Rembrandt's Medium – A Study of Rembrandt's Painting Technique via Copying

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Summary

Perhaps no other artist's painting technique has attracted as much attention as Rembrandt's who splendidly combined special qualities of oil painting characterised by colour transparency seen in the Flemish school and colour opacity and plasticity of pastose paint developed after the Venetian school. It is no exaggeration to say that Rembrandt's technique, brought to fruition in his works, was a milestone in the history of painting.

The chemical analysis of paintings has immensely advanced in recent years. It has brought to light facts that completely differ from the previously widely accepted theories of what Rembrandt's technique might have been. The contemporary research through copying based on the newly available information presents significant value in elucidating his technique.

This paper focuses on researching Rembrandt's medium. The author first discusses the making of paint mixtures using data gleaned from the literature. Next, he discusses the outcome and issues encountered in the process of copying the original at the Louvre. Finally, he presents a hypothesis drawn from the above and discusses how it applies to the actual paintings. Through this step-by-step discussion, the author verifies the information he used and, from a perspective of a painter, explores the aspects of Rembrandt's technique that cannot be learned from chemical analysis alone.

Introduction

Historical Significance of Rembrandt's Technique

Oil painting techniques that have been developed in Flanders in the 15th century took advantage of transparency and viscosity that tempera or fresco paints did not have, and thus enabled a subtle tone control in transitions between light and shadow, and spatial depth achieved by multi-layered glazing. Later, when the use of canvas was introduced, pastose paints, which had been improved by the Italian (i.e. Venetian) painters, acquired an added characteristic of plasticity on top of transparency, an already known quality of oil paint. Until then, luminosity had been achieved by exploiting the whites of the underpainting. Application of thick and opaque paint allowed to express luminosity by pastose white paint, and at the same time, facilitated transformation of shapes in the middle of the painting process. Thus, the inherent rigidity of the outline-based painting techniques was gradually replaced by a freer and more direct representation of light and shadow through coloured surfaces and their volume. Rubens (Peter Paul Rubens, 1577-1640) and Rembrandt (Rembrandt Harmensz Van Rijn, 1606-1669) in North Europe, particularly in Flanders and the Netherlands, re-instated

the original transparency of the new techniques of the Venetian school in their works. By applying transparent colours on top of a vivid bottom layer and using opaque and thick paint for increased contrast, these painters of the Flemish school were able to create impressive spatial effects and light with a material feel. In a sense, they can be seen as the artists who brought the oil painting technique to perfection.

This is why Rembrandt's technique has always been a subject of great interest for many a researcher and painter. In recent years, the advance of scientific analyses that assisted restoration efforts at many national galleries meant that sophisticated scientific methods could be used to analyse painting media where, until recently, the naked eye had been the only tool available. Data gained from these new research methods fundamentally questioned the theories we thought to be commonsensical.

By copying the original painting using the newly available information and the methods as close to the original as possible, I attempted to verify findings reported in the research literature. In my research, I mainly focused on the painting medium to discuss from a painter's perspective the analytical results and the issues observed during the process of copying Rembrandt's original artwork.

Copied Artwork

Image 1. Portrait de l'artiste à la toque et à la chaîne d'or (Self-Portrait Wearing a Toque and a Gold Chain)

Rembrandt created the subject of my copying experiment, *Portrait de l'artiste à la toque et à la chaîne d'or* (1633) (Self-Portrait Wearing a Toque and a Gold Chain, Image 1), in the early period of his career. Its owner is the Louvre in Paris, France. Throughout his lifetime, Rembrandt painted on both wood panels and canvas, and, in his early life, more often than not, he preferred wood. The above portrait was painted on a wood panel and took advantage of a transparent brown *imprimatura*[1] that was applied as an underpainting. The effect of allowing the chalk ground to show through in the slightly lighted areas of the face reflecting light and as the base colour of the hair was characteristic of Rembrandt's works painted on wood. This method smartly exploits paint's transparency, which was a common technique of the early Flemish school. On the other hand, lead white paint was thickly applied in the lightest areas to create a strong texture. An opaque and thick application of paint in the lightest areas demonstrates the effect of impasto, the use of which had been pioneered by the Venetian school. This technique enabled sculpting the lights with thick white paint and transformed the way by which light and shadow were separated. From reliance on outlines, the painters progressed to a more audacious use of paint to create coloured patches. Caravaggio (Michelangelo Merisi da Caravaggio, 1571-1610) furthered this approach even more, and his influence is clearly seen in Rembrandt's work.

