Factum Foundation’s Involvement and Activities in ARCHiVe
May 2019 - May 2020

Factum Foundation has had a team of two or three people working part time in Venice during the past year. The aim for the next year is to increase this to two full time people and several part time specialists working on different projects. Between September 2019 and January 2020 Guendalina Damone, Lizzie Mitchell and Tess Tomassini were working on the preparation of the recently published book *The Aura in the Age of Digital Materiality; Rethinking Preservation in the Shadow of an Uncertain Future* (published by Silvana Editoriale - pdf [here](https://skinny.lumina.com/servlet/JiveServlet/previewAttachment/8535591642417327906/1828526919220728374/8535591642417327906-1828526919220728374.pdf)). It is a 400-page, hardback book with texts by many experts in the field including Hartwig Fischer, Simon Schaffer, Mari Lending, Nadja Aksamija, Bruno Latour and a host of others. It includes a short story based on Factum’s work on the Veronese facsimile for the Cini written by Richard Powers (the Pulitzer Prize winning author) in 2010 for a Cini dialogue. There are also some important observations by Shirley Krenak, an indigenous activist from Mato Grosso in Brazil talking about authenticity, sharing and cultural respect.

The book covers the work Factum Foundation is doing in ARCHiVe in many different ways but there are two specific essays in the book about ARCHiVe. One by Adam Lowe and the other by Rashmi Gajare, the intern Factum brought into ARCHiVe who worked on the Alain Daniélou Collection. Rashmi Gajare and Factum Foundation are now collaborating to develop another project in India to digitally record and train people to document the KonKan Petroglyphs. It’s a great project that has connections to Factum’s digital restoration of the Sacred Cave of Kamukuwaká and the recent trip to Easter Island, which will involve ARCHiVe directly in the collaboration with PIQL relating to long term digital storage of cultural assets.

Since then, ARCHiVe has been regularly mentioned in local and regional newspapers (Corriere del Veneto, Corriere di Verona, Amadeus, La Nuova) as well as national (Il Sole 24 Ore, Il Giornale dell’Arte) and international (Apollo Magazine, 24heures, Bon pour la Tête) media outlets.

In 2019, for the publication of the Antonio Canova. Atelier, the Honorable Gianluca Vacca, Undersecretary, Ministry of Cultural Heritage and Activities made the following statement:

The desire to add value to our artistic heritage through the digitisation of works that, for safety and conservation reasons, cannot be put on display to the public encourages us to find new ways of accessing our cultural heritage: modern channels of use and models for enhancement and protection, in addition to new opportunities for study and research. The conscious use of digital technology is an extraordinary tool for the promotion of knowledge, the sharing of learning and cultural heritage, and, at the same time, the creation of new opportunities for employment and economic and social development. I am firmly convinced of the importance of valorizing and putting into place those worthwhile experiences that are already active in Italy, but which are too often realized in isolation. For this reason, as a Ministry, we are working on the creation of a single control room, so that all digitalisation projects can be set within the same framework. We need to think of a strategic plan centred on sharing and exchanging knowledge and skills. A system capable of ensuring maximum efficiency for an increasingly high-quality service. It is a matter of putting together a systematic and structured network in order to guarantee the full protection and development of our artistic heritage. The model that has been launched at ARCHiVe (The Analysis and Recording of Cultural Heritage in Venice) by the Fondazione Giorgio Cini in collaboration with Factum Foundation and EPFL brings together philology, recording and the analysis of data. This mix of knowledge and technology is urgently required. With the Atelier Canova project, led by Chiara Casarin together with Adam Lowe of the Factum Foundation, the Bassano del Grappa Musei Civici are promoting this development and, through the digitalisation of the works of Antonio Canova, finally making an artistic heritage that is worthy of attention available to the public.

The Aura in the Age of Digital Materiality; Rethinking Preservation in the Shadow of an Uncertain Future triggered a series of live discussions on the 1st, 2nd and 3rd May organised by the Art Newspaper and Factum Foundation. The three events, each lasting about 80 minutes, have been viewed by almost 20,000 people and will remain online as part of the growing archive on material that is being generated relating to the activities of ARCHiVe. The discussions and a selection of the audience questions are included as an annex to this report (pp.41-46). The caliber of the participants in these events is evidence of the reputation that Factum has established over the past years and the respect people have for its work. This is something that is helping to shape the work we are doing in ARCHiVe. This document looks at what has been achieved over the past year, how the research is building momentum, how it can be sustainable and what needs to happen in the year ahead (2020 and 2021).

What are its most important achievements to date?

Factum’s activities in relation to ARCHiVe can be structured into five areas, and although not exhaustive, below are examples of recent activities in each area.

1. Recording
2. Training
3. Dissemination
4. Research + Development
5. Exhibitions and publications
Within the ARCHiVe structure, Factum Foundation’s main role is to find practical solutions for 2D and 3D recording methodologies, capable of obtaining high-resolution documentation of cultural heritage artifacts. In collaboration with the Cini Foundation and DHLAB-EPFL, this information is processed, archived, studied, and shared in order to extract new knowledge. In the last months, a series of projects have been carried that have pushed forward the role of 3D and 2D recording for the preservation, circulation and understanding of cultural heritage.

