Remote Research through the Modeling and Reconstruction of a Medieval Monastery Site in Languedoc

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ABSTRACT

The Benedictine Abbey of St. Pierre of Psalmodi (known as Psalmodi), near the walled city of Aigues-Mortes, has lain in ruinous condition since the early 18th century. Like many similar sites, archaeologists and historians are able to glean many facts from digging and research, yet their ultimate understanding of the site has been hindered by how difficult it is to visualize the many phases. The current project aims at providing the researchers (and eventually the public) with better visualization tools: a vectorized state plan with an elaborate layer structure, a 3D state model, and a simple massing model of the six major phases of the site. This phase was completed in September 2004. The data is shared by the researchers (scattered over the US and Europe) via the web and also via direct sharing of the larger files.

The prior computer graphic work at Psalmodi, which was discovered and first excavated by a small British/American team in the 1960s, took place in 1996. In that campaign the site was re-surveyed with an electronic theodolite and the first CAD plan (showing topography and the outline of historic features) was assembled by the primary author. However, no three-dimensional models were constructed. The 2004 campaign, which is the subject of this paper, has addressed that lack of three-dimensional information.

It is our hope that the project might serve as a template for other similar archaeological sites which are in the process of synthesizing their data. The platforms used (micro-computers) and software (Auto CAD, 3d Studio Max, Macromedia Flash etc.) are intended to be widely available; the modelers had software and architectural expertise but no especial archaeological knowledge. In this way the project can be a prototype for the small or medium sized excavation's research team. Both the budget ($12,000) and the amount of time needed (2.5 months – 1 director, two assistants) were reasonable alternatives for such excavations – with the reward that the researchers have a greatly facilitated understanding of their subject. A 2005 season is projected which will involve more detailed 3D modeling based on individual architectural blocks from the various phases of the abbey.

1. THE MONASTIC ISLAND AND ITS ARCHITECTURE

The Benedictine Abbey of Saints Peter and Paul at Psalmodi had its origins in the 8th C AD[1]. The estuary island of Psalmodi, now a rise of ground in a marshy area, shows evidence of Iron Age occupation, possibly as a seasonal fishing station. However, it was the long (from the 8th C to the 14th C) and troubled building campaigns of the abbey church and its cloister, refectory and other attached elements which concerns our visualization project. After its destruction in 1704, the site became a quarry for building material, and a eventually a *mas*, or farm estate, was built over its remains.

2. THE EXCAVATION

A single group, affiliated with Williams College in Massachusetts, has worked at the site for over 40 years. In that time we have seen several owners and archaeological keepers. The significance of the site, originally thought to be a single nave Gothic building, emerged in the 1970s, as the Gothic phase proved to be a large structure with side aisles and the pre-Gothic church remains were discovered under the Gothic paving (see fig. 1 for an overview of the site in 2004). The excavation has been seen as (and continues to be) primarily a "learning" excavation, and the list of students participating who are now involved in preservation, art history and related endeavors is impressive. Although the site is mentioned in several tourist guides, it is still in private hands and is not exploited for tourism.

3. THE EARLIER DIGITAL PLANS

In 1997 during a brief campaign at Psalmodi I remeasured the site using a total station[2]. After establishing 5 fixed polygon points and measuring about 25 pass-points we verified that the hand-drawn 1:50 state plan was accurate within all reasonable standards. I created a simple CAD topographic plan (not yet calibrated to absolute heights or for optimal orientation).

1 For the history of the Abbey, see Boudurand 1882, 53-165; Goiffron, 1895, p. 5-34, p. 239-268; Grubb, 1975.

2 The 1997 measuring project was directed by Elizabeth Riorden, assisted by Sebastian Heath and Michael Baumann.

4. THE 2004 CAMPAIGN

4.1 PLANNING

In 2003 the core group of archaeologists and I established priorities for the 2004 digital project to be conducted by the University of Cincinnati architecture group, utilizing CERHAS – the University's "Center for the Reconstruction of Historic and Archaeological Sites". My own conviction is that the site is *under-visualized*, due to its ruined state and the complexity of the monastic development. Since the beginning of the excavation there had been an historic lack of interpretive three-dimensional information. In addition, I wanted to find out what could be done for a relatively modest amount of money. We reached a consensus about how to proceed in 2004: first priority was the creation of a detailed CAD state plan. The second priority was to find a way to create a 3D CAD "state model" and to find a way to make the result more accessible for those not adept at CAD.

