Q1. Please state the name and contact details of the lead applicant.

PI: Dr Joanne Vine, Research Facilitator for Fitzwilliam Museum (jrv31@cam.ac.uk, 01223 332924)

Co-Is: Daniel Pett, Head of Digital & IT (dejp3@cam.ac.uk), Fitzwilliam Museum

Helena Rodwell, Assistant Conservator - Collections Care (hjr41@cam.ac.uk)

Q2. Project title.

Do (not) Touch: Using 3-D modelling to explore tactile interaction with museum collections and how this can affect the visitor perception and reaction to the museum's 'Do Not Touch' policy

Q3. Please explain clearly what you plan to do with the funding if successful - specifically the internal and external stakeholders you will work with and what you will do. (Max 300 words).

This project responds to the cultural heritage global challenge and will enable the Fitzwilliam Museum to:

(1) trial new ways of collaborating with key actors in the heritage ecosystem;

(2) create a solid evidence base and basis for partnership facilitating long-term collaborations and opening up new bidding opportunities; and

(3) offer training to embed knowledge across the University and UCMs. Activity is focused on how to deter visitors from touching objects in the Museum's collection, whilst responding positively to people's desire to connect and engage with the objects through tactile engagement. This is a current international museum challenge and the subject of a Fitzwilliam pilot project.

1.   Challenge definition

Workshop 1: use of 3D for object-based learning and reducing incidents of touching in Museums. Speakers and audience will cover industry, educators, universities, galleries, museums and archives.

Workshop 2: training and upskilling UCM and University staff (including ECRs) on 3D modelling.

Workshop 3: impact of using 3D for object-based learning on collections care, how visitors interact with contributions leading to development of large-scale projects as a result of sharing and discussing findings.

2.   Response 1

Collaboration with industry leaders ThinkSee3D to create at least 10 digital and subsequently printed 3D model(s) based on pieces identified during Do Not Touch project used in handling desk and educational activities. Models will be displayed online via Sketchfab, providing reach of several million users and the ability to integrate with other platforms.

3.   Response 2

Gallery interactive installation. Complete audience research facilitated through the use of 3 iPad Pro tablets to demonstrate augmented reality (AR) and 3D modelling within the gallery space and collate

insight data from visitors. Short-term interactive installation and audience research at another museum.

4.   Response 3

Increase capacity and knowledge of 3D model production within UCM and University, including ECRs.

Q4. Please tell us about the proposed outputs and outcomes from the project(s). (Max 300 words).

• New relationships with sector-leading experts from industry, conservation policy, museums, galleries, archives, education, academia to scope the challenge (workshop 1).

• Create the basis of a larger-scale collaborative project (suitable for UKRI Industrial Strategy funding) based on co-developed findings and challenges from responses 1-3 (workshop 3).

• Develop co-produced replicas with ThinkSee3D building on findings from Do Not Touch project: the first time this company has been involved as full partner in research project, rather than being commissioned.

• Bring together software providers and disseminators – Agisoft, Reality Capture and Sketchfab – to implement their software, produce documentation and write materials to go on their websites, supporting others in heritage sector to engage.

• Evidence-based report for heritage organisations on if/how 3D models can lessen the risk of damage to collections and how audiences respond to new engagement methods, linked to existing work where 3D models and material samples are used as a tactile interface to museum collections for visitor enjoyment and education, including at British Museum on handling desks and Louvre Abu Dhabi as installations.

• Increase broader societal impact of existing Museum work on tactile displays by not restricting to groups and bringing to a regional (non-UCM) museum to test wider applicability of findings.

• Building on existing Museum research on visitors touching objects and projects that give specific audiences (including blind and partially sighted and early years) access to tactile experiences, discover if 3D models can lessen the risk of damage to collections.

• 3D models that can continue to be used as a handling collection, providing new opportunities for deeper learning and engagement and better understanding of audience needs.

• Provide material that can be consumed as new VR/AR products.

• Upskill researchers across University and UCM in 3D making.

• New opportunities for social media and marketing using 3D scans and objects, appealing to more diverse audiences.

Q5. How will the project(s) contribute to the knowledge transfer and impact goals of your Department, Faculty or Institute? (Max 300 words).