Rembrandt also used paint's plasticity to depict lights. He promoted this technique to define texture and even increase the material strength of a paint layer. The copying subject I selected for my current research is representative of these characteristics in such places as the gold chain where the artist used decorative thickness of paint as a means of expression.

Study of Rembrandt – Paint Plasticity

Rembrandt's Medium

In the beginning of the 20th century, a German author, Max Doerner (1870-1939) wrote in his book entitled *Malmaterial und seine Verwendung im Bilde* that Rembrandt had used "a medium containing Venetian balsam, thickened oil, and mastic resin." This suggested that Rembrandt used a resin-rich medium[2]. Doerner presented a theory that resin was the key to achieving viscosity and plasticity of thickly applied paint layers and transparency of glazes, which the Rembrandt's artworks are famous of. For a long time, this was accepted as a convincing theory. However, in the days of Doerner, the science of organic material analysis still was in its infancy, and painting media was mainly analysed by the naked eye. In recent years, the scientific analysis of painting media undertaken by national galleries in the course of various restoration projects has yielded analytical data that were inaccessible in Doerner's days.

According to an analysis conducted by the National Gallery in London, Rembrandt's

[1] A technique of applying a neutral colour to the entire surface to increase the effect of whites in light areas. A transparent neutral colour base is achieved by spreading a thin solution of paint over the surface with a flat brush.
[2] *Malmaterial und seine Verwendung im Bilde*, Max Doerner, p.153

medium was surprisingly simple: it was found to consist of a single drying oil, such as linseed or walnut oil (the latter was used rarely and only with pale colours)[3]. The resin that Rembrandt had supposedly used was not detected in any of Rembrandt's paintings although there were a few instances when other artists associated with Rembrandt used small quantities of resin in their media. This begs the question: is it possible to create a work displaying plasticity and transparency inherent in Rembrandt's paintings by using paints mixed with drying oil and nothing else? Paint transparency can also be explained by aging: the refractive index of drying oils is known to increase over time, and as a result, paint layers may become more transparent. But what about plasticity in the thickly painted areas? To find out, I made an experiment mixing paint and linseed oil.

The Experiment of Mixing Lead White and Oil

In Rembrandt's days, colours were hand-mixed by apprentices in his workshop. Tubed paints would appear only in the middle of the 19th century after the metal tube had been invented. As the mass production of artist paints began, their most desired quality was stability. In order to be sold on the market, tubed oil paints needed to be storable meaning that oil should not deteriorate or separate from pigment. To achieve this, manufacturers use various additives: emulsifiers are added to prevent separation or leakage of oil; cobalt, manganese or lead driers to aid the drying process and level out drying speed of different colours; extenders to reduce the costs. Naturally, the present-day artist paints that contain all the above additives have a very different quality than paints used by Rembrandt. Therefore, in my research, I used lead white pigment, which was crucial for achieving plasticity in Rembrandt's work, and mixed it with several media that presumably were available at Rembrandt's time. By mixing the paints with the media, I tried to gauge the true potential of Rembrandt's medium.

First, I mixed raw linseed oil and lead white. I put the resulting mixture on a brush and tried to paint with it. There was no problem with its plasticity, and the brush moved freely. However, the oil did not have much viscosity; therefore, the mixture had a much thinner feel than the sticky, bulky and viscous substance unique to Rembrandt. In addition, the biggest problem was that it took seven to ten days before the paint mixture was feeling dry to the touch even though I used lead white known for its fast drying. This meant that it would have taken weeks before the entire paint layer was completely dry in places where the mixture was applied thickly. It is impossible to know how many days Rembrandt's paint mixture took to dry, but judging by the number of works he left behind and his workshop's high production rates, the time the paint took to dry in my experiment was definitely too long. Also, slow drying meant that painted surface would remain sticky for a long time and collect a lot of dust. However, excessive dust was never found on Rembrandt's paintings. Therefore, it is logical to assume that some measures were taken to accelerate the drying process. There are many possible methods to accelerate the drying process of the oils, and analytical data cannot reveal what exact method(s) Rembrandt used. With these limitations in mind, I compared two methods that are thought to have been available in Rembrandt's days: 1) use of black oil (Image 2), and 2) use of sun-thickened linseed oil (Image 3). I made these oils from linseed oil, mixed each of them with paint, applied the mixture onto a surface and compared results (Image 4).

