Replicating the Palette from Pierre-François Tingry’s The Painter’s and Colourman’s Complete Guide

Kelsey Britt
University of Pennsylvania

Follow this and additional works at: https://repository.upenn.edu/hp_theses

https://repository.upenn.edu/hp_theses/661

Suggested Citation:

This paper is posted at ScholarlyCommons. https://repository.upenn.edu/hp_theses/661
For more information, please contact repository@pobox.upenn.edu.
Replicating the Palette from Pierre-François Tingry’s The Painter’s and Colourman’s Complete Guide

Abstract
This thesis addresses the replication of house paints with period methods and materials as described in the third edition of Pierre-François Tingry’s (1743-1821) treatise, The Painter’s and Colourman’s Complete Guide (1830). Drawing on documentary sources, conservation and preservation literature, and previous examples of paint replication, it examines the historic materials and methods of preparing oil-based house paints and explores possibilities of accurate paint replication. It also considers paint treatises as an important source of information for understanding historic paints and discusses the history of paint replication in the U.S., including the current interest in replicating historic paints with hand-ground traditional materials. The resulting paint palette augments the collection other paint palettes in the Historic Materials Study Collection at the Architectural Conservation Laboratory at the Graduate Program in Historic Preservation at the University of Pennsylvania.

Keywords
architectural finishes, paint replication, Pierre-François Tingry, paint treatise, historic house paints

Disciplines
Historic Preservation and Conservation

Comments
Suggested Citation:


This thesis or dissertation is available at ScholarlyCommons: https://repository.upenn.edu/hp_theses/661
REPLICATING THE PALETTE FROM PIERRE-FRANÇOIS TINGRY’S

THE PAINTER’S AND COLOURMAN’S COMPLETE GUIDE

Kelsey Anne Britt

A THESIS

in

Historic Preservation

Presented to the Faculties of the University of Pennsylvania in Partial Fulfillment of the Requirements of the Degree of

MASTER OF SCIENCE IN HISTORIC PRESERVATION

2018

__________________________________________
Advisor
Catherine S. Myers
Lecturer in Historic Preservation

__________________________________________
Program Chair
Frank G. Matero
Professor
ACKNOWLEDGEMENTS

First and foremost, I would like to thank my advisor Catherine S. Myers for her encouragement and dedication. I could not have completed this project without her guidance. I would like to thank Frank Matero for presenting me with the idea to replicate a palette and for his and the department in Historic Preservation’s support. To Patrick Baty, for his expertise and for generously answering my questions and offering advice. Lastly, thank you to Francesca Ammon for your editorial guidance.

Thank you to my family and to Andrew for their constant love and support. I dedicate this thesis in loving memory of my father Douglas Britt and aunt Dolores Perry.
# TABLE OF CONTENTS

1.0 INTRODUCTION .................................................................................. 1
  1.1 Previous Paint Palette Replications .................................................. 11
  1.2 Pierre-François Tingry (1743-1821) ................................................. 13
  1.3 House Painting Treatises and the House Painting Trade ............... 16

2.0 MAKING PAINTS: METHODS AND OBSERVATIONS .................. 29
  2.1 Literature Review ........................................................................... 30
  2.2 Selecting Materials, Tools, and Supplies ...................................... 32
  2.3 Replicating the Palette: Methods and Observations ..................... 44
  2.4 The Completed Palette: Observations .......................................... 59
  2.5 Color Measurements ..................................................................... 65

3.0 CONCLUSIONS ................................................................................. 67
  3.1 The Impact of Pigments on the Resulting Paint Colors .................. 67
  3.2 The Impact of Linseed Oil and Turpentine Paint Colors .................. 70
  3.3 The Impact of Driers .................................................................... 71
  3.4 The Impact of Recipes on Reproducibility ..................................... 71
  3.5 Reference Collection and Color Measurements ........................... 74
  3.6 Recommendations for Future Research ....................................... 75

BIBLIOGRAPHY ......................................................................................... 77

Appendix A | Methods and Observations .................................................. 83
Appendix B | Photographs of the Palette .................................................... 96
Appendix C | CIE L*a*b* Color Measurement Values .................................. 108

INDEX ....................................................................................................... 118
LIST OF FIGURES

Figure 1.1: Eighteenth-century oil paint exposed on shutter from Stenton .................................................. 5
Figure 1.2: Finishes in the parlor in the Great House at Stratford Hall .................................................. 8
Figure 1.3: Hand-ground paints installed in the Great House at Stratford Hall ........................................... 9
Figure 1.4: Common tools used in paint replication ......................................................................................... 10
Figure 1.5: Glass grinding paint and muller used in paint replication ....................................................... 11
Figure 1.6: House painters at work, 1830 ...................................................................................................... 24
Figure 2.1: An artist’s tube of lead white oil paint ...................................................................................... 38
Figure 2.2: Cold-pressed linseed oil and turpenoid ...................................................................................... 40
Figure 2.3: Cold-pressed walnut oil and violin rosin medium ................................................................. 43
Figure 2.4: Clear white pine blocks prior to sizing ....................................................................................... 41
Figure 2.5: Clear white pine blocks with size applied .................................................................................. 46
Figure 2.6: Primed and sized clear white pine blocks ............................................................................... 47
Figure 2.7: Pigments and driers ground in oil and mixed paints .............................................................. 48
Figure 2.8: Mixing Prussian blue pigment in linseed oil ............................................................................ 49
Figure 2.9: Grinding Prussian blue pigment in linseed oil ....................................................................... 50
Figure 2.10: Dry smalt pigment and linseed oil ......................................................................................... 51
Figure 2.11: Smalt pigment mixed in linseed oil ......................................................................................... 52
Figure 2.12: Smalt pigment ground in linseed oil ....................................................................................... 52
Figure 2.13: Challenges faced when mulling paint color 12-A and 12-B ................................................... 55
Figure 2.14: Testing paint consistency before application ........................................................................... 57
Figure 2.15: Painting out Another Blue made with Saxon Blue (11-A) ..................................................... 58
Figure 2.16: Paint colors impacted by the Lead(II) Acetate drier ............................................................. 59
Figure 2.17: The completed eighteen-color palette .................................................................................. 60
Figure 2.18: Freshly applied second coats of paint .................................................................................... 62
Figure 2.19: A freshly applied second coat of Vermilion (Red 1) [17-A] paint ......................................... 63
CHAPTER 1

1.0 INTRODUCTION

Replicating a historic paint palette, not unlike recreating a historic truss system or fabricating a mud brick wall, offers insights into the workmanship and technology of the past. In the process, one learns both predictable and unexpected lessons, while leaving behind a facsimile of historic materials and techniques for study.

The following detailed description of the replication of traditional hand-ground paints according to Pierre-François Tingry’s 1830-31 treatise, *The Painter’s and Colourman’s Complete Guide*, explores the possibility of accurately replicating a palette of paints from the formulas provided in this widely-distributed handbook. Recounting the fabrication details, from sourcing materials, grinding pigments to the intricacies of paint mixing and application, it examines this difficult but beautiful paint medium. In so doing, it asserts that the exercise of recreating the paint palette contributes to understanding of the process and variability of architectural oil paints both as freshly applied finishes and, eventually, as aged paints. Placing these early oil paints in context, it also examines the paint treatise as the essential guide for painters in the days before mass production of paints. Finally, it attempts to connect the hands-on exercise of reproducing a historic palette with burgeoning interest in replication of oil bound architectural paints. In the end, it defends the benefits for research and study of reproducing historic paints from a treatise believed to have impacted the painting trade of the U.S. in the first half of the nineteenth century.

Pierre-François Tingry was a French chemist and professor who spent most of his career teaching in Switzerland. His treatise on paint and other finishes, *The Painter’s and Colourman’s Complete Guide*, enjoyed popularity in Europe and the early republic of America. Published in three editions over the course of some thirty years, it evolved from an 1803 handbook in French addressing primarily varnishes and varnish-enhanced paints to one considering most types of house painting.
CHAPTER 1

The original edition was quickly translated into English (London, 1804) for British consumption. A practical chemist revised a second edition, published in London in 1816, in an attempt to simplify the complicated recipes developed by Tingry for the first edition. This edition also remained focused on varnishes. The third edition, revised by a second practical chemist and geared towards the English audience, was published in London in 1830 and in Philadelphia the following year. It became “one of the most useful manuals on house-painting for years.” Sales in shops in Philadelphia, New York, Boston, Baltimore, and Washington, DC, suggest that this final edition was widely influential.

In a period when most technical house painting literature originated in England, Tingry’s revised third edition, published in London and then in the U.S., made it widely available along the Eastern seaboard. While the connection to England is important and typical of the period, Tingry’s treatise is also an outlier among most house painting treatises available in England and the U.S., as it contains a hybrid of color and house painting knowledge based on Swiss, French, and English

---


2 Pierre-François Tingry, The Painter and Varnisher’s Guide; or, A Treatise, Both in Theory and Practice, on the Art of Making and Applying Varnishes, on the Different Kinds of Painting; and on the Method of Preparing Colours Both Simple and Compound (London: Printed for Sherwood, Neely, and Jones, 1816.)


sources. Additionally, while craftsmen and colourmen typically authored treatises, all three editions of Tingry’s work were written and/or edited by practical chemists from different backgrounds. In terms of reliable reproducibility, ratios and weights are provided for many oil colors in the palette. The chapter dedicated to house painting, authored by an English chemist, is also a detailed and methodical, clear step-by-step guide for making and applying house paints. Furthermore, a review of the scholarship on house painting in England in the U.S. revealed frequent discussions of Tingry’s treatise; scholars have also recognized the influence of the third edition.5

Tingry’s treatise on oil paints was certainly a necessary guide for this relatively new and difficult to manage house paint. Oil based house paints emerged in the seventeenth century as alternatives to “common” or “plain” painting types, such as casein, lime-based paint, oil/varnish mixtures, and varnishes applied to plaster and wood.6 Commonly referred to as “hand-ground paints”, “traditional” or “historic paints” these oil paints were intended for application to wood substrates such as doors and trim. They were widely preferred for their beauty, protection of the substrate against various types of deterioration, and durability. Usually mixed with the highly desirable lead white pigment, which lent siccative and adhesive properties to the paint, traditional oil paints until the early twentieth century.7

Because they were handmade with sometimes difficult to handle materials, the appearance of

traditional oil paints tended to vary considerably from one batch and one location to another. Even in controlled environments, “climate, pigment source and manufacture, quality of raw materials, and substrate composition” impacted a coating’s consistency. Physical and chemical alterations of materials contributed to changes in appearance. Linseed oil, the most common oil house paint medium, yellows over time. This yellowing impacts perceptions of paint color and has a particularly negative and irreversible effect on white and blue paints. Additionally, certain pigments fail to remain evenly suspended in a linseed oil medium. Other pigments, due to their material properties, deteriorate over time. Fugitive pigments lose their color. Lead white loses some of its hiding power over time and becomes translucent. Weathering and climate also negatively impact oil paints, resulting in color fading and loss of sheen. Layers of soot and dirt trapped between paint layers affect the appearance of colors. Examining evidence of these colors by way of microscopical analysis of paint samples is not always a reliable method for determining the original color of historic finishes. With these factors in mind, replicating historic paints offers an additional tool for understanding their appearance.

Replicating a historic paint palette from Tingry’s treatise responds to a growing interest in reproducing historic paints with authentic materials. Professionals and others have long recognized the visual differences between modern and historic paints, observing that the modern acrylic latex and alkyd paints used for replication, with their uniform, opaque and often plastic appearance, fail to imitate the unique vibrancy, warmth, and irregularity characteristic of traditional oil paints (Figure

---

9 Ibid.
1.1) The rising interest in returning to hand-ground paints to interpret historic finishes attests to a growing awareness that synthetic paints are a poor substitute.

The first widely known replication of historic paints in the U.S. occurred at Colonial Williamsburg in 1920s through 1940s when the repainting of historic buildings marked the first large-scale color interpretation in the country. Repainted over time as the restoration of buildings was

---

Figure 1.1: An example of eighteenth-century oil paint, exposed mechanically using a scalpel, on a shutter from Stenton in Philadelphia, Pennsylvania. The small panel resting on the shutter shows the hand-ground paint made to match the shutter’s exposed finish. Photo by Catherine S. Myers.

completed, the paints would have been composed of drying oils and lead pigment and were probably mixed by the painters. Regardless, the results demonstrated the limitations of analytical techniques at the time and the highly subjective interpretation of color that dogged the understanding of the British Atlantic colonial color schemes for decades. Improvements in scientific method led to greater accuracy in at Colonial Williamsburg and elsewhere over time. Following developments in the paint industry beginning in the 1930s and the removal of lead paints from the market in the 1970s, professionals in Williamsburg and elsewhere turned to commercially available alkyd “oil” and acrylic latex paints for historic paint replication. However, capturing the nuances of color, texture, transparency lagged behind for years.

As analytical techniques improved and early efforts at paint replications with hand-ground historic paints led to fine-tuning of this challenging paint type, a new-found interest in representing architectural finishes with authentic materials emerged in the 1980s. Stewards of historic sites elected to capture the “unique warmth, vibrancy, and hand-crafted irregularity” of traditional paints by replicating them with materials as close to the originals as possible in a manner consistent with the historic period in lieu of more economical modern materials. Chris Ohrstrom was a pioneer in the U.S. of historic paints reproduction based in historic treatises. His replications of hand-ground paints at the Hart-Choate House at the National Museum of American History in Washington, DC, at

---


Kenmore in Fredericksburg, Virginia, and in the Great House at Stratford Hall, in Stratford, Virginia (Figures 1.2 and 1.3), led to founding a small company with Matthew Mosca in the 1990s to produce hand-ground paints. The Lansdowne Room at the Philadelphia Museum of Art offers another important example of early paint replication, when chemist and preservationist Morgan Phillips and Director of Conservation, Marigene Butler, employed a combination of historic and modern materials to interpret the finishes in the room.\textsuperscript{14} Matthew Mosca repainted the Dining Room at George Washington’s Mount Vernon in Virginia to represent original paints twenty years after their installation in 1799.\textsuperscript{15} Additional examples at the Cupola House in Edenton, North Carolina, Stenton in Philadelphia, Pennsylvania, and the important collaborative projects of Susan Buck and Erika Sanchez Goodwillie and Christopher Mills at Montpelier, Monticello, a new replication at Mount Vernon, period rooms at the Metropolitan, and others have offered a far more accurate understanding of the past and have demonstrated acceptance of how these materials will darken, or fade, and otherwise change over time.\textsuperscript{16}

Figure 1.2: Following the room’s 1795 paint scheme, this image shows the hand-ground verdigris paint installed in the parlor of the Great House at Stratford Hall, Stratford, Virginia. Photo by Catherine S. Myers.
Material replication of the components of hand-ground paints poses difficulty. Materials sourced and processed according to modern standards are not chemically or physically identical to historic materials. While materials varied historically, today modern pigments and binding media, such as linseed oil, are considerably more refined than their historic counterparts. Because a “series of complex chemical reactions [was required] to produce a consistent drying film,” historically, the appearance of paints varied greatly and predicting the original appearance of a finish with any precision is difficult.\textsuperscript{17} Moreover, safety regulations prevent practitioners from using toxic materials

\textsuperscript{17} Goodwillie and Mills, 88.
when replicating historic paints. Undoubtedly, these departures from historic materials effect the appearance and material properties of the replicated paint. Lead white, for example, was historically used in large quantities, along with other lead-containing and hazardous pigments. Christopher Mills and Erika Sanchez Goodwillie, who frequently replicate historic paints, address this by using titanium white and calcium carbonate as substitutes for lead white.\textsuperscript{18} In addition to excluding modern material whenever possible, to “capture the texture and aesthetic of centuries-old paint,” practitioners employ tools as similar to those available during the target period of replication, including grinding stones and mullers and round, boar’s hair house painter’s brushes (Figures 1.4 and 1.5).\textsuperscript{19}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{brushes.png}
\caption{A modern, oval, pure bristle brush comparable to the traditional round brushes used by house painters and tempered steel palette knives necessary for mixing pigments with linseed oil. Photo by Kelsey A. Britt.}
\end{figure}

\textsuperscript{18} Ibid., 86.
\textsuperscript{19} Ibid.
1.1 Previous Paint Palette Replications

While paint replication with traditional paints has grown in popularity, paint palettes replicated from historic treatises are comparatively rare.²⁰ Four projects to replicate linseed oil-based paint palettes published in English are known to the author.²¹

The first of these occurred in 1966, when Theodore Zuk Penn created a forty-piece collection as the subject of his University of Delaware master’s thesis, “Decorative and Protective Finishes, 1750-1850: Materials, Process, and Craft.”²² Using various treatises for paints and varnishes, Penn replicated pigmented finishes, resin finishes, and tinted resin finishes to present processes

---

²¹ There may be additional replicated palettes not discovered during research.
²² Penn, 3.
involved in painting wooden furniture. Penn intended to “convince the reader that there is craftsmanship in even the simplest type of paint.”

As part of a course on architectural surface finishes at Columbia University in the 1980s, Frank G. Matero and Thomas Harboe replicated the palette from Hezekiah Reynolds’s *Directions for House and Ship Painting*, published in 1812. Also carried out at Columbia University, in 1984, Caroline Alderson and Peter Wollenberg produced a palette representing thirty-nine house painting colors popular between 1850 and World War I as part of a course on American architectural finishes. Published in 1984, their research aimed to “produce a palette accurately reflecting the most popular colors in use during the period.”

Lastly, beginning in the early 1990s, paint analyst Patrick Baty attempted to replicate a palette based on John Smith’s treatise, *The Art of Painting in Oyl*, on three occasions. Though published in multiple editions with minor revisions throughout the eighteenth century, Smith’s treatise reflected a late seventeenth-century palette. First, Baty carried out the exercise while completing his dissertation at the University of East London in the early 1990s. Then, while employed by English Heritage, Baty created colors from the palette for paint manufacturer Dulux’s “Heritage” collection. On a third occasion, he revisited the same project 10 years later. The author did not locate any publications related to the first effort. However, several color names appear in both Smith’s treatise and Dulux’s “Heritage” collection. The work of Penn, Matero and Harboe, and Alderson and Wollenberg is housed at the Architectural Conservation Laboratory at the Graduate Program in Historic Preservation at the University of Pennsylvania.

---

23 Ibid.
24 Hezekiah Reynolds, *Directions for House and Ship Painting* (New Haven, CT: Printed by Eli Hudson, 1812);
Frank G. Matero, email to author, August 23, 2018.
25 Alderson, 47.
26 Baty, email to author, January 8, 2018.
In contrast to these four projects, paint analyst Frank S. Welsh took a different approach to developing a database of Colonial era architectural paint colors. Instead of working from treatises, Welsh analyzed paint samples from historic buildings in the Mid-Atlantic region and catalogued “more than one hundred hues from more than 175 colonial structures from a broad cross section of buildings dating from 1715 to 1815.”  

Welsh analyzed these samples to answer questions commonly asked by those researching Colonial era architectural paints, such as, “What are the authentic colors? What pigments were used to make them? How were the colors used?” Based on the samples, Welsh developed a palette of thirty-five paint colors. Each paint color is accompanied by the following information: the sample location, the type of paint, an assigned color name, the layer’s known or approximated age, pigments identified via microscopic analysis, and the paint’s CIE L*a*b* values. Welsh asserts that the similarities in paint colors found throughout the region provides evidence for “a routine or traditional way of communicating color in the eighteenth century from painter to painter from homeowner to homeowner.”

1.2 Pierre-François Tingry (1743-1821)

Pierre-François Tingry was born in Soissons, France, in 1743. After completing his pharmacy studies in Paris, Tingry spent his career as an inorganic chemist, mineralogist, and professor in Geneva, Switzerland, teaching chemistry, natural history, and mineralogy at the Academy of Geneva. He was apparently a man of many interests. At the academy, he instructed pharmacy, goldsmithing, and ceramics students, as well as other artists, and published on topics including

---

29 Ibid., 80.
30 Ibid., 71.
theoretical and practical chemistry, plant chemistry, chemistry for artists, and mineral waters.\textsuperscript{32}

During Tingry’s time at the academy, a society for the Encouragement of the Arts, Agriculture, and Commerce was established. This society tasked the Committee of Chemistry, which included Tingry, with “[considering] those arts of which no methodical descriptions had been given by the Academy of Sciences at Paris.”\textsuperscript{33} Varnishing was among these arts, which the committee recognized as being entirely founded on chemistry.

To write \textit{The Painter and Varnisher’s Guide} (1803), Tingry built upon the work of J.F. Watin and his 1772 treatise on varnishes entitled \textit{L’Art du peintre, doreur, vern.}\textsuperscript{34} In this first edition, Tingry approached varnishes and paints from a very technical angle, gave little attention to house painting, and updated Watin’s research so that it adhered to the “modern” system of chemical nomenclature.\textsuperscript{35} Most of his recipes were “unnecessarily elaborate” or “or based on war-time expediency.”\textsuperscript{36}

When this first edition, written in French, was published in Switzerland in 1803, when lingering tensions between England and France still existed in the years following the French Revolution (1789-99). Nonetheless, the first edition was quickly translated to English and published in London in 1804, indicating some interest in the treatise or perhaps, reflecting the lack of current treatises available in England at that time. A second, edited edition of the treatise was published in London in 1816.\textsuperscript{37} The editor “attempted to render [the treatise] more familiar to the artist without rendering it less scientific.”\textsuperscript{38}

\textsuperscript{32} Chaigneau, 17.
\textsuperscript{33} Tingry, \textit{The Painter and Varnisher’s Guide}, iv.
\textsuperscript{36} Baty, “The Methods and Materials,” 15.
\textsuperscript{37} Pierre-François Tingry, \textit{The Painter and Varnisher’s Guide; or, A Treatise, Both in Theory and Practice, on the Art of Making and Applying Varnishes, on the Different Kinds of Painting; and on the Method of Preparing Colours Both Simple and Compound} (London: Printed for Sherwood, Neely, and Jones, 1816.)
\textsuperscript{38} Ibid., iv.
CHAPTER 1

By all accounts, both the 1803 (1804) and 1816 editions derived from French source material and Tingry’s own investigations while at the academy in Switzerland. Though an Englishmen attempted to simplify the second edition, both the first and second editions lack evidence of English influences, practices, and methods. In fact, both editions shared few similarities with its predecessor, John Smith’s *The Art of Painting in Oyl*, or any of the treatises published in England following the 1804 and 1816 editions.\(^{39}\) Due to the technical, complicated nature of both editions, it seems unlikely that house painters would have found either edition useful. The treatises’ recipes also varied in specificity.

