Studying 18th-Century Paintings and Works of Art on Paper

CATS Proceedings, II, 2014 Edited by Helen Evans and Kimberley Muir

STUDYING 18TH-CENTURY PAINTINGS AND WORKS OF ART ON PAPER

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in association with



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FOREWORD

This is the second CATS conference proceedings with papers from the international conference *Technology & Practice: Studying 18th Century Paintings & Art on Paper.* This two-day technical art history conference was held on 2–3 June 2014 at the 18th-century Frederiksberg Palace in Copenhagen. The conference was organised by CATS in collaboration with Helsinki Metropolia University of Applied Science in Helsinki, Finland, Nationalmuseum in Stockholm, Sweden, and the University of Oslo, Norway.

The conference focused on artists' techniques and materials, source research, conservation science, the history of science and technology, trade and pharmacy during the 18th century. Speakers explored tradition and changes in artistic practices in the light of the establishment of a series of national art academies in Europe throughout the century. The talks included topics such as workshop practice and materials, art historical and technical approaches to documentary evidence, and technical examination and the analysis of paintings and drawings. Issues of trade, supply and questions concerning the demand for materials for diverse artistic expressions were also analysed and discussed. Two keynote presentations and 16 papers were presented of which 15 appear in this publication following peer review and editing by our two most capable editors.

We hope you will find this second volume of CATS conference proceedings as enjoyable and enlightening as the previous one and that the information contained herein will stimulate further research into aspects of studying the technology and practice of 18th-century paintings and art on paper. As with the first CATS Proceedings, this volume is also available as a paperback book from Archetype Publications.

> On behalf of the organisers Prof Dr Jørgen Wadum Director of CATS

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DISCIPLINE AND WONDER: THE 18TH-CENTURY ART ACADEMY AND THE INVENTION OF THE ARTIST AS A FREE PRACTITIONER

Mikkel Bogh

ABSTRACT How did artists acquire knowledge of their fields of practice – whether painting, sculpture or drawing – in the 18th century? What was the nature and content of artistic training in a century that saw the establishment in many, if not most, European countries of academies or schools of art after the French model? What were the inherent tensions in a formal training system the purpose of which was to professionalise, to discipline and to secure the freedom of the artist? And how did the new training institutions sit in the context of an emerging art market that was gradually replacing the traditional art patronage system? A discussion of practices relating to 18th-century painting and art on paper, with a particular focus on the material and technical aspects of artistic production, should not only address the use, production and the availability of specific types of colour, paper, canvas, tools etc. but should also take into account the changing conditions of the making and training of artists including the role of new institutions such as the art academy during this period. This paper examines the function and workings of the art academies and their relation to artists' and artisans' workshops during this century. My argument revolves around the apparent paradox that the institutionalisation of art training and the academic disciplining of artists emerged at the same time in history as, and is intimately bound up with, the notion of the free artist.

Introduction

By and large the academy of art is an invention of the 18th century, but the academy as a public art school had its important predecessors in 16th-century Florence and notably in 17th-century Paris. The establishment in 1648 of the French Royal Academy of Painting (Académie royale de peinture et de sculpture) was motivated by the ambition on the part of those artists working under royal protection, the so-called brevetaires, to form an arena for the discussion, promotion and distribution of painting and sculpture that was independent of the restrictive guild system with its community rituals as well as its rigid regulations regarding techniques, materials, nationality and choice of subject.1 Many artists working outside the protection of the guild felt the need to develop a more flexible organisation, especially in light of the many new commissions emerging as a result of a building boom following a boosted French economy. In order for the academy to gain royal protection and to acquire state funding, the institution had to convince officials that it was a school offering teaching programmes for young talent. The need to shape an institutional identity in opposition to the guild gave rise to a whole rhetoric of art versus crafts. Thus the academy was seen as a place where the theory and practice of fine art, not just the craft of painting, was taught. Here aspiring artists would be offered an opportunity to rise above the level of the skilled craftsman through a theoretically informed programme based on intellectual ideas and drawing. This would take place in an institution where ideals of beauty, themes and composition were discussed among peers. The teaching programme developed in a new and more systematic direction under the directorships of Jean-Baptiste Colbert from 1661 and, from 1683, Charles Le Brun. From this point in time the institution was intimately bound up with efforts to reorient and ultimately control artistic production in order for it to serve the absolutist monarchy and the building of the nation. In the case of the French Royal Academy, a reorientation towards a specific French idiom implied the development of a 'classical' and grand style that was deemed non-Italian as well as non-Spanish.2



Fig. 1 Antoine Watteau, Gersaint's Signboard, 1721, oil on canvas, 163 × 308 cm, Charlottenburg Palace, Berlin.

However it took time for this idea to disseminate to other European countries, partly because of financial issues. In 1720 there existed only three or four academies of art and only six new academies opened during the following two decades. As late as 1740, less than 10 academies offered teaching curriculums.3 Academies still worked mainly as professional forums and clubs where peers could meet and exchange ideas relating to philosophy, geometry and literature, and where norms and standards of the profession could be agreed - most did not function as public art schools in the modern sense. All this changed dramatically after the mid-century. Over the next four decades more than 100 art academies and public art schools emerged, most of which now included teaching duties. According to Nikolaus Pevsner, the fast establishment of institutions of artistic training ran parallel to the development of a neo-classical style in the arts. Excavations beginning in Herculaneum (1738) and in Pompeii (1748), together with the publication of German art historian J.J. Wincklemann's seminal works on Greek art, helped to lay the foundation for this neo-classical fashion. The classical Greek canon was promoted as the new norm of contemporary style and focus was once again put on the human figure. The new style, and the conformism that accompanied it, offered a sort of impetus for the adoption of normative curricula, as well as for the introduction of academic standards and abstract ideals against which observations of nature could be measured and corrected.

Pevsner probably overemphasised the stylistic background of the almost explosive emergence of public art schools throughout Europe, even though academies evolved from an anti-Rococo trend. The need for normativity was not only a question of the stylistic rigour of classical style and of making sure art students got it right. Training students in a more or less classicist style, based on a Renaissance principle of instruction through drawing, fixed in a set of academic and institutional norms, was, at least in smaller European nations such as Denmark, partly a means of producing local artists of high quality to avoid dependence on expensively imported artists from France, and partly a way of securing control of official imagery. At a time when the art market was already flourishing and, to a growing extent, artists' productions were following routes other than those provided by patrons and official commissions, there was an imagined risk that artists would become too idiosyncratic in their choice of subject and style. The transformation of the area of artistic production and distribution, as well as the development of new relationships between artists and consumers, did not happen overnight - it was only by the mid-19th century that the art market and art institutions such as museums, art criticism, auctions etc. were in place as a coherent art system. But this development had already begun in the late 17th century and even had its precursors in cities such as Antwerp and Frankfurt back in the mid-16th century, long before academies assumed the role of quality assurance institutions previously played by the guilds.⁴

Antoine Watteau's famous late work *Gersaint's Signboard* (1721) (Fig. 1) offers a hint of what an early 18th-century art market would have looked like. Far from being the place where artists' works were commissioned directly by patrons, dealers such as the Paris art dealer Gersaint (for whose small boutique Watteau made this outdoor sign) had a great variety of artists, themes and even styles on display and in storage. Gersaint in this painting is offering works made by artists for an anonymous albeit noble public of both amateurs and connoisseurs, who in this painting are coming with a view to enjoying hitherto unseen work. In the context of a European art market appealing to or even, as it were, generating independent artists, the art academy had the dual function of both delivering professional local artists for a

buying public as well as setting the standards of what was appropriate including standards of decorum, legibility and interpretation.⁵ Officially sanctioned art, including work distributed to anonymous consumers in the art market, was to be correct in tone, taste and content. But most importantly, each state and each prince in the second half of the 18th century considered the art academy as a way of guaranteeing that the most talented and skilled artisans would be raised to the level of artists and architects. Thus the art academy ensured that every state would have in its possession highly educated artists to take on commissions from the royal household, the aristocracy and the wealthiest bourgeois citizens. The ability to provide decorative, built and representational solutions for the absolutist state and its highest ranking proponents and representatives was, from the outset, the most important official rationale of the art academy. But the academy cannot be seen as distinct from the emerging modern art market and the other new institutions of art.

The workshop and the academy

Transformations not only took place between artist and buyers or consumers of art - the commercialisation of the art market had been under way since at least the mid-16th century. Now an entire system of art was in progress, and the art academy was only one institutional factor in the creation of a system that had not previously existed. Of course, ever since the Renaissance there had been a growing awareness that 'fine art' was a profession or a category of its own, but as late as the first half of the 18th century there was still no clear distinction made between fine art understood as painting, sculpture and engraving and any other business in the production of images such as shop signs, furniture painting, applied art etc. Encyclopaedias in the early part of the century did not use beaux-art as an area of knowledge in its own right. Sculpture and architecture were mentioned in categories such as 'mechanics' whereas painting existed under the category 'optics,'6 both being part of general mathematics. However, d'Alembert, Diderot and the other editors of the French Encyclopédie (1751) suggested a totally different and new systematisation of human knowledge, divided into three headings: 'memory', 'reason' and 'imagination'. Painting, sculpture and engraving belonged to the latter category. As imaginative and poetic areas of knowledge, on a par with, yet distinct from, science and the humanities, a clear line of demarcation was now being drawn around the fine arts separating these from crafts-based image practices. The gradual opening up to the public of museums of art, the advent of the juried exhibition beginning with the annual salon introduced by the French Royal Academy in Paris in 1737, as well as the birth and development of art criticism through which a reading and art-consuming public would get evaluative interpretations of recent exhibitions and publication, together with the segregation of the fine arts as an area of knowledge suggested by the Encyclopédie, formed part of the institutional and discursive process leading to the definition

of art as a separate and autonomous field or, in the words of Larry Shiner, to the 'invention of art'.⁷

The new system of art was, of course, not as coherent as it might seem from a historical distance. Even though the transformation had a clear direction, old and new forms of production, evaluation and distribution of art existed side by side during the 18th and 19th centuries. The same applies to the public art schools whose roles as instructive institutions were by no means unambiguous. No doubt the academies contributed to the establishment of a system of fine art or beaux-arts according to which art was an autonomous practice and the artist a practitioner in a field more or less unrestricted by the rules and norms pertaining to the rest of society, as well as to other fields of practice, particularly those of the artisans. At the same time, however, the academy was closely bound up with a master-apprentice model that was basically inherited from late medieval times and according to which students of art would receive their most fundamental training through working in close proximity to a master in his workshop and in certain cases would serve as his assistant. Academies in the 18th century did not offer any training in basic artisanal skills such as carving, colour fabrication and painting. To achieve such skills was of course part of any artists' toolkit and mastery in the arts was also considered mastery of execution, meaning technical-material ability. But this part of artistic practice was not included in the curriculum offered by the academy. Until the mid-19th-century, technical and material handling was taught to art students in private studios where 'masters' held workshops and classes - some were not doing so in their capacity as academy professors but as a private and extracurricular activity. These were, of course, more than mere technical workshops. Stylistic influence was part of what students sought just as a general sensibility towards subject matter and 'artistic discourse' was being handed over.

Before, during or after their academic programme, students of art would seek further training and inspiration from well-known masters such as Jacques-Louis David in Paris. Thus early in his career Danish painter C.W. Eckersberg went to study with David in Paris for almost three years, a fact that did not make him a 'pupil' of David in the sense that Anne-Louis Girodet had been a pupil-assistant - and eventually also in opposition - to David.8 But the instruction Eckersberg received in David's studio did indeed provide him with a stronger vision and a firmer grip on composition, spatial construction and figure drawing. It is no coincidence that Eckersberg attended lessons at David's studio on his way to Rome. For most public art schools, the French Royal Academy was still the model to follow and a trip to Rome was tantamount to becoming an accomplished artist according to this way of teaching. It was all about studying and imitating the great masters from both classical antiquity and the Renaissance. The Grand Tour was part of postgraduate artistic training in the 18th century, often made financially possible by an academic prize or grant from taking part in annual competitions. But the programme in the academy per se was largely taken over from the 17th century by the French Royal Academy which, for its part, was based on late Renaissance Florentine and Roman academy models.9 What seems radically new in a larger cultural historical context, however, is the role now assigned to the academy and its programmes in terms of preparing and shaping artists to become autonomous actors producing independent work to a consuming rather than commissioning audience. Assuming this role in an institutional structure basically inherited from the 16th and 17th centuries was a complex task to say the least. Henceforward the academy was assigned to discipline students in a classical tradition through strictly curricular studies but was, at the very same time, meant to evoke a free and independent spirit compelling wonderment through 'signature' works to be circulated in the art market. But what did such a curriculum look like? How were students taught in the art academies of the 18th century?

Design before colour

A curriculum, the basic tenet of which was to institutionalise the distinction and separation of the artist from the artisan, would necessarily have to elevate its students above the mere practical approach to art making.¹⁰ Although many art academies in the 18th century - the Royal Danish Academy of Fine Art in Copenhagen being a case in point – did function as training institutions for artisans such as masons, stucco modellers, decoration painters and cabinet makers showing artistic potential, the main purpose was to recruit from this stock of often very young craftsmen (the Danish sculptor Bertel Thorvaldsen was admitted to the academy at the age of 13), those who could develop their practice into art and who had the intellectual capacity and the discipline required to work with 'elevated' subject matters. The academy curriculum consequently did not offer any classes or instruction in the craftsmanship demanded by painting, engraving and sculpture, thus there were no classes in stone carving, colour mixing or easel painting. By and large the academy was a drawing school. In this respect academies also followed the French and ultimately the Florentine art school models. Studying drawing was surely a matter of developing eminent draughtsmanship but there was more to it than that.

Drawing was first and foremost referring to the Renaissance neo-platonic idea of disegno, meaning underlying design, theoretical coherence and layout and idea rather than the practice of drawing, even though the notion, at least in an 18th-century academic practice, was not devoid of subtle reference to both idea and drawing as it was seen as the unity of graphic activity. Giorgio Vasari, in his *Lives of the Artists* from 1568, articulated it as: 'Disegno is an apparent expression and declaration of the concetto that is held in the mind and of that which, to say the same thing, has been imagined in the intellect and fabricated in the *idea*.¹¹ The fact that the courses taught in 18th-century art academies were either pure drawing lessons or lectures on subjects such as geometry, anatomy, history, mythology and philosophy was, in the words of Nikolaus Pevsner, due to the 'conscious and well-considered conviction of the theorists of those days that the activity of the industrial artist is nothing but the translation of drawings into different materials with the aid of different tools.¹² Whereas the French Royal Academy had only a few hours of late afternoon classes in drawing, the remainder of the day being devoted to theoretical classes, an 18th-century curriculum consisted mostly of drawing with theory secondary. Starting with drawing from drawings, the student would pass on to drawing from casts ending with drawing from life models or life drawing. These courses were in fact taught in different classes within the academies and students were granted admission according to their talent. At the Copenhagen academy in 1784, 138 students attended the Elementary course, 70 Ornament drawing, 20 Antique drawing and 29 Life-drawing.

But transferring the acquired drawing skills to sculpture, engraving or painting mostly took place in workshops outside the academy. In Paris a particular school was set up in 1748 in order to provide instruction in the practice of oil painting to the six best students of the academy who were awarded the Grand Prix. The École des Élèves Protégés was not favoured by the academy theoreticians who found it to be too practical and too oriented towards painterly practice and it was eventually closed down in 1775, once again leaving instruction in the practice of painting to the private studios of artists. The result of this drawing-based and theoretical academy model was that painterly methodology developed unsystematically and individually: each studio and each workshop kept its secrets and its recipes to itself. In the academy, however, drawing was where everything started – and ended. Drawing was not contaminated by the flesh of paint: it was almost immaterial and as such much closer to the ideal, the concetto, than painting, sculpture and building. Contemporary philosophers held the same view. Kant and Schiller both showed contempt of, or at least assigned no central role to, manual skill and practical-technical matters, including those of colour and colouring.13 They considered drawing to be closer to reason as well as to a moral state that was elevated above nature. Freedom in this respect was by no means a matter of the freedom to 'express oneself' through colour and gesture a purely modern invention - but was a question of being free of the constraints of matter and desire, of achieving a spiritual freedom or 'drive' that, in the eyes of Schiller, could counterbalance the 'sensuous drive'.¹⁴ Drawing and design were seen as superior to colour. The Florentine Cinquecento conviction that design came before colour was taken up in academies of the 18th century, the most radical of which would praise the 'contour' as the primary hinge between theory and practice, the ideal and the real. Mastery of drawing meant greater freedom in this sense: greater independence from nature and desire. Academic teaching syllabuses reflected this idea and its accompanying value system. But freedom could take new directions not necessarily acceptable in an academy system in which discipline and the norm was essential.

Dilemmas of institutional freedom

Art academies of the 18th century were not harmonious entities. Torn between serving the king and producing artists for the market, they were sometimes in opposition to royal power. Internal conflicts and dilemmas were often felt between the official training programme and the drives and desires of individual students and professors. In Copenhagen, academy professors such as Johannes Wiedewelt and Nicolai Abildgaard were both accepting commissions from the king and proudly offering decorative and representative solutions to meet the standards of the day and the expectations of the royal household. But at the very same time they were students of radical French enlightenment thinking, who were reading books by Voltaire during clandestine meetings and producing works mocking royal power or promoting a Sturm und Drang passion not regarded as appropriate by the official academy. Almost from the outset the academy was characterised - some would even say racked - by a tension that we could call the paradox of freedom. Academies disciplined their students through theory, norms, ideas of correctness and decorum, standards of drawing etc. Achieving a freedom from the dependence of nature and craftsmanship was one of the declared purposes of this institutionalisation of teaching. Academic teaching was higher education, not a matter of practice. But the notion of freedom and of the free artist also meant that individuals could turn away from the institutionalised norms in pursuit of new territories of expression.

According to this academic discourse, genius and freedom sum up the attributes of the new artist that would be distinct from the routine-based and dependent craftsperson. But this freedom also meant 'freedom from the imitation of traditional models (originality), freedom from the dictates of reason and rule (inspiration), freedom from restrictions on fantasy (imagination), freedom from the exact imitation of nature (creation).¹⁵ Whereas most students, in accordance with the authority structure of their time, were likely to follow the example of their academy professors and the directions in terms of style and taste given by the institution, others were beginning to feel that the constraints of academic rules and norms did not allow for the realisation of the very same freedom that the academy claimed to bestow upon its students. A student who was expected to be original, inspired, individual and imaginative could not at the same time live within a framework that set too narrow standards of practice. In addition, the fact that painting and sculpture was so downsized, that drawing was the prime subject of teaching, gave rise to dissatisfaction on the part of the most freedom-seeking young artists. Danish sculptor Bertel Thorvaldsen, who in his youth in Copenhagen attended a clandestine reading group where the French revolution was debated, left the Royal Danish Academy as a student in the 1790s in order to study antiquity in Rome. No doubt Thorvaldsen wanted to be closer to the original antique statues he adored, but he was also seeking his fortune as an international, independent and free artist working outside the confines of the academy. Thorvaldsen eventually returned to Copenhagen after 42 years in Rome as an academy professor, more so in name that in deed, as he never taught and never had any students. He was a cosmopolitan artist fit for a cosmopolitan art market.

William Hogarth, who started his career as a silver engraver and significantly rose to the rank of painter-artist, was taking part in the English debate around the establishment of a national academy. But Hogarth differed from many of his peers in his wish for a free academy that was democratically organised and that would be responsive to the real society around it.16 The French model was too hierarchical according to him, and too little supportive of indigenous art like his own satirical paintings and prints that were attracting significant publicity and lots of local buyers. Hogarth, who characteristically used the pseudonym 'Britophil', was by his own understanding a free British artist who wanted free national academies where local artists could flourish, not cosmopolitan institutions based on Parisian norms. In that sense he was the first artist to deliberately use his national identity as part of his public artistic persona and, as such, his position anticipated a tension within national academies between proponents of the regional arts and those who were in favour of international taste and style.17

As a student at the Royal Danish Academy in Copenhagen, the German-Danish artist Asmus Jacob Carstens had already shown contempt for the drawing-oriented curriculum and thus at an early stage engaged in large painting compositions. Shortly after leaving the school he settled in Berlin where he was granted a teaching position at the academy in Berlin. But the academic system was not to his liking and even when he was sent to Rome on a scholarship he wrote back to his academy complaining about how the institution destroyed talent and originality: 'When there were no academies great artists lived and were encouraged by the powers of their time to use their genius on great works, whereas academies have caused Art to deteriorate until it has become content with working at head- and tail-pieces in books.'18 In another letter to his friend and mentor Baron von Heinitz, curator of the Berlin academy and a Prussian minister of mining, he wanted to explain why he had to stay in Rome permanently and needed more funds: 'I wish to tell your Excellency that I do not belong to the Berlin academy but to mankind ... I can develop myself only here, amongst the best works of art that exist in the world, and shall continue to the best of my powers to justify myself to the world by my work.'19 Rebellious Sturm und Drang or neo-classicist artists of the late 18th century, whether French, Danish, English or German, were caught up in the dilemmas of institutionally promoted freedom: they not only badly needed the support of the academy - they were in a sense themselves products of the same art system as the academies - but at the same time they opposed the rules, the authoritarian structure and the often rigid teaching methods of the art schools.

Conclusions

Academies as public art schools in the 18th century assumed a vital role in the evolution that led to the invention of the notion of the independent artist; an artist who at the same time was fit for the anonymous art market and could accept official commissions. Building taste, style, knowledge and a certain measure of originality and creative genius required

discipline, correction and exposure to a normative curriculum, as well as the necessary permissions that would lead to independence and freedom. The paradox inherent in the process of academic training was that academies needed normative curricula and rule-based teaching in order to define art as beaux-art, i.e. as a separate area of its own, elevated above the practices of artisans, and in order to produce artists as independent actors and freelancers capable of making 'masterworks'. Thus the academies were promoters of rules inasmuch as they were giving rise to the idea of art as freedom from rules. They were disciplining institutions in the sense that they were producers of wonder and originality. Today's art academies and art schools are not short of inherent dilemmas and tensions inherited from the first academies of the 18th century. Individual creation and freedom, the nurturing of talent and capacities in the individual students, have to find their place within a more or less strict curricular programme. Drawing as the common disciplining act has disappeared and workshops offering teaching in techniques and materials are at the students' disposal. But it is still a vexing question in art academic discourse as to which ways higher education can, or even should, incorporate the practices and materials of art production in its programme. The tension in the academy between practice and discourse has not been resolved to this day. We might even call it productive.

Notes

- For a succinct, contextual account of the formation of the Académie royale de peinture et de sculpture, based on the ambition of making a school of figure drawing, in Paris in 1648, see T. Crow, *Painters and Public Life in Eighteenth-Century Paris*, New Haven and London, Yale University Press, 1985, pp. 23–36. For a more elaborate rhetorical and discursive analysis of the academy and its role in relation the Paris guild, the Maitrise, see P. Duro, *The Academy and the Limits of Painting in Seventeenth-Century France*, Cambridge, Cambridge University Press, 1997, pp. 31–62.
- 2. M. Fumaroli, L'École du silence. Le sentiment des images au XVIIe siècle, Paris, Flammarion, 1998, pp. 478–536.
- N. Pevsner, Academies of Art: Past and Present, Cambridge, Cambridge University Press, 1940, pp. 140–141.
- 4. Two important contributions to the description of the burgeoning and flowering art market under the pre-academic guild-regulated system from the mid-16th to the mid-17th century Antwerp are E.A. Honig, Painting & the Market in Early Modern Antwerp, New Haven and London, Yale University Press, 1998, and F. Vermeylen, Painting for the Market: Commercialization of Art in Antwerp's Golden Age, Turnhout, Brepols Publishers, 2003. Honig points to the fact that by the mid-17th century the focus and interests of the art-loving audience had changed. While early Antwerp art buyers tended to pay little attention to authorship and authenticity, during the 17th century the idea of artistic originality gained foothold and so the connoisseur - an individual in possession of a refined judgement and a detailed knowledge of art and artists - became central to the art market (Honig, op. cit., pp. 170–212). This new attention to singularity of style and signature also affected the ways in which artists developed technically and branded themselves; see in particular the brilliant analysis

in C.D.M. Atkins, *The Signature Style of Frans Hals: Painting, Subjectivity, and the Market in Early Modernity,* Amsterdam, Amsterdam University Press, 2012. What was lacking, however, in the early modern art markets of, for example, Bruges, Antwerp, Amsterdam and Frankfurt was exactly the coherent institutional system including art criticism, museums, academic education etc. that came to be characteristic of the 18th-century art world.

- A particularly useful discussion of the role of the Académie royale de peinture et de sculpture, not least under the directorship of Charles Le Brun, in securing the legibility of French history painting and thus its role in the formation of a truly discursive visual language can be found in N. Bryson, *Word and Image: French Painting of the Ancien Régime*, Cambridge, Cambridge University Press 1982, pp. 29–57.
- L. Shiner, *The Invention of Art: A Cultural History*, Chicago, University of Chicago Press, 2001, pp. 80–81.
- Ibid. Another and somewhat more cumbersome approach to the evolution, from the 16th to the 19th century, of an autonomous auto-referential system of art is N. Luhmann, *Die Kunst der Gesellschaft*, Frankfurt am Main, Suhrkamp, 1995, pp. 215–300.
- T. Crow, *Emulation: Making Artists for Revolutionary France*, New Haven and London, Yale University Press, 1995, pp. 117– 144.
- C. Goldstein, *Teaching Art: Academies and Schools from Vasari* to Albers, Cambridge, Cambridge University Press, 1996, pp. 10–29.
- 10. The art and craft opposition was an important part of the founding narrative of the academy. But only a few of the dismissive characterisations of the guild offered by the academy were based on facts. In 17th-century France however, this narrative was instrumental in the formation of the Académie: 'While the existence of the guild provided the Academy with an easily identifiable boundary between art and craft that in reality did not exist, it also had the advantage of creating a "before and after" complexion to the years around 1648': Duro 1997 (cited in note 1), p. 33.
- 11. Goldstein 1996 (cited in note 9), p. 14.
- 12. Pevsner 1940 (cited in note 3), p. 174.
- 13. For an excellent and nuanced account of Kant's idea of the primacy of design and composition (over matter and, in Kant's words, 'The charm of colors or the agreeable tones of the instrument') see P. Guyer, *Kant and the Claims of Taste*, Cambridge MA and London, Cambridge University Press, 1979, pp. 224–248. Paul Guyer sums up Kant's view on colour versus drawing: 'Kant's use of such terms as "drawing" and "outline" suggests that nothing but the lineal, geometrical, or spatial properties of even complexly colored objects are responsible for their beauty. Colors, whether singly or in groups, can never do more than add charm to beauty': op. cit., p. 226)
- 14. Shiner 2001 (cited in note 6), pp. 146-151.
- 15. Ibid., p. 112.
- 16. Ibid., p. 117.
- M. Craske, Art in Europe 1700–1800, Oxford, Oxford University Press, 1997, p. 109.
- 18. Pevsner 1940 (cited in note 3), p. 195.
- 19. Ibid., p. 197.

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THE EFFECT OF PRUSSIAN BLUE ON THE TECHNIQUE OF THE DANISH COURT PAINTERS HENDRIK KROCK AND BENOÎT LE COFFRE

Loa Ludvigsen, Mikala Bagge and Vibeke Rask

ABSTRACT This paper is a preliminary study centred on cross-sections collected by the National Museum of Denmark over the past 40 years. The focus is Denmark in the early 1700s, represented by the two court painters Hendrik Krock and Benoit le Coffre. The aim is to compare their painting materials and use thereof in the period 1708–30. Emphasis is placed on the handling of the ground and paint layers and the use of blue pigments. Prussian blue was used in *plafond* paintings, by both artists, from the year 1721. From 1722 onwards the use of Prussian blue seems to exclude the use of other blue pigments in paintings by Krock. Judging from the differences in the structures of the paint layers in the paint samples, Krock and Coffre probably did not collaborate in their studio practice.

Introduction

King Frederik IV had a strong interest in architecture and the arts and, accordingly, there was a boom in large-scale building projects during his reign. He inherited the Danish throne in 1699, by which time he had already started the construction of the princely summer palace in Frederiksberg after an Italian Baroque model, possibly a villa in Frascati, either Aldobrandini or Villa Ludovisi, which he saw on his Grand Tour of Europe in 1692–93.1 The king had the palaces decorated with elaborate stucco and paintings, especially plafond paintings, i.e. paintings on canvas made for decorating a ceiling. For this he used both his court painters and reused paintings from abandoned castles and palaces. The preferred artists for the decoration of the newly built palaces were Benoît le Coffre² and Hendrik Krock,³ both of whom Frederik IV appointed as court painters (in 1700 and 1706, respectively). Krock and Coffre were taken in by the court under the reign of Christian V, the father of Frederik IV, to legitimise the absolute monarchy through the arts. Trained to become court artists, the monarchy paid for their studies and travels.

The early 1700s were a time of change in the arts in Denmark. Elling used the term 'Baroque-Romanticism' to describe the period between the disruption of Baroque and the early Rococo. This period is known for its openness and susceptibility to various influences from outside the country. Coloristically and in the style of the figures, artists looked toward Flanders, Holland and Italy with their colourful characters still based on Christian and Pagan mythological figures, which appear alongside a multitude of foreign and odd figures in old costumes. These many characters are seen in history painting as well as genre art and portraits. As something new, artists found inspiration in other arts such as music and theatre. This is especially true of Coffre.⁴

The artists

Even though they were trained by different schools and display different artistic styles, one cannot mention either Krock or Coffre without the other, as they worked side by side on these large royal enterprises. Coffre was the true artist, whereas Krock was known for his solid skills and for being more of a craftsman.⁵ They worked together on large decoration projects until Coffre's death in 1722. Krock's style was that of the skilled copyist, a solid composer of paintings in the classical Italian Baroque style. Coffre was influenced by the new ideals and motifs that emerged in French painting of the 1690s – he was an anti-classicist painter. The king obviously wanted both artists to decorate his properties and it has been speculated that he was not all that interested in paintings and their style, and that he might have wanted Krock's Baroque paintings for his representative paintings and Coffre's playful pre-Rococo style for his more private chambers, thus purposely choosing both artists.⁶ This would have been a deliberate choice: a liking for both artists' works and consequently their differences in style.

Benoît le Coffre

Benoît le Coffre (1671-1722) came from an artistic family. His father, Claude le Coffre, and Uncle Etienne came to Denmark from France in 1669, working as stucco workers and painters for the Danish royal family from the year 1675 onwards. Benoît le Coffre probably started his training in the workshop shared by his father and uncle. Around 1690 he went to Paris to train at the Royal Academy of Painting and Sculpture. He won the Grand Prize in 1692 for the now lost painting Hagar in the Desert but does not seem to have used the accompanying scholarship to attend the French Academy in Rome. Coffre is thought to have been influenced by Charles Le Brun, whose style was still influential at the academy, as well as Nicolas Poussin. Not much is known of his whereabouts after 1692, but he probably stayed in Paris and learned the basic principles of the modern style (the pre-Rococo), possibly making acquaintances with leading French artists such as Jean-Antoine Watteau, Jean Raoux, Claude Gillot or their contemporaries.⁷ Coffre was back in Denmark in 1696, painting portraits of Niels Juel in full figure (Egeskov Castle) and later that year of Princess Sofie Hedvig, inspired in style by Hyacinthe Rigaud and Pierre Mignard. Both were artists with whom Coffre might have been acquainted in Paris.8 He seems to have been continuously connected to the new French art, perhaps through prints and the like brought to him by travelling actors, etc.9 Appointed court painter in 1700, Coffre was always led by his playful imagination; sometimes his paintings were sublime, at other times uninspired.¹⁰ Although he had a large production, his financial situation was never good and he died impoverished in 1722.

Hendrik Krock

Hendrik Krock (1671–1738), on the other hand, did very well for himself. He was born in Flensburg, the son of a wealthy merchant. Due to his interest in the arts, he went off to be trained at the age of 11 by the painter Johann Eyerschöttel. Later he trained under Peder Andersen¹¹ and started working at the court at Frederiksborg Castle. Krock was to be educated to become a history painter. He went on three trips to Italy and studied under the highly influential artist Carlo Maratta, in Rome, on his last travels 1702–1705, before being called home to work on the decoration of the new and old palaces and castles with Coffre. In 1706 he was appointed court painter. Maratta's influence on Krock was significant and through copying the masters as well as contemporary artworks, working loyally with a number of models and reusing figures in various compositions, he produced Baroque paintings inspired by antiquity.¹² Maratta himself had a large workshop and Krock might have learned workshop management from him as well, as it is well known that Krock had a large production of paintings of all sorts. He became steadily more prosperous and was appointed chancellor¹³ by the king in 1722. Krock also worked actively for the establishment of an Academy of Fine Arts in Denmark, but died before it was realised. He died in 1738, wealthy and respected by his contemporaries.

Technical investigations: painting technique and materials

Twenty-two cross-sections¹⁴ were taken in areas of blue from 10 paintings: three by Coffre and seven by Krock. The crosssections were collected over the past 40 years and the criterion for inclusion in this paper was that they had a blue top layer of paint. As stated above, the two court painters were working on large joint enterprises, first delivering 20 plafond paintings for Frederiksberg Palace in a shared commission. Coffre seems to have worked more freely with designs. Elling argued that Coffre's *plafond* paintings are usually considered easel paintings placed in the ceiling.¹⁵ His paintings are executed alla prima, built up with many thin layers; sometimes they were overpainted if they were not satisfactory in tone or colour. Krock's paintings seem to have been thoroughly planned and the painting is executed with precision and minimal layering. Major changes are not seen in his paintings although minor changes in the fall of drapery, for example, have been observed.

First use of Prussian blue

King Frederik IV built the Chancellery in Copenhagen, in 1720-21, commissioning *plafond* paintings from Krock and Coffre. Cross-sections from three of the remaining paintings (Figs 1-3) have been examined, two by Krock and one by Coffre. Prussian blue, smalt and indigo were found in these cross-sections, as described in Table 1. This very brief investigation suggests that the two artists seem to have used the same materials, but in different ways. The paint and ground layers are of different coarseness (especially in the ground layers) and composition, suggesting that the artists worked separately, probably in different workshops, despite being commissioned together. Although both artists use a red ground containing earth pigments and chalk, the morphology differs. Had they worked side by side, they might have used the same materials and possibly shared a primer. Since little is known of trade, pigment prices and material sources for court artists in Denmark in the early 1700s, it is difficult to determine exactly why Prussian blue came to replace the use of other blue pigments, even the presumably cheaper indigo, in these large *plafond* paintings. Perhaps the listed benefits from the 1710 notice in

Table 1 Table showing the build-up of layers in the paintings from the Chancellery series, 1720–21. (© National Museum of Denmark.)

Layer	Allegory of Victory (Krock)	Justice and Peace (Krock)		Allegory (Coffre)
3	<i>Dark blue</i> Prussian blue Lead white	<i>Light blue</i> Smalt Lead white	<i>Dark blue</i> Prussian blue Lead white	<i>Dark blue</i> Prussian blue Lead white
2	<i>Brown</i> Earth pigments Lead white Carbon black	<i>Light brown</i> Earth pigments Lead white Carbon black	<i>Light brown</i> Earth pigments Lead white Carbon black	<i>Light blue</i> Indigo Lead white
1	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk
	- All and			



Fig. 1 Hendrik Krock, *Allegory of Victory*, Chancellery, Copenhagen, Denmark,1720–21. (© National Museum of Denmark.)

Miscellanea Berolinensia¹⁶ reached Denmark around this time, praising as it did this new blue pigment for its handling properties, colourfastness, non-poisonous qualities and favourable price, being just one-tenth that of ultramarine.¹⁷ Prussian blue was used by Pieter van der Werff in his painting Entombment of Christ signed and dated 1709, in Picture Gallery Sanssouci in Potsdam. This corresponds with the knowledge that the pigment was sent to various cities in Europe as early as 1709. Johann Conrad Dippel, who might have been involved in the discovery of Prussian blue and knew how to produce the pigment as early as 1707, is thought to have sold it to Hasperg in Paris in 1714. Dippel moved to Altona in 1714 (which was Danish at this time) and was sentenced to life imprisonment from 1719 to 1726, serving his sentence on the Danish island of Bornholm.¹⁸ Could he somehow have played a role in supplying the pigment to the two Danish court painters? To the best of our knowledge, the identification of Prussian blue in these works by Krock and Coffre represents the earliest findings of Prussian blue in Denmark (1721), and coincides with the pigment being used in paintings elsewhere. For example, it has



Fig. 2 Hendrik Krock, *Justice and Peace*, Chancellery, Copenhagen, Denmark 1720–21. (© National Museum of Denmark.)



Fig. 3 Benoît le Coffre, *Allegory*, Chancellery, Copenhagen, Denmark 1720–21. (© National Museum of Denmark.)

been found in Holland in a painting dated 1720, in a Canaletto painting from 1719–23, and even Boston, USA in 1723.¹⁹

Krock used very thin layers of Prussian blue and lead white with no dead colouring underneath. The use of a lighter second priming layer gives, as expected, an overall lighter appearance to *Justice and Peace* compared to *Allegory*

	2	ι	o				
Layer	<i>Flora</i> (Krock)		Time Reveals the Tru (Krock)	th	Sunset (Coffre)		
							Varnish & overpaint
10				Overpaint	<i>Dark blue</i> Indigo Smalt Carbon black Lead white	<i>Dark blue</i> Indigo Lead	<i>Light blue</i> Smalt Lead white
4	<i>Light blue</i> Smalt Lead white	<i>Dark blue</i> Ultramarine Lead white	<i>Light blue</i> Smalt Lead white	<i>Light blue</i> Smalt Lead white	<i>Black</i> Carbon black	<i>Black</i> Carbon black	<i>Light grey</i> Smalt Lead white
	<i>Light grey</i> Carbon black Lead white	<i>Dark grey</i> Carbon black Lead white	<i>Light grey</i> Carbon black Lead white	<i>Light grey</i> Carbon black Lead white	<i>Light brown</i> Earth pigments Lead white Carbon black	<i>Light brown</i> Earth pigments Lead white Carbon black	<i>White</i> Lead white
8	<i>Light brown</i> Umber Earth pigments Lead white Carbon black	<i>Light brown</i> Umber Earth pigments Lead white Carbon black	<i>Light brown</i> Umber Earth pigments Lead white Carbon black	<i>Light brown</i> Umber Earth pigments Lead white Carbon black	<i>Dark grey</i> Carbon black Lead white	<i>Dark grey</i> Carbon black Lead white	<i>Dark grey</i> Carbon black Lead white
-	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk	<i>Red</i> Earth pigments Chalk
		1b 0 00 00 00 00 00 00 00 00 00 00 00 00			I I I I I I I I I I I I I I I I I I I	250µm	

Table 2 Table showing the build-up of layers in the Frederiksberg Palace paintings. (© National Museum of Denmark.)



Fig. 4 Hendrik Krock, *Flora*, Frederiksberg Palace, Denmark, 1708–13. (© Roberto Fortuna, National Museum of Denmark.)

of Victory (see Figs 1 and 2) but the use of smalt and lead white for the sky in Justice and Peace also assists the character of light in the painting. Smalt and lead white had been the preferred pigment combination for the large areas of sky in Krock's *plafond* paintings. Krock used the colour strength of Prussian blue in Justice and Peace as a substitute for ultramarine. Prussian blue was found in the blue drapery in the central figure in the same way he used ultramarine in a sash in the painting Flora from 1708-13. In Allegory of Victory, the pigments in the blue sky are Prussian blue and lead white. The differences between the two paintings might illustrate the beginning of Elling's observations on Krock's style: 'when he is lucky, a cool and clear overall tone is achieved, and the paintings remain firm and light. Not uncommon in later years, his colour scheme becomes metallic and pitched.^{'20} This shift in tonality could be a by-product of the new possibilities of the high tinting qualities of the relatively low-priced Prussian blue²¹ and the different hue of blue that could be obtained from it. The change in tonality was taken to an extreme in the altarpiece The Resurrection (1725) from Rye church, with a powerful blue depicting the sky.

Judging from this preliminary investigation, it seems that Coffre changed his technique from working in many layers in the Frederiksberg paintings from 1708–13 to using one priming layer and a dead colouring underneath a very thin layer of Prussian blue and lead white. The use of indigo and lead white was a traditional underlayer for ultramarine and it is interesting to see this reference dating back to a mid-17th-century painting technique.²²



Fig. 5 Hendrik Krock, *Time Reveals the Truth*, Frederiksberg Palace, 1708–13. (© Roberto Fortuna, National Museum of Denmark.)



Fig. 6 Benoît le Coffre, *Sunset*, Frederiksberg Palace, 1708–13. (© Roberto Fortuna, National Museum of Denmark.)

The differences in the artists' handling of Prussian blue correspond with the differences seen in their earlier works. This might speak to the assumption that although they were commissioned to work as a team, they worked independently with no evident exchange or mutual influence on their respective painting techniques. They both used the new pigment, Prussian blue, but they used it differently. Krock is still working up his layers as seen in earlier *plafond* paintings – with two priming layers – but he has skipped the grey dead colouring as if he knew, and as seen in these cross-sections, that a very thin layer of Prussian blue with a little lead white would have adequate hiding power. The fact that smalt is used for the sky in one painting and Prussian blue in the other marks the transition from painting with traditional blue pigments to the use of Prussian blue.



Fig. 7 Detail of the two blue smalt layers, Benoît le Coffre, *Sunset*, 1708–13 (see Fig. 6). (© National Museum of Denmark.)

The use of blue pigment from 1708 to 1730 by Krock and Coffre

The first known shared commission for Krock and Coffre was the delivery of 20 *plafond* paintings to Frederiksberg Palace after its renovation in the years 1708–13. The blue pigments found in the three paintings, two by Krock and one by Coffre (Figs 4–6), are smalt and indigo; ultramarine was found only in *Flora* by Krock (Fig. 4 and Table 2).

The paintings *Flora* and *Time Reveals the Truth*, both by Krock, revealed a similar building up of layers as smalt was used in the light blue layers with a light grey dead colouring underneath. Smalt mixed with lead white was also used by Coffre in the light blue sky. It is likely that the first layer was painted over because of dullness due to its inferior quality; there is no varnish or dirt layer between the two smalt layers when looking at the cross-section (Table 2). The repaint of the smalt layer does not follow the contours of the figures and yellowish clouds very closely, as if hastily done, and is visible with the naked eye (Fig. 7).

Ultramarine was only used in the bright blue sash of a putto with a dark grey underpainting in the *Flora* painting by Krock. A bright blue mantle in *Time Reveals the Truth* was identified as smalt in one area; another area could not be identified with handheld X-ray fluorescence (XRF) spectroscopy.²³ Krock might have used indigo in the darker areas, since only lead white was detected, but this requires a cross-section and further analysis. Coffre did not use ultramarine in his painting, but the dark blue of the robe of the female figure at the bottom (Fig. 6) was achieved by a layer of carbon black serving as dead colouring for the blue, which is indigo mixed with lead white. A mixture of smalt, indigo, carbon black and lead white was used in the area depicting the night sky. Coffre used

indigo quite extensively, and the colours have not degraded or discoloured. Leaning on Van Eikema Hommes' research, both the fine dead colouring layer of carbon black, as well as the dark tonality of the paint layer, may explain why the blue colour is so well preserved. The fact that the painting has been hanging on the ceiling in Frederiksberg Palace, protected from sunlight, might also be part of the explanation. At this time, competition in the market for providing good quality indigo for a reasonable price, as well as the artists' awareness that they could purify the pigments themselves, could account for the extensive use and the impressive colour. It was not until the 17th century that indigo was more commonly used as the top paint layer in blue passages.²⁴

In 1717 Krock painted the altarpiece for Fakse church. In the Christ figure we see the ultramarine over a dead colouring of indigo and lead white (Fig. 8a). This use of indigo under ultramarine is described by De Mayerne and many other sources of the 15th and 16th centuries, as one well suited for indigo.²⁵ A greyish blue used for one of the disciples in the foreground contains a mixture of ultramarine and lead white on top of a light grey layer of carbon black, lead white and quartz (Fig. 8b). The cross-section from the disciple in light blue shows ultramarine in lead white on a dark grey dead colouring of carbon black and lead white (Fig. 8c). Three different types of dead colouring are employed in the various blue areas for this extensive use of the costly ultramarine, which is rarely used on minor figures. Ultramarine has only been found in one other painting by Krock - in the blue sash of the putto to the left of the figure of Flora (see Fig. 4). The painting is inscribed 'MDCCX VII Curatore æd. hujus sacr. Faxoens. Christano Reitzer fecit Henricus Krock pict. reg.'26 showing that this prestigious altarpiece was painted by court painter Krock and paid for by Chr. Reitzer, a rich and powerful



Fig. 8 Cross-sections from *The Last Supper*, Fakse church, 1717, all containing ultramarine: (a) Christ figure; (b) disciple in greyish blue; (c) disciple in light blue. (© National Museum of Denmark.)



Fig. 9 Cross-sections showing the development in the use of Prussian blue by Hendrik Krock 1720–1730: (a) *Allegory of Victory*, Chancellery, 1720–21; (b) *The Resurrection*, Frydendal church, 1722; (c) *Ceres*, Fredensborg Palace, 1723–24; (d) *The Resurrection*, Rye church 1725; (e) *The Rape of the Sabine Women*, Selsoe Palace, 1730. (© National Museum of Denmark.)

patron and official at the court. Reitzer might have wanted to display his wealth and power by dictating the use of the finest blue for his commissioned altarpiece.

Krock painted *The Resurrection* altarpiece for Frydendal church on copper in 1722. The ground comprises chalk, red earth pigments and quartz, while the paint consists of three layers of Prussian blue; the bottom layer, being lighter, contains more lead white (Fig. 9b). In this case, it seems that the powerful colour strength of Prussian blue simplified Krock's technique, allowing him to leave out the greyish dead colouring layer under the blue colours.

The *plafond* painting *Ceres* from Fredensborg Palace was painted in 1723–24. Krock still used a red ground, a brown second priming layer, and directly on top, a light blue layer of Prussian blue and lead white (Fig. 9c). In 1725 Krock painted another Resurrection, this time on canvas for Rye church. The blue layer is Prussian blue in lead white on a single layer of a grainy brown ground of iron oxides, lead white, carbon black and quartz. The cross-section contains only two layers: the ground and a single blue layer (Fig. 9d). The last cross-section is from an interior from Selsø Palace, painted in 1730. It consists of a similar coarse, dark, brown ground as seen in Rye church. Directly on top of the ground we see two thin layers of Prussian blue and lead white (Fig. 9e). The Prussian blue in all the paintings does not seem to have discoloured; the placement of some of the paintings in the ceilings, where they were more protected from the light, might be one explanation for this, as was seen in the case of Coffre's indigo paint layers, which are also well preserved. In some of the crosssections (Fig. 9a,b,d) Prussian blue is mixed with only a little lead white. This might also contribute to the preservation of the Prussian blue as well as its composition.²⁷

The introduction of Prussian blue definitely simplified Krock's technique, putting an end to the use of both dead colouring in blue areas and alternative blue pigments (Fig. 9). Since the material from Coffre's paintings is so scarce, due to his early death in 1722 and the limited number of remaining paintings, it is hard to be conclusive about his technique. It

is rather remarkable that the introduction of Prussian blue to Krock seems to displace all prior practices in the handling of blue pigment over a period of eight years. To confirm if the same is true for Coffre and other contemporary Danish artists, further research is needed.

Workshop practices

Little is known of the two artists' workshops and workshop practices. Judging from this provisional investigation, Krock and Coffre are not thought to have shared a studio or worked closely together on these large joint commissions. Apart from their stylistic differences, which they maintained throughout the years, their handling of paint seems to indicate different working methods. Since one was trained in the French tradition and the other in the Italian, these differences are to be expected, especially in the early paintings. They use, to some extent, the same materials, which makes sense considering that Copenhagen was a small city at the beginning of the 18th century.

Both artists painted on grounds consisting of a red ironcontaining earth colour with variable amounts of quartz and chalk (Fig. 8). In the Frederiksberg series, Krock used a light brown second priming layer, whereas Coffre used a fine dark grey layer as a second priming. Krock worked with a single dead colouring layer underneath his blue paint layers, whereas Coffre used two layers of dead colouring in the dark blue areas and one in the light blue areas. Their respective techniques reflected their styles: Krock was controlled, building up his painting with minimal paint layers and making relatively few changes, while Coffre worked more freely, setting the tone of his painting in many layers. Later on, in the series from the Chancellery, Krock was still working up his paintings as in the Frederiksberg series, using the priming layers in his alla prima technique, one painting with a lighter second priming layer than the other. It appears that Coffre skipped the second

priming layers by this time, but still worked with local dead colouring for his final paint layers.

Coffre used indigo for the dead colouring in the Chancellery series and for the final dark blue paint layers in the Frederiksberg series, while indigo has only been found in dead colouring in paintings by Krock. On the other hand, Krock used the costly ultramarine, which has not been found in Coffre's paintings. This could be a reflection of their different training: perhaps indigo was viewed as a good dark blue pigment in the French tradition, while ultramarine was maybe more widely used in the Italian tradition. It could also be something as obvious as price, as it is certainly established that Coffre was not as prosperous as Krock, who not only came from a well-off background, but also married into a wealthy family. Coffre might simply have been more economical in his choice of materials. As Prussian blue was introduced in Denmark, they both used it for the Chancellery series, but still retained their individual techniques.

Conclusions

In this preliminary study it seems that Prussian blue became a favourite with both artists soon after it was introduced, sometime between 1717 and 1721. As Prussian blue replaced the use of other blue pigments, it also seems to have affected the build-up of paint layers: from 1725 onwards only one priming layer is seen in Krock's paintings, with one or two layers of Prussian blue in lead white painted on top. Before that we see the extensive use of smalt in the sky, which often occupies a large part of *plafond* paintings and is therefore a natural choice due to its lower price. In the *plafond* paintings studied only small areas are composed of ultramarine and restricted to paintings by Krock. Among noteworthy findings are the extensive use of ultramarine in the altarpiece from Fakse by Krock and the quite frequent use of indigo by Coffre in areas of rich dark blues. The reason that the colour of the indigo remains so strong may be related to the fact that these works are *plafond* paintings and as such have been exposed to very little light. Ultramarine has not been found in Coffre's *plafond* paintings, and conversely indigo has not been found (other than in the dead colouring) in Krock's paintings but it could be present in *Time Reveals the Truth* from the Frederiksberg series. Although the artists used similar pigments, the handling of the paint was different. This leads to the conclusion that the painters worked in separate studios, their cooperation thus being primarily administrative. These are the results of this very preliminary research into the techniques and materials of these important Danish artists, which will hopefully be investigated further in the future.

Experimental appendix

Optical microscopy

A Leica DM 4000M microscope with Leica Application Suite 4.1 software. With incident light and transmitted light, and the filter settings dark field (DF), bright field (BF) and differential interference contrast (DIC). UV filters A and I3.

Handheld X-ray fluorescence spectroscopy

Analysis was performed using a Bruker Tracer III-V energy dispersive X-ray fluorescence analyser, with silicon PIN detector (SiPIN). The system was equipped with a rhodium (Rh) transmission target with maximum voltage of 40 kV.

Micro-Raman spectroscopy

A dispersive Bruker Senterra Raman microscope equipped with a thermoelectrically cooled charged-coupled device (CCD) detector. Under the following experimental conditions the cross-sections were measured in several areas:

- Excitation: 785 nm (red laser)
- Grating: 1200 lines/mm
- Objective: 50×
- + Spot size: ~2 μm
- Spectral resolution: 9–18 cm⁻¹
- Laser power: 1 mW
- Integration time: 10–15 seconds
- Number of scans: 1–2

Scanning electron microscopy-energy dispersive X-ray spectroscopy (SEM-EDX)

A JEOL, JSM-5310LV microscope with an energy dispersive X-ray spectrometer, using ISIS software produced by Oxford Link. 20 KeV.

Acknowledgements

First and foremost we would like to thank our many colleagues at the National Museum of Denmark, who collected some of these cross-sections over the last 40 years. We would also like to thank our CATS partners Michelle Taube, Anna Vila, David Buti, Johanne Nielsen, and Mads Chr. Christensen for facilitating new analyses on the selected cross-sections.

Notes

- 1. F.J. Meier, Frederiksberg slot, dets ældste historie for en stor del efter utrykte kilder, Gyldendal, 1896, pp. 27–28.
- 2. Benoît le Coffre is also referred to as Benoît Le Coffre and Bendix Le Coffre in the literature.
- 3. Hendrik Krock is also referred to as Hinrich Krock and Henrik Krock in the literature.
- 4. C. Elling, *Bendix le Coffre*, Copenhagen, Kunstmuseets Aarsskrift, 1936, pp. 14–16.
- C. Elling, 'Senbarok Og Rokoko', in Erik Zahle (ed.), Danmarks Malerkunst Fra Middelalder Til Nutid, Copenhagen, H. Hirschprungs forlag, 1937, pp. 6–74.
- 6. S. Theimann, *Hinrich Krock*, 1671–1738 der Hofmaler im absolutistischen Dänemark, Copenhagen, Forum, 1980, p. 296.
- 7. Elling 1936 (cited in note 4), p. 3.
- V. Poulsen, 'Benoît Le Coffre', in E. Lassen and J. Danielsen (eds), Dansk Kunsthistorie: Billedkunst Og Skulptur. Bind 3. Akademiet Og Guldalderen, Copenhagen, Politiken, 1972, pp. 340-348.
- 9. Coffre was connected to the theatre scene in Copenhagen through his marriage to the French actress Marie Hélène la Croix. See Elling 1936 (cited in note 4), p. 18.
- 10. Poulsen 1972 (cited in note 8), p. 355.
- 11. Peder Andersen is also known as Peder Normand. He was associated with the Danish court, working as painter and teacher among other things.
- 12. Krock made copies after his master Maratta, but also studied Peter Paul Rubens and Titian (Tiziano Vecellio) among others; see Elling 1937 (cited in note 5), p. 69.
- 13. Chancellor was a title to rank him in society but with no political power attached to it.
- 14. See the experimental appendix for further details.
- 15. Elling 1936 (cited in note 4), p. 14.
- A promotion by Johann Leonard Frisch; see J. Bartoll, 'The early use of Prussian blue in paintings,' *The e-Journal of Nondestructive Testing* 13(9), 2008, p. 4, available at: www.ndt. net/search/docs.php3?MainSource=65 (accessed July 2014);
 F. Delamare, 'Prussian blue: an unexpected destiny', in *Blue Pigments: 5000 Years of Art and Industry*, London, Archetype Publications, 2013, p. 152.

- 17. R. Harley, Artist's Pigments c. 1600–1835: A Study in English Documentary Sources, 2nd edn, London, Archetype Publications, 2001, p. 72.
- 18. Bartoll 2008 (cited in note 16).
- J. Bartoll and B. Jackisch, 'Prussian blue: a chronology of the early years', *Zeitschrift für Kunsttechnologie und Konservierung* 24(1), 2010, pp. 88–102; Delamare 2013 (cited in note 16).
- 20. Elling 1937 (cited in note 5), pp. 69-70.
- 21. Delamare 2013 (cited in note 16), p. 151.
- 22. M. van Eikema Hommes, Changing Pictures: Discoloration in 15th-17th-Century Oil Paintings, London, Archetype Publications, 2004, pp. 91–169; J. Plesters, 'Ultramarine blue, natural and artificial', in A. Roy (ed.), Artists' Pigments: A Handbook of their History and Characteristics, New York, Oxford University Press, 1993, vol. 2, pp. 37–66.
- 23. See specifications in the experimental appendix.
- 24. Van Eikema Hommes 2004 (cited in note 22); Harley 2001 (cited in note 17), pp. 67–70.
- 25. van Eikema Hommes 2004 (cited in note 22); Harley 2001 (cited in note 17).
- 26. '1717 when this Church Guardian was Chr. Reitzer. Court Painter Henrik Krock did this.' Translation by the author, Fakse Kirke in *Danmarks Kirker*, n.d., p. 521, available at: http://danmarkskirker.natmus.dk/praestoe/fakse-kirke/ (accessed July 2014).
- B. Berrie, 'Prussian blue', in E.W. FitzHugh (ed.), Artists' Pigments: A Handbook of their History and Characteristics, New York, Oxford University Press, 1997, vol. 3, pp. 191–217; and Delamare 2013 (cited in note 16).

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BREAKING NEW GROUND: INVESTIGATING PELLEGRINI'S USE OF GROUND IN THE GOLDEN ROOM OF THE MAURITSHUIS

Carol Pottasch, Susan Smelt and Ralph Haswell

ABSTRACT As little is known about the 1718 commission of the decorative ensemble by Giovanni Antonio Pellegrini for the Golden Room in the Royal Picture Gallery Mauritshuis in The Hague, the Netherlands, the purpose of this paper is to shed more light on the choice of decoration, the attribution of parts of the ensemble and the materials used for the grounds of the paintings. Gerard de Lairesse's *Groot Schilderboek* was consulted for information on the theory of Dutch Classicism and stylistic ideas, which are discussed in the context of the subject matter, technique and appearance of the Golden Room. Until recently it was doubted whether the six flower tondos that are part of the ensemble were painted by Pellegrini. The observation of a 'signature brushstroke' found throughout the paintings of the ensemble, together with the analyses of the grounds, led to the conclusion that all the paintings were executed by the Italian master. Analyses of the ground layers with light microscopy and scanning electron microscopy with energy dispersive X-ray (SEM-EDX) microanalysis indicated that besides lead white and a carbon-based black a large proportion of the ground composition consists of quartz, chalk and clay. Research of the literature shows that this is not a common mixture; it may possibly have been used for its mechanical properties and might have been locally mined.

