Mapping the wet land:
The painter-cartographer in the Low Countries, 1480-1550

Oliver Kik

Detail fig. 4

The Low Countries have always had an ambiguous relationship with the sea. While much of the prosperity of the region was the result of maritime trade routes which connected the region to the Mediterranean, the Baltic, the East and the New World, this relationship was also defined by a continuous struggle against changing shorelines of the North Sea and land reclamation projects that required vast financial investments, as well as unceasing maintenance of infrastructure such as dykes and canals. City officials and administrations were able to rely on artists, cartographers, land surveyors, city masons and other professional players to visualize the various hydrological campaigns, making the region a fertile breeding pond for early cartographic developments. This essay examines the intersection between art, geometry and science in the context of the dissemination of geometrical knowledge in the Low Countries during the first half of the sixteenth century, with particular attention to these artists' relationship with water and hydrology. To what extent did geometrical knowledge inform painter-cartographers in the representation of water's relationship with the land? What were the trajectories through which this knowledge was acquired? And finally, how did this knowledge affect the changing role of the early modern Netherlandish artist during the first half of the sixteenth century?

Early mapmaking in the Low Countries before 1500 was professionally situated at the disciplinary crossroad between architectural design, painting and city planning. Most often, the city geometer, or land surveyor, would be appointed to render a cartographic representation of an area with the context of urban changes, as well as for judicial disputes (e.g., building violations, ownership issues, border quarrels).[1] Archival references to land surveyors in the Low Countries have been documented as early as the thirteenth century.[2] Most often, the master mason to the city also acted as land surveyor, but sometimes painters too could be relied upon for these commissions.[3] Although it was not uncommon for land surveyors and painters to collaborate, in fifteenth-century cartographic design practice the role of painters was often limited to granting the visualization of space an additional aesthetic flair without offering much scientific input, in addition to the measurements made by the land surveyor. The dualism between the geographic role of the land surveyor on one hand and the chorographic function of the painter on the other hand can be traced back to the ancient writing of Ptolemy (c. 100-170), who drew a distinct professional line between *geography* and *chorography*.[4]

The interdisciplinary relationship between painting and cartography has not gone unnoticed in art historical literature, yet it has often been approached within the context of the development of landscape painting as a defining genre of Netherlandish painting.[5] Within this narrative, the early cartographic experiments of painters are understood as a crucial step towards the development of landscape painting as an individual genre in the North.[6] Yet this focus on the importance of the developments of the landscape genre in Netherlandish art has overshadowed the professional role of the painter-cartographer for the dissemination of technical and scientific knowledge between professional groups. By the early sixteenth century, the artistic involvement in mapping projects started to exceed the mere chorographic visual input. Artists such as Lanceloot Blondeel (1496-1561), Pieter Pourbus (1523-1584), Cornelis Anthonisz (c. 1505-1553) and Jan van Scorel (1495-1562) showed a great familiarity with geometrical principles such as trigonometry and triangulation. Their involvement with surveying tasks noticeably shifted from a purely aesthetic role towards an active input on the technical and scientific design process of maps. While this increasing commitment of Netherlandish painters to cartographic projects during the first half of the sixteenth century has often been mentioned in biographical overviews or exhibition catalogues, it remains a subject which has mostly been described as merely a side activity in a painter's career, often hastily explained with the Burckhardtian *topos* of the Renaissance *uomo universale*.[7] Conversely, the fact that these figures are primarily known as painters and their products were manuscript maps implies that these artists are rarely seriously included in overviews of Netherlandish cartography.[8] By providing a more coherent overview of various painter-cartographers and their intellectual networks in the Low Countries, this essay argues that by the early decades of the sixteenth

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century a new generation of painters employed their newly acquired intellectual knowledge of geometry, trigonometry and triangulation in order to independently render and plot accurate maps, particularly of the coasts and hydrological projects. As a result of this process, their social position was elevated by association with geometry as a liberal art. While in the first part I will provide a short overview of the best-documented cartographic projects executed by Netherlandish painters depicting the relationship between land and water, the second part will focus more on artistic networks connecting these projects and the circulation of scientific geometrical knowledge.

Turning back the tide. Bruges's battle against the water

Since the thirteenth century, Bruges's status as a cultural hub relied on its proximity to the sea, yet, the silting-up of the Zwin estuary equally contributed to the city's gradual economic and cultural demise during the course of the sixteenth century.[9] This demise was already anticipated at an early stage as new engineering and mapping projects were undertaken during the fifteenth and sixteenth centuries to counter the imminent environmental change and to prolong the economic success of Bruges and its surrounding area. In the 1480s plans were made to dig a new canal (Nieuw Gedelf) by connecting the main passage of the Zwin estuary to the river Scheldt, hoping to lengthen the tides and continue commercial access to the port of Bruges. This project and others like it would occupy the Bruges civic authorities for the following century, and included many cartographic commissions which involved the participation of painters, as is reflected in the city accounts.

Between 1480 and 1483 various payments were made to the painter Jan Fabiaen for several maps which 'had to show the hydrology of the city'.[10] In the year 1499-1500 several drawings of the Zwin area and Oostburg were commissioned to painters, among them a certain Cornelis Fieric.[11] The earliest visual representation within the context of this long-term mapping project is the painted map by Jan de Hervy (c. 1450-1509), for which the painter was paid 3 pounds and 10 shillings in 1501-1502.[12] This and two other similar payments are associated with a painted map on canvas, now in the collection of the Groeninge Museum in Bruges (fig. 1).[13] The map is typical for what one would expect of a chorographic representation as defined by Ptolemy: conceived by a painter, it represents Bruges and its surrounding area 'minutely so that we can see harbours, the villages, the people, the course of smaller rivers, diverging from larger ones, and similar things'.[14] None of the distances are measurable, and no other information is provided as regards to the distances between places.[15] By 1516 the Nieuw Gedelf canal project had failed in its objective of optimizing the navigability of the waterway to Bruges, and the project was abandoned.

Few new cartographic developments seem to have been documented in Bruges until 1546, after which Lanceloot Blondeel was contracted to design new maps of the Zwin area. The painter was paid 2 pounds gr. for the design of a map made in oil paint. This is most likely the plan which is signed and dated *Concept ende Ordonantie van Landsloot Blondeel de Schil-*

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der. A° 1546 (fig. 2).[16] The map represents the area around Bruges and offers a solution to the silting by plotting a canal between Damme and Sluis. It shows a more scientific approach to geographical rendering as the map applies a more orthogonal projection, objectifying the represented area. Originally trained as a master mason, the Bruges painter had a profound

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understanding of geometrical principles and perspectival projection methods. Despite this more scientific approach, the map presented to the city magistrates by Blondeel still lacks the inclusion of a scale line -- a crucial cartographic property which would make it comparable to contemporary cartographic advances such as those by Jacob van Deventer (c. 1505-1575).

One year later the young Bruges painter Pieter Pourbus, Blondeel's son-in-law, also became actively involved as a cartographic designer in the context of the resurgence of the Bruges maritime economy and its harbour. Throughout his productive career, between 1549 and 1580, Pourbus received no less than 28 cartographic commissions, of which only 6 now survive.[17] They all provide a good idea of the painter's geometrical plotting abilities and his technical rendering skills. Among Pourbus's most impressive cartographic accomplishments is his *Large map* of 1571, depicting the entire legislative area of the Liberty of Bruges ('Brugse Vrije'; fig. 3).[18] The accounts of the Liberty of Bruges on this map, which span a period of 10 years, provide us with a detailed overview of the working methods of painters employed on such projects. His preparations included field research and land surveying; he also produces dozens of smaller regional maps and sketches, and finally he combined all these preparatory drawings in the finalized product, a map on canvas (323 x 651 cm), which can be regarded as one most scientifically accurate renderings of the area. Karel van Mander listed the map among Pourbus's major artistic achievements.[19] The wealth of archival and visual information of Bruges's unceasing battle with the North Sea documents an evolution in the role played by the painter in cartographical commissions, moving from mere aesthetic input towards a scientific involvement. This was the result of an increasing interest in and knowledge of geometrical design principles by a new generation of artists, as we will explore further on.

