057	0.0182	manual	-0.017
3	0.6144	0.6343	0.0153	manual	-0.0199	0.5503	0.6169	0.019	manual	-0.067
4	0.5163	0.5567	0.0154	manual	-0.0404	0.5019	0.5378	0.0207	manual	-0.036
5	0.5160	0.4916	0.0175	**autom.**	0.0244	0.5664	0.5630	0.0222	**autom.**	0.003
6	0.5772	0.5775	0.0201	manual	-0.0003	0.5468	0.5568	0.0205	manual	-0.010
7	0.6164	0.601	0.0178	**autom.**	0.0154	0.574	0.5904	0.0198	manual	-0.016
8	0.4350	0.5562	0.0213	manual	-0.1212	0.6192	0.5887	0.0218	**autom.**	0.031
9	0.4414	0.5304	0.0192	manual	-0.0890	0.5279	0.5436	0.0196	manual	-0.016
10	0.5419	0.5707	0.0187	manual	-0.0288	-	-	-	-	-
11	0.5151	0.5482	0.0189	manual	-0.0331	-	-	-	-	-
12	0.5563	0.5242	0.0230	**autom.**	0.0321	-	-	-	-	-
Average	0.5289	0.5577	0.0187	manual	-0.0288	0.5400	0.5532	0.0200	manual	-0.013
Whole	0.3803	0.3902	0.0273	manual	-0.0099	0.3803	0.3902	0.0832	**manual**	-0.010

Table F.21: Comparison of the quality assessment of ROIs from the manual and automated reconstruction of BPE, Inc. 438, fol. 8^{r}, measured with the quality metric Structural Similarity Index Measure (SSIM). The *Result* column gives which method performed best for individual ROIs (value in cell), averaging all results (*Average*) and comparing the unsegmented reconstruction (*Whole image*). Δ refers the difference of value between the manual reconstruction and the automated reconstruction. The evaluation of the 2D-correlation index ranges from 0 (perfect structural dissimilarity) to +1 (perfect structural similarity).

	SSIM									
ROI	**Freehand ROIs**					**Geometric ROIs**				
	Autom.	***Manual***	***sigma***	***Result***	***Delta***	***Autom.***	***Manual***	***sigma***	***Result***	***Delta***
1	0.9168	0.9427	0.0079	manual	-0.0259	0.9455	0.9484	0.0070	manual	-0.0029
2	0.9242	0.9297	0.0127	manual	-0.0055	0.9328	0.9366	0.0090	manual	-0.0038
3	0.9765	0.9796	0.0055	manual	-0.0031	0.9439	0.9464	0.0090	manual	-0.0025
4	0.9769	0.9795	0.0027	manual	-0.0026	0.9477	0.9480	0.0123	manual	-0.0003
5	0.9584	0.9604	0.0055	manual	-0.0020	0.9308	0.9305	0.0123	**autom.**	0.0003
6	0.9835	0.983	0.0026	**autom.**	0.0005	0.9434	0.9489	0.0085	manual	-0.0055
7	0.9543	0.953	0.0079	**autom.**	0.0013	0.9504	0.9513	0.0083	manual	-0.0009
8	0.9805	0.9799	0.0029	**autom.**	0.0006	0.9404	0.9401	0.0117	**autom.**	0.0003
9	0.9782	0.9805	0.0029	manual	-0.0023	0.9480	0.9528	0.0084	manual	-0.0048
10	0.9599	0.9606	0.0064	manual	-0.0007	0.9425	0.9448	0.0096	manual	-0.0022
11	0.9573	0.962	0.0070	manual	-0.0047	0.4904	0.5069	0.0832	manual	-0.0165
12	0.8046	0.8056	0.0350	manual	-0.0010	-	-	-	-	-
Average	0.9476	0.9514	0.0082	manual	-0.0038	0.5400	0.5532	0.0200	manual	-0.013
Whole	0.4904	0.5069	0.0832	manual	-0.0165	0.3803	0.3902	0.0832	manual	-0.010

G. Recipes from medieval treatises for human modelling

Schedula Diversarum Artium, Theophilus Presbyter (12th cent.)

