Technical art history: painters' supports and studio practices of Rembrandt, Dou and Vermeer

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Observing and being able to perceive the abundance of visual information around us at all times is in itself a complicated task. Comprehending this data and visualizing it in oil paint on a two-dimensional canvas is what makes an artist. The artist is a perceiver who pays special attention to the points of view from which the world can be seen and one who catches and records for the rest of us the most revealing perspectives on things.¹

Johannes Vermeer's apparent preoccupation with effects of light and textures in small interiors makes him an appealing narrator, with a full artistic license, of seventeenth-century Holland. The specific way in which Vermeer gives a luminous sfumato to the contours of the objects within his paintings further adds to his mastery of space by detaching subjects from the background.

Leonardo da Vinci's Trattato della pittura, of which a French translation was published in 1651 in Paris,² and Samuel van Hoogstraeten's Inleiding tot de hooge schoole der schilderkonst (1678) can be seen as important sources for understanding Vermeer's painterly effects. Van Hoogstraeten discusses manipulation of reality and the trend of creating illusions, trompe l'oeil, which may have influenced Vermeer very early in his career.

During the Vermeer exhibition in Washington and The Hague (1995–1996), I had the opportunity to compare the individual paintings to each other and to examine them closely. Together with the technical research on the majority of the pictures, this has led me to conclude that the hitherto assumed chronology of Vermeer's paintings must be slightly modified.³ I have also come to question the attribution of Saint Praxedis to Vermeer on stylistic and technical grounds.

Observing

It has been noted that the interiors in Vermeer's paintings often seem to contain more light than they receive through the windows. Van Hoogstraeten wrote that "often great masters violate this, letting the lesser light inside overwhelm the stronger light from outside,"⁴ and by that he seems to refer to the paintings of Vermeer. The artist used the various bright surfaces and materials of the objects in his interiors as reflections of the light that enters through the large windows. This can be observed in the face of The Geographer, for instance. Here we find more light falling on the shadowed side of the face than we would expect at first, were it not for the light reflected on his face from the open map lying on the table, bathed in sunlight.⁵ This kind of reflection is comparable to the much smaller reflection cast from the white collar on the chin of the Girl with a Pearl Earring.⁶ Similar diffuse light reflections can be seen in A Lady Seated at the Virginal, where the girl's arms and satin dress are mirrored in the polished front of the musical instrument. These observations are important in understanding

*Johannes Vermeer, Lady Writing a Letter with Her Maid (detail), c. 1670, oil on canvas. National Gallery of Ireland, Dublin*
Vermeer’s close scrutiny of the nature of light.

The reflections all may seem natural, but in fact Vermeer is creating intriguing situations, as there often seem to be more light sources than those we recognize at first. The glowing highlights of the copper studs on the blue chair in *A Lady at the Virginal with a Gentleman* (fig. 1), for convenience usually titled *The Music Lesson*, may serve as an example. The nails on the seat show strong highlights on the left side and a smaller reflection next to their right sides. The nails on the chair-back, however, have the strong highlight placed at the right side, with a smaller one to the left. It therefore looks as if there is a second light source which, oddly enough, is not casting its light on other objects in the composition. The studs on the lower edge of the blue chair in *A Lady Standing at the Virginal* show not two but three highlights: a small reflection above left on the side of the...
window, a stronger one at the top right side, and a third reflection at the lower edge of the stud. This reflection comes from the light that hits the white marbled floor and is echoed in the nails. A similar secondary light can be seen in the back of the chair which is strongly illuminated by the reflection of the light in the imagined white wall behind the virginal.

Observing and studying nature critically must have been essential for Vermeer, enabling him to play with form, texture, light, and secondary light with virtuosity. Leonardo also was occupied with the nature of the optical system, light, and the function of the eye. At the beginning of the sixteenth century he drew the conclusion that the so-called visual rays from the same parts of an object would reach different parts of the visual pupil, the eye, and vice versa. By this the geometrical simplicity of the canonical "pyramid of vision" was disrupted, according to which near forms occluded remoter objects in an absolutely straightforward manner. According to Leonardo's later theories, no edge will ever be seen absolutely and no object near the eye will occlude distant objects in a totally clearcut manner. This thesis also seemed to explain why a very small object close to the eye appears to be translucent, and why we are able to see relatively well through an open-weave cloth held near the eye. Do Leonardo's observations explain the haloing and circles of confusion that Vermeer applied in many of his paintings, which by some are thought to be achieved by looking through a camera obscura? Probably not, but an explanation for these phenomena may implicitly be found in a letter from Nicolas Poussin (1594/1595–1665) to François Sublet de Noyers, describing two methods of viewing objects: "one is by simple seeing and the other ponders them attentively. Simple seeing is nothing other than natural reception in the eye of the form and resemblance of the seen object. But to see an object with deliberation... we search with a particular procedure for a way to understand the same object properly. Therefore we may say that simple 'aspect' is a natural operation, while that which I call 'prospect' is a function of reason and depends on three things: knowledge of the eye, of the visual ray, and of the distance from the eye to the object." Of course Vermeer was not acquainted with this letter; nevertheless, it explains how an observant painter such as Vermeer could have examined the visible world and subsequently created paintings with his painterly skill, without any optical device other than his eye.

When observing the light, a very substantial part of perceiving it is by the shadowed areas near the lit object itself. By its sheer presence a shadow can suggest an object or person not present in the picture plane. In the same way, light falling into the interior from unseen windows, as can be seen in Gerard Houckgeest's Ambulatory of the Nieuwe Kerk in Delft (fig. 2) on the columns receding toward the left, will reveal part of the scene hidden from the viewer.

Johannes Kepler (1571–1630), who compared the dioptric mechanism of the eye with the image created by a camera obscura, published important discoveries on the nature of seeing. The Keplerian notion of sight, stating that vision is brought about by a picture of the observed object being formed, or "painted" as he described it, on the concave surface of the retina, was shared by René Descartes (1596–1650)—who lived in The Hague from 1638 to 1649—in his book La Dioptrique. It appears
to have been an important topic among the Dutch scholars and connoisseurs of the time. Intellectuals all over Europe were occupied with understanding perspective, the ways of recording space correctly and of creating the most convincing spatial illusion.