The 2D and 3D recording of cultural artefacts is at the core of Factum’s work in ARCHiVe. Systematic digitisation and archiving of books, manuscripts, photographs and other documents has been carried the ARCHiVe facilities in Venice. The Replica Recto/Verso 360 scanner has recorded the entire Photo Library of about 1 million images with manuscript and printed notations. At the same time, off-site recording projects have taken place in locations throughout Venice (Palazzo di Malta, Biblioteca Marciana, Palazzo Abatellis, Palazzo Grimani, Banksy’s street art, etc.) and Italy (recording Canova’s drawings and sculptures in Bassano del Grappa and the recording of Baschenis’ paintings Bergamot and Niccolo del Arca’s Compianto in Bologna). A team linked to ARCHiVe recorded Raphael’s tomb in the Pantheon and a significant part of the recording of Raphael’s Cartoons at the V&A was made by trainees from ARCHiVe, working under Factum Foundation’s supervision.

In August 2019, the Factum Foundation carried out its largest and most important 3D recording project to date: the digitisation of the Raphael Cartoons at the V&A Museum. For the first time, the surface of these monumental paintings on paper was captured in 3D using four Lucida scanners. Additionally, high-resolution panoramic colour and infra-red photography was carried out. The Lucida scanners were working in tandem (one of which is permanently located in ARCHiVe) in order to record a total area of about 140 sqm in less than 5 weeks (with alternating teams working in three eight-hour shifts). After the completion of the recording, the processing of the data involved stitching together all individual sections to form a continuous panorama of the surface of the seven cartoons. Part of this work was carried out in ARCHiVe’s studio in Venice by Emanuele Zampieri (IUAV) and Lucy Killoran (Edinburgh University), working alongside Guendalina Damone and Carlos Bayod. It was an important exercise in digital management. The result of this work has been the creation of a series of multi-
layered files with colour, relief and infra-red data in perfect registration. This information will allow
the V&A to carry out an in-depth study of the condition of the cartoons, the way they were made and
the risks they face. It will also bring these artworks to new audiences both as facsimiles (the facsimile
of the Sacrifice of Listra is currently in the Raffaello exhibition at the Scuderie del Quirinale in Rome)
and through online browsers (using Factum Foundation’s multi-layered application). Focussed work is
now ongoing to link the browser to the IIIF platform.

Recording the surface of architectural, archaeological and artworks in high-resolution is only the first
step. If the information cannot be visualised, studied, compared, analysed and archived it is
meaningless. Making 3D recording central to preservation initiatives is key to Factum’s work and
ARCHiVe’s mission. Most serious digitisation projects pay attention to the way the data can be
accessed and viewed, but to date none record the surface of complete paintings in high-resolution
(the remarkable work that was done on Van Eyck’s Adoration of the Lamb is an example). Recording
accurate surface information should now be an essential part of any digitisation project. A recent
application of this is the new multi-layer browser developed to show the Hall of Beauties from the
Tomb of Seti I demonstrates the importance of surface recording and reveals how much things can
change over time. This application combines in a single layered archive the 3D relief and the colour of
the four walls in the room (as recorded in 2016). But it also incorporates other layers that are relevant
to understand the complex trajectory of the site: watercolour drawings by Belzoni from 1818,
photographs by Harry Burton from the 1920’s, a digital restoration of the walls carried out by Factum
and a condition report can be viewed at the same scale. The improvement of the browser, an
important part of the work in ARCHiVe over the past year, allows these diverse datasets to be seen in
different combinations. To view an example of this application please visit:

The Lucida 3D Scanner is currently the preferred system to digitise the surface of paintings and low-
relief objects (as well as maps, drawings, frescoes, etc.) due to the high correspondence between the
obtained data and the real texture of the original object. For virtual (screen-based) and physical
output, the 3D information obtained with this system still has no equal in the recording of low relief
surfaces. Factum Foundation is constantly looking for better ways of recording the surface of things,
in order to understand the dynamic nature of objects that define our cultural environment. Close-
range photogrammetry has been applied to record the surface of paintings in specific occasions (like
Monet’s Waterlilies in New York) but it has its limitations due to the information-to-noise ratio and
the lighting requirements. The advantage of photogrammetric recording of surfaces both speed of capture and the fact that relief and colour are recorded at the same time and in perfect alignment (eliminating the need of registering one layer onto the other in the post-processing phase). One of the most promising developments that has significant consequences for the way 3D data is recorded by the ARCHiVe team is photometric stereo/RTI recording. Based on the possibility of extracting accurate 3D information of a surface by recording the same area under different light sources, photometric-stereo recording could be the preferred approach in the near future. Tests are being carried out in Factum Foundation in order to guarantee a data workflow that maintains resolution and precision in all stages of the process. The expected outcome of this work will be an adaptable, portable and easy to use recording system, capable of obtaining 3D and colour information at the same time with higher resolution than the Lucida Scanner. This is one of the main research projects for the coming year.
1.1 Completed and Long-term Projects

All completed projects at ARCHiVe are fully archived and backed up.

