

Impact case study (REF3)

Institution: University of Reading		
Unit of Assessment: 29 Classics		
Title of case study: Digital Rome: inspiring access to Rome's ancient architecture and history through 3D visualisations		
Period when the underpinning research was undertaken: 2007-20.		
Details of staff conducting the underpinning research from the submitting unit:		
Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Matthew Nicholls	Lecturer Senior Lecturer Associate Professor Professor	15/09/07- present
Period when the claimed impact occurred: 2014 – 20.		
Is this case study continued from a case study submitted in 2014? Y		
<p>1. Summary of the impact</p> <p>Ancient architecture is traditionally illustrated with black-and-white line art, which can be off-putting for non-specialist audiences and students. More fundamentally, static 2-dimensional pictures, usually confined to individual buildings, cannot convincingly represent 3-dimensional architectural space or how it was perceived (including via motion). 3D digital reconstruction offers powerful new ways of studying ancient environments; at a whole-city scale this includes insights into how buildings corresponded to each other and to their environment. Matthew Nicholls' digital model of ancient Rome, unique in scale and method, is therefore an important scholarly resource – a “virtual laboratory” for sightlines, visibility and light/shadow studies. The model's vivid moving interactive imagery supports innovations in education (for pupils; training educators; creating educational resources), informs commercial contexts (games, digital visualisation, broadcast, and education) and has improved public outreach.</p>		
<p>2. Underpinning research</p> <p>Nicholls' research has made major contributions to our understanding of Rome's architecture and built environment. It is grounded in interdisciplinary archaeological, literary, historical, historiographical, epigraphic, numismatic, and iconographic material (outputs 1– 5). While this evidence for the ancient city is relatively abundant, it often exists in isolated sub-disciplinary contexts and is expressed visually by limited 2D monochrome line art, such as ground plans and sections. 3D imagery can present something closer to the original appearance of the buildings and spaces in question to academic and public audiences and allows research hypotheses to be explored and visualised. This potential informed the early development of the digital model. As the growing model became itself a significant tool for research, teaching, and disseminating knowledge, Nicholls' research extended into the pedagogy and practice of visualisation in i) humanities disciplines and ii) the crossover between academia, heritage and education sector, and commercial work, explored through his tenure of a British Academy “Rising Star” Engagement Award (BARSEA).</p> <p>The 3D computer model (output 1), drawn by hand in architectural software, offers a visually convincing impression of the entire ancient city of Rome. It is unique in its approach, scale, “hand-built” quality, and detail. Nicholls' research is grounded in a long scholarly tradition including graphic, plastic, and written media, but this new digital medium allows for flexible outputs including still and animated imagery, interactive elements that users can explore for themselves, and illumination and sightline studies. The underpinning research necessarily incorporates thousands of “conclusions” about individual structures, many of which are subject to alternative</p>		

theories. These findings have been incorporated into successive versions of the model: they include visual expressions of uncertainty as well as 'realistic' colouring, layering to control (in)visibility of elements, and the creation of a database to capture decisions taken. Nicholls has contributed substantially to the development of practices and applications in these areas through workshops, in research papers at major conferences (eg papers at CHNT Vienna in 2016, 2018), and papers on the research background and pedagogical use of the project (eg keynote talk on digital teaching, University of Winchester, 2018; Mellon Visiting Professor at Bates College, 2016). While practical and theoretical advances in this new field are often rapidly iterated and expressed in workshops and conferences, Nicholls' work on the use and reception of the model (output 6) has also contributed to a growing body of print scholarship on visualisation.

Recognition has progressed from local to national and international. After internal awards and seed funding (£35k total since 2010), Nicholls won the Guardian/HEA's "Innovative Educator of the Year" award (2014), a BARSEA award (2015, to bring academic digital modelling into contact with commercial and public sector practitioners), and a National Teaching Fellowship (2018, total external funding £30k). Nicholls draws on his own research to teach students, for example, to research, produce, and annotate their own digital reconstructions.

3. References to the research

Nicholls' research meets the 2* quality criteria as it makes a significant contribution to the range of digital modelling research and its applications; it has developed a worldwide reputation in more than one academic field and among educational and commercial users. The significance and rigour of the underpinning research have been recognized by scholars' requests to use the model's images in peer-reviewed academic publications in order to inform their argument and illustrate specific hypotheses. Nicholls' research is internationally recognised and has become a point of reference in the study of urbanisation in ancient Rome.