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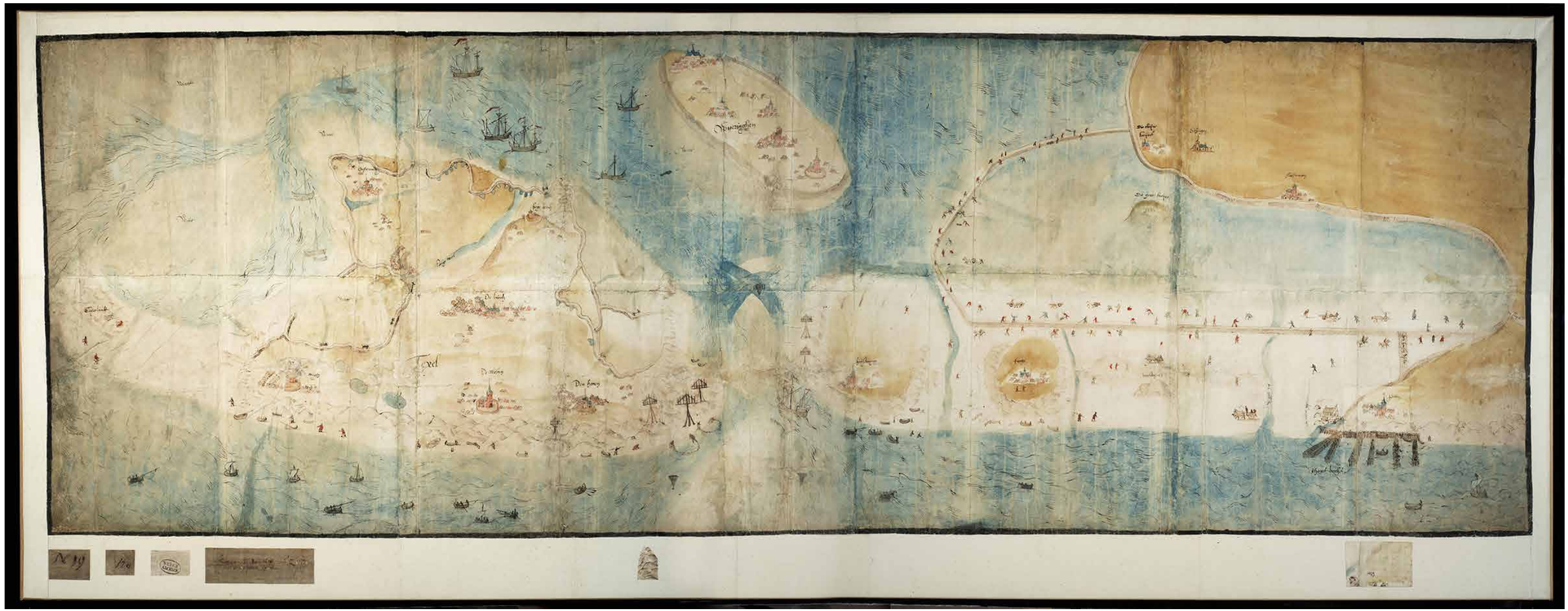
Northern projects

Like Bruges, the northern regions of Holland and Zeeland also employed a growing number of painters in order to visualize hydrographic projects. They were mostly land reclamation projects, and they illustrate how the contemporary Bruges projects outlined above should be considered a part of an interconnected broader Netherlandish phenomenon. Like most of the earlier Bruges maps, Jan van Scorel's designs for the draining of the Zijpe area was closely connected with a hydrological battle against a dangerously transgressing water line. Between 1547 and 1551, Van Scorel and the engineer and carpenter Willem van Noort collaborated on several projects, including the draining of the Zijpe area by an ingenious system of embankments.[20] Unlike the civic projects in Bruges, the initiative here came from the Utrecht painter himself: in 1551, he received an imperial patent for the execution of these works which he undertook with the financial support of shareholders and investors who he found on the Antwerp financial market.[21] The project was named Nova Roma, in response to the artist's interest in antiquity and that of his investors. The designs for the project were recorded in a large book, of which only two maps survive.[22]

The first extant map of the Nova Roma project is named 'concept and description of the Zijpe, done over many years' (fig. 4), depicting the area between Petten and Eierland.[23] Although filled with more anecdotal details and without the indication of the exact scale line, the topography is rendered by combining a perspectival landscape with an orthographic plan, facilitating in the map's measurability (not unlike Blondeel's map of 1546). Andeas Vlieringh (c. 1507-1579), a hydrological engineer who had inspected the levee works in 1553, described Van Scorel in his *Treatise on embankment* (1576-1579) as the best possible individual to paint a map of the embankments.[24] In addition, Van Scorel was also active as a hydrological engineer. In June 1549 he collaborated with the above-mentioned Willem van Noort on the design of a ship which would be able to dredge the Vecht and Rhine Rivers in order to secure the commercial maritime passage to Utrecht.[25]

Cornelis Anthonisz's iconic *Bird's-eye view of Amsterdam* (1538) is the final example to be discussed here as the product of a painter engaged in cartographic projects. For this commission by the city government, the Amsterdam painter was paid 6 pounds, and the map was to be sent to Charles V as a gift from the city as a sign of the authorities' loyalty to the imperial majesty.[26] The map, however, never reached the emperor and was displayed in the town hall. By 1544 the map had reached a certain level of local fame, and to foster the city's growing civic pride, the bird's-eye view was distributed to a wider audience as a large woodcut in 12 blocks (fig. 5).[27] Although the impressive bird's-eye view of Amsterdam was Anthonisz's most renowned cartographic feat, the artist received a range of cartographic commissions. In 1541 he made a map for the city authorities of Amsterdam which was described as 'a map of the North Sea reaching into the Zuyder Sea'.[28] That year, another payment was made to 'Cornelis Thonisz. Schilder' for painting a map of the same area displaying the depths and sandbars. Neither map has survived. In 1543 he published a *Caerte van Oostlant*, depicting the Northern Netherlands, with Denmark,