In the late 1650s Vermeer changed his Woman Asleep (fig. 3) into a virtual doorzicht, or "view," by eliminating a man and a dog originally in the adjacent room. He may have been inspired by Van Hoogstraeten's Perspective of a Dutch Interior Viewed from a Doorway of 1658 (fig. 4). Naturally optics, telescopes, microscopes, magnifying glasses, spectacles, and the camera obscura interested not only philosophers, theologians, and surveyors but also painters. The seventeenth-century Dutch painter-theorist Samuel van Hoogstraeten, who wrote with fascination about the camera obscura, stated that young painters could benefit from looking at its images. Further on, he stated that an image as created with this apparatus could also be obtained by using a magnifying glass and mirrors. Although these distort the image a little, they reflect most of the colors and the image accurately.

Van Hoogstraeten's fascination with the camera obscura has been interpreted as advice to painters to paint in a dark room. Apart from the fact that no painter would ever sit with his palette full of bright colors in a dark room painting an upside-down image, the Dutch word afmalen has been misinterpreted. What Van Hoogstraeten meant was that he wanted to tell something about the "pictorial invention [that is, the camera obscura] by means of which one can have all the things that are outside painted by reflection in a closed and dark room." He in fact referred to the image as painting itself as a reflection on the wall or a paper held in front of the lens. Therefore the interpretation of the word afmalen as an active deed of the painter is wrong. When Van Hoogstraeten described the use of a camera obscura, he did not mean a little box with a lens through which one can trace an image on a piece of parchment; he simply explained how one can make the outside world visible, upside down, in a room by letting a lens focus the outside world on either the wall or on a piece of paper held in front of the light cone (fig. 5).

Contours

To some extent Leonardo thought that shadows were more important than outlines. This is reflected in his sfumato, the soft, blended transition of contours. "The outlines of second-plane objects will never be as clear as those of foreground objects," he wrote and continued: "the line has in itself neither matter nor substance and may rather be called an imaginary idea than a real object." Caravaggio (1573–1610) often juxtaposed a strongly lit area with a dark one. By means of this tonal contrast he enhanced the radiance of light. This phenomenon, in the seventeenth century called tenebroso or chiaroscuro, became a specialty of the Utrecht Caravaggisti.

In order to avoid the risk of silhouetting objects in a stage setting, Vermeer chose his own technique of rendering transition tones.
in cases where light values contrasted with each other in space. The luminosity, or slight radiation of the objects in the shift of color between two planes was created either by using overlapping paint or leaving the ground visible. Here it is worth mentioning, noting that Vermeer often placed his blue-skirted women against white backgrounds, that Leonardo observed "objects placed against a light background... will naturally appear detached from that ground," thus enhancing the spatial illusion.

The sfumato effect was also implemented by seventeenth-century Dutch painters such as Rembrandt (1606-1669), who, with a moderately loaded brush of highly viscous paint, gave contours a diffuse character. He did this by allowing underlying paint to shimmer through the later applied brush strokes which had left only paint from certain brush hairs on areas extruding as a result of impasto underpaint or a pronounced canvas weave. Vermeer, in his individual way of rendering sfumato, let areas of paint slightly overlap at the transition areas along contours in order to create a special luminous effect around his pictorial motifs. The result of this technique can be seen, for example, around the skirt of The Milkmaid (see fig. 10 in the paper by Nicola Costaras elsewhere in this volume) and the Young Woman with a Water Pitcher, but also between the floor tiles in The Music Lesson (see fig. 14). Whereas Vermeer overlapped the layers, his forger of the 1930s, Han van Meegeren (1889-1947), painted a light blue or bright ochre line along the contours in order to create a similar effect.

The practical way of painting the transition zone between one object and another recalls, once again, Leonardo's words: "Since the end of one color is the beginning of another, it must not be called a line, for nothing intervenes between one color placed in front of another except its end, which is imperceptible even when viewed from near at hand." Vermeer in several situations literally avoided having the color of one form touch that of another in order to make soft transitions between objects. This is the case with the outline of the neck in the Portrait of a Young Woman and with the right contour of the Lady Seated at the Virginal, where the buff ground is used directly as a middle tone [fig. 6].
ment Leonardo wrote: "Therefore, painter, do not accentuate it [the contour] in distant objects." Analogous to this, Vermeer created the diffuse borderline between the floor tiles in The Music Lesson. Here he allowed the edges of the initially painted white tiles to be overlapped slightly by the black underpaint of the dark tiles. These were covered by a blue-and-black scumble that, in its own way, overlaps the outlines of the white tiles [fig. 7]. Vermeer's use of "hemel[blauw]" (sky blue) for objects in the foreground can be seen as an odd inversion of aerial perspective, considering Van Hoogstraten's opinion that this color should be reserved for objects in the background.

Abraham Bosse (1611-1678), in the introduction to a book of 1664 by François Desargues (1593-1662), one of the most influential French theorists on perspective in the seventeenth century, stated that previous writers on perspective generally were concerned with three subjects: the base, the elevation, and the shadows. Desargues developed a theory in which he used only two concepts: de trek, or the elevation on the base, and het sterk en flaauw, the variation of color intensity. Desargues argues that the stronger or more intense the color of an object, the more it springs to the foreground and, vice versa, when the color is more subdued it recedes in space. Therefore a strong red color should preferably be used for objects in the foreground, as Vermeer did with the red dress of the woman in The Girl with the Wineglass, in order to create depth for the objects or figures placed behind it. Although artists had long been aware of aerial perspective, this observation is also important to Vermeer's formula for creating space.

Vermeer seems to have deliberately violated the rules of aerial perspective in a number of cases. As mentioned above, he painted the transition zone between the tiles in the foreground of The Music Lesson [fig. 14] in a bluish sfumato. In the same painting the woman playing the virginal is wearing a red skirt, although she is standing in the background of the composition. By giving her a red dress Vermeer apparently wanted her to spring forward toward the viewer, thus stressing her as the main actress in this mise-en-scène.

