Labyrinthine Digital Histories

Interpretive, Extensible and Referential

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Abstract: Interactive and media-rich digital representations are being increasingly used to offer passages through time and space, a role that was traditionally supported by travels and travelogues, maps, sketches, books and oral histories. In the last two decades, a number of projects have been implemented using digital media with the aim of recording past and extant artefacts and environments. However, the future of such digital past remains as fragile as the memories and moments it tries to capture. There is a need to go beyond creating introverted and closed historical reconstruction projects. This paper surveys significant issues and describes our ongoing work in developing an interpretive, extensible and referential framework toward virtual reconstruction projects.

1 INTRODUCTION

Viewing the Chartres cathedral from a distance with its twin towers and the green roof soaring above the corn-fields, or walking along its rows of flying buttresses or viewing the interior columns soaring up toward the vaulted ceiling, one soon realises that this is a place where architecture transcends a mere act of building. The apparent stability of architectural elements and masses plays against the changing light and sound creating a moving experience. Since architecture as tangible and measurable shapes is accessible through geometric representations, it is only too tempting to use it as scaffolding for representing architecture. That is, in fact, how we initially began work on a project on digital representation of the Chartres cathedral.

Based on selected literature on the cathedral and published drawings, work on a detailed three dimensional model was initiated. The model is an approximation of proportionally correct architectural elements at various levels of details (Figure 1).

While the work on the three-dimensional model is progressing, it has become increasingly clear that such geometric representations though useful may actually convey a misleading degree of completeness and finality that hides many discontinuities and fragmentary knowledge about the cathedral. For example, the cathedral building program lasted over thirty years. About nine separate teams of masons with up to 300 people each worked on the project, carrying out works that

lasted for varying durations from a few months to a couple of years. The spire of the second tower flanking the main façade was built 350 years later than the rest of the structure. There are competing arguments that suggest different sequences of construction. The conjectures about the lower level crypt await further resolution. Whereas the modern gaze roams almost unobtrusively over, around and inside the cathedral, it was not always the case. The cathedral was used and experienced differently by the people of Chartres depending on their social status.

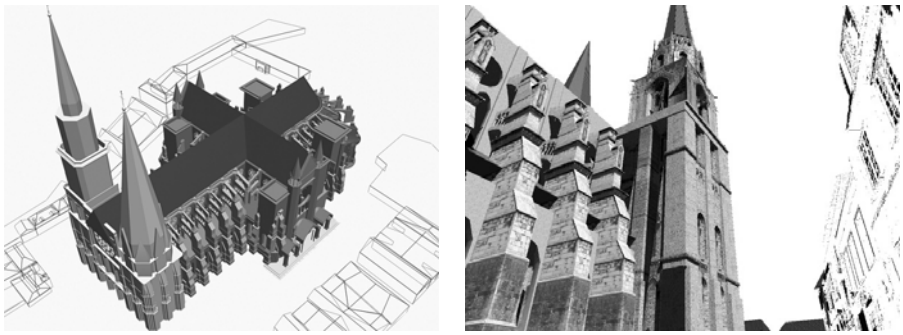

Figure 1 Digital model of the Chartres cathedral

As Favier (1990) noted: "A cathedral is quite different from a well-defined painting, which the painter can varnish once he has completed it. Because it is alive, the cathedral – and Chartres more than most – is never complete (…)" As a result, the material, temporal, typological and historical aspects of architecture do not lend themselves to traditional and isolated geometric representations using digital media. These observations motivate a research program on historical architectural reconstruction outlined in this paper. Briefly described, we seek to develop digital representations in reconstruction projects that suggest *evolving commentary of arguments* or *interpretations* rather than *conclusive documents*. That, in turn, requires an *extensible* and *referential* framework of information. Extensible so that information can be added to it over time. Referential so that information can be reused and referenced using pointers to relevant internal and external information and sources. To investigate how we might develop extensible and referential interpretations, the following section begins with a survey of key ideas and developments that have guided recent digital reconstruction projects.

