Discoloration in Renaissance and Baroque Oil Paintings. Instructions for Painters, theoretical Concepts, and Scientific Data
van Eikema Hommes, M.H.
A Proposal for the Classification of Painting Methods and Recipes *

A great number of studies into 15th to 17th-century oil paintings have revealed that painters at that time applied their paint in a methodical manner. Although many such 'recipes' are known, the question of their exact function has received little previous attention. Contemporaneous workshop handbooks and treatises contain a great number of instructions regarding the build up of the paint-layer and often mention the motive for a specific working method. The information regarding painting techniques in historical texts is mostly fragmentary and unsystematic. It is therefore difficult to obtain a complete overview of the knowledge and techniques that painters formerly had at their disposal. By studying the function of instructions regarding painting techniques, however, it is possible to structure this information. It also facilitates the interpretation of divergent instructions and recipes. By assembling fragmented instructions with a similar function from divergent sources, this fragmentary information can be linked, completed and explained. As explained in the introduction, the use of information obtained from chronologically and geographically divergent sources may be justified.

This chapter presents a survey of the various functions for painting according to a fixed order. The following main categories of instructions can be distinguished:

1. Instructions for preserving the original appearance of the painting.
2. Instructions for taking into account the limited compatibility of pigments.
3. Instructions for using differences in hiding power and unting strength of the pigments.
4. Instructions to compensate for differences in drying time.
5. Instructions for fast and easy painting.
6. Instructions for taking price differences into account.
7. Instructions for indicating light and shade and the rendering of objects.
8. Instructions for simplifying the organisation of the representation.
9. Instructions concerning the sequence of painting.
10. Instructions concerning the division of labour within the workshop.

Based on 17th and early 18th-century source material, the following demonstrates how focussing on the function contributes to the interpretation of technical formulas. Although the reader might be familiar with some of the examples given, from the literature it emerges that until now no attempt has been made to develop a system like the following for this aim.

Instructions for preserving the original appearance of the painting.

It is generally known that an oil paint-layer can change so much that in time it may deviate strongly from its original appearance. Discoloration of the paint can be the consequence of the discoloration of certain pigments or the yellowing of the oil medium; changes may occur as a result of bleeding, a too fast or too slow drying process of the paint and too much or too little sinking in of the medium. Furthermore, some paint-layers become more transparent over time. From the historical texts examined it emerges that painters were conscious of such problems and took them into account when applying the pigments and media. An example is the handling of the blue pigment indigo. Owing to the pigment's limited light fastness in oil media, indigo paint may fade rapidly obtaining a pale greyish or greenish hue. Painters were well acquainted with this discoloration and they also knew that this phenomenon especially occurred under the influence of light.1 Because of its limited colour-fastness,

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1. For example, the remark by the Parisian painter Pierre LeBrun (1635); see Merrifield (1849; 1967), vol. 2, p. 817.
sources regularly recommend restricting the use of the pigment to the underpaint-layer. In The art of painting (1692), the English art lover Marshall Smith warned: 'Indigo turns green in time and should be chiefly us'd in dead-colouring [= underpainting]. The Dutch painter Wilhelm Beurs, whose book De groote waereld in 't kleen geschildert (Fig. 1) was published in the same year as Smith's, also advised painting a second layer on top of the indigo. Beurs, however, gave an explanation for this: discoloration of indigo was prevented by this second paint-layer: Notice, that if one wants to make indigo and its colour permanent, it is necessary to glaze or finish with ultramarine, as it appears lighter or darker in nature. Indeed, a paint-layer of colourfast ultramarine will function as a filter, reducing the intensity of the light transmitted and consequently protecting the indigo from fading.

This is just one example of the numerous formulas, which take into account the changing appearance of a painting that will be considered in greater detail in the following chapters.

Instructions for taking into account the limited compatibility of pigments.