Vermeer's ability to create soft contours as a result of his awareness of the nature of light was further developed in his later paintings, for example, in Lady Writing a Letter with Her Maid. This painting shows Vermeer's further developed skills in depicting both the direct and secondary reflections of bright sur-
faces juxtaposed with darker areas (fig. 8). The crisp, white right-hand sleeve of the lady seated behind the table stands out with a knife-edge sharp contour against the dark background. On the other hand, her left sleeve, painted in shadow against the brilliant off-white wall behind her, shows the soft contour created by a slight overlap of colors. When observing a darker object against a luminous background, sharp contours cannot be perceived by the eye, however well defined the object in front of the light may be.

Leonardo stated that it is important to have the shadow area of the dark object—in the case of Vermeer, often a dark blue skirt or apron—placed against a background that is not equally dark, because then nothing can be seen but the illuminated areas. Vermeer went even further and often omitted any expected shadow behind his figures, but in contrast showed the white walls lit brightly. Leonardo advised that if your figure “is both light and dark, put the dark side against a light background and the light side against a dark background,” which is exactly the contrapposto in lit and unlit areas that Vermeer used in many of his pictures. He created a similar phenomenon in A Lady Standing at the Virginal and several of his other later paintings.

The draperies in Vermeer’s late paintings are painted with highlights that one does not observe in his earlier works. This bears testimony to a further development of his awareness of the physical and psychological effects of light and shadow and their correlation, as well as to his ability to explore these phenomena on his canvases. For some the later paint-
ings lack the much-appreciated quality of the work of his middle period, in which the color harmony is generally thought to be more subtle. However, we must bear in mind that Vermeer was continuously in search of understanding the concept of sight and making visual statements of his comprehension of how the perceiving eye can combine the stimuli into a finished image on the canvas.

Vermeer began with spontaneous compositions in his early history paintings but soon evolved into the discovery of perspective, as first encountered in Officer and a Laughing Girl. Pointillism and impasto paint, as employed in The Milkmaid (fig. 9), became his next step. Vermeer's further voyage led him through the rendering of different surface textures, as seen most remarkably in the View of Delft, into smoothly painted interiors where cast shadows and the differentiation of contours became important factors for his composed images.

In Allegory of Faith, based not only on Cesare Ripa's Iconologia (1644) but probably also on Van Hoogstraten's Allegory of Time and Eternity (fig. 10) of c. 1654, we find a very schematic way of depicting the objects. Vermeer suggests the items rather than carefully rendering them. The text in the open Bible is painted as gray patches; the reflections on the chalice, as well as those on Christ on the crucifix, hardly indicate a pattern; the reflections in the glass orb, on close scrutiny, can be described only as abstract blobs of paint. However, one must imagine that the painting is meant to be seen from some distance, hanging relatively high on the wall. Vermeer placed the horizon in the composition crossing the woman's hand on her breast and the highly symbolic transition zone between the base of the ebony crucifix, the written text of the Bible, and Christ's crown of thorns overlapping both Bible and crucifix. At this height we have the viewer's eye level, which places the painting towering on the wall. In this position the individual paint strokes within the tapestry, the Bible, the chalice, and so on, melt together and form recognizable objects. It is fascinating to observe how daringly free Vermeer was, in painting this large canvas, from the ideals of the fijn­schilders (the "fine painters"), according to which no individual paint stroke should betray the hand of the artist.
It has not been noted in earlier commentaries that the black-and-white floor tiles in *Allegory of Faith* have the same pattern as the tiles in many other paintings by Vermeer. The color scheme is inverted, however, so that we see cross-patterns of the tiles made up of five white tiles, whereas in his other paintings we see them exclusively as black tiles. By doing this Vermeer created more light in the lower part of the painting, which again elongates the image.

**Shadows and Reflected Light**

The shadow of the nail in the wall above the head of *The Milkmaid* ([fig. 11]) and in the upper left corner of the *Woman Holding a Balance* were important statements meant to give the eye a sense of space and to set the backdrop. Yet these walls, with all their flaking plaster and nail holes, are rarely seen in other seventeenth-century paintings with bourgeois interiors. They also form part of the captivating power of fooling the eye, similar to the illusion created by the curtain hanging in front of Vermeer's early *Girl Reading a Letter at an Open Window*. The art of painting, wrote Van Hoogstraten, is a science for representing all the ideas or thoughts that visible nature in its entirety can produce in order to deceive the eye with outline and color. These bedriegertjes (deceptions of the eye) would give the painter the greatest benefits and raise him high in the opinion of his clients.

Of course, Vermeer was aware that shadows are produced by objects that prevent light reaching an area behind them. As Leonardo demonstrated, light has a tendency to bend slightly inward in the shadow area when passing along the outline of the object, thus creating shadows that are not clearcut but diffuse in outline. Van Hoogstraten echoed this when writing that the light from the sun is so strong and from such a large source that the light embraces the object onto which it falls. This is illustrated by the lead bars in the foremost window in *The Music Lesson* which were painted in lapis lazuli, instead of black, and stand out against the strong daylight penetrating the window ([fig. 12]). This gives the bars a much thinner appearance, as if light is being folded around the lead, therefore diffusing the line. This phenomenon is in accord with Leonardo's example of looking through a coarse canvas, as mentioned earlier. The cast shadows of the lead bars in the glass in lead windows in *The Astronomer* and in the later *Lady Writing a Letter with Her Maid* ([fig. 8]) were left unpainted. Vermeer instead used the buff-colored ground to play the role of shadow.

The color of the shadow is important to the artist. Its tint is determined by the color of the light source but also by the viewer's distance, and is therefore not necessarily consistent with the color of the light. “I have often seen a white object with red lights and bluish shadows,” wrote Leonardo, an observation that Van Hoogstraten and Vermeer also made. The shadows cast by the wooden rods holding the maps on the walls in *Woman in Blue Reading a Letter* ([fig. 13]) and in *Young Woman with a Water Pitcher* were painted with a mixture of lead white, ochre, and natural ultramarine. But, most significantly, the shadows falling on the white-plastered walls themselves are often also modeled in ochre, lead white, and natural ultramarine, as seen especially in *The Music Lesson* ([fig. 14]). Below the barely visible triangular shadow, formed behind the upper bar of the lower window next to the virginal, one observes a bluish shadow falling on the wall lit by a yellowish-blue light coming through the window. Also the wall under and behind the virginal shows shadows, some of which could have been recorded after reality and some notably that add a bluish tint to the plastered wall. By using these colors Vermeer wanted to indicate that the color of the light falling on this lower part of the wall, as well as on the floor, was determined by the blue sky outside. As one looks upward on the back wall we note that the tonality changes into warmer tones, indicating a diffuse, reflected light from objects in the street, outside our field of vision. Vermeer gave this reflected light a yellowish tint in order to distinguish it from direct light.

