Institution: University of St Andrews

Unit of Assessment: 31 (Classics)

Title of case study: Virtual reconstructions in education and heritage management

1. Summary of the impact

Dr Sweetman's research on the churches of the late-antique Peloponnese included a virtual reconstruction of the Acropolis Basilica in Sparta, which was developed in conjunction with a pair of publications on the pedagogical applications of virtual reconstructions. This initial work led to the development of nine other virtual reconstructions – including St Andrews Cathedral, Linlithgow Palace and the Brora Salt Pans in Sutherland – which have contributed to making cultural heritage more accessible to a wide range of users. Specifically:

i. They have helped a range of tourist and cultural heritage bodies in Scotland and beyond to improve accessibility by means of virtual tourism and to increase public interest in local heritage. (*Public understanding and heritage management*)

ii. They have been used in the classrooms of seven Scottish schools in projects related to the Curriculum for Excellence, resulting in increased understanding of and enthusiasm for archaeology and Scottish and classical history. They have influenced Education Scotland in their development of new plans for using digital technologies to enhance learning, and have been made available via Education Scotland's 'Glow' website to schools throughout Scotland. (*Education*)

2. Underpinning research

Dr Sweetman's research has made an innovative contribution to our understanding of the late antique Basilica on the Spartan Acropolis, and of the use of church space in the late antique Peloponnese more broadly. It has also advanced our understanding of the pedagogical value of virtual reconstructions.

(i) Since arriving at the University of St Andrews in 2003 much of Dr Sweetman's work has focused on the functions of architectural space and the use of architecture and topography in the Christianization process in the Peloponnese. Central to that research was a virtual, three-dimensional reconstruction of the sixth-century phase of the Sparta basilica complex, based on her excavations (**output 1**). It was created jointly with Dr Alan Miller, Lecturer in Computer Science in St Andrews, and subsequently made available online (**output 2**). The virtual reconstruction allowed Dr Sweetman to test a series of hypotheses about the architectural layout and functions of the building. Being able to experience the reconstructed space virtually led to an improved understanding of lines of sight within the building and their likely significance for social stratification, and of the likely organisation of space for liturgical practices. Key findings (**outputs 3** and **4**) include: the probability of a domed roof for the Basilica over the Bema as early as the late antique period; new insights into how the West building and church were connected with each other, which in turn made it possible to identify the likely presence of upper galleries; new understanding of the way in which the West building's stairs functioned as a viewing platform, which strengthens the arguments for a martyr's tomb; the conclusion that the liturgy practised in the building is lkely to have had a focus on procession; the conclusion that some aspects of the building were designed to be socially exclusive (through access and lines of sight), which is a typical feature of the late-antique Christianization process.

(ii) A secondary strand of research into pedagogical applications of learning through virtual reconstructions was conducted in collaboration with the School of Computer Science (**outputs 5** and **6**). Most importantly, Allison et al. (2010) (**output 6**) explored educational applications of the virtual platform outside academic research. Sweetman's contributions focused on the use of virtual platforms in teaching archaeology. She found that these platforms improve the learning experience of pupils and students in Classics, History and Archaeology. The research also reached some preliminary conclusions about the way in which virtual experience of the architecture and space of archaeological sites, especially when integrated with a game concept, can allow tourists and students to gain a richer understanding of locations which are geographically remote or no longer in existence in their original form.

