Technical art history : painters’ supports and studio practices of Rembrandt, Dou and Vermeer
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In the autumn of 1998, the world learned with astonishment of the results of a routine examination with infrared reflectography (IRR) of the Mauritshuis painting that had been known until then as Rembrandt’s *Self-Portrait of c. 1629*, which revealed a detailed underdrawing.¹ This reopened the debate on the authenticity of the painting, and a subsequent confrontation with the Nuremberg version cast serious doubt on the authenticity of the Mauritshuis work.² Not only is an underdrawing alien to Rembrandt’s working method but, as will be argued below, the character of the underdrawing in this case indicates that the painting was probably made in Rembrandt’s studio with the aid of a cartoon. The surface of a finished painting is of course crucial for its attribution, and the smooth, linear technique in the Mauritshuis work is totally unlike any other painting by Rembrandt. Other aspects of the painting technique too indicate that this painting cannot be by Rembrandt. The painted undermodelling, in particular, proved to be key to distinguishing a Rembrandt painting from a work by one of his contemporaries. It is our understanding of the build-up of paint layers and their characteristic handling together with the final touches that makes us fully comprehend a painting.³ It will become clear that it is vital to integrate information from *under the skin* of the paint with the *final* paint layer. In most cases neither of these two elements taken alone is sufficient to decide ‘Rembrandt—Not Rembrandt’.⁴

The underdrawing below the smooth paint surface of the Mauritshuis painting prompted a comparison between the Mauritshuis painting and the one in Nuremberg; they were placed side-by-side for the first time.⁴ Everyone present agreed that the painting in Nuremberg exhibited all the qualities of an autograph Rembrandt, whereas the Mauritshuis work did not. Though a yellowed varnish covers both paintings the flesh colour appears paler and cooler in tonality in the Nuremberg painting compared to the Mauritshuis picture, which has a more orange and hence a warmer tone. The richness or saturation of colour in the Mauritshuis work compared to the Nuremberg one is characteristic of a copy. The same is seen in the *Portrait of Rembrandt in Oriental Attire* in the Rembrandthuis compared to the slightly more restrained palette of the original in the Petit Palais, Paris, and also in the *Portrait of Rembrandt with Gorget and Beret* (Mukichi Okada Association Museum in Atami, Japan, hereafter ‘Atami’) where the colour scheme is warmer than its probable prototype in Indianapolis.¹

In the Nuremberg work, the paint depicting the facial features is applied vividly and freely, sculpting the face in light and shadow. In the Mauritshuis painting the brushstrokes are narrower and follow the contours of the face in a somewhat restrained manner (figs. 1 and 2). While there is no secondary blending of the paint with a soft brush in the Nuremberg painting, the Mauritshuis picture reveals the
extensive use of a soft brush to create smooth transitions between light and shadow. This blending is seen on the cheek, which retains its mellow appearance when viewed from close by. Unlike the shadows of the Nuremberg picture, those in the Mauritshuis version are painted with an opaque cool brown that practically covers the underlying reddish-brown undermodelling. The following elements, described in the catalogue entry in *Rembrandt by Himself*, are noteworthy: the light brown highlight in the right iris (grey in the original) has been positioned too low, near the middle of the iris; furthermore, the artist made a slight error in the position of the highlight on the lower lip, which is too low and too far to the left to be convincing for a light source at upper left. Another difference between the Nuremberg and the Mauritshuis works is that the position of the eyes are slightly closer together in the latter, while the facial features are somewhat elongated, comparable only to the rather awkward *Self-Portrait with Plumed Beret* in Boston. In the Nuremberg painting the face is rounder in form, as in accepted self-portraits from the same period. All these points not only confirm Rembrandt as the maker of the Nuremberg painting but emphasise that the Mauritshuis work is a copy, possessing many of the mistakes associated with copies. The inevitable dismay at the loss of a genuine Rembrandt in the Mauritshuis collection was somewhat alleviated by the fact that the *Portrait of Rembrandt with Gorget* is nonetheless a work of great painterly quality.

In 1658 William Sanderson, an English author of painter’s manuals, described the difference between an original and a copy thus:

An Imitator, does never come neer the first Author, (unless by excellent modern masters own working) a similitude ever more, comes short in truth, which is in the things themselves: The Copier being forced to accommodate himself, to another mans intent.
Capturing another artist’s intention always poses a particular problem when making a copy. The problems encountered by the copyist of the Mauritshuis picture have been enumerated above. Sanderson continued,

Old Pictures in a wonderful simplicity of Colours, draw their chief Commandations, from a more accurate, and graceful designe. New Pieces, on the contrary, being but carelessly designed, stand most of all on their garish Colours, and some affectation of Light and shadows, strained with over-daring.

It is almost as if Sanderson was aware of our current discussion.

As the unexpected underdrawing became the small stone that overturned the carriage, triggering a reappraisal of the attribution of the Mauritshuis painting, the following paragraphs will explain its significance for the assignment of this work as a copy. Though underdrawing has never been associated with Rembrandt before, it has been suggested that cartoons were used in his studio.

The function of underdrawing and the use of cartoons

The use of cartoons, though generally associated with the Italian Renaissance, was common among painters in the Netherlands from the Middle Ages onwards. The practice was widespread in early seventeenth-century studios. Van Mander devotes a full nine verses of his Schilder-boeck (1604) to this subject, recommending that artists make cartoons of the model or composition to be transferred to the painting support. In particular, young artists must not forget to include areas of shadow, highlights, plasticity and all the other elements essential to an exact copy of the subject. We find a brilliant example in a painting by Anthony Van Dyck (fig. 3), which has clear indentations from a cartoon showing the contours of the composition in the ground. The artist ‘merely’ had to fill in the right colour within the areas indicated by these lines. It has recently been suggested that the composition of Rembrandt’s Sacrifice of Isaac of 1635 (Hermitage, St. Petersburg) was transferred within the master’s workshop to another canvas with the aid of a cartoon. The copy (Munich, Bayerische Staatsgemäldesammlungen) is dated 1636 and is attributed to Rembrandt’s pupil Govert Flinck (1615–1660).

At first sight the underdrawing in the Mauritshuis picture appears sketchy in execution, drawn with a fairly free hand. The hair is merely indicated with fluid, curly lines and the gorget is drawn with numerous parallel sketch-like lines in a quest for the right form. Yet closer inspection of the IRR image reveals that the facial features were executed with considerable care, with double lines being used for the upper lip and the outline of the jaw. These extra lines, possibly denoting an area of shadow or the placement of a light reflection, are indicative of a careful copy after a prototype in which these features were already known. An artist drawing directly after nature would instead have employed hatching or the like to suggest varying degrees of illumination in the face.

