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Mapping/Painting the Medieval Landscape. A Landscape-archaeological analysis of the medieval landscape as depicted by Pieter Pourbus

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Summary: During the Middle Ages, the metropolis of Bruges thrived through its overseas trade. A large tidal inlet – called Zwin – provided a navigable passage from the North Sea, through the wetlands, to the heart of the city. In the middle of the 16th century, the Eighty Years War (1568-1648) transformed the Zwin area from an axis of trade into a frontline of war. Of course, this had a profound impact on the environment. At the start of this sudden landscape transformation, painter-cartographer Pieter Pourbus portrayed the countryside of Bruges with a unique level of detail, accuracy and scale. Although this painted map is often used as an illustration, it has so far remained incomprehensibly understudied. Moreover, recent research has shown that the current landscape-historical narratives depicted in this part of the North Sea area are severely outdated. In order to fill these gaps and study this unique landscape through this unique painting, we will merge newly developed digital techniques from art history and geography (Digital Thematic Deconstruction), and complement this with a renewed archaeological and historical survey of the region. By unlocking the details of the painted map, we will make an invisible landscape reappear, and unveil the historical, archaeological and environmental records of this remarkable manmade landscape

Introducing Bruges' medieval harbour landscape

During the Middle Ages, Bruges became the leading commercial metropolis of northwestern Europe. The specific position it held within transcontinental and maritime trade route networks played a crucial role in this development (Murray 2005). Yet, lying more than 10km inland, a navigable connection to the sea was not self-evident for Bruges. In order to attain and retain such connections, natural creeks were connected with man-made canals, dams and sluices, creating a port system that was named *totum pro parte* after its main waterway: the Zwin tidal inlet (Ryckaert & Vandewalle 1982). Thus, Bruges' hinterland towards the coast was transformed into a linear suburban extension of the city, shaping a unique coastal portuary landscape. This late medieval embanked and densely populated landscape replaced the early medieval coastal landscape of salt marshes and mudflats. At the end of the medieval period, this landscape of commerce would be transformed into a militarised landscape of conflict. Indeed, in the context of the Eighty Years' War (1568-1648), dikes were breached, farmland inundated, harbours deserted and bulwarks constructed, reshaping the Zwin area from an axis of trade into a frontline of war. However, recent research has shown that the landscape-historical narrative of this unique coastal environment is still embedded in outdated geomorphological framework that is in need of new landscape-archaeological data (Trachet *et al.* 2015).

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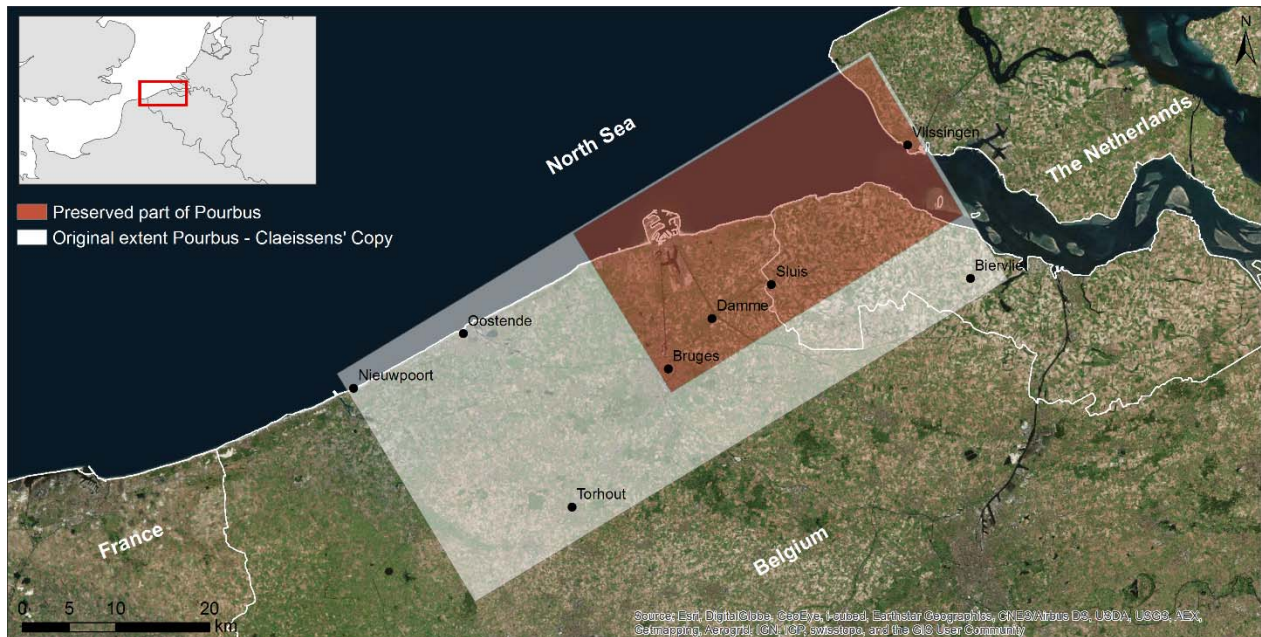


