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Edited by Kelly Greenop and Chris Landorf

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The Conference Convenors received a total of 44 abstracts. Abstracts underwent a double-blind peer review by two members of the Conference Organising Committee. Authors of accepted abstracts (32) were invited to submit a full paper. All submitted full papers (18) were again double-blind peer reviewed by two reviewers. Papers were matched as closely as possible to referees in a related field and with similar interests to the authors. Sixteen full papers were accepted for presentation at the conference and a further 6 papers were invited to present based on submitted abstracts and work-in-progress. Revised papers underwent a final post-conference review before notification of acceptance for publication in these conference proceedings.

Please note that papers displayed as abstracts only in the proceedings are currently being developed for submission to a digital cultural heritage special edition of an academic journal.

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Virtual Perspective and The University of Newcastle Hunter Living Histories Initiative

Newcastle Time Machine – a multi-disciplinary approach to digital cultural heritage

Abstract

This article discusses the University of Newcastle's Hunter (Living) Histories initiative (HHI) and the multi-disciplinary heritage model to develop collaborative digital cultural heritage projects. The HHI engages across the university and wider communities to develop heritage projects that are shared globally across various social and digital media platforms. One of the projects undertaken by the group is the 3D Virtual Hunter Project, which created the Newcastle Time Machine, embodying fly-throughs and 3D immersive recreations of the early Aboriginal and Colonial Newcastle, up until 1830. Its creators worked over many years in collaboration with the University's Cultural Collections and used archival written and visual sources to construct the base model for the project, analysing and comparing historic artworks and surveys to assess the most accurate and authentic original sources of the early Newcastle landscape. The methodology to use primary sources as evidence to construct a landscape as accurately as possible was crucial so that the historical past is interpreted with authenticity and integrity. As an educational tool, this project reflects the new digital age and changes in teaching and learning strategies, providing a vision of an historical past in a contemporary present. The Newcastle Time Machine has been further extended by incorporating Virtual Reality (VR) Technology to further enhance this experience. The Newcastle project provides a digital heritage platform that has implications for heritage management. The digital visualisation of the historic environment of Newcastle past is a new way of perceiving the city, and more effective than imagining what Newcastle would have looked like from only studying written sources.

Keywords: Digital heritage; virtual reality, 3D model; computer model; historical analysis; visual sources

Introduction

This article is a case study examining a digital heritage project undertaken by the UON's HHI using a multi-disciplinary approach and brings many participants together around history and heritage (Eklund and Hardy, 2014). The case study explores how the multi-disciplinary approach was also effective in the area of digital heritage to produce the 'Newcastle Time Machine'. This group, previously known as the Coal River Working Party, is a model that facilitates university-community engagement and members of the group include academics, students, and people from the wider community, as well as government and non-government organisations. It must be noted here that the authors of this article are contributors to HHI and the Newcastle Time Machine.

Background – Towards heritage digitisation

The original inspiration to create a virtual experiential repository of historical resources for Newcastle began in the mid-1990s, through involvement with the Mayfield Residents Group, University of Newcastle (UON). Archivist Gionni di Gravio recollects:

> On my way to one of their meetings, which incidentally was being held in the upstairs of the local the Stag and Hunter Hotel, I passed two young men eating their fish and chips in an alcove, and leaving their food scraps and rubbish all over the ground. Upon arrival at the hotel I was very impressed with what I saw; all around the foyer were printed photographs of the Mayfield houses and landscape. As I proceeded up the stairs, the images changed to photographs of the original Hotel when it was originally established as the Amos Hotel. I was so inspired by what the publican had done with the history and historical context of the hotel, I thought to myself: maybe, if those two fellows eating the fish and chips could understand more about the history of the ground beneath their feet, and under the bitumen of the sidewalk, then maybe they wouldn't trash it. So, after the meeting, I rushed home, and upended the contents of my filing cabinets containing historical photographs, notes and documents and began digitising material on the history of Mayfield for eventual uploading to the web.
> (di Gravio 2016)

Di Gravio had been working in the UON's Auchmuty Library for a number of years, and had thrown himself into learning HTML, as well as learning to digitise on rudimentary flatbed scanners. He possessed the technical knowhow to enable the university library to digitise and publish material online to the free Geocities site in 1995 as 'The Mayfield Website' (The Mayfield Website1996), arranging the digitised material including texts, photographs, maps and plans relating to the suburb in chronological order.

The National Library assessed the 'The Mayfield Website' for inclusion in their Pandora archive as one of 'national significance'. The Mayfield website also led to further collaborative projects, with the UON's archivist participation on industrial, business and community committees involved in initiatives utilising historical archival records held in the University. This brought the University and the community closer together.

