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Community engagement and participation with 3D cultural heritage visualisations.

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Executive Summary

Laser scanning of heritage sites is an established mechanism for capturing and recording the sites for scientific research, digital conservation and for developing resources for user engagement. While laser scanning can be costly and time consuming, new developments in scanning technologies means that scans can be taken in much less time and at a higher quality thereby allowing areas of heritage interest to be scanned at a lower cost. Some scanners also take photographs of the sites, for overlay on the point cloud data which produces enhanced visualisations.

This pilot project has investigated user engagement and interaction with 3D visualisations of heritage sites. A portable laser scanner was used to capture a 3D scan of Elgin Ladyhill/Castle in the North-East of Scotland. These are important local landmarks; the ruins of Elgin castle date back to the 12th century and stand at one end of the Royal Burgh High Street. The scan was compiled and rendered and made available for viewing through open source technology (Meshlab, on both laptop and iPad) and used as a basis for the social research. A user engagement event and informal social research interviews with members of the community was conducted in Elgin Library.

The technical findings of the project were that the new scanners allowed for sites to be captured more quickly, in better detail and were much more user friendly than laser scanners used by the project team in the past. Visualisations were easily produced but integrating data into the scans proved to be more difficult. Architectural software such as Revit were determined to have the required functionality and performance but are proprietary and not appropriate for non expert users. Open source visualisation technologies that were trialed were found to have limited functionality and did not perform well with HD data.

The social research findings demonstrated that that there is a great level of interest in 3D visualisation of local heritage. This adds to the existing body of knowledge about the popularity of community heritage more generally. It was particularly encouraging that the research participants were interested in the technical details of the laser scanning and that the scans inspired interesting discussions about heritage in the local area. Respondents also reported opportunities for these technologies to be used for tourism and educational resources.

The project team will build on the findings from this research to develop laser scanning projects with a range of applications for user groups such as: local community heritage organisations, tourists and school children. Specifically, the team intend to develop a more extensive project investigating 3D visualisation and integration of user generated content using open source gaming platforms.

Introduction and Aims and Objectives

Developments in ICT are facilitating new opportunities for communities, academics and heritage organisations to engage with local cultural heritage resources. Recent projects have seen interesting developments including cultural heritage repositories (such as Culture Sampo, Kist O' the Riches and CURIOS) and augmented reality Apps for smartphones such as Kulturarv, which allows users to explore Danish heritage. In addition, initiatives involving laser scanning of heritage sites have become popular as evidenced by high profile initiatives such as The Scottish Ten which is digitally documenting Scotland's five UNESCO-inscribed World Heritage Sites (WHS) and five international heritage sites in Scotland to create a database of digital information on globally significant heritage sites.

These visualisation projects are being conducted for the purposes of digital conservation in order to preserve a record of vulnerable sites, for recording scientific data about sites and also to facilitate new forms of public engagement with heritage (Zlot et al 2013; Laing 2011). Conducting laser scanning of sites can be very costly and time consuming requiring specialist expensive equipment (Scott et al 2013). However, in recent years, more portable laser scanners have been developed that are capable of scanning greater areas in less time and can produce high quality 3D visualisations in a more user friendly manner (Yastikli 2007). This presents opportunities for researchers to work with community groups to scan heritage sites that are locally significant but that may not meet the criteria for WHS and therefore tend to be overlooked in the large high profile visualisation projects.

Digital cultural heritage initiatives have been demonstrated to be popular and engaging mechanisms for communities to engage with their heritage (Tait et al 2013). They have potential as education tools, for empowerment through co-production of local knowledge, to encourage community engagement in local history, and for recreation and tourism consumption purposes (Stevens et al. 2010; Flinn 2007). User participation, combined with the greater exploitation of cultural and archival artefacts in an online environment, is a key priority for many heritage based organisations and funding (from agencies such as Historic Scotland, Heritage Lottery Fund and others) is increasingly dependent on clear strategies for digital content and participation. Providing mechanisms through which local users can participate and engage with resources allows for a greater diversity of perspectives and interpretations of community heritage to be represented (Creswell, 2011; DeSilvey, 2012).