[3] *Art in the Making: Rembrandt* – New Edition, National Gallery, London

Image 2. Hand-made black oil

Image 3. From right to left: raw linseed oil; homemade sun-thickened linseed oil; commercially available sun-thickened linseed oil

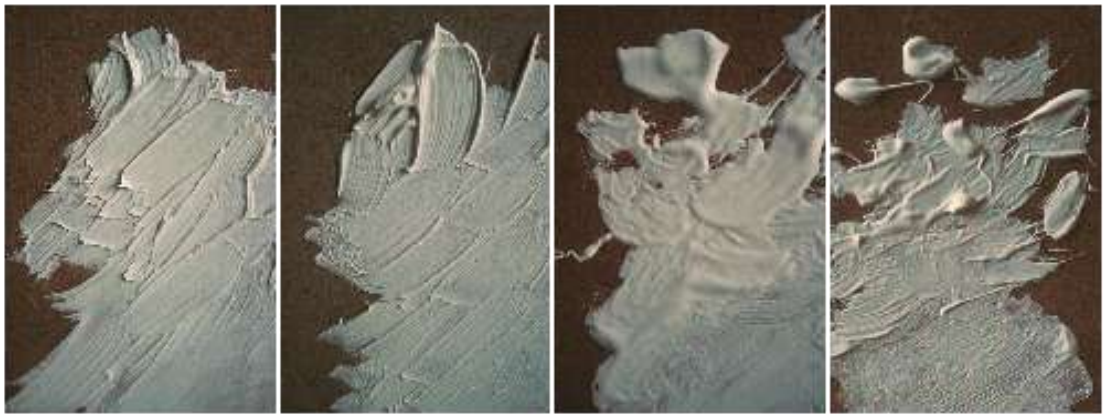

Image 4. Lead white painting experiment. From left to right: linseed oil; black oil; sun-thickened linseed oil; sun-thickened linseed oil with egg yolk.

Black oil is oil with an addition of lead to accelerate drying. I added lead white pigment to linseed oil in a ratio of 1:10 and heated the mixture at a temperature not exceeding 150 degrees. The oil colour gradually changed to that of coffee. I adjusted heating time using oil colour as a guide. The darker the oil colour is, the faster it dries, but if the oil dries too quickly, it will make the wet-in-wet[4] work more difficult, and if the oil is too dark, it will interfere with the whiteness of lead white. After some trial and error, I decided to use black oil that was not completely black but rather caramel in colour (Image 2).

The sun-thickened linseed oil is processed oil that contains no additives and was not exposed to heat. Exposing the oil to air, water and sunlight makes it dry faster. First you pour several centimetres of linseed oil on a quantity of water in a basin (the oil would float on the surface of water). This exposes the oil to both oxygen and water. The oil and water need to be mixed daily; the mixture must stand for one and a half months in summer, or more than three months in winter. Exposure to sunlight makes the oil turn pale yellow and more transparent. (However, the commercially available sun-thickened linseed oil is heat-processed at the final stage to ensure all residual water completely evaporates, and is therefore caramel-coloured.) Also, due to

[4] A technique of flexible mixing or blending the oil paints on a wet surface. It can be described as an oil painting technique that most efficiently utilises characteristics of drying oils (those that dry slowly by the process called oxidative polymerisation).

oxidative polymerisation from exposure to the air, the oil gains a honey-like consistency (Image 3).

I mixed the lead white pigment with each of the two oils and applied the mixture with a brush.

The points to be observed during this experiment were:
1) drying time of the paint mixture,
2) plasticity, and
3) brushability (Table 3).

The mixture containing black oil produced a surface that was dry to the touch after one to one and a half days. This drying time was the fastest among all the media I experimented with. The purpose of heating the oil below a temperature of 150 degrees is to dissolve lead, which serves as a siccative. At this temperature, the oil does not polymerise and retains viscosity of raw linseed oil. The mixture of paint and black oil is slightly viscous, but it has almost the same plasticity as the mixture containing raw linseed oil. This paint mixture can be easily spread with a brush. However, due to low viscosity, it does not produce a sufficiently viscous substance, and one can clearly see the brush marks. It is closer to the present-day artist paints than the classical paint of the old masters.

The paint mixture containing sun-thickened linseed oil produced a surface that felt dry to the touch after one and a half to two days. This was a remarkably higher drying speed than that of the one the mixture containing raw linseed oil could produce, which made it suitable for professional painting. However, this oil is very viscous, and mixing it with paint required quite a lot of physical effort. When I was putting this paint mixture on a brush, I could sense its stickiness and heaviness. It was extremely "long". Once I applied it onto a surface, my brushstroke instantly lost its shape. Over time, impasto sunk in and moved under its own weight. Two weeks later, after the surface fully dried, I could observe fine wrinkles appearing in thickly painted areas (Image 5). In order to increase plasticity, I tried to apply a thicker mixture, but it was nearly impossible to move it around with the brush. I found it totally unworkable. This mixture was not suitable to reproduce Rembrandt's typical thick but spreadable brushstrokes.