4.2 DIGITIZING THE PLAN

In June 2004 we commenced with the digitizing of the plan, using AutoCAD[3]. The 1997 digital plan did not show stone-by-stone detail, so this was our goal. The north-south orientation of the digital plan (which was arbitrary) was changed to a church orientation and a 10 m grid was established with alpha-numeric tags. We transferred this grid to a new CAD file. Next, we took all verifiable 1:20 scale detail plans and tagged them with a code that identified their location relative to the 10 m grid (such a systematic drawing naming had never been done). A similar procedure applied to any elevation drawings, for use in the 3d phase of work. The tagging allowed the quick calibration of all the detail plans, scanned as Jpegs and imported as raster images into the 2d CAD master file (or plan). We created the digitized stone-by-stone plan using polylines and layering, for control of line weights and chronology.

4.3 THE SITE WORK

We traveled from Cincinnati to France at the very end of June and stayed at the site for 10 days. We had several objectives: to search for any missing documentation in the field archive, to verify the few plan discrepancies, to photograph all walls with a tagging system for future use in the 3d state plan, and to undertake an educational survey of important medieval sites nearby, in order to understand and visualize the architectural context.
While at the site, Director Brooks Stoddard explained the series of buildings which had existed on the site, and from this conversation sprang the idea of making a simple CAD massing model of each phase, and perhaps animating it to show the growth.

4.4 THE 3D STATE MODEL

We reconvened in Cincinnati at the beginning of August, and began the next, more challenging part of the project: the 3d state plan. Since my decade of work at the site of Troy, essentially bringing it into the digital world, I had grappled with the degree of difficulty presented by modelling a ruin. There are so many indeterminate shapes, surfaces and relationships. Our idea with Psalmodi was to attempt a level of detail and degree of abstraction which would allow us to combine the stone-by-stone plans and elevations together in one file, with the by-product being a semi-realistic model. However, the idea is more that of a 3d information archive than a visualization. Photography works quite well for seeing a ruin, but a photograph by itself is not interactive, and that was our goal. The exact process of doing this was unknown to us, and Brad French and Emily Hatch tried many experiments before they hit upon the feasible solution, using solid modelling, Boolean procedures and careful editing. To summarize the process: first, rough wall solids were created by extruding and intersecting closed polylines representing the plan and elevation data; second, each stone was extruded 1 centimetre and applied to the top and side surfaces of these wall solids (instead of bit-mapping or bump-mapping) and finally, the walls were brought together in one CAD file (see fig.2). For rendering, the AutoCAD file was imported into 3D Studio Max.

4.5 THE 3D DIGITAL MASSING MODELS

As the 3d state plan was underway, we began the simple exterior massing models. Brad French modeled the 6 phases (from a hypothetical early Christian chapel perhaps concurrent with the first diocese of near-by Maguelone in the late 6th C, to the late Gothic phase) from simple free-hand axonometric sketches which I drew at about the scale 1:500. The models are meant to be seen as "sketch models" as all detail is absent, and even the basic shapes are of course debatable.

3 **The work beginning in June 2004 was directed by Elizabeth Riorden, with the participation of Bradley French and Emily Hatch.**

It is not meant to be definitive, but to improve 3d understanding of a complex series of buildings, and allow insights resulting from illustration of attempted ideas. At their unveiling, so to speak, among our small research group the sense of finally "seeing" Psalmodi, after so many years or days at the ruined site, was striking. This is my own argument for illustration as a part of the scientific and analytical process

4.6 THE WEBSITE

As I state in the section on planning above, one of the priorities established in our 2003 planning session was the dissemination of the digital results to at least the group of scholars working on the site. The site owner does not wish at this time to make such material available to the world via the Web. But that did not preclude using the web, in a set of un-tagged pages, as a way to make the material available. The biggest problem is still the inaccessibility of CAD to those who are not trained in its use. We know that other options are available, but we did not have the resources in 2004 to investigate these in depth, and so this will continue in the future. As a step one of the process we created a very simple website (using Macromedia Flash). The plan is tabbed so that different phases can be seen, or all information together. It is possible, by clicking, to get a more detailed plan view. There is a similar capacity with the 3d state plan, however free rotation is not allowed, so we chose 2 main diagonal view points for the pre-rendered views. Perspective views are also offered. We used the same strategy of the 2 main diagonal views for the massing models, and the two short animations of the monastery's growth.

