It'll be all white on the night... won't it?

Benjamin Woolley sets his tracing skills to work on the White Tower at the Tower of London. And the Intergraph made an impression — on his table.

Here's a story about how to turn real buildings into 3D models, with nothing more than an obsolete scanner and a nifty graphics utility.

A colleague asked me to compile a short animation featuring the Tower of London. All he gave me to work with was a series of old CAD models of the Tower, and a couple of days to do it in. The CAD files were huge and used the AutoCAD DXF format.

It is technically quite difficult to convert to a 3D animation package file format, including Autodesk's PRJ/3DS format. I did manage to convert some of the files, but the level of detail was so high, as it tends to be in CAD models, that it would have taken days, possibly weeks, to identify each object, label it and texture it. Given the urgency of the job, I decided on a quicker and dirtier tack.

My starting point was a ground plan of the central White Tower in a book about the Tower of London's history. I scanned the plan using my trusty Logitech hand

(3) *The result of lofting the traced image, with a stone material mapped on to its surface*

scanner, setting the colour depth to black-and-white to ensure maximum contrast between the outline and the background. I touched up the result using Photoshop, to cut out extraneous detail and scanning noise. You can see the finished image in

(1) *The scanned image of the White Tower's floor plan*
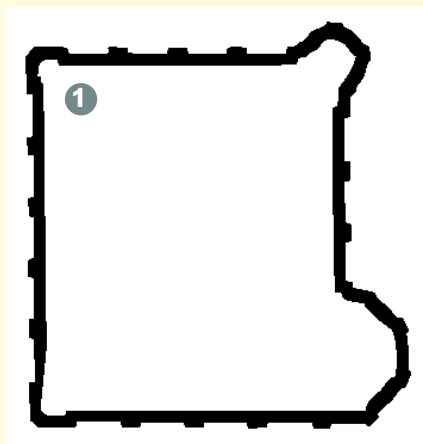**(2)** *The traced image. The little squares mark the position of the vertices*

Fig 1. It doesn't look exciting, but it was just what I needed for the next stage, namely tracing.

Tracing turns the flat bitmap image into a vector graphic, which is a drawing made up of lines and vertices, as shown in *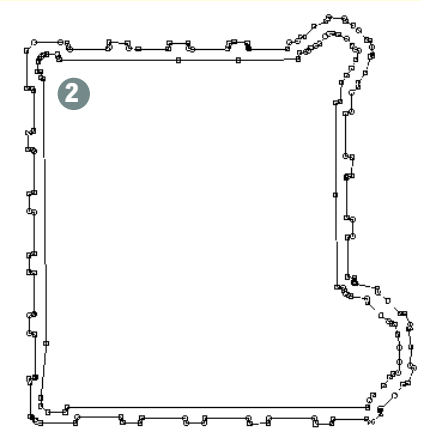Fig 2*. The software I used was the OCR-Trace component of CorelDraw 6. Having gone off Corel following my experiences with CorelDraw 4, which was prone to crashing at vital moments, I feel the company has redeemed itself with version 6. Not least because of the improved quality of all the ancillary software, OCR-Trace included. It did an excellent job.

I exported the vector graphic as a DXF file, which I could import into 3D Studio as a shape. I tidied up the geometry, and then "lofted" it into a 3D object *(Fig 3)*. This provided the basis of the finished model *(Fig 4)*. There's a lot wrong with it, not least the texture of the walls, which is the wrong colour. The building is not called the White Tower for nothing. At least I know the general shape of the architecture is accurate.

This scanning/tracing technique has a number of applications. I could photograph an object from a number of angles using a conventional camera, develop the picture on to Photo CD and use a bitmap editor to emphasise the edges. Most bitmap editors, such as Photoshop and Corel PhotoPaint, have this facility. Submitting the result to the

tracing program would generate a series of profiles that could be used to build a 3D model of the original. It would be a lot of work, but cheaper than using a 3D scanner.

Balance of power

Like great empires, great operating systems rise and fall. Unix, some predict, is about to be toppled from its pre-eminent position as the world's industrial-strength workstation operating system. And Windows NT, we are told, will be its replacement. Unix users will scoff at such a suggestion. NT, they say, cannot cope with more than a handful of processors, and does not enjoy Unix's track record for running "mission critical" installations.