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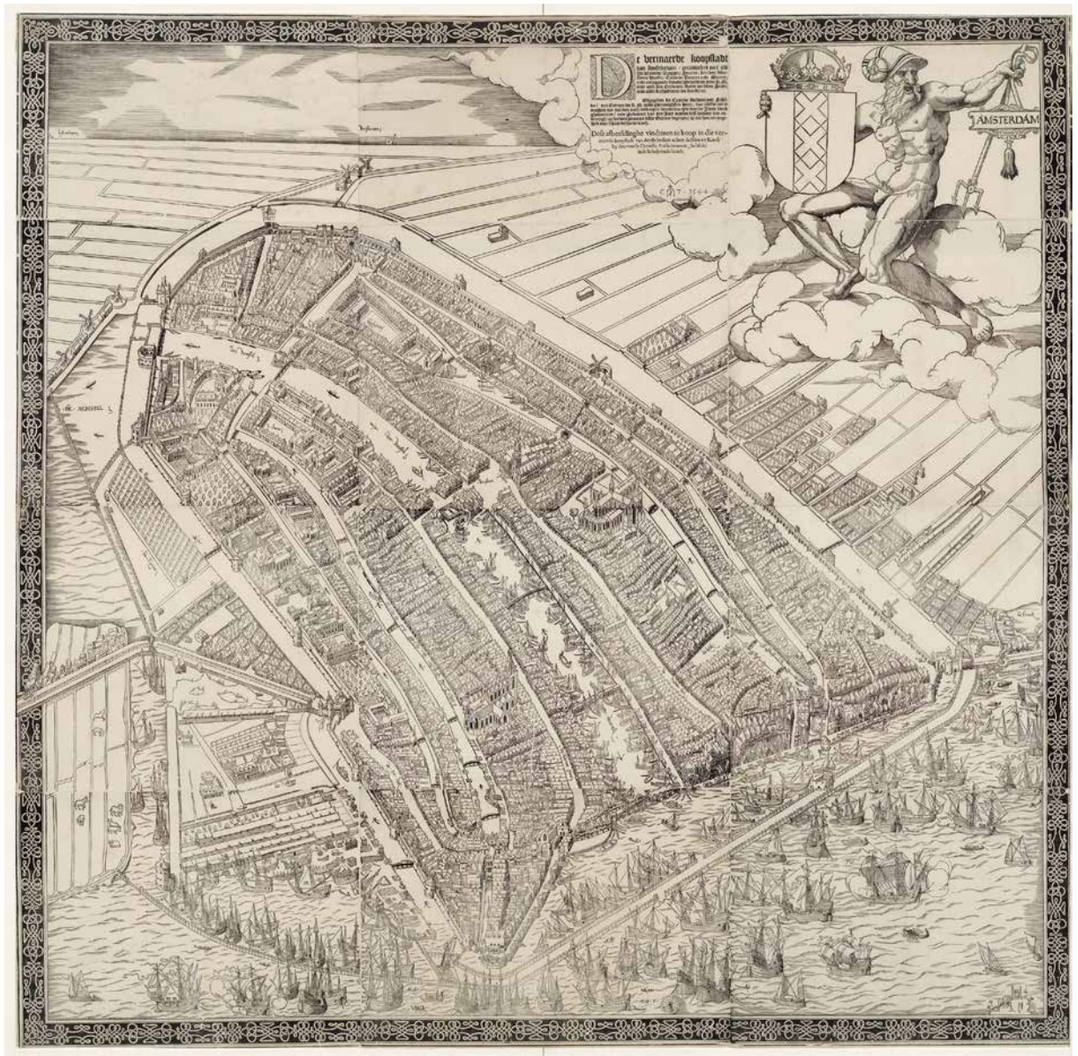
Sweden and the Baltic region.[29] The map represented enormous progress in the development of maritime cartography, distancing itself from the often generic contemporary portolan maps.[30] It contains all the modern cartographic conventions (portolan lines, scales, northern orientation, orthographic projection and even strapwork cartouches) and should be regarded as a culmination of geometrical plotting by a painter. This was only a few years before professional cartographers such as Ortelius and Mercator entered the stage of mapmaking.[31] In the note to the reader on his *Caerte van Oostlant*, Anthonisz promises to publish a book in which he will explain more extensively everything he could not include in the little cartouche, adding that the book will include 'things pleasurable and useful to mariners'. This would become the *Onderwijsinge vander zee* (1554), one of the earliest Dutch nautical manuals, which includes four woodcuts signed by Anthonisz.[32] All of these projects illustrate an artist possessed with a high degree of technical understanding.

'Allen liefhebberen der Konste'

Although painter-cartographers were sometimes assisted or escorted by official land surveyors, their collaboration with appointed surveyors should not be indicative of a lack of geometrical and cartographic expertise on their part. Quite often these land surveyors were requested to assess the painter's calculations.[33] Even an experienced cartographer such as Jacob van Deventer was often assisted and informed by local land surveyors during his many cartographic campaigns between the 1540s and the early 1570s.[34] These artists were specifically contracted because of their understanding of geometrical design principles and trigonometry, for which they were often lauded.[35]

Pourbus, for example, was contracted as a land surveyor in 1583, when he was a member of a commission that was to offer advice on the hydrology of the Ieperleet. Later that year, he was paid to examine and advise on the reinforcement of the Sluis dykes.[36] Van Mander describes him as 'a good



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cosmographer or surveyor'[37] -- a reference that is not just Van Mander's arbitrary appraisal but most likely based on the painter's self-promoted reputation. On his map of the hydrography of Romboutswerve (1577), the Bruges painter specifically articulates that he had made the map 'according to the art of chorography'.[38] In some of the accounts of the Liberty of Bruges, Pourbus is referred to as an engineer (*ingeniaris*) and land surveyor.[39] In addition, the Bruges rhetorician Zeger van Male describes him as 'an expert painter and engineer in the arts of arithmetic'.[40] Although Pourbus was often documented collaborating with land surveyors appointed by the city or Liberty of Bruges, his own technical acumen clearly sufficed in order to design, triangulate and render these maps.

Praising the *Conquest of Tunis* (1546-1554) tapestry series by Jan Cornelisz Vermeyen, Van Mander explicitly states: 'in this as well as other aspects of art he had a very intelligent and subtle manner of working, he was neither inexperienced in geometry nor surveying nor other noble sciences'.[41] The explicit reference to geometry and land surveying as both an art and a science is very relevant in the context of geometry's role as a means to elevate a painter's social status, as we shall see. Van Mander may have been referring to the text on the first Tunis tapestry, which represents a detailed map of the Mediterranean, framed by two Corinthian columns (echoing the *plus ultra* coat-of-arms of Charles V; fig. 6). The text in the cartouche at the lower right clearly stresses the painter's expertise as a cosmographical designer: 'As an artist I have been more concerned about the precise positioning, than the requirements of painting. Everything depicted, both sea and land, is fully in accordance to the laws and rules of cosmography. (…) It is thanks to this precision that the characteristics and events in the other tapestries can be better understood'.[42] In addition, this expertise is stressed by the fact that the text in the cartouche is carried by the bearded artist himself, while holding a compass and pointing to the scale line as a sign of accuracy.[43] Vermeyen consciously represents himself here not as a painter or draftsman, but rather as a cosmographer.

The same reference to geometrical expertise can also be deduced in Blondeel's signature on his paintings and on both of his preserved maps, where his initials (LAB) are consistently combined with a mason's trowel. Having started his career as a mason, the Bruges painter clearly displays his knowledge of geometrical design as an asset in his activities as a cartographer. Comparable to Vermeyen's textile map, Anthonisz's *Bird's-eye view of Amsterdam* displays a self-conscious reference to geometrical expertise in the printed text, as it is stated that his map is dedicated to 'His Royal Majesty, the honourable city council and all the lovers of the arts'.[44] This final part should be interpreted not merely as an aesthetic appraisal, but rather as an indication of how these artists applied the liberal arts (geometry and arithmetic, in particular) to achieve their end result and to promote their status as masters of the liberal arts.