This project will: increase the number of ECRs receiving KE training (in 3D); increase the number of collaborative activities with non-academic organisations/users of research; and increase engagements with policy professionals. Projects resulting from this pump priming funding will increase the value of co-produced research in the Museum and grow the number of collaborations with organisations/users of research new to Cambridge and/or the HE sector.

As a museum, the Fitzwilliam is a key part of the UK's research infrastructure, supporting significant KE and impact activity to an international community of interdisciplinary researchers. Through offering opportunities for researchers to upskill in 3D, a key skill in material-based arts and humanities research, and offering new opportunities to bring University researchers into interface with a range of key actors in the heritage ecosystem, this project aims not only to impact on Museum KT activity but that of the wider University.

Involving other Museums, providing a new best practice report on tactile and immersive displays, and including a regional museum to test the interactive display, links clearly to our role as an Arts Council England National Portfolio Organisation in which we are expected to demonstrate sectoral leadership.

New collaborations will lead to applications to the AHRC via their Industrial Strategy allocation, as well as bids for other digital funding. These projects will enable long-term and deeper industrial partnerships focused on increasing the accessibility of the Museum's collections, a core aim of our Higher Education Museums and Galleries funding, as well as ACE.

Q6.   Please provide an outline of the proposed budget for the project(s) and the total grant that you are requesting.

WORKSHOPS

Workshop 1: Staffing costs to open Museum on non-opening day (£250), Speakers' travel (£250) and catering (£1,000) Total = £1,500

Workshop 2: 1 day training rate for 3D trainer (£500) and catering (£300) Total = £800

Workshop 3: Staffing costs to open Museum on non-opening day (£250), Speakers' travel (£250) and catering (£1,000) Total = £1,500

Total for 3 workshops = £3,800

RESPONSE 1

Production of at least 10 digital and 3D printed models at cost price by Industry leaders ThinkSee3D. Total = £4,000

RESPONSE 2

Gallery interactive installation

Installation of touch screens, 3 iPad Pro tablets, materials for handling sessions (£3,000), hardware (£1,764) and researcher time (5 days at scale 7 on TES rates = £807).

Total = £5,571

RESPONSE 3:

Increasing capacity for 3D model production in UCM and University

Purchase of 2 x 12 month license fees for Capturing Reality and purchase of 9 license fees for Agisoft Photoscan pro (educational pricing)

Total = £4,466

Total requested: £17,837

Q7. Please indicate any match funding that you have identified and state whether this is approved or tentative at this stage. (Match funding will be viewed positively but is not essential).

The Fitzwilliam Museum will provide:

Suitable accommodation for workshops (under challenge definition phase)	£200 (based on Corporate hire rates) x 3 workshops = £600
IT staff time for in-gallery installation of digital 3D assets (response 2)	3 days of Daniel Pett's time = £876.53
Expertise and tuition in 3D modeling (via Daniel Pett, Head of Digital and IT for responses 1 and 3)	3 days of Daniel Pett's time = £876.53
Expertise in conservation and handling of objects to facilitate activities (via Helena Rodwell) and lead on Do Not Touch research	10 days of Helena Rodwell's time = £1810.98
Dedicated long-term space on the Fitzwilliam and UCM websites	Included in web hosting and free licensing via Sketchfab
Negotiation of relationship with SketchFab for use of their dissemination platform	1 day of Daniel Pett's time = £292.11
In-house printing for interpretation boards	10 vinyl prints and hard board backs. 10 x £100 = £1000
Long-term digital preservation of the assets created (RAW files, 3D models)	10,000 RAW images £982.32 (based on Archaeological Data Service calculator)
TOTAL	**£6438.47**

Q8.   Please set out the review process that you will apply to determine the individual projects financed within the awarded budget, if your application is successful.

Workshops and training sessions

Survey at start of event/as part of registration process to assess expectations and knowledge; records of type of attendee (e.g. industry, academic, heritage sector); end of event survey to assess event expectations against results and understand potential collaborative opportunities arising from

discussions; and (where permission granted) 6 month follow-up to share experience and potential project ideas.

Responses to surveys, alongside informal networking at the events, will be used to generate new research projects and funding applications based on discussions at the event. Attendees will be asked to share their email address and contact details to facilitate the development of collaborative partnerships.

