Institution: University College London
Unit of Assessment: 15 – Archaeology
Title of case study: MicroPasts: Fostering large-scale public and multi-institutional collaborations online to enhance heritage interpretation and improve digital professional standards
Period when the underpinning research was undertaken: 2014-2020
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:
Andrew Bevan	Professor of Spatial and Comparative Archaeology	2004-present
Chiara Bonacchi	Postdoctoral Research Associate	2014-2017
Adi Keinan-Schoonbaert	Postdoctoral Research Associate	2014-2016
Jennifer Wexler	Postdoctoral Research Associate	2016
Rachael Sparks	Senior Lecturer	2005-present

Period when the claimed impact occurred: 2014-2020
Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact (indicative maximum 100 words)

MicroPasts is an online crowdsourcing platform where members of the public and specialists alike collaborate to develop new archaeological and heritage research data, such as archive transcriptions, translations, scientific dates, 3D artefact models and georeferenced sites. Co-founded by UCL and the British Museum in 2014, it is an ongoing, sustainable venture that has led to new collaborations with 27 other archaeology and heritage institutions in the UK and around the world. More than 3,500 members of the public have completed 150,018 data collection tasks. Contributors come from more than 20 different countries worldwide and do not typically work in archaeology or heritage. This has: enabled co-production of new cultural artefacts; enhanced heritage interpretation through collaboration with museum professionals; improved digital professional standards and training in the heritage and cultural sector, and enhanced public participation and learning.

2. Underpinning research (indicative maximum 500 words)

Co-founded by UCL and the British Museum and funded by the AHRC, the MicroPasts project (i and ii, 2013-present) has been a collective endeavour involving multiple institutions from the start. The project brought together partner institutions to develop, implement and start to evaluate a novel model to support collaborative research in archaeology, history and heritage that drew on crowd-sourcing, co-design and crowd-funding. This model led to the establishment of MicroPasts, an online crowdsourcing platform where members of the public and specialists collaborate to develop new archaeological and heritage research data. Although a product of genuinely collaborative effort, the project is a coherent progression of Bevan's research expertise and priorities.

Bevan has conducted pioneering work on the exploitation of the new kinds of increasingly large, often geo-referenced, archaeological information, as well as the digital enrichment of so-called 'legacy' datasets that lie under-utilised in traditional print publications and interim reports. His work has also developed new ways to address well-known problems in archaeological evidence, such as via adoption of relative risk models (from epidemiology) to mitigate distortions in the spatial distribution of known archaeological finds caused by present-day investigation of land use patterns (e.g. **[R1]**). The harvesting of 'legacy' archaeological resources, in particular, opens up crucial new ways to involve the public in archaeology: as desk-based citizen archaeologists at the frontiers of archaeological research, volunteers are unconstrained by the issues associated with involvement in fieldwork, such as accessibility (an agenda set in **[R2]**). Bevan has, for example, developed methodologies for both fully-automated and crowdsourced extraction of published radiocarbon dates from pdf and web sources, as well as for their ensuing analysis using further novel methods, leading to the development of the software package 'rcarbon' that provides tools for analysis of large radiocarbon datasets (latest version **[R3]**, now downloaded more than 20,000 times and used in over 65 publications). As part of this work on radiocarbon, MicroPasts enabled contributors

to check 40,000 UK 'grey literature' interim reports of UK archaeological excavations for radiocarbon dates and thereby contributed to the largest database of such dates in the UK. When combined with other sources, this led to publication in a world-leading science journal **[R4]** of a large-scale regional comparison of human population dynamics, food production strategies and climate change over the Holocene.

MicroPasts has itself enabled a critical, systematic evaluation of this form of desk-based citizen archaeology. One aspect of this research agenda that spans the outputs of Bevan, Bonacchi, Wexler and Sparks (as well as co-founder Pett and collaborator Wilkin at the British Museum), has been evaluation of the extent of digital engagement with archaeology and heritage resources – who uses such resources and why? This and other evaluations were built into the project by Bevan, Bonacchi and Pett from its earliest design phase, leading to several important peer-reviewed outputs, including assessments of how to achieve better quality control in crowd-sourcing tasks such as vector shape digitising, findspot georeferencing or document transcription **[R5]**, and **[R6]** the strengths and weakness the ways of that academic crowdsourcing and crowdfunding might interact.

