Historical recipes for preparatory layers for oil paintings in manuals, manuscripts and handbooks in North West Europe, 1550-1900: analysis and reconstructions

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General conclusions

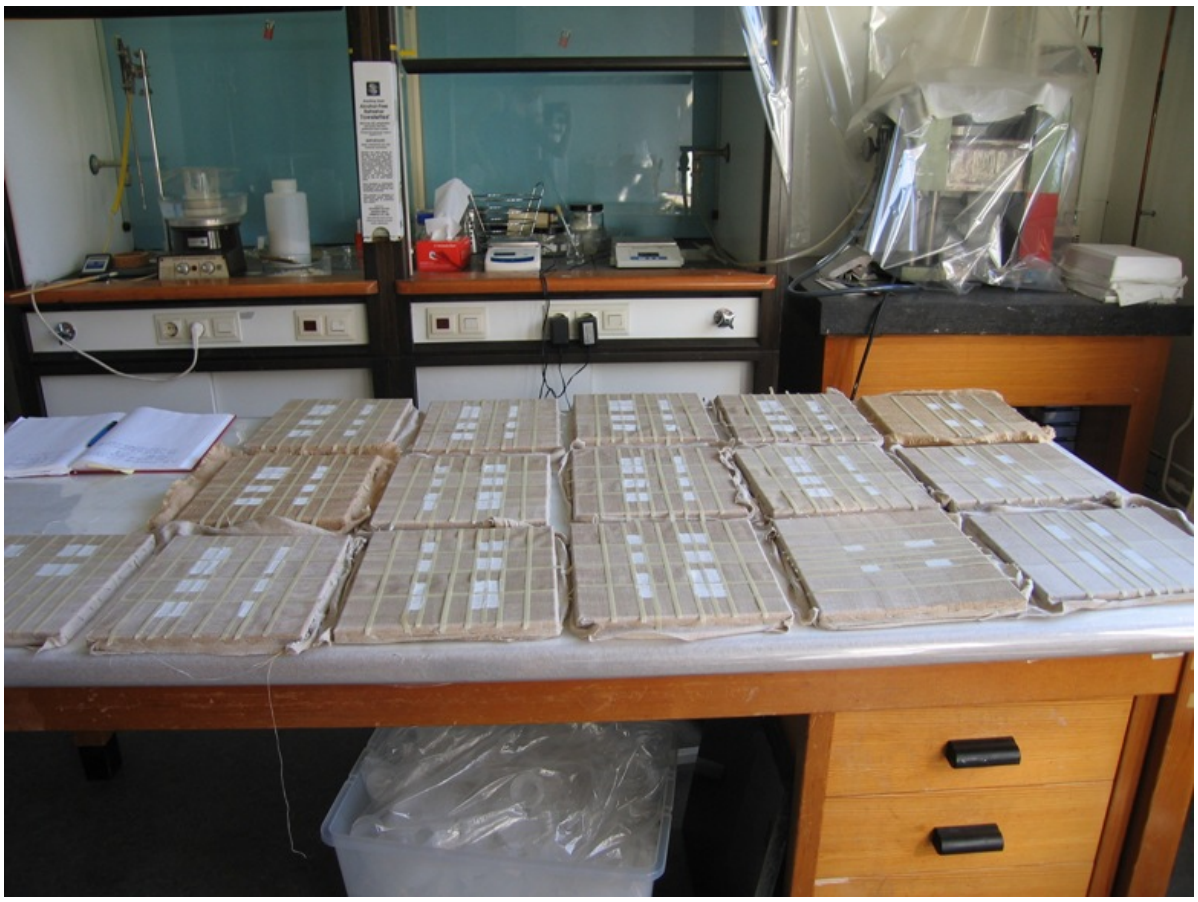

Figure 16.1 Reconstructions of animal glue size layers, the topic of Chapter 11.

Chapter 16 General conclusions

Priming is a colour laid on the cloth, &c. previous to those which are to form the picture

Compendium 1808.[1]

While the 1808 *Compendium* makes the preparation of supports for painting sound simple, this dissertation has demonstrated that preparatory layers are more than a simple layer of colour, and that there is much to learn about their nature from historical recipes. The choice in materials, the layer build-up, ground colour, ground absorbency, the questions who applied the grounds and how grounds influenced painting technique in subsequent layers; these are all aspects that need to be studied for a good understanding of the subject. And a thorough understanding is indeed required in order to answer important questions relating to both painting technique and paint degradation. This has been shown in the case studies presented.