The dedication to 'all lovers of the arts' is a common trope often applied to treatises on geometry and architecture from the final quarter of the fifteenth century onward, often stressing the connection between art, science and geometry. In the *Fialenbüchlein* (Booklet on pinnacles), a printed booklet on gothic design principles printed in 1489 by Nuremberg goldsmith Hanns Schmuttermayer, the introduction explains that it was intended 'for the instruction of our fellowmen and all masters and journeymen who use this high and liberal art of geometry'.[45] When Albrecht Dürer published his *Underweysung der Messung* (Treatise on measurement) in 1525, he was even more unequivocal about the connection between art and geometry, as in his dedicatory epistle he specifies who might benefit from his book: 'For the benefit of all who seek after art, and for the use not only of painters but also goldsmiths, sculptors, stonemasons, cabinet makers, and all who have need of geometry'.[46] When Dürer mentions on the title page of the same treatise that his book is intended for '*allen kunstlieb habenden*', he refers to those who practice the liberal arts.[47] Much in the same tradition,

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Pieter Coecke van Aelst addresses a similar reading audience when he dedicates his translation of Serlio, *Generale regelen* (1539), to 'the lovers of Architecture'.[48]

As one of the four arts of the quadrivium, geometry was a powerful instrument for increasing one's professional and social status. Within an early modern urban and courtly humanist network, knowledge of the quadrivium gained considerable prominence through the course of the fifteenth and sixteenth centuries, as European intellectuals and humanist thinkers valued the mathematical quadrivium alongside the already established language-based and more scholastic trivium in their search for knowledge and rationalization of the perceived world.[49] As the quadrivium's importance grew within a humanist urban middle class, the ability to apply geometrical and arithmetical principles with a compass and ruler increasingly distinguished the architectural designer from other manual craftsmen, including painters. Applications of such terms as *artiest*, *Constelijk*, *scientie* and *ingenium* would often refer to a craftsman's mastery of the liberal art of geometry.[50] Particularly when stressing the scientific know-how required to design and render complex cartographic projects, many of these painters took the opportunity to display their expertise in this liberal art.

Practical workshop geometry

The key to understanding the active role of these Netherlandish painter-cartographers was their knowledge of advanced Euclidian geometry. During the fifteenth century, Euclidian geometrical principles, such as trigonometric calculations to define distances and measurements, were used not only by masons and architects but also by metal- and goldsmiths, woodcarvers, sculptors, carpenters and joiners. Basically, any master artist leading a workshop involved in what is often referred to in documents as *Metselrije* would have been required to produce architectural design drawings that involved the application of Euclidian geometrical rules of thumb.[51] By the turn of the sixteenth century, however, this knowledge had become more widely available to a new generation of painters who often had family roots in the prosopographical group of architectural designers. Lanceloot Blondeel, as mentioned above, most likely originated from a family of Bruges masons, proudly displaying this in his signature.[52] Blondeel's interest in geometry and its applications to the visual arts exceeded a mere knowledge of practical mason's geometry, as the artist owned a copy of Jean Pèlerin's *De artificiali perspectiva* (1505) in 1549.[53] His theoretical interest in geometry and the difficulties in representing three-dimensional space on a two-dimensional plane are at the intersection of architectural design, cartographic plotting and the art of painting. This geometrical knowledge was also the core of the humanist artist's fascination with the liberal arts, which connects him to other *Pictores docti* of his generation, discussed below.

Knowledge from abroad. Dürer and De' Barbari

Having established that geometrical knowledge broadened both the practical and social abilities of the early modern Netherlandish artist, it is also interesting to examine how these hydrological projects relate to one another and where these artists discussed above developed an interest in geometry, particularly when they had no family roots connecting them to geometrical design practice. Connecting Blondeel's Bruges mapping project to Van Scorel's Zijpe project is the fact that the two painters had collaborated on the first documented restoration of the *Ghent altarpiece* in 1550.[54] This was four years after Blondeel had finished his hydrological map of Bruges, and one year before Van Scorel's involvement in the ambitious project of draining the Zijpe area. It is therefore tempting to consider a transfer of geometrical design knowledge between these established painters. Van Scorel may, however, have already developed an interest in geometry at the beginning of his career. According to Van Mander, when Van Scorel passed through Speyer on his journey to Italy and Jerusalem in 1518, he had met 'a clergyman, very *art-full* in architecture and perspective, to whom he apprenticed himself for a long time so as to acquire these arts'.[55] Both architectural design and linear perspective are seen as applications of the liberal art of geometry. Shortly after his stay in Speyer, and after a brief stay in Strasbourg and Basel, Van Scorel arrived in Nuremberg, 'home of the art-full Albrecht Dürer, with whom he stayed a while to learn'.[56] Both the Speyer clergyman and Albrecht Dürer are characterized by Van Mander as *constigh,* which, rather than an arbitrary choice of word, should be read as an allusion to Dürer's fascination with geometry as a liberal art. Panofsky argues that Dürer was 'a natural-born geometrician'.[57] During his (assumed) first Venetian sojourn in 1495, Dürer is known to have greatly admired the geometrical applications to the visual arts proposed by Jacopo de' Barbari (c. 1460-1516); his admiration had passed by the time of his second trip to Venice in 1505-1507.[58] Dürer wrote to Wilibald Pirckheimer that he would ride to Bologna where there was someone who would teach him the art of perspective.[59] Dürer's geometrical interest would finally result in his treatise *Unterweysung der Mesung* (1525), and the posthumously published *Vier Bücher von Menschlisher Proportion* (1528). During his plausible stay at the Dürer workshop, Van Scorel could not have been in a better environment to further develop the geometrical teachings with which he had already been acquainted in Speyer. Continuing his trip to Italy, Van Scorel painted the *Triptych of the Holy Kinship* in 1520 for the Frangipani family, signing it 'Joannes Scorel hollandius pictorie artis amator pingebat', thus unambiguously presenting himself as a lover of the liberal arts.[60]

The projection method in Cornelis Anthonisz's *Bird's-eye view of Amsterdam* has long been associated with De' Barbari's famous *Bird's-eye view of Venice*, commissioned by Anton Kolb (Dürer's godfather).[61] In his analysis of De' Barbari's map, Juergen Schultz convincingly argues that the Venetian map must have been a composite of images taken from various elevated viewpoints (such as church towers and campaniles) merged together.[62] Trigonometrical calculations and the measuring of distances between known monuments -- together with more conventional linear

perspective -- would have enabled the artist to plot the three-dimensional city on a two-dimensional surface. The same scientific and systematic approach seems to have been used by Cornelis Anthonisz for his Amsterdam map.[63] When triangulating the city, Anthonisz must have used several church towers and wall towers to determine angles and distances. Various distortions in the perspective suggest that the map is a montage of multiple studies and combines perspectival rendering with axonometry. Daantje Meuwissen recently attributed the 'Berlin sketchbook' to Cornelis Anthonisz, partly because it contains many drawings that can be seen as preparatory sketches for *Bird's-eye view of Amsterdam* of 1538. [64] With its scientific triangulated rendering, the perspectival map of Amsterdam started a long tradition of bird's-eye views, making this cartographic typology a Netherlandish specialty.[65]