When mixed in paint, certain historical pigments can cause a chemical reaction that could cause the paint to change colour. Sulphide-containing pigments can, for example, react with pigments consisting of either lead or copper compounds. However, study of paintings has shown that whilst these reactions may occur in an aqueous medium they rarely arise in oil paint. Hence, it is interesting to note in the sources that for several pigments great caution was considered necessary in oil painting. The instructions especially warn against mixtures containing orpiment and authors regularly recommend that this pigment be applied in a separate paint-layer. In the so-called De Mayerne manuscript (1620-46), a collection of notes by the English court physician Theodore Turquet De Mayerne that focuses on technical aspects of painting, the painter Cornelis Janssens van Keulen (1593-1661) is quoted as warning that the orpiment paint-layer should absolutely not be overpainted: 'Orpiment will ly faire en any colour, except verdigres, but no colour can ly faire on him, he kills them all.' This warning may explain why in contemporary instructions orpiment is usually restricted for the last highlights, only to be applied when the other paint-layers are dry. An example is the advice, which De Mayerne noted down from Anthony van Dyck (1599-1641):

Painting yellow. One uses orpiment, which is the most beautiful yellow colour one can have... but mixed with any other colours it spoils them... And in order to use it, it must be used unmixed, after the drapery (for which, used unmixed, it is very suitable) has been made with other yellow colours. And on this [paint] when thoroughly dry, one must indicate the light [part of the drapery] with orpiment on the lit side. In this way the result will be very beautiful.

Instructions for using differences in hiding power and tinting strength of the pigments.

Painters recognized that pigments had different hiding powers, providing opaque or transparent oil paint-layers, and that the tinting strength varied considerably for any one pigment. Sources frequently
recommend employing the various pigments such that their specific qualities are used completely. The usual advice is to apply pigments with little hiding power in the upper paint-layer while using pigments with strong hiding power and/or tuing strength in the underpainting. For example, the De Mayerne manuscript gives an instructions that recommends applying the pigment ivory black, mentioning that it possesses no body, as a translucent paint-layer or a glaze, over opaque undercolours: *The deepest black is made of ivory... This black does not have body [n'a point de corps] and serves to paint over another black, [such as] lampblack as a glaze and then it makes the darkest black.*

Historical texts recommend glazes for various purposes. They advise glazing an opaque paint-layer because of the beauty of the colour obtained or so as to obtain a great number of different colours. In addition, a glaze is recommended for obtaining unity in a specific area of the painting or to tone down a passage when painted too distinctly. Wilhelm Beurs advises, for example, for the rendering of a red flower: *When it is painted in the described way and it is dry, glaze or paint it over lightly with only Florentine lakes to tone down the strength of the lights and shadows.*

A glaze is also recommended locally to indicate the shadow of an object. The workshop handbook entitled *Le petit peintre de Mr. de St. Jehan,* part of the De Mayerne manuscript, mentions the following formula for rendering a black drapery: *Lampblack, a little umber, a bit of white. Shadow with ivory black, mixed with a little verdigris. For the lights, lampblack mixed with white and a little umber.* Since the aforementioned instruction quoted from the De Mayerne manuscript recommends the pigment ivory black for glazing, one may assume that according to the Mr. de St. Jehan the ivory black had to be applied as a glaze.

**Instructions to compensate for differences in drying time.**

The drying time of oil paint is significantly influenced by the pigments employed. For example, paint made of black pigments or red lake hardly dries, while pigments that contain copper, lead or manganese compounds accelerate the drying process of the oil considerably. The extremely long drying time of certain paints can substantially delay the painting process, though a very swift drying time is usually no less desirable. A great number of instructions are therefore intended to regulate the drying time of the various oil paints. It is frequently advised that slow drying paints be mixed with a small quantity of pigments or metal salts, which accelerated the drying of this paint. Depending on the pigment used, one could choose different siccatives. In the workshop handbook of *Le petit peintre* different siccatives are advised for the various black pigments: *Ivory black [dries] with verdigris, smoke black with umber.* This remark explains why in instruction from *Le petit peintre* quoted in the previous paragraph verdigris had to be added to a glaze paint made of ivory black.