16.1 The approach: recipe analysis, reconstructions, comparison with paintings

The approach that was followed in this thesis rested on three pillars: recipe analysis, reconstruction, and comparison between recipes and actual paintings. Employed in combination, these methods have led to a significant increase in our understanding of preparatory layer technique and possible mechanisms of their degradation.

Chapters 8 to 15 developed potential avenues of research applying this methodology. Recipes were analysed, reconstructed and compared to actual paintings in order to answer questions regarding subjects such as the role of commercial manufacturers, the stability of the preparatory system, flour paste and starch paste size layers and grounds, the quality of lead white employed in ground layers and imprimatura binders.

A second intention in writing this thesis was to create a body of knowledge that can be consulted in order to learn more about the material composition and the degradation of paintings dating from a long time period and large geographical area. This has resulted in Chapters 5 to 7 of Part I, which together form a detailed overview of the recipe texts and can be used as a reference tool about the materials, layer build-up and application methods of preparatory layers in North West Europe. It anticipated that this overview will be of unique value both for the conservation field and the field of (technical) art history.

[1] *Compendium* 1808: 67

16.2.1 Recipes for preparatory layers: from a fragmented image to continuity

The systematic description and analysis of the contents of the collected recipes has resulted in an increased level of understanding about trends and developments of preparatory layers, has provided a broader geographical and chronological context, has led to insights into the differences between the preparatory systems advised for the different supports and has resulted in a better understanding of developments in the characteristics of preparatory layers, such as ground colour. Through the wide scope of this investigation, a connection has been established between the results of previous studies that focused on shorter time periods or smaller geographical areas. This dissertation has placed such studies in a wider context.

Investigating individual recipes and ingredients in the context of a large collection of recipes led to an improved insight into their nature. This is well illustrated with the example of 'Spanish white'. By comparing descriptions of 'Spanish white' in different recipes, it was demonstrated that, while this term often refers to calcium carbonate, it was also used for a calcium carbonate that had undergone a specific treatment, and for bismuth white or a white clay (*see* Chapter 6). As all these materials have different chemical compositions, such information is very important, both for investigations into the chemistry and degradation of preparatory layers and for investigations that aim to understand artists' procedures and motives. In Chapter 13, the often complicated and confusing history of lead white terminology was clarified. The fact that the term Venetian lead white was synonymous in seventeenth and eighteenth century sources with a high quality lead white, while in nineteenth century sources the same name was used for low quality lead white with extenders added, underscores the importance of investigating descriptions of materials from a long time period, before drawing conclusions about individual recipes.

Bar graphs played an important role throughout the text, providing visual summaries of trends and chronological developments. They were very important for example in analysing the ground colours described in the recipes. By employing bar graphs, patterns emerged and could be followed throughout time. The introduction of bar graphs may even be called crucial for the success of the recipe analyses, as they provided the means to obtain an overview over such a sizable number of recipes.[2]

16.2.2 Reconstructions for the interpretation of recipes and for comparisons with actual paintings

Reconstructions of historical recipes were highly important in this dissertation. They cted as a bridge between written texts and phenomena observed in actual paintings. Such bridges proved to be needed. Visual observations and instrumental analysis are necessarily limited to the finished, aged and degraded painting and the influence of specific layers on the material quality or on paint handling often remains hidden, as do the pathways of a painting's degradation. Whereas historical recipe texts provide information

[2] As discussed also in the introduction, a certain level of standardisation was unavoidable for these bar graphs to remain understandable. Therefore, they should not be studied in isolation but in their context inside chapters that examine the nature, quality and preparation of the layers.

about the characteristics of the freshly produced painting, they are at times difficult to connect to the aged painting without experiencing the actual effects of the processes described. This was demonstrated, for example, in the study on size layers. Historical recipes paid attention frequently to size layers, while these layers hardly receive attention in paintings investigations, due to their unobtrusive nature. As a result, knowledge about the role of size layers in the layer build-up remained limited to hypotheses, based on historical comments and general knowledge about the nature of modern glues. Reconstructions were able to fill this lacuna. Analysis of the recipe collection revealed important information about the historical preparation and application of animal glue and of flour or starch based size layers, recipes provided sufficient information to allow for reconstructions with historically appropriate materials, and reconstructions demonstrated which properties were important for the use of these materials as size layers.

