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Vermeer becoming Vermeer

The exhibition *Vermeer and the Masters of Genre Painting: Inspiration and Rivalry*, held in Paris, Dublin, and Washington in 2017–2018, demonstrated multiple thematic and compositional connections in the paintings of Johannes Vermeer and his contemporaries.[1] Telling groupings of comparable works showed that Dutch high-end genre painters from the latter part of the seventeenth century knew each other's works, which they often emulated and sought to surpass. One such grouping in the exhibition, for example, included five paintings that depict a young woman standing before a mirror, including masterpieces by Vermeer (1632–1674), Gerard ter Borch the Younger (1617–1681), and Frans van Mieris (1635–1681) [Fig. 1 a–c]. Inadvertently, however, despite the exhibition's underlying premise that thematic and stylistic similarities connected these works, the overwhelming response to *Vermeer and the Masters of Genre Painting: Inspiration and Rivalry* was that Vermeer's paintings are different. They are more compelling and have a gravitas not found in the paintings of others.

The exhibition demonstrated that Vermeer created his genre paintings with a different mindset than his contemporaries. Even though figures in Vermeer's paintings are generally engaged in a domestic activity, such as reading a letter or playing a lute [Fig. 2], they do so quietly and with restrained gestures. His luminous images engage us immediately, but the underlying structure of his compositions, the character of his light, and the

1 a. Gerard ter Borch, «Young Woman at her Toilet with a Maid», *c*. 1650–1651, oil on panel, New York, The Metropolitan Museum of Art, Gift of J. Pierpont Morgan, 1917, Inv. 17.190.10

1 b. Frans van Mieris, «Woman before a Mirror», *c*. 1662, oil on panel, Berlin, Staatliche Museen zu Berlin – Preußischer Kulturbesitz, Gemäldegalerie, Inv. 838

freedom of his brushwork indicate that he was interested in creating something beyond the semblance of reality. Vermeer minimized the transient, momentary quality of his pictorial narratives to give them a more enduring quality. The difference between Vermeer's concerns and those of his contemporaries is particularly evident in his freely brushed, and often abstract rendering of fabrics. Unlike with Ter Borch or Van Mieris, with Vermeer one never has to question whether a textile is real or painted.

Vermeer's abstractions begin with his carefully structured and sparsely furnished interiors, which create a framework for the narratives in his paintings. He thought carefully about perspective, the placement of the vanishing point, and the proportional relationships of the horizontals and verticals created by wall maps, paintings, and musical instruments. As in *Woman Writing a Letter*, he even followed the principles of the golden mean to assure harmonious relationships of his pictorial elements [Fig. 3]. Vermeer not only altered the size and scale of objects for compositional purposes, but technical examinations also reveal that he adjusted the placement of objects, and eliminated others, as in a basket of laundry in *The Milkmaid*, during the creative process [Fig. 4].[2] Through such refinements, he sought to elevate his scenes to reflect higher and more universal ideals that transcend the ebb and flow of daily existence.

Unfortunately, a full understanding of Vermeer's goals and aspirations will probably never be found. I have addressed these questions at various times in my studies of Vermeer's career, assessing the impact of his early history paintings on his genre scenes, underscoring the importance of perspective and optics in his work, and emphasizing the classicizing character of his images.[3] In this essay, I have taken two different approaches

1c. Johannes Vermeer, «Woman with a Pearl Necklace», *c*. 1662–1665, oil on canvas, Berlin, Staatliche Museen zu Berlin – Preußischer Kulturbesitz, Gemäldegalerie, Inv. 912B

2. Johannes Vermeer, «Woman with a Lute», *c*. 1662–1665, oil on canvas, New York, The Metropolitan Museum of Art, Bequest of Collis P. Huntington, 1900, Inv. 25.110.24

3. Johannes Vermeer, «Lady Writing», *c*. 1665–1667, oil on canvas, Washington, The National Gallery of Art, Gift of Harry Waldron Havemeyer and Horace Havemeyer, Jr. in memory of their father, Horace Havemeyer, Inv. 1962.10.1

4a. Johannes Vermeer, «The Milkmaid», *c*. 1658–1660, oil on canvas, Rijksmuseum, Amsterdam, Inv. SK-A-2344

4 b. Johannes Vermeer, «The Milkmaid» (as in Fig. 4a), reflectogram detail

to broaden the discussion. The first is to postulate about the nature of Vermeer's instruction, a topic that has not been examined in any meaningful way beyond speculations of who might have been his master. The hope is that by reflecting on the type of training Vermeer would have received, one will have a better framework for understanding his creative process. The second approach is to introduce a wider network of individuals that Vermeer might have known during his formative years than those traditionally mentioned, which are primarily family members, artists, and collectors. This expanded network includes members of Delft's community of scientists, astronomers, and surveyors who were vitally interested in examining and discovering the nature of the world about them. The questions these individuals investigated likely informed Vermeer's quest to create carefully proportioned, mathematically structured, and light-filled images.

Identifying Probabilities

It is challenging to determine how Vermeer arrived at this approach to painting since so little information exists about his attitudes towards art.[4] If he ever wrote about his goals and aspirations as an artist, those texts, sadly, have never surfaced. Specific information about his community of friends and colleagues is sparse. Although the broad outlines of his artistic career in Delft after he joined the St Luke's Guild at the end of December 1653 are relatively clear, one has very little sense of the daily rhythms of his life. Ironically, the extensive research in the Delft archives that Michael Montias and others have undertaken has unearthed more information about Vermeer's extended family than about the artist himself.[5] Archival evidence, of course, is often skewed to problematic issues in one's life. Apart from births, deaths, and marriages, transcripts do not generally record the actions of someone acting honorably and without discord.

Vermeer's name does not appear once in documents between 1632, the year of his birth, and 1653, the year in which he married Catharina Bolnes and registered as a master painter in the Delft St Luke's Guild. No documents indicate how Vermeer's parents, Reynier Jansz Vos (1591–1652) and Digne Baltens (*c*. 1596–1670), raised their son or in what ways they encouraged him to become an artist. What was the nature of his schooling, and when, and with whom, did he begin his artistic training? We do not even know if Vermeer studied in Delft or in another artistic center.

How does one assess the probable nature of Vermeer's artistic training when so little information exists upon which to base conclusions? This quandary is comparable to the one that confronted the organizers of *Vermeer and the Masters of Genre Painting: Inspiration and Rivalry*. Before reaching conclusions about relationships between one master and another, it was important to determine the probability that artists had met and how they would have known each other's paintings.[6] In a similar vein, it is possible to reach informed judgments about the timing and character of Vermeer's training through the lens of probability. It is highly likely, for example, that Vermeer was drawn to an artistic career through the influence and encouragement of his parents. Reynier Vos and Digne Baltens were connected to the world of art through inheritance and professional activities. They also had a network of friends and family who would have supported that career choice. Another strong probability that underlies the following discussion is that Vermeer's education would have followed a path generally taken by other aspiring Dutch artists, among them Gerard ter Borch the Younger.

5. Karel van Mander, *Het Schilder-Boeck*, Haarlem, 1604, titlepage, Washington, The National Gallery of Art Library, Gift of Paul Mellon

Vermeer's father, Reynier Vos, was trained as a caffa worker, a maker of fine textiles, and he continued to be involved in a network of caffa workers throughout most of his life. In 1631, however, he registered as an art dealer in Delft's Guild of St Luke.[7] His decision to become an art dealer may have been stimulated by the fact that he also had become an inn keeper and that Digne Baltens had inherited from her father a collection of books and paintings.[8] Even before his wife's inheritance, however, Reynier already owned a small collection of paintings. Among the works listed in a 1623 inventory were a still life, portraits, including those of the Stadhouder's family (indicating his allegiance to the Prince of Orange), history paintings and genre scenes, one of which depicted a lute player. As Montias has noted, the subjects of the genre scenes reflect the most recent innovations of the Utrecht Caravaggisti and indicate 'Reynier's discerning taste for the latest trends in the Dutch painting of his time'.[9] The clothing and household items listed in the inventory were quite luxurious and indicate that the couple lived at a comfortable economic level.