2 THE PAST RECLAIMED

As Woodwark (1991) recounts, some of the earliest experiments in digitally supported historic reconstruction work originated as early as 1983 at the University of Bath. The work on modelling Roman Baths in that project represented the first known documented application of solid modeling and computer graphics for reconstructive purposes. The project involved an archaeologist and a team of

researchers in computational geometry. The model they developed used only one solid primitive – the planar half space – and did not include any facility for real-time interaction or animation. Since then over the last few decades, increasingly more complex and ambitious virtual reconstruction projects have been realised. Examples of such projects abound and they include historic sites from cultures and civilizations around the globe. Representative examples of such virtual reconstruction projects include the Dunhuang caves and the Xian terracotta soldiers in China, the Indus Valley cities of Harappa and the Mughal city of Fatehpur Sikri in India, the Egyptian pyramids and temples, the Mesopotamian stone tablets and palaces, the Greek agoras, the Roman forums and theatres, the Mayan and Aztec cities, the European cathedrals and the temples of Angkor Wat in Cambodia, and many more. Brief surveys of many of these projects are available in Forte and Siliotti (1996), Addison (2001), Barcelo et. al. (2000), and in the proceedings of a number of conferences in virtual reality, archaeology, and cultural heritage.

Interactive and media-rich digital representations are being increasingly used to offer passages through time and space. These projects in virtual reconstruction extend earlier traditions that relied upon travels and travelogues, maps, sketches, books and oral histories to analyse, record, reconstruct and communicate the past, present and future spatial environments (Figure 2). For example, Giambattista Piranesi, an Italian draftsman in the 18th century, drew not only the existing ruins of Rome but turned them into fantastic, visionary spaces populated with fragments of disparate elements from many archaeological sites. Piranesi's etchings are the hallmarks of historic and imaginary reconstructions. Subsequently, people such as Austin Henry Layard in 1840's established the modern tradition of graphic reconstructions in his work on the Mesopotamian archaeological investigations (Gilkes 2001). Luigi Canina in the 1850's further extended this tradition in studies of the Appian Way in which he created 'before' and 'after' drawings of the ruins and reconstructions. It was not until this century that a different sensibility appears in the discourse on such reconstructions, one which emphasises evidence, veracity of detail and *relativist* interpretations in place of a singular history marking a shift in how reconstructions are undertaken, understood and communicated.

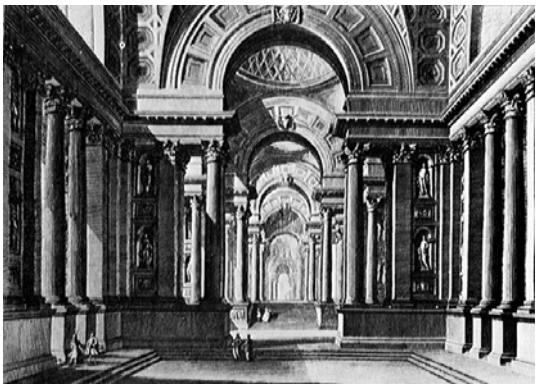

Figure 2 Reconstruction of an ancient temple by Piranesi

The introduction of digital media in historic reconstruction studies in the early 80's is marked by a shift to the visual of a different kind. The developments in digital technologies have led to virtual reconstructions that range from 'manufactured deficiencies' to 'manufactured intensities' (Gillings, 2002). The availability of powerful hardware and software enable development of three dimensional reconstructions with details of a higher order of magnitude than was ever possible before. The ability to interact with such information in real-time anywhere anytime opens many new opportunities to reprise the past.

3 FUTURE OF THE DIGITAL PAST

However, what is the future of such digital past? In most cases, it remains as fragile as the memories and moments it tries to capture. Some of the most problematic issues with digital reconstruction projects include the following.

