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Rediscovering and modernising the digital Old Minster of Winchester

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ABSTRACT

The models and animations of the Old Minster, Winchester were remarkable in 1984–6 for producing the earliest animated tour of a virtual archaeological monument. Thought to be lost, thirty years on the original model files were rediscovered buried under layers of now unsupported code and recovered.

This paper describes how the models were initially developed in the 1980s and then subsequently retrieved, restored and re-purposed in 2015. The original project is re-evaluated in the light of contemporary best practice. In modernising the digital Old Minster this virtual model has also been translated into a material one in the form of a 3D-print. This physical instantiation of the model challenges conventional understandings of, and blurs the boundary between, real and virtual heritage. We contend that left unaddressed this lack of clarity is set to radically disrupt current best practice in the discipline.

> "Aethelwold also rebuilt the building of the Old Minster with lofty walls and new roofs, strengthening it on its southern and northern sides with solid side chapels and arches of various kinds. Similarly he added numerous chapels to house holy altars; these disguise the entrance to the main doorway so that if someone were to walk through the interior of the church with unfamiliar steps, he would not know whence he came, nor how to retrace his steps… On the Structure of the Tower. It has five stories fenestrated with open belfry windows, and it opens out in all four directions".
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> Wulfstan of Winchester, *Narratio metrica de S. Swithun, c.CE 996* (Translation Lapidge 2003, 376–7)

1. Introduction

The models and animations of the Old Minster, Winchester were remarkable in 1984–6 for producing the earliest animated virtual tour of a computer-generated interpretive visualisation of lost cultural heritage using experimental solid modelling software called Winsom (Burridge et al., 1989; Reilly, 1989, 1992 pp. 152–155). They were not the first models of their kind. A computer model of the Romano-British temple of Sulis Minerva in Bath was probably the first solid model of an archaeological reconstruction (Smith, 1985; Lavender et al., 1990; Woodwark, 1991). A pseudo-tour consisting of a sequence of key views was produced but it was not animated (see Reilly, 1992, 1996 for an outline of several early solid-modelling projects in archaeology).

In hindsight, the Old Minster project might be seen as the spark that ignited an explosion of creativity in producing and presenting hypothetical interpretations and reconstructions of cultural heritage to a broad-based, international audience in a virtual format. The combination of an internationally significant archaeological and historical site associated with the application of the latest'high-technology', promoted by a professional corporate communications officer at IBM, ensured this project made a huge, if temporary, impact. Certainly it was very successful in garnering the attention of a large, international, broad-based audience through broadcasters (e.g. BBC South Today, 1986), the press (e.g. Reilly and Weber, 1991), industry periodicals (e.g. Jones, 1988) and popular scientific magazines (Anon., 1987), museum exhibitions (e.g. British Museum 1986–7) as well as academic audiences in conferences and specialist publications (e.g. Reilly, 1989; Reilly, 1992, pp. 152–154).

Of late, we have detected a marked and growing interest in taking stock of the early days of 3D modelling of cultural heritage (e.g. Wittur, 2013; Messemer, 2015). In recent years one of the authors (Reilly) had received several unfulfilled requests for copies of the *Old Minster* models which were thought lost. A chance discussion between Stephen Todd and Andrew Walter, precipitated by a request to Paul Reilly for an historical account of the project, led in April 2015 to the rediscovery of the models which had astonishingly survived. Encapsulated as test models in another

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research extension to the original Winsom software called ESME (Burridge et al., 1989, 550) they had endured the many radical technology changes of the intervening decades. The historical significance of this collection, together with the emergence of specialist online journals to curate and provide access to such models, persuaded us to assemble as much as possible of the models and associated intellectual capital (code, manuals, definition files, images, correspondence, patents), and port them with an account of their history into an open, stable and secure digital environment, in order to make them available for historians of digital cultural heritage and other interested parties.

2. Setting the scene

Crucial to its success, but hidden behind the screens, the'minster movie' project was a unique intersection of archaeologists, computer scientists and engineers specialising in 3D computer modelling and graphics systems. In fact, this first-of-a-kind status of the minster movie in archaeology was the product of an innovative collaboration environment fostered within an international network of IBM scientific centres (Kolsky and MacKinnon, 1989). The IBM UK Scientific Centre (UKSC) focussed on human computer interfaces which, at the time, meant graphics, databases, image-processing and speech synthesis, and happened to be located in Winchester. It attracted independent visiting domain specialists, who while experts in their field sometimes had very limited knowledge or experience of computer applications. There were also a small cadre of post-doctoral research fellows who came to the scientific centre from such diverse fields as chemistry, physics, visual arts and archaeology (e.g. Colley and Todd, 1985) for two or three years with both domain expertise and considerable experience in computer applications. Research fellows were embedded in multidisciplinary teams supported by some of IBM's best technology and eminent researchers, supplemented by an annual intake of talented university students gaining work experience. Research fellows, or visiting scientists, would identify significant challenges in their particular realm of expertise, and the broader team would be aligned to help them overcome them. Application development was multidisciplinary, project driven and dynamic; a forerunner to the 'continuous beta' model in widespread favour with software developers today.