During the recent technical examination of the portraits in the Mauritshuis collection, another much earlier painting revealed an astonishingly similar use of an underdrawing. In Jacopo de’ Barbari’s Portrait of Hendrik, Duke of Mecklenburg, 1507, the hair, cap, and dress were suggested in an underdrawing only in loose, free movements. The face, on the other hand, was rendered carefully, using double lines for the upper lip where the highlight was to be placed in the final painted version (figs. 4 and 5). The care and detail with which the facial details were drawn in both De Barbari’s painting and the Portrait of Rembrandt with Gorget recalls the age-old view of drawing as ‘den Vader van t’schilderen’. For centuries, apprentice painters practised drawing faces, hands and feet for years before graduating to painting, whether they were studying in Italy, Germany or the Netherlands.
These drawings were probably made on erasable tavolette, and the vast majority have been lost. This makes it hard to identify a budding artist through his early development as a draftsman. Nevertheless, we may view the differences between the two ‘hidden’ underdrawings in the Portrait of Hendrik, Duke of Mecklenburg and the Portrait of Rembrandt with Gorget as exemplifying the comparative styles of draughtsmanship in two artistic centres, however far apart in time. Both artists clearly saw careful preparation of the composition in drawings and/or underdrawings as essential. Van Mander stressed in his Schilder-boeck that only the most skilled artists could apply the dead-colouring directly to the support without any indication of a composition. The more inexperienced painter would have to invest much time sketching the scene painstakingly in charcoal and then drawing the outlines in meticulous detail with silverpoint before starting to paint.

Ariane van Suchtelen rightly notes in her entry on De Barbari’s painting that the underdrawing appears to have been made using a cartoon from which the main features were traced onto the white ground. Then the faint chalky lines were drawn up with a pen, carefully following essential contours, and freely indicating features of lesser importance. In his Il Libro dell’Arte (c. 1400) Cennini writes that when the artist has finished his underdrawing, he should ponder the result for a few days before making any necessary improvements:

When it seems to you about right (and bear in mind that you may copy and examine things done by other good masters; that is no shame to you), when the figure is satisfactory, take the feather (bird’s wing) and rub it over the drawing very lightly, until the drawing is practically effaced; though not so much but that you may still make out your strokes. And take a little dish half full of fresh water, and a few drops of ink; reinforce your whole drawing, with a small pointed miniever brush. Then take a little bunch of feathers, and sweep the whole drawing free of charcoal.
The technique described here doubtless corresponds to working procedures north of the Alps. Meticulous examination of the infrared reflectograph image reveals an interesting feature recalling Cennini’s words and supporting the use of a cartoon in the Portrait of Rembrandt with Gorget. A second, fainter pair of eyes, part of a mouth and part of the left hairline appear slightly lower and further to the right compared to the clearly visible drawing that was used in the final picture (fig. 5). These faint traces clearly represented an initial attempt to determine the position of the face.

While De’ Barbari did not follow all the drawn indications of dress, hair and cap in the painting process, he did keep to it when painting the face. It seems that an identical procedure was employed in the Mauritshuis Portrait of Rembrandt with Gorget: tracing with a cartoon and erasing unwanted lines (‘with a bird’s feather’) before making the final underdrawing. Van Mander refers to a similar working procedure, advocating that young artists should wipe off their carefully drawn composition with silverpoint before starting to paint. In Portrait of Rembrandt with Gorget too the final underdrawing was followed carefully in the face, but elsewhere the sketchy lines served only to give a rough indication of form. In a recent study Ella Hendriks has shown that the Haarlem portraitist Johannes Cornelisz. Verspronck (1606/09–1662) used extensive underdrawing in his portraits. He also supplied rough indications of elements such as hair, which he did not follow in the final painting process.
When the almost completely erased initial outline of the face in the Mauritshuis picture was traced onto a transparent overlay and superimposed over Rembrandt’s painted *Self-Portrait with Gorget* in Nuremberg, the position of these features proved to coincide exactly with those of the latter painting. In both tracing and painting the figure leans somewhat to the right, as in most of Rembrandt’s early self-portraits. What is more, in the Mauritshuis work the left outline of the gorget and the sitter’s shoulder were positioned a little further to the right in the underdrawing than in the final painting. In contrast, the outline in the traced underdrawing perfectly matches that of the sitter’s shoulder in the Nuremberg painting.

The hypothesis that the copyist of the *Portrait of Rembrandt with Gorget* in the Mauritshuis used a cartoon is further substantiated by superimposing the two separate underdrawings of the face found in this work over one another. The lines used for eyes, mouth and hairline are practically identical. This strongly suggests that the painter of the Mauritshuis work used a cartoon of only the facial characteristics when transferring the image. After his first attempt he probably wiped off most of the black chalk; he then moved his cartoon upward and to the left to complete his second tracing, producing the clearly visible underdrawing followed in the executed paint layers.
It seems safe to conclude that the copyist of the Mauritshuis picture initially intended to make a 'literal' copy of the Nuremberg Self-Portrait with an identical position of the figure on the panel. He then altered the position of the head by drawing the face again, a few centimetres upwards and to the left. The new position gave the sitter a more upright posture, projecting an air of self-assurance not found in the Nuremberg painting. This position was followed in the meticulously executed final paint layers. The transformation was so complete that Rembrandt's Nuremberg portrait in the Hague version acquired the formality of a Portrait of Rembrandt.

The discovery of the underdrawing in the Portrait of Rembrandt with Gorget, however, naturally caused some to wonder if—against all odds—examination of other early Rembrandt paintings under the same conditions might not reveal similar underdrawings. Even if we established the drawing as stylistically incompatible with Rembrandt, was it not conceivable that another 'head', 'tronie' or history painting might reveal faint traces of drawn lines below the paint layer? To answer this question a substantial number of early Rembrandts were subjected to systematic IRR analysis for the first time. This project also included paintings formerly attributed to Rembrandt and works by Jan Lievens, Gerrit Dou, and Isaac de Jouderville—59 works in all. The provisional results revealed underdrawings only in paintings by or attributed to Gerrit Dou (see table 1).

The project also proved that Rembrandt's virtuoso application and use of undermodelling in paint shows up in the IRR image. We had gained a completely new source of information. IRR analysis reveals that the shaded parts of the face in all examined Rembrandt 'heads' from 1626 to 1634 (the period of this study) have a characteristic patchy appearance. Since this phenomenon is absent from portrait paintings by Lievens, Dou, De Jouderville and other artists close to Rembrandt, we may have discovered an important clue for the identification of Rembrandt's painting technique. IRR analysis shows up his virtuoso application and integration of a painted undermodelling below the paint surface and enables us to distinguish Rembrandt's technique from that of his early contemporaries. The analysis proved that the preparatory layers, the undermodelling, in the Mauritshuis work clearly differ from Rembrandt's technique.