Meanwhile, a digital revolution was underway during the mid-1990s. Di Gravio recalls playing 3D immersive ground-breaking computer games such as *Myst* and *Riven* and so, after setting up a website for the University Archives in 1996, by 1998 he was trying to find people who could help three dimensionalise the archive's virtual experience. The following email describes his dream:

> I would like our virtual visitors to view a graphic Archives and Special Collections homepage which consists of an image of a rare book room. A table lies in the foreground with manuscripts strewn about, an hourglass etc, and behind lies a bookcase; to the left is the Archivist's office. If they wish to see the Archives collection they walk towards the table and click on the manuscripts; if they want the rare book collections, they click on the bookcase; if they click on the Archivist's door, Denis, (the University Archivist) appears and gives a 2-minute

> welcome and short introduction as a video piece. What do you think about this sort of thing? I've been trying to convince the forces to not look at the net as a series of word processed documents lying out in space but as a living thing with living minds, as visitors that want to see exciting visual things and wish to interact and "meet" other virtual objects or experiences. I would like to develop this sort of thing because I think there is quite a market out there for Archivists and Rare Book Librarians to make their rare and fragile collections accessible, but at the same time safeguard preservation issues. (di Gravio 1998)

At the end of 2000, Dr Glenn Albrecht, Senior Lecturer in Environmental Studies at the UON, prepared a paper entitled *Rediscovering the Coquun: Towards an Environmental History of the Hunter River* where he attempted, through a series of historical accounts, to provide a view of how things have changed with the River over time, and called for continuing ecological restoration work and the establishment of a native sense of place by restoring the Aboriginal place names with their English equivalents (Albrecht 2000). He greatly appreciated being able to use the online resources made available through the Mayfield Website, and inspired the UON archives to expand the idea of the website to incorporate the entire Hunter River Landscape, and bring together a listing of historic descriptions of the landscape across time. These listings were arranged in chronological order and digitised, and it was at this point that a vision of creating a virtual research landscape was born in an email to interested colleagues (di Gravio 2000). The Virtual Coquun-Hunter River Project was launched two weeks later, expanding historical resources to the entire region.

In August 2002, the UON archives began to work on bringing together all original Aboriginal resources under the 'Virtual Sourcebook for Aboriginal Studies in the Hunter Region' (Cultural Collections 2000). In 2003 the Nobbys Coal River Precinct website was set up to support the work of the newly established Coal River Working Party (CRWP) (Coal River Working Party 2003). In 2004, CRWP founding member, and Professor of Surveying, Emeritus Professor John Fryer, and his colleague Sabry El-Hakim, painstakingly constructed a 3D representation of the Baiame Cave at Milbrodale Aboriginal Rock Art site in the Hunter Valley (Fryer 2016).

In 2006, di Gravio attended and presented at the eLearning Symposium held at RMIT University (Mapping Historical Resources on the Google Earth Canvas for Teaching and Research, eLearning symposium 2006). To their credit, the teachers had invited a world of outsiders to their symposium, which made it a compelling get together. Among the themes, the hot topic was how to encourage teachers and their classrooms into the 3D game environment, where most of their students currently were, as part of the 'digital native' generation (Iverson and Smith 2012; Prensky 2001).

Di Gravio presented his experiments in mapping archival historical research resources across the three-dimensional landscape of Google Earth and the future possibilities of building virtual teaching environments that we would inhabit. He presented a similar paper *Mapping Historical Resources on the Google Earth Canvas for Teaching and Research* to the Australian Society of Archivists National Conference in Alice Springs in 2007. In 2007 the initial 3D virtual Nobbys was constructed and imported into Google Earth for the New Institute. (di Gravio and Sherlock 2007). In 2008, it was formally announced (with tongue in cheek) that The UON's CRWP would begin construction of a real-time machine (Coal River Working Party 2008). Following the announcement, very little progress in an actual 3D virtual landscape materialised. There was however significant work that established the validity and reliability of the methods being used by the members of the CRWP, and formed the technical foundation for all of the subsequent 3D constructions.

Between 2007 and 2011, surveying students at UON, under the supervision of Peter Sherlock of the CRWP, evaluated the 1830 Armstrong map and 1828 Mitchell field books for their final-year projects (Towers and

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Sumner 2009). The students' work showed that the original survey work and mapping was of a very high standard, and readily relatable to the 21st Century cadastre and surveys of Newcastle, with an accuracy in the range 1-3 metres. This increased confidence in using the 19th Century mapping, and also improved the reliability of other early mapping.

In 2010 and 2011, Russell Rigby and John Fryer of the CRWP demonstrated that the original height of Nobbys, recorded as 61 metres (203 feet) in the *Historical Records of Australia* for more than 100 years, was grossly in error. They used a combination of the early 19th Century mapping, a detailed study of the geometric and textural relationships in colonial-era artworks, and contemporary reports to show that the original height was 45 metres, before the reduction to the present height of 30 metres for the erection of the Nobbys Lighthouse in 1857. The consistency of the results obtained from various sources and methods showed that the colonial artworks were much more than just pretty pictures, but contained valuable information that could be used in recovering the shape and detail of the heritage landscape.

It was not until early 2012 when the UON archives engaged Charles Martin that the first 3D historical terrain map for Newcastle was created with the assistance of Russell Rigby. This terrain map made its debut at the November 2012 meeting of the CRWP to an excited audience and community (Coal River Working Party Nov 5 and Nov 29 2012). The *Newcastle Herald* even made it front page news (Ray 2012).