Some of these reconstructions led to surprising conclusions. For instance, they demonstrated that – contrary to expectations – a poor glue quality (alum tawed goat's skin glue) is actually a very good choice for a size layer. The fact that a visual relationship was found between pinholes in reconstructions of animal glue size layers and pinholes in a painting by Vincent van Gogh, demonstrated how reconstructions can inform us on plausible causes for defects observed in actual paintings.

Reconstructions of flour paste or starch paste size layers (and ground layers), provided insight into the properties and visual characteristics of this other type of size layer. Starch and flour paste were regularly advised in historical recipes, but are found only rarely in painting analyses. Cross sections of the reconstructions demonstrate that flour paste and starch paste grounds are visually very similar to other size and ground materials used in historical paintings. By comparing actual ground samples with these reference samples, future researchers can be alerted to the possibility that such pastes may be present.

Two other reconstruction studies, of lead white cleaning and decanting methods and of streaky imprimatura binders, demonstrated how reconstructions can complement and help explain the results of instrumental analysis.
Lead white cleaning and decanting reconstructions (Chapter 14) were executed in relation to recent research into the role that this pigment plays in the saponification and degradation of oil paint layers. Reconstructions demonstrated that not only lead white washing, but also decanting procedures described in historical recipes influence the chemical composition of the pigment, more precisely the balance between neutral and basic lead carbonate. Since the reactivity of both grades of lead white differs, the reconstructions showed that lead white purification methods co-determine the stability of the pigment in oil, i. e. it's tendency to saponify. For preparatory layers, a lower grade of lead white was sometimes selected, as described in a number of recipes (*see* Paragraph 13.8) and found in Vermeer's *The art of painting*. This may be a factor in explaining the high degree of saponification of some lead white containing preparatory layers.

Due to their thinness, streaky imprimaturas are difficult to sample and analyse. While some prior studies included binder analysis of the imprimatura layer, the fact that recent investigations reveal that paint binder components are mobile even in aged paintings, limits the possibility for the positive identification of the binder of such thin layers.

Reconstructions provide another approach, which proved to be helpful in testing the plausibility of the different hypotheses of earlier researchers about the nature of imprimatura binders. In Chapter 15, the working properties of several binders were investigated in order to find out if they could actually be used to prepare thin, streaky layers on a chalk and glue ground. These reconstructions demonstrated that certain binders are very unlikely candidates for streaky imprimaturas, narrowing down the list of possibilities.

While Chapters 11 to 15 proved the value of reconstructions in creating an improved understanding of painting technique and paint degradation, this dissertation has in addition demonstrated how reconstructions may be employed to interpret details in the recipes themselves. This is exemplified for instance with the animal glue consistency tests, regularly described in historical recipes, and employed in Chapter 11 to decide glue concentration for size layer reconstructions. Reconstructions demonstrated why consistency was particularly important during the application stage. It was shown to influence both application method, glue absorbance into the support and the amount of glue that was needed for a sizing layer. Through reconstructions, the effectiveness of the historical testing methods was shown.

Throughout Part II, attention was paid to a careful selection of raw materials for reconstructions. As the reconstructions produced for this dissertation serve as a bridge between the historical recipes and actual paintings, direct comparisons needed to be possible. For this reason, it was very important to perform investigations into the historical properties of materials such as lead white, animal skins employed for glue extraction, historical flour or linseed oil cultivars. In particular Chapter 12, which contains a very detailed description of the steps taken to ensure appropriate materials, exemplifies how an investigation into appropriate materials may evolve. By working with traditional materials, modern chemicals were excluded, such as flow agents, chemical bleaching agents and fungicides. In addition, preparation protocols designed after a thorough analysis of seventeenth to nineteenth century recipes, were shown to differ from modern preparation methods in details that influence the chemical composition of the ingredient.

It is evident that exact copies cannot be created of the systems that were employed during certain time periods. Only approximations are possible. In all cases, compromises were unavoidable, and conclusions were adapted due to these compromises. Nevertheless, investigations executed to find historically appropriate materials, such as alum tawed goat's leather (Chapter 11), and to determine how such materials were prepared and employed according to historical methods, did bring the results closer to historical practice. These efforts have been proven worthwhile as they resulted in insights into historical painting practice that could not have been obtained using materials which have undergone modern processing.