Responses 1-2

We will create simple feedback forms and integrate 1-2 questions into the interactive display for audiences to assess their experience, learning, engagement and enjoyment. Tactile workshops will also be evaluated using standard Education Dept questions. Feedback will feed into the scope and development of larger scale projects. Where possible, and at specific events, such as Cam Late and focused workshops, staff members will engage directly with audiences to understand how they respond to the digital and replica 3D objects. Quantitative data will be gathered from number of downloads of 3D images and number of visitors engaging with the interactive displays.

Particular attention will be given to how the industrial and policy maker partnership work used in this project could be used as a model for other projects, including planning of displays across the UCM. We will complete a full internal review at the end of this project, transferring the knowledge across the UCM and ultimately to other heritage sector organisations.

Additional questions

Cross-school collaborations established so far

Dr Anne Alexander, Digital Humanities Co-ordinator. Dr Alexander is very keen for the CDH to be involved in this project, as the workshops would fit very well with the Learning Programme. The CDH will partner with us around organising the workshops and will advertise through their networks by integrating them into the Learning Programme for next year. They will also be involved in discussions about the workshop content in order to better understand what colleagues in the museums feel are the priorities for skills development in this area and how these align with different research methods questions which arise from using these technologies. Potential areas of shared interest include exploring questions of interactivity, as the CDH has started to develop ideas for a workshop series with an element investigating the different meanings of 'interactive'. This project could provide the CDH – and their network – with a good case study in a museum context.

Dr Jack Ashby, Museum of Zoology, School of Biological Sciences. Dr Ashby has a particular research interest in using university museum spaces and audiences to test new models of engagement in ways that can inform the wider sector. The Museum will attend workshops and offer a gallery as another test space for our interventions.

Dr Donal Cooper, Department of History of Art, School of Arts and Humanities. Dr Cooper is interested in the application of digital media to recover and communicate original contexts for artworks. In conjunction with the National Gallery, Dr Cooper is co-supervising an AHRC-funded doctoral project to reconstruct the historic settings of a number of the gallery's Renaissance altarpieces.

Marla Fuchs and Mercedes Hernandez-Gomez, Department of Plant Sciences, School of Biological Sciences. Interested in understanding more about how 3D scanning, visualisation and printing could engage new audiences in their programmes (EIT Food and TIGR2ESS).

Dr Jessica Gardner, University Library, Non-Schools Institution, and Maciej Pawlikowski, Digital Content Unit (UL) are very happy to be involved.

Dr Alessandro Launaro, Faculty of Classics, School of Arts and Humanities. Has an interest in virtual reconstructions of artefacts and is happy to be involved in the workshops.

Jo McPhee, Head of Programmes, University of Cambridge Museums. This project is of significant interest to the University of Cambridge Museums. It will provide the opportunity to not only consider new ways of engaging audiences with our collections, but also increase the skills and expertise of our staff. As a consortium with member constituents based across the University's Schools, projects like this enable truly collaborative and interdisciplinary working.

Prof Bill O'Neill, Department of Engineering, School of Technology, has offered to support us with the 3D workshops.

Dr Carola-Bibiane Schönlieb, Department of Applied Mathematics and Theoretical Physics, School of Physical Sciences. Dr Schönlieb works on mathematical methods for the analysis and processing of digital images, and has a particular interest in how these techniques can be used in arts and heritage contexts.

Dr Miranda Stearn, Head of Learning, Fitzwilliam Museum. Dr Stearn is interested in how we can provide tactile experiences to visitors that enables them to have a positive experience at the Museum. Areas to be investigated could include: what are the limits of replicas, AR and VR experiences? How do replicas work in the context of object-based teaching and learning sessions? There are a variety of contexts in which these ideas could be tested, for instance with early years, visitors with sensory impairments, as well as in health settings and more generally with those visitors who cannot physically come to museums. This project will provide routes to start answering some of the questions.

Dr Susanne Turner, Museum of Classical Archaeology, School of Humanities and Social Sciences. The Museum has a significant problem with touching and there has been a noticeable uptick in breakages in the last couple of years. Channelling people's desire to touching different – less fragile – objects is a challenge. As the Museum's collection is grounded in replication so any opportunities to link the Museum's collection to 19th century reproductions with digital reproductive technology offers a way of widening out the scope and potential of the collection.

