Battery Aachen

Using Landscape Reconstruction for On-Site Exploration of a World War One Military Unit

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***Abstract*—This short paper shows the work that has been done in collaboration between Visual Dimension bvba and the Raversyde Museum for the reconstruction of the military site of the Battery Aachen, giving some hints of the further development of the project.**

***Index Terms* — landscape reconstruction, 3D modelling, heritage valorisation, virtual reconstruction, war heritage.**

I. Introduction

Battery Aachen is the only preserved coast battery from the First World War in Belgium. It was a military unit built by the Germans who invaded Belgium in the summer of 1914. Battery Aachen is located at Raversyde, a village on the outskirts of Ostend, Belgium. It was constructed on the former Royal domain, founded by King Leopold II in 1904.

The battery contained 4 cannons, 2 observation bunkers with telemeters, quarters for officers and soldiers, ammunition depots, bombproof shelters, small rail tracks for ammunition transport, etc (fig. 1). Because of several attacks by Allied ships in the end of 1915, some infrastructure was reinforced. In the summer of 1918 the Germans left the battery and finally surrendered in November 1918.

Fig. 1: A part of Battery Aachen in 1915

In the Second World War, the battery was re-occupied by the Germans and integrated in the 'Atlantikwall'. This 'Atlantic Wall' was a defence frontline of 2.685 km starting from the very north of Norway to the Spanish border.

The domain Raversyde also contains the Battery Saltzwedel Neu constructed in the Second World War next to Battery Aachen. In total, the domain contains 60 bunkers, 2 km open and underground trenches, observation posts and gun emplacements. These are accessible to the public in the open-air museum 'Raversyde Atlantikwall', owned and operated by the Province of West-Flanders and are part of the European project WWII Heritage.

Our tasks were firstly to reconstruct Battery Aachen in 3D in its original form in 1915 and after the reinforcements in 1917 as realistic and detailed as possible and secondly to propose and create applications from this virtual reconstruction which can be used in the updated open-air museum in 2015-2016.

II. Reconstruction

Because there is very little archaeological information and no detailed study of the building remains, the virtual reconstruction was not easy. Luckily, there is a good amount of photographic sources available as the Germans documented their military activities in detail. We started by sorting out all available photographs of the Battery site by presumed date and location where possible. The aerial photographs helped a lot on localising these terrestrial photographs (fig. 2). Some photographs were clear and sharp, others were blurry or badly exposed, as photography was still a young discipline at that time. Additional photography of similar batteries and equipment at nearby sites was collected too. In addition, some textual descriptions (by spies) and a few technical drawings of the equipment were available.

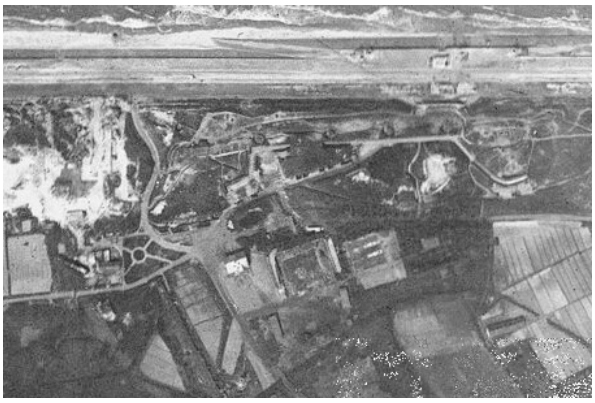

Fig. 2: Aerial view of Battery Aachen in April 1918

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The second step was analysing and correlating the images, the building remains and the other sources. Together with the experts of the museum and the Province, we discussed every photo and text available. Of course, not everything was immediately clear and therefore drawings and 3D helped to interpret the sources in an iterative way. In a few cases, an external specialist on WWI was needed to provide information and help with the interpretation. After more than 10 meetings we came to a 'final' virtual reconstruction of Battery Aachen in 1915 and 1917.