Introduction

Recently the Royal Picture Gallery Mauritshuis in The Hague, the Netherlands completed the restoration project of the painted ensemble in the Golden Room (Fig. 1). This grand reception room was painted in the early 18th century by the Venetian artist Giovanni Antonio Pellegrini (1675-1741).¹ For a long time there was little interest in this Italian painted ensemble, the Mauritshuis being more famous and popular for its collection of 17th-century Dutch and Flemish old master paintings, for instance Vermeer and Rembrandt. In addition, the paintings by Pellegrini appeared quite dark as they were covered with dark surface grime, very discoloured varnish layers and disturbing retouches. Not much was known about the ensemble and even the attribution of parts of the decorative scheme to Pellegrini was doubted.² This changed when the treatment of the ensemble facilitated a detailed study of the painting technique and analysis of paint samples.3

Until now Pellegrini's painting technique has not been investigated in depth.⁴ This paper is based on continuing research that was started during the restoration project. As nothing is known about the commission of the ensemble this paper attempts to provide more insight into the choice of subjects and painting techniques by turning to Gerard de Lairesse, based on the assumption that the commissioners, and perhaps Pellegrini also, were aware of the classical ideas published 10 years earlier by De Lairesse in his Groot Schilderboek.⁵ Part of the research centred on the attribution and this paper answers the question of whether or not the whole ensemble was painted by Pellegrini. The main body of the paper consists of the preliminary results of the technical analysis, which focuses on the composition of the grounds of all 15 paintings. The analysis was carried out with the scanning electron microscope with energy dispersive X-ray (SEM-EDX) microanalysis in collaboration with the Shell Technology Centre, Amsterdam. The painting technique of the grisailles is then discussed and compared with instructions in De Lairesse's treatise.



Fig. 1 The Golden Room of the Mauritshuis in 2012 before restoration. (Photo: F. van der Burg.)

The Mauritshuis and Giovanni Antonio Pellegrini

The Mauritshuis in The Hague, a grand house from 1644, was commissioned by Johan Maurits of Nassau Siegen. Unfortunately the interior of the house was destroyed by a fire in 1704. By that date the Mauritshuis was privately owned and was rented to the States of Holland, which used it as a luxury hotel for ambassadors of state. It took several years to raise enough money to rebuild the Mauritshuis and to refurbish the interior.⁶ To give the grand reception room on the ground floor its former grandeur, Giovanni Antonio Pellegrini, the famous Venetian artist who was travelling through the Netherlands, was granted the commission to paint a decorative ensemble.

Pellegrini was born in 1675 in Venice where he started his prolific career. As Venice grew politically more isolated and its financial position declined, Pellegrini accepted the invitation of the Earl of Manchester, ambassador to Queen Anne, and travelled to England in 1708.⁷ Pellegrini then became a much sought-after artist. Foreign courts and rulers, often with far more money and much grander projects in mind compared to the situation in Venice, turned to Venetian artists trained in the decorative arts.⁸ Most of Pellegrini's works were executed outside of Venice, yet his style is typically Venetian. Together with Sebastiano Ricci, he is considered to be the originator of the Venetian Rococo style.⁹ For the next 30 years Pellegrini worked for important patrons all over Europe. After he left England he worked in Düsseldorf for



Fig. 2 *The Republic* (see Fig. 4b). (a) Detail showing the signature of Pellegrini; (b) detail of the spine of the book showing the inscription 'Republic[a]'.



Fig. 3 Giovanni Antonio Pellegrini, (a) *The Dwindling Night* (inv. 1137); (b) *Aurora* (inv. 1136); (c) *Apollo* (inv. 1135), 1718, canvas, 192 × 262 cm, The Hague, Mauritshuis. The ceiling paintings after restoration. (Photos: Margareta Svensson.)

Kurfurst Johan Wilhelm van der Pfaltz, who was known to be the great art patron of the period. In late 1716 he travelled to Antwerp where he painted a ceiling for the City Hall and several paintings for the Brewers Guild.¹⁰ Around 1717 he passed through the Netherlands where he was offered several commissions. Most likely his first project was in Amsterdam for Gerrit Corver, the very wealthy future mayor of that city¹¹ and after that two projects in The Hague, one of them the ensemble for the Mauritshuis.¹²

The ensemble of the Golden Room consists of 15 paintings in total: three ceiling paintings, two chimney paintings, four grisailles and six tondos above the doors. Very little is known regarding the design for the room. No texts, designs, studies or any other contemporary evidence of the grand room are known, in spite of the fact that Pellegrini is, in general, a well-documented artist, as he and his wife wrote many letters during their travels.¹³ The ensemble is not dated and only one of the 15 paintings, a chimney painting, is signed by Pellegrini (Fig. 2a).¹⁴ The only surviving archival record relating to Pellegrini's presence in The Hague documents that on 31 May 1718 he became a member of the artists' club Pictura.¹⁵ By January 1719 he was in London.¹⁶ It is therefore likely that he painted the ensemble in 1718. Although the ceiling and chimney paintings are clearly in Pellegrini's rapid new style, it was doubted whether the flower paintings were also painted by him.¹⁷

The appearance of the Golden Room and its painted ensemble

To understand the choice of subjects we can turn to Gerard de Lairesse who published his Groot Schilderboek in 1707. This book is considered a Dutch reference work on the theoretical rules of French Classicism both in style and subject matter. One of the first rules is that the painted decorations should be subordinate to the architecture and to the function of the room.¹⁸ In accordance with the classical style, mythological subjects should be chosen. An artist could only reach the highest level if he derived his subjects from antique mythology, classical history or the Bible.¹⁹ The choice of subject was intended to give the visitor a 'moral' education.²⁰ On the three ceiling paintings of the Golden Room, Pellegrini painted Night and Day connected by Dawn by painting personifications derived from Roman mythology: Nox, the goddess of night, flying away from the start of day in *The Dwindling Night* (Fig. 3a), followed by Aurora the goddess of the dawn (Fig. 3b), and Apollo, the god of the sun (Fig. 3c). These three ceiling paintings together give the impression of looking through windows to an open sky.

Pellegrini also used mythological subjects for the chimney paintings. On one of the chimney paintings Vulcan, the god of fire, is depicted in his forge with, to the right, his wife Venus, the goddess of love (Fig. 4a). She in turn points at a small vessel in the distance, which is bringing back Aeneas, her son. Venus had asked Vulcan to make a set of armour for Aeneas when he left for war in Latium. His victory led to the founding of Rome.²¹ In the context of the ensemble of the Golden Room, Rome could represent the Republic therefore it is not surprising that on the other chimney painting we see two female figures representing the personification of the Republic (Fig. 4b). The States of Holland were celebrating a relatively peaceful age and were going through a prosperous period. A glorification of the Republic would have been an appropriate subject matter. The figure on the right holds an hourglass and a burning torch. She looks at a lion, which lies beneath her. The figure on the left is holding a sceptre exactly under the face of the lion. At the bottom of the painting there



Fig. 4 Giovanni Antonio Pellegrini, (a) *Vulcanus and Venus* (inv. 1142); (b) *The Republic* (inv. 1143), 1718, canvas, 235×189 cm, The Hague, Mauritshuis. The chimney paintings after restoration. (Photos: Margareta Svensson.)



Fig. 5 Giovanni Antonio Pellegrini, (a) *Fire* (inv. 1138); (b) *Air* (inv. 1139); (c) *Water* (inv. 1140); (d) *Earth* (inv. 1141), 1718, canvas, *c*.260 × 113 cm, The Hague, Mauritshuis. The grisailles after restoration. (Photos: Margareta Svensson.)

is a large book on which is written 'Republic[a]' (Fig. 2b). The sceptre and the lion allude to good government by the States of Holland. The fact that this is the only signed canvas could indicate the importance of this painting.²² Although a reference to fire is quite common on a fireplace, there might also be an allusion to the fire of 1704.²³

The grisailles on the wall imitate painted sculptures in low relief in which female figures project slightly from the background, so-called bas-reliefs. These female figures represent the personifications of the four elements: *Fire* holding a pot on fire (Fig. 5a), *Air* with a peacock in her arms (Fig. 5b), *Water* holding a sceptre (Fig. 5c) and *Earth* embracing the



Fig. 6 Giovanni Antonio Pellegrini, *The Flower Tondos*, 1718, canvas, 96 × 96 cm, The Hague, Mauritshuis. (a) inv. 1144; (b) inv. 1145; (c) inv. 1146; (d) inv. 1147; (e) inv. 1148; (f) inv. 1149. (Photos: Margareta Svensson.)

horn of plenty (Fig. 5d). Altogether they represent 'heaven and earth'. According to De Lairesse, the subject matter is not the most important feature of the bas-reliefs; they should add, 'in an educational way, to the beauty of the building.'²⁴

Buvelot recently showed that the grisailles in the Golden Room are - both in composition and style - very similar to sketches made for painted bas-reliefs for Duivenvoorde,²⁵ a grand house in the vicinity of The Hague that was built at around the same time and thus fit very well with the taste of the time. A recent study on the original colour scheme of the currently unpainted oak-panelled walls of the Golden Room revealed that the whole room was originally painted a medium grey tone, probably meant to imitate some kind of stone.²⁶ As part of these 'stone walls' the grisailles must have given the room a very spatial, three-dimensional effect. De Lairesse was very much in favour of marble or painted bas-reliefs in an entrance or reception room. It did not make much difference, according to De Lairesse, whether the basreliefs were painted or carved,²⁷ as painters were in debt to sculptors and vice versa, which he explains earlier in his treatise.²⁸ He then continues to explain how bas-reliefs or grisailles are to be painted, as will be discussed in greater detail below. De Lairesse emphasises that the figures should be relatively pure without distractions and without disturbing dark shadows.29

Above all the doors of the room, round paintings depicting flower still lifes were placed (Fig. 6). The commissioners of the ensemble must have been aware of De Lairesse's ideas in relation to the technique in which the flower tondos are painted. It is interesting to note that De Lairesse's instructions are reflected in Pellegrini's work; De Lairesse wrote: 'On a gilded or silvered background flowers have a special appearance, but they look even more beautiful on a copper, metal or bronze background, because of the darkness, as gold is too colourful and silver too pale.^{'30} The tondos of the Golden Room were painted on a brass background, probably to give them just the right hue. Unfortunately the brass, a compound of copper and zinc, has completely oxidised to a greenish layer. As Meloni has shown, the corrosion has also weakened the adhesion of the paint layer, which may account for the poor but stable condition they are in today.³¹

The grounds of the ceiling and chimney paintings and the tondos

As previously mentioned, since the late 19th century, the attribution of the flower tondos to Pellegrini and when they were painted has been questioned. In order to study the painting technique, materials and layer build-up, paint samples were taken from all the paintings and prepared as cross-sections. Examination of the cross-sections with light microscopy suggests that the grounds of the ceiling paintings, the chimney paintings and the flower tondos have a very similar composition, which is different from those of the grisailles (Fig. 7a–c).



Fig. 7 a–c Three cross-sections showing similar ground layers from (a) *Vulcanus and Venus* (Fig. 4a), bright field, magnification 100× [MH1142x02]; (b) *Aurora* (Fig. 3b), bright field, magnification 100× [MH1136x06]; (c) *Flower Tondo* (Fig. 6b), bright field, magnification 400×, stitched in Photoshop [MH1145x02a]. **Fig. 7 d–f** Details of 7a–c showing translucent particles with reddish rings: (d) [MH1142x02]; (e) [MH1136x06], (f) [MH1145x02a].

SEM-EDX analyses were used to determine the composition of the grounds. The canvases of the ceiling, chimney and tondo paintings were first primed with what appears to be a thin greyish translucent layer of starch mixed with chalk and earth pigments (EDX overall layer: Ca, C, O, Si, Al and Fe).^{32,33} This layer was only present in a few cross-sections. On top of this, there is an orange, earth-rich ground, mainly consisting of chalk (EDX: Ca, C and O), red and yellow earth and some lead white, umber and a fine carbon-based black pigment, possibly lampblack (EDX overall layer: Mg, Al, Si, Pb, K, Ca, C, O, Mn and Fe and occasionally traces of Na, Ti, Zn and Ba).

The second ground layer is very comparable in particle morphology and distribution in the cross-sections from the three groups of paintings, and the earth components have very specific particles in common which is worth considering in more detail (Fig. 7d–f). These particles are the large, faceted, semi-translucent, colourless particles with a ring of small orange particles around them that give the layer its specific appearance. The majority of these large particles range in size from about 15–20 μm , with larger particles (often 25 μm and occasionally 50 μm) observed. These large particles look more or less the same when viewed in reflected and ultraviolet light under the light microscope.

Examination of a cross-section from *Aurora* with SEM shows that in the backscatter electron image (BSE) these colourless particles also look more or less the same (Fig. 8). Analyses with EDX, however, showed that there are three different compositions to be defined. Some of these large particles are chalk particles (EDX: Ca, C and O) measuring from 15 to 25 μ m. Other particles are probably quartz or sand (EDX: Si and O) and are surrounded by an orange- or red-dish-coloured ring of clay (EDX: Fe, Al and Si), judging by the colour possibly including small hematite particles (iron(III) oxide).³⁴ A third variety of these large particles consists of a



Fig. 8 Cross-section from *Aurora* (Fig. 7b): (a) bright field, magnification 100×; (b) BSE image, magnification 1000×, and elemental maps: (c) calcium; (d) silicon; (e) aluminium; (f) iron.

combination of silicon and aluminium, some type of aluminosilicate clay, possibly kaolinite (EDX: Si, Al and O). These are also surrounded by small iron-rich particles.

The same observations were made in cross-sections taken from the other ceiling paintings, the chimney paintings and the flower tondos. The analysis shows that the ground contains a considerable amount of quartz or sand, chalk and clay minerals mixed with lead white, umber and black. The use of quartz or potter's clay in a ground was common in Italy and had already been mentioned by Vasari.³⁵ In 17th-century Dutch art this type of ground with the coarse quartz particles is not common. The use of pure quartz/clay grounds has thus far only been reported in paintings by Rembrandt and his studio, but in these the quartz and chalk particles do not appear to have the reddish rings around them. The so-called quartz ground on paintings by Rembrandt is a single, greyish earth layer with a high quartz content.³⁶ It is known that the quartz ground on the *Night Watch* was still very flexible when it was rolled up during the Second World War.³⁷ In the last quarter of the 17th century the Dutch writer Simon



Fig. 9 Detail of Nox's foot from The Dwindling Night (Fig. 3a). The dark contour shows the ground left in reserve.

Eikelenberg may have mentioned a ground consisting of clay when he wrote about using '*potaarde*', a Dutch word that refers to 'earth for pots' mixed with linseed oil for grounds.³⁸ Potter's clay has a high percentage of sand to give it plastic properties and chalk to make it suitable for earthenware.³⁹ Was a quartz-rich ground a function of Pellegrini's Italian origin or was it a product of locally available materials? It is an interesting thought that Pellegrini possibly wanted these materials in the grounds of his large paintings for their flexibility.^{40, 41}

It has recently been recognised that the regional origin of earth colours determines their composition and colour.⁴² The provenance of ochre is difficult to determine although the accompanying minerals are of definite diagnostic value.⁴³ Little research has been carried out on the composition of earth colours and their provenance. An important reason for this is that it is very difficult to perform research on clay molecules in paint samples where the clay is bound with a binding medium,⁴⁴ but the fact that clay was mined along the rivers near The Hague for earthenware could point to a local provenance.⁴⁵ However, it cannot be ruled out that the clay, the sand and the chalk were imported.

The great similarity in the composition of the grounds leads to the conclusion that the flower tondos and the ceiling and chimney paintings all have the same origin and were painted at the same time. Of course this could mean that an assistant or contemporary of Pellegrini may have painted the flower tondos. Thus, the ground compositions alone are not sufficient to prove whether or not the tondos were painted by Pellegrini. It was therefore necessary to study the painting technique.

Use of the ground in Pellegrini's painting technique

As part of his fast and efficient painting technique, Pellegrini made use of the ground in all his paintings. Although over time the ground has become more visible because of the saponification of the lead white in the paint layers on top, the ground colour is visible at the surface. Even though in the cross-sections the layer appears as an overall orangey layer, on the surface it looks like a dark grey colour. In some areas of the ceiling paintings Pellegrini did not cover the ground layer completely, but left this dark grey layer of the ground visible (Fig. 9). He used the ground to define the contours of the figures and let it shimmer through the clouds. In the chimney paintings, where the ground has the same composition, the colour is used in a different way. As the main colours of the two chimney paintings are dark brown and black, the colour of the ground is again used as a mid-tone, only this time it appears as a relatively lighter tone. The painting technique is almost identical to that found in the ceiling paintings, and around the contours the warm grey tone lends the figures and objects a soft glow.

Painting technique and attribution

After removal of the disturbing and discoloured varnish layers, the paint layers of the nine large paintings could carefully be studied and compared. Pellegrini had a fast and efficient painting technique. The accurate and lively brushstrokes are a



Fig. 10 Examples of Pellegrini's 'signature brushstroke', a quick zigzag: (a) detail of a flower tondo (Fig. 6e); (b) detail of *The Dwindling Night* (Fig. 3a); (c) detail of *Fire* (Fig. 5a); (d) detail of *The Republic* (Fig. 4b).

pleasure in themselves to look at. He painted quickly, mostly in one layer with vivid brushwork using a broad brush.⁴⁶ In the nine artworks with unquestioned attribution – the ceiling and chimney paintings and the grisailles – we have recognised a 'signature brushstroke'. This is a loose quick zigzag brushstroke, mostly used to temper the colour, but also to suggest form (Fig. 10). The brushwork of the flower tondos is difficult to judge because of their condition; they are severely damaged and heavily overpainted. Nevertheless, some similar zigzag brushstrokes are still visible, which points to Pellegrini (Fig. 10a). The fact that this characteristic brushstroke is also visible in the flower tondos supports the attribution to Pellegrini.

Composition of the ground of the grisailles

A cross-section from one of the grisailles shows a different build-up and composition in comparison to the ceiling, chimney and tondo paintings (Fig. 11). The grounds of the grisailles consist of two layers. The bottom layer is composed mainly of lead white (EDX: Pb, C and O). Some chalk was also indicated (EDX: Ca, C and O), along with the addition of a little quartz (EDX: Si, O or Si, Al, O) (sometimes with a reddish ring) and a carbon-based (possibly charcoal) black. The second ground layer consists mainly of chalk (EDX: Ca, C and O). In addition, there are also some lead white particles, a fine black pigment and yellow and red earths. Examination with the light microscope and the EDX analyses provide evidence of the use of quartz with the reddish rings. Although we cannot rule out that the quartz was added for economic reasons, it could also have been used for its plastic effect.

It would appear that in both layers the pigments are mixed with oil, although binding medium analysis has not been performed at this point. It is remarkable that the second ground layer consists of much more chalk than the first ground layer. It is not clear to what effect this was done, as generally in 17th-century paintings one finds first



Fig. 11 Cross-section from *Fire* (Fig. 5a) [MH1138x02]: (a) bright field, magnification 200×; (b) UV radiation, magnification 200×; (c) BSE image, magnification 500× and elemental maps: (d) calcium; (e) lead.

a chalk-rich layer and a second ground layer consisting of more lead white. It is noteworthy that Pellegrini used two different types of ground in the ensemble but we can only speculate as to whether the grisaille technique and the cool tone of marble stone are the reason for the difference, as explained further in the next section.

Painting technique of the grisailles

In the grisailles Pellegrini used the ground as a light midtone. A different composition was identified in these grounds compared with the ceiling, chimney and tondo paintings. As the grisailles were intended to resemble marble statues in a niche, the reason for the use of a different ground could lie in the painting technique. In 1707 De Lairesse described the way in which grisailles should be painted. The artist should colour the canvas in the tone of the final marble statue, 'between light and shadow'. He then draws the composition with a pencil. He starts by painting the shadows and accentuates them with a darker colour wet-in-wet. The ground serves as a light colour. To finish the bas-relief the painting should be covered by a very thin translucent layer of the first ground colour mixed with turpentine oil and in this wet layer the last highlights should be applied. These highlights will even out in the translucent paint layer giving the image a very even appearance without showing individual brushstrokes.⁴⁷

The sequence that Pellegrini used for his paintings is similar to De Lairesse's instructions, except that a lively brushstroke is evident everywhere. But by working wetin-wet Pellegrini creates a wide range of tones and, like De Lairesse, also starts with the mid-tone. There is no evidence of a drawing, but a thin reddish-brown painted sketch is visible indicating shadows with some light lines to define the architecture. The deepest shadows were then painted. Pellegrini then began to use a lighter brown for the shadows and a light cream colour for all the light areas. By working wet-in-wet in the light brown shadows he modified and softened them. By painting the light paint over the dry deep shadows a cool mid-tone was created. The brushstrokes of the hard bristle brushes sometimes expose the ground creating an additional hue. Finally the last highlights were added.



Fig. 12 Cross-section from Mattheus Terwesten, *Allegory of Peace, c.*1740, canvas, 118 × 79 cm, The Hague, Mauritshuis [MH1042x04]: (a) bright field, magnification 400×; (b) UV radiation, magnification 400×; (c) BSE image and elemental maps: (d) calcium; (e) silicon; (f) aluminium.

Material comparison of the ensemble with paintings from local artists from The Hague

In order to determine whether the specific translucent particles with the orange-reddish rings had a local origin we compared the cross-sections from the paintings of the ensemble of the Golden Room to other paintings by local artists from The Hague.

The Mauritshuis owns a painting by Mattheus Terwesten (1670–1757) dating from around 1740 (*Allegory of Peace*,

c.1740, canvas (oval), 118 × 74 cm, Mauritshuis, The Hague, inv.1042).⁴⁸ Terwesten worked in The Hague from 1690 until his death in 1757. In the context of Pellegrini it is interesting to read that Terwesten was described by Jacob Campo Weyerman in 1769 as being as 'skilled as a Pellegrino.'⁴⁹ Terwesten's painting once formed part of a decorative scheme, but was probably not originally made for the Mauritshuis. It is currently built into one of the cabinets of the Mauritshuis.

During the treatment of the painting, cross-sections were taken (Fig. 12). 50 The ground layer shows strong similarities to



Fig. 13 Cross-section from Giovanni Antonio Pellegrini, *The Four Elements of the Brewers*, 1716–17, canvas, 142 × 242 cm, The Brewers Museum, Antwerp: (a) bright field, magnification 200×; (b) UV radiation, magnification 200×; (c) BSE image and elemental maps: (d) calcium; (e) lead.

the grounds in the Pellegrini ensemble paintings. Here again we see large, faceted particles, similar to those observed in the ceiling, chimney and tondo paintings. And once again in the BSE image these large particles look similar. Furthermore, the elemental maps show that the large particle at the bottom of the sample consists of silicon oxide (EDX: Si and O) and is surrounded by a reddish ring containing iron particles. Other particles consist of silicon and aluminum (EDX: Si, Al, Na and O). These specific particles in the ground layer of Terwesten's painting look similar to those found in the ceiling, chimney and tondo paintings. This could point to a local origin of the materials, raising the possibility that Terwesten and Pellegrini may have used locally primed canvases.

Another example from the Mauritshuis that seems to indicate the use of locally primed canvas is a painting by Aert de Gelder, *Portrait of Herman Boerhave*, professor of medicine at Leyden (c.1722, canvas (oval), 79 × 64 cm, The Hague, Mauritshuis, inv. 757). Aert de Gelder worked in his native town Dordrecht, about 50 km from The Hague. When examined with the light microscope, a cross-section from this painting shows a very similar ground layer with colourless particles surrounded by reddish rings. The cross-section was not analysed with SEM-EDX. 51

Material usage in other paintings by Pellegrini

The materials Pellegrini employed in the Mauritshuis were also compared with materials used in paintings made elsewhere in Europe by the artist. The city of Antwerp owns Pellegrini's The Four Elements of the Brewers (The Brewers Museum, Antwerp, 1716–17, canvas, 142×242 cm).⁵² Pellegrini went to Antwerp in 1717, a year before going to the Netherlands to paint the ensemble of the Golden Room. This painting shows some of the characteristic features of Pellegrini's painting technique: his 'signature brushstroke' and the colour of the ground layer, which is also used in this painting to define the contours of the figure. Upon initial inspection, the colour of the ground in this painting looks similar to the ground in the ceiling paintings but examination of the cross-section reveals a completely different layer build-up (Fig. 13). The SEM-EDX analysis showed that the lower layer consists of almost pure chalk (EDX: Ca, C and O). The second layer comprises mainly chalk (EDX: Ca, C and O) with additions of lead white (EDX: Pb), yellow and red earth pigments (EDX: Si, Al and Fe) and charcoal black. This composition also differs from the ground of the grisailles that consists of a lower, almost pure layer of lead white on top of which a mixture of lead white and chalk was applied.

More similarities were found between the orange earthrich ground of our paintings with a painting by Pellegrini in the National Gallery, London (*Rebecca at the Well*, *c*.1708–13, canvas, 127×105 cm, The National Gallery, London) where similar earth particles were found (with a lead white and charcoal layer on top). The lower earth-containing layer is beige with reddish-orange particles. However examination of the cross-section with light microscopy at the National Gallery did not reveal the presence of the translucent colourless particles found in the paintings from The Hague.⁵³

Conclusions

The study of the painting ensemble of the Golden Room is ongoing. This paper combined the research of the painting technique with art historical research and chemical analyses to prove that the paintings for the ceiling, the chimneys and the flower tondos have the same grounds and were painted at the same time. A 'signature brushstroke' detected in all four groups of paintings provides further evidence that the flower tondos were in fact also painted by Pellegrini. The style and choice of subjects fit closely with the fashionable Louis XIV style and reflect the theoretical ideas found in De Lairesse's *Groot Schilderboek*. Pellegrini shows his versatility by bringing together so many different kinds of paintings as part of a well thought-out programme as advocated by De Lairesse, and demonstrating a mastery of different techniques: the imitation of marble in the grisailles, creating the illusion of a view up to the realms of the Gods in the ceiling paintings, flower still lifes painted on metal leaf, and the chimney paintings with their allusion to the prosperous States of Holland.

Analyses of the cross-sections revealed that the composition of the ground layer is noteworthy. The combination of quartz, chalk and an aluminosilicate, all with reddish rings of clay minerals, may help to determine the provenance of the clay. It is possible that Pellegrini was aware of the advantageous effect of a ground layer containing a high percentage of quartz: its flexibility. This is supported by the fact that in the grounds of the grisailles, quartz was added to the otherwise very stiff lead white. The different composition of this ground was chosen for its colour.

The fact that there is evidence of at least two, and possibly three, very similar grounds on paintings by Pellegrini, Terwesten and De Gelder dated between 1718 and *c*.1740 containing quartz, chalk and an aluminosilicate could indicate a local source. Further research on the composition and the origin of the earth pigments could shed more light on where the artists obtained their materials and the development of the ground layer in Dutch art in the early 18th century.

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Notes

- For more information on Pellegrini see: B. Aikema and E. Mijnlieff, 'Giovanni Antonio Pellegrini 1716–1718: a Venetian painter in the Low Countries', in J. de Jong, D. Meijers, H. Pennock and V. Schmidt (eds), Nederland-Italie: Artistic Relations between the Low Countries and Italy 1400–1750, Netherlands Yearbook for the History of Art, Zwolle, Waanders Uitgevers, 1993, vol. 44, pp. 215–242; G. Knox, Antonio Pellegrini 1675–1741, Oxford, Clarendon Press, 1995.
- 2. Q. Buvelot, *Mauritshuis: The Building*, Zwolle, Waanders Uitgevers, 2014, pp. 140, 261, note 123.
- 3. With thanks to Shell Technology Centre, Amsterdam, which carried out analysis of the paint samples.

- 4. C. Pottasch, J. van den Burg and M. van Eikema Hommes, 'Venetian splendour in the Mauritshuis: a little known painting ensemble by Pellegrini in the Netherlands', in *Painting Technique, History and Studio Practice*, Amsterdam, Rijksmuseum, forthcoming.
- 5. Gerard de Lairesse, *Groot Schilderboek*, Haarlem, 1707 (1740, 1969).
- 6. Buvelot 2014 (cited in note 2), pp. 118–119. To raise money for the rebuilding of the Mauritshuis a number of lotteries were organised.
- 7. M. Levy, *Painting in Eighteenth Century Venice*, New Haven and London, Yale University Press, 1977, p. 6.
- 8. Ibid., p. 26.
- M. Levy, Rococo to Revolution: Major Trends in Eighteenth Century Painting, London, Thames and Hudson, 1966, p. 39; Levy 1977 (cited in note 7), p. 40.
- 10. Aikema and Mijnlieff 1993 (cited in note 1), pp. 219-221.
- 11. Ibid., p. 223.
- 12. Ibid., especially pp. 216–220.
- 13. B. Sani and L.S. Olschski (eds), *Rosalba Carriera: lettere, diari, frammenti,* Florence, 1985.
- 14. The painting has the following inscription: 'Republica: Pellegrini F'.
- 15. Aikema and Mijnlieff 1993 (cited in note 1), p. 217. Pictura was a more or less academic club of artists founded in 1656 in The Hague by local artists who were dissatisfied with the Guild of Saint Luke.
- Aikema and Mijnlieff 1993 (cited in note 1), pp. 228, 238, note 57.
- 17. Buvelot 2014 (cited in note 2), pp. 140, 261 note 123.
- 18. De Lairesse 1707 (cited in note 5), Book 8, chapter 7, p. 66.
- D.P. Snoep, 'Classicisme en historieschilderkunst in de zeventiende eeuw', in A. Blankert *et al.* (eds), God & Goden. Verhalen uit de Bijbelse en klassieke oudheid door Rembrandt en zijn tijdgenoten, Amsterdam, The Hague, Rijksmuseum, Staatsuitgeverij, 1981, pp. 237–239.
- 20. Ibid., p. 244.
- 21. J. Hall, *Subjects and Symbols in Art*, London, Richard D. Irwin, 1987, p. 338.
- 22. Lea van der Vinde, curator at the Mauritshuis, carried out the research on the subject matter.
- 23. H. Führi-Snetlage and C. Pottasch, 'A break in the clouds', *Mauritshuis in Focus*, 27(1), 2014, pp. 23–28.
- 24. De Lairesse 1707 (cited in note 5), Book 10, chapter 4, p. 234: 'op leerzaame wijze, tot cieraad der Gebouwen dienen'.
- 25. E. Hartkamp-Jonxis and A. de Vries (eds), *Duivenvoorde: Bewoners, landgoed, kasteel, interieur en collectie,* Zwolle, Waanders Uitgeverij, 2010, p. 93. The sketches are attributed to the circle of Daniel Marot (possibly Mattheus Terwesten).
- 26. M. van Eikema Hommes, 'De originele kleurafwerking van de Gouden zaal', in Buvelot 2014 (cited in note 2), pp. 152–157.
- 27. De Lairesse 1707 (cited in note 5), Book 10, chapter 3, pp. 227–228.

- 28. D. Snoep, 'Lairesse als plafond- en kamer schilder', Bulletin van het Rijksmuseum 18(4), 1970, pp. 172–176; De Lairesse 1707 (cited in note 5), Book 2, chapter 6, p. 63: 'The painter has to make figures of clay to understand form and the sculptor has to learn painting for ordinantie en stelling (arrangement and composition).'
- 29. De Lairesse 1707 (cited in note 5), Book 10, chapter 3, p. 231.
- 30. Ibid., Book 12, chapter 4, p. 362: 'Op een goude en zilvere grond hebben de bloemen een byzondere welstand, doch staan echter veel schoonder op koper, metaal of brons, ter oorzaake van hunne donkerachtige luister, vermits het goud wat te veel gekoleurd is en het zilver te bleek.'
- 31. S. Meloni, M. Salazar-Walsh, R. Haswell and C. Toussat, 'Golden paintings for the Golden Room of the Mauritshuis? The search for the original appearance of six flower tondos', poster presented at *Technology and Practice: Studying 18th Century Paintings and Art on Paper*, Copenhagen, 2–3 June 2014.
- 32. EDX: Ca, C, O, Si, Al, Fe. The starch was identified visually: large fluorescent particles in UV and in the backscatter image they appear black.
- 33. Pigments were analysed with light microscopy in the Mauritshuis using a Leica DM2500 light microscope. SEM-EDX analyses were carried out at Shell Technology Centre, Amsterdam with a SE microscope JEOL7000F and the EDX is a Noran System Seven (NSS) from Thermo Fisher Scientific.
- D. Hradil, T. Grygar, J. Hradilova and P. Bezdicka, 'Clay and iron oxide pigments in the history of painting', *Applied Clay Science* 22, 2003, pp. 230–231.
- 35. K. Groen and E. van Duijn, Paintings in the Laboratory: Scientific Examination for Art History and Conservation, London, Archetype Publications, 2014, p. 43, p. 49 note 63. See also: L.S. Maclehose and G. Baldwin Brown (eds), Vasari on Technique; By Giorgio Vasari, Dover Publications, 1960, pp. 241–242.
- 36. Groen and van Duijn 2014 (cited in note 35), p. 53.
- 37. Ibid., p. 43.
- 38. Ibid., pp. 43, 49 note 61, and 53.
- 39. The clay used for the Delft earthenware is a mixture partly consisting of a clay mined along the river in Rijswijk near The Hague. Groen and van Duijn 2014 (cited in note 35), p. 53.
- 40. Ibid., pp. 46, 49 note 67: 'Pieter Barbiers used a ground layer with 60% quartz for painted wall hangings. The flat mica in the clay provides the flexibility.'
- 41. In this respect it is interesting to note that Pellegrini also added quartz (EDX: Si, O and sometimes Mg) to his paint layers.
- 42. Hradil et al. 2003 (cited in note 34), p. 223.
- 43. Ibid., p. 229.
- 44. Groen and van Duijn 2014 (cited in note 35), pp. 58–61. It is nearly impossible to ascertain which clay is present with EDX or XRF analyses.
- 45. Ibid., p. 53. A local clay was mined as close as Rijswijk near The Hague and used for Delft earthenware.
- 46. The study and analyses of the paint layers will be the subject of a forthcoming paper in 2015.
- 47. De Lairesse 1707 (cited in note 5), Book 10, chapter 3, pp. 230–231. De Lairesse knew very well how to paint grisailles, as can be seen in his grisailles for Ph. De Flines Mansion on the Herengracht, now in the Rijksmuseum, Nrs. A4174-A4178.
- 48. This painting was restored by Marya Albrecht, intern from the University of Amsterdam, in 2013.
- J.C. Weyermans, De Levens-beschrijvingen der Nederlandsche konst-schilders en konst-schilderessen, Dordrecht, 1769, vol. 4, p. 168: 'Vorders zullen wy er Toedoen dat Mattheus Terwesten zo vaardig is als een Luca Jordano of een Pellegrino.' With thanks to Marya Albrecht.
- 50. Cross-section [MH1042x04], Mauritshuis, The Hague.
- 51. Groen and van Duijn 2014 (cited in note 35), pp. 46, 49, describe in note 67 three other examples of grounds containing a mixture of quartz and lead white, of which two are paintings by Aert de Gelder.

- 52. We are very much indebted to Marc Leenarts, conservator in Antwerp, for his time and assistance in obtaining permission to take a paint sample.
- 53. With thanks to Marika Spring, The National Gallery, London for providing information on this painting.

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LIOTARD'S PASTELS: TECHNIQUES OF AN 18TH-CENTURY PASTELLIST

Leila Sauvage and Cécile Gombaud

ABSTRACT In 2007 the Rijksmuseum, Amsterdam initiated a conservation and research project on framed pastels by the Swiss artist Jean-Etienne Liotard. For the first time, 21 pastels were unframed and available for documentation, examination and technological analysis. In order to reconstruct both his workshop practice and his palette, materials used by the artist were examined as well as his production process. The first results of this project are presented here with a preliminary palette of colours. Liotard's working methods were studied – from the supports to the application of colours – and then compared to various sources. The 1762 treatise on parchment making by Jérôme De La Lande, *Lart de faire le parchemin*, provided very interesting information on vellum support for pastel painting. Apart from the *Traité des principes et règles de la peinture* (1781) written by Liotard himself, the archives of his only pupil in pastel painting, Princess Karoline Luise von Hessen-Darmstadt, can be considered a unique and direct record of Liotard's practice.

Introduction

Jean-Etienne Liotard (1702-1789) is considered one of the major artists of the 18th century. He painted in oil, painted miniatures, made enamels and engraved, but pastel, his favourite medium, established his reputation. The Rijksmuseum, Amsterdam, houses the second largest collection of his pastels with 23 works, while the Musée d'Art et d'Histoire de Genève, with 37, has the largest. Many others are held in private collections all over the world. In 2007, the paper conservation studio of the Rijksmuseum initiated a conservation project in which the Liotard pastels were all unframed and documented. In preparation for the reopening of the Rijksmuseum in 2013, it was decided to conserve 13 of his pastels. This was a unique opportunity to investigate the artist's techniques allowing analytical data to be compared with written sources for the first time. The early results of this ongoing research project are presented in this paper.

Corpus and methodology

The research project was based on two types of primary sources: material evidence (pastel paintings) and written sources (archival material and treatises) from the 18th century. Secondary sources addressed some of the technological aspects of pastel painting¹ and of Liotard's work, and enabled

the identification of primary sources.² They also provided information on Liotard and his pupil.³ Specific studies on the city of Geneva⁴ and fixatives⁵ provided the necessary information to put this research in a broader context.

Apart from his pastels, Liotard's treatise is the main primary source as it contains theoretical rules established by the artist himself. Information on the pastellist's tools and the making of pastel sticks was provided by contemporary sources, such as Chaperon's *Traité de la peinture au pastel* (1788). The notes taken in 1746 by Liotard's unique pupil in pastel painting, Princess Karoline Luise von Hessen-Darmstadt (1723–1783), during a series of lessons, complemented the treatises' corpus with a direct record. They are now contained in volume XVI of her correspondence and notes on art.⁶

Regarding the material sources, a corpus of 13 pastels, representing a good sample of Liotard's production over his career (from 1735 until 1789), were unframed for technical research. The surface, the sides and the versos of pastels were studied (SK-A-1197 and SK-A-232) as well as two unfinished pastels (SK-A-1196 and RP-T-2010-58). They revealed valuable information on Liotard's preliminary colour tests, wet or dry, on the backs of pastels (SK-A-232) (Fig. 1). These findings provided vital information on his palette, which was then compared with the notes taken during Liotard's lessons in 1746.

The same methodology was applied to the study of all the available material sources. Visual examination was carried out with high-resolution photography using direct,

Pigments identified		Pastel (Inventory number, Title, date, support)										
Colour	Pigment/colorant	SK-A-228 <i>La Liseuse</i> , 1746, parchment	SK-A-231 <i>M. Coignard,</i> parchment	SK-A-232 <i>M. Boère,</i> 1746, parchment	SK-A-233 <i>Mme Boère</i> , 1746, parchment	SK-A-234 <i>F. Algarotti,</i> parchment						
	Calcite	x	х	x	x	х						
	Lead white	x	х	x	x	х						
	Tin white		х	x								
Whites	Bismuth white											
	Ba or Ti white?		х	x	?							
	Zinc white			Imber, Title, date, support) SK-A-231 SK-A-232 SK-A-233 SK-A-234 F. Algarotti, parchment x x x x x x x x x x x x x x x x x x x x x x x x x x x x x x ?								
	Cinnabar/ vermilion	x	х	x	x							
Flesh topos	Ochre	x	х	x	х							
riesii tones	Cu-based green-blue	x			х							
Pigments identified Colour Whites Flesh tones Yellows, oranges, browns Reds Greens Blues Blacks	Lead and bismuth whites											
	Various ochres		х	x	х							
Yellows, oranges,	Umber		х	x	х							
browns	Orpiment											
	Cr-based yellow											
Reds	Cinnabar/ vermilion	x										
	Red ochre											
	Green verditer			?								
	Other Cu-based pigment											
Greens	Mixture of Prussian blue and ochre			?								
	Mixture of Cu-based pigment and ochre			?								
	Mixture of indigo and ochre											
	Prussian blue	x		x	х	x						
Greens	Azurite											
Blues	Other Cu-based pigment		x									
Diuco	Indigo	Other Cu-based pigment x										
	Mixture of Prussian blue and Cu-based pigment	x		x	x	x						
Blues Blacks	Bone black		х	x	x	х						
DIACKS	Black ochre	x	x	x	x	x						

Table 1 A summary of the pigments identified by elemental analysis on Liotard's pastels. The question marks indicate an incomplete identification and a need for further research.

Pastel (Inventory number, Title, date, support)													
SK-A-238 <i>MJ. of Saxony,</i> 1750, parchment	SK-A-240 Young Woman in Turkish Interior, parchment+canvas	SK-A-242 <i>Three Graces,</i> parchment	SK-A-1195 Apollo and Daphne, paper+canvas	SK-A-1197 View from Geneva, 1765, parchment	RP-T-2010-57 <i>C. Calkoen,</i> parchment	RP-T-2010-58 <i>Unknown lady,</i> parchment							
x	х	x	х	х	x	х							
x	х	х	х	х	х								
	х			х	?								
x	х				х								
?	?			?	?								
	Х				?								
x	x	x											
x	х	х			х								
x													
x					x								
x	х	х	х	Х	х	х							
x	х	х	х	Х	х	х							
	х	x	х	х	x								
					х								
x	х	x		Х	x	х							
x	х	х				х							
	?	?		?									
	?	?		?	х								
		?											
				?									
x	x	?	x	x		x							
?				х									
?			X										
x	x	?	x	х									
	x	х		х									
x		x	х	х	x								



Fig. 1 Jean-Etienne Liotard, Portrait of Monsieur Boère, 1746, pastel on parchment, SK-A-232: verso. (© Rijksmuseum, Amsterdam.)

raking and transmitted light, ultraviolet and infrared radiation, and with digital microscopy (Hirox). Non-destructive elementary analyses (micro X-ray fluorescence (μ XRF) and scanning macro X-ray fluorescence (MA-XRF)) were carried out on some of Liotard's pastels.⁷ MA-XRF revealed the location of one chemical element on the pastel, and also provided a visual indication of the way it was applied on the support. On the MA-XRF maps shown below (Figs 8–10), the higher concentration of an element is shown as a whiter area; dark areas indicate that the element was not detected. When



Fig. 2 Jean-Etienne Liotard, Portrait of the Princess von Hessen-Darmstadt, 1745, pastel on parchment, inv. 2962. (© Staatliche Kunsthalle, Karlsruhe.)

micro sampling was possible, Raman spectroscopy and polarised light microscopy (PLM) were used to complete pigment identification (Table 1). The pastel, *Portrait of the Princess von Hessen-Darmstadt* (1745, Staatliche Kunsthalle, Karlsruhe, inv. 2962) is a very good illustration of a pastellist at work (Fig. 2).

Liotard's pastel supports

Liotard painted pastels on various supports, some quite unusual such as prepared canvas, silk and wood. The Rijksmuseum houses some of these, for example, the *Portrait*



Fig. 3 Jean-Etienne Liotard, Portrait of Madame Boère, 1746, pastel on parchment, SK-A-233: detail showing the parchment's texture in raking light. (© Rijksmuseum, Amsterdam.)

of William Ponsonby (SK-A-237), which is executed on a prepared canvas. A thick layer of blue gouache has been applied to the canvas and shows through the canvas on the back. The *Sleeping Nymph* (SK-A-1194) was painted on a wood panel. Further investigation is needed to determine how it was prepared.

At this time, when painting in pastel, it was common practice to paste paper onto a stretched canvas. There are five pastels painted on this type of support in the Rijksmuseum. The portraits of Archduke Franz Maximilian (SK-A-1199) and his brother Archduke Karl Ferdinand (SK-A-1198) are unfinished. Executed in Vienna in 1778, these two pastel sketches on blue paper were mounted at a later date. The three other pastels were originally mounted on strainers. Apollo and Daphne (SK-A-1195) was drawn on three pieces of paper pasted together. In addition to the main sheet, a paper strip was added along the left edge and another at the bottom. Infrared reflectography (IRR) shows continuity of the underdrawing, proving that the additional strips were added by Liotard. It was common practice among pastellists to paste several pieces of paper together, either to match the size of a strainer, as in this example, or to attach pre-drawn parts of the composition. Maurice-Quentin de La Tour (1704–1788) often used this technique to include the faces in his portraits. Two portraits - Portrait of Louis de Bourbon (SK-A-235) and Portrait of a Young Boy (SK-A-243) - were drawn on a single sheet of paper but the original colour is difficult to determine without further investigation.

However, Liotard painted most of his pastels on parchment, in particular vellum, his favourite support. Vellum was frequently used by 18th-century pastel painters. In 1762, De La Lande (1732–1807) wrote in his treatise on parchment making: 'Rosalba and de La Tour have always used paper, whereas Mr Boucher and Mr Liotard prefer vellum. M. Boucher whose authority probably equals in that regard, the celebrity of the painter of the Graces, finds that on vellum colours look fresher, lights are brighter, that there is more velvety and finesse.'⁸

There are 16 pastels on vellum in the Rijksmuseum collection. In the *Portrait of Madame Boère* (SK-A-233), one can easily appreciate in raking light the fibrous, velvety texture of vellum. It grabs pastel pigments and perfectly imitates the texture of skin in portraits (Fig. 3). But texture was not the only advantage Liotard found in vellum. For three years (1723–26), Liotard was apprenticed to the Parisian master, Jean-Baptiste Massé (1687–1767), who taught him miniature painting on ivory and particularly on vellum, his speciality. Trained as a miniaturist, Liotard might indeed have appreciated the very smooth, white and translucent surface of calfskin⁹ aged between eight days and six weeks.¹⁰ It enabled him to work small-scale details while its property of absorbing colours allowed more layering than on paper or ivory.¹¹



Fig. 4 Jean-Etienne Liotard, The Three Graces, 1737, pastel on parchment, SK-A-242: microphotograph of the dents in the parchment. (© Rijksmuseum, Amsterdam.)

Vellum for pastel painting

De La Lande's treatise provides an in-depth description of the production and uses of vellum during the 18th century:

To stretch vellum on a strainer, it has to be humidified on the flesh side; but one has to be careful that water doesn't reach the back because the velvety texture would sink and the vellum would become too smooth; in that case, one would have to work in a similar way as with a pumice stone, with a knife rubbed on a soft file; the uneven marks or thin dents left by the file, render vellum fluffy [fibrous], as it was when it came out of the workshop.¹²

This refers to the parallel dents left by the soft file that are sometimes visible on Liotard's vellum supports. Figure 4 is a microphotograph of a detail from *The Three Graces* (SK-A-242): the fibrous texture had probably been damaged due to an excess of humidity during the stretching process. In these areas, pastel adhered specifically on top of the ridges whereas undamaged vellum would be able to hold onto the pastel powder to facilitate drawing and layering.

Liotard's vellum supports were always stretched on rather thick wooden strainers, and were usually folded and secured at the sides with iron nails. A crossbar sometimes reinforced



Fig. 5 Jean-Etienne Liotard, *View from the Artist's Studio in Geneva*, 1765–1770, pastel on parchment, SK-A-1197: the back superimposed on a picture in transmitted light of a modern calf parchment (H. de Groot, Rotterdam). (© Rijksmuseum, Amsterdam.)

the strainer. The back of *View from the Artist's Studio in Geneva* (SK-A-1197) when superimposed on a photograph in transmitted light on a piece of modern calf parchment, shows which part of the skin was used (Fig. 5). The spine area

is particularly thin in calfskin, while the sides are thicker.¹³ The hipbone area is visible where the vellum is more translucent. According to De La Lande: 'The skin side is chosen to paint in pastel, whereas the flesh side is required for miniature; however some vellums are prepared to be used on both sides which allows both choices.¹⁴ The standard size of a half-figure pastel portrait by Liotard (65/60 × 45/40 cm) corresponds to the useful part of a vellum hide.¹⁵

The Young Woman in a Turkish interior (SK-A-240), more than 1 m high, is a rare case of two vellum sheets pasted onto a stretched canvas with a parchment strip concealing the seal. This mounting technique is very unusual and interesting as De La Lande describes sewing, rather than gluing, to attach together vellum pieces to paint in pastel.¹⁶ Looking at a microphotograph of a vellum sample from this large pastel, the identification of the animal type and of the vellum side used is impossible. The structure has been altered due to the skin preparation during the vellum's production process. It is very difficult to characterise precisely Liotard's vellum supports and therefore to deduce from where they originate. They could have been bought locally wherever the artist was staying or possibly brought from Liotard's hometown of Geneva.

Pastel medium

A pastel stick is traditionally made of a ground colour (mineral pigment or dried colorant) mixed with a binder, gum arabic being the most common. The quantity of binder added is just enough to hold the pigments together, as the particles should be easily transferred to the drawing support. The amount is usually too small to be identified with the techniques mentioned earlier, which explains why most of the studies in this field focus on pigment and colorant identification. A white filler, usually calcium carbonate and/or a white clay (kaolin), is added to the pure pigment to create a range of lighter hues.

Mixing pastel colours directly on the support is more difficult than in oil painting. The pastellist needed a large set of individual pastels, containing different hues (including mixtures), but also a range of intensities for each hue. Pastel sticks were usually stored in a wooden box.¹⁷ The fabrication of a complete set of pastel sticks required substantial knowledge of the different physical and chemical properties, such as shape, size, texture, hardness, binding property and chemical compatibility of each pastel ingredient. Most of the recipes do not give the precise proportion of each ingredient so artists needed to gain experience to be able to produce a homogeneous set of pastel sticks. They had to know, for example, that some pigments had very strong binding properties, requiring very little binder in order to make a stick. In his treatise, Chaperon listed the properties of each ingredient and advised the reader on incompatibilities or specific sensitivities.18 The emergence of the pastel maker as a new kind of artists' supplier was thus a solution to the lack of technological knowledge of some pastellists, as well as an efficient response to the new demand for ready-made pastel sticks in Europe during the golden age of pastel painting.

Liotard's pastels and practice

Discussing Liotard's workshop practice and palette is challenging as the artist never described tools or gave precise technical recipes. The treatise he published in 1781 remains highly theoretical with 12 principles and 20 rules. His aesthetic theories were combined with advice on the proper artist's attitude, based on patience, reason, choice of subjects and the acceptance of criticism regardless of who provided it.¹⁹ Even had Liotard known of and tried ready-made pastels by the likes of Stoupan, the famous Swiss pastel maker,²⁰he would probably have made most of his pastel crayons himself as he possessed the relevant technical knowledge.

Liotard defined more precisely his use of colours in rules V and XV, recommending the use of nine tones: four light, four dark and one medium. In rule XV of his treatise he urged the reader to 'Spend as much as necessary to obtain the brightest, the most beautiful, the most solid, the deepest and the best ground colours.²¹ He further elaborated: '[such colours] are useful in any kind of paint'.22 The artist also advised against the use of green earth, blue ashes and orpine in oil painting unless the salts they contain were washed off. This corroborates the suggestion that Liotard possessed the technical skills and knowledge to make his own pastels. Liotard's son also referred to this knowledge in a 1779 letter sent to his mother in which he urged her to have his father gather 'all the writings regarding the secrets he found on the way to make pastels of solid colours'23 The same year, Liotard answered via his wife that he did not have any writings on his techniques.²⁴

Looking at unfinished pastels and at the backs of pastels is fundamental to understanding of the production process. As previously mentioned, in some cases Liotard used the side or the back of the parchment support as a palette to try out pastel sticks (see Fig. 1).

Underdrawing: composition and shadows

In the *Portrait of the Princess von Hessen-Darmstadt* (see Fig. 2), Liotard depicted his pupil drawing on a stretched vellum nailed to a wooden strainer with the tools used by a pastellist, including a box of pastel sticks to organise colours, a painter's mahl stick and an easel. The princess is outlining her composition with a dark pastel or chalk before applying colours. In her general rules, the princess included the advice given to her by her master regarding drawing: a drawing should be made 'for each part of a painting that appears very difficult to me', 'finely drawn with a sketching charcoal', 'traced again with red chalk and wiped away with flour'.²⁵ Here, she might have mistaken flour for bread, used to remove the excess of charcoal once a drawing had been secured with red chalk. Drawing is very important in Liotard's process as it is the title given to one of his 12 principles.²⁶

Marcel Roethlisberger and Renée Loche explain in their monograph on Liotard that there are only a few preliminary 1:1 scale sketches of Liotard's finished pastels, which makes underdrawing all the more important to Liotard as



Fig. 6 Jean-Etienne Liotard, *Portrait of Monsieur Boère*: photograph in direct light and infrared reflectograph. (© Rijksmuseum, Amsterdam.)

the composition is directly invented and drawn on the support.²⁷ IRR has confirmed that the artist used a carbon-based chalk or pastel in order to outline his composition. Hatches were also used as an underdrawing technique. In the *Portrait of Monsieur Boère*, the darker side of the sleeve is a layering of dark hatches applied in a coarse and quick manner with the pastel stick (Fig. 6). Despite the layer of blue pastel applied on top, the dark area shows through, building up shades in the garment. As in oil painting's glacis technique, Liotard used the translucency of coloured layers applied on top of dark drawn areas. Following the same pattern, light shades on the right side of the face were created by underlayers of what seem to be carbon-based washes applied with a brush.

Trained as an engraver at an early stage of his career, Liotard knew that building up hatches was essential to create shadows and convey the illusion of three-dimensional effects. In rules I, II, III and IX of his treatise, he develops his theories on shadows and their imitation, stating that shadows should be gradually built up both in the lightest and in the darkest areas. One of his principles is chiaroscuro, which he characterised as follows: 'It also consists in organising, in a painting, lights and shadows, to group them in order to emphasise the painting's effect and brightness, or subject one is depicting.'²⁸ However, translucency of the media was not the only way to create the illusion of depth – translucency of the vellum support was also used by the artist.

Building up coloured layers

In rules VII, VIII, X, XIV, XVI and XIX, Liotard developed his theories on the application of colours. Completing his writing, the notes taken by Princess Karoline Luise are a practical list of steps to be followed in order to draw with pastels. According to the princess, Liotard began his portraits with umber, cinnabar and white to create shadows, adding that, 'all the background colours should be applied evenly without



Fig. 7 Jean-Etienne Liotard, *Portrait of Cornelis Deutz van Assendelft*, 1756, pastel on parchment, inv. BR0541, Collectie Rijskmuseum, Twenthe, Enschede. Bruikleen particuliere collective, Zwolle: verso and recto. (© Rijksmuseum, Twenthe, Enschede and Nico Lingbeek.).

smudging them.²⁹ Liotard used this technique both on the verso and on the recto of his works.

Silhouettes on the back of pastels

Behind many drawings the artist did indeed use this technique of drawn silhouettes – they contribute to building up shadows on the recto, using the translucency of the support. This technique can be related to Liotard's work in miniature and transparencies on glass.³⁰

Access to the back of pastels is very difficult as they are rarely unframed. The silhouette technique is not evident on the backs of the Rijksmuseum pastels that are accessible. Due to infestation, some pastels have recently been removed from their strainers and mounted on supports such as plywood or pressed wood, preventing any access to the vellum's verso. Some pastels on vellum have been mounted on strainers with stretched canvas, again blocking access to the back of the parchment. These original mountings appear to be a reuse of stretched canvas. It is difficult to say if this was an act of preventive conservation (to protect the back) or an artistic gesture (to block the light). Reuse, however, remains the main hypothesis at a time when materials were not always easily available.

Very rare cases of silhouettes on the backs of pastels are known. The *Portrait of the Marquise Wilhelmine de Brandenburg-Bayreuth* (inv. BayNS.G89, Bayerische Verwaltung der staatlichen Schlosser, Gärten und Seen, Neues Schloss) painted in 1745/46, is one example while the *Portrait of Cornelis Deutz van Assendelft* (1730–1788) housed in the Rijskmuseum Twenthe, Enschede (BR0541) is another. The conservation treatment performed by the paper conservator Nico Lingbeek in 1998 provided access to the back of the Enschede pastel. In both cases wet and dry techniques were



Fig. 8 Jean-Etienne Liotard, *Portrait of Madame Boère*, detail (from left to right): photograph in direct light, in transmitted light, MA-XRF maps of Mn, Fe, Pb and Hg elements. (© M. Alfeld, Universiteit Antwerpen; TU Delft; Rijksmuseum, Amsterdam.)



Fig. 9 Jean-Etienne Liotard, View from the Artist's Studio in Geneva: (from left to right) photograph in direct light, MA-XRF maps of As, Mn, Sn, Pb(L), Cu and Ca elements. (© M. Alfeld, Universiteit Antwerpen; TU Delft; Rijksmuseum, Amsterdam.)

used. In the first example, ochre, umber and blue were applied with pastel sticks. In the second example, a large red and black wash was applied wet with a brush in the garment area (Fig. 7), referring to the princess's note number 14: 'The garments are applied in thin and even layer, and then the folds are drawn.'³¹ Black, red, yellow and blue washed pastel also seem to have been applied on the face. The white collar is also indicated.

Underlayering on the recto

The cases of the *Portrait of Madame Boère* and *Portrait of Marie-Josèphe of Saxony* (SK-A-238) are very good examples of MA-XRF maps matching the princess's notes. As in his

silhouette work, Liotard used the same set of colours to start his portraits. These underlayers contributed to building up shades and depth. In rules IV and VI, the artist described the treatment of colours in relation to shadows. This preliminary step of dark underlayering was carried out in preparation for the application of lighter colours and can be related to Liotard's treatise: 'it is very difficult for a colorist to make believe in shadows where there are only colours.'³²

In the *Portrait of Madame Boère*, MA-XRF revealed both the location of one element on the pastel and offered a visual idea of the way it was applied on the surface. The umber layer builds shadows in the dark area of the face whereas the cinnabar layer builds modulations in the lightest areas. In transmitted light, both the dense-coloured areas are highly



Fig.10 Jean-Etienne Liotard, *Portrait of Marie-Josèphe of Saxony*, 1749, pastel on parchment, detail: (from left to right) photograph in direct light, MA-XRF maps of Fe, Hg and Cu elements. (© M. Alfeld, Universiteit Antwerpen; TU Delft; Rijksmuseum, Amsterdam.)

visible. Once the portrait was completed, the underlayer was no longer visible (Fig. 8).

Underlayers are sometimes difficult to characterise, but MA-XRF again proves useful. The *View from the Artist's Studio in Geneva* is an excellent illustration of this (Fig. 9). A wet underlayer has been broadly applied below the sky and the fields, complying with Liotard's rules: 'Light and brown backgrounds have to be uniformly applied without any colour thicknesses, because if colour is coarsely applied, it makes the background stand out, whereas it seems more distant when it is evenly applied.'³³ The calcium layer, visible with MA-XRF, could be part of the production process of parchment, however, analysis revealed that calcite was probably the filler used in most of Liotard's pastel sticks.

Lead and copper, used mixed together, show the same washed application pattern on the MA-XRF maps. The copper wash is visible on the side of the pastel and was identified as azurite with Raman spectroscopy analysis. Tin is also present in the underlayers, possibly mixed with lead and copper. All these layers contribute to depicting the atmospheric perspective above the mountains. Calcium carbonate, lead and tin white seem to have been used at an early stage of the composition.