Years after Tingry’s death in 1821, a practical chemist identified as “J.J.,” presumed to be living in London, edited the treatise a second time, likely in response to a number of treatises published in the first two decades of the 1800s in England.\(^{40}\) He “improved” the treatise by simplifying recipes and adding a considerable amount of text on house painting.\(^{41}\) Attributed to Tingry and published as *The Painter’s and Colourman’s Complete Guide* in London in 1830, this third edition of the treatise was designed for use by artists, amateurs, and anyone desiring to paint their own home.\(^{42}\) In the preface, the editor asserted that the revised third edition then became “most complete Treatise on Painting and Colours ever offered to the British public.”\(^{43}\) Significantly, this third edition also included pigments introduced during the first three decades of the nineteenth century.\(^{44}\) In 1831, the third edition was published in Philadelphia and sold in major cities throughout the eastern seaboard, specifically, Philadelphia, New York, Boston, Baltimore, and Washington, DC.\(^{45}\) Unlike the other treatises available in the U.S., the third edition contains a hybrid of


\(^{40}\) Baty, “The Methods and Materials,” 16.


\(^{42}\) Ibid.

\(^{43}\) Ibid.

\(^{44}\) Bristow, “Interior House Painting,” Volume 1, 30.

information based on French, Swiss, and English practices and knowledge of finishes. Furthermore, most treatises on house painting were authored by craftsmen and colourmen. Like Tingry, both the second and third editions’ editors were chemists.

1.3 House Painting Treatises and the House Painting Trade

Historic treatises are essential reading for makers of traditional paints. During the Colonial and Early Republic eras in America, English craftsmen and colourmen typically authored treatises. The first treatise written by an American appeared in 1812 with the publication of Hezekiah Reynolds’s *Directions for House and Ship Painting*. These handbooks offer detailed instructions for preparation and formulation of paints and other finishes that cannot be gained from the scientific analysis of paint samples. However, their usefulness varies considerably. While some treatises were very specific others were vague.

In both the U.S. and England, house painting methods did not markedly evolve between the 1660s and 1850s, except for the addition of three important new pigments. They included Prussian blue, a pigment discovered in 1703-07 and first made in the 1720s; chrome yellow, which became commercially available sometime after 1818; and zinc white around 1840. Otherwise, the same oil binding media and fillers first used in fifteenth-century artist painting continued to define the possibilities for making oil paints. Painters selected both ancient and a few new pigments according to their accessibility, demonstrated appearance and utility. English craftsmen and treatises transferred technical knowledge to the U.S., influencing the field’s development during the country’s Colonial and Early Republic eras. Because of the limited evolution in house painting in this period and the

---

46 Hezekiah Reynolds, *Directions for House and Ship Painting* (New Haven, CT: Printed by Eli Hudson, 1812).
trade’s important connection to England, it is essential to understand the origins of house painting and house-painting literature in England and the evolution of house painting, particularly in this country beginning in the Colonial era.

Before the mid-1860s, when a ready-mixed paint industry first emerged in the U.S., there was not an overwhelming amount of house painting literature published in England or the United States. Treatises providing meaningful information for replication are even more rare. House painting literature in England developed as a result of shifting construction trends in seventeenth-century England. First, there was a transition from hardwood timber construction to softwood, which required oil paint for protection. While softwood became a popular exterior material, interior fashions also changed. Wood wainscoting began to replace wall tapestries. These shifts resulted in the need for skilled house painters, which brought about the professionalization of house painting, elevating it from a craft to a “mix of craft and trade.” House painting practices and traditions were rooted in the centuries-old, medieval “Painter-Stainers” craft. Painter-stainers disseminated knowledge and training through their guilds and fraternities. These tradesmen carried out decorative and common painting, while homeowners often carried out their own maintenance painting on an as-needed basis.

Beginning in the Middle Ages, artists and craftsman compiled “how to” manuals on various arts and trades, including artistic oil painting, but few publications referenced the practice of house painting before the 1670s. Well-known examples of medieval manuals addressing artistic oil painting include Theophilus’s *Schedula diversarum atrium*, compiled between 1100 and 1120, and Cennino

---

48 Moss, 55.
50 Ibid.
Cennini’s *Il libro dell’arte*, published in 1437. In his work, Cennini addressed “pigments, brushes, drawing, panel painting, the art of fresco, painting on fabrics and casting, amongst other techniques and tricks.” The pre-1670s texts that did address house painting were primarily concerned with pricing a house painter’s services, not the techniques, tools, or materials required for the trade. Coinciding with the rise of softwood construction, the Great Fire of London in 1666, ushered in a period of large-scale rebuilding in the city and prompted the publication of treatises on building construction.

The rise of treatises and manuals on house painting allowed craftsman and colourmen to disseminate information on materials and tools, paint making and color mixing, and house painting. In 1687, London craftsman and horologist John Smith published what is considered the oldest surviving, and likely the first, treatise on house painting in the English language, *The Art of Painting in Oyl*. A previous edition, *The Art of Painting*, published in 1676, primarily focused on applying oil paints to sundials. The second, and nine subsequent versions, published between 1701 and 1825, focused materials and practices of house painting.

Though house painting methods and materials did not drastically evolve between the 1660s and 1850s, the pigment Prussian blue did not appear in the five eighteenth-century editions of Smith’s treatise published following its 1704-07 development. Considering the number of editions published without updated information, there may have been little incentive for Smith, and later for

---

editors, to revise the treatise during the eighteenth century. It also seems that house-painting literature in this century remained fairly stagnant, as evidenced by the common-place practice of plagiarism, when other authors’ frequently claimed Smith’s writing to be their own work, and a lag in the publication of significant house-painting treatises until the early nineteenth century.\textsuperscript{58} For example, paint analyst Patrick Baty reviewed house-painting literature published in London for his dissertation, “The Methods and Materials of the House-Painter in England, An Analysis of House-Painting Literature: 1660-1850.”\textsuperscript{59} Baty presented twelve treatises from this nearly two-hundred-year-long period that he recognized as “considerably more informative than others.”\textsuperscript{60} Aside from John Smith’s \textit{The Art of Painting in Oyl}, all were published in the 1800s. As aforementioned, it is believed that the a “succession” of treatises published in London in the early 1800s served as the catalyst for the revised third edition of Tingry’s treatise. In fact, out of the twelve treatises Baty discussed in his dissertation, five were published between 1811 and 1829.\textsuperscript{61}

As established, the majority of treatises published in the U.S. were authored by English craftsman and colourman. Like Tingry’s treatise, Hezekiah Reynolds’s \textit{Directions for House and Ship Painting} was an outlier among them. Published in New Haven, Connecticut, in 1812, “it was the earliest known American publication on house and ship painting compiled by a practicing New England craftsman and not based upon English printed sources.”\textsuperscript{62}

1.3.1 House Painting in the U.S.: From the Colonial Era to Mid-Nineteenth Century

Evidence from documentary and physical sources indicate that the paints applied before the

\footnotesize
\textsuperscript{58} Ibid., 15.
\textsuperscript{59} Ibid.
\textsuperscript{60} Ibid., 13.
\textsuperscript{61} Ibid.
1700s in the American colonies were not oil-based finishes, but distempers, casein paints, and limewashes. It is common for surviving Colonial-era buildings to retain some evidence of the widespread application of whitewash to interior woodwork and plaster.

English craftsmen were the first painters or “painter-stainers” to work in the colonies. Archival documentation reveals that professional English painters were actively working in the colonies “long before we begin to find the physical evidence of paint used on buildings” and arriving in greater numbers by the late 1600s. Painter Thomas Child arrived in Boston in 1685, followed by John Gibbs in 1703. Both men apprenticed with the London Painter-Stainers Guild. Though the guild system did not take form in the colonies, mixing paints and performing decorative and common (house) painting still required extensive training, and English painters transferred their knowledge via apprenticeships. Though published treatises made knowledge of the painting trade available to a wider audience, the transfer of knowledge between craftsmen and apprentices was more often based on intentionally secretive “guild ‘mysteries’” designed to protect painters from competition.

In New England, the earliest physical evidence of decorative oil paints applied to architectural elements dates to the 1670s. However, the earliest mention of “colors laid in oil” to buildings occurs after 1700. Historic documents, including the records of early painters like Gibbs and Child, indicate that common (house) painting and decorative painting increased in popularity beginning in the early 1700s, especially among wealthy urbanites. These clients became particularly

---

64 Ibid.
65 Ibid.
66 Ibid., 18.
67 Ibid., 19.
68 Ibid.
69 Ibid., 13.
70 Ibid., 18.
interested in exterior finishes, while in rural areas in New England, most homes remained unpainted throughout the eighteenth century. Typically, oil paints were applied only to exterior trim.\textsuperscript{71} As a result of their specialized skills and training, painters in early America not only provided clients with common and decorative services, such as faux wood graining and marbleizing. They also performed artistic, landscape and portrait painting and painted carriages, ships, and signs.\textsuperscript{72}

### 1.3.2 Pigments, Binders, and Thinners

Before the rise of commercially produced paints in the last decades of the nineteenth century, house painters mixed their own paints by hand, by grinding pigment in a binding medium (most often linseed oil) with a stone slab and muller or a paint mill.\textsuperscript{73} Colourmen supplied dry pigments, binder, and thinner imported from England and elsewhere in Europe.

The selection of pigments available to a house painter in the colonies remained “nearly static” throughout the 1700s.\textsuperscript{74} During this century, American painters had access to just over three dozen pigments, primarily imported from Europe. As stated in Section 1.3: House Painting Treatises and the House Painting Trade, all but three pigments (Prussian blue, chrome yellow, and titanium white) had been discovered before the eighteenth century.\textsuperscript{75} Few pigments were locally sourced, except a handful of earth pigments and lampblack, manufactured in New England by the 1760s.\textsuperscript{76} In urban areas, pigments both dry and ground in oil were typically available by the early nineteenth century.

\textsuperscript{71} Ibid., 23.  
\textsuperscript{72} Ibid., 19.  
\textsuperscript{74} Cummings and Candee, 22.  
\textsuperscript{75} Ibid.  
\textsuperscript{76} Ibid.
century. These ground pigments, which came in a thick paste, could be further diluted with binder and/or thinner.

It became especially common for house painters to purchase white lead ground in oil, which they used in large quantities. In rural areas, pigments ground in oil were only available when ordered from urban merchants. Linseed oil, produced from flax seeds, was the most common paint medium used on wood substrates, such as doors and windows during the eighteenth and nineteenth centuries. During the first half of the eighteenth century, most linseed oil was imported. With the rise of flax farming along the East Coast following the American Revolution, locally-produced linseed oil became more readily available. Less common due to their expense, and typically used only in artist’s colors, house painters sometimes ground pigments in walnut and poppy seed oils, especially when mixing expensive oil varnishes. After grinding pigments in oil, house painters thinned paints to increase their workability and facilitate application. Turpentine, distilled from pine nuts, was the most common paint thinner until the last quarter of the nineteenth century.

Though ready-mixed paints were first produced after the Civil War, companies producing paints spent years refining the product. Through a process of trial and error, paint manufacturers grappled with issues such as container sizes, color consistency, and paint shelf lives. Even by 1900, only two-thirds of paints were sold in a ready-mixed form. As a result, hand-ground paints continued to be in demand well into the late nineteenth century.

---

78 Newman, 258.
79 Ibid., 257.
80 Ibid., 264.
81 Moss, 55.
82 Newman, 257.
1.3.3 The Application of Traditional Architectural Oil Paints

House painters executed most aspects of their craft, including paint fabrication, on site (Figure 1.6). This process was labor intensive and time consuming. Often, house painters dedicated an entire 14-hour workday to grinding pigments. The process began with boiling linseed oil in order to clarify the oil. Using a grindstone and muller, a house painter began by grinding dry pigments in small quantities of oil. After achieving an ideal consistency, clarified oil was added to thin the paint. Once stored in a pan or stone pot, turpentine oil was added to further thin the paint.\(^\text{83}\)

\(^{83}\) Bock, 33.
Figure 1.6: An image of house painters at work from the third edition of Tingry’s treatise. 84

When pigments ground in oil could be purchased from merchants, a house painter may make paints using lead white ground in oil or another pigment ground in oil, stored in pig bladders, as a time-saving measure. These pre-ground pigments were also mixed on site and thinned with linseed oil and turpentine.

Though oil paints rose in popularity in the early 1700s, house painters continued to commonly paint with distempers, casein, and limewashes in addition to oils. Limewashes remained especially popular in utilitarian spaces, while distempers were usually used on interior plaster. Though all three types of paints were applied to plaster substrates, wood trim always received oil paint, even before painting building exteriors in oil became commonplace. As homeowners recognized its protective nature, and the number of highly-skilled house painters continued to rise in the American colonies, common oil painting became increasingly throughout the eighteenth century.

1.3.3.1 Color Trends

As architectural oil paints became more commonplace, color trends followed. Prussian blue introduced a unique hue of blue at a reasonable price. Famously used by George Washington at Mount Vernon, it became widely popular. Thomas Jefferson transformed previous interpretation of interior color when he chose the newly developed chrome yellow for painting at Monticello. However, the introduction of new pigments was rare. Analyses performed of paint samples dating to the early 1700s through the early 1800s provides evidence for a predictable range of colors. Evidence also indicates that “no one color emerges as the most popular color in America” during this time, but that certain colors were commonly used for exterior and interior spaces. For instance, the first half of the eighteenth century saw medium and dark-toned reddish brown and grey paints on building

---

85 Welsh, 70.
86 Ibid.
exteriors, while a shift towards blues, yellowish whites, and light greys occurred after 1750.\(^{87}\)

In addition to physical evidence, archival documentation has aided in understanding which colors were commonly applied to buildings, and where. Both physical and documentary evidence reveal that approaches to the range of colors used in a domestic interior varied between homeowners. In certain homes, a different color would be applied in every single room, while in other homes, the interior color scheme was limited to one or two paint colors.

Black (derived of either lamp black or bone black ground in oil) and Spanish brown (a brownish red iron-oxide pigment), were often applied to baseboards to conceal dirt. For the same reason, browns were also used on interior features like handrails and window benches.\(^{88}\) There is also evidence that Spanish brown was used in domestic interiors as a priming paint color. In the previous century, even John Smith recommended the hue for priming in *The Art of Painting in Oyl*.\(^{89}\) In the years before the 1750s, Spanish brown, became the “most widely used color on the exterior trim of masonry buildings.”\(^{90}\)

In the early to mid-nineteenth century, evidence suggests that light grey was applied to exterior building elements, such as trim, cornices, and clapboards. Since grey was easily formed by mixing a black pigment and lead white, medium and dark greys also appeared. Dark grey used in contrast with white became a common color scheme. In addition to this contrasting color scheme, evidence also suggests that owners of fashionable homes favored bolder trim colors that contrasted with wall colors throughout the first half of the 1700s.\(^{91}\)

Unlike most eighteenth and early nineteenth-century paint colors, green was quite variable and appeared in many shades. These variations in green were achieved by mixing verdigris with

\(^{87}\) Ibid.

\(^{88}\) Ibid., 72.


\(^{90}\) Ibid., 70.

\(^{91}\) Cummings and Candee, 24.
pigments such as lead white, yellow ochre, Prussian blue, lamp black, and red iron oxides.\textsuperscript{92} Considered to be the “purist of all colonial colors,” during the first half of the eighteenth century, painters often applied verdigris ground in oil over a gray or blue-gray base in multiple coats to achieve a dark-blue green color.\textsuperscript{93} By the late 1790s, dark green made with verdigris in oil or varnish emerged as a popular color for shutters. Greens were more easily achieved by combining Prussian blue with yellow pigments.

A “moderate” orange yellow color was common, while pale yellows were often applied to interior trim or to plaster walls in distemper form.\textsuperscript{94} Between the early 1700s and early 1800s, vermilion, the precious red pigment made from ground cinnabar, and bright reddish oranges, also made with vermilion or red lead, remained the least popular paint colors. Due to their expense, they were reserved for cupboard interiors as a “show-off” color.\textsuperscript{95} Light pink colors (made from “lead white and calcium carbonate tinted with either vermilion, hematite, or red iron oxide and shaded with charcoal black, yellow ochre, and umber”) and appear on both interior and exterior trim.\textsuperscript{96} A medium blue achieved by combining lead white and Prussian blue has been found in the majority of Colonial-era homes.\textsuperscript{97} This medium blue was used on exterior on baseboards, clapboards, windows, doors and interior walls and trim.

In his 1812 treatise, Hezekiah Reynolds presented colors based on their applicability for “outside” and “inside” work. While greens, reds, and lighter paint colors in the cream and gray families are suggested for both exterior and interior applications, others appear in only one category. For example, black is included in the list of exterior paint, but not interior paint colors. This is an

\textsuperscript{92} Welsh, 75.
\textsuperscript{93} Ibid., 71.
\textsuperscript{94} Ibid., 75-76.
\textsuperscript{95} Ibid., 76.
\textsuperscript{96} Ibid., 77.
\textsuperscript{97} Moss, 55.
interesting shift from the previous century considering its popular application to interior
baseboards. Conversely, blues, purple, and browns and reddish browns intended to recall various
species of wood and likely used for faux wood graining, are reserved for interior work. During this
same period and into the following decades, an interest in the architecture of classical Rome and
Greece, inspired by the eighteenth century excavation at Herculaneum and elsewhere, generated a
preference for soft interior colors such as, “straw, gray, green, and fawn,” but also bold flat colors,
such as reds, blues, and yellows. Flatter interior paints also gained popularity during the 1820s,
though gloss paints were still used.

---

98 Reynolds and Candee, 9-12.
99 Ibid., 15-20.
100 Moss, 55.; Alexandra Alevizatos Kirtley and Peggy A. Olley, Classical Splendor: Painted Furniture for a
101 Alderson, 48.
2.0 MAKING PAINTS: METHODS AND OBSERVATIONS

Replicating Pierre-François Tingry’s house paints from the third edition of *The Painter's and Colourman's Complete Guide*, while seeking to answer questions of their accuracy, involved a combination of documentary research and hands-on paint making and application.

Selecting an influential treatise that had not been previously replicated with sufficient detail to yield meaningful results was the starting point. Initially, the author considered replicating John Smith’s *The Art of Painting in Oyl*, because it is the oldest extant document of its kind.102 This idea presented an alluring challenge. However, the lack of specific details for paint formulation combined with expert advice led the author to eliminate this treatise from consideration.103

After careful review of historic house painting treatises published between the seventeenth and nineteenth centuries and scholarship on house painting treatises and historic paint palettes, the author selected the third edition of Pierre-François Tingry’s *The Painter's and Colourman's Complete Guide*, published in London in 1830 and in Philadelphia in 1831.104 The treatise represented an unusual range of source material, including French, Swiss, and English approaches to colors and house painting; it was known to have been widely availability in the U.S. by 1831 with distribution in the major cities along the East Coast. Further, acknowledgement by scholars, and the reproducibility of its paint formulas makes it an obvious choice for replication.

---


103 Patrick Baty, email to author, January 8, 2018, January 20, 2018.

After selecting the treatise, the review of literature expanded to consider the context of the period, nineteenth-century paint technology, previous paint replications, reproduction of study palettes, and the complexities of paint analysis and replication represented in conservation literature.

2.1 Literature Review

In the first phase of the literature review, the author’s focus was narrow and centered on John Smith’s *The Art of Painting in Oyl* and scholarship specific to Smith, namely the work of scholar Patrick Baty. After eliminating this treatise from consideration, the second phase of research involved the search for a new treatise to replicated on context and precedent. Naturally, this phase involved the review of new subjects and sources. It also addressed primary source materials and literature on paint palette replication projects, historic paint analysis, the house painting craft and trade, the influence and dissemination of treatises, connections between the house painting trade in England and the U.S., and domestic paint color trends. In the third phase, the author relied on literature on the materiality, performance, and application of historic architectural paints to aid in placing the subject in context and selecting supplies. Interviews with experts allowed for dialog and also provided valuable information and influenced the direction of research.\(^{105}\) While the author identified an abundance of literature on paint analysis and color matching, literature on palette replication was limited. Though the challenges posed by replicating a treatise’s palette likely corresponds to the limited number of published replicated palette projects, this finding reinforced the author’s decision and desire to replicate a paint palette from a treatise.

During the initial research phase, the author recognized that replicating the palette from

\(^{105}\) Baty, email to author, January 8, 2018 and January 20, 2018.; Kremer Pigments, email to author, January 8, 2018 and January 11, 2018.
The Art of Painting in Oyl presented several challenges. In an effort to better understand the subject, the author contacted historian of paint and color Patrick Baty for guidance. Baty discussed his own efforts to replicate colors from Smith’s treatise on three occasions, first, while a student at the University of East London; then as an employee of English Heritage; and finally, while revisiting that same work some 10 years later. He explained the numerous factors and challenges specific to this project. He also proposed that the author consider replicating Smith’s treatise, posing the question, “Are there better sources if your ultimate aim is to help guide the restoration of historical buildings?”

Returning to the central goal of this project—to replicate a palette that will contribute to the knowledge of historic architectural paints and modern conservation practices—the author moved to select a better candidate for replication.

Using knowledge from the initial literature review, criteria was established for selecting a new treatise. Treatises published after the mid-nineteenth century, treatises lacking evidence of their availability and dissemination in the U.S., and/or treatises whose replication would overlap with or duplicate the efforts of other scholars were eliminated from consideration. The feasibility of replicating paint colors was also a factor. The new treatise would need to be as specific as possible. Moving forward with the project, the author examined primary source materials, specifically, eighteenth- and nineteenth-century treatises, and existing scholarship on paint palette replication projects, historic paint analysis, the house painting craft and trade, the influence and dissemination of treatises, and connections between the house painting trade in England and the U.S.


---

106 Ibid.
substantial amount of house painting literature and reviewed a “small number of contemporary [treatises] that were considerably more informative than others.” With the exception of Smith’s early editions, as aforementioned in Chapter 1, all the treatises dated to the nineteenth century. Pierre-François Tingry’s *The Painter’s and Colourman’s Complete Guide* was among these contemporary treatises.

With some initial interest in Tingry’s treatise, identifying literature on historic paint palette replication proved integral to changing the direction of the thesis. Tingry’s 1830-31 treatise fit nearly between the four palette replication projects and one comparable paint palette discussed in Chapter 1 (see Section 1.1: Previous Paint Palette Replications). After ensuring that Tingry’s palette had not been replicated elsewhere, the author moved forward with the decision to represent this period in time that had not be studied by others.

### 2.2 Selecting Materials, Tools, and Supplies

After selecting the third edition of Pierre-François Tingry’s *The Painter’s and Colourman’s Complete Guide*, the author began the third phase of the literature review, which focused on the material qualities of the pigments, binding medium, and driers that constitute paint as well as paint application and performance. When it came time to select materials and tools most similar to those available in 1830-31, numerous questions arose. Ultimately, the author relied heavily upon these sources, coupled with those investigated during phase two and advice from experts in the field, when selecting materials and tools.