The following paragraphs will show that the initial paint layers below the surface to a large extent determine the final image, and explain how this layer can be read as 'fingerprints' that help us to determine whether or not a portrait is by Rembrandt.

Looking below the surface

In the 1930s the master forger Han van Meegeren had hoodwinked the art world into accepting several of his works as early history paintings by Johannes Vermeer. When the swindle was discovered, science was called upon to analyse the forgeries. It proved a simple matter, using sophisticated new techniques, to distinguish original materials from those that had been artificially aged. The connoisseur's eye would not suffice; the assistance of new technologies and science was needed to unmask the forgeries. One of the first studies publishing the findings of this new interdisciplinary collaboration was Rembrandt in the Mauritshuis by De Vries et al. The Rembrandt Research Project (RRP) was determined from the outset to employ all available analytical methods in order to clarify Rembrandt's complex technique and to resolve authenticity problems. The impact of this scientific approach cannot be overestimated and the RRP method was probably the starting point of what is known today as 'technical art history'. After almost forty years of Rembrandt research, this scientific approach has produced one of the best-documented oeuvres of any artist. Even analysis using X-radiography, infrared photography, detailed documentation of panels using dendrochronology and of canvases using
The use of IRR or a Charge-Coupled Device (CCD) for the study of paintings is mainly used to find out whether an artist used a sketch, a punched cartoon, a combination of the two, or a precise underdrawing applied to the white ground prior to the painting process. The discovery of an underdrawing has often helped conservators and art historians to suggest an attribution of a painting otherwise difficult to place. IRR has proved especially valuable in examinations of paintings from the 15th and 16th centuries, sporadically for the 17th century. But its potential has yet to be fully exploited. Brushstrokes and underdrawings containing carbon black will show up dark, as they absorb the IR radiation. They contrast clearly with areas in which no black has been employed, the latter showing up as a bright colour, as they reflect the IR radiation. Red or brown paint will show up in bright hues depending on the nature of the paint, thick application being relatively brighter. Where uncovered or only thinly covering the white or slightly tinted ground, the result will also appear bright on the infrared reflectograph. More tonal values within this monochrome scale indicate the nature and number of adjacent or superimposed paint layers.

These possibilities become extremely interesting when applied to study the initial stages of Rembrandt’s painting process, as described in detail by Ernst van de Wetering in his recent monograph Rembrandt, The Painter at Work. Over the — coloured — oil ground, Rembrandt would start by delineating the composition in lines of varying thickness. Then he would apply the dead-colouring or undermo—
delling in monochrome hues ranging from dark reddish brown to light ochre. Certain areas would be heavily toned and some even impasto; others would be semi-transparent, allowing the light ground to shine through. *The Concord of the State* (c. 1640; Museum Boijmans Van Beuningen, Rotterdam) gives us an impression of an early stage in the painting process before the application of the final paint layers. The sketchiness of this initial undermodelling, energetically applied since the hand is expressing at this stage what an artist has ‘already seen painted in his mind’s eye’, can be described as consisting of splotches of paint, somewhat recalling the Italian art lover Baldinucci who wrote in 1686 about Rembrandt’s unusually free hand, drawing forms with ‘tratti irregolari’. In the *Anatomy Lesson of Dr. Nicolaes Tulp* cross-sectional analysis confirmed that Rembrandt applied a brown painted undermodelling at an early stage, which – in ‘tratti irregolari’ – would define the main form and principal shadows. Bomford, Brown and Roy had already written at length on Rembrandt’s use of this procedure in his *Judas Repentant* (1629) and the *Portrait of Aechje Claesdr. Pesser* (1641). Scientific analysis has revealed that at this stage Rembrandt was probably working with paint bound in an aqueous medium. Besides according with sporadic references in painters’ manuals, this would also seem logical. An initial paint layer in such a medium would dry very quickly and enable the artist to continue in oil without wasting time waiting for an initial oil layer to dry. But the use of an aqueous undermodelling has another implication, which appears particularly significant to our interpretation of Rembrandt’s works. As soon as the aqueous layer is dry, oil paint can be applied directly without ‘erasing’ the brushstrokes of patchy brownish undermodelling. Thus Rembrandt could apply oil paint and rework the image wet-in-wet directly on the surface without losing his ‘composition’ below. This is also why IRR reveals the undermodelling so clearly. While in X-radiographs of the paintings, parts containing lead white show up light as opposed to parts without lead white, with IRR the non radio-absorbent brownish undermodelling becomes visible.

**Examples of paintings recently examined with IRR**

IRR comparison of the *Self-Portrait with Gorget* in Nuremberg with the *Portrait of Rembrandt with Gorget* in the Mauritshuis revealed numerous discrepancies. In the Nuremberg self-portrait the hair is painted in long fluid strokes, and the open brushwork shows up in the shaded sections of the face, to the right of the sitter’s right eye, in the hair, and below the gorget and black attire, revealing a transparent reddish-brown undermodelling that endows the painting with depth. Fluid paint has formed droplets that have started to run down the surface below the left eye. The brushstrokes in the face do not slavishly follow the form but only indicate it. The illuminated part of the face is modelled in a range of ochres including admixtures of lead white and a red pigment, probably vermilion. Additions in red lake accentuate nostrils and lips. Beneath the left eye tiny dabs of vermilion indicate the eyelashes. The Mauritshuis painting has been made, as already noted, using a rather different technique. The facial features are modelled in narrow brushstrokes following the form as in an engraver’s work. There are scarcely any uncovered areas in the finely painted hair, and all the shaded parts of the face have been produced by adding brown or greenish paint rather than by allowing the undermodelling to shimmer through.

This difference in technique is clearly visible when comparing the IRR images of the two paintings (see figs. c and d, pp. 186–187). IRR analysis shows up the brown undermodelling that plays such a key role in the Nuremberg painting in the form of numerous bright areas, primarily in the shaded parts of the face and the hair. The luminosity below the right eye is created by allowing the brown undermodelling to
Rembrandt, *Self-Portrait as a Young Man*, c. 1628, panel, 22.5 x 18.6 cm. Amsterdam, Rijksmuseum.