Intermediate layers

This first coloured layer was then completed with 'the midtones with burnt ochre, broken with blue or purple; the lights with shade of minium', described by Princess Karoline Luise (note number 16). The use of blue to render the bluish tone of veins under the translucent skin is clearly visible in the copper scan obtained by MA-XRF from the *Portrait of Marie-Josèphe of Saxony* (Fig. 10). This green-blue pigment is visible in the eyelids, the chin and next to the mouth, slightly showing through the translucent skin. It is used either alone as a layer or could have been blended with another pigment as described by the princess: 'all the flesh is perfectly applied and later blended with a very tight blue and white stick, light and shadow together.'²⁴

The use of intermediate layers was also identified in *View* of the Artist's Studio in Geneva. On top of the wet underlayer described earlier, Liotard applied dry pastel broadly to indicate the main areas of his composition, before painting the details in the foreground (see Fig. 9). In underlayers as well as intermediate layers, no hatches or strokes are visible, following Liotard's rule number VI, to get 'an even background layer'. Again, the princess's notes provide technical details on the mode of application. To create large areas of colour with dry pastels, the layers can be 'worked with a large [pastel] stick.'³⁵ This probably refers to the use of the long side of the stick for a broader application.

Top layers

The princess specified that one should keep 'the nice colours and lights for the end'. The *Portrait of Madame Boère* and *Portrait of Marie-Josèphe of Saxony* are clear examples of the application of this rule. Analysis revealed that Liotard used cinnabar and umber sticks containing more lead white as his layers progressed, blending each one into the other (see Fig. 8). The colours could be blended with the fingers, a brush, or a stump made from rolled leather, felt or paper.³⁶ Princess Karoline Luise insisted many times, probably following Liotard's guidelines, on colour blending in order to obtain very subtle and smooth transitions at each step of the layering process.³⁷

In the last layer of these portraits, the artist sometimes used bismuth white for its pearlescent properties, imitating perfectly the cosmetic powders of the time.³⁸ Liotard left here an illustration of his rule VII, because the lights come from the superimposed layers, not from light lines.³⁹ In this instance the technique is based on an optical mixture of primary colours, not on the use of many different colours.

Highlights

The last step of this layering process is the detail, particularly important for the foreground according to Liotard's rule VIII. Close examination of the upper pastel layers of his pastels led to the identification of two techniques. First, employing the drawing technique of highlighting, the pastellist could use the sharpened tip of a pastel stick to draw the details. This technique was widely used by Liotard, who insisted in his rule VII,



Fig. 11 Jean-Etienne Liotard, *View from the Artist's Studio in Geneva:* detail in raking light. The upper part shows two horses finely detailed with a sharp dry pastel stick (a few millimetres in height). The relief of the wet pastel, applied with a brush, is visible in the plants in the foreground.



Fig. 12 Jean-Etienne Liotard, *La Liseuse*, 1746, pastel on parchment, SK-A-228: microphotograph. (© Rijksmuseum, Amsterdam.)

titled 'No stroke', that 'highlights [should be] blended with other colours'. The trees and animals in the background of *View from the Artist's Studio in Geneva* were created using this technique (Fig. 11).

Digital microscopy and raking light revealed a second technique, inspired by the miniaturist and enamel painting

techniques: *La Liseuse* (SK-A-228) and *View from the Artist's Studio in Geneva* are two examples of the use of a miniaturist technique for pastel painting. To depict the crucifix on the *Liseuse's* necklace (2 cm long), Liotard applied pastel as a 'wet paste' on top of a layer of dry pastel (Fig. 12). In the same way, the little white plants in the foreground of the landscape were

delicately painted over an even, dry background (see Fig. 11). Liotard probably mixed pastel powder with water and applied the wash obtained with a very fine brush to achieve this effect.

Generally, Liotard elaborated his pastels carefully respecting his principle of 'No strokes' (rule VII) to create the shadows. Colours were applied as evenly as possible. However the artist contradicted his own theory in a few details, such as the face of *Marie-Josephe of Saxony* (1749), where the cheeks show a series of parallel dark pink hatches (see Fig. 10). This more vibrant mode of application reveals a free practice of pastel painting in direct opposition to instructions in his 1781 treatise.

Fixatives

Liotard mentioned fixatives in a letter he sent to the Earl of Bessborough in 1763.40 He warmly advised the earl to have his pastels fixed by Monsieur Jurine (1722–1779) in Geneva: 'He fixed nine of my works, and three for an English man Sir Chaloner whom I painted not long ago and over sixty works here.'41 It is unclear whether the 60 works referred to were his or works by other artists from the area of Geneva, from where the letter was sent. In his Dictionary of Pastellists before 1800, Neil Jeffares mentions Sébastien Jurine in the 'Inventors, writers and suppliers' section⁴² as well as Jurine's advertisement in the Gazeteer & New Daily Advertiser published in 1765, which confirms that the earl followed Liotard's advice since he is listed with other British clients of Jurine. There is no information on the content of Jurine's recipe. In the same letter to his client and patron, Liotard also declared that Jurine could fix pastels as well as Loriot in Paris.

Antoine-Joseph Loriot (1716–1782) invented a fixative recipe in 1753 that was officially disclosed at the Académie Royale de Peinture et de Sculpture, Paris, in 1780. It consisted of a solution of fish glue in water and alcohol – two volumes of alcohol should be mixed with one volume of dilution.⁴³ Jurine's recipe is probably comparable to Loriot's as fish glue is used in several contemporaneous recipes to fix pastels. Moreover, Jurine stated in his advertisement: 'His Method not only prevents the colours from falling or fading, or being easily rubbed off, but likewise takes out every Spot of Mouldiness, and hinders the forming of others.'⁴⁴ Loriot claimed the same antifungal properties for his own fixative and Jurine's recipe may also have contained alcohol as an antifungal preventive treatment.

In order to characterise the presence of a fixative on Liotard's pastels, the conservation scientist Julia Schultz analysed three samples from Rijksmuseum pastels in 2009. The antibody-based technique ELISA gave negative results for sturgeon glue or any protein-based substance. The concentration of the protein may have been too low or the protein might have degraded, either by the addition of ethanol in the production process or by ageing.⁴⁵

Conclusions

The Rijksmuseum pastel conservation project provides a unique opportunity to access unframed pastels during their treatment. This research project on Liotard's techniques is rare in the field of research in pastel painting as it combines examination and analysis of unframed pastel paintings with direct and indirect sources and technical treatises. Princess Karoline Luise von Hessen-Darmstadt's notes contribute to the understanding of his working process. She also represents the development of pastel painting among women of high rank by the middle of the 18th century. The princess's connection to Liotard also illustrates the itinerant career of the artist, which can be related not only to the materials to which he had access, but also to his practice. Our understanding of Liotard's palette needs to be completed with analysis of its organic compounds. His knowledge and use of Stoupan's and other pastel makers' pastels are verified and relate to the problems of making his own pastels due to his frequent travels. However, Liotard's procedures for painting or drawing in pastel primarily originate in a very solid, multidisciplinary technological background gained as an apprentice and developed throughout long years of practice. It had a strong impact on his practice and on the colours he used to paint in pastel, some of which were unknown in oil painting such as bismuth and tin white.

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Notes

- 1. T. Burns, *The Invention of Pastel Painting*, London, Archetype Publications, 2007.
- 2. M.G. Roethlisberger and R. Loche, *Jean-Etienne Liotard: catalogue, sources et correspondances,* 2 vols, Dornspijk, The Netherlands, Davaco, 2008.
- J. Lauts, 'Jean-Etienne Liotard und seine Schülerin Markgräfin Karoline Luise von Baden', Jahrbuch der Staatlichen Kunstsammlungen in Baden-Württemberg 14, 1977, pp. 43–70.
- G.A. Bridel, 'Les pastels de Lausanne', *Revue historique vaudoise*, Lausanne, Société Vaudoise d'Histoire et d'Archéologie, 1944, pp. 10–21.
- N. Jeffares, *Dictionary of Pastellists before 1800*, London, Unicorn Press, 2006. Available at: www.pastellists.com (accessed May 2015).
- 6. Corr. 5a, Bd.96, Landesarchiv GLAK, Groβherzogliches Familienarchiv, Karlsruhe, Germany.
- 7. For the μXRF analysis, the μXRF ARTAX (Bruker Nano GmbH, Berlin, Germany) was used with the following parameters: molyb-denum tube with polycapillary lens (lens 0.060), voltage 50 kV, current 598 μA, detector XFLASH 3001. For the MA-XRF analysis, the MA-XRF scanner M6 Jetstream (Bruker Nano GmbH, Berlin, Germany) was used, with the following parameters: Rh anode, voltage 50 kV, current 500 μA. The technique was developed by M. Alfeld (University of Antwerpen) and Technische Universiteit Delft. For more information on this last technique, see M. Alfeld, J. Vaz Pedroso, M. van Eikema Hommes, G. Van der Snickt, G. Tauber, J. Blaas, M. Haschke, K. Erler, J. Dik and K. Janssens., 'A mobile instrument for in situ scanning macro-XRF investigation of historical paintings', *Journal of Analytical Atomic Spectrometry* 28, 2013, pp. 760–767.
- 8 'La Rosalba et M. de la Tour se sont toujours servi du papier ; tandis que M. Boucher & M. Liotard préfèrent le vélin. M. Boucher dont l'autorité doit égaler dans cette parti, la célébrité de ce fameux Peintre des Grâces, trouve que sur le vélin, les couleurs sont plus fraiches, les clairs plus brillants, qu'il y a plus de velouté & même plus de finesse.' J. De La Lande, *Art de faire le parchemin*, Paris, H.L. Guerin et L.F. Delatour, 1762, p. 33, §61.
- 9. Ibid., p.5, §4.
- 10. Ibid., p. 24, §44.
- 11. Ibid., p. 31, §58.
- 12. Ibid., p. 34, §61: 'Pour tendre le vélin sur le châssis, il faut le mouiller du côté de la chair; mais on doit prendre garde que l'eau ne pénètre pas le côté du dos: car le velouté s'abattroit, & et le vélin seroit trop lisse; dans ce cas on seroit réduit à fair eun travail semblable à celui de la pierre-ponce, avec un couteau passé sur une lime douce; les petites inégalités, ou dentelures fines, que la lime y a laissées, rendent ce vélin pelucheux comme il l'étoit au sortir de l'attelier.'
- 13. Ibid., p. 24, §44.
- 14. Ibid., p. 34, §61: 'C'est le côté du dos que l'on choisit, pour peindre en pastel, au contraitre de la miniature qui exige le côté chair; cependant il y a des vélins qui sont préparés des deux côtés, & dans lesquels on peut choisir.'
- 15. Roethlisberger and Loche 2008 (cited in note 2), vol. 1, p. 106.
- 16. De La Lande 1762 (cited in note 8), p. 33, §61.
- For an illustration of a pastel box, see D. Diderot and J. d'Alembert, Encyclopédie, Paris, 1751–1772, Peinture-Planche VI.
- 18. P.R. de Chaperon, *Traité de la peinture au pastel*, Paris, Defer de Maisonneuve, 1788, chs II, III, IV.
- 19. J.E. Liotard, *Traité des principes et règles de la peinture*, Genève, 1781, rules XI, XII, XIII and XX.
- Roethlisberger and Loche 2008 (cited in note 2), vol. 2, p. 809: (Genève, 13 octobre 1778): 'J'y joins ... des pastels la grande boîte

est pour toi, & la petite des pastels de Stoupass parce qu'on ne les trouve plus, mais d'un autre qui valent encore mieux a se que dit ton Papa.'

- Liotard 1781 (cited in note 19), p. 119: 'N'épargnez rien pour avoir les couleurs les plus claires, les plus belles, les plus solides, les plus foncées et les mieux broyées.'
- 22. Ibid., p. 121: 'elles sont utiles pour toute espèce de genre de peindre'.
- 23. Roethlisberger and Loche 2008 (cited in note 2), vol. 2, p. 817, Lettre de Jean-Etienne Liotard fils à sa mère (Amsterdam, 6 septembre 1779): 'tous les écrits qui intéressent les secrets qu'il a trouvés sur la manière de faire les Pastels de couleur solide'.
 24. Il il e 200
- 24. Ibid., p. 820.
- 25. Ibid., vol. 1, p. 111: 'pour chacune des parties d'un tableau qui me paraissent les plus difficiles'; 'finement dessiné au charbon à ébauche'; 'repassé à la sanguine et essuyé avec de la farine'.
- 26. Liotard 1781 (cited in note 19), p. 48.
- 27. Roethlisberger and Loche 2008 (cited in note 2), vol. 1, p. 108.
- 28. Liotard 1781 (cited in note 19), p. 56: 'il consiste aussi à distribuer, dans un tableau, les clairs et les ombres, en les groupant d'une manière capable d'augmenter l'effet et l'éclat de la peinture, ou du sujet que l'on traite'.
- Roethlisberger and Loche 2008 (cited in note 2), vol. 1, p. 110: 'Toutes les couleurs de fond doivent être appliquées lisses, en évitant de les frotter.'
- 30. Ibid., vol. 2, p. 606.
- Ibid., vol. 1, p. 111 : 'Les vêtements sont appliqués en couche mince et à plat, ensuite on y dessine les plis.'
- 32. Liotard 1781 (cited in note 19), p. 49, §Du Coloris.
- 33. Ibid., p. 80: 'Il faut que dans la peinture les fonds clairs ou bruns soient peints unis, et sans aucune épaisseur de couleur; car si elle est grossièrement appliquée, elle fait avancer le fond, qui paraît d'autant plus éloigné, qu'il est couché uni.'
- Roethlisberger and Loche 2008 (cited in note 2), vol. 1, p. 111, note 26.
- 35. Ibid., note 22.
- 36. Burns 2007 (cited in note 1), pp. 31, 121.
- 37. Roethlisberger and Loche 2008 (cited in note 2), vol. 1, p. 111, notes 3, 23, 24 and 26.
- 38. Burns 2007 (cited in note 1), pp. 89-94.
- 39. Liotard 1781 (cited in note 19), rule VII: 'No strokes: there are coloured layers, no strokes.'
- J. Anderson, 'Fixing pastels: a letter from Liotard to the 2nd Earl of Bessborough in 1763', *The Burlington Magazine* CXXXVI, 1994, pp. 23–25.
- 41. Ibid., p. 25: 'il m'a fixe 9 de mes ouvrages et 3 pour un Anglais M Chaloner que j 'ay peint il y a peu de tems, et plus de 60 autres portraits icy'.
- 42. Jeffares 2006 (cited in note 5), 'Suppliers/Jurine'.
- 43. A. Renou, Secret de fixer le pastel, s.l., 1780.
- 44. Jeffares 2006 (cited in note 5), 'Suppliers/Jurine'.
- 45. J. Schultz and K. Petersen, 'Immunology and art: using antibodybased techniques to identify proteins and gums in binding media and adhesives', in *Symposium on Adhesives and Consolidants for Conservation: Research and Applications*, Ottawa, ICC, 2011.

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AN INVESTIGATION OF THE PAINTING TECHNIQUE IN PORTRAITS BY JENS JUEL

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ABSTRACT This paper summarises the findings of the first technical art historical study executed on paintings by the Danish portrait painter Jens Juel (1745–1802). Eight portrait paintings on canvas from two different time periods in Juel's career have been examined and compared in order to establish the artist's use of materials, working methods and painting techniques. The findings include the characteristics of the canvas structure and painting grounds, how the canvas was prepared and the artist's use of underdrawing, as well as the layered build-up of the flesh tones. The findings are considered in relation to what is already known about the traditional painting techniques and materials of the era.

Introduction

Jens Juel (1745–1802) is considered one of the most important portrait painters in the history of Danish art and culture. He was extremely popular in his lifetime. All members of the Danish royal family, the aristocracy and the bourgeoisie wanted their portrait painted by him and he was known for making his models look their best. His portraits are characterised by elegance and carefully rendered details. He was skilled at capturing the latest trends, and his art reflects the transition from the lofty portrayals of the Rococo to more Realist depictions.

Juel has been the subject of several art historical studies,¹ and although he left behind close to a thousand portrait and landscape paintings, drawings, sketches and pastels, so far very little has been known about his painting technique. He did not produce much written correspondence and his wife is known to have burned all of the personal papers that existed following his death.

To date, only limited information on artists' use of materials and techniques in the 18th century in Denmark has been obtained. This investigation is the first study of paintings by Juel to combine scientific, technical and art historical research and therefore represents an initial insight into the techniques, materials and studio practice of a late 18th-century Danish artist. The investigation addresses questions on the type of materials, working methods and painting techniques used by Juel and whether any changes in his artistic practice can be traced between his early and later works. The results and findings are considered in relation to what is known about traditional European painting techniques and the use of materials at the time. It is hoped that the present study will contribute to an elaborate knowledge of artistic practice in Denmark as well as to comparative studies in European painting techniques throughout the 18th century.²

Jens Juel

Jens Juel's training and career as a painter largely reflects the traditions of the time. His education at the academy was based primarily on theory and drawing, and as the art academies of the time did not provide an education in the practice of painting, the aspiring painter was expected to undertake an apprenticeship in a master's studio as well as private classes in the studio of the professors of the art academy.

Juel was born in 1745 on the island of Funen in Denmark. Having shown a talent for drawing he initiated his apprentice years at the age of 15 in the studio of painter Johann Michael Gehrmann in Hamburg, Germany. The division between artist and craftsman was still at an early stage and Juel was most likely trained in all the practical aspects of painting. His abilities soon rose to match those of his master and around 1765 he was admitted into the newly established Royal Danish Academy of Fine Arts in Copenhagen, founded in 1754, which was based on the ideals of the French art academy.



Fig. 1 Jens Juel, *Self-Portrait*, 1766, oil on canvas, 34.5 × 43 cm, The Royal Danish Academy of Fine Arts.



Fig. 2 Jens Juel, *Portrait of Countess Caroline Schimmelmann (?) née Tugendreich Freideborn*, 1768, oil on canvas, 78 × 62 cm, The National Gallery of Denmark.



Fig. 3 Jens Juel, *Queen Caroline Mathilde*, 1769, oil on canvas, 75.5×62 cm, The National Gallery of Denmark.



Fig. 4 Jens Juel, Sophie Birgitta Mathiesen, 1769, oil on canvas, 45 × 37 cm, The National Gallery of Denmark.

Soon after Juel's arrival in Copenhagen, while attending the academy, he started receiving orders for portraits in the social circle related to the bourgeois family with which he resided. His popularity escalated quickly and he soon caught the attention of the royal family. Portrait painting became his main focus although he was required to practise classical history painting at the academy for which he managed to win two gold medals: the small gold medal in 1767 and the great gold medal in 1771. The travel stipend associated with the latter went to his contemporary, the history painter Nicolai Abildgaard. Juel did, however, receive a four-year private stipend instead and in 1772 he embarked on his Grand Tour. This trip ultimately extended to eight years, as he accepted orders for portraits during his travels throughout the most



Fig. 5 Jens Juel, Margarethe Moltke née Lovenskiold, 1786, oil on canvas, 69.5×54 cm, The National Gallery of Denmark.



Fig. 7 Jens Juel, *Carsten Wilhelm Heinrich Hennings*, 1790, oil on canvas, 69×53.5 cm, Medical Museion, Denmark.





Fig. 6 Johan Christian Bodendick, 1789, oil on canvas, 69 \times 53.5 cm, Medical Museion, Denmark.

important artistic centres in Europe. He travelled through Hamburg, Dresden, Vienna, Venice, Bologna, Florence, Rome, Naples, Paris, Geneva, Kassel and back through Hamburg, before returning to Copenhagen in 1780. Following his return

Fig. 8 Jens Juel, Maria Ulrica Berner, 1792, oil on canvas, 69×53.5 cm, The National Gallery of Denmark.

to Copenhagen, he became a member of the academy, court painter, professor and later director of the academy, while at the same time maintaining a busy working studio with assistants and students.

Painting number	1	2	3	4	5	6	7	8
Year	1766	1768	1769	1769	1786	1789	1790	1792
Fibre identification	Linen	Presumably linen (not analysed)	Linen	Linen	Linen	Presumably linen (not analysed)	Linen	Linen
Selvedge	Upper edge	Upper and lower edge	_	_	_	-	_	_
Direction								
Warp	Horizontal	Horizontal	-	-	-	-	-	-
Weft	Vertical	Vertical	-	-	-	-	-	-
Thread count								
Horizontal	15/cm	11–12/cm	11/cm	10/cm	14/cm	14/cm	13-14/cm	14–15/cm
Vertical	12/cm	9/cm	9–10/cm	11/cm	14-15/cm	9–10/cm	13/cm	14–15/cm
Thread thickness								
Horizontal	0.3–0.7 mm	0.4–1.0 mm	0.3–0.8 mm	0.3–1.0 mm	0.4–0.8 mm	-	0.4–0.8 mm	0.4–0.8 mm
Vertical	0.35 mm	0.4 mm	0.4–0.7 mm	0.3–1.0 mm	0.4–0.8 mm	-	0.3–0.7 mm	0.3–0.5 mm
Lining	Glue-paste	Glue-paste	Wax	None	None	Wax	Glue-paste	Glue-paste

Table 1 Canvas support analyses of eight examined portraits by Jens Juel (the portraits are numbered 1–8 in correspondence with their dating). All the canvases are plain weave and all threads are spun with a Z-twist at an angle of approximately 25 degrees.

Selected portraits for the investigation

From the large number of portraits executed by Juel, eight portraits from two different periods of time in his career were selected for the purpose of the investigation. Four portraits were chosen from his early period prior to the Grand Tour (1772-80). These were painted between 1766 and 1769, while Juel was attending the Royal Danish Academy of Fine Arts in Copenhagen (Figs 1–4). Another four portraits were chosen from the later period following his return to Denmark, and were painted between 1786 and 1792 (Figs 5-8). The selection was based on the aim of identifying possible changes in the technical application and the use of materials between the two periods. All the portraits are oil on canvas with known dating and depict the sitter in bust length, except for one artwork, which is a self-portrait presenting Juel in three-quarter figure. The artworks were kindly made available by three institutions in Copenhagen: the Royal Danish Academy of Fine Arts, the National Gallery of Denmark and the Medical Museion. In addition to Juel's paintings, contemporary written sources and the artist's self-portrait depiction in the studio are also taken into account. The portraits are referred to by the numbers 1-8, corresponding to the chronology of their production and the order in which they are presented in this paper.

Focus and methods of the investigation

The investigation of Juel's materials, working methods and painting techniques was limited to the examination of the canvas structure and ground layers, how the canvas was prepared and the artist's use of underdrawing. Due to time restraints and the sensitivity of removing sampling material, the examination of the paint layer was confined to the buildup of the flesh tones. The scientific methods used in the investigation included visual analyses, ultraviolet fluorescence, infrared reflectography (IRR), X-radiography, canvas analyses, cross-section analysis and attenuated total reflectance-Fourier transform infrared (ATR-FTIR) spectroscopy. Since no prior structured technical examination of Juel's artworks had been carried out, these methods were selected with the purpose of obtaining a preliminary insight into the materials and techniques used by the artist and to acquire knowledge that could possibly lead to further investigation. The discussion in this study is thus based on the findings obtained by these methods.

Jens Juel's use of materials

Canvas support

The canvas support of all eight paintings was examined using visual analyses and optical microscopy. All eight portraits are painted on canvas consisting of a single piece of fabric without seams. Selvedges were identified on two of the canvases. On the *Self-Portrait* (1) from 1766, a selvedge was identified on the upper edge of the painting while on the portrait of Countess Caroline Schimmelmann (2) from 1768, a selvedge was identified on both the upper and the lower edges of the canvas, indicating that this represents the full width of the canvas in the weft direction, measuring approximately 82–83 cm. In both cases the weft direction is vertically oriented.

Canvas fibre analyses were performed on six of the eight canvases.³ All were identified as linen (flax), and the additional two canvases are assumed also to consist of linen

x		1792	Light grevish white		Up to at least	0.12 mm					2. Varnish	1. Paint layer	0. Ground: White layer with white pigment granules and a few small dark particles		Chalk	Oil	I	Lead white	
are listed in note 9.		1790	Double ground Reddish brown	White	Up to at least	0.005 mm	0.05 mm		4. Varnish	3. Paint layer	2. Paint layer	1. Underpaint	0. Ground: Reddish- brown layer with individual red pigment granules	00. Ground: White even layer with some red pigment granules	Chalk	Oil	Gypsum	I	
K-F11K absorption peaks 6		1789	Double ground Grevish white	Greyish	Up to at least	0.04 mm	0.085 mm			3. Varnish	2. Paint layer	1. Paint layer	0. Ground: White layer with white pigment granules and a few red and black pigment granules	00. Ground: Light grey layer with a few small black and red pigment granules and a few white particles	-	Not analysed			
ce with their dating). Al I		1786	Light grevish brown		Up to at least	0.1 mm		5. Varnish	4. Paint layer	3. Paint layer	2. Underpaint	1. Underpaint	0. Ground: Light greyish-brown layer with red pigment granules in varying sizes and some coarser white particles		Chalk	Oil	Gypsum	Lead white	
rred 1–8 in corresponden		1769	Reddish brown		Up to at least	0.18 mm					2. Varnish	1. Paint layer	0. Ground: Reddish- brown layer with larger coarse particles of iron oxides, and fewer white particles in varying sizes		Chalk	Oil	I	I	
l (the portraits are numbe		1769	Reddish brown		Up to at least	0.15 mm					2. Paint layer	1. Paint layer/ underpaint	0. Ground: Reddish- brown layer with larger coarse particles of iron oxides, and few coarse white particles		-	Not analysed			
ined portraits by jens jue		1768	Reddish brown		Up to at least	0.15 mm						1. Paint layer	0. Ground: Reddish- brown layer with larger coarse particles of iron oxides, and fewer smaller white particles		Chalk	Oil	I	I	
/er analyses on eight exam 1		1766	Dark reddish brown		Up to at least	0.3 mm					2. Paint layer	1. Underpaint	0. Ground: Reddish- brown layer with larger coarse particles of iron oxides, as well as coarse white particles		Chalk	Oil	I	I	
Early neriod	Cross-section	Year	Colour			Thickness		Layers with description of grounds							Composition	FTIR results			

fibre threads. All eight canvases are plain weave, with thread counts of 9 to15 threads/cm with variations between the warp and weft directions from 0 to 5 threads/cm. In all cases, the thickness of the threads varies between 0.3 and 1 mm, and the threads are spun with a Z-twist at an angle of approximately 25 degrees.⁴ The canvases all show similar characteristics, however none of the canvases were close enough in characteristics as to be determined to originate from the same canvas roll. The results of the canvas analyses are shown in Table 1.

The variations in thread width and thread count strongly indicate that the threads are handspun and handwoven, which correlates with the industrial evolution of the time, since the spinning wheel and the mechanical loom were not commonly used until the early 19th century. It is likely that the canvases were locally produced since the ruling mercantilism of the time sought to promote the production of flax in Denmark and to avoid the import of linen from other European countries.⁵ However, records from customs and merchants show that a large amount of linen and fabrics from overseas was available. It is known that there was a great deal of smuggling taking place, which made a number of banned goods available.⁶Thus the assumption that the linen was locally produced cannot be definitively concluded.

Grounds

The colour, structure and composition of the grounds were examined using ATR-FTIR and cross-section analysis. Microscopic samples of the ground material, taken from along the tacking edges, were analysed on six of the eight paintings using ATR-FTIR.⁷ Analysis of the spectrum for each sample indicated that all six grounds contain oil and chalk. On the later portraits the spectra confirmed the presence of gypsum in one of the grounds (7), the presence of lead white in another (8) and a third indicated the possible presence of both gypsum and lead white (6). All six spectra also showed the presence of a protein, which could originate from either the sizing process, from animal glue or egg added to the ground mixture as an emulsion, or possibly from conservation treatments.8 However, without further methods of analysis it is not possible to characterise the specific nature of these contents. The presence of starch in the spectra from four of the samples corresponds with the portraits having a glue-paste lining.9

The grounds were further examined by cross-section analyses. A microscopic sample was collected from the cheek area of each portrait, except for the self-portrait, where the sample was taken from along the edge of the painting. The grounds on the portraits from the early period are very similar in colour, structure and composition, consisting of a single dark, reddish-brown layer. Larger coarse particles observable in the cross-sections were, based on a visual estimate, tentatively identified as iron oxides. The grounds of the four portraits from the later period differ significantly from the earlier grounds, and from each other, in terms of colour, structure and the number of layers. On two of the later portraits a double ground was used. The portrait of Margarethe Moltke (5) from 1786 has one greyish-brown ground layer applied while the portrait of Johan Christian Bodendick (6) from 1789 has a greyish ground layer followed by a greyish-white layer. On the portrait of Carsten Wilhelm Heinrich Hennings (7) from 1790 a white layer was applied followed by a thin reddishbrown layer and on the portrait of Maria Ulrica Berner (8) from 1792, a single greyish-white ground layer was applied. The summarised results of the ground analyses are shown in Table 2.

The various grounds found in Juel's paintings are more or less typical for the types of grounds found in traditional and contemporary European painting practice and consist of materials that were in traditional use at the time. Historical written sources as well as technical studies have shown that no precise recipe existed for the preparation of grounds, and it does not seem uncommon that the grounds consist of varying combinations of the available materials even among paintings by the same artist. Ernst van de Wetering's examinations of Rembrandt's grounds, for instance, show that no two grounds shared the same composition.¹⁰ Likewise examinations by Troels Filtenborg on the grounds of Juel's contemporary, Nicolai Abildgaard, reveal a large diversity and no systematic use of grounds.¹¹

There seems, however, to be some consistency in Juel's choice of ground colour. It is evident that a change took place between Juel's early and later periods, with a tendency to use increasingly lighter grounds in the later period. In addition to the ground layer the application of underpainting on two of the later portraits (5 and 7) seems to have been used to modify the ground colour, respectively dark greyish brown and red, in order to establish a lighter base colour for the final paint layers of the flesh. On the portrait of Margarethe Moltke (5), two layers of lighter greyish underpaint were applied on top of the darker greyish-brown layer. On the portrait of Carsten Hennings (7), a light grey underpainting was applied on top of the red ground layer. The use of the desired ground colour in the first application must certainly have shortened the total working time, as on the portrait of Maria Berner (8) from 1792, where a single white ground was used. Additional existing crosssections from four other paintings by Juel in the collection of the National Gallery of Denmark seem to support this tendency.¹² The use of increasingly lighter grounds is also the general trend seen in European painting technique from the mid-18th century to the mid-19th century where light-coloured grounds predominate. The rather significant change in the colour and characteristics of the ground layer between Juel's early and late periods raises questions about whether there might have been a cause for this change. Further investigation of Juel's choice of ground colour in a broader sampling of his works may help to clarify whether this change occurred at a specific time, or whether there was some practical or theoretical reasoning or perhaps a source of inspiration.

Working methods

Preparation: canvas and grounds

From the appearance of the tacking edges and the presence or lack of cusping as seen on the X-radiographs, it was concluded that all eight canvases were cut from larger pre-primed canvases before they were mounted onto a strainer or stretcher.13 None of the paintings display cusping along all edges, and in all cases the ground layer extends all the way to the edges of the canvas. The canvas edges were evenly cut and in several cases markings from a knife are present along the tacking edges. On the portrait of Countess Schimmelmann (2) from 1768, cusping could be seen both along the upper and lower edges, as well as along the left edge of the canvas. As mentioned above, a selvedge was identified along the upper and lower edges of the canvas and thus indicates the full width of the canvas roll. The border of the ground layer is uneven along three edges; these edges appear to correspond to the border of the ground application on the larger pre-primed canvas.

On all but one of the paintings (4), brushstrokes from the application of the paint layers continue onto the tacking edges, indicating that the paint layers were applied after the primed canvas had been mounted onto a strainer or stretcher of similar size and format to the present stretcher.¹⁴ None of the present stretchers appear to be original. Both the self-portrait (1) from 1766 and the 1791 self-portrait *The Artist and his Wife Rosine Née Dørschel*, belonging to the National Gallery of Denmark, depict Juel in his studio, seated in front of an easel, painting a canvas, which has already been primed and mounted. Only on the portrait of Sophie Birgitta Mathiesen (4) from 1769 does the paint layer extend to the perimeters of the tacking edges, suggesting that the portrait has possibly been adjusted in size and cut down.

The similarity of the grounds from the early period could suggest that they were prepared in Juel's studio. It is uncertain if the later grounds were applied in the studio or if primed canvas was purchased from a commercial primer to support the demanding production of portraits in Juel's studio. It had become common throughout Europe from the 17th century for artists to purchase commercially primed canvases. It is also likely that pre-primed canvases could be purchased in Denmark in the late 18th century, but it is unclear to what extent this practice was common. No specific names or references to artists' shops or suppliers are mentioned until the early 19th century, and often the sources do not differentiate between primed and unprimed canvas.¹⁵ The sales catalogue from the estate auction in 1786 following the death of professor and painter Johan Edward Mandelberg lists rolls of primed canvas as well as numerous primed and unprimed canvases mounted on strainers or stretchers. The fact that both primed and unprimed canvases were documented might suggest that the priming was executed in the studio.¹⁶ The sales catalogue for the estate auction in 1803 following Juel's death also lists both rolled canvas and strainers or stretchers with and without canvas mounted on them.¹⁷ The catalogue does not mention whether or not the mounted canvases were primed thus from this information no conclusion can be made about whether priming was still a part of studio practice.



Fig. 9 Detail of Jens Juel, *Self-Portrait* (Fig. 1). Juel is executing an underdrawing (*esquisse*) using a brush and light paint on a reddishbrown ground.

Underdrawing and pentimenti

No underdrawing or guidelines were detected using IRR,¹⁸ possibly because the contrast between the ground and the underdrawing is not strong enough to make the drawing distinguishable, as is often the case with coloured grounds. However, no underdrawing was detected on the later portraits either, where a lighter ground was used. The answer may be found in the self-portrait (1) from 1766. Here it can be seen that Juel is in the process of executing an underdrawing using a brush and light paint on a reddish-brown ground (Figs 1 and 9). An underdrawing like this would not be possible to detect using IRR as it would be absorbed in the overlying paint layers. This type of underdrawing, called an *esquisse*, seems to have been commonly used at the time and features among others described by the French writer Charles Antoine Jombert, after the artist Roger de Piles. Jombert suggests the esquisse is initially executed using chalk, which could easily be corrected with a damp sponge and then followed by a thin paint application by brush on top of the same contours.¹⁹ The *esquisse* is also described by the director of the French Academy, Jean-Baptiste Oudry, in a lecture to the academy in 1752.20 The lecture, in which Oudry also describes the application of the subsequent paint layers, is considered to be an



Fig. 10 X-radiograph of Jens Juel, *Sophie Birgitta Mathiesen* (Fig. 4). The X-radiograph reveals that in the original composition the sitter was depicted wearing a different type of head covering, in the shape of a bonnet.

important source on painting technique, as the art academy rarely commented on the practical application of paint layers. In a 1753 portrait by Jean-Baptiste Perronneau, belonging to the Museé du Louvre, Oudry is depicted executing the *esquisse* on a canvas. The *esquisse* can be seen on several artist portraits and allegories of the time, such as the self-portrait by the Swiss portrait painter Anton Graff, *Selbstporträt mit dem grünen Augenschirm*, from 1813 in the collection of the Alte Nationalgalerie in Berlin. Anton Graff was one of the leading portrait painters in Germany and Juel is known to have worked in Graff's Dresden studio for a while during his Grand Tour.

In the examination of the portraits it could be seen that Juel on several occasions made changes to the composition during the working process. For instance, on the 1766 selfportrait (1), the head, the hand, the sleeve and the brushes placed in the *pincelire* have been moved slightly in comparison to the first draft. This is evident in the infrared image and the X-radiograph, as well as with the naked eye as the paint layer has become more transparent over time. Pentimenti are visible most obviously and interestingly in the portrait of Sophie Birgitta Mathiesen (4) from 1769. In the final painting she is depicted wearing a fur hat with a gold tassel but the X-radiograph reveals that she was originally painted wearing a different type of head covering, in the shape of a bonnet (Fig. 10). There are known instances where Juel has gone back and made changes to his portraits several years later to bring them more up to date in response to changing fashion.²¹ As mentioned above, the paint layer extends to the perimeter of the tacking edges and might have been cut down. However, no evidence was found that could help to determine whether the change of head covering was painted at a later time than the original execution of the portrait or whether this revision was related to the change in size.

Painting technique

Paint layers

For this investigation, the analysis of the paint layer application was limited to the flesh tones and only a single sample was collected for cross-section analyses. No specific pigment analyses were carried out during this investigation and the following observations are based on microscopic examination of the cross-sections and the surface of the painting. In the cross-sections from the cheek (nos. 2–8 in Table 2), it can be seen that the paint application for the flesh tones consists of only one or two layers in varying thicknesses. There are no signs of intermediate varnish layers or glazes. The paint layers have a light opaque pink colour with red, white and a few dark pigment particles. In the three latest portraits, a yellow pigment was added to the flesh paint, which was not detected in the flesh paint of the earlier portraits. It is possible that Juel made a deliberate change to his technique with regard to the colour of the paint layer, giving a warmer tonality to the flesh of the sitter in relation to the changing fashion and style towards more realist depictions.

The use of only one or two layers in the flesh is very simple in comparison to the painting practice seemingly widely adopted by French painters of the mid-18th century. In the aforementioned lecture by Jean-Baptiste Oudry, the structured systematic build-up of the paint layers, following the esquisse, are described as the three well-defined stages: ébaucher, peindre à fond and retoucher. The first stage was the initial thin paint layer, which defined the elements of the composition. The succeeding stage consisted of the continuing build-up and modelling in layers to create an even transition between the elements and depth in the composition before the final touches, glazes and highlights (retouches) were added in the last stage. Finally, the highlights were applied using a slight impasto to add immediacy to the painting.²² It was recommended that the layers between each stage should be allowed to dry completely before the next stage was initiated and possibly with intermediate varnish layers to prevent oil medium absorption from the subsequent paint layers. According to Oudry this would also make the colours spread and cover more easily.23

Juel's portraits have a soft appearance with a fluid and even transition between the compositional elements creating a visual expression corresponding to French painting theory. Based on careful observation of the surface of the paintings, a fairly layered build-up and the use of glazing do appear to have been utilised in the draperies of the portraits. Smooth and overlapping brushwork creates a soft and even transition between the figure and the background. Faintly visible brushstrokes were used according to the character and surface texture of the material rendered. The drapery has a freer and moderately sketchy appearance while particular elements, such as the buttons and accessories, were executed with great attention to detail.

In the execution of the flesh, Juel did not make use of the multilayered paint application described by Oudry and his contemporaries. Instead he used a wet-in-wet *alla prima*



Fig. 11 Detail of Jens Juel, *Maria Ulrica Berner* (Fig. 8) showing the modelling of the flesh tones.

painting technique whereby, with a confident hand, he modelled, integrated and blended the transitions between the compositional elements creating a fluid and even paint surface. The flesh was built up from darker to lighter mid-tones to create soft shadows and light, adding highlights and deep shadows in the final stages. The highlights were applied last and with a slight impasto corresponding to the French practice. The impasto highlight creates a relief effect compared to the adjacent smooth and even paint layer, adding depth to the portrait (Fig. 11).

The simple layering and apparently rapid technique of paint application as seen in the flesh tones seem to correlate with descriptions of one of the few contemporary witnesses who commented on Juel's painting technique. Around 1800 the German painters Philip Otto Runge and Caspar David Friedrich were students in Juel's studio in Copenhagen. In relation to Juel's painting technique, Runge writes in a letter:

Once in a while he has a manner, in which he executes his paintings, which after my opinion cannot be recommended: he retouches them almost from the beginning and executes them partly, you do not know how and you are astonished at how beautiful it turns out in the end.²⁴

To obtain as high a quality of artistic expression to the extent seen in Juel's portraits, a wet-in-wet *alla prima* painting technique requires a precise paint application with a confident sense of colour and texture. Juel's portraits had already been in high demand from early in his career, which may have encouraged the development of a more rapid technique. In addition it would have increased the convenience for the sitter as less working time was required. The *alla prima* technique to some extent resembles the technique of painting with pastels. In his later years Juel increasingly executed more pastels, which were cheaper for the client and faster for the painter.²⁵

Conclusions

This investigation of a selection of the portraits of Jens Juel has provided an initial insight into the materials and painting techniques of this late 18th-century Danish artist. Juel's training and career strongly correlates with the traditions and theory of the time. This signifies the extent of the influence of the French art academy in Europe and the general tendencies for the technical application of the paint layers and use of materials.

The study has shown that Juel used plain-weave canvases, handwoven and medium in structure, which were possibly of local origin due to the political policies of the times. The canvases were cut from pre-primed canvas before they were mounted on a stretcher or strainer and the painting executed.

Analysis of the grounds indicated the presence of chalk and oil with the possible addition of a protein. The grounds change from a dark reddish-brown colour with similar structure in the paintings from the early period, to the use of lighter grounds, very different in character, in the later period. Juel presumably used a painted sketch, like the French esquisse, and on several paintings pentimenti were detected. The paint layers of the flesh show a very simple layer structure consisting of only one or two layers, in comparison to the multilayered conventional French painting technique. In the carnation Juel used a wet-in-wet alla prima painting technique where he integrated and blended the transitions between the elements and tonalities, creating a fluid and even paint surface. A relatively layered build-up and the use of glazing seem to have been utilised more in the drapery. Details were applied in a precise manner and highlights were applied last and with a slight impasto. Cross-sections indicated that a yellow pigment was applied to the flesh paint in the later portraits, whereas no yellow pigment was detected in paint layers from the earlier portraits.

Juel appears to have relied on the traditional materials used by painters throughout the preceding centuries which changed dramatically in the era after Juel's death in 1802. The findings of this study raise questions, however, which suggest further investigation into the materials and techniques employed by the artist in order to confirm the use of materials and the applied painting techniques. Further studies may reveal a more precise date for the tendency of a change in ground colour and the addition of a yellow pigment to the flesh tones in the later portraits as seen in this study.

Acknowledgements

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Notes

- Art historical studies include, but are not limited to: E. Poulsen, Jens Juel I–II, Copenhagen, Christian Ejlers' Forlag, 1991; C. Christensen (ed.), Hvis engle kunne male ... Jens Juels portrætkunst, Det Nationalhistoriske Museum på Frederiksborg, Christian Ejlers' Forlag, 1996; K. Monrad, Jens Juel, Dansk Klassikerkunst, Copenhagen, Kunstbogklubben, Forlaget Søren Fogtdal A/S, 1996.
- 2. The investigation of Jens Juel's painting technique was carried out as a Master's thesis at the Royal Danish Academy of Fine Arts, Schools of Architecture, Design and Conservation and completed in August 2013. The thesis is accessible in Danish at the Library of the School of Conservation (KViC) or by contacting the author.
- 3. On two of the portraits (nos. 2 and 6), the character of the lining treatment did not allow access for removal of thread samples for fibre analysis. Fibre analysis was performed using polarised light microscopy (PLM) to identify the morphology of the fibres as well as a drying-twist test.
- 4. Measurements and thread counts were executed manually and under the microscope. Thread counts were carried out either on the tacking edges, on the verso of the artwork where no lining was present, or, if lining was present, on the X-radiographs using a thread counter. A minimum of three different locations were measured and counted to an estimated average result.
- 5. A. Nielsen (ed.), *Industriens Historie i Danmark*, Copenhagen, Gad, 1943, vol. II, pp. 27–28, 63–71.
- Ibid., pp. 27–33, 63–71; Toldetaten, *Toldetatens 350-års jubileum*, nr. 301, January, Copenhagen, Direktoratet for told-væsenet, 1982, pp. 9–11.
- 7. On two of the paintings (nos. 3 and 6), the character of the wax lining did not allow access to remove sampling material from the tacking edges. ATR-FTIR was performed on a Perkin Elmer Spectrum 100 FT-IR Spectrometer+Universal ATR Sampling Accessory. The spectra were recorded in the range 4000– 650cm⁻¹ and represent the averaging of 4 scans.
- 8. The ground sample from the portrait of Carsten Hennings (7) from 1790 was collected prior to the awareness of the presence of a double ground layer, and it must be taken into consideration that it is unclear whether the result corresponds to one of the layers or a combination of the two.
- 9. The interpretation of the spectra from the six ground samples are based on references in M.R. Derrick, D. Stulik and J.M. Laundry, *Infrared Spectroscopy in Conservation Science*, Los Angeles, Getty Conservation Institute, 1999. The absorption peaks on the spectra, which are indicative for the interpretations are as follows: oil: 2920 cm⁻¹, 2850–2853 cm⁻¹ and 1713–1707 cm⁻¹; chalk: 2520 cm⁻¹, 1794 cm⁻¹, 1395 cm⁻¹, 871 cm⁻¹ and 711 cm⁻¹; gypsum: 3527 cm⁻¹, 3440–3396 cm⁻¹, 1104–1099 cm⁻¹ and 671–655 cm⁻¹; lead white: 1395 cm⁻¹ and 680 cm⁻¹; protein: 1650–1620 cm⁻¹; starch: 2920 cm⁻¹, 2851 cm⁻¹ and 1713 cm⁻¹.
- E. van de Wetering, Rembrandt: The Painter at Work, Amsterdam, Amsterdam University Press, 1997, pp. 17–21.
- 11. T. Filtenborg, *Between Formula and Freestyle: Nicolai Abildgaard and 18th-Century Painting Technique*, London, Archetype Publications in association with Statens Museum for Kunst and CATS, Copenhagen, 2014, p. 17.
- 12. A cross-section from Samuel Anointing David from 1767 (SMK cross-section 32d) presents a reddish-brown ground similar to the early portraits included in this study. Cross-sections from King Christian VII in Coronation Suit, 1789 (SMK cross-section 99b+c), Marie Antoinette Warming, 1800 (SMK cross-section 30c) and Frederik Warming, 1800 (SMK cross-section 31b) all have a light or whitish ground.

- 13. All eight paintings were examined by X-radiography. On the five paintings belonging to the National Gallery of Denmark, X-radiography was carried out by photographer Jacob Skou-Hansen with an Andrex BW85 X-ray tube at 24–30 kV, 5 mA, 60 sec on a Dürr NDT Crip3040109 digital plate and scanned on a HD-CR 35 NDT laser scanner. On the additional three paintings X-radiography was carried out at the Royal Danish Academy of Fine Arts, Schools of Architecture, Design and Conservation (KADK) with an Andrex 3002 FTA X-ray tube at 15–25 kV, 5mA, 45 sec using 30 × 40 cm, Agfa Structurix D7DW X-ray film.
- 14. With regard to the format of the portraits, it is evident that the fashionable shape of the bust-length portrait had shifted from rectangular to oval between Juel's early and later periods. The first oval-shaped portraits by Juel appear after 1770.
- C.K. Andersen, T. Filtenborg, A.B. Scharff and M. Scharff, 'The industrialization of canvas production in Denmark and its implication for the preservation of Danish nineteenth cen- tury paintings', in *Incredible Industry: Preserving the Evidence* of *Industrial Society, Proceedings of the Nordic Association of Conservators 18th Conference, Copenhagen, May 2009*, pp. 39–49.
- 16. J.E. Mandelberg, Fortegnelse paa en deel malerier, haandtegninger, studia, kobbere, böger, samt adskillige maler-redskaber m.v. som afgangne professor og hof-maler Johannes Mandelberg enke-frue mandagen den 20 novbr lader bortsælge (List of a number of paintings, hand-drawings, studies, coppers, books, and several painting tools etc, which the widow of departed professor and court painter Johannes Mandelberg on Monday the 20th of Nov. will be selling), estate auction catalogue, 20 November 1786, 1786, pp. 60–61.
- 17. J. Juel, Fortegnelse over en deel kunstsager bestaaende af: Malerier, tegninger, Kobbere og Gipssager samt nogle forgyldte Rammer og Maler-Redskaber saa og endeel Bøger m. v. som afgangne Professor ved Kunsternes Academie Jens Juels Enke ved offentlig Auction lader bortsælge ... (List of a number of art objects consisting of: paintings, drawings, coppers, and plaster objects as well as some gilded frames and painting tools and a number of books etc, which the widow of departed Professor at the Academy of the Arts Jens Juel at a public auction will be selling ...), estate auction catalogue, 21 April 1803, p. 30.
- IRR was carried out on all the paintings using a CCD Phase One LightPhase back on a digital Hasselblad Camera and a B+W 58 093 filter with a spectral sensitivity ranging up to 1100 nm.
- 19. C.A. Jombert, Les premiers elements de la peinture pratique. Par M. De Piles, de l'Académie Royale de Peinture & Sculpture. Nouvelle Édition Entierement refondue et augmentée

considérablement, par Charles-Antoine Jombert, Amsterdam and Leipzig, Arkstée & Merkus, Libraires, 1766, pp. 107–119.

- 20. J.-B. Oudry, Discours sur la pratique de la peinture et ses procédés principeau: èbaucher, peindre à fond et retoucher (Discourse on the practice of painting and its main processes: underpainting, overpainting and retouching), delivered to the Académie royale, 2 December 1752, translated by Steve Stella with additional contributions from Alan Phenix, Tiarna Doherty and Michael Swicklick, Los Angeles, The Getty Conservation Institute, 2008, pp. 1–27.
- 21. In the portrait *Crown Princess Marie Sophie Frederikke* from 1792, the crown princess was first depicted in a black dress. Around 1800 Juel was asked to partially repaint the portrait and change the dress according to a more appropriate fashion. See Poulsen 1991 (cited in note 1), vol. 1, cat. no. 577 and 783, pp. 164 and 210; Christensen 1996 (cited in note 1), p. 55; Monrad 1996 (cited in note 1), pp. 35–36.
- 22. Oudry 2008 (cited in note 20), pp. 1–27; Jombert 1766 (cited in note 19), pp. 107–119.
- 23. Oudry 2008 (cited in note 20), p. 11.
- 24. 'Er hat indes itzt eine Manier, die Bilder herauszubringen, die, wie ich glaube, nicht zu recommendieren ist: er retouschiert sie fast von vorne an and bringt sie zum teil heraus, man weiß selbst nicht wie, and man muß sich wundern, wie schön es doch zuletzt wird'. Letter to Johann Wolfgang Goethe, 23 August 1801, quoted in P. Betthausen, *Philipp Otto Runge, Briefe und Schriften*, Berlin, Henschelverlag, 1983, p. 55; Christensen 1996 (cited in note 1), p. 135.
- 25. The common price for a bust-length portrait seems to have been 80 *rigsdaler* (rdl) and 40 rdl for a copy. The cost of a threequarter figure portrait was 200 rdl, while a large full-figure portrait for the royal family cost 600 rdl. The cost of a pastel in Juel's later years was 25 rdl. Poulsen 1991 (cited in note 1), p. 21; Christensen 1996 (cited in note 1), p. 52; Monrad 1996 (cited in note 1), p. 30; *Invoice from Jens Juel to Queen Caroline Mathilde dated 27 February 1769*, Rigsarkivet, Partikulærkammeret, Dronning Caroline Mathilde, Bilag til Kasseregnskaber 1766–1772, 1769, 4–4.

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72 FLORIN FOR COLOURS, WHITE AND GLUE: THE TIEPOLOS, THE VENINOS AND WÜRZBURG

Andreas Burmester and Stefanie Correll

ABSTRACT During their stay in Würzburg, Germany around 1750, Giovanni Battista and Giovanni Domenico Tiepolo created not only the 'Europe fresco' in the grand staircase of the Würzburg Residence, a World Heritage Site, but also many canvas paintings, oil sketches and drawings. Our contribution revisits the palette of five Tiepolo paintings that was identified in 1996. The aim is to embed the palette, as characterised in 1996, into the historic context. Recent research on the colour trade in Würzburg pharmacies and that of a special type of merchant (the so-called '*Materialisten*') is discussed. Recently discovered price lists and other documents of the Würzburg 'materialist' Carl Venino have enabled the development of a thorough understanding of the 18th-century colour-trading scheme, which differs from earlier periods. For the first time, documentary sources allow a time-dependent description of the Tiepolos' palette. This contribution demonstrates the urgent need for documentary research and its impressive power in the interpretation of modern scientific results.

Introduction

Every man's life knows successes and failures: on the occasion of a large exhibition on the Tiepolos in Würzburg in 1996, one of the authors of this contribution (A.B.) was asked to contribute as a scientist. The editor, an art historian, decided to print the article on the Tiepolos' colourful palette² in black and white and as the very last paper in a two-volume catalogue.³ The colourful cross-sections were printed separately from the text. Furthermore, AATA online (the Getty online abstract database) referenced the catalogue, including four of the 19 papers, but the one on colour was not abstracted. This omission laid the foundation for the present contribution.

Around 1750, the Venetian painters Giovanni Battista ('Gianbattista') Tiepolo (1696–1770), his son Giovanni Domenico Tiepolo (1727–1804) and their workshop were active at the Würzburg Residence. This remarkable site was built between 1720 and 1780 by the renowned Baroque architect Johann Balthasar Neumann (1687–1753). Today it is a UNESCO World Heritage Site with the famous 'Europe fresco' in the grand staircase. Created between 1752 and 1753, it was the largest fresco ever painted by the Tiepolos. It is their major work of art and was commissioned by Prince-Bishop Carl Philipp von Greiffenclau (1690–1754). During their stay in Würzburg, the Tiepolos created various canvas paintings, including the large format *Adoration of the Kings*, painted in 1753 by Gianbattista for a monastery close to Würzburg and now at the Alte Pinakothek, Munich (Fig. 1). Other paintings of a smaller format and painted by the son, Domenico, are still *in situ*: they are integrated as *supraportas* (overdoors) into the overwhelmingly rich Rococo decoration of Neumann's imperial hall.

What do we know about the Tiepolos' palette? Although there are art history contributions on the role of colour in the Tiepolos' colourful oeuvre, the pigments used on their paintings have only rarely been studied.⁴ In general, publications on 18th-century colour are few and far between. The 1996 contribution pointed the reader to the very early use of Naples yellow and Prussian blue on Italian paintings. Whereas Naples yellow slowly replaced lead-tin yellow, Prussian blue competed with the expensive azurite and ultramarine, especially in green tones. Yellow ochre and green earth enriched the narrow palette during this period of transition towards the stronger yellows and saturated greens of the 19th century. The 1996 contribution concluded with four general observations:

- 1. The palettes of Tiepolo father and of Tiepolo son ('the Tiepolos') did not show any differences.
- 2. The paintings created by the Tiepolos in Venice around 1739 did not show a different palette compared to those created 12 years later in Würzburg.



Fig. 1 Giovanni Battista Tiepolo, *The Adoration of the Kings*, 1753, canvas, 408×210.5 cm, Alte Pinakothek, Munich (inv. no. 1159). (Photo © Bayerische Staatsgemäldesammlungen Munich.)



Fig. 2 Pharmacy at the Würzburg Julius hospital, furniture around 1765 (postcard from around 1930 in private ownership).

- 3. The findings supported the view that the first half of the 18th century was a time of change: Prussian blue and Naples yellow were introduced, azurite, verdigris, mountain green, smalt and lead-tin yellow disappeared and the ochres and green earth which appeared for a short period created a new palette.
- 4. However, the contribution could not firmly answer two key questions: Did the Tiepolos buy their colours in Würzburg or did they bring them from Venice? And, there was another point, which in 1996 was more a feeling rather than a certainty: Does the palette described in modern terms in 1996 have anything to do with historic reality?

Whereas the second question was addressed in different projects and led to a paradigm shift between 1998⁵ and 2006,⁶ the first question had to wait for the discovery of a small receipt in the building accounts of the Würzburg Residence. This receipt tells us that the Würzburg merchant Carl Venino received '72 florin for colours, 810 pounds of white and a half centner of glue'. This small document correlates a certain site, the Würzburg Residence, and a person, the merchant Carl Venino, who obviously sold colours and other artists' materials. But who was Carl Venino?

To answer this, we have to find out what was on offer in the rich town of Würzburg around 1750. Similar to the palette with all its innovations, there was a great change in the way colours or any kind of painting material were traded in the 18th century. People producing colours on a small scale, such as colour burners or early chemists, gained importance over those with mining experience as in earlier centuries. Intermediate traders replaced the large trading companies, and direct connections between merchants superseded the fairs and markets as earlier places of exchange. A difficult question to answer concerns the role of pharmacies in a period of emerging small-scale companies,⁷ where customers, such as the artist, a monk or an employee of the residence, bought colours, white and glue.

A visit to Würzburg pharmacies

In the case of Würzburg, did the artist patronise a pharmacy or a common colour shop? In the Franconian region, both possibilities are supported by documents, the first of which is a receipt from the monastery of Ebrach (50 km east of Würzburg) for the sum of 2 *Florin*, 7 *Kreuzer* and 2 *Heller* for colours collected by the painter from the pharmacy. Thus the pharmacy served as the place where the artist bought colours. In the case of Ebrach, we can only guess that the painter went to the pharmacy of the local monastery, which was probably the only pharmacy in that small town. The situation in the much larger city of Würzburg was different: this rich town had at least two pharmacies, one of which is the pharmacy of the Julius hospital with its wonderful furnishings of 1765 and which can still be visited today (Fig. 2).

However, hospital pharmacies in larger communities often restricted themselves to medicines, whereas artists' supplies were provided by a secular pharmacy. For Würzburg, this was the pharmacy Zum Hirschen, which received a privilege in 1609. Although regrettably the pharmacist's wife and daughter were burnt at the stake in 1627, this pharmacy is still active today. All sales in these two pharmacies were regulated by a number of price lists (Taxae) that were valid for Würzburg and the Franconian region. For instance, a price list from 1735⁸ reflects the wide range of 'Simplicia', 'Composita' and 'Praeparata' offered in Würzburg and the Franconian region.9 This list and its amendment from 1743 do indeed contain some of the materials we are interested in, such as lead white and cinnabar, which are also of pharmaceutical use. However, there is (1) no mention of lead yellow, yellow ochre, green earth, Naples yellow or Prussian blue, and (2) there is no chapter on 'Pigmenta et Colores'.¹⁰ The materials of interest are spread over the chapters 'De Metallis & Metallicis' (metals and their derivatives) and 'De Lapidibus & Terris' (stones and earths). This also applies to the Taxa of 1726. However, if we look at that of 1681, there is a big surprise: it lists lead yellow, mountain blue, Lacca or yellow ochre and other materials as colours, but not as pharmaceuticals, evidence that the pharmacy offered colours for the painter.

