

# Reconstruction of the interior of the Saint Salvator abbey of Ename around 1290

Carlotta Capurro, Dries Nollet and Daniel Pletinckx

Visual Dimension bvba, Ename, Belgium

## Resumen

*En este trabajo describimos el proceso de investigación sobre la reconstrucción de la abadía de San Salvador en Ename (Oudenaarde, Bélgica) en el siglo XIII, tanto en su decoración arquitectónica como en su mobiliario. El motivo de la reconstrucción es la creación de un juego educativo para los visitantes del Centro Provincial de Patrimonio, construido justo al lado de la zona arqueológica de la abadía.*

**Palabras Clave:** 3D RECONSTRUCTION, DIGITAL RESTORATION, SERIOUS GAME, KINECT, 3D VISUALIZATION, EDUCATIONAL GAME.

## Abstract

*In this paper we outline the process of research about the reconstruction of the Saint Saviour abbey in Ename (Oudenaarde, Belgium) in the 13th century both in its architectural decoration and in its furnishing. The reason for the reconstruction is the creation of an educational game for the visitors of the Provincial Heritage Centre, built just next to the archaeological site of the abbey.*

**Key words:** 3D RECONSTRUCTION, DIGITAL RESTORATION, SERIOUS GAME, KINECT, 3D VISUALIZATION, EDUCATIONAL GAME.

## 1. INTRODUCTION

The Saint Saviour abbey was built by the count of Flanders in 1063 on the remains of a major medieval trade settlement. It existed until 1795 when it was abolished in the French Revolution. The history and evolution of the abbey is well documented, both by historical sources and by more than 25 years of extensive excavation. The reconstruction of the abbey site and interiors (Fig.1) has been undertaken in order to come up with the creation of a serious game that will allow people to virtually walk in the abbey and discover the daily life of monks in the 13th century. The educational game will be installed in the Provincial Heritage Centre of Ename. The building is indeed erected next to the archaeological site of the abbey and the game

will be deployed in a room on the top floor, overlooking the archaeological site. In this way, we create a strong link between the archaeological site and its digital reconstruction.



*Fig 1. 3D reconstruction of Saint Saviour abbey in 1290s.*

## 2. GOALS OF THE PROJECT

The interactive 3D visualisation of the abbey site and interiors has multiple goals. First of all, the 3D visualisation links to the complex archaeological remains and shows the splendour of the medieval phase of this rich abbey that was closely linked to the count of Flanders and inhabited by only thirteen monks. The reconstructed period also shows the scriptorium in which Martijn van Torhout, a well known medieval writer, was active (MILIS, 1963-64).

A second important goal of the project is the re-contextualisation of museum objects. Several objects of various nature have been excavated in the abbey's site and are today on display in the Provincial Archaeological Museum (pam) of Ename [online 1], close to the archaeological site. In the digital reconstruction of the abbey, artefacts are shown in their original context and function. This not only helps the visitor to understand better the nature of the museum objects, but explains also the concept of heritage, and the reason why we spend effort and budget to excavate and preserve objects from the past.

Finally, a third goal of the project is a better interpretation of available archaeological and historical data. Reconstructing the inside of the abbey has improved significantly the understanding of the structure of the buildings, their function and interrelation (PLETINCKX, 2007).

In the reconstruction of the furniture and the objects of the abbey, we used a great number of iconographic sources. Illuminated manuscripts, for example, offer a large number of depictions of furniture and tools in use in the Middle Ages. In this way, we were able to refurbish the space of the scriptorium, the library and the guest quarter.

Very important in this process were the objects found during the excavation and on display in the museum. They have been digitally restored and placed back in the virtual abbey. Some of them, such as a glazed ceramic pitcher, an exclusive high-end product, witness the richness of the abbey.

## 3. THE RECONSTRUCTION

The Saint Saviour abbey of Ename was founded in 1063 by Adèle of France, the wife of count Baldwin V of Flanders, and had an eight-century long history. It was dismantled after 1795, when it was confiscated by the French Republic in consequence of the French Revolution.

The abbey hosted only twelve monks and an abbot. Although small, the Saint Saviour abbey was rich and underwent a series of expansion works during centuries. It always remained very loyal to the Count of Flanders and was probably used as a guest house for his influential guests.