Figure 1: The Belgian coastal area with indication of the areas covered by Pourbus' paintings.

Introducing Pourbus' painted map of the Liberty of Bruges

At the 16th-century tipping point of landscape transformation, painter Pieter Pourbus finished his *Map of the Liberty of Bruges* (1571). The painting, in 1561 commissioned by the powerful Liberty of Bruges (the rich and extensive rural district around Bruges ruled by the local nobility), depicts the urbanised coastal hinterland of Bruges at the end of its late medieval economic heyday (Huvenne 1984: 286-291). With an unprecedented level of both detail and overview, Pourbus meticulously reproduced the coastal countryside with indication of cities, towns, houses, dikes, roads, waterways, mills, toponyms, etc. Although the scale of 1:12 000 is not uncommonly large, the combination of this scale with its size of 322 cm x 151 cm is rather unique for a late 16th century map. Moreover, it can be assumed that the painting was originally four times larger, as an exact copy of this painting dating from 1601, measures 614 cm x 361 cm and covers a much wider area around Bruges (Figure 2). Taking into account the unique topographic and geometric accuracy of this painting (Germonprez 2007; Depuydt *et al.* 2008) and its intrinsic value as a document of historical interest, it is incomprehensible how understudied it remains so far. In fact, it seems that Pourbus' map of the Liberty of Bruges has always lingered at the margins of in-depth art historic and cartographic research. On the one hand, the painted maps from the 16th century, mostly portraying intra-muros cityscapes from a bird's-eye view (e.g. Marcus Gheeraerts, Braun & Hogenberg's, or Guicciardini), lean closer towards the traditional renaissance paintings of that period and consequently received mainly scholarly attention from art historians, focussing on iconographic properties (e.g. Schulz 1978; Frangenberg 1994; Hills 1996) or underlying hidden agendas (e.g. Harley 2001; Dewilde *et al.* 2016). On the other hand, the earliest 16th-century maps making use of Gemma Frisius' triangulation methods (e.g. Mercator, Van Deventer, Apian or Saxton), framed larger territories and only symbolically indicated the centres of habitation and the major road- and waterways. Although the line between art and science was not always very clear at that time, these documents lean closer towards the maps of the 17th and 18th century and are therefore chiefly studied in the domains of historical-cartography and geography, where geometric accuracy receives most attention (e.g. Jenny & Hurni 2011; Jongepier *et al.*

2016; Vervust 2016). Thus, considering its large size, its large scale, its level of detail, its near-orthographic perspective, and its atypical choice of materials (oil paint on canvas), the map-painting of the Liberty of Bruges is a unique oddity on the interface of late medieval renaissance painting and early modern Enlightened mapmaking.



Figure 2: Pourbus' original painting of the Liberty of Bruges, being photographed with a mobile frame (©Dominique Provoost).

Despite these distinctive characteristics, the only noteworthy study of the Pourbus map is a collection of papers at the occasion of a facsimile-reproduction of (the copy of) the map (van der Heyden & Depuydt 1998). Although many disciplines were involved (cartography, history, art history, landscape-history and toponomy), most of the research remained superficial. The editorial of the booklet concludes that far-reaching analysis lay beyond the scope of this publication and that these papers must be seen as initiatory research opening avenues for further study on the then-presented facsimile-reproduction. Alas, these extensive analyses, promising as they might have been, were never realised. In none of the disciplines.