16.2 Authors' intentions and artists' motives

Recipes have shown themselves to be a rich source of information. They are much more than lists of ingredients and procedure descriptions. Authors often included explanations of their reasons to advise certain materials or techniques, or to advise against the use of others. Analysis of the sources has demonstrated how their personal experience and their position in society influenced the importance authors attached to certain arguments, and how these factors had a reflection upon the character of the advice given to the readers of recipe books.

16.2.1 The character of the source and its influence on the type of advice provided

Investigations of those sources that provide in-depth information on the decision processes involved in selecting a ground, demonstrated that considerations of a very different nature steered the advice of the authors. While some authors focused on art theoretical considerations, others concentrated on the features of the fresh materials and their influence on the working properties and visual characteristics of the fresh painting.[3] And the properties of the aged materials also carried weight. In addition, availability and costs of materials were mentioned in historical sources as factors that co-determined the choice of preparatory system. The influence of material costs was clear in recipes in the De Mayerne manuscript (1620-44) and those provided by Bouvier (1827),[4] attention to costs was also evident in the Winsor & Newton Archive (nineteenth century), where reference was made to the use of left-overs and lower quality products for certain applications that were less crucial, such as sizing the reverse sides of millboard supports.[5]

Which category of motivation carried most weight, depended on the character of the source, which itself expressed the personality, education and and environment of the author.
The role of art theory in guiding decisions regarding painting practice, was noticeable in particular in the context of books published under the influence of French Academic thinking, (e.g. those by Félibien, De Piles, Dupuy du Grez). There, practice was closely linked to art theory or art history. This was evident not only in the order of the chapters, but also within the instructions themselves. De Piles (1673, 1684) first described the nature of painting, provided instructions on proportions and discussed colour theory, before focusing on painting utensils, materials and layer build-up. He described the merits of white grounds in the context of the examples of the 'great colourists of the past', and not only offered a historical perspective, but also incorporated scientific insights from the field of optics in his explanation of their effects.[6] Dupuy du Grez (1699) combined optics, colour theory, art history, geometry and descriptions of painting practice in his treatise, quoting from well-known authors like Vasari, Lomazzo and Vitruvius.

[3] *See* for example the recipes of Beale (1677, 1681), Beurs (1692), Sully (1809-71, 1873), Ellis (1883).
[4] De Mayerne (1620-44: 98v) introduces a first ground layer of ochre as a means to 'save' ('espargner'); Bouvier (1827: 567-70) writes that a thick ground is very expensive.
[5] W&N notebook 'A relic of Old times 1833 P.01', 183?-1876: REP029L15.
[6] De Piles, comments to translation of Du Fresnoy 1673: 215-6. In his own treatise, De Piles (1684: 126-131) also discusses ground colour from a historical perspective, relating it to the methods employed by Titian and Veronese.

In some nineteenth century sources, theory and practice were also joined, and again, a connection existed with art academies. For example, English painter Barry, in lectures read at the Royal Academy in London (1848), discussed the colour for ground layers, but also dealt with art history, design, composition, chiaroscuro and colour. Such marriages between theory and practice reveal something about the position of the authors in society, alternatively, the position they aimed for. While these authors did not hide the fact that they would 'get their hands dirty', the way their publications were organised emphasized the connection between such manual labour and intellectual efforts.

Practical instructions were dominant in the manuscripts written by De Mayerne (1620-44) and Beale (1681), but also in the Winsor & Newton Archive (19th century). In these examples, the practical nature is linked to the function of the books, as they can be considered as observations made inside a painter's studio, workshop notes or factory workfloor instructions.

A practical orientation was also evident in books published for amateur audiences. In particular books written for middle class amateur painters, of which Beurs (1692) is an early example, had as their main purpose to help their readers to produce an attractive looking, pleasing picture. Here, no or very few references were made to art theory or history. Instructions often had the character of fixed formulae. Notwithstanding these differences, however, comparison between recipes written for amateur painters and for professional painters demonstrated that, although the tone may differ and the recipe may be presented in a different context, the materials mentioned in the practical instructions themselves, as well as the ground colours described, showed no significant differences.