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7. Mayerne (1620-46); see Graaf (1958), p. 143: *'Le plus fort noir se fait avec umber, broisé dans un rais deur de fer bien forcé, avec Lai [un sapientia] et sel. Ce noir n’a point de corps, & est pour mettre sur un autre noir de lamp comme en glaçant, & alors est noir en extrême.'*

8. For example the instruction given by J.M. Cröker (1719); see Schaeß (1982), p. 97.

9. See for example the recipes for drapery given by Marshall Smith, (1692), p. 84. Those instructions show that a range of drapery colours were obtained by varying the undercolours of a glaze paint or vice versa.


12. *Le petit peintre* mentions how the various oil paints could take vast differences in time to dry; Mayerne (1620-46); see Graaf (1958), p. 147.

13. Mayerne (1620-46); see Graaf (1958), p. 153: *'Le noir d'umber avec le rest de gris. Le noir de fumée avec la terre d'umber.'*
The use of extremely slow drying paints was usually restricted to the upper paint-layer. De Mayern e recorded for example: *Asphalt for the rendering of the darkest shadows of the flesh colour, when everything is dry.* 14 According to this instruction asphalt will be applied as a glaze since this use is advised in a similar formula in *Arte poética e da pintura e symetria com principios da perspectiva* (1615) by the Spanish author Felipe Nunes: *This [asphalt] is to be used for shadowing the flesh colours in the manner of a glaze after the figure has dried.* 15 It is interesting that both De Mayerne and Nunes emphasise that the glaze may only be applied after complete drying of the other paint-layers. Consequently the glaze can be applied more easily, but moreover more thinly, and will therefore dry more quickly.

**Instructions for fast and easy painting.**

The choice of a specific use of material or a specific painting technique could further depend on whether one could paint faster and more easily. In the sources one regularly finds instructions that recommend a particular method for this very reason. In *El museo pictórico y la escala óptica* (1715-24), the Spanish painter Antonio Palomino Y Velasco offered two different methods for finishing a blue drapery, which had been underpainted with small, white pigment and indigo. He mentioned that the second method is easier:

> When the underpainting is dry, go over it with only fine smalt and white tempered only with walnut oil... But the easiest way to work the finishing touches is to apply a glaze of smalt alone over the entire underpainting of the drapery, diluting it with the walnut oil and turpentine spirit. Then work over the glaze, and darken the darks with indigo alone. 16

Note that only for the 'easier' method Palomino applied indigo in the upper paint-layer. The effect of deep intense shadows is far easier to achieve with indigo, due to its high tinting strength, than with smalt, which only has a limited tinting strength and hiding power. The advantage of a facile and swift technique can explain why indigo was nevertheless recommended in many recipes for the upper paint-layer even though painters knew it faded.

**Instructions for taking price differences into account.**

There used to be vast differences in price between the various pigments. Ochres and other earth pigments were rather inexpensive, but the price of bright yellow, red and blue pigments could be considerable. 17 Differences in price not only existed between the various pigments, but also between different qualities of one type of pigment. The painter would try to minimise his use of these costly pigments. By means of a systematic method of working he could, for example, restrict expensive pigments to the upper paint-layer. The next advice concerns an economical utilisation of a relative expensive pigment: vermilion. In *Der wohl anführende Malher* (1719), the German painter Joan Melchior Cröker advised:

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14. Mayerne (1620-46); see Graaf (1958), p. 146: 'Spalte pour enfoncer la charnure au plus profond, quand tout est sec.'

