# Brief summary of novel digital capture techniques

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The following briefly summarizes and gives examples of the various forms of novel digital photography and video capture that have been used by myself to record heritage objects, sites and cultural events. Links to web pages or images will be provided for more detail.

Gigapixel photography

Gigapixel photography is a way to capture higher resolution digital images than a single camera shot can achieve. This is accomplished by taking a large number of photographs and stitching them together to form a single image. Very similar in principle to Google Earth, one can zoom out to see the whole image, or zoom in to see detail. The hardware to produce this involves a high resolution SLR camera and a motorised robotic rig. An example of a gigapixel image is shown below constructed from about 20 photographs, the original is over 60,000 pixels across, noting that a high end SLR only captures about 5,000 pixels across.
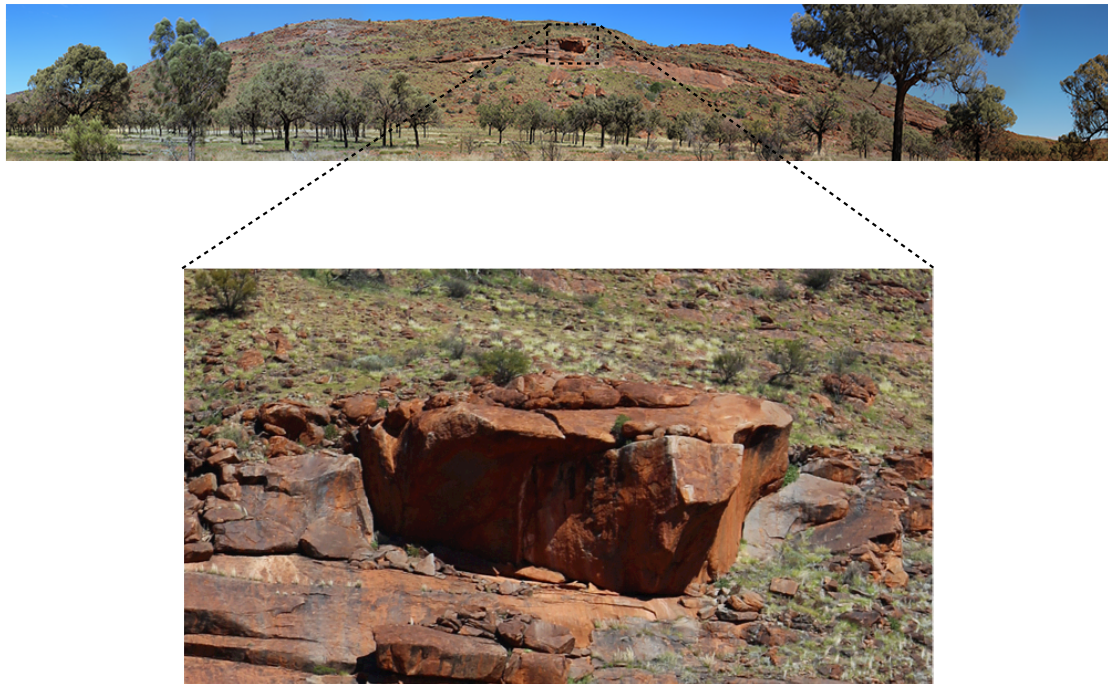
Some further examples can be found here: http://paulbourke.net/fun/Ngintaka/

Bubble photography

These images are a way of capturing everything from a single position, also known as spherical panoramas. While they can be high resolution like the gigapixel images, they are more commonly used to give an overall impression of a site. They can be captured very quickly and thus the images from a large number of positions can be acquired. An example is given below, it wraps around across the left and right edge, the top of the image is directly up, and bottom of the image is directly down. While the images below look distorted, that is just a consequence of mapping a sphere onto a plane, much like how maps of the Earth are distorted.

These images can be displayed without the distortions and they can be used to create virtual tours of the site, an example of which can be found here:
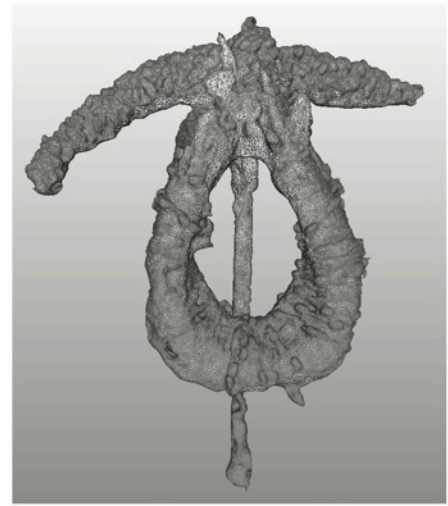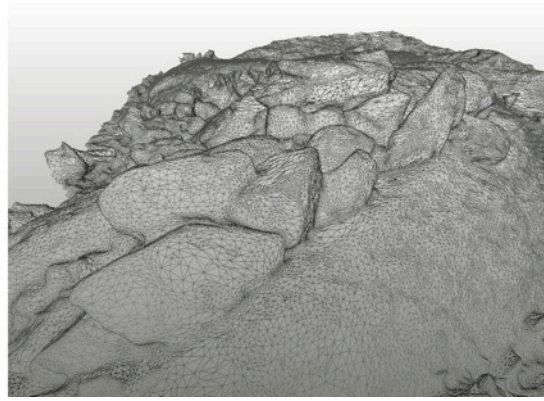
http://paulbourke.net/exhibition/Wanmanna/

An example of how the above can be experienced can be found here:

http://paulbourke.net/fun/Ngintaka/pano12.html

3D reconstruction from photographs

Using sophisticated algorithms it is now possible to automatically create 3D representations of objects based only on photographs. This is a way of recording the 3D structure of a model rather than just a collection of flat photographs, these models can then be interactively explored/examined on a computer. This is a rapidly evolving field and one with very exciting applications for the digital recording of heritage objects as well creating assets for virtual environments (such as serious gaming). The following examples illustrate the underlying geometric data along with a textured representations, these model can be freely rotated and explored from any angle.

Examples of one possible pipeline here: http://paulbourke.net/miscellaneous/reconstructionphoto/

Further discussion here on accuracy: http://paulbourke.net/miscellaneous/reconaccuracy/

360 degree video

The bubble photography described above can also be applied to video. That is, one can record video that captures everything that happens around a single position. This is most suited to capturing cultural events that might occur around the camera position. While there are two or three hardware solutions in the market to achieve this they generally suffer from limited resolution, we own the highest resolution camera currently available camera for this type of capture. An example of the footage is shown below, in this case the recording of a healing ceremony for the Mah Meri tribes in Malaysia. Note that the footage extends 360 degree horizontally (the left edge maps to the right edge) and about 135 degrees vertically (from the north pole to about -45 below the equator).

The camera itself is shown below.

Displays

In addition to the above there are a number of display technologies that can be used to interact and explore the digital assets described. Two of these (there are others) are high resolution tiled displays and dome environments. An example of a high resolution tiled display is as follows, but it can be arranged in different configurations to suit the nature of the content.

An example of a dome display is the iDome, see below, where one can freely navigate, for example, within a bubble image or within 360 degree video.

Another dome orientation is a planetarium style dome, located horizontally above the viewer. The following is from the Gascoyne Aboriginal Heritage and Culture Centre. The dome orientation chosen is dictated by the type of content anticipated. Some other examples of domes by myself can be found here:

http://paulbourke.net/exhibition/domeinstall/