Replication of historic paint colors requires consideration of several factors. Replication cannot rely on the information contained in a treatise alone. As previously discussed, it is difficult to know with certainty the exact original color of historic paints due to darkening and other

---

108 Ibid., 13.
alterations. Likewise, matching color to historic paint evidence that no longer appears as it did when freshly applied does not yield accurate results. Finally, modern materials available today are considerably more refined than those available to house painters during the first and second quarters of the nineteenth century and are not entirely reliable substitutes for historic paints. Most treatises, with the exception of Hezekiah Reynolds’s *Directions for House and Ship Painting*, do not provide exact formulas for paint colors, as technical knowledge was passed between craftsmen. Furthermore, certain combinations of pigments were not intended to produce a single color but a range of colors, leaving the client or house painter free to select the desired hue.\(^\text{109}\) Considering these factors and the subjectivity involved in paint replication, the author relied on preservation and conservation scholarship as a guide in the selection of materials and paint-making and application processes. Conservation scholarship, specifically focused on paint analysis and paint replication, aided the author in understanding the materiality and composition of historic oil paints and the processes and challenges associated with replicating these materials.

2.2.1 Paint Colors and Pigments

After examining the literature, especially *The Painter’s and Colourman’s Complete Guide*, the author selected eighteen paint colors to replicate. She relied on Chapters V, “On the Composition of Colours,” which provides general instructions for preparing oil, distemper, and varnish colors, and Chapter VIII, entitled “Housepainting.”\(^\text{110}\) To limit the number of colors to those most common and accessible, the author determined that only oil paints intended for wood substrates


\(^{110}\) Tingry, *The Painter’s & Colourman’s Complete Guide*, 189, 263.; Chapter V includes broader instructions for preparing oil, distemper, and varnish colors, while Chapter VIII presents advice specific to the house painting trade.
and paint colors reproducible with materials available today would be selected.

The author turned to documentary sources to ensure that the selected colors would be reproducible. First, other chapters in the Tingry treatise provided period information on materials and in some instances, where they were sourced around 1830. The methods for preparing pigments, binding mediums, driers, and other necessary materials were also discussed in the treatise.\(^{111}\)

For contemporary experience and perspectives, the author looked to case studies in the conservation literature where traditional paints had been reproduced, either as interpretations of architecture or as paint palettes.\(^{112}\) These sources aided in selecting materials and guided the

---

\(^{111}\) Ibid., 1, 36.

author in working through problems when faced with unknowns. The author also relied upon


Ultimately, after looking to the literature, several colors were omitted because Tingry did not provide enough information for their replication. Considering time and budget constraints, along with the overall goals of the project, the author also omitted colors similar to those already selected; and those less likely to yield meaningful information (See Appendix A.1 for omitted paint colors).

Two paint colors not covered by Tingry in Chapter V of the treatise were added to the palette: vermilion and Venetian red. Chapter V does not include red architectural oil paint colors. Knowing the popularity of architectural red paints in the second quarter of the nineteenth century, the author looked to Chapter VIII for guidance. This chapter includes the statement, “that reds are from vermilion, red lead, Venetian red, &c.”


114 Tingry, 275.
The following paint colors were selected for the palette:

- Black (1-A)
- White (2-A, 2-B)
- Light Grey (3-A, 3-B)
- Colour of Oak Wood (4-A)
- Colour of Walnut-Tree Wood (5-A)
- Naples or Patent Yellow (6-A, 6-B)
- Chrome Yellow (7-A, 7-B)
- Buff Colour (8-A, 8-B)
- Olive Green (9-A, 9-B)
- Blue (10-A, 10-B)
- Another Blue made with Saxon Blue (14-A, 14-B)
- Blue (11-A, 11-B)
- Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air (12-A, 12-B, 12-C)
- Compound Green (13-A, 13-B, 13-C)
- Chestnut (14-A, 14-B)
- Chocolate (15-A, 15-B)
- Pompadour (16-A, 16-B, 16-B-1)
- Vermilion (Red 1) [17-A]
- Venetian Red (Red 2) [18-A, 18-A-1]

From the project’s inception, the author understood that the materials available today differ in numerous ways from those available historically. These differences have some impact on the appearance of historic replicated paints, but they are largely unavoidable. For example, modern pigments and binding medium, i.e. linseed oil, available are considerably more refined than their historic counterparts. Today, synthetic versions of inorganic mineral pigments are sold and historically, many pigments varied in quality and color depending on the time and location of their sourcing. (Also, both historically and currently, the color, texture, and quality of a pigment depended on where it was mined and/or how it was produced.)

Having determined which paint colors to replicate, the author again relied on the treatise and the same conservation and material sources to guide the process of purchasing pigments. To further ensure the consistency and quality of the pigments, she sourced pigments from two suppliers: Kremer Pigments in New York and Natural Pigments in northern California. With

---


116 Kremer Pigments, a German-based company, is a highly-reputable supplier of “raw materials for art & conservation, historic and modern pigments, mediums, binders, dyes, vegetable color paints, oils,
the exception of lead white, every pigment was obtained in dry form. To minimize health risks and expedite preparatory work, the author selected a lead white paint ground in linseed oil, the binder recommended by Tingry (Figure 2.1). Historically, house painters used lead white in large quantities and found the pigment desirable due its opaque coverage and natural, fast-drying properties. It serves as the base for many colors in this palette. By the 1830s, purchasing lead white ground in oil was already common practice. Tingry noted that, “few persons will, we presume, be disposed to submit to the trouble of grinding it in oil, seeing that it can be so readily obtained of the colourman.”

---

117 Tingry, 274.; The product initially selected, Cremnitz White in Linseed Oil (#460007), a lead white paint, was not in stock at Kremer Pigments and would not be available in time for the project. The lead white used for the project was artist quality and likely contained a greater quantity of linseed oil than that used by a nineteenth-century house painter.

118 Tingry, 266.
Most pigments required for the palette bear the same modern and historical name. In other instances, several common or alternate names are attributed to the same pigment. For example, a brief review of the conservation literature on historic paints reveals that “lamp black” and “furnace black” are the same material. Selecting comparable, modern materials for the palette’s iron oxide pigments—red ochre, yellow ochre, ochre de rue, Spanish brown, and “purple brown” iron oxide—required additional research and consideration. Historically and currently, names such as “red ochre” apply to an infinite variety of red iron oxide colors.

119 Eastaugh, et. al, 91.
In several instances, Tingry included a generic color name such as “yellow” or “blue” in instructions for preparing a paint color in Chapter V. To determine how to proceed, the author referred to Chapter VIII, where a summary of typical house painting paint colors and the appropriate pigments used to achieve these colors are provided.\textsuperscript{120} For consistency, the author selected one pigment to use in place of each generic color name (i.e. “French ochre” in place of “yellow). It is important to note that ochres vary drastically based on their source location, ranging in color from bright yellow to dull greenish yellow to reddish yellow. Ochres also range from red, to reddish brown, to brown.

2.2.2 Binders, Solvents, and Driers

After selecting the pigments, the author followed the same methodology to choose the remaining materials necessary to make paints to Tingry’s specifications: the linseed oil binder, turpentine solvent, two forms of drier, walnut oil, and a resinous drying oil. In addition to relying on conservation literature, the author continued to refer to both Chapters V and VIII of the Tingry treatise, particularly to the directions specific to house painting in Chapter VIII.

When preparing traditional architectural oil paints, the use of an oil medium is essential for binding the pigments but also for achieving the desired consistency and ultimately, appearance. Extracted from flax seed, linseed oil was “by far the most common oil used in housepainting.”\textsuperscript{121} Referring to cold pressed linseed oil, produced without heating the flax seeds,

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{120} Tingry, 264.
\end{itemize}
\end{footnotesize}
Tingry also asserted “that common linseed oil…is the most convenient vehicle for paints.”\textsuperscript{122}

Therefore, a cold-pressed linseed oil, not boiled, was selected for the project (Figure 2.2).\textsuperscript{123}

![Figure 2.2: The Cold-Pressed Linseed Oil binder (left), purchased from Kremer Pigments, and Odorless Turpenoid (right) solvent used in place of turpentine. Photo by Kelsey A. Britt.](image)

Evident from the paint color names, Tingry formulated “green for doors, shutters, iron or wooden railing, palisades, balustrades, and for all articles exposed to the air” specifically for an architectural application. Instead of defaulting to the instructions in Chapter VIII and omitting and/or replacing any nut, poppy, or resinous oils with linseed oil due to the higher expense, the author decided to follow Tingry’s more elaborate recipe. To achieve this, a cold-pressed walnut oil and violin rosin oil medium were selected (Figure 2.3).

\textsuperscript{122} Ibid., 274.
Although lead pigment acts as a drier, Tingry specified two additional driers for house paints; sugar of lead [Lead(II) Acetate] for white and lighter, more delicate colors; and white vitriol (litharge) for dark colors.\textsuperscript{125} Both driers were acquired in dry form for the project.\textsuperscript{126}

\begin{flushright}
\footnotesize

\textsuperscript{125} Tingry, 269, 273.

\end{flushright}
2.2.3 Wood Substrate

With the main goal of replicating oil paints applied to exterior and interior architectural elements, such as cladding, paneling, windows, shutters, doors, and trim, a plaster substrate was immediately eliminated from consideration as a substrate.

Selecting a wood substrate took into consideration not only woods comparable to those in the early republic but also longevity and suitability for archival storage. Therefore, the substrate’s species, quality, density, appearance, and color were all factors to be considered, not only because they impact oil paint absorption, but also because they impact the appearance of the paint once it applied to the substrate. The author selected clear white pine (Eastern White Pine), a high-quality lumber historically and currently used in buildings construction in the U.S.\(^\text{127}\) Light in color, clear white pine possesses a fine, uniform texture and straight and even grain, making the lumber ideal for oil paint application (Figure 2.4).\(^\text{128}\)

---

\(^{127}\) The author visited Rittenhouse Lumber & Millwork in Flourtown, Pennsylvania, and selected a 1”-x-4”, 16’-long clear white pine board free of knots and imperfections. The board was cut to the required dimensions, resulting in 4” x 5-7/8” x 1” blocks. Each block provides ample area to understand the appearance of each paint, but as a reference collection, the blocks are an ideal size for handling and storage. The selected lumber was not treated with preservatives.

2.2.4 Tools and Supplies

Tingry recommended common painting brushes for first coats and ground tools, which were higher-quality “round, or oval brush(es)” for third coats. The following natural-bristle brushes were selected for the project (Figure 1.4):

- Jack Richeson Oval Bristle Fresco 2- ⅜”
- Jack Richeson Oval Bristle Fresco 1-1/2”
- Flat, ½” paint brushes, natural bristles

The most time-consuming and difficult aspect of paint making centered on grinding the pigments in oil. This labor intensive and time-consuming process required the craftsman to coat each particle of a powdered dry pigment with oil by mulling the pigment in oil on a grindstone. Though much smaller quantities of paint were made at a time, the process followed by the author

---

is the same as that followed by a nineteenth-century house painter. See Appendix A.2 for additional tools and supplies used during the project.

2.3 Replicating the Palette: Methods and Observations

Tingry’s instructions for paint colors range from vague to precise. While many formulas specify ratios and measurements, others offer little if any specific direction. For example, *Colour of Oak Wood* (4-A) is one of the more detailed recipes:

“...The basis of this colour is formed of white lead; three-fourths of this and a fourth of ochre de rue, umber earth, and yellow ochre: the last three ingredients being employed in proportions according to the required tint, give a matter equally proper for distemper, for varnish, and for oil.”

While the resulting color for *Naples or Patent Yellow* (5-A) is left to the discretion of the painter or client:

“The splendour of which depends, however, on the proportion of the white lead; and this must be varied according to the particular nature of the colouring matter employed...”

Before making the paints, it was important to reconcile how to approach Tingry’s instructions for preparing the paint colors selected for the palette. To prepare other paint colors, Tingry encourages the craftsman to vary amounts of lead white or pigments to achieve a “great variety of shades.” It is not always clear why Tingry provided, specific detailed recipes, either by weight or ratios of materials, but gave instructions for other colors. Certain paint colors, such as *Colour of Oak Wood* (4-A) or *Colour of Walnut-Tree Wood* (5-A), likely required specific instructions. These colors were intended to imitate colors in nature and it does not seem likely that Tingry intended for these colors to be highly variable or subjective. The author developed a system to address these issues, determining which paint colors required only one version and which colors would benefit from two or more versions.

130 Ibid., 195-196.
131 Ibid., 197.
132 Tingry, 192.
One version of a color was prepared for colors made with one pigment only, such as Black (1-A), and for colors well described by specific recipes, such as Colour of Oak Wood (4-A). To demonstrate that a range of colors were possible for many of the formulas, two of more versions were made for the following types of colors: colors for which a slightly different amount of pigment would achieve distinctive difference in appearance, such as Light Grey (3-A, 3-B); colors that could be achieved with different combinations of pigments, such as Olive Green (9-A, 9-B); colors for which more than one type of binder is used, such as the ratio between walnut oil and rosin oil. [ie: Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to Air (12-A, 12-B, 12-C)]; and colors that did not meet the author’s expectations, such as Compound Green (13-A, 13-B, 13-C).

To reduce errors, pertinent information needed to prepare each selected paint color, such as recipes from the treatise and supplies, was compiled into one table (See Appendix A.4). The author relied on and referred to this information throughout the paint-making process. Except for Vermilion (Red 1) [17-A] and Venetian Red (Red 2) [18-A, 18-A-1], the author uses the paint color names designated by Tingry. For clarity, each paint color was assigned an alphabetic numeric identifier (See Appendix A.4).

2.3.1 The Size and Primer

With the project underway, the author prepared the wood blocks, first by lightly sanding them with a medium-grade sanding sponge to smooth rough edges. Thereafter, she applied a size, composed of linseed oil, turpentine, and a small amount of lead white paint to all sides of the blocks. Because it is the first layer and will be absorbed into the “new wood,” the size is intentionally thinner and contains larger quantities of linseed oil and turpentine than the coats of oil paint that follow (Figure 2.5). Tingry called for a “size,” but his instructions did not adhere to the traditional meaning of the term. Understanding wood’s porosity and historic paint application
methods, the author deviated from Tingry’s instructions to apply this thin layer. A second 
application, a lead white and linseed oil primer (which Tingry refers to as a “size”) was applied 
several days later.¹³³

Based on Tingry’s instructions, the author developed the following ratio for the lead white primer:

3 parts lead white in linseed oil: 1 part cold-pressed linseed oil: 30ml of turpentine

Using a flat, ½”-wide common paint brush with natural bristles, the author applied the 
primer to the face and sides of each block (Figure 2.6). Without a dyer, the blocks required 
additional drying time before the backs could be sized. Once dry, the author used an acid-free 
marker to label the backs of blocks with an alpha numeric identifier and the associated paint color 
name.

¹³³ For this project, it is important to understand Tingry’s terminology; the size (in actuality, a primer) is 
considered the “first coat.” The “second” and “third coats” are two layers of paint applied after the 
primer. (See Tingry: 268-269).
2.3.2 Procedures for Preparing and Applying Paints

The following text summarizes the procedures followed for preparing and applying the oil paints. In actuality, the process did not follow such a linear format. A handful of paints were prepared and applied at a time, with the author learning lessons about the process along the way. For detailed information on the processes and quantities of materials used to prepare each paint refer to Appendix A.4.

All dry pigments and the two driers were ground in cold-pressed linseed oil using the following supplies: a glass grinding plate, a glass muller, and palette knives. Quantities of linseed oil varied with each pigment and dyer and were not recorded. All paints were stored in 4 oz glass jars and labeled (Figure 2.7).
2.3.2.1 Grinding Pigments and Driers: Observations

Due to varied chemical and physical properties and production methods, dry pigments may be very fine or coarse or possess an unusual morphology that complicates mixing it into a workable paint. As a result, the paint made from grinding different pigments in linseed oil ranges in texture, from smooth to slightly gritty and from rich in media to dry, even when using an equal amount of oil. During the grinding process, the author recognized similarities in texture, ease or difficulty of preparation, and difference in resulting appearance from one pigment to the next. The two driers used also required grinding in linseed oil.

Finely divided pigments, such as Prussian blue, furnace black, bone black, and Van Dyke brown displayed similar qualities during grinding. With the use of only a palette knife, each pigment mixed easily with linseed oil resulting in smooth paints and took on a thick, “mud-like” consistency similar to that of artist’s paints sold in a tube (Figures 2.8 and 2.9). Interestingly, at this thicker consistency, each mixture appeared to have iridescent visual qualities. The author
added additional linseed oil to each paint prior to mulling, which did not present any challenges. Due to the addition of linseed oil, the Prussian blue and Van Dyke brown paints appeared to be black at certain angles. The prepared paints had a high-gloss appearance.

![Figure 2.8: The author mixing Prussian blue pigment with linseed oil using a palette knife. Photo by Catherine S. Myers.](image-url)
French ochre, yellow iron oxide natural, Burgundy red ochre, and English red, all iron oxide pigments, and chrome yellow, a lead chromate and lead sulfate-based pigment, behaved similarly during mulling. After adding linseed to each pigment, the mulling process diminished each paint’s visual qualities and resulted in an inconsistent lumpy texture due to friction between the glass plate and glass muller.\textsuperscript{134}

Venetian red, vermilion, raw umber, stil de grain, and smalt did not pose a challenge.\textsuperscript{135} For all five pigments, preparation proved straightforward, but the pigments possessed other unique characteristics.

After mixing the pigment with linseed oil, the Venetian red paint became smooth, almost silky. While grinding was effortless, similar to Prussian blue, furnace black, bone black, and Van Dyke brown, the resulting texture lacked the same thickness and body of these four paints.

\textsuperscript{134} The performance of the iron oxide pigments during in mulling is likely due to the presence of clay.\textsuperscript{135} Stil de grain is derived from unripe buckthorn berries.
Preparing the raw umber paint was similar to preparing the Venetian red paint, but the resulting paint retained a slightly greater body and thickness.

In contrast to all of the easy-to-prepare pigments, vermilion and stil de grain possessed coarse, gritty textures. Surprisingly, during mulling, the vermilion paint quickly became smooth, vibrant in color, and took on a glossy sheen. In contrast, after adding linseed oil to the stil de grain and beginning to grind the paint, the pigment particles became darker and remained visible in the oil for a time. Slowly, with mulling, the paint’s color became more uniform.

In its dry form, the smalt pigment bore a smooth, powdery appearance, yet the particles were difficult to separate (Figure 2.10). Adding linseed oil to the pigment greatly diminished its vibrant color and resulted in a poor appearance (Figure 2.11). Texture improved greatly with mulling (Figure 2.12).

![Figure 2.10: A small mound of smalt pigment in dry form after adding linseed oil. Photo by Kelsey A. Britt.](image)

136 This poor appearance is likely the result of linseed oil and smalt have similar refractive indexes. Linseed oil has a refractive index of 1.47-1.49, while smalt’s refractive index ranges from 1.46 to 1.55.
Figure 2.11: Smalt pigment after being mixed with linseed oil using a palette knife, but prior to mulling. Photo by Kelsey A. Britt.

Figure 2.12: Smalt pigment in linseed oil after mulling. Note the improved consistency of the paint. Photo by Kelsey A. Britt.
Workability of verdigris and the caput mortuum violet pigments proved most difficult. Due to its particle size and gritty, coarse, sand-like texture, the verdigris pigment was ground in small quantities. Similar to vermilion and stil de grain, the pigment’s morphology and size caused it to audibly scratch against the glass grinding plate. Despite numerous mulling efforts, its texture did not improve.

The two lead-based driers, vitriol (litharge) and Lead(II) Acetate, obtained for the project exhibit different forms: ground powder versus crystalline granules, respectively.\(^{137}\) Grinding the vitriol (litharge) drier in cold-pressed linseed oil resulted in a thick, chalky paste. The author ground the Lead(II) Acetate drier on multiple occasions, but was not able to reduce the granules to a desired size.

Within the context of this project, the caput mortuum violet’s large particle size was unrivaled. Though an iron oxide pigment, caput mortuum violet did not behave like the French ochre, yellow iron oxide, natural, Burgundy red ochre, and English red pigments. The pigment was exceptionally grainy and did not improve with grinding, resulting in a thick, gritty paint.\(^{138}\) When it the time came to mix the paints, the Prussian blue and verdigris pigments had not remained suspended in the linseed oil after they were ground.

### 2.3.2.2 Paint Color Recipes and Mixing Paint Colors

After grinding the pigments in linseed oil, single-pigment paints colors were nearly finished. All other paint colors in the palette, whether comprised of lead white and pigment(s) or a combination of multiple pigments, were combined in a clean jar and mixed with a palette knife. For the paint colors requiring different proportions of the same ingredients, the author began by

\(^{137}\) The Lead(II) Acetate was sourced from a chemical supply company, Carolina Biological.\(^{138}\) Researchers (Oliveira et. al) observed a correlation between the hue of caput mortuum violet pigments, specifically, and their particle size. The darker the pigment, the larger the particle size. (See Eastlaugh et. al, *Pigment Compendium*, 87).
preparing a “base” color that was divided among to jars and then augmented with lead white or pigment(s). For specific information pertaining to each paint color, including excerpts from Tingry’s treatise regarding the formulas and supplies, the materials used, and how the author formulated the paint colors, refer to Appendix A.4.

Mixing Paint Colors: Weight vs. Volume

The process of replicating colors by following the recipes became further complicated when the author recognized that Tingry specifies quantities for certain recipes by weight and others by volume. For example, Colour of Oak Wood (4-A) is comprised of “white lead; three-fourths of this and a fourth of ochre de rue, umber earth, and yellow ochre” while Compound Green (13-A, 13-B, 13-C) necessitates “two pounds of white lead, four ounces of Dutch pink, and an ounce of Prussian blue or indigo.”

When mixing paint colors, measuring out and recording quantities of paints remained paramount to ensure replicability. However, soon the author realized that applying this approach to recipes with quantities specified by volume and also containing lead white was not accurate. Lead white weighs significantly more by volume than the other pigments required for the project. Therefore, White (2-A) and Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air (12-A, 12-B) were prepared by volume (Figure 2.13). When measuring out paints to mix colors, the author also ascertained that each paint’s pigment to linseed oil ratio had to vary, because linseed oil was added as needed during the grinding process.

\[^{139}\text{Ibid., 195-196, 205.}\]
Figure 2.13: Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air (12-A, 12-B) required a large quantity of lead white and was prepared by volume, not by weight. The lead white resulted in a surprisingly bright and turquoise color after extended periods of mulling. Despite mulling multiple times, the author was not able to achieve an ideal consistency for paint colors 12-A and 12-B. (The recipe for 12-C was modified for comparison and contains a lesser quantity of lead white than that stipulated by the treatise.) Photo by Kelsey A. Britt.