How we see these future collaborations developing

- We have full involvement from ThinkSee3D and SketchFab in this project. SketchFab has over 6.5m unique visitors every month, 1.5m registered users, over 2m models. ThinkSee3D are a professional trade company who have been investigating, creating and exploring the boundaries between digital and physical model making, using modern and traditional methods to create engaging digital and physical objects. Their services include photogrammetry, colour 3D replicas, precision 3D printing, low volume high quality retail production, digital 3D modelling & design, CT scan to 3D models, 3D engagement exhibits, 3D research and sculpture replication. These companies provide knowledge, expertise and access to huge potential audiences for our collections and research. We will use the initial relationships created as part of this project to shape and create new future collaborations that provide access to the Museums objects to millions of users, and develop the services provided by ThinkSee3D and SketchFab for the benefit of the wider heritage sector.

- We expect this project to develop new avenues of economic impact for the UCMs and wider heritage sector. For instance, ThinkSee3D have used their 3D scans to created 3D printed objects to sell in other Museum shops; this is something that the UCMs have yet to do but that there is interest in exploring. For instance, The Fitzwilliam Museum has provided a project partner letter of support to an AHRC project that is going to investigate how to take advantage of emerging technologies to reap the economic benefits for digitisation and gain

real-time insight into museum audiences. This project demonstrates our interest in this space but this project will opportunities to establish clearer links and ways forward.

- We have also had initial discussions with Museum in a Box, a company that provides a new way for people to interact with digital cultural heritage collections. It taps into the wealth of information that organisations put online every day. By placing the object (such as a 3D scan or playing card) onto a 'brain box' users can access the latest information about these objects. Museum in a Box has worked with many museums, including the Smithsonian and the British Museum (principally with one of the co-investigators on this bid) but this project would bring their experience to the UCM, providing new opportunities for collaboratively developing this product.

- In order to reach new audiences and bring relevant expertise from other sectors, we are in discussions with the Institute for Manufacturing (Dr Nicky Athanassopoulou) around them providing their expertise to our project. The manufacturing sector has already been grappling with some of the issues associated with additive manufacturing, including scalability and integration into existing systems and processes. We expect that the creative and cultural sectors will benefit from this knowledge, and that this project could open up new avenues of impact and engagement for the IfM.

- We have received an expression of interest from MakeSpace who are happy to involve their creative practitioners this project – and future work that arises from this pilot – providing another avenue of potential impact and relationships that this project will enable us to explore and develop. Involving creative practitioners will provide new routes to impact, and new ways of engaging audiences in our collections.

- A key element of this project is the involvement of the UCMs. We have expressions of interest from individuals and have discussed 3D pilots (eg work with Classical Archaeology), and have the UCM's Head of Programmes (see above) backing. We will be piloting new ways of engaging audiences, which will be shared through the UCM blog and as other partners come on board through their channels too.

- One of the challenges of working in the heritage sector is demonstrating the impact of our work. Our evaluation material will be used as the basis for future funding applications, as this project will enable us to provide more evidence around how audiences respond to our interventions in galleries. We will integrate evaluation methods being developed as part of an AHRC follow-on fund project, *Embedding and demonstrating the value of technology-enhanced cultural impact measurement for arts and culture organisations*, to ensure findings are robust.

- Through creating new training opportunities for researchers across the UCMs and University of Cambridge, in collaboration with the CDH, we will enable researchers to use 3D in their own research and impact activities so opening up new opportunities across a range of disciplines.

- We are looking to use these collaborations to bid for funding through AHRC/other Research Councils Industrial Strategy allocations. We are particularly interested in audience engagement and immersive experiences in the creative industries. There may also be opportunities through NESTA that fit with our aims.

- We frequently hear from researchers across the University that they are uncertain about how to collaborate with us. Through bringing potential collaborators to the Museum and discussing projects with our curators, conservators and research scientists, we will catalyse new bidding and partnership opportunities across the Institution.

- Through developing new collaborations, this project will open up new funding opportunities outside of traditional arts and humanities funders so enhancing the chance of success and broadening the impact and reach of our work.