All of this may be true, but the balance of power between the two has never been more finely poised. The reason is the emergence of a number of pumped-up PCs offering workstation-class performance for a relatively modest price. I have been trying the Intergraph TDZ-300, and the combination is awesome.

Let's not pretend that the Intergraph is an ordinary desktop system. The model I was using featured a 200MHz Pentium Pro processor, 64Mb of RAM, 12Mb of VRAM on a card boasting Intergraph's own OpenGL 3D graphics acceleration, a monster 21in screen which nearly made my table collapse, and a 2Gb hard disk. That lot retails at about £14,000.

Starting up the Intergraph was a strange sensation. The bootup sequence featured the same series of BIOS messages you would find on the most humble PC. Even with Word or Excel running under Windows NT, it felt like using a MiG for a package flight to Spain. Only with Photoshop, Painter 4 and 3D Studio Max

(4) *A render of the final model of the White Tower. A faithful rendition of the original, except that it is not white*

loaded did the full power of the hardware begin to manifest itself. My response was excitement tinged with disappointment.

The excitement comes from seeing what a Pentium Pro in a fast system can do. You do not need fancy benchmarks to observe the performance boost when you are doing 3D work. It is as though, until this moment, you have been working in a mud bath, with every movement and manipulation a laborious effort. With the Pro, reactions are instant. A rendered preview changes in real time, booleans happen in the blink of an eye, and models of complex architecture can be moved around the screen as though on a cushion of compressed air.

The disappointment comes with the discovery that, even with a 200MHz Pentium Pro under the bonnet and all that RAM and VRAM, the system has limits which are quickly reached. A polygon count running into the tens of thousands plunges you back in the mud.

This is to be expected. All workstations have their limits, even ones running Unix. The Intergraph, or even a top-of-the-range Dell or Compaq, in combination with NT, shows that those limits are no longer beyond the reach of the PC.

Max attack

The Intergraph gave me the opportunity to get my teeth into Autodesk's all-new 3D Studio Max, and I relished it. This month I want to dwell on one or two of Max's problems, not because it is bad, but because it is good. It is a package that pro and semi-pro 3D artists have to assess if they want to keep up with the state of their art.

The problems mostly concern the interface. Firstly, it is completely different from

that of 3D Studio Release 4 (3DSR4). The learning curve required to move from 3DSR4 to Max is no gentler than the one you must climb to move to LightWave, which currently costs £2,000 less than Max. This is important to remember when working out which upgrade route to take.

The second problem with the interface concerns its aesthetics. Autodesk, or Kinetix, the company's new brand name for its 3D products, is proud of the look of Max, claiming it is all the things GUI interfaces are supposed to be: intuitive, simple and elegant. Compared to 3DSR4, it is all of these, but by the standards of modern Windows and Macintosh applications, it's a mess. There is simply too much of it exposed to the user at any one time.

Furthermore, it raises expectations of a level of interactivity that is not quite delivered. You cannot change the geometry of an object directly, except when you create it. You have to do so via a parameters panel, although changes are updated interactively, which almost substitutes.

Another problem is part of one of the product's greatest strengths: its modularity. To get the most out of Max, you will need plug-ins. Some come as standard. There are particle and "bones" systems which can be used to create falling snow or skeletons. Most users will need to buy non-standard plug-ins, and the cost will not be trivial. Character Studio, the Autodesk character animation plug-in, is priced at £600.

Modularity also means that compatibility could become an issue. A model that relies on non-standard plug-ins for its geometry or materials will only work on a Max system that has those plug-ins installed.

Such problems need to be set against the fact that Max is excellent. It's sophisticated and richly specified. Even after weeks with it, I am only beginning to scratch the surface. It makes good use of NT's multiprocessing capabilities, now boasts a truly exceptional, if quite complicated, modeller and materials editor, and has a renderer that makes a clever compromise between quality and time. It offers intriguing features like the ability to render over TCP/IP networks, which means, in theory, you could have render farms spread across the Internet. You also have good documentation, and the reassurance of knowing that you are a member of a user base that is likely to prove as extensive and supportive as 3DSR4's. ■