The main aim of this research is to investigate the impact of 3D visualisations of local heritage sites on community engagement with heritage by conducting a pilot study of Elgin Ladyhill/Castle.

The research objectives are:

- To investigate the extent that the use of 3D visualisations of local heritage assets impact on individuals' sense of place and community identity, heritage and participation
- To evaluate if this leads to increased awareness and understanding of local cultural and heritage assets
- Specifically examine the 'added value' of digital participation and investigating how innovative mechanisms for interacting with data act as enablers to co-production of heritage assets.

This seed project has investigated user engagement and interaction with 3D visualisations of heritage sites. A portable laser scanner was used to capture a 3D scan of Elgin Ladyhill/Castle in the North-East of Scotland. These are important local landmarks; the ruins of Elgin castle date back to the 12th century and stand at one end of the Royal Burgh High Street. The scan was compiled and rendered using proprietary software (Leica Cyclone) and made available for viewing through open source technology (Meshlab, on both laptop and iPad) and used as a basis for the social research. A user engagement event and informal social research interviews with members of the community was conducted in Elgin Library.

As well as investigating the user experience of viewing local heritage sites in a virtual environment, this seed project also investigated mechanisms for incorporating user-generated content into the visualisations. A point of investigation was to determine how non professional users can contribute information to 3D visualisations and thereby enhance knowledge and understanding through 'tagging' and commenting on digital artefacts (Basu, 2012).

Key Findings

The key findings can be split into two sections- the technical findings from the scanning and visualisation and the findings from the user engagement and interviews.

Findings from the Scanning and Visualisations

The original project plan indicated that we would use a laser scanner that RGU already owned for the project. However, the research team had the opportunity to trial a new scanner, which was used as an alternative.

The scanner used was a Leica C10, shown in the image the left. Test scans were conducted at the RGU campus to ensure that the scanner was operational. On the 19th of March, two researchers from RGU travelled to Elgin to conduct the laser scanning of Elgin Ladyhill.

It was found that the Leica C10 scanner was able to capture scans much more quickly and in higher definition than previous scanners that the project team had used. The scanner works by scanning thousands of points per second and overlaying these with photographs to produce high quality images. This included taking photographs of the sites, for overlay on the point cloud data. In total four scans were captured, two in high definition and a further two in medium definition.

Figure 1: Leica C10 scanner and Elgin Ladyhill

It was also found that the battery life of the scanner was much better than previous scanners that had been used. In future projects this means that it is feasible to capture much larger areas. Therefore, although the test site was that of Lady Hill, many of the respondent comments related to other sites either located nearby or which were connected in other ways (e.g. shared history). Future studies would aim to capture that wider geographical area.

A further advantage determined from the new generation of scanners is that they have more tolerance for wind and rain disturbance. On the day of the scanning it was very windy, which may have led to a lower quality scan with previous versions. Although modern laser scanners can continue to operate in the rain, this can lead to rather 'noisy' scans, as the laser light hits raindrops, rather than buildings or landscapes. This was not an issue experienced on the day of the test scans undertaken here, but could conceivably lead to slight delays should weather affect future studies. It is finally worth noting that scanners do not require external lighting (other than to take photographs), so the equipment could certainly collect scan data from dark environments (such as the interior of old buildings).