Chapter 1: The mixture of pigments for nude bodies

Translated version in English: The colour, which is called the flesh tone, with which the face and nude bodies are painted is composed as follows. Take flake-white (which is white made from lead) and, without grinding it, put it just as it is, dry, in a copper or iron pot, place it over a fire and heat it until it has changed to a yellow colour. Then grind it and mix with it some ordinary flake-white and vermilion until it becomes the colour of flesh. Mix these colours according to how you want them: for example, if you want to have red faces add more vermilion; if you want light faces add more white, and, if pallid ones, add instead of vermilion a little green earth[1].

Original version in Latin: *Color qui dicitur membrana, quo pinguntur facies et nuda corpora, sic componitur. Tolle cerosam, id est album, quod fit ex plumbo, et mitte eam, non tritam sed ita ut est siccam, in uas cupreum uel ferreum, et pone super prunas ardentes et combure, donec conuertatur in flauum colorem. Deinde tere eum et admisce ei albam cerosam et cenobrium, donec carni similis fiat. Quorum colorum mixtura in tuo sit arbitrio, ut si uerbi gratia rubeas facies habere uis, plus adde cenobrii; si uero candidas, plus appone albi; si autem pallidas, appone pro cenobrio modicum prasini.*

Chapter 2: The pigment "prasinus"

Translated version in English: Green earth is a pigment, which looks like viridian mixed with black. Its nature is such that it is not ground upon stone, but, when put in water, it dissolves and is then carefully strained through a cloth. On a new wall it can be very usefully employed as a green colour[2].

Original version in Latin: *Qui prasinus est quasi confectio quaedam habens similitudinem uiridis coloris et nigri, cuius natura talis est, quod non teritur super lapidem sed missus in aquam resoluitur et per pannum*

[1] Translated version from Hawthorne et al., *Theophilus: On Divers Arts*, p. 14.
[2] Translated version from *ibid.*, p. 16

diligenter colatur; cuius usus in recenti muro pro uiridi colore satis utilis habetur.

Chapter 3: The colour called "posc"

Translated version in English: When you have mixed the flesh colour and with it filled in the faces and nude [parts of] figures, mix with it green earth and red (which is burnt from ochre) and a little vermilion, and prepare the shadow colour for flesh. With this you define the eyebrows and eyes, the nostrils and mouth, the chin, the hollows round the nostrils and the temples, the lines of the forehead and neck, the curves of the face, the beards of young men, the relief of the hands and feet, and all the parts that are separately defined in the nude figure[3].

Original version in Latin: *Cum uero membranam miscueris et inde facies et nuda corpora impleueris, admisce ei prasinum et rubeum, qui comburitur ex ogra, et modicum cenobrii, et confice posc; ex quo designabis supercilia et oculos, nares et os, mentum et fossulas circa nares et timpora, rugas in fronte et collo et rotunditatem faciei, barbas iuuenum et articulos manuum et pedum et omnia membra quae distinguuntur in nudo corpore.*

Chapter 4: The first rose pigment

Translated version in English: Then mix with the plain flesh colour a little vermilion and a little red lead5 and prepare the colour which is called rose. With this you redden the upper and lower jaw, the mouth and lower chin, the neck, the wrinkles of the forehead slightly, the forehead itself on each side above the temple, the length of the nose, on each side above the nostrils, and the relief of the other nude parts of the figure[4]. *Original version in Latin*: *Deinde misce cum simplici membrana modicum cenobrii et parum minii, et confice colorem qui dicitur rosa, unde rubricabis utramque maxillam, os et mentum inferius, collum et rugas frontis modice, ipsam frontem super timpora ex utraque parte, nasum in longitudine et super nares ex utraque parte, articulos et caetera membra in nudo corpore.*

Chapter 5: The first highlighting pigment

Translated version in English: After this, with the plain flesh colour mix ground flake-white and prepare the colour which is called the highlight. With this you will paint the eyebrows, the length of the nose, on each side above the openings of the nostrils, the fine lines around the eyes, below the temples, above the chin, near the nostrils and on each side of the mouth, the upper forehead, between the wrinkles of the forehead sparingly, the neck in the middle, around the ears, around the relief of the hands and feet and the centre of the highest relief of the hands, feet and arms[5].