3. References to the research (indicative maximum of six references)

R1. Crema, E.R., Bevan, A. 2020. Inference from Large Sets of Radiocarbon Dates: Software and Methods Radiocarbon, doi:10.1017/RDC.2020.95 (see also the digital repository https://github.com/ahb108/rcarbon)

R2. Bevan, A. 2012. Spatial methods for analysing large-scale artefact inventories. *Antiquity, 86*(332), 492-506. https://doi.org/10.1017/S0003598X0006289X

R3. Bevan, A. 2015. The data deluge, *Antiquity, 89*(348), 1473-1484. https://doi.org/10.15184/aqy.2015.102

R4. Bevan, A., Pett, D., Chiara, B., Keinan-Schoonbaert, A., Lombraña González, D., Sparks R., and N. Wilkin. 2014. Citizen archaeologists. Online collaborative research about the human past, *Human Computation*, *1*(2), 183-197. https://doi.org/10.15346/hc.v1i2.9 Emerged from grant i.

R5. Bonacchi, C., Bevan, A., Pett, D., Keinan-Schoonbaert, A. 2015. Experiments in Crowd-funding community archaeology, *Community Archaeology and Heritage,* 3.2: 184-198. doi: https://doi.org/10.1179/2051819615Z.00000000041. Emerged from grant i

R6. Bevan, A., Colledge, S., Fuller, D., Fyfe, R., S. Shennan, S. and C. Stevens 2017. Holocene fluctuations in human population demonstrate repeated links to food production and climate, *Procs of the National Academy of Sciences, 114(*49), E10524-E10531. https://doi.org/10.1073/pnas.1709190114

All outputs were peer reviewed.

Grants
  i. AHRC Connected Communities Research Grant (AH/L007657/1, 2013-2015, "Crowd- and Community-fuelled Archaeological Research", GBP314,200, Bevan PI, Pett CoI, Sparks CoI, Bonacchi as named researcher)
  ii. AHRC Follow-on Funding (AH/M00953X/1, 2015, "Building sustainability and informing policy: The MicroPasts programme of knowledge exchange", GBP76,394, Bevan PI, Pett CoI, Bonacchi and Keinan-Schoonbaert as named researchers)

4. Details of the impact (indicative maximum 750 words)

The MicroPasts project has engaged members of the public in archaeology and heritage in non-traditional ways, while also creating re-usable open data, software and expertise, and building a crowd-sourcing project that is sustainable in the long term. MicroPasts is an online crowdsourcing platform where members of the public and specialists alike collaborate to develop new archaeological and heritage research data. Contributors to the MicroPasts platform participate (anonymously or as registered users) to help wider data-gathering efforts by completing short tasks online. Examples include transcribing a museum catalogue card or an archaeologist's diary

page, adding metadata tags of people and places visible in old archaeological photographs, tracing the outline of an object in one of many photographs to support 3D photogrammetric modelling, searching a 'grey literature' report for structured information such as radiocarbon dates, or georeferencing an archaeological findspot. This collaboration has led to four strands of impact: enhanced public participation and learning; co-production of new cultural artefacts; enhanced heritage interpretation through collaboration with museum professionals; and improved digital professional standards and training in the heritage and cultural sector.

Enhanced Public Participation and Learning
Since April 2014, over 3,500 members of the public have contributed to data-gathering projects by completing tasks on the MicroPasts site. Nearly half of users were in the UK (26%) and US (20%) while the other 56% were located in over 20 other countries **[A]**. Contributors have completed 150,018 task runs for 252 different MicroPasts projects **[A]**. User surveys indicate that 72% of contributors do not work professionally in history or archaeology, implying a reach well beyond traditional academic data collection projects. For example, one volunteer is an administrative assistant living in Canada and nearing retirement, who started helping on MicroPasts in 2014 and has now completed 4,323 tasks. She notes **[B]** that: "my small part contributes to something much larger and [more] academically important than I ever could have imagined when I registered to participate […] I have expanded my knowledge and interest about archaeology and have developed my own set of reference information [...] I now also do volunteer transcription work for a number of other organizations including The British Library." Other contributors describe a range of benefits including: the aesthetic pleasure of looking at old diaries or photos or artefact drawings; relaxing with something simple but useful; being able to help and give back to an institution they had visited in the past; contributing to scientific research, and reconnecting with people in archaeology, history or heritage **[R2]**. Contributing to MicroPasts has also had intellectual and professional benefits: at least three contributors have now moved into archaeological jobs or have taken up degrees in archaeology.