Although a digital copy of the painting is nowadays already available, the rather limited resolution of this digital reproduction did not allow an in-depth analysis of its content. Moreover, the evolution of digital techniques and methodologies have since then revolutionized both humanities and geographical sciences and have the potential to explore maps and paintings on a very different level. On the one hand, the technique of *georeferencing* has enabled cartographers to assign spatial coordinates to unreferenced but inherently spatial data (like a painting, a map or an aerial

photograph), so they can be projected on modern, geographically correct datasets (Balletti 2006). On the other hand, techniques such as the *Digital Thematic Deconstruction (DTD)*, which systematically transcribes and thematically categorises all the cartographic or iconographic elements in a map, allows historians to re-evaluate topographic features and patterns both in greater depth and from a holistic perspective (Vannieuwenhuyze & Vernackt 2014). Such digitalisation, vectorisation and georectification of paintings and maps have already been successfully implemented in both cityscape-projects (e.g. the MAGIS project in Bruges¹, the Nolli Map project in Rome², the Alpage project in Paris³, or the mapping of medieval Chester⁴), and landscapes-projects (e.g. County maps of Hertfordshire⁵, Norfolk⁶, Suffolk⁷ and Essex⁸ in the UK or the HISGIS project in the Netherlands⁹). However, whereas the cityscape-focussed projects have been able to integrate late medieval and 16th-century documents, the landscape-focussed projects have so far only implemented maps from the 18th century onwards. Moreover, only few and always the later maps have been georeferenced and studied in relation to the later city- or landscape. The proposed combination of georectification and digital thematic deconstruction will thus explore the application of separately established yet still largely unintegrated techniques to study medieval landscapes at the onset of triangulated mapping.