CCD computer assembly of: Rembrandt, *Self-Portrait as a Young Man*, c. 1628, panel, 22.5 x 18.6 cm. Amsterdam, Rijksmuseum (copyright A. Verburg/Stichting RKD).

shimmer through the transparent paint layers, not by adding a brighter paint layer as in the Mauritshuis picture. The IRR image of the latter painting does not exhibit any of the characteristics of the Nuremberg image. Apart from the clearly visible underdrawing, the hair appears to have been modelled in three wide and wavy horizontal sections, one above the other. The IRR image also clarifies the modelling of the background, which is unreadable in the painting. We discover brushstrokes following the contours behind the head, something also visible in the work in Atami (see below). The shaded part of the face remains evenly grey except for a lighter area below the eye created by a light flesh colour applied over the painted shadow.

When the IRR images of the Nuremberg and Mauritshuis paintings revealed such differences in painting technique, the next step was to look at some other early Rembrandt self-portraits and their copies. I should like to present the findings of two of these comparisons.

Rembrandt’s earliest painted self-portrait, executed around 1628 (fig. 6) was not rediscovered until 1959. Until then a version in the museum of Cassel had been regarded as the original (fig. 7). The Amsterdam version is undoubtedly the better of the two. Its vivid brushstrokes do not follow the form of the face but rather ‘sculpt’ the head. Scratch marks reveal the brown undermodelling in its variety of hues: light behind the neck, dark above the head. Rembrandt’s scratches in the wet paint allow us to glimpse the varied tonal values in his undermodelling. In comparison, in the Cassel work the copyist has tried to imitate the master’s vigorous style of painting, but the brush handling is coarse and completely uncharacteristic of Rembrandt. The entire work appears to have been painted in one quick session, wet-in-wet. The background was still wet when the contour of the face was paint-
ed, and the hair too has been painted wet-in-wet into the background. The paint application is fluid and reveals a mannered hand with a very distinct ductus appearing as repetitive strokes, almost like hatching. The Cassel work's status as a contemporary copy after the Amsterdam painting is beyond doubt, although its nonchalant style of painting almost gives it the air of a caricature.

The IRR images of the two paintings are again highly revealing. The original (fig. 8) has an uneven and blotched appearance in the shaded part of the forehead, at the left eye, below this at the tip of the nose and on the lips. All the scratch marks down to the buff-coloured ground in the hair have an almost even bright tonality. The openings in the ragged brushstrokes in the background show up bright where the ground is partly uncovered. The copy (fig. 9) has none of this blotchy quality, and the paint layers lack transparency in the areas of shade in comparison to the original.

A third pair of self portraits consists of the Self-Portrait with Gorget and Beret in Indianapolis (fig. 10), attributed to Rembrandt, and the copy after this painting in Atami (fig. 11). Although Grimm suggested the hand of Gerrit Dou in the Indianapolis portrait, several features such as the divergent brushstrokes on the nose, the modelling in the downward-curving brushstrokes of the right cheek and the characteristic scratch marks in the hair clearly point to Rembrandt. The shaded area on the forehead and the left cheek is painted thinly, which is also noticeable in the corrections made to the first version of the beret. The IRR image of this painting (fig. 12) clearly shows the blotchy quality caused by the undermodelling, which seems to confirm the attribution to Rembrandt. The shaded part of the face is built up of numerous small brushstrokes, some on the surface and others below. The transparency of the dark paint to the right of the mouth allows the ground to shimmer through, creating a slight reflection from diffuse light from the left of the face.

In the Portrait of Rembrandt with Gorget and Beret in Atami the paint is applied in a fluid medium in the gorget and scarf, and only along the upper shoulder is a brown undermodelling slightly visible, which does not play any major role, however, in the finished image. The face is painted in opaque colours comparable to the Mauritshuis portrait and is executed with tiny brushstrokes following the form, although the earlobe is not defined beyond a blob of reddish-brown paint. The highlight on the bridge of the nose is executed in soft yellowish-pink paint. The highlight in the eye consists of two small, thin parallel lines, and the iris overlaps the lower eyelid and contains no diffuse light reflection. The shaded part of the face has been achieved using opaque brown paint and a few pink strokes on the chin. There does not appear to be any spontaneity in the application in face or gorget.
The latter is carefully modelled into a convincing metallic structure. The highlight on the gorget is applied with a fine brush and moved slightly towards the upper left. The scarf, which consists of numerous thin brushstrokes over a thin brownish paint, the brown semi-transparent shoulder and the beret are painted with more forceful liquid strokes, each about 1 cm in width. The nostrils and mouth have been accomplished using a brownish-red impasto. There is no addition of black as in the Indianapolis version. The scratch marks in the hair are often at odds with the form of the painted curls, which are themselves blurred and ill-defined. The detail that clinches the conclusion that the portrait in Atami is a copy after the Indianapolis painting is the highlight on the upper lip. It appears diffuse and was painted at an early stage, before the flesh colour surrounding it. This indicates painting from front to back, a method primarily favoured in copies. The Indianapolis painting also has light reflections on the lower lip close to the left corner of the mouth, whereas the same spot in the Atami portrait is done in bright pinkish paint, contrasting with the darker red in the painted surroundings. In contrast to the vivid brushstrokes in varying directions in the Indianapolis portrait, the Atami painting is much smoother and restrained in execution. Although the examination of the latter painting was not conclusive, it will be no surprise that the IRR image shows no bright areas or blotchy qualities in the shaded part of the face, but is evenly greyish as in the Mauritshuis work.

At a colloquium held jointly by the Netherlands Institute for Art History (RKD) and the Mauritshuis in December 1999 in connection with the Rembrandt by Himself exhibition in The Hague there was an animated debate on whether the Self-Portrait with Beret, Unfinished (c. 1659) from Aix-en-Provence could be accepted as...
a ‘Rembrandt’ or not (fig. 13). Several scholars, largely within the drawing and prints disciplines, insisted that the unfinished portrait was comparable to some of Rembrandt’s drawings, particularly one in Rotterdam (cat. 77) and one in Vienna (cat. 78, fig. 14). In his catalogue entry on the Aix-painting, Christopher White commented, ‘The striking and most effective combination of precise definition and very free brushstrokes describing the head and clothing can also be found in contemporary drawings, particularly in the self-portrait in Vienna, which also shows the artist in similar dress’. In the small unfinished panel, the ochreish-brown between the dark brownish-black and greyish paint is the uncovered ground layer. The warm colour stems not only from the buff-coloured ground but also from later varnishing. The dappled brown and blackish brushstrokes of the undermodelling are likewise distinguishable below the final paint layer in Self Portrait with Two Circles of c. 1665-1669, Kenwood House (fig. 15). In 1692 Marshall Smith commented on this kind of painting:

Rembrandt had a Bold Free way, Colours layd with a great Body, and many times in Old Mens Heads extraordinary deep Shaddows, very difficult to Copy, the Colours being layd on Rough and in full touches, though sometimes neatly Finish’d.