Image 5. The mixture of lead white and sun-thickened linseed oil (shown on Image 4) two weeks after application.

Medium – Another Possibility

My experiment with two media followed a learned assumption derived from the National Gallery's analytical data yet failed to achieve a satisfactory result. Although black oil was impeccable in terms of drying speed, plasticity and workability of paint mixture, its viscosity was too low and did not match the level of viscosity unique for Rembrandt. From experimenting with the medium, I learned that paint viscosity is relative to the level of polymerisation of drying oil, but I also learned that plasticity rapidly declines in a manner almost inversely proportional to the degree of polymerisation. Was it really possible to combine two conflicting qualities, viscosity and plasticity, without adding any resin or beeswax?

The National Gallery also reported another finding: some of the samples contained white chalk mixed with lead white. In Rembrandt's time, there were two types of lead white, and one of them had white chalk added as a bulking agent. This lead white was mainly used for underpainting and never in the top layers. Use of white chalk may give paint some degree of plasticity and also transparency. Could it be that Rembrandt added white chalk to increase paint plasticity? But on the other hand, the National Gallery's analysis of the *Portrait of Philips Lucasz* revealed that the lace collar was painted with a pure lead white impasto, which demonstrates that paint plasticity could be achieved without addition of white chalk.

Ernst Van De Wetering[5] reported in his book entitled *Rembrandt: The painter at Work* published in 1997 that egg was detected in Rembrandt's medium when the Rijksmuseum in Amsterdam conducted restoration and scientific analysis of *Jewish Bride* and *Syndics of the Drapers' Guild*. The book mentions that no additives other than drying oils were found in the medium samples that were analysed by the National Gallery and described in the book *Art in the Making: Rembrandt*. It further points out that only a trace amount of egg was found in the actual Rembrandt's medium whereas the analytical method chosen by the National Gallery was designed to detect resin and wax, which, according to traditional beliefs, should have been part of Rembrandt's medium. Other than egg, vegetable gum was detected in the medium used with red lake, and pinholes were observed under the microscope hinting at evaporation of water through the paint layer. Based on the above, the master's medium could have been an emulsion containing some kind of protein. The book states that it was possible egg was needed as an emulsifier, once water was added to prevent uncontrolled spreading of poisonous lead white. The book also argues that plasticity and smooth fluidity, or in other words, improved brushability probably were side effects of medium emulsification through addition of egg. If this theory is true, applying this method to sun-thickened linseed oil (which demonstrated high viscosity but low plasticity) could prove to be an effective solution. Therefore, I added a small amount of egg yolk to the above described paint mixture of lead white and sun-thickened linseed oil. The amount of egg yolk was just a tiny scoop

[5] Head of the Rembrandt Research Project (RRP); Professor Emeritus of Art History, University of Amsterdam; and author of *Rembrandt: the Painter at Work*, 1997.

at the tip of a painting knife. After mixing it in, I brushed the resulting mixture onto a surface. Remarkably, the brush moved much more smoothly while both plasticity and an adequate level of viscosity were retained. It was finally possible to re-create Rembrandt's voluminous texture. Adding a trace amount of egg presented a possibility to resolve the conflict between viscosity and plasticity.

Taking this method a step further, I created a new medium by mixing lead white with sun-thickened linseed oil and adding an adequate amount of egg yolk for improved plasticity.

Table 1. Media Experiment Results

	Drying time (until dry to touch)	Plasticity	Brushability
Linseed oil	Over 10 days	Good (low viscosity)	Good (light)
Black oil	1 to 1 ½ days	Good (low viscosity)	Good (light)
Sun-thickened linseed oil	1 ½ to 2 days	Good (high viscosity)	Brush is too heavy to move
Sun-thickened linseed oil + egg yolk	2 days	Good (medium viscosity)	Good (viscous)

Verification Test – Copying Rembrandt's Work

Colours Used

Research made it possible to establish pigments Rembrandt used to create his masterpieces. The choice of pigments is far greater now than in his time. He was mainly using inexpensive natural earths plus several minerals and some man-made pigments such as transparent lakes, lead white and vermilion. His palette included a number of pigments that are no longer manufactured or used, such as lead-tin yellow and smalt.