A major work of reconstruction of the appearance of the abbey was undertaken by Visual Dimension bvba in the period 1997-2004 (PLETINCKX, 2007). The work was based upon the results of more than thirty years of excavations (Saint Saviour abbey was excavated from 1941 to 1946 by prof. A. Vande Walle and from 1982 to 2004 by the team of Dirk Callebaut) (CALLEBAUT, 1987) and on the extensive research both on the history of the site and the evolution of its landscape.

The choice to visualise the interior of the abbey as it could have been in 1290s is due to the fact that major books (some preserved in Leiden, Oudenaarde and Oxford) were written around that time by Martijn van Torhout, and the game shows the scriptorium while these pages are being written (Fig. 2).

In order to come up with a consistent reconstruction of its interior, all the available sources about the abbey have been reviewed and the archaeological site has been carefully inspected in order to collect all the useful information for the work.

All the information collected on the archaeological site has been compared with still standing buildings erected in the same period. This operation was possible due to a certain amount of standardisation that characterised the architectural style of the abbatial buildings. Manuscripts and documents provide other useful information on the appearance of the rooms.



Fig 2. *Photographic reproduction Codex Enamensis Martijn Torhout. Original Manuscripts No. 32. (Photo by MOU, Oudenaarde).*

When existing, the archaeological evidence has been used to determine the appearance of architectural elements. All the elements that have not been found archaeologically have been reconstructed with a linear style recalling the appearance of medieval examples.

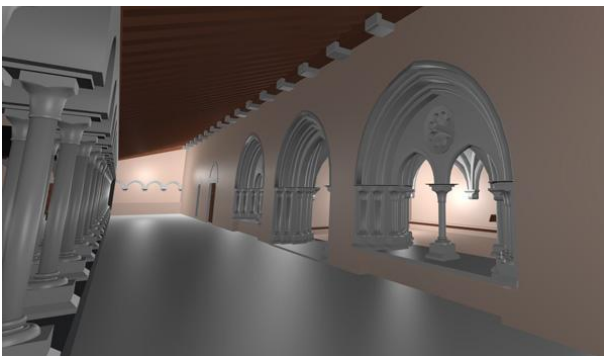


Fig 3. *3D reconstruction of the chapter room.*

Emblematic in this sense is the reconstruction of the chapter room (Fig. 3). Its remains are still easily readable on the archaeological site, where information about its size, structure and the number of door and windows can be found (Fig. 4).

In the foundations are the support structures of two columns, almost in the centre of the room, that divided it in three equal spaces. The level of the floor, two steps lower than the cloister floor level, can be detected in the structure of the remains. The basements of the columns of a splayed portal on the two sides of the door are still in their original position (Fig. 5). Once compared with coeval examples, they perfectly match both in style and structure. On the right side of the back wall was a door: its structure is preserved and the iron hinge are still inserted in the wall. Finally, from a documentary source it is known that three small windows were present in the same wall.



Fig 4. *Remains of the chapter room in the archaeological site of Ename.*



Fig 5. *Chapter Room. Basements of the columns of a splayed portal.*

The comparison of the remains of the portal of Saint Saviour abbey with coeval examples shows that it is highly possible that it was flanked by two mullioned windows. The inspection of the

remains shows that the two window sills are still inserted in the remains of walls.

The floor level, combined with the possible layer analysis of the structure, determined the height of the ceiling and of all the elements of the room.

The capitals used on the central columns and as a support for the arcades of the ceiling is based on an existing example still preserved on site.

In order to create the virtual reconstruction of a working abbey, furniture have also to be inserted in it. Information on the appearance has been taken from miniatures and other coeval visual sources.

We decided to create a scriptorium in the abbey (Fig. 6), even if nowhere in written sources a direct mention of it is available. On the contrary, several indirect clues make its existence highly possible. During the excavations, several objects belonging to the binding process of manuscripts have been found. It is then reasonable to suppose that, if books were bound in the abbey, they were also written inside its walls. A possible proof of this is that Martijn van Torhout, a famous medieval writer, was a monk of the abbey. Even if the information is not attested in sources, it is possible that he carried out his literary production inside the abbey.



Fig 6. 3D reconstruction of the scriptorium.