There is now a simple question: why, at the time of the Tiepolos' stay in Würzburg in around 1750, did the pharmacy no longer supply artists with colours, white and glue? What happened between 1681 and 1726? The answers will bring us back to the '72 florin for colours, 810 pounds of white and a half centner of glue' that the Würzburg merchant Carl Venino received,¹¹ a receipt issued in connection with the 'Europe fresco'.

The Venino merchants

To get to know Venino, we have to go back to 1716, when the spice merchant (*Spezereihändler*) Carl Antonio Venino from Lierna on Lake Como became a citizen of Würzburg and was given permission to open a shop.¹² Obviously, his shop was so successful that he commissioned no less a person than Balthasar Neumann to build a grand commercial building, the so-called Rombachhof, in the middle of the city, close to the Würzburg Residence (Fig. 3).

In 1740, Venino opened his new shop for materials and spices (*Material- und Spezereiwaren*) at Eichhornstrasse (Squirrel Street) 23. The impressive three-storey building included business premises on the lower floors and domestic premises on the upper floor. Customers were received in a spacious salesroom behind the rusticated façade and the open arcades (Fig. 4). In the centre was a sales counter with a cash desk and an account book in which every transaction was recorded. The walls of the shop were fitted with storage shelves (Fig. 5).



Fig. 3 Venino's shop: The Rombachhof at Eichhornstraße 23 in Würzburg. (Geschichtswerkstatt, Würzburg.)

Venino, known at that time as a 'materialist', offered an enormous variety of goods: spices (including aniseed, valerian, cardamom, coriander, caraway, curcuma, laurel, oregano, lemon balm, nutmeg, clove, pepper, vanilla and cinnamon) as well as fruit and vegetables (such as dates, figs, fennel, ginger, coconut, carrots, plums, quinces, radishes and lemons). He also stocked different roots, seeds and berries as well as animal products such as castoreum, muskrat and several species of fish (pike, herring, salmon, anchovy and dried cod). Manufactured foods, such as bread, cheese, noodles, sausages, honey and different varieties of oil were also found within the assortment. Customers could even buy luxury items such as sugar, coffee, cacao, chocolate, tobacco, wine and schnapps. This broad range of daily goods was supplemented by houseware (knives, yarns, wicks, firestones and smoke candles) and even cosmetic products, for example hair powders, artificial beauty patches, toothpicks and wigs.

Thanks to meticulous bookkeeping we know that colourware (*Farbware*) was an essential part of Venino's business: remarkable, handwritten price lists from 1727 (Fig. 6) and 1790 (Fig. 7) reveal that pigments, dyestuffs and binders as well as additives and accessories for painting and drawing were bought in, stored and traded by the Venino merchants. As can be concluded from these price lists, all common pigments and dyestuffs – such as lead white, chalk, coloured earths, auripigment, Naples yellow, *Schüttgelb*, cochineal, minium, cinnabar, mountain green, verdigris, green earth, Schweinfurt green, indigo, Prussian blue, soot and bone black – were available in different qualities, prices and packaging sizes. In conclusion, the Venino shop provided all the materials required by artists and craftsmen working in Würzburg within the period under consideration.

The rich archival material of the Venino shop provides a detailed insight into their trade and trade relations.¹³ Obviously, the Veninos occupied a central position within the European



Fig. 4 The Rombachhof: front elevation. (Ink drawing 1750, Mainfränkisches Museum, Würzburg.)



Fig. 5 The Rombachhof: ground floor. (Ink drawing 1750, Mainfränkisches Museum, Würzburg.)

trade chain. Numerous contacts to other 'materialists', chandlers and suppliers in Liverpool, London, Copenhagen, Amsterdam, Rotterdam, Straßbourg, Marseille, Trieste, Augsburg, Nuremberg, Magdeburg, Hamburg, Bremen, Cologne, Mainz and, finally, Frankfurt (Main) can be found in the large number of price lists, waybills, order coupons and invoices. For pricing purposes, the Veninos systematically archived these price lists, so-called *Preiscourants*, which were collected regularly from all their business partners (Fig. 8).

The *Preiscourants* listed all available goods and current prices for a particular day. They also sometimes contained information on the quality, origin and trading units of the stocked materials. These data, in conjunction with information from additional archival material, reveal well-defined alliances between the Veninos and suppliers, transport companies and customers. For the first time, the documentary sources can be used to trace a detailed network of trading partners in the colour business, which reveals that the Veninos operated within a national and European network.

On a more general level, a number of professional guilds were involved in trading in former times: merchants (Kaufleute), wholesalers (Grossisten), chandlers (Krämer), materialists, spice merchants (Spezereihändler), druggists and pharmacists. But what kind of traders were the Veninos? In common terms, a merchant was always a wholesaler, in contrast to a chandler, who was a retailer. Thus merchants and wholesalers refer to the quantity of goods traded and not to one specific type. Unlike merchants and wholesalers, chandlers traded with small units, measured in ells, loaths and pounds. At the beginning of the 18th century, the business split into separate branches. This diversification was stimulated by the general expansion of trade, for example, in manufactured goods and products from the colonies. The range of offered products was now divided into categories based not only on the products' origin, but also on the consumer's demands,14 and promoted the opening of shops by materialists, spice merchants and druggists. All these terms refer to a specialised trade, regardless of the quantity of traded goods. In 1783, Krünitz wrote that a 'material' means a natural product, so a 'materialist' means a trader who is trading in all raw products, including products artificially manufactured and those made by chemistry.¹⁵ A spice merchant (Spezereihändler) or druggist (Droguist) refers to a trader involved in wholesaling or detail business with spices or drugs. A trader exclusively engaged in detail business was known as a spice chandler (Gewürzkrämer): he dealt in special goods, including selected spices, balms, fragrant woods, essential oils and other oriental products (Morgenländische Produkte).¹⁶ In contrast, pharmacists handled goods, regardless of whether they were natural (Simplicia), mixed (Composita) or prepared for, in most cases, pharmaceutical purposes (Praeparata). In addition, pharmacists acted within strictly controlled legal regulations that defined all duties. Price lists (Taxae) released by the local authorities contained all the materials on offer. Trade in toxic materials was restricted to the pharmacies, which were closely controlled by the local physician (Collegium Pharmaceuticum);17 however, some toxic materials of nonpharmaceutical relevance, such as lead white and cinnabar, could be sold by materialists as well.

The Venino merchants are regarded as wholesalers because of the large amount of traded products, and as materialists, due to the type of their assortment. Various delivery notes, bills and customs receipts from different traders prove

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Fig. 6 Price list from the Würzburg merchant Venino, 1727. (Germanisches Nationalmuseum GNM/2° H.1627a.)

that there was active merchandise traffic at Venino's shop. This provides an insight into the mode of transportation,¹⁸ which was also subject to strict regulations and high costs, depending on customs duties from a great number of territories scattered over Germany around 1800. The largest fraction of the costs can be assigned to the numerous customs

facilities. To make matters worse, customs tariffs were not regulated consistently because each territory had its own tariff schedule.¹⁹ If the Veninos wanted to transport goods from one town to another, they had to pay customs at several stations, which were usually close to roads, bridges, rivers and town gates. For example, between Augsburg and Nuremberg,

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Fig. 7 Price list from the Würzburg merchant Venino, 1790. (Staatsarchiv Würzburg, Signature StAWÜ/Broili/ box 207 Diverse Papiere 8.)

which each had their own toll points, there were at least four other customs facilities.

A client usually made a payment in addition to the commodity price to cover all extra costs such as customs duties, outgoings for packaging or crane charges. The Venino documents include a number of waybills that detail freightage for special goods and routes. Goods were sent by carrier, carter or skipper, each kind of transportation entailing other costs. A carrier was only employed for short distances and small deliveries. Materialists, such as the Veninos, or wholesalers traded huge quantities of goods over long distances using carters and skippers. To assign all the goods on a carriage or a ship to a specific sender, each waybill and the item itself was marked with the sender's symbol. These property signs, drawn with a brush loaded with soot black in glue, often carried an ornate monogram or another memorable symbol (Fig. 9).²⁰

The transport itself was characterised by a high level of work division. Besides carters and skippers, other guilds

were involved in packing and loading goods onto wagons and ships: bale binders (Ballenbinder), stashers (Stauer), packers, porters, unloaders, uploaders and menials for weighing who were responsible for storing and tying the goods into barrels and packages. Especially sensitive and precious goods were to be handled with care to endure long transportation distances. Within the Veninos' price lists there are several hints on the type of packaging used including big and small bales, barrels (8 bushel barrels, 12 bushel barrels), bottles, different types of boxes and parcels. They also contain information on the use of ropes, linen and baskets as well as on the costs of the packages or 'emballage'. Precious goods were wrapped in woven fabrics or, in the case of materials such as indigo or cochineal, into 'Serons, Suronen, Suronen' or 'Saronen', which were sacks made of animal skin. Such products were placed in a barrel or box within their first packing. Finally, they were wrapped in waxed mats of linen or laid on straw. Today, we no longer

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Fig. 8 Frontispiece of a *Preiscourant* of the Nuremberg merchant Johann Conrad Roscher. (Staatsarchiv Würzburg, StAWÜ/Broili/box 205.)

know the sizes of all the boxes and packing units mentioned therefore we can often only estimate the size of bushels or barrels. These are defined in very different ways, depending on the respective territory.²¹ If the goods survived the arduous transportation, they were either stacked in warehouses or placed in the salesroom where the customer could find all the products presented in packets, boxes, glasses, paper or textile covers and laid out on shelves and in drawers.

With all this in mind, it is obvious that the Veninos played an important role within the network by connecting suppliers and wholesalers with retail dealers and end consumers. Among the most prominent customers were monasteries, such as Ebrach, and stately homes and castles, such as Veitshöchheim and Werneck, as well as the Würzburg Residence mentioned above. Because of their frequent deliveries to the residence, the Venino merchants were entitled purveyors to the Bavarian court (*Königlich Bayerische Hoflieferanten*). In the residence's account book of 1751, which is part of the so-called *Residenzbaurechungen*,²²

a number of deliveries from Venino are listed, including items sold to the Tiepolos and their day labourers:

Total sum of money spent [...]

14 [fl = florin] for 810 [lb = pounds] of white and a $\frac{1}{2}$ centner glue paid to Carl Venino [...]

50 [fl] 6 [bz = Batzen] for colours handed out by Carl Venino [...]

4 [fl] 12 [bz] paid to two day labourers from the painter Dieplo [read Tiepolo] [...]

- 4 [fl] 6 [bz] paid to the same [two day labourers] [...]
- 4 [fl] 12 [bz] paid to the same [two day labourers] [...]
- 4 [fl] 6 [bz] paid for day wages of those two labourers
- from the painter Dieplo [read again Tiepolo].²³

Obviously, the colours, white and glue provided by Carl Venino were used by artists who worked at the residence including not only the Tiepolos, but also Antonio Bossi. During the years 1750/51, Bossi did the stuccowork within


Fig. 9 Property signs of the merchants Roeder from Mainz (left) and Roscher from Nuremberg (right), both 1792. (Staatsarchiv Würzburg, StAWÜ/Broili 149, waybills 29.12.1792 and 26.06.1792.)



Fig. 10 The former Rombachhof, 1946. (© Geschichtswerkstatt Würzburg.)

the 'Sala Terrena' and the imperial hall (Kaisersaal) at the Würzburg Residence. At the same time, Giovanni Battista Tiepolo and his workshop created the famous 'Europe fresco' on the ceiling of the residence's grand staircase and the ceiling frescoes in the 'Kaisersaal'.²⁴

Returning to the question of why the pharmacy no longer supplied artists with colours, white and glue, in Würzburg, the 'materialist' Carl Venino supplied artists' materials on a grand scale. The Tiepolos, their workshop and other artists made ample use of Venino's assortment. Although this is not necessarily the case for all other German cities of the time, in Würzburg at least, the 'materialist' replaced the pharmacist as the supplier of artists' materials from 1716 onwards. Whereas the impressive building of the Veninos was totally destroyed by Anglo-American bombers at the end of the Second World War, the bulk of the business correspondence has survived in the Staatsarchiv Würzburg (Fig. 10).

One of the authors of this contribution (S.C.) has extracted all the information on colours (*Farbwaren*) and related artists' materials and entered it into a database, which is part of a publication on the Venino case.²⁵ The 110 archival boxes (the so-called Broili family estate) at the Staatsarchiv Würzburg contain most of the documents from around 1790 and are awaiting future studies on other materials, such as tobacco.²⁶ In addition to art history and the technological aspects, the documents illustrate aspects of trading history and the role of former professional guilds. The archival material also contains additional information on many other goods and their type of transportation, packing and other details of the complex trading process of the 18th century.

The Tiepolos' palette

The palette of the Würzburg Tiepolo paintings of the 1750s²⁷ was examined in the 1960s, 70s and 90s at the Doerner Institut, Munich, and has been discussed in detail elsewhere.²⁸ As was common at that time, the colourful pigments were explicitly described on the basis of their chemistry and mineralogy, i.e. in modern terms. This contribution enables translation of the modern descriptions into historic terms with the help of the two Venino lists of 1727 and 1790.

Both lists include white chalk (called *Weiße Kreit(t)e* in the Venino lists) and three types of lead white (Bleyweiß). Cheap chalk or the cheapest type of lead white, blended with chalk, was used as a filler for the ground layers. The lead white used in the paint layers was of better quality: three times as expensive as the ordinary grade, it was sold as Venetian lead white (Bleyweiß venetian[isch]). Another grade, listed in 1790 as Schiffer weiß, has an even higher price. Dutch lead white was not offered by Venino. Cröker states in 1736 that the ordinary grade and the Venetian lead whites are common on the painters' palette, but not Schiffer weiß. Cröker continues that lead white is produced in different places, whereas the Venetian is the most beautiful and the best, even more expensive than the Dutch lead white.²⁹ He knew that lead white from Venice was beautiful, hard and snow-white.³⁰ This is the telling argument – lead white has to be snow-white!

The Veninos offered different cheap qualities of yellow ochres (Ocker), light and dark, very fine and ord[inair] as well as green earth. The identified red-brown ochre was correlated with cheap English red (Englisch Roth) in different qualities and was the only red earth offered. At the Venino shop, Naples yellow was available as Neapolitanischgelb ff, whereas lead-tin-antimony yellow,³¹ which has only recently been identified in the Tiepolo cross-sections for this study, is not listed. A detailed search in the pigment database of the Doerner Institut reveals that, in the 1960s and 70s, Hermann Kühn frequently identified antimony containing lead-tin yellow on 17th/18th-century paintings from the Netherlands, Italy and France. Kühn decided not to give a name to this yellow, which disappeared from the artist's palette in the 19th century. His position is supported by the Venino price lists, in which the different types of lead oxides are concealed within the term lead yellow (*bley gelb*), which is absent from the 1727 list but appears on that of 1790. In the middle of the 18th century, the Tiepolos used both bley gelb and Neapolitanischgelb, the price of Naples yellow being a little higher than that of lead yellow. Cröker mentions that lead yellow is a 'nice yellow colour', although the one from England exceeds all others.³² He adds, still in the tradition of the Kunstbüchlein of earlier centuries, that it is prepared from lead, but is cheaper to buy than to make it.³³ Although Naples yellow is a lead-antimony yellow, the secret of its production may have prevented it from being known under the term lead yellow: Cröker knew it as Neopolitanisch Gelbe without giving any details.³⁴ As a consequence, one pot with Neapolitanischgelb, but several pots with different grades of *bley gelb* must have been on the

shelves in Venino's shop. The client simply picked the pot containing the yellow of his choice without having any idea of the chemistry behind it – just the yellow shade and the price guided his decision.³⁵

Ultramarine and different qualities of Prussian blue are also included in the Venino lists. The price for natural ultramarine (Ultra marin) increased considerably from nine times as expensive as verdigris in 1727 to around 150 times in 1790 for a dark grade (duncklen Ultramarin). The early use of Prussian blue has already been mentioned and it is supposed that the Tiepolo workshop was one of the earliest to use this new blue.³⁶ The analytical results do not reveal which grade of Berliner Blau was used on the Tiepolo paintings examined but its high aluminium content is typical of early production forms.³⁷ It is remarkable that Berliner Blau already appeared as Berliener blau fein and Berliener blau Mitte, that is, in two different grades, on the Venino list of 1727. A few years after its introduction,³⁸ it was being offered in pounds! Its recipe was published in 1724 and soon became the main blue in greens, and mixed with yellows it produced an astonishingly wide range of hues. Only a few years later in 1730, Minerophilo pointed out that Prussian blue was available cheaply and in large amounts.³⁹ It was praised by Cröker in 1736 as a very nice blue,40 invented in Berlin, and as a replacement for ultramarine, indigo and woad. However, we still do not know where the Veninos obtained the brand new Berliener blau in 1727. The second list of 1790 contains two grades, Berliner blau fein and ordinair, again both offered in pounds. The price was around two to six times higher than verdigris, depending on the quality. Thus Berliner Blau clearly became cheaper over the century.

As an opaque red, cinnabar is listed as *Zinober gests[toßen] fein* in the 1727 price list, and as mountain cinnabar or *Berg Cinober* (the unprepared mineral) or slotted cinnabar (*Cinober geßtoßen*) in 1790.⁴¹ At that time, this red powder was used either for pharmaceutical purposes or as a pigment. Its price was four to five times higher than that of verdigris.

The early analyses used here do not reveal the exact nature of the red-purple lake. This is mirrored in the colour Kugellack - small balls or droplets (called *lacca in globulis* in the pharmacy price lists) of a red lake - offered by the Veninos; no plant or animal source is given.⁴² In the 1727 list, both Kugel Lacc fein and Kugel Lacc Mittel are cheap. The simplest type, as well as the very expensive *Florentiner lacc*, does not appear. Indicating its nature as a common recycling material, the price of *Kugellack* is even lower than that of verdigris! In the 1790 list, Florentiner lacc is 10 times as expensive as verdigris, whereas the price for Kugellack is just one and a half times higher than that of verdigris. These observations are reflected in the documentary sources of the time: Cröker comments that the expensive Florentine lake is used for good paintings, whereas Kugellack is sufficient for simpler works.43 For our case with the high ranking court commissioners, the importance of the order for the Würzburg Residence as well as the Europe-wide reputation of the Tiepolos suggest the use of Florentine lake for the examined Tiepolo paintings. It should



Fig. 11 Oven for *Kienruβ* production, *c*.1771(?), copperplate engraving by Bernard, from Diderot and d'Alembert, *Travail du Noir de Fumée* (private ownership).



Fig. 12 Backscatter SEM image (25 kV) of a *Kienruß* particle. (Tilenschi © Doerner Institut Munich.)

be noted that pharmacy price lists of the time frequently mention *Kugellack* as a so-called painter lake (*Mahlerlack*). Moreover, Florentine lake and *Kugellack* are usually both found in chapters on '*Pigmenta et Colores*'.

In the pre-industrial era of the Veninos, nothing was wasted, and every waste material found its use. Our first example is *Kessel braun*, a metallic brown-black, which is simply waste from hammering, sawing or filing hot iron or copper.⁴⁴ The brown iron oxide identified on our paintings

could thus be *Kessel braun*. Due to its unclear nature as a waste product in kettlemaker workshops or in farriers, the historical term is ambiguous for a good reason, whereas today, the term *Kessel braun* is controversially discussed as a copper⁴⁵ or an iron compound.⁴⁶ The second example is *Kienruß*, plant soot black: resin containing pine and spruce bark or rootstocks was carbonised in specially designed ovens (Fig. 11).

The cheap and lovely black was sold by the Veninos as *Kienruß* in large barrels. Recent analyses have shown that a sample of contemporary Swedish *Kimrök* contains traces of sodium, magnesium, silicon, sulphur, potassium, iron, calcium and phosphorus, all of which are involved in the metabolism of trees.⁴⁷ Traditionally, the microscopic morphology and the presence of the last two elements indicate a mixture of bone and plant black. However, in our case study, the single source is *Kienruß*. Not surprisingly, many particles in the sample show the morphology of ground plant ash that also contains calcium and phosphorus (Fig. 12).

Expensive bone black (*Beinschwartz*) appears in both Venino lists, whereas plant black is missing. *Kienruß* is listed in 1790 and, as known from the account books mentioned above, barrels of *Kienruß* were purchased for decoration of the residence. In former examinations of Tiepolo paintings, the presence of calcium and phosphorus in blacks was interpreted as bone black.⁴⁸ However, none of the account books indicates acquisition of plant black. This view is supported by the historical technical books: as mentioned by Cröker, *Kienruß* was the most important black at that time.⁴⁹ There is no doubt that it was used in large quantities in the 18th century. As is pointed out, its quality and composition were dependent on the production process and from which part of the oven the cold soot was collected. In contrast to bone black, which is difficult to produce,⁵⁰ *Kienruß* is very cheap.

In summary, the combination of analytical findings, the Venino lists and the technical literature of the time allow us to reconstruct the historic palette of the Tiepolos which consisted of *Weyße Kreite*, *Bleyweiß* and/or *Bleyweiß venetianisch*, *Ocker ordinair*, *Grüne Erden*, *Englisch Roth*, *Berliener Blau fein* and/or *ordinair*, *duncklen Ultramarin*, *Bleygelb*, *Neapolitanisch Gelb*, *Cinober geßtoßen*, *Florentiner Lack*, *Kessel braun* and *Kienruß*.

Conclusions

During their Würzburg years, the Venetian painters Giovanni Battista and Giovanni Domenico Tiepolo and their workshop bought all they needed from the local merchant ('materialist') Carl Venino. Examination of the Würzburg pharmacy price lists reveals that, as soon as Venino's shop opened in 1716, the previous role of the pharmacy as a supplier of artists' material was taken over by 'materialists'. Their wide range of goods included a large number of artists' colours. In Venino's shop, these were listed in as yet unexplored handwritten price lists of 1727 and 1790. Additional information regarding the grades offered, the origin of the material and the price pattern is also found in these lists. Price lists of other merchants (*Preiscourants*) give an insight into which national and European networks the Veninos were embedded. The rich information extracted from these documentary sources has been used for an interpretation of the palette identified on several masterworks of the Tiepolos of the 1750s, allowing us to verbally describe the Tiepolo palette as published in an earlier communication in 1996; however, it is now deeply rooted in the historic background.

The loss of relevance of the pharmacy in supplying artists is evident. As shown here, this is certainly true for Würzburg, but in other cases Taxae prove the pharmacy's ongoing role. For instance, the price lists of Goslar from 1731 or Braunschweig from 1755, to mention just two, have impressive chapters on colours that include Naples yellow and Prussian blue. Our contribution, which had '72 florin for colours, white and glue' as a starting point, exemplifies that all that is needed for this type of research is the right archive, an old-style education lost in the Bologna process, literacy and patience, years of time, the ability to overcome failure, a sense of humour and a considerable amount of luck. You may then experience that working in archives is indeed worthwhile. As we know, the application of science to the field of art has value in itself. However, in cases such as those of the Tiepolos and the Veninos only the combination of both creates meaning and increases our knowledge of the past.

Notes

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- 11. '72fl Ausgaben für Farben, 810 Pfund Weiß und einen halben Zentner Leim, die der Würzburger Carl Venino erhält', quoted from T. Kossatz, 'Quellen zum Würzburger Werk Giovanni Battista Tiepolos und seiner Söhne', in Krückmann 1996 (cited in note 3), vol. 2, p. 173, doc. 25.
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- 13. Ibid.
- 14. R. Bettger, Das Handwerk in Augsburg beim Übergang der Stadt an das Königsreich Bayern, Augsburg, 1979, pp. 25–27.
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- 25. Correll 2012 (cited in note 12).
- 26. Staatsarchiv Würzburg, Familienarchiv Broili.
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- 33. 'jedoch kommt man genauer darzu, wenn man sie kauft, als wenn man sie selbst macht', Cröker 1736 (cited in note 29), p. 91.
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- 35. Krekel et al. 2006 (cited in note 6).
- 36. Augusti 1992 (cited in note 4), p. 163 reports the earliest use of Prussian blue on a Tiepolo painting at the Scuola dei Carmini in Venice from the late 1740s.
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- 46. G. Heydenreich, 'The Leipzig trade fairs as a market for painters' materials in the sixteenth century', in J. Kirby, S. Nash and J. Cannon (eds), *Trade in Artists' Materials: Markets and Commerce in Europe to 1700*, London, Archetype Publications, 2010, p. 309.
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- 48. Augusti 1992 (cited in note 4), p. 163.
- 49. Cröker 1736 (cited in note 29), p. 120f; and Heydenreich 2010 (cited in note 46), p. 310.
- 50. Burmester and Krekel 1998 (cited in note 5), p. 81.

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THE COARSE PAINTER AND HIS POSITION IN 17TH- AND 18TH-CENTURY DUTCH DECORATIVE PAINTING

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ABSTRACT In modern studies of Dutch art, the makers of decorative paintings in the 17th and 18th centuries are usually referred to as 'decorative painters' or 'interior painters', as if this was a profession in its own right. However, neither name existed at the time. In the 17th and 18th centuries, the painter's trade – defined in the regulations of the Guild of St Luke – encompassed two separate and independent groups: the artist painters and the coarse painters. Because the best-known 'decorative painters' were also recognised artist painters, in art history the painting of decorations has come to be regarded as primarily their work. Archival research, however, has revealed that it was not unusual for a painted decoration to be the result of close collaboration between artist painters and coarse painters. In some cases a highly complex decoration actually proves to have been made by a coarse painter working alone. This will be demonstrated by reference to a painted chamber in Almelo dated 1778. Technical research has shown that all the painted work was executed by a coarse painter

Introduction

Nowadays, the makers of Dutch 17th- and 18th-century decorative paintings, such as ceiling paintings, overdoors and mantelpieces, and painted wall hangings, are often referred to as 'decorative painters' or 'interior painters', as if this was a profession in its own right. However, these terms did not exist in this period. In official documents of the time, a Dutch painter would generally be described simply as a 'painter' (*schilder*) – a practice that makes it difficult to establish whether such painters made their living using a refined technique similar to that of Rembrandt or Vermeer, or with a coarser style such as the many unknown painters who executed all the painting on signboards (Fig. 1).²

However, what everyone who worked with a brush – fine or coarse – had in common was membership of the same professional organisation, the Guild of St Luke, which could be found in most of the larger towns in the Dutch Republic.³ Some of these guild records have survived, and it is interesting to note that as a rule they made no distinction between the different types of painters.⁴ One of the very few exceptions is Leiden where painters were registered either as fine artists (*fijnschilder* or *konstschilder*) or coarse painters (*kladschilder* or *schilder met de groote quast*).⁵ A distinction was thus made in the records between painters who worked with a 'fine' brush and in general made their living from easel paintings, and painters who used a 'large' brush (*de groote quast*) and essentially carried out all the other painted work. The painters who used a coarse brush are described in this paper as 'coarse painters', but translating the term *fijnschilder* is a more complicated matter. The most obvious translation is 'fine painter', but because in the Dutch context this translation can cause confusion with the specific style of painting commonly referred to them as 'artist painters', a term also used in other archival studies.⁶

It is clear from the Leiden guild records that the two types of painters were regarded as two different professions that together formed the artists' community in Leiden. In theory they each had their own domain, but sometimes their interests conflicted. It is precisely these conflicts that provide a revealing insight into how decorative paintings were produced in the 17th and 18th centuries and is the main subject of this paper. In the first part we demonstrate that



Fig. 1 Painted signboard for a shipyard, 1675–1700, wood, 62.5 × 76 × 8 cm, Amsterdam, Rijksmuseum. (Photo: Rijksmuseum.)

in this period the coarse painter's share in complex decorative painting ensembles was much greater than might have been expected. The second part shows how, under certain conditions, a coarse painter was even able to paint complex decorations on his own.

The qualities required by a skilled coarse painter

We begin by examining exactly what the work of a coarse painter in the 17th and 18th centuries entailed. Although these painters are clearly demarcated in the Leiden guild records as a separate professional group, these records refer only occasionally and generally obliquely to the nature of their work. There has been virtually no art historical research into exactly what their work involved.⁷ Nor is there a contemporary source or publication with general information about the profession – a sort of 'coarse painterly' counterpart to the existing works of art theory by Samuel van Hoogstraten (1678) and Gerard de Lairesse (1707).⁸ The first extensive Dutch publication on coarse painting dates from 1801: a handbook titled *Grondig Onderwijs in de Schilder- en Verw-kunst*, written by Lambertus Simis (1754/5–after 1809) who

was active as a coarse painter in the last quarter of the 18th century.⁹ In his address 'to the reader', Simis leaves it in no doubt that this book is 'entirely new of its kind':

Indeed, no one has yet taken the trouble to publish anything of importance about the painting of works of all kinds and the preparation of the paints required to make them. It is true that some authors, in the past and more recently, have written about fine art painting, but none of them specifically treated the painting of houses, rooms, furniture, carriages and much more besides, as if this did not deserve a mention.¹⁰

The chapter in which Simis sums up all that is required of a 'competent' coarse painter provides a fairly good impression of his work. As well as painting the interior and exterior of houses and other buildings in a single colour – the type of work that is done today by a house painter – a coarse painter also painted signboards 'of various kinds, each according to its particular nature and to the owner's opinion.¹¹ The demand for this type of painting was so great in the 17th and 18th centuries that some coarse painters decided to specialise and make painting signboards their chief source of income. Into more or less the same category came the painting of coats of arms and marriage and memorial boards. It was also the job



Fig. 2 Anonymous, memorial board of Tjalling Homme van Camstra, 1727, panel, 147×47.9 cm, Leeuwarden, Fries Museum. (Photo: Johan van der Veer.)

of the coarse painter to add the names and dates that were often required on these boards. He was expected to be able to 'heighten and deepen' the letters and numbers in an appropriate manner (Fig. 2).¹²

In distinguished houses and public buildings, the woodwork was frequently ornamented with beautifully carved decorations. However, if a woodcarver was not available or the client considered the beautifully carved foliage and festoons too expensive, it was up to the coarse painter to suggest carvings on doors, frames, panelling and mantelpieces with paint. Painting furniture was likewise one of his jobs. As well as painting such pieces a plain colour, the coarse painter also had to be able, if required, to decorate those 'tables, chairs and other furniture with flowers, garlands, vases etc.'13 Although not mentioned by Simis, it seems safe to assume that his repertoire also included decorating furniture with biblical scenes and similar designs, such as those frequently seen on tea tables and similar pieces. The coarse painter could do the same on walls and doors. For example, the Leiden City Council ledgers record a payment to the coarse painter Marcus Leopoldus (c.1625-1671) for decorating the door of a wooden gate with a landscape in perspective.¹⁴ If a client set high standards for the quality of a design, however, he would generally have such work done by an artist painter. At the start of his career, for instance, the Leiden artist painter Jan Mortel (1652–1719) painted portraits, but then he 'started to paint flowers and fruit still lifes, be it for chimney breasts or tea tables and anything where money was to be made'.15

In this period it was more important to suggest the nature of a material than to use the material itself, and a good coarse painter could certainly meet the demand. He was expected to be able to simulate wood grains of all kinds, from oak to much costlier types such as tropical ebony and rosewood. This technique was used both on the woodwork that was part of the fixtures and fittings and on wooden furniture and other objects made by cabinetmakers.

According to Simis a coarse painter also had to be a competent gilder, 'at least mat gold and silver, and to be able to lacquer, bronze and strew metals.'16 Gilding could be applied to picture frames, a task for which the coarse painter Marcus Leopoldus earned 14 guilders and 8 stivers in 1658, when he gilded the foliar ornaments around the frame of the group portrait of the governors of the Laridonhof - a court of alms houses in Leiden.¹⁷ But commissions could also be large and more complex such as, for instance, the mantelpiece in Huize de Dieu in Alkmaar, which in 1744 was abundantly decorated with gold leaf and other types of metal leaf (Fig. 3). We know from archival records that this work was done by Jan Ponse (1705/6-1757). Ponse can be identified as a coarse painter from the inventory of his belongings compiled in 1740 after the death of his first wife, which shows that he was a painter of trays, tea tables and other furniture.¹⁸

Another important skill listed by Simis is marbling, a technique for effectively imitating marble with paint. Imitation marble and gilded decorations appear to have been in such high demand that, as archival records show, some coarse painters chose to specialise as a gilder (vergulder) or marbler (marmerschilder). Marbling was highly respected and, according to the Dutch painter and author Jacob Campo Weyerman (1677-1747), 'the elevated step of marbler' (de verheven trap van Marmerschilder) was the highest level of honour a coarse painter could achieve.19 A skilled marbler could turn his hand to anything including marbled mantelpieces and alcoves in three shades of marbling - white, violet and black. Among the specialists in this field was Willem van Nijmegen (1636–1698), who was enrolled in the Leiden guild as a 'coarse painter' in 1685. His achievements were universally praised and it must have been the public's appreciation of imitation marble and Van Nijmegen's illustrious reputation that prompted the renowned 18th-century Leiden collector Johan van der Marck to include Van Nijmegen's portrait by Ferdinand Bol (1616-1680) - now lost - in his famous collection of artists' portraits, which was sold at auction in Amsterdam in 1773. Van der Marck's description 'marbler', written under Van Nijmegen's portrait on the list, was certainly not intended as disdainful - on the contrary.

Art historians might well recognise some of these skills as typical of a coarse painter. This is also true of his ability, as described by Simis, to paint 'some ornaments and other adornments' such as garlands and foliar motifs.²⁰ However, an art historian might not expect to read in Simis's book that a coarse painter should also be able to paint *trompe-l'oeils* of 'some sculptures in grey', in other words in grisaille and 'all with the right proportions,'²¹ or that he was also expected to represent mock architecture, such as niches, columns, pillars with capitals, basements and architraves, and to reproduce these with their projecting and receding parts.²²



Fig. 3 Mantelpiece decorated with gold leaf and other types of metal leaf by the coarse painter Jan Ponse, 1744, House De Dieu, Alkmaar, Langestraat 114. (Photo: Joop Elsinga.)

That these types of work were considered part of the coarse painters' domain may come as a surprise. Painting sculpture in grisaille called for a thorough understanding of the proportions of the human body, while painting architectural elements required mathematical knowledge. We usually regard these abilities as part of the expertise of an artist painter and do not expect to find them in a coarse painter. Rightly, in fact, even Simis admits that this type of work is usually done by artist painters. However, he emphasises that the division between the two professions is far from clear:

After all, there is no strict demarcation to be found in Painting indicating the place where the artist painter's work actually stops; none, other than that fine painting is chiefly confined to works of art that are not general but can only be executed by a few, such as portraits, landscapes and seascapes, excellent histories etc.²³

The forms of painting that Simis sums up here require the ability and skill either to observe and paint directly from nature or to conceive one's own compositions. We may infer from this, although Simis is not explicit, that it was these skills that the coarse painter lacked. However, when a coarse painter had access to an example in the form of a drawing or print he was perfectly capable of painting figurative representations, as demonstrated below in the case study of the salon in Almelo.

Working from examples is undoubtedly why the Leiden coarse painter David Hoogschilt (c.1625-1692) left no fewer than 50 'lots' of prints when he died and it is not in the least surprising that most of them were snapped up at the auction



Fig. 4 Anonymous, painted ceiling with sky and fowl, surrounded by arabesques representing the four seasons, 1675–1725, canvas, 525 × 365 cm, Hoorn, Grote Oost 22. (Photo: Cultural Heritage Agency of the Netherlands.)

of his effects by fellow craftsmen.²⁴ In other words, a coarse painter was able to paint figures in grisaille and mock architecture, but only when he had a precise print or drawing from which to work. We may therefore assume that the perspective painting by Marcus Leopoldus referred to above would have been made after a print example.

Division of the work

There is little if any documentation for the great majority of 17th- and 18th-century commissions for decorative painting work making it difficult to establish precisely how this work was carried out. If we confine ourselves to decorative wall and ceiling paintings with both figurative and ornamental elements they can in theory – judging by what has been said about his work and competencies – have been executed entirely independently by a coarse painter (Fig. 4). For example, the ceiling in Hoorn – an oval containing an illusionistic open sky with birds, and four arabesques in imitation relief in the corners – is composed almost entirely of elements that 'a competent coarse painter' should have been able to paint provided he could work from drawings or prints.

This does not mean, however, that the Hoorn decoration was actually the work of a coarse painter. It is equally justifiable to argue that the maker must have been an artist painter given that painting figurative elements was first and foremost his area of expertise, even if we judge that the result, as is the case in Hoorn, is not of the highest quality. Not every artist painter was blessed with the talent of Melchior Hondecoeter (1636–1695) who, unlike the painter in Hoorn, excelled in painting birds. And in the event that the Hoorn decoration was not painted from one or more prints but from a design specially created for the purpose, it seems obvious that the work should be attributed to an artist painter. Again, conceiving compositions was his area of expertise. Nonetheless the artist painter did not have sole rights when it came to creating designs. We know of examples, albeit very few, of coarse painters who designed decorations. Admittedly these designs were usually fairly simple and, moreover, made by coarse painters with a reputation that extended beyond the boundaries of their own home town.²⁵

To complicate matters still further, the ornamental element of a decoration could well have been painted by an artist painter, for it was by no means certain that this type of work was automatically given to a coarse painter, regardless of whether or not it came within his field of expertise.



Fig. 5 (a) Coffered ceiling painted by Martinus Saegmolen at Pieterskerkgracht 9, Leiden; (b) detail of the phrase in Italian and signature. (Photo: Cultural Heritage Agency of the Netherlands.)



Fig. 6 The trend in the number of members of the Guild of St Luke in Leiden divided into artist painters (blue line) and coarse painters (red line), 1648–1702. (Sources: Regional Archive Leiden: Archive of the Guilds, inv. 849 and 850 and Baptismal, Marriage and Burial Registers; The Hague, RKD Netherlands Institute for Art History, Bredius notes.)

This has everything to do with the existing guild regulations. As pointed out at the beginning of this paper, both artist painters and coarse painters were united in the same guild. However, this guild – and not only in Leiden – did not offer the two crafts the same protection; the artist painters were clearly favoured. They were permitted to undertake all types of painting at any time, including the work coarse painters regarded as their domain. Conversely, coarse painters were not allowed to do the work of artist painters.²⁶ The coarse painters, needless to say, were far from happy with the inequality, but despite their frequent protests this rule was not withdrawn during the lifetime of the guild, which was dissolved at the end of the 18th century.

It is impossible to say precisely how the ceiling painting in Hoorn and similar decorations came about. Nonetheless there are examples that suggest that in any event decorations of this kind were not always painted by a coarse painter or an artist painter working alone – there must have been collaborations between the two professional groups in which the different tasks were divided along the lines of their individual expertise. A decorated coffered ceiling painted by the artist painter Martinus Saegmolen (1619–1669) for the Leiden cloth merchant Abraham le Pla in 1652 is particularly interesting in this context. Saegmolen only painted the figurative elements, which were on the coffers, leaving the ornamental components and the marbling on the beams to someone else. We know this from an Italian text painted on one of the coffers by Saegmolen himself: Questi quadrati et non le trabi ha depinto, M. Sagemolo (these panels and not the beams were painted by M. Saegmolen) (Fig. 5).²⁷ A curious sentence, but also an important indication that artist painters and coarse painters respected one another's domains and it seems that the monopoly on coarse painting sought by the coarse painters was usually respected by the artist painters.

Mutual respect was not the only reason why painted work was undertaken in line with each craft's expertise: social pressure may have played an even greater role – in Leiden



Fig. 7 Cornelis Holsteyn and Matheus van Pellekum, painted ceiling in the governors' room of the former municipal orphanage with allegorical representations of *Love, Mercy* and *Charity,* surrounded by festoons with coats of arms of the former six governors, 1656, wood, 1230×574 cm, Amsterdam, Amsterdam Museum. (Photo: Amsterdam Museum.)



Fig. 8 Elias van Nijmegen, design for a painted ceiling representing an allegory of *Fame*, 1677–1755, paper, 36.9 × 50 cm, Amsterdam, Rijksmuseum. (Photo: Rijksmuseum.)

in any event – as can be deduced from the graph in Figure 6. In this graph the blue line illustrates the ongoing decline in the number of artist painters in Leiden after 1660, caused by the continuing crisis in the art market.²⁸ Conversely, the red line demonstrates the rapid increase in the number of coarse painters as a result of the growing demand for decorative painting. The graph demonstrates convincingly that from 1660 onward so many coarse painters were active that it would have been very unwise for an artist painter to neglect their claims.²⁹

That this type of cooperation was not unique to Leiden is clear from a well-documented example of a decorated ceiling in Amsterdam's former Burgerweeshuis (the old municipal orphanage), painted in 1656 by the coarse painter Matheus van Pellekum (*c*.1630–1679) and the artist painter Cornelis Holsteyn (1618–1658).³⁰ For this ceiling, Holsteyn painted a personification of *Love* in the centre, flanked lengthwise by *Mercy* and *Charity* (Fig. 7). Van Pellekum filled the large field around them with ornamental garlands and coats of arms, precisely the type of work Simis attributed to the coarse painter.

The arbitration case between the Amsterdam patrician Dirck van Oudshoorn and Johannes Post (1639-1689) in 1672 is another interesting example that shows how painted decorations usually combined 'fine art' and coarse painting. Johannes Post was the son of the famous Pieter Post (1608-1669) and, like his father, an architect and artist painter. After completing the decorative programme in Van Oudshoorn's magnificent house at number 436 Herengracht, Post asked for more money than the 1400 guilders that had been agreed. To support his claim he asked Matheus van Pellekum, who had worked on the orphanage ceiling, and the artist painter Barent Graat (1628–1709) to arbitrate.³¹ Van Oudshoorn also wanted the advice of experts (goede mannen) so he called on the artist painter Gerbrand van den Eeckhout (1621-1674) and Anthony de Haes, whose profession could not be determined but who might have been a coarse painter. The fact that two artist painters and at least one coarse painter were chosen for their opinion on the decoration suggests that it consisted of both figurative and ornamental elements and that these had been executed by painters of both disciplines.³²

These examples indicate that in decorative painting commissions, the painting work that was required would usually have been divided in accordance with the two areas of expertise. This kind of cooperation was not the only form, however, as our earlier study into the working methods of the famous Dutch printmaker and painter Romeyn de Hooghe (1645-1708), combining archival studies and technical research, reveals.33 It appears from archival records of De Hooghe's commissions for painted wall hangings and ceiling decorations that he confined his involvement to designing these decorations and transferring his designs to the actual painting support. He also indicated the colours of the figures and forms. However, the rest of the work was carried out by specially engaged coarse painters, as is evident from the contracts and correspondence, with De Hooghe keeping a close eye on the quality of their work. This approach was used both for relatively simple decorations such as grisailles with a single allegorical figure and for complex compositions involving many figures, such as the (1701) wall hangings in the Burgomasters' chamber in Enkhuizen town hall.

De Hooghe's working method strongly resembled that of his colleague and contemporary Elias van Nijmegen (1667-1755). His decorations often depicted beautiful park landscapes with sculptural groups, obelisks and vases, surrounded by contoured mouldings with complicated ornamental patterns. According to the 18th-century painter and author Jan van Gool (1685-1763), Van Nijmegen confined himself to creating the composition and drawings for these decorations and then kept a critical watch on the proceedings to ensure 'that everyone did his best to carry out the task entrusted to him.³⁴ In other words, he supervised the painters who did the actual work (Fig. 8). Van Gool says nothing about the professional background of 'everyone', but given De Hooghe's working methods the assumption that there must have been a number of coarse painters among Van Nijmegen's fellow workers seems justified.

The coarse painter as sole author: the results of a technical investigation

In the complex decorative painting schemes discussed so far, the role of the coarse painter was confined to that of co-worker or assistant. Some coarse painters, however, were capable of painting such large-scale decorations entirely on their own. While a coarse painter might not have been able to invent an intricate decoration, some were perfectly capable of painting one providing they could work from prints or drawings. A striking example of this can be found in a salon decorated with painted wall hangings in the Hofkeshuis in Almelo, a city in the east of the Netherlands, close to the German border (Figs 9 and 10). Recent research into the materials and techniques used in this room has shown that the wall hangings and all the woodwork must have been painted by one painter.³⁵ We know his name, Andries Warmoes (1748–1793), because he signed one of the hangings, adding the date 1778. Little is known about Warmoes's life, and there is no record in the archives to tell us whether he was an artist painter or a coarse painter.³⁶ However, the type of painting on the hangings and the woodwork corresponds so precisely with Simis's description of the work of the coarse painter that we have to assume that he belonged to this group of painters.

The wall hangings were commissioned by the cloth manufacturer Egbert Hofkes (1738-1822) for the main reception room at the back of the upper floor of the house. The whole decoration, 2.5 m high and nearly 20 m long, is painted on canvas in imitation relief in shades of brown, the technique known as brunaille. The canvases cover three walls and depict the triumphal procession of the Roman consul Quintus Fabius Maximus. The wall hanging is divided into four sections, each of which has a trompe-l'oeil moulded architectural frame surrounded by reddish-brown imitation marbling. The painting is a faithful but greatly enlarged copy of the marble relief on the chimney breast in the Burgomasters' chamber in Amsterdam Town Hall, now the Royal Palace. The image was copied not from the relief itself, but from a set of seven engravings published in a book on the town hall.³⁷ The prints do not show the fireplace frieze in its entirety: some sections do not appear in the print and these sections are also missing from the wall hangings. It is clear from this that the wall hanging is an example of a coarse painter working from prints. It was, incidentally, the client, Egbert Hofkes, not Warmoes, who selected these prints, apparently making an extremely original commentary on the turbulent political circumstances of the time.³⁸

The physical condition of the wall hanging is exceptional. The canvases have never been lined or removed from the wall and are mounted exactly as they were when they were hung originally. This means that they can tell us a great deal about how such decorations were produced, and thus about the practice of a coarse painter. The canvases were attached with upholstery tacks to a framework of battens fixed to the wall on top of the wainscoting. They have a double ground: a silicate layer mixed with glue under a chalk layer mixed with oil. Both ground layers were applied before the canvases were stretched onto the battens. We know this because it was possible to remove a few tacks temporarily from the bottom



Fig. 9 Overview of the reception room at the back side of the upper floor of the Hofkeshuis, Grotestraat 62, Almelo with Andries Warmoes, *Triumphal Procession of Quintus Fabius Maximus*, signed and dated '*AND*. *WARMOES PINXIT Ao 1778*'. (Photo: Cultural Heritage Agency of the Netherlands.)



Fig. 10 Canvas on the north wall of the room (see Fig. 9) with Fabius Maximus in his chariot, drawn by four horses, with infantry, women making music and horsemen, 240 × 727 cm. (Photo: Rik Klein Gotink Photography.)

edge of the canvas to the right of the door, so that the canvas could be lifted slightly (Fig. 11). From a sample taken from the folded canvas in this area it could be seen that all the ground layers were present, clear evidence that a ready primed canvas had been mounted in the salon.

The painting itself, however, was not carried out until after the canvases had been mounted. A beige-grey paint layer applied directly onto the ground on all the canvases provides the basic colour for the image and remains clearly visible in the end result. This layer is a mixture of lead white, chalk, fine black and some red earth, precisely the mixture of pigments used in the image itself. This base layer must therefore have been applied by Warmoes. It can be found over the whole of the front of the canvases, but is absent where the canvas edges were folded behind. In other words, the layer was not painted on until after the canvases had been stretched in the room. We can conclude from this that Warmoes actually did his painting in the Almelo salon itself. There are further indications that support this finding such as, for example, the upholstery tacks that are painted in the same colour as the surrounding canvas. Warmoes set to work by drawing the composition with thin brown paint. The design of the triumphal procession corresponds so closely to the prints that we may safely state that it was not drawn onto the canvas freehand: he must have used a grid to transfer and enlarge the composition from the prints, although no traces of this have been found on the canvases. Enlarging the composition from the prints this accurately was no easy feat, but Warmoes's example reveals that it was a task that could safely be entrusted to a coarse painter.

The difficulty of Warmoes's work was compounded by the fact that he had to reverse the direction of the incidence of the light on one of his canvases. The light comes from the left in the prints, a direction that could be adopted for most of the canvases in the salon. However, for the large canvas on the north wall (see Fig. 10), hanging to the left of the windows, the light had to come from the right, meaning that Warmoes could not use the print as an example for his modelling because all the shadows had to be on the other side of each form. Warmoes was quite successful as evidenced by the convincingly modelled figures.

Warmoes also painted the *trompe-l'oeil* moulding around the canvases, taking great pains with this and using shrewdly placed shadows, as well as the imitation marble that surrounds the moulding. Referring back to Simis's book, it is clear that Warmoes's wall hanging contains precisely those elements that Simis describes as the work of the coarse painter. We see the *trompe-l'oeil* painting of sculptures *en grisaille* with the correct proportions, the representation of mock architecture, the painting of ornaments and embellishments and the imitation of marble. The salon in the Hofkeshuis presents a typical example of the repertoire of the coarse painter, which is what Warmoes does indeed appear to be.

It is characteristic in this respect that his work was not confined to the canvases: Warmoes also painted the woodwork in the room, which is currently white. However, the careful removal of paint layers, scraping away one coat at a time to leave a 'ladder' of successive paint layers, has revealed that the original colour finish is well preserved underneath: a reddish-brown wood imitation (Fig. 12). The base was a chalk-glue ground covered with a thick layer of pink oil paint consisting of vermilion, lead white and chalk under a translucent reddish-brown oil paint containing red earth, with a little black and organic red, with which the hairs of the brush were used to imitate the grain of the wood. This woodwork was enlivened with small gilded and purple-red accents.

Very similar painted decorations are also found in the only other decorative commission undertaken by Warmoes of which we are aware: an inner portal in Texel he decorated in 1787 with grisailles, gilding and imitation of both white- and grey-veined and pink- and black-veined marble (Fig. 13). This leads us to suspect that Warmoes also painted the woodwork in the Hofkeshuis, a suspicion that appears to be confirmed by an examination of the wainscoting. In this regard it is important to know that when the canvases were stretched and fixed onto their battens, the canvas edges were turned over twice, creating a thick triple-layer canvas edge just above the wainscoting. We can now see that all the finishing layers on the wainscoting stop exactly at this thick edge – beneath them



Fig. 11 A few tacks were loosened to the right of the door to the room (see Fig. 9). The linen canvas was folded over at the back several times to create a thick edge. It can be seen that all the finishing layers on the wainscoting stop exactly at this thick canvas edge. (Photo: Margriet van Eikema Hommes.)



Fig. 12 Careful scraping of the paint layers of the wainscoting shows the original reddish-brown wood effect. The mouldings surrounding the wainscoting inner panels were decorated: the outer frame was purple and the inner one was gilded. The scraping reveals the yellow ochre base for the gold leaf. (Photo: Ruth Jongsma, Bureau voor kleuronderzoek & restauratie.)



Fig. 13 Inner portal from Brakestein House, signed and dated 'A. WARMOES PINXIT A° 1787'. Het Schoutenhuis, Den Burg, Texel. (Photo: Margriet van Eikema Hommes.)

there is only bare wood (see Fig. 11). This indicates that the wainscoting was not painted until after the canvases were stretched: an unusual and particularly awkward sequence of events, but explicable if we assume that Warmoes had to also execute the woodwork. Like gilding, imitating different types of wood was, as we have demonstrated, an essential part of the coarse painter's work. The build-up of the paint layers and the pigments Warmoes used are exactly the same as those to which Simis refers in his prescription for 'dark red or mahogany wood', specifically seasoned wood that had aged to a deep, warm sheen.³⁹

We may thus conclude that the paintwork Warmoes executed in the Hofkeshuis is a virtual display chart of all the proficiencies of a coarse painter. This salon is an unmistakable example of the work of a coarse painter who was perfectly capable of painting a complex decoration in its entirety, provided that he was able to use prints as his models.

Conclusions

In this paper, on the basis of Simis's handbook, archival records and the technical analysis of Warmoes's wall hangings, we have endeavoured to change the prevailing view of the position and working domain of the coarse painter - a profession about which very little was known, and one that has been much underrated in the literature on Dutch 17thand 18th-century art. Our aim was to show that his share in the decorative painting of the period was most important and that many of the Netherlands' surviving monuments benefited greatly from his efforts. The work of the coarse painter covered an extremely wide range: he could be a 'house painter' (huisschilder), but he was often also a 'decorative painter' (sierschilder). He was a man with two hats, which he wore when he was painting objects and when working on the interior and exterior decorations of houses and other buildings. The degree to which he was a 'house painter' or a 'decorative painter' would have differed from one individual to the next. Some coarse painters were masters of a particular skill to such a high standard that they could specialise in, for instance, the imitation of marble, gilding or painting coats of arms and signboards. Regardless of which hat suited him best, however, a coarse painter always had to deal with a client whose wishes he had to fulfil. If he painted decorations, they were never to his own design, but copied from or based on prints or the designs of an artist painter. Simple decorations were part of his repertoire, but if they were complex or part of a decorative programme that required a range of intellectual skills he followed the design of an architect or artist and worked

closely with him. Warmoes's example proved, however, that on occasion a coarse painter could also tackle difficult and elaborate decoration commissions entirely on his own – but never without prints to guide him.

Notes

- 1. This research is part of the five-year research project (2011–2016) led by Dr Margriet van Eikema Hommes, 'From Isolation to Coherence: An Integrated Technical, Visual and Historical Study of Seventeenth- and Eighteenth-Century Dutch Painting Ensembles', supported by the Netherlands Organization of Scientific Research (Innovational Research Incentives Schemes, Vidi-grant); see www.fromisolationtocoherence.nl. This project is based at Delft University of Technology. The Cultural Heritage Agency of the Netherlands and the Rijksmuseum are partners in the project. The paper was translated into English by Lynne Richards.
- 2. For all descriptions of the profession of 'painter' in the Netherlands see L. de Pauw-De Veen, *De begrippen 'schilder', 'schilderij' en 'schilderen' in de zeventiende eeuw,* Brussels, Paleis der Academiën, 1969. This book deals mainly with the artist painter; coarse painters are barely mentioned.
- 3. G.J. Hoogewerff, *De geschiedenis van de St. Lucasgilden in Nederland*, Amsterdam, P.N. van Kampen & Zn, 1947.
- 4. See, for example J.M. Montias, *Artists and Artisans in Delft: A Socio-Economic Study of the Seventeenth Century*, Princeton, Princeton University Press, 1982.
- For the records of the Leiden Guild of St Luke and for references to further reading see P. Bakker, 'Crisis? Welke crisis? Kanttekeningen bij het economisch verval van de schilderkunst in Leiden na 1660', *De zeventiende eeuw* 27(2), 2011, pp. 232– 269.
- 6. See, for example Montias 1982 (cited in note 4).
- 7. An exception is R. Jongsma, *Een onderzoek naar schilderingen in het 17de eeuwse binnenhuis*, MA thesis, University of Amsterdam, 1994, which looks in Chapter 2 at the part coarse painters played in wall and ceiling decorations and their collaboration with artist painters. Two studies on the coarse painter's trade were published simultaneously, but independently, in 2011: O. van der Klooster, *Van Leidse schilders mette groote quast. Historische buitenkleuren in de Sleutelstad*, Leiden, Primavera Pers, 2011; Bakker 2011 (cited in note 5).
- 8. S. van Hoogstraten, *Inleyding tot de hooge schoole der schilderkonst: anders de zichtbaere werelt*, Rotterdam, Fransois van Hoogstraten, 1678; G. de Lairesse, *Groot schilderboek*, Amsterdam, the heirs of Willem de Coup, 1707.
- 9. L. Simis, Grondig Onderwijs in de Schilder- en Verw-kunst, bevattende eene duidelyke onderichting in den aard, den oorsprong, sterkte en zwakte der verwen, olyeteiten, enz., het bereiden, en behoorlyk, of kwalyk gebruik derzelven, ook over het behandelen der werken, huizen en rydtuigen, gladhout- en marmer-schilderen, vergulden, verzilveren en metaalen als mede het verlakken en witwerken enz., 2 vols, Amsterdam, Hendrick Gartman, 1801 and 1807.
- 10. '[I]mmers heeft tot heden toe nog niemand de moeite op zig genomen, om iet belangryks over het schilderen van allerleie werken, en het bereiden der daartoe benodigde verwen, in het licht te geeven. Het is zoo dat sommigen, in vroegere en laatere tyden, het een en ander over het kunstschilderen geschreven hebben, doch geen van deezen heeft het schilderen van huizen, vertrekken meubelen, rydtuigen, en wat dies meer zy,

bepaaldlyk verhandeld, even als verdiende 't zelve geene aanmerking.' Simis 1801 (cited in note 9), p. 2.