The scans were joined together using the Leica Cyclone software package, which is required to extract and then process scan data from the scanner itself. This proved to be simple to use and produce visualisations as shown below, but has the disadvantage that it is proprietary technology. As it was a trial version we had limited access to some of the more advanced functionality and the trial version expired before the end of the project. Nevertheless, the software itself operates fully in 'viewing' mode, irrespective of licensing, and was used as such to produce many of the still and video outputs.
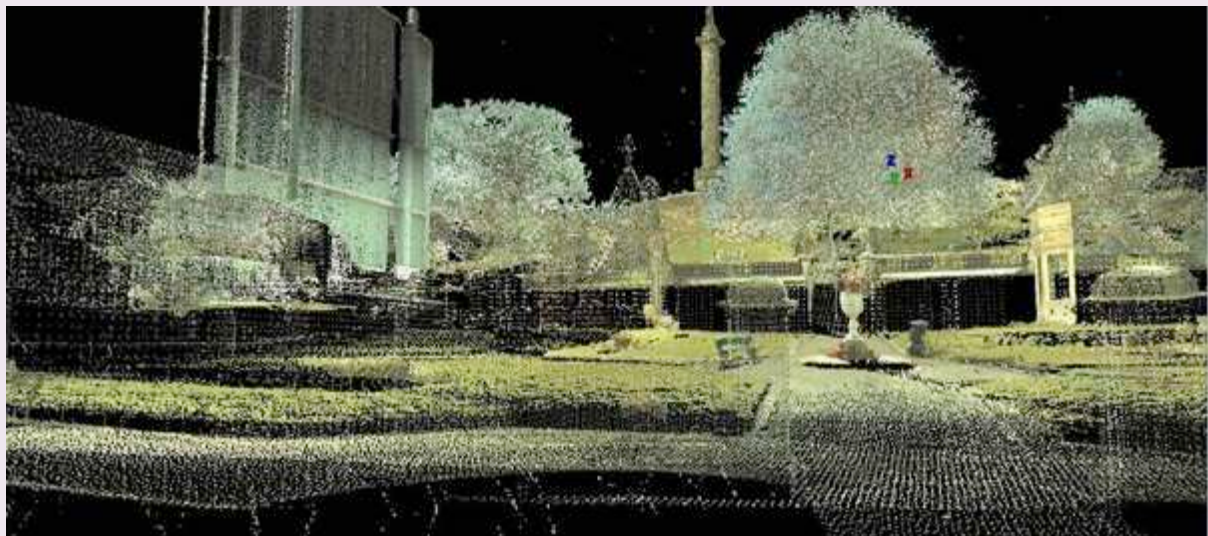
Figure 2: Visualisation from scan data

The scan data can be exported to other software packages including open source packages and various other software options for visualizing the data and integrating user generated content were investigated. These will be discussed further in the next section.

Images were captured from the scans and videos of 'fly throughs' were captured using Camtasia Studio which is a screen recording technology.

A video was uploaded to Youtube which has received 164 views as of 09/04/14 and was also posted to Twitter.

Two relevant Facebook groups were identified and links to the videos and invitations to attend the user engagement event were posted. Elgin Past To Present is a very active group with 3229 members as of 04/04/14 where people post photos and discuss issues of local heritage and culture. Our video was 'liked' 13 times and one positive comment was made.

The video and invitation was also shared on Moray Council Libraries and Information Services Facebook group which has 622 members as of 04/04/14 and is the official Facebook group of the library services. This is a less active page with fewer contributions from members of the public. Our video only received one 'like' and no comments on this page.

It is clear from this project, and others which the project team that have been involved in, that social media are tremendously popular mechanisms for users to engage with local heritage. Future projects will make more use of Facebook, Twitter, Pinterest and Flickr for disseminating findings and sourcing user-generated content.

Findings from the User Engagement Workshops and Interviews

A user engagement event was held in Elgin Library on the 4th of April 2014. Several project demos were created:

- Two further videos from the scan data were captured using Camtasia Studio and were played on a loop.
- A version was created that users could navigate themselves using the open source visualisation software Meshlab
- An iPad visualisation was created using Meshlab so that users could experience interacting with scan data.

The user engagement event was limited in scope as it was during a weekday and was dependent on recruiting participants who were in the library at the time of the event. It was originally intended to do more formal user testing and recorded interviews but this proved to be impractical due to limitations in the space that was available for the project team.

Figure 3: User engagement event at Elgin Library

In total 16 informal interviews were conducted. Due to the limitations outlined above of the 'accidental' sampling technique, the participants cannot be considered representative of the local population. However, a reasonable range of views were gathered:

- There were a diversity of ages of participants although a disproportionate number of older people volunteered to participate.
- Some were long term residents of Elgin but some were relatively new to the area
- Some were library staff who provided a valuable perspective on the role of the library in community engagement.
- Some individuals had been involved directly in local community history activities and some were not.

An interview guide was developed but the interviews were largely unstructured as participants commented and asked questions while looking at the demos and so it was not appropriate to hold formal structured interviews. Instead notes were taken by one of the researchers throughout the day and the findings were synthesized and will be presented thematically.