- ***Multiple interpretive perspectives***: In the quest for sensually recreating a historical context supported by digital multimedia, virtual reconstruction projects often lose sight of the fact that what they portray are often provisional and competing perspectives. The discipline of archaeology emerged gradually from the 18th century obsession with collecting and categorising objects on the basis of stylistic logic, finally taking root in the 19th century as a modern discipline. The subsequent "processual archaeology" was a reaction against the preceding methodological apparatus of cataloguing and timelines. As Lewis Binford (1965), one of the champions of the new phase in archaeology, noted: "The archaeologist's task... lies in abstracting from cultural products the normative concepts extant in the minds of men now dead." It is also not just a coincidence that museums have increasingly come to adopt an interpretive role instead of just being the modern-day *kunstkammer* (cabinets of natural curiosities). This, of course, opens up the problematic issue of which version of description and explanation is being communicated in any reconstruction project. The implicit and explicit choices made in any virtual reconstruction are thus inextricably linked with specific worldviews and theoretical agendas.
- ***Source data, representations and uses***: Due to the need to accommodate multiple perspectives, it is essential to record and communicate provenance of data in virtual reconstruction projects. Further, spatial reconstruction projects of natural and manmade artefacts including buildings, involve use of multiple representations such as text, drawings, images, sounds, etc. Consequently such projects demand substantial resources to develop and hence evolve as one-off, hand-crafted initiatives centred on a mass of data that are rarely available or useful to any but the original and highly specific objectives. For example, most 3D datasets developed in such projects create and follow their own data schemes that are unique to those projects. In order to gain real-time performance increases, many datasets are also optimised for specific applications. As a result, most work remains one-off and rarely usable in other projects except at the level of the lowest common denominator, namely

geometric primitives or triangulated faces. Except perhaps for such geometric representations, it is usually not possible to access, extend or reuse such information outside of original project goals. Such problems of creating reusable data standards, semantic structures and databases are not unique to the virtual reconstruction community. The AEC sector is still grappling with development of data exchange standards. These issues are also faced by the professionals involved with cultural heritage information management (see for example the Getty Centre data standards and guidelines, online at http://www.getty.edu/research/conducting_research/standards/).

- ***Evaluation***: While significant efforts are directed at developing virtual reconstruction projects, there is a lack of critical methodologies for and results describing post-implementation evaluation or assessment. Unlike written documents, there is yet no tradition of critique and scholarship among virtual reconstruction community. An unfortunate outcome of this neglect is that it is difficult to abstract valuable higher level principles from isolated projects.

The implications of the above problematic issues are that many virtual reconstruction projects powered by the advanced hardware and software succumb to the 'software fog' (Niccolucci 2002) in which remaking history one pixel at a time hides the connection between concepts and representation. Thus projects become vehicles for displaying the technological virtuosity which no doubt dazzles even the most sceptical viewers but many of these projects become consigned to bit-rust no sooner than they are developed. Of the problematic issues discussed above, we have explored elsewhere why and how we might evaluate virtual environments in another project (Champion Dave and Bishop, 2003). In the following are discussed how we plan to investigate the other two issues.

4 INTERPRETIVE DIGITAL RECONSTRUCTIONS

We face a paradoxical situation in which the technologies to capture and generate data for use in virtual reconstructions are leaping forward (see IEEE, 2000 for a good review) but modelling such data in an extensible and reusable way while also supporting different perspectives on them is not advancing at the same pace.

We explore these issues through a prototype project using the Chartres cathedral as historical context, a fascinating example of architecture as book and a complex building project that is at once an institution but also a commentary on social and cultural values. In this project, we consider all digital representations of the Chartres cathedral as *evolving commentary of arguments* or *interpretations* rather than *conclusive documents*. That, in turn, requires such representations to be *extensible* and *referential* information. Extensible so that information can be added to it over time. Referential so that information can be reused and referenced using pointers to relevant internal and external information and sources.

To this end, we first identified the following set of features and operations that are essential to support interpretive engagement with information in this project. In this

stage, we focus not on the means (how these features will be achieved) but on the ends (what is to be enabled and why). The project should support:

- ***temporal sequence of assembly and interrogation of parts***: It will enable us to understand not just structural implications of elements like buttresses of the cathedral but also the very making of these elements and associated changes in labour and how continuities in construction emerged even when teams of masons and workers kept moving frequently from site to site.
- ***representations that support multiple levels of details at various scales***: It will, for example, help show the readability of iconographic program of Chartres as a text that can be read progressively from different vantage points.