The outside walls, below the windows in *The Music Lesson* and *The Girl with the Wineglass*, the area that is shaded most and forms a contrast to the strong light entering the windows above, were painted by Vermeer in a dark natural ultramarine, thus indicating the very deepest shadow. Over this first layer he then applied varied layers of earth colors in order to give the wall a natural appearance. The earth

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1. Johannes Vermeer, *The Milkmaid* (detail), 1658–1660, oil on canvas (Rijksmuseum, Amsterdam)


3. Majesty Queen Elizabeth II
11. Johannes Vermeer,
*Woman in Blue Reading a Letter* (detail), c. 1663–1664
oii on canvas
Rijksmuseum, Amsterdam

14. Johannes Vermeer,
*Lady at the Virginal with a Gentleman* (*The Music Lesson* [detail]), c. 1662–1664, oil on canvas
Her Majesty Queen Elizabeth II


colors, umber or ocher, should be seen as a reflection of the multiple warm colors of the strongly lit interior. Again Leonardo may help us understand Vermeer’s technique; he stated that the surface of every object partakes of the color of the adjacent object, meaning that no object is ever seen entirely in its natural color.47

Interiors showing black-and-white marble tiles are found in an overwhelming number of seventeenth-century Dutch paintings. We find them on the floors of rich burghers’ houses as well as in the popular church interiors, leaving us with the impression that they were common in seventeenth-century Dutch interiors. It has recently been noted that the many marbled floors found, for instance, in Vermeer’s paintings were most probably rare in reality.48 If these tiles were not commonly found even in upper-class interiors, then they must have been added by the painter for another purpose. One obvious reason could have been to create a certain allure of richness that would attract clients, but certainly also the effect of perspective, of creating a spatial illusion, could have been a significant reason for furnishing interiors with these patterns. A combination of the two possibilities seems most likely. The seventeenth-century artist, including Vermeer, is constantly playing with our senses and composes interiors so convincing that we consider them real. This was of course more than the Delft burghers would have said about Daniel Vosmaer’s View of Delft with a Loggia (fig. 15) of 1663.49 Nevertheless, the loggia serves exactly the same function, although more obviously unrealistic than the lavishly represented black-and-white tiled floors in paintings by Vermeer and his contemporaries.

In this context it is interesting to observe that the connoisseur of art, intellectual-at-large, and secretary of stadtholder Frederik Hendrik, Constantijn Huygens, in his portrait by Thomas de Keyser (1596/1597–1667) of 1627 (fig. 16), is shown with many valuable instruments and maps but with no luxuriously marbled floor. Broad, common wooden planks, as one would expect the floors to be made of in this period, form the base of this excellent composition. Five years before his portrait was painted, Huygens wrote that “all painting is dead by comparison [to the camera obscura], for this is life itself, or something more elevated, if one could articulate it.”41 However, in the central vanishing point of the composition, placed on the chest of Huygens, one finds the pinhole in the paint, used by De Keyser for constructing the correct perspective.41

Painting uit den geest, literally “from the mind,” meaning creating a composition based on images of things seen and mirrored in the imagination, was regarded as the highest level within the visual arts. Van Hoogstraeten literally compares the painter’s mind to a stage
on which he should pull back the curtain and paint the imagined scene.\footnote{212}{WADUM}

Van Hoogstraeten's trompe l'oeils may have influenced Vermeer, and the former's \textit{Feigned Cabinet Door}, of 1655,\footnote{52}{Van Hoogstraeten's trompe l'oeils may have influenced Vermeer, and the former's \textit{Feigned Cabinet Door}, of 1655,52 with a shadow from a nail on it similar to that on the back wall of \textit{The Milkmaid} (fig. 11), is one of these visual pleasures that would have fascinated a seventeenth-century spectator. It is also noteworthy that Vermeer's early \textit{Girl Reading a Letter at an Open Window}, which originally had a more straightforward iconography showing a woman reading a love letter under a picture of Cupid,\footnote{54}{Van Hoogstraeten regarded a work painted \emph{uit den geest} as an image representing an imitation of natural things, but the arrangement and ordering of those things proceeds from the memory of the artist. He holds the parts of what he resolves to paint in his imagination in disorder until he puts them together in such a way that they form a whole picture.}54 was turned into a trompe l'oeil by adding a curtain hanging on a rod in front of the scene. Vermeer even included in this painting the imaginary shadow of an imaginary frame.\footnote{55}{Van Hoogstraeten regarded a work painted \emph{uit den geest} as an image representing an imitation of natural things, but the arrangement and ordering of those things proceeds from the memory of the artist. He holds the parts of what he resolves to paint in his imagination in disorder until he puts them together in such a way that they form a whole picture.55}

In the seventeenth century a perfect painting was considered to be an image that makes things that do not exist appear to exist and thus deceives the viewer in a permissible, pleasurable, and praiseworthy manner.\footnote{56}{Van Hoogstraeten regarded a work painted \emph{uit den geest} as an image representing an imitation of natural things, but the arrangement and ordering of those things proceeds from the memory of the artist. He holds the parts of what he resolves to paint in his imagination in disorder until he puts them together in such a way that they form a whole picture.}56 Van Hoogstraeten regarded a work painted \emph{uit den geest} as an image representing an imitation of natural things, but the arrangement and ordering of those things proceeds from the memory of the artist. He holds the parts of what he resolves to paint in his imagination in disorder until he puts them together in such a way that they form a whole picture.\footnote{57}{Van Hoogstraeten regarded a work painted \emph{uit den geest} as an image representing an imitation of natural things, but the arrangement and ordering of those things proceeds from the memory of the artist. He holds the parts of what he resolves to paint in his imagination in disorder until he puts them together in such a way that they form a whole picture.}57 The art of Vermeer seems to be closely connected with this attitude. His interiors are composed as a mise-en-scène, with curtains, special light effects, and a composition with a strong spatial illusion. We, the spectators, are also staged by the artist and often placed behind a \textit{repoussoir} in the foreground. This we see very clearly in \textit{The Music Lesson}, where the viewer is furthermore, as so often in Vermeer's paintings, positioned below the eye level of the depicted persons.