Key issues facing local heritage in Elgin

Respondents were asked to identify areas of local heritage significance and areas that they felt were important to capture and any challenges that they were facing. Several respondents mentioned that the area had experienced severe flooding in recent times. Respondents were not sure if heritage sites had been directly affected but indicated that the issue of flooding was dominating local concerns in the area at the time. Some respondents asked whether the scanning could be used to help to identify areas that were at risk from flooding.

A further issue that was raised was the local political and economic drivers for capitalizing on the local heritage. Several respondents commented that the local Council viewed heritage as a key economic asset and that they were keen to develop initiatives that showcased heritage including (but not exclusively) involving digital technologies. A separate but related issue that was raised was what, if any, the role of the library should be in terms of local heritage. It was discovered that there was a plan to relocate the Heritage Centre may be relocated to the library and that the library viewed this as a positive development because they viewed this as an opportunity to expand their role and may encourage more people to use the library services.

Users indicated a number of other areas that could be included in future scanning work including: Gordon Castle and Spynie Palace, Duffus castle, old closes off the High Street, Clarkley hill near Burghead.

Technical Interest

An interesting and unexpected finding was the level of interest that the participants had in the technical aspects of the scanning. Users asked a lot of questions about: how the scanner worked, what the advantages were of laser scans over photography, how the photography was integrated and how long it took to make the models. Many respondents thought that the scans would have taken much longer and been much more expensive to produce.

Some users were more interested in the technical details than they were with the heritage aspects of the project and indicated that they would like to find out more about laser scanning and may be interested in participating in future work. A suggestion which will be discussed further in the section on 'next steps' will be to include community scanning events where members of the community can be directly involved in the scanning process under the guidance of researchers from RGU.

Impact of 3D visualisation on understanding of local heritage

All respondents responded positively to viewing the scans with several commenting that is was reminiscent of what they had seen on TV shows such as Time Team. Some key comments included:

- That the scan allowed them to 'see it in a new way' by viewing Elgin Ladyhill from different perspectives. Many respondents commented that they had either never been to the top of Ladyhill or had not done so in years and therefore viewing the site from these angles was a different experience for them.

- Several respondents commented that this was an area that they 'took for granted' because it was a familiar landmark and that having viewed it on the scans they would then go and pay more attention to Elgin Ladyhill when they were passing it. Some commented that it is common for people to notice heritage in cities that are being visited but not so much in their own location.

- A commonly recurring theme was that respondents commented that that they were thought that the area looked better or 'more romantic' on the scans than it did in 'real life'.

- As they were viewing the scans many respondents commented about areas that had changed over the years and asked whether it would be possible to remove newer buildings from the scans so that people could see how the area 'used to be'.

Usability and User Engagement on Laptop and tablet

Participants did not raise any specific concerns about the usability of the scans although one person commented that it would have been better to have used bigger screens, especially for the videos.

A point of investigation of the research was to investigate the relative usability of the tablet and laptop versions. Users tended not to spend a large amount of time manipulating the scans on the iPad and did not make specific comments about the relative usability of the iPad compared with the laptop version. Comments tended to be fairly generic with users again focusing on technical questions and making suggestions about how it could be used in other contexts.

More formalised user testing will be incorporated into future projects.

Applications, Co-Production and User Engagement

As has been indicated in previous findings, many respondents were keen to give ideas about how the 3D scans could be used for a variety of purposes. This will feed directly into future project developments.

- Users suggested that the video capture of scans could be used for marketing purposes.
- It was suggested that incorporating other forms of content such as texts, photographs, sounds and comments from users would add value to the scans and broaden the applications. Some participants had some more ambitious but very creative ideas for augmented reality applications.
- Many users indicated that the scans could be used to develop 'heritage trails' for tourists to use on Smartphones or Tablets. These could alert tourists to areas of historical significance and would also allow for crowdsourcing of experiences.
- It was also suggested that this could facilitate the linking of other local initaitives. For example, one respondent noted that they were aware of a collection of old photographs of the area, some of which had been digitized and so suggested that these could be included. A further suggestion was to work with a group that was conducting citizen archaeology in the area.
- It was suggested that more events could be held in the library which could involve digital and non digital initiatives (for example, it was suggested that an event could involve interacting with the scans and also drawing local heritage landmarks)
- It was suggested that photography workshops could be held where users could go out and photograph heritage sites and that these could also be incorporated.

