

Good Choice of Photogrammetric Approaches during the same Mission

Ways of Saint James in Namur

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Introduction

In December 2018, the Université libre de Bruxelles was accredited by the Province of Namur Tourism Federation to carry out 3D acquisitions of several points of interest on the ways of Saint James within the framework of the European Loci Iacobi Cosme project. The mission assigned to the platform was carried out in January 2019 and focused on a selection of five selected pieces of Namur heritage, representative of the city's importance in the history of the pilgrimage. This article attempts to demonstrate the different selected acquisition methods, the choice of artefacts according to their characteristics as well as the intrinsic and extrinsic ins and outs leading to the methodological acquisition choices operated during the mission. All the objects were treated photogrammetrically in a classic way and following the quality chart presented by H.-L. Guillaume and A. Schenkel (2019).

Choice of the artifacts

The choice of the artefacts to be acquired results from the Province of Namur Tourism Federation asking in consultation with the operators. The initial list included the following five points of interest, including both liturgical small and medium-sized furniture, and one architecture:

- Baptismal font - Abbey of Hastière - HASTIÈRE,
- Statue of Saint-Jacques by the Master of Waha - Trem.a - NAMUR,
- Reliquary of the foot of Saint-Jacques by Hugo d'Oignies - Trem.a - NAMUR,
- [Belfry \(Saint-Jacques tower\) - NAMUR.](#)

Following the list of points of interest, it was necessary to make a methodological choice on the most suitable photogrammetric acquisition techniques.

Baptismal font : classical photogrammetry

This liturgical furniture located in the church of the Abbey of Hastières near Namur dates from the 14th - 15th century. It is carved out of a monolithic block of local blue stone making approximately one meter twenty high with a cup-shaped receptacle and is decorated at each of its corners with a religious face.

The analysis of the object made it possible to determine the most appropriate technique for its survey. The accessibility of the baptismal font of the Abbey of Hastière, the possibility of having a minimum radius of 2m around the object, its size and the nature of the material of which it is made, as well as the possibility of lighting it in a punctual way allowed the Panorama team to carry out a classic photogrammetric acquisition on a tripod using a Nikon D810 and a Nikkor 35mm F2 lens with two portable LED lamps mounted on the camera's flash shoe as shown in Figure 1. In order to respect the colorimetry and the scale of the object, a colorimetric chart was used in conjunction with 20-bit circular coded targets whose centers were placed at a distance of 10cm on a ruler.



Fig. 1. On site acquisition of Baptismal font (© Benoît Trémouroux)

Statue of Saint-Jacques : speed photogrammetry

Polychrome oak statue probably made around 1520-1530 attributed to the Master of Waha who was an exceptional sculptor and one of the most remarkable figures of the Gothic style. This statue, like the foot-shaped reliquary, is conserved in the Provincial Museum of Ancient Arts of Namur. The figure is wearing a large hat with the characteristic attributes: a gourd, two crossed pilgrim's sticks, a typical pilgrim's hat and a shell known as a scallop.

As the TreM.a was only authorized for a single day and as the museum does not close its doors, it was necessary to use a fast photogrammetric acquisition technique that could take place between two groups of visitors to avoid any human presence other than the operator during the acquisition in order not to introduce artifacts during the shooting (especially cast shadows).

It was therefore obvious to use the speed photogrammetry technique. After taking a control picture with a colorimetric chart, 20-bit coded targets are placed around the object. The essence of the technique lies in the precise settings of the camera and its continuous shooting capabilities in correlation with the reliability of its autofocus.

The Nikon DSLR camera (D810) is set to shutter speed mode at 1/250 shutter speed to avoid blur while walking around the object with an aperture between F8 and F9 to obtain a sufficient depth of field with a lighting device mounted on the fixture had to provide sufficient diffuse light. The operator used a 1200LM SL-108 flash ring light with auto ISO mode (maximum stop set to the sensor noise limit +/- ISO 800/1250) or manually set to ISO 800. The camera is configured on slow continuous shutter mode (CL) set to 4 frames per second to limit the total number of frames and shoot in lossless compression format to avoid fulfilling the frame buffer, RAW usage is too heavy and is too time-consuming to transfer the data from the acquisition buffer to the memory card, stopping the shooting. Calibrated auto focus is set to continuous mode or 3D Focus with 9 active collimators. The exposure metering [AE] is locked for the entire shot to avoid calculating the white balance for each picture.,

In less than ten minutes, no less than 4300 images were acquired covering the entire undercuts and details of the model.