Original version in Latin: *Post haec misce cum simplici membrana cerosam tritam, et compone colorem qui dicitur lumina, unde illuminabis supercilia, nasum in longitudine et super foramina narium ex utraque*

[3]Translated version from Hawthorne et al., *Theophilus: On Divers Arts*, p. 17.
[4]Translated version from *ibid.*, p. 17.
[5]Translated version from *ibid.*, p. 17.

parte, subtiles tractus circa oculos et timpora inferius et mentum superius, et iuxta nares et os ex utraque parte, frontem superius, inter rugas frontis modice et collum in medio et circa aures ac articulos manuum et pedum exterius et omnem rotunditatem manuum et pedum et brachiorum in medio.

Chapter 6: "Veneda", to be put on the eyes

Translated version in English: Then mix black with a little white; this colour is called dark grey. With it fill in the pupils of the eyes. Add to it still more white and fill the eyes on either side. Between this colour and the pupil apply plain white and blend in with water[6].

Original version in Latin: *Deinde commisce nigrum cum modico albo, qui color uocatur ueneda, et inde imple pupillas oculorum. Adde ei etiam de albo amplius, et imple oculos ex utraque parte, et album simplex linies inter pupillam et ipsum colorem, et cum aqua lauabis.*

Chapter 7: The second shadow pigment

Translated version in English: Afterwards take the shadow colour for flesh which has been referred to above6 and mix with it more green earth and burnt ochre so that it is a darker shade of the former colour. Then fill the middle space between the eyebrows and eyes, under the middle of the eyes, near the nose, between the mouth and chin, on the down or beards of young men, on the half-palms towards the thumb, on the feet above the smaller areas of relief, and on the faces of children and women from the chin right up to the temples[7].

Original version in Latin: *Postea accipe posc, de quo supra dictum est, et admisce ei amplius de prasino et rubeo, ita ut umbra sit anterioris coloris, et imple medium spatium inter supercilia et oculos et sub oculis medium et iuxta nasum et inter os et mentum et granos seu barbulas adolescentum et palmas dimidias uersus pollicem et pedes supra minores articulos et facies puerorum et mulierum a mento usque ad timpora.*

Chapter 8: The second rose pigment

Translated version in English: Then mix vermilion with rose and with it paint the middle of the mouth in such a way that the previous [rose colour] appears above and below, and make fine strokes over the [first] rose colour, on the face, the neck, and the forehead, and with it define the relief of the palms, the joints of all the limbs, and the nails[8].

Original version in Latin: *Deinde misce cum rosa cenobrium, et linies inde in medio oris, ita ut anterior superius inferiusque pareat, et fac subtiles tractus super rosam in facie, in collo et in fronte, et designabis inde articulos in palmis et iuncturas omnium membrorum et ungulas.*

[6]Translated version from Hawthorne et al., *Theophilus: On Divers Arts*, p. 18.
[7]Translated version from *ibid.* p. 18.
[8]Translated version from *ibid.* p. 18.

Chapter 9: The second highlighting pigment

Translated version in English: If the face lacks contrast so that one highlight does not suffice, add more white to the first highlight and paint fine strokes everywhere over the first highlight[9].

Original version in Latin: *Et si facies tenebrosa fuerit, ut ei non sufficiat una lumina, adde ei amplius de albo et super priorem linies subtiles tractus per omnia.*

Chapter 10: The hair of boys, adolescent and young men

Translated version in English: After this, mix a little black with yellow ochre, fill in the hair of boys and outline it with black. Add more black to the yellow ochre, fill in the hair of youths and lighten with the first colour. Add still more black and fill in the hair of young men and lighten with the second colour[10].

Original version in Latin: *Post haec misce modicum nigri cum ogra et imple capillos puerorum, et discerne eos cum nigro. Adde amplius nigri cum ogra et imple capillos adolescentum, et illumina cum priori. Adde amplius adhuc nigri et imple capillos iuuenum, et illumina cum secundo.*

Chapter 11: The beard of adolescent

Translated version in English: Mix green earth and burnt ochre and, if you wish, a little rose colour and fill in the beards of youths. Mix yellow ochre, black and burnt ochre, and fill in the hair; lighten with yellow ochre mixed with a little black, and with this colour make dark strokes on the beard[11].