- '[V]an onderscheidene soorten, elk naar zynen byzonderen aard, en volgens de meening van den eigenaar.' Simis 1801 (cited in note 9), p. 107.
- 12. Simis 1801 (cited in note 9), p. 110.
- 13. '[T]afels, stoelen en verdere meubelen, met bloemen, festonnen, vazen enz.' Simis 1801 (cited in note 9), p. 107.
- See, for example T.G. Kootte (ed.), *De bijbel in huis. Bijbelse verhalen op huisraad in de zeventiende en achttiende eeuw*, exh. cat., Rijksmuseum Het Catharijneconvent Utrecht, Zwolle, Waanders, 1991.
- 15. '[O]m [daarna] bloemen en fruijtstukken te maken, het zij voor schoorstenen of thee tafels en al waar geld mede te winnen was.' Regional Archive Leiden, library 254-41a (adversaria Leiden painters) *Lijste van Schilders, die binnen de Stad Leijden* geboren zijn, off aldaar gewoond en de kunst geoeffend hebben, unpublished late 18th-century manuscript by an anonymous author.
- '[T]en minsten het mat-goud en zilver, en hetzelve kunnen lacceeren, bronsen en metalen stroojjen'. Simis 1801 (cited in note 9), p. 110.
- M.L. Wurfbain, Stedelijk Museum De Lakenhal. Catalogus van de schilderijen en tekeningen, Leiden, Stedelijk Museum De Lakenhal, 1983, p. 213.
- 18. Information kindly provided by Richard Harmanni, who is working with Ige Verslype on a publication on the painted decorations in House De Dieu in Alkmaar as part of the project *From Isolation to Coherence* (see note 1).
- J.C. Weyerman, De levens-beschryvingen der Nederlandsche konst-schilders en konst-schilderessen, met een uytbreiding over de schilder-konst der Ouden, 4 vols, Dordrecht, Blussé & Zn, 1769, vol. 4, p. 17.
- 20. Simis 1801 (cited in note 9), p. 110.
- '[E]enig beeldwerk in het graauw of grijs te kunnen schilderen, en hetzelve in zijne behoorlijke proportie te kunnen verdeelen.' Simis 1801 (cited in note 9), p. 108.
- 22. Ibid., pp. 107-108.
- 23. 'Immers is er ook nog geene juiste affscheiding in de Schilderkunst te vinden, aanwyzende de plaats, waar eigenlyk het fynschilders werk ophoudt; geene andere, dan dat het fynschilderen zich wel voornamelijk bepaalt tot kunstwerken, die niet algemeen maar slechts door weinigen uitgevoerd kunnen worden, zoo als portraiten, land- en zee-gezigten, uitmuntende historiën, enz.' Simis 1801 (cited in note 9), p. 108.
- 24. Regional Archive Leiden, Notarial Archive, notary Wolff, inventory 1578, deed 87, 15 January 1692.
- 25. For example, the fact that Matheus van Pellekum, a highly successful coarse painter referred to several times hereafter, was sometimes described as an artist painter (*kunstschilder*) in a document was probably because he designed decorations himself. See A. Heppner, 'De verhouding van kunstschilder tot decoratieschilder in de 17e eeuw: Holsteyn en Van Pillecum', *Oud Holland* 61, 1946, p. 53. For an example of a decoration designed by him see A. Wassenbergh, 'Zolderschildering in het Gemeentehuis te Heerenveen door Matthias van Pelckum', *Oud Holland* 62, 1947, pp. 152–155. For the direct relationship between the concepts of 'art' and 'design', see H. Miedema, 'Kunst, Kunstenaar, kunstschilder. Een bijdrage tot de geschiedenis van de begrippen', *Oud Holland* 102, 1988, p. 74.
- 26. Bakker 2011 (cited in note 5), pp. 261–262.
- 27. Ibid., pp. 249–250, 266–267.
- 28. For the crisis in the art market after 1660, see Bakker 2011 (cited in note 5); M.J. Bok, *Vraag en aanbod op de Nederlandse kunstmarkt: 1580–1700*, PhD dissertation, Department of History, University of Utrecht, 1994.

- 29. Bakker 2011 (cited in note 5), pp. 254-257.
- 30. Heppner 1946 (cited in note 25), pp. 47-58.
- Amsterdam City Archives, Notarial Archives: notary C. van Poelenburgh, inv. 3435 (film 3487), fol. 265, 12 September 1672; and notary H. Venkel, inv. 3018, pp. 123–124, 12 October 1672. The last inventory is also partly transcribed in A. Bredius, *Künstler-Inventare. Urkunden zur Geschichte der holländischen Kunst des 16ten, 17ten und 18ten Jahrhunderts*, 7 vols, The Hague, Martinus Nijhoff, 1915, vol. 5, pp. 1699–1700.
- 32. This is not entirely certain. Johannes Post, like his father, was an architect and artist, although we know of almost no work by him. In archival records he is usually associated with decorative work, primarily as a gilder, and in theory he could have done all the work – including the design – himself. However, given that a number of deeds refer to collaboration with a coarse painter on other occasions, it is likely that he would also have taken on one or more coarse painters temporarily to work on the commission for Van Oudshoorn. Bredius 1915 (cited in note 31), vol. 5, pp. 1691–1712.
- 33. M. van Eikema Hommes and P. Bakker, 'Van de hoogachtbaerheyd en ontsachelijke grootheyd van het burgermeesterampt: Romeyn de Hooghes ontwerpen en schilderingen voor de burgemeesterskamer van het stadhuis van Enkhuizen (1707)', in H. van Nierop (ed.), *Romeyn de Hooghe: De verbeelding van de late Gouden Eeuw*, Zwolle, Waanders, 2008, pp. 222–243.
- J.W. Niemeijer, 'De ateliernalatenschap van het Rotterdamse schildersgeslacht Van Nijmegen', *Bulletin van het Rijksmuseum* 17, 1969, p. 60.
- 35. This paper discusses just a selection of the findings of this research. For an extensive discussion of all the results see M. van Eikema Hommes, K. Keune, P. Bakker and I. Verslype, 'Andries Warmoes's *Triumphal Procession* (1778) in the Hofkeshuis: a technical study of an exceptional painted wall hanging', in A.

Wallert (ed.), *Postprints of the Painting Techniques Conference, Rijksmuseum 2013*, in production; and M. van Eikema Hommes and P. Bakker, 'To overcome without fighting: the meaning of a painted wall hanging (1778) in the Hofkeshuis in Almelo [with an appendix on the life and oeuvre of the painter Andries Warmoes]', in *Oud Holland*, to be published in 2016.

- 36. Warmoes was born in 1748 in Venlo where he presumably also received his training as a painter. In the 1770s he worked in Twente. Around 1785 Warmoes was active in the Zaan region, north of Amsterdam; in or before 1787 he left for Texel where he stayed several years. Shortly before 1790 he moved back to the Zaan region, where he was buried in 1793. See appendix in Van Eikema Hommes and Bakker (cited in note 35).
- H. Quellinus, Van de voornaemste Statuen ende Ciraten, vant konstrijck Stadhuys van Amstelredam, tmeeste in marmer gemaeckt, door Artus Quellinus, Beelthouwer der voorseyde stadt, 2 vols, Amsterdam, 1655 and 1663, vol. 2, pp. XLVI–LII.
- As will be argued by Eikema Hommes and Bakker (cited in note 35).
- 39. Simis 1801 (cited in note 9), pp. 241-242.

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A 'PAINTED CHAMBER' IN BEVERWIJK BY JACOBUS LUBERTI AUGUSTINI: NOVEL INSIGHTS INTO THE WORKING METHODS AND PAINTING PRACTICES IN A PAINTED WALL-HANGING FACTORY

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ABSTRACT The restoration of the 'painted chamber' in Beverwijk by Jacobus Luberti Augustini instigated an in-depth technical study of the room and its painted canvas wall hangings. Through close observation with the naked eye, ultraviolet light, infrared reflectography and the study of paint samples in combination with art historical and archival research and information from contemporary art technological sources, insights were provided into the production practice of an 18th-century painted wall-hanging factory (a so-called *behangselfabriek*, a large workshop in which several painters worked together on painted wall hangings under the supervision of one painter). Research showed that within the same room different types of canvas and grounds were used. The canvases were prepared in the workshop in such a way that seams would not be visible, following the instructions of Lambertus Simis as cited in his painting treatise of 1801. Infrared reflectography and the study of the painting technique revealed various types of underdrawing and painting methods, demonstrating the different hands that worked on the ensemble. To guarantee the overall unity and ensure the optical illusion of the painted ensemble, several measures were taken such as indications of the same level of the horizon throughout the individual landscape paintings, working instructions inscribed on the reverse of the canvases, and painting the canvas borders surrounding the landscape paintings and wooden panelling in the room all at once *in situ*.

Introduction

Christiaan Sepp, author of the 1902 city guide for Beverwijk, a small town in the north of the Netherlands, states that a walk on one of its main streets, the so-called Breestraat 'is made so much more pleasant because of the high-end shops and elegant houses on both sides'.¹ Although unfortunately these high-end shops are now regular chain stores and most of the elegant houses have not stood the test of time, the mid-18th-century house at Breestraat 101, is still standing today (Fig. 1). The building, commissioned by Pieter Lourisz Stelt (1690–1777), a brewer and merchant of vinegar, was constructed from two adjacent early 17th-century houses. After his death, his son Lourens Stelt (1736–1784), also in the vinegar trade, inherited the house and probably ordered the redecoration of the salon on the ground floor situated at the right side of the main entrance.² The entire room was decorated with painted

canvas wall hangings from the wooden panelling up to the original stucco ceiling. In the centre of the latter, the dove of peace surrounded by rays of divine light is depicted, with ornaments in the four corners representing the allegories of Trade, Jurisprudence, Religion and Freedom. Five large-scale colourful canvases on the walls depict Dutch landscapes in which figures walk, fish and rest. In between the windows and next to the period marble fireplace, smaller canvases show painted garlands symbolising the Sciences and Arts, while above two built-in cabinets, painted medallions in grisaille portray the busts of Bacchus and Ceres. Peace, Freedom and Prosperity are represented by painted putti in grisaille on the canvases above the three doors (Fig. 2). The practice of oil painting on canvas wall coverings for domestic residences of the well-to-do bourgeoisie started in the Netherlands in the second quarter of the 17th century and became fashionable in the last guarter of that period. The so-called 'painted



Fig. 1 Breestraat 101, Beverwijk. (Photo: Rijksdienst voor Cultureel Erfgoed.)

wall hangings' (*geschilderde behangsels*) were originally referred to as 'salon pieces' (*zaalstukken*), 'painted chambers' (*geschilderde kamers*) or 'chambers in the round' (*kamers in 't rond*).³ In the course of the 18th century, painted wall hangings became so popular that large-scale workshops, called 'painted wall-hanging factories' (*behangselfabrieken*),⁴ were established in which several painters worked together on painted wall hangings under the supervision of one painter.

In 2011, a much needed renovation of the building at Breestraat 101 and conservation treatment of the painted ensemble was started. The weakened structure of the property had caused serious damage to the construction of the 'painted chamber', almost leading to the collapse of the ceiling and resulting in extensive deformations in the original supports of the painted wall hangings and tears in the canvases and substantial paint loss.⁵ The restoration instigated an in-depth technical study of the 18th-century ensemble. As the canvases had never been removed from the walls and were barely treated in the decades since their conception, the Beverwijk room provided an exceptional source of information on the techniques used for these painted rooms. As such, this research provides novel insights into the working methods and painting practices of an 18th-century factory of painted wall hangings. This information is crucial for the conservation and awareness of this rare, but unfortunately often neglected and endangered part of our cultural heritage.⁶

Changed appearances of the 'painted chamber'

The original appearance of the Beverwijk 'painted chamber' has changed over the years as commissioning patron Lourens Stelt, his descendants and subsequent owners have put their



Fig. 2 The 'painted chamber', Breestraat 101, Beverwijk: (top left) northwest wall with painted garlands depicting allegories of *Geometry*, *Music* and *The Art of Painting*; (top right) northeast wall with painted wall hangings adorned with landscapes and overdoors depicting *Peace* and *Freedom*; (bottom left) southeast wall with landscapes, overdoor representing *Prosperity* and medallions depicting the busts of *Bacchus* and *Ceres*; (bottom right) southwest wall with painted garlands depicting *Astronomy*, *Sculpture* and *Architecture*. (Photos: R. Gerritsen for Stadsherstel B.V.)

own stamps on it. Research into the different appearance of Dutch historical interiors over time has shown how dramatically these alterations can change the character of an interior and that occurrences of these interventions can be numerous.7 Although, as stated earlier, the number of intrusions into the 'painted chamber' of Beverwijk are limited, the impact on its original form should not be underestimated. Currently, the look of the chamber is dominated by the intrusive, rather glossy and solid pink colour of the woodwork, the upper part of the mantelpiece, the borders around the painted landscapes and the backgrounds of the painted garlands. Historical paint research and analyses of paint cross-sections from the different elements have shown that the original finish of the now pink-coloured areas consisted of a light lilac colour with a deep purple paint used for accents and shadows.⁸ The pink paint used to cover the original lilac and purple finish is quite thick and glossy, resulting in a much more smooth and dense surface than was originally intended. That the original lilac and purple finish would have given the room a more lively appearance is, for instance, visible in an old cleaning test in the border of the left landscape painting of the northeast wall (Fig. 3).

The application of the pink overpaint was not limited to the borders of the landscapes and the woodwork but was also applied over the original subtle lilac backgrounds of the painted garlands. Sometimes a small edge of original paint



Fig. 3 Old cleaning test in the pink border of the painted landscape on the northeast wall showing the lilac and purple colours of the original finish, now covered with a solid, rather heavy and glossy pink paint layer.

has been left exposed around the garlands but in other places the pink paint continues beyond the edges of the original contours. During examination of the room it became evident that the pink paint of the background of the garlands on either side of the chimney did not cover an earlier paint layer; rather, it was applied directly on top of the ground layer. Examination of paint cross-sections has shown that the pink paint of the canvases flanking the chimney and the pink paint in the rest



Fig. 4 (a) Cross-section from a shadow in the background of *The Art of Painting*, (left) darkfield illumination, (right) ultraviolet light. Layers 1–6 are part of the original paint layers. The following layers are part of the intervention in the room in which the chamber was painted a glossy pink. Layers 8 and 9 are similar to the paint layers used for the pink background in the later addition at the left side of the chimney (see (b) layer 3 and 4).(b) Cross-section from the pink background in the later added garland depicting *Sculpture*, southwest wall, left side of the chimney, darkfield and ultraviolet light. The two paint layers (layers 3 and 4) of the pink background are painted directly on top of a double ground. They are similar to the paint that covers the original background in *The Art of Painting* (see (a) layers 8 and 9).

of the room has the same build-up and composition (Fig. 4).9 Since the other garlands all have the lilac-painted background underneath the pink overpaint, this indicates that the pieces flanking the chimney must have been added when the room was painted pink. It is possible that, at the time this was done, these canvases were so damaged that they had to be replaced completely. Sample analysis has revealed that the grounds of these later added canvases contain large amounts of barium sulphate, indicating they were most likely added at some point from the early 19th century onwards.¹⁰ The same ground was also found in the portrait of Ceres above the built-in cabinet. This medallion and the garlands bordering the chimney were all painted on finely woven canvas supports, in contrast to the other (original) canvases in the room.¹¹ Three canvases were thus added at a later date at the same time that the pink paint was applied, and although at first sight they blend in well with the other paintings, on close examination they clearly show a different painting technique.

Jacobus Luberti Augustini

The signature on the three overdoors – 'J.L. Augustini' – indicates that they were made by the Haarlem painter Jacobus Luberti Augustini (1748–1822). Jacobus was trained in the flourishing painted wall-hanging factory of his father, Jan Augustini (1725–1773), located in Haarlem. Besides decorative paintings, several drawings and portraits are known by Augustini junior, among them the large-scale portrait of the regents of the Amsterdam Lepers' House, dated 1773 (Fig. 5). Roeland van Eynden (1747-1819) and Adriaan van der Willigen (1766–1841), the earliest biographers of Jacobus, specifically praise his allegories painted in grisaille as if they were stone reliefs, the likes of which we see represented in the overdoors of the Beverwijk chamber. The biographers also state that Jacobus eventually put his palette and paintbrushes aside and became a tax collector in Haarlem, thereafter followed by a profession in book publishing. $^{\mbox{\tiny 12}}$ As the latest known dated painting by Jacobus is the 1778 portrait of Dirk Veegens,¹³ it was sometimes assumed that he quit his painting career shortly after this year.¹⁴ In 1778 the young painter, however, became the owner of the factory founded by his father: in June of that year he bought the house with the painted wall-hanging factory, including all materials, paints and tools belonging to it, from his mother, who had managed the property since the untimely death of her husband in 1773.15 As Jacobus even took out a loan to obtain the funds to buy the house and studio, it seems unlikely that he would have abandoned his investment shortly after 1778.¹⁶ It is not known how long Augustini junior continued operation of the painted wall-hanging factory, but the workshop must have been up and running until at least 1782. This is evident as in April of that year, an advertisement in the newspaper De Oprechte Haarlemse Courant announced that one or two painters of good conduct and specialised in the painting of still-lifes and/ or antique ornaments, who would like to work in a painted wall-hanging factory in Haarlem, can address Jacobus Luberti Augustini there. Painters who were interested in applying for the position were furthermore asked to bring some examples



Fig. 5 Jacobus Luberti Augustini, *The Four Regents, the Secretary and the House Father of the Lepers' House of Amsterdam*, 1773, canvas, 176 × 212 cm, signed and dated, lower left: *Jacob Augustini Luberti / Pinx. 1773.* Rijksmuseum Amsterdam, inv. no. SK-C-586.

of their work.¹⁷ Jacobus may have continued to run the factory beyond 1782, or at least continued his painting career in some way, as he is noted as a painter on a members' list of the Haarlem Guild of St Luke dated 1788–1798. This list is ordered by street name and mentions Jacobus as a resident of three different addresses, indicating that he continued his work as a painter for some time, possibly even some years, after 1788 (the starting date of the list).¹⁸ After Jacobus's address at the Koningstraat, the note *uytgeschye* (quit) appears, indicating that he abandoned his membership of the Guild of St Luke and his professional career as a painter. It is not known when this happened but we do know that Jacobus eventually went on to choose a career in book publishing and as of 1799 he was primarily active in this trade.¹⁹

Technical research as an aid in the study of production techniques of a painted wallhanging factory

Little is known about the production methods of painted wall hangings in the 18th century and when discussed in the literature, these studies do not make use of object-based research, relying mostly on archival sources.²⁰ The restoration of the 'painted chamber' in Beverwijk made an in-depth technical study of the painted wall hangings possible. As the canvases had to be removed from the room for treatment, close observation with the naked eye, under magnification and with the

use of ultraviolet light and infrared reflectography of both the front and reverse of the wall hangings was possible in the conservation studio. To study the materials used and the build-up of the ground and paint layers, several paint samples were taken.

The canvas support: materials used, stretching and priming

Usually the edges of canvases are the most vulnerable to damages and as such have often been lost, taking with them evidence of the original method of stretching. In the Beverwijk room, however, these traces, such as original tacking edges, tacking holes, seams and cusping, have been preserved. This exceptional condition allowed for a reconstruction of the original late 18th-century method of stretching and preparation of the painted wall hangings.²¹ Although one might expect a similar use of materials and preparation of the canvas supports within one painted ensemble, technical research of the Beverwijk room revealed the use of a diversity of materials and techniques.

For the original painted wall hangings two different types of canvas were used. All overdoors and the original medallion with the bust of *Bacchus* were painted on single pieces of canvas of a medium weave, with a density of approximately 13 horizontal threads (warp) and 11 vertical threads (weft)/cm. The large landscapes and the original garlands, however, were painted on a very open-weave canvas with approximately 6



Fig. 6 Jacobus Luberti Augustini, *Allegory on Peace*, canvas, 96.5 × 121 cm, signed, lower left: *J:L: Augustini / Pinxit*. Overdoor, northeast wall, 'painted chamber', Beverwijk.

horizontal threads (weft) and 7 vertical threads (warp)/cm and were constructed of vertical strips of canvas sewn together.

None of the three canvas supports of the overdoors show clear primary cusping and as the ground continues up to the edges of the supports, they must have been cut from a larger pre-primed canvas. The composition of the beige ground of all three overdoors is the same and was applied in two layers. The first somewhat brownish layer contains earth pigments mixed with some lead white and is followed by a thin creamcoloured layer containing mostly lead white with some chalk and earth pigments. After cutting the overdoor pieces from the larger pre-primed canvas, they were stretched over a stretcher or strainer in order to be painted. This is evidenced by the unpainted but primed tacking edges of all three overdoor canvas supports (Fig. 6). After painting, the canvases were removed from their temporary stretchers or strainers, the tacking edges were unfolded and the canvases were nailed flat onto the wooden planks attached to the walls. A slightly raised edge in the canvas support where it was folded over the temporary stretcher or strainer can still be discerned in the overdoor supports. After installation the tacking edges of the overdoors were covered with small wooden strips.

Although the same type of canvas used in the overdoors was also employed for the medallion above the built-in cabinet of the southeast wall, a different ground was applied. The canvas for the medallion was also prepared with two ground layers. The bottom brownish ground layer consists of clay with some remarkable fibres, coated with a solid white paint,²² mixed into the layer. This lower layer is followed by a thin white layer of lead white and chalk. Not only does the

preparation of this canvas differ from that of the overdoors but the mode of attachment to the wall varies. Instead of being attached with nails, the medallion is glued on top of the wooden planks of the built-in cabinet. Before pasting, the canvas support of the medallion was cut exactly to the shape of the carved wooden opening of the cabinet.

While the supports of the overdoors and medallion consist of single pieces of canvas, the supports of the landscapes and garlands were constructed from several vertical strips of canvas. These strips of canvas were sewn together at the selvedges with a simple overcast stitch. The selvedges were laid 'flat' against each other and as such did not create a hem on the back of the canvas. From the selvedges it can be deduced that the width of the canvas roll was approximately 89 cm. The fact that cusping is visible on some but not all edges of the individual landscapes and garlands indicates that the supports were not primed in their final format size but must have been cut from larger pieces of primed canvas. At outer edges that show clear cusping, pieces of bare unprimed canvas can sometimes be discerned with tacking holes corresponding to stretching for priming. Furthermore these edges display tacking holes that either derive from attaching the canvases to the wall, or from the nails that were used to attach the wooden slats covering the tacking edges. There are no traces indicative of a second restretching of the canvases after priming and before painting. At the edges without cusping, traces of restretching after priming are also missing and show only nail holes that derive from attaching the canvases to the walls or from the wooden slats covering the tacking edges. This implies that the canvases used for the landscapes and garlands



Fig. 7 Top: individual original canvases in order of their placement in the 'painted chamber', starting at the left side of the northeast wall. Clear cusping is indicated with a wavy red line, slight cusping with a wavy blue line. The white vertical dotted lines represent seams in the canvases. Bottom:three reconstructed large-scale canvases of approximately 289×268 cm from which the individual pieces must have been cut after priming and painting.

were not only primed on large stretchers, but also painted on these frames: more than one painting would have been executed on the large primed canvas, then later cut and separated. Assuming that only paintings for this project were painted on the large primed format, an attempt was made to reconstruct the positioning of the individual canvases within the larger format. Using as a guideline the fact that the roll width was approximately 89 cm and that primary cusping only appears at the outer edges of the larger canvas (and not at the cut edges), this reconstruction shows that the canvases were probably primed in large-scale formats of approximately 289 (the height of the canvases) \times 267 cm (a roll width of 89 cm \times 3) (Fig. 7).²³ The reconstruction fits three large-scale canvases. The two original garlands that do not fit in this reconstruction must have been cut from a fourth large-scale canvas, together with the original canvases flanking the chimney.

The priming used for the canvases of the landscapes and garlands is thick and completely penetrates the open weave of the fabric, such that the canvas is totally embedded in ground on both the front and the reverse. The ground consists of three layers: the first two layers are thick and contain mainly clay, while the upper off-white layer is thin and consists of mostly lead white with the addition of some chalk (see Fig. 4a).²⁴

This type of canvas preparation is completely in line with that recommended specifically for painted wall hangings by Lambertus Simis (1754/5–after 1809) in his treatise *Grondig Onderwijs in de Schilder- en Verw-kunst.*²⁵ Simis's publication is the only known Dutch art technological source that deals specifically with the preparation of the support for painted wall hangings. For behangsels he advises the use of an open-weave canvas (in contrast to the more finely woven canvas recommended for easel paintings), sewn together in as many vertical strips as needed. He then recommends that the canvas be stretched on a stretcher larger in size than the canvases, which can be expanded. Two layers of clay priming are then applied. These layers, after drying, should be sanded with pumice stone after which a final ground layer 'to your liking' ('naar goedvinden') can be added.²⁶ Prepared in this way you will have a canvas support, Simis explains, 'without the seams being visible' ('zonder dat de naden gezien kunnen worden').27 And indeed even today it is difficult to distinguish the location of the seams in these canvases, an important feature for this type of painted wall hanging, where a paint surface undisturbed by seams contributes to the intended illusion of windows opening onto sunny Dutch landscapes.

The practice of preparing canvases for painted wall hangings in the workshop itself was common in large-scale *behangselfabrieken*. The heavy and time-consuming work of priming and stretching large canvas supports was delegated to pupils in the studio. In the contract of painter Jacob Cats (1741–1799), for instance, who worked for several years in the vast, Amsterdam-based, painted wall-hanging factory of Jan Hendrik Troost van Groenendoelen (1721–1794), the task of priming and stretching canvases was explicitly



Fig. 8 Infrared reflectogram of the landscape on the right side of the northeast wall. The arrow at the right points to the underdrawing line used to indicate the horizon. The arrows at the left indicate perspectival underdrawing lines.



Fig. 9 Detail of the garland depicting *The Art of Painting*. In the infrared reflectogram at the right a portrait is visible, which was not executed during the painting process.

stated.²⁸ Pre-primed canvases for wall hangings could also be purchased ready-made from workshops that specialised in the manufacture of these products. Announcements in 18th-century newspapers reveal that there were numerous shops supplying these pre-primed supports. These types of shop must have supplied prepared canvases to painters without a large workshop, such as the Amsterdam *behangselschilder* Jurriaan Andriessen (1742–1819), who was assisted only by his brother and a few pupils who worked in his studio.²⁹ Unfortunately no archival sources are known that give us information on the organisation of Jacobus Luberti Augustini's factory, and how many pupils and assistant painters he had working for him over the years. The fact that the coarsely woven canvases for the Beverwijk chamber were primed in his studio, however, suggests that he would have had considerable assistance and that the scale of his workshop was probably substantial.

The design process: preparatory sketches and instructions for painting

After stretching and priming the canvases, the next phase in the process would begin: the compositional planning of the wall hangings. To gain more insight into this phase, the painted wall hangings were investigated with infrared reflectography (IRR), revealing several different types of underdrawing.³⁰

The infrared reflectograms of the overdoors showed an underdrawing for the architectural borders of the composition, applied in what appears to be a dry medium. Underdrawing in the figures however was not detected – possibly a material was used that cannot be made visible with IRR such as white or red chalk. In the large landscapes a similar



Fig. 10 Jurriaan Andriessen, *Elevation of one of the walls for the dining room of D. Luden*, 1785, watercolour and graphite on paper, 17.1 × 44.4 cm, Rijksmuseum Amsterdam, inv. no. RP-T-001124.

rudimentary underdrawing in a dry medium could be made visible. Here the outer edges of the rectangular picture field were drawn as well as indications for the bay leaf borders. In all the landscapes, a line for the horizon (approximately 50 cm from the bottom edge of the canvas) was detected, as well as a few construction lines in aid of correct perspective (Fig. 8). In contrast to the basic and sparse underdrawing of the overdoors and landscapes, a surprisingly elaborate underdrawing in what appears to be a dry medium was detected in the garlands and the original medallion. Sketchy lines were used to delineate the forms. Shaded areas were fully indicated with freely drawn cursory lines and even the contours of the cast shadows in the original background (now covered with the pink overpaint) were indicated. This underdawing was precisely followed during the painting process with the exception of small deviations in contours and two remarkable omissions in the garlands symbolising Astronomy and *The Art of Painting.* The pages of the open book in *Astronomy* are left blank in the final painting, while the infrared reflectogram revealed that in the underdrawing phase, planets with their orbits were indicated on these pages. The Art of Painting infrared study showed a portrait drawn en profil in the painter's palette (Fig. 9). Intriguingly, just like the planets in Astronomy, this portrait was never executed during the painting process. In the picture of Bacchus, a similar elaborate underdrawing was detected with lines indicating the borders of the medallion, a vertical line running through the centre of the medallion and sketchy lines delineating the head, facial features, hair and leaves in the hair of the figure.

The variations in the amount of underdrawing in the different pieces could be the result of different hands working within the same workshop on one ensemble. As painters often had a speciality, such as the painting of flowers or antique ornaments, it is not unlikely that each painter had his own way of working. Regardless of the quantity of underdrawing, the underdrawing that was observed in all of the pieces contributes at all times to the overall unity of the pictures by marking those elements that are crucial for the cohesion of the ensemble and



Fig. 11 Detail of the reverse of the overdoor depicting *Allegory of Peace* with inscription in white chalk: *Regts Ligt* (right light).

the suggestion of an optical illusion, such as the indication of the horizon on the same level in every landscape picture.

Apart from the underdrawing functioning as a guide during the painting process, there must have been a separate overall design drawing outlining the layout and composition of the 'painted chamber'. Although such designs by Jacobus Luberti Augustini are not known, many designs from other painters have survived and provide an indication of how these would have looked. For instance, numerous examples of designs for painted chambers by the previously mentioned behangselschilder Jurriaan Andriessen exist. These drawings served both as an example for the commissioning patron and as a working document for the painter. In the design Andriessen produced for the dining room of Dirk Luden at Keizersgracht 105 in Amsterdam (Fig. 10), the painter made several notes that relate to the size and location of the painted wall hangings, as well as clear indications of the direction of the natural light in the room. In the illustrated design for one of the walls for Luden's dining room, the light came from the left side as can clearly be seen from the indicated cast shadow of the chimney. Incorporating the natural light source of the



Fig. 12 Detail of the figures from the landscape painting on the left side of the southeast wall.

room into painted wall hangings was an important aspect in these decorative schemes as this strongly contributed to the optical illusion of the painted chamber. Although a design like this has not survived for the Beverwijk chamber, inscriptions on the reverse of the canvases are evidence that in this room similar working instructions were used. Several different instructions were noted in white chalk on the reverse of the canvases and just as in Andriessen's design for Luden's dining room, they refer to dimensions, note the location of the canvases or indicate the direction of the light. For example, on the back of the support of the landscape on the right side of the northeast wall 'tegen de dwarsgang' (against the transverse corridor) is written, indicating the location of the canvas within the room. On the same canvas support, the note '4 voet en 3¼ duim' (4 feet and 3¼ thumb) corresponds to the width of the rectangular picture field. On the back of several canvases, both on the overdoors as well as on the landscape paintings, inscriptions indicating the light angle can be found.³¹ For instance on the reverse of the overdoor depicting Peace the inscription reads 'Regts Ligt' (right light) (Fig. 11). It is remarkable that the light is stated as coming from the right, while the light in the painting is depicted as coming from the left (see Fig. 6), in line with the actual direction of light in the room. Throughout the 'painted chamber' the indication of the light on the reverse of the canvases is opposite to that of the painted direction of the light and the actual light angle in the room. So far, no satisfactory explanation has been found for this discrepancy and it is tempting to think that the artist just

confused left with right. However one interprets the indications of the angle of light, the instructions must have been clear for the employees in the studio as the painted light corresponds with the direction of the natural light throughout the 'painted chamber'; an important feature that contributes to the sense of illusion.

Paint layers: diversity in style and techniques

After the underdrawing phase was carried out, the actual painting process began. Just as different types of underdrawing were observed, diverse hands can be distinguished in the execution of the paintwork. The overdoors were painted from dark to light, following a free and confident initial sketchy layin, applied in dark, fluid, brown lines and some translucent washes. White paint was subsequently applied in thin layers for the midtones, leaving the underlayer and first sketch to show through in varying gradations. For the lightest areas and highlights the white paint was applied more thickly in opaque layers, showing some pastose brushwork.

In contrast to the confident technique of the overdoors, the garlands were painted with rather stiff brushstrokes, closely following the elaborate underdrawing. Throughout the picture the paint was applied in what appears to be one or two, thick, opaque and rather flat layers resulting in limited modelling. In a final stage, basic details such as thin lines of paint to indicate the strings of the musical instruments were added with slightly pastose white paint. A similar technique is visible in the picture of Bacchus. Here also, the paint closely follows the underdrawing and shows a comparable, rather stiff way of painting.

The landscapes were painted in a systematic, layered way. The sky and foreground were painted first with somewhat coarse, vigorous brushstrokes. The trees were painted over the completed sky, as is clearly visible in raking light. Initially the large tree trunks and branches were painted, after which the leaves were added. The figures were painted in a final stage after the background was completely finished, including the highlights and fine details, which is clearly visible in slightly translucent areas of the upper paint layers where the earlier painted background shows through the figures (Fig. 12).

The figures in the landscape exhibit remarkable similarities with those in Augustini's large paintings of the regents of the Lepers' house. Although one has to be careful about drawing conclusions from the comparison of almost life-size figures with the many small figures in the landscapes of the Beverwijk room, there are evident parallels between them. In both pictures the figures are elegant and remarkably elongated with typical, slightly egg-shaped heads and heavy eyelids. Folds in the draperies are indicated with rather rounded shapes in both works, with high contrast between lit and shaded areas. These similarities suggest that it must have been Augustini who painted the figures in the landscape.

The difference in painting techniques suggests that at least two painters worked on the wall hangings under the supervision of Augustini: one painter who was in charge of the garlands and the medallion and the other who was responsible for the landscapes. The figures would then have been added to the landscapes in the final stages by Augustini, who was also responsible for the signed overdoors.

Onsite installation of the painted wall hangings

After finishing the paintings in the Haarlem *behangselfabriek*, the canvases were transported to the room in Beverwijk and nailed into place on the wooden slats or planks on the walls. It is possible that Augustini and/or one of his employees was responsible for this, but it could also have been carried out by a professional 'wallpaperer' (*behanger*). It is known, for instance, that the painted wall hangings for the three adjacent rooms in Loenersloot Castle attributed to the Augustini workshop, were installed by the professional wallpaperer C.V. Bree, in February and September of 1774, as can be deduced from the original invoice that has survived.³²

After installation, the edges of the canvases were covered with small wooden battens. At this point changes could still be made to the paintings *in situ*. This is beautifully illustrated by one of the interesting drawings from the illustrated diary of artist Christiaan Andriessen (1775–1846), son of Jurriaan Andriessen. In a drawing dated 9 August 1805 we see Christiaan making adjustments on already installed painted wall hangings. The entry in the diary reads: 'this part I still do not like' ('dit staat me niet aan dat').33 Whether or not Augustini or one of his employees made changes to the paintings in situ could not be established. What is clear, however, is that the original lilac borders of the landscapes were painted in situ together with the woodwork. Paint samples from the wooden panelling indicate that the original lilac finish of the woodwork has a similar build-up and composition of the paint layers as that of the lilac borders of the landscapes. As this paint is not apparent on the edges of the canvas that were covered with the original wooden strips around the edges, the borders and woodwork must have been painted onsite in one campaign. It is likely that this was done by one of the employees of the Augustini factory. There are several known examples of workers from the behangselfabriek, for instance those of the aforementioned factory of Troost van Groenendoelen, who also painted the woodwork surrounding the painted wall hangings.³⁴ The fluid transition of the painted canvas borders with the painted woodwork contributes greatly to the optical illusion of the 'painted chamber' and visitors to the Beverwijk room would experience the landscape paintings as windows through which they could gaze across beautiful Dutch landscapes.

Conclusions

The study of the 'painted chamber' in Beverwijk revealed that throughout its production a number of measures were taken to ensure the optical illusion of the room: from preparing the canvas supports in such a way that the seams would be invisible and indicating the horizon in the underdrawing stage to ensure it was painted at the same level in all the individual landscapes, to painting the canvas borders and the wooden panelling in the room concurrently with the same paint. In the behangselfabriek several painters worked under the supervision of Jacobus Luberti Augustini and although this is not clear at first sight, technical study has revealed the presence of several hands, as evidenced by the diverse underdrawing and painting techniques. The execution of the decorative scheme and the overall unity of the works, carried out by multiple hands, was assisted by several working instructions, such as indications of the direction of the natural light and notations regarding the placement and dimensions of the individual canvases. It is hoped that with the treatment and accompanying technical study of the Beverwijk room, the 'out-of-doors' experience of this indoors setting, as conceived by the Augustini behangselfabriek more than two centuries ago, is once again restored and safeguarded for the future.

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Notes

- 1. '[W]ordt in hooge mate veraangenaamd door de nette winkels en deftige woonhuizen aan weerskanten'. *C.* Sepp, *Gids voor Beverwijk en omstreken*, Beverwijk, 1902, p. 11.
- 2. A. Schweitzer, 'Het herenhuis en zijn bewoners', in A. Schweitzer and A. van Dongen (eds), *De Pastorie in de Breestraat. Nieuwe inzichten in de geschiedenis van Beverwijk. Historische Reeks Midden-Kennemerland*, 4, 2014, pp. 85-144, esp. pp. 114-122.
- 3. M. van Eikema Hommes, *Art and Allegiance in the Dutch Golden Age: The Ambitions of a Wealthy Widow in a Painted Chamber by Ferdinand Bol,* Amsterdam, Amsterdam University Press, 2012, p. 15.
- For a discussion on the development of painted wall-hanging factories (*behangselfabrieken*), see R. Harmanni, *Jurriaan Andriessen (1742–1819): 'behangselschilder'*, 4 vols, PhD dissertation, Leiden University, 2006, esp. pp. 154–167.
- 5. Breestraat 101 in Beverwijk was acquired by Stadsherstel BV Amsterdam in 2011. This company restores and renovates monumental buildings and seeks appropriate reuses for the historical properties. The treatment of the painted salon was conducted by Rescura which employed Johanneke Verhave to direct the conservation and restoration of the canvases. The complete conservation team consisted of Johanneke Verhave, Susan Smelt, Marjan de Visser, Josien van de Werf, Herman van Putten and interns Annemieke Heuft, Hinke Sigmond and Martine Posthuma-de Boer.
- 6. This study is part of the five-year research project 'From Isolation to Coherence: An Integrated Technical, Visual and Historical Study of 17th and 18th century Dutch Painting Ensembles' supported by the Netherlands Organization for Scientific Research. The project is based at Delft University of Technology and led by Dr Margriet van Eikema Hommes. For information on the project and its research team, see www.fromisolationtocoherence.nl (accessed May 2015).
- 7. See, for examples of changed appearances of historical interiors, R. Jongsma and M. de Keijzer, 'Keuzes voor het behouden, conserveren, restaureren of reconstrueren van het kleurgebruik in achttiende-eeuwse interieurs', in M. Vasques Dias (ed.), 18e-eeuws neoclassicisme in Nederland. Meubel en interieur à l'antique. Handelingen Achtste Nederlandse Symposium Houten Meubelrestauratie. Stichting Ebenist, Haarlem 2 oktober 2009, Amsterdam, Stichting Ebenist, 2009, pp. 68–81.
- 8. Paint samples were imbedded in Technovit 2000 LC and dry polished with Micro-Mesh. Scanning electron microscopy with energy dispersive X-ray (SEM-EDX) spectroscopy was carried out with a JEOL JSM 5910 LV scanning electron microscope (SEM) and Noran Vantage EDX spectroscopy system with Pioneer Norvar detector. Backscattered electron (BSE) images of the cross-sections were mostly taken at 20 kV accelerating voltage, at a 10 mm eucentric working distance. Prior to SEM-EDX analysis, samples were gold coated to improve surface conductivity. Historical paint research of the painted room in Beverwijk was done by drs. Judith Bohan. J. Bohan, *Rapportage verkennend kleuronderzoek interieur voormalige R. K. pastorie Breestraat 101 te Beverwijk*, unpublished report, 2012, esp. pp. 19–23.
- 9. Sample analysis of a cross-section from a shadow in the background of *The Art of Painting* (see Fig. 4a) shows the following build-up of paint layers (underlined elements were detected in high quantities): 1. First clay ground (<u>Si, Al, Fe</u>, Ti, K, Mn); 2. Second clay ground (<u>Si, Al, Fe</u>, Ti, K, Mn) with the addition of lead white (<u>Pb</u>) and chalk (Ca); 3. Third cream ground layer containing lead white (<u>Pb</u>) and chalk (Ca); 4. Lilac paint layer (part of the original background of the garland) consisting of a

mixture of lead white (Pb), chalk (Ca) and iron oxides (Fe, Si); 5. Purple paint layer (part of the original background of the garland) containing lead white (Pb), chalk (Ca), iron oxides (Fe, Si) and a small addition of a blue pigment (Prussian blue?) (Fe, K, Al, Cl); 6. Brown organic glaze containing carbon black (C, Al, Si, Na, Ca, Mg, K, S). On top of this layer a 'lead crust' has developed (Pb, K, S), indicating an end phase. The following layers are part of the intervention in the room in which the chamber was painted a glossy pink; 7. Thin pinkish (?) layer containing lead white (Pb) and chalk (Ca); 8. Pink paint layer containing very fine and compact lead white (Pb), some chalk (Ca) and some finely ground red iron oxides (Fe, Si), mixed with some barium sulphate (Ba, S). 9. Pink slightly translucent paint layer containing very fine and compact lead white (Pb), some chalk (Ca) and some finely ground red iron oxides (Fe, Si). Layers 8 and 9 are similar to layers 3 and 4 in the cross-section from the pink background in the later added garland depicting *Sculpture* (see Fig. 4b). 10. Thin brown glaze consisting of earth pigments, with the possible addition of some lead white (Fe, Al, Si, Ca, Pb); 11. Thin varnish layer, clearly fluorescent in UV light. The crosssection from the pink background in the later added garland depicting Sculpture, southwest wall, left side of the chimney (see Fig. 4b) shows the following build-up: 1. First ground containing clay (Si, Al, Fe, Ti, K); 2. Second ground layer containing mostly barium sulphate (Ba, S), lead white (Pb), chalk (Ca) and a small addition of iron oxides (Fe, Si); 3. Pink paint layer containing very fine and compact lead white (Pb), some chalk (Ca) and some finely ground red iron oxides (Fe, Si), mixed with some barium sulphate (Ba, S); 4. Pink slightly translucent paint layer containing very fine and compact lead white (Pb), some chalk (Ca) and some finely ground red iron oxides (Fe, Si). Layers 3 and 4 are similar to layers 8 and 9 in the cross-section from the background of The Art of Painting (see Fig. 4a).

- For information on barium sulphate, see N. Eastaugh, V. Walsh, T. Chaplin and R. Siddall, *Pigment Compendium: A Dictionary* of Historical Pigments, Amsterdam, Elsevier Science, 2004, pp. 44–45.
- 11. The later added finely woven canvases have the appearance of cotton, while the original canvases appear to be linen.
- R. Van Eijnden and A. Van der Willigen, Geschiedenis der Vaderlandsche Schilderkunst sedert de helft der XVIII eeuw, Haarlem, 1817, vol. 2, p. 192.
- Jacobus Luberti Augustini, *Portrait of Dirk Veegens*, canvas, 62 × 49.5 cm, signed and dated, lower left: J. Luberti Augustini / Fecit 1778, Frans Hals Museum, Haarlem, inv. nos. 66-282.
- 14. P.C. Molhuijsen and P.J. Blok, *Nieuw Nederlandsch biografisch woordenboek*, Leiden, 1911, vol. I, pp. 194–195.
- 15. B.C. Sliggers, 'Een inventarisatie van geschilderd behang te Haarlem. In het bijzonder dat van Jan Augustini (1729–1773)', in *Liber amicorum Jhr. C.C. van Valkenburg*, 's-Gravenhage, Centraal Bureau voor Genealogie, 1985, pp. 323–341, esp. p. 327.
- Noord-Hollands Archief, Oud Notarieel Archief Haarlem 1272–57 (30 May 1778).
- 17. Oprechte Haarlemse Courant, Thursday 18 April 1782, no. 47: 'Een of twee SCHILDERS, van goede Conduites zig voornaamentlyk appliceerende op het Schilderen van Stilleevens en Antique Ornamenten, geneegen zynde, op een Behangsel Fabricq in haarlem te Werken; kunnen zig met iets van hunne Konst tot een Proeve adresseeren aan J. LUBERTI AUGUSTINI aldaar.'
- 18. H. Miedema, *De archiefbescheiden van het St. Lukasgilde te Haarlem*, 2 vols, Alphen aan den Rijn, Canaletto, 1980, vol. 2, esp. pp. 1013, 1024 and 1025. Although the cited member list by street name is dated 1788–1798, the list was likely kept up beyond 1798, see op. cit. 1008, note 375.

- 19. B. Sliggers, *Painting in Haarlem 1500–1850: The Collection of the Frans Hals Museum*, Ghent, Ludion, 2006, p. 365.
- 20. See, for instance, H. Bosma, ""Het verderf van onze kunst in de 18de eeuw, het zoogenaamd behangselschilderen ...". Over de Nederlandse behangselschilderkunst, de fabriek voor geschilderd behangsel te Hoorn en enkele kamerdecoraties die daar werden vervaardigd', in Achttiende-eeuwse kunst in de Nederlanden, Leids kunsthistorisch jaarboek 4 (1985), Delft, Delftsche Uitgevers Maatschappij, 1987, pp. 357–377, esp. pp. 358–360; and Harmanni 2006 (cited in note 4), esp. pp. 162– 164.
- 21. As this paper focuses on the technique of the original 18thcentury painted wall hangings, the technical research on the later additions – the garlands bordering the chimney and the medallion with the bust of *Ceres* – will not be addressed here.
- 22. The fibres were found in the ground layer of several paint samples from this picture. Fibres could be added to ground layers to enhance elasticity and adhesion. See B. Bünsche, 'Kunsttechnologische und kunsthistorische Betrachtungen zur Aufbereitung und Verwendung von tierischen und pflanzlichen Fasern in Grundier- und Kittmassen: dargestellt an Beispielen der bildenden und angewandten Kunst', VDR Beiträge zur Erhaltung von Kunst und Kulturgut 1, 2011, pp. 46-60 (with thanks to Clara Lauridsen for pointing out this article). Enhanced elasticity and adhesion might be expected to be useful for large canvases, but do not seem to be properties that would be specifically necessary for this straightforward regular size canvas. A different explanation could be that the fibres were added as (recycled) bulk material to the ground. Possibly a canvas primed with a lead white paint was used for this bulk material, which would explain the lead white paint present on the fibres.
- 23. That the width of the paintings in the reconstruction is somewhat smaller than 267 cm could be explained by the fact that some fabric could have been cut either when the paintings were taken out of the larger format or when they were installed *in situ*.
- 24. See also note 9.
- 25. L. Simis, Grondig Onderwijs in de Schilder en Verw -kunst, bevattende eene duidelyke onderichting in den aard, den oorsprong, sterkte en zwakte der verwen, olyeteiten, enz., het bereiden, en behoorlyk, of kwalyk gebruik derzelven, ook over het behandelen der werke, huizen en rydtuigen, galdhout - en marmer -schilderen, vergulden, verzilveren en metaalen als mede het verlakken en witwerken enz., 2 vols, Amsterdam, 1801 and 1807.
- 26. Ibid., vol. 1, pp. 158-160.
- 27. Ibid., p. 159.

- S.A.C. Dudok van Heel, 'Jacob Cats e.a. als behangselschilder in de fabriek van Jan Hendrik Troost van Groenendoelen', Maandblad Amstelodamum 59, 1972, pp. 151–163, esp. p. 151.
- 29. Harmanni 2006 (cited in note 4), p. 164.
- 30. IRR was carried out with an Osiris scanning InGaAs camera equipped with a 16×16 tile system of 512×512 focal plane array to just beyond 1700 nm. Visible light was filtered through an 875 nm infrared filter.
- 31. In the two landscape paintings on the southeast wall, inscriptions referring to dimensions and the direction of light are partly visible at the bottom edges of the front of the canvases. These inscriptions were written in what appears to be the same material used for the underdrawing in the paintings. The notations were partly covered with paint and were made more readily visible with IRR. With the removal of the canvases from the temporary frames used during priming and painting, the inscriptions were partially cut off. It is possible that more canvases carried working instructions on the front but were lost during the production process.
- 32. Utrechts Archief, *Inventaris van de familie Martini Buys*, no. 673.
- 33. Harmanni 2006 (cited in note 4), p. 238. With thanks to Richard Harmanni for suggesting this diary entry of Christiaan Andriessen.
- 34. Ibid., p. 165; and Dudok van Heel 1972 (cited in note 28), pp. 155–156.

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EIGHTEENTH-CENTURY PRACTICES IN THE ART ACADEMIES IN SPAIN: THE USE OF PAPER IN PRINTS AND DRAWINGS

Clara de la Peña Mc Tigue

ABSTRACT Spain in the 18th century underwent a transformation in the production of prints and drawings thanks to royal patronage and the foundation of the Spanish royal academies. In parallel, the development and availability of high quality domestic and foreign papers contributed to the establishment of drawing and printmaking in Spain. A large body of works by Spanish artists trained in the art academies who preceded Goya have survived, but remain mostly unknown outside Spain and largely understudied from a material standpoint. This paper provides an overview of the types of paper used in 18th-century Spanish prints and drawings, how they were sourced and what papers were favoured by art academy students and established artists. Relevant examples have been drawn from the visual examination and comparative research of Spanish prints and drawings in collections at the British Museum, London, the Museo del Prado and the Biblioteca Nacional de España, Madrid, and the Spanish royal academies among others.

Introduction

This technical study on 18th-century paper supports used in Spanish graphic arts relies, among other factors, on the visual examination and interpretation of over 500 prints and drawings which were kindly made available by conservators and curators in print rooms across five major collections. Although the supports are often not watermarked, may have been adhered to backings and damaged after centuries of use, the physical and structural characteristics recorded provide a valuable resource to the understanding of what types of paper were available and favoured by Spanish artists. This paper describes how the transformation of Spanish graphic practices and the flourishing of the paper trade and papermaking in 18th-century Spain ran in parallel.

1700–1750: the arrival of the Bourbons and Genoese paper imports

During the 18th century, Spain enjoyed a period of cultural and economic recovery under the reign of the Bourbon dynasty. Philip V, the first Bourbon king, inherited the throne after the last Hapsburg king, Charles II, died without leaving any issue. The new French king commissioned French and Italian artists to decorate the new court residences in Madrid.1 Foreign artists such as Michel-Ange Houasse and Corrado Giaquinto deeply influenced a whole generation of Spanish artists to follow. In architecture, the late Baroque style, rooted in Spanish 17th-century art, was also very popular in court circles and was best exemplified by José Benito de Churriguera and Teodoro Ardemans. Court painter Miguel Jacinto Meléndez successfully combined both styles.² Regardless of the artists' intent or training influences, paper supports in Spanish prints and drawings from the first half of the 18th century do not differ significantly from those found in the 17th century. White papers are seldom watermarked, and as for the formation of the sheets, they often display a distinct shadow around the chain lines, characteristic of paper pulp beaten with water-powered hammers during the manufacturing process. Churriguera's Cartouche and Teodoro Ardemans' Study of a Temporary Monument in a Church are good examples of thick, high quality papers reserved for large architectural commissions and bear similar characteristics to earlier imported papers;³ these well-formed sheets, which often bear Italian watermarks, have an even structure throughout and fine furnish with scarce inclusions.



Fig. 1 Matías de Irala Yuso, *Design with Musical Putti*, pen and brown ink and grey wash over black chalk pricked for transfer, 28.6 × 18.5 cm, British Museum, London 1846, 0509.167: transmitted light detail showing the pricked drawing on thick antique laid paper with a cloudy structure.

In the 17th and early 18th century, high quality papers found in Spanish prints and drawings were mostly imported from Italy. Since the 15th century, Spain had relied primarily on Italian paper imports to supply the administrative needs of its rapidly growing empire. High quality paper was expensive and hard to obtain for smaller and local printing businesses, which often had to source local paper. Genoese merchants jealously controlled the production and distribution of paper towards the colonies and were often granted tax relief in lieu of payment of the debt amassed by the Spanish Hapsburg court, while Spanish papermakers had few government incentives and were taxed heavily for distributing their papers more widely and overseas. Paper mills in Spain were scarce, often short lived and produced mostly paper of low quality, which was a serious problem for printers wanting to establish their businesses in Spain.⁴ Religious texts and important print runs were also outsourced overseas.

Philip V soon called for a more centralised government in order to control the advantages of trade and imports of all the regions of Spain, convinced that disunity only benefited specific individuals in the country as well as foreign governments. In line with this policy, and following a series of discussions with church authorities throughout Spain, the king decided in 1717 to nationalise the printing of religious texts. The prior of El Escorial Eugenio de la Llave was quick to warn the monarch that the paper mills in Spain were too few in number to fulfil the demands of such a large printing production: rags throughout Spain were sold and exported cheaply to Italy, with no government control. The limited number of paper mills produced paper of much lower quality than Italian paper. While in the process of reviving the domestic papermaking industry in Spain, Philip V would need to import paper from abroad. During the first half of the 18th century, the more conciliatory attitude of the Bourbon court encouraged many proposals from printers, who could rarely afford imported paper, complaining that the poor quality of the domestic paper compromised the quality of their impressions. In order to balance the costs and quality of their books, printers often used reams from various papermakers for the same edition. In 1753, the king, unhappy with the quality of paper in Spanish impressions, dictated that all paper used by Spanish printers and bookmakers would have to match the fine quality of Catalan paper from Capellades or would face sanctions. In the past, individual Catalan papermakers had



Fig. 2 Michel-Ange Houasse, *A Seated Man Drawing*, 1722–1727, black chalk and white heightening on blue paper, 6.3×13.5 cm, Biblioteca Nacional de España, DIB/13/4/82: detail of the blue paper structure.



Fig. 3 Antonio González Ruiz, *Man with a Shaft*, *c*.1739, red chalk on whitebrown paper, 44 × 36.5 cm, Museo del Prado, D0361: showing the poorly beaten furnish with displacement of pulp during the papermaking process.

applied for government support and had been granted tax relief and privileges. However, Capellades paper could not reach all the regions of Spain and little was done at a government level to improve the papermaking industry as a whole.⁵ In this climate, single-sheet image printmaking during the first half of the 18th century stood little chance of succeeding – skilled printmakers were rare and print houses had ageing facilities.⁶

The printmaker, draughtsman and painter, Fray Matías de Irala Yuso, who worked in a secluded monastery in Zaragoza, enjoyed exceptional popularity during his lifetime. His anatomy series, Amphitheatrum Matritense first appeared in 1728 illustrating a book published by the Madrid printer Bernardo Peralta, of which two first editions are kept at the Biblioteca Nacional de España in Madrid. In both examples the paper used for the text has no watermarks, has a cloudy structure and many inclusions. The images by Matías de Irala Yuso were inserted after the sections of the book had been sewn together and are carefully pasted to a page guard in each chapter. The engravings are printed on a higher quality paper bearing a rare three circle Genoese watermark crowned with a cross. A crescent moon appears in the first circle, while the other two circles, surprisingly, are empty.7 Other works by Irala Yuso tend to be printed on white papers of medium quality, with pulp unevenly distributed, inclusions and are rarely watermarked. Paper quality depended on various factors such as the cleanliness of the linen and hemp rags, the method used to ferment or sort the fibres, the types of hammers used to beat the pulp, and the application of the gelatine sizing to the sheets.⁸ The variations in quality suggest the diverse origin and scarcity of paper available for printmakers at the time. Irala Yuso's Design with Musical Putti is a large detailed drawing executed on a medium-thick paper in order to withstand overall pricking for transfer onto the plate. It has uneven distribution of pulp and bast fibre inclusions, suggesting that the quality was not strictly controlled at all stages of the papermaking process (Fig. 1).9

Accounts of existing paper mills in Spain became more common in the 18th century and show that they were gradually producing paper suitable for printing: the paper mills in Beteta and Palomera (Cuenca) distributed paper to printers in Madrid. The paper mill established in 1720 in Nuevo Baztán (Madrid) made fine paper and printing paper and enjoyed an excellent reputation at the Madrid court.¹⁰ Other mills in Guadalajara were leased to quality Catalan papermakers such as Ramón Romaní, while paper from El Paular (Madrid), thanks to government incentives, began to improve. By 1728, there were 35 mills in Catalonia from which possibly twothirds produced white paper.

Papers in Spain in early 18th-century Spain ranged in order of quality:

- The finest papers: *florete, entrefino* and *fino*.
- Medium quality paper: *papel de imprenta* (printing paper) and *de escribir* (writing paper).
- The lowest quality paper: *papel de bula* (paper used for printing *bulles* with a white-brown furnish), *papel de*

naipes (for playing cards and ephemera), *papel de estraza* (coarse brown paper) and *carton* (card).¹¹ Most blue-coloured papers can also be included in this lower category.

It is important to note that brown and blue papers ranged widely in properties and qualities depending on the cleanliness of paper mills, the quality of the raw materials and the beating of the coarse fibres, which would have different proportions of linen mixed with sack, sail cloth, straw and even wood chips. The end result and the price varied depending on their commercial use. *Bulle* paper had a white-brown furnish while packing paper was coarser and cheaper.¹² Paper used for playing cards also varied in quality depending on the end user.¹³

Accounts of 16th- and 17th-century Spanish paper mills mention significant quantities of blue paper being made alongside brown or white papers. Although white and brown papers are accounted for in 18th-century Spanish paper mill inventories, blue papers rarely appear. Genoese paper mills made small quantities of *turchino* paper to wrap reams of the finest white paper shipped to Spain and its colonies. Some French paper mills, on the other hand, tended to keep the production separate and specialise solely in blue paper, which was then imported in large quantities. French blue papers might have also made their way into the peninsula.¹⁴

Coarse brown and blue papers were very popular in the latter half of the 17th century among court painters such as Juan Carreño de Miranda, especially for quick chalk studies. In the 18th century, Miguel Jacinto Meléndez also used coarse brown paper with a very uneven furnish and poorly beaten pulp in the 5 Studies of the Heads of a Monk.¹⁵ French artist Michel-Ange Houasse, who worked for the Bourbon court in Madrid, favoured thin brown and blue papers for a series of figurative drawings associated with his genre paintings. Chain and laid lines are still defined among the clumps of poorly beaten indigo-dyed pulp, such as in A Seated Man Drawing (Fig. 2). A slight texture provided sufficient grip to hold the friable media as well as allow a smooth surface for detail. The coloured sheet also provided the mid-tone to work the chalk outlines and apply white heightening. These papers are similar to those found in 18th-century chalk drawings by Watteau, and also reflect the techniques learned from Houasse's training at the French Academy. Thin brown and blue papers would also be passed on as common supports for Spanish art academy practice, such as the faulty sheet found in Man with a Shaft by a young Antonio González Ruiz (Fig. 3).¹⁶

The founding of the Spanish Royal Academy and Dutch papers

By the mid-18th century, under King Ferdinand VI, Spain began to pave the way for true cultural and political reform. The need for a government-financed instruction for the visual arts in order to improve and support all disciplines had been voiced by Spanish artists for centuries, but it was not until 1752 that the Real Academia de Bellas Artes de San Fernando (Royal Academy of Fine Arts of San Fernando) received its royal charter and was established in Madrid. Royal academies in Europe were conceived as platforms to share new ideas in the arts and sciences. Spanish royal academies boosted strong national character: under Bourbon control and support they aimed to spur and implement reform in Spain and its colonies. The court had previously relied on foreign artists to elevate the status of royal and civil commissions. The Real Academia de Bellas Artes de San Fernando was founded with the desire to create a true generation of Spanish architects, painters and engravers of sufficient stature and solid training to establish a long-lasting artistic tradition.