Against this background, archaeologists Birthe Kjølbye-Biddle and Martin Biddle approached IBM UKSC in 1984 with the challenge of presenting the results of their investigations into the development of the Anglo-Saxon priory cathedral of Winchester, conducted in the 1960s, to the general public in an easily accessible way. Possibly the most imposing building in pre-Norman Britain, the only trace of the Old Minster on the ground today is the footprint of the building's final phase laid out in bricks marking the robber trenches left from its demolition in c.1093/4 to the north of the present Norman cathedral.

3. Making the digital Old Minster

3.1. Motivation

In 1984, three-dimensional computer graphics seemed to archaeologists an exciting and appropriate way to illustrate and convey a sense of the scale of these now lost medieval ecclesiastical edifices in a stimulating new format. For the IBM researchers, the project would help to promote both their own and the company's technical prowess and relevance to the scientific community, and drive technical advances in their experimental 3D modelling technology called Winsom.

3.2. The winchester solid modeller (Winsom)

Winsom was based on the principles of Constructive Solid Geometry (CSG), using basic boolean operators (i.e. add, subtract, union, difference, intersection) to build complex objects from combinations of simple ones (namely half plane, cube, sphere, cone, and torus). Originally built to make orthogonal images of complex molecules such as insulin, in its day Winsom's solid modelling technology was cutting edge (Quarendon, 1984; Burridge et al., 1989). However, an ever expanding field of application areas meant that additional requirements were constantly being generated. Winsom was therefore an organic research vehicle, which produced its own set of challenges. As we shall see later on, although the models might be unchanged, radically new views of same model could and did 'evolve' with new implementations of specific functions.

3.3. Constructing the models

Kjølbye-Biddle provided a set of drawings, plans, sections and all other then known evidence, such as pictures of architectural parallels surviving elsewhere in Europe, insights distilled from historical descriptions (Kjølbye-Biddle, 1986; Kjølbye-Biddle and Biddle, forthcoming). She also worked closely with the technical team to ensure the models they built conformed to her expert opinion. It is important to recognise that there was much less awareness of computer techniques in the archaeological community at that time, and computer interfaces were also much more basic. In practice much of the work of inputting and editing the models was done over many weeks by a team of student interns overseen by Andy Walter.[2] Winsom was not an interactive program, and initially there was no real-time wire-frame or other tool available to help,[3] so the model development process required text changes to be made in the model file, and then resubmitting the model to be rendered by Winsom to generate a new single static image. Even when we had one of the regular review sessions with Dr. Kjølbye-Biddle at the computer terminal, it was always one of the computer specialists who typed the instructions to advance the interaction into the computer and make any adjustments to the models; we called this 'chauffeur-driven mode'.

Six models were developed in Winsom and rendered to show the general external appearance of the buildings. Five of the original interpretive models produced to illustrate the development of the Old Minster are positioned over their archaeological footprints in Fig. 1. The models are rather modest in their appearance. Although supported, and used on other heritage models such as the medieval Westgate of Winchester, texture-mapping was never used on the Old Minster models. No knowledge of the material or structural properties of the Old Minster were considered, and no attempt was made to conduct any kind of viability assessment, such as stress analysis. The emphasis was on geometry, explaining the layout and conveying the scale of construction of the different phases.

The models of the later phases were large and complex. In order to make them simpler to manipulate and parameterise they were developed in a modular fashion, using a series of sub-model files, each one representing a different component of the minster

[2] With stable code and definition files, much of the leg-work was done by summer students (Mike Stanley, Alison Bradley, Phil Barlow and Stephen Watt), with a layer of supervision and control from the permanent staff, who fed any technical problems to the authors of the software led by Peter Quarendon for their attention.

[3] Images showing wireframes of the Old Minster models were eventually produced using Fastdraw, another research application extension to Winsom built after the minster movie (Burridge et al., 1989). See also Fig. 6.