Original version in Latin: *Misce prasinum et rubeum et, si uis, rosae modicum, et imple barbas adolescentum. Misce ogram et nigrum et rubeum, et imple capillos, et illumina ogra modico nigro mixta, et ex eadem mixtura fac nigros tractus in barba.*

Chapter 12: The hair and body of senile and old men

Translated version in English: Mix a little black with flake-white, and fill in the hair and beards of senile men. Add to this colour more black and a little burnt ochre, make strokes with it and paint with plain flake-white. Again mix more black with the flake-white, fill in the hair and beards of old men, and make strokes of the same colour. Mix more black with it and a little burnt ochre and paint with the colour you applied to the hair of the senile. If you so wish, make the hair and beards blacker in the same way[12].

Original version in Latin: *Misce modicum nigri cum cerosa, et imple capillos et barbas decrepitorum. Adde eidem colori amplius nigri et modicum rubei, et fac inde tractus et illuminabis simplici cerosa. Commisce rursum cerosae amplius nigri, et imple capillos et barbas senum, et fac tractus ex eodem colore, admixto ei nigro amplius et modico rubeo, et illumina eo unde decrepitos impleueras. Eo ordine, si uis, adhuc nigriores capillos et barbas compone.*

[9] Translated version from Hawthorne et al., *Theophilus: On Divers Arts*, p. 18.
[10] Translated version from *ibid.* p. 19.
[11] Translated version from *ibid.* p. 19.
[12] Translated version from *ibid.* p. 19.

Chapter 13: 'Exudra' and the other pigments for the face

Translated version in English: Mix a little black with burnt ochre; this colour is called dark red. With it make strokes around the pupils of the eyes and in the middle of the mouth, and fine strokes between the mouth and chin. After this, with plain burnt ochre make the eyebrows, and fine strokes between the eyes and eyebrows, below the eyes, on the right side of the nose in full face, above the nostrils on each side, below the mouth, around the forehead, on the hollow cheeks of old men, around the fingers of the hands, in the areas of relief of the feet, and, in the profile view, in front of the nostrils. The eyebrows of old men or those of senile ones you make with the dark grey with which you filled in the pupils. Then, with plain black, you paint the eyebrows of young men so that a little of the burnt ochre shows through, above the eyes, the openings of the nostrils, on each side of the mouth, around the ears, on the outside of the hands and fingers, and the relief and remaining lines of the body. Make all the lines round the nude [parts of the] figure in burnt ochre and outline the nails with rose[13].

Original version in Latin: *Deinde admisce rubeo modicum nigri, qui color uocatur exudra, et fac inde tractus circa pupillas oculorum et in medio oris et subtiles tractus inter os et mentum. Post haec cum simplici rubeo fac supercilia et subtiles tractus inter oculos et supercilia et oculos inferius, et in plena facie nasum in dextera parte et super nares ex utraque parte, et os inferius et circa frontem et maxillas senum interius, et circa digitos manuum et articulos pedum interius, et in conuersa facie circa nares in anteriori parte. Supercilia uero senum siue decrepitorum facies cum ueneda, unde pupillas implesti. Deinde cum simplici nigro iuuenum supercilia facies, ita ut superius aliquantulumm rubein appareat, et oculos superius et foramina narium et os ex utraque parte et circa auriculas, manus et digitos exterius et articulos et caeteros corporis tractus. Omnes uero tractus circa nuda corpora fac cum rubeo, et ungues designabis cum exteriores rosa.*

De Arte illuminandi (14th cent.)

Marginal note: Annotation on how to made the carnation of faces and other parts of the body

Translated version in English: If you want to make a flesh colour for the face or other parts of the body, fill the areas of the carnation with green earth mixed with a lot of [lead] white. Do it in such a way that the green [pigment] hardly reveals itself and the paint is fluid. Then cover the solid parts of the body with a similarly fluid *terrecta*, which you make by mixing yellow, black, indigo and red. Shade where necessary; then add relief and light with [lead] white and little green [earths] where it needs highlighting, similarly to painters. Then take red with little [lead] white to paint all coloured areas. Give the same mixture carefully to the dark areas; at least, glaze the entire carnation including the highlights with an extremely fluid paint [made of] the greatest part of [lead] white and red, depending on the nuance you want to give to the flesh.