Reynier Vos expanded his businesses in the mid-1630s when he leased De Vliegende Vos (The Flying Fox), an inn on the Voldersgracht. He expanded his business yet again in 1648, when he acquired a large, centrally located tavern, the Mechelen, on the Market Square. The confluence of taverns with art dealership was a natural, given the foot-traffic one would find in such an establishment. The Delft St Luke's Guild also had no public showroom for artists to display their works, so private arrangements such as this were not uncommon.[10]

The notary handling many of Reynier's affairs during these years was Willem de Langue (1599–1656), an art connoisseur and collector who was also involved with several Delft painters, including Leonaert Bramer, Willem van Vliet, Jacob Delff, Moses van Uyttenbroek, Hans Jordaens, Balthasar van der Ast, and Evert van Aelst.[11] It is likely that Reynier's tavern was a meeting place for this network of artists and art lovers, contacts that would have enriched the young Johannes' engagement with the arts. If, as seems probable, Digne Baltens inherited at least a portion of her father's library as well as some of his paintings, one can imagine that the discussions at the tavern were informed.[12] After Reyner's death in 1652, ownership of the tavern Mechelen passed on to his widow, while Johannes, who was then 20 years old, took over his father's art dealership, a business that he maintained after he became a professional painter.

Presuming that Reynier Vos wanted his son to pursue a career in the arts, when and where might he have found a teacher/mentor in Delft who could provide him with the appropriate training? Judging from information gleaned from the experiences of other aspiring artists, including Gerard ter Borch the Younger and Jan Lievens (1607–1674), a strong probability is that Johannes Vermeer's training would have begun by the age of 8 to 10 years old, that is, by the early 1640s. At that time the family was living on the Voldersgracht, the location of the Vliegende Vos. Nearby was the home of a respected member of the Delft Guild of St Luke, the artist Cornelis Daemen Rietwijck (*c*. 1590–1660), a portrait painter who ran a drawing school. It is entirely possible, indeed once again highly probable, that Vermeer's father sent the young Johannes to learn the fundamentals of art from him. Rietwijck was an educated individual: the inventory of his possessions indicates that he had a significant library.[13] He was Catholic, and most of his books dealt with religious issues, but he also had books about antiquity, historical accounts of travel to the Near and Far East, emblematic and philosophical literature, and, significantly, *Het Schilderboek* by Karel van Mander (1548–1606) [Fig. 5].[14] Aside from Van Mander's important treatise on the art of painting, Rietwijck also owned prints, drawings, and plaster casts that would also have been important for instructing young artists.

6. Gerard ter Borch the Younger, «Study of a left hand after a print by Hendrick Goltzius», *c*. 1627–1628, pen and brown ink on laid paper, Amsterdam, Rijksmuseum, Inv. RP-T-1887-A-770

The Importance of Drawing

What type of education and artistic training might Vermeer have received from Rietwijck or some other master in Delft? Virtually every seventeenth-century Dutch theorist, including Samuel van Hoogstraten (1627–1678), and Willem Goeree (1635–1711), followed Van Mander's precept that 'drawing is the father of painting […] and the portal to many of the arts'.[15] Van Mander urged aspiring artists to learn to draw at the outset of their career and to continue to draw daily. Given Van Mander's emphasis on the importance of drawing, the fact that Rietwijck ran a drawing school reinforces the likelihood that Reynier Vos enrolled Johannes in his program.

An ability to draw was not just considered a prerequisite for an artist's training, it was also valued as an important educational tool in the highest echelons of society. Prince Maurits (1567–1625) wanted to learn to draw for a practical reason: he felt it would improve his ability to design military fortifications and accurately depict their surroundings.[16] Aside from his own personal interest in drawing, Maurits, in conjunction with Simon Stevin (*c*. 1548–1620), his mathematics teacher, developed a program integrating drawing, perspective, and mathematics at the Duytsche Mathematique at the University of Leiden. Maurits, who established the school in 1600, hoped that young scholars would use these lessons to serve their country as surveyors and military engineers. The aristocratic Constantijn Huygens (1596–1687), on the other hand, learned to draw for broad, cultural motivations than for practical reasons. Aside from its usefulness in mathematics, he firmly believed that an ability to draw would not only allow him to depict the physical world, but it would also 'hone his powers of judgment' in the arts.[17]

The clearest example of the training a young artist would receive is the one that Gerard ter Borch the Younger was given by his father, Gerard ter Borch the Elder (1583–1662), a history remarkably well known because the father kept and dated his son's drawings.[18] Ter Borch's father began by instructing his son to make pen and ink copies after prints and drawings [Fig. 6]. The young student soon graduated to copying casts of antique sculpture, a challenge that taught him how to model with light and dark, a sequence that Rietwijck would presumably have also followed since he owned a collection of prints, drawings, and plaster casts. Gerard the Younger subsequently made delicate head studies, both in chalk but with a brush, as well as rapid studies of figures in action. Although no student work by Vermeer has been preserved, one must assume that his initial training would have similarly focused on the importance of drawing as the foundation for becoming a painter.

Few of Ter Borch's drawings have been preserved after he left his father's workshop, even though evidence indicates that he continued to draw throughout his career, including compositional

7. Gerard ter Borch the Younger, «Lady at her Toilet, attended by a maid and page», c. 1660, pen and brown ink on laid paper, Amsterdam, Rijksmuseum, Inv. RP-T-1887-A-816

8a. Johannes Vermeer, «The Art of Painting», *c*. 1666–1668, oil on canvas, Vienna, Kunsthistorisches Museum, Gemäldegalerie, Inv. 9128

8b. Johannes Vermeer, «The Art of Painting» (as in Fig. 8a), detail

drawings [Fig. 7]. The randomness of this historical record is a reminder of how difficult it is to assess the full importance of drawings in any artist's creative process. This contrast – between the plethora of Ter Borch's drawings from his student days and the dearth of them from the latter part of his career – provides a cautionary note when considering the lack of drawings in Vermeer's oeuvre, which surely must have existed. What accidents of history have caused them to disappear? Have they all been discarded or destroyed, or are some, tucked away in an undiscovered album, awaiting discovery, as was recently the case with a slew of drawings by Gerrit van Honthorst (1592–1656)?[19]

In *Het Schilderboek* of 1604 Van Mander specifically linked preliminary drawings to composing paintings. He noted how some artists first put their thoughts down on paper and then used these drawings when making underdrawings on their canvas or panel supports. Such drawings could be careful studies after nature (*naar het leven*) or sketched from the imagination (*uyt den gheest*), the latter likely related to themes found in biblical and mythological themes, which he decreed the most important subjects for an artist to paint. When painting complex history paintings, however, Van Mander recommended that artists should use their preliminary sketches to make a full-scale cartoon of their composition, which they would then trace onto their painting's support.

The full-scale cartoons that Van Mander recommended making when creating complicated history paintings largely went out of fashion after naturalism became the dominant stylistic trend in Dutch art.[20] By the 1620s most artists preferred a more flexible approach for making underdrawings, largely basing them on quickly rendered preliminary compositional sketches reinforced by studies of prominent details, such as figures, faces, buildings, shells, and flowers. To ensure that perspective and proportions were correct many would also refine their underdrawings with a ruler and compass.[21] Unfortunately, few such compositional or studio drawings of this nature have survived, perhaps because they became damaged during the painting process and were discarded.[22]

Technical studies, particularly X-radiography and infrared reflectography, have consistently discovered that Vermeer blocked in his painting compositions, an indication that he fully embraced the idea that underdrawings were essential for the creative process [Fig. 8a].[23] The information has revealed that he executed these underdrawings with a brush, often in conjunction with broad washes. Current examination techniques, however, do not reveal underdrawings made with white or red chalk, which is a serious consideration when assessing the master's underdrawings. Vermeer's celebrated *The Art of Painting* [Fig. 8b] reveals that his artistic process involved making a white chalk underdrawing on the primed canvas before blocking in his forms with a brush. The fluidity of the chalk strokes on the canvas suggests that these chalk lines were quickly drawn, likely based on a preliminary study made on paper. This stage would be followed by one in which the artist carefully models the laurel leaves with paints and highlights. *The Art of Painting* provides clear evidence that the art of drawing was important for Vermeer and should be understood as an essential component of his artistic education.

