Section 3: Virtual Reality Methods and Techniques#

3.6 Bubble worlds#

The term 'bubble worlds' covers a large range of application packages designed to offer a quick, easy and cheap way to present landscapes and indoor environments in the round. They are a simple technique for giving a general impression of a place and are excellent for guided walks.

Bubble worlds can be created with standard camera and computer equipment and with no special training, although special hardware is available to assist. All application packages take a broadly similar approach. The technique comprises the generation of a seamless panoramic image that is projected onto the inside surface of a 'notional' cylinder or sphere and then viewed through an interactive window on the computer screen. This can give the impression of viewing an entire space from the ground to the sky and 360 degrees around through a moveable window.

Bubble worlds were designed for Internet delivery and can be viewed using Java-enabled browsers or browser plug-ins. As a result they are becoming a favoured technique for presenting snapshots of full virtual reality worlds on the Internet.

3.6.1 How to view bubble worlds

No special hardware is required for viewing bubble worlds. They can be viewed on low-specification computers, normally via a web browser. Most bubble world formats depend on either Java applets (which require a Java-enabled browser) or browser plug-ins. Some bubble world formats require a stand alone application that is invoked by a browser.

The navigation tools vary for each bubble world format; as a minimum users will be able to pan, tilt and zoom. It is the ability to pan, tilt and zoom via the viewing window that gives the impression of three-dimensionality so apparent with these products. Bubble world interfaces tend to be intuitive and easy to learn in comparison with the more complex interfaces of VRML clients.

3.6.2 What is needed to create bubble worlds?

This is not a standardised technique and a wide range of software applications is available to create bubble worlds. However, Apple's Quick Time Virtual Reality (QTVR) is becoming a *de facto* standard for bubble worlds because of its ease of use, reliability and interface design. QTVR offers file formats for both panoramas and object movies, a browser plug-in, stand-alone viewer and a comprehensive range of authoring tools.

Bubble worlds can be generated from a sequence of overlapping photographs taken from a single point. Special lens attachments allow full environments to be captured in a single image, although image quality is compromised (there is inherently more information in a sequence of images of any given scene than in a single image of that scene at the same resolution). Photographic prints can be scanned for manipulation by the production packages but use of a digital camera greatly simplifies the procedure. The ultimate delivery medium and intended use of the final panorama must be considered when capturing an image. For example, a single-image panorama is quick and simple to take with a specially designed lens and produces a bubble world perfectly suited for a website but unsuitable for projection on a large screen during a lecture. Users may prefer to download a higher resolution bubble world to run locally rather than run a lower resolution version on-line. Project managers may choose to capture high-resolution images and/or panoramas for archive purposes while delivering a lower resolution version of the world on-line; this approach allows for upgrading of the delivered product as hardware and software specifications improve.

Some production packages are very tolerant and adequate panoramas can be generated by standing in an environment and taking the photographic sequence by hand. However, this is not recommended, and expensive and time-consuming trips can be avoided by capturing the highest quality sequence of images on the first occasion. The best way of doing this is to use a panoramic head, a tripod attachment that allows the camera's recording plate to sit at 90 degrees to the horizontal plane, centred over the point of rotation. This minimises distortion when separate images are joined or 'stitched' to create a single panoramic image. Panoramic heads can be used with the camera in 'portrait mode' allowing greater vertical coverage for each image in the sequence. Although more shots are required to capture the full 360 degrees, a separate sequence is not required to capture higher or lower sections of the environment.

Not all panoramas need to be 360 degrees. If file size is an issue then a 180 degree panorama at higher resolution may be better than a 360 degree one at lower resolution. For most landscape panoramas a single sequence of images in portrait orientation will be adequate. Panoramic heads often have graded positions that allow the camera to be rotated at exact angular increments. This results in better quality panoramas as most software packages assume that each image covers a specific spread of degrees and that the overlap between images is constant.

Once the image or image sequence has been captured the images are 'stitched together' then 'blended' to remove any obvious join lines. At this stage some packages are better than others and, depending on the initial camera settings and lighting conditions, it may be very difficult to get two separate images to blend together without the 'join' being obvious. The better packages allow for the entire panorama, or panoramic tile, to be exported to a third party photographic manipulation package for editing. This eases the process of removing unwanted elements, adding reconstructed or speculative elements and manually blending and smoothing joins between images.

Factors affecting the presentation of a bubble world can normally be edited when the panorama is created. For example the window size, starting position, zoom range and file compression can be specified. Several bubble worlds can be linked together by hyperlink 'hot spots', generating a series of navigable scenes in a single file. Users can move from point to point within the environment by moving from one panorama to another. In web browsers other hyperlinks can move the user to text documents or still images. Some production packages allow various effects such as sound and streaming video to be embedded in certain types of bubble world.

3.6.3 What are object movies?

QTVR allows for the creation of object movies. If a panorama can be imagined as being projected onto the inside of a 'notional' cylinder then an object movie is the reverse of this. The images are projected on the outside of the cylinder. A sequence of images of an object are used to create the impression of three-dimensionality but much more quickly, cheaply and easily than by actually generating three-dimensional models. As with bubble worlds, a range of additional functionality can be added to object movies. As well as allowing objects to be rotated, imaginative use of the technology allows for other conditions to be changed interactively, such as lighting or background.

3.6.4 How to find out more

A useful starting point for more information is the Panoguide website maintained by James Rigg. This site includes lists of software, costs, tabulated summaries of features, reviews of performance and is kept up to date as new software appears. See http://www.panoguide.com.

See the article by Stuart Jeffrey in *Internet Archaeology* (Jeffrey 2001) for a discussion of the uses of various techniques for visualising three-dimensional models of sculptured stones in their landscape context.