[13] Translated version from Hawthorne et al., *Theophilus: On Divers Arts*, pp. 19-20.

Should your figures be too tiny, do not retouch any part except for the highlights. You can add highlights giving pure white, if you wish. Mix red, black and little yellow to make the black part of the eyes and contouring. You can also use indigo or black; give them [to those areas] as previously explained. The above details should suffice[14].

Original version in Latin: *Si vis facere incarnaturam faciei vel aliorum membrorum, primo debes investire locum totum, quem debes incarnare, de terra viridi cum multo albo, ita quod modicum appareat viriditas, et liquido modo deinde cum terrecta, que fit ex glauco, et nigro indico et rubeo, liquido modo, reinvestiendo proprietates figurarum, umbrando loca debita; deinde cum albo et modico viride releva vel clarifica loca elevanda, sicut pictores faciunt. Postmodum vero habeas rubeum cum pauco albo, et colora loca que debent esse colorata, et lento modo da de eadem materia supra loca umbrata, et finaliter cum multo albo et pauco rubeo, sicut vis colorare incarnaturam, liquidissimo modo totam incarnationem lineas, sed magis loca relevata quam umbrata. Et si figure essent nimis parve, quasi non tangas nisi loca relevata, et in fine iterum releva melius cum albo puro, si vis; et fac album in oculis et nigrum; et fac profilaturas in locis debitis cum rubeo et nigro et modico de glauco mixtis, vel cum indico, si vis, aut nigrum, quod melius est, et apta ut scis; et hec superficialiter sufficiant dicta.*

De Coloribus Diversis, Alcherius (15th cent.)

Recipe 317: The flesh colour of images is thus made

Translated version in English: Take terre verte, white, and lake, mix them together, and fill what you please with them. Then make a shade [tint] of green and ochre so that it may be like green, and mix with it a little lake, and mark the shadows with it; then make the rose colour with white and synople and lay it whenever you may think proper. Then make the flesh colour of ochre and white, with a little synople, and fill up the solid parts but that which is laid on the rose colour should be very thin. Then take some of that colour and lay on the eyebrows, and under the feet, on the mouth, chin, neck, and ears. Then draw as it were veins, and then with pure lake mark the eye-lashes, nostrils, eyes, and limbs. Then shade again lightly with pure white, and then draw the eyelids, eyes, and other members[15].

Original version in Latin: *Prenez vert terrin blanc et laque, et mellez ensemble et emplissiez la ou vous vouldrez, puis faictes ombre de vert et ocre en telle maniere que ce soit comme vert et mellez avecques un po de laque, et siguez vos lits, et puis ombre et puis rose de blanc et de synople, et roses la ou vous plaira, puis faites charnure docre et de blanc et dun po de cinople et mettez dedans les signemens espes et eil qui sera sur la rose sera tres sutil, puis prenez de celle couleurs et mettez sur les surcils et dessoubs les piez et sur la bouche et au menton et a la goile et aux oreilles. Et en faut si comme se fust vains, puis designez de pur lac les cilles et narines et les yeulx et tons les membres. Et metez de rechief dedens umbre legierement*

[14]Translation by the dissertation's author; original text in Brunello, *De arte illuminandi: e altri trattati sulla tecnica della miniatura medievale*, pp. 132, 134.

[15]Translated version from Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms of Jehan Le Begue, p. 300.

et de lac loignez un petit, puis le blanchissez de blanc pur, puis designez les cilles et les yeulz et les autres membres.

Recipe 344: To make a colour which is called "posc" for the undraped part of images

Translated version in English: Mix a little cynobre with simple flesh colour and a little minium and you will have the said *posc* colour, with which you will redden teeth (gums), nostrils, mouths, hands, the under part of necks, the wrinkles of foreheads, the temples, and the articulations and other members in all the undraped parts of painted and round figures[16].