A major uncertainty in considering Vermeer's artistic training is whether all of it took place in Delft. In general, a pupil would train for about six years with various artists before becoming a master in his own right. For example, after Gerard the Elder provided a proper framework for his son's career in Deventer, he arranged for him to travel to Haarlem and Amsterdam to study with masters who could expand his son's artistic horizons. This situation is comparable to the one that Reynier Vos would have faced in Delft. Accomplished as he may have been, Vermeer's likely initial teacher, the portrait painter Rietwijck, would not have had the expertise to instruct his student in becoming a history painter, which Van Mander had deemed the highest echelon in the visual arts.

9. Crispijn van de Passe II, «A Drawing School in the Evening», engraving, from *Van 't Light der teken en schilderkonst*, Amsterdam, 1643, Washington, The National Gallery of Art Library, David K.E. Bruce Fund

In the 1640s there seem to have been few good options in Delft for studying with an established painter. The most prominent artist with a workshop for training students was the still-life painter Evert van Aelst (1602–1657), who taught his nephew Willem van Aelst (1627–1683), and Emanuel de Witte (1617–1692). However, it is unlikely that Reynier would have sent his son to train with Van Aelst since they had recently been embroiled in a financial dispute. Leonard Bramer (1596–1674), arguably the preeminent Delft artist at the time, and a member of the network of artists associated with Vermeer's father, would seem to have been another possibility. Nevertheless, there is no evidence that Bramer ever took on students or apprentices. A more likely scenario is that Bramer would have urged Reynier Vos to send his son to Utrecht to study with the famed Abraham Bloemaert (1566–1651). Bramer had been a student of Bloemaert and was hence aware of kind of training the young Johannes would receive with this master. Bloemaert was a great draftsman, and one of the founders of a drawing academy in Utrecht in 1612. As seen in an engraving depicting one of the classes in the academy, with Bloemaert standing at the left, his students learned to draw from a live model whose form is illuminated by strong overhead light [Fig. 9].[24]

10. Abraham Bloemaert, «Study of Arms, Hands and Heads», c. 1612, red and white chalk on laid paper, Amsterdam, Rijksmuseum, Inv. RP-T-1887-A-886(V)

11. Gerard Houckgeest, «Interior of the Oude Kerk in Delft», 1654, oil on panel, Amsterdam, Rijksmuseum, Inv. SK-A-1584

Bloemaert was a great history painter who had a remarkable knowledge of the bible and mythology and whose large-scale paintings are similar in scale to those Vermeer would paint early in his career. His creative process for conceiving these works is instructive for an approach that Vermeer may have used. Bloemaert generally made compositional drawings for these works that would then serve as the basis for an underdrawing that he would freely render with brush and wash to indicate chiaroscuro effects. While composing his paintings he would also utilize figure studies to clarify specific poses and gestures [Fig. 10].[25] Although no such drawings by Vermeer exist, the underdrawings on his canvases and panels that have been discovered through technical examinations have similar characteristics.

Artistic Currents in Delft in the Early 1650s

Should Vermeer have gone to Utrecht to learn from Abraham Bloemaert, that training would have likely ended by the late 1640s because by then Bloemaert had become quite elderly and the level of activity in his workshop had diminished.[26] Unfortunately, the probability quotient for assessing the subsequent nature of Vermeer's training now becomes quite low, and it is particularly difficult to determine what path he may have taken at this stage of his life. The likelihood that Vermeer returned to Delft in the late 1640s to continue his artistic training is not great. Stylistic elements in Vermeer's history paintings are more akin to Utrecht and Amsterdam traditions than to Delft ones. Should Vermeer have stayed in Utrecht after a period of study with Bloemaert, he could have apprenticed with Jan van Bijlert (1597/98–1671),

12. Johannes Vermeer, «Woman Reading a Letter Before an Open Window», *c*. 1657–1658, oil on canvas, Dresden, Gemäldegalerie Alte Meister, Staatliche Kunstsammlungen Dresden, Inv. 1336. Photo: Wolfgang Kreische

13. Carel Fabritius, «View in Delft», 1652, oil on canvas, London, The National Gallery, Presented by the Art Fund, 1922

who ran an active studio and trained several painters. Bijlert had begun his career as a Caravaggesque painter, but by the 1640s he developed a classicizing style that is redolent of Vermeer's approach. Might Vermeer have gone to Amsterdam to study with Rembrandt? It is not impossible although no document mentions Vermeer in that master's workshop. Nevertheless, Vermeer's early paintings contain figural types and chiaroscuro effects that reflect Rembrandt's manner of painting from the late 1640s and early 1650s.[27]

No documents mention Vermeer in Delft until 5 April, 1653, just prior to his wedding to Catherina Bolnes (1631–1687). It is likely, however, that he had been in Delft for some time before that date, presumably as a result of his father's death in October 1652, when he probably returned home to help his mother run the tavern Mechelen. Vermeer may have met Catherina Bolnes and her mother Maria Thins (1593–1680) at that time, although how he came to know them poses an interesting quandary. Not only were Catherina Bolnes and Maria Thins Catholic, and he Protestant, but they were also of a higher social status than Vermeer's family.[28]

The artistic scene that greeted Vermeer when he returned to Delft was lively, most evidently in the dynamic, light-filled architectural paintings of Gerard Houckgeest (1600–1661) and Emanuel de Witte. Both painters were well versed in the perspective theories of Hans Vredeman de Vries (1527 – *c*. 1607) and Hendrick Hondius (1573 – *c*. 1650), but their great innovation was to utilize perspective to enhance their lifelike depictions of contemporary life.[29] Houckgeest and De Witte were also interested in illusionism and occasionally depicted a curtain seemingly hanging before a painting of a church interior [Fig. 11], a motif that Vermeer later adapted in his *Woman Reading a Letter Before an Open Window* [Fig. 12]. Although Vermeer seemingly learned much from these masters about perspective, light, and illusionism, it is improbable that he studied with either of them: De Witte left Delft for Amsterdam in 1651 and Houckgeest moved away in 1652.[30]

A more likely possibility, which is intimated in a poem published in 1667, is that Vermeer studied with Carel Fabritius (1622–1654).[31] This great painter, who was tragically killed in the Delft powder explosion of 1654, had been a pupil of Rembrandt in the early 1640s. Even though he soon returned to his native Midden-Beemster, a village north of Amsterdam, he remained connected to the master's workshop before he moved to Delft in 1650. Should Vermeer have gone to Amsterdam to study with Rembrandt in the late 1640s, he may have met Fabritius at that time. Regardless, according to guild rules, Vermeer would not have been allowed to study with Fabritius before the latter became a master in the St Luke's Guild on 29 October 1652.[32]

Thus, any internship with Fabritius would have been short, ending by December 1653 when Vermeer registered as a master in the St Luke's Guild.

In Delft, Fabritius evolved away from Rembrandt's manner and developed a light-filled style of painting. He also became fascinated with optics, and may well have utilized a wide-angle lens when executing his *Musical Instrument Seller in Delft* (*View in Delft*), 1652 [Fig. 13].[33] Samuel van Hoogstraten wrote that Fabritius was able, through his knowledge of optical effects gained from mirrors, globes, and lenses, to create illusionistic wall paintings, such as the one he made for Theodorus Vallensis, dean of the Delft surgeons' guild.[34] One can imagine that Vermeer and Fabritius would have found common ground in discussions of how perspective and optics could be used to enhance pictorial narratives, concerns that would become vital for Vermeer when he began painting genre scenes in the later 1650s.