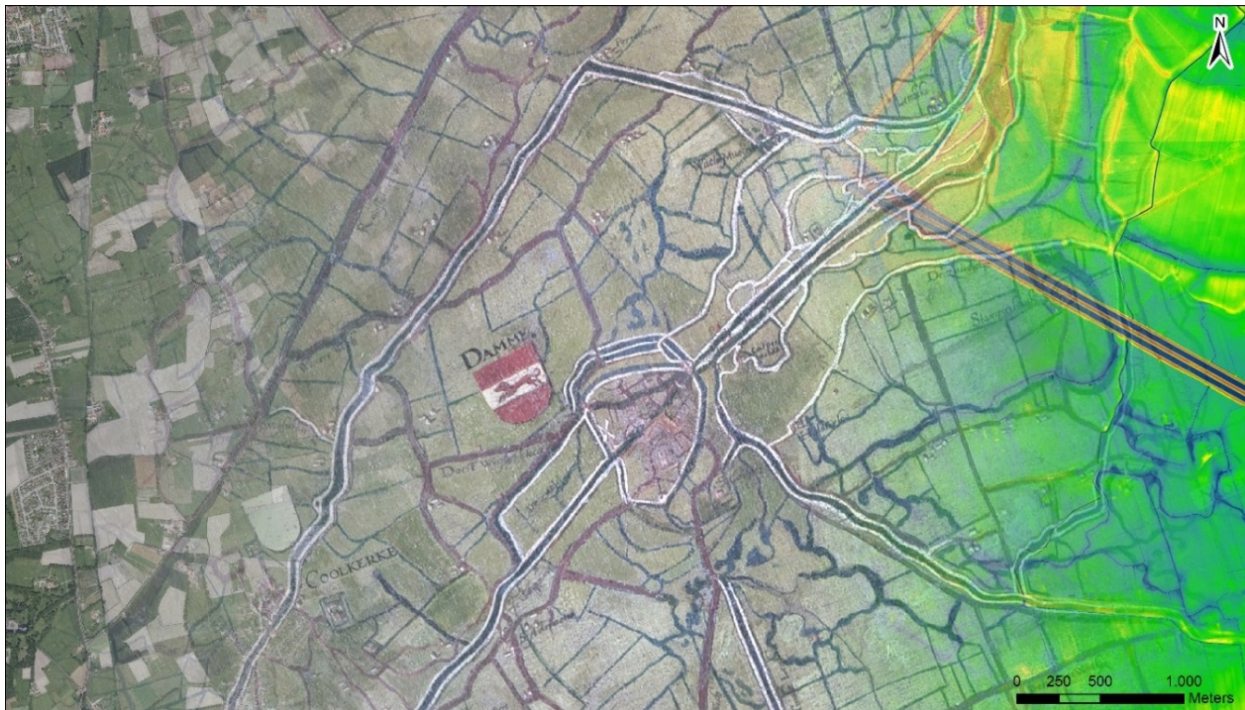


Figure 3: The area of Damme on a georeferenced excerpt of the map of Pourbus (centre) overlaid by an aerial photograph (left) and the LiDAR-data (right).

¹ <http://magis.kaartenhuisbrugge.be>

² <http://nolli.uoregon.edu/>

³ http://mapd.sig.huma-num.fr/alpage_public/flash/

⁴ <http://www.medievalchester.ac.uk>

⁵ <http://www.duryandrewsmapofhertfordshire.co.uk/>

⁶ <http://www.fadensmapofnorfolk.co.uk>

⁷ <http://www.hodskinsonsmapofsuffolk.co.uk/>

⁸ <http://www.chapmanandremapofessex.co.uk/>

⁹ <http://www.hisgis.nl>

Objectives

The main research goal of this project is the interdisciplinary study of the late medieval landscape and topography of the coastal hinterland of late medieval Bruges that is depicted on the Pourbus map. Relating to the above indicated gaps in previous research, this main goal is subdivided in three more specific objectives.

A first objective is pursuing an in-depth study of the individual topographical elements of the map. Seemingly truthful to the landscape it is depicting, the painting is composed of an innumerable amount of topographical elements that form a palimpsest of features. Because it is impossible to grasp all these juxtaposed details at one glance or by browsing over the painting, a piece-by-piece meticulous analysis will lead to a better understanding of the individual elements, mutual relation and patterns, and finally the landscape as a whole. After the digital transcription of the map, the vectorised polygon objects will be related to a geodatabase containing historical, archaeological and environmental data. In this way, the two-dimensional static painting will be deconstructed into the multi-layered and multi-dimensional historical landscape it represents. By questioning the landscape-archaeological reality of the individual features, the aim is to get an insight in the apparent objectivity of this document. How did Pourbus perceive the Zwin area? What was the role of the Liberty of Bruges who commissioned the painting? How did this education as a painter influence his cartographic work? Answering these questions will contextualise the materialization of this map and guide us in a better understanding of the painting as a whole.

The second objective is methodological and seeks to merge established techniques from geography and art history into an innovative methodology to study historical maps. By bridging the gap between both the approaches and the disciplines, we want to create the possibility to address an important, yet often neglected aspect of both art historical and cartographic approaches of early maps and paintings: the analysis of the actual topographic content. As the digitalisation of art and maps has been making great progress in the last years, scientists from different backgrounds should engage in the scientific exploration and capitalisation of this 'digital turn'. The highly detailed digital transcription and georectification of the Pourbus map will provide an excellent case-study that will show how these novel techniques can lift a painting or map from a pretty illustration, to a tool for research.

The third objective is to contribute to the landscape-historical debate of the Belgian coastal area in general, and the Zwin area in particular. By studying the history of the landscape, we want to provide a scientifically-grounded framework for its future adaptations. By studying how the landscape evolved, why certain landscape-infrastructure measures were taken, who were the decisive agents, and which were the crucial factors, we want to uncover the dynamic interaction between man and nature and raise awareness of the fragility and temporality of coastal wetlands, also in Flanders. Previous research showed that the landscape-historical narrative of this part of the coastal area is outdated and has not kept up with research trends in the surrounding regions (Trachet et al. 2015). The multidisciplinary focus on specific landscape elements (e.g. dikes or smaller waterways) have in the first place uncovered this shortcoming and will therefore provide the perfect stepping-stone to piece together an updated narrative.