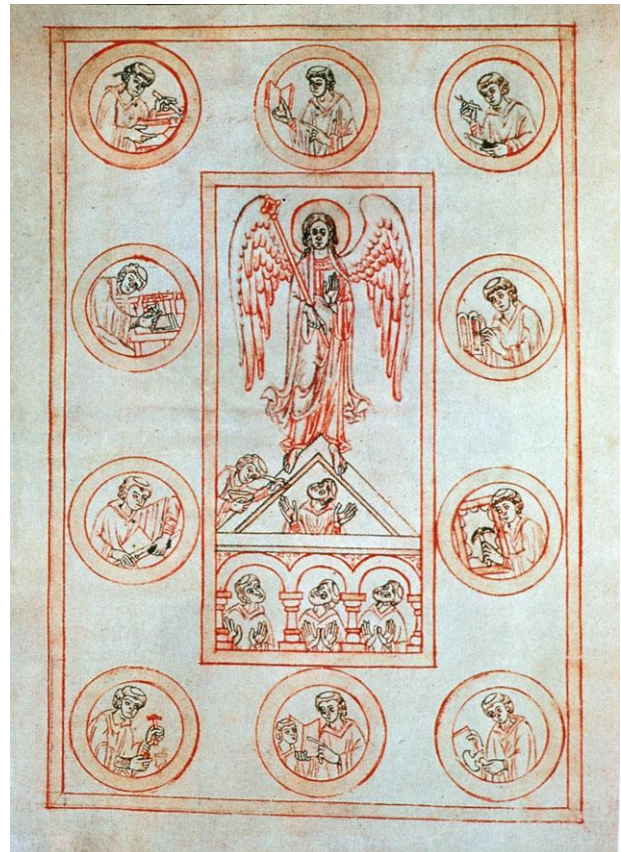
An inventory of books belonging from Saint Saviour abbey has been published by Ludo Milis (1963-64). This document attested the dimension of the library of the abbey at that time.

Miniatures from several codices have been compared and used as visual sources for the reconstruction of writing desks, reading chairs, bookstands, closets and writing tools (Fig. 7).



Fig 7. One of the miniatures used as visual sources in the creation of the scriptorium furnishing (Madrid, Biblioteca de San Lorenzo de El Escorial).

To respect the educational purpose of the game, also the tools used in the preparation of parchment have been added in the scriptorium. During the virtual tour, the guide will have the possibility to explain children the process that led to the creation of a book, showing all the tools employed (Fig. 8).



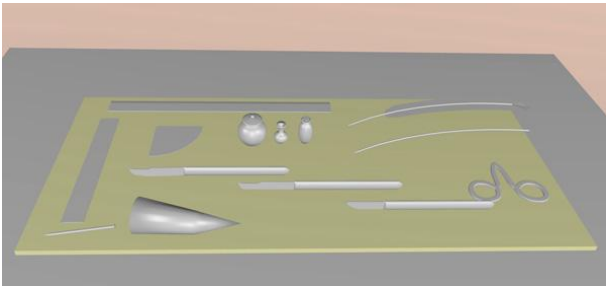


Fig 8. 3D reconstruction of tools used by monks and a miniature that was used as visual sources. (Miniature from “De officiis ministrorum” by Ambrogio, 12<sup>th</sup> century German Gothic Bamberg, Staatsbibliothek, Ms. Patr.5, folio 1r.).



Fig 9. 3D reconstruction of a pitcher excavated in Ename and the object exhibit in the archaeological museum.

Finally, objects found during the archaeological excavations and belonging to the period of interest have been digitally restored (Fig. 9). In this way, a strong link between the real object shown in the museum and its virtual replica is created. Children will be able to make the link between the real and the virtual object, and understand the nature of fragmented remains by seeing them in their original shape and context of use.

#### 4. THE GAME

The game is targeted to school children visiting the site and will be structured as a treasure hunt where the player, in a limited time, will be free to explore the cloister and the spaces of the abbey in order to collect useful clues and objects. As taking an object can have consequences, children have to think about the function of that object or the way monks live in an abbey.