15. Nunes (1615); see the translation by Veliz (1986), p. 4.

16. Palomino (1715-24; 1795-97), vol. 2, p. 67: 'Y en estarlo seco, se labra solo con esmalte fino y blanco, uno y otro templado con aceyte de nueces, y para mayor se le mezcla al aceyte un poquito de aquellar para que se rebuda ... pero al modo mas facil de labrarle a el acabar, es haciendo todo el poello buscancado con el esmalte solo, soltandole con el aceyte de nueces, y aquellar, y despues labrar sobre el bano, y apretar los obscuros con el anil solo.' The English translation of the Spanish sources, emended where appropriate, is from Veliz (1986), p. 166.

If you want to paint with vermilion, and employ it economically, first, apply on the passage a ground colour with red earth mixed with enough lead white, such that it becomes light red or skin colour. Then, let it dry, and repaint this with the vermilion. In this way the vermilion will be brighter, and one does not need so much of this.\(^{18}\)

The Spanish painter José Hidalgo recommended the same procedure in *Principios para estudiar el nobilísimo y real arte de la pintura* (1693), but without mentioning the function of this working method: ‘If it is to be red, then the first coat is put on with almagra [= red earth] and red lead, and the last with vermilion and carmine.’\(^9\) In the light of Croker’s advice, it is likely that Hidalgo’s instruction was also intended to reduce the costs.

*Instructions for indicating light and shade and the rendering of objects.*

In the period examined, one of the most important ambitions in painting was the lifelike representation of objects. In the course of time, systems had been developed to render the modelling of the objects and their textural characteristics in the quickest, best and easiest way. In the sources examined many of these procedures may be found. These instructions show that painters believed that for a convincing depiction of an object, specific pigments had to be used for its passages of light and shade. In addition, the painting process was split up in various stages, with a definite layered structure being used for the light, middle and shadow tones. For example, in *Den grondt der edel vry schilder-const* (1604; Fig. 2) the Dutch painter and art theoretician Karel van Mander warned that for rendering velvet, light and shade had to be applied in a way that was different from the one used to depict other drapery: *In contrast to your other textile, where you render with light paint all the relief in the folds, this is completely different with velvet [drapery], as you make these entirely dark and paint flat highlights only on the reflecting sides.*\(^{20}\) This advice shows similarity to an instruction for depicting red velvet from *Le petit peintre.* Red velvet. Red lake with couperose\(^{21}\)

Shadow with the same colour and a little lampblack. On the lit side [paint with] vermilion only by means of lines.\(^{22}\) Both instructions recommend applying a dark paint-layer first and emphasise rendering the lights flat, without relief. Furthermore, the instructions appear to complement each other. The recipe of *Le petit peintre* provides information about the rendering of shadows and tells us that the highlights had to be depicted as lines, while Van Mander informs us about the exact place where these highlights should be painted.

The great advantage of following these and other instructions was that the rendering of effects did not continually have to be reinvented. Instead, the painter was certain of his results in advance so that he could build up his painting accurately. This way of working had several advantages. The painter could estimate the quantity of materials required for his work and the time he needed for rendering the various elements in the representation. As a result, the costs could be closely controlled.

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18. Croker (1719); see Schießl (1982), p. 97: ‘Will man was mit Zinnober anstreichen, und damit sparsam umgehen, so gleiche man erst die Stücke mit Beuwerde, das mit Bleyweiß gänzlich vermischet, damit es eine helle rothe oder Lath-Farbe werde; laß es dann trocknen, und überstrichet es mit dem Zinnober, so völlet der Zinnobereller, und man braucht auch darüber nichts so rief.’


20. Mander (1604), f. 44v: ‘In plaats dat ghy u laken met gheleeuwen lakenfels de playen playte te doen verfien, daer ghy het gants anders met de flowersien, want ghy maken al bruyn, en ghy stelx delen, de canten uwerstroond, u lakenfels effen.’

21. Presumably this is iron sulphate used as a dryer. In French sources, zinc sulphate is usually referred to as *couperose blanche.*

Instructions: for simplifying the organisation of the representation.