For my experiment however, I wanted to emulate Rembrandt's method as close as possible; therefore, I decided to grind the colours myself. Where the required amount was very small (in case of vermilion) and where the colours needed to be diluted with a large quantity of medium (in case of lake pigments), I assumed that the impact of medium contained in tubed colours could be ignored, and opted for commercially available artist paints. This way, I used both hand-made and mass-manufactured colours. Colours I selected for this experiment are presented in the list below:

White: Lead White
Black: Ivory Black
Red: Vermilion, Alizarin Crimson
Yellow: Yellow Ochre, Italian Pink, Lead-Tin Yellow
Blue: Azurite, Smalt

Brown: Burnt Sienna, Burnt Umber, Van Dyke Brown, English Red

Of the above, I eventually dropped lead-tin yellow and azurite as I realized, in the process of copying, that these were unnecessary for my project.

Substrate and Preparation

Rembrandt, depending on his objective, mainly used two different types of substrates: wood panels and canvas. He used oak boards primed with animal glue (size). On top of the glue layer, he would apply a thin layer of chalk ground (gesso) using glue as a binder. On top of this layer, he would apply a very thin underpainting, a mixture of lead white, chalk and small amount of umber to create a light-coloured preparation (*imprimatura*), using drying oils as a binder. Two main purposes of the *imprimatura* were to create a neutrally coloured background so that whites applied in light areas would become more prominent, and to control the absorption rate of the chalk ground to prevent oil from being sucked out of the subsequent paint layer.

There are two basic types of canvas grounds, and with both types, drying oils were used as a binder. The first type is called “double ground”. First, a layer of a relatively cheap earth pigment is brushed on to fill the canvas texture; the second layer consists of a grey, light brown, or dull grayish yellow colour, with lead white as its main component. This seems to be the most common type of canvas ground. Rubens and Van Dyke also used it.

The other type appeared in the 1640s – a single-layer ground with a rough surface, with silica as its main component, and containing brown ochre and a small amount of lead white. Why silica was used is unknown but it is assumed that its low price and easy availability were behind it.

Looking at the subject for copying, *Self-Portrait Wearing a Toque and a Gold Chain (1633)*, from up close, we can see a brown *imprimatura* showing through glazes in the parts of the face which reflect light, and being the base colour of the hair. However, we don't see the *imprimatura* directly; it only shows through glazes. Therefore, it is impossible to judge its exact colour. *A Woman Bathing in a Stream* owned by the National Gallery in London (see Image 6) was painted on a wood panel. It reveals the *imprimatura* colour directly in the gaps between overlaying brushstrokes (Image 7). I decided to use the *imprimatura* colour seen in this painting in my copy (Image 8).

Image 6 and 7. *A Woman Bathing in a Stream* (National Gallery, London). You can see the *imprimatura* colour in the gaps between overlaying brushstrokes.

Image 8. Coloured base for my copy (brown *imprimatura* on wood)

Image 9.
Image 10.

Image 11.
Image 12.

Image 13. Completed underpainting
Image 14.

Image 15. Completed copy

Process of Copying

I made my copy directly from the original painting at the Louvre, which owns the original.

1) Wash Layer
After priming the panel with a water-based chalk ground, I applied a brown *imprimatura* to create a coloured base.

In the beginning, I painted roughly with Van Dyke brown to capture larger shapes and major contrast between lights and darks (Image 9).

2) Dead Layer
Instead of a true black-and-white monochrome called grisaille, I used a monochrome layer made with earth pigments. This is a stage where a "dead layer" is created that will serve as a foundation for glazing.[6] If warm colours of underpainting are allowed to show through, it will greatly assist with the painting's temperature or variation between warm and cold colours (Image 10).

[6] To be precise, the term 'grisaille' means a black-and-white or monochrome painting. However, it appears that a broader definition of this term is sometimes used. For example, the passage referring to Rembrandt's grisaille in *Art in the Making: Rembrandt* reads, "[He] used various tones of brown directly in the first layer of grisaille." In this case, it seems that the term's definition is closer to that of *camaïeu*.

Lead white was applied opaquely and thickly in the lights on the face (Image 11) while the underpainting shines through a thin, semi-transparent colour layer in dark areas (Image 12).

The lights on the hair were painted without use of white. Dark colours containing no white pigment were brushed on top of the lighter underpainting – nothing else. To depict black garment, again, no opaque grey was used. Instead, I used darker and paler versions of black without addition of white pigment. However, a small amount of white was mixed in light areas to create a sense of volume. Similar to lights on the face, the gold chain was painted with a mixture of a small amount of egg yolk and lead white to give it more body. This enabled me to reproduce thick application of paint that is regarded Rembrandt's signature style (Image 13).