The mirror above the virginal in \textit{The Music Lesson} has been described as a careful recording of the perspective of the floor and the table seen in it. In fact this is not the case, as the table in the mirror is painted with a receding line toward the left, whereas the table in reality recedes toward the right. By making this change Vermeer achieved a more homogeneous composition in the mirror. This indicates that the mirror for the artist was yet another painting carefully constructed according to his compositional needs—and not a reproduction from a supposed reality. This places the mirrored image of the artist's easel in another perspective, as a deliberate wish to be present in this picture.

\textit{The Girl with the Red Hat} and \textit{Girl with a Pearl Earring} have a number of similarities: the lips show identical light reflections from moisture, and the out-of-focus manner in which the lion finials in the first painting have been painted is comparable to the way the yellow jacket in the latter is executed. Has this been done because the image was rendered via a camera obscura that could not focus well, or because the artist wanted us to believe that we were looking through such a device when viewing the girls? There is still another, more convincing explanation: Vermeer was so much aware of the way the eye
Vermeer, The Girl with the Red Hat, infrared reflectogram

sees that he deliberately created the two images in such a manner that the faces are in focus, but the foregrounds are not. By painting the yellow jacket, made of a material that cannot be precisely determined, with blobs of fluid, yellow paint, comparable to the diffuse highlights on the lion finials in The Girl with the Red Hat, he forces us to turn our searching gaze back to the faces. Vermeer makes us concentrate on these faces, thus stressing our intimate contact with the women. He manipulates us into full concentration on the two onlooking females, creating quite a different mood than when viewing his Portrait of a Young Woman. The effect of the two former tronies, with deliberately unfocused foregrounds, is similar to what we experience when we are in a conversation with someone and are looking at the person's eyes. In this situation the person's jacket or tie is an unfocused element that we record but do not concentrate on, a phenomenon the artist wanted to establish in a most surprising way.

Adjustments to the Chronology

Based on a thorough study of Vermeer's paintings, the materials and technique he used, a revision of the chronology of his works seems necessary. It has been stated by various writers that until now the chronological order of Vermeer's oeuvre has been largely based on subjective considerations. With new knowledge of his materials and methods, I believe that Vermeer's small production can be beneficially revised along the following lines.

Mistress and Maid (Frick Collection), hitherto dated c. 1667, shows similarities to early paintings. The work in itself is difficult to assess, as the whole background appears to have been overpainted at a later time, but the handling of the yellow fur-trimmed jacket, with its bold brush strokes, is reminiscent of The Procuress (Dresden), dated 1656, and A Woman Asleep (fig. 3), formerly dated c. 1657. The lack of a correct perspective in the Chinese box on the table of Mistress and Maid, and the very strange way the woman is writing, in an odd direction, lead me to believe that this painting must be placed early in Vermeer's career, c. 1659–1660. The flesh colors, built up over reddish underpaint, do not contain any greenish shadow tones, as they do in Vermeer's works after 1660. In Mistress and Maid the shadows are grayish in tonality, and except for the area along the yellow coat there is an overall sfumato along the contours. In Woman Asleep, which I date to 1658–1659, soft modeling of the paint can only be found in the face of the girl. The rest of the composition is characterized by sharp contours and relatively thick layers of paint.

Remarkably, the white highlights in Mistress and Maid are painted with a highly viscous lead white, and the brush has left marks of the hairs clearly visible in the paint, a phenomenon one encounters in only one other painting by Vermeer, the Woman Asleep. In this painting the chair in the foreground (added later), which is weak in execution, as one may observe in the studs on the chair, is
rendered in a way comparable to those in *Mistress and Maid.* Furthermore, the flesh tones of the maid have a grayish tonality, just as in *Woman Asleep.* I tend to believe that all these characteristics indicate that *Mistress and Maid* was one of Vermeer's first attempts in painting a genre piece. The format used at this early stage, c. 1659–1660, appears to be somewhat too large to work out in an entirely satisfactory way. After this experiment, Vermeer turned to a smaller format for his interior scenes. A few years later he returned to the subject with the very fine *Lady Writing* (c. 1665, in Washington).

*The Girl with the Red Hat* (c. 1665), recognized as an authentic painting by Vermeer, was done over a portrait of a man. It has often been considered that this unfinished male portrait might have been painted by Carel Fabritius (1622–1654), an artist Vermeer is supposed to have held in high esteem. However, it has always puzzled me why one decided not to attribute this work to Vermeer himself. We know that early in his career he painted with strong, forceful brush strokes, laying the paint on the support in impasto, very similar to what is shown by an x-radiograph (fig. 17) and an infrared reflectogram image (fig. 18) of the obscure portrait underneath. *The Girl with the Red Hat.* Moreover, the male figure does resemble the so-called self-portrait on the left in *The Procuress.* The two paintings by Vermeer with male figures in the Dissius sale (1696)—*Self-Portrait* and *Man Washing His Hands*—furthermore indicate that men were more often present in Vermeer's oeuvre than one tends to think. If my hypothesis is correct, this would mean that the underlying portrait of the man may be an authentic early work by Vermeer himself, painted around 1656. After having abandoned it for a considerable time, Vermeer could have reused the small panel and painted *The Girl with the Red Hat* over it.

**Saint Praxedis, a Question of Attribution**

In the past a large number of paintings were attributed to Vermeer. Some of these have undergone serious questioning concerning their authenticity, resulting in their deattribution and purging from the artist's oeuvre. One painting, however, has recently been added to Vermeer's oeuvre, *Saint Praxedis* (fig. 19).