Drawing, known in Spain as *diseño*, was at the heart of all artistic practices in the academy, based on both Italian and French art academy teaching. All students began with the principles (beginner level, copying from the collection of prints collected in the academy), progressed onto drawing casts, and finalised their basic training by drawing from life (Fig. 4). The teaching of students was supported by the government and aspiring artists from impoverished backgrounds sometimes received full scholarships. The academy also provided materials, including paper, for all enrolled students.¹⁷

By 1757 the Genoese monopoly on paper in Spain began to break down and other foreign papers from Holland and France entered the market. This was due mainly to the legislation introduced by the Bourbons, which reduced the tax privileges granted to Genoese paper merchants, measures that were supposed to benefit the domestic paper industry. Tax exemptions and privileges gradually reached more individual Spanish papermakers but despite this, during the 1750s and 60s, Spanish paper production was still insufficient, allowing Dutch papermakers to become the strongest contenders against the supremacy of the Genoese paper trade in Spain.

Every three years the Royal Academy organised a competition in all disciplines. Based on Italian and French academies, the competition was divided into the same categories: the first class, *pensado*, a historical subject for which the students were given six months to create a painting or drawing; the second class, *de repente*, where the students had to produce a quick drawing in a few hours; and finally the third class, the drawing of a statue. Each edict stated the paper for the competitions would be provided by the academy.

From the 1760s until the early 1780s, all edicts for the competitions stated that the exercises would be performed on *papel de Olanda* (Dutch paper) of a specific size or *papel común* (regular paper) for engraving.¹⁸ There is no mention of *papel de Olanda* in earlier edicts from the 1750s.¹⁹ However, in the Royal Academy special account books reserved for expenses associated with the 1753 prizes, the accountant states 'I bought two quires of *papel de Olanda* for applicants to use in the competition.²⁰ In the same year, a talented 14-year-old student named Mariano Salvador Maella won the prize in two of the categories: the third class category was won for an accomplished drawing of *Faun with a Lamb* which bears the countermark 'Villedary' in the centre of the sheet.²¹

The entries in the account books in the years following record similar quantities of *papel de Olanda* bought for competitions. After 1756 a quire of *papel de marca mayor*, a



Fig. 4 José del Castillo, *Male Nude*, 1759, chalk on paper, 55.4 × 42.4 cm, Universidad Complutense, Madrid, drawing 1944: an example of live drawing in art academy practice. (© The Library of the Faculty of Fine Arts at the Complutense University of Madrid.)

large-format paper for the engraving competitions, was also added. Very few receipts were kept associated with paper and only appear as simple entries in the account books. Whole reams of Dutch paper are not mentioned, possibly because such large quantities in the early 1750s would have cost almost 900 *reales* per ream. Smaller batches of paper, bought as and when needed from stationers in Madrid, were still significant expenses to be noted in the books. But for academy student Juan Mínguez, the 25 *reales* he requested to buy a few sheets of Dutch paper in 1758 to draw the Reales Descalzas church in Madrid, amounted to approximately a quarter of his monthly allowance. Nevertheless, money spent on paper could be considered a small sum compared to other essential expenses for the running of the academy such as building works, or the high cost of candles and oil for lighting the drawing rooms.²² The accountant recorded dozens of reams of *papel fino* per year, reserved for the printing of the edicts and general office work in the academy. The porters sometimes carried and stored up to 123 reams of *papel de marca* (half the size of *marca mayor*) per month. The actual examination of the paper used for these account books reveals high quality paper with the Genoese three circle watermark. Unfortunately the accountants at the time did not note where they sourced the paper. As an exception, a receipt from 1758 from José de Hermosilla confirmed that he transported to the doors of the academy 150 reams of medium format paper from the Catalan region of Capellades, which he had bought from José de Cañizares.²³ Although fine paper for writing was made by Catalan papermakers, the scarcity of high quality paper in Spain by the mid-18th century was yet to be resolved.



Fig. 5 José Camarón i Bonanat, *Roman Charity*, red chalk on white Hollander beater paper, 51.3 × 37.6 cm, Museo del Prado D3061: detail of a Strasbourg Lily watermark by Bonanat showing a very fine and regular furnish with marked chain lines, characteristic of Hollander beater papers. (Photo: Museo del Prado watermark database.)

A new Dutch innovation introduced in Holland in the 1670s, the Hollander beater, had revolutionised the Dutch paper industry, making it the most productive and efficient in Europe.²⁴ By the mid-18th century, paper mills in Holland and some areas of France were using a large tub with metal blades which allowed a finer and quicker beating of the pulp than the traditional hammers. This, together with the development of moulds with a more open structure, meant that the formation of the sheet was much faster.²⁵ Artists under the auspices of the academy who later executed important private and royal commissions after their training invested in this expensive paper but it was far less common in book printing and manuscripts, where possibly the cheaper French and Italian papers were considered more affordable for larger productions.

Dutch watermarks appear in art academy drawings of the 1750s and 60s as well as in drawings by more established artists. Coats of arms with a Strasbourg Lily can be found in model drawings by the German artist Anton Rafael Mengs, who moved to Madrid to work for the court, becoming an important benefactor and teacher at the Royal Academy.²⁶ Similar watermarks are also found in exercises from the 1750s and 60s by students who trained at the academy and were mentored by Mengs, such as Mariano Salvador Maella and José del Castillo. Antonio González Velázquez, a highly successful Spanish artist who had a lifelong association with the academy, used white Hollander beater papers throughout his career for small-format pen and ink drawings, which often bear partial Dutch watermarks.²⁷ The watermarks can be traced back to the Dutch regions of the Zaan and Veleuwe


Fig. 6 Mariano Salvador Maella, *Male Nude with a Helmet*, 1762, black chalk and white heightening on blue paper, 50.4×32 cm, Universidad Complutense, Madrid, 2024: detail showing a blue antique laid paper with unevenly distributed pulp.

where papermaker and merchant families such as Honig, Villedary, Kool and Blauw established profitable businesses.²⁸ The papermakers' names are often found below different versions of the Strasbourg Lily such as the large C&I.Honig watermark in *Roman Charity* by the prolific draughtsman José Camarón i Bonanat, who executed preparatory drawings of religious and profane subjects that were then used for paintings or translated into print for book illustrations (Fig. 5).²⁹

The Hollander beater was first mentioned and illustrated in Diderot and d'Alembert's *Encyclopédie* and Lalande's *Art du faire le papier*, published in France in 1761, after which it was soon adapted to French paper mills. Lalande's work was not translated into Spanish until 1779, and the invention was not adopted in the peninsula until the 19th century. In a letter from 1764, an industrious and highly educated Valencian papermaker named Albors, states 'I am assembling a machine with a cylinder, I will produce more reams at a cheaper cost ... and if I succeed I will be the first to have brought this discovery to Spain', but he failed however, probably due to lack of staff or appropriate facilities, and went back to using stampers.³⁰

Following Houasse's tradition, blue papers were still very popular for chalk drawing exercises and favoured by artists such as Francisco Bayeu throughout his career.³¹ New European manufacturing processes that developed as the century evolved rendered a wider variety and toning to coloured papers. Blue papers often lack watermarks and present



Fig. 7 José del Castillo, *Phaun Sitting on Rocks*, 1762, red chalk and white heightening on blue prepared paper, 56.3×43.3 cm, Universidad Complutense, Madrid, 2121: detail showing the prior blue preparation of the paper under red chalk media.

an uneven furnish with many inclusions and a less careful formation of the sheet, making it difficult to verify their provenance. *Male Nude with a Helmet* by Mariano Salvador Maella is a good example of the cloudy structure of large format blue paper found in art academy drawings (Fig. 6). In addition to local papers and blue papers imported from Italy or France, it is likely that blue paper from Holland might also have been imported to Spain and its colonies: by 1740 Dutch paper mills in the Zaan were producing more than 70,000 reams of blue paper per year.³²

As part of their training, artists associated with the Royal Academy prepared their own papers prior to drawing. Artists frequently chose good quality white paper as evidenced by the large watermarks that are often hinted at under the prepared surface. The applied ground rendered a grey or pink mid-tone to the sturdy surface with good properties, and offered a good alternative to undersized blue papers. In addition, the ground provided an excellent tooth for chalks and highlights, which can be seen in the detail of Phaun Sitting on Rocks by José del Castillo (Fig. 7).³³ The grounds were possibly prepared with a filler of finely ground chalk, a pigment to tone the paper and a binding medium such as gum arabic or gelatine.³⁴ The diluted mix was then applied with a brush onto the blank paper. The actual brushwork provides information on the working practices of individual artists: Mengs prepared his drawings carefully, often following the vertical direction of the sheet, while Salvador Maella brushed the surfaces using dynamic zigzag motions (Figs 8 and 9).

The learning process of accomplished students from the Royal Academy culminated in a sojourn in the Spanish academy in Rome. Sketchbooks by Mariano Salvador Maella, José del Castillo, and a later sketchbook by Francisco de Goya, have been studied in depth and the watermarks collected at the Museo del Prado.³⁵ All three sketchbooks are of identical format and bear a range of watermarks similar to earlier papers produced in Fabriano, one of the most important papermaking centres in the Italian Marches during the Renaissance.³⁶ Bookbinders possibly assembled the blank



Fig. 8 Antonio Raphael Mengs, *Time*, black and red chalk and white heightening on cream prepared paper, 36.4×45.7 cm, Museo del Prado, D3070: detail in transmitted light. This is an example of the neat one-directional brushstrokes that characterise the artist's self-prepared surfaces (see Fig 4).



Fig. 9 Mariano Salvador Maella, *Academia*, 1759, red chalk and white heightening on dark grey prepared paper, 51.3×37 cm, Museo del Prado D0312: in contrast, Maella is showing his characteristic paper preparation with multi-directional brushstrokes (see Fig. 5).

pages and provided them to the stationers or art academies.³⁷ Maella's *Male in Roman Attire*, executed during his stay in Italy, also bears a similar watermark.³⁸ No Dutch watermarks, however, have been found in the Roman drawings examined for this study. Spanish artists studying in Rome in the mid-18th century and later would probably have bought and used local Italian paper. Some of the male nude exercises on white paper made by Spanish students training in Rome also bear Italian watermarks. The marked, regular shadow around the chain lines and fine laid lines in Italian papers of this period is a possible indication that paper mills in central Italy continued to use hammer beaters at this time.



Fig. 10 (a) Ramón Romaní countermark (12) and (b) a corresponding one found in *Academia* by Ángel Bueno, red chalk on antique laid paper, 178.3, 58.4 × 42 cm, Museo del Prado, D3057. (Photos: Museo del Prado watermark database.)

The emergence of Spanish artists and Spanish paper

By the latter part of the 18th century, Spain had undergone a major technical transformation on the production of prints and drawings, mainly due to the establishment of the Royal Academy. Spanish artists trained in the academy who had benefited from studies abroad started to emerge and began to develop a personal unique style.

By the mid-18th century legislation introduced by the Bourbons had a significant effect on the production of paper in Spain. In the 1780s a royal decree extended earlier individual tax privileges on domestic rags to all Spanish papermakers. Large cities in close proximity to papermaking centres began supplying huge quantities of raw material and provided a market for the finished product. Thanks to these measures, scattered paper mills in Catalonia and Valencia developed into important papermaking centres. By the end of the 1780s there were almost 200 paper mills in Catalonia.³⁹ The construction of dams and reservoirs provided a generous supply of clean water, especially in the region of Capellades, guaranteeing a sustainable paper industry.

Transport links between regions in Spain improved gradually during the 18th century. While preceding Bourbon kings had slowly abolished constraining regional taxes, Charles III took these laws beyond Spanish borders by liberalising the export market. A healthier and more mature Catalan paper industry was ready to compete with Italian and French imports destined for the Americas. Ports throughout the coasts of Spain could now trade more freely with the colonies. Catalan papermakers began to export large quantities of paper from the port of Barcelona to 22 American outposts. As the production and quality of domestic paper improved, papermaking became one the most prosperous sectors in the Catalan economy together with wine and spirits.⁴⁰

By the 1770s and 80s Spanish watermarks from the region of Capellades appeared in Spanish prints and drawings. Catalan watermarks can be found in drawings by established artists such as Mariano Salvador Maella's *Madonna and Crucifixion*. Royal Academy students in these decades also began to use Capellades paper as evidenced by the Ramón Romaní countermark (Fig. 10a) and the watermark in *Academia* by Ángel Bueno (Fig. 10b).⁴¹ From the 1770s until the 1790s drafts for private clients and royal commissions were drawn on a large variety of papers. Dutch, Italian and French imported paper, Catalan paper and an array of coloured papers of different qualities were available to artists in the last quarter of the 18th century and could possibly be sourced from stationers and print shops in Madrid.

In the arts the uses and public perception of prints and the rise in quality of the work produced by Spanish printmakers translated into a very active market which enjoyed huge popularity both in Spain and abroad. Juan Cruz Cano y Olmedilla, a successful Madrid printmaker, created a collection of Spanish costume that became very popular in Spain and France. Cano y Olmedilla was part of the first generation sent abroad, specifically to France, to learn printmaking. The



Fig. 11 José Soteras countermark in paper with fibre inclusions. Etching and engraving on antique laid paper, 1777, bound in *Album of Spanish Costumes* by Juan Cruz Cano y Olmedilla, Biblioteca Nacional de España, ER3393(24).

costume series included over 200 Spanish costumes published between 1777 and 1788. They were so successful that the artist himself denounced the existence of fraudulent editions during his lifetime.42 A complete series of these prints has been sewn together into a later 19th-century binding at the Biblioteca Nacional de España. The bulk of the album was printed on 18th-century Catalan paper from the Capellades region. Most papers in the album bear a rare countermark by a papermaker called José Soteras in a rather low quality paper, with some bearing Ramón Romaní countermarks and a few pages with a Romeu countermark.43 Plate 26 depicts a peasant woman with a regional dress from Salamanca with a José Soteras watermark - very few watermarks by this papermaker have been recorded. Soteras operated in the Capellades region, but the exact location of his paper mill is still unknown (Fig. 11). Another early edition of plate 26 at the British Museum is printed on Dutch Hollander beater paper with the Villedary countermark (Fig. 12).

While Catalan watermarks are often found in the last quarter of the 18th century in prints and drawings, papers from other prominent papermaking regions of the late 18th century, such as Valencia, are rare. With a much smaller production than that of Catalonia, Valencian paper mills produced brown paper for playing cards as well as thin cigarette paper to supply the most profitable Bourbon enterprise of the period - the royal tobacco companies. The Valencian region of Alcoi made paper for cheap text printing in the 1770s and 80s. Valencian watermarks appear often in archival material at the San Carlos Royal Academy of Fine Arts in Valencia from the 1780s onwards. In line with the Madrid Royal Academy, imperial size paper was supplied for drawings entering art competitions. Large-format paper of superior quality was not manufactured in Valencia at the time so the drawings were possibly made on Catalan or imported paper, which is often noted in San Carlos inventories.44



Fig. 12 Jean Villedary watermark on Hollander beater paper, 1777, British Museum, 1896.0511.131.

Other regions in Spain concentrated on local markets, such as the numerous brown paper mills in Andalusia and a few mills in the northern region of Aragon. The scattered Castilian paper mills survived with the aid of government subsidies and continued to supply paper to the capital, although they were mostly overshadowed by the thriving centres of the Spanish Levant. In the 1790s, after the fortunes of the tobacco industry plummeted, Valencian papermakers lost their main source of income. In an ingenious effort to keep afloat they successfully implemented the Hollander beater and by the 19th century they were renowned for their exceptional white papers. By the end of the 18th century both political reform and the remarkable development of Spanish papermaking came to a sudden halt after Charles III's reign due to the Napoleonic wars and the loss of the colonies.⁴⁵

By the final decades of the 18th century, Spanish artists had a thorough technical knowledge of printing and drawing techniques, were in touch with the latest European artistic trends and had achieved recognition and status within Spain. The popularity and formative training of Francisco de Goya cannot be understood without the influence of the Royal Academy and the Spanish artists who preceded him. Additionally, Goya's earlier graphic works are a testimony to the variety of paper supports found in late 18thcentury Spain.⁴⁶

Conclusions

During the 18th century, Spain underwent a true transformation in graphic practices. With government support and inspired by a European spirit of Enlightenment, the royal academies produced generations of accomplished Spanish artists. At the core of their artistic practice was drawing, and through printing they promoted, added value and instilled appreciation of the visual arts. In parallel, protectionist measures gradually introduced by the Spanish court revolutionised the paper industry. Artists made use of the wide variety of imported and domestic papers available to them.

In the first half of the 18th century, the court commissioned French and Italian artists as well as established Spanish artists from a late Baroque tradition of which some preparatory drawings survive. Genoese watermarks can often be found in Spanish architectural drawings while the printing industry still relied on poorer quality Spanish paper and foreign imports. Spanish paper was overshadowed by the strong influx of imported Italian paper. Under a more conciliatory government than the Hapsburgs, papermakers and printers began to voice their concerns about the poor state of the paper mills and the paper industry. By the mid-18th century, the newly founded Royal Academy in Madrid (Real Academia de Bellas Artes de San Fernando) subsidised material, including paper, used by art students. The government began to implement stronger measures to break the Genoese monopoly and therefore benefit the Spanish paper trade, but domestic production was still insufficient and Dutch paper entered the Spanish market. The Dutch made use of a new invention, the Hollander beater, to create finely beaten paper at a faster rate. Although Spanish artists made ingenious use of paper intended for letter writing or packing paper to suit particular purposes, thick and expensive Dutch papers produced especially for the art market were favoured by artists and sourced for competition entries for academy prizes and precious image printing. By the last quarter of the 18th century tax exemptions and subsidies to individual papermakers were extended by royal decree to all Spanish papermakers. Catalan paper mills from the region of Capellades cleverly optimised natural resources, improved their production and entered a newly liberalised market destined for the colonies. By the 1770s Catalan papers were commonly used for art academy exercises, by Spanish artists and printers together with Dutch and Italian imports. The range of papers available to artists by the end of the 18th century provided another basis for experimentation by Francisco de Goya in his unparalleled graphic works.

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Notes

- 1. La Granja, Philip V's summer residence, was modelled on Versailles. It combines both the Spanish late Baroque (Ardemans) and French and Italian styles (Procaccini and Juvarra).
- 2. M. McDonald, *Renaissance to Goya: Prints and Drawings from Spain*, London, British Museum Press, 2012, pp. 189–194.
- 3. DIB/15/10/6 *Cartouche*, also see DIB/14/48/1, *Octogonal Frame*, both in Biblioteca Nacional de España. 1846,0509.175 *Study of a Temporary Monument in a Church*, and 1890,1209.48 *Isabella de Farnesio*, both in British Museum.
- 4. See C. de la Peña Mc Tigue, 'Paper and papermaking in Spain', in M. McDonald (ed.), *Renaissance to Goya: Prints and Drawings from Spain*, London, British Museum Press, 2012, pp. 275–281, pp. 276–278 (on Genoese paper monopoly versus French and Spanish papers).
- 5. For more info see De la Peña Mc Tigue 2012 (cited in note 4). Since the 17th century, due to the Genoese monopoly on paper, Spanish printers even in Madrid had scarce resources and would often resort to using cheaper French imported paper, even contraband papers which were smuggled through the Pyrenean border.
- 6. J.C. Balmaceda, La contribución Genovesa al Desarrollo de la manufactura papelera e Española, CAHIP, Málaga, 2005, pp. 79–84; G. Gayoso Carreira, Historia del papel en España, 3 vols, Diputación Provincial de Lugo, Lugo, 2006, p. 88. In some instances the central government subsidised imported paper for specific printed enterprises.
- 7. Genoese watermarks usually bear acronyms stating the quality of the paper and the papermaker's initials. I would like to thank José Carlos Balmaceda for information on this particular watermark.
- P. Bower, 'Blues, browns and drabs: the evolution of coloured papers', in H.H. Stratis and B. Salvesen (eds), *The Broad Spectrum: Studies in the Materials, Techniques and Conservation of Color on Paper*, London, Archetype Publications, 2002, pp. 130–133.
- 9. 1846,0509.16 *Design with Musical Putti*, The British Museum, London.
- 10. Nuevo Baztán designed by Churriguera was newly erected in 1709 as an industrial centre. The main benefactor, Juan de Goyeneche, had been a huge supporter of the Bourbon succession and his progressive ideas. Although other enterprises in the new town such as glass making or pottery failed, the paper

mill managed to utilise government incentives and produce fine paper as well as obtain tax exemptions to distribute its reams nationally until the end of the century: Balmaceda 2005 (cited in note 6), pp. 85–92.

- Gayoso Carreira 2006 (cited in note 6), pp. 70–74; M. Gutiérrez i Poch, Desarrollo de la manufactura papelera española durante el siglo XVIII, Actas del iv Congreso de Historia del Papel en España, Córdoba, AHHP, 2001, pp. 335–350, p. 336.
- 12. For more information on raw materials and types of blue and brown papers see J. Krill, *English Artists' Paper: Renaissance to Regency*, London, Trefoil, 1987, pp. 51–61. Peter Bower mentions thin wrapping papers made in England and France in the 18th century containing old rope stock, hemp and hemp waste, making them durable and strong. On the other hand, French *papier de bulle* (corresponding to *papel de bula*) added linen rags to give a lighter furnish: Bower 2002 (cited in note 8), p. 48.
- 13. For Spanish printed ephemera (types of supports and uses), see McDonald 2012 (cited in note 2), pp. 40–41.
- 14. For blue paper in Spanish mills see O. Valls i Subirá, *La historia del papel en España*, 3 vols, Madrid, 1978–82, vol I, pp. 55–57. Small quantities of blue papers were often made in white paper mills to wrap the reams: Bower 2002 (cited in note 8). For Genoese blue paper to wrap reams see Balmaceda 2005 (cited in note 6), p. 129.
- 15. DIB/18/1/7168, Biblioteca Nacional de España.
- 16. DIB13/04/82 A Seated Man Drawing. See also DIB18/1/16-23 for fine white, brown and blue papers used by Houasse, all at the Biblioteca Nacional de España. For more information on Houasse see McDonald 2012 (cited in note 2), pp. 193–194. D0361 Man with a Shaft, Museo del Prado.
- 17. There was an important market for foreign prints, which had been used as aids in Spanish artists' ateliers since the 17th century; see A. Vizcaíno Villanueva, *El pintor en la Sociedad Madrileña durante el Reinado de Felipe IV*, Madrid, Fundación Universitaria Española, 2005, p. 151. With thanks to Alvaro Pascual Chenel for pointing out this reference. Materials such as chalks and pencils were provided by the academy; I. Azcárate Luxan, *Historia y alegoría: los concursos de pintura de la Real Academia de Bellas Artes de San Fernando (1753–1808)*, Madrid, Real Academia de Bellas Artes de San Fernando, 1994, p. 13.
- 18. Papel de Olanda is a rather ambiguous term, since the expression was also used in France (papier d'Hollande) to refer to papers of high quality; see W.A. Churchill, Watermarks in Paper in Holland, England, France, etc. in the XVII and XVIII Centuries and their Interconnection, Amsterdam, M. Hertzberger, 1965, p. 9. A drawing by Anton Raphael Mengs, Venus and Putti, has a rare watermark, OLANDA, which could be a later Italian watermark indicating high quality. This drawing was possibly made in Lugano in 1777 at the end of Mengs' career. D2307, Museo del Prado.
- 19. Standardised sizes, which were established in the Cartieri de Voltri in the 15th century; see C.C. Bambach, *Drawing and Painting in the Italian Renaissance Workshop*, Cambridge, Cambridge University Press, 1999, pp. 34–36, 368–371. Paper is mentioned in the Royal Academy award documents 1754– 1780 as well as the edicts printed prior to the competition. See document t 05-21-01, Real Academia de Bellas Artes de San Fernando Archives.
- 20. Ream = 500 sheets; quire = 25 sheets.
- 21. P1502, *Faun with a Lamb*, Real Academia de Bellas Artes de San Fernando. The countermark Villedary is similar to Churchill 1965 (cited in note 18), n. 407. The Dutch paper mill owner Jean Villedary made papers in French territory until 1758, after which he established mills in Holland. This might suggest that the paper used in P1502 might have been made in a French mill under Dutch management; Churchill 1965 (cited in note 18), pp. 21–22.

- 22. See Document 05-21-01, Real Academia de Bellas Artes de San Fernando Archives, for receipts and entries on paper from 1753–1759.
- 23. Ibid.
- 24. J.L. Nuevo Ábalos, 'Proteccionismo y progreso papelero en España durante el siglo xviii', Actas del iv Congreso de Historia del Papel en España, Córdoba, 2001, pp. 351–358.
- 25. Churchill mentions that Spain at this time bought most of its papers from Genoa and Holland. French paper mills in Brittany aimed to imitate Dutch and Genoese papers in order to capture some of the important trade destined for the colonies: Churchill 1965 (cited in note 18), p. 59.
- McDonald 2012 (cited in note 2), p. 203. See D3070 (possibly Strasbourg Lily under prepared paper) D3071 (Strasbourg Lily similar to Churchill 1965 (cited in note 18), p. 421, papermaker J. Kool), Museo del Prado.
- 27. For examples of Strasbourg Lily watermarks see Mengs D3070, D3074, Museo del Prado, in Maella D3482, Museo del Prado, DIB13/5/68, DIB13/5/71, DIB13/5/77, Biblioteca Nacional de España. In Castillo D0674, D0675, D0679, Museo del Prado. Partial Dutch watermarks in González Velázquez DIB 13/05/29, DIB 13/05/54 DIB13/05/56, Biblioteca Nacional de España.
- 28. See E. Wenger, M.L. Ferrando Cusí, C. Hidalgo Brinquis and P. Rückert, *Cabeza de Buey y Sirena, la Historia del Papel y las Filigranas desde el Medievo hasta la Modernidad*, Bernstein Project, Stuttgart, Valencia and Vienna, 2011, pp. 37–40, for the development of paper mills in these Dutch regions. See Churchill 1965 (cited in note 18), pp. 13–18, for dates and further identification of Dutch countermarks.
- 29. D3059 *Roman Charity*, Museo del Prado. For more information on Camarón i Bonanat see McDonald 2012 (cited in note 2), pp. 224–228.
- 30. Wenger et al. 2011 (cited in note 28), p.27.
- 31. The Museo del Prado holds around 450 drawings by Francisco Bayeu, mostly on coloured papers.
- 32. 1672 *Male Nude with a Helmet*, Facultad de Bellas Artes, Universidad Complutense.
- 33. 2121, *Phaun Sitting on Rocks*, Facultad de Bellas Artes, Univesidad Complutense.
- 34. This practice could have derived from prepared grounds used in Italian Renaissance drawings which are described in J. Bescoby and J. Rayner, 'Supports and preparations', in J. Ambers, C. Higgitt and D. Saunders (eds), *Italian Renaissance Drawings: Technical Examination and Analysis*, London, Archetype Publications, 2010, pp. 23–37, p. 33.
- 35. J.M. Matilla, *Cuadernos Italianos en el Museo del Prado*, exh. cat., Madrid, 2012. See catalogue entries for Maella, Castillo and Goya sketchbooks which include watermark photos. With thanks to Gloria Solache Vilela for all her help in the Prado print room and for providing useful information on the papers in the sketchbooks.
- 36. Gloria Solache Vilela has now identified watermarks in the Prado Italian sketchbooks. Findings on the location of Italian mills where this paper was made in the 18th century will be included in an article soon to be published as part of the AHHP 2015 conference proceedings: 'El cuaderno italiano de Goya. Estudio formal del papel y sus filigranas'.

- 37. It is yet not clear how Spanish artists sourced their papers, but research into 17th-century artists' inventories during Philip IV's reign has revealed that bound blank paper albums were part of the Spanish painters' atelier; see Vizcaíno Villanueva 2005 (cited in note 17), pp. 155–157. Later, the mid-1750s account books from the Royal Academy mention how blank papers were assembled by bookbinder Antonio Sancha, See year 1758 receipt, Document 05-21-01, Real Academia de Bellas Artes de San Fernando Archives.
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- 42. McDonald 2012 (cited in note 2), p. 222.
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- 44. Paper supplied to the Real Academia de Bellas Artes de San Fernando; C. Rodriguez Zarzosa and E. Herráez Sánchez, 'Las filigranas en las primeras impresiones de San Carlos', *Actas del iv Congreso de Historia del Papel en España*, Córdoba, AHHP, 2001, pp. 221–235, pp. 221–222. The drawings entered for competition in the San Carlos Royal Academy of Fine Arts have yet to be examined.
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NICOLAI ABILDGAARD: AN 18TH-CENTURY DANISH ARTIST AND HIS PAPER

Ingelise Nielsen and Niels Borring

ABSTRACT A collection of 550–600 drawings and sketches by the Danish artist Nicolai Abildgaard (1743–1809) forms the basis for an ongoing project aiming to set up a database of watermarks from the Royal Collection of Graphic Art at Statens Museum for Kunst. The Watermark Toolkit software package from the *Bernstein – The Memory of Paper* portal is being used to create the database. The watermarks are recorded by digital photography in transmitted light or by digital X-radiography. An examination of watermarks in contemporary documents has been carried out to better understand the papers which were used in Denmark at the time of Abildgaard. The preliminary results have shown that he used both Danish paper (approx. 35%) and paper of foreign origin (approx. 65%) for his drawings. The large majority of the foreign papers are of Dutch origin. We have found a striking resemblance between the paper and watermarks in the drawings collection and in documents from the Royal Danish Academy of Fine Arts. It may lead to the conclusion that Abildgaard either bought his paper from the same source as the academy or his paper was supplied by the academy.

Introduction

This paper presents the preliminary results of a study of watermarks in the Royal Collection of Graphic Art at Statens Museum for Kunst (SMK) in Copenhagen. Watermarks in paper are very useful to researchers because they can be used for dating, identifying sizes, mill trademarks and locations, and for determining the quality of a sheet of paper. Although paper may not have been used immediately after production, artists, like other paper consumers, mostly bought their paper in relatively small quantities and used it during a limited number of years.

The oldest watermark that we know of is Italian and dates from the 13th century.¹ In its simplest version, a watermark is made by one or more metal threads which are sewn to the wire of the paper mould. These threads will show up as lighter areas in the final paper sheet. Watermarks in paper are therefore usually visible in transmitted light. To identify a watermark it is often necessary to consult one or more of the watermark catalogues on the market.² These catalogues are most often arranged according to motif, period of time or geographical area, and finding a matching design in the books can be a very time-consuming task.

As the watermark collections became digitised and made searchable on the internet in a database format, the retrieval process became easier for the researcher. However it was the creation of the *Bernstein* – *The Memory of Paper* portal that made it possible to search a number of watermark databases simultaneously.³ Since 2009 the number of searchable databases in the portal has grown from four to 21 (August 2014). The portal is the visible result of an EU-funded research project which aims to create an integrated European digital environment for the expertise and history of paper by interlinking existing European databases of paper reproductions and making their content accessible to specialised image processing tools for the measurement of paper features.⁴

Apart from a variety of search facilities, the portal includes a searchable bibliography with more than 31,000 records on different aspects of paper. It also gives access to an opensource software package (Watermark Toolkit) with a freeware licence. With this software it is easy to create a watermark database with the same field structure as the databases in the *Bernstein – The Memory of Paper* portal. The database can then be uploaded or linked to the portal.⁵

The watermark database at CATS

Due to a generous donation from the Villum Foundation and the Velux Foundation, the Centre for Art Technological Studies and Conservation (CATS) was established in 2011 as a



Fig. 1 Portrait of Nicolai Abildgaard by Johannes Wiedewelt. Statens Museum for Kunst, KKS10722.



Fig. 2 Many of Abildgaard's drawings contain only the main watermark (WM), the countermark (CM) or just fragments of a watermark because they have been cut from larger paper sheets. One-third of the drawings show no traces of a watermark.

research partnership between SMK, the National Museum of Denmark and the School of Conservation at the Royal Danish Academy of Fine Arts, Schools of Architecture, Design and Conservation. One of the goals for the researchers at CATS is to set up a database of watermarks from the Royal Collection of Graphic Art at SMK. As a pilot project we have chosen the collection of works on paper by Nicolai Abildgaard comprising approximately 550–600 drawings and sketches, most of which are undated.

Nicolai Abildgaard (1743–1809) was a Danish painter, designer and architect (Fig. 1). Like many of his European contemporaries, Abildgaard went to Rome (1772–77) to study the ancient and Renaissance masters. In 1777 he returned to Denmark to work for the Danish king, Christian VII. On his journey back to Denmark, Abildgaard travelled via Paris, the Netherlands and Hamburg before arriving in Copenhagen in 1778, where he became member of the Academy of Fine Arts (the academy) and was appointed professor. He was director of the academy from 1789 to 1792 and again from 1801 to his death in 1809.

Among his works are historic paintings as well as literary and mythological works. He spent several years on 10 monumental canvas paintings for the Banqueting Hall at Christiansborg Castle. Unfortunately most of them were destroyed in a fire in 1794 which reduced the castle to ruins and only three paintings survived. His drawing skills were highly admired, but he also produced decorative work, sculpture and furniture designs as well as being engaged as an architect. The collection at SMK includes drawings of all these types of designs.

To build our database we are using the Watermark Toolkit software package from the Bernstein project. Our database will be searchable through the *Bernstein – The Memory of Paper* portal. In the majority of drawings the watermarks are clearly visible in transmitted light. These drawings are placed on a Planistar HQ5000 light table and photographed using a Canon Eos mark III camera with Zeiss macro planar T* 50 mm and Canon EF macro 100 mm



Fig. 3 An example of a document from the Royal Academy in Abildgaard's time.

objectives. The remaining watermarks will be recorded by X-radiography using an Andrex BW85 X-ray tube on Dürr NDT CRIP3040109/NDT HDIP3040108 digital image plates, and subsequently scanned in a HD-CR 35 NDT laser scanner.

In large drawings we are likely to find both a main watermark and a countermark, but generally a drawing only contains one of the two, or even just part of one, or none at all, as exemplified in Figure 2. This is also the case with the majority of Abildgaard's drawings.

Because of the many fragmented watermarks in the collection it was necessary to improve our knowledge of the papers which were used in Denmark in Abildgaard's time. Since the chances of finding paper sheets with both a main watermark and a countermark are more likely in archival material than in drawings, we turned to the National Archives and selected three groups of documents for closer examination:

- 1. The Academy of Fine Arts: drafts for letters, memorials (memos) and minutes of meetings in the academy assembly⁶ (Fig. 3)
- 2. Drafts for letters from the Danish chancellery to the Zealand area.⁷
- 3. Drafts and letters to and from Sokkelund and Smørum counties where the largest Danish paper mills were located in the period under study.⁸



Fig. 4 An example of a drawing with both a main watermark (the Roman goddess Fortuna) and a countermark (Van der Ley). Statens Museum for Kunst, KKSgb4075. H: 54.9 cm; W: 43.1 cm.



Fig. 5 Two drawings in the Abildgaard collection after being joined together. Left: Statens Museum for Kunst, KKSgb4048. H: 33.3 cm; W: 52.7 cm. Right: Statens Museum for Kunst, KKSgb4047. H: 33.9 cm; W: 50.8 cm.

Results

Examination of the watermarks in Abildgaard's drawings has shown that he used both Danish paper (approx. 35%) and paper of foreign origin (approx. 65%) for his drawings. A large majority of the foreign papers bear Dutch watermarks with the names of paper companies such as Honig & Zoonen, Van der Ley, Blauw, Schouten and Hessels. The Danish papers came mostly from the paper mills of Strandmøllen and Ørholm on the river Mølleåen north of Copenhagen, Engelsholm paper mill near Vejle in Jutland, Flensburg paper mill in North Schleswig (presentday Germany) and Nedre Mølle (Lower Mill) near Oslo in Norway. The mills in Flensburg and Oslo are regarded as Danish since North Schleswig and Norway were part of the Kingdom of Denmark in Abildgaard's time. Similar Dutch and Danish watermarks were also found in the examined papers at the Danish National Archives. The resemblance between the paper and watermarks in Abildgaard's drawings and in the academy documents is striking.

The distribution between Danish and foreign papers in Abildgaard's drawings is a good reflection of the general picture of paper consumption in Denmark in the late 18th century and beginning of the 19th century. One reason for the problem was the general lack of rags for the pulp. It was claimed that considerable quantities of rags were exported from Denmark to Holland and England.⁹ The utilisation of the rags was not optimal and the quality of the Danish paper could not compare with that of imported paper from Holland and France.¹⁰ It is only in Abildgaard's large architectural



Fig. 6 KKSgb4047 and KKSgb4048 after being rearranged. The two drawings probably originated from the same sheet of paper.





Fig. 7 The watermarks from KKSgb4047 and KKSgb4048.



Fig. 8 One of Abildgaard's decoration drawings for the Banqueting Hall at Christiansborg Castle. Statens Museum for Kunst, KKSgb4054. H: 42.3 cm; W: 52.1 cm.



Fig. 9 An example of a beehive watermark from the Danish paper mill at $\ensuremath{\textit{\varnothing}}\xspace{rel}$ holm.

drawings that we find paper with both a main watermark and a countermark such as the example shown in Figure 4. This rather peculiar looking drawing shows a monument for the tombs of the prominent Copenhagen businessman Peter Tutein and his wife. They both died in 1799 and were buried at Assistens cemetery in Copenhagen, but their bodies were moved to the family estate a few years later. The motif of the main watermark depicts the Roman goddess Fortuna above the Arms of Strasbourg with the letters VDL underneath. The countermark shows the name Van der Ley. The Fortuna motif has been used in watermarks since the 16th century but it is linked particularly to the Dutch paper company Van der Ley and the paper mill Het Fortuin (The Fortune) in Zandijk, North Holland.¹¹ Van der Ley was renowned for the production of high-quality writing, printing and drawing papers.

The inventory numbers KKSgb4047 and KKSgb4048 both show a panoramic view over a Mediterranean-looking town. The two drawings have been registered as separate objects, but as seen in Figure 5 they fit nicely together. If we rearrange the position of the two drawings (Fig. 6) and look at the watermarks (Fig. 7) we may also conclude that the two parts most probably originate from the same sheet of paper.

The main watermark shows a *fleur-de-lis* in a shield with the letters VDL (= Van der Ley) underneath the shield. The letters IV in the countermark are the initials of the French papermaker Jean Villedary. After his death his initials continued to be used as a mark of quality by other papermakers, including Van der Ley.¹² In 1764 Jacob Honig & Zoonen introduced the beehive watermark to the market. The company owned, among others, the paper mill De Vergulde Bijenkorf (The Gilded Beehive) in Zaandijk, North Holland.¹³ Abildgaard used paper from J. Honig & Zoonen for a large number of his drawings. We have found some beehive marks which can definitely be attributed to this company and even more examples of countermarks, or fragments of countermarks, with the name J. Honig & Zoonen. Judging from the examined documents in the National Archives, J. Honig & Zoonen was an important supplier of paper to the Danish market in Abildgaard's time.

We do not know if the watermark in Figure 8 (a beehive in a shield), can be attributed to J. Honig & Zoonen since



Fig. 10 Drawing on draft paper from Ørholm paper mill with a royal monogram of King Christian VII. Statens Museum for Kunst, KKSgb3899. H: 14.1 cm; W: 23.1 cm.



Fig. 11 Drawing on draft paper with a countermark from Ørholm paper mill. Statens Museum for Kunst, KKSgb3716. H: 19.7 cm; W: 33 cm.



Fig. 12 Drawing on draft paper from Strandmøllen with a royal monogram of King Christian VII. Statens Museum for Kunst, KKS7989. H: 18.6 cm; W: 17.2 cm.

there is no countermark to be seen in the paper. Abildgaard made this drawing as a draft for the decoration of one of the walls in the Banqueting Hall at Christiansborg Castle. This watermark was only found in Abildgaard's decoration drawings. The beehive motif was also used by Danish paper mills, including Strandmøllen and Ørholm paper mill (see Fig. 9). In the National Archives we found this beehive mark together with a countermark from Ørholm paper





Fig. 13 Drawing on Italian paper from Al Masso paper mill. Statens Museum for Kunst, KKSgb3756.

mill. The earliest example was found in a document dated 5 June 1797.¹⁴

From a dating point of view, the paper mill at Ørholm is important because it did not produce paper before July 1794. It was established by Henry Nelthropp and John Joseph Harris, two Englishmen with a background in the leather industry. In 1793 they obtained a licence to set up a paper mill at Ørholm and to collect rags for paper production. Besides the licence they were also granted a loan of 25,000 Danish *rigsdaler* from the Treasury who wanted to increase Danish paper production and subsequently to decrease the import of foreign paper.¹⁵Ørholm paper mill also used a royal monogram of King Christian VII as their watermark (see Fig. 10) together with different countermarks including the mark shown in Figure 11. Both marks appear in several drawings in the Abildgaard collection.

Before Ørholm paper appeared on the market, Strandmøllen, established in 1643, was the largest producer of paper in Denmark. From 1718 to 1896 it was owned by members of the Drewsen family.¹⁶ Strandmøllen also used a royal monogram of King Christian VII but the design differed from the Ørholm version (Fig. 12).

In the National Archives we found many examples of this royal monogram with the initials CD as a countermark (CD =

Christian Drewsen). Both the Ørholm and Strandmøllen versions appear in Abildgaard's drawings. The paper with the royal monogram from Strandmøllen and from Ørholm mill appears in two qualities in the drawings and in the documents: one is a cream-coloured paper with a relatively smooth surface while the other is a bluish-greyish coloured paper with a rough surface. According to Drewsen,¹⁷ Strandmøllen produced three types of writing paper, one of which was draft paper; presumably the bluish-greyish coloured paper belongs to this category.

Although the large majority of the foreign paper in the Abildgaard collection was produced in Holland there are a few exceptions. We have found three examples of a watermark with the name Engelade but we did not come across this mark in the National Archives. Engelade is the name of a location in Niedersachsen, Germany which had a paper mill operating from 1620 to 1866. Apparently this mill played an important economic role in the northern part of Germany.¹⁸ Abildgaard may have bought the paper on his travels.

One thing we have found puzzling during our examination of Abildgaard's drawings is that Italian paper seems to be almost completely absent in the collection— we have only been able to identify one watermark as Italian (see Fig. 13), from the paper mill Al Masso near Pescia.

Conclusions

The striking resemblance between the paper and watermarks in the drawings collection and in documents from the Royal Danish Academy of Fine Arts may lead to the assumption that Abildgaard either bought his paper from the same source as the academy or his paper was supplied by the academy. The watermarks in Figs 4, 5 and 8 did not appear in the examined documents at the National Archives. However, these papers were probably sold as drawing paper in a larger format than ordinary writing paper. Otherwise there is no obvious discrepancy between Abildgaard's choice of papers for drawings and sketches and what we have found in contemporary archival material. As for the question of the missing Italian paper, we have a few watermarks that are not yet identified. There are also a considerable number of drawings without traces of watermarks, some of which may be of Italian origin. It is also possible that Abildgaard's drawings and sketches from Italy were not among the paper objects that were acquired by SMK.

We are still at the early stages of our research. To date, all the drawings in the Abildgaard collection have been examined visually in transmitted light. However, we have to wait for the reproduction of the watermarks by photography or digital X-radiography to be completed before we can start comparing the marks and draw further conclusions. We will also need to study the paper structure and to correlate our accumulated data with art historical data on Abildgaard.

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Notes

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SEMI-MECHANICAL TRANSFER METHODS IN NICOLAI ABILDGAARD'S DRAWINGS

Niels Borring

ABSTRACT Although many drawings are often valued as individual works of art, most drawings are part of an artistic process of a project on which the artist is working. They can reveal how the artist has approached an image or a composition as well as verify that drawing was genuinely the first artist's discipline as described by Vasari in his treatise *Le vite de' piu eccellenti pittori, scultori e architetti* from 1568. However, many drawings that appear to be executed in the drawing media only also show traces of underdrawings or semi-mechanical transfer techniques. The latter types of drawings are often not highly regarded, and are considered as a mark of an apprentice, a later copyist or a lesser artist. In the case of the Danish 18th-century painter Nicolai Abildgaard, it is not that simple as he used a broad range of transfer techniques, as well as copying techniques, creatively in his art.

Introduction

The Danish Academy was established in 1754 having been inspired by the founding of the French Academy (Académie royale de peintre et de sculpture) in 1648. Accordingly the education of Danish artists changed and no longer solely depended on the traditional apprenticeship in a master's studio. As in the other European art academies, the teaching consisted primarily of classes in drawing. The student progressed through freehand drawing, after prints and drawings and finally after plaster casts and sculptures and only after passing these classes was he was able to move on to lifedrawing classes after a live model.¹ These classes are today often referred to as drawing after the flat, the round and after life. In the Danish Academy, the final classes were referred to as the Model or Figure School.

Odd as it may seem today, there was no teaching in painting at the academy at the time, and the student would still be apprenticed to a master. By drawing after good examples from antiquity and the Renaissance, the student would build up a catalogue of classical figures and poses that he could draw upon in his art while at the same time capturing the grandeur of the classical ideal.² The education of a young artist would have this duality of being connected to the academy and an apprentice. In the case of Nicolai Abildgaard, he was apprenticed to the Swedish-Danish artist and professor at the Danish Academy, Johan Edvard Mandelberg.³

According to the contemporary philologist and friend, Torkel Baden, Abildgaard was so skilled in drawing that he skipped the drawing after the round classes. Unheard of at the time, and without academy approval, he jumped directly from drawing after prints and drawings to drawing from life,4 thereby missing the classes in which the student learned to capture a three-dimensional object in the two-dimensional media that drawing represents. The story told by Baden could lead to the conclusion that Abildgaard might not have thought very highly of the drawing classes and the arduous academy tradition for educating students. However, the reverse is true - Abildgaard was very much in favour of the academic tradition of drawing. As art historian C.F. Høyen said about him: 'Abildgaard loved Art. He had many students, he kept them busy drawing at the Figure School and encouraged them by drawing himself. According to Høyen, Abildgaard even said: 'The most important in this institution, is that we do have a Figure School; but I am the only one thinking on the necessity of having a suitable model to draw from.'5

The Royal Collection of Graphic Art at Statens Museum for Kunst (SMK), the National Gallery of Denmark, has more than 500 drawings by Abildgaard. The collection is testament to the artist's drawing skills using a broad palette of techniques: pencil/graphite, black, red and white chalk, pen and ink, washes, water colour and gouaches. The study that has been undertaken also shows that within the collection a



Fig. 1 Left: Detail of a study for the relief *The Liberation*, Statens Museum for Kunst, KKS13202. Right: *A Woman Reprimanding a Crying Boy*, Statens Museum for Kunst, KKSgb3990. The holes from the perforation can easily be seen in transmitted light.

significant number of drawings seem to have been used in some kind of semi-mechanical transfer, suggesting that either the artist himself made use of transfer methods in the artistic process or that these drawings were used for other copying purposes either by Abildgaard or someone else. These methods can help transfer the outline of an image for another copy on paper or transfer the image to another media. As this requires that the artist has to redraw the image, the drawing is no longer completely in freehand. The discovery of the use of semi-mechanical drawing and copying aids somehow seems to contradict the statement that Abildgaard possessed elaborate drawing skills.

Semi-mechanical transfer methods

The semi-mechanical transfer methods found in the works by Abildgaard in the Graphic Art Collection include:

- 2 pounced drawings, where the outline of the motif has been pricked by a needle.
- 4 drawings with transparent paper so the image can be seen mirrored.
- 6 squared drawings, where the paper has been lined horizontally and vertically to create a grid in order to help the artist redraw the image.
- 47 traced drawings, where the outline of a motif has been traced with a pencil or stylus for transferring the image to an underlying paper or other media. Of these traced drawings, 36 of the drawings have a blackened verso.

Pouncing or spolvero

Pouncing or spolvero is usually connected with transferring an image to painting. The marks that the pouncing technique leaves on the original drawing are clearly visible because they perforate the paper (see Fig. 1). The copying principle of the technique is that the pounced drawing is powdered with black dust that penetrates through the holes and leaves small dots on the paper or canvas below. If the image is transferred to a media with a dark background, the dust could be white chalk. The artist would then redraw the image by following the small dots. The technique has been used since medieval and Renaissance times and is best known for transferring an image to a painting. But it can also be found in drawings,⁷ although no such drawings with the typical small dots have been identified among Abildgaard's works. Only two pounced drawings still exist in this collection: one is a study for the relief The Liberation (KKS13202) (Fig. 1, left) for the Liberty Memorial Monument, which was erected in memory of the abolition of the adscription in 1788, and the other is A Woman Reprimanding a Crying Boy (KKSgb3990) (Fig. 1, right).

There does seem to be some resemblance in the composition of the two drawings, however *A Woman Reprimanding a Crying Boy* (Fig. 1, right) can be linked to a grisaille painting exactly the same size at Frederiksborg Castle.⁸ Whether Abildgaard was responsible for the pouncing of the drawing cannot be confirmed: he may have simply taken responsibility for the overall design with the more decorative painted elements allocated to possibly a coarse painter or an apprentice. There exist two other drawings with the motif *The Liberation* in the collection, one of which is the



Fig. 2 A Study for Simo, Sosia and the Slaves, Statens Museum for Kunst, KKSgb3862, for the painting Simo and his Former Slave Sosia from Terence's Andria.



Fig. 3 The FTIR spectra from KKS3862 show that it is aged oil. The peak at 1714 $\rm cm^{-1}$ is typical for aged oil.

final version used in the Liberty Memorial Monument. The pounced drawing *The Liberation* (Fig. 1, left) seems to be an early sketch for this motif, but the reason for the pouncing of the drawing still remains unknown as to date this version has not been identified anywhere else.

Transparent paper

The collection contains some examples of mirroring or reversing by making the paper transparent. Although the technique in these cases may not necessarily be employed for transferring or copying purposes, I have included them in this survey of Abildgaard's drawing as they are still an aid in the artistic process, testing out composition, figures and poses.

The *Study for Simo, Sosia and the Slaves* (KKSgb3862) (Fig. 2) was executed for one of Abildgaard's four paintings from Terence's *Andria* series⁹ painted in 1801–04. Today it is very brown and darkened but originally it would have been transparent. Fourier transform infrared (FTIR) analysis shows that the brown substance is aged oil, possibly with a resin added (Fig. 3), something that Abildgaard did according to his recipes.¹⁰ The peak at 1714 cm⁻¹is typical for aged oil.

An interesting aspect in this drawing is that the whole surface of the paper has been covered ith oil. There is no trace of an underdrawing in black chalk or charcoal in the paper, and except for one small area, the ink does not penetrate to the verso of the paper – it is lying on top of the oiled paper. The recto of the paper seems to have been rubbed with an eraser, leaving many fibres on the surface partly loosened. As there



Fig. 4 Left: Running Female Figure with Two Arms Stretched, Statens Museum for Kunst, KKS8610, 175×137 mm. Middle: Running Female Figure with One Arm Stretched, Statens Museum for Kunst, KKSgb3690, 162×106 mm. Right: Detail of Pax Triumphans, Statens Museum for Kunst, KKSgb3691, H: 191 mm.

are no traces of an underdrawing (small traces can usually be found under the ink lines), it is possible that the distorted surface of the paper is the result of extensive rubbing to remove sand used for drying off excess ink. It could also indicate that as the oil had not dried completely, the artist decided not to wait for the ink to air dry but speeded up the drying process to prevent disturbance to the artistic process. However, small particles that in low magnification resemble sand appear in high magnification to be particles from a broken oil film. The fact that the oil covers the whole surface of the paper and that the ink is lying on top of the paper is an indication that the oil was added before the drawing. Accordingly it would suggest that the oiled transparent paper was used to redraw and copy the figures from other drawings by placing a light source behind.

In the painting *Simo and his Former Slave Sosia* (KMS587), Abildgaard has used the composition mirrored. By employing transparent paper he was able to bring together the figures and figure groups from different sketches and test out the composition prior to drawing them for the painting. It would probably indicate that Abildgaard had settled on the postures of the figures but was not satisfied with the overall composition. The use of a transparent paper also suggests that he had already decided that the motif in the painting should be mirrored when he did the drawing.

Another example of Abildgaard's use of making paper transparent is found in the two drawings with running female figures, both done in ink on paper: *Running Female Figure with Two Arms Stretched* (KKS8610) and *Running Female Figure with One Arm Stretched* (KKSgb3690) (Fig. 4). Like the *Study for Simo, Sosia and the Slaves* (KKSgb3862) the appearance of these drawings today is quite different from how they would have looked in Abildgaard's time, when they were transparent. In these two drawings the oil is 'painted' so that it just covers the outlines of the figures. This suggests that the oil was applied after the drawing was done, and that the purpose of the 'oiling' was to be able to see the image mirrored. The two oils appear very different in colour, possibly because the artist used a different mix of oil and resin or different oils. The 'halos' along the edge of the applied oil are also different in the two drawings, indicating that the oil-resin mixture was more diluted in the female figure in KKSgb3690, allowing it to soak more easily into the paper thus creating a broader halo. Under the microscope it is also obvious that the ink is not lying on top of the oiled paper, but has soaked into the paper. This also confirms that the oil was applied to the finished drawings.

A former director of SMK, Leo Swane, connected these two drawings with two drawings of *Pax Triumphans* (KKSgb3691 and KKS8398), in which the Danish genius stops the chariot with the war goddess Biga (Fig. 4, far right). There is in fact some resemblance between the two figures and the genius, especially in the lower part of the *Running Female with One Arm Stretched* and the Danish genius. However, it does not make sense that the two drawings have been made transparent to allow the figures to be used mirrored, as the Danish genius is not mirrored.

If the two drawings are compared with the female figure in another painting from Terence's *Andria* series, *The Slave Davus and the Maid Mysis* (Fig. 5), it becomes obvious that Abildgaard used the poses of the reversed figures in the *Maid Mysis* in the painting. The maid in the painting is much larger (approximately 40 cm), nevertheless the upper part of the *Running Female Figure with Two Stretched Arms* fits quite well with the upper and mid part of the maid while the feet of the *Running Female Figure with One Arm Stretched* is a better fit with the lower part of the maid.



Fig. 5 Left and middle: The two drawings mirrored in transmitted light. Right: The Slave Davus and the Maid Mysis, Statens Museum for Kunst, KMS587.



Fig. 6 Left: Nicolai Abildgaard, study for *Kjøbenhavns Skilderie, No 3*, Statens Museum for Kunst, KKSgb3681. Right: The print *Kjøbenhavns Skilderie, No 3*, Statens Museum for Kunst, KKS10919a, by J.F. Clemens.

In his book on Abildgaard's painting techniques, Troels Filtenborg discusses that for 'the paintings where the transfer of the design has involved a change of scale, it is likely that the method of squaring the drawings was also employed, although it is difficult to establish to what extent, as few squared drawings (and no squared paintings) by Abildgaard have as yet been identified'.¹¹ The reason for a possible undetected squaring on the paintings may be that the squaring was done in white chalk on a dark background that is not detectable with infrared reflectography (IRR). The transfer of the composition could however also have been projected by using a *laterna magica*, a technique demonstrated by Abildgaard in the *Kjøbenhavns Skilderie*, a satirical series of prints by J.F. Clemens (Fig. 6, left and right respectively). However, which technique he used for

transferring the figures to the canvas, whether squaring, projecting or freehand drawing, remains unknown. The figure in the painting is not an exact copy of the figures in the drawings, so whatever technique Abildgaard used, he probably elaborated on and finished the figure on the canvas.

Squaring and tracing

From medieval times, squaring in combination with a grid in front of the motif has been used by artists to help capture landscape and town perspectives, and to aid with the proportions and foreshortening of models. This can be seen in



Fig. 7 Illustration on the use of squaring by Albrecht Dürer from his book *Die Unterweysung der Messung* from 1525, Statens Museum for Kunst, KKSgb8182.

the famous illustration on perspective by the German artist Albrecht Dürer (Fig. 7). However, squaring is also used to maximise, minimise or copy a whole composition, to help to place a single figure in another part of the composition or in a complete new drawing. Squaring on top of a drawing is obviously applied after the drawing has been finished, making that drawing the *original* after which a 'copy' has been drawn. If the squaring lies below the drawing, it was clearly placed there before copying to help the artist achieve the right size, composition and posture of the figures, i.e. creating a grid to help capture an image or make a *copy*.

Many of the squared drawings by Abildgaard show signs of also having been used for semi-mechanical transfer by tracing. Tracing, or indirect incision as it is also known, implies that the contours of the image in the drawing are redrawn with a stylus or pencil. The verso is smudged with charcoal, chalk or graphite, and in the process the image is copied to another underlying paper or to a painting. The redrawing leaves the contours of the image deepened that can sometimes be detected as can be seen on the verso of the drawing *Pax Triumphans* (KKS8398) (Fig. 8).

Apart from the smudged verso, often the black chalk, charcoal or graphite is missing where the stylus has traced the contour (also visible in Fig. 8). However, not all drawings that have been traced on the recto have a smudged verso – sometimes the tracing is easy to see on the verso anyway. It is possible that the artist or whoever did the tracing (possibly a printmaker) could have used a smudged paper to place underneath the drawing instead (in the same way as carbon paper was used in the past).

Copying for printing?

These two phenomena can be found in the drawings related to the print series *Niels Klim's Underground Travels* made by J.F. Clemens.¹² The sketch *The Monkey-President of Martinia* (Fig. 9) is just such a study for the print made by Clemens. The sketch is larger than the print, and both the drawing and the squaring are done in graphite. It cannot be verified whether



Fig. 8 Pax Triumphans verso, Statens Museum for Kunst, KKS8398. The traced lines can be seen on the verso.

the squaring is below or on top of the drawing but it does seem obvious that the purpose of the squaring must have been to minimise the image.

In the printing process the image is reversed, and in the process of transferring the image, there must have been a drawn copy the same size as the print as in the case of The Envoys Visiting the Emperor of Qvama (KKSgb3702) (Fig. 10), where the drawing has been traced and has smudging on the verso. The tracing in this instance has been done in graphite, as has the smudging on the verso, and as it can be seen in the print, the image has been reversed, as would be expected. Therefore it appears that the tracing and the smudging was done as part of the process for transferring the image to print. However, there are examples of drawings with the same motif, where both the large drawing and the smaller print size drawings still exist and the smaller one has been traced but shows no sign of smudging on the verso. Whereas the larger drawings were probably the first versions, the print size drawings were almost certainly the final print-ready versions. The motifs in the prints in these examples are not mirrored in the printing process.

If the motif is to be identical to the initial drawing, and not reversed in the printing process, the image would need to be drawn mirrored on the printing plate. This would most



Fig. 9 Left: Nicolai Abildbaard, *The Monkey-President of Martinia*, Statens Museum for Kunst, KKSgb3701, 180 × 154 mm. Right: J.F. Clemens, print of *The Monkey-President of Martinia*, Statens Museum for Kunst, KKS5932, 132 × 99 mm.