Reliquary of Saint Jacques : cross polarisation photogrammetry

The reliquary foot of Saint-Jacques le Majeur from the treasure of Hugo d'Oignies, belonging to the collection of the King Baudouin Foundation, on deposit at the Archaeological Society of Namur, is preserved and exhibited at the TreM.a (Museum of Ancient Arts of the City of Namur). Executed by Hugo d'Oignies, a talented goldsmith, between 1226 and 1238, this reliquary made of silver, gilded copper, gems, pearls and enamels is supposed to contain a bone of Saint-Jacques le Majeur. This reliquary is part of a set of remarkable pieces that constitute an invaluable treasure.

The reliquary in the shape of the foot of Saint Jacques is conserved at the TreM.a in a secure showcase. In order to carry out the photogrammetric survey, as an exceptional piece of art, it is impossible as an operator to move the reliquary outside the conservation room or to handle the object without the help of the curator. The materials making up the reliquary of the foot of Saint Jacques are extremely reflective. The 3D acquisition of such pieces generally requires the use of a matte coating to obtain suitable reconstructions, but these products are strongly discouraged in the case of museum pieces (risk of contamination or deterioration of the artefacts) and require the intervention of a restorer for subsequent complete cleaning.

As the reliquary was the centrepiece of the project's acquisitions, it was impossible to eliminate it from the list of points of interest. In order to respect all the constraints linked intrinsically and extrinsically to the object, it was decided to proceed with a cross-polarization photogrammetric acquisition. The cross-polarization photogrammetric technique uses a circular polarized filter on the camera lens and a linear polarized filter on the light source. The two filters placed at 90° to each other allows the almost total elimination of reflections and to partially recover a specular map. The lighting device used was two Litra Led Light mounted on the camera's flash shoe with filter add-on.



Fig. 2. On site situation of the Saint James foot reliquary, and the Sketchfab final model (© PANORAMA)

The acquisition took place in the object's conservation room. The reliquary was handled solely by the museum curator and placed on a table that was made available by the museum. Since it could not be handled in all directions, it was decided to reconstruct in 3D sculpting the arch of the foot that could not be reliably acquired as shown in Figure 2.

Belfry : terrestrial, aerial photogrammetry and TLS

Initially called "Tour St-Jacques", the belfry of Namur, an entirely circular tower made of limestone blocks, was built in 1388. It took on its present appearance in the 16th century by reducing the height of the walls and removing the crenellations, thus condemning the last two floors in favour of a bell tower. In 1841, it was equipped with a municipal public clock. The Belfry was listed by UNESCO as a "World Heritage Site" in December 1999.

The belfry is located in the centre of Namur, behind the town hall, on a small pedestrian square, next to other buildings. In order to guarantee a total coverage of the surface of the building, it was decided to use several techniques: terrestrial photogrammetry using several lenses for details, aerial photogrammetry using drones for the upper parts and the roof, and a Faro Focus S350 for the entire building and the surrounding environment. Lasergrammetric acquisitions make it easy to guarantee the correct sizing of the building, while photogrammetric acquisitions make it possible to obtain a higher quality of appearances.

All three techniques were performed at the same time in half a day. The terrestrial photogrammetric acquisitions were carried out with a Nikon D810 on tripod equipped with different lenses according to targets: facade (50mm F1.4), gutters (70mm F4.5), and details (200mm F2.8). About drones acquisitions, the operator used a 20mpx sensor quadrirotor, manually guided to best follow the roof's geometry. The scanner was used at several different heights as well as on the terrace of a building adjacent to the tower. The three acquisitions were merged in Capturing Reality as shown in Figure 3 to obtain a consolidated model with high measure precision and high texture quality.