Original version in Middle French: *Mettez avec simple membrane un poi de cynobre et un poi de mine, et vous avez la dicte couleur posc, de laquelle vous rougirez dens, naselles, bouche, mains, col par dessoubs, et les fronces du front, et les tremples, et les articles et les autres membres en tons nus dimages pourtraictes et rondes.*

Recipe 345: To make two colours, one called "lumine", and the other "cedre" or "excedre", for the undraped parts of figures

Translated version in English: Mix flesh colour, well-ground ceruse, and verblee [vertbleu] with cynobre, and you will have a colour which is called *lumine*, with which you will illuminate the eyebrows, the upper part of the nose, and the nostrils with very fine lines. The other colour is made by mixing red with a little black, which produces a colour called *cedre* or *excedre*, with which you will make the touches round the pupils of the eyes[17].

Original version in Middle French: *Mellez avec cynobre membrane ceruse bien molue et verblee si avez couleur qui est appellee lumine, de laquelle vous enluminerez les sourcils, le nez au long, et sur les pertuis des narines, faisant les trais soubtilz; et lautre est se vous mellez avec rouge un po de noir vous avez couleur qui est nommee cedre ou excedre, de quoi vous ferez les trais environ les pupilles.*

Strasbourg family (15th cent.)

Recipe 78: Making of flesh colour

Translated version in English: Item, if you want to make a beautiful flesh colour for young people. Then, take a little cinnabar (and) as much as red lead and the greatest part of/(less) Paris red. Mix a greater part of lead white into it and mix them all together so that the flesh colour is neither too red nor too light. If it is too red, mix in more lead white until it is correct. On that one should shade with cinnabar to which a little ochre and red lead is mixed. One should outline the eyes and the nose and the hands with face-brown-red

[16] Translated version from Merrifield, *Original Treatises, Dating from the XIIth to the XVIIIth Centuries*, vol. 1, Ms of Jehan Le Begue, p. 314.

[17] Translated version from *ibid.* p. vol. 1, pp. 314, 316.

to which a little soot is mixed and one should outline the pupil in the eyes with indigo to which a little verdigris is mixed[18].

Original version in High German: *Item wil du ein schön libvar machen zu jungen lüten so nim enwenig zinobers ouch als vil minie und aller meist paris rot und müsche dar unter das merteil bliwis und temperer das alles wol under enander das die libvar weder ze rot noch ze bleich si und ist si ze rot so müsche me bliwis dar in untz das ir recht wirt dar uff sol man setwen mit zinober do enwenig vergers und minie under si gemüschet und schetwe die antlit und und hende und do das bild nakent si man sol di ougen und nasen uff strichen und die hende mit antlit brun rot do enwenig ruses under gemischet si und sterlini in die ougen sol man mit endlich an strichen do enwenig spangrunes under gemischet si.*

Recipe 79: Another flesh colour

Translated version in English: Again, another flesh colour for brown people. Then take burnt red ochre and a little red lead and three times as much lead white. Mix well all together so that it is neither too light nor too deep. Shade with brown red into which a little soot is mixed. One should redden the cheeks with cinnabar to which a little brazil is mixed[19].

Original version in High German: *Aber ein ander libvarw zu braunen lüten so nim roten gebrennten verger und ein wenig minien und dristund als vil bilwis und temperer das wol under enander weder ze liecht noch ze satt und schetwe daruff mit brun rot do enwenig ruses si darunder getempert und die wangen sol man rüsimeren mit zinober do enwenig persit rot under gemischet si.*

Recipe 80: Another flesh colour

Translated version in English: Again another flesh colour for old people. Then take red lead and as much ochre and a little azure ashes and the greatest part of lead white. Mix well all together, neither too light nor too deep. On that, one should shade with ochre to which a little brown red is mixed (or with soot to which a little indigo is mixed). In this way one can modify the shadows so that one face is shaded differently than another, so they never look all the same one shading[20].

Original version in High German: *Aber ein ander libvar zu alten lüten so nim minien und verger glich und enwenig lazureschen und aller meist bilwis und temperer das alles wol under enander weder ze liecht noch ze satt und dar uff sol man schetwen mit verger do enwenig brun rot under getempert si und als mag man die schetwunge verwandlen das ein antlit anders wirt geschetwet denn das ander das si nüt alle glich sigent gestalt mit einen schetwungen.*

[18]Translated version from Neven, *The Strasbourg manuscript : a medieval tradition of artists' recipe collections (1400-1570)*, p. 125.

[19]Translated version from *ibid.* p. 125.

[20]Translated version from *ibid.* p. 125.