Fig. 10 Left and middle: *The Envoys Visiting the Emperor of Qvama*, recto and verso, Statens Museum for Kunst, KKSgb3702. Right: The print by Clemens with the motif reversed, Statens Museum for Kunst, KKS10905. The print and the drawing are the same size.

probably mean that there must have existed a drawing with the mirrored image. Such a transferred mirrored copy could easily have been made by placing a fresh sheet of paper under the drawing, and under this a sheet of 'carbon paper' with the smudged side up. The mirrored image would appear on the verso of the clean paper and when transferred to a printing plate and printed, the image would be identical to that of the first drawing. The drawings and print for the *Niels Klim Reappears in the Norwegian Mountains* (Fig. 11) are probably such an example.

This may explain why some of the drawings have smudging on the verso and some do not – at least for those that have



Fig. 11 Left: Nicolai Abildgaard, *Niels Klim Reappears in the Norwegian Mountains*, Statens Museum for Kunst, KKSgb3706, 174 × 186 mm. Middle: *Niels Klim Reappears in the Norwegian Mountains*, Statens Museum for Kunst, KKSgb3707, 155 × 112 mm. Right: J.F. Clemens, *Niels Klim Reappears in the Norwegian Mountains*, Statens Museum for Kunst, KKSgb3707, 155 × 112 mm. Right: J.F. Clemens, *Niels Klim Reappears in the Norwegian Mountains*, Statens Museum for Kunst, KKSgb3707, 155 × 112 mm. Right: J.F. Clemens, *Niels Klim Reappears in the Norwegian Mountains*, Statens Museum for Kunst, KKSgb5928.



Fig. 12 Top left and right: *Study for a Composition: A King Knight a Man, Surrounded by Warriors at a Thingstead,* Statens Museum for Kunst, KKSgb3663, recto and verso. Bottom left: *Study for a Composition: A King Knight a Man, Surrounded by Warriors at a Thingstead,* Statens Museum for Kunst, KKSgb3664. Bottom right: magnification of the transferred lines in black chalk, Statens Museum for Kunst, KKSgb3664.

been used for printing. This 'rule' does seem to apply to all the other drawings made for the print series that Abildgaard did with Clemens. An interesting question, of course, is whether it was Abildgaard or the printer, Clemens, who did the squaring and the minimising of the images. It does seem obvious that Abildgaard would want to approve the final image before transferring it to print, but would he also do all the laborious work of minimising the images to the size of the



Fig. 13 Left: Mourning Nemesis, Statens Museum for Kunst, KKSgb3794. Right: Mourning Nemesis, Statens Museum for Kunst, KKSgb3795.

prints in the book? If he was so closely involved in the printing process, why did he not just make his sketches the right size from the start? There are no answers yet but these questions are interesting to keep in mind.

Copying as a creative tool in the artistic process?

While trace marks and smudging in many of the drawings can easily be explained as deriving from some kind of use for printing, others show that Abildgaard did use transfer techniques as a creative and speedy way to obtain a new copy on which to work. An example can be seen in the *Study for a Composition: A King Knight a Man, Surrounded by Warriors at a Thingstead* (KKSgb3664) (Fig. 12), copied from the other drawing with the same title (KKSgb3663). Here the smudged verso is done in black chalk. The smudging that is missing on the verso can be identified under the microscope as lines in the copied version. So it seems that Abildgaard, once he had worked out the composition, did not care to draw it once more, but chose to transfer-copy the composition instead, and then continue working on the transferred copy.

While the connection between some drawings and transfers are easy to establish, others are more difficult to find, as in the case of the two versions (KKSgb3794 and KKSgb3795) of the *Mourning Nemesis* (Fig. 13). The drawings are sketches for the water colour *Nemesis Mourning over the Exile of P.A. Heiberg* in the collection of the Royal Danish Library. KKSgb3794 (Fig. 13, left) seems to have been transferred using a lot of pressure, because the contours of the image can be clearly seen on the verso while KKSgb3795 (Fig. 13, right) has what appear to be transferred lines in graphite, easily identified under the microscope or in raking light.

If the two versions are placed on top of each other in Photoshop, parts of the drawings are found to match completely. However, even when other parts also match, the overall image does not. In the watercolour drawing, the design appears to be a mixture of the two drawings. The drapery in the front clearly matches that of KKSgb3794 (Fig. 13, left), while other parts of the drapery and the wings match KKSgb3795 (Fig. 13, right). Of course, in the final drawing Abildgaard could have drawn elements from the two versions, but the design fits so well that it may indicate that he copy-transferred from the two versions.

Conclusions

The majority of Nicolai Abildgaard's drawings are done in freehand, something at which he seems very skilled. The large number of drawings that have been passed on to us also indicate that Abildgaard took drawing as an academy discipline very seriously, which has also been verified by his contemporaries. It is therefore a surprise that approximately 10% of his drawings show traces of copying or transfer methods, as transfer techniques do not appear to be part of the teaching in drawing at the academy. The majority of drawings with transfer marks seem to relate to the graphic reproductions printed by Clemens. This would probably explain many of the transfer marks, such as the squaring and the tracing, and smudged versos. It can probably also be disputed whether all of these drawings are by Abildgaard or if they - or some - were done by Clemens after Abildgaard's design. Only two existing drawings in the collection at SMK are related to the transfer of an image to a painting using the spolvero technique. This technique is usually associated with traditional painting workshop practice, and the reason that only two still exist could be that the drawings were either destroyed during the process or were not returned to Abildgaard.

The other type of drawings made transparent with oil show that Abildgaard used both transparent paper for copying purposes and for mirroring images but which technique he actually used for transferring the images on paper to canvas still remains unanswered. Perhaps he mixed techniques, but the drawings show Abildgaard adopted a very practical attitude towards testing out figures in a composition and possibly also for transferring the figures onto canvas. It is also in this more creative manner that the rest of the transfer drawings can be viewed. Abildgaard copied his own figures and whole compositions freely with semi-mechanical methods and elaborates on some of these copy drawings. It seems that he mixed disciplines and working processes from both the traditional painting studio and the academy teaching. All in all he seems to have had a relaxed and creative attitude towards various aids.

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Notes

- T. Lederballe (ed.), 'Krop og tradition', in Nicolai Abildgaard, *Kroppen i oprør*, Copenhagen, Statens Museum for Kunst, 2009.
 Ibid.
- 3. See eng.wikipedia.org/wiki/Johan_Edvard_Mandenberg. Johan Edvard Mandelberg, 1731–1786. Mandenberg was a Swedish artist who studied with Francois Boucher in Paris. He was offered financial support by the Danish king, Frederik V on the condition that he would paint for the king. After studying in Rome he came to Denmark in 1759 to become member of the academy, and in 1763 was appointed professor.
- 4. See Lederballe 2009 (cited in note 1), p. 18.
- 5. Ibid., p. 16: 'Abildgaard elskede kunsten, havde mange elever, holdt dem til flittigen at tegne i Modelskolen, og opmuntrede dem ved selv at tegne. I øvrigt sagde han: "Det vigtigste ved hele denne stiftelse er dette: at vi have en Modelskole; men jeg er den eneste, der tænker på, at det er nødvendigt at have en brugbare model".

- 6. C. Bambach, *Drawing and Painting in the Renaissance Workshop*, Cambridge, Cambridge University Press, 1999.
- 7. C. Bambach, *The Tradition of Pouncing Drawings in the Italian Renaissance Workshop: Innovation and Derivation*, vol. 1, New Haven and London, Yale University Press, 1988.
- 8. See T. Filtenborg, *Between Formula and Freestyle: Nicolai Abildgaard and 18th-Century Painting Technique*, London, Archetype Publications in association with Statens Museum for Kunst and CATS, Copenhagen, 2014, p.40, note 8: 'The cartoon *A Woman Reprimanding a Crying Boy* (367 × 309 mm, black chalk on pricked paper, The Royal Collection of Prints and Drawings, Statens Museum for Kunst, KKSgb3990) for the equivalent painting *School Scene* (69.2 ×108.7 cm, oil on gold leaf on canvas, The Museum of National History, Frederiksborg Castle, A7456). The identical measurements of the drawing and the equivalent section in the painting make it likely that the drawing was in fact utilised as a cartoon, although no traces of the transfer or underdrawing have been identified in the painting.'
- 9 See P. Nørgaard Larsen in Lederballe 2009 (cited in note 1), text for cat. nos. 67, 68, 69 and 70, pp. 267–268. Abildgaard held the French edition of the play *Andria* from AD 166 written by Publius Trentius Afer in his library. In 1801–04 he painted four pictures with motifs from the play.
- 10. See Filtenborg 2014 (cited in note 8), p. 37.
- 11. Ibid.
- 12. See Lederballe 2009 (cited in note 1), p. 102. Niels Klim's *Underground Travels* was first published in Latin in Leipzig in 1741, in an attempt to avoid Danish censorship. The book was published in Danish in 1789 in the translation by Jens Baggesen with prints by Clemens after the design by Abildgaard.

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CANVAS SUPPORTS IN PAINTINGS BY NICOLAI ABILDGAARD: FABRICS AND FORMATS

Troels Filtenborg

ABSTRACT An investigation of the technique and materials in paintings by the Danish artist Nicolai Abildgaard included examination of the canvas supports in a large number of his works. Thread count and weave density were studied by automated weave-mapping computer software, designed for working with digital X-radiographs. This was also used for the comparison of weave patterns in order to establish matches between the canvases of various paintings and thereby verify that different canvases originated from the same bolt. The canvas supports of paintings executed by Abildgaard in Rome 1772–77 appeared to be typical only in some ways for Italian canvas production of the era. In comparison, the supports of his Danish paintings were found to have features in common that to a large degree were determined by practical and economic factors such as Danish 18th-century fiscal policy, market conditions and manufacture circumstances. This applied to the quality of the fabric, i.e. the type of fibre, thread count and tightness of weave, as well as the scale and the formats within which the majority of the paintings fall.

Introduction

The artist and architect Nicolai Abildgaard (1743–1809) was the most prominent history painter in Denmark in the latter part of the 18th century. As professor, and for two terms director, at the Royal Academy of Fine Arts in Copenhagen, he exerted influence on many Danish artists of the following generation such as C.W. Eckersberg and other painters of the so-called Golden Age of Danish painting.



Fig. 1 Detail of the tacking edge of *The Wounded Philoctetes* (see Fig. 2) showing the coarse and open weave, typical of the canvas in Abildgaard's paintings from his sojourn in Rome.

A large number of Abildgaard's paintings from throughout his career have in recent years been subjected to technical studies by X-radiography, infrared reflectography and spectroscopic and elemental analysis. As part of the study, the thread count and weave density of a number of painting canvases were analysed by automated weave-mapping software, designed for working with digital X-radiographs. This software was used to identify warp and weft directions and to compare weave patterns in order to establish matches between the canvas supports of various paintings.

As a result of the composite nature of his training at the Royal Academy of Fine Arts in Copenhagen (1764-67), as well as in Rome (1772–77) and a few months in Paris (1777), a number of factors in Abildgaard's formative years were influential in shaping his painting methods and choice of materials. The impression, conveyed by the present study, of an artist unwilling to comply with one single set of received standards for the production of paintings, is perhaps therefore not surprising. Structural characteristics of his works show varying technical solutions applied in the creative process, with no clear relation to the chronology of his production. Defying a specific formula, an apparent feature of his working method is the coexistence of a stepwise, systematic approach, typical for academic painting technique of the period, alongside a freer, more alla prima manner of execution.1

The lack of a distinct pattern and an element of arbitrariness in Abildgaard's technique suggest that its most characteristic feature is in fact its inconsistency. That being said, certain elements of his practice were obviously conditioned by circumstances of his time and place, such as the nature and availability of specific materials. A substantial number of the canvas supports in Abildgaard's paintings thus have features in common that to a large extent were governed by practical and economic factors such as market conditions and manufacture circumstances for Danish canvas in the late 18th century. This applies to the quality of the fabrics as well as the scale and the formats of the majority of his paintings.

Abildgaard's painting canvases in the context of contemporary canvas manufacture

During his years in Rome, Abildgaard most likely painted on canvases purchased locally and presumably manufactured in Italy, although canvas imported from France also seems to have been available. Italian and French canvases were often made entirely of hemp or, alternatively, a hemp-linen mixture (i.e. with the warp of hemp and the weft of flax), as has been reported in Italian as well as French paintings of the 18th century.² However, analysis of three canvases from Abildgaard's Roman years failed to identify hemp, indicating instead that flax was the fibre of the warp as well as the weft threads in two of the canvases, while results for the third canvas were inconclusive.³

After his return to Denmark in 1777, Abildgaard seems to have painted mostly, if not entirely, on linen canvases. Fibre analysis of the canvases from four grisaille overdoor paintings showed the use of flax even in these rather coarse canvases where one might expect the use of hemp, a material used in Denmark, for instance, for sailcloth and mattress covers.⁴ It is very likely that the supports in Abildgaard's paintings from then on were almost entirely of domestic origin. The mercantilism of Danish 18th-century fiscal policy implied that the country should be self-sufficient to the largest possible extent. This meant that restrictions were placed on the import of products such as flax and linen. This protectionism persisted for some commodities well into the 19th century with the effect that high tariff rates were imposed on imported canvas. Rates for the very finest qualities of linen were only 6–12% of their value, but reached 20–50% for the standard and medium qualities, which were those that constituted the bulk of the domestic production and the types mostly used for painting supports. While customs regulations fluctuated and were occasionally modified, for example briefly in the late 1790s, the protectionism was not abandoned entirely until 1838.⁵ Customs registers of the time show that some import of canvas did in fact take place but this was in moderate quantities and typically involved finer and bleached qualities from Germany and the Netherlands. In addition, from 1741 on there was even an overall ban on the import of the coarsest fabrics made either from tow, flax or hemp.⁶ Consequently, there is a reasonable likelihood that the vast majority of the canvases used by Abildgaard after his return from Italy were of Danish origin.

Indeed, the canvases employed by Abildgaard during this part of his career do appear to be typical products of local 18th-century linen manufacture. Compared to the canvases of the paintings from Abildgaard's period in Rome, which tend to be rather coarse and with an open weave (Fig. 1) – some with no more than 8×6 threads/cm² – the domestic ones are more tightly woven.⁷ The canvases in both groups are made in a plain weave. However, apart from the supports of Abildgaard's overdoor paintings (typically 10-11 threads/cm²), his canvases tend to have between 10 and 14 threads/cm², and are therefore in general not particularly fine, although they do show some variation in quality. The survey of thread counts showed no obvious development in his production towards painting on either finer or coarser canvases. Of course, the major part of canvas manufacture served a number of purposes other than its use as painting supports. The latter would have applied to a minimal part of the production, so the range of available canvas grades determined the quality of the painting supports rather than the opposite.

In Denmark, the output of individual independent weavers constituted the bulk of 18th-century canvas production. Although a few larger Danish weaving enterprises did operate in the second half of the century, some with a considerable number of looms, it was still basically a pre-industrial manufacturing process in the sense that neither power-spinning machines nor power looms existed for the production of linen in the country before well into the 19th century.⁸

Looking at the sizes of Abildgaard's paintings, they too appear to be conditioned by local circumstances. Among those executed in Italy, the size of his *Wounded Philoctetes* from 1775 (Fig. 2), converted into Roman measures of the period, closely approximates 50×70 Roman inches with the tacking edges included. A similar correlation is found in *Male Figure* (1774) and *Seated Male Nude* (1772–77), both with dimensions very close to 40×30 Roman inches. Alternatively, the height of the latter paintings (100.5 and 98 cm, respectively, not including the tacking edges) is roughly equivalent to half a Roman *canna*. The Roman *canna* for linen was equivalent to 2 metres and indications are that canvas was sold by this unit.⁹

In Denmark, cloth was sold by the ell. The official Danish ell was, since 1698, equivalent to 62.77 cm.¹⁰ This measure of length is recurrent in the sizes of several Abildgaard canvases. The paintings Hamlet and his Mother. Episode from Shakespeare's Hamlet ($50.5 \times 64 \text{ cm}$), Fingal Sees the Ghosts of his Forefathers by Moonlight (69.5 × 61 cm) (Fig. 3), The Archangel Michael and Satan Disputing about the Body of Moses (49.7 × 61.7 cm), Richard III before the Battle of Bosworth ($39.5 \times 61 \text{ cm}$), The Dying Messalina ($61 \times 77 \text{ cm}$), and Culmin's Ghost Appearing Before his Mother (62 × 78 cm) all have sizes which in either height or width are very close to one *ell*; in several cases there is an almost exact match with the tacking edges included.¹¹ Furthermore, the canvases of 11 oil sketches for Abildgaard's decorative scheme at the Christiansborg Palace, executed 1778-91, including their tacking edges, are all almost precisely one *ell* high.



Fig. 2 Nicolai Abildgaard, *The Wounded Philoctetes*, 1775, oil on canvas, 123×175.5 cm, Statens Museum for Kunst, KMS586.



Fig. 3 Nicolai Abildgaard, *Fingal Sees the Ghosts of his Forefathers by Moonlight, c*.1782, oil on canvas, 49.5×61 cm, Statens Museum for Kunst, KMS3986.

The growing tendency in the 17th and 18th centuries for commercial priming of canvases to replace this element of the practical work in the artists' studios obviously also reached Denmark, although probably with some delay. Indications are that, as in other European cities of the period, commercially primed canvas was indeed available in 18th-century Copenhagen. Yet, no names or information on professional primers or suppliers before the first half of the 19th century seem to have survived. The sales catalogue for the estate auction in 1786, after the death of Abildgaard's teacher at the



Fig. 4 Based on the matching patterns of their weave densities, colour coded on the basis of automated thread counts (in this case the weft threads), the canvases of two paintings were found to originate from the same bolt of canvas: *Niels Klim Thinks he Hears the Deacon when he is Awakened by a Bull* (1785–87, oil on canvas, 41.5 × 35.5 cm, Statens Museum for Kunst, KMS593) and *Niels Klim in Potu* (1785–87, oil on canvas, 41.5 × 34 cm, Statens Museum for Kunst, KMS3901).

Royal Academy, Professor Johan Edvard Mandelberg, lists among the contents of his studio bolts of primed canvas as well as various canvases mounted on strainers.¹² Among the latter, the catalogue does however appear to differentiate between primed and unprimed canvases, suggesting that Mandelberg's studio practice included the individual priming of separate painting canvases as well as perhaps the employment of commercially primed canvases.

The development of commercial priming was followed by the introduction of standardised support dimensions, a practice already documented in France by the mid-18th century. Antoine-Joseph Pernety, in his *Dictionaire portatif de peinture, sculpture et gravure* from 1757 (of which Abildgaard owned a copy) lists 15 set formats of primed and stretched canvases, named according to their individual prices and therefore presumably available on the market.¹³ The question remains, however, as to what extent, or at what rate, contemporary painters adopted these standardised supports. The paragraph on painting canvas in Diderot's *Encyclopédie* from 1765 indicates that the term *toile* denoted a stretched and ready-primed canvas, but it does not suggest whether this term also implied a set format.¹⁴

Results of computer-assisted weave analysis and automated thread count investigation, based on digital X-radiographs as well as observation of primary cusping, demonstrate that Abildgaard's canvases were, in most cases, cut from larger, ready-primed pieces.¹⁵ In several instances different painting supports were found to have come from the same bolt of canvas (Fig. 4). Not surprisingly, this is particularly evident for some of Abildgaard's serial paintings, for instance his illustrations (1785–87) for Ludvig Holberg's novel *The Journey of Niels Klim to the World Underground*. In this case, five of the 10 canvases could be shown to originate from the same bolt (Fig. 5). Furthermore, they share



Fig. 5 Five of the paintings in Abildgaard's *Niels Klim* series (1785–87) were shown to originate from the same bolt of canvas, based on matching weave density patterns in their warp and weft threads

Pernety canvas formats 1757



Fig. 6 Diagram of standardised formats of primed and stretched canvases as listed in A.-J. Pernety's *Dictionaire portatif de peinture, sculpture et gravure,* 1757.



Fig. 7 Diagram of the formats of 91 canvas paintings by Abildgaard, dated 1766-1809.

the same type of terracotta-coloured ground, different from the ground found in the remaining paintings of the series.

Abildgaard's canvases were rarely primed after stretching on their individual strainers; in the present study (apart from three surviving large-scale canvases executed for the Christiansborg Palace) this applied only to the early *Philoctetes* painted in Rome (see Fig. 2), the small *Fingal Sees the Ghosts of his Forefathers by Moonlight* (see Fig. 3), and the late four scenes from Terence's comedy *Andria* created by Abildgaard for the walls in his own home 1801–1804.¹⁶ Although it is possible that Abildgaard did sometimes have his canvases primed and stretched to order, indications are that, in Copenhagen, the purchase of ready-stretched canvases was not common practice among artists at the time: the 1802 sales catalogue for the estate auction, after the death of the painter Jens Juel, Abildgaard's friend and colleague as professor at the Royal Academy of Fine Arts, lists among the studio contents 11 strainers.¹⁷

A diagram of the formats listed by Pernety shows a stepwise, almost straight linear pattern (Fig. 6). Compared to that, a survey of the formats of 88 paintings by Abildgaard

Table 1 The dimensions of 91 paintings by Abildgaard dating from throughout his career.

Title	Date	Dimensions (in cm)
The Israelites Gathering Manna in the Desert	1766	109.5 × 141.5
David Anointed by Samuel	<i>c</i> .1767	39 × 47.8
David Anointed by Samuel	1767	103.3×136.8
Male figure, Rome	1774	100.5×75
Adrastus Slaying Himself at the Tomb of Atys	c.1774–75	48×57.4
The Wounded Philoctetes	1775	123×175.5
Standing Nude, Rome	1772–77	68.1×51.7
Seated Male Nude	1772–77	98 × 75
Hamlet delivering a Letter Written by Himself to the Queen of Scotland	1773–79	47.8×53
Ymir Suckling the Cow Audhumla	c.1777	37×45.5
Svein Forkbeard Ransomed by Danish Women	1778	103×154.5
Hamlet and his Mother	c.1778	50.5×64
King Christian I Proclaiming Holstein a Duchy (oil sketch)	1778	60.5×38
King Christian I Proclaiming Holstein a Duchy	1780	308×197
King Christian III succouring Denmark (oil sketch)	1780	61.5×37
King Christian III succouring Denmark	1781	317×200
Frederik II Builds Kronborg Castle at Elsinore (oil sketch)	1781	61.5×36.5
Frederik II Builds Kronborg Castle at Elsinore	1781-82	309×197
Ossian	1780-82	42×35.5
Christian IV aboard his Flagship 'Trefoldigheden' (oil sketch)	1782	61×37
Cupid Playing the Lyre	c.1782	28.5×23.4
The Archangel Michael and Satan Disputing about the Body of Moses	c.1782	49.7×61.7
Fingal Sees the Ghosts of his Forefathers by Moonlight	c.1782	49.5×61
Absolute Monarchy Assigned to Frederik III in 1660 (oil sketch)	1783	61×37
The Heir Apparent, Prince Frederik Awakening the Sleeping Fama with the Aid of Clio	c.1783	115×93
Christian V's Danish Law 1683 (oil sketch)	1784	61×37
Socrates with his Daemon	c.1784	790×115
Richard the Third, from Shakespeare's Richard the Third	c.1785	32×45
Magnus Stenbock Surrenders the Fortress Tønningen to King Frederik in 1714 (oil sketch)	1785	61×37
The Construction of Copenhagen's Dock in the Reign of Christian VI (oil sketch)	1786	61.5×37
Niels Klim Thinks he Hears the Deacon when He is Awakened by a Bull	1785-87	41.5×35.5
The Guards Leading Away a Potuan	1785-87	42.5×35.5
The Potuans are Surprised to see Niels Klim Genuflect in front of the Wise Prince	1785-87	42×35.5
Niels Klim in Potu	1785-87	41.5×34
The Prayers of the Potuans at the Feast of the Unfathomable God	1785-87	42×35.5
The Triumph of a Potuan, whose Reform Proposal has been Approved	1785-87	42×35.5
Niels Klim Attends the Sentencing of the Deceased Potuan Prince	1785-87	42.5×35.5
The Doctor's Wife Reveals her Husband's Intention of Anatomizing Niels Klim	1785-87	42×35.5
Quamites Taking the Shipwrecked Niels Klim into their Yawl of Withies and Oak Twigs	1785-87	41.6×35.5
Niels Klim Receives the Homage of the Quamites	1785-87	42×35.5
King Frederik V as Patron of Science and the Arts (oil sketch)	1787	61 × 37.5
Richard the Third Awakening from his Nightmare	1787	38 × 29
Richard the Third before the Battle at Bosworth	1780-89	39.5 × 61
<i>The Abolition of Adscription in 1788</i> (oil sketch)	1789–90	62.5×37
Christian VII Uniting the Ducal with the Royal Part of Holstein in 1767 (oil sketch)	1789–90	60.5×38.5
Ismene and Antigone Plead with Theseus	1790s	38 × 46.5

Title	Date	Dimensions (in cm)
Socrates and Aspasia	c.1790	30×43
Fingal Giving Ossian his Weapons	c.1790	64.2×72.5
Amor and Psyche Embracing	c.1790	42×35.5
Alexander's Messenger with the Persian Philosopher	c.1790	40.9×52.1
Jupiter Weighing the Fate of Man	1793	129.5×108
Culmin's Ghost Appearing Before his Mother	Before 1794	63×78
Fulvia and Albina	c.1796–97	47×48
Albina, Fulvia, The Tribute, and Julia	c.1796–97	47×47
The Dying Messalina	c.1797	61×77
Two Young Men Confessing to Alexander the Great their Conspiracy	c.1800	33.5×38.5
Nightmare	c.1800	35.3×41.7
Theology	1800	73×56.5
Philosophy	1800	73×57.5
Justice	1800	73.5×57
A Woman Condemned to Starvation in a Cave	1800	35.5×42
Nightmare	1800	41.5×54.5
Julia and Fulvia	1800	47×46.5
Marc Anthony, Augustus, Julia, Sextus Pompey, and Soldiers	1800	47.8×59.4
Alexander the Great and Diogenes	1800s	47×38
Theology. Allegory	1800s	73.2×57
The World Supremacy of Christianity. Allegory	1800s	29 × 36.5
The Oath of Fealty in 1660	1806	47×41
Anacreaon and Bathyllus	1808	47×37.5
Tibullus Lamenting outside the Door of his Beloved	1808	47.5×37.5
The Housekeeper of the Robbers Comforting the Young Girl with the Myth of Cupid and Psyche	1808	42×47.5
Helena Reproaches the Wounded Paris for his Bad Behavior	1808	32 × 39.5
Fotis Sees her Lover Lucius transformed into an Ass	c.1809	33.5×42.5
Fotis the Maid Horrified that the Witch's Ointment Transforms her Lover Lucius into an Ass rather than a Bird	1809	42×47
Apollo Charging the Parcae to Visit Ceres, who has Fled from the Earth	1809	47.5×48
The Fates Delivering a Message from Apollo to Ceres	1809	45×46.5
Tarquin and the Sibyl	1809	47.5×47.5
Sappho and the Girl from Mytilene	1809	47.5×38
Catul and Lesbia	1809	47×37.5
Papirius and his Mother	1809	100×107
Protestantism. Allegory	1809	29 × 37
The Catholic World View. Allegory	1809	29 × 37
Odysseus Takes Counsil with Teiresias	1809	44×52
Jus Indigenatus. Allegory of the Right of Citizenship	undated	32.5×44
Cathmor and Sulmalla	undated	47×38
Richard the Third Awakening Terrified from his Nightmare	undated	37×30
A Leave-taking Scene	undated	27×32
Allegory	undated	28.6 × 29
The Evening Star	undated	28×70.5
Alexander and Diogenes	undated	41×53
Ornamental panel, presumably a wall decoration	undated	51×51



Fig. 8 Jens Juel, *Niels Ryberg with his Son Johan Christian and his Daughter-in-Law Engelke, née Falbe*, 1797, oil on canvas, 253 × 336.5 cm, Statens Museum for Kunst, KMS6251.

demonstrates a considerable degree of dispersion (Table 1 and Fig. 7), indicating that he did not conform to any standardised sizes. Only three paintings in the survey, for instance, have dimensions closely approximating those listed by Pernety. Although there is an element of uncertainty in the fact that the size of the individual painting may have changed more or less over time as a result of conservation treatments, trimming, extension or repeated wedging, the degree of deviation from a standard, such as that illustrated in the first diagram (see Fig. 6), is obvious. Most of Abildgaard's paintings have in fact retained their tacking edges, which in one respect does ensure a degree of certainty.

Looking further for a pattern in Abildgaard's formats, there turns out to be little conformity with the classic harmonious relationships such as the golden ratio or other formats of the so-called dynamic symmetry. The survey uncovered only a few examples of proportions matching any of these particular ratios. Among the very few are the paintings Abildgaard created for the great hall at the Christiansborg Palace, 1778-91, whose formats, judging from the 11 oil sketches and the three surviving large-scale paintings, match almost exactly the golden ratio.¹⁸ However, the paintings for this decorative scheme were created for a pre-existing architectural setting, so Abildgaard did not have a free hand with regard to their proportions. They remain rare exceptions: as a rule, various other factors - apart from aesthetic deliberations or compositional pre-meditation - influenced the various dimensions he chose. As mentioned above, the range of available canvas grades conditioned the quality of the fabric in the painting supports. The same is true to some extent of their dimensions. The prevailing loom width of 18th-century Danish linen was 70-80 cm, whereas wider canvas is seen less frequently.¹⁹ In fact, as seen in the table and diagram of Abildgaard's canvas sizes (see Table 1 and Fig. 7), the vast majority of his paintings lies within this range in at least one dimension. In many cases either the vertical or horizontal measurement of the painting, including the tacking edges, conforms to the loom standard, while an even larger number of smaller paintings have sizes that are in one dimension equivalent to half the prevalent loom width (such as the paintings from the Niels Klim series).²⁰ Primary cusping at one side and the respective opposite side of otherwise matching canvases, such as those in several of the serial paintings, is one indication of their shared origin. Likewise, the occurrence of primary cusping along two opposite sides of a single painting canvas indicates that the primed canvas generally represents the loom width and was not cut from a wider strip (provided, of course, that the canvas was not primed after it was mounted on its stretcher).

Outside this pattern are typically paintings such as a few late works of small sizes with compositions prompting proportions closer to a square format (see Table 1). But in some of Abildgaard's medium-sized canvases, composed of two strips sewn together, the prevalent loom width is recognised again in these strips. For the supports of the four late paintings with scenes from Terence's comedy *Andria*,²¹ Abildgaard used canvases composed of two horizontal strips, each 80 cm wide and therefore within the domestic norm. However, occasionally, in larger paintings, the canvas strips have a size that corresponds to a loom width that had already been current throughout Europe for more than a century.²² The supports of three surviving large paintings, created for the Christiansborg Palace,²³ each consist of two vertical strips sewn together, with the seams slightly off-centre. The wider strips, which have selvedges, are (including their tacking edges) 106, 106.5 and 116 cm wide, respectively. The widths of the first two closely match the canvases of two other Abildgaard paintings that fall outside of the prevalent Danish loom width: the *Svein Forkbeard Ransomed by Danish Women* (1778, *c*.105 cm including tacking edges), and the late *Papirius and his Mother* (1809, 106 cm including tacking edges).²⁴ However, although sharing a similar width, the canvases in all five paintings have differing thread counts therefore do not originate from the same bolt.

Of course, imported canvas wider than the domestic standard was not entirely inaccessible to Abildgaard but would have meant a considerably increased expense unless he was granted exemption from the customs duty. In view of the prestigious nature of the royal commission for the Christiansborg Palace paintings, one might expect this to be the case. It is known for instance that, a generation later, Eckersberg was granted a dispensation for his equivalent large-scale paintings for the palace. However, among the applications in the archives of the Central Customs Office for duty-free import of canvas, none were made by Abildgaard or otherwise related to the project.²⁵ Therefore, the odds are that the Christiansborg canvases were also local products. In fact, a couple of contemporary Danish linen manufacturers were able to produce canvas wider than the 70–80 cm norm. In the accounts of the linen workshops at Christianshavn it appears that in 1745, wages were paid for 10 bed ticks, 2 *ell* and 3 quarters wide (c.170 cm), and the linen workshops at Køng, established by the merchant and industrialist Niels Ryberg, had at least one loom after 1786 capable of producing canvas of extraordinary width.²⁶ It is likely, for example, that the very large canvas for the family portrait of Niels Ryberg with his son and daughter-in-law, painted by Jens Juel in 1797 (253 × 336.5 cm) (Fig. 8), was indeed produced at Ryberg's own establishment.²⁷ And in the late 1820s the mill - by then run by the state - delivered fabric, including painting canvas, in connection with the building of the new Christiansborg Palace.28

Conclusions

Abildgaard's canvas formats do not as a rule conform to any of the classic harmonious relationships used in pictorial art, nor do they match the standardised sizes introduced commercially in the mid-18th century and later adopted in the so-called 'landscape', 'marine' and 'figure' formats emerging in the 19th century. Instead, apart from aesthetic or compositional pre-meditation, his choices of size and format were, to a large extent, governed by the local conditions of the time and place of execution of his paintings, whether abroad or in Denmark. For the greater part of his career this was related to a set of basic practical circumstances in the Danish production of linen canvas, as well as market conditions in Denmark in the late 18th century.

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Notes

- 1. For a discussion of Abildgaard's painting technique, see T. Filtenborg, *Between Formula and Freestyle: Nicolai Abildgaard and 18th-Century Painting Technique*, London, Archetype Publications in association with Statens Museum for Kunst and CATS, Copenhagen, 2014, pp. 17–62.
- M. Koller, 'Das Staffeleibild der Neuzeit, Maltechniken im 17. und 18. Jarhundert', *Reclam's Handbuch der künstlerisechen Techniken*, Stuttgart, Reclam, 1984, vol. 1, p. 339; K. Vanderlip Carbonnel, 'A study of French painting canvases', *Journal of the American Institute for Conservation* 1(20), 1980, pp. 3–20; E. O'Donoghue and V. Rasmussen, 'The treatment of two overdoor paintings by Francois Boucher', in *AIC Paintings Specialty Group Postprints*, Washington, DC, American Institute for Conservation of Historic and Artistic Works, 1996, pp. 37–51, esp. p. 41.
- 3. Fibre identification was carried out by Johanne Marie Nielsen at the Centre for Art and Technological Studies (CATS) on warp and weft threads from the following works: *Male Figure. After Michelangelo's 'Last Judgement' in the Sistine Chapel* (1774, KMS7131); *The Wounded Philoctetes* (1775, KMS586); and *Ymir Suckling the Cow Audhumla* (c.1777, KMS3397), all in the Statens Museum for Kunst (SMK), Copenhagen. The analysis procedure followed the method described in Textile Institute, Identification of Textile Materials, Manchester, Textile Institute, 1968, p. 110, available at: www.conservation-wiki. com/w/?title=BP_Chapter_1_-_Fibre_Identification (accessed January 2013).
- 4. Fibre identification on the four canvases was carried out by Johanne Marie Nielsen and Samantha Skelton using polarised light microscopy (red plate test) as described in M. Goodway, 'Fibre identification in practice', *Journal of the American Institute for Conservation* 26(1), 1987, pp. 27–44.
- Bro Jørgensen in A. Nielsen (ed.), *Industriens historie*, Copenhagen, Gad, 1943, vol. 2, pp. 104–106, 150, and A. Nielsen (ed.), *Industriens historie*, Copenhagen, Gad, 1944, vol. 3, pp. 128, 170, 282.
- 6. Customs ledgers from the central customs house from 1762 and 1768, the State Archives, Copenhagen, Denmark. Information kindly shared by Kent Alstrup, the Agency for Palaces and Cultural Properties.
- 7. According to the prominent 18th-century source, A.-J. Pernety's Dictionaire portatif de peinture, sculpture et gravure from 1757, canvases in France were traditionally labelled with regard to quality, according to their country of origin, with terms such as Toile d'Italie, Toile de Flandres / Toile Flammande and Toile Françoise; see A.-J. Pernety, Dictionnaire portatif de peinture, sculpture et gravure, Paris, 1757 (German edn Berlin, 1764), pp. 534–535. It is worth noting, with reference to Abildgaard's
production, that *Toile d'Italie* was indeed the term for fabric of the coarsest weave. It may have implied a general practice among Italian painters of painting on canvases of a poorer quality than their French colleagues (*Toile Françoise* was the designation for the finest weave), but it may also have been simply a consequence of the principal type of canvas exported from Italy and available in France. In Abildgaard's case, mundane economic considerations may have been the simple reason for his choice of coarser fabrics during his years in Italy.

- C.K. Andersen, T.F. Filtenborg, A. Bruselius Scharff and M. Scharff, 'The industrialisation of canvas production in Denmark and its implication for the preservation of Danish 19th-century paintings', in *Incredible Industry: Preserving the Evidence* of *Industrial Society. Proceedings of the Nordic Association of Conservators 18th Conference, Copenhagen, May 2009*, pp. 39–49.
- 9. The Wounded Philoctetes (1775, 123 × 175.5 cm, Statens Museum for Kunst, KMS586); Male Figure. After Michelangelo's 'Last Judgement' in the Sistine Chapel (1774, 100.5 × 75 cm, Statens Museum for Kunst, KMS7131); Seated Male Nude (1772-77, 98 × 75 cm, private collection). Eighteenth-century Italy had no communal unit of measurement as the decimal system was not implemented until 1850. A variety of local units occasionally had names in common, but represented different values. As an example, in Naples, the canna was 10 palmi (c.2.26 m), whereas in Sicily it equalled 8 palmi (c.2.07 m) and in Tuscany, 5 bracci (c.2.92 m). In addition, measurements could vary according to the item measured: a braccio of wool was c.68 cm and that of silk, c.64 cm. A Roman piede (foot) was 29.33 cm and an inch was 2.465 cm. See the Thorvaldsens Museum Archives, http://brevarkivet.thorvaldsensmuseum.dk/emner/artikler/ maal-og-vaegt (accessed July 2013). The Roman canna for cloth was equivalent to 2 m, while it was 2.234 m for buildings. Several entries in the diaries of C.W. Eckersberg from his years in Rome (1813-16) show that he too bought canvas measured by the canna; see A. Villadsen (ed.), C.W. Eckersbergs dagbøger, Copenhagen, Nyt nordisk Forlag Arnold Busck, 2009.
- 10. Corresponding to 2 ft, Ole Rømer's regulations of 1683 and 1698 set a Danish *ell* at 2 Rhineland feet, i.e. 62.77 cm, a measure that remained in force until 1907. However, until the first decades of the 19th century, different *ell* measures were still in use locally, varying between 56.5 and 62.8 cm
- Hamlet and his Mother. Episode from Shakespeare's Hamlet (c.1778, 50.5 × 64 cm, Statens Museum for Kunst, KMS1019); Fingal Sees the Ghosts of his Forefathers by Moonlight (c.1782, 49.5 × 61 cm, Statens Museum for Kunst, KMS3986); The Archangel Michael and Satan Disputing about the Body of Moses (c.1782, 49.7 × 61.7 cm, AROS Kunstmuseum, No. 699); Marc Anthony, Augustus, Julia, Sextus Pompey, and Soldiers (c.1800, 47.8 × 59.4 cm, AROS Aarhus Kunstmuseum, 858); Richard III Before the Battle of Bosworth (1780–89, 39.5 × 61 cm, Randers Kunstmuseum, Inv.1), The Dying Messalina (c.1797, 61 x 77 cm, Statens Museum for Kunst, KMS3651), Culmin's Ghost Appearing Before his Mother (before 1794, 62 × 78 cm, Nationalmusem Stockholm, NM4471).
- 12. J. Mandelberg, Fortegnelse paa en deel malerier, haandtegninger, studia, kobbere, böger, samt adskillige maler-redskaber m. v. som afgangne professor og hof-maler Johannes Mandelberg enke-frue mandagen den 20 novbr lader bortsælge (List of a number of paintings, hand-drawings, studies, coppers, books, and several painting tools etc, which the widow of departed professor and court painter Johannes Mandelberg on Monday the 20th of Nov. will be selling), estate auction catalogue 20 November 1786, pp. 60–61.
- Pernety 1757 (cited in note 7), pp. xc-xcii. Pernety's measures are given in the pre-Napoleonic *pieds, pouces* and *lignes* (corresponding to feet, inches and lines) of 32.484, 2.707 and 0.226

cm respectively. The metric system was introduced in France in 1795.

- 14. D. Diderot, Encyclopédie ou dictionnaire raisonné des sciences, des arts et des métiers, par une société de gens des lettres, Paris, 1765, vol. 16, p. 379: 'Toile, en terme de Peinture, signifie un quadre de bois couvert d'une toile imprimée de quelques couleurs en huile, sur laquelle les Peintres peignent leurs tableaux. Ce sont ordinairement les marchands droguistes épiciers qui vendent les drogues & couleurs des peintres, qui font aussi imprimer & qui débitent ces sortes de toiles.' Anthea Callen has demonstrated the likelihood that the origin of the later French standard canvas sizes emerging in the 19th century lay in the practical and commercial domain of manufacturers and merchants rather than as a result of any aesthetic demands; see A. Callen, Artists' Materials and Techniques in Nineteenthcentury France, 2 vols, PhD dissertation, Courtauld Institute of Art, 1980, vol. 1, pp. 50–72.
- 15. Automated thread counting and weave mapping were carried out on digital X-radiographs using software developed by C.R. Johnson, Jr., Cornell University, New York, and D.H. Johnson, Rice University, Houston, Texas. X-radiography was carried out by Jacob Skou-Hansen and the author with an Andrex BW85 X-ray tube at 30 kV, 5 mA, 60 sec., on Dürr NDT CRIP3040109 digital HD image plates with a resolution of 25 μm which were subsequently scanned in a HD-CR 35 NDT laser scanner. For descriptions of the thread counting and weave mapping method and interpretation of results, see C.R. Johnson Jr., E. Hendriks, P. Noble and M. Franken, 'Advances in computerassisted canvas examination: thread counting algorithms', AIC Paintings Specialty Group Postprints, Washington, DC, American Institute for Conservation of Historic and Artistic Works, 2009, pp. 1-17; D.H. Johnson, C.R. Johnson Jr., A.G. Klein, W.A. Sethares, H. Lee and E. Hendriks, 'A thread counting algorithm for art forensics', in Proceedings of the 13th IEEE DSP Workshop, January 2009, pp. 679-684; A.G. Klein, D.H. Johnson, W.A. Sethares, H. Lee, C.R. Johnson Jr. and E. Hendriks, 'Algorithms for old master painting canvas thread counting from X-rays', in Proceedings of the IEEE Asilomar Conference on Signals, Systems, and Computers, 26–29 October 2008, pp. 1229-1233.
- 16. The Wounded Philoctetes (1775, 123 × 175.5 cm, KMS586); Fingal Sees the Ghosts of his Forefathers by Moonlight (c.1782, 49.5 × 61 cm, KMS3986). The four Terence paintings are Simo and his Former Slave Sosia (1803, 157.5 × 142 cm, KMS587); Pamphilus and his Servant Davus (1802, 157.5 × 128.5 cm, KMS588); The Midwife Taking Leave of the Girl from Andros (1801, 157.5 × 128.5 cm, KMS589); The Slave Davus and the Maid Mysis (1804, 157.5 × 142 cm, KMS590). All paintings in the Statens Museum for Kunst collection.
- 17. J. Juel, Fortegnelse over endeel Kunstsager bestaaende af: Malerier, Tegninger, Kobbere og Gibssager samt nogle forgyldte Rammer og Maler-Redskaber saa og endeel Bøger m. v. som afgangne Professor ved Kunsternes Academie Jens Juels Enke ved offentlig Auction lader bortsælge ... (List of a number of art objects consisting of: paintings, drawings, coppers, and plaster objects as well as some gilded frames and painting tools and a number of books etc, which the widow of departed Professor at the Academie of the Arts Jens Juel at a public auction will be selling...), estate auction catalogue, 21 April 1803, p. 30.___
- 18. The mathematical formula for the golden ratio is $\wp = \frac{\sqrt{5+1}}{2} \approx 1.6180$, where ϕ = the longest side. If the shortest side is 1 the longest side will thus be 1.6180. In Abildgaard's oil sketches for the Christiansborg series the relationship varies from 1.5714 to 1.6489.
- 19. See Bro Jørgensen in Nielsen 1944 (cited in note 5), p. 40; H.F. Dalgaard, *Hør som Husflid*, Copenhagen, Borgen, 1980, pp. 15, 91.

- 20. Examples from the first group are Socrates with his Daemon (c.1784, 79 × 115 cm, Ny Carlsberg Glyptotek, MIN1595); Fingal Giving Ossian his Weapons (c.1790, 64.2 × 72.5 cm, KUNSTEN Museum of Modern Art Aalborg, NK1); Culmin's Ghost Appearing Before his Mother (before 1794, 63 × 78 cm, Nationalmuseum Stockholm, NM4471); The Dying Messalina and her Mother (c.1797, 61 × 77 cm, Statens Museum for Kunst, KMS3651); Justice (1800, 73.5 × 57 cm, Statens Museum for Kunst, KMS3880); Philosophy (1800, 73 × 57.5 cm, Statens Museum for Kunst, KMS7591); Theology (1800, 73×56.5 cm, Statens Museum for Kunst, KMS3343). To the second group belong the 11 sketches for the paintings in the large hall at Christiansborg Palace and the series of 10 paintings illustrating Holberg's novel The Journey of Niels Klim to the World Underground, as well as Ossian Singing his Swan Song (1780-82, 42 × 35.5 cm, Statens Museum for Kunst, KMS395); Richard III Awakening from his Nightmare (1787, 38 × 29 cm, Nasjonalmuseet Oslo, NG.M.03196); Amor and Psyche Embracing (c.1790, 42 × 35.5 cm, Nivaagaard Picture Gallery, 0183NMK2000-1); Ismene and Antigone Plead with Theseus (1790s, 38 × 46.5 cm, Statens Museum for Kunst, KMS7593); Nightmare (c.1800, 35.3 × 41.7 cm, Vestsjællands Kunstmuseum, No. 50); Catul and Lesbia (1809, 47 × 37.5 cm, Nivaagaard Picture Gallery, 0194NMK2000-1); Sappho and the Girl from Mytilene (1809, 47.5 × 38 cm, Statens Museum for Kunst, KMS3650); Fotis the Maid Horrified that the Witch's Ointment Transforms her Lover Lucius into an Ass Rather than a Bird (date unknown, 33.5×42.5 cm, Statens Museum for Kunst, KMS3240).
- 21. See note 16.
- 22. See J. Plesters and T. Lazzarini, 'Preliminary observations on the technique and materials of Tintoretto', in *Conservation of Paintings and the Graphic Arts. Preprints of the Contributions* to the Lisbon Congress 1972, London, IIC, 1972, pp. 173–180; H.

von Sonnenburg, 'Zur Maltechnik Murillos, II, Ergänzung und Vergleich mit zeitgenössichen spanischen Bildern', *Maltechnik Restauro* 86, 1980, pp. 159–179; E. van de Wetering, *Rembrandt: The Painter at Work*, Amsterdam, Amsterdam University Press, 1997, pp. 123–128.

- 23. King Christian I Proclaiming Holstein a Duchy (1780, 308 × 197 cm, Statens Museum for Kunst, KMS3297); Christian III Succouring Denmark (1781, 317 × 200 cm, Statens Museum for Kunst, KMSsp861); Frederik II Builds Kronborg Castle at Elsinore (1781–82, 309 × 197 cm, Statens Museum for Kunst, KMS3296).
- 24. Svein Forkbeard Ransomed by Danish Women (1778, The Royal Danish Academy of Fine Arts, KS4); *Papirius and his Mother* (1809, Statens Museum for Kunst, KMS1707).
- 25. Information kindly shared by Kent Alstrup, the Agency for Palaces and Cultural Properties.
- 26. See Bro Jørgensen in Nielsen 1943 (cited in note 5), pp. 33–34; Dalgaard 1980 (cited in note 19), p. 21; Andersen *et al.* 2009 (cited in note 8); C. Paludan, 'Køng Fabrik 1774–1804', in *Kulturhistoriske Studier*, Sydsjællands Museum, 2003, pp. 56–57.
- 27. Niels Ryberg with his Son Johan Christian and his Daughter-in-Law Engelke, née Falbe (1797, 253 × 336.5 cm, Statens Museum for Kunst, KMS6251).
- 28. Information from the Køng mill archive, kindly shared by Charlotte Paludan.

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'1ST OLIO AFTER CAPIVI': COPAIBA BALSAM IN THE PAINTINGS OF SIR JOSHUA REYNOLDS

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ABSTRACT Joshua Reynolds (1723–1792) is notorious for experimenting with his painting materials and for the resultant paint defects, such as cracking and fading, which have arisen in his paintings. Many of the problems with his technique are associated with the rate of drying of his paint layers and can be related to his use of additives in his oil paint and his adoption of alternative paint media, such as resins and wax. This paper focuses in particular on Reynolds's use of copaiba balsam. The entries in his 'technical notes', where he records using copaiba balsam, are examined. In addition we report the findings of technical analysis of his paintings that relate to the identification of copaiba balsam, carried out at the National Gallery, London, during the Wallace Collection Reynolds Research Project. The use of gas chromatography-mass spectrometry (GC-MS) for the detection of copaiba balsam, and the limitations of this technique when examining complex paint mixtures, is discussed.

Introduction

The term 'copaiba balsam' describes the soft oleoresin produced by trees of the Copaifera genus from the Leguminosae family.1 These are mainly native to South America with a few species also found in Africa.² Copaiba balsams became known to Europeans in the 17th century. They were recognised for their medicinal qualities and were presumably used primarily for this purpose.³ Langenheim reports that copaiba balsam was listed in the London Pharmacopoeia as early as 1677,4 and Oléo-résine de Copahu was described in Guibourt's Histoire abrégée des drogues simples published somewhat later in 1836.5 In the 19th century the use of copaiba balsam as a component added to oil paint or as a paint medium seems to have become more prevalent. The Compendium of Colours published in 1808 records two recipes for preparing asphaltum, both involving heating copaiba balsam, attributed to the artists Anton Raphael Mengs and Benjamin West.⁶ Eastlake mentions the use of copaiba especially in relation to verdigris.⁷ The American artist Rembrandt Peale also advised adding copaiba balsam to verdigris.8 William Beechey recorded adding a drop of copaiba balsam to improve the handling qualities of an oilresin paint medium.9 Later in the 19th century Vincent van Gogh is reported to have added copaiba balsam to his paint to prevent the sinking of dark colours.¹⁰ Copaiba balsam has also been used in restoration processes to revive paint and varnish: the resin was combined with alcohol vapours in a treatment referred to as the Pettenkofer process.¹¹

It is particularly interesting to consider the use of copaiba balsam with respect to Joshua Reynolds's painting technique since he is known to have experimented with this material. There is little contemporary written discussion of the use of copaiba balsam for painting although it is mentioned by the anonymous author of *Traité de la peinture au pastel* as an alternative to oil.¹² However Reynolds recorded using a resin of this type and it has previously been identified in his *Self Portrait* in the Royal Collection.¹³ The Wallace Collection Reynolds Research Project presented the opportunity to undertake medium analysis on a group of Reynolds paintings spanning a significant proportion of his career. This paper presents some of the analytical results related to copaiba balsam in the context of his technique.

Copaiba balsam in Reynolds's 'technical notes'

Although Reynolds was generally secretive about his painting technique, and is even reported to have kept his experimental mixtures under lock and key,¹⁴ he did make some notes about his materials and how he used them in the back of two account ledgers. These ledgers, discovered after his death, are



Fig. 1 Sir Joshua Reynolds, *Saint John the Baptist in the Wilderness*, after 1776, oil, resin and wax on canvas, 127.8 × 102.4 cm, The Wallace Collection. This is one version of the composition referred to in the 'technical notes' as 'St John'. (© By kind permission of the Trustees of the Wallace Collection, London. Photo: The National Gallery, London.)

now in the Fitzwilliam Museum in Cambridge.¹⁵ The notes, which are described throughout this paper as the 'technical notes', were first mentioned in the diary of the artist Benjamin Robert Haydon on 4 June 1838. He records that Beechey had been given access to them by Mr Gwatkin who was

married to Reynolds's niece Theophila. Haydon also copied Beechey's transcription of some of the notes along with his comments.¹⁶ The 'technical notes' are written principally in a mixture of Italian and English with the occasional word of Latin. Reynolds refers to a range of materials including paint media, such as wax and oil, pigments and varnish, often relating them to a particular painting or indicating that they were used at a certain stage of execution. In the 'technical notes' Reynolds uses the term 'capivi', which he sometimes shortened to 'cap'. This was understood to refer to copaiba balsam by the earliest commentators; Beechey uses the term 'balsam of copaiva'17 and Eastlake 'copaiba'.18 The first 'technical note' is dated 7 July 1766 and the last 1781, but there are approximately only 74 individual notes therefore in comparison to Reynolds's total output during this period they only relate to a very select number of his paintings. Aside from a single entry on the last page of the 1766 sitters book, no other technical memoranda survive.¹⁹ It is possible that other records may have existed, nevertheless the 'technical notes' cover a long period of time. Considering this, they evidently do not comprise an exhaustive list of his experiments.

Reynolds records using copaiba balsam on nine occasions between the years 1767 and 1770; of the nine entries, five record copaiba balsam used in combination with wax. Reynolds must certainly have taken an interest in the resurgence of encaustic painting in Europe in the 1750s. The Comte de Caylus's treatise on encaustic and wax painting techniques was published in 1755²⁰ and in 1760 the artist Johann Heinrich Müntz produced an English version of Caylus's encaustic technique.²¹ Although the encaustic technique required only wax and heat, the more experimental cold wax painting technique Caylus describes employs wax dissolved in turpentine, modified with various oils, fats and resins to help mitigate the brittleness of the dried wax paint.²² Although Caylus does not specifically mention copaiba he does describe using 'résines liquides',23 and by the 19th century German sources mention copaiba in relation to wax painting.²⁴ Interestingly one German source recommends adding a small amount of wax to a copaiba balsam medium to reduce the brittleness of the copaiba paint film.25

The first entry in the 'technical notes' to reference copaiba balsam is a portrait of 'Offe' (the pet name of Reynolds's niece Theophila) around 1767. This painting is thought to be a portrait of a girl with her hands in a muff, which has a wooden panel support.²⁶ In this case Reynolds seems to record painting the whole picture using a medium of wax and copaiba balsam.²⁷ This painting may be referred to in a later note made around 1770 stating that the picture was painted entirely in wax and copaiba balsam but that the head was painted over a base made of white oil paint.28 The following 'technical note' records that the same technique was used for a portrait of Lady Melbourne but that a canvas was used for the support.²⁹ Reynolds may have been adding copaiba balsam to wax as a plasticiser in order to make the wax less brittle. This seems to be supported by a further note from around 1770 that records wax and copaiba used to fill in cracks that had developed in two paintings, one of a Nymph and Bacchus and the other of 'St John' (Fig. 1), which had been started with wax alone.³⁰ In an entry dated 10 July 1769, Reynolds notes using a varnish made of wax and copaiba resin for the final stages of a selfportrait. In this case the first layers are in oil and the picture is glazed in wax varnish and copaiba resin with lake (presumably red lake), yellow ochre, blue and black.³¹

Copaiba balsam is also recorded as a paint medium on its own. Most of the notes refer to specific paintings, however an entry dated 22 January 1770 (although related to a self-portrait) seems to indicate that Reynolds generally used copaiba balsam as an alternative to oil. The entry begins 'Sono stabilito in maniera di dipingar' which Beechey interpreted as meaning this was his 'most approved method' and Haydon 'a fine proceeding,'32 but perhaps we can say his 'established technique'. He then states that either oil or copaiba balsam can be used for the first and second sittings. In this method the first and second sittings are a grey dead colouring, followed by a third sitting where yellow ochre, lake, black and ultramarine are used without white. Finally the picture is retouched with the colours and a little white.³³ It is not entirely clear from this note whether copaiba balsam was used for the last stages; however two other entries in the ledgers do clearly indicate that copaiba balsam was employed as the medium for final paint layers.

A note dated 6 February 1770 does not refer to a specific painting but records the first two sittings in oil and then the third sitting using copaiba balsam with lake and yellow and black without white.³⁴ The final layers of the portraits of Dr Johnson and Oliver Goldsmith are also recorded as copaiba balsam with pigments but excluding white, applied over an oil paint layer. For the portrait of Goldsmith, Reynolds also notes using copaiba balsam and white for the sitter's hand.³⁵

The identification and classification of copaiba balsam

Several different species of Copaifera produce the resinous material known as copaiba balsam and while they share broad similarities, their chemical composition varies. Fresh copaiba balsam is a fluid resin composed of small amounts of diterpenoids dissolved in a solution of volatile sesquiterpenes; in some species the diterpenoid components represent as little as 3% of the fresh resin.³⁶ Upon aging, the sesquiterpenoid components evaporate, leaving only the diterpenoid portion. Furthermore not all the remaining diterpenoids are stable and components from fresh copaiba such as hardwickiic acid and polyalthic acid are not present at all in aged samples.³⁷ Therefore the identification of copaiba balsam in a sample of aged oil paint by gas chromatography-mass spectrometry (GC-MS) analysis rests on the detection of minute quantities of a restricted set of diterpenoids. The peaks for these components are often barely distinguishable from the chromatographic baseline and are easily overlooked. In addition, many of the labdane diterpenoids present in copaiba balsam are also found in resins or balsams produced by trees within the Leguminosae family other than those of the Copaifera genus, for example in hard copal resins. The identification of copaiba as opposed to another type of resin is not straightforward, however the combination of diterpenoids detected can be characteristic.