This painting was attributed to Johannes Vermeer of Delft for the first time in 1969 and was firmly included in Vermeer's oeuvre in 1986. The painting is generally believed to be a copy after a painting by Felice Fichelli (1605–c. 1669), now in the Collection Fergani, Ferrara (fig. 20).

The *"Vermeer" Saint Praxedis* [Barbara Piasecka Johnson Collection] hanging next to the fully accepted Vermeer paintings provided an excellent opportunity to compare and study their respective characteristics in execution. It must be noted that a number of the qualities concerning Vermeer's painting technique, the rendering of contours, shadows, and manipulation of light, as mentioned above, do not apply to the Johnson Collection *Saint Praxedis,* nor to the early history.
o. Felice Ficherelli, *Saint Martin*, c. 1645, oil on canvas, collection Ferrami, Ferrara

1. Detail of fig. 19

2. Detail of fig. 19


When comparing *Saint Praxedis* with the two early history paintings bearing Vermeer's signature it became apparent to me that the execution of *Saint Praxedis* differs from that of the others. This is especially seen in the execution of details, as the hand that applied the paint has its own specific calligraphy. The flow of the brush, shown by the paint left behind, indicates how steady the hand was that handled the brush. In the large painting *Christ in the House of Mary and Martha* one observes a very secure mastery of the paint application. Broad, bold brush strokes were employed when Vermeer created the blues and reds of the clothing in the foreground, all done in fluid, soft strokes. Rounded, curved, and straight lines alternate with each other, and the confidence with which these have been put down is striking. This is also true of the detailed brushwork in *Diana and Her Companions*, which shows a very secure and steady painter's hand.

This cannot be said of *Saint Praxedis*. On several places in the red dress and on the white sleeve one finds brush strokes that reveal either an unsteadiness or at least a different way of dragging the brush over the surface. Minute wavy strokes display a hand that trembled when applying the paint; this is most clearly visible in a white brush stroke on the sleeve (fig. 21). The waviness, which occurs on a small scale, is found everywhere in the red tunic of the saint (fig. 22) and shows a pattern one does not find in any other Vermeer paintings.

The way a hand applies the paint, especially when the artist is not concentrating on a specific form, results from an automatic movement of the hand and therefore reveals the individual. Of course, an artist copying another artist's painting would probably try to emulate his source's brushwork. However, as far as I can judge from photographic evidence, wavy brush-handling is not found in the Ficherelli painting in Ferrara (fig. 20). Nevertheless, the three works by Ficherelli in the National Gallery of Ireland in Dublin—*The Sacrifice of Isaac* [c. 1640], *Lot and His Daughters*, and *Saint Mary Magdalen* (figs. 23, 24, 25)—show exactly the same waviness in the brushwork as the so-called Vermeer *Saint Praxedis*. In *The Sacrifice of Isaac* (fig. 23) and *Saint Praxedis* (figs. 25, 26, 27)—show exactly the same waviness in the brushwork as the so-called Vermeer *Saint Praxedis*. In *The Sacrifice of Isaac* (fig. 23) these characteristic patterns are visible in the thickly painted dress of Isaac, and in *Lot and His Daughters* (fig. 24) we see the wavy handling of the paint below the elbow of Lot and in the dress of the daughter at the right. The drapery around the hips of the saint in *Mary Magdalen* (fig. 25), painted in an identical tonality as the dress of Saint Praxedis, shows the typical calligraphy of Ficherelli's hand. These observations therefore raise serious questions concerning the present attribution of the *Saint Praxedis* in the Johnson Collection.

There are also other elements in this painting that cause problems in understanding its nature as a copy. When copying another artist's work one would expect the painter to work from the front toward the back, in contrast with the normal way of painting. This means that the copyist would begin by rendering the outlines of the most important elements in the composition. In the *Saint
Praxedis attributed to Vermeer this is not the case. The ewer in which the saint collects the blood of the beheaded man was not blocked out in the red dress before it was painted. The red dress extends under the left quarter of the urn, indicating an initial asymmetrical object, and both handles appear to be painted over the finished red dress (fig. 26). Furthermore, the dark silhouette of the architecture behind the dead body was painted before the corpse. We can make this out by the fact that a dark patch of shadow is shimmering through the shoulder of the corpse (fig. 27). One would not expect to find these phenomena, appearing like pentimenti, in an almost literal copy.

The Ficherelli painting in Ferrara (fig. 20) does show a number of minor differences, such as the outline of the drapery on the left shoulder of the saint and the headdress against the finished sky. Reflectograms of Ficherelli’s painting reveal a number of preparatory drawings, especially in the drapery, arms, and hands.

The facial flesh tones in the Johnson Collection Saint Praxedis (fig. 19) have a light base, and the shadows are made with the brush tip. Such a working method cannot be traced in the work of Vermeer, neither in his early nor later paintings. Usually they possess a well-defined shadow area in the underpaint which is modeled directly over the ground or imprimatura.
Another interesting factor is that no smalt was ever detected in this painting.\textsuperscript{70} In \textit{Christ in the House of Mary and Martha} one finds large amounts of smalt and indigo, and the same goes for \textit{Diana and Her Companions}. In both early paintings the smalt is detected even in areas that are not blue, for instance in the background or flesh colors.

A dark underpainting was found under the blue sky in \textit{Saint Praxedis}; this underpainting consists mainly of natural ultramarine, possibly with the addition of indigo.\textsuperscript{71} In \textit{Diana and Her Companions} there is no dark underpaint in the area of the sky, as had previously been noted as a similarity between this painting and \textit{Saint Praxedis}. On the contrary, the thin, transparent reddish-brown layer, applied over the ground in \textit{Diana and Her Companions}, probably does not cover the area of the sky. However, in \textit{The Sacrifice of Isaac} (fig. 23) one clearly observes the dark underpaint over which Ficherelli modeled the blue sky in natural ultramarine.

A final note is that, to my knowledge, rarely does a copyist sign his replica twice. Speaking of signatures, the directly readable signature “Meer 1655,” lower left, must be regarded as apocryphal. Part of this signature is visible to the naked eye despite the fact that the paint under it is heavily abraded.\textsuperscript{72} The knobs of the canvas are even partly visible under the signature (fig. 28), indicating that the paint layer was abraded before the signature was added. In my opinion the signature is not integral to the painting. The inscription “Meer N R[...o]o,” bottom right is, however, so rudimentary that any interpretation would be factitious.

