Rock Art Residency

Practitioner

Josh Harle is a Sydney-based multidisciplinary researcher and media artist. His practice explores the contemporary use of digital technologies to map and make sense of the world, critiquing the often ideological practice of digital capture that results in representations ranging from the schematic and reductive (e.g. GPS navigation and Google maps) to the immersive and evocative (e.g. narrative-based video games).

His works take various established and emerging mapping technologies (such as laser scanning, photogrammetry, 3D printing) and re-appropriates them as expressive mediums, altering their outcomes to introduce an affective element which is normally absent, and preserving the performative nature of their creation.

Harle's doctoral thesis formed part of an Australia Research Council linkage grant with the NSW Emergency Information Coordination Unit, developing new approaches to spatial representation, including the use of first-person computer game engines as powerful research tools in the investigation of existing and speculative architecture.

In 2013, Harle was commissioned to create a large-scale virtual environment based on the Museum of Contemporary Art, which is currently installed on a trial-basis at the museum itself. Harle's current work focusses on critical mapping projects, and the 'digital conservation' of real-world sites through photogrammetry, presented through compelling, evocative virtual environments. In 2014 he was awarded an Australia Council for the Arts research grant to support a residency under the title 'working with archaeologists and Aboriginal communities to produce virtual tours of rock art sites'.

Description

The residency project extends Harle's spatial mapping research, with the aim of creating evocative 3D interactive environments of rock art sites in Western Australia. Over the 14-week residency Harle will work with CRAR+M and in consultation with traditional owners to develop a form of representation which allows for meaningful, contextualised sense of the original site, which may include recorded virtual 'tours'.

While the project's application of an image-based 3D reconstruction technique to cave sites is not unique, the project distinguishes itself through the intended portability of the resulting reconstruction (running on tablets), recorded guide and annotation features, and a focus on communicating the wider context and experience of the site.

The works will allow first-person navigation of the sites, and will feature environmental sound recordings and realistic lighting. The sites will be documented with white-balanced lighting, which will allow the later application of dynamic lighting (such as that of a nearby fire, a torch, or setting sun). Harle intends to explore possible forms of guided experience and story-telling through the ability to record and playback audio and gestures within the environment. The Unity 3D game engine will be used, allowing the creation of interactive, photo-realistic environments that can be shared online, through tablet device apps, or via a PC or Mac computer.

The intended aims of the residency are to

- develop a compelling medium for visualising rock art for broadening public awareness of vulnerable sites,

- emphasise the importance of documenting sites as real places, rather than abstracted images, i.e. utilising emerging scanning and visualisation technology in a culturally appropriate, holistic way,

- allow the visualisations to be inhabited as evocative places through spatial storytelling.

In addition the project is expected to help support the stated goals of Centre for Rock Art Research and Management, to

- Conduct and promote excellence in multidisciplinary research in Indigenous rock art;

- Undertake collaborative partnerships with Indigenous communities to develop a more holistic understanding of Indigenous rock art;

- Foster world-class partnerships and interdisciplinary engagement to further the research goals of the Centre;

- Promote the conservation, protection and appropriate management of rock art; and

- Communicate the centre's activities to partners, the academic community and broader public.

Virtual tours of rock art sites reduce direct impacts on the physical fabric of the sites, and increase access to sites for their interpretation by tourists. Visualisation of sites in this manner dramatically increases exposure and public awareness of the importance and vulnerability of these sites, through the compelling, accessible form of representation.

The reconstructions could provide digital documentation and archive tools, innovate ways to view and interpret rock art, and form a baseline reference for identifying and analysing damage (such as weathering and graffiti) and changes to rock art sites.

The project is deeply committed to investigating the use of emerging technologies in a form which is culturally appropriate, in accordance with the Australia Council protocols for producing Indigenous Australian visual arts, and in collaboration with Indigenous communities.

Project goals

Project goals are intended to support the overall aims of the research, and have emerged from earlier prototyping and consultation.