Copaiba balsam has previously been found in a selfportrait by Reynolds, now in the Royal Collection, which was



Fig. 2 Common labdane compounds identifiable by GC-MS characteristic of copaiba balsam.

analysed at the National Gallery, London in 1986. GC-MS was used to identify labdane esters in a sample of glaze-like paint, indicating a Leguminosae resin, probably copaiba balsam, in addition to various other components.³⁸ Since then, GC-MS has been more widely applied to the identification of copaiba balsams in paint samples. Van der Werf *et al.* have shown that it is possible to further classify copaiba into one of two types, each containing a limited number of species of *Copaifera*: Type A, which includes *C. multijuga* and *C. cearensis*, is characterised mainly by copalic acid and originates from eastern Brazil, as well as the western and middle Amazon; Type B includes *C. langsdorffii*, *C. duckei* and *C. guianensis* (from areas within the Amazon), and is identified by the presence of kaurane and ent-pinifolic acids.³⁹ Eperuic acid is common to both types (Fig. 2).⁴⁰

Paint samples

Reynolds's paintings often have a complex layer structure, so sampling was targeted to identify specific layers wherever possible. Paint samples were removed from the pictures by careful scraping with a scalpel under magnification and sampling was carried out alongside the examination of crosssections to inform the understanding of the layer structure. In many cases the samples were collected in stages in an attempt to separate upper varnish layers, glazes and more solid paint layers from one another. In cases where the paint had emerged through cracks onto the surface, small beads of paint were removed with a scalpel. All samples were then examined under the microscope, and where possible any contaminating varnish was carefully separated from the paint before methylation and analysis by GC-MS (for technical details, see the experimental appendix). In each of the samples the paint medium was based on a heat-bodied drying oil, with linseed, walnut and possibly poppyseed oils all identified. All the paint samples contained a mixture of materials usually with other resins present as well. The compounds relating to a Leguminosae resin were only detected in small quantities and only represent one component of the paint mixture. However, comparative analysis of the varnish layers was also undertaken for each painting and where a leguminous resin was identified we can be reasonably certain that it is present in the original layer structure. The following discussion focuses on the results that relate specifically to copaiba balsam and Table 1 indicates which marker compounds were detected in each paint sample.

Discussion of GC-MS results

Three different paint samples from Miss Nelly O'Brien (Wallace Collection) (Fig. 3) gave a strong indication for the presence of copaiba balsam. In each sample 16β-kauran-19oic acid methyl ester (see Table 1) was detected by GC-MS (Fig. 4). This compound is extremely characteristic of copaiba balsam and indicates that the resin is likely to be from the type B group of species. Miss Nelly O'Brien was the only painting in this group where this marker was identified and these samples give the clearest evidence for copaiba balsam. Small amounts of ent-pinifolic acid dimethyl ester and in one sample a little copalic acid methyl ester were also detected, providing additional support for the presence of this type of resin. Interestingly the paint samples were taken from different areas of the picture with varied layer structures and paint applications. One sample contained an underlying layer of yellow paint from the foliage that had come to the surface through drying cracks in the upper paint layers, one sample contained layers of a dark glaze with intermediate varnish layers (Fig. 5), and the final sample was taken from a more solid white underpaint in the light patch of sky (the green and brown glazes in this area are now rather worn exposing the pale underlayer). The presence of copaiba balsam in all three samples suggests that Reynolds used this material extensively

Table 1 Table of GC-MS results sh	rowing diterpenoid c	components detected.					
Title	Date	Description	Copalic acid	16β-Kauran- 19-oic acid	ent-Pinifolic acid	Eperuic acid	Unidentified labdanes
The 4th Duke of Queensbury ('Old Q') as Earl of March	1759-60	Pink/grey underpaint of drapery	ý				
Miss Nelly O'Brien	about 1762–64	Yellow paint coming up through cracks in foliage		y	у		
		Thin brown paint and varnish interlayers from the foliage		y	у		
		White underpaint from the sky	у	y	У		
Mrs Elizabeth Carnac	1775	Pale green paint from foreground			у	у	
		Pinkish beige impastoed paint from left edge				у	
		Blue paint from the sky			у	у	
		Green paint from a leaf towards the right edge, strongly fluorescent in UV light*			у	у	У
		Brushstroke of milky green paint from the tree, strongly fluorescent in UV light*			У		Y
		Dark brown green paint from the right edge of the main tree trunk, strongly fluorescent in UV light*			У	у	Y
Miss Jane Bowles	1775	Black background paint from the small loss to the left of sitter's head. Includes varnish				у	
		Brown paint from the trees at the upper right edge				у	
Saint John the Baptist in the Wilderness	after 1776	Flesh paint from ankle Orange foliage from background			у	У	
Mrs Mary Nesbitt	1781	Brown background paint coming up through cracks in sky			у	у	
		Brown layer over surface of sky			у	у	y
		Varnish and glaze from dove's body			у	у	y
		Pink paint coming up through crack in sky next to sitter's neck			у	у	
		Flesh paint from area of sitter's back			У	у	
		Yellow/grey drapery paint			У	у	
Frances, Countess of Lincoln	1781 - 84	Grey paint from sleeve, bottom edge			У	у	
		Blue paint of sky			У	у	
Colonel Tarleton	1782	Brown of horse's neck left-hand edge, upper layers	у				
Mrs Mary Robinson ('Perdita')	1783 - 84	Dark grey paint of sky and surface coating, top left corner	у				
		Discoloured coating and traces of blue paint, sea left edge	y				



Fig. 3 Sir Joshua Reynolds, *Miss Nelly O'Brien*, *c*.1762–64, oil and resin on canvas, 126.3 × 110 cm, The Wallace Collection. The areas of the sample sites are marked. (© By kind permission of the Trustees of the Wallace Collection, London. Photo: The National Gallery, London.)



Fig. 5 Cross-section from the foliage of *Miss Nelly O'Brien* (see Fig. 3): (a) in visible light and (b) ultraviolet light, showing complex layering. Both the yellow paint and the dark glazes with intermediate varnish layers were found to contain copaiba balsam. (© The National Gallery, London.)



Fig. 4 GC-MS analysis of yellow paint from the background of *Miss Nelly O'Brien*. Portion of the total ion chromatogram showing the stearate methyl ester peak from the drying oil and the peak for the characteristic component of copaiba, 16β-kauran-19-oic acid methyl ester. The inset shows the electron impact mass spectrum from this peak.



Fig. 6 GC-MS analysis of flesh paint from *Saint John the Baptist in the Wilderness*. Portion of the total ion chromatogram showing the stearate methyl ester peak from the drying oil and the eperuic acid methyl ester peak. The inset shows the electron impact mass spectrum from this peak.

throughout this painting in both the early stages of execution and for the final glazes.

In samples from a further five pictures methylated eperuic acid was identified, frequently in combination with ent-pinifolic acid dimethyl ester. Paint samples from *Miss Jane Bowles, Mrs Elizabeth Carnac, Saint John the Baptist in the Wilderness, Mrs Mary Nesbitt* and *Frances, Countess of Lincoln* (all the Wallace Collection) gave results of this kind (Fig. 6). Although only detected in small amounts, these compounds are stable markers that indicate the presence of a Leguminosae resin, although the specific type of resin has not been determined. Eperuic acid has been identified in samples of copaiba balsam from both groups of species but is not normally the major stable diterpenoid. While these results show that a resin of this class is present, the absence of either a kaurane or copalic acid is inconsistent with published copaiba balsam compositions.

However, in some samples from two of these paintings, *Mrs Elizabeth Carnac* and *Mrs Mary Nesbitt*, the GC-MS analysis detected additional components providing further evidence for the presence of a leguminous resin. In *Mrs Elizabeth Carnac*, numerous adjustments and final touches of paint were added to the portrait at a late stage, probably made by Reynolds himself after the figure and background had been completed by assistants.⁴¹ These individual brushstrokes of paint were fluorescent under ultraviolet light, displaying a different behaviour from the surrounding paint (Fig. 7). Three samples were taken from such brushstrokes and in each case an additional series of labdane esters, characterised by the mass fragment m/z 121, were observed by GC-MS analysis.42 Not all of these compounds have been identified but the mass spectra indicate that two of these components are oxygenated labdane derivatives.⁴³ The same components were again detected in two samples from Mrs Mary Nesbitt, both of which contained glaze layers, from over the sky and the body of the dove. Interestingly these particular compounds, when found with eperuic acid and labda-8-en-15-oates, are characteristic of African copals.44 There is considerable overlap between components in copaiba balsams and African copals and we have not been able to specify precisely the type of resin present here. In addition the variation in the compounds detected in the different samples from Mrs Mary Nesbitt and Mrs Elizabeth Carnac may indicate that these paintings contain more than one resin.

An additional group of paintings showed evidence of a leguminous resin of a different composition. In samples from three paintings – *The Duke of Queensberry* and *Mrs Mary Robinson* (both the Wallace Collection) and *Colonel Tarleton* (The National Gallery, London) – traces of copalic acid methyl ester (see Fig. 2) were detected by GC-MS without evidence of any other labdanes. Copalic acid is reported to be a major component of copaiba balsams from the type A group of species. However the absence of any other marker components in these samples and the very small quantities



Fig. 7 (a) Detail of Sir Joshua Reynolds, *Mrs Elizabeth Carnac*, 1775, The Wallace Collection, showing the foliage and (b) a detail taken in ultraviolet light during cleaning, showing the localised fluorescence of some paint. The area of the ultraviolet light detail is marked with a rectangle. (© By kind permission of the Trustees of the Wallace Collection, London. (a) Photo: The National Gallery, London. (b) Photo: Anna Sandén.)



Fig. 8 Photomicrograph of the drying cracks in the foliage of *Miss Nelly O'Brien* (see Fig. 3), showing the yellow paint emerging from cracks. (© By kind permission of the Trustees of the Wallace Collection, London.)



Fig. 9 GC-MS analysis of yellow paint from the background of *Miss Nelly O'Brien*. Portion of the total ion chromatogram showing the additional peaks for the oxo-dicarboxylic acid dimethyl ester and the hydroxy fatty acids.

of copalic acid detected make it difficult to firmly identify the source of the resin. A different type of copaiba from that detected in *Miss Nelly O'Brien* may have been used but it is also possible that the copalic acid is due to the presence of a hard copal resin.⁴⁵

Partially dried oil and drying defects

In several paint samples taken from areas that exhibited drying defects, it was found that the oil paint had not properly cross-linked. The medium of the yellow paint in Miss Nelly O'Brien that was emerging from the drying cracks has already been discussed and was identified as heat-bodied walnut oil with copaiba balsam (Fig. 8). This paint has obviously remained mobile over time and interestingly the chromatogram contained a substantial peak for an oxo-dicarboxylic acid, dimethyl ester, which is not normally observed in such large quantities in dried oil films. Several peaks for hydroxy fatty acids also seem to be present, including two peaks that are probably isomers of dihydroxy octadecanoic acid methyl ester. These components perhaps represent an intermediate phase in the formation of a polymerised oil network, and again are not normally detected to such an extent in analyses of aged oil paint films (Fig. 9).

The flesh paint in *Mrs Mary Nesbitt* has suffered from severe small-scale wrinkling, with a series of ductile drying cracks especially evident across the sitter's face (Fig. 10). GC-MS analysis of a sample from the flesh paint on the sitter's back identified small amounts of two isomers of the doubly unsaturated C18 fatty acid methyl ester. In a well-dried oil film, unsaturated fatty acids of this type normally react, crosslinking to form a polymerised network. Their detection in this sample again suggests that the drying mechanism has not proceeded in the normal way.

In both paint samples, copaiba balsam or a related type of resin was found in addition to the oil, and the presence of drying defects is consistent with copaiba balsam's reputed use to slow the drying of oil paint. However, the unpolymerised components of the oil network, detected by GC-MS, were not the same in each case. Furthermore additional peaks of this type were not always observed in samples containing copaiba balsam or in samples from areas of paint with marked drying defects visible at the surface. While it is probable that the copaiba balsam present in the paint has influenced the drying of the oil it cannot be concluded that it is the sole cause of the drying defects, which are likely to depend on several factors, notably Reynolds's use of multiple layers.

Wax

It is worth noting that small amounts of beeswax were identified by GC-MS in both the paint samples from *Saint John the Baptist in the Wilderness* (see Fig. 1) in which



Fig. 10 Detail of Sir Joshua Reynolds, *Mrs Mary Nesbitt*, 1781, The Wallace Collection, showing wrinkling and cracking of the flesh paint. (© By kind permission of the Trustees of the Wallace Collection, London. Photo: The National Gallery, London.)

a copaiba-type resin was thought to be present. These results are interesting in the light of the 'technical note' in Reynolds's ledgers, discussed earlier, that suggests that both wax and copaiba balsam were used for at least one version of the Infant John the Baptist. However, the poor condition of this picture means that it is difficult to be certain about whether the wax is part of the original layer structure. The painting has a long history of flaking and has been consolidated many times, so the wax may have been introduced at a later date. Nonetheless, only traces of wax were found in the samples of varnish and from areas of restoration, and the markers for a copaiba-type resin were only identified in the samples containing original paint.

Pine resin

In all samples copaiba balsam marker compounds were found in conjunction with peaks indicating a Pinaceae component.⁴⁶ This is consistent with reports by Van der Werf *et al.* and Steigenberger, which suggest that commercially available copaiba balsams were often adulterated with pine resin, possibly to make them cheaper.⁴⁷ However it is difficult to conclude that pine resin was present as an additive in the copaiba balsam used by Reynolds since analysis of his paintings has shown that pine resin is often present, even when copaiba balsam is absent.

Conclusions

The primary source material, together with the results from GC-MS analysis, suggest that copaiba balsam was indeed used by Reynolds. During the Reynolds Research Project, medium analysis was undertaken for all 12 paintings by Reynolds in the Wallace Collection, as well as revisiting some of the analyses previously undertaken on the National Gallery Reynolds paintings. The results from Miss Nelly O'Brien give a clear indication that copaiba balsam is present in the original materials and in this instance we are able to specify that it is probably from the type B group of Copaifera such as C. langsdorffii, C. duckei and C. guianensis. In eight further paintings, components indicating the presence of a related type of resin were detected in paint samples. A variety of different diterpenoid marker compounds was identified in different samples, suggesting that several different resins of this kind may have been employed. However it has not been possible to specify the exact type of resin in each case. The variations observed in the analytical results may reflect differences in the material purchased by Reynolds as copaiba balsam, although it is also possible that other types of Leguminosae resins such as hard copals were also used.

Reynolds's records suggest that he used copaiba balsam in a variety of ways and in this study copaiba balsam, or a related leguminous resin, has been detected in both opaque paint layers as well as glaze layers. Despite the documentary evidence that Reynolds may have used copaiba balsam as a medium on its own, drying oils and other resinous components were identified in all the samples that contain copaiba. However, it was impossible to sample the very thin glaze layers in isolation. No traces of components from a Leguminosae resin were found in the upper varnish layers from any of the paintings analysed. It is therefore highly unlikely that the presence of copaiba balsam is due to a conservation treatment such as the Pettenkoffer process. Interestingly, none of the pictures in this study fit within the date range covered by the nine 'technical notes' that mention copaiba balsam, so clearly it is a material he used more extensively than the notes alone might indicate.

Experimental appendix: GC-MS conditions

3-(Trifluoromethyl)phenyl trimethylammonium hydroxide (TMTFTH) (20 μ L) was added to the samples, which were heated (70°C for 4 hours) and then centrifuged. The samples were then injected (1 μ L) using an autosampler into an Agilent 7890A gas chromatograph coupled with an Agilent 5975C quadrupole mass spectrometer. An SGE BPX5 capillary column (5% phenyl polysilphenylene-siloxane stationary phase, 30 m length × 0.25 mm internal diameter × 0.25 μ m film thickness) was used to provide suitable separation of the components under a constant flow of helium gas (1.2 mL min⁻¹). The GC inlet was set at 270°C. The analyses were performed in splitless mode with chromatographic conditions as follows: initial temperature 80°C held for 2 min, increased

at 10°C min⁻¹ to 200°C, held for 3 min, increased at 7°C min⁻¹ to 280°C, held for 3 min, then increased at 20°C min⁻¹ to 300°C, held for 20 min. There was a 5 minute solvent delay. The transfer line was set to 280°C, with the MS source temperature at 230°C and the quadrupole at 150°C. Mass spectra were recorded under electron impact ionisation (70 eV) in the range of m/z 45 to 650.

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Notes

- 1. See J.S. Mills and R. White, *The Organic Chemistry of Museum Objects*, 2nd edn, New York, Butterworth and Heinemann, 1999, p. 105; and I.D. Van der Werf, K.J. van den Berg, S. Schmitt and J.J. Boon, 'Molecular characterization of copaiba balsam as used in painting techniques and restoration procedures', *Studies in Conservation* 45(1), 2000, pp. 1–18. Although the name Leguminosae has been replaced by the modern term Fabaceae, we continue to use it in this context since it is still treated as valid by the International Association for Plant Taxonomy, and it is commonly used to describe resins of this family within the field of art conservation and analysis. See www.iapt-taxon.org/ nomen/main.php?page=art18 (accessed May 2015).
- 2. African *Copaifera* species produce resins with higher amounts of polymerising diterpenes, leading to the formation of hard copals. G. Steigenberger, *The Vigani Cabinet: Analysis of Historical Resinous Materials by Gas Chromatography-Mass Spectrometry and Infrared Spectroscopy*, PhD dissertation, Technical University Dresden, 2013, p. 21.
- J.H. Langenheim, *Plant Resins: Chemistry, Evolution, Ecology, Ethnobotany*, Portland, Cambridge, Timber Press, 2003, p. 336.
 Ibid.
- N.J.B.G. Guibourt, *Histoire abrégée des drogues simples*, 3rd edn, 2 vols, Paris, Méquignon-Marvis, Père et Fils, 1836, vol. 2, pp. 569–574.
- Anon., The Artist's Repository or Encyclopedia of Fine Arts, Vol. 3: Landscape Compendium of Colours, London, C. Taylor, 1808, pp. 11–12.
- 7. C. Eastlake, *Materials for a History of Oil Painting*, 2 vols, London, Longman, Brown, Green and Longmans, 1847, vol. 1, pp. 459–461.
- L. Mayer and G. Myers, 'The Court of Death through conservators' eyes', Bulletin of the Detroit Institute of Arts 1/2(70), 1996, pp. 10, 13, n. 23.
- 9. 'I dissolved mastic in alcohol, then mixed it with sugar of lead water, and strained it through a linen cloth, then mixed it in

clear dying oil ... by adding more oil it became a butter without stickiness. One drop of copaiva made it better.' T. Taylor (ed.), *Autobiography and Memoirs of B.R. Haydon (1786–1846)*, London, Peter Davies, 1926, pp. 855–856.

- K.J. van den Berg, Analysis of Diterpenoid Resins and Polymers in Paint Media and Varnishes, PhD dissertation, FOM Institute AMOLF, Amsterdam, 2003, pp. 67–68.
- See S. Schmitt, 'Progress in research on effects of the Pettenkofer process', Art et chimie, la couleur: actes du congress, Paris, CNRS Editions, 2000, pp. 137–140.
- 12. Anon., *Traité de la peinture au pastel*, Paris, chez Deferde Maisonneuve, Libraire, 1788, pp. 69–70.
- R. White, 'Brown and black organic glazes, pigments and paints', *National Gallery Technical Bulletin* 10, 1986, pp. 59–60;
 R. Morrison, 'Mastic and megilp in Reynolds's *Lord Heathfield* of Gibraltar: a challenge for conservation', *National Gallery Technical Bulletin* 31, 2010, p. 121.
- 14. J. Northcote, *The Life of Sir Joshua Reynolds*, 2 vols, London, Henry Colburn, 1818, vol. 1, p. 21.
- 15. The ledgers, including the 'technical notes', were transcribed in full and published by Cormack in the journal of the Walpole Society. M. Cormack, 'The ledgers of Sir Joshua Reynolds', *The Walpole Society* XLII, 1968–70, pp. 105–169. Hélène Dubois revisited the notes during her research project at the Hamilton Kerr Institute and corrected Cormack's transcription as well as including some interpretation. H. Dubois, *Aspects of Sir Joshua Reynolds' Painting Technique: A Study of the Primary Sources with Reference to the Examination of Paintings*, MA research project, Cambridge, Hamilton Kerr Institute, 1992–93, Appendix 1. All quotes from the 'technical notes' are referenced from Cormack 1968–70 but with corrections from Dubois 1992–93 and recent examination of the ledgers by Alexandra Gent.
- 16. B.R. Haydon, *The Diary of Benjamin Robert Haydon*, W.B. Pope (ed.), 5 vols, Cambridge, MA, Harvard University Press, 1960– 63, vol. 5. Charles Robert Leslie and Tom Taylor refer to the 'technical notes' in the footnotes of *The Life and Times of Sir Joshua Reynolds* often with analysis by William Beechey and Benjamin Robert Haydon. C.R. Leslie and T. Taylor, *The Life and Times of Sir Joshua Reynolds*, 2 vols, London, 1865. Charles Eastlake includes some of the notes and his own interpretation in *Materials for a History of Oil Painting*. Eastlake 1847 (cited in note 7).
- 17. Haydon 1960-63 (cited in note 16).
- 18. Eastlake 1847 (cited in note 7).
- H. Dubois, "Use a little wax with your colours but don't tell anybody": Joshua Reynolds's painting experiments with wax and his sources', *Hamilton Kerr Institute Bulletin* 3, 2000, p. 98.
- A.C.P. de Caylus and M.J. Majault, Mémoire sur la peinture à l'encaustique et sur la peinture à la cire, Geneva/Paris, Pisott, 1755.
- 21. J.H. Müntz, Encaustic: or, Count Caylus's Method of Painting in the Manner of the Ancients, to which is added a Sure and Easy Method for Fixing Crayons, London, 1760, printed for the author.
- 22. Dubois 2000 (cited in note 19), pp. 97-106.
- 23. Caylus and Majault 1755 (cited in note 20), p. 77.
- 24. F. Knirim, Die Harzmalerei der Alten. Ein Versuch zur Einführung einer weit mehr Vortheile als Oel-, Wachs-, Frescound Temperawasser-Malerei gewährenden und so whol zu Wand- als zu Staffelei-Gemälden von allen Grössen brauchbaren Malerei [etc], Leipzig, 1839. See also U. Schiessl, "Apage Satanas! Apage Copaiva!" Über Materialmodern in der Restauriergeschichter', Zeitschrift für Kunsttechnologie und Konservierung 1, 1987, p. 165.
- 25. Eastlake 1847 (cited in note 7), vol. 1, p. 461.

- Cat. no. 1391 in D. Mannings, Sir Joshua Reynolds: A Complete Catalogue of his Paintings, New Haven, Yale University Press, 2000, p. 363.
- 27. 'Offe's Picture painted with Cera & Cap. solo- cinabro' (vol. 1, f.52v), Cormack 1968–70 (cited in note 15), p. 141.
- 28. 'Offe a fatto intiera mente con Cap. & Cera / (for cancelled) le Testa sopra in (terra cancelled) fondo preparato / con olio e biacca' (vol. 1, f.54 [back cover]), Cormack 1968–70 (cited in note 15), p. 143.
- 'Lady Milbourn Do. sopra una tela di fundo' (vol. 1, f.54 [back cover]), Cormack 1968–70 (cited in note 15), p. 143. Mannings 2000 (cited in note 26), p. 297, cat. no. 1079.
- 30. 'The nincean Nymph with Baccus principiato / con cera solo finito con cera & capivi / per causa it crak'd. / Do. St. John' (vol. 1, f. 54 [back cover]), Cormack 1968–70 (cited in note 15), p. 143. The Nymph and Bacchus is probably *Ino and the Infant Bacchus*, cat. no. 2123 in Mannings 2000 (cited in note 26), p. 552. The St John may be *Child Baptist in the Wilderness* which was destroyed. *Saint John the Baptist in the Wilderness*, the Wallace Collection, is a version of this painting. Mannings 2000 (cited in note 26), p. 516.
- 31. 'July (20 cancelled) 10th / 1769 my own Picture painted first with oil (after / glazed without white by Capivi. yellow oker & Lake. no Vern cancelled) Painted with Lake Yellow oker. Blue & black, Capi & cera verni', (vol. 1, f.53.r), Cormack 1968–70 (cited in note 15), p. 142. Possibly cat. no. 9 in Mannings 2000 (cited in note 26), p. 47.
- 32. Haydon 1960-63 (cited in note 16), vol. 5, p. 581.
- 33. 'Jan 22 1770 Sono Stailito in maniera di dipingar / Prima e secondo o con olio, o Capivi / Gli cololi / solo nero, ultrami / e biacca / Secondo medesimo, ultimo con / Giallo. okero e lacca e nero e ultramari / sensa biacca, retoccato con poca biacca e Gli altri Color / my own given to Mr Burk' (vol. 1, f.53v), Cormack 1968–70 (cited in note 15), p. 142.
- 34. 'Feb. 6. 1770 / primo olio Biacca e nero / Secondo olio biacca e Lacca / terzio / lacca e Giallo capivi e nero senza Biacca' (vol. 1, f.53.v), Cormack 1968–70 (cited in note 15), p. 142.
- 35. 'Dr Johnston and Goldsmith 1st olio after Capivi with (colour cancelled) Colori / but without white. The hand of Goldsmith cap. and White' (vol. 1, f.53.r), Cormack 1968–70 (cited in note 15), p. 142. Both the portrait of Dr Johnson (cat. no. 1012) and Oliver Goldsmith (cat. no. 736) are at Knole. Mannings 2000 (cited in note 26), p. 220, pp. 280–281.
- 36. Langenheim 2003 (cited in note 3).
- 37. Steigenberger 2013 (cited in note 2).
- 38. White 1986 (cited in note 13), pp. 58-60.
- 39. The diterpenoid content of Leguminosae resins consists of resin acids which mainly have the enantiomeric structure of those found in conifer resins. However, the techniques used in this study are not able to determine stereochemistry.
- 40. Steigenberger 2013 (cited in note 2); Van der Werf *et al.* 2000 (cited in note 1).
- 41. For further discussion of this see A. Gent, R. Morrison and R. Jones, '*The Strawberry Girl*: repetition in Reynolds's studio practice', in E. Hermens (ed.), *European Paintings 15th-18th Century: Copying, Replicating and Emulating,* Archetype Publications, London in association with CATS, Copenhagen, 2014, pp. 122–131.
- 42. Each of these samples also contained some fir balsam in addition. However fir balsam was also identified in samples of brown surface coating from elsewhere on the painting and may not be related to the medium of the fluorescent brushstrokes.
- 43. The identification of these components is based on the comparison of mass spectra with those published by Steigenberger. She assigns these compounds as 'eL33': 18-hydroxy-ent-labda-8(20)-en-15-oate and 'eL34': hydroxy-ent-labda-8(20)-dien-15-oate

(unknown position of hydroxyl). See Steigenberger 2013 (cited in note 2).

- 44. Ibid.
- 45. A second paint sample from *Colonel Tarleton* was analysed by GC-MS. Although none of the marker compounds given in Figure 2 were detected, a small peak for one of the oxygenated labdane derivatives found in samples from *Mrs Elizabeth Carnac* and *Mrs Mary Nesbitt* was observed.
- 46. Interestingly, several samples in this study which contained a Leguminosae resin also showed evidence of an unusual photooxidation product of pine resin: the methyl ester of 7-oxo-8, 11, 13, 15-abietatetraenoic acid, B⁺ 251; M⁺ 326. It is not clear how this photo-oxidation product forms, nor if the leguminous diterpenoid fraction affects its formation.
- 47. Van der Werf *et al.* 2000 (cited in note 1); Steigenberger 2013 (cited in note 2).

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FERDINAND BAUER'S *FLORA GRAECA* COLOUR CODE

Richard Mulholland

ABSTRACT Outside of the natural sciences, the work of Ferdinand Bauer, the pre-eminent 18th-century natural history painter is little known. However, his botanical and zoological paintings on paper are considered to be among the finest in the world. Of particular interest is the unusual drawing and painting technique he utilised, recording colour information on specimens by annotating preliminary pencil sketches with numerical colour codes to be painted at a much later stage referring directly to a painted colour chart. This paper discusses Bauer's botanical illustration and his painting methods in the context of colour charts and systems developed by earlier naturalists. It documents Bauer's technique and highlights the fact that if his watercolour paintings were created using this colour reference system, often many years after seeing the original specimens, and that they are highly regarded even today for their visual accuracy, it speaks to his expertise as an artist.

Introduction

Outside of the natural sciences, the work of Ferdinand Bauer (1760–1826), the pre-eminent 18th-century natural history painter is little known. However, his botanical and zoological paintings on paper are considered to be among the finest in the world, and the verisimilitude of the illustrations of flowers he made for the exquisitely printed 10-volume *Flora Graeca* (1806–40), regarded by many as the most beautiful botanical work ever produced, have led to his reputation as one of the greatest botanical painters in history (Fig. 1).¹

The level of scientific accuracy in Bauer's paintings was unprecedented at a time when many botanical illustrations were idealised representations of specimens. Bauer certainly observed live specimens, but he did not paint them in colour in the field. Rather, subject to the limitations of working as a travelling artist, moving from place to place quickly, and often under difficult circumstances, he made very basic pencil sketches, recording vital colour information from specimens only by annotating these with a series of numerical colour codes which referred directly to a painted colour chart, now lost.² That Bauer's watercolour paintings were created using only dried herbarium specimens and this colour reference system, often several years after seeing the original plants, and that they are highly regarded today for their visual accuracy, speaks to his expertise as an artist and his memory for colour. The papers that Bauer used for both his sketches and watercolours have been analysed and documented,³ but his watercolour palette and how exactly he utilised his colour code have not been adequately explored.



Fig. 1 James Sowerby (after Ferdinand Bauer), frontispiece for volume 1 of *The Flora Graeca*, 1806–40, hand-coloured engraving (MS Sherard 761). (© Bodleian Library, University of Oxford, 2015.)



Fig. 2: Ferdinand Bauer, *Morino Persica*, watercolour on paper (MS. Sherard 243/19). (© Bodleian Library, University of Oxford, 2015.)

The Flora Graeca

The exploration of the flora and fauna of the Levant and the Balkan Peninsula in the late 18th century formed the background for one of the most ambitious and expensive botanical works ever published (Fig. 2). Unprecedented in the quality of its illustrations, its printing and its attention to naturalistic detail, the Flora Graeca was published in 10 lavishly printed volumes between 1806 and 1840 to only 25 subscribers, and was the legacy of the third professor of botany at Oxford University, John Sibthorp (1758-1796), who commissioned and funded two expeditions to the Levant and the subsequent publication of the book. Following in the footsteps of the great French naturalist, Joseph Pitton de Tournefort (1656-1708), who was commissioned by Louis XIV to study the flora of the Aegean, Sibthorp made two expeditions (1786-87 and 1794-95) to the eastern Mediterranean and made the comprehensive study of its flora that was eventually to become the Flora Graeca.

The *Flora Graeca* is significant for a number of reasons. Firstly, it developed and updated Dioscorides's 1st-century AD treatise, *De materia medica*, which until the *Flora Graeca* was published, remained a standard text for the identification of medicinal plants used in Greece. Secondly, the work is of prime importance in the scientific and botanical fields in that it is a comprehensive survey of botanical data from a particular geographical area at a specific point in time. Perhaps most significantly however, Bauer's remarkable skill and attention to detail means that it is also regarded as one of the finest pieces of botanical art ever produced. It is also extremely rare in the fact that all stages of its publication are still in existence almost in their entirety at Oxford including all Bauer's field sketches, his original paintings and several copies of the first edition engraved by the printer and botanical painter, James Sowerby.

Landing in Greece in 1786, Sibthorp and his team were early tourists to the area, much of which was still under the control of the Ottoman Empire and prone to civil unrest. They arrived long before the attractions of Greece and the Orient became popular as destinations for the Grand Tour – many years before Lord Byron and Lord Elgin – and as Stephen Harris has noted, Sibthorp's expeditions were fundamental to opening up the eastern Mediterranean to both natural history researchers and those pursuing the Grand Tour.⁴ Although Sibthorp did not live to see the *Flora Graeca* in print, he ensured his own legacy by funding the substantial costs of its publication through his estate.

Despite its impressive scope, the *Flora Graeca* is not a comprehensive work. Following closely the spirit of Linneaus and the Royal Society, Sibthorp understood that the success of such a botanical endeavour was highly dependent on its ability to convey accurate visual information as a tool for both generation and exchange of knowledge. In this spirit, he stipulated in his will that only specimens that were directly observed and sketched from life by Bauer were to be published.⁵

Sibthorp's attention to detail also extended to ensuring the colour fidelity of the hand-coloured engravings for the publication - something that was commonly overlooked in botanical publications at the time, and often the subject of consternation between publisher and printer.⁶ Responsibility for the hand-colouring of printed books usually fell to the printer. The cost of employing professional artists would have been prohibitive and therefore artists were typically untrained amateurs, often women and children. Although Bauer petitioned to engrave the plates of his illustrations himself, James Edward Smith, botanist, founder of the Linnean Society, and by then editor of the Flora Graeca, engaged the services of James Sowerby, an established and talented botanical illustrator, engraver and naturalist who had engraved the plates for Smith's own work, English Botany (1813). Sowerby maintained an unusually high degree of quality control over the colouring of his engravings, and appears to have employed members of his own workshop for the purpose. Consequently the colouring of the prints is also remarkably accurate. It is probably no coincidence that Sowerby also had a strong interest in colour theory, publishing a pamphlet on his own ideas about colour and colour ordering in 1809.7 If Bauer's colours are impressively accurate, Sowerby's replication of them are equally so. For the most part in the finest printings of the Flora Graeca, they are almost indistinguishable from the original paintings (Fig. 3).



Fig. 3 Left: Ferdinand Bauer, Iris Germanicus, watercolour on paper (MS Sherard 245/70). Right: James Sowerby (after Ferdinand Bauer), Iris Germanicus, hand-coloured engraving from the first edition of The Flora Graeca, 1806–40 (MS Sherard 761/t40. (© Bodleian Library, University of Oxford, 2015.)

Ferdinand Bauer: Princeps Pictorum

In 1866, Richard and Samuel Redgrave declared that Turner had arrived at 'perfect knowledge and perfect mastery' in the medium of watercolour.8 However, as Fiona Mann has discussed, Turner's virtuosity with watercolour has cast a shadow over both later artists and the appreciation of those that came before.9 While mastery of technique in watercolour was certainly exemplified in the English 18th- and 19th-century landscape school, in the paintings of the lesser known natural history painters, a similar mastery and knowledge of the medium was present in abundance. Of course for artists working in the fields of botany and zoology, fields that were only beginning to emerge as scientific disciplines in the 18th century, painting was required in the first instance to be as perfect a representation of nature as their skill allowed, ostensibly omitting any hint of individual artistic expression. In the hierarchy of artistic genres, the work of natural history artists was often seen as utilitarian, less appreciated and understood as a visual art than it was as scientific illustration. However, in the finest examples, their work could be simultaneously scientifically viable and expressive and beautiful in character.

Ferdinand Bauer and his two brothers, Franz and Josef, were talented artists from a young age, very likely self-taught.¹⁰ Their father was court painter to the princes of Liechtenstein in Feldsberg, in what was then lower Austria (present-day Valdice, Czech Republic), but died when the brothers were very young. Of six siblings, three – Franz, Josef and Ferdinand – demonstrated exceptional talent for painting

and were apprenticed to Norbert Boccius (1729–1806), prior of the monastery of the Brothers of Mercy in Feldsberg. A noted naturalist and physician, Boccius seemingly both taught and commissioned the three Bauers to contribute paintings to the first volume of his *Liber regni vegetabilis* (The Codex Liechtenstein), a comprehensive florilegium of over 2700 botanical miniature paintings, first published in 1776. Where his hand can be identified Ferdinand, who was only 15 at the time of his apprenticeship, demonstrates the exquisite attention to detail that is seen throughout his later work. More importantly however, a number of early sketches by the brothers (now at the Natural History Museum in Vienna) contain an elementary system of numerical colour codes, indicating perhaps that Boccius's teaching may have been the source of Bauer's system of recording colour.

Franz and Ferdinand Bauer then attended the Akademie der Bildenden Künst in Vienna, where they also worked for the famed naturalist, Nikolaus von Jacquin. Ferdinand Bauer left Vienna in 1786 to accompany Sibthorp on his expedition, and Franz Bauer left two years later to become the official draughtsman to Joseph Banks at Kew Botanical Gardens in London, where he remained until his death. Bauer only travelled on the first Sibthorp expedition in 1786, returning to Oxford the following year to complete paintings based on the sketches (of both animals and plants) he made in the field. However, after completing some 1500 paintings of flora, fauna and landscapes, 966 of which were finally engraved for the *Flora Graeca*, and somewhat disillusioned with the experience, Bauer accepted an offer from Banks to become official artist on Matthew Flinders's botanical expedition to Australia



Fig. 4 Ferdinand Bauer, sketch showing *Iris Germanicus* and numerical colour codes, graphite pencil on paper, 1786–87 (MS Sherard 247/107). (© Bodleian Library, University of Oxford, 2015.)

(1801–05). He returned to Austria in 1814, where he continued to work for a number of botanists in both London and Vienna until his death in 1826.

Sibthorp was introduced to Bauer in Vienna in 1784 by Joseph Franz von Jacquin when he visited the elder von Jacquin to consult an early copy of Dioscorides. Clearly impressed, in a letter written to his travelling companion John Hawkins on 3 March 1786, he also demonstrates that Bauer, despite having no formal scientific education outside of his apprenticeship in Feldsberg, certainly had significant knowledge of botany. He states: 'My painter in each part of natural history is *Princeps Pictorum.* He joins to the Taste of the Painter the Knowledge of a Naturalist - And Animal, Plant and Fossil touched by his hand shew the Master.'¹¹

This was certainly high praise. Sibthorp, after all, had seen first-hand the work of the great botanical painter, George Dionysus Ehret when Ehret worked for his father at the Oxford Botanical Garden. Despite this adulation however, it is clear that Bauer's status on the expedition was very low, and that Sibthorp appears to have treated him as little more than a servant. One of Bauer's few extant letters complains about his salary, and it is telling perhaps that in Sibthorp's frequent correspondence with Joseph Banks, Bauer is referred to only as 'my painter' or 'my artist' – not once by name.

Bauer's painting method

Travelling artists on large and fast-moving expeditions were naturally subject to the limitations of working in the field. Botanical artists typically made rapid sketches in pencil, usually annotated in longhand or with the addition of small areas of colour to use as reference for painting at a later stage.¹² Bauer followed a similar pattern. Basic plant structure and scale were replicated in his paintings using his sketches and by referring to the dried specimens in Sibthorp's herbarium.¹³ However, the crucial colour information on the specimens was recorded solely by means of his numerical code which seems to refer to a systematic colour chart with at least 273 shades.

What is interesting about Bauer's preliminary drawings is the distinct lack of visual information that they contain. His drawings are little more than quickly sketched outlines (Fig. 4). In most cases, there is a complete lack of shading, no indication of form, texture, gloss or other tactile qualities and no further written annotations regarding colour tone, shade, hue or intensity. The code seems to be all that he required to achieve almost perfect colour fidelity in the replication of living specimens on the page - living specimens that he had observed up to five years prior to painting them. It is remarkable then that Bauer's drawings, which were carefully examined prior to publication by the most eminent botanists of the day, contained few botanical errors, that they remain a significant resource for the study of the flora of the eastern Mediterranean today, and that they were frequently used throughout the 19th century as a reference to describe botanical types.14

Bauer's antecedents: medieval printed herbals

To achieve accuracy in depicted representations of nature in colour became a common preoccupation for 18th-century naturalists. However, most early books on plants were herbals, and illustrations were largely woodblock printed in black and white, typically copied from earlier printed sources and often with added flourishes and embellishments. They were idealised versions of the plants they depicted, and moreover very much subordinate to the text.

Botanical texts in the early modern period were encountered largely as copies of Dioscorides's treatise De materia medica (c.AD 70).15 There are illustrations of plants in more than 20 manuscripts of Dioscorides throughout the medieval period. However, these are generally idealistic, schematic images, far from accurate in their representation of nature. Change seems to have occurred through northern Italy and Germany in the mid-15th century. The earliest Italian translation of Dioscorides produced in the mid-1470s had more sophisticated illustrations made by German artists, who were among the first to definitively state that their drawings were made 'ad vivum'. Despite this advance in image-making however, and as early as 1529, naturalists criticised the value of including images, suggesting that it was simply impossible that illustrations could provide accurate botanical information given the changeability of specimens throughout the year.

Perhaps the first accurate printed herbal was *Herbarium vivae eicones* (literally, *Lifelike Pictures of Plants*) written by Otto Brunfels (1488–1534) and published in Strasbourg between 1532 and 1536. It was praised for its naturalistic depiction of plants in the woodcuts of its illustrator Hans Weiditz (1495–1536), who may have been a pupil of Dürer. However, crucially, while Brunfels's text was largely copied verbatim from antique sources, Weiditz's illustrations were taken from life.

Weiditz's original watercolours, which were identified in the early 20th century, are an important landmark in the history of botanical illustration. In addition to the drawnfrom-nature accuracy of the paintings themselves, they also contain extensive annotations on the size, colour and texture of the each plant, demonstrating both a standard of accuracy that had not been seen before, and indicating a system of annotation or shorthand that showed the significant botanical knowledge of the artist. This was something that Ferdinand Bauer seems to have inherited and perfected in his abstracted shorthand for documenting accurate colour information from his specimens.

The Italian naturalist, Pietro Andrea Matioli (1501–1577) had also attempted to create accurate illustrations from dried specimens in his editions of Dioscorides, but it was Leonhard Fuchs's (1501–1566) *De historia stirpium* of 1542 that represented a more significant move towards modern botanical illustration. Fuchs's publication included 550 illustrations in woodblock print and a page naming both artist and printmaker, but perhaps more importantly drawing attention to the fact that their work was carried out from fresh specimens.

Fuchs's illustrations were not direct portraits of individual specimens as seen in Brunfels's text, and he also ensured that his artists did not indulge their expressive whim and embellish their illustrations with unnecessary detail. Fuchs's representations were idealised in accordance with the text, but crucially with the intention that the reader might be able see all variations of the plant found in nature in one illustration (something that is still carried out by botanical illustrators today). As Touwaide has discussed, Fuchs's illustrator based each illustration on a large number of specimens, distilling out of them an abstraction of characteristics to produce a more general, and to Fuchs, more accurate definition.¹⁶

Smith has observed that Brunfels and Fuchs, rather than breaking with tradition, were in fact harking back to a tradition of scientific naturalism expressed in an early 15thcentury herbal from Padua, the Carrara Herbal. The Carrara text was in fact an Italian translation of the Liber aggregatus in medicinis simplicibus, originally written in the 9th century. It is worthy of note here, as the book's patron, Francesco II was also patron to Cennino Cennini. Smith thus sees the Carrara herbal as an artisanal response to the ongoing discourse on the status of the artist in the depiction of nature in the 15th century and beyond.¹⁷ Practising artists grew in status due to the association with emerging scientific fields, together with the rejection of pattern books in favour of working directly from nature. Although artists were not quick to adopt the methods seen in the Carrara herbal, Smith sees a steady progression of artistic procedure from the paintings of Martin Schongauer to Dürer, and from Dürer to his pupil Weiditz. These early botanical artists were beginning a debate, encouraged by the foundation of the great scientific societies in the 17th century, on the importance of directly observing and accurately documenting nature.

Recording colour: colour systems and charts

The limitations of accurately recording colour from botanical specimens were voiced in the 1st century AD by Pliny. In the *Natural Histories*, he writes:

Not only is a picture misleading as the colours are so many, particularly as the aim is to copy nature, but besides this much imperfection arises from the manifold hazards in the accuracy of copyists. In addition, it is not enough for each plant to be painted at one period only of its life, since it alters its appearance with the fourfold changes of the year.¹⁸

Similarly in the 18th century, the great Carl von Linnaeus notably rejected colour as a criteria for describing plants in his taxonomic system. Linnaeus determined that for describing plant taxonomy, only four criteria were constant and therefore useful: number of organs, shape, position and proportion. Echoing Pliny, he wrote in 1751, 'Colour is remarkably changeable, and so is of no value in definitions.'¹⁹

In spite of this, achieving accuracy in depicted representations of nature in colour became a common preoccupation for 17th and 18th-century naturalists. Colour charts and systems of ordering colour were certainly nothing new when Bauer embarked on his journey to the eastern Mediterranean in 1786. Isaac Newton identified the prismatic spectrum of daylight in 1672, and a number of systems followed developing Newton's ideas in the 17th and 18th centuries. However in the 18th century, creating colour theories and systematising colour became a popular preoccupation, as both scientists and artists attempted to order, classify, name and systematise colour in different ways. These were often presented with the suggestion that if colour could be so ordered, it would not only be of benefit to scientific knowledge, but also that such systems could be used in a practical way to assist the work of artists and craftsmen.20

An early example is Richard Waller's colour table of 1686, *Table of Physiological Colors Both Mixt and Simple*, which was specifically created to assist naturalists in describing standard colours for natural history specimens (Fig. 5). Although he was not an artist, Waller was perhaps the first to present a theory for mixing colours and suggest a practical use for it, claiming that his chart could be used by artists and scientists alike in describing objects observed in the real world.

Waller approached the standardisation of his colours scientifically, using only natural pigments for his 'simple colours' (red, blue, yellow) and applying each colour to his chart in a standard-sized dot using a small, sprung tapered pipe.²¹ Accompanying the chart were notes in English and Latin, and perhaps more significantly, colour terms and pigment names in Latin, Greek, English and French. Colours are classified in Waller's chart by referring to the 'simple' colours of red, yellow and blue together with white and black. What is interesting about his chart in particular is that he specified the pigments to be used for each colour. In this way, the name of the colour in his chart would always refer to a specific pigment or mixture of pigments. Indeed recent analysis of two examples of Waller's chart by fibre optic reflectance spectroscopy (FORS) has confirmed that the pigments specified in his explanatory notes were indeed the same as those used for his painted charts.²²

Perhaps the most significant 18th-century example is the colour chart created by the German botanist and entymologist, Jacob Christian Schäffer, who also proposed a system with the intention of standardising colour description for artists and naturalists. His system was based on describing colours by referring to real examples found in the animal, vegetable and mineral realms of the natural world. Of the benefits of his system, he wrote:

The first benefit will arise for those naturalists and other scholars ... who have neither the opportunity, nor could or would they wish to spend the money, to have the objects that they describe drawn, engraved in copper and then hand-coloured. These could express themselves ... by quickly and precisely referring to the colour charts, without having to spend painstaking time naming and describing the colours.²³



Fig. 5 Richard Waller, *Tabula Colorum Physiologica* from 'A catalogue of simple and mixt colours, with a specimen of each colour prefixt to its proper name', *Philosophical Transactions of the Royal Society*, vol. 16, 1686–87. Note the blackening of both massicot and red lead pigments. (By permission of the Warden and Scholars of New College, Oxford.)



Fig. 6 Folio from Thaddeus Haenke's 2487 colour chart. (© Archivo del Real Jardín Botánico, CSIC, Madrid.)



Fig. 7 Ferdinand Bauer's earlier 140 colour chart used in Vienna c.1780s, with additional colour swatches added by Thaddeus Haenke. (© Archivo del Real Jardín Botánico, CSIC, Madrid.)

Colour swatches on Schäffer's chart referred directly to those colours observed in animals, insects, flowers and minerals, and the accompanying text explained how one might replicate the colours using commonly available pigments. For example, *Red number 41*, described as 'the red of a woodpecker's breast', was a combination of minium, cochineal and lead white. Similarly,

Red number 40 is described as 'the red of a woodpecker's head,' and was a combination of carmine, cinnabar and brazilwood lake. As Lowengard points out however, Schäffer's system was based on the presumption that colours found in nature were constant and unchanging, something that he could certainly not guarantee. ²⁴ Despite the noble attempts by Schäffer, Waller and others to produce systematised colour charts that would have a practical use, there is virtually no evidence that they were used by artists, craftsmen or naturalists in a significant way. They may have simply been considered irrelevant by artists, or the lack of consistency in the way one observes, memorises and reproduces colour may have meant that the systems were simply too unwieldy for practical usage.

Certainly the limitations, not to mention the variety, of hue obtained from any given pigment would have been an impediment to capturing colour in any meaningful way. As one writer on artists' technique wrote in 1805, 'I shall only add, that in mixing these colours, the imperfections of the pigments we have to use must be allowed for; for they will all fall very far short of those seen in the prismatic spectrum.²⁵

Bauer's colour system

Ferdinand Bauer, and to a lesser extent, his brother Franz appear to be the only significant natural history artists to have used this kind of colour code in a practical way. As mentioned, numerical codes are found on early drawings by both Bauers from the 1770s. However, where Ferdinand seems to have continued to develop this initial system of some 140 colours into one of at least 273 colours for the *Flora Graeca*, and from then into a considerably more complex system of 1000 colours for the Mathew Flinders expedition to Australia, Franz Bauer did not appear to use the system after he came to London in the late 1780s. Ferdinand Bauer of course, was travelling and working in the field, and therefore much more in need of a system of shorthand than his brother, who was firmly entrenched at Kew.

In whatever form they took, Bauer's colour charts for both the *Flora Graeca* and his later Australian paintings have been lost. How exactly Bauer used these charts is unknown, but it is certain that the numerical codes definitively correspond to an ordered colour system.²⁶ An earlier colour chart ostensibly used by the brothers was discovered in the archives of the Real Jardín Botánico in Madrid by Walter Lack and Victoria Ibanez in 1997. It contains notes that appear to be in Ferdinand Bauer's hand and coloured swatches that directly correlate with numerical codes found in the Codex Liechtenstein sketches and the colours in their subsequent paintings. However, unlike Waller's and Schäffer's charts, there is no reference to the pigments Bauer used to create each colour (Figs 6 and 7).²⁷

This Madrid chart was further annotated and amended into a considerably larger and more complex system by the German naturalist Thaddeus Haenke, who had probably met Franz Bauer while visiting von Jacquin around 1786, and presumably acquired or was given the colour chart.²⁸ Haenke vastly increased the number of swatches in Bauer's original 140 colour chart to create a table of some 2487 colours, forming a 16-page pamphlet which he took with him on his own travels.²⁹ Shortly after meeting von Jacquin, Haenke was employed by the Spanish crown to accompany Alessandro Malaspina on an expedition to the New World (1786–88). Despite the apparent effort of creating the system however, there are no field drawings from the Malaspina expedition coded with numbers that refer to his chart, and it seems that neither Haenke nor the artists on that expedition actually used the system. Haenke was not an artist, and as Mabberley and de San Pío Aladrén point out, his arrangement of colours is rather chaotic. They speculate that since the inscriptions were written only in Latin and German, they would most likely not have been understood by the Spanish-speaking illustrators on that expedition, and that ultimately the chart itself may simply have been little more than an academic exercise.³⁰

Bauer's visual memory for colour and ability to reproduce it with great accuracy is certainly remarkable. We may never understand completely how he was able to perfect this method, but the Bodleian Libraries, Oxford University, are currently undertaking a significant research project engaged in the analysis of the pigments Bauer used in his paintings. This will enable us to cross-reference the pigments with the numerical codes found in Bauer's sketches, with the intention of replicating, at least partially, the appearance of the original colour chart. This will go some way towards understanding Bauer's extraordinary feel for colour and pigment, how he utilised his colour code, and ultimately how he was able to achieve such an impressive degree of colour fidelity in his work.

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Notes

 By far the most comprehensive source on Sibthorp, the Bauers, and on the remarkable story of the publication of the *Flora Graeca* is Lack and Mabberley's 1999 publication *The Flora Graeca Story: Sibthorp, Bauer and Hawkins in the Levant* Extensive work on the *Flora Graeca* has also been carried out by Stephen Harris: see H.W. Lack and D.J. Mabberley, *The Flora Graeca Story: Sibthorp, Bauer and Hawkins in the Levant*, Oxford, Oxford University Press, 1999; S. Harris, 'The scientific context of botanical art', in S. Sherwood (ed.), *A New Flowering: 1000 Years of Botanical Art*, Oxford, Ashmolean Museum, 2005, 186–191; S. Harris, *The Magnificent Flora Graeca: How the Mediterranean came to the English Garden*, Oxford, Oxford University Press, 2007. The Haenke/Bauer colour chart and Bauer's illustrations for Matthew Flinders's expedition to Australia have been extensively researched by Mabberley, who also documented the colours used in Bauer's more elaborate 1000 colour code used for that expedition.

- 2. Most of Ferdinand Bauer's finished watercolours survive, as do a large number of his original pencil drawings. The drawings for the *Flora Graeca* are held by the Department of Plant Sciences, University of Oxford and those made during the *Investigator* voyage to Australia are in the archives of the Naturhistorisches Museum in Vienna. Bauer's drawings for Lambert's *A Monograph of the Genus Pinus*, which he made between 1803 and1824, are in the Natural History Museum, London.
- N. Bell, 'History revealed: looking at Ferdinand Bauer's Flora Graeca', in Looking at Paper: Evidence and Interpretation, Symposium Proceedings, Toronto, 13–16 May 1999.
- 4. Harris 2007 (cited in note 1).
- 5. Sibthorp also demanded that the 966 illustrations for each of the 30 complete copies be folio sized (475×330 mm) and consequently the expense was vast. The *Flora Graeca* attracted only 25 subscribers, each paying the sum of £620 a small fortune at a time when the average annual wage for an adult male in England and Wales was £36; Harris 2007 (cited in note 1), p. 163. Forty copies of a vastly inferior quality second edition were produced in 1845, each sold at the considerably lower sum of £63.
- 6. K. Nickelsen, 'The challenge of colour: eighteenth-century botanists and the hand-colouring of illustrations', *Annals of Science* 63(1), 2006, pp. 3–23.
- 7. J. Sowerby, A New Elucidation of Colours, Original Prismatic, and Material, London, 1809.
- 8. R. Redgrave and S. Redgrave, A Century of Painters of the English School, London, Smith, Elder & Co, 1866.
- F. Mann, Brushing the Surface: The Practice and Critical Reception of Watercolour Techniques in England 1850–1880, PhD thesis, Department of the History of Art, Oxford Brookes University, 2013.
- 10. Lack and Mabberley 1999 (cited in note 1).
- 11. Sibthorp (1786) letter to John Hawkins, 3rd March 1786, quoted Lack and Mabberley (1999), p. 32.
- H.W. Lack and V. Ibanez, 'Recording colour in early eighteenth century botanical drawings: Sydney Parkinson, Ferdinand Bauer and Thaddeus Haenke', *Curtis's Botanical Magazine* 6, 1997, pp. 87–100.
- 13. Bauer also seemingly kept his own small herbarium of dried specimens, and it is likely that he had access to a very limited number of living plants at the Oxford Botanical Garden. However the majority of plants were only available to him dried and pressed in the collection of specimens he and Sibthorp acquired from the expedition.
- 14. For example, *Orchidea Genoplesium baueri*, first described by Robert Brown using Bauer's original illustration made during the Flinders expedition to Australia (in R. Brown, *Prodromus floræ Novæ Hollandiæ et Insulæ Van-Diemen: exhibens characteres plantarum quas annis 1802–1805*, London, 1810). A botanical type is an individual specimen to which a scientific name is formally attributed and to which the defining features of the taxon are ascribed. Typically referring to an individual specimen, on rare occasions where a specimen is unavailable or is of poor quality, an illustration can be used. Throughout the 19th century, Bauer's images were used as the sole basis for a number of plant and fish taxa; Dr David Mabberley, pers. comm., 2015.
- 15. Dioscorides's *De materia medica*, written towards the end of the 1st century AD, was a combination of pharmacology and

botany. The earliest known copy, however, exists as fragments of papyrus from AD 512. The first manuscript of Dioscorides in the West is probably an early 14th-century copy made in Constantinople now in the Laurentian Library in Florence (MS Plut. 74.3 Biblioteca Medicea Laurenzia): see P.H. Smith, 'Artisanal knowledge and the representation of nature in sixteenth century Germany', in T. O'Malley and A.R. Meyers (eds), *The Art of Natural History: Illustrated Treatises and Botanical Paintings 1400–1850*, Studies in the History of Art, Symposium Papers XLVI, National Gallery of Art, Washington DC, Yale University Press, 2002, pp. 15–33.

- 16. A. Touwaide, 'Botany and humanism in the Renaissance: background, interaction, contradictions', in T. O'Malley and A.R. Meyers (eds), *The Art of Natural History: Illustrated Treatises* and Botanical Paintings 1400–1850, Studies in the History of Art, Symposium Papers XLVI, National Gallery of Art, Washington DC, Yale University Press, 2002, pp. 33–63, p. 45.
- 17. Smith 2002 (cited in note 15), p. 28.
- 18. Pliny, Natural Histories XXV.IV, p. 141.
- C. von Linnaeus, *Linnaeus' Philosophia Botanica*, S. Freer (trans.), Oxford, Oxford University Press, 1751, p. 229.
- For a comprehensive discussion on systems of ordering colour in the 18th century, see S. Lowengard, *The Creation of Colour in Eighteenth Century Europe*, 2006. Columbia University Press.
 E-book available from: www.gutenberg-e.org/lowengard/ index.html (accessed December 2014).
- S. Kusukawa, 'Richard Waller's colour chart (1686)', in F. Steinle and M. Bushart (eds), *Colour Histories: Science, Art, and Technology in the 17th and 18th Centuries*, Berlin, W. de Gruyter, 2015.
- 22. Ibid.
- J.C. Schäffer, Entwurf einer allgemeinen Farbenverein; oder Versuch und Muster einer gemeinnützlichen Bestimmung und Benennung der Farben, Nüremberg, 1769, quoted in Nickelsen 2006 (cited in note 6).
- 24. Lowengard 2006.
- 25. M. Gartside, An Essay on Light and Shade on Colours and on Composition in General, London, Thomas Davison, 1805.
- 26. D.J. Mabberley with E. Pignatti-Wikus and C. Riedl-Dorn, 'Ferdinand Bauer's field drawings of endemic Western Australian plants made at King George Sound and Lucky Bay, December 1801–January 1802 (I and II)', *Rendiconte Fisiche* Accademie Lincei 9(11), 2000/2001, pp. 201–244.
- 27. Lack and Ibanez 1997 (cited in note 12).
- 28. Ibid.; D.J. Mabberley and M.P. de San Pío Aladrén, La carta de colores de Haenke de la Expedición Malaspina: un enigma, Madrid, Real Jardín Botánico, 2011.
- 29. Haenke created the chart between 1789 and 1793, intending it be used for botanical illustration in the field. He titled it, *Systema Colorum tabulare atque comparativum pro expeditiori plantarum cum vivis coloribus adumbratione in itinere cum hispanis navibus circa globum terraqueum annis.*
- 30. Mabberley and de San Pío Aladrén 2011 (cited in note 28).

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