De' Barbari was employed at the Netherlandish courts of Philip of Burgundy (1464-1524) and Margaret of Austria (1480-1530) in Mechelen from 1510 until his death in 1516. [66] Although it remains speculative, the artist's final working years in the Low Countries may have been instrumental to the dissemination of advanced geometrical thinking within the artistic circle of the Habsburg court. During his Italian years, De' Barbari was part of the intellectual network around the Franciscan friar and mathematician Luca Pacioli (1445-1514), whose portrait he famously painted in 1495. [67] His *De divina proportione* was first published in Venice in 1509 and focused on Euclidian geometry, mathematical proportions, geometric perspective and the Platonic solids.[68] The geometrical teachings of Pacioli equally had an influence on Dürer's own writings on geometry, proportions and perspective, with De' Barbari as mediator.[69] Even after Dürer had lost his high esteem for De' Barbari, in June 1521 he was still very keen on acquiring a small booklet that must have been in the possession of Margaret of Austria for some time after De' Barbari had deceased. By the time of Dürer's request, however, she had already given it to her court artist.[70] The contents of the *Büchlein* remains unclear, but it was most likely on geometrical theory, since this was the nature of Dürer's main interest in De' Barbari's art. If so, the presence of 'Master Jacopo's booklet' at the Mechelen court (between 1510 and sometime before Dürer's request in June 1521) would have been the earliest presence of advanced Euclidean theory in the Low Countries. As mentioned earlier, Euclidian rules of thumb had been applied in daily workshop practice by the likes of goldsmiths, carpenters and master masons. A basic understanding of geometrical rules could also be grasped from small instruction manuals such as those by Roriczer or Schmuttermayer. For the wider Dutch-speaking audience of merchants, public officials and land surveyors, short booklets such as Thomas van der Noot's *Die Waerachtige Const der Geometrien* (1513) would have been a good introduction to some of the basic rules.[71] The booklet was a short-hand guide for any profession that came in contact with mathematical, arithmetical or geometrical principles, ranging from measuring the height of a church tower to measuring the content of a wine barrel. These practical treatises differed considerably from the more theoretical and complex treatises on geometry aimed at a more humanist audience, such as those by Leon Battista Alberti, Pomponius Gauricus, Albrecht Dürer or Luca Pacioli. They often combined Euclidian theory with other antique authors (e.g., Archimedes, Vitruvius, Aristotle and Ptolemy), often supplemented with original empirical findings. A large number of the drawings contained in Cornelis Anthonisz's Berlin sketchbook closely relate to the geometrical theory explained by Pacioli and contained in Dürer's *Underweysung*. In particular, the presence of Platonic polyhedral solids among the drawings in the Berlin sketchbook shows an awareness of a new intellectual thinking about geometry and its applications in the visual arts, including cartography.[72] In order to acquire these advanced geometrical concepts, many geometrically learned painters could rely on a developing urban humanist network of likeminded patrons, and publishers.

Local humanist networks

The role of Netherlandish artistic and humanist networks is also essential for understanding how painter-cartographers during the first half of the sixteenth century developed the technical acumen to design and render maps. Paul Huvenne has already noted that Pourbus applied the triangulation methods devised by Gemma Frisius (1508-1555) in many of his cartographic projects.[73] The method was based on knowledge of trigonometry and the application of Pythagoras's theorem in the field.[74] The dissemination of Frisius's theory occurred within a network and reading audience of Antwerp humanists with an interest in art theory, principles of antique architecture and the liberal arts.

The first edition (1533) of Frisius's *Libellus de locorum describendorum ratione* was published in Antwerp by Johannes Grapheus (1502-1571), and the second edition (1540) was published by Gillis Coppens van Diest. Both publishers were at the heart of the rise of urban humanism in Antwerp and were operating within a tight artistic network.[75] Johannes Grapheus was the brother of Cornelius Grapheus (1482-1558), the city secretary of Antwerp. The Grapheus brothers are known to have been a driving force behind the dissemination of humanist art theory in the Low Counties. Cornelius wrote the introduction to Pieter Coecke van Aelst's earlier-mentioned Serlio translation (1539), and had previously quoted Alberti and Vitruvius in his introduction to Pomponius Gauricus's *De sculptura* (1528), published by his brother.[76] Cornelius Grapheus was also responsible for the organization and program of the famous triumphal entry of Prince Philip into Antwerp in 1549, also illustrated with woodcuts designed by Coecke van Aelst.[77] Gillis Coppens van Diest, on the other hand, would become the publisher of the *Triumphal entry* as well as Pieter Coecke van Aelst's treatises.[78]

In addition to the Antwerp humanist milieu, the intellectual environment of Leuven University may also have played a pivotal role in the spread of early cartographic knowledge among artistic networks. With key figures such as Frisius and Jacob van Deventer, the university was a centre of the early development of mathematics, cartography and the development of scientific instruments.[79] Meuwissen has recently also pointed to the Amsterdam painter, land surveyor and cartographer Willem Hendricksz Croock (c. 1489-1551) as a possible link between Leuven and the cartographic knowledge of Cornelis Anthonisz.[80] Croock had studied in Leuven and

was acquainted with Jacob Cornelisz van Oostsanen, with whom he had painted banners for warships in 1520.[81]

According to Petrus van Opmeer, Croock and Van Oostsanen were the most renowned artists of Amsterdam.[82] The Cornelisz workshop in Amsterdam also provides a possible connection to Jan van Scorel, as the painter's first training was received there. Croock's maps bear a striking overall visual resemblance to Van Scorel's cartography, in its use of specific colour codes, the combined perspectives and identical figurative details, suggesting that the two painter-cartographers were working in close relation. The Amsterdam workshop would have been a fruitful environment, with many leading humanist figures, some educated in Leuven, having their portraits made.[83] An important contact in the intellectual network of Van Oostsanen in Amsterdam was Pompeius Occo (1483-1537), a wealthy German banker who had moved to Amsterdam in 1510 to promote the interests of the Fugger family in the city.[84] In the Amsterdam artistic network, Occo played the role of humanist catalyst, comparable to that of Grapheus in Antwerp at the same time. Pompeius Occo's uncle was the Augsburg Fugger banker Adolph Occo (1463-1503), who was a lifelong friend of the Netherlandish humanist Rudolph Agricola (1443-1485). In a letter dated 19 October 1480, Agricola refers to Vitruvius, an indication that the humanist network around Occo shared a keen interest in architectural and geometrical theory.[85] A bibliophile, Pompeius inherited half of his Augsburg uncle's library and obtained the personal library of Agricola.[86] Given the Fugger connection, the humanist network around Occo and his role as Van Oostsanen's patron and neighbour, it is likely that Van Oostsanen and his students (such as Cornelis Anthonisz) were able to access an early edition of Dürer's treatise on geometry.

Conclusion

In 1456 the Genoese humanist and diplomat Bartolomeo Fazio (1400/14-1457) famously mentioned Jan van Eyck as having produced a world map for Burgundian Duke Philip the Good.[87] The object in question was described as 'a circular representation of the world, which he painted for Philip, Prince of the Belgians, and it is thought that no work has been done more perfectly in our time; you may distinguish in it not only the places and the lie of continents, but also, by measurement, the distance between places'.[88] Earlier in the same text, Fazio praises the Bruges painter for being 'skilled in geometry and such arts'.[89] Although the attribution of such *Mappa mundi* to Jan van Eyck has been somewhat contested in recent years,[90] Fazio's description and his appraisal of the artist's geometrical acumen remains significant, as it forms a key element in our understanding of the phenomenon of the painter-cartographer in the Low Countries, linking a painter's technical know-how with the ability to design maps. Furthermore, the fact that geometry is explicitly mentioned as an art is also relevant in the changing appreciation of painting as one of the liberal arts. Fazio's reference to Van Eyck as a cartographic designer can be understood as an exceptional precedent to the early sixteenth century, when the scientific contributions of Netherlandish painters to mapmaking came to fruition.

While the involvement of painters in cartographic design practice cannot be singled out as a solely Netherlandish phenomenon, the particular geographic situation of the region, the civic focus on maritime hydrology and the mercantile necessity of maintaining a healthy commercial environment created a unique situation in the Netherlands, which can perhaps only be compared to that of Venice.[91] The intense collaboration between artists, humanist scientists and cartographers can be considered an important precedent to the erudite Antwerp network around Abraham Ortelius, approximately a generation later.[92] Although Van Scorel is the only artist recorded as a hydrological engineer, these early sixteenth-century artists displayed an interest and knowledge of advanced geometrical problems and the science of triangulation in order to project and render their maps in a measurable form, exceeding the mere chorographic or aesthetic role occupied by their predecessors.