Rembrandt’s search for the correct form as seen in the undermodelling in this late self-portrait appears comparable to the patchiness visible in IRR images of paintings from Rembrandt’s early period. His method corresponds to Van Mander’s description of bold and inventive painters who ‘without great trouble would work directly with brush and paint in a free approach and thus set down their paintings deftly in the dead-colour; they sometimes “re-dead-colour” soon after, so as to achieve a better composition. Thus those who are abundantly inventive go audaciously to work, thereafter making an improvement here and there’. What IRR reveals is that a mottled, patchy undermodelling or dead-colour and ‘re-dead-colour’ is to be found below the paint film of all Rembrandt’s heads or portraits examined in this survey. As we have seen, the final result derives from what is below together with what is on the surface. In Rembrandt’s case, there is also a unique execution of specific layer(s) within the ‘sandwich’ that distinguishes the master chef from his apprentices and close associates.
De Jouderville and Lievens

Several paintings by pupils and followers were also studied using IRR. Interesting though many of the findings were, they will not be discussed in detail here. I would like to briefly present the conclusions reached on two paintings, however – one by Isaac de Jouderville and one by Jan Lievens.

As Claus Grimm had tentatively attributed the Mauritshuis painting to Isaac de Jouderville in 1991, the latter’s sole signed ‘Tronie of a Young Man (Self-Portrait?)’ from Dublin was examined using IRR.49 However, the painting displays no trace of the delicate mastery of paint to which the face of the Mauritshuis portrait bears witness. De Jouderville worked with smaller brushes and more liquid, brightly-coloured paint than Rembrandt. Although the hair is rendered in a manner somewhat similar to that in the Mauritshuis portrait, the scarf and dress are not. The IRR image of this painting (fig. 16) shows no underdrawing and the shadows in the face display no patchiness comparable to that in Rembrandt’s portraits.50 Jan Lievens’s ‘Tronie of a Young Man with Gorget (Portrait of Rembrandt?)’ c. 162951 was executed using a small brush that followed the form of the head. Unlike the Mauritshuis portrait, the shaded part of the face is painted thinly, revealing the brownish undermodelling, and the light ground gives this translucent layer a certain glow. For the background a larger brush was used, wielded in loose zigzag patterns. The gorget was originally fully visible and finished but is now partly covered by the brown of the cape.52 The IRR and CCD analysis did not reveal any underdrawing. The imprimatur or undermodelling was clearly visible, but there was no blotchiness in the face (fig. 17).43
Conclusion

I believe we must accept that the young Rembrandt's technique was neither so detailed nor so smooth as is generally believed. The master himself suggested in a letter in 1639 that his paintings should be hung in a strong light so that they could 'voncken' [sparkle], an effect attributable to his use of impasto which reflects the light. Rembrandt became such a consummate artist because he mastered the 'rough' technique of painting in blotches and coarse brushstrokes in his early twenties. With this technique he distinguished himself not only from the smoother, more colourful style of his master, Pieter Lastman, but also from the established portrait style at the stadholder’s court in The Hague, which favoured the smooth French style of portraying the nobility. Painters such as Jan van Ravesteijn (c. 1570-1657) had commissions by the dozen. Still, the young Rembrandt was not with-
out his admirers at court, as Constantijn Huygens noted in 1629. Huygens was probably acting on behalf of the stadholder Frederik Hendrik when he purchased *The Taking of Samson* (1628; Berlin) and *Simeon's Hymn of Praise* (1631; Mauritshuis), and commissioned the *Portrait of Amalia of Solms* (1632; Paris, Musée Jacquemart-André) and the *Passion Series* (1633–1646; Munich, Alte Pinakothek). Appreciation in courtly circles never seduced Rembrandt into adopting a smooth manner, however; his technique of applying and building of layers of paint on his panels or canvases remained entirely unique.

In several of Rembrandt’s early heads, IRR analysis reveals a characteristic blotchy appearance. This helps us to distinguish the master’s paintings from those by artists in his immediate circle, all of whom appear to have applied the preliminary paint layers in a different, more careful manner. The small group of painstakingly executed *tronies* and self-portraits that until 1986 had been grouped around the Mauritshuis painting helped to foster the myth of Rembrandt’s early ‘smooth’ period. The recent de-attributions, primarily representing the conclusions of the RRP staff themselves, have been confirmed by IRR analysis: these works do not exhibit any patchiness or vigour in the painting of transparent and ‘unfinished’ superimposed layers. A comparative analysis of the early – apprentices’ – copies made within Rembrandt’s workshop after prototypes by the master, the ‘satellite pictures’ as Van de Wetering calls them, would be a logical continuation of the IRR research on Rembrandt’s oeuvre. In an unpublished lecture, Christopher Brown has referred to the idea of ‘largely anonymous assistants [...] painting independent portraits in [Rembrandt’s] style’ as a hypothesis ‘unsubstantiated by contemporary documents and based on a circular argument’. However, technical research clearly shows that there were several painters making Rembrandt-like pictures in and outside the master’s workshop.

Gerrit Dou has been suggested as a possible candidate for the authorship of the Mauritshuis portrait. Although Dou was still young in 1631–1633, even his early paintings display a far smoother and more detailed manner of painting than was ever practised by Rembrandt. Trained as a draughtsman and glass engraver, Dou was always meticulous in his handling of the brush. Eric Jan Sluijter observes that in contrast to Rembrandt, Dou espoused the cause of painting non-narrative scenes, in which realism mattered more than emotions or action. How true. This perspicacious remark brings out the differences in preoccupation and mood between Dou and Rembrandt. It is exactly to the point in describing the differences between the two portraits in Nuremberg and The Hague.
* At the RKD/Mauritshuis colloquium on 8 December 1999 I gave a talk entitled ‘From Rembrandt to Dou. The Mauritshuis portrait of Rembrandt at the age of 23’, presenting a possible attribution of this painting to Rembrandt’s first apprentice, Gerrit Dou. This discussion is still going on (see reference elsewhere in this text). The present paper, however, will focus largely on further information relevant to rejecting the Mauritshuis painting as a Rembrandt. Many colleagues have helped and inspired me along the path to clarifying and formulating the results and ideas presented in this paper: Rachel Billinge, David Bomford, Hans Brommer, Quentin Burdeau, Edwin Buijsen, Andrew O’Connor, Caroline van der Elst, Michiel Franken, Claus Grimm, Daniel Hess, Martina C. Homolka, Elmer Kollin, Cynthia Kortenhorst, Mark Leonard, Walser A. Liedtke, David A. Miller, Volker Marquardt, Petra Noblet, Peter van der Ploeg, Martin Royallen-Kish, Marcia C. Steele, Yvonne Susfien, Axel Rüger, Peter Schatborn, Ariane van Suchtelen, Tokugo Uchida, Adria Verburg, Ernst van de Wetering, Marielle de Winkel, Mar- garet Wolters, and many more colleagues outside and within the Mauritshuis. I am also extremely grateful to Beverley Jackson for her editing of the English text.