Co-production of new cultural artefacts
MicroPasts' core deliverable is new archaeological information: co-produced in all cases, openly available online from the moment of its creation and freely re-usable as new digital cultural artefacts. For example, by crowdsourcing "photo-masks" to enable high quality photogrammetric reconstructions, it has created over 100 3D models of museum artefacts. These have been viewed online at https://sketchfab.com/micropasts over 53,600 times, downloaded over 3,000 times, 3D printed at public libraries multiple times, re-purposed in virtual museums and widely shared **[C]**. For example, a Mary Rose shipwreck tankard has been viewed 7,500 times online, converted to a low-poly version by an interested user that is well-suited to use in on or offline gaming environments, and 3D printed by the Mary Rose Trust for outreach packs. The co-production of 3D digital models has led to the creation of further cultural artefacts; for example a Bronze Age spearhead was digitally printed and accurately painted by a co-host of podcast '3D Printing Today'. The project featured in the 9 April 2015 episode in which the presenters praised the importance for makers of MicroPasts' commitment to sharing data for re-use **[C]**.

Enhanced heritage interpretation through collaboration with museum professionals
Founded upon collaboration with the British Museum (BM), two initial Micropasts initiatives were the crowd-sourcing of a Bronze Age metalwork card catalogue and 3D modelling of Bronze Age objects. MicroPasts contributors transcribed 100% of the uploaded material concerning this dataset which related to over 30,000 Bronze Age weapons, tools and ornaments. As the curator of these collections at the British Museum explains, this made these materials available to a much wider audience: "this internationally significant dataset had only been available to a small number of British based scholars" and its digitisation "brought some of the joys – and eccentricities – of Bronze Age metalwork to a much wider audience than hitherto reached by generations of museum curators" **[D1]**. They also produced 73 3D models of British Museum Bronze Age artefacts (of the 100+ mentioned above) that were made available to the public via Sketchfab. While such an approach to museum artefacts has now been popularized, at the time it was, as Wilkin puts it, "trailblazing" and "provided important opportunities for new forms of dissemination of the museum collection and for collaboration between public and museum staff, in line with the museum's wider

aims and objectives for sharing the collection online and making it studiable worldwide" **[D1]**. The 3D printed models produced by participants also led to enhanced heritage interpretation in outreach settings. Co-produced digital 3D artefact models were used to populate reconstructions of Bronze Age houses in the British Museum Samsung Digital Discovery Centre. These underpinned activities over a weekend (8-9 August 2015) whereby 1,200 family, teen, and school visitors explored a virtual reality Bronze Age site, which included 3D scans of objects placed in their original settings. Participants could access multiple interpretations of how these objects might have been used across three digital platforms. Wilkin described how the virtual reality environment "proved valuable in providing a range of different media with which to engage a public audience through objects that have otherwise been the preserve of the Bronze Age finds specialist", enhancing engagement with heritage interpretation for visitors **[D2]**. Feedback from participants confirmed the positive impact virtual reality had on learning about the Museum's collection: "it made me feel as if I was actually there and gave me a sense of how things actually were in the Bronze Age" **[D2]**. MicroPasts enhanced curatorial practice: for Wilkin, the project "left an indelible mark on my attitudes to digital technology and on my curatorial practice" **[D1]**.

The success of this collaboration led to wider impact within the libraries, archives and museums sector. MicroPasts has enabled crowd-sourcing projects involving 27 other museums, archives, libraries, heritage groups and research projects internationally, from the Society of Antiquaries of London to the Minnesota Historical Society in the US and Museo Egizio in Italy **[E]**. Each project has led to knowledge transfer and opportunities for institutional public outreach, as well as considerable media coverage in 17 major international newspapers as well as archaeology and heritage and culture and technology magazines, and on social media **[F]**. This includes features in *The Guardian* (August 2014, shared 291 times), Italian daily *la Repubblica* (December 2015), and Greek daily *To Vima* (August 2014) (respective circulation at the time of publication 177,827; 331,446; 114,035). The Mary Rose Trust has printed co-produced 3D models of its artefacts for its outreach packs. Their Collections Manager notes, "We were hugely impressed by […] the high quality 3D models that were produced as part of this project. The models opened up […] the Mary Rose collection in terms of its accessibility to a wider (and digital) audience […and] have been used by the Trust in everything from outreach projects, to educational tools and even for research and reference [enabling] visitors to get closer to and inspired by these fascinating, but very fragile objects." **[G]**). In 2015 contributors transcribed 500 object records for the Egypt Exploration Society (EES) in 10 days and, as the Director of the EES explains, this helped them in their project to "digitise and make available thousands of records […] relating to historical excavations" in Egypt and Sudan **[H]**. They explain that "[w]orking with MicroPasts was an exciting and transformative period for the Society's archive. It allowed us to engage our supporters around the world with items ordinarily unavailable to them. The data gathered gave us new insights into our collections and allowed us to provide educational training to interns exploring pioneering research avenues." Two interns undertook projects using the newly accessible data: one "completed an online exhibition about the colonial context of archaeological work in Sudan during the 1930s, and [the other] considered aspects of 'Endangered Heritage' in the wake of the Egyptian revolution" **[H]**. The collaboration has had a long-lasting impact on the EES: "The legacy of the MicroPasts project continues as our collections remain accessible online, and those wishing to search for more in-depth information can use our online catalogue to search more specifically". It has led to knowledge exchange with other organisations: "Being invited to the MicroPasts conference in March 2015 allowed us to see how other organisations were working and develop various synergies to support our work further." As the Director concludes, "The support we received from the MicroPasts team meant that a small organisation like the EES was able to achieve so much more." **[H]**. The New Forest Park Authority were likewise able to build capacity through the collaboration with MicroPasts. They were able to translate diaries from a German wartime POW camp in the forest, and an archaeologist on the project comments, "it soon became apparent that the German was, in places, technical, written in High German and contained German words that were 'difficult' to translate into English. […] We would not have been able to do these translations of WWII German documents if it was not for this platform's involvement and that of its volunteers". They explain that "The work of the MicroPasts volunteers to translate these sometimes technical and challenging documents has gone beyond expectation. […] allowing us and future researchers