The primary reason for a layered painting technique is that the paint-layers that had been set up need to be dry enough to be overpainted. Based on this working procedure, which was dictated by the constraints of the materials themselves, the painting process was divided in different, often clearly defined, phases. In the 17th century it was common practice to render the composition, the main division of light and shade and, according to several painting procedures, also the first lay in of the colours in the underpainting: the dead-colour. After the dead-colour had dried, the painting process was usually divided into two further steps: first, the working up or painting up wherein the painter elaborated colour, modelling and textural effects of the elements of the representation and secondly the phase of finishing or retouching, in which the strongest highlights and the deepest shadows as well as all sorts of details were painted. A large number of instructions refers to this working sequence. In the Groot schilderboek (1707) the Dutch painter Gerard de Lairesse mentioned that during the dead-colouring the painter should organise the following parts of the representation:

Now, so as not to work in vain, one must bear in mind before all else that the overall harmony and illusion [houding] be well observed: that the tints and colours be arranged in such a way that, from the requirements of the recession and distance, when the eye glances at the painting, everything has an appearance of plausible three-dimensional construction [welstand] and its appropriate qualities: then for the painting up not much effort is required.23

De Lairesse also went into the function of the layered working sequence. He believed that when the painter painted up a well dead-coloured painting, this had the advantage that he no longer needed to occupy himself with the organisation of the representation as a whole, but could concentrate completely on the precise elaboration of the separate components of the painting.24 De Lairesse’s advice may contribute to the interpretation of instructions regarding the layered working sequence found in other sources. For example, it becomes apparent why the contemporary Dutch painter Beurs recommended to paint up the details of the representation only after everything [of the representation] had been reproduced with an appearance of solidity [in een goede welstand gesonden word].25

Instructions concerning the sequence of painting.

Many instructions refer to the working sequence the painter had to keep to during his dead-colouring and painting-up. During the underpainting, it is recommended that the painter proceeds, depending on the subject to be painted, either from the foreground to the background or precisely in reverse sequence. Beurs warned for example:

The figures (to begin with) the painter must apply first. Both in a room, a landscape or in another meeting place of people.

In a room it is not indeclicte to paint the rear at last. But in a landscape after the figures (if they are painted herein

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23. Lairesse (1707), vol. 1, p. 12-13: ‘Om nu niet vergete in arbeiden, ze moeten voornamelyk in acht nemen, dat de algemene houding, wel waargenomen word dat de tinct en verden synzeg geslacht zijn, dat na versi der wyking en afstand, en het stuk uit der hand gezien wordende, als in een volksmen welstand heeft, en syn keloorkyke eigenschappen behoeft dan zal er weinig moeiten tot het opmaaken vertoond worden.' For the concept of houding and the meaning of the word welstand which regularly appears in company of houding. Taylor (1992).


25. Beurs (1692), p. 53, on the painting of a seascape: ‘...en deze schepen hun men daar na, als alles in een goede welstand gesonden word, met mast en toeweren opmaaken.'
because of the history or [just] as ornament [one has to paint] the sky, the mountains and the ground from the background to the foreground.26

Beurs did not mention the motive for the sequence he suggested. However, an advice of De Lairesse, who recommended a comparable working sequence, may provide some insight. De Lairesse wrote:

About dead-colouring and how one should do this surely and skillfully. It is my opinion that it is the best and swiftest way to begin from the background, especially when the landscape is most distinct. Since all objects should be subordinated to the brightness or gloominess of the sky and the tints of the objects must be found, the light on the foreground, and the strength of the figures, must be adapted to this; if began otherwise, these aspects will be difficult to determine. However, when figures of other large objects are the most pronounced [in the painting], it is better to begin where one will see the greatest strength, on the first or second ground and in this way proceed in the opposite direction.27

Instructions concerning the division of labour within the workshop.