About the 3D Virtual Hunter Project

As already described, the idea of a 3D Virtual Hunter Project was conceived during the 2000s and eventually animated fly-throughs of early Newcastle were created in 2013-2014 as part of work on the 3D Virtual Newcastle Time Machine (Newcastle Time Machine – 1830- Dec 2013).

This virtual model presents historic sources on a digital platform for free public access to tell the Newcastle Story, and engender a much greater understanding of Newcastle's history and heritage, and its unique place in Australia's Aboriginal and European history. The creator worked in collaboration with the UON's Coal River Working Party (renamed Hunter (Living) Histories Initiative in 2016) to produce several digital fly-throughs of early Newcastle in the decades between 1800 and 1830 (Ray 2012). The nominated decades represent the period leading up to the commencement of the construction of the breakwater (Macquarie Pier) in 1818, and the clearing of a major track of coastal dune vegetation at Flagstaff Hill (Fort Scratchley), which later led to the encroachment of the sand dunes.

There were limitations to budget and timing. The work was funded by the Vera Deacon Regional History Fund and supported by the UON's Auchmuty Library (Coal River Working Party 2013). This project was later renamed the 3D Virtual Hunter Project with aims to expand to include the entire Hunter Region, NSW. The creator of the fly-throughs during this phase was an architect, visual designer/artist, and his initial task was to survey the various historical resources and complete a geospatial analysis relating to archaeology and heritage.

Historical analysis and interpretation

The following is an overview of the initial work and methodology used in constructing the 3D model of early Aboriginal and Colonial Newcastle, up until 1830. Research and investigation of historical sources was a significant and essential part of the survey process. It has taken particular skill and expertise to decipher traditional research materials (e.g., historic documents, site maps) and transform them into engaging, immersive, and interactive experiences.

Newcastle's rich and varied history has been documented in primary sources from the time of 'discovery' by Lieutenant Shortland to the subsequent establishment of a settlement and port at the mouth of the Hunter River in the early 1800s. The first attempt to settle this port in 1801 was short lived due to poor management. The area was resettled in 1804 as a place for reoffending convicts after the Castle

Hill uprising and it remained the centre of secondary punishment in the colony until 1823. At the time of early settlement Newcastle played host to some fine artists and map makers.

Survey Process

The advent of computers and the ability to re-interpret primary sources in a contemporary way allows a completely new appraisal and understanding

Figure 1. Comparative view using various visual sources (1807 to 1829) are analysed to gain a better understanding of changing landscape and built environment of early Newcastle. (Source: Cultural Collections, University of Newcastle. Creator Charles Martin).

of the physical nature of the early settlement. Early visual sources such as artworks and maps were cross referenced and data collated and incorporated into 3D technology. What became evident in the interpretation stage of this project, was that over a short period, changes to the landscape were considerable: not only was the built environment developed, but the topographical nature of the environment underwent much change, largely with the construction of the breakwater out to Nobbys Island. Many of the primary drawings executed on site in Newcastle are more reliable in terms of accuracy than

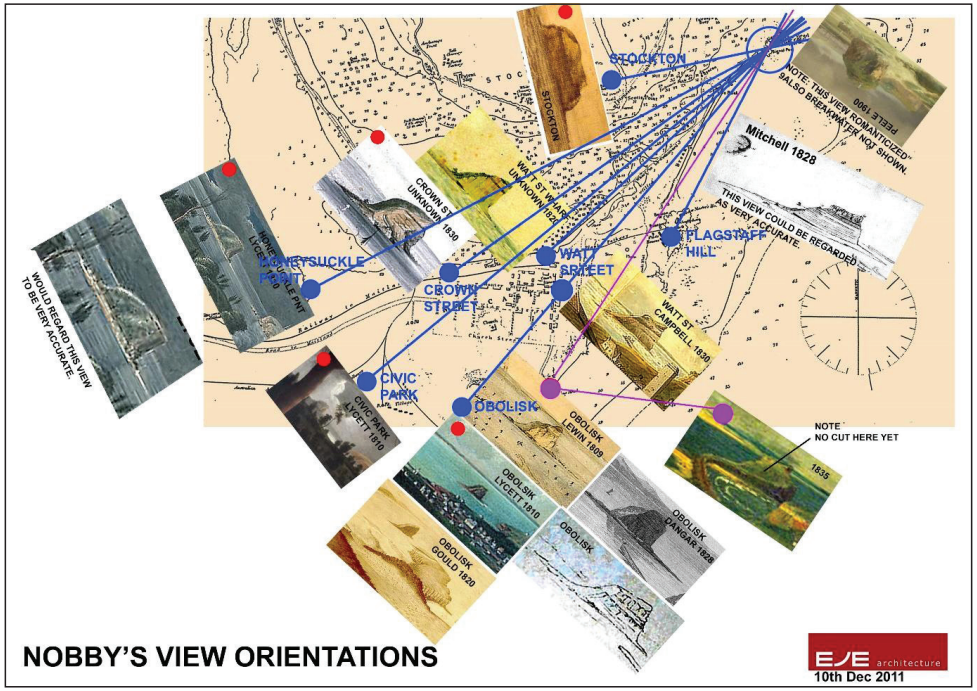

Figure 2. Comparative view using various visual sources of Nobbys Headland (1807 to 1829) are analysed to gain a better understanding of changing landscape and built environment. (Source: Cultural Collections, University of Newcastle, EJE Architecture (in kind support). Creator Charles Martin).