the opportunity to 'hear their words' from this important point in local, national and world history" **[I]**.

Improving digital professional training and standards
MicroPasts has developed professional digital standards in a number of areas. For example, the project published 5 tutorials on 3D photogrammetry and crowd-sourcing, which have been re-used in several academic teaching settings (both internal and external to the founder institutions). As one person put it (whose professional life had moved away from archaeology but has since found permanent employment in digital applications at the Natural History Museum): "Public engagement is a key requirement for the type of Museum post I wanted to apply for [and] thanks to MicroPasts I was able to meet this [… A]ppreciation of the possibilities of crowdsourcing that I first experienced with MicroPasts has greatly influenced my own crowdsourcing transcription project [launched by the Natural History Museum in 2020... and] ensured that I understood good practice." **[B]**. In 2014, the platform itself was the first in the UK to adopt and demonstrate the effectiveness of a crowdsourcing framework called Pybossa for cultural research and engagement **[R4]**, that has since also been adopted by the British Library and the British Film Institute amongst others. The platform immediately shares its data publicly and is built on reusable open-source software: data, software and further learning resources or community expertise have all been re-used, for new academic research for museum engagement and to a wide range of people's personal interests.

Those who provide professional training and shape policy in the cultural sector benefited from a 2016 MicroPasts knowledge exchange workshop, which provided guidance on co-producing knowledge online for the sector and the project has been cited in sector-shaping publications **[J]**. For example, the 2014 report of the Towards a Collaborative Strategy for sector information management (TACOS) project, an initiative of two networks for heritage professionals (the Forum on Information Standards in Heritage and the Historic Environment Information Resources Network), used MicroPasts as an example "of how crowdsourcing might be put to use in the enhancement of historic environment datasets". It saw MicroPasts as a test case "in assessing the feasibility of partially resourcing historic environment information projects this way" **[J]**. This new model for community archaeology has enhanced heritage interpretation, improved digital professional standards and training in the heritage and cultural sector, and provided professional development opportunities for volunteers who co-produced archaeological research.

5. Sources to corroborate the impact (indicative maximum of 10 references)

A. MicroPasts Google Analytics map showing non-London IP address locations for site visitors 2017-19 https://bit.ly/38FOdBd and tasks: https://bit.ly/3tsYeJl
B. Testimonials from MicroPasts volunteers (see also oral testimony at RGS: https://bit.ly/2CptMZ4)
C. 3D model reach documentation; 3D printing today podcast https://bit.ly/3dkkzEv
D. **(1)** Testimonial statement Curator: Early Europe, British Museum; **(2)**'Virtual reality at the British Museum: What is the value of virtual reality environments for learning by children and young people, schools, and families?', Paper given at MW2016: Museums and the Web (April 2016), https://bit.ly/30LdGVh
E. Completed projects and collaborating institutions (https://bit.ly/3rZf1mX)
F. Coverage in Major International Newspapers, archaeology and heritage or culture and technology magazines
G. Mary Rose Trust testimonial
H. Testimonial, Director of Egypt Exploration Society
I. Testimonial, Archaeologist, New Forest Park Authority
J. Project report: Towards a Collaborative Strategy for sector information management (TACOS), 2014.