Key Issues

We can summarise the key emergent issues from the technical and social research to be the following:

1. New generation scanners represent a significant step on from previous versions. They scan much more quickly, and in higher definition, and are therefore a feasible mechanism for capturing large areas. However, they are still costly and do require some technical knowledge to work them and so are unsuitable for community groups to use themselves. As it was clear that users were very interested in participating in the scanning we conclude that a key emergent issue is in designing initiatives where users and researchers can work together to capture the scans.

2. Identifying suitable software proved to be difficult and requires further exploration. Architectural software such as Revit is very powerful and could incorporate data from users. However, they are proprietary software and were designed as a building information modeling software rather than a mechanism for user engagement and so is rather too complex and not fit for purpose for end users. The open source 3D visualisation software Meshlab was used for the laptop and iPad versions of the scans but were found to have limitations. Meshlab has been used successfully before to develop visualisations but has limitations on the size of file that it can process and did not work seamlessly with the very detailed HD scans. The best compromise option between functionality and usability is likely to be open source gaming engines. A number of open source game engines have been developed using HTML5 which works across all platforms. The laser scans could be used as a 'base' for the visualisations and then users could use software such as 123D (which uses photographs and cloud based photogrammetry to build a 3D model) and these could be integrated into the scan thus creating a 'townscape' based on both laser scans and user generated content.

3. We determined that there is a great level of interest in 3D visualisation of local heritage. This adds to the existing body of knowledge about the popularity of community heritage more generally. It was particularly encouraging that the research participants were interested in the technical details of the laser scanning and that the scans inspired interesting discussions about heritage in the local area.

4. As well as the general appeal of 3D visualisations, respondents also saw the opportunities for these technologies to be used for tourism and educational resources. More research will be required to develop applications that are appropriate and engaging for these groups such as: local community heritage organisations, tourists and school children which were all groups identified by respondents.

Next Steps

The next steps for the project will be to build on the key issues identified in the previous section. Elgin Library have indicated that they will be willing to continue to work with us in future and respondents also gave us information and contact details for other local organisations to work with.

There are many potential paths for future project work but the project team are particularly interested in:

1. Holding community scanning events where local people can suggest areas to scan and (in collaboration with the RGU team) can participate in the scanning process.
2. Conduct a more extensive mapping and online ethnographic study of local community groups with a particular focus on Facebook and Flickr initiatives.
3. Investigate the use of open source game engines as a mechanism for creating interactive resources for community digital heritage.
4. Conduct more extensive user engagement workshops and events with specific target groups.
5. Investigate sustainability of community digital heritage resources and specifically determine what role institutions such as libraries can have in ensuring long term sustainability of community digital heritage assets.

Impact

The impact of this project has been to provide a proof of concept that laser scanning is a feasible mechanism for capturing community digital heritage. It has also demonstrated that there is interest in these initiatives from members of the public, from the library sector and other community heritage groups. The project has also determined that there is demand for more interactive mechanisms and that the ability to incorporate user generated content into 3D scans would be beneficial.

Dissemination

The findings of this seed project are currently being written up for dissemination in an academic journal. The project was due to be presented at the CILIPS (Chartered Institute of Libraries and Information Professionals Scotland) Discovery Day on the 22nd of April 2014 but unfortunately this event has been postponed. The project team have indicated that they would like to present when the event is rescheduled.

A video version of this report will be produced and shared on Youtube. Links will be sent to the CCN+ network and the video will be shared on our social media accounts. The project team will also send a copy of this report and the video to the contacts established at Elgin Library and will post links on the Elgin Past to Present and Moray Council Libraries and Information Services Facebook group/page.

The user engagement event also served as a mechanism for dissemination to non academic users.

Funding

Several funding sources have been identified to build on this project:

- As a result of our user engagement event in Elgin Library we have been invited to join discussions to become part of a funding bid with several groups in the area.
- We are in discussion with institutions in several European countries regarding the development of Horizon 2020 applications.
- There are potential sources of funding from other Digital Economy networks which are currently being investigated.

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