2 Mauritshuis press release on 30 November 1998. See also E. Gremian, ‘The Rembrandt Research Project: reculer pour mieux sauter’, Oud Holland 113 (1999), no. 3, pp. 113-160, pointing to the chain reaction of attributions of early smoothly painted works from the Leiden period triggered by the rejection of the Mauritshuis painting from Rembrandt’s oeuvre. From a technical viewpoint it is interesting to note that the recent Isabel Stuart Gardner exhibition catalogue Rembrandt creates Rembrandt. Art and Ambition in Leiden, 1629-1754, presents conflicting, mainly subjective opinions with regard to the authorship of the Mauritshuis portrait of the young Rembrandt. The general reader will be hard pressed to assimilate the following three arguments: a. K. Wheelock Jr finds Rembrandt’s authorship of the Mauritshuis portrait of the Young Rembrandt ‘entirely possible, indeed probable’ (p. 19). His argument derives largely from a lecture given by Eric Jan Sluijter (8 December 1999). Wheelock describes the underdrawing as ‘schematic’ and asserts that ‘its existence here is logical given that the painting is a second [autograph] version’ (p. 19, note 24).

b. Christopher White writes, in contrast, that Rembrandt ‘did not draw in chalk on the panel [before starting to work]’ (p. 55), but that he began directly by applying lightly brushed-in lines over which he ‘painted freely in monochrome’.

c. Finally, A. Chong writes in his entry on the Mauritshuis painting (cat. no. 6) that despite the opinions of Wheelock, Sehama, Sluijter and others he has long ceased to consider the Mauritshuis painting as an autograph work, concluding ‘A beautiful painting does not need to have been painted by Rembrandt’ (p. 97). Chong invokes the totality of the information accumulated between the late 19th century and 1999. The Boston catalogue contains no reference to J. Wadum and C. van der Elst, ‘Attribution et désattribution. Les portraits de Nuremberg et de La Haye’, Dessin de l’Art 61 (1999), pp. 34-43, which presents additional information about the differing techniques between the Nuremberg and Mauritshuis paintings.

The catalogue raisonné Portraits in the Mauritshuis, Zwolle (forthcoming) will include numerous examples illuminating this statement.

4 This took place on 7-8 October 1998, in the conservation studio of the Germanisches Nationalmuseum, where both paintings underwent intense visual scrutiny as well as examination using stereomicroscope, IRR and side-by-side comparison of X-radiographs. The initial examination was carried out by M.C. Homolka, head of paintings conservation, and Jorgen Wadum. Both paintings were further examined by a delegation from the Mauritshuis (C. White, London; P.J. Dupare, Mauritshuis; E. Buijsen and A. Verburg, RKD) and studied meticulously using the RKD’s IRR and CCD cameras.

A personal evaluation of the two paintings by E. van de Wetering (RRF) was also taken into account. Wadum, Buijsen and Verburg also documented the characteristics of technique and execution in the two paintings.

5 E. van de Wetering had already expressed his personal reservations about the Atami work in the Corpus. See: Rembrandt by himself, cat. no. 8, pp. 100-101, proposing attribution of the Indianapolis painting to Rembrandt.

6 I shall spare the reader yet another detailed comparison of the Nuremberg and Hague paintings and make only a few important observations; for the rest the reader is referred to several accounts of the confrontation: C. White and Q. Burdeau (eds.), exh. cat. Rembrandt by himself, London (National Gallery of Art) / The Hague (Mauritshuis) 1999-2000, cat. nos. 14a and 14b, pp. 112-117; Wadum/Van der Elst 1999 (note 2), pp. 34-43; cat. no. 11 in Portraits in The Mauritshuis, Zwolle (forthcoming).

7 A. Chong in: Rembrandt creates Rembrandt. Art and Ambition in Leiden, 1629-1754, pp. 91-97 and note 4, not only agrees that the Mauritshuis painting is not by Rembrandt but also asserts that for him Grimm’s argument (1999) was the point of no return (already stated by Chong at a lecture given at the Rijksmuseum on 21 May 1999).

8 W. Sandersen, Graaf des, or, the use of the Pen and Pensil, in Designing, Drawing, and Painting, with an exact Discoverie of each of them, London, 1618. I am grateful to Marielle de Winkel for drawing my attention to this source.


11 Miedema 1975 (note 9), chap. 128, p. 854 writes that a precise understand- ing as to when the before the mixed colours are applied exactly where needed.


13 Although the probability of a cartoon being used for the Mauritshuis painting would exclude the authorship of a skilled young master-painter such as Rembrandt, the researchers did consider whether Rembrandt could have made a comparable drawing. The execution of the underdrawing seems very remote from Rembrandt’s style of draughtsmanship, whether in chalk, pen or another medium. Fluid and unrestrained lines such as those seen in the early hair are very rare in Rembrandt’s
drawn oeuvre. Indeed, Rembrandt seems always to have had a firm grip on his drawing tools even when his style is sketchy. The resulting abrupt, relatively short, energetic lines would often produce somewhat angular curls in contrast to the voluminous form found in the underdrawing.

14 A. K. Wheelock Jr in: Rembrandt create Rembrandt, Art and Ambition in Leiden, 1629-1651, p. 23, note 24, uses the single word 'schematic' to describe the underdrawing. He thus ignores the clear differentiation between the carefully drawn facial features and the rest of the underdrawing, which is more 'impressionistic'.

15 Cat. no. 11, Portraits in the Mauritshuis, Zwolle 2001 (forthcoming).

16 Miedema 1973 (note 9), cap. 211, p. 98.


18 See also: J. Bolten, Method & Practice, Dutch and Flemish Drawing Books 1550-1750, which discusses the practice of teaching apprentices to copy after drawing books to acquire draughtsmanship skills. Van Mander describes this at length in his Grondt, chapter 2.


21 Cat. no. 11, Portraits in the Mauritshuis, Zwolle (forthcoming).


25 No other known apprentices such as Aert van der Neer (1604-1678), Pieter de Hooch (1629-1680), and Gerard ter Borch (1618-1681) were examined, as they are nowhere mentioned in relation to Rembrandt before 1635. What is more, their youth was thought to exclude them from consideration as possible authors of the Mauritshuis painting.