3) Glaze
After the underpainting has dried, glazing was done to give intensity to colours and a feeling of depth to the surface. According to the chemical analysis, a complex composition including vermilion, several earth pigments, lakes, white and black was used for wet-in-wet glazing of skin parts (Image 14). Typical for Rembrandt and Rubens' works is application of cold colours in halftones between lights and darks. Use of azurite for glazing in the *Portrait of Philips Lucasz*, owned by the National Gallery, London, has been reported. I was thinking of using azurite in my copy, but an effect similar to the original was already achieved by using grey (mixture of white and black), and I decided to exclude azurite this time (Image 15).

Discussion on and Application of Glazing as a Means to Create Texture

My Reflections after Copying

By making a copy while standing in front of the original painting, I was able to check out some hypotheses but also stumbled upon some new questions. I confirmed that the use of sun-thickened linseed oil and a small amount of egg yolk rightfully reproduced the substantial texture of the light areas, a major characteristic of Rembrandt's work, by taking advantage of paint plasticity (Image 16). On the other hand, I found it surprisingly difficult to glaze over dark areas. A basic principle of the post-Venetian school of oil painting is that paint is applied opaquely and thickly in lights and transparently – as a thin glaze – in darks. However, a careful observation of Rembrandt and Rubens' works reveals that some dark areas have a surprisingly thick impastoed texture. For example, *Slaughtered Ox* owned by the Louvre shows a thick application of transparent colour in dark areas of the hanging ox's flesh (Image 17). *The Angel Raphael Leaving the Family of Tobit* shows relief-like bulges of paint in dark areas on angel's both wings (Image 18). The method used in my experiment was unlikely to reproduce this effect. The same can be said of the black areas of the artist's gown in the *Self-Portrait Wearing a Toque and a Gold Chain*, subject of this research paper. Paint remains sufficiently transparent to slightly reveal the *imprimatura*, but at the same time, it was applied thickly enough to retain brushstrokes.

As for the dark parts of the human figure, semi-transparent greyish colours were used to let *imprimatura* and whiteness of the chalk ground show through. At the same time, semi-transparent grey paint has retained enough body to form a bulky texture. However, opaque grey, if used as a semi-transparent colour rather than a thin glaze, would entirely obscure the colour of the underpainting. In order to create a substantial texture of note, one must use an essentially transparent colour.

It is a known fact that oil paints become more transparent with age. If we assume that transparency seen in Rembrandt's work has resulted from aging, we have to conclude that he applied paints thickly and opaquely. However, if you apply black thickly and opaquely, the way it was used in the gown, with no regard to browns of the underpainting, the resultant black colour would look extremely flat, and the sense of spatial depth will disappear. The same can be said of the dark areas of the human figure. Therefore, we must presume that Rembrandt applied paint thickly yet was sure he would achieve a certain level of transparency.

Image 16. A section of the copy

Image 17. *Slaughtered Ox*

Image 18. A section of *The Angel Raphael Leaving the Family of Tobit*

Description of Medium Found in Oil Sketches

Rembrandt and Rubens left behind many oil sketches that were completed in a very short time. When you paint an oil sketch or anything that needs to be finished quickly, you inevitably make ease of painting your first priority. Transparent thick application can also be found in that type of work. *Portrait of a Young Jew (1948)* is an example of such an oil sketch (Image 19). This painting was probably completed within one day except for glazes that were quickly applied after the painting had fully dried. If you study it carefully, you will see ridges of opaque paint in the light parts of the face whereas the clothing was quickly finished with a small amount of semi-transparent paint applied on top of a brown *imprimatura*. If you look at those parts, you will find them so oil-rich that it appears as if the pigment was floating in the oil. If that much oil were used, brushstrokes would have become completely obliterated. Yet brushstrokes are very prominent here, and the paint layer has a substantial body in the dark areas of the hair, for example. If you complete a painting within a few hours using a large amount of oil, painted areas lying next to each other would amalgamate and outlines will become blurred. None of this can be observed in the original artwork – it displays crisp brushstrokes. Of course, it is also a matter of painter's skills, but it is fairly obvious that the painter managed to create a paint of particular quality, which made this effect possible.

From these observations, we can deduce the following medium characteristics:
1) The medium itself offered some level of plasticity,
2) The medium allowed the painter to apply different colours in adjacent areas in a short period of time without a risk of unintended blending.

Image 19. Rembrandt's *Portrait of a Young Jew*

Transparent Thick Paint Layer

I can think of two possible ways how a substantial texture that is thick and transparent at the same time could be achieved. One is to use a less staining pigment as an extender. Another is adding more medium to paint.

I tried to verify these assumptions by using ivory black, based on the data collected from the available literature.