5. THE PLANNED 2005 CAMPAIGN AND THE FUTURE

With my new collaborators (Jeff Tilman, of the faculty of my School, and Travis Eby, one of our graduating BS Arch students) I plan to do the following:

a. pick up any changes to the massing models
b. discuss other approaches to dissemination of the models to the researchers
c. add the missing elevations to the 3d state model from the photos, using Photoshop for rectification and scaling
d. measure at the site many of the details and architectural fragments, for use in a much more detailed modeling of several of the key interiors from both the Romanesque and Gothic phases.
e. Pursue preliminary SQL uses of the 3D State Model.
f. Prepare material to use in a larger grant application for the year 2007.
g. In this way I hope that we will be able to grow the digital project as the research, conservation, display and publication on Psalmodi grows.

REFERENCES

BOUDURAND, E. (1882) – Statuts particuliers de l'abbaye de Psalmodi. In Mémoires de l'académie de Nîmes, p. 53-165.

GOIFFON, E. (1895) – Psalmodi. In Revue de Midi, p. 5-34, 239-268.

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FIGURES

Fig.1 – The remains of the abbey church of Psalmodi in July 2004.

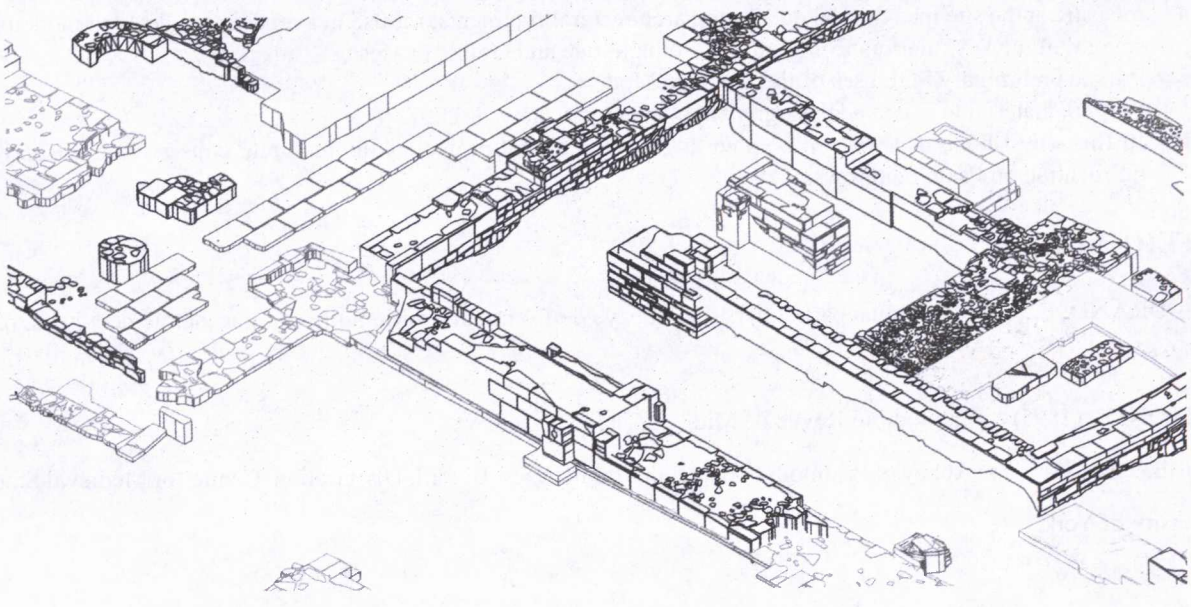

Fig. 2 – A detail of the Psalmodi "3D State Model".