3. References to the research

1. Sweetman, R. and Katsara, E. (2002), 'The Acropolis Basilica Project, Sparta: a preliminary report for the 2000 season', *Annual of the British School at Athens* 97: 429-68 [peer-reviewed journal]
2. Sweetman, R. and Miller, A. (2009). Virtual reconstruction of the Acropolis Basilica, Sparta in the sixth century CE. Developed 2008; open access since 2009. Available at http://openvirtualworlds.org/basilica/, static page at http://openvirtualworlds.org/unity-static/web-basilica/web-basilica.html [an important point of reference for all further work on the site, making innovative use of virtual reconstruction techniques]
3. Sweetman, R. (2009), 'Acropolis Basilica, Sparta: the broader research issues', in Cavanagh, W.G., Gallou, C., and Georgiadis, M. (eds.), *Sparta and Laconia from Prehistory to Pre-Modern* (*BSA Studies*): 331-43 [peer-reviewed edited volume]
4. Sweetman, R. (2010), 'Christianization of the Peloponnese: the topography and function of late antique churches', *Journal of Late Antiquity* 3, 203-61 [peer-reviewed journal]
5. Allison, C., Getchell, K., Miller, A., and Sweetman, R. (2009), 'Exploring the second life of a Byzantine Basilica', in Petrovic, O., and Brand, A. (eds.), *Serious Games on the Move* (New York), 165-80 [chosen for conference on the basis of peer review of submitted abstracts; then as one of the strongest papers for publication in the resulting edited volume]
6. Allison, C., Getchell, K., Miller, A., Nicoll, R., and Sweetman, R. (2010), 'Games, methodologies and immersive environments for virtual fieldwork', in *IEEE Transactions on Learning Technologies*: 281-93 [peer-reviewed journal article] [DOI: 10.1109/TLT.2010.25]

4. Details of the impact

Dr Sweetman's research on the Sparta Basilica, part of a larger project on the churches of the late-antique Peloponnese, involved a virtual reconstruction of the basilica complex. That was developed together with a pair of publications on the pedagogical applications of virtual reconstruction. It was funded by an HEA grant of £3000. That work then made possible the development of a series of other virtual reconstructions by a team in the School of Computer Science working in consultation with Dr Sweetman and other colleagues in St Andrews. The next reconstruction after the Sparta Basilica was St Andrews Cathedral (static page at https://vimeo.com/71629823). Following a demonstration of the Cathedral reconstruction to Historic Scotland, the team was commissioned to complete a reconstruction of Linlithgow palace (which had been started and abandoned by a commercial company). Two further reconstructions were then completed independently by the project team in Computer Science (Martyrs' Church, St Andrews, and 1920s Harlem), and a further five in collaboration with SCAPE Trust, which aims to research, preserve and promote the archaeology of Scotland's coast (the Trust is affiliated with and partly funded by the University of St Andrews), and with a series of museums both in Scotland and in Iceland. Those five are: the Brora Salt Pans and a medieval settlement in Caen in Sutherland, both on display in **Timespan Museum and Arts Centre** in Helmsdale, Sutherland; the sixteenth-century fort at Eyemouth, to be displayed in **Eyemouth Museum**; the Fethaland Fishing Station, to be displayed in the **Shetland Museum**; and a tenth-century Icelandic Viking longhouse in the Mosfell Valley. The reconstructions are available online (http://openvirtualworlds.org/start/). These reconstructions have begun to make a substantial contribution to heritage management, public understanding and educational practice, in Scotland and beyond.

i. Heritage management and public understanding of Scottish and classical history

The initial benefit of this work has been to heritage managers working in Scotland and beyond. The work on Linlithgow Palace was supported by a £3000 grant from Historic Scotland (in addition to a further grant from Education Scotland noted in section ii, below) in recognition of its importance as a model for the future accessibility agenda of Scottish tourism more broadly. The value of this work for preserving community heritage has been recognised through funding given by the Heritage Lottery fund (£60,000), MakeITHappen (£17,000), and Historic Scotland (£10,000), allocated in order to give the reconstructions permanent exhibition space in the museums noted above. Dr Sweetman's initial research on the Sparta Basilica, with its innovative use of virtual reconstruction, and the subsequent extension of those techniques to other sites have thus benefited heritage managers in a range of institutions, helping them to further their goals of increasing accessibility to

local archaeological material. That work has also helped stimulate wider dialogue about the future directions of digital heritage management beyond the sites named above through being exhibited at the DigiDoc 2012 conference (a Historic Scotland event) to a mixed audience (160) including heritage managers.