Besides recipe books written for artists, the recipe collection includes a number of books that were published for a very wide audience, such as encyclopaedias and dictionaries. In this thesis, recipes from such sources were discussed next to recipes from specialized books for artists and recipes from painters' manuscripts. This comparison demonstrated that sources for the general public tended to follow the same trends as those identified in more specialized sources. Although sources for the general public were not at the forefront of development, they generally described similar materials or ground colours as appeared in the more specialized manuals or manuscripts. However, a higher degree of repetition was evident in books for a the general public. For instance, the recipe of Félibien (1676) for a double ground on canvas was continued for a long time in books for wide audiences, while sources directed at artists were already describing different types of materials. A study into the different editions and occurrences of Félibien's recipe in this thesis (*See* Paragraph 5.3.1) demonstrated that by investigating such repeated recipes in the context of earlier and contemporary sources, a more balanced interpretation of recurring and frequently repeated recipes can be provided.

16.2.2 Recipes as a source of information about artists' intentions and fears

Chapter 10 demonstrated that the role of preparatory layers in determining the ageing and degradation of paintings was a recurring issue. It proved very important to investigate author considerations about ageing and degradation, as authors took such considerations as a starting point for their advice to employ certain materials in preparatory layers. As a

result, certain trends in the use of painting materials and paintings methods could not have been understood without looking at authors' worries about untimely degradation of their preparatory layers. For example, the presence of materials such as plasticizers was motivated through concerns about brittleness, and absorbent grounds were discussed in relation to the much-feared yellowing of the paint layers as a result of darkening of the oil binder. Worries about degradation also influenced the relation between artists and commercial manufacturers.

Layer thickness is a complicated issue. It was discussed historically as a factor influencing the degradation of oil paintings. However it was related not only to its effect on degradation due to flaking, but also to its effect on the aesthetic qualities of a painting. Artists needed to find a balance. Thickly applied layers were described as leading to delamination, in particular for flexible supports like canvas. But as a thin ground does not fill the canvas interstices as much as a thick ground, and therefore a thin layer could result in a disturbingly visible canvas weave. A number of authors related the decision whether a texture was considered acceptable to the subject and to the scale of the painting, and also to the viewing distance (*see* Chapter 7). They advised different preparatory layer thicknesses, depending on the nature of the painting.

This discussion about authors' descriptions of the choice in layer thickness demonstrates, that the relation between an artist and his ground was not without difficulty. A voice was given to the dual relationship between artists and grounds by Félibien (1676), who wrote: 'if one would not prime canvases and would paint straight on top, the colours would be better and would remain more beautiful…'.[7] Nevertheless Félibien considered a preparatory system unavoidable and provided recipes.
While Vibert (1892) described the ideal ground as flexible, supportive and 'equal to the occasion' like a good servant,[8] this dissertation demonstrated that in real life, the perfect ground was very difficult to achieve. Artists needed to choose between materials and techniques that all had their downsides. Materials were not as malleable and subservient as they wished them to be. Choices were complicated further by the context of the preparatory system: preparatory layers were only one step of the whole layer build-up of a painting and all layers needed to be compatible. The character of the preparatory system not only influenced later stages of painting but also had its effect on the ageing characteristics of the painting as a whole.

When looking at different trends in the chronology of preparatory layers with an awareness of this struggle, many recipes turn out to have a second, deeper level of meaning, as instructions may often be seen as attempts to gain control over both painting procedures and over the ageing of paintings.

How difficulties motivated changes in painting technique, and how these changes would subsequently result in new challenges or struggles, was demonstrated very well in the instructions for absorbent grounds. Absorbent grounds were praised for their ability to draw out some of the oil binder from the paint layers. This was considered a positive characteristic, as authors feared that excess oil would lead to darkening of the colours. But

[7] Félibien 1676: 407-8
[8] Vibert 1892: 96-8.

absorbent grounds led to a challenge, because they had an important drawback: their absorbing qualities hindered paint application: paints lost their fluidity on an absorbent ground (*see* Paragraph 7.4). To solve this issue, solutions were presented, but each solution had negative consequences as well: the binder of subsequent layers could be thinned with turpentine oil, but painters were warned that this could result in underbound paints and matt surfaces (*see* Paragraph 10.4.4); the ground could be covered with an isolation layer that lowered its absorption, but authors feared that the lowered absorbency would have a much lessened positive effect on long-term colour stability (*see* Paragraph 10.4.5).