This advancement was the result of the correlation of various factors: a new generation of artists with family backgrounds in practical geometry (e.g., Blondeel); the early development of triangulation in Leuven; the growing interest in architectural and geometrical knowledge of urban humanists (e.g., Grapheus and Occo) and of courtly nobility (e.g., Philip of Burgundy); the influx of a novel theoretical approach towards geometry originating from Italy and embraced by artists such as De' Barbari and Dürer, and finally a quest by artists to elevate the social and intellectual status of the painter, achievable through knowledge of the liberal art of geometry. It was through their involvement in cartography that this new class of artist could truly showcase their *ingenium*.

Notes

1 Cat. Brussels 1976, xiv-xv; Van de Vijver 2006, 3171.

2 The earliest mention of an *agrimessore* was in 1297-1298, in Bruges. Viaene 1966, 6. In other Dutch documents they are also referred to as *geometer, lantmeetere, cosmograaf, paelder* or *gesworen erfscheyder*.

3 In 1462, for instance, a certain 'Gheert de Lantmetere, schildere' was commissioned to measure and make a drawing of some streets of Brussels to provide evidence in a legal dispute. Pinchart 1860-1882, vol. 2, 156; Bakker 2004, 172.

4 According to the Alexandrian astronomer, the two forms of geographical representation should be carried out by different professional profiles. Chorography -- meaning the visual description of space, combining the Greek terms *choros* (Χώρος) and *graphia* (γραψια) -- was seen as a more describing and painterly manner of geographical representation, whereas geography was regarded as a more mathematical approach.

5 The relationship between landscape painting and chorography was first explored in Alpers 1983, 133-136, and is further developed, for example, in Gibson 1989, Büttner 2000, Bakker 2004, 170-188, and Büttner 2006.

6 This visual distinction between chorographic representations of the world and the so-called world landscape is rather flimsy, as illustrated by the representation of the *Flood of Dordrecht in 1421,* by an anonymous local painter in the final quarter of the 15th century. In accordance with Ptolemy's definition, the pictorial elements in this chorographic representation prevail over the topographical accuracy and measurability. Helmus 1991; cat. Rotterdam 2008, no. 60.

7 For example, Tahon 1998, cat. Bruges 1998, cat. Bruges 2017 and Jehoel 2020. The exception is Paul Huvenne's dissertation, where the cartographic commissions of Pieter Pourbus receive much attention. Huvenne 1984; cat. Bruges 1984.

8 See, for example, Koeman *et al.* 2007, 1344-1346.

9 Almost as soon as the Zwin estuary was created by a series of storm surges around the middle of the 12th century, the estuary was not adequately fed by rivers and quickly started to silt up. In recent historiography, the demise of Bruges's economic success by the final quarter of the 15th century is mainly explained in political and economic terms, downplaying the ecological factor. Yet contemporaries perceived the silting up of the Zwin estuary as one of the defining causes of Bruges's commercial demise. On Bruges's economic decline, see Van Uytven 1995, Bolton & Guidi-Bruscoli 2008, Haemers 2009 and Dewilde *et al.* 2018; 3-4.

10 Parmentier 1955; Geinaert 1964-2014; Dewilde *et al.* 2018, 9-10.

11 Gilliodts-Van Severen 1895, 52-54.

12 'Item Jan dervy voor tschildern ende in pourtrature stellene van holye vaerwe tnieuwe bedelf, ende ooc andere zaken iii L x S groten'. Stadsarchief Brugge, Stadsrekening, 1501-1502, fol. 80v.; Roberts 1991, 83.

13 Bruges, Groeninge Museum, inv.0.1382.

14 Ptolomy, *Geographia,* 1.1.

15 In the context of the same canal project, the Bruges city accounts of the years 1513-1514 mention a payment to the well-known painter Jan Provoost (c. 1465-1529) for no less than eight detailed maps of the Zwin area and its proposed canal. Since

no existing maps can convincingly be associated with these payments, it is impossible to draw any visual conclusions about Provoost's cartographic output. Yet, notably, he received this commission at the height of his career, when he was appointed first *vinder* of the Bruges Guild of St Luke: 'Item betaelt Jan Provost, acht quarten inhoudende den leghere van den Zwene, den ghestanden van den Zwarte Gate, Passegheule en de nieuwen bedelve, mits de polders, prochien ende steden daer ontrent'. Mertens 1982, 229; Parmentier 1941, 97; Spronk 1998.

16 Weale 1908, 297.

17 For an overview of Pourbus's cartographic work, see Huvenne 1984.

18 De Smet 1947; Huvenne 1984, 287-289; Van der Herten 1998; cat. Bruges 2017, no. 40; Trachet 2022. The cartographic oeuvre of Pourbus received some long-awaited attention in a small exhibition between December 2022 and April 2023, held at the Groeninge Museum Bruges, curated by Jan Trachet. See Trachet 2023.

19 Van Mander 1604, fol. 257v; Miedema 1994-1999, vol. 2, 289. Because of continuous wear and tear on the map, Liberty magistrates commissioned a copy of Pourbus's map in 1597, executed by Pieter II Claeissens. On this copy, see Tahon 1998 and cat. Bruges 2017, 277.

20 A first initiative was made in 1508, when the painter Pieter Gerritz was commissioned to make maps of the region, based on the calculations of the land surveyor Michiel Bartz. Bremer 2002; Jehoel 2020, 287. In 1540 the painter Cornelis Claesz. was contracted to make a map of the island Wieringen. Van Scorel probably based his map on this previous model. Van Broekhoven 2009, 62-63.

21 On the financing of the project, see especially Jehoel 2020, 287-289.

22 Vierlingh 1920, 305.

23 The second preserved map is more schematic and simplified, as it divides the gained land into seven parishes (named after Rome's seven pilgrim churches), and into three major plots. The Hague, National Archive, Hingman Collection, no. 2473.

24 Colijn 2008.

25 Muller Fz. 1881-1882, 246-251. The project would never come to fruition and resulted in considerable conflicts between the painter and the carpenter. In a court case, both parties claimed superior technical expertise over the other in the design of the dredging vessel. Van Scorel's design knowledge possibly relied on the description of similar hydrological machines in the 10th book of Vitruvius' *De architectura*.

26 Dubiez 1969; Armstrong 1990, 12-13; Colijn 2008; Knevel 2014; Knevel 2015; Meuwissen 2017, 19-20.

27 Hollstein 1949-, vol. 30, no. 47. The edition in 12 woodblocks was an impressive technical feat and can be considered one of the more luxurious print series available on the northern market at the time.

28 De Graaf 1870, 511; Karrow 1993, 43; Colijn 2008, 194-195.

29 Keuning 1950a; Keuning 1950b; Dubiez 1969, 16-21; Lang 1986. Unfortunately, no copy has been preserved of the Amsterdam first edition. The printed woodcut in nine sheets knew quite some popularity, as a third state was issued by the Antwerp publisher Arnold Nicolai in 1560. Koeman *et. al.* 2007, 1304.

30 Schilder 1985, 98-99.

31 Keuning 1950a, 51; Meurer 1991, 36. The scientific approach and meticulousness of Anthonisz's maps were recognized by Ortelius, who refers to Anthonisz.s *Caerte van Oostlant* in his celebrated *Theatrum orbis terrarum*.

32 The *Onderwijsinge* was published by Jan Ewoutsz., who was also responsible for most of Anthonisz's moralizing prints. Dubiez 1969, 22-26; Armstrong 1990, 17; Karrow 1993, 47.

