

Architectural history and computing: developing a new discipline

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38.1. Introduction

This paper is concerned with recent technical advances which provide architects, art and architectural historians with opportunities to acquire a far better understanding of the design processes underlying the revered monuments of the past. The focus of the paper will be the research carried out by the Alberti Group, based at Edinburgh, and the work now in preparation for a major international exhibition on the Italian Renaissance architect Leon Battista Alberti.

38.2. Outlining the problem

Architecture derives from the intellect of an individual and the actions of the many: it is the tangible outcome of a complex creative process. This process is never easy to fully comprehend, especially after a lapse of time, while the outward forms which result are tactile, measurable and describable. Perhaps, because architecture in its totality is so difficult to grasp, most architectural commentators attach greater importance to the appearance of a finished building rather than the ideas behind its making. Yet, this can only be to the detriment of architectural debate, since intentions and processes are more primary than form, for they cause forms to exist and give them their significance and meaning.

Built precedent has always been an important source of visual and intellectual stimulation for architects, though history has been more often regarded as a commodity to be trawled, or even plundered, in order to justify or substantiate architectural responses, and has rarely been treated objectively. For example, we are all familiar with speculative overlays of line and geometrical outline on elevational drawings, and even photographs, of ancient and more modern buildings. Facades and plans are presented in this way to exhibit the underlying order and harmony which has been lost or obscured by passing time and alternative approaches to architecture.

As long as there are no guidelines as to how such investigations should proceed, approaches will vary, with variable results. But so many of these studies have been plain sloppy and indiscriminating that almost any geometrical or proportional system could be "proved" to work for a particular building. Consequently, this age old search for underlying natural principles in architecture has become debased and relegated by serious academics to the "loony fringe" of architectural history. This can only hinder the development of architecture. For the alternative to the serious study of process and the intellectual structuring of buildings is to describe surface and style. Architects have for too

long been trapped in a cycle of criticism concerned with marginal rather than major issues, and continue to be so.

So how do we move forward? One way, would be to make the links between art historical method and architecture more effective. Architectural history is a relatively new discipline which has developed out of art history. However, there is now a new breed of historians-cum-architects who have been trained as professional architects and who understand the theory and practice associated with designing and building. Rather than maintaining the separateness of the 'art' of history and design, and the 'science' of building, there is the potential for integration.

38.3. Computer technology and photogrammetry

The move in this direction has been aided by advances in computer technology and the use of photogrammetry. It is now possible to be much more objective about the physical evidence of the buildings themselves and to test theories more rigorously and consistently using photogrammetry, a technique which supplies precise and verifiable measurements. Photogrammetry has great advantages over the traditional tape and theodolite method which is time-consuming and produces measured and measurable lines rather than a series of points in space. Consequently, with photogrammetry it is possible to follow lines of settlement with older buildings and determine whether or not the architect's design has been distorted by the passing of time.

As well as providing a high level of accuracy, photogrammetric survey results are readily verifiable. To check a survey it is necessary only to return to the set of original photogrammetric prints, from which any number of plots are possible within the controlled environment of a studio. No longer does the historian need to be frustrated by the published results of traditional surveys of the same building which are notorious for their variances.

Armed with accurate and verifiable surveys of buildings the architectural historian can then make better use of the often sparse historical data — drawings, contemporary descriptions, written theory and precedent. Incomplete or radically altered historic buildings can be studied in considerable physical detail and reconstructed, or remodelled, on the computer to produce two dimensional line drawings, or as three dimensional models which may then be brought "alive" by being rendered and animated.

38.4. The Alberti Group

The Alberti Group has been actively engaged in this process over the last three years in preparation for an international exhibition sponsored by Olivetti of Italy on the

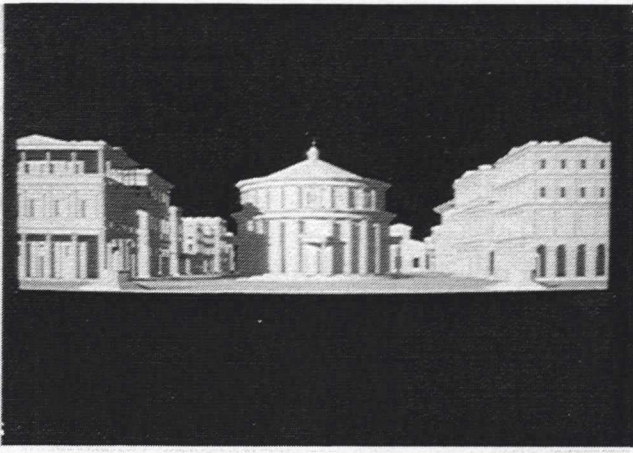


Figure 38.1: Reconstruction of the "Ideal City" painting in Urbino as a three dimensional model.

intellectual and architect Leon Battista Alberti (1404–1472). The Alberti Group was formed to research and represent Alberti's ideas, expressed in his Latin architectural treatise "On the art of building in ten books" (Rykwert et al. 1988), and to compare his architectural theory and practice.