28 P. Klein reported (26 September 1699) that the Mauritshuis panel was probably used after 1619; the Nuremberg panel was estimated ready for use after 1612. It should not be forgotten that both panels were probably trimmed by as much as 2 cm. The lost piece would contain a certain number of year rings, which theoretically implies that the availability of both panels would be closer to the second half of the 1620s.

29 Infrared photography has a sensitivity of up to 1500 nm; the infrared reflectography used in this study was done with a Hamamatsu vidicon camera sensitive up to 1900 nm.


31 The CCD camera produces an image in the near IR spectrum, around 800-1000 nm. The Hamamatsu EIR vidicon is sensitive at 1500-1900 nm.


33 E. Buijzen and M. Wolbers (RCD) are currently working on a project of this nature, with a degree of collaboration with the Mauritshuis and the 'De Mayerne-project' [MoiAn (14)]

34 C. van der Velden and E. van der Velden, 'De Mayerne-project' [MoiAn] and note 83.


38 Proteinaceous materials may be expected in these initial layers or undermodelling, as found in Conward of the State (Rotterdam, Boijmans Van Beuningen) and in Titus of an Old Man (Rembrandt's workshop, Mauritshuis, inv no. 165). Of course, other artists too mixed mediums in this way, e.g. the anonymous painter of the Amsterdam Holy Family by Night (information supplied by A. Wallert at the Rembrandts Colloquium in the Rijksmuseum, Amsterdam, on 7 December 1995), which was probably produced in Rembrandt's studio. The Haarlem painter Verspronck is another case in point; see: E. Hendrikse, 'Johannes Cornelisz. Verspronck. The Technique of a Seventeenth-Century Haarlem Portraitist', in: Looking Through Paintings, Baarn/London, pp. 227-263. The use of proteinaceous binding medium has also been detected in lower paint layers in several paintings by Johan­nes Vermeer.

43 Similar liquid paint that has started to drip down the painted surface is also visible on the sitter's left temple in the Metropolitan's Portrait of a man, signed RHL van Ryn 1634 / AT, 40, (inv. no. 64.126).


45 The circumstances under which the painting was examined were not ideal for a very detailed study. I am grateful to Arie Wallert, Rijksmuseum, for letting me borrow the museum's Hamamatsu IRR camera during a visit to Atami in April 2000.

46 White and Buvelot 1999-2000 (note 6), cat. no. 71, p. 206.

47 I am grateful to Marieke de Winckel for stimulating discussion on the issue of original versus copy and for drawing my attention to this source: Marshall Smith, The Art of Painting, according to the theory and practice of the best Italian, French and German masters, London (The Vendue) 1691, p. 89.


51 I am grateful to Andrew O'Connor for letting C. van der Elst and myself study De Jouderville's painting out of the frame (14 September 1998), and for providing recent photographic documentation.

52 It should be noted that the greyish haze over the sitter's right eye is due to wear, not to technique.

53 Panel, 77 x 44 cm. Amsterdam, Rijksmuseum.

54 It should be noted that the RRP has described Lievens's 'trompe l'œil' as sharing a number of related features with the Boston Self-Portrait with Painted Beret and the Mauritshuis Portrait of Rembrandt with Gorget, Corpus, vol. 1, pp. 618-644.

55 I am indebted to Wouter Kloek and Arie Wallert for permission to study this and other paintings in the Rijksmuseum, Amsterdam.

56 Van de Wetering 1997 (note 17), pp. 311-312.


58 A preliminary estimate of the number of 'satellite pictures' one might expect to examine is about 25. However, far more probably exist.


60 Rembrandt's strong influence on Dou's early technique and its development, together with conclusions garnered from the IRR analyses, provided circumstantial evidence pointing to Dou as a possible artist behind the Mauritshuis painting. Some of this information was presented at the RKD/Mauritshuis colloquium in December 1999; the reader is referred to my forthcoming article, "'Dou doesn't paint, oh no, he juggles with his brush'". Gerrit Dou a Rembrandtesque Fijnmakers?, Art Matters - Netherlands Technical Studies in Art, no. 1, 2001 (expected spring 2002).


<table>
<thead>
<tr>
<th>Title</th>
<th>Collection</th>
<th>Date</th>
<th>Patchiness in IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Early Rembrandt paintings examined with IRR: no underdrawing&quot;</td>
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<tr>
<td>History Piece</td>
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<td>Allegory of Music</td>
<td>Rijksmuseum</td>
<td>1626</td>
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<tr>
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<td>New York, priv. coll.</td>
<td>1626-27</td>
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<tr>
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<td>1628-29</td>
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</tr>
<tr>
<td>Young Self-Portrait</td>
<td>Nuremburgh</td>
<td>1629-30</td>
<td>yes</td>
</tr>
<tr>
<td>Self-Portrait</td>
<td>Indianapolis</td>
<td>1629-30</td>
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</tr>
<tr>
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<td>Boston, L.S.G.</td>
<td>1629</td>
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<tr>
<td>Self-Portrait</td>
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<td>Mauritshuis</td>
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<td>Simeon in the Temple</td>
<td>Mauritshuis</td>
<td>1631</td>
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<tr>
<td>Self-Portrait as a Burger</td>
<td>Glasgow</td>
<td>1632</td>
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<tr>
<td>Anatomy Lesson of Dr Tulp</td>
<td>Mauritshuis</td>
<td>1632</td>
<td>some</td>
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<td>1633</td>
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<td>Portrait of Haesje v. Cleuburg</td>
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<td>1634-35</td>
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<td>Susanna</td>
<td>Mauritshuis</td>
<td>1636</td>
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<tr>
<td>Former Early Rembrandts: no underdrawing</td>
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<tr>
<td>Laughing Man</td>
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</tr>
<tr>
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<td>Cleveland</td>
<td>1631</td>
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<tr>
<td>Study of an Old Woman</td>
<td>Mauritshuis</td>
<td>1631?</td>
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<tr>
<td>Portrait of an Old Woman</td>
<td>Windsor Castle</td>
<td>1631-32</td>
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<tr>
<td>A Rabbi in a Fur Cloak</td>
<td>Buckingham Palace</td>
<td>1635</td>
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<td>Mauritshuis</td>
<td>1635?</td>
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<tr>
<td>Early Copies after Rembrandt: only one with underdrawing</td>
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<td>1631-32</td>
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<tr>
<td>Isaack de Jouderville: no underdrawing</td>
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<tr>
<td>Attributed to De Jouderville: no underdrawing</td>
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<td>Windsor Castle</td>
<td>1631</td>
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<tr>
<td>Laughing Man</td>
<td>Museum Bredius</td>
<td>1630</td>
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<tr>
<td>Bust of a Young Man</td>
<td>Cleveland</td>
<td>1631</td>
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</tr>
<tr>
<td>Copies after De Jouderville: no underdrawing</td>
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<tr>
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<tr>
<td>Laughing Man (after Museum Bredius)</td>
<td>Sotheby's N.Y.</td>
<td>?</td>
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<tr>
<td>Early Jan Lievens: no underdrawing</td>
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<tr>
<td>Portrait of Rembrandt</td>
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<tr>
<td>Portrait of Constantijn Huygens</td>
<td>Rijksmuseum</td>
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<tr>
<td>Examples of early Gerrit Dou paintings with an underdrawing</td>
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<td>Rembrandt's Father</td>
<td>Cassel</td>
<td>1630</td>
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<tr>
<td>Rembrandt's Mother</td>
<td>Cassel</td>
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<tr>
<td>Rembrandt's Mother reading</td>
<td>Rijksmuseum</td>
<td>1630-31</td>
<td>none</td>
</tr>
</tbody>
</table>
Technical information concerning the illustrations:

**fig. 4:** Infrared reflectography was carried out by Jaap van der Woerd, Muriel Geldof and J. R. J van Asperen de Boer together with J. Wadum, and are part of the MolArt program (Molecular Aspects of Ageing in Painted works of Art), funded by NWO (Dutch scientific organisation). The infrared reflectography set-up consists of a high resolution (640 x 486 pixels) Platinum Sili­
cide (PtSi) camera (1.2-2.5 micrometer) by AEG Infrarot Module (Heilbron, Germany). The painting was illuminated by two halogen lamps, 60 Volts DC. The camera had a micro Nikkor photographic objective and was positioned using a Linhof tripod. The IRR computer assembly was made with Panavue Image Assembler.

**fig. 5:** Infrared reflectography was carried out by Jörgen Wadum, Edwin Buijsen and Adri Verburg in the restoration workshop of the Germanisches Nationalmuseum, Nuremberg, on 7-8 October 1998, using the RKD’s equipment consisting of a Hamamatsu C1400 equipped with a N1606Select vidicon, a Nikon Micro-Nikkor 1:2.8/55 mm lens, Kodak Wratten 87C filter, with a Lucius & Baer VM 1710 monitor (625 lines). Digitized documentation with a Meteor RCB framegrabber, 768 x 574 pixels, colorvision toolkit (Visualbasic). The digital images were assembled on a computer using Adobe Photoshop 5.0.

**fig. 8:** This painting was examined by Jörgen Wadum, Edwin Buijsen and Adri Verburg in the Rijksmuseum, Amsterdam, on 26 October 1998, using the RKD’s IRR-equipment and the CCD-camera of Adri Verburg consisting of a Focal Plane Si Array, 512 x 512 pixels, Nikkor 55 mm f 3.5 lens, Schott RG 1000 3 mm Filter, 850-linesmonitor. Digitized documentation with a Meteor RCB framegrabber, 768 x 574 pixels, colorvision toolkit (Visualbasic). The digital images were assembled on a computer using Adobe Photoshop 5.0.

**fig. 9:** This painting was examined by Jörgen Wadum and Margreet Wolters in the Staatliche Museum, Gemäldegalerie Alte Meister, Schloss Wilhelmshöhe, Cassel, on 22 November 1999, using the IRR-camera of the Rubenianum, Antwerp, consisting of a Hamamatsu camera C-12400 equipped with a PbO-PbS composit target super infrared vidicon, with a Nikon Micro-Nikkor 122.8/55 mm lens with a Kodak Wratten 87C filter, with a Lucius & Baer VM 1710 monitor (625 lines). Digitized documentation with a Meteor RCB framegrabber, 768 x 574 pixels, colorvision toolkit (Visualbasic). The digital images were assembled on a computer using Adobe Photoshop 5.0.

**fig. 10:** See also: A. F. Janson’s detailed argument in favour of an attribution of this painting to Rembrandt in ‘Rembrandt in the Indianapolis Museum of Art’, Perceptions I (1981), pp. 7-21. The panel used for this painting has been dated to after 1598; however, as 10 cm were not measured, a later date would appear more than possible; report of 20 April 1999 by P. Klein. This and other information on this painting was kindly provided by David A. Miller, Senior Conservator of Paintings, Indianapolis Museum of Art.

**fig. 11:** Tokugo Uchida, chief curator at the MOA Museum in Atami, generously let me examine his painting out of its glass case, enabling me to use the IRR vidicon camera.

**fig. 12:** I am grateful to the Indianapolis Museum of Art for allowing me to study their painting during the exhibition at the National Gallery, London, and for providing excellent photographs of it.

**fig. 17:** This painting was examined by Jörgen Wadum, Edwin Buijsen and Adri Verburg in the Rijksmuseum, Amsterdam, on 26 October 1998, using the RKD’s IRR-equipment and the CCD-camera of Adri Verburg consisting of a Focal Plane Si Array, 512 x 512 pixels, Nikkor 55 mm f 3.5 lens, Schott RG 1000 3 mm Filter, 850-linesmonitor. Digitized documentation with a Meteor RCB framegrabber, 768 x 574 pixels, colorvision toolkit (Visualbasic). The digital images were assembled on a computer using Adobe Photoshop 5.0.

Infrared reflectography was carried out by Jørgen Wadum, Edwin Buijsen and Adol Verburg in the restoration workshop of the Germanisches Nationalmuseum, Nuremberg, on 7-8 October 1998, using the RKD’s equipment consisting of a Hamamatsu C 1400 equipped with a N1606-00select vidicon, a Nikon Micro-Nikkor 1:2.8/55 mm lens, Kodak Wratten 87C filter, with a Lucius & Baer VM 1710 monitor (643 lines). Digitized documentation with a Meteor RCB framegrabber, 768 x 574 pixels, colorvision toolkit (Visualbasic). The digital images were assembled on a computer using Adobe Photoshop 5.0.

Infrared reflectography was carried out by Jørgen Wadum, Edwin Buijsen and Adri Verburg in the restoration workshop of the Germanisches Nationalmuseum, Nuremberg, on 7-8 October 1998, using the RKD's equipment consisting of a Hamamatsu C 2400 equipped with a N 2606-06 select vidicon, a Nikon Micro-Nikkor 114.8/55 mm lens, Kodak Wratten 87C filter, with a Lucius & Baer VM 1710 monitor (525 lines). Digitized documentation with a Meteor RCB frame-grabber, 768 x 576 pixels, colorvision toolkit (Visual Basic). The digital images were assembled on a computer using Adobe Photoshop 5.0.