Mixing Paint Colors: Pigment Intensity

The color intensity of Prussian blue, Venetian red, and furnace black required that paints containing these pigments be added sparingly when mixing colors. On several occasions when mixing colors, the author added Prussian blue, Venetian red, or furnace black paint in quantities too great, overpowering the other paint color(s). In these instances, a portion of the paint was decanted in a new container and weighed, and the new proportions of paint colors were calculated before the author began adding in new paint(s) in to achieve the desired paint color. The author did not observe that a pigment’s origin (i.e. natural versus synthetic) had an impact on its color intensity.
Mixing Paint Colors: Adding the Driers

For both specified driers, Tingry recommend using a ratio of “about half an ounce [of drier] to a pound of the paint.”\(^{140}\) For ease, the author converted this ratio from ounces and pounds to grams.\(^ {141}\)

Mixing Paint Colors: Linseed Oil and Thinner

After adding the drier to each paint, small quantities of cold-pressed linseed oil and/or turpentine to improve their consistency before painting. These amounts were not recorded. The author did observer that, generally, the ratio of linseed oil to pigment impacted the pigment’s intensity. Due to its pale, yellow coloration, the cold-pressed linseed oil must have imparted some color to the paint. Because the oils now available are more refined than those prepared by nineteenth-century house painters, it is also assumed that the modern oil imparted more or less color to the paint than a historic oil. Modern processing techniques would also have some impact on the oil’s drying properties.

2.3.2.3 Painting Out the Palette

Though all paints were thinned with linseed oil and/or turpentine before application, the paints still retained body and would not drip off of the brush (Figure 2.14). The author tried to achieve consistent thicknesses, but inevitably, were slight variations in thickness among the paint

\(^{140}\) Ibid., 269.

\(^{141}\) Reducing the recipe from the treatise, 0.5oz = 14g and 1lb = 453g. Therefore, after making each paint, the author relied on the following formula to determine the required amount of drier: 14g/453g = \(x/y\), where \(x\) = the amount of drier in grams and \(y\) = weight of prepared paint in grams. Therefore, 30g of paint, for example, would require 0.9g of drier.
colors. The author observed that the thinner the paint, the easier it was to diminish the appearance of brush strokes.

![Image](image1.png)

Figure 2.14: The author ensuring that the paint does not drip off the brush and an ideal consistency has been before painting out *Another Blue made with Saxon Blue* (11-A). Photo by Catherine S. Myers.

The second coats were applied to the blocks with an oval brush (Figure 2.15). It often took several days before the second coat was dry enough to apply the third coat. The types of pigments, quantities of oil, and type of drier in a paint also impacted drying time.
Before applying the third coats of paint to the blocks, each paint was thinned with additional quantities of cold-pressed linseed oil and turpentine, as needed. The author took care in applying the third coats with an oval brush, painting the layer our horizontally and vertically and horizontally, to reduce the appearance of brush strokes.

Used only in darker-colored paints, the litharge (vitriol) drier did not have a noticeable visual impact on these paints, while still wet, despite its thick paste-like consistency. During the paint making and application process, the drier polymerized faster than all of the other pigments used for the project and began to discolor while stored in a jar.

On the contrary, the Lead(II) Acetate drier negatively impacted the appearance of wet paints. Used for lighter paint colors, the author first added the drier to White (2-A, 2-B), Colour of Oak Wood (4-A), Colour of Walnut-Tree Wood (5-A), and Buff Colour (8-A). Though already ground in linseed oil, the small quantity of dye in each paint left visible granules when each second coat was applied to the wood blocks (Figure 2.16). Displeased with the appearance of these paints, the
author ground these paint colors (again, the dyer was already mixed in) with the muller. As the second coats began to dry, a small, flat paint brush was used in an attempt to brush the granules from the paint. Then, before applying the third coat, the second coat was lightly sanded with a sanding sponge. The author followed the same process for *Naples or Patent Yellow* (6-A, 6-B) and *Chrome Yellow* (7-A, 7-B), lighter yellow colors that also required the Lead(II) Acetate drier.

![Figure 2.16: The freshly applied Colour of Oak Wood (4-A), Colour of Walnut-Tree Wood (5-A), and Naples of Patent Yellow (6-A, 6-B) before the blocks drier, were sanded, and these paints were reapplied without the Lead(II) Acetate drier. The granular texture imparted by the drier is visible on these samples. Photo by Kelsey A. Britt.](image)

2.4 The Completed Palette: Observations

Factors including conditions, quality and source of materials, and the practitioner’s skills and judgement contribute to the vast color possibilities that can be achieved when replicating traditional paints. Even precise execution of directions and formulas from a treatise results in color variations. (See Figure 2.17 for the completed eighteen-color palette and Appendix B.1 for individual photographs of each painted block in the palette.)
Figure 2.17: The Completed Eighteen-Color Palette

<table>
<thead>
<tr>
<th>TOP ROW:</th>
<th>BOTTOM ROW:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1-A - BLACK</td>
<td>12-A - GREEN FOR DOORS, SHUTTERS, IRON OR WOODEN RAILING, PALISADES, BALUSTRADES, AND FOR ALL ARTICLES EXPOSED TO THE AIR</td>
</tr>
<tr>
<td>2-A - WHITE</td>
<td>12-B - GREEN FOR DOORS, SHUTTERS, IRON OR WOODEN RAILING, PALISADES, BALUSTRADES, AND FOR ALL ARTICLES EXPOSED TO THE AIR</td>
</tr>
<tr>
<td>2-B - WHITE</td>
<td>12-C - GREEN FOR DOORS, SHUTTERS, IRON OR WOODEN RAILING, PALISADES, BALUSTRADES, AND FOR ALL ARTICLES EXPOSED TO THE AIR</td>
</tr>
<tr>
<td>3-A - LIGHT GREY</td>
<td>13-A - COMPOUND GREEN</td>
</tr>
<tr>
<td>3-B - LIGHT GREY</td>
<td>13-B - COMPOUND GREEN</td>
</tr>
<tr>
<td>4-A - COLOUR OF OAK WOOD</td>
<td>13-C - COMPOUND GREEN</td>
</tr>
<tr>
<td>5-A - COLOUR OF WALNUT WOOD</td>
<td>14-A - CHESTNUT</td>
</tr>
<tr>
<td>6-A - NAPLES OR PATENT YELLOW</td>
<td>14-B - CHESTNUT</td>
</tr>
<tr>
<td>6-B - NAPLES OR PATENT YELLOW</td>
<td>15-A - CHOCOLATE</td>
</tr>
<tr>
<td>7-A - CHROME YELLOW</td>
<td>15-B - CHOCOLATE</td>
</tr>
<tr>
<td>7-B - CHROME YELLOW</td>
<td>16-A - POMPADOUR</td>
</tr>
<tr>
<td>8-A - BUFF COLOUR</td>
<td>16-B - POMPADOUR (VERSION 2)</td>
</tr>
<tr>
<td>8-B - BUFF COLOUR</td>
<td>17-A - VERMILION (RED 1)</td>
</tr>
<tr>
<td>9-A - OLIVE GREEN</td>
<td>18-A - VENETIAN RED (RED 2)</td>
</tr>
<tr>
<td>9-B - OLIVE GREEN</td>
<td>18-B - VENETIAN RED (RED 2) [VERSION 2]</td>
</tr>
<tr>
<td>10-A - BLUE</td>
<td></td>
</tr>
<tr>
<td>10-B - BLUE</td>
<td></td>
</tr>
<tr>
<td>11-A - ANOTHER BLUE MADE WITH Saxon BLUE</td>
<td></td>
</tr>
<tr>
<td>11-B - ANOTHER BLUE MADE WITH Saxon BLUE</td>
<td></td>
</tr>
</tbody>
</table>
2.4.1 Color Impressions

The color range and intensity of the Tingry palette were at opposite ends of the spectrum: either bold and intense, lacking or containing only small quantities of lead white, or much lighter, softer in tone with small amounts of colored pigment(s) and a large quantity of lead white. Overall, the palette included mostly yellows and browns, many of which reference woods.

The author’s expectations for the colors based on the descriptions provided by Tingry and some knowledge of historic paint colors were not always met. Both *Buff Colour* (8-A, 8-B) and *Colour of Walnut-Tree Wood* (5-A) were considerably more yellow than anticipated. *Buff*, a common historical paint color, is included in other palettes and is typically a paler yellow-brown color, while *Colour of Walnut-Tree Wood* (5-A) did not resemble the color of walnut wood. *Chocolate* (15-A) is achieved with “Spanish brown and lamp black,” but the resulting color was black.¹⁴²

Though the author followed Tingry’s instructions for the second version of *Compound Green* (13-B), the additional Prussian blue paint yielded a blue color, not green. Displeased, the author prepared a third version of the paint color (13-C) using Tingry’s quantities of lead white, stile de grain, and Prussian blue, omitting the additional quantity of Prussian blue paint.¹⁴³ Still, this combination resulted in a blue paint, possibly as a result of the strong tinting power of Prussian blue and the weakened tinting power of organic stil de grain.

In addition to the difficulty of working with verdigris, both versions of *Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air* (12-A, 12-B) yielded an unexpected, light turquoise color. Because the color was intended for widespread exterior application, the color achieved seemed unusual. Additionally, the author ground both versions of the color with a muller before applying all second and third coats, but the verdigris pigment did not remain evenly dispersed in oil once applied to the blocks. Despite following the

¹⁴² Ibid., 208.
¹⁴³ Ibid., 205.
recommended ratio, the light color achieved seemed inaccurate and the author prepared a third version of the color (12-C), reducing the amount of lead white.

According to the treatise, there are two ways to achieve the color pompadour: with a purple brown iron oxide or by combining any red and blue pigments. The combination of Venetian red and Prussian blue yielded a color similar to the purple brown iron oxide-based paint (15-A). Because the combination of red and blue pigments will yield “an infinite variety of purples,” the author determined that it would be best to alter the paint made for Pompadour (16-B) with additional Venetian red, resulting in 16-B-1, to achieve a color less similar to the first version (16-A).\textsuperscript{144}

\textsuperscript{144} Ibid., 208-209.
2.4.2 Texture

Though all paints were thinned with linseed oil and/or turpentine before application, there were slight variations in thickness among the paints. These variations in thickness impacted brushstroke visibility. Brush strokes are most visible in the sample for *Black* (1-A).

The author waited for the third coat to dry and found that she was still displeased with the grainy appearance of all paints containing the Lead(II) Acetate drier. Following the proportions recorded in Appendix A.4, all of these paints were remade without the drier and reapplied to the wood blocks, after lightly sanding down the first two coats 100-grit sandpaper to eliminate the graininess.

Some texture, attributed to the drier, was also observed in *Vermilion (Red 1)* [17-A] (Figure 2.19). Vermilion pigment was ground in oil without the litharge (vitriol) drier and applied over the sanded first and second coats.

![Figure 2.19: The freshly applied second coat of Vermilion (Red 1) [17-A]. Initially, the vitriol (litharge) drier did not appear to impact the paint’s texture. Photo by Kelsey A. Britt.](image)
In addition to the driers, certain pigments proved to be grainy despite extensive grinding. The paints made with caput mortuum violet and verdigris were most negatively impacted. The large particles in *Pompadour* (15-A) congealed as the paint dried and resulted in a raised texture. Due to the verdigris, samples with *Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air* (12-A, 12-B, 12-C) and *Olive Green* (9-A) also exhibit a gritty, raised texture.

2.4.3 Gloss

After the prepared samples dried to the touch, the author observed that each sample adhered to one of the following finishes: flat, uneven gloss, semigloss, gloss, and high-gloss. The varying quantities of turpentine used when preparing the paints appeared to have a greater impact on the final appearance of the paints than anticipated.

Once dry, the paints prepared for *Naples or Patent Yellow* (6-B), *Compound Green* (13-A, 13-B, 13-C), *Another Blue made with Saxon Blue* (11-A, 11-B), and *Buff Colour* (8-A, 8-B) lost their gloss, resulting in a dull, flat finish. The samples painted with *White* (2-B), *Light Grey* (3-A, 3-B), *Chrome Yellow* (7-B), and *Olive Green* (9-B) have uneven finishes, comprised of both flat and glossy areas. The *Black* (1-A), *Blue* (10-A, 10-B), and *Olive Green* (9-A) paints retained some sheen after drying and the samples have a semigloss finish. The majority of the paints did retain their sheen after drying and the following samples have a gloss finish: *White* (2-A), *Colour of Oak Wood* (4-A), *Colour of Walnut-Tree Wood* (5-A), *Naples or Patent Yellow* (6-A), *Chestnut* (14-A, 14-B), *Chocolate* (15-A, 15-B), *Pompadour* (16-B, 16-B-1), *Vermilion (Red 1)* [17-A], and *Venetian Red (Red 2)* [18-A and 18-A-1]. Lastly, several colors displayed a more intense gloss finish, standing out among the other samples. Therefore, the author categorized *Chrome Yellow* (7-A) and *Green for Doors, Shutters, Iron or

---

145 The resulting dull, flat finish likely resulted from insufficient linseed oil and excessive turpentine use.
Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air (12-A, 12-B, 12-C) as having a high-gloss finish.

2.5 Color Measurements

Once paints dried to the touch, the author measured the color of each sample with a portable Konica Minolta CM-2600d spectrophotometer.\textsuperscript{146} The averaged CIE L*\textsuperscript{a*b*} (CIELAB) color notations were recorded and are presented here in Appendix C.1. As a comparison, color measurements were also taken from the second coat of several paint colors in the alternate sample group (See Appendix C.2).

Color space is a “geometrical representation defined by means of three components in a space.”\textsuperscript{147} Color space models, of which there are many, organize colors in specific ways and represent each color perception as a point with an assigned numerical value.\textsuperscript{148} Among these models, CIE XYZ (CIE L a b), was established in 1913 when the Commission Internationale de l'Eclairage (CIE) formed to “evaluate and set standards for the scientific community involved with color research and application.”\textsuperscript{149} In 1976, CIE defined the CIE L*\textsuperscript{a*b*} color space (distinguished with asterisks from the 1931 L a b model).\textsuperscript{150} CIE L*\textsuperscript{a*b*} color measurements are performed using a spectrophotometer, which measures three aspects of a color: lightness or

\begin{itemize}
  \item Sabu M. Thampi et. al, ed., \textit{Recent Advances in Intelligent Informatics} (Cham, Switzerland: Springer, 2017), 76.
  \item Rolf G. Kuehni, \textit{Color Space and Its Divisions: Color Order from Antiquity to the Present} (Hoboken, NJ: John Wiley & Sons, Inc., 2003), 336.; The following are different color spaces: YCbCr, YUV, Y\textsuperscript{PbPb}, Y\textsuperscript{CbcCr}, Y\textsuperscript{DbDr}, Y\textsuperscript{UV}, Y\textsuperscript{IQ}, HIS, XYZ, CIE XYZ [CIE L a b], CIE L*\textsuperscript{a*b*}, L*\textsuperscript{u*v*}. (See Thampi et. al, ed., 336.)
  \item Welsh, 80.
\end{itemize}
whiteness-blackness (L*), green-red components (a*), and blue-yellow components (b*).\textsuperscript{151}

Both the Specular Component Included (SCI), which measures reflectance, and Specular Component Excluded (SCE), which excludes reflectance, measurements were recorded.\textsuperscript{152} Once placed flat against a sample, the instrument averages the three automatic SCI/SCE measurements, taken one second apart, providing the numerical L* a* b* values for each mode. To achieve an accurate color measurement, the author took three such color measurements in different locations on each painted block. These non-averaged color measurements are provided in Appendix C.3 and Appendix C.4.

\textsuperscript{151} These measurements are expressed numerically on a 0-100 scale. L* values are always positive, while a* and b* are expressed in positive and negative numbers.

CHAPTER 3

3.0 CONCLUSIONS

Replicating Tingry’s oil paints from the third edition of *The Painter’s and Colourman’s Complete Guide* demonstrated the craft and difficulty of making oil-based house paints by hand. Almost every aspect of the process, from grinding pigments to achieving the proper gloss, underlined the experience needed for properly making and applying these paints. The following analysis of the replication Tingry’s paint palette addresses each of the component parts of the paint, namely the pigments, binding medium, solvent, and driers, before addressing the subject of reproducibility.

3.1 The Impact of Pigments on the Resulting Paint Colors

Historic hand-made oil paints display a unique warmth, vibrancy, and irregularity.153 Often, the inconsistencies in the appearance at the time of their application could not be avoided. The process of hand-grinding pigments resulted in non-uniform and inconsistently dispersed pigment particles, which ranged in size from small to large and in texture from coarse to angular.154

The crude nature of hand-ground pigments significantly impacted paint color and appearance. Pigments did not remain suspended in the linseed oil, sometimes causing streaking, and paint colors were never uniform.155 The varying particle sizes and resulting “unevenness” of paint colors also reflected light in way that made the painted surface look “lively.”156 Due to the fugitive nature of hand-ground pigments, their material properties, and environmental exposures and conditions some paint colors would change after only a few years.

Pigments today differ from those in the nineteenth century; the quality and sources have

---

155 Bock, 35.
changed. In most cases, the dry pigments available on the market today are considerably more finely ground than the pigments available during the second quarter of the nineteenth century. Due to their uniformity, modern pigments typically distribute more evenly through a vehicle, such as linseed oil. Despite the advances in pigment processing, the author observed instances in which the modern pigments selected for the project negatively impacted the appearance of the paints.

The considerable departure in appearance from the color name demonstrated the possibilities for pigments from different sources to effect color. Without knowledge of the exact source and color of the pigments Tingry specified required a process of trial and error and subjective judgement. For example, the iron oxide (earth) pigments available to Tingry in early nineteenth-century Switzerland or those available to the American house painter in the same period differ from those available to the author. Furthermore, a term such as “yellow ochre,” can be generically applied to range of yellow-hued iron oxide pigments. All of these factors have some legible impact on the paint colors in the palette containing earth pigments. The author selected two yellow ochre pigments available to her in the university laboratory’s pigment collection. Though yellow, both ochres displayed a noticeably red undertone, as opposed to green or brown tones of other yellow ochres.

The surprising non-green color of Compound Green (13-B, 13-C) led the author to surmise that modern and historic pigments may vary in intensity. Both version of the paint color required a small quantity of Prussian blue that immediately overpowered the de grain pigment for this recipe and resulted in blue paint colors, not green. In fact, Prussian blue consistently proved to be the most powerful of the pigments, but is it possible that the stil de grain yellow available during the early nineteenth century possessed greater coloring power and intensity? Research reveals that stil de grain, also referred to as “Dutch Pink,” is sourced from various buckthorn berries and is characterized by its pale color and poor lightfastness. Historically, stil de grain was extracted as a dye, but advances

---

allowed the dye to be converted to an inorganic pigment. This however, did not improve the pigment’s coloring power or ability to withstand fading. It is unclear why Tingry specified such a large quantity of Prussian blue be used in combination with this pale pigment.

The coarse verdigris and caput mortuum violet pigments used for the new palette would certainly have been a finer grade or manipulated differently by skilled painters in 1830. As discussed in Chapter 2, verdigris, used in making *Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air* (12-A, 12-B, 12-C) and *Olive Green* (9-A), also challenged eighteenth- and nineteenth-century house painters. The synthetic, copper acetate-based pigment has needle-shaped particles that are very hard and do not remain evenly dispersed in oil.158 Historically, house painters found that substituting varnish for linseed oil improved the appearance of verdigris-based paints, which were applied in multiple coats. Colors 12-A, 12-B, and 12-C required violin rosin medium and walnut oil. The author found that the thickness of the varnish slightly improved the appearance of the verdigris pigment’s large, coarse particles for 12-A and 12-B, but the varnish had less of an effect on the appearance of 12-C, which contained a smaller quantity of lead white. The quality of *Olive Green* (9-A) was the worst among all of the paints containing verdigris and displayed a raised, granular texture. On the other hand, it was the only verdigris-containing paint to demonstrate an even color. Seemingly, the modern verdigris pigment available today has not markedly improved over the historic product.

Though the challenges of working with verdigris are well recognized, as noted in the previous paragraph, and the author concludes that either a lack of technical expertise or the quality of the product from the supplier resulted in the appearance *Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air* (12-A, 12-B, 12-C) and *Olive Green* (9-A). Historically, these colors would not have met the standards of a house painter or a client.

---

158 Goodwillie and Mills, 90.
In the case of the caput mortuum violet pigment, used to make Pompadour (16-A), it is believed that the pigment’s poor quality and texture lies with the supplier and the fact that there is a connection between the pigment’s darker hue and its particle size. (See footnote 135 in Chapter 2). The pigment particles were substantially larger than those of all other pigments used in the project. It also did not respond to mulling and was unlike any of the other iron oxide pigments in terms of quality. Documentary sources describing pigments were consulted, but no discussions of caput mortuum violet’s poor quality as a pigment or difficult workability were found.

3.2 The Impact of Linseed Oil and Turpentine Paint Colors

Hand-ground pigments are not the only component impacting the appearance of historic paints. Varying quantities of linseed oil and turpentine effect a paint’s gloss. A high ratio of linseed oil to pigment imparts a “characteristic sheen.”¹⁵⁹ Though, when oil paints were applied to building exteriors, their glossy finish typically faded to a dull, matted finish after two-to-three seasons of exposure to the elements. To apply the linseed oil paints, house painters used coarse round brushes, which caused oil paints to have visible “dull streaks” or a characteristically “ropey” finish.¹⁶⁰ Linseed oil’s slow drying time may also result in an uneven finish and varying gloss intensity. When applied to a porous wood surface, linseed oil sometimes migrates to the substrate, creating areas dull areas on the painted surface and areas that retain the “higher pigment-to-binder” ratio, an effect is referred to as flashing.¹⁶¹

While linseed oil today is more refined than the boiled and clarified linseed oils of the nineteenth century, all of the paint colors in the replicated palette (aside from Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air [12-A, 12-B, 12-C],

---

¹⁵⁹ Bock, 34.
¹⁶⁰ Ibid.
¹⁶¹ Goodwillie and Mills, 88.
which contain a large quantity of rosin oil) display one or more of these qualities. Some have ropey textures, some present matte finish, while others resulted in uneven finishes.\footnote{Even in spite of retaining lead white in the paint formulas, the media-rich artist grade lead white paint, which was chosen to replicate the palette because of its easy availability, may have produced quite different results than the lead white paint used in the nineteenth century.}

Most concerning, despite applying a size and a primer, several paint colors lost their sheen (\textit{Naples or Patent Yellow [6-B], Another Blue made with Saxon Blue [11-A, 11-B], and Buff Colour [8-A, 8-B]}), while two additional paint colors display flashing (\textit{Chrome Yellow [7-B] and Olive Green [9-B]}). Because the same size and primer were applied to each palette block, the author ascertains that varying quantities of turpentine used had some effect on those paint colors lacking sheen.\footnote{Disappointed with the appearance of these flattened paints, as a result of excessive turpentine, the author added a layer of linseed oil to these paint colors while they were still drying to increase their gloss.}

\section*{3.3 The Impact of Driers}

Though imperfections in appearance are expected with hand-ground paints, both driers negatively impacted the texture of the paints. The Lead(II) Acetate drier, the most detrimental to the appearance of the paints, must not be comparable in composition to the chemical recommended by Tingry or used historically by house painters. Though initially it did not appear to be problematic, the litharge (vitriol) also imparted some texture to the darker-color paints.