The added extenders were:
1) white chalk, and
2) smalt.

The media the volume of which was increased were:
3) Sun-thickened linseed oil, and
4) Emulsion of sun-thickened linseed oil and egg yolk.

And the results were as below (Image 20):

Image 20. Comparison study using ivory black. From left to right: mixed with white chalk, smalt, sun-thickened linseed oil, and emulsion of sun-thickened linseed oil and egg yolk.

Use of white chalk as an extender was mentioned in the final chapter of the National Gallery's research report. In my experiment, white chalk did increase transparency and plasticity to some extent, but to achieve a satisfactory level of transparency, I needed nearly a 70% mix of the white chalk. When applied thickly, the paint mixture started drooping. In my copy of Rembrandt's work, I used this method to paint black garment. To some extent, I could achieve the desired effect. However, if white chalk had been used for this purpose, the painter would have used large amounts of it in many other areas as well. The analytical results indicated that a limited amount of chalk was used as an extender for lead white in the underpainting and in some parts of glaze layers. The analytical results do not seem to agree with this theory.

Smalt can be also used as an extender. Smalt is ground cobalt glass; it is a transparent blue pigment of low tinting strength. Other than being used as a blue pigment, it was frequently added as a siccative to the slow drying paints. The National Gallery's analysis showed that it was also used as a means to increase thickness of dark glazes. However, use of smalt seems to be mostly associated with Rembrandt's later works. It is questionable if smalt was frequently used in paintings produced in his early career, which I selected for my study. The attempt to use smalt had a similar outcome as the use of white chalk. I tried this medium in some areas of the toque but was not satisfied with the results.

As for the option of increasing the medium-to-pigment ratio, if you look at the old masters' works with this idea in mind, you will notice that classical paintings (not only Rembrandt's) are more oil-rich than you previously thought. However, while adding more drying oil increases transparency, it decreases plasticity. Excessive amounts of oil always make paint runny. My experiment equally proved that adding more medium reduces plasticity.

The last remaining possibility was the use of egg. For my copy, I added the necessary amount of egg yolk to lead white to achieve desired plasticity, but was it possible to add egg yolk to a medium as a thinner?

I first mixed a small amount of egg yolk with the same amount of vinegar. Then I slowly added sun-thickened linseed oil while blending and emulsifying the mixture. When the quantity of added oil reached about five parts of egg yolk, the emulsion suddenly started forming mayonnaise-like peaks. Using this concoction as a medium, I mixed in the pigments and made a paint mixture. Taking a small amount with the tip of a brush and mixing it with paint, I found that I could freely control transparency. During my experiment, I also found that the paint mixture would retain brushstrokes if applied thickly but nevertheless provide a desired degree of transparency and plasticity.

From these experiments and building on a theory that Rembrandt used small amounts of egg yolk in the areas where plasticity was required, I deduced the following hypothesis: Rembrandt used an emulsion containing egg yolk as a medium and paint thinner. The advantage of this approach is that it "kills two birds with one stone": we can obtain a medium that facilitates both good

brushability and transparency. By using this medium as a thinner, the painter can also effortlessly achieve desired transparency and plasticity. There is no need to take an unnatural step of adding white chalk or smalt just to achieve the thickness and plasticity of transparent paints.

The problem is that using a thinner containing a large quantity of drying oil may, from the very beginning, create a very oil-rich surface. This would be contrary to the oil painting principle of "fat over lean." However, Rembrandt's approach naturally followed the above principle because he painted lower layers opaque and upper layers transparent. Where a lower layer was made using a transparent paint mixture, the same level of transparency in most cases was also maintained in the subsequent layers. In other words, an opaque layer containing more pigment was never sandwiched between two transparent layers. Therefore, the "fat over lean" principle was never breached.

Next experiment was to create an oil sketch to check how effective this emulsion was as a medium.

Painting an Oil Sketch with the Emulsion as a Medium

First I prepared a water-based white chalk ground and applied a brown *imprimatura*.

I completed the underpainting in about three hours. I made a rough sketch with strongly diluted Van Dyke brown, and without waiting for the paint to dry, proceeded to applying a lead white paint mixture in lighted areas thickly. In dark areas, I spread a thin layer of transparent paint to let the underpainting show through. For black hair, I used paint thinned with the medium to a transparent state without much thinking about how I was going to move it around with the brush (Image 21). A few days later when the underpainting was dry, I spent about two hours glazing it (Image 22). Brushstrokes that appeared in light areas (Image 23) and substantial texture created by the paint plasticity in dark areas (Image 24) were effortlessly achieved by this working method.