visual sources copied from sketches and other works; whereas, secondary sources are more suspect in terms of accuracy because detail could easily have been

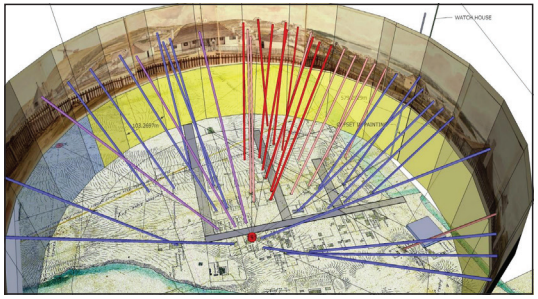

Figure 3. Locating built environment shown in Panorama of Newcastle by Edwards Close in 1818 (Edward Close, 1820) in the landscape as per Armstrong Map 1830 (John Armstrong 1830) (Source: Cultural Collections, University of Newcastle. Creator Charles Martin).

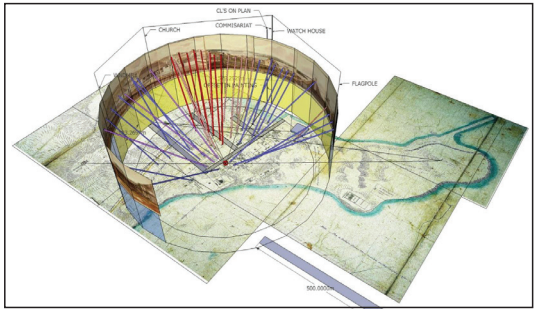

Figure 4. Locating built environment shown in Panorama of Newcastle by Edward Close in 1818 in the landscape as per the Armstrong Map 1830. (Source: Cultural Collections, University of Newcastle. Creator Charles Martin).

changed by the creator who may not have visited the place which they were depicting, nor been interested in documenting the exactness of the topography and built environment.

By constructing initial test models (Figures 3 and 4) on the computer and checking against the reference material (historic sources), it became evident that some of the early impressions were inaccurate. Some of the visual sources exhibit great attention to detail and accuracy, whilst others less so. However, all of the sources did provide invaluable interpretative information and were useful in assembling the final 3D model.

Sketchup software was used to create the computer model of the Newcastle Time Machine. This is a simple modelling program. For rendering of the model, the software *Photoshop* was used to create a painted over effect and artistic overlay.

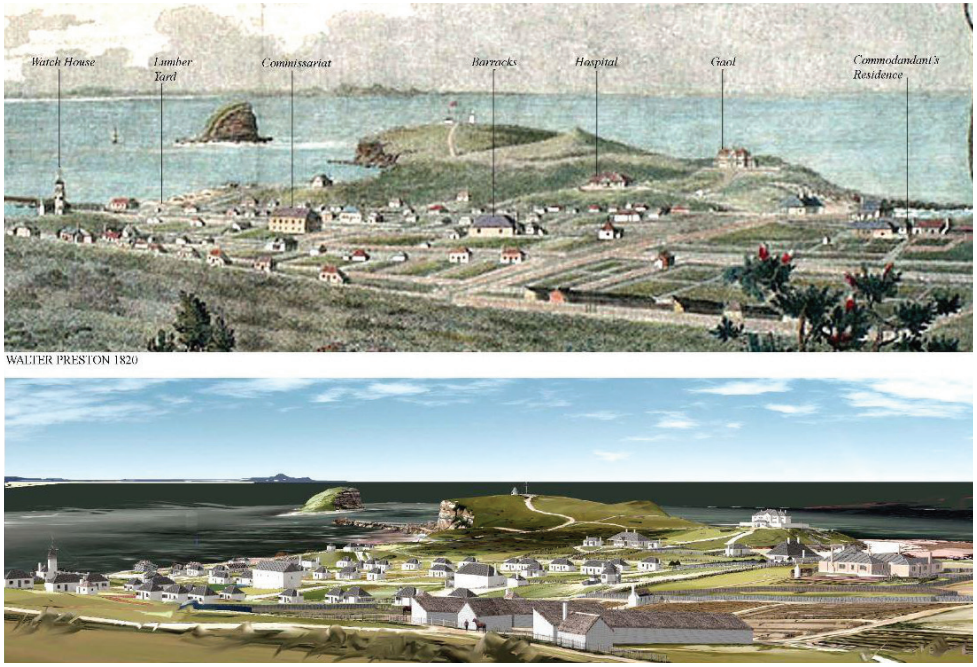

Figure 5. Comparative Computer Model showing from the Windmill (now Obelisk Hill). (Source: Cultural Collections, University of Newcastle. Creator Charles Martin).