The first specific instances in which Vermeer is documented in the presence of other artists occurred in April 1653, shortly before and after his marriage to Catharina Bolnes on 20 April of that year. On 5 April Leonard Bramer appeared before the notary Willem de Langue, a friend of Vermeer's family, to testify that he and Vermeer had been at the home of Maria Thins the previous evening. At that time Maria Thins had declared that the marriage of Johannes Vermeer and her daughter Catherina Bolnes could proceed. On 22 April, two days after the marriage, Vermeer and Gerard ter Borch were both witnesses in a deposition concerning an inheritance, where the notary was once again Willem de Langue.[35]

The circumstances underlying these two encounters with artists are likely quite different. Bramer was from Delft and a friend of Vermeer's family, who likely spoke on Vermeer's behalf because he was Catholic and could give reassurances about Vermeer's character to Maria Thins. Ter Borch, however, was from Deventer and there is no indication that the two artists had ever previously met. The timing of their meeting is intriguing, and one wonders if Ter Borch had come to Delft to attend the much younger artist's wedding. Alternatively, it is possible that the notary/collector/art connoisseur Willem de Lange facilitated the occasion to introduce Vermeer, who would not even register in the St Luke's Guild until the end of December, to one of the finest and most innovative artists of his day, famed for his 'modern' subjects, such as his engaging *Young Woman at her Toilet with a Maid* [Fig. 7].

It would take a few years before the impact of Fabritius' and Ter Borch's painting styles would become evident in Vermeer's works. Vermeer may have shifted away from history painting in the mid-to-late 1650s because of changes in the market, but his own interests had also clearly evolved. Following Fabritius' lead, the young Delft artist began experimenting with perspective and optics to create light-filled images of 'modern' themes, largely patterned after Ter Borch's innovative subject matter. Despite their importance to Vermeer, Fabritius and Ter Borch were not the only reasons that Vermeer sought to portray 'modern' subjects in this manner. Delft was the nexus of new ideas in science and optics that were being discussed within a broad network of scientists and scholars. Crucial to these discussions, however, was their theological underpinning: discoveries of nature bring us to a greater understanding of God's greatness than otherwise possible.

The Broader Scholarly Network in Delft

Discussions of Vermeer's network of like-minded individuals in Delft has primarily focused on family and other artists, but there was a much broader community interested in exploring the natural world than that narrow slice of the population.[36] Delft had no university, but it was a center of intellectual inquiry, particularly in the interrelated realms of natural philosophy, mathematics, and optics, concerns fundamental to Vermeer's artistic interests.[37] Discoveries in natural science were constantly occurring because of the presence in Delft of branch offices of the Dutch East India Company, the Dutch West India Company, and the Noordsche Companies, all of whom had ships that carried back to the Netherlands rarities from the far reaches of the globe.[38] These same ships required good navigation tools, such as astrolabes and sextants. As a consequence, there was a great interest in Delft in the development of optical devices, such as telescopes, to help guide their expeditions.

In 1614 the Delft Anatomy Theater opened, and this facility, which was in the Oude Kerk, became an important meeting place for anyone interested in medicine, physiology, and viewing dissections. This venue also became a mecca for physicians, surveyors, astronomers, and artists interested in discussing other intellectual concerns.[39] Lectures on a variety of topics were held on a weekly basis. Attached to the Anatomy Theater was a library and a museum, which, like the one in Leiden, was essentially a Kunst und Wunderkammer containing skeletons and other rarities with moral-philosophical implications.[40] Many of those who came to gatherings at the Anatomy Theater were interested in scientific instruments, including the microscope, that required lenses, which may be another reason that Delft became a center for their production.

Huib Zuidervaart and Marlise Rijks have carefully examined the production of lenses in Delft in the first half of the seventeenth century.[41] They identified Evert Harmansz Steenwijck (*c*. 1579–1654), one of the few Dutch opticians at that time, as the individual who constructed in 1610 a telescope that had enormous repercussions for the study of natural philosophy and cosmology.[42] Interestingly, two of his sons, Harmen (1612–1656) and Pieter (*c*. 1615 – after 1656) became successful painters, evidence that the network in Delft between scientists and artists was extremely close. Both brothers painted *vanitas* still lifes with

14. Harmen Steenwijck, «Vanitas Still Life», *c*. 1650, oil on panel, Leiden, Museum De Lakenhal, Inv. S 408

sunlight streaming in from above, suggesting that they were not only interested in light as a natural phenomenon but also for its spiritual implications [Fig. 14]. Strikingly, direct links exist between the Steenwijck and Vermeer families. Pieter was part of the network of artists who knew Reynier Vos, and in 1640 they both served as witnesses in a deposition.[43]

In the early 1650s Evert van Steenwijck's renown for making optical instruments attracted the attention of the Dutch diplomat, Lieuwe van Aitzema (1600–1669), who sought to acquire a special telescope for one of his patrons, the German Duke August of Braunschweig-Lüneburg (1597–1666). Steenwijck died in 1654 before he could produce this instrument, but Van Aitzema was able to acquire one from another local practitioner, Johan van der Wyck (1623–1679), who had moved to Delft from Breda by the end of October 1654. The timing of his move was likely connected to the devastating gunpowder explosion of 12 October that year.[44] Aside from his expertise in optics, Van der Wyck was an expert in military engineering. The States General, concerned that the explosion had crucially weakened the country's military defenses, sent reinforcements to Delft to strengthen the military presence at this critical munition's repository.

Van der Wyck had studied mathematics and optics in Breda at the Collegium Auriacum, which the Prince of Orange, Frederik Hendrik (1584–1647), had founded in 1646 to train young men for the army and the civil service, a program very similar to the one that Prince Maurits had established in 1600 at the University of Leiden.[45] In Breda Van der Wyck learned to grind lenses and build optical instruments, something that he continued to do after moving to Delft. Van der Wyck was a friend of the three sons of Constantijn Huygens, all of whom had studied at the Collegium Auriacum, and all of whom were interested in optics. Likely because of his connections to the Huygens family, in August 1655 Van der Wyck traveled from Delft to The Hague to demonstrate the wonders of his *camera obscura*.[46] The timing of this presentation affirms the importance of optical studies in Delft at the very outset of Vermeer's career.

Jacob Spoors (1595–1677) was a particularly important individual in this network of natural philosophers, mathematicians, and makers of scientific instruments in Delft.[47] Spoors had begun his professional career as a surgeon in his native Delft in 1614, the very year that the Anatomy Theater was founded. It may be assumed that he regularly attended lectures there about medicine, optics, mathematics, and the arts. Perhaps inspired by these discussions, Spoors decided to change careers and become a surveyor. He enrolled at the University of Leiden to study mathematics (probably at the Duytsche Mathematique), and in 1622 he passed his certification to become a surveyor.[48] Spoors then moved to Oud-Beijerland, near Dordrecht, where he also became a notary public. At the same time, he conducted experiments in optics and astronomy. Spoors continued to work professionally as surveyor and notary after he returned to his native Delft in 1636, but he also devoted much energy to the study of mathematics, as well as optics and astronomy. He likely shared these interests with his neighbors Johan van der Wyck and Evert Harmansz Steenwijck, from whom, it seems, he purchased a telescope.[49]

Spoors, excited by the observations he was able to make with a telescope, which he names a 'ghesicht-gereetschap' (tool for the eye), wrote a remarkable treatise in 1638: *Oratie van de nieuwe wonderen des wereldts, de nuttigheyd, de waerdigheyd, der wis- ende meet-konsten* (*Oration on the New Wonders of the World, and on the Use and Dignity of Mathematics and*

Geometry).[50] In his publication Spoors describes the marvels he has seen with new optical device, including sunspots, mountains on the Moon, and Jupiter's four moons. The underlying premise of *Oratie*, however, is that such observations are significant because they reveal God's greatness and perfection.[51] Spoors wrote that a knowledge of geometry is crucial for surveying the earth, but only when applying optics and mathematics to the study of the heavens can one appreciate the order and regularity of God's creation. For him, God's perfection is most aptly visualized as a circle: both are perfect geometric forms, with neither beginning nor end.[52]

Spoors' short yet erudite text (only 44 pages long) is filled with references to great thinkers of both the past and present who sought to understand the essence of God's creation. He mentions, among others, poets like Virgil, Homer and Cicero; philosophers and astronomers, including Ptolemy, Copernicus, Galileo, Kepler, and Tycho Brahe; mathematicians, among them Simon Stevin and his Leiden mathematics professor Willebord Snel. He also includes Cornelis Drebbel because of a planetarium he created, and Willem Blaeu, for mapping the world and the stars. These references not only indicate the depth of Spoors' knowledge of literary sources, but also an awareness of the most recent developments in optics, confirmation of the broad network of likeminded scientists and practitioners he knew.