\section*{3.4 The Impact of Recipes on Reproducibility}

Despite best efforts to remain objective and follow Tingry’s formulas as carefully as possible, it became clear that the appearance of the paint colors largely depends on the materials used and the person(s) replicating the formulas of the treatise. Diligent attempts to avoid subjectivity by looking to preservation and conservation literature and period literature and basing decisions on specific
direction and careful material choice, as opposed to personal preferences, still required subjective interpretation of the treatise.

Regardless of individual interpretation, the treatise represented eighteenth- and early nineteenth-century color trends well. Colors such as grey and blue—made either with lamp black and lead white or Prussian blue and lead white, respectively—were popular and also varied in tint from building to building. For the majority of the paint colors, there is no one exact color. Any house painter following the treatise would have achieved results that slightly varied from Tingry’s and from his fellow craftsmen.

Given the variables and multiple sources of information, replicating a historic paint palette is an inexact science. Paint formulas from historic sources vary widely and are sometimes unspecific. Modern refinement of historic materials changes paint appearance. Contemporary reports on making traditional paints are not always in agreement. The small number of palette replication projects in existence attests to these challenges and likely, to the fact that there is not an abundance of treatises that can be reliably replicated with certainty. Furthermore, geographic differences may have resulted in difference in paints. Materials sourced by a painter in London would probably have differed from those sourced by a house painter working in New England. The choice of red ochre is a case in point. The red ochre recommended by Tingry, sourced from Auvergne, France, the mines sourcing this pigment closed decades prior to this project. A comparable red ochre dating from the 1970s and mined 100 miles northwest of Auvergne was selected, but undoubtedly, this ochre differs in color from the pigment recommended by Tingry.

---

165 Research on suppliers, their sources and specific supplies for individual projects would shed additional light on the range of raw materials to which painters had access in different cities.
Additionally, historically, the color of a paint varied between batches and between house painters and projects. The considerable variation in color from relatively specific formulas suggests that painters used their own judgment in achieving color rather than strictly following formulas. Subjective judgment, trial and error and material sources all played a role in mixing a paint. When considering that “climate, pigment source and manufacture, quality of raw materials, and substrate composition” all impacted a paint’s color and appearance, house painters themselves did not always achieve consistent results. Success at making paints clearly required a great deal of trial and error over the source of a painter’s career.

When also considering environmental conditions and materials sourcing, there would not have been one “true” hue for the majority of the paint colors in the treatise. For these reasons, exact replication of the paint palette from Tingry’s treatise is clearly not possible. Instead, one can replicate a version of what such a palette might have been, knowing that different attempts, with pigments sourced from different places and provided by different vendors would produce different colors.

At a time when house painting more closely resembled an art than a science, house painters relied on experience to produce the necessary consistency, color, and gloss. By trial and error, they knew how different pigment would respond to grinding, how to gauge drying time, how paints films would form as they dried, and the numerous other aspects of successfully making and applying paints.

How painters in nineteenth-century America would have used Tingry’s treatise, given their expertise, the availability of materials, and the client and builder’s wishes is also not well understood. Adoption of the paint formulas and practice would have certainly been influenced from experience using it elsewhere, hearsay, and availability of the text. Likely, the handbook served a guide for a suitable color palette of the time. It would have certainly been an important primer for less

167 Goodwillie and Christopher Mills, 88.
experienced painters. However, it is likely that most knowledge lay in the hands of the practitioner more than in the pages of the handbook.

Nonetheless, handbooks, such as Tingry’s offered valuable information and must have been especially sought after by less experienced painters. The sale of the treatise in American cities suggests that demand for that information was great, possibly due to the newness of the country and development of the building trades.

The current surge of handmade paint replications in historic buildings and museum exhibitions demonstrate growing recognition of their importance in achieving nuance in the interpretation of the past. By augmenting conventional methods of microscopic analysis and color matching, production of paint palettes from historic treatises, such as Tingry’s treatise, add support to those replicating historic paints.

When viewing replicated paints and comparing them to interpretations with modern paints, there is little doubt that these traditional paints more closely approximate the historic paint’s original appearance.\(^{168}\) These luminous and beautiful finishes, which allow for longed-for evidence of the human hand, aid conservation professionals and stewards of historic properties in efforts to more accurately understand and represent the past. Visitors to historic properties may even find the resulting aesthetic experiences yields an “unsettling familiarity.”\(^{169}\)

### 3.5 Reference Collection and Color Measurements

Due to the traditional materials used during replication, the paint colors will discolor and

\(^{168}\) Refer to efforts by Erika Sanchez Goodwillie and Christopher Mills to replicate and install verdigris paint in “From Pigment Particles to Parlor Walls: Contemporary Practice in the Reproduction of Historic Paints” and Catherine S. Myers to determine and replicate the yellow paint used in Stenton’s Lodging Room in “Finding the Right Yellow: Fine Tuning a Color in Stenton’s Yellow Lodging Room.” (See *Macro to Micro: Examining Architectural Finishes*, 2018.)

\(^{169}\) Goodwillie and Mills, 98.
alter in appearance over time. Approximating the dark conditions in which historic paints often exist, due to layers of paint applied over them, the paint palette will be stored in the dark with minimal exposure to ultraviolet light. Considering what is known about the aging properties of traditional oil paints, over time, the hue and tone of paints will alter as the linseed oil yellows and certain pigments deteriorate. As the paints continue to dry, certain paint colors will likely lose their sheen and glossy finish. The paints will also become brittle as they age.

Monitoring the color of the samples over time will provide quantitative data about color change of the paints. Measurements of the ΔE, or color difference, in the future will offer quantitative data on the amount of color change at various intervals. By continuing to take color measurements, alterations to the paint colors in the palette can be determined over time.

3.6 Recommendations for Future Research

The palette also provides opportunities for future research. In addition to monitoring how the paints age through color measurements, the collection offers the opportunity for the preparation and study of paint cross sections to determine how freshly applied traditional materials appear microscopically. For comparison, an alternate sample collection was also prepared. For this collection, the paint colors were painted out on a balsa wood substrate.

Because the Architectural Conservation Laboratory maintains three replicated palette collections and Frank S. Welsh’s colonial palette is published, comparing the resulting colors, paint color names, and paint color formulas from this replicated palette to other replicated palettes may reveal additional color trends or similarities between the colors developed by Tingry in Switzerland and those recommended by English and American craftsmen.

To fully understand the influence of Tingry’s work, tracing the dissemination of the treatise is also recommended. Exploring estate documents, the records of early painters, including their specifications and contracts, and measurer’s accounts may lead to physical evidence of sites where a
house painter followed Tingry’s treatise and techniques.
BIBLIOGRAPHY


Appendix A.1: Eliminated Paint Colors

A) The following paint colors were eliminated from the replicated from the palette because they were not intended for house painting and/or wood surface application:

- Green Colour for Articles Exposed to Friction and Percussion, such as the Wheels of Carriages, &c.
- Reds for the Bodies of Carriages, Coach Wheels, &c.
- Red for Buffets
- Bright Red
- Crimson—Rose Colour

B) The following paint colors were eliminated from the replicated palette because they were color not intended for oil painting:

- Jonquil
- A Beautiful Lemon Yellow
- Sea Green for Distemper
- Sea Green for Varnish
- Violet

C) The following paint color was eliminated from the replicated palette because it was intended for wood graining:

- Colour of Mahogany

D) The following paint colors were eliminated from the replicated palette because the formula contained nondescript or contradictory information:

- Yellow
- Sea Green

E) The following paint colors were eliminated from the replicated palette to minimize repetition of similar paint colors in the palette:

- Pearl Grey
- Flaxen Grey
- Sea Green
Appendix A.2: Tools and Supplies

The following tools and supplies were required for the project:

- Honeywell North Half Mask Respirator (Item # 4T870)<sup>170</sup>
- Honeywell Filter, P100, Threaded, PK4 (Item # 6T451)
- glass grinding plates
- glass muller
- Ball 4-Ounce Quilted Crystal Jelly Jars with Lids and Bands for paint storage
- Richeson Flat, Tempered Steel Palette Knife (3-7/8" x 1-1/2")
- Richeson Flat, Tempered Steel Palette Knife (4-5/8" x 5/8")
- 3M Full Size Sanding Sponge, Medium Grade
- metal stirring sticks
- wood tongue depressors
- plastic pipettes
- nitrile gloves
- plastic measuring cups
- plastic containers for mixing paints
- protective smock
- tape for labels
- Acid-free fine-point Sharpies

<sup>170</sup> Whenever working with toxic pigments, the author wore a respirator.
## Appendix A.3: Pigments Selected for Replicating Tingry’s Palette

<table>
<thead>
<tr>
<th>Pigment Specified in Treatise</th>
<th>Pigment Selected (Contemporary Name or Comparable Substitute)</th>
<th>Supplier</th>
<th>Product #</th>
</tr>
</thead>
<tbody>
<tr>
<td>White Lead</td>
<td>Lead White in Linseed Oil</td>
<td>Natural Pigments</td>
<td>N/A</td>
</tr>
<tr>
<td>“Black”</td>
<td>Furnace Black</td>
<td>Kremer Pigments</td>
<td>47250</td>
</tr>
<tr>
<td>Ivory Black</td>
<td>Bone Black</td>
<td>Kremer Pigments</td>
<td>47100</td>
</tr>
<tr>
<td>Lamp Black</td>
<td>Furnace Black</td>
<td>Kremer Pigments</td>
<td>47250</td>
</tr>
<tr>
<td>“Brighter Reds”</td>
<td>Vermilion</td>
<td>Kremer Pigments</td>
<td>42000</td>
</tr>
<tr>
<td>“Red”</td>
<td>Venetian Red</td>
<td>Kremer Pigments</td>
<td>40510</td>
</tr>
<tr>
<td>English Red</td>
<td>English Red</td>
<td>Kremer Pigments</td>
<td>40542</td>
</tr>
<tr>
<td>Red Ochre</td>
<td>Burgundy Red Ochre</td>
<td>Kremer Pigments</td>
<td>11575</td>
</tr>
<tr>
<td>Venetian Red</td>
<td>Venetian Red</td>
<td>Kremer Pigments</td>
<td>40542</td>
</tr>
<tr>
<td>Vermilion</td>
<td>Vermilion</td>
<td>Kremer Pigments</td>
<td>42000</td>
</tr>
<tr>
<td>“Yellow”</td>
<td>French Ochre</td>
<td>Kremer Pigments</td>
<td>40010</td>
</tr>
<tr>
<td>Chrome Yellow</td>
<td>Chrome Yellow Hell</td>
<td>Kremer Pigments</td>
<td>10100</td>
</tr>
<tr>
<td>Dutch Pink</td>
<td>Stil de Grain</td>
<td>Natural Pigments</td>
<td>417-14</td>
</tr>
<tr>
<td>Ochre de Rue</td>
<td>Yellow Iron Oxide Natural</td>
<td>Kremer Pigments</td>
<td>40301</td>
</tr>
<tr>
<td>Yellow Ochre</td>
<td>French Ochre</td>
<td>Kremer Pigments</td>
<td>40010</td>
</tr>
<tr>
<td>“Blue”</td>
<td>Prussian Blue</td>
<td>Kremer Pigments</td>
<td>45200</td>
</tr>
<tr>
<td>Saxon Blue</td>
<td>Smalt</td>
<td>Natural Pigments</td>
<td>417-14</td>
</tr>
<tr>
<td>Prussian Blue</td>
<td>Prussian Blue</td>
<td>Kremer Pigments</td>
<td>45200</td>
</tr>
<tr>
<td>Verdigris</td>
<td>Verdigris</td>
<td>Kremer Pigments</td>
<td>44450</td>
</tr>
<tr>
<td>Spanish Brown</td>
<td>Vandyke Brown</td>
<td>Kremer Pigments</td>
<td>41000</td>
</tr>
<tr>
<td>Umber Earth</td>
<td>Raw Umber</td>
<td>Kremer Pigments</td>
<td>40610</td>
</tr>
<tr>
<td>“Purple Brown” Iron Oxide</td>
<td>Caput Mortuum Violet</td>
<td>Kremer Pigments</td>
<td>48750</td>
</tr>
</tbody>
</table>
## Appendix A.4: Preparation Instructions, Supplies, and Recipes for Replicating Paint Colors

The following table contains the relevant information from the treatise, including recipes, instructions, and supplies, necessary to replicate the paint colors, the materials used by the author to replicate each color, the formula developed, with quantities, for each paint color.

<table>
<thead>
<tr>
<th>ID #</th>
<th>Color Name</th>
<th>Recipe and/or Preparation Instructions</th>
<th>Pigment(s) [Contemporary Name/Selected Pigment]</th>
<th>Supplies</th>
<th>Recipe Prepared and Used</th>
</tr>
</thead>
</table>
| 1-A  | Black      | "...considerable discrimination is necessary for the carbonaceous parts of peach stones, of beech wood, of ivory, of vine twigs, of bones, of lamp black, &c. produce black of various shades and qualities." [171]  
"Painters usually prefer blacks made from burnt vine twigs or peach stones, to black of Cassel or Cologne, and even to that of asplialtum." [172]  
"For a permanent, although a very inferior black in out-door oil painting, the black oxide of manganese is now employed." [173]  
"The consumption of lamp-black is greatest in common painting." [174] | Lamp Black [Furnace Black] | Cold-Pressed Linseed Oil Turpentine | -Furnace Black pigment ground in Cold-Pressed Linseed Oil  
-Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities  
-Omitted drier to observe/compare drying time to the paints mixed with driers (either Vitriol [Litharge] or Lead(II) Acetate) |
| 2-A  | White      | "Sometimes a white is desired without any gloss whatever; this is made by merely grinding white lead in oil of turpentine. It is an expensive colour, in consequence of the large quantity of the oil of turpentine which evaporates during the grinding. When this colour consists of white lead and the oil of turpentine only, it is called dead white; but painters, for convenience occasionally mix linseed or other drying oils with it. And as oil of turpentine almost wholly evaporates when thus combined with lead, it is advisable to mix a portion, however small, of some drying oil or varnish with it, to render the lead more tenacious." [175] | White Lead [Lead White in Linseed Oil] | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate* | -3 parts Lead White in Linseed Oil: 1 Part Cold-Pressed Linseed Oil  
-0.7g of Lead(II) Acetate  
-Turpentine added as need in small quantities |
| 2-B  | White      | "If a dull white be not required, the colour is heightened with a little Prussian blue, or with a little indigo, which is here preferable, or with a little prepared black. The latter gives it a grey cast. In this particular case, if a very fine durable white be required, grind it with a little oil of turpentine, and mix it with the varnish No. II." [176] | White Lead [Lead White in Linseed Oil] Prussian Blue | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate* | -20g of Lead White in Linseed Oil  
-5g of Cold-Pressed Linseed Oil  
-1 droplet of Prussian Blue pigment added with a pipette  
-0.8g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil  
-Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities |

---

[171] Tingry, 190  
[172] Ibid.  
[173] Ibid., 190-191.  
[174] Ibid., 191.  
[175] Ibid., 192.  
[176] Ibid., 191-192
<table>
<thead>
<tr>
<th>ID #</th>
<th>Color Name</th>
<th>Recipe and/or Preparation Instructions</th>
<th>Pigment(s) [Contemporary Name/Selected Pigment]</th>
<th>Supplies</th>
<th>Recipe Prepared and Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>3-A</td>
<td>Light Grey</td>
<td>&quot;White lead ground with a little nut oil, or oil of poppy, and mixed with a small quantity of lamp black, forms a grey colour. With this matter, therefore, mixed with black in different proportions, a great variety of shades may be formed from the lightest to the darkest grey.&quot;^{177}</td>
<td>White Lead [Lead White in Linseed Oil] &lt;br&gt; Lamp Black [Furnace Black]</td>
<td>Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate* &lt;br&gt; Formula: &lt;br&gt; -30.3g of Lead White in Linseed Oil &lt;br&gt; -0.9g of Furnace Black pigment ground in Cold-Pressed Linseed Oil &lt;br&gt; -2.7g of Cold-Pressed Linseed Oil &lt;br&gt; -1.0g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil &lt;br&gt; -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
<td></td>
</tr>
<tr>
<td>3-B</td>
<td>Light Grey</td>
<td>&quot;White lead ground with a little nut oil, or oil of poppy, and mixed with a small quantity of lamp black, forms a grey colour. With this matter, therefore, mixed with black in different proportions, a great variety of shades may be formed from the lightest to the darkest grey.&quot;^{178}</td>
<td>Lead White in Linseed Oil &lt;br&gt; Lamp Black [Furnace Black]</td>
<td>Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate* &lt;br&gt; Formula: &lt;br&gt; -50.6g of mixture prepared for 3-A (comprised of 45.4g Lead White in Linseed Oil; 0.1g Furnace Black pigment ground in Cold-Pressed Linseed Oil; 4.0g of Cold-Pressed Linseed Oil; 1.5g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil) &lt;br&gt; -1.4g of Furnace Black pigment ground in Cold-Pressed Linseed Oil &lt;br&gt; -0.04g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil &lt;br&gt; -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
<td></td>
</tr>
<tr>
<td>4-A</td>
<td>Colour of Oak Wood</td>
<td>&quot;The basis of this colour is formed of white lead; three-fourths of this and a fourth of ochre de rue, umber earth, and yellow ochre: the last three ingredients being employed in proportions according to the required tint, give a matter equally proper for distemper, for varnish, and for oil.&quot;^{179}</td>
<td>White Lead [Lead White in Linseed Oil] &lt;br&gt; Ochre de Rue [Yellow Iron Oxide, Natural] &lt;br&gt; Umber Earth [Raw Umber] &lt;br&gt; Yellow Ochre [French Ochre]</td>
<td>Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate* &lt;br&gt; Formula: &lt;br&gt; -3.9g of Yellow Iron Oxide, Natural pigment ground in Cold-Pressed Linseed Oil &lt;br&gt; -3.9g French Ochre pigment ground in Cold-Pressed Linseed Oil &lt;br&gt; -2.7g of Raw Umber Pigment ground in Cold-Pressed Linseed Oil &lt;br&gt; -2.13g of Lead White in Linseed Oil &lt;br&gt; -1.0g of Lead(II) Acetate &lt;br&gt; -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
<td></td>
</tr>
<tr>
<td>5-A</td>
<td>Colour of Walnut-Tree Wood</td>
<td>&quot;given quantity of white lead, half that quantity of ochre de rue, a little umber earth, red ochre, and yellow ochre, compose a colour proper for distemper, for varnish, and for oil.&quot;^{180}</td>
<td>White Lead [Lead White in Linseed Oil] &lt;br&gt; Ochre de Rue [Yellow Iron Oxide, Natural] &lt;br&gt; Umber Earth [Raw Umber] &lt;br&gt; Red Ochre [Burgundy Red Ochre] &lt;br&gt; Yellow Ochre [French Ochre]</td>
<td>Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate* &lt;br&gt; Formula: &lt;br&gt; -15.5g of Lead White in Linseed Oil &lt;br&gt; -7.7g of Yellow Iron Oxide pigment ground in Cold-Pressed Linseed Oil &lt;br&gt; -2.7g of Raw Umber pigment in Cold-Pressed Linseed Oil &lt;br&gt; -3.6g of Burgundy Red Ochre pigment in Cold-Pressed Linseed Oil &lt;br&gt; -0.6g of French Ochre pigment in Cold-Pressed Linseed Oil &lt;br&gt; -1.0g of Lead(II) Acetate in Cold-Pressed Linseed Oil &lt;br&gt; -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
<td></td>
</tr>
</tbody>
</table>

---

^{177} Tingry, 192.  
^{178} Ibid.  
^{179} Ibid., 195-196.  
^{180} Ibid., 196.
### APPENDIX A

<table>
<thead>
<tr>
<th>ID #</th>
<th>Color Name</th>
<th>Recipe and/or Preparation Instructions</th>
<th>Pigment(s) [Contemporary Name/Selected Pigment]</th>
<th>Supplies</th>
<th>Recipe Prepared and Used</th>
</tr>
</thead>
</table>
| 6-A  | Naples or Patent Yellow     | "...yellow ochres, are mixed with white lead..."[^181]  
*the splendour of which depends, however, on the proportion of the white lead; and this must be varied according to the particular nature of the colouring matter employed. If the ground of the colour be ochre, and if oil painting be intended, the grinding with oil added to oil of turpentine may be omitted, as the latter alone will be sufficient; with fat oil, however, more pliability and more body are obtained.*[^182] | White Lead [Lead White in Linseed Oil]  
Yellow Ochre [French Ochre] | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate[^*] | 4.0g of Lead White in Linseed Oil  
11.0g of French Ochre pigment ground in Cold-Pressed Linseed Oil  
0.5g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil  
Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities |
| 6-B  | Naples or Patent Yellow     | "...yellow ochres, are mixed with white lead..."[^183]  
*the splendour of which depends, however, on the proportion of the white lead; and this must be varied according to the particular nature of the colouring matter employed. If the ground of the colour be ochre, and if oil painting be intended, the grinding with oil added to oil of turpentine may be omitted, as the latter alone will be sufficient; with fat oil, however, more pliability and more body are obtained.*[^184] | White Lead [Lead White in Linseed Oil]  
Yellow Ochre [French Ochre] | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate[^*] | 30.0g of Lead White in Linseed Oil  
15.0g of French Ochre pigment ground in Cold-Pressed Linseed Oil  
1.4g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil  
Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities |
| 7-A  | Chrome Yellow               | "...is also excellent as an oil colour..."[^185]                                                      | Chrome Yellow [Chrome Yellow Hell]            | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate[^*]                  | 50.3g of Chrome Yellow Hell pigment ground in Cold-Pressed Linseed Oil  
1.5g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil  
Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities |
| 7-B  | Chrome Yellow               | "...is also excellent as an oil colour..."[^186]                                                      | White Lead [Lead White in Linseed Oil]  
Chrome Yellow [Chrome Yellow Hell] | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate[^*] | 40.1g of Chrome Yellow Hell pigment ground in Cold-Pressed Linseed Oil  
38.3g of Lead White in Linseed Oil  
1.5g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil  
Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities |
| 8-A  | Buff Colour                 | "'Yellow' is the foundation of buff colour, which is modified by a little red lead, or still better by vermilion, and white lead in small quantity."[^187]  
*For oil painting it is ground and mixed up with the drying oil designed for it.*[^188]  
*That yellows are from ochres, patent yellow, Chrome yellow, &c.*[^189] | White Lead [Lead White in Linseed Oil]  
Yellow [French Ochre]  
Vermilion [Vermilion] | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate[^*] | 15.2g of French Ochre pigment ground in Cold-Pressed Linseed Oil  
17.3g of Vermilion pigment ground in Cold-Pressed Linseed Oil  
23.5g of Lead White in Linseed Oil  
1.2g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil  
Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities |

[^181]: Ibid.  
[^182]: Ibid., 197.  
[^183]: Ibid., 196.  
[^184]: Ibid., 197.  
[^185]: Ibid., 198.  
[^186]: Ibid.  
[^187]: Ibid., 198-199.  
[^188]: Ibid., 199.  
[^189]: Ibid., 275.
<table>
<thead>
<tr>
<th>ID #</th>
<th>Color Name</th>
<th>Recipe and/or Preparation Instructions</th>
<th>Pigment(s) [Contemporary Name/Selected Pigment]</th>
<th>Suppliers</th>
<th>Recipe Prepared and Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-B</td>
<td>Buff Colour</td>
<td>“Yellow is the foundation of buff colour, which is modified by a little red lead, or still better by vermilion, and white lead in small quantity.”&lt;sup&gt;119&lt;/sup&gt;</td>
<td>White Lead [Lead White in Linseed Oil] Yellow [French Ochre] Vermilion [Vermilion]</td>
<td>Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate*</td>
<td>-9g of mixture prepared for 8-A (comprised of 2.4g of French Ochre pigment ground in Cold-Pressed Linseed Oil; 2.7g of Vermilion pigment ground in Cold-Pressed Linseed Oil; 3.7g of Lead White in Linseed Oil; 0.2g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil) -10g of Lead White in Linseed Oil -0.3g of Lead(II) Acetate ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>9-A</td>
<td>Olive Green</td>
<td>“...is a composition, the shades of which may be diversified. If black and a little blue be mixed with yellow, you will have olive-colour. The yellow ochres, with a little verdigris and lamp black, form this colour; or yellow ochre and blue, such as Prussian blue, alone. It is proper for oil and for varnish.”&lt;sup&gt;120&lt;/sup&gt;</td>
<td>Yellow Ochre [French Ochre] Verdigris [Verdigris] Lamp Black [Furnace Black]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol [Litharge]</td>
<td>-13.4g of French Ochre pigment ground in Cold-Pressed Linseed Oil -13.6g of Verdigris pigment ground in Cold-Pressed Linseed Oil -0.5g of Furnace Black pigment ground in Linseed Oil -0.8g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>9-B</td>
<td>Olive Green</td>
<td>“...is a composition, the shades of which may be diversified. If black and a little blue be mixed with yellow, you will have olive-colour. The yellow ochres, with a little verdigris and lamp black, form this colour; or yellow ochre and blue, such as Prussian blue, alone. It is proper for oil and for varnish.”&lt;sup&gt;120&lt;/sup&gt;</td>
<td>Yellow Ochre [French Ochre] Prussian Blue [Prussian Blue] Lamp Black [Furnace Black]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol [Litharge]</td>
<td>7.4g of French Ochre pigment ground in Cold-Pressed Linseed Oil -7.6g of Prussian Blue pigment ground in Cold-Pressed Linseed Oil -7.8g of Furnace Black pigment ground in Cold-Pressed Linseed Oil -0.2g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>10-A</td>
<td>Blue</td>
<td>“When Prussian blue or indigo has been employed without mixture, the colour produced is too dark. It has no splendour, and even appears black: it is, therefore, usual to dilute it with white. As much white lead as may be thought necessary for the whole of the intended work is ground with...with oil of turpentine, or merely with the latter, which is equally proper for oil painting; and a quantity of either of these blues sufficient to produce the required tone is added.”&lt;sup&gt;120&lt;/sup&gt;</td>
<td>White Lead [Lead White in Linseed Oil] Prussian Blue [Prussian Blue]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol [Litharge]</td>
<td>-4.2g of Lead White in Linseed Oil -1.0g of Prussian Blue pigment ground in Cold-Pressed Linseed Oil -1.3g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>10-B</td>
<td>Blue</td>
<td>“When Prussian blue or indigo has been employed without mixture, the colour produced is too dark. It has no splendour, and even appears black: it is, therefore, usual to dilute it with white. As much white lead as may be thought necessary for the whole of the intended work is ground with...with oil of turpentine, or merely with the latter, which is equally proper for oil painting; and a quantity of either of these blues sufficient to produce the required tone is added.”&lt;sup&gt;120&lt;/sup&gt;</td>
<td>White Lead [Lead White in Linseed Oil] Prussian Blue [Prussian Blue]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol [Litharge]</td>
<td>-28.7g of mixture prepared for 10-A (comprised of 27.2g of Lead White in Linseed Oil; 0.7g of Prussian Blue pigment ground in Cold-Pressed Linseed Oil; 0.8g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil) -6.0g of Prussian Blue ground in Cold-Pressed Linseed Oil -0.2g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil</td>
</tr>
</tbody>
</table>

<sup>119</sup> Ibid., 198-199.  
<sup>120</sup> Ibid., 199.
<table>
<thead>
<tr>
<th>ID #</th>
<th>Color Name</th>
<th>Recipe and/or Preparation Instructions</th>
<th>Pigment(s) [Contemporary Name/Selected Pigment]</th>
<th>Supplies</th>
<th>Recipe Prepared and Used</th>
</tr>
</thead>
</table>
| 11-A | Another Blue made with Saxon Blue | "It is employed for sky blues. The case is the same with blue verditer. Both these blues stand well in distemper, in varnish, and in oil."

> White Lead [Lead White in Linseed Oil]

> Saxon Blue [Smalt] | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate | - Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities |
| 11-B | Another Blue made with Saxon Blue | "It is employed for sky blues. The case is the same with blue verditer. Both these blues stand well in distemper, in varnish, and in oil."

> White Lead [Lead White in Linseed Oil]

> Saxon Blue [Smalt] | Cold-Pressed Linseed Oil Turpentine Lead(II) Acetate | - Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities |
| 12-A | Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air | "White lead is usually the base of this colour. When it is required to bring it to the most agreeable tone, grind two parts of white lead with nut oil, and one part of verdigris with oil of turpentine. Then mix up the two colours with one half common drying nut oil and one half resinous drying nut oil. This colour appears at first to be a pale blue, which the action of the light will soon convert to green, and in this state it is very durable."

> White Lead [Lead White in Linseed Oil]

> Verdigris [Verdigris] | Cold-Pressed Linseed Oil Cold-Pressed Walnut Oil Turpentine Rosin Oil Medium Vitriol (Litharge) | - Pressed Walnut Oil: 1 part Lead White in Linseed Oil

> 0.9g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil

> 1/8oz of Cold-Pressed Walnut Oil |

| 12-B | Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air | "White lead is usually the base of this colour. When it is required to bring it to the most agreeable tone, grind two parts of white lead with nut oil, and one part of verdigris with oil of turpentine. Then mix up the two colours with one half common drying nut oil and one half resinous drying nut oil. This colour appears at first to be a pale blue, which the action of the light will soon convert to green, and in this state it is very durable."

> White Lead [Lead White in Linseed Oil]

> Verdigris [Verdigris] | Cold-Pressed Linseed Oil Cold-Pressed Walnut Oil Turpentine Rosin Oil Medium Vitriol (Litharge) | - 2 parts Verdigris ground in Cold-Pressed Linseed Oil: 1 part Lead White in Linseed Oil

> 0.9g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil

> 1/8oz of Cold-Pressed Walnut Oil |

| 12-C | Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air | Due to unexpectedly light, nearly Turquoise, color of 12-A and 12-B, reduced quantity of Lead White in Linseed Oil in order to compare appearance of 12-C to 12-A and 12-B. | White Lead [Lead White in Linseed Oil]

> Verdigris [Verdigris] | Cold-Pressed Linseed Oil Cold-Pressed Walnut Oil Turpentine Rosin Oil Medium Vitriol (Litharge) | - 2.9g of Verdigris pigment ground in Cold-Pressed Linseed Oil

> 1.5g of Lead White in Linseed Oil |

> 0.9g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil

> Mixture of 25% paint to 75% 1:1 mixture of Cold-Pressed Walnut Oil and Turpentine Rosin Oil Medium |

---

197 Ibid.
198 Ibid., 201.
199 Ibid.
200 Ibid., 204.
201 Ibid.
<table>
<thead>
<tr>
<th>ID #</th>
<th>Color Name</th>
<th>Recipe and/or Preparation Instructions</th>
<th>Pigment(s) [Contemporary Name/Selected Pigment]</th>
<th>Supplies</th>
<th>Recipe Prepared and Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-A</td>
<td>Compound Green</td>
<td>“…take two pounds of white lead, four ounces of Dutch pink, and an ounce of Prussian blue or indigo. This mixture produces a green, the intensity of which may be increased or diminished by the addition of yellow or blue.”&lt;sup&gt;201&lt;/sup&gt;</td>
<td>White Lead [Lead White in Linseed Oil] Dutch Pink [Stil de Grain] Prussian Blue [Prussian Blue] Yellow [French Ochre]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>-14.1g of Lead White in Linseed Oil -1.7g of Stil de Grain pigment ground in Cold-Pressed Linseed Oil -0.4g of Prussian Blue pigment ground in Cold-Pressed Linseed Oil -4.0g of Turpentine -2.0g of French Ochre pigment ground in Cold-Pressed Linseed Oil -0.6g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>13-B</td>
<td>Compound Green</td>
<td>“…take two pounds of white lead, four ounces of Dutch pink, and an ounce of Prussian blue or indigo. This mixture produces a green, the intensity of which may be increased or diminished by the addition of yellow or blue.”&lt;sup&gt;202&lt;/sup&gt;</td>
<td>White Lead [Lead White in Linseed Oil] Dutch Pink [Stil de Grain] Prussian Blue [Prussian Blue]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>-23.7g of mixture prepared for 10-A (16.6g of Lead White in Linseed Oil; 2.0g of Stil de Grain pigment ground in Cold-Pressed Linseed Oil; 0.5g of Prussian Blue pigment ground in Cold-Pressed Linseed Oil; 4.7g of Turpentine; 0.7g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil) -1.6g of Prussian Blue pigment ground in Cold-Pressed Linseed Oil -0.04g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>13-C</td>
<td>Compound Green</td>
<td>“…take two pounds of white lead, four ounces of Dutch pink, and an ounce of Prussian blue or indigo. This mixture produces a green, the intensity of which may be increased or diminished by the addition of yellow or blue.”&lt;sup&gt;203&lt;/sup&gt;</td>
<td>White Lead [Lead White in Linseed Oil] Dutch Pink [Stil de Grain] Prussian Blue [Prussian Blue]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>-15.3g of Lead White in Linseed Oil -1.9g of Stil de Grain pigment ground in Cold-Pressed Linseed Oil -0.5g of Prussian Blue pigment ground in Cold-Pressed Linseed Oil -0.5g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>14-A</td>
<td>Chestnut</td>
<td>&quot;This colour is composed of red, yellow, and black. The English red, or red ochre of Auvergne, ochre de rue, and a little black, form a dark chestnut colour - This composition is proper for painting of every kind.&quot;&lt;sup&gt;204&lt;/sup&gt;</td>
<td>English Red [English Red] Ochre de Rue [Yellow Iron Oxide, Natural] Black [Furnace Black]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>-1.5g base halved from 3g mixture (0.7g of English Red pigment ground in Cold-Pressed Linseed Oil; 0.05g of Furnace Black ground in Cold-Pressed Linseed Oil; 0.1g of French Ochre ground in Cold-Pressed Linseed Oil; 0.7g of Yellow Iron Oxide, Natural pigment ground in Cold-Pressed Linseed Oil) -0.6g of Furnace Black pigment ground in Cold-Pressed Linseed Oil -9.3g of Yellow Iron Oxide, Natural pigment ground in Cold-Pressed Linseed Oil -0.4g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
</tbody>
</table>

---

<sup>201</sup> Ibid., 205.  
<sup>202</sup> Ibid., 205.  
<sup>203</sup> Ibid.  
<sup>204</sup> Ibid., 208.
APPENDIX A

<table>
<thead>
<tr>
<th>ID #</th>
<th>Color Name</th>
<th>Recipe and/or Preparation Instructions</th>
<th>Pigment(s) [Contemporary Name/Selected Pigment]</th>
<th>Supplies</th>
<th>Recipe Prepared and Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>14-B</td>
<td>Chestnut</td>
<td>&quot;This colour is composed of red, yellow, and black. The English red, or red ochre of Auvergne, ochre de rue, and a little black, form a dark chestnut colour. This composition is proper for painting of every kind.&quot;</td>
<td>English Red [English Red] Ochre de Rue [Yellow Iron Oxide, Natural Black]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>-1.5g base halved from 3.0g mixture (comprised of 0.7g of English Red pigment ground in Cold-Pressed Linseed Oil; 0.05g of Furnace Black ground in Cold-Pressed Linseed Oil; 0.1g of French Ochre ground in Cold-Pressed Linseed Oil; 0.7g of Yellow Iron Oxide, Natural pigment ground in Cold-Pressed Linseed Oil)</td>
</tr>
<tr>
<td>15-A</td>
<td>Chocolate</td>
<td>&quot;...is composed of red and black. The shades of chocolate may be much diversified. With Spanish brown and lamp black, and the addition of white vitriol as a drier, a dull yet durable chocolate is obtained. With brighter reds and ivory black, with the addition of litharge, a better chocolate is produced; and if mixed up with drying oil, with the addition of the varnish No. III. Its appearance will be improved.&quot;</td>
<td>Spanish Brown [Vandyke Brown] Lamp Black [Furnace Black]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>-11.2g of Vandyke Brown ground in Cold-Pressed Linseed Oil -2.4g of Furnace Black ground in Cold-Pressed Linseed Oil -0.4g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>15-B</td>
<td>Chocolate</td>
<td>&quot;...is composed of red and black. The shades of chocolate may be much diversified. With Spanish brown and lamp black, and the addition of white vitriol as a drier, a dull yet durable chocolate is obtained. With brighter reds and ivory black, with the addition of litharge, a better chocolate is produced; and if mixed up with drying oil, with the addition of the varnish No. III. Its appearance will be improved.&quot;</td>
<td>Brighter Reds [Vermilion] Ivory Black [Bone Black]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>-10.3g of English Red pigment ground in Cold-Pressed Linseed Oil -23.1g of Bone Black pigment ground in Cold-Pressed Linseed Oil -1.0g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>15-C</td>
<td>Chocolate</td>
<td>&quot;...is composed of red and black. The shades of chocolate may be much diversified. With Spanish brown and lamp black, and the addition of white vitriol as a drier, a dull yet durable chocolate is obtained. With brighter reds and ivory black, with the addition of litharge, a better chocolate is produced; and if mixed up with drying oil, with the addition of the varnish No. III. Its appearance will be improved.&quot;</td>
<td>Umber Earth [Raw Umber] Lamp Black [Furnace Brown]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>-</td>
</tr>
<tr>
<td>16-A</td>
<td>Pompadour</td>
<td>&quot;As has been stated under the oxides of iron, purple brown is almost the only simple purple known. It may be prepared with drying oil and litharge; its brilliance may be increased by a mixture with the varnish No. III. As purple is a composition of red and blue, a combination of these colours will afford an infinite variety of purples.&quot;</td>
<td>Purple Brown [Caput Mortuum Violet]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol (Litharge)</td>
<td>Formula -29.0g of Caput Mortuum Violet pigment ground in Cold-Pressed Linseed Oil -0.5g of Vitriol (Litharge) ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
</tbody>
</table>

---

206 Ibid.  
207 Ibid.  
208 Ibid.  
209 Ibid.  
210 Ibid., 275.
<table>
<thead>
<tr>
<th>ID #</th>
<th>Color Name</th>
<th>Recipe and/or Preparation Instructions</th>
<th>Pigment(s) [Contemporary Name/Selected Pigment]</th>
<th>Supplies</th>
<th>Recipe Prepared and Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-B</td>
<td>Pompadour</td>
<td>&quot;As has been stated under the oxides of iron, purple brown is almost the only simple purple known. It may be prepared with drying oil and litharge; its brilliance may be increased by a mixture with the varnish No. III. As purple is a composition of red and blue, a combination of these colours will afford an infinite variety of purples.&quot;*213 *That pompadour is from the purple oxide of iron, commonly called purple brown.&quot;*212</td>
<td>Venetian Red [Venetian Red] Prussian Blue [Prussian Blue]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol [Litharge]</td>
<td>-5.8g of mixture prepared for 16-C (comprised of 2.4g of Prussian Blue pigment ground in Cold-Pressed Linseed Oil; 3.3g of Venetian Red pigment ground in Cold-Pressed Linseed Oil; 0.06g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil) -5.6g of Venetian Red pigment ground in Cold-Pressed Linseed Oil -0.2g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>16-B-1</td>
<td>Pompadour</td>
<td>&quot;As has been stated under the oxides of iron, purple brown is almost the only simple purple known. It may be prepared with drying oil and litharge; its brilliance may be increased by a mixture with the varnish No. III. As purple is a composition of red and blue, a combination of these colours will afford an infinite variety of purples.&quot;*214 *That pompadour is from the purple oxide of iron, commonly called purple brown.&quot;*214</td>
<td>Venetian Red [Venetian Red] Prussian Blue [Prussian Blue]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol [Litharge]</td>
<td>-14.7g of Vermilion pigment ground in Cold-Pressed Linseed Oil -0.5g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>17-A</td>
<td>Vermilion (Red 1)</td>
<td>&quot;That reds are from vermilion, red lead, Venetian red, &amp;c.&quot;*216</td>
<td>Vermilion [Vermilion]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol [Litharge]†</td>
<td>-43.0g of Venetian Red pigment ground in Cold-Pressed Linseed Oil -1.3g of Vitriol [Litharge] ground in Cold-Pressed Linseed Oil -Cold-Pressed Linseed Oil/Turpentine added as needed in small quantities</td>
</tr>
<tr>
<td>18-A</td>
<td>Venetian Red (Red 2)</td>
<td>&quot;That reds are from vermilion, red lead, Venetian red, &amp;c.&quot;*216</td>
<td>Venetian Red [Venetian Red]</td>
<td>Cold-Pressed Linseed Oil Turpentine Vitriol [Litharge]</td>
<td>-5g of Venetian Red pigment ground in Cold-Pressed Linseed Oil</td>
</tr>
<tr>
<td>18-A-1</td>
<td>Venetian Red (Red 2)</td>
<td>&quot;That reds are from vermilion, red lead, Venetian red, &amp;c.&quot;*217</td>
<td>Venetian Red [Venetian Red]</td>
<td>Cold-Pressed Linseed Oil Turpentine</td>
<td>-5g of Venetian Red pigment ground in Cold-Pressed Linseed Oil</td>
</tr>
</tbody>
</table>

---

211 Ibid., 208-209.
212 Ibid., 275.
213 Ibid., 208-209.
214 Ibid., 275.
215 Ibid.
216 Ibid.
217 Ibid.
Following the instructions in the treatise, a Lead(II) Acetate drier ground in linseed oil was used for white and lighter, delicate paint colors. Disappointed with the dry appearance of the paint colors mixed the Lead(II) Acetate, the author made new batches of all of paints that contained the drier, except for Another Blue made with Saxon Blue (11-A and 11-B), and omitted the drier. The paint blocks were lightly sanded to reduce the texture imparted by the Lead(II) Acetate drier and painted out the newly made paints on the sanded surfaces. This chart contains the original recipes with the drier. The remade paints were prepared by following reduced versions of these recipes.

†It appears that the litharge (vitriol) drier negatively impacted the dry appearance of Vermilion (Red 1) [17-A]. The author ground a small quantity of vermilion in linseed oil, lightly sanded the painted block, and applied the newly made paint to the block.
Appendix B | Photographs of the Palette
Appendix B.1: Individual Photographs of the Palette

Figure 1: 1-A – Lamp Black.

Figure 2: 2-A (left) and 2-B (right) – White.
Figure 3: 3-A (left) and 3-B (right) – Light Grey.

Figure 4: 4-A – Colour of Oak Wood.
Figure 5: 5-A – Colour of Walnut-Tree Wood.

Figure 6: 6-A (left) and 6-B (right) - Naples or Patent Yellow.
Figure 7: 7-A (left) and 7-B (right) – Chrome Yellow.

Figure 8: 8-A (left) and 8-B (right) – Buff Colour.
Figure 9: 9-A (left) and 9-B (right) Olive Green.

Figure 10: 10-A (left) and 10-B (right) – Blue.
Figure 11: 11-A (left) and 11-B (right) – Another Blue made with Saxon Blue.

Figure 12: 12-A (left) and 12-B (right) - Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air.
Figure 13: 12-C - Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air.

Figure 14: 13-A (left) and 13-B (right): Compound Green.
Figure 15: 13-C: Compound Green.

Figure 16: 14-A (left) and 14-B (right): Chestnut.
Figure 17: 15-A (left) and 15-B (right) – Chocolate.

Figure 18: 16-A (left) and 16-B (right): Pompadour.
Figure 19: 16-B-1 – Pompadour.

Figure 20: 17-A – Vermilion (Red 1).
Figure 21: 18-A – Venetian Red (Red 2).

Figure 22: 18-A-1 – Venetian Red (Red 2).
Appendix C | CIE L*a*b* Color Measurement Values
Appendix C.1: CIE L*a*b* Color Measurements - Eighteen-Color Palette

Three color measurements were taken from three locations (top, middle, and bottom) on each paint sample. The values in this table are the averages of those three measurements.