As has become obvious to the reader, it is not only the iconographic but certainly also the stylistic difference that makes it seriously problematic to accept \textit{Saint Praxedis} as a painting executed by Johannes Vermeer of Delft.\textsuperscript{73} Based on a comparison of technique and the manner of applying the paint with pictures by Ficherelli, an attribution of the Johnson Collection \textit{Saint Praxedis} to Ficherelli seems apparent. It still has to be determined if the Ferrara \textit{Saint Praxedis} is autograph or a copy.

Epilogue

The awareness of correspondences in Vermeer's paintings to particular passages in manuscripts or books possibly known to the artist\textsuperscript{74} places him in a contemporary context. The romantic idea of Vermeer living in isolation is a tale from the past. His craftsmanship does not stand alone but is founded on a large knowledge of painting techniques inherited from predecessors and shared by his contemporaries. By studying Vermeer's paintings carefully, specific phenomena become apparent, which in turn throw a new light on his stylistic development and thus on the chronology of his paintings.

There are few disputed paintings in Vermeer's oeuvre, aside from \textit{Saint Praxedis} in the Johnson Collection. As this painting does not have much in common with Vermeer's known works, but certainly has much in common with those of the Italian painter Felice Ficherelli, its attribution to Vermeer is questionable.\textsuperscript{75}
NOTES

Being able to study Vermeer’s oeuvre in depth has been a privilege in itself. Many persons have, knowingly or not, been encouraging during this work. I wish to thank Arthur K. Wheelock Jr. for his interest and openness for discussion, and Ernst van de Wetering for engaging observations on Vermeer. In particular I am indebted to Nicola Costaras and the staff of the Royal Cabinet of Paintings Mauritshuis, among whom Ben Broos and Marlies Enklaar gave valuable reflections on this paper, and to Frederik van Koetsveld for his continuous support throughout the Vermeer project.


2. Traité de la peinture de Leonard de Vinci donné au public et traduit d’italien en français par R.F.S.D.C. [Roland Fréart Sieur de Chamberay] [Paris, 1651]. The reading of a manuscript copy of the Trattato is seemingly reflected in Rembrandt’s paintings dating from the early 1640s. At this time Carel Fabritius, who later became a Delft colleague of Vermeer, was still working in Rembrandt’s studio; see Kenneth Clark, Rembrandt and the Italian Renaissance (New York, 1966), where Rembrandt’s use of light and shadow is compared with passages in the Trattato. See also Leonid D. Couprie, “De jonge Rembrandt in zijn atelier, 1629. Een perspectivische analyse van een paneelje in het Museum of Fine Arts in Boston,” Jaarboek voor geschiedenis en oudheidkunde van Leiden en omstreken 86 (1994), 69–96, who states that the young Rembrandt in his Young Painter in His Atelier of 1629 demonstrated his mastery of the rules of perspective.

3. The dating of Vermeer’s paintings in this article is based on Arthur K. Wheelock Jr., Vermeer and the Art of Painting (New Haven and London, 1995), unless otherwise indicated.


9. Vermeer’s use of the traditional pin-and-string method is demonstrated in Jørgen Wadum, “Johannes Vermeer’s Use of Perspective,” in Historical Painting...

10. The letter to De Noyers has not been preserved, but André Felibien cites it in his Entretiens sur les sciences, lettres et belles-lettres, avec ses plus excellens pâtêtres (Paris, 1685), "VII. Entretien sur les Vies." The quotation is taken from Claire Pac, Felibien's Life of Poussin (London, 1725) ed. 1981, 43–44: "Il faut savoir, dirait-on, qu’il y a deux manières de voir les objets, l’une en les voyant simplement, & l’autre en les considérant avec attention. Voir simplement n’est autre chose que recevoir naturellement dans l’œil, la forme & la ressemblance de la chose vue. Mais voir un objet en le considérant, s’est qu’outre la simple & naturelle réception de la forme dans l’œil, l’on cherche avec une application particulière, le moyen de bien connaître ce même objet: ainsi on peut dire que le simple aspect est une opération naturelle, & que ce que je nomme le Prospect, est un office de nuit qui dépend de trois choses, savoir de l’œil, du rayon visuel, & de la distance; œil à l’objet; & c’est de cette connaissance dont il serait à souhaiter que ceux qui se mêlent de donner leur jugement, fussent bien instruits. "I am indebted to Michael Franken for information concerning this text. See also Carl Goldstein, "The Meaning of Poussin’s Letter to Sublet de Noyers," Burlington Magazine 108 (1966), 233–239.

11. Oil on panel, 65.5 x 77.5 cm, signed and dated "1653," Royal Cabinet of Paintings Mauritshuis, The Hague, inv. no. 57.


14. René Descartes, La Dioptrique (Leiden, 1637).


16. Oil on canvas, 103 x 71 cm, Musée du Louvre, Paris, inv. no. RF 1922. The keys hanging from the lock were added at a late stage in the painting process. The painting within the painting is a well-known paraphrase of a composition by Gerard ter Borch, with whom Vermeer signed a document in Delft in April 1653.

17. Van Hoogstraeten 1678, 263: "Ik ben verzekerd, dat het zien van deze weerglans in 't donker't gesicht van de Schilderjeugt geen klein licht kan geven" (I am convinced that seeing this image in the dark [room] will not fail to make a deep impression on the vision of young painters).

18. Van Hoogstraeten 1678, 263: "Maa ga dit zolvale [the image from a camera obscura] is ook te zien in verklein glazen en spiegellic, die, hoewelke de tevreden wat verbrugen, het gros der koloreringe en houdinge zierlijk verlooven." 

19. Van Hoogstraeten 1678, 263: "zich geen wenper tegen den muur . . . doch alles het onderste hoven." 

20. Van Hoogstraeten 1678, 263: "zoo moet ik van den schildersachtig vond spreken, wau melde men al de dinghen, die buiten zijn, in een besloute en dus­tere kamer door weerglans kan afnemen."