33 Also, in Netherlandish architectural design practice, for major building projects it was standard practice to request a second opinion by another, external architect. Hurx 2018, 216-217.

34 Rutte & Vannieuwenhuyze 2018, 31.

35 Blondeel's *Concept ende Ordonantie* was the result of a collaboration between the painter and the hydrological engineers Jan van der Meersch and a certain Nicolas of Brussels. Van der Meersch, a Bruges city official, is described in one document as 'director of the hydraulic works'. When Blondeel's successor, the painter Joost van der Beke, was asked to paint two maps of the same region in 1548, he was paid to inspect the area and 'measure the course of the river and the depth of the sea' together with Hendrik van Beernem, the municipal register of the Vrije and a land surveyor (*lantmetre*). In addition, Pieter Pourbus was regularly assisted by city officials and land surveyors. In 1549 he was paid for surveying the possibilities for the design of a new canal, together with land surveyor Charles van Bonem. Similarly, while preparing his map of Rombouts-werve (1577), Pourbus was escorted by land surveyor Ingel Stoet, together with three other city magistrates.

36 Huvenne 1984, 311.

37 Van Mander 1604, fol. 257v; Miedema 1994-1999, vol. 2, 289.

38 'Naer de conste vande chorographie'. Cat. Bruges 1984, 29-34.

39 Huvenne 1984, 129-130, 715-718.

40 'Expert schilder/ ende Ingeniaris in de consten van de Arithmetica'. Van Male 1590, fol. 29r; Huvenne 1980; Huvenne 1984, 786; Huvenne 2017, 48.

41 'in dit en andere deelen der Const/ een seer verstandighe en aerdighe handelinge: in Geometrie oft Land-maet/ en meer edel wetenschappen niet onervaren wesende'. Van Mander 1604, fol. 224v.

42 'Teniendo mucho mas respect ala precision de su assiento: que a la propiedad dela pintura. Y assi come sto se ha he cho en lo de la mar conforme a la cosmografia assi en lo dela tierra el pintor ha observado lo que a su arte se deve. (…) se pueden despues major entender las particularidades de los otros tapizes y el sitio de aquellas partes do passo lo que en ellos contiente'. Horn 1989, 261.

43 Horn 1989, 261; Vienna 2013, 66-71.

44 'ter eeren K.M., ende oock den eersamen Raet der selver Stadt, ende alllen liefheberen der konste, etc'.

45 Shelby 1977, 58.

46 Ashcroft 2017, 777.

47 Panofsky 1943 (2005), 242-246. Dürer, who was very familiar with Schmuttermayer's booklet, understood painting, sculpture, metalwork, stone cutting, carpentry and architecture as practices sharing the same theoretical foundation based on geometry. Eser 2012, 25.

48 Coecke van Aelst 1539, fol. 1r.

49 Reiss 1997, 134-153.

50 The term could also refer to any technical ability or skill; see Verwijs & Verdam 1885-1952, vol. 6, 1810-1813. On the use of these terms in the Low Countries within a specific courtly context, see De Jonge 2010 and De Jonge 2017.

51 On the role of Euclidian geometry in early modern architectural design practice, see Shelby 1972, Shelby 1977, Bork 2011 and Kavaler 2012, esp. 56-68. The requirement to make architectural drawings by other professions than masons was made very clear in an often-quoted court case in 1542 between stonemason Jacob van der Borch and Utrecht carpenter Willem van Noort. The former had claimed that only members of the stonemason's guild were able to design architecture, while it was concluded in the court case that a wide variety of professions ranging from goldsmiths to carpenters were able to deliver such designs. Interestingly, it was also Cornelius Grapheus who was responsible for recording these court proceeding; as such he made several references to Alberti and Vitruvius. Muller Fz. 1881-1882; Meischke 1988; Miedema 1980; Kuyper 1994, 305-311; De Jonge 2007, 48-49; Hurx 2018, 42-47; Kik 2021, 27-41.

52 Weale 1908, 278.

53 The copy owned by Blondeel was kept at the Ghent University Library (inv. no. G 6075), but has gone missing. It is monogrammed and dated 1549. Cat. Bruges 1984, 74; Huvenne 2017, 48; cat. Bruges 2017, nos. 3, 4, 5, 6.

54 Van Vaernewijck 1568, fol. 117v.

55 'alwaer hy vondt een gheestelijck Man/ seer constigh in Metslrije en Vercortinghen/ by welcken hy hem begaf een tijt langh/ dese consten af te leeren'. Van Mander 1604, fol. 235r. The identity of this clergyman remains unclear. Also see Jehoel 2020, 90-92.

56 'Hy is oock gecomen tot Norenburgh/ by den constighen Albert Dürer, daer hy om leeren eenighen tijdt by bleef'. Van Mander 1604, fol. 235r.; Miedema 1994-1996, vol. 3, 276; Jehoel 2020, 96-100.

57 Panofsky (1943) 2005, 254. Being the son of a goldsmith, Dürer would have had knowledge of basic practical Euclidian geometry as it was applied in workshop practices. He was familiar with the late 15th-century architectural booklets on geometrical principles such as Regensburg master mason Mathes Roriczer's *Büchlein der Fialen Gerechtigkeit* (1486), the *Geometrica Deutsch* (1488) and the *Fialenbüchlein* (1489) by the aforementioned Nuremberg goldsmith and geometrical theorist Hanns Schmuttermayer. In a document of 1487, a Hermann Leisner mentions that he still owed money to two Nuremberg goldsmiths: Hanns Schmuttermayer and Albrecht Dürer (the elder). This strongly suggests that the two may have collaborated on a commission. On these booklets and their connection to Dürer, see Shelby 1977; Strohmayer 2004; Schmitt 2004, 172; Remond 2012, 500; and Eser 2012, 25.

58 In an oft-quoted letter to Wilibald Pirckheimer, Dürer writes from Venice on 7 February 1506: 'The stuff that pleased me so well eleven years ago does not please me at all now. (…) And I can tell you that there are much better painters here than Master Jacopo. But Anton Kolb swears an oath that there is no better painter alive on earth than Jacopo. The others laugh at him and say if he were any good, he'd have stayed here, etc'. Rupprich 1956, vol. 1, 44; Böckem 2016, 29-30; Ashcroft 2017, vol. 1, 140. Despite Dürer's condescending remarks about Master Jacopo, he acknowledges De' Barbari as a source of inspiration in 1522, when writing a draft version of his treatise *Human proportions*.

59 Rupprich 1956, vol. 1, 105; Ashcroft 2017, vol. 1, 168. The identity of the Bolognese teacher is not clear; some have suggested he is the mathematician Luca Pacioli, but he was in Florence at that time.

60 Friedländer 1967-1976, vol. 6, no. 289; De Meyere 1981, 7-10; Faries 1989, 63-65; Jehoel 2020, 87-88, 103-113.

61 Dubiez 1969, 69; Schultz 1978, 472; Nutti 1994, 116; Colijn 2008; cat. Alkmaar & Amsterdam 2014, 47; Meuwissen 2017.

62 Schultz 1978, 431-446; Howard 1997, 103-106. Bratti suggests an alternative working method, that De' Barbari would have used an orthographic ground plan, which he then manipulated to achieve the bird's-eye perspective. Bratti 1927.

63 Maikel Niël first proposed that the Amsterdam map was constructed with the aids of compass measurements from several elevated viewpoints in the city, such as church towers, ships' masts and the city's fortifications; Niël 2000, 107-113.