This sequence illustrates the fact that a change in materials or techniques would not necessarily lead to a solution of a problem, but could even be the beginning of a new challenge. Struggles with materials were present throughout the period and did not cease to exist as new techniques or materials were introduced. Notwithstanding this fact, sources do provide evidence of a never-ceasing belief that a perfect ground would eventually be found in new materials and procedures. Faith in possibilities for improvement, in particular resulting from scientific advances and mechanical inventions, was in clear evidence in for example the late nineteenth century articles in the *Technische Mitteilungen* and also spoke from Church's (1890) and Vibert's (1892) manuals.

16.3 Recommendations for further research

The comprehensive overview of recipes for preparatory layers for oil painting in North West Europe that has been created for this dissertation, and the increased insight into the function of these materials and layering in actual paintings, forms a good starting point for further research into this subject. Such further research can expand our knowledge in different directions by studying different categories of data and by employing and combining different investigative methods.

First of all, it is recommended to expand the geographical area and time period studied through systematic and broad-based recipe research. Clarke's (2001) overview of Medieval recipe books showed, that libraries and archives throughout Europe contain manuscripts that have not yet been fully disclosed and transcribed.[9] At present it is not known whether investigation of these – and other – early manuscripts will lead to the discovery of more recipes for preparatory layers. However because of the scarcity of pre-1550 recipes, in particular from North European countries, any new discoveries would institute an exciting addition to what is now known about preparatory layers for early (oil) painting.

The references to selected South European sources throughout the text of this thesis demonstrated, that North European writers were influenced by South European

[9] Preparations are under way for the online publication of a large recipe database with Medieval paint recipes, in cooperation with the Max Planck Institute for the History of Science in Berlin. Oral communication Sylvie Neven, June 16, 2014 at the Interim Meeting and Sixth Symposium of the ICOM-CC Working Group Art Technological Source Research, 1-17 June 2014, Rijksmuseum, Amsterdam.
See also the website of the Max Planck Institute for the History of Science: http://www.mpiwg-berlin.mpg.de/en/research/projects/FGDupre_Written_Tran, accessed 21-6-2014.

colleagues and vice versa. Research with a similar comprehensive scope such as has been employed here, but gathering and investigating South European recipes, will reveal more about the connections between the authors of recipes for preparatory layers in North West and South Europe.

This dissertation focused primarily on recipes and on practical instructions for the application and use of materials for preparatory layers. This category of sources was selected as it provides detailed information on preparation and application, while also revealing indications of artists' motives. Now that it study has resulted in a comprehensive overview of such recipes, a research line that deserves to be developed in the future is the integration of the results of this dissertation with research that investigates other types of historical sources, such as artists' inventories. This would lead to an improved insight into the meaning of the recipes studied in this thesis and would also provide further information on their relevance for actual painting practice. Research into such inventories may disclose more facts about the size and scope of artists' libraries and will potentially lead to a better understanding of the role of instruction books in the education of artists from the seventeenth century onward. The small pilot study of book auction catalogues that was included in the present investigation, provided an example of the potential yield.[10] Linking the outcomes of this thesis with research into local differences in the education system of artists and their status in society, as well as to studies into the development of a public of interested *dilletanti*, would provide a wider and more integrated context for the recipes.

While archival research of inventories may uncover more information about the function of recipe books, other types of historical and archival sources can also increase our insight into the context of recipe books. Economical, historical or geographical developments will have had an influence on the materials employed in preparatory layers. This topic has not yet received focused attention, although a good start was made with a conference on routes for the trade in artists' materials before 1700 (Kirby et al. 2010). Research into the influence of trade routes, trade embargoes, wars, epidemics, etc., on the availability of materials and recipe books, may help explain some of the characteristics of the recipe collection and may assist in creating an improved understanding of the actual use of materials in preparatory layers.

An additional focus in archival research could be on the importance of the location of artists. A number of authors of recipe books referred to the fact that they were writing for artists who were not able to purchase their supports ready-primed because they lived outside the large cities or who could not attend art academies for the same reason (*see* Chapter 2 and Appendix 2). The question how developments in transportation and mobility influenced the education of artists, is very relevant.