Spoors fully adhered to the planetary system devised by Nicolas Copernicus (1473–1543), who placed the sun at the center of the universe rather than the earth and determined that the planets followed a circular orbit around the sun. Spoors found Copernicus' theory to be closer to the 'true form of the Heavens' than that of Claudius Ptolemy (*c*. 100–170) because it was more 'orderly' and 'perfect'. Spoors further argued that the perfect proportions that characterize the solar system must be maintained in man's own creations, whether in the artistic sphere, music, medicine, or in such crafts as shipbuilding.[53] Spoors' discussion of proportions in the art of painting is quite extensive and focuses on the importance of perspective, color, and properly proportioned human figures.[54] Finally, aside from perfect proportions, Spoors also considered light from the sun to be another essential aspect of God's divine plan. He included four vignettes on the title page of *Oratie* to demonstrate various ways in which the sun and north star shed light on the wonders of the universe. As Zuidervaart and Rijks have rightly stressed, Spoors viewed sunlight as the 'moral counterpart of shadow'.[55]

Spoors dedicated his book to Delft's magistrates in hopes that they would govern their city with the ideals of proportion and harmony found in the divine order. His ideas, thus, were known to the body politic, as well as to theologians, scientists, artists, and craftsmen. Spoors' text foreshadows, in many ways, the significance of proportion, perspective, light and optics for establishing the moral underpinnings of Vermeer's paintings. One can hardly imagine that the two men, despite their differences in age, did not discuss issues of such great mutual concern after Vermeer became engaged in the intellectual and artistic climate in Delft in the early1650s.

Vermeer would have known about Spoors and his philosophical ideas in many ways, including through the network of art lovers, one of whom was Spoors' fellow notary and friend of the Vermeer family, Willem de Lange. Spoors was also associated with other painters, among them, Michael van Mierevelt (1566–1641), who portrayed Spoors and his wife.[56] Finally, Spoors had a close relationship with other scientists, including Anthony van Leeuwenhoek (1632–1723), who moved back to his native Delft from Amsterdam in 1655. Not only were Spoors and Van Leeuwenhoek both members of the St. Nicolaas Gilde and related by marriage, the two men shared an interest in optics and a conviction that scientific discoveries brought one closer to a knowledge of God's greatness. Van Leeuwenhoek was not at that point in his life involved with microscopy, but, likely through his relationship with Spoors, he 'began to study navigation, astronomy, mathematics, and philosophy, that is natural science'.[57] As a result of these studies, he passed his exams to be a surveyor in 1669. Subsequently, Spoors and Van Leeuwenhoek collaborated on surveying projects.

More importantly, Vermeer knew Spoors personally. Spoors not only served as a notary for Maria Thins, but also for himself. Spoors had met Maria Thins when he was a surveyor and notary in Oud-Beijerland because she owned property in that municipality. On both 15 July 1649, and 12 November 1651 Spoors served as the notary at depositions concerning family matters related to her.[58] In 1657 Spoors was the notary at the important deposition when Vermeer and Catharina Bolnes promised to repay fully a loan that they had received from Pieter Claesz van Ruyven.[59] The notarial relationship between Vermeer and Spoors continued at least until 1674, when Vermeer was present at a hearing confirming that Spoors and Maria Thins had a longstanding relationship because of the lands she owned in Oud-Beijerland.[60]

The Impact on Vermeer of his Artistic Training and the Intellectual Climate in Delft

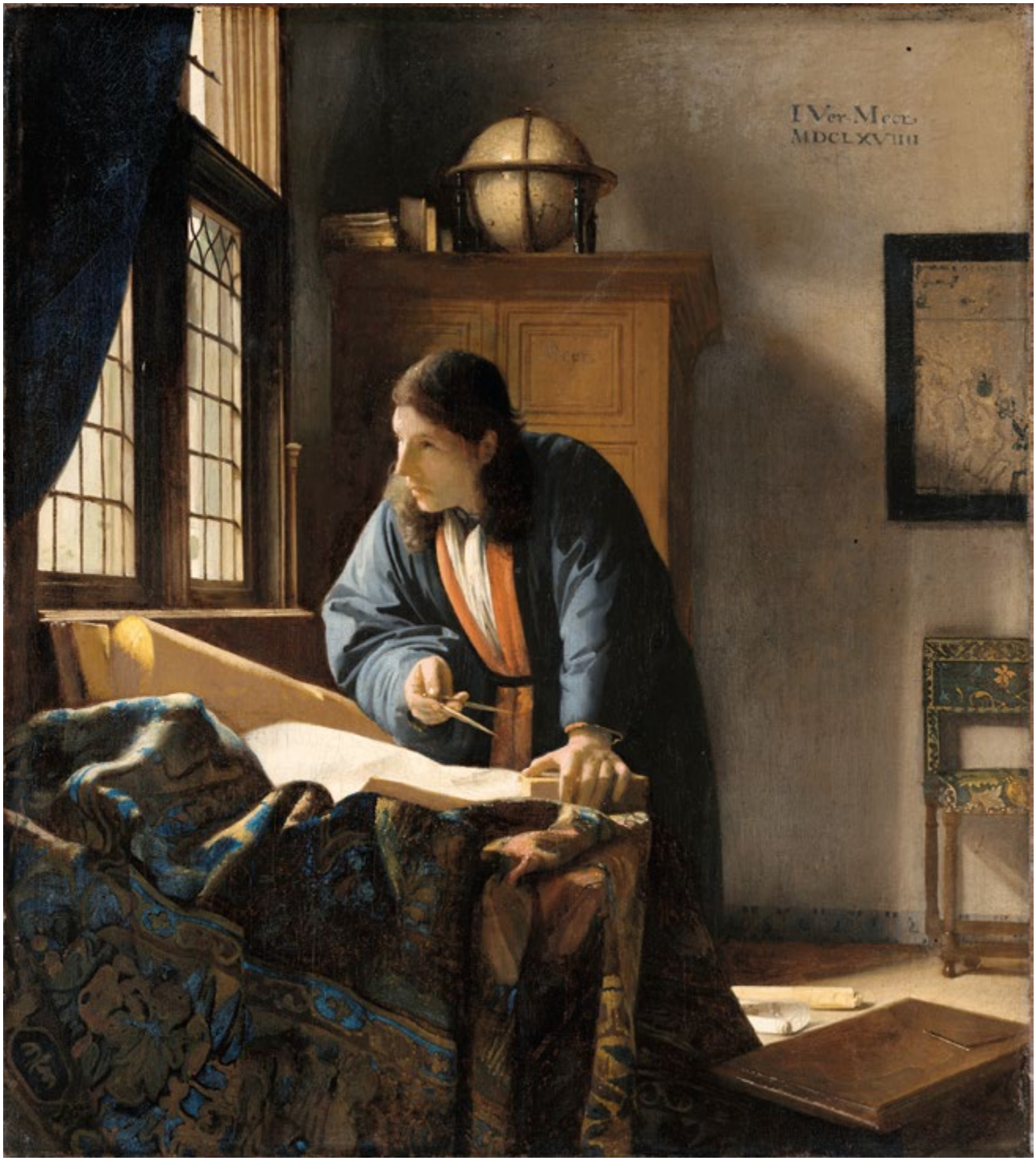
The underlying premise of this article, which was stimulated by the experience of *Vermeer and the Masters of Genre Painting: Inspiration and Rivalry*, is that Vermeer's genre paintings differ profoundly from those of his contemporaries. In trying to determine what underlay Vermeer's distinctive approach to painting, it seemed appropriate to consider two factors, largely heretofore undiscussed: the nature of his artistic training and the impact of the artistic and intellectual climate in Delft. The conclusion I reached when considering Vermeer's artistic training is that the probability is extremely high that he followed a well-hewn path,