Although the game is played in a single player mode, the rest of the class group helps the player to take the right decisions, supported by a member of the educational staff. It will also be possible to explore this virtual environment of the abbey in a non-gaming mode. In this way, museum guides will be able to show around visitors in the virtual abbey to link with the archaeological remains and excavated objects on display in the museum.

The story is setted in the morning of the Pentecost day in 1290. The precious ivory crosier of abbot Gerard van Strijpen, that was broken some days before, has to be placed back on its staff as it is going to be used during the procession, after the noon mass. But the craftsman, who repaired the crosier, was in Oudenaarde and the servant, who went to fetch it, lost the key of the wooden chest in which it was stored on his way back to the abbey. When the game starts, all the servant of the abbey are in panic as the time to find back the key is very short and for this reason all the doors of the abbey are open and no one is controlling the gate.

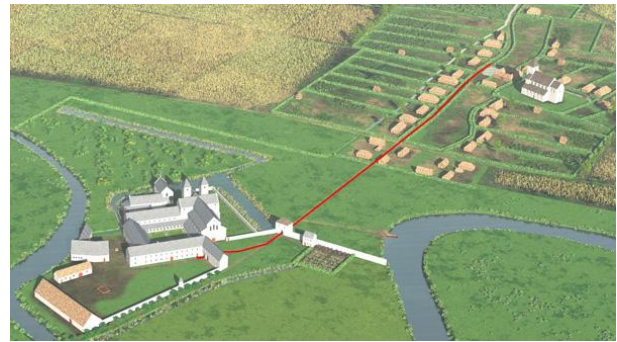
On his tour through the abbey, the user will find several hints to this situation, so that the user will understand where the key can be found and that he will be able to open the chest that is in the house of the gatekeeper and recover the repaired ivory crosier, just in time for making the abbot's staff ready.

The virtual world is projected on a 2,25 m by 4 m screen and interaction with the virtual world happens through natural interaction based on a Kinect2 camera. The goal is to develop a natural interaction without menus or modes, in which all activities of navigation, object selection and object manipulation happen through a set of gestures. This means that the gestures for navigation need to be clearly distinguishable from selection and manipulation gestures.

Exploring virtual environments in a museum has specific requirements that are different from normal games or serious games. The most important is that the time a person can navigate through the virtual environment is limited, for several reasons. Evaluation of the Etruscanning [online 2] [online 3] [online 4] application in the Allard Pierson museum (PIETRONI et al., 2012) in Amsterdam show that the average use of the application is about 10 minutes and that 9 people out of 10 (have to) look how other people use the application instead of using it themselves. This means concretely that the natural interaction needs to be very intuitive and that replacing one person by another (possibly with different body measurements) must be very smoothly and robust.

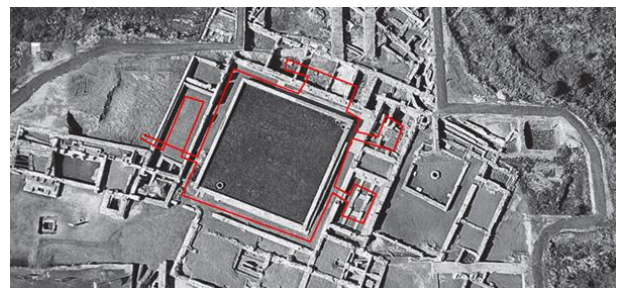
This means also that the exploration must be efficient and easy, there is no time to get lost in the virtual world. An elegant way to implement this, is navigation along a predefined path, that leads along all points of interest, requiring less time to perform a guided tour or search task. All visualisation happens in a first-person mode.

In the first version of the game only one quest has been created. It starts at current location of the Ename museum, next to the Saint-Laurentius church, and leads towards the abbey. Going to the abbey can be used to improve the navigation and exploration skills.



*Fig 10. Part 1 of the walkthrough.*

The walkthrough of the scene is organised as follows. Part 1 consists of the walk from the starting point in the village through the gate of the abbey to the visitor's portal of the abbey (Fig. 10).