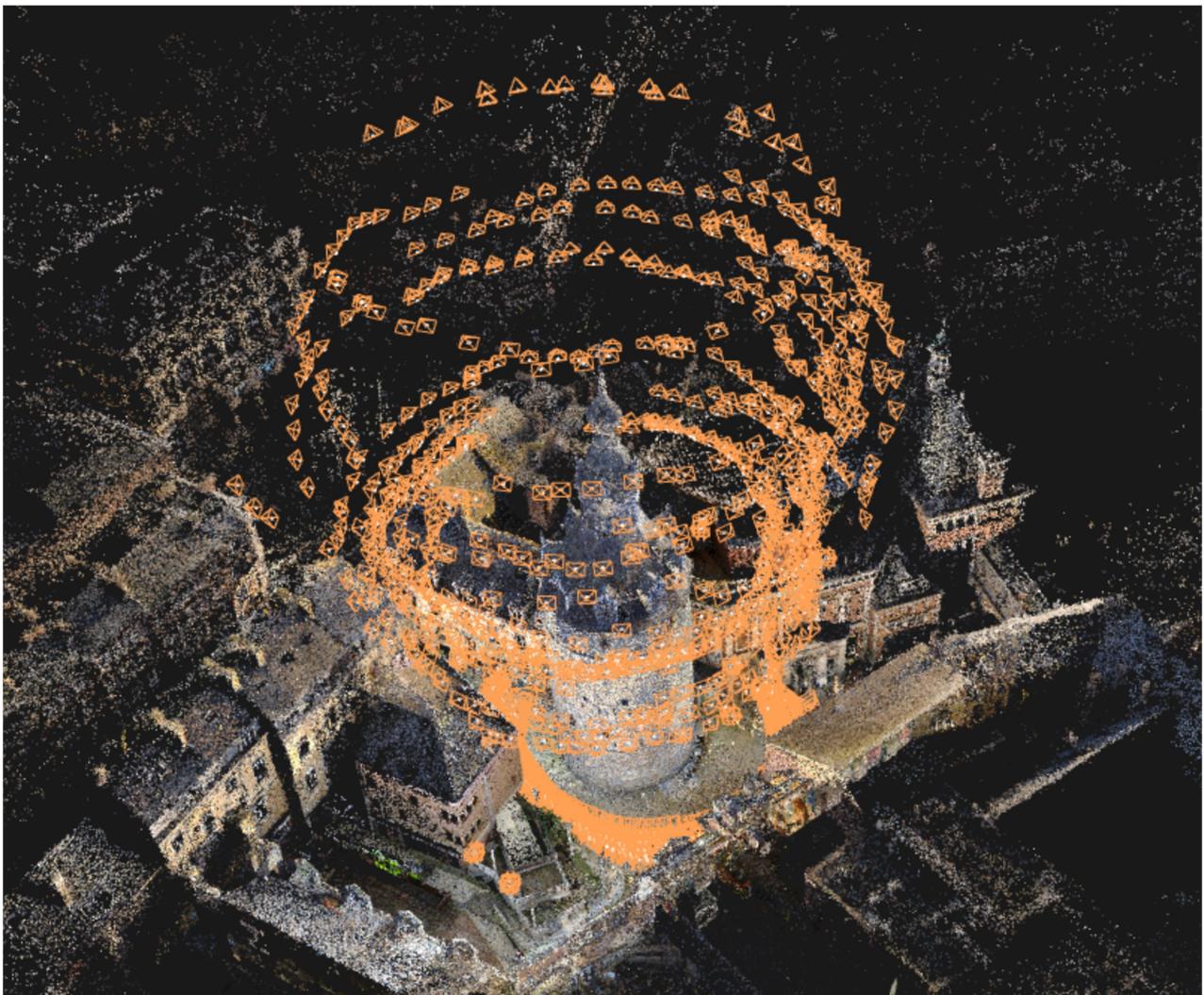


Fig. 3. Belfry acquisition positions in photogrammetric reconstruction software (© PANORAMA)

Conclusion

Photogrammetry is a surveying technique that is as broad in its application as conventional photographic techniques. It requires a thorough knowledge of the acquisition methodology in order to adapt the survey method to the object. It seems impossible to use only a unique survey method: it depends on the nature of

the object, its materials, its size and the context of the survey, not to mention the possibility of merging data from several types of acquisition equipment.

The mission presented here only touches on the different techniques that can be implemented within a specific mission but lets members of the team create workflows to manage some special texture maps or merge different types of acquisition sources to obtain better assets. Those workflows were added to the 2021 updated training course that the platform organises at the Brussel's university to share with the new students a new way to manage acquired data through those particular datasets. It should be noted that in addition to the use of scanners and airborne UAVs, it is also possible to use automated photogrammetric rigs with one or more devices, to carry out macro photogrammetry or multispectral photogrammetry, and to merge data from underground radar, satellites or underwater UAVs. Modern photogrammetry is no longer limited to the sole use of the camera and its field of action concerning archaeological and heritage surveying continually pushes back the technological limits of three-dimensional reproduction.

References

- Luhmann, T., Robson, S., Kyle, S., Boehm, J. (2013). *Close-Range Photogrammetry and 3D Imaging*. 2nd ed. Berlin: De Gruyter
- Hallot, P. 1 and Gil M. (2019). Methodology for 3D Acquisition of Highly Reflective Goldsmithing Artefacts. *DIVA – Art, Archaeology and Heritage Research Unit*, Liège.
- Guillaume, H.-L. and Schenkel, A. (2019). Good Practices Necessity on 3D on-line Museum. Models Publications. Quality Chart for Museum Photogrammetric 3D Asset. *Proceedings of the 24th International Conference on Cultural Heritage and New Technologies 2019*, Vienna, 10 pages.