64 Meuwissen 2017, 34-40.

65 Later examples include *Bird's-eye view of Bruges* (1563) by Marcus Gheeraerts (c. 1520-1590), and *Map of Antwerp* (1565) by Virgilius Bononiensis; the cartographic genre culminated in the wealth of elevated city views in *Civitates orbis terrarum* (pub. between 1572 and 1617) by Georg Braun (1541-1622) and Frans Hogenberg (1535-1590). While the Amsterdam map certainly is not the earliest example of a bird's-eye view in the Low Countries, it was the first with a strict and consistent rendering system, identical to that used by De' Barbari in his view of Venice in 1500. An anonymous bird's-eye view of Antwerp, dated c. 1520, slightly predates that of Cornelis Anthonisz (Rijksmuseum, Rijksprentenkabinet, RP-P-OB-4318). Also predating the Amsterdam map is the anonymous bird's-eye view of Ghent dated 1534. Decavele 1975.

66 Duverger 1931; Duverger 1980; Sterk 1980, 102-103; Eichberger 2002, 284-288; Böckem 2016, 258-271; Bass 2016, 52.

67 Naples, Museo Capodimonte. Ferrari 2006, 80-82; Böckem 2016, 58-77. In the double portrait, the Franciscan scholar poses while drawing a Euclidean theorem on a chalkboard, pointing with his other hand to an open volume of Euclid's *Elements*. The intellectual milieu surrounding Pacioli -- which besides Piero also included Leonardo -- would have provided the proper mathematical and geometrical background for De' Barbari to construct and triangulate the Venetian mapping project. It was during the painting of this portrait that Pacioli was developing his studies on geometrical projections, proportions and rendering methods, vaguely borrowing from the mathematical and geometrical treatises of Piero della Francesca.

68 The research on Pacioli is extensive. For recent monographs, see Giusti 1998, Castrucci 2003, Ciocci 2003 and Ciocci 2009. Pacioli probably met Piero della Francesca between 1491 and 1493 in the convent of their shared birthplace, Borgo San Sepolcro, during the preparations of his *Sum[m]a de Arithmetica, geometria proportioni & proportionalità,* published in 1494, and a second edition in 1523. Field 2005, 6-7; Banker 2014, 94; Böckem 2016, 60.

69 Panofsky 1943 (2005), 252; Remond 2012, 499.

70 'Ich hat die hohe Frau um Meister Jacobs Büchlein, aber sie sagte, sie hätte es bereits ihrem Maler versprochen'. Rupprich 1956, vol. 2, 173; Eichberger 2002, 287, 373-374; Unverfehrt 2007, 183; Ashcroft 2017, vol. 1, 584; Eichberger 2021. The court artist to whom the booklet was given is often considered to have been Bernard van Orley. This is plausible given the artist's interest in antique form and compositions, his affinity with Raphaelesque visual language and especially his love for perspectival foreshortened figures. However, Van Orley was not the only artist active at Margaret's court. Another candidate would have been Gerard Horenbout (1465-1540). In 1515, shortly before the death of De' Barbari, Horenbout was appointed court artist of Margaret of Austria. The Ghent miniaturist, along with his younger nephew Frans Horenbout, was involved in several cartographic projects. Denucé 1928; Denucé 1929; Büttner 2000, 102.

71 Bockstaele 1984; Van de Vijver 2006, 3173. The woodcut on its title page depicts the three target audiences: a mason measuring the cubic volume of a stone,

a wine-seller measuring the depth of his barrel, and a land surveyor holding a quadrant used to triangulate positions. The fact that the book was published in Dutch might have aided in the dissemination of this knowledge to other professions.

72 Van Tuinen 2014, fols. 3v, 16v, 41r, 45r. Also see Kik 2021, 116-122.

73 Huvenne 1984; cat. Bruges 1984; Trachet 2023.

74 Pogo 1935; Koeman 1985, 88; Hallyn 2008. In his *Libellus de locorum describendorum ratione* (1533), Frisius perfected the method of triangulation required to design measurable orthogonal projections as seen from above.

75 On Antwerp humanism, see De Schepper 1993 and Pleij 2020.

76 De Jonge 1998; De Jonge 2004; De Jonge 2007, 41-53; De Jonge *et al.* 2020, 199.

77 Roobaert 1960; Kuyper 1994; Meadow 1998; Bussels 2012. The erudite artistic network around Grapheus also had some close ties to the painter-cartographers in the Low Countries: Jan van Scorel's assistant on the Zijpe project, the engineer and carpenter Willem van Noort, was one of the protagonists in a famous court case in 1542, in which the changing role of the visual artist as an architectural designer was the subject of discussion. The court case was presided by Cornelius Grapheus, who quoted Vitruvius and Alberti to strengthen Van Noort's arguments. See Kik 2021, 27-41 (with further references).

78 On Gillis Coppens van Diest, see Rouzet 1975, vol. 1, 45-46, and Valkema Blouw 1988.

79 De Smet 1967a; De Smet 1967b; Koeman *et al.* 2007, 1296-1298.

80 Croock also held the position of municipal building master of Amsterdam (*fabrieksmeester*) between 1532 and 1538. Duverger 1961; Huusen 1972; Van Eeghen 1986; Van Essen 2011; Meuwissen 2017, 43.

81 Huusen 1972, 34; Meuwissen 2017, 43.

82 'Fuit certe decori Nurembergo/, sicuti Leydae et Amstelredamo Guilielmus Crocus et Jacobus Cornelius, Harlemo Theodoricus Daaventiensis et Hannoniae Joannes Mabusis'. Van Opmeer 1611, I, fol. 448. Duverger suggests that Croock was included in this list mainly because one of Van Opmeer's tutors was the humanist priest Cornelius Crocus (1500-1550), who may have been related to Willem Croock. Duverger 1961, 79.

83 On the intellectual network surrounding the workshop of Jacob Cornelisz van Oostsanen, see Meuwissen 2014, 94, and Jehoel 2020, 48-56.

84 On Occo, see Sterck 1934, 23-30, and Nübel 1972.

85 Akkerman & Van der Laan 2016, 42-43, 213-218.

86 Sterck 1934, 21.

87 Baxandall 1964; Sterling 1976; Dhanens 1980; Steppe 1983; Paviot 1991; Martens 2020, 142.

88 'Eius est mundi comprehensio orbiculari forma. Quam Philippo belgarum principi pinxit. Quo nullum consumatius opus nostra aetate factum putatur. In quo non solum loca situsque regionum. Sed etiam locorum destiantiam metiendo dignoscas'. Translation from Baxandall 1964, 102. On Van Eyck's scientific context, see De Mey 2012 and Martens 2020.

89 '(…) leterarum non nihil doctus. Geometriae praesertim et aerum atrium quae ad picturae ornamentum accederent'.

90 The authorship of the map has been attributed to the Burgundian Guillaume Hobit; see Paviot 1991.

91 There are many examples of Italian artists involved in cartographic projects. Giotto received a commission for a map of Florence around 1336; see Degenhard & Schmitt 1973, 6; Büttner 2000, 74. Shortly after describing the workings of basic Euclidean geometry and linear perspective in his *De pictura* (1435), Leon Battista Alberti carried out a topographical survey of the city of Rome that, he claims, was conducted as accurately as possible using 'mathematical tools' such as a circular odometer. Around 1450 he published his findings in a small book, *Descriptio urbis Romæ*; see Pinto 1976; Tavernor 1998, 13-23; Furno & Carpo 2000. Also, Leonardo's orthographical representation of Imola stands out as a revolutionary engagement of an artist as a scientific mapmaker; see Kemp 1981, 228-231; Kemp 1990, 169-171.

92 Meganck 2017.

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Detail fig. 3