Since completion, the reconstructions have also begun to make significant contributions to enhancing public understanding of the archaeological sites in question among local communities and tourists. One striking development is the way in which the use of gaming platforms in the reconstructions (which can be accessed via game controllers and natural movement) has encouraged more enthusiastic engagement with local heritage from younger visitors. The Timespan museum in Sutherland writes (**source 1**): '*In Timespan, we have been looking for ways to attract new audiences to learn about our heritage, which can be considered by some as a bit dry and dusty and just for the older folk. Here we have up to date technology that children and young adults are familiar with, regularly use and work with, so bringing our heritage fully into the 21st century…*' According to Timespan, the availability of the Longhouse reconstruction on their website from June 2013 has contributed to an increase in traffic, with a 21% increase in visitors during the first month (2489 in June, from 2059 in May), an increase in average session time from 2 to 4 minutes, and an increase from 38% to 59% in returning visitors. Members of the project held a public event to launch the Caen reconstruction at the Timespan Museum in May 2013: 100% of those who filled in questionnaires (**source 6**) agreed or strongly agreed with the statements 'The exhibit helped me imagine what it would have been like to live in Caen' and 'I would now like to find out more about life in the Highlands'. The launch was covered in one local newspaper (the *John O'Groat Journal and Caithness Courier*, 5/6/13) and two national ones (*The Herald*, 28/5/13, and *The Scotsman*, 25/5/13). In addition, the reconstructions have reached a wide public audience through a series of one-off events for mixed audiences of children and adults: MUSA museum, St Andrews (January 2012, 60 visitors); Dundee Science Centre (March 2012, 1000 visitors); 'Food for Thought', St Andrews (June 2012, 800 visitors); 'Across the Universe', St Andrews (June 2013, 450 visitors); likewise through presentations at five non-academic community archaeology conferences in 2012: Highland Archaeology Fortnight; Tayside and Fife Archaeology; Scotland Community Heritage; East Lothian & Borders Archaeology; Dunkeld Community Archaeology. At all these events the reconstructions have been made available to visitors for trial. Visitor-book comments from all these events were unanimously positive. Many suggested that the experience had contributed to revising their perception of the sites, and many expressed a desire to follow up the experience by visiting the sites or by connecting to the reconstructions from home. Typical comments include: '*Kids were very interested and enjoyed being able to interact with the cathedral. The controllers…made it easy for them to do this*'; '*Fantastic work. Can't wait to visit St Andrews again to look at the cathedral ruins*' (from Dundee Science Centre, **source 7**) and '*A fantastic learning tool and great fun to use*' (from Food for Thought, **source 8**). Wider dissemination has been achieved through local BBC and STV news coverage, following up on the Food for Thought event mentioned above (24/6/12), and through articles about the online launch of the cathedral reconstruction in both the Dundee *Courier* and the St Andrews *Citizen* in July 2012 (**source 9**: 'A virtual time machine has been officially unveiled in St Andrews, allowing the exciting opportunity to explore the town's cathedral…[It is] intended to give users a new perspective on Scottish history, accessible across the generations'). The project websites had received over 12,000 page views by 31/7/13, the Facebook page had 400 friends and had achieved a peak weekly reach of 8000.

ii. Education

The reconstructions have also begun to be used widely in Scottish schools. Education Scotland collaborated with Historic Scotland in their support for the Linlithgow Palace reconstruction (see above) by a grant of £2450 in March 2012. The Linlithgow Palace and St Andrews Cathedral reconstructions are hosted on the refurbished Education Scotland 'Glow' website which makes them available as resources for all schools in Scotland. The Glow website is central to Education Scotland's initiative on game-based learning within the Curriculum for Excellence (CfE). A representative of Education Scotland writes (**source 2**): '*We…see this work as something that can underpin a widening of interest in the historical tapestry of Scottish schools and this experience has helped raise the bar of aspiration for us…so much that we are now looking to develop national challenges that would see learners recreate [other] historical sites…using tools such as Google Sketchup or even Minecraft. Over the past few years the Emerging Technologies Team [at*

Education Scotland] has gained a lot of recognition for its innovative use of digital technologies to enhance and enrich learning…The partnership of the team at St Andrews University has been invaluable in helping us maintain our presence in this domain and without it we would have ended this avenue of enquiry some time ago'.