1. Virtual Rome image folder <http://centaur.reading.ac.uk/95071/>
2. Nicholls, M. C. (2011) Galen and libraries in the Peri Alupias. *Journal of Roman Studies*, 101: 123-142. ISSN 1753-528X, DOI: <https://doi.org/10.1017/S0075435811000049>
3. Nicholls, M. 2019. *Bookish places in imperial Rome: bookshops and the urban landscape of learning*. In: Adams, S. A. (ed.) *Scholastic Culture in the Hellenistic and Roman Eras: Greek, Latin, and Jewish*. Berlin: De Gruyter, 51-68. DOI: <https://doi.org/10.1515/9783110660982>
4. Nicholls, M. (2017) *Libraries and communication in the Ancient World*. In: Naiden, F. S. and Talbert, R. J.A. (eds) *Mercury's Wings: exploring modes of communication in the ancient world*. Oxford & New York: Oxford University Press. ISBN 9780195386844.
5. Nicholls, Matthew (2018) *The Battle of the Teutoburg Forest commemorated: from the Arch of Germanicus to the Arminius Monument*. In: Leoussi, Athena and Heuser, Beatrice (eds.) *Famous Battles and How They Shaped the Modern World: From Troy to Courtrai, 1200 BC-1302 AD*. Pen & Sword Books, Barnsley and Havertown, PA. ISBN 9781473893733.
6. Nicholls, M. 2019. *Sketchup and digital modelling for Classics*. In: Natoli, B. and Hunt, S. *Teaching Classics with Technology*. London: Bloomsbury, 131-144. ISBN: 9781350110939.

4. Details of the impact

a. Educational impact on adult learners via a FutureLearn Massive Open Online Course (MOOC)

The principal development of this project since 2014 has been its use in a successful Massive Open Online Course (MOOC) on the FutureLearn platform: *Rome: A Virtual Tour of an Ancient City*. FutureLearn MOOCs have a global reach, bringing university research to a huge public audience for free (with scope for paid upgrades for permanent access.) The platform has over 8 million registered learners from 190 countries. The course includes five weeks of online content that combine digital reconstructions with documentary footage shot in Rome. The unique feature

of this course is its incorporation of digital Rome model footage and interactive “live” 3D models of buildings for learners to explore which has made it a conspicuous leader in history/archaeology MOOCs worldwide. Detailed figures for the first run (April 2017) show higher overall recruitment figures than the average both for all MOOCs and for comparable history courses; a very strong out-performance for active learner engagement; and significantly higher proportions of learners completing over 50% or 90% of the course than on other comparable MOOCs (E1.)



During its 10 runs (as of December 2020), the MOOC has attracted over 59,000 learners from 190 countries placing it in the top quartile for all MOOCs on the FutureLearn platform. These learners include large numbers of working (26.3%), self-employed (9.1%), retired people (34.1%) and full-time students (6.1%) across a spectrum of ages (E1). Specific impact among the learners includes 93.9% positive feedback ratings, with 98% of survey respondents stating that the 3D model had given them a greater understanding of the ancient city. A further 60% of survey respondents said that the 3D model gave them a better understanding of Ancient Rome than more traditional methods including guidebooks. One learner commented: “Not long after I took the course, I actually went to Rome. This course helped me understand the layout of what the city might have looked like thanks to the virtual maps and designs presented in the course. It was a much more enriching experience because of this”; another learner commented “I would like to return to Rome as I know I would look at it differently now” (E2). The 3D model and the course have been the inspiration for many trips to Rome, or to museums and sites related to the city, (83% of survey respondents) as well as acting as a substitute for those prevented from travel, for example because of disability, ill health or the Covid-19 pandemic (47% of survey respondents, E2).

As a pioneering example of using 3D content within a digital educational offering, the MOOC attracted considerable publicity, has generated significant revenue (£33,179.40), and has acted as a model for others. It has been featured as the subject of stories in print media, radio, TV news, and promotions by FutureLearn and *The Guardian* on the basis of positive feedback, high recruitment, retention, engagement and conversion to revenue (E1). FutureLearn commented in 2018 that the course was “in the top 30 most financially successful FutureLearn courses of 2017/18”. Universities including Coventry and Cardiff have also used Nicholls's work, particularly the 3D models in the Rome course and another course, *Introduction to Microbiology*, as valuable case studies to inform their own course development (E3).