*Fig 11. Part 2 of the walkthrough.*

Part 2 is the exploration of the inside of the abbey. The user will walk through the cloister and access a limited number of rooms, in this defined order: the portal, the guest room, the chapter room, the scriptorium, the library and finally the refectory, leaving the building through the same portal (Fig. 11). This means that the indoor and outdoor scenes can be separated from each other by the one entrance door of the portal. So, the application consists of two worlds. The first is the outdoor scene which is a 2 by 2 km terrain with buildings and vegetation. The other is the indoor scene of the abbey that consist of all interiors and all buildings that are visible from the internal courtyard of the abbey. Window glass in that time was translucent, not transparent, so no outdoor environment can be seen from the rooms that have windows on the outdoor environment.



Fig 12. Part 3 of the walkthrough.

Part 3 of the walk leads to the ferry where one can cross the river with the ferryboat (Fig. 12). The ferry connected the side of the river where Ename is, to the one of Oudenaarde and it was operated by the monks, that were allowed to collect tolls on the crossing. The boat goes automatically to the other side of the river when the user gets in.



Fig 13. Part 4 of the walkthrough.

Part 4 of the walk returns, via the large vegetable garden, to the small building next to the gate of the abbey (Fig. 13). This building was used for the gatekeeper to live, for receiving peasants paying their rent or for distributing food to the poor coming to the abbey gate.

In this first version of the game, there is currently no interaction with the scene. Doors that are closed remain closed, the user can only

pass through open doors. As there is a predefined path, no collision detection is needed. This will change in later versions of the game, in which multiple quests will be developed, in a more complex setting.

There is a simple soundscape in the game. The outdoor scene has some bird and animal sounds. In the indoor of the abbey, there is the distant sound of singing of the monks in the abbey church. The displacement of the user also has some associated sounds, depending on the type of the floor covering.

For this first version of the game, the number of objects that can be selected will be limited to about ten. The hints are given through a story (a short sound file) that the user hears when he selects and manipulates an object.

Once the user has heard the story of the object, he can decide to take it with him or put it back. When an object is taken, a small icon for that object appears on the bottom of the screen.

The gestures are defined in a gesture editor and can be tested immediately in the Kinect environment described above. This allows to fine-tune the gesture grammar to be optimal for the game and for the audience.

## 5. CONCLUSION

The virtual reconstruction of the interior of the Ename abbey in 1290 not only has provided a much better scientific understanding of the archaeological remains and excavation results, but also provides an appealing way to experience the abbey through the use of real time interactive exploration, based upon natural interaction, in direct relation to the archaeological remains.

## ACKNOWLEDGEMENTS

“The research leading to these results is partly funded by the EU Community's FP7 ICT under the V-MusT.net Project (Grant Agreement 270404). The publication reflects only the author's views and the Community is not liable for any use that may be made of the information contained therein. Neither the V-MusT.net consortium as a whole, nor a certain participant of the V-MusT.net consortium, warrant that the information contained in this document is capable of use, nor that use of the information is free from risk, and accepts no liability for loss or damage suffered by any person using this information”.

## REFERENCES

CALLEBAUT, Dirk (1987): “De vroeg-middeleeuwse portus en Benedictijnenabdij van Ename (Stad Oudenaarde)” in *Archaeologia Belgica*, III: 213-224.

MILIS, Ludo (1963-64): “De Kloosterbibliotheek van Ename” in *Oudenaards genootschap voor geschiedenis en oudheidkunde*, Handelingen 1963-64, pp. 96-107.

PIETRONI, Eva; RAY, Christie; RUFA, Claudio; PLETINCKX, Daniel and VAN KAMPEN, Iefke (2012): “Natural interaction in VR environments for Cultural Heritage and its impact inside museums: The Etruscanning project” in *Virtual Systems and Multimedia (VSMM), 2012 18th International Conference*, pp. 339–346. IEEE 2012.

PLETINCKX, Daniel (2007): “Interpretation Management. How to make sustainable visualisations of the past”, Epoch know how books. Stockholm. [online] [http://media.digitalheritage.se/2010/07/Interpretation\\_Managment\\_TII.pdf](http://media.digitalheritage.se/2010/07/Interpretation_Managment_TII.pdf)

[online 1] <http://www.pam-ov.be/ename>

[online 2] <http://regolinigalassi.wordpress.com/>

[online 3] <http://www.youtube.com/watch?v=WBS48y6wT9k>

[online 4] <http://www.youtube.com/watch?v=iiW4dbfo5yU>