Image 21. Underpainting

Image 22. Glazing
Image 23. Thick paint in light areas



Image 24. Substantial texture in dark areas
Image 25.
Image 26. Enlarged view of the hair in the painting depicted in Image 25

One thing I noticed while running this experiment was that I was able to apply different layers of paint without accidentally intermixing colours despite working wet-in-wet. For example, when you paint a highlight in the hair, it is hard to draw thin sharp lines on a wet surface because colours tend to blend. While experimenting with this approach, I found that the highlight colour could spread over the wet lower layer without blending with it, and to some extent remained transparent (Image 26). This matches the qualities of a medium I specified in the chapter entitled "Description of Medium Found in Oil Sketches".

Based on the results of my experiment, I concluded that my hypothesis that Rembrandt used an emulsion containing egg yolk as his medium at least deserves a discussion. Further study of existing literature and analytical data will be required to verify my hypothesis.

Conclusion

Rembrandt's Medium and Flemish School of Painting

Once again, I would like to revisit the position Rembrandt holds in the history of painting techniques.

As I stated in the beginning of this paper, a prominent mark of Rembrandt's technique is that it integrated transparent painting found in the early Flemish school with exploiting paint plasticity that can be seen in the Venetian school. When I just started out, I was looking at this as a question of paint layer structure. I was asking myself whether expression of light should rely on the luminosity of the underpainting or the whiteness of the paint. However, when I actually stood

with a paintbrush in my hand and copied the master's original work, another question came to the surface: "Of what was his medium made?"

A recent medium analysis established that Jan van Eyck (1395-1441) (Image 27), Rogier van del Weyden (1399/1400-1464) (Images 28 and 29) and other early Flemish painters of the 15th century also used egg and glue in their creations. This suggests that their medium may also have been an emulsion containing protein[7]. In order to discuss this possibility, I actually mixed crimson lake, a typical transparent red paint, and found that mixing egg and glue changed the refractive index of the entire mixture and lessened the medium's transparency proportionally to the concentration of egg and glue. However, if a very small amount of them was added, it stopped the paint mixture from drooping. With this effect, an artist can dramatically increase the thickness of the paint layer and still easily control transitions. Armed with this hypothesis, let us have another look at the works of early Flemish painters, Rembrandt and Rubens. We can see that they had a common quality – a unique glazing technique, which enabled them to create dark areas, transparent and richly textured at the same time.

When we look at the works of Rembrandt and Rubens, we can say that they demonstrated more of the Venetian school techniques represented by Tiziano Vecellio rather than transparent glazing techniques observed in the early Flemish school. In other words, the Venetians improved the thick paint mixture to create an opaque and substantially thick application of paint in light areas. They expressed contrast between lights and darks by applying transparent paint over an opaque layer. When we look at this in terms of the medium and its composition, however, the rendering of dark areas clearly reveals the uniqueness of the Flemish school's approach. In this sense, I propose that we reposition Rembrandt as one of the last painters of the Flemish school founded by van Eyck and others.

Anthony van Dyke (1599-1641), a Rembrandt's contemporary, started his painting career as Rubens' apprentice. However, when you look at Van Dyke's work, you will notice that a thick layer of paint in dark areas, a telltale sign of the Flemish tradition, is no longer there despite the fact that he was, without any doubt, strongly influenced by his teacher. The question of how Van Dyke selected his ingredients remains a mystery worthy of further study. Whatever the truth may be, this interesting example suggests that it was the time of transition from the Flemish painting techniques to those of subsequent schools of painting.

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[7] Rogier van der Weyden – *St. Luke Drawing the Virgin*, the Museum of Fine Arts, Boston
Rembrandt: The painter at Work, Ernst van de Wetering

Image 27. Thick application of paint in dark areas seen in a painting of van Eyck.

Image 28 and 29. Thick application of paint in dark areas seen in a painting of Weyden.

References

1. *Art in the Making: Rembrandt - New Edition*, National Gallery, London, 2006

2. Ernst Van de Wetering: *Rembrandt: The Painter at Work, 1997*

3. *A Study of Techniques by Copying Tiziano Vecellio and Rembrandt*, Kuniharu Saito, Research Journal No. 27, Musashino Art University, 1996

4. *Rembrandt and the Face of Jesus*, Lloyd Dewitt, 2011

5. *Rogier van der Weyden - St. Luke drawing the Virgin*, The Museum of Fine Arts, Boston, 1997

6. *Malmaterial und seine Verwendung im Bilde*, Max Doerner, Japanese translation by Ichiro Sato, 1980