A. Landscape

In the past, we have made some major landscape reconstructions and therefore we know more or less the process [1] together with its strengths and weaknesses (Ename abbey reconstruction [2]).

The reconstruction itself was not easy because the current landscape of the battery is dune landscape that is quite different than it was in the 1915-1917 period.

We first defined the area to reconstruct (defined in 3D by square planes). We received the current terrain as a 3D mesh and converted it to a grey-scale height-map so that we could alter the terrain via digital painting in Photoshop. Modifying the terrain easily was necessary not only because the dunes were quite different 100 years ago but also to provide sufficient flexibility to shape the dunes as seen in the photographs.

Defining the vegetation was also done through brushing. These vegetation maps were loaded into the landscape software (E-on Vue) that creates highly realistic 3D vegetated landscapes with animation, fractal ground textures, water animation and sky with cloud animations. In this software we define for each terrain type the plants, their position and distribution. When the landscape is fully defined, the vegetation is populated in a procedural way all over the terrain (fig. 3).

Fig. 3: 3D landscape reconstruction of Battery Aachen

B. Buildings and objects

All buildings and objects were modelled and textured via free, Open Source 3D modelling software (Blender). The modelling of the cannons, observation bunkers, barbed wire fences, telemeter and living quarters of the officers and soldiers was a huge task not only because not everything could be interpreted properly on the photographs, but also because those structures were covered partially by the dune landscape. Reconstructing two periods in time made it even more complex as the 3D models needed to be consistent over time, fitting with the building remains and all other available sources (fig. 4).

Some objects that could be seen on the photographs were also modelled, based upon similar objects (from photographs, plans or preserved objects) or simply from the photograph (fig. 5). In some cases, it was difficult to define the material from the unsharp, black and white photographs.

In any case, the interpretation of all sources and the formulation of hypotheses that fitted with the terrain and the expert knowledge benefitted heavily from the 3D aspect. Doing the same job in 2D on maps and aerial photographs is simply impossible.

Fig. 4: Detail of the 3D reconstruction of Battery Aachen

Fig. 5: Photograph of a remaining artillery position

C. Verification

When the 3D model was ready, it was verified by rendering multiple views that fitted with the most important old and new photographs (fig. 6). This verification is not only a check of the correctness of the 3D model but is also necessary to make visualisations of the 3D model fit with the reality on site (see chapter IV).

III. Documenting the interpretation process

Battery Aachen is quite unique as it is one of the only remaining structures of the German coastal defense system in Europe. The virtual reconstruction of Battery Aachen therefore has not only an added value for visitors at the Raversyde site, but is also interesting for scholars on WWI and everybody interested in the first World War. Therefore, we are documenting the interpretation process of the virtual reconstruction of Battery Aachen in a blog [6].

This blog serves also as a teaser towards the general public, stimulating them to visit the Raversyde museum and site. For this purpose, we also provide rendered animations [7] that try to emulate the view and the atmosphere of Battery Aachen.

IV. Future applications

The 3D model of Battery Aachen will be used in several ways on site and in the museum. We list here some possible ways to use this detailed 3D model in the near future.

Fig. 6: Observation bunker of Battery Aachen in 1915

A. Panoramas

The procedural landscape reconstruction, as generated by Vue, is an extremely complex 3D model that cannot simply be exported from the application. A simple way to use this complex 3D model is to render a set of panoramas that not only show the richness of the reconstructed scenery, but also give a good feeling for the spaces and the landscape.

We already made a panorama application from the landscape reconstruction of the Ename abbey [2], which is installed in a kiosk with touchscreen, located next to the archaeological remains of the abbey. The panoramas are selected from an aerial view on the 3D model, showing the whole site. The panorama viewpoints can be situated on the terrain (giving a good feeling of the location) or slightly raised (giving an overview of the area). Scrolling with the finger over the panorama enables you to look around.