The Recording of Evaristo Baschenis’s paintings
https://www.factumfoundation.org/pag/1594/evaristo-baschenis-musical-still-lives

Between January and February 2020, Factum Foundation recorded, with the Lucida Scanner and panoramic photography, four paintings regarded as studio works from a series of still lives of musical instruments by Evaristo Baschenis (1617-1677), belonging to Museo Arte Tempo in Clusone and the Collegio Vescovile Sant’Alessandro in Bergamo, Italy. This is the first step in a collaboration between ARCHiVe, the Fondazione Giorgio Cini’s Early Music Seminars, and the University of Tours, directed by Pedro Memelsdorff, to identify the paintings commissioned by the monastic community on San Giorgio Maggiore and to understand both their meaning and the means of their production.

Since the early eighteenth-century Evaristo Baschenis (Bergamo, 1617-1677) has attracted the curiosity of scholars from various disciplines, including art historians, musicologists and semiologists. While art historians have analysed the unusual quality of Baschenis’s naturalism our interest is in the material aspects of his studio-based, serial production methods involving both composition, transfer techniques and colour notation. Pedro Memelsdorf is using the high-resolution data to explore the links between his iconography - obsolete and often dusty musical instruments (with inscriptions in the dust), flanked by both precious objects and wrinkled sheet music or rotten fruit. The paintings are a reflection on sound, touch and time. But what other information is hidden in their complex surfaces.

Musical historians have observed the stereometric and photographic accuracy with which Baschenis reproduces his instruments - especially the chordophones - even identifying the signatures of some of their sixteenth-seventeenth-century makers. The paintings are being cross-related to Baschenis’ carefully inventoried collection of instruments. While musical detail is important in the paintings, it is difficult to identify the scores that are almost always reduced to stylised and illegible forms of graphic notation.

It is known that in about 1676, Abbot Francesco Superchi donated a series of eight musical still-lifes by Baschenis to the monastery of San Giorgio Maggiore in Venice, possibly divided into four pairs.
From the testimonials of Marco Valle, Francesco Maria Tassi and Anton Maria Zanetti it is also known that the paintings decorated the library of the monastery (although their exact location within Longhena’s Library is unknown). They were removed in July 1806 by Napoleon's troops and temporarily deposited in the Scuola della Misericordia. In December 1806, four of the canvases were chosen by the Crown and taken to the Royal Palace (in the Procuratie Nuove), and from there to the premises of the former Commenda dei Cavalieri dell’Ordine of Malta. The other four were sent to Milan.

Three of the paintings that stayed in Venice were auctioned before 1822, while one was given to the Gallerie dell’Accademia in November 1838. The four paintings in Milan were initially housed in the Accademia di Brera but they were also sold at some time before 1846. As a result, the painting in the Accademia in Venice is the only painting that definitely belongs to the original series that was in the library on San Giorgio.

The project consists in recording as many paintings as by Baschenis to create an archive of his works and those produced by his studio. This will provide the data to analyse the paintings in detail to understand his working method and the meaning of the paintings.

The Recording of Banksy’s Graffiti in Venice

In 2019, amid rumours that it would soon be removed, the Fondazione Giorgio Cini and Factum Foundation decided, in the light of all the recent flooding, to demonstrate that high-resolution recording in colour and 3D must be done before an object is lost or damaged. Banksy’s graffiti was scheduled for removal, but it was recorded by an ARCHiVe team at a resolution that will allow for the production of an exact facsimile if the artist wants this to happen. The current proposal is that when the painting is removed the artist will be contacted and the painting will be resurrected on the island of San Giorgio. The recording of the graffiti was carried out as an example of the role technology is playing in the preservation of diverse forms of heritage.
The sculptural group of the *Compianto sul Cristo morto* (*Lamentation over the Dead Christ*) by Niccolò dell’Arca is located in the main chapel of the Church of Santa Maria della Vita, Bologna. This dramatic depiction of sorrow and death was commissioned by the brotherhood of the Battuti Bianchi around 1463 and consists of a group of life-sized figures – the Madonna and the Three Marys, St John the Apostle and Joseph of Arimathea – weeping over the dead body of Christ, which is laid out between them ready for deposition in the tomb.

The fragility of the seven terracotta statues led Factum Foundation, in collaboration with Genus Bononiae, to record the group in December 2019 as part of the exhibition *The Materiality of the Aura* at Palazzo Fava, commissioned by Fabio Roversi Monaco. The team doing the work was from ARCHiVe and Madrid.

Working at night over the course of a week within the Sanctuary of Santa Maria della Vita, Factum’s team used an Artec Spyder (a hand-held structured light scanner) and photogrammetry to record each of the statues. As the figures are fixed to the ground and had to be recorded *in situ*, this two-pronged approach was necessary to minimise the equipment required and reduce the risks associated with working in restricted spaces. Reality Capture and other specialised software were then used to process this data into digital models. ZBrush was used for organic modelling in places where data was missing due to the impossibility of accessing the sculptures safely.
The collaboration with