- **Portability (achieved)**
  Performance optimisation of 3D geometry informed by approaches used in contemporary video game development, enabling the creation of 3D reconstructions that run on an tablet device or phone. This allows:

    i) site documentation made available to the public through online app stores, and

    ii) resulting digital documentation to be available to remote communities, used as a basis for further research, education, and rock art management. In particular this can provide access to a spatial representation of the site for those unable to physically visit the site.

- **Annotations (to be extended)**
  Allow information about the sites to be recorded and shared within the virtual environment, for use with individual or parallel use-cases – research, cultural communication, management, and public discussion:

  i) through recorded audio tours that include motion through the space and indicative gesturing. This is already implemented, but may be extended to allow recording in and sharing of new tools using the tablet app;

  ii) enable annotations placed in 3D space to be created and shared.

- **Extended Illustration/Visualisation (to be extended)**
  The possibility of illustrating time-lapse events in the site (already implemented), and switching between natural colour images, annotated, D-stretch and CPED imagery.

- **Site Geographical Context**
  Communicating (or evoking a sense of) the geographical context of the sites by introducing the visualisation through recorded first-person GoPro footage of the journey to the site. The video content will end at the point of view of the initial view of the 3D reconstruction.

- **Robust tour recording**
  Using photogrammetric reconstruction of camera positions for capturing guide motion. This would use a GoPro camera worn by the guide to 'record' their motion, using frames from the video as input images for 3D reconstruction. With this method spatial recording of tour motion and audio come be done in a fairly unencumbered way, without the need of exotic equipment.

Outcomes

The primary outcome of the residency will be a body of knowledge around the use of the developed approaches with rock art. This will include a discussion on the differing requirements (size, accuracy and resolution of geometry, performance and portability) of a visualisation dependent on application (research, management, science communication, public exposure). This body of knowledge will also include specifically developed tools (3DS Max, Unity 3D, and command-line batch scripts) and documentation of workflows for producing reconstructions with the above elements.

The public outcome of the project will be a presentation of the artist's virtual reconstruction research (including rock art research if permission are available), along with project documentation and a critical discussion of the project.

In addition, the broader release of a particular site reconstruction project as a tablet device app will be part of the possible outcomes discussed with relevant communities, and may form the basis of a virtual tourism program.

Measuring Success

In the event of the final works being released online, their ability to engage public awareness can be

measured through the number of downloads the tablet application receives, and associated online feedback.

Most significantly, the intention of the project is to start a discussion with an emphasis on a form of representation which is evocative, respectful to the site, able to communicate its cultural significance, and which avoids being a technological novelty.

The project's success in encouraging discussion on the culturally appropriate use of emerging 3D technologies will be on the basis of wider response to the final works. Retrospective discussion of the perceived weaknesses of the approach and outcomes will be at least as valuable to further research as discussion of the strengths.

Further Research

Further areas of research:

- Dynamically loading (and downloading) levels of detail (LOD) for models. Effectively a 'deep zoom' style dynamic navigator for zooming into and loading content on the fly, using Unity 3D's LOD groups and AssetBundles with at various levels

- Exporting camera motion from VisualSFM instead of PhotoScan, since by using the VisualSFM sequence pair matching function you can bracket the number of neighbouring video frames are matched (rather than matching all images to each other). This makes the camera alignment stage linearly not exponentially related to number of images.

- Experimenting with drone-based image capture in Murujuga (Burrup Peninsula), possibly utilising Greg Dering's DJI Phantom & Ricoh fixed lens combination.

- Develop an approach to handling very large geographical sites and datasets, i.e. comprehensive drone imagery used for camera alignment, but only selectively processed. This is also an approach to meaningfully managing image sets. Areas of interest can be selectively reconstructed from imagery when and if models are needed, e.g. in the event of graffiti, weathering, or movement.

- Work on visualising within the portable tablet app the time-lapse comparisons in rock art. Mark Willis has been looking at producing these comparisons, and the my Trafalgar St Tunnel PC, Mac and Oculus Rift app gives the ability to switch between different periods of imagery.

- Continue to extend the annotation elements (especially persistent, shared online annotation).