15. Johannes Vermeer, «The Milkmaid» (as in Fig. 4a), detail

one that did not vary in any substantive way from the experiences of other Dutch genre painters, among them Gerard ter Borch, Frans van Mieris, and Gabriel Metsu (1629–1667). However, it became clear that the artistic and intellectual character of Delft were unique to Vermeer's experiences, and thus were likely a determining factor in forming Vermeer's goals and aspirations as a painter.

The importance of intellectual discourse in Delft for Vermeer is not only evident in his interest in optics, light and perspective, but it is also seen in the underlying moral tenor of Vermeer's paintings. He began his career as a history painter, depicting stories from the bible and mythology of great moral consequence, but he continued to express these values in his scenes of contemporary life. In these 'modern' subjects, Vermeer favored quiet moments of reflection and portrayed them in ways that make them seem consequential. Largely through his carefully proportioned compositions and sensitivity to the physical and spiritual character of light, Vermeer created images that have a timeless rather than momentary character. Vermeer's approach does not reflect the teachings of art theorists like Van Mander, but instead parallels ideas found in the realm of science. His source of inspiration likely derived from discussions he had with thinkers in Delft like Jacob Spoors. The ideas that Spoors expressed in *Oration on the New Wonders of the World, and on the Use and Dignity of Mathematics and Geometry*, that ideal proportions are the measure of all things and that correct perspective was essential for a work of art, are ones that Vermeer fully embraced. Light was no less vital to Spoors and Vermeer, both for the study of nature and for its spiritual symbolism.

The seeds of this interest in exploring the physical world with optical devices and depicting it in ways that reveal the underlying truths of nature, were ones that absorbed Vermeer throughout his career. For example, the *camera obscura* that Johan van der Wyck developed in Delft in the mid-1650s, which Vermeer likely saw, was not only interesting for artistic and scientific reasons, but also, as Constantijn Huygens wrote in 1622, in response to seeing Cornelis Drebbel's *camera obscura*, for revealing the laws of nature: 'The art of painting is dead by comparison, for this is life itself, or something more elevated, if we could find a word for it'.[61] The notion that the *camera obscura* produces images 'more elevated than life itself' may help explain Vermeer's innovative use of specular highlights to emulate unfocused images from a *camera obscura*, as in the basket of bread in *The Milkmaid* [Fig. 15].



16. Johannes Vermeer, «The Geographer», 1669, oil on canvas, Frankfurt am Main, Städel Museum, Inv. 1149

17. Johannes Vermeer, «The Astronomer», 1668, oil on canvas, Paris, Musée du Louvre, Département des peintures (RF 1983-28)

The most compelling example of how fully Vermeer appreciated the connections between the study of nature and the spiritual realm came in the late 1660s with his pendant paintings *The Geographer* and *The Astronomer* [Figs 16, 17]. When Vermeer created these works he was at the height of his artistic powers, secure in his compositional ability to integrate figures convincingly within their environment; assured in his understanding of light, both to illuminate the scene and to evoke quiet moods of contemplation; certain about how to use paint to suggest the rough textures of carpets as well as the translucency of glass; and sophisticated in his means for imbuing apparent scenes of daily life with profound moral, theological, and spiritual meaning.

With *The Geographer* and *The Astronomer* Vermeer expresses the excitement of intellectual inquiry in the scholars' poses and purposeful expressions, as their inquisitive minds search for answers to questions they have posed about the earth and the stars. The geographer rests one hand on a treatise and holds dividers in the other while he gazes toward the light, confident that with knowledge based on a firm, scholarly foundation, and with the aid of precise measuring tools, he can chart new realms through his own measured judgment. Vermeer's astronomer, on the other hand, is more of a seeker of universal truths than his counterpart. As he reaches out to measure with his hand the distance between the constellations depicted on the celestial globe, he searches for a new understanding of the mystery of the cosmos, more concerned with the study of the underlying laws of nature than with observation of the sky itself.

Lying on the table next to the astronomer is Adriaen Metius' book on astronomy and geography. It is opened to a page that reads:

> The first observers and investigators of the situation and course of the stars have been […] our ancestors the patriarchs who through inspiration from God the Lord and the knowledge of geometry and assistance of mathematical instruments have measured and described for us the firmament and the course of the stars.[62]

This text, which asserts the importance of divine inspiration in guiding science in the exploration of the mysteries of the firmament, indicates the principles guiding the astronomer's studies. Vermeer reinforces this theological underpinning to the astronomer's exploration of the firmament by depicting a painting of *The Finding of Moses* on the rear wall. This Old Testament story was allegorically interpreted as evidence of God's divine providence.

Vermeer could only have come upon the specialized knowledge of scientific texts, instruments, maps, and globes by consulting with someone who was involved with geography and astronomy. Moreover, this consultant would also have needed to understand the philosophical and theological issues related to their study. This individual was likely Jacob Spoors. Spoors' friend and colleague, Anthony van Leeuwenhoek, who passed his examination for surveyor in Delft on 4 February 1669, exactly when Vermeer was painting these works, may have actually been Vermeer's model in these two remarkable paintings.[63]

The existence of a network of artists, mathematicians, scientists in Delft who were interested in using optical devices to explore the physical world, and who were aware of the spiritual

implications of such studies, has long been overlooked. These worlds of inquiry have been studied separately, but without a full appreciation of the many ways in which they overlap. Several venues in Delft, unconnected to church and city government, would have welcomed such thoughtful individuals who wanted to convene and to share ideas. The Anatomy Theater, for example, was a gathering place for a broad range of individuals, primarily those concerned with medical issues, but also for scientists and artists interested in learning about and sharing new ways to examine nature. The Guild of St Luke was focused on creative endeavors in fine arts and crafts, but, as has been seen, these interests also spilled over to taverns and inns where paintings were sold. Topics of discussion in such settings, one can imagine, would have included art and science, politics and social issues, and the quality of the beer. Other likely venues for those interested in the confluence of art, science, optics, and philosophy were homes of music lovers, studios and workplaces of artists, and the makers of optical instruments.

Vermeer clearly was part of this community of likeminded searchers for knowledge of the physical and spiritual worlds. Although these forms of inquiry likely existed in other Dutch cities, they were particularly pronounced in Delft, in large part because it was such a center for the study of optics. Although the ideas and concepts that Vermeer garnered from this community hardly explain every aspect of his artistic genius, they help explain why he approached his art so differently than did his contemporaries.

[1] *Vermeer and the Masters of Genre Painting: Inspiration and Rivalry*, Paris, Musée du Louvre; Dublin, National Gallery of Ireland; Washington, National Gallery of Art, 2017–2018. The exhibition was organized by the curators of the three participating museums, Blaise Ducos from Paris, Adriaan E. Waiboer from Dublin, and me from Washington. Adriaan Waiboer initiated the project and was the driving force behind the exhibition's concept.