The different phases in the painting process allowed a division of labour in the painter’s workshop, resulting in a quick and efficient production of paintings. Occasionally, sources go into this division of labour in the workshop, as in the treatise Diálogos de la pintura (1633) by the Spanish painter and art theoretician Vicente Carducho:

A similar procedure emerges from a notebook of the Flemish painter Pieter van Lint (1609-93), in which he describes his duties as an apprentice in the workshop of the Antwerp painter Artus Wolffort (1581-1641), from 1624 to 1631. Van Lint gives a detailed account of the paintings he made, and distinguishes in this work the phases: doversen [to dead-colour], overtorens of sort is doen [to paint up] and retouchen [to retouch]. Several times, Van Lint mentions he started to overtorens or sort is doen a painting,

26. Beurs (1692), pp. 51-52: ‘De Beelden (om daar mede aan te vangen) moet een schilder eerst aanzetten, ‘t is in een kamer, landschap of andere vergaderplaats van menschen. In een kamer maakt men met eer aanzienlijk, ‘t afgrijze, dat eerst afgemaakt, op het laatste dag in een landschap na de beelden (als ‘er in boomen door de geschilderden of een vermaak) de boog, bergen en gronden van afgezet na de voorgrond toe.’

27. Lairesse: (1707), vol. 1, p. 12: ‘Van het dooverzen, om vast en waardig schijnt te doen. Hierin komt my voor, de allerwiss en zeerwaardig stuk, het van achteren te beginnen, secundairwaard, wanneer het landschap meest te zien heeft. Dientzelve na de kleur of zoodanig de licht Zimbabwe, als dingen welksover moeten, en de toneelen der voorwerpen gevonden; want het licht op de voorgrond, en de kracht der beelden, moet daar nu gepast worden, hechten, anders begonnen wijdere, eenen aanspraak te maken. Maar om het voornaamste in beelden of anders groot voorwerpen bestaat, is het beter te beginnen daar met de meeste kracht in een zet, het soor daar op de eerste of tweede grond, en op die men ruim na achterwaarts.’

28. An oficial is a painter who has completed the initial apprenticeship, possibly having passed examination by guild or academy in various areas of his profession: Veliz (1988), p. xviii.

29. Carducho (1633); see Serraller (1979), p. 384: “El perito pintor hace los rasguños, ó esquisas, y estudia cada parte de por si, que después la junta todo en dibujo, ó carta acabado, y compuesto científicamente. Eso, y los demás dibujos entrega al oficial, y él pasa los perfíles, ó dibujos con quinientas, sobre el lienzo, ó pared, y le muestra, y mece de color, que llamamos acabar, ó empujar, acediendo el maestro cuidadoso a ver, y corregir, y advertir de palabras, y con los perfíles lo que yerra, cuando no se ajusta con lo dibujado (y que esto llaman corroborar los perfíles); y después que el oficial lo dice por acabado, el maestro lo buste a retocar, y perfecturar, que es lo último…”. Translation by Veliz. (1986), p. 27.
but he does not mention whether he painted the dead-colour. For example: *and by the 17th of November... [I] began to overdoen a Hercules, [which I] finished, 21 November.* In the light of Carducho’s description, it is plausible that these paintings had been dead-coloured by another apprentice in Artus Wolffort’s workshop.

**Conclusion**

By studying instructions concerning painting techniques in historical sources and considering their function within the painting process, their divergent and fragmented information, can be structured to simplify the interpretation. A survey has been presented of the most important groups of functions. On this basis it is possible to examine each painting instruction for its - one or more - technical aims. In this way various aspects of a recipe can be separately examined and compared with other recipes that refer to the same aspect of painting technique. This categorisation is only possible if one collectively considers all European sources over a 15th to 18th century period. Once this is done, gradual changes and possible local variations emerge from the mass of data.

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30. Listt (1624-31), f. 7: ‘en by den zeventiende van november... begon daen een herkules te over doen rubijes XXI van november.’