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Abstract

This dissertation focuses on historical recipes for preparatory layers for oil painting in North West Europe during the period 1550-1900. It is a study of a large collection of recipes through a long time period, by analysis of recipe texts and their context, by recipe-based reconstructions and by comparison of these reconstructions with actual paintings. It has been undertaken to create a more comprehensive and broad-based understanding of the materials that were employed in preparatory layers and of their function.

Knowledge of the materials employed in preparatory layers is important both for better informed conservation and restoration strategies as well as for art technological investigations. Discussions in historical sources that reveal painters' motives for employing certain materials furthermore teach us about their thinking process, the aesthetic values painters aimed for and it places the materials within a broader theoretical context.

Although earlier researchers have employed recipe research in investigations of preparatory layers for oil paintings, they focused on smaller geographical areas, shorter periods or the techniques employed by individual artists. Furthermore, a number of these studies have relied only on a relatively small group of well known, easily available written sources.

The recipe collection established for this research contains some 700 quotes from published artists' manuals and other recipe books, as well as from a selection of manuscripts from within the period. The heart of the recipe collection consists of sixteenth to nineteenth century recipes from Denmark, Germany, The Netherlands, the United Kingdom and France. The recipe collection also includes a number of pre-1550 recipes and selected recipes from Italian, Spanish and American sources, all added to provide a context for the North West European recipes. The year 1550 was chosen as starting date, since too little information from historical recipe books and manuscripts is available from before that date to allow for a recipe-based approach. The year 1900 has been taken as an endpoint, as the introduction of new synthetic materials that already started in the late nineteenth century, is considered to be a new episode in the history of preparatory layers.

Through its wide scope, this thesis has been able to lay the landscape for preparatory layers in North West Europe. It has been able to connect the results of previous studies. By adding a large number of recipes that hitherto were not included in research on painting technique, by executing reconstructions to investigate the working properties and ageing characteristics of groups of materials employed in preparatory layers and by making the full text of the historical recipes available to future researchers, this dissertation has taken an important step that significantly increases our understanding of the materials and techniques employed for preparatory layers and has opened up a collection of historical recipes that will help future research develop more insight into the subject.

It is in this dissertation that reconstructions based on such a large collection of wide ranging recipes have been applied to the subject of preparatory layers for the first time in

a systematic manner and with historically appropriate materials. In the case of preparatory layers, (partially) hidden from view in the finished object, reconstructions are of particular importance as they allow for insights into the role of these layers during the creation of the painting and they inform us of their influence on the final paintings.

Efforts to locate materials that resemble historically available materials in their composition, morphology and degree of purity, allow for conclusions that can inform scientific analysis. Continued monitoring of reconstructions while they undergo natural ageing, will in the future allow for conclusions regarding the long-term stability of materials similar to those employed in actual paintings.

The dissertation consists of an **introduction** to the subject, which includes a description of previous research and introduces the central research topic, of two main parts, **Part I** and **Part II**, and of **general conclusions**.

In **Part I**, the recipe collection is described and the recipe texts are analysed.

Part I commences with **Chapter 2**, which provides a detailed overview of the size of the recipe collection, the scope of the recipe books and discusses the role of copies, translations and later editions. By investigating the paratext of the recipe books, the style and level of detail of the recipes, the intention of the authors as revealed in introductions and in the scope of the books, information can be found about their intended audiences. Chapter 2 reports on a pilot study that investigates the presence of recipe books in published artists archives and their occurrence in seventeenth and eighteenth century book auction catalogues of book in artists' libraries.

Chapter 3 focuses on the terminology employed for the different layers that together build the preparatory system and places these terms in a historical context. Terminology has developed throughout history. Name changes have occurred and the interpretation of certain terms is not straightforward. Chapter 3 includes a comparison of terms used historically for preparatory layers in English, Dutch, German and French, as well as a general description of the functions of each of the layers within the preparatory system.

Chapter 4 provides an overview of developments in ground preparation within the period directly preceding 1550 and serves as an introduction to the main period. Inevitable, because very few recipes from before 1550 have survived, this chapter is based mainly on paintings investigations by earlier researchers. Such earlier research has tended to focus on time periods and areas during which important art historical developments took place. Therefore, attention is not equally divided throughout the period.

Chapter 5 analyses the chronology of preparatory layers for easel paintings within the period 1550-1900. It is subdivided into sections that deal with the materials and layer build-up advised for different supports (panel, canvas, copper, stone, board and paper). By discussing materials and layer build-up in chronological order, and by ordering recipes in graphs that contain their most important characteristics, patterns and trends are found and followed through time. A final section of Chapter 5 examines differences between the preparatory systems advised for the different supports.

Chapter 6 focuses on the materials described for use in preparatory layers in historical recipes. It provides recipes for the preparation of binders mentioned in Chapter 5. Information on pigments and fillers focuses on the use of these materials inside preparatory layers. Some materials advised for use in preparatory layers have carried different names throughout the period investigated. This necessitates a thorough

investigation into terminology, for instance for the meaning of the terms 'bole' and 'turpentine'. The tables accompanying this chapter document the period during which materials are mentioned for use in preparatory layers.

Chapter 7 describes the application and texture of preparatory layers as discussed in historical sources. Application and smoothing both influence the visual characteristics of preparatory layers, and historical recipes form a unique source of information on the motivation to employ certain methods as well as the exact procedures followed. This chapter also discusses the consistency of the different layers, layer thickness and the preparation of the primed support for painting.