Methodology

Corresponding to the three above objectives, the methodology of the project is also triple-layered. First, the map will be digitally processed. Second, the map-elements will be coupled to a geodatabase. Third, these micro-scaled elements will be analysed on a regional extent and framed in the macro-scaled landscape-historical narrative of the region.

1. Digital processing of the map.

The first step in this project will be the production of a new high-resolution digital copy of the painting. Although the latest digital copy already provides a reasonable detailed image at 300 dpi, not all topographic details or toponyms depicted on the map are legible. Nevertheless, present-day digitalisation techniques already provide ultra-high-resolution recording which promise a full readability of the painting. In order to obtain an orthographic reproduction of the map, the individual photographs will be processed with photogrammetric software (Agisoft Photoscan). When the desirable digital resolution is achieved, the image can be further processed. On the one hand, we will perform a Digital Thematic Deconstruction (DTD) on the map of Pourbus, similar to the DTD that was implemented on Marcus Geeraerts' map of 16th-century Bruges (Vannieuwenhuyze & Vernackt 2014). This process comprises the vectorisation (also called 'digital transcription') of every single cartographic element in polygons. After dismantling the image, the polygons will be categorised using a simple but layered typology, featuring more generic terms at a first level (e.g. city, town, hamlet, field or linear element), and more small-scaled or specific typologies on a second level (e.g. church, castle, house, mill, road, dike, creek, canal, bridge or sluice). On the other hand, we will make a new georeferenced version of the map in GIS. Using more specialist cartographic software like MapAnalyst, we will be able to further assess the planimetric accuracy of the map, and compare it to recent cartographic studies in neighbouring areas (Jongepier et al. 2016; Vervust 2016). The methodological challenge and innovation lies in the combined application of both georeferencing and digital deconstruction, in which it will be crucial to obtain results in which the individual elements are located as geographically correct as possible, without being unacceptably deformed.

2. Building a historical geodatabase

The second phase of the project will focus on the topographic content of the map and entails an in-depth study and identification of the individual map elements. Initially, the topographic elements will be compared with existing databases, such as the Central Archaeological Inventory (CAI), the Inventory for Architectural Heritage (DIBE), corings from the Subsoil Database Flanders (DOV), and the so-called 'anchorages' recorded in the Flemish Landscape Atlas, which are all available as GIS-shapefiles. Next, the remaining unidentified elements will be further verified through other non-inventoried but readily available data layers, such as aerial photographs, LiDAR, and historical maps. On a selection of enigmatic elements that might embody pivotal information on the landscape history of the region, we will pursue a more in-depth study through a combination of archival work and archaeological field survey.

3. Framing into landscape-historical multi-proxi narrative

The third phase of the project, will move from the micro-scaled elementary approach towards a landscape-wide macro-scaled approach. Because all these available data have a spatial dimension, a GIS-environment is the obvious tool to integrate these different sources, as it offers a platform

to collect, visualise and analyse the vast amount of historical, cartographic, soil, remotely sensed and archaeological data in an efficient way. The individual categorised and identified elements will be spatially analysed for linked patterns and the entire Medieval and Early Modern countryside will be addressed in a holistic way. At this point, also the analysis of the depicted toponyms and the subtle varieties of green used on the map will be addressed. This last property will be particularly related to the information of the Belgian Soil Map and the LiDAR data, and coupled to a profound study of dike-development, as they provide key information to assess and modernise the geomorphological frameworks of interpretation for the area.

Preliminary results

The first steps of digitising the painting has already been taken using a Hasselblad H5D-200c MS camera (Figure 2). The frame used for this recording was specifically constructed to photograph large paintings and consists of a vertical shaft that can be moved horizontally over a rail. The camera is attached on a platform on the vertical shaft and is moved vertically in equal distances. The frame was positioned 1 m from the painting. The photographs were taken in vertical series of 18 photographs per line, displacing the camera 7.5 cm per photograph. When a line was finished, the vertical shaft was displaced with 10 cm and a new top-down series was taken. This summed up to 629 photographs with a 75% overlap. Next, these photographs were processed in Agisoft Photoscan in order to compile an orthographic visualisation of the painting. The exact dimensions of the painting were measured with laser and served as ground control points for the local reference system. This resulted in orthographic image of the painted map with a resolution of 0,00518 mm per pixel.