Maps were also used in a comparative analysis to gain as accurate as possible a delineation of the landscape and built structures. The Meehan (1818) and Armstrong (1830) maps were the best contemporary references available, and by creating composites each map shows how Newcastle's early streets were laid out and it was not long after this that a grid street layout was adopted (referred to as the Dangar Plan), which remains in Newcastle's present street layout.

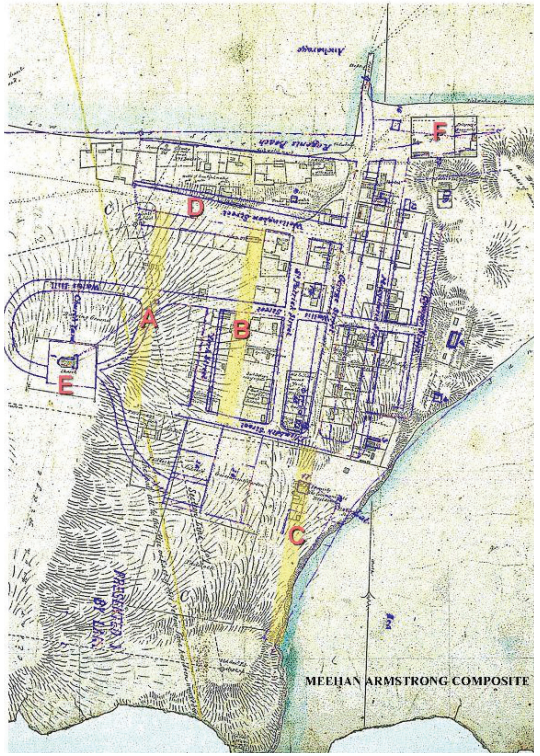

Figure 6. Overlays of the Meehan map (1818) and Armstrong map (1830). (Source: Cultural Collections, University of Newcastle. Creator Charles Martin).

Figure 6 shows the former Commandant's Residence (C) situated on what later became the extension of Watt Street to Ordnance Street. Hunter Street (D), then Wellington Street, was a simple track leading to the west. Christ Church (E) commanded the most prominent positions of Newcastle, and was by far the tallest structure in the settlement in 1830. By the time Armstrong had compiled his map, the Lumber Yard (F) had been formalised into a rectilinear enclosure. The boundaries of this remain evident in 2017. Of particular interest is that the harbour foreshore was still in its original pristine state with a sandy beach (Regent's Beach) and had deep channels.

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Collaboration and consultation

As the models continued to be worked up, with ongoing consultation with historians and members of the CRWP to identify buildings taking place. Where possible, inhabitants identified bringing a human perspective to the project. Members of the CRWP come from the disciplines of history, engineering, geology, surveying, archaeology, creative arts, education, digital/ IT, and have adopted an approach that engages the UON and the community (Hardy and Eklund 2014). It is a wide disciplinary membership. The methodology of the Newcastle Time Machine was well suited to a multidisciplinary model because it meant historical, archival, surveying and geological knowledge and expertise was always available.

During this phase, the creator gained considerable knowledge of the landscape and environment of early Newcastle. However, inaccuracies in the primary sources raised new questions about the early Newcastle environment. Questions were posed to historians and others in specialist fields and in some cases discrepancies were resolved, while other questions remained unresolved. Often an 'educated' guess was made to locate as best as possible, the position of buildings and landmarks.

The project was a 'work in progress' and under regular review with further research and development required. The plan was for the model to be transferred to a more sophisticated program and to seek partners and benefactors to progress the digital experience.

Conversion of the Newcastle Time Machine to a virtual reality experience

In 2014 the Newcastle Time Machine was further extended by incorporating Virtual Reality (VR) Technology. The 3D model, renders and flythrough of early Newcastle and other files were provided to a virtual reality and augmented reality development studio under the direction of Tim Davidson. The earlier model was converted to an interactive 360 degree virtual reality experience using the Oculus Rift VR

headset. Using the Oculus Rift meant our VR platform viewers could experience a truly immersive tour of early Newcastle.

The conversion process imported models into Unity 3D, a real-time render and game development engine. The original models were very high in detail and resolution and although these were ideal for flythrough animations and 3D images, for interactive experiences, and virtual reality much of this detail was removed. This is called 'mesh cleaning'. Once the mesh cleaning and conversion were complete, a build of the virtual environment surrounding the Newcastle Model began. During the conversion process the landscape model was unable to correctly migrate across to the new software, and a new model was built and a replica of the original model file. The landscape was then populated with flora, textures and materials, as well as roads, paths and tracks, retraced in accordance with the original files and maps provided by Charles Martin. With the redevelopment of the landscape complete, additional environmental aspects were included in the scene, such as water and lighting. The 'mesh cleaned' model was added, and this included lower resolution models of the buildings, structures, ships, fences, and people that were added into the scene.

