Cultural Heritage Management in the spatial dimension

A case study of high resolution rock art recording from the East Pilbara

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Project Context

- In 2014 RTIO commissioned the high resolution rock art recording of 4 rock art sites at West Angelas
- Aim to produce a high resolution, in-perpetuity record of all known rock art sites in the project area
- 2 rock shelters with pigment art and cupules and 2 open sites with pigment art and engravings were recorded over 3 days.

Project Location

Archaeology

- Field data recorded onto iPads loaded with FileMakePro13 database. Info recorded at site, panel and motif level
- A Canon EOS 5D DSLR camera was used for digital photography.
- Detailed motif recording included digital photography using a Canon 5D Mark II and a Canon G12 with D-Stretch loaded on its card
- Line drawings of pigment art were completed
- Dynolite magnifier/camera attached to a field laptop was used to observe superimposition detail and pigment condition.

Laser scanning

- Laser scanning
  - Very high density laser scanning data using Leica's C10 (green light laser scanner) – 532nm
  - Very high density laser scanning data from Trimble TX5 (infrared light laser scanner) – 905nm close range reconstruction quality
  - Geo-referenced to real time kinematic GPS observation provided by mine surveyors
  - Multiple scans from each scanner were registered together
  - Post processed using Leica Cyclone

Laser scan ouput

Laser Scanning Pros

- Enables accurate 3D measuring of rock art features

Laser Scanning Advantages

Advantages

- Laser scanning and photogrammetry is non-invasive
- Precision details and accuracy
- Enables a true digital record of the site that can be used to recreate a geometrically accurate representations of key features and/or the entire site itself
- Automatic filters can be applied to visualise the structures that may not be easily identifiable in traditional archaeological recording methods
- Interactive interpretive opportunities when meshed with high resolution photos
- Can be geo-referenced and is a true spatial record

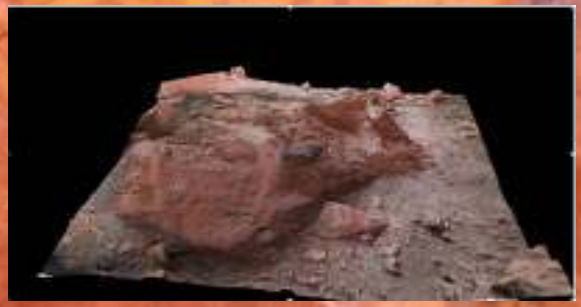
Constraints/Challenges

- Cost of equipment (more than a piece of string!)
- Time – field and post- processing
- Terrain – lugging the scanner!
- End-user product
- Large volume of points resulting in large data size
- Stakeholder Expectations
- Technical experts required
- Pre-work - base stations
- Poor colour representations

Photogrammetry and 3D visualisation Methods

- Photos for 3D reconstruction were taken with a Canon 5D Mark III SLR camera and various lenses (28, 50 and 100mm prime)
- Photogrammetric 3D reconstructions were created using PhotoScan (Agisoft) or in-house pipelines based upon open source components (Bunder, PMVS2, Meshlab).
- Gigapan (robotic device) was used to capture full mosaic renderings of site area.

3D visualisation of surface details



3D and photogrammetry pros

- Fast
- low hardware and operator budget
- high quality textures
- Opportunity for less missing geometry
- Significant interpretive opportunities in high resolution
- Opportunities for linking to other visualisation technologies such as Occulus, drones etc.

3D Photogrammetry Constraints

- Lower accuracy and not truly spatial without further work
- Higher variability in accuracy
- Still a developing area with regular changes in technology

CHM applications

- Full visual 3D record of key archaeological features that can be viewed by Traditional Owners that could not visit the site
- Scanning data can be used to better manage and monitor site condition
- Interpretation and visualisation of features to educate mine personnel in relation to site significance

Virtual tours

Interactive interpretation

- Insert Occulus movie (hopefully I'll get one of the TOs using it

3D printed models

- Include photo/demonstration of plastic model

Conclusion

- Spatial and visual technologies can assist archaeologists, Traditional Owners and industry in the proactive management of heritage
- For high value rock art sites in particular these technologies present significant opportunities in interpreting and understanding the rock art
- Educational and community interpretive opportunities
- Archaeologists working with other technical specialists always produces better outcomes
- Choose the right technology for the job