

## Section 1: A Brief Introduction to CAD#

### 1.6 Data Visualisation: Rendering Techniques & Analysis Methods#

In addition to GIS applications, CAD files may also be passed to other kinds of programs to be used in different ways. Two of those program types, rendering software and virtual reality software, have the potential to transform the rather prosaic line art of a CAD model into startlingly lifelike images. CAD files may also be passed to drawing programs to produce final publication standard illustrations with appropriate labels and graphics. It is important, however, that CAD should not be confused with virtual reality, or vector and raster drawing programs.

#### 1.6.1 Rendering Software

Rendering software provides tools to add surface materials, textures, and colours to CAD models. In addition, lighting - even the light of the sun in a particular place on the globe - can be simulated, complete with reflections, shadows, and more subtle effects of reflected light. The results can be realistic views of structures, images that make such structures come to life for the viewers. Rendering software has become so popular that CAD programs often include good rendering tools, but the best renderings are produced with specialised rendering programs.

#### 1.6.2 Virtual Reality

The other kind of program for producing more realistic views, virtual reality software, has received a great deal of attention in the archaeological community. It has the potential to take photorealism to another level, creating virtual worlds with all the effects of rendering programs plus the ability to mimic moving through or around the model, seeing it from any angle and watching things change as the viewpoints change. Stereo views are even possible. Although the promise of virtual reality software has been recognised for some time, the computer power needed to provide the best level of verisimilitude and the ability to move freely in three-dimensional space is not yet widely enough available to provide high quality results outside research laboratories.

CAD models are often used as the basis for many virtual worlds. The virtual world used in a VRML model, for example, can be described as a series of coordinates in a text editor. Such a process, however, is difficult and time consuming and it is best to develop the world initially as a CAD model and then to convert the CAD model into VRML using a convertor. The CAD model should remain the core data source for archaeological materials.

#### 1.6.3 Painting and Drawing Programs

Drawing programs and paint programs are also sometimes confused with CAD. However, there are important differences which are most significant when comparing CAD and paint programs.

CAD programs store lines, arcs and circles using mathematical formulae (vectors) so that they can be represented at any scale, on screen or on paper, at any time. While 'Paint programs' permit users to draw lines, arcs, and circles, they store the results as individual dots (pixels or rasters). Once drawn the results are only isolated, independent dots that cannot be understood as composing larger entities. Enlarging or reducing such drawings often results in computer images with jagged lines in some places and blotchy, unclear shapes in others. Editing such drawings must be done one dot at a time. These programs are not designed for line art, nor are they able to deal with precise dimensions unrelated to the scale of the drawing.

'Drawing programs' are closer to CAD programs as they also use vectors to store drawings. However, unlike CAD data, the vectors are not tied to real-world numbers. Instead, they are related

to the drawing page and are scaled implicitly. Furthermore, the three-dimensional features are very limited. These programs are capable of making excellent presentation drawings, using CAD output as the starting point, but they lack many of the precision and three-dimensional features of CAD programs.

Both paint and drawing programs lack some of the features that can make a CAD model so much more complex than a drawing or illustration - when CAD files are passed to any of these programs (rendering, virtual reality, paint or drawing) it is generally without the layers and attached data tables that give CAD models their flexibility.

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