[2] For example, infrared reflectography has revealed that Vermeer eliminated a map from the rear wall and a lute in the foreground chair in *Woman with a Pearl Necklace* (see Fig. 1c). See A. K. Wheelock, Jr., and B. P. J. Broos, *Johannes Vermeer*, exh. cat., National Gallery of Art, Washington; Royal Picture Gallery Mauritshuis, The Hague, Zwolle, 1995, p. 154.

[3] For recent discussions, see my essays 'Erudition and Artistry', in *Vermeer and the Masters of Genre Painting*, pp. 21–36; and 'Johannes Vermeer – a Classicist among Genre Painters', in S. Koja, U. Neidhardt, A. K. Wheelock Jr., *et al*., *Johannes Vermeer: On Reflection*, exh. cat., Gemäldegalerie Alte Meister, Dresden, 2021, pp. 35–53.

[4] I would like to thank Rozemarijn Landsman and Henriette Rahusen for their thoughtful comments on this text.

[5] J. M. Montias, *Vermeer and His Milieu: A Web of Social History*, Princeton, 1989. I owe tremendous gratitude for the extensive research that Montias undertook in the Delft archives. Most of the documentary information discussed in this article comes from his publications.

[6] Several factors were considered in making those judgments. Aside from similarities in style, composition, and subject matter, the level of probability was influenced by family and master–student relationships, documented interactions between painters and collectors, and the proximity of the cities in which the artists worked.

[7] Montias, *Vermeer and His Milieu*, p. 62, notes that Reynier Vos registered to be an art dealer in Delft's Guild of St Luke on 12 August 1631. See Document 132.

[8] Montias, *Vermeer and His Milieu*, p. 87, notes that the paintings Digne Bolnes inherited from her father, Balthasar Claesz Gerrits, likely constituted Reynier's initial inventory as an art dealer.

[9] Montias, *Vermeer and His Milieu*, pp. 56–58. The inventory was taken on 8 Dec. 1623. See Document 94.

[10] J. M. Montias, 'Art Dealers in the Seventeenth-Century Netherlands', *Simiolus*: *Netherlands Quarterly for the History of Art*, 1988, 18, no. 4, pp. 245 (244–256).

[11] Montias, *Vermeer and His Milieu*, p. 62. A seventeenth-century Dutch notary public assumed many of the same responsibilities as those of a contemporary lawyer, including drawing up trade contracts, wills, and testimonies.

[12] Montias, *Vermeer and His Milieu*, pp. 86–87. The collection of paintings was deemed to be worth a great deal of money (several thousand guilders) and the library was described as 'beautiful as anyone in town,

worth to all appearances far more than a thousand guilders' (Document 115, dated 16 May 1627). Montias, however, believes that the extent of the collection of paintings and significance of library were exaggerated.

13 P. Begheyn, and J. J. V. M. De Vet, 'De Bibliotheek Van De Delftse Schilder Cornelis Damen Rietwijck (1589/1590–1660)', *Oud Holland*, vol. 128, 2015, no. 4, pp. 187–198.

14 K. van Mander, *Het Schilder-boeck*, Haarlem, 1604.

15 For a discussion of the importance of drawings in the creative process, see: W. W. Robinson and P. Schatborn, 'Drawing into Painting: An Overview', in P. Schatborn, W. W. Robinson, A. K. Wheelock, Jr., G. Luijten, and H. Rahusen, *Drawings for Paintings in the Age of Rembrandt*, exh. cat. Washington, National Gallery of Art, Washington, 2016, pp. 5–16.

16 S. Dupré, 'The Historiography of Perspective and Reflexy-Const in Netherlandish Art', *Netherlands Yearbook for History of Art/Nederlands Kunsthistorisch Jaarboek*, 61, 2011, 1, pp. 4–14, discusses the importance of optics and perspective in mathematical treatises, paying particular attention to the relationship between Prince Maurits and Simon Stevin.

17 H. Roodenburg, 'Visiting Vermeer: Performing Civility', in *In His Milieu Book: Essays on Netherlandish Art in Memory of John Michael Montias*, ed. by A. Golahny, M. M. Mochizuki and L. Vergara, Amsterdam, 2006.

18 A. McNeil Kettering, *Drawings from the Ter Borch Studio Estate*, 2 vols, The Hague, 1988. These drawings have been preserved in the Ter Borch archives in the Rijksmuseum. See also A. K. Wheelock, Jr., *Gerard ter Borch*, exh. cat. Washington, DC, National Gallery of Art; The Detroit Institute of Arts; Amsterdam, Rijksmuseum, Zwolle, 2004.

19 See D. Bronze, *Vingt-sept dessins de Gerrit Van Honthorst* (*1592–1656*), exh. cat., Saint-Honoré Art Consulting, Paris, 2014, unpaginated.

20 See A. K. Wheelock Jr., 'Drawings and Underdrawings: The Creative Process in Dutch Painting', in *Drawings for Paintings*, pp. 17–33. Although the preeminent painter of church interiors, Pieter Saenredam (1597–1665), did make careful construction drawings that he would then transfer to his panels, most architectural painters of a later generation than Saenredam, including Jan van der Heyden (1637–1712) and Gerrit Berckheyde (1638–1698), did not make cartoons on separate sheets of paper. Instead, they drew their carefully measured designs, or construction drawings, directly on their painting's support.

21 Many artists reused/adapted such studio drawings in different paintings, which means that they became welcome labor-saving devices.

22 Stijn Alsteens discusses this problem in the work of Joachim Wtewael in his essay 'Wtewael as Draftsman', in J. Clifton, L. M. Helmus, A. K. Wheelock Jr., *Pleasure and Piety: The Art of Joachim Wtewael* (*1566–1638*), exh. cat., Centraal Museum, Utrecht; National Gallery of Art, Washington; Museum of Fine Arts, Houston, 2015–2016, Washington, 2015, pp. 56–57.

23 For a discussion of Vermeer paintings with pen and wash underdrawings, see A. K. Wheelock, Jr., *Vermeer & the Art of Painting*, New Haven, 1995.

24 For information about the nature of Bloemaert's drawing school, see M. J. Bok, '"Nulla dies sine linie": De opleiding van schilders in Utrecht in de eerste helft van de zeventiende eeuw', *De Zeventiende Eeuw*, 6, 1990, 1, pp. 58–65.

25 See *Drawings for Paintings*, pp. 76–78. Around 1650 several of Bloemaert's head studies were published in the *Tekenboek* (*Artis Apellae liber*), which became an important model book for artists.

26 I would like to thank Elizabeth Nogrady for discussing the Bloemaert workshop with me.

27 Montias, *Vermeer and His Milieu*, p. 105, also believes that Vermeer may have had an apprenticeship in Amsterdam. For associations between the figure of Diana in Vermeer's *Diana and her Companions*, *c*. 1655–1656, in the Mauritshuis, and Rembrandt's *Bathsheba*, 1654, in the Louvre, see Wheelock, *Vermeer & the Art of Painting*, pp. 29–37. This appropriation indicates that Vermeer was studying Rembrandt's works after he became a master in the Delft St Luke's Guild.

28 Montias, *Vermeer and His Milieu*, p. 107, plausibly suggests that Abraham Bloemaert, who was related by marriage to Maria Thins, may have been the intermediary if, indeed, Vermeer had been apprenticed to the Utrecht master.

29 J. Vredeman de Vries, *Perspective*, The Hague and Leiden, 1604–1605; H. Hondius, *Perspective Konsten*, The Hague, 1625.

30 A. K. Wheelock, Jr., 'Gerard Houckgeest and Emanuel De Witte: Architectural Painting in Delft around 1650', *Simiolus: Netherlands Quarterly for the History of Art*, 8, 1975, no. 3, pp. 167–185.