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>ID #</th>
<th>Color Name</th>
<th>SCI/SCE</th>
<th>L* Value</th>
<th>a* Value</th>
<th>b* Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/24/18</td>
<td>1-A</td>
<td>Black</td>
<td>SCI</td>
<td>0.69</td>
<td>0.14</td>
<td>0.30</td>
</tr>
<tr>
<td>07/24/18</td>
<td>1-A</td>
<td>Black</td>
<td>SCE</td>
<td>0.09</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>07/24/18</td>
<td>2-A</td>
<td>White</td>
<td>SCI</td>
<td>94.24</td>
<td>-0.91</td>
<td>6.51</td>
</tr>
<tr>
<td>07/24/18</td>
<td>2-A</td>
<td>White</td>
<td>SCE</td>
<td>93.91</td>
<td>-0.83</td>
<td>6.75</td>
</tr>
<tr>
<td>07/24/18</td>
<td>2-B</td>
<td>White</td>
<td>SCI</td>
<td>92.79</td>
<td>-2.35</td>
<td>4.14</td>
</tr>
<tr>
<td>07/24/18</td>
<td>2-B</td>
<td>White</td>
<td>SCE</td>
<td>71.97</td>
<td>-2.28</td>
<td>4.35</td>
</tr>
<tr>
<td>07/24/18</td>
<td>3-A</td>
<td>Light Grey</td>
<td>SCI</td>
<td>76.84</td>
<td>-0.87</td>
<td>-1.86</td>
</tr>
<tr>
<td>07/24/18</td>
<td>3-A</td>
<td>Light Grey</td>
<td>SCE</td>
<td>76.70</td>
<td>-0.81</td>
<td>-1.65</td>
</tr>
<tr>
<td>07/24/18</td>
<td>3-B</td>
<td>Light Grey</td>
<td>SCI</td>
<td>50.64</td>
<td>-0.72</td>
<td>-4.58</td>
</tr>
<tr>
<td>07/24/18</td>
<td>3-B</td>
<td>Light Grey</td>
<td>SCE</td>
<td>50.60</td>
<td>-0.69</td>
<td>-4.17</td>
</tr>
<tr>
<td>07/24/18</td>
<td>4-A</td>
<td>Colour of Oak Wood</td>
<td>SCI</td>
<td>54.81</td>
<td>9.93</td>
<td>28.58</td>
</tr>
<tr>
<td>07/24/18</td>
<td>4-A</td>
<td>Colour of Oak Wood</td>
<td>SCE</td>
<td>54.83</td>
<td>9.95</td>
<td>28.65</td>
</tr>
<tr>
<td>07/24/18</td>
<td>5-A</td>
<td>Colour of Walnut-Tree Wood</td>
<td>SCI</td>
<td>46.77</td>
<td>13.26</td>
<td>24.19</td>
</tr>
<tr>
<td>07/24/18</td>
<td>5-A</td>
<td>Colour of Walnut-Tree Wood</td>
<td>SCE</td>
<td>46.56</td>
<td>13.37</td>
<td>24.58</td>
</tr>
<tr>
<td>07/24/18</td>
<td>6-A</td>
<td>Naples or Patent Yellow</td>
<td>SCI</td>
<td>56.97</td>
<td>18.98</td>
<td>49.91</td>
</tr>
<tr>
<td>07/24/18</td>
<td>6-A</td>
<td>Naples or Patent Yellow</td>
<td>SCE</td>
<td>57.00</td>
<td>18.97</td>
<td>49.76</td>
</tr>
<tr>
<td>07/24/18</td>
<td>6-B</td>
<td>Naples or Patent Yellow</td>
<td>SCI</td>
<td>66.77</td>
<td>14.75</td>
<td>40.47</td>
</tr>
<tr>
<td>07/24/18</td>
<td>6-B</td>
<td>Naples or Patent Yellow</td>
<td>SCE</td>
<td>66.72</td>
<td>14.74</td>
<td>40.38</td>
</tr>
<tr>
<td>07/24/18</td>
<td>7-A</td>
<td>Chrome Yellow</td>
<td>SCI</td>
<td>80.36</td>
<td>5.27</td>
<td>108.9</td>
</tr>
<tr>
<td>07/24/18</td>
<td>7-A</td>
<td>Chrome Yellow</td>
<td>SCE</td>
<td>80.29</td>
<td>5.25</td>
<td>108.1</td>
</tr>
<tr>
<td>07/24/18</td>
<td>7-B</td>
<td>Chrome Yellow</td>
<td>SCI</td>
<td>84.71</td>
<td>1.43</td>
<td>79.94</td>
</tr>
<tr>
<td>07/24/18</td>
<td>7-B</td>
<td>Chrome Yellow</td>
<td>SCE</td>
<td>84.53</td>
<td>1.48</td>
<td>79.79</td>
</tr>
<tr>
<td>07/24/18</td>
<td>8-A</td>
<td>Buff Colour</td>
<td>SCI</td>
<td>60.92</td>
<td>19.67</td>
<td>37.79</td>
</tr>
<tr>
<td>07/24/18</td>
<td>8-A</td>
<td>Buff Colour</td>
<td>SCE</td>
<td>60.90</td>
<td>19.63</td>
<td>37.62</td>
</tr>
<tr>
<td>07/24/18</td>
<td>8-B</td>
<td>Buff Colour</td>
<td>SCI</td>
<td>72.36</td>
<td>15.14</td>
<td>29.00</td>
</tr>
<tr>
<td>07/24/18</td>
<td>8-B</td>
<td>Buff Colour</td>
<td>SCE</td>
<td>72.19</td>
<td>15.15</td>
<td>29.06</td>
</tr>
<tr>
<td>07/24/18</td>
<td>9-A</td>
<td>Olive Green</td>
<td>SCI</td>
<td>25.39</td>
<td>0.76</td>
<td>27.77</td>
</tr>
<tr>
<td>07/24/18</td>
<td>9-A</td>
<td>Olive Green</td>
<td>SCE</td>
<td>21.93</td>
<td>1.92</td>
<td>34.15</td>
</tr>
<tr>
<td>07/24/18</td>
<td>9-B</td>
<td>Olive Green</td>
<td>SCI</td>
<td>30.26</td>
<td>3.22</td>
<td>33.61</td>
</tr>
<tr>
<td>07/24/18</td>
<td>9-B</td>
<td>Olive Green</td>
<td>SCE</td>
<td>28.24</td>
<td>2.38</td>
<td>37.59</td>
</tr>
<tr>
<td>07/24/18</td>
<td>10-A</td>
<td>Blue</td>
<td>SCI</td>
<td>71.26</td>
<td>-11.44</td>
<td>-15.93</td>
</tr>
<tr>
<td>07/24/18</td>
<td>10-A</td>
<td>Blue</td>
<td>SCE</td>
<td>70.81</td>
<td>-11.55</td>
<td>-15.89</td>
</tr>
<tr>
<td>07/24/18</td>
<td>10-B</td>
<td>Blue</td>
<td>SCI</td>
<td>35.09</td>
<td>-8.53</td>
<td>-23.37</td>
</tr>
<tr>
<td>Sample Date</td>
<td>ID #</td>
<td>Color Name</td>
<td>SCI/SCE</td>
<td>L* Value</td>
<td>a* Value</td>
<td>b* Value</td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td>----------------------------------------------------------------------------</td>
<td>---------</td>
<td>----------</td>
<td>----------</td>
<td>----------</td>
</tr>
<tr>
<td>07/24/18</td>
<td>10-B</td>
<td>Blue</td>
<td>SCE</td>
<td>33.16</td>
<td>-9.26</td>
<td>-24.35</td>
</tr>
<tr>
<td>07/24/18</td>
<td>11-A</td>
<td>Another Blue made with Saxon Blue</td>
<td>SCI</td>
<td>88.10</td>
<td>-1.94</td>
<td>-2.05</td>
</tr>
<tr>
<td>07/24/18</td>
<td>11-A</td>
<td>Another Blue made with Saxon Blue</td>
<td>SCE</td>
<td>87.49</td>
<td>-9.26</td>
<td>-1.82</td>
</tr>
<tr>
<td>07/24/18</td>
<td>11-B</td>
<td>Another Blue made with Saxon Blue</td>
<td>SCI</td>
<td>35.09</td>
<td>-8.53</td>
<td>-7.12</td>
</tr>
<tr>
<td>07/24/18</td>
<td>11-B</td>
<td>Another Blue made with Saxon Blue</td>
<td>SCE</td>
<td>33.16</td>
<td>-9.26</td>
<td>-6.99</td>
</tr>
<tr>
<td>07/24/18</td>
<td>13-A</td>
<td>Compound Green</td>
<td>SCI</td>
<td>58.09</td>
<td>-12.17</td>
<td>-14.10</td>
</tr>
<tr>
<td>07/24/18</td>
<td>13-A</td>
<td>Compound Green</td>
<td>SCE</td>
<td>58.08</td>
<td>-12.12</td>
<td>-13.86</td>
</tr>
<tr>
<td>07/24/18</td>
<td>13-B</td>
<td>Compound Green</td>
<td>SCI</td>
<td>62.71</td>
<td>-9.92</td>
<td>6.82</td>
</tr>
<tr>
<td>07/24/18</td>
<td>13-B</td>
<td>Compound Green</td>
<td>SCE</td>
<td>62.64</td>
<td>-9.85</td>
<td>6.97</td>
</tr>
<tr>
<td>07/24/18</td>
<td>13-C</td>
<td>Compound Green</td>
<td>SCI</td>
<td>57.24</td>
<td>-16.92</td>
<td>-15.87</td>
</tr>
<tr>
<td>07/24/18</td>
<td>13-C</td>
<td>Compound Green</td>
<td>SCE</td>
<td>55.93</td>
<td>-17.47</td>
<td>-16.13</td>
</tr>
<tr>
<td>07/24/18</td>
<td>14-B</td>
<td>Chestnut</td>
<td>SCI</td>
<td>14.13</td>
<td>10.79</td>
<td>19.47</td>
</tr>
<tr>
<td>07/24/18</td>
<td>14-A</td>
<td>Chestnut</td>
<td>SCE</td>
<td>0.74</td>
<td>0.61</td>
<td>0.27</td>
</tr>
<tr>
<td>07/24/18</td>
<td>14-B</td>
<td>Chestnut</td>
<td>SCI</td>
<td>24.60</td>
<td>23.06</td>
<td>35.30</td>
</tr>
<tr>
<td>07/24/18</td>
<td>14-B</td>
<td>Chestnut</td>
<td>SCE</td>
<td>19.89</td>
<td>27.60</td>
<td>31.78</td>
</tr>
<tr>
<td>07/24/18</td>
<td>15-A</td>
<td>Chocolate</td>
<td>SCI</td>
<td>0.38</td>
<td>0.08</td>
<td>0.04</td>
</tr>
<tr>
<td>07/24/18</td>
<td>15-A</td>
<td>Chocolate</td>
<td>SCE</td>
<td>0.09</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>07/24/18</td>
<td>15-B</td>
<td>Chocolate</td>
<td>SCI</td>
<td>11.52</td>
<td>16.50</td>
<td>19.35</td>
</tr>
<tr>
<td>07/24/18</td>
<td>15-B</td>
<td>Chocolate</td>
<td>SCE</td>
<td>7.94</td>
<td>19.23</td>
<td>13.54</td>
</tr>
</tbody>
</table>

8/22/2018 12-A Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air

SCE 66.14 -62.89 5.69

8/22/2018 12-A Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air

SCE 29.99 -67.92 5.99

8/22/2018 12-B Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air

SCI 55.17 -29.09 13.24

8/22/2018 12-B Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air

SCE 52.59 -31.50 14.73

8/22/2018 12-C Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air

SCI 57.94 -28.43 12.53

8/22/2018 12-C Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air

SCE 55.58 -30.40 13.80

07/24/18 13-A Compound Green

SCI 58.09 -12.17 -14.10

07/24/18 13-B Compound Green

SCI 62.71 -9.92 6.82

8/22/2018 13-C Compound Green

SCI 57.24 -16.92 -15.87

8/22/2018 13-C Compound Green

SCE 55.93 -17.47 -16.13

07/24/18 14-B Chestnut

SCI 14.13 10.79 19.47

07/24/18 14-A Chestnut

SCE 0.74 0.61 0.27

07/24/18 14-B Chestnut

SCI 24.60 23.06 35.30

07/24/18 14-B Chestnut

SCE 19.89 27.60 31.78

07/24/18 15-A Chocolate

SCI 0.38 0.08 0.04

07/24/18 15-A Chocolate

SCE 0.09 0.00 0.00

07/24/18 15-B Chocolate

SCI 11.52 16.50 19.35

07/24/18 15-B Chocolate

SCE 7.94 19.23 13.54
<table>
<thead>
<tr>
<th>Sample Date</th>
<th>ID #</th>
<th>Color Name</th>
<th>SCI/ SCE</th>
<th>L* Value</th>
<th>a* Value</th>
<th>b* Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>07/24/18</td>
<td>16-A</td>
<td>Pompadour</td>
<td>SCI</td>
<td>11.12</td>
<td>19.41</td>
<td>18.95</td>
</tr>
<tr>
<td>07/24/18</td>
<td>16-A</td>
<td>Pompadour</td>
<td>SCE</td>
<td>10.41</td>
<td>20.04</td>
<td>17.73</td>
</tr>
<tr>
<td>07/24/18</td>
<td>16-B</td>
<td>Pompadour</td>
<td>SCI</td>
<td>13.92</td>
<td>18.85</td>
<td>23.31</td>
</tr>
<tr>
<td>07/24/18</td>
<td>16-B</td>
<td>Pompadour</td>
<td>SCE</td>
<td>7.69</td>
<td>19.82</td>
<td>13.11</td>
</tr>
<tr>
<td>07/24/18</td>
<td>16-B-1</td>
<td>Pompadour</td>
<td>SCI</td>
<td>8.02</td>
<td>13.84</td>
<td>12.64</td>
</tr>
<tr>
<td>07/24/18</td>
<td>16-B-1</td>
<td>Pompadour</td>
<td>SCE</td>
<td>0.19</td>
<td>0.27</td>
<td>0.17</td>
</tr>
<tr>
<td>07/24/18</td>
<td>17-A</td>
<td>Vermilion (Red 1)</td>
<td>SCI</td>
<td>38.79</td>
<td>55.21</td>
<td>43.87</td>
</tr>
<tr>
<td>07/24/18</td>
<td>17-A</td>
<td>Vermilion (Red 1)</td>
<td>SCE</td>
<td>38.64</td>
<td>55.10</td>
<td>45.05</td>
</tr>
<tr>
<td>07/24/18</td>
<td>18-A</td>
<td>Venetian Red (Red 2)</td>
<td>SCI</td>
<td>27.26</td>
<td>39.00</td>
<td>45.56</td>
</tr>
<tr>
<td>07/24/18</td>
<td>18-A</td>
<td>Venetian Red (Red 2)</td>
<td>SCE</td>
<td>25.79</td>
<td>41.65</td>
<td>38.56</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>18-A-1</td>
<td>Venetian Red (Red 2)</td>
<td>SCI</td>
<td>26.72</td>
<td>40.30</td>
<td>45.89</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>18-A-1</td>
<td>Venetian Red (Red 2)</td>
<td>SCE</td>
<td>26.84</td>
<td>40.26</td>
<td>46.07</td>
</tr>
</tbody>
</table>
Appendix C.2: CIE L*a*b* Color Measurements - Alternate Sample Collection

For comparison, an alternate sample collection was prepared. For this collection, the prepared paints were painted out on balsa wood substrates. Color measurements were taken from a handful of paint colors in the alternate collection when only the second coats were applied.

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>ID #</th>
<th>Color Name</th>
<th>SCI/SCE</th>
<th>L* Value</th>
<th>a* Value</th>
<th>b* Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/24/2018</td>
<td>6-A</td>
<td>Naples or Patent Yellow</td>
<td>SCI</td>
<td>54.82</td>
<td>22.45</td>
<td>57.39</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>6-A</td>
<td>Naples or Patent Yellow</td>
<td>SCE</td>
<td>53.12</td>
<td>23.33</td>
<td>66.88</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>6-B</td>
<td>Naples or Patent Yellow</td>
<td>SCI</td>
<td>65.59</td>
<td>20.54</td>
<td>48.95</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>6-B</td>
<td>Naples or Patent Yellow</td>
<td>SCE</td>
<td>65.48</td>
<td>20.53</td>
<td>48.96</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>8-A</td>
<td>Buff Colour</td>
<td>SCI</td>
<td>59.09</td>
<td>24.88</td>
<td>45.18</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>8-A</td>
<td>Buff Colour</td>
<td>SCE</td>
<td>57.91</td>
<td>25.48</td>
<td>48.03</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>13-A</td>
<td>Compound Green</td>
<td>SCE</td>
<td>59.56</td>
<td>-12.55</td>
<td>-12.82</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>13-B</td>
<td>Compound Green</td>
<td>SCI</td>
<td>64.82</td>
<td>-9.93</td>
<td>7.94</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>13-B</td>
<td>Compound Green</td>
<td>SCE</td>
<td>64.66</td>
<td>-9.87</td>
<td>8.11</td>
</tr>
</tbody>
</table>
### Appendix C.3: CIE L*a*b* Color Measurements - Eighteen-Color Palette (3 Samples per Paint Color)

Three color measurements were taken from three locations (top, middle, and bottom) on each paint sample. The averages of these values are included in Appendix C.1.