b. Educational impact on teachers and school pupils

The model has been widely used in schools, where it engages and informs a “digital generation” who expect high quality visual material; this can be a transformative experience for teacher and pupils’ understanding of the ancient past. Engagement with the digital model has had a pedagogical impact on teachers, school children, students, and educators globally: as one teacher from Canada writes: “We live in a visual world [...] Professor Nicholls' course design takes all of the realities faced by students and teachers and meets them head on. With a brilliant blend of visual, oral and written resources Professor Nicholls created a 5-week course that has honestly changed the minds of many of my students” (E4). Nicholls’ model has been used in workshops on digital resources for Classics teachers run by the Joint Association for Classics Teachers and two workshops on digital modelling to approximately 30 PGCE Classics students in Cambridge who will, on graduation, take these ideas to their new classrooms. One participant

commented: “I know that [colleague] and I will be revamping our courses to incorporate elements of your project and help bring the city to life for the girls” (E4). Nicholls’ digital model has also been incorporated into educational video products used in schools including the popular Cambridge University Schools Classics Project and a commercial Massolit online educational resource film on Augustan Rome, licensed to schools for A-level use. Massolit report that Nicholls’ course has been watched a total of 22,527 times since records started in March 2017. This makes it the 40th most popular course out of over 450 courses on all topics on the site, and the 5th most popular Classics and Ancient History course (E5).

c. Commercial impact on broadcasters, museums and digital Industries

Nicholls’ digital model has been used in a variety of commercial settings. The Swedish computer games company The Station has used the Rome model. Nicholls also provided consultancy to inform the game’s historical accuracy, gameplay, and visual look and feel, helping it to pass major development milestones with the project’s commissioner. As the CEO writes: “To be able to have one of the foremost experts on Ancient Rome verifying our designs has made a great impact on the choice of architecture, materials, colours and patterns as well as help us design functions of buildings for worship, crafts, entertainment and much, much more. One of the guiding ‘Pillars’ of our project has been ‘Inspired by History’...With the assistance of Dr Nicholls we believe we have been able to create an experience that is not only entertaining but also informative and inspiring” (E6). The model has also been licenced for use in documentaries by Smithsonian TV channel, Windfall Films and Nutopia for the Travel Channel, all of which were broadcast and relicensed globally. Both Nutopia’s VFX and Windfall Films commented that without Nicholls’ model, they would have been unable to achieve the desired quality in their programmes (E7). Nicholls’ model has also been used by a number of museums in their exhibitions. For example, the Allard Pierson Museum, Amsterdam, the London Guildhall Art Gallery, London and the Narbo Via, Narbonne used images from the model to shape displays about architecture of ancient Rome in relation to their own holdings. The Allard Pierson exhibit had over 15,000 visitors. The education officer at the Guildhall writes: “I think it worked really well with your reconstructions providing a unique component to the show” and a partner from Foster + Partners working on the Narbo Via exhibition described how Nicholl’s 3D model has led to “new modes of presenting the past” (E8).

Nicholls’ expertise in creating and deploying the model has attracted industry partners who work in the virtual reality (VR), augmented reality (AR), visualisation, and education markets. These users have benefitted from both the Rome material and his knowledge of the pedagogical potential of digital visualisation. Nicholls has worked as a “Visiting Professional” with the US digital modelling software firm SketchUp giving public workshops on digital modelling (including in schools and teacher training contexts) and keynote lectures at international conferences. As a result of their work with Nicholls, SketchUp now have a greater insight into how and why their product is used, and this has increased dissemination to new users (E9). Through a partnership with the French technology firm Kubity VR, learner responses from the MOOC have helped with their product development, including in highlighting frequently asked for features from users. Rome imagery is used in advertising their product online and at commercial conventions and is prominently featured as a case study of the software’s use on their website and their principal promotional video (E10). Nicholls’ work as an educational expert with Context ICT consultancy has informed their 2016 and 2017 reports for the VR industry and the use of technology in education. Nicholls presented on this topic at an industry VR Summit at the British Museum, at a VR Research Group event at the Musée Jacquemart-André in Paris, and at the large consumer electronics IFA Summit Berlin.

These diverse applications all draw on the model’s capacity to offer vivid new ways of exploring ancient Rome. Though created primarily as a scholarly tool, it has found a huge global audience, whose enthusiastic comments show how it has brought new insights. These qualities of visual accessibility drawing on comprehensive research, capable of engaging broad audiences, have attracted numerous commercial partners in many sectors.

5. Sources to corroborate the impact

- [E1]** FutureLearn reports and statistics.
- [E2]** FutureLearn featured learner comments and survey results.
- [E3]** Letter from FutureLearn.
- [E4]** Testimonials from teachers.
- [E5]** Testimonial from Massolit
- [E6]** Testimonial from The Station.
- [E7]** Testimonials from Nutopia and Windfall (single PDF file).
- [E8]** Testimonials/evidence from Allard Pierson Museum, Guildhall Art Gallery (London) and Fosters + Partners.
- [E9]** Testimonial and evidence from SketchUp.
- [E10]** Testimonial and links from Kubity VR.