Such a panorama application [8] can link to video ‘themes’ that tell stories about the people who lived there, or to info panels that show additional images with text. The application can be implemented on a kiosk with touch screen or on mobile devices such as tablets and smartphones.

For Battery Aachen we suggest to use iBeacons. iBeacons are very small devices that send wireless Bluetooth signals to mobile systems to ‘trigger’ an activity on that system.

The idea is to walk around with your tablet or smartphone on the open-air site. When the visitor comes close to an interesting spot, a signal is sent to their device, which launches the 3D rendered panorama of the 1915 reconstruction with the same orientation as the visitor. They can look around and see/compare the current situation with 1915. On that panorama there are hotspots that can be triggered to see for example the situation in 1917 or to get more information about a specific part of that panorama, such as the cannon, which is absent today. We will start testing this system in the coming months.

B. Real-time visualisation

One important feature of the landscape reconstruction method that we developed [1] is that the full landscape reconstruction is documented on a more abstract level (i.e. the terrain types and vegetation maps). This allows rebuilding the landscape for real-time use [4] in a highly optimised way.

We are currently finishing an interactive walkthrough (pilot project for an educational game) in and around the abbey of Ename in 1290 [3]: a short throw projector shows on large screen the 3D environment that the visitor is exploring. The visitor is standing in front of a Kinect2 camera that reads the body movements and gestures that allow interacting with the 3D environment (for example, lifting the right arm makes the user go forward in the environment). Besides navigation in the virtual environment, objects can be selected and manipulated. This ‘natural interaction’ system can also be used by guides to show around groups in the virtual reconstruction of the abbey.

In case of Battery Aachen we could provide something similar. We have already made the terrain, models and vegetation layers so the process of creating the real time version of this 3D landscape reconstruction is pretty straightforward.

We could install this real time setup in a room in the visitor centre and have guides with a group walk around in the 1915 and 1917 reconstructions, experiencing with video / sound / interaction the history and function of Battery Aachen, after visiting the real remains in open air.

C. Interactive 3D print

Today it is possible to print high quality 3D models at a reasonable cost, even for large models. We developed a methodology (called Virtex Light [10]) to make 3D prints of monuments and sites interactive and applied this in 2014 to the Ara Pacis for the Keys2Rome exhibition [5]. This printed Ara Pacis model is about 45 cm wide and contains push buttons that trigger information, displayed on an LCD screen placed next to the model [9]. On the screen, the textured 3D model is visualised, together with additional photographs and text (which can be spoken and/or written).

In this way, the 3D printed physical model becomes an appealing storytelling device. For Battery Aachen, the proposal is to print the whole site with its dunes, coast, and infrastructure as one model in 3D, with integrated buttons, indicated by light shining through the model (fig. 7).

Fig. 7: 3D model of Battery Aachen (1917) for 3D printing

V. Conclusion

This was our most difficult landscape reconstruction project yet in terms of complexity. The difficult interplay between the complex building structures, the terrain and the vegetation were pushing the boundaries of what is practically possible in procedural landscape reconstruction in 3D and resulted in a labour-intensive high precision fine-tuning of vegetation (many thousands of plants and trees) and many 3D elements.

For the first time, we were able to reconstruct mainly from photographs, for which we could rely on an impressive collection that was painstakingly assembled by the curator of Raversyde and the project coordinator of this project. Working from photographs has its own specific advantages and problems and could be improved by tools that help to measure. Improving the scanning of old aerial photography probably can help also to improve the details and the dynamic range.

This project is a very good example of 3D reconstruction as a research activity of which the results nevertheless can be re-used for public presentations in the museum and on site (for which we made three proposals).

This project shows also that virtual reconstruction can recreate a site not only in its historical complexity but also in its historical landscape structure, yielding a realistic and believable 3D model that helps to tell the story of this important place in a crucial moment in history.

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All URLs were checked on 27/05/2015.