The interactive Virtual Newcastle was starting to take shape. With the virtual environment complete, capabilities were incorporated enabling the viewer to freely navigate around the landscape using a game control pad. A Virtual Reality component was added, which allowed the Newcastle Time Machine experience to be viewed using the Oculus Rift virtual reality headset. This created a new and truly immersive experience in which users were able to feel as if they were actually there. Unfortunately, after considerable user testing, it was discovered that a number of users started to feel nauseous when navigating within the Virtual Reality experience. This is a relatively common phenomenon, known as 'VR sickness', caused by the mind expecting to receive feedback from the body when moving, and when it doesn't receive this, the user at times feels unwell. After extensive testing, 'VR Sickness' was overcome

by making two simple additions to the experience. The first was to place the user on a 'tour' path. This meant that the user could no longer freely roam, but was taken on a pre-defined tour of the township. Whilst this limited the level of interactivity, the user could still have a similar immersive experience and the likelihood of VR sickness was significantly reduced. The second element used to prevent VR Sickness was to place the user inside a virtual 'Horse and buggy'; this saw lingering nausea subside almost completely.

Digital heritage perspective

The heritage discourse in Australia has changed significantly over the decades, and is gradually shifting away from a dominance of 'heritage professionals' and 'old buildings', but has multiple definitions (Australian Government, Dept. of the Environment and Energy 2016). Although digital heritage is not explicitly mentioned in the National Heritage Strategy (2016), it is relevant in heritage circles because digital technologies are used in cultural heritage practices, thus expanding and challenging the definition of 'heritage'. Digital heritage has broad use (Wu and Din 2015, p. xli), referring to digital technologies, archaeology, virtual world environments, video games, and other online methods for exploring the past; it therefore makes sense that contributors to digital heritage also come from many diverse fields. The idea of multiple digital heritage players is legitimised by the status given as stated in *UNESCO Charter on the Preservation of Digital Heritage*: "[digital heritage] embraces cultural, educational, scientific and administrative resources, as technical, legal, medical and other kinds of information created digitally, or converted into digital form from existing analogue resources." (UNESCO 2003b). As Cameron and Kenderine suggest, digital innovation is opening up discussions about current heritage practices and the future direction of heritage (2010, p. 3). This new shift of the heritage sector into the digital realm could be further strengthened by using multi-disciplinary

approaches, particularly information technology and digital specialists.

Digital heritage projects can be tailor made depending on the locality, expertise and technological support available. Digital platforms are becoming a normalised part of contemporary society and digital heritage will continue to take many forms and be applied to diverse heritage and histories. Diversity of digital heritage is outlined in Cultural Heritage in a Changing World (Borowiecki, Forbes and Fresa 2006) and the work around digital dance and performance by Whatley and Sabiescu (2006, pp. 17-36.) shows just how distinct and unique digital heritage projects can be.

Digital technologies are increasingly being used in the heritage industry and the digital revolution will provide collaborative opportunities. 'Heritage' is becoming very technical due to digital implementation and therefore it is increasingly necessary for heritage professions to learn new digital techniques. The diversity of these skills is described in *Digital Heritage: Applying Digital Imaging to Cultural Heritage* (MacDonald 2006). It is, therefore, essential to support shareholders in the realm of digital heritage, including bodies such as ICOMOS, National Trust of Australia (NSW), the education sector, GLAM organisations, and the tourism sector. It is also important that digital heritage as a concept is incorporated in the Burra Charter, as 'digital heritage' incorporated in the *UNESCO Charter on the Preservation of Digital Heritage*. Similarly, efforts to reach out to the digital humanities professions and other associated bodies are needed, as there seems to be a digital revolution in the area of humanities. As Combi (Combi 2016, p. 4) points out, technical revolutions often turn out to be cultural revolutions.

In other parts of the world, digital archiving is usually used to safeguard buildings and monuments (see work by Cyark) from natural disasters, whereas the Newcastle project impresses the historic city of the early 1800s onto a contemporary digital platform. It does not document the modern city in 2017. Nevertheless, the Newcastle 3D model can be used to read the modern landscape and understand impacts from proposed change, such as urban revitalisation and development, a pressing threat to the cultural heritage of the city.

An advantage of digital heritage and 3D modelling is that audiences can experience history visually rather than via the often-limited written sources (as was the case in Newcastle) by the recreation using 3D models. Digital heritage can be used by heritage professionals and others. Digital preservation and heritage conservation are aided by the practice of 3D technology. Virtual digital models that use relatively reliable primary sources (as described in this Newcastle project) are effective heritage management tools that assist in the better understanding of historic landscapes. The lack of historical secondary sources has meant historical evidence is not always there–evidence that is usually crucial to heritage conservation practice underpinning conservation documents (such as Conservation Management Plans).