Chapter 8 analyses comments regarding ground colour and investigates developments in ground colour described in the recipes. It starts with a discussion of general trends in ground colour, which are examined in bar graphs that provide representations of ground colours throughout the period. Some historical authors discuss ground colour in the context of the materials employed by the 'Old Masters'. Such historical awareness is present as early as the seventeenth century, and is often focused on the supposed use of white grounds by Titian. Chapter 8 investigates whether there are indications that ground colour is related to the subject of a painting. Comments regarding the influence of ground colour on the colour strength of the paints applied on top, appear throughout the period.

Chapter 9 addresses the role of commercial suppliers of prepared supports. Historical recipes books throughout the period regularly refer to the availability of commercially primed supports. Discussions on commercially primed supports centre on concerns with their quality and on the fact that commercially primed supports must age before use. The recipes from the Winsor & Newton archive manuscripts provide unique insights into the workflow practices of a nineteenth century colourman. The growing availability of commercially primed supports results in recipes for the modification of shop-purchased canvas. Such recipes only appear in the nineteenth century. Although references to the availability of commercially primed canvas confirm that the role of commercial primers is very important in the nineteenth century, this does not lead to complete standardization.

Chapter 10 focuses on the influence of preparatory layers on the long-term stability of paintings. Comments by historical authors about the stability of preparatory layer materials offer unique insight into the motives that guide artists in their choice of materials. Some authors discuss the influence of specific pigments or of the addition of siccatives on the degradation of paintings. However the influence of ground colour and ground absorbency attract most attention throughout the period. While Chapter 5 demonstrates that relatively saturated, oil-bound grounds played an important role from the sixteenth to the nineteenth century, most discussions about ground absorbency focus on 'absorbent grounds', aqueous or emulsion-bound grounds that are supposed to soak up excess oil from the paints applied on top and thus to prevent a marked effect of yellowed oil binder on the colours of the aged painting. To prevent the degradation of paintings, some authors advise additives to the preparatory layers or the application of protective layers for the reverse side of the painting.

While Part I of this thesis focuses on the recipe collection as a whole and investigates recipes through textual analysis, **Part II** consists of a series of reconstruction case-studies that demonstrate how the analysis of a large collection of historical recipes, used as a basis for reconstructions, allows for investigations of questions that are difficult to approach by other methods.

The first study, **Chapter 11**, examines the characteristics of animal glue size layers. It investigates the materials, preparation, function and application of size layers mentioned in historical recipes, followed by reports on reconstructions of glue size layers, based on these recipes. Reconstructions explore variations in raw materials, preparation and application methods described in historical recipes. All glues are analysed to determine their viscosity, Bloom value and pH.

Chapter 12 investigates the visual characteristics of flour paste or starch paste bound layers within the preparatory system. Flour pastes and starch pastes are regularly described for use in preparatory layers throughout the period, but are identified very infrequently in painting investigations. Historical recipes often describe additions of animal glue or oil to starch-containing layers. This complicates the interpretation of results from instrumental analysis of starch containing preparatory layers. Investigations of the presence of starch are usually initiated only when starch granules, characteristic for flour or starch, are seen in cross sections. Reconstructions demonstrate that such starch granules are no longer seen when starch or flour is heated with water, which is a method described in historical recipes. Starch containing ground layers then have visual characteristics similar to layers bound with oil or glue. Reconstructions allow for a better understanding of the visual characteristics, physical and chemical properties of such layers. Cross sections and polarised light microscopy images are included with this chapter as reference tools.

Chapters 13 and 14 look at lead white quality and terminology and examine the role of processing methods on lead white quality. Lead white plays an important role in saponification processes that take place inside paint and ground layers, sometimes resulting in the formation of surface crusts and protrusions. Lead white quality may influence the reactivity of the pigment. Some historical recipes indicate that lower quality lead whites can be allowed in preparatory layers. However, detailed knowledge of the factors that determine lead white quality is lacking. By studying a large body of recipes, Chapter 13 investigates lead white production methods, lead white terminology and quality as presented in written sources from the 15th to the 19th century.

Historical recipes describe several refining methods to improve the quality of lead white, most often by grinding or washing with water and/or vinegar. Processing methods also include decanting (particle size separation based on gravitational sedimentation speed). In low-quality lead whites, presumably such refinement methods are executed less carefully or they are omitted. Chapter 14 reports on reconstructions of refinement methods using 'historically appropriate' materials and techniques and investigates the influence of refinement methods on lead white composition.

Chapter 15 investigates binding media for *streaky* imprimaturas, such as used by Peter Paul Rubens and other 17th-century Flemish artists. The binders used for these imprimaturas remain uncertain, due to difficulties in sampling such thin layers for instrumental analysis. Several binders have been suggested in modern conservation literature. Reconstructions based on historical recipes compare and evaluate their working properties. They help in ruling out some binders with working properties that do not lead to convincing results. Reconstructions will be used to investigate the application of immunodetection analysis of proteinaceous binding media, as it is hoped that in the future immunodetection will be able to clarify some of the questions regarding the use of streaky imprimatura binders.

Chapter 16, the general conclusion, discusses the main findings and results of this thesis. It reflects on the character of the sources and type of information provided, and the relationship between writers, artists and the preparation of their supports.