31 Montias, *Vermeer and His Milieu*, p. 104, discusses the implications of the verses of a poem by Arnold Bon that Dirck van Bleyswijck published in his *Beschryvinge der Stadt Delft*, Delft, 1667. These verses read: 'But happily there rose from his fire [referring to Fabritius' death in the gunpowder explosion in October 1654], Vermeer, who masterlike, was able to emulate him'.

32 Vermeer likely only moved to Delft that very October (presumably from an apprenticeship elsewhere) to assist his mother after his father's death that month.

33 See A. K. Wheelock Jr., 'Carel Fabritius: Perspective and Optics in Delft', *Nederlands Kunsthistorisch Jaarboek*, 24, 1973, pp. 63–83.

34 S. van Hoogstraten, *Inleyding tot de Hooge Schoole der Schilderkonst. Anders de Zichtbaere Werelt*, Rotterdam, 1678 (reprint, Doornspijk, 1969), p. 274.

35 Montias, *Vermeer and His Milieu*, pp. 99–103, Documents 250 and 251.

36 The following discussion fundamentally differs from Michael Montias' assessment of the intellectual climate in Delft. See Montias, *Vermeer and His Milieu*, p. 138, where he writes: 'There was not enough intellectual ferment beyond art in Delft to keep a young artist from plying his craft'.

37 T. Weststeijn, *The Visible World: Samuel van Hoogstraten's Art Theory and the Legitimation of Painting in the Dutch Golden Age*, Amsterdam, 2008, p. 342, perceptively noted that 'the shared interest in new optical phenomena and experiments was an important element of the intellectual climate in and around Delft, Rotterdam and Dordrecht'.

38 For the network of Delft individuals interested in natural science, see E. Jorink, '"Alle bedenckelijcke curieusheden": Delftse verzamelingen en de ontwikkeling van de natuurwetenschap in de zeventiende eeuw', in *Schatten in Delft*, ed. by E. Bergvelt, Zwolle 2002, pp. 101–125.

39 J. C. C. Rupp, 'Het Theatrum Anatomicum: Publiekscommunicatief Fossiel of "Archetype"', *Gewina*, 25, 2002, pp. 191–209.

40 J. Ray, *Observations Topographical*, *Moral*, *& Physiological Made in a Journey through part of the Low-Countries*, *Germany*, *and France*, London, 1673, pp. 28–29. For information about the Anatomy Theater and its library, see H. Houtzager, 'Waar de chirurgijns en medici bijeenkwamen', in H. Houtzager and M. Jonker, *De snijkunst verbeeld: Delftse anatomische lessen nader belicht*, Zwolle, 2002, pp. 51–63.

41 H. J. Zuidervaart and M. Rijks, '"Most Rare Workmen": Optical Practitioners in Early Seventeenth-century Delft', *The British Journal for the History of Science*, 48, 2014, no. 1, pp. 53–85. Not only do I owe much to their many insights in this article, but Zuidervaart and Rijks have also kindly shared their ideas and thoughts in Zoom calls and in other communications.

42 In 1610 the University of Leiden's famed mathematics professor, Rudolf Snel, demonstrated Steenwijck's telescope to his students.

43 Montias, *Vermeer and His Milieu*, p. 70, Document 156.

44 The following account on Johan van der Wyck is largely drawn from H. J. Zuidervaart, 'The Remarkable Career of a "Most Rare Workman" Johan van der Wyck (1623–1679), a Dutch-educated Military Engineer and Optical Practitioner. Part 1: In the Service of the Dutch Republic', *Bulletin of the Scientific Instrument Society*, 138, 2018, pp. 16–23.

45 Van der Wyck's education taught him practical applications of mathematics and optics, but also important to him was the more abstract and theological aspects of these interrelated disciplines. He was intent on searching for 'the right heavenly mathematics'.

46 Zuidervaart, 'The Remarkable Career', p. 17. This occasion was attended by an English writer, fascinated by optics, Samuel Hartlib, who wrote:

> At [The] Haage now to bee performed by one paire of glasse in the window to represent and conveigh all the objects without upon the Streets upon the table in the middle of the roome. The inventor, as I take it, is Van der Wijcke […] who makes all manner of Tubes and Microscopes excelling those of Braband […]. [He is] a most rare Workeman.

Surprisingly, Zuidervaart does not identify this optical device was a *camera obscura*. Instead, he describes it as 'some kind of projection device'.

47 The following discussion is largely based on Zuidervaart and Rijks, '"Most Rare Workmen"', pp. 53–85.

48 For the *Duytsche Mathematique*, see G. Wiesenfeldt, 'The "Duytsche Mathematique" and Leiden Family Networks, 1600–1620', in *Locations of Knowledge in Dutch Contexts*, Leiden, 2019, pp. 40–63.

49 For a discussion and map of the location of homes in Delft of individuals involved in the world of optics, including Spoors, Steenwijck, and Van der Wyck, see Zuidervaart and Rijks, '"Most Rare Workmen"', pp. 24–25.

50 Jacob Spoors, *Oratie van de nieuwe wonderen des wereldts*, *de nuttigheyd*, *de waerdigheyd*, *der wis- ende meet-konsten* (Oration on the New Wonders of the World, and on the Use and Dignity of Mathematics and Geometry), Delft, 1638.

51 As emphasized by Zuidervaart and Rijks, '"Most Rare Workmen"', Spoors' publication belongs to the tradition of Dutch 'books of wonder', which were widespread in the seventeenth century. In his text (1638), Spoors emphasizes that Willebord Snel, his mathematics professor in Leiden, taught him the fundamental difference between using geometry to map the earth and to lift one's eyes to the heavens to understand God's might.

52 Spoors, *Oratie*, p. 22.

53 Spoors, *Oratie*, pp. 37–38, also ties the prosperity of the land to the way these arts help in the design of fortifications, such as those that allowed Prince Maurits to protect the homeland. He also stresses that these arts are also essential for creating navigational instruments, like astrolabes, that are important for travelling at sea.

54 Spoors, *Oratie*, p. 34. Whether or not nature's correct proportions are mirrored determines whether a painting gives an 'ideal' or 'monstrous' image ('een wanschapen Monster, als een volmaeckt beelde gelijcken'). See also Zuidervaart and Rijks, '"Most Rare Workmen"', p. 13, for a discussion of Spoors' commentary on the importance of proportion in the art of painting. They rightly note that 'By saying this, Spoors more or less puts into words a way of thinking that in due time became mainstream thought among Delft painters'.

55 Zuidervaart and Rijks, '"Most Rare Workmen"', p. 15.

56 Spoors was also the uncle of Pieter de Hooch's goddaughter.

57 Reinier Boitet, *Beschryving der Stad Delft*, Delft, 1729, pp. 765–770.

58 Montias, *Vermeer and His Milieu*, Document 222, 15 July 1649, and Document 238, 12 November 1651.

59 Montias, *Vermeer and His Milieu*, pp. 134–135, Document 271, 30 November 1657: 'They bind their respective persons and their assets to this end and are willing to let themselves be condemned by the judges of this city [in case of nonrepayment] and irrevocably constitute Covert Rota, Jacob Spoors, and Frans Bogart, attorneys before the court (vierschaar) of this city, both to request this condemnation and to consent thereto'. Montias, wrongly I believe given the specific wording of this document, suggests that it is 'at least conceivable' that the loan was 'an advance on the future purchase of one or more paintings'.

60 Montias, *Vermeer and His Milieu*, Document 348, 31 March 1674.

61 See A. K. Wheelock Jr, 'Constantijn Huygens and early attitudes toward the camera obscura', *History of Photography*, 1, 1977, no. 2, pp. 93–103.

62 The identity of this book, and English translation of the text, were made by J. Welu, 'Vermeer's Astronomer: Observations on an Open Book', *The Art Bulletin*, 68, 1986, pp. 263–266.

63 I have suggested that Van Leeuwenhoek was the model for the geographer and astronomer in various publications, including Wheelock and Broos, *Vermeer*, pp. 170–175.