Digital technology has many applications in cultural heritage management and protection, and digital heritage can be effective in embedding cultural understanding into planning instruments. Newcastle is undergoing revitalisation since the closure of BHP in 1999, and in 2017 major new development is taking place, or planned, such as major transport infrastructure including light rail (Farquhar 2016). The digital heritage 3D project provides knowledge about the city landscape to better understand the topography and features such as water courses, shorelines and sites of early human occupation by indigenising the city and embodying Aboriginal knowledge and wisdom into planning frameworks to create sustainable cities of the future (Hardy, di Gravio and Robertson 2015). The layout of the built environment as it was in the early 1800s is valuable information that can inform urban planners of the potential of archaeological sites. This is particularly pertinent to Aboriginal and European historical archaeology scattered across the Newcastle landscape. It is not unusual for significant relics to be discovered or rediscovered during development in the inner city, and 3D virtual projects are effective

heritage conservation management tools that can inform planning.

This project has made good use of the primary sources available and has embedded historical evidence into digital platforms to produce a relatively accurate 3D model, and is an educational, professional and academic research tool.

Conclusion

The 'Newcastle Time Team' project has had many contributors actively involved at particular phases of the project, from locating and digitally repatriating historic sources, to researching and re-interpreting sources in digital forms. As discussed, the project is not about digitising Newcastle as a heritage city in 3D representations, but it interprets the historic landscape of the past. The process has required particular expertise to analyse research material, and has taken considerable period to create (mid-1990s to 2017), to formulate ideas, procure relevant documents, analyse sources and apply cultural sources to digital imaging to create a model that is as reliable as can be. At the heart of this project has been time, and documentary evidence.

We acknowledge that a single case study is not a broadly-based review of the effectiveness of the multi-disciplinary approach; however, qualitative statistics related to this digital project have come after an article, 'Turning Back Time', was published on the front page of the *Newcastle Herald* and received over 1K 'likes' and 432 'shares' on the *Herald*'s Facebook page within a month (Owen 2017).

Finally, the collaborative aspects of this digital heritage project can significantly enrich outcomes because of the multidisciplinary approach that was taken. The multidisciplinary model used by HHI could be used by other tertiary institutions to develop digital heritage projects associated with an individual university. It is an approach not typically used in the tertiary setting, but has come about due to the shift towards innovative ways to digitise and interpret archival sources. The multidisciplinary approach is an appropriate mechanism that provides a forum where many voices are heard and recognises the value of collaboration, particularly with those in the digital and creative industries.

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References

Australian Government, Department of the Environment and Energy. 2016. Definition of Heritage. Accessed 13 January 2017. https://www.environment.gov.au/heritage/about/national

Albrecht, G. 2000. "Rediscovering the Coquun: Towards an Environmental History of the Hunter River." Address given at the River Forum 2000 at Wyndham Estate, Hunter River. Accessed 13 January 2017. http://libguides.newcastle.edu.au/chrp/albrecht#s-lg-box-wrapper-5982476

Armstrong, J. 1830. "The Town of Newcastle, New South Wales." Map showing its present actual state, with part of the adjoining Country, and The Coal Works of The Australian Agricultural Company, from a Careful Survey in 1830 by Jno. Armstrong. Wellington: Alexander Turnbull Library, The National Library of New Zealand.

Borowiecki, K. J., N. Forbes, and A. Fresa, eds., 2006. *Cultural Heritage in a Changing World.* New York: Springer Press.

Cameron, F. and S. Kenderine, eds., 2010. *Theorizing Digital Cultural Heritage: A Critical Discourse.* Cambridge: MIT Press.

Close, E. 1820. "Barracks with Christ Church in the Distance, Newcastle, New South Wales." Artwork. National Library of Australia. Catalogue number 4564445.

Coal River Working Party blog. 2003. *"ABOUT".* Assessed 13 January 2017. https://hunterlivinghistories.com/about/

Coal River Working Party blog. 2008. "The Coal River Time Machine", March 13. Accessed 13 January 2017. https://hunterlivinghistories.com/2008/03/13/the-coal-river-time-machine/

Coal River Working Party blog. November 29, 2012. "Virtual Newcastle circa 1800", March 13. Accessed 13 January 2017. https://hunterlivinghistories.com/2012/11/29/virtual-newcastle-circa-1800-1830-ad/

Coal River Working Party blog. February 16, 2014. "3D Virtual Newcastle – What Charles and Vera achieved in 34 days of 2013", March 13. Accessed 13 January 2017. https://hunterlivinghistories.com/2014/02/16/34-days/

Combi, M. 2016. "Cultures and Technology: An Analysis of Some of the Changes in Progress- Digital, Global and Local Culture." In *Cultural Heritage in a Changing World*, edited by K. Borowiecki, N. Forbes, and A. Fresa, 3-16. New York: Springer Press.

Cultural Collections, UON Library WordPress. (2007) "Coal River Surveying Students win Excellence in Surveying Awards." Accessed 13 January 2017. https://uoncc.wordpress.com/2007/10/04/coal-river-surveying-students-win-excellence-in-surveying-awards/

Cultural Collections, University of Newcastle. 2000. "Virtual Coquun-Hunter River Project Guide". Virtual guide produced by the University of Newcastle, Australia. Accessed 13 January 2017. http://libguides.newcastle.edu.au/chrp

Cyark. 2014. Accessed 13 January 2017. http://cyark.org/

Di Gravio, G., and P. Sherlock. 2007. "The Coal River Project – from Convicts and the Dreamtime to Google Earth". Presentation (Monteath's 3D programmers Andrew Baker, David Wallace and landscape mapper) at the UON Coal River Working Party meeting, Callaghan Campus, Newcastle, 29 March.