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>ID #</th>
<th>Color Name</th>
<th>SC/SCI</th>
<th>L* Value (1-3)</th>
<th>a* Value (1-3)</th>
<th>b* Value (1-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/24/2018</td>
<td>1-A</td>
<td>Black Black</td>
<td>SCE</td>
<td>(1)9.00; (2)10.03; (3)3.00</td>
<td>(1)9.00; (2)10.03; (3)3.00</td>
<td>(1)9.00; (2)10.03; (3)3.00</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>1-A</td>
<td>Black Black</td>
<td>SCI</td>
<td>(1)10.09; (2)10.09; (3)0.09</td>
<td>(1)10.09; (2)10.09; (3)0.09</td>
<td>(1)10.09; (2)10.09; (3)0.09</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>2-A</td>
<td>White White</td>
<td>SCI</td>
<td>(1)94.08; (2)94.11; (3)94.53</td>
<td>(1)1.06; (2)0.86; (3)0.80</td>
<td>(1)4.14; (2)1.06; (3)36.24</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>2-A</td>
<td>White White</td>
<td>SCE</td>
<td>(1)93.76; (2)93.78; (3)94.21</td>
<td>(1)0.99; (2)0.79; (3)0.73</td>
<td>(1)7.40; (2)16.38; (3)36.48</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>2-B</td>
<td>White White</td>
<td>SCI</td>
<td>(1)92.65; (2)92.82; (3)92.90</td>
<td>(1)2.27; (2)2.32; (3)2.47</td>
<td>(1)4.42; (2)14.15; (3)3.86</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>2-B</td>
<td>White White</td>
<td>SCE</td>
<td>(1)92.39; (2)92.61; (3)92.70</td>
<td>(1)2.20; (2)2.25; (3)2.39</td>
<td>(1)4.62; (2)24.36; (3)34.07</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>3-A</td>
<td>Light Grey</td>
<td>SCI</td>
<td>(1)57.73; (2)76.59; (3)76.79</td>
<td>(1)0.86; (2)0.86; (3)0.88</td>
<td>(1)1.82; (2)1.93; (3)1.84</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>3-A</td>
<td>Light Grey</td>
<td>SCE</td>
<td>(1)77.00; (2)76.45; (3)76.65</td>
<td>(1)0.80; (2)0.80; (3)0.82</td>
<td>(1)1.61; (2)1.72; (3)1.62</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>3-B</td>
<td>Light Grey</td>
<td>SCI</td>
<td>(1)50.87; (2)50.88; (3)50.18</td>
<td>(1)0.72; (2)0.72; (3)0.72</td>
<td>(1)4.29; (2)4.35; (3)4.39</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>3-B</td>
<td>Light Grey</td>
<td>SCE</td>
<td>(1)50.88; (2)50.73; (3)50.18</td>
<td>(1)0.69; (2)0.70; (3)0.69</td>
<td>(1)4.11; (2)4.19; (3)4.21</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>4-A</td>
<td>Colour of Oak Wood</td>
<td>SCI</td>
<td>(1)54.82; (2)54.75; (3)54.87</td>
<td>(1)9.80; (2)9.99; (3)9.99</td>
<td>(1)28.25; (2)28.71; (3)28.77</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>4-A</td>
<td>Colour of Oak Wood</td>
<td>SCE</td>
<td>(1)54.83; (2)54.76; (3)54.90</td>
<td>(1)9.82; (2)9.99; (3)9.99</td>
<td>(1)28.33; (2)38.80; (3)28.83</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>5-A</td>
<td>Colour of Walnut Tree Wood</td>
<td>SCI</td>
<td>(1)46.68; (2)46.64; (3)47.00</td>
<td>(1)13.18; (2)13.26; (3)13.35</td>
<td>(1)24.08; (2)24.47; (3)24.01</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>5-A</td>
<td>Colour of Walnut Tree Wood</td>
<td>SCE</td>
<td>(1)46.47; (2)46.35; (3)46.87</td>
<td>(1)13.29; (2)13.40; (3)13.42</td>
<td>(1)24.45; (2)24.97; (3)24.32</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>6-A</td>
<td>Naples or Patent Yellow</td>
<td>SCI</td>
<td>(1)56.95; (2)57.18; (3)56.79</td>
<td>(1)18.87; (2)19.11; (3)18.86</td>
<td>(1)50.25; (2)49.61; (3)49.88</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>6-A</td>
<td>Naples or Patent Yellow</td>
<td>SCE</td>
<td>(1)56.99; (2)57.18; (3)56.79</td>
<td>(1)18.95; (2)19.07; (3)18.89</td>
<td>(1)50.00; (2)49.29; (3)50.00</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>6-B</td>
<td>Naples or Patent Yellow</td>
<td>SCI</td>
<td>(1)67.35; (2)65.59; (3)67.38</td>
<td>(1)14.75; (2)14.65; (3)14.84</td>
<td>(1)40.09; (2)40.20; (3)41.11</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>6-B</td>
<td>Naples or Patent Yellow</td>
<td>SCE</td>
<td>(1)67.33; (2)65.49; (3)67.33</td>
<td>(1)14.74; (2)14.65; (3)14.84</td>
<td>(1)40.00; (2)40.13; (3)41.00</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>7-A</td>
<td>Chrome Yellow</td>
<td>SCI</td>
<td>(1)80.42; (2)80.39; (3)80.28</td>
<td>(1)5.34; (2)5.23; (3)5.24</td>
<td>(1)109.0; (2)108.6; (3)109.1</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>7-A</td>
<td>Chrome Yellow</td>
<td>SCE</td>
<td>(1)80.34; (2)80.32; (3)80.22</td>
<td>(1)5.33; (2)5.21; (3)5.22</td>
<td>(1)108.2; (2)107.8; (3)108.3</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>7-B</td>
<td>Chrome Yellow</td>
<td>SCI</td>
<td>(1)84.64; (2)84.81; (3)84.65</td>
<td>(1)1.49; (2)1.20; (3)1.61</td>
<td>(1)79.99; (2)81.04; (3)78.80</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>7-B</td>
<td>Chrome Yellow</td>
<td>SCE</td>
<td>(1)84.46; (2)84.81; (3)84.65</td>
<td>(1)1.49; (2)1.20; (3)1.65</td>
<td>(1)79.85; (2)80.87; (3)78.65</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>8-A</td>
<td>Buff Colour</td>
<td>SCI</td>
<td>(1)60.97; (2)60.95; (3)60.85</td>
<td>(1)19.58; (2)19.64; (3)19.79</td>
<td>(1)37.70; (2)37.78; (3)37.88</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>8-A</td>
<td>Buff Colour</td>
<td>SCE</td>
<td>(1)60.93; (2)60.93; (3)60.85</td>
<td>(1)19.54; (2)19.60; (3)19.75</td>
<td>(1)37.69; (2)37.35; (3)37.83</td>
</tr>
<tr>
<td>Sample Date</td>
<td>ID #</td>
<td>Color Name</td>
<td>SCI</td>
<td>SCE</td>
<td>L* Value (1-3)</td>
<td>a* Value (1-3)</td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td>------------</td>
<td>-----</td>
<td>-----</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>8-B</td>
<td>Buff Colour</td>
<td>SCI</td>
<td>(1)72.16; (2)72.32; (3)72.61</td>
<td>(1)15.43; (2)15.26; (3)14.74</td>
<td>(1)29.47; (2)29.10; (3)28.43</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SCE</td>
<td>(1)71.95; (2)72.14; (3)72.49</td>
<td>(1)15.45; (2)15.26; (3)14.74</td>
<td>(1)29.57; (2)29.19; (3)28.44</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>9-A</td>
<td>Olive Green</td>
<td>SCI</td>
<td>(1)25.35; (2)25.19; (3)25.64</td>
<td>(1)10.86; (2)10.75; (3)10.66</td>
<td>(1)18.46; (2)18.06; (3)26.79</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SCE</td>
<td>(1)20.92; (2)21.04; (3)21.83</td>
<td>(1)12.53; (2)12.25; (3)30.99</td>
<td>(1)35.00; (2)35.04; (3)32.42</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>9-B</td>
<td>Olive Green</td>
<td>SCI</td>
<td>(1)30.48; (2)30.27; (3)30.04</td>
<td>(1)11.09; (2)11.51; (3)11.87</td>
<td>(1)32.56; (2)33.41; (3)34.86</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>SCE</td>
<td>(1)30.11; (2)29.55; (3)25.07</td>
<td>(1)11.20; (2)11.67; (3)14.28</td>
<td>(1)34.18; (2)36.31; (3)42.29</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>10-A</td>
<td>Blue</td>
<td>SCI</td>
<td>(1)71.23; (2)71.95; (3)70.90</td>
<td>(1)11.59; (2)11.59; (3)11.15</td>
<td>(1)15.84; (2)16.31; (3)15.64</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>10-A</td>
<td>Blue</td>
<td>SCE</td>
<td>(1)70.96; (2)71.15; (3)70.32</td>
<td>(1)11.58; (2)11.71; (3)11.37</td>
<td>(1)15.61; (2)16.22; (3)15.85</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>10-B</td>
<td>Blue</td>
<td>SCI</td>
<td>(1)35.52; (2)35.33; (3)34.42</td>
<td>(1)8.53; (2)8.52; (3)8.54</td>
<td>(1)23.33; (2)23.37; (3)23.40</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>10-B</td>
<td>Blue</td>
<td>SCE</td>
<td>(1)33.45; (2)33.03; (3)32.99</td>
<td>(1)9.32; (2)9.41; (3)9.04</td>
<td>(1)24.42; (2)24.60; (3)24.03</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>11-A</td>
<td>Another Blue made with Saxon Blue</td>
<td>SCI</td>
<td>(1)87.94; (2)87.99; (3)88.39</td>
<td>(1)1.92; (2)1.90; (3)2.00</td>
<td>(1)2.30; (2)2.24; (3)1.61</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>11-A</td>
<td>Another Blue made with Saxon Blue</td>
<td>SCE</td>
<td>(1)87.12; (2)87.32; (3)88.03</td>
<td>(1)9.32; (2)9.41; (3)9.04</td>
<td>(1)2.04; (2)2.02; (3)1.99</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>11-B</td>
<td>Another Blue made with Saxon Blue</td>
<td>SCI</td>
<td>(1)35.52; (2)35.33; (3)34.42</td>
<td>(1)8.53; (2)8.52; (3)8.54</td>
<td>(1)6.78; (2)7.69; (3)6.90</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>11-B</td>
<td>Another Blue made with Saxon Blue</td>
<td>SCE</td>
<td>(1)33.45; (2)33.03; (3)32.99</td>
<td>(1)9.32; (2)9.41; (3)9.04</td>
<td>(1)6.62; (2)7.59; (3)6.76</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>12-A</td>
<td>Green for Doors, Shutters, Iron or Wooden Railing, Palsades, Balustrades, and for All Articles Exposed to the Air</td>
<td>SCI</td>
<td>(1)56.75; (2)55.44; (3)53.33</td>
<td>(1)28.33; (2)29.08; (3)29.87</td>
<td>(1)14.01; (2)13.09; (3)12.61</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>12-A</td>
<td>Green for Doors, Shutters, Iron or Wooden Railing, Palsades, Balustrades, and for All Articles Exposed to the Air</td>
<td>SCE</td>
<td>(1)54.48; (2)52.73; (3)50.55</td>
<td>(1)30.25; (2)31.57; (3)32.67</td>
<td>(1)15.31; (2)14.67; (3)14.20</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>12-B</td>
<td>Green for Doors, Shutters, Iron or Wooden Railing, Palsades, Balustrades, and for All Articles Exposed to the Air</td>
<td>SCI</td>
<td>(1)58.40; (2)57.35; (3)58.06</td>
<td>(1)28.87; (2)27.82; (3)28.61</td>
<td>(1)12.97; (2)11.63; (3)12.98</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>12-B</td>
<td>Green for Doors, Shutters, Iron or Wooden Railing, Palsades, Balustrades, and for All Articles Exposed to the Air</td>
<td>SCE</td>
<td>(1)55.94; (2)54.58; (3)55.21</td>
<td>(1)30.95; (2)30.15; (3)30.10</td>
<td>(1)14.27; (2)13.13; (3)13.99</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>12-C</td>
<td>Green for Doors, Shutters, Iron or Wooden Railing, Palsades, Balustrades, and for All Articles Exposed to the Air</td>
<td>SCI</td>
<td>(1)30.86; (2)35.14; (3)30.41</td>
<td>(1)63.56; (2)59.56; (3)65.53</td>
<td>(1)5.47; (2)6.76; (3)4.85</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>12-C</td>
<td>Green for Doors, Shutters, Iron or Wooden Railing, Palsades, Balustrades, and for All Articles Exposed to the Air</td>
<td>SCE</td>
<td>(1)29.18; (2)32.89; (3)27.90</td>
<td>(1)67.90; (2)66.02; (3)70.25</td>
<td>(1)5.73; (2)7.06; (3)5.18</td>
</tr>
<tr>
<td>Sample Date</td>
<td>ID #</td>
<td>Color Name</td>
<td>SCE/SCI</td>
<td>L* Value (1-3)</td>
<td>a* Value (1-3)</td>
<td>b* Value (1-3)</td>
</tr>
<tr>
<td>-------------</td>
<td>-------</td>
<td>-----------------------</td>
<td>---------</td>
<td>---------------</td>
<td>---------------</td>
<td>---------------</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>13-A</td>
<td>Compound Green</td>
<td>SCI</td>
<td>(1)59.20; (2)57.91; (3)57.15</td>
<td>(1)-12.45; (2)-12.08; (3)-11.99</td>
<td>(1)-14.82; (2)-13.99; (3)-13.50</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>13-A</td>
<td>Compound Green</td>
<td>SCE</td>
<td>(1)59.18; (2)57.90; (3)57.16</td>
<td>(1)-12.41; (2)-12.03; (3)-11.92</td>
<td>(1)-14.58; (2)-13.75; (3)-13.26</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>13-B</td>
<td>Compound Green</td>
<td>SCI</td>
<td>(1)62.44; (2)62.70; (3)63.00</td>
<td>(1)-9.91; (2)-9.87; (3)-9.99</td>
<td>(1)17.01; (2)16.78; (3)6.68</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>13-B</td>
<td>Compound Green</td>
<td>SCE</td>
<td>(1)62.38; (2)62.62; (3)62.91</td>
<td>(1)-9.82; (2)-9.80; (3)-9.92</td>
<td>(1)17.14; (2)16.93; (3)6.83</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>13-C</td>
<td>Compound Green</td>
<td>SCI</td>
<td>(1)58.18; (2)56.48; (3)57.06</td>
<td>(1)-16.86; (2)-16.87; (3)-17.02</td>
<td>(1)-15.70; (2)-15.88; (3)-16.03</td>
</tr>
<tr>
<td>8/22/2018</td>
<td>13-C</td>
<td>Compound Green</td>
<td>SCE</td>
<td>(1)56.77; (2)55.22; (3)55.80</td>
<td>(1)-17.44; (2)-17.41; (3)-17.56</td>
<td>(1)-15.89; (2)-16.03; (3)-16.46</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>14-B</td>
<td>Chestnut</td>
<td>SCI</td>
<td>(1)13.92; (2)13.70; (3)14.77</td>
<td>(1)10.83; (2)10.61; (3)10.93</td>
<td>(1)19.43; (2)19.12; (3)19.82</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>14-A</td>
<td>Chestnut</td>
<td>SCE</td>
<td>(1)20.26; (2)20.09; (3)20.39</td>
<td>(1)0.68; (2)0.00; (3)1.16</td>
<td>(1)30.30; (2)20.00; (3)30.52</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>14-B</td>
<td>Chestnut</td>
<td>SCI</td>
<td>(1)24.50; (2)24.88; (3)24.43</td>
<td>(1)23.00; (2)23.18; (3)23.00</td>
<td>(1)35.49; (2)35.18; (3)35.23</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>14-B</td>
<td>Chestnut</td>
<td>SCE</td>
<td>(1)24.98; (2)17.25; (3)17.43</td>
<td>(1)23.24; (2)29.61; (3)29.96</td>
<td>(1)35.45; (2)29.98; (3)29.90</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>15-A</td>
<td>Chocolate</td>
<td>SCI</td>
<td>(1)10.30; (2)10.55; (3)10.29</td>
<td>(1)0.07; (2)0.10; (3)0.07</td>
<td>(1)10.03; (2)0.05; (3)0.03</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>15-A</td>
<td>Chocolate</td>
<td>SCE</td>
<td>(1)0.09; (2)0.09; (3)0.09</td>
<td>(1)0.00; (2)0.00; (3)0.00</td>
<td>(1)10.00; (2)0.00; (3)0.00</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>15-B</td>
<td>Chocolate</td>
<td>SCI</td>
<td>(1)11.03; (2)11.88; (3)11.66</td>
<td>(1)16.77; (2)16.27; (3)16.45</td>
<td>(1)18.73; (2)19.76; (3)19.56</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>15-B</td>
<td>Chocolate</td>
<td>SCE</td>
<td>(1)58.01; (2)58.21; (3)57.61</td>
<td>(1)19.02; (2)19.33; (3)19.35</td>
<td>(1)13.66; (2)14.00; (3)12.97</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>16-A</td>
<td>Pompadour</td>
<td>SCI</td>
<td>(1)11.19; (2)11.36; (3)11.81</td>
<td>(1)20.15; (2)18.61; (3)19.47</td>
<td>(1)19.08; (2)19.33; (3)18.44</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>16-A</td>
<td>Pompadour</td>
<td>SCE</td>
<td>(1)12.11; (2)11.77; (3)11.36</td>
<td>(1)22.80; (2)18.26; (3)19.07</td>
<td>(1)13.85; (2)19.98; (3)19.36</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>16-B</td>
<td>Pompadour</td>
<td>SCI</td>
<td>(1)33.50; (2)33.63; (3)33.42</td>
<td>(1)18.49; (2)19.05; (3)19.02</td>
<td>(1)22.77; (2)23.26; (3)23.93</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>16-B</td>
<td>Pompadour</td>
<td>SCE</td>
<td>(1)48.49; (2)48.40; (3)46.19</td>
<td>(1)19.94; (2)20.49; (3)19.04</td>
<td>(1)14.48; (2)14.33; (3)10.52</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>16-B-1</td>
<td>Pompadour</td>
<td>SCI</td>
<td>(1)58.03; (2)47.84; (3)38.19</td>
<td>(1)13.81; (2)13.97; (3)13.73</td>
<td>(1)12.49; (2)12.64; (3)12.78</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>16-B-1</td>
<td>Pompadour</td>
<td>SCE</td>
<td>(1)0.09; (2)0.39; (3)0.09</td>
<td>(1)0.00; (2)0.81; (3)0.00</td>
<td>(1)10.00; (2)0.51; (3)0.00</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>17-A</td>
<td>Vermilion (Red 1)</td>
<td>SCI</td>
<td>(1)38.72; (2)38.75; (3)38.90</td>
<td>(1)54.38; (2)55.51; (3)55.75</td>
<td>(1)43.62; (2)45.96; (3)48.02</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>17-A</td>
<td>Vermilion (Red 1)</td>
<td>SCE</td>
<td>(1)38.72; (2)38.55; (3)38.64</td>
<td>(1)54.05; (2)55.46; (3)55.79</td>
<td>(1)42.79; (2)45.98; (3)46.38</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>18-A</td>
<td>Venetian Red (Red 2)</td>
<td>SCI</td>
<td>(1)27.26; (2)27.25; (3)27.27</td>
<td>(1)39.10; (2)39.00; (3)38.89</td>
<td>(1)45.52; (2)45.58; (3)45.57</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>18-A</td>
<td>Venetian Red (Red 2)</td>
<td>SCE</td>
<td>(1)27.41; (2)22.38; (3)27.59</td>
<td>(1)41.58; (2)41.61; (3)41.75</td>
<td>(1)38.48; (2)38.43; (3)38.78</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>18-A-1</td>
<td>Venetian Red (Red 2)</td>
<td>SCI</td>
<td>(1)26.13; (2)27.62; (3)32.62</td>
<td>(1)40.00; (2)41.53; (3)39.38</td>
<td>(1)44.87; (2)47.44; (3)45.35</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>18-A-1</td>
<td>Venetian Red (Red 2)</td>
<td>SCE</td>
<td>(1)26.45; (2)27.95; (3)32.11</td>
<td>(1)39.73; (2)41.25; (3)39.81</td>
<td>(1)45.41; (2)47.95; (3)44.84</td>
</tr>
</tbody>
</table>
Appendix C.4: Original CIE L*a*b* Color Measurements of Remade Paints (3 per Paint Color)

With the exception of *Vermilion (Red 1)* [17-A], these are the original CIE L*a*b* values for paint colors eventually remade without the Lead(II) Acetate drier. *Vermilion (Red 1)* was also made without and reapplied without its litharge (vitrilo) drier.

<table>
<thead>
<tr>
<th>Sample Date</th>
<th>ID#</th>
<th>Color Name</th>
<th>SCI/SCE</th>
<th>L* Value (1-3)</th>
<th>a* Value (1-3)</th>
<th>b* Value (1-3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>7/24/2018</td>
<td>3-A</td>
<td>Light Grey</td>
<td>SCI</td>
<td>[1]73.83; [2]73.71; [3]74.10</td>
<td>[1]-0.71; [2]-0.71; [3]-0.65</td>
<td>[1]-2.41; [2]-2.44; [3]-2.34</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>3-A</td>
<td>Light Grey</td>
<td>SCE</td>
<td>[1]73.57; [2]73.38; [3]73.89</td>
<td>[1]-0.57; [2]-0.58 [3]-0.62</td>
<td>[1]-2.22; [2]-2.27; [3]-2.15</td>
</tr>
<tr>
<td>Sample Date</td>
<td>ID#</td>
<td>Color Name</td>
<td>SCI/SCE</td>
<td>L* Value [1-3]</td>
<td>b* Value [1-3]</td>
<td>c* Value [1-3]</td>
</tr>
<tr>
<td>-------------</td>
<td>------</td>
<td>-----------------------</td>
<td>---------</td>
<td>----------------</td>
<td>----------------</td>
<td>----------------</td>
</tr>
<tr>
<td>7/24/2018</td>
<td>17-A</td>
<td>Vermilion (Red 1)</td>
<td>SCE</td>
<td>(1) 25.41; (2) 35.50; (3) 35.35</td>
<td>(1) 63.23; (2) 63.20; (3) 63.17</td>
<td>(1) 60.89; (2) 61.05; (3) 60.80</td>
</tr>
</tbody>
</table>
acrylic latex paint 4, 6
Alderson, Caroline 12
alkyd paint 4, 6
Another Blue made with Saxon Blue (11-A, 11-B) 36, 57, 58, 62, 64, 71
The Art of Painting in Oil 12, 15, 18, 19, 26, 29, 30, 31

B
Baltimore 2, 15, 30, 31
Baty, Patrick 12, 19
binder 4, 9, 10, 11, 21-22, 23, 37, 39-41, 45, 68, 69, 70-71
Black (1-A) 36, 45, 63, 64
Blue (10-A, 10-B) 36, 64
Boston 2, 15, 20
brushes 10, 18, 43, 46, 56, 57, 58, 59, 63, 70
Buck, Susan 7
Buff Colour (8-A, 8-B) 36, 58, 61, 64, 71
Butler, Marigene 7

C
casein paint 3, 20, 25
calcium carbonate 10, 27
Cennini, Cennino 17, 18
Child, Thomas 20
Chestnut (14-A, 14-B) 36, 64
Chocolate (15-A, 15-B) 36, 64
Chrome Yellow (7-A, 7-B) 36, 50, 59, 64, 71
Colonial era 13, 17, 19-21, 27
Colonial Williamsburg 5, 6
colourmen 3, 16, 18, 21, 37
color matching 5, 30, 33, 74
color measurements 65-66, 74-75
CIE L a b 65
CIE L*a*b* 65, 66
Colour of Oak Wood (4-A) 36, 44, 45, 54, 58, 59, 64

D
Directions for House and Ship Painting 16, 19
drrier 6, 39-41, 47, 48-54, 56, 57, 58, 59, 63, 64, 71

E
Early Republic era 1, 16, 42

G
Gibbs, John 20
Goodwillie, Erika Sanchez 7, 10
Green for Doors, Shutters, Iron or Wooden Railing, Palisades, Balustrades, and for All Articles Exposed to the Air (12-A, 12-B, 12-C) 36, 40, 45, 54, 55, 61, 62, 64, 69, 70

H
Harboe, Thomas 12
house painting 2, 3, 12, 14, 15, 16, 17, 18, 19, 20, 21, 30, 31, 32, 39
house painters 17, 18, 21, 20, 22, 23, 24, 25, 33, 37, 44, 56, 69, 70, 71, 72, 73, 76
guilds 17, 20
house paints 4, 29, 41, 67
color trends 25-28, 39
historic 1, 3, 4, 5, 6, 7, 8, 9, hand-ground/made 1, 3, 5, 6, 7, 9, 22, 23, 67, 74
traditional 1, 3, 4, 6, 11, 16, 23, 34, 39, 67

I
Il libro dell’arte, 18
INDEX

J

Jefferson, Thomas 25

K

Kenmore 7

L

L’Art du peintre, doreur, vern
lead white 10, 25, 26, 27, 37, 38, 44, 45, 46, 47, 72
Lead(II) Acetate 41, 53, 58, 59, 63, 71
Light Grey (3-A, 3-B) 36, 45, 64
London 2, 12, 14, 15, 18, 19, 20, 72
Lime wash 3, 20, 25
linseed oil 4, 9, 10, 11, 21, 22, 23, 36, 37, 38, 39, 40, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 56, 58, 63, 67, 68, 69, 70-71, 75

M

Matero, Frank G. 12
Metropolitan Museum of Art 7
microscopical analysis 4, 13
Mills, Christopher 7
Monticello 7, 25
Montpelier 7
Mosca, Matthew 7
Mount Vernon 7
mullers/mulling 10, 11, 21, 23, 43, 47, 48, 50, 53, 54, 59, 61, 64, 70
Myers, Catherine S. 5

N

Naples or Patent Yellow (6-A, 6-B) 36, 44, 59, 64, 71
National Museum of American History 6

O

Olive Green (9-A, 9-B) 36, 45, 64, 69, 71

oil paints
  aging 1, 3, 4, 33, 75
  hand-ground/made 1, 3, 5, 6, 7, 8, 9, 22, 23, 39, 67, 74
  replication 5, 6, 7, 8, 9, 10, 11, 59, 74
Ohrstrom, Chris 6

P

paint exposure 5
The Painter’s and Colourman’s Complete Guide 29, 32, 33, 34, 35, 39, 40
palette 1, 4, 29, 31, 35, 36, 37, 38, 44-59, 59-65, 67, 73, 75
  replication projects 11-13, 30, 32, 34, 72
palette knives 10, 47, 48, 49, 52, 53
Penn, Theodore Zuk 11
Philadelphia 2, 7, 15
Philadelphia Museum of Art 7
Phillips, Morgan 7
pigment(s) 1, 3, 4, 6, 9, 10, 13, 15, 16, 18, 21-22, 23, 25, 26, 27, 32, 33-39, 41, 43, 44, 45, 47, 48-53, 54, 55, 56, 57, 58, 61, 62, 64, 67-70, 72, 73, 75
  bone black 26, 48, 50
  Burgundy red ochre 50, 53, 72
  caput mortuum violet 53, 64, 69, 70
  charcoal black 27
  chrome yellow 16, 21, 25
  English red 50, 53
  furnace (lamp) black 38, 48, 50, 55, 72
  hematite 27
  Prussian blue 16, 18, 21, 25, 27, 48, 49, 50, 53, 54, 55, 61, 62, 68, 69, 72
  raw umber 50, 51
  red iron oxide (ochre) 26, 38, 72
  smalt 50, 51, 52
  stil de grain 50, 51, 53, 61, 68
  titanium white 10, 21
  umber 27
Van Dyke brown 48, 49, 50
vermilion 27, 35, 50, 51, 53
Venetian red 35, 50, 51, 55, 62
verdigris 53, 61, 64
yellow ochre 27, 68
French ochre 39, 50, 53
yellow iron oxide natural 50, 53
plaster substrate(s) 20, 25, 27, 42
Pompadour (16-A, 16-B, 16-B-1) 62, 64, 70, 71
poppy oil 22, 40
primer 45-47, 71, 73

R

Reynolds, Hezekiah 12, 16, 19, 27, 33

S

Schedula diversarum atrium 17
size 45-47
Smith, John 12, 15, 18, 19, 26
Stratford Hall 7, 8, 9
Stenton 7

T

Theophilus 17
thinner 21-22, 25, 39, 40, 45, 46, 56, 58, 63, 64, 70-71
Tingry, Pierre-François 1, 2, 3, 4, 13-16, 19, 24, 29, 32, 34, 35, 37, 39, 40, 41, 43, 44, 45, 46, 54, 56, 61
titanium white 10, 21
treatise(s) 1, 2, 3, 4, 6, 11, 12, 13, 14, 15, 16-19, 20, 21, 24, 27, 29
turpentine (turpenoid) 21-22, 23, 25, 39, 40, 45, 46, 56, 58, 63, 64, 70-71

V

varnish 1, 2, 3, 11, 14, 22, 27, 33, 44, 69
Venetian Red (Red 2) [18-A, 18-A-1] 35, 36, 45, 64
Vermilion (Red 1) [17-A] 35, 36, 45, 63, 64
violin rosin medium 40, 41, 45, 69, 71
vitrail (litharge) 41, 53, 58, 63, 71

W

walnut oil 22, 40, 41, 45, 69, 71
Washington, George 7, 25
Washington, DC 6, 15
Watin, J.F. 14
White (2-A, 2-B) 36, 54, 58, 64
wood substrate(s) 3, 5, 12, 17, 20, 21, 22, 25, 26, 27, 42, 43, 45, 70, 75
Welsh, Frank S. 13
Wollenberg, Peter 12