A first attempt to georeference the eastern part of the Pourbus map proved successful and resulted in a Root Mean Square Position Error of 102m and a Standard Deviation of 80m¹⁰, using 451 reference points. Moreover, numerous topographical and iconographical map-elements that are anomalous to the historical, archaeological and environmental narratives of the region have already been located. Comparison with other data, such as aerial photographs or digital elevation models, proof the archaeological reality of these features (Figures 3 and 4). Although still premature, the positive preliminary results promise (i) a successful application and innovative integration of the newly available techniques and (ii) results that will significantly broaden our view on the landscape history of Bruges' medieval portuary zone.

¹⁰ These calculations are based on a 1st polynomial transformation. For further processing of the map, a Spline Transformation is used.

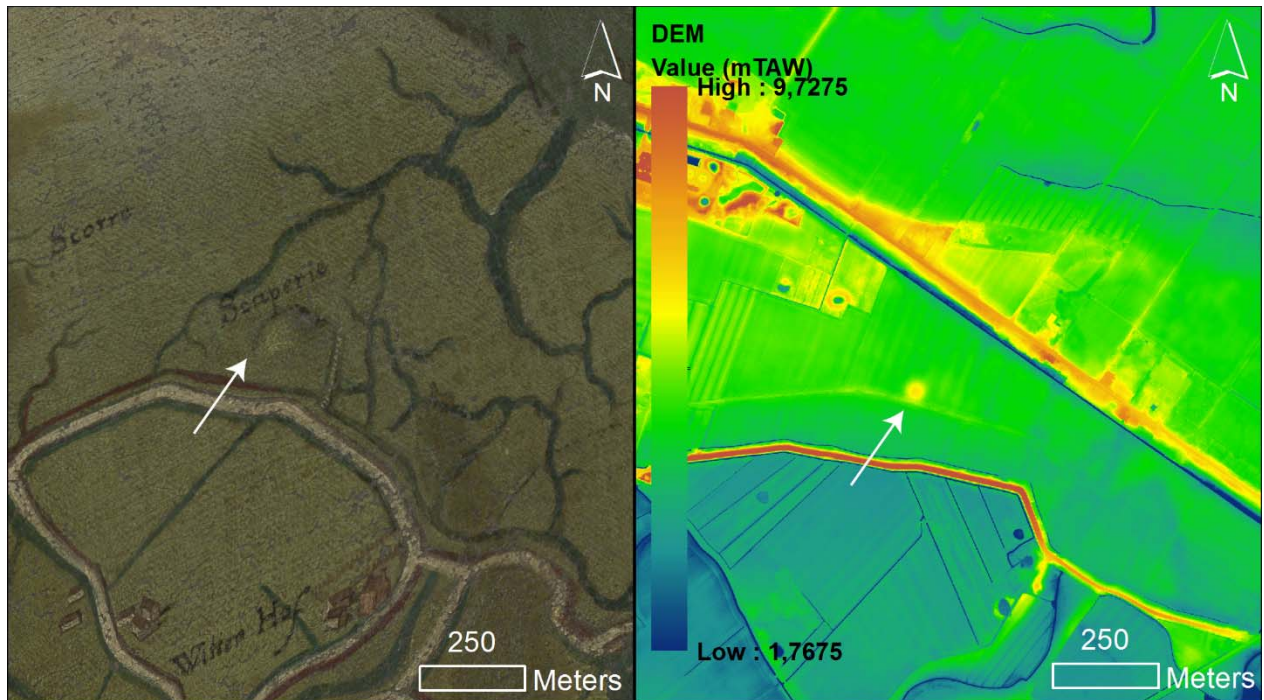


Figure 4: Previously unknown mound named 'scaperie' ("sheep farm"), painted in the unembanked wetlands (left), still visible in the now embanked polders on the DEM of Flanders (right). (©Lukasweb (left) and ©AGIV (right)).

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