21. Celeste Brusati, Artifice and Illusion. The Art and Writings of Samuel Van Hoogstraeten (Chicago and London, 1995), 71, translates the Dutch text as follows: "I must say something about the picture-making invention with which one can paint by means of reflections in a closed and darkened room everything which is outside." She further explains that Van Hoogstraeten writes "how to make reflected images of these things appear, painted upside down and in miniature, on the wall of the darkened room."

What Van Hoogstraeten says is that the world outside is "painting" itself in miniature (Van Hoogstraeten 1678, 263). "That which a painter in the darkened room, looking through a little hole in t’licht zyn, afschieten deur het gat, en zich gaan werpen tegen den muur, en met de zelve verwe al’t geen, dat buiten is, in ‘t klein schilderen")."


23. Pedretti 1964, 47.


25. Wheelock (1995, 45) writes that Vermeer "contoured her entire right side with a thin stroke of white paint," which is not the case. It is an overlapping of areas, just as Wheelock correctly suggests elsewhere (1995, 108).


27. Han van Meegeren was also aware of this special luminosity along Vermeer’s contours, although he did not master the technique for creating this effect. Compare with Van Meegeren’s Woman Reading Ma­sic, 1935–1936, oil on canvas, 58.5 x 57 cm, Rijks­museum, Amsterdam, inv. no. A4240.


33. Pedretti 1964, 58.

34. Frick Collection, New York.
35. Royal Cabinet of Paintings Mauritshuis, The Hague, inv. no. 22.
36. Brusati 1991, 77 (fig. 43); checklist no. 47, dated 1614. Whereas Werner Sumowski suggests the late 1660s (Christie's, London, 3 December 1948, lot 15 and 6 October 1950, lot 46, oil on canvas, 84 x 122 cm).
37. Cesare Ripa, Iconologia (Amsterdam, 1644), ed. Soest, 1971, 147, in "Fede, Geloof", mentions that behind her (the female personification of Faith) hangs a crown of thorns on a nail ("Achter haar haanght een Doornen Kroon aen een spiecker"). The significance of the position of the crown of thorns has not been dealt with in recent publications on Vermeer.
39. National Gallery of Art, Washington, Widener Collection. I owe this observation to Ernst van de Wetering, who demonstrated it in his lecture at the Amsterdam University, Institute of Art History, Vermeer Symposium (11 March 1986).
40. Van Hoogstraeten 1678, 258.
41. Van Hoogstraeten 1678, 259.
42. Van Hoogstraeten 1678, 259.
43. Page 164.
44. Van Hoogstraeten 1678, 258.
45. Metropolitan Museum of Art, New York, Marquand Collection 1886.
46. An often mentioned example is the shadow of the two legs of the virginial cast on the back wall. They could never have been observed like this in reality, as that would indicate a light source from below window level, placed somewhere between the windows.
47. Page 164.
48. Page 164.
50. Oil on canvas, 89 x 78 cm, Stedelijk Museum "Het Prinsenhof," Delft, inv. no. NK 3927.
52. Constantijn Huygens and His Clerk, signed "TDRKAN 1627," oil on panel, 98.4 x 66.3 cm, National Gallery, London, inv. no. 212.
53. Van Hoogstraeten 1678, 178: "Wel aen, last ons na het voorstel Toneel openen, en gedenkwardige dae den vertoonen: uit ons zelven vaeren, of, om beter te zeggen, in ons zelven de gordijn opschuiven, en in ons gemoed de geschiede daet eerst afschilderen, en daer toe al onze krachten te werk stellen."
54. Feigned Cabinet Door, 1655, oil on canvas, Gemäldegalerie der Akademie der Bildenden Künste, Vienna, inv. no. 1406.
56. I am indebted to Winfried Heiber, Dresden, for this information.
57. Van Hoogstraeten 1678, 25.
58. Van Hoogstraeten 1678, 176.
60. William Suhr noted in his 1952 treatment report that "the writing quill held by the mistress seems strangely short and awkwardly placed, raising the question of whether it is original, or perhaps a later addition." Report in the Frick Collection, New York.
61. The study on the chair on which the girl is seated consists of strong touches of lake, black, gold leaf, ochre, and lead-tin yellow. The study on the chair in the foreground are made up of pale scumbles of gray and ochre plus a little lead white.
62. The canvas size and structure of Mistress and Maid, 89 x 78 cm, relate to those of the Woman Asleep, 86 x 75 cm. The latter shows cupping at all sides, but not as pronounced as one would expect and does find on other Vermeer canvases. It could therefore have been slightly trimmed from an original size identical to that used for Mistress and Maid. For other examples of identical sizes, see the contribution by Nicola Costaras to this volume.
64. On The Girl with the Red Hat and the portrait of a man beneath it, see the contributions by Nicola Costaras and Melanie Gifford to this volume.
67. As a consequence of this, some [art] historians even raised questions about the authorship of these paintings, stimulated by the unexplainable paradox that the artist made such an abrupt change of style when moving from large-scale history painting into medium-scale genre scenes.
68. All three in the National Gallery of Ireland, Dublin, inv. nos. 1070, 1746, 1707.
68. This was noted by Lionel Koenig in Józef Grabowski, ed., Jan Vermeer van Delft (1632–1675). Saint Proclus: An Exhibition of a Painting from the Collection of Barbara Piasecka Johnson [exh. cat., International Cultural Centre and the Warsaw Royal Castle] (Cracow, 1991). It should be noted that in this exhibition catalogue the captions of the x-radiographs of the Princeton and the Italian Saint Proclus have been interchanged.


70. Herman Kühn in 1972 did not find smalt; Barbara Miller 1984, analytical report in the National Gallery of Art, Science Department, states that no small, vermilion, or lead-tin yellow was detected.

71. Miller 1984 does state that the traces of indigo, and even Prussian blue (first available in the first half of the eighteenth century), were not fully documented.


74. Several unspecified books are mentioned in the inventory of Vermeer's possessions of 1676. See John Michael Montias, Vermeer and His Milieu: A Web of Social History (Princeton, 1989), doc. 364, 159–160.

75. See my forthcoming publication on this matter.