Di Gravio, G. 2012. "Virtual Newcastle circa 1800-183AD" Hunter Living Histories blog on 29 November 2012. https://hunterlivinghistories.com/2012/11/29/virtual-newcastle-circa-1800-1830-ad/

Di Gravio, G., e-mail to Greg Preston, 11 September 1998.

Di Gravio, G., e-mail to research colleagues, 1 December 2000.

Di Gravio, G., 10 January 2016. Personal reflection of association between 'heritage' and 'digital'.

Din, H. and S. Wu, eds., 2015 *Digital Heritage and Culture: Strategy and Implementation.* Singapore: World Scientific Publishing.

Farquhar, L. 2016. "NSW Government releases further details of Newcastle's new light rail." *1233 ABC News.* April 11. Accessed 13 January 2017. http://www.abc.net.au/news/2016-04-05/nsw-government-releases-further-details-of-new-light-rail/7300302

Fryer, J. 2016. "The Past Matters: Rock art and Indigenous Heritage Workshop." YouTube video recording at *Past Matters Rock Art and Indigenous Heritage Workshop*, May 20, 2016 at University of Newcastle's Auchmuty Library. Accessed 13 January 2016. https://www.youtube.com/watch?v=GbHtRNw2fUg

Hardy, A. and E. Eklund. 2014. "Multidisciplinary Approach to University – Community Engagement." *The Australasian Journal of University-Community Engagement* 9: 77-99.

Hardy, A., G. di Gravio and B.Robertson, 2015. WordPress post "Indigenising the City: Embodying Aboriginal knowledge and wisdom into planning frameworks to create sustainable cities of the future." Paper presented at the Spaces and Flows: Sixth International Conference.

University Center Chicago. Accessed 13 January 2017. https://hunterlivinghistories.com/2015/11/03/indigenising-the-city/

Iverson, O. S. and R. C. Smith. 2012. "Connecting to Everyday Practices: Experiences from the Digital Natives Exhibition." In *Heritage and Social Media: Understanding Heritage in a Participatory Culture*, edited by E. Giaccardi, 130. London: Routledge.

Kelly, M.. 2011. "6500-year-old heritage junked." *Newcastle Herald,* May 20.

MacDonald, L. ed., 2006. *Digital Heritage: Applying Digital Imaging to Cultural Heritage.* Oxford: Butterworth-Heinemann.

Owen, B. 2017. "Turning Back Time". *Newcastle Herald,* April 20. Accessed 17 May 2017.

Prensky, M. 2001. Digital Natives, Digital Immigrants. *Horizon* 9 (5): 1-6.

Ray, G. 2012. "VIDEO: Fly through 3D history of Newcastle." *Newcastle Herald*, November 30. Accessed 13 January 2017. http://www.theherald.com.au/story/1157494/video-fly-through-3d-history-of-newcastle/

Royal Commission of Inquiry into the Coal Industry (New South Wales). Accessed 13 January 2017. http://search.records.nsw.gov.au/agencies/4978

The Mayfield Website. 1996. Accessed 13 January 2017. http://pandora.nla.gov.au/nph-wb/20000720130000/http://www.library.newcastle.edu.au/archives/mayfield.html

Thomson, J. Letter from Mr John Thomson to Captain Schanck, H.R.N.S.W., Vol. III (September 8, 1799): 716-718.

Towers, C., and T. Sumner. 2009. "Sir Thomas Mitchell 1828 Newcastle Survey Report – Full Report and Summary" Accessed 13 January 2017.

Sir Thomas Mitchell's Angular Observations and Field-Note Sketches of Newcastle.

UNESCO. 2003b. "Charter on the Preservation of Digital Heritage". Paris, UNESCO Website. Accessed 13 January 2017. http://portal.unesco.org/en/ev.php-URL_ID=17721andURL_DO=DO_TOPICandURL_SECTION=201.html

University of Newcastle, Coal River Working Party Minutes 5 November 2012. Accessed 13 January 2017. https://coalriver.files.wordpress.com/2014/01/crwp-minutes-2012-november.pdf

Whatley, S. and A. G. Sabiescu. 2006. "Interdisciplinary Collaborations in the Creation of Digital Dance and Performance: A critical Examination." In *Cultural Heritage in a Changing World*, edited by K. Borowiecki, N. Forbes, and A. Fresa, 17-36. New York: Springer Press.

Wilson, J., and A.Widgery. 2007. "Fort Scratchley DTM and Coal River Working Party Surveying Project Report." University of Newcastle Students. Accessed 13 January 2017. https://downloads.newcastle.edu.au/library/cultural%20collections/pdf/johnwilson_coalriver%20report_full.pdf

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