A third direction that could be developed further, is the comparison between written recipes and actual paintings. More systematic and extensive comparions would provide

[10] Unfortunately previous research into the inventories of Dutch seventeenth century artists by Bredius (1915-22) focused mainly on paintings and artists' materials and only partially transcribed the book titles mentioned in the original archives. *See* for other examples where archival research was included to support investigations into the practices of individual painters, for instance by Goldberg (1998) or Heydenreich (2007b).

evidence for (or against) the link between both[11] and would also raise our level of understanding of the original appearance and degradation of historical paintings. While the reconstruction-based studies in this thesis made connections with actual painting practice, a systematic comparison between developments and trends noted in the recipes and similar trends in actual painting practice was not yet possible on the basis of present knowledge. The fact that this dissertation showed how reconstructions can be used to increase our level of understanding of phenomena encountered in actual paintings, does demonstrate that such comparisons are extremely interesting and worthwhile. An example of an area where further studies are needed is the research into flour paste and starch in preparatory layers. The present investigation broadened the time period and geographical scope where such materials were recommended for use and provided a strong argument that their presence should be investigated as part of the standard instrumental analysis protocol employed for preparatory layers. But only when in future investigations the presence of flour or starch in preparatory layers is investigated, will it become possible to answer the question whether starch and flour paste were indeed part of the toolbox of seventeenth and eighteenth century primers, as the documentary evidence suggests.
If systematic comparisons between historical recipes and results of instrumental analysis of actual paintings are to be executed, future research into the topic of ground colour would benefit from the development of international protocols for ground colour names, and the use of a standard colour chart. At present, a systematic comparison between different studies of paintings is hampered strongly by the individuality in colour descriptions, where the 'beige' of one researcher may be similar to another researcher's 'light brown'.

Continued monitoring of naturally ageing reconstructions will no doubt provide important information regarding the stability of historically used preparatory systems. It is expected to lead to a better understanding of the chemical stability of, for instance, 'low quality' materials, e.g. unrefined lead white, and of the visual and chemical characteristics of aged flour paste grounds. Because all preparation steps and the character of the materials employed for the reconstructions produced for this dissertation are well documented, these reconstructions will be valuable in studies that investigate the degradation mechanisms that are thought to influence the ageing of actual paintings, such as lead soap formation, the mobility of paint components and transparency issues.

16.3.1 A final word

There are numerous areas in which the methodology that has been employed for this dissertation could enlighten, complement or extend other research avenues. Besides the research lines specified above, a similar approach could be suitable for a large number of topics relating to artists' technique and paint degradation. If this dissertation can play a role as a model for research into to other topics, it has served its purpose well.

[11] Systematic comparisons of recipes and actual paintings will furthermore provide an additional means to investigate the hypothesis that practice preceded decriptions of painting methods in manuals. *See* for instance Smith 2010: 48, who refers to this hypothesis.

If, in addition, paintings conservators and other researchers can employ its results in their search for an explanation of the state of preservation of paintings, a second goal has been achieved. It is hoped that the information that has now become available through this dissertation, including the results of experiments and the increased insights into artists' motives, will be employed to support this search. The availability of the full text of all recipes quoted in this thesis on CD will assist these future investigations.

A detailed understanding of the materials that may be present in the preparatory system stands at the basis of insight into the chemical and physical characteristics of these layers. As these chemical and physical characteristics determine the response of the preparatory system to environmental changes and to conservation treatments, a response that influences the longevity of the painting as a whole, increased knowledge of preparatory system composition is an important step towards better informed conservation protocols, that ensure a longer future for the paintings that we all care for. And this is the ultimate goal that this investigation hopes to have brought somewhat closer.

To conclude this dissertation, it seems fitting to return to Mrs. Merrifield, who provided the first quote in this thesis. Her words were borrowed to introduce the relevance of the subject of preparatory layers in Chapter 1. More than one-and-a-half century ago, this remarkable woman was already walking the path that was taken for this dissertation; she was combining recipe research with chemical experiments, trying to understand phenomena observed in actual paintings. In the preface to her *Medieval and Renaissance treatises on the arts of painting* (1849), Mrs. Merrifield addressed her readers with a simple wish, that perfectly expresses my sentiments now that I am bringing this dissertation to a conclusion:

> I indulge the hope that my labours … may be found useful,
>
> and not altogether uninteresting.[12]

Amsterdam, February 2014

[12] Merrifield 1849 (1999): cccxi.