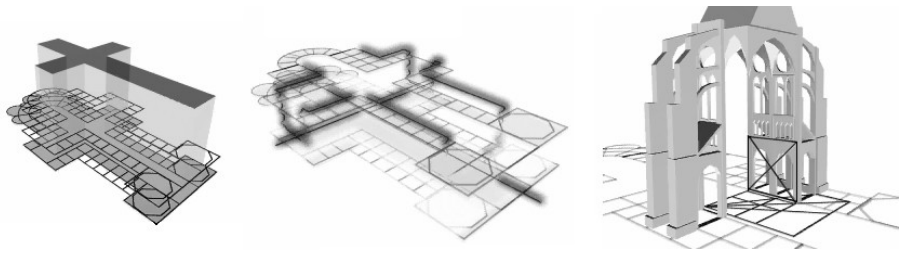

Figure 3 Examples of analytical representations

- ***Objects with parametric attributes***: It will support exploration of elements such as the curiously different towers flanking the main portal and their geometries, or how the modular ratios unite horizontal and vertical planes in the cathedral (Figure 3).
- ***Compositional hierarchy of spaces and objects***: It will help exploration of spaces of inclusion and exclusion, of rituals and social hierarchy, and how these are materially translated in the cathedral.
- ***Substitution and addition of objects***: The cathedral was the site of two separate fires and the main building program that lasted over 30 years. Similarly, much debate surrounds the illuminated windows some of which have undergone restoration at different points in time.
- ***Typologies and diffusion of concepts***: While the burgers of Chartres may have viewed their cathedral as the epitome of the Gothic expression, there are different versions of that Gothic that traversed along the cross-roads on which Chartres was located. This shows up as regional variations of Gothic not only in France but in Germany and England. Similarly there is a family of buttress designs that unites cathedrals dispersed in space and time in France.
- ***Accretion of information and authorship***: Almost all the information about the cathedral reflects serendipitous ways in which the cathedral has been reconceptualised as additional information was unearthed by different researchers. This process reflects not just a history of the cathedral but also the world views of those who added to this knowledge and their contemporaries.

- ***Multiple viewpoints and interpretations***: The views of the cathedral as it is today do not reveal the fact that most worshippers sat on the cold hard stones on the floor or on bales of hay. Neither does it reveal that unless one paid at the gate (no longer existing), one would see only the spires of the cathedral from outside the main wall. The viewpoints thus become a critical vehicle for understanding social hierarchy.
- ***Environmental conditions***: Some of the most interesting elements of the Chartres cathedral are illuminated windows which can be appreciated fully only with dynamic atmosphere and light simulation. Similarly sound plays equally important role in the cathedral. On a macro scale, the cathedral building boom in the 12th century saw the biggest deforestation and stone quarrying in French history. Thus the material history of these institutions is intimately tied with implications that went beyond the grounds they occupied in space.
- ***Objects with behaviours***: Dynamically scriptable objects and characters will help represent social codes and hierarchies for example by limiting and allowing access to various spaces of the cathedral. These will help with understanding cathedrals as social institutions that are different from contemporary conceptions. For example, ball games were played in the side aisles of the Cathedral when it was not occupied with religious service.
- ***Presence of multiple readers/visitors***: It will acknowledge other viewpoints, activities and interests thus supporting exchanges that were the accidental by-product of pilgrimages and festivals associated with the Chartres Cathedral.
- ***Extensible information structure***: It should be possible for this information to grow and for visitors to deposit additional information over time. This is quite similar to what the travellers and researchers do: create their own accounts that, in turn, inform and guide the others.
- ***Referential information structure***: It should be possible to retrieve the underlying structure of objects and their source data including authorship in the project so that such data can be commented upon, provided with an alternative, or referenced to other objects outside this project, for example, soil studies that explain why particular French clay used in the stained glass manufacture resulted in the peculiar *blooming* blues and reds.

4.1 Conceptual Framework

The preceding wish-list or building blocks of the ongoing project are currently being developed using small test bed examples in the first instance. As stated earlier, the intention is to identify a rich set of operations or features that will support interactive exploration of alternative viewpoints and information, and allow extension of the project information over time.

If this project description begins to vaguely resemble a *multidimensional Wiki*, it is closer to the spirit of the project than any other description we could envisage. The original design principles of Wiki include *open, incremental, organic, mundane,*

universal, overt, unified, precise, tolerant, observable and convergent (Cunningham, 2004). We extend these principles with a few additional ones to embrace Binford's call to *abstract from cultural products the normative concepts extant in the minds of men* by developing digital infrastructure that supports open annotated commentaries instead of isolated documents. Some of the ideas outlined above are implemented in various degrees in our work and others (see for example Kensek, Dodd and Cipolla, 2002; Snyder and Paley, 2001; Champion, Dave and Bishop, 2003).

Conceptually, we view virtual reconstructions as revolving around the three axes of spatial, temporal and knowledge-based annotations (Figure 4).

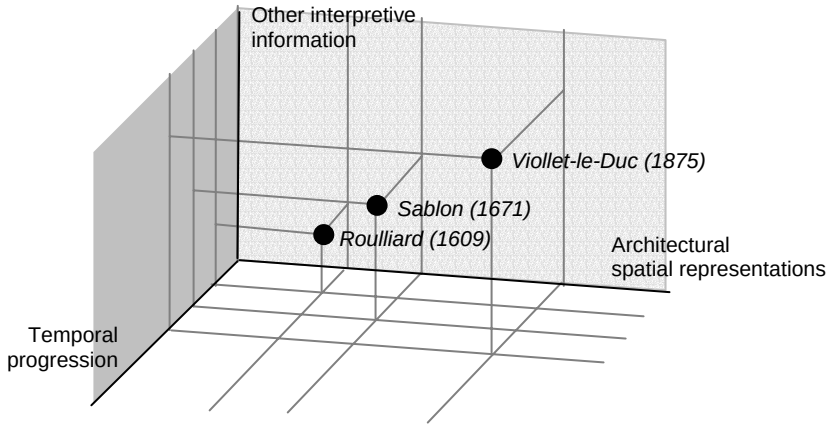

Figure 4 Reconstruction as accretion of understanding

In response, we draw upon ideas first promulgated in gIBIS (Conklin and Begeman, 1988), Wiki (Cunningham, 2004) and XML-based multimedia databases to develop a computational architecture (Figure 5).

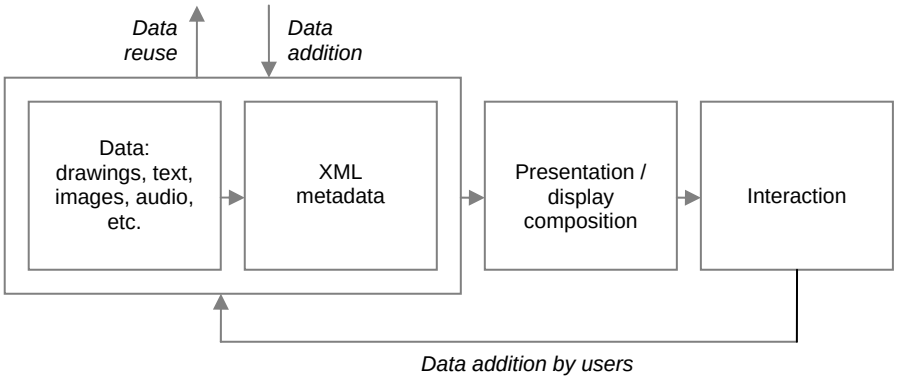

Figure 5 Framework components

The computational framework to support the above objectives separates data from the description of what they contain, and further both these are separated from how they can be composed in multiple presentation or display structures. Such a separation between data, their meanings, and presentation enables the possibility for reuse, extensibility and serving multiple compositional needs in the context of virtual reconstruction information. This framework is currently being implemented using data related to the Chartres cathedral documents.

5 CONCLUSION

Virtual reconstruction projects can become richer through labyrinthine narratives since histories are never complete and are continuously re-created and re-written as ongoing projects. To go beyond creating one-off and closed historical reconstruction projects, this paper outlined significant issues and described our ongoing work in developing an interpretive, extensible and referential framework toward virtual reconstruction projects. The framework suggested here offers a set of high-level requirements and a generic conceptual framework for virtual reconstruction projects using digital technologies.

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