The first three reconstructions (Sparta Basilica, St Andrews Cathedral, and Linlithgow Palace) have been used in seven schools (Linlithgow PS, Linlithgow Academy, Madras College, Strathkinness PS, Dundee High School, Glenrothes High School, Helmsdale PS) in classes and projects. For example, the Cathedral reconstruction was used as the basis for developing a Local Unit of the CfE at secondary level at Madras College, St Andrews, in 2012-13. It was launched in October/November 2012 via a three-day event at the school, attended by 400 students, which included talks and hands-on experience. Students then visited the Cathedral ruins and completed assessment projects based on the reconstructions. A representative of Madras College writes (**source 3**): '*Rebecca's reconstruction had a positive impact on pupils, teaching staff and the wider community…The quality and quantity of work students have been doing in their own time speaks of how the Cathedral reconstruction has fired their imagination. I haven't known anything like it before*'. The reconstructions are attractive to teachers because learners are empowered by using familiar technology, and because they are accessible to a range of age groups and to students with different learning requirements. A representative of the Department of Additional Support at Glenrothes High School writes (in reference to his first experience of the reconstructions while still at Madras College) (**source 4**): *'I took a group of DAS pupils in to see the material and was struck at how engaged they were with the format. Many of these children with a range of moderate learning difficulties spend many hours on x-box and playstation so the controls were recognisable and posed far less threat than a pencil and paper...The pupils engaged fully with the activity, and the arrangement allowed for co-operative learning, good communication, and was fun'*. That initial experience led him to invite the project team to engage in further collaboration after he moved to Glenrothes. The team spent two days there working with 40 students with learning difficulties in June 2013. The DAS has agreed to be involved in a pilot project trialling the use of the reconstructions for its pupils during 2013-14. A representative from the High School of Dundee writes (**source 5**) about a recent visit by Dr Sweetman: '*The virtual simulations engendered discussions about how people would have behaved and felt, encouraging pupils to approach their studies with empathy and therefore a clearer understanding of their forebears' motivation and decision making…This year I have a group of boys who often appear disengaged from their topic studies and, perhaps understandably, would rather play football or computer games. Allowing them the opportunity to combine their love of games technology and their studies is a perfect solution…It was pleasing to see their increased involvement with the content of the lesson…The pupils could better see the purpose of archaeological research with such a vivid and visual method of presenting them with the information*'. The reconstructions have also been used outside class teaching and project assignments. For example, 200 school students from Linlithgow Academy were involved in an event in June 2012, organised in collaboration with Education Scotland. They were filmed acting as tour guides in 16th-century costume and placed within the Linlithgow reconstruction using green-screen technology (http://vimeo.com/71629822). The project has also contributed to dialogue about future directions for virtual reconstruction in education through presentations at two major educational conferences: the Scottish Association of Teachers of History Conference (audience of 160) and IED Immersive Education, Paris (60).

5. Sources to corroborate the impact

1. Chair, Timespan Museum, Sutherland
2. National Advisor for Emerging Technologies and Learning, Education Scotland
3. Secondary school teacher, Madras College
4. Head of Department of Additional Support, Glenrothes High School
5. Primary school teacher, High School of Dundee
6. 13 questionnaires from an event at Timespan museum, 26/5/13
7. 42 visitor-book feedback responses from the Dundee Science Centre display, 17-18/3/12
8. 17 visitor-book feedback responses from 'Food for Thought', 24/6/12
9. St Andrews *Citizen*, 1st July 2012 (http://www.fifetoday.co.uk/news/local-headlines/explore-middle-ages-cathedral-in-its-prime-1-2381857)

N.B. sources 6-9 all corroborate the claims made above about impact on public understanding.