Alberti has suffered a bad press from historians, not least because none of his buildings were finished in his lifetime, or have been drastically altered by subsequent architects, *i.e.* extended, modified, redecorated, and even neo-classicised. Alberti's last building, Sant'Andrea in Mantua, will be used to outline the difficulties faced, and to explain a) the process employed to reconstruct Alberti's design intentions (Rykwert & Tavernor 1986), and b) how computers were used to explore ways of communicating Alberti's ideas for an exhibition in a multi-media setting.

38.4.1. Sant'Andrea in Mantua

The Alberti Group commissioned photogrammetric surveys of Sant'Andrea and received this information in the form of AutoCAD drawing files. The surveys were carried out by Computer Mapping Services of Selsey. Using pc 486-based machines supplied by Olivetti it was possible to ma-

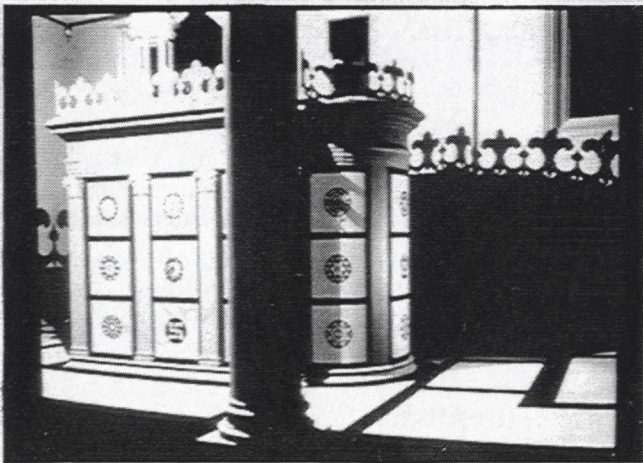


Figure 38.2: The Rucellai chapel and sepulchre in Florence, by Alberti.

nipulate these drawing files and to extract, with an accuracy of millimetres, any dimension required, such as a column width, door opening height, and minutiae of ornamental detail. These dimensions were converted into the official unit of measurement used in Mantua in the 15th century, the Mantuan Braccia, and the proportions of the building analysed and compared to Alberti's architectural practice elsewhere and the "ideals" expressed in his various writings.

This archaeological evidence, along with historical documents, such as letters written by Alberti, his patron and builders, and certain sketches, provided an important factual context for our reconstructions of Alberti's original intentions at Sant'Andrea. Using the three-dimensional capabilities of AutoCAD and AutoSolid, computer models of the reconstructions of the church were then built. The models were passed to the WAVEFRONT animation pack-

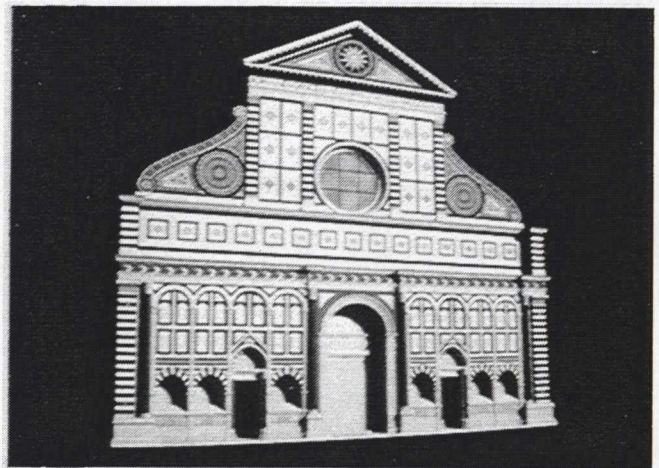


Figure 38.3. The facade of Santa Maria Novella, Florence, by Alberti.

age running on Silicon Graphics machines to create sequences which are intended to explain the building in its city context as well as details of the proportional systems employed in the building.

38.4.2. Image presentation

Some examples of the three-dimensional computer models generated for the exhibition are shown in Figs. 38.1–38.3. Visitors to the exhibition will be able to interact with this information directly, testing proportional and formal alternatives themselves and, technology permitting, perhaps creating their own views and movement paths through the building which would be rendered and shaded in front of them.

Using techniques like these, it is believed that it will be possible for a greater range of people to comprehend more completely developments in proportional theory and design processes in Renaissance and other periods of art and architectural history. Thus, it is likely that the computer has a role in opening up the debate about design fundamentals and the art of architecture to a much wider audience than has been possible before.

The Alberti Group exhibition opens in Mantua, at Palazzo Te, in the late summer of 1994. It will employ traditional exhibition displays with videos, interactive computers, and computer derived wooden models. The Alberti Group of architects and historians is attempting to bridge the chasm between disciplines, and this exhibition will be an opportunity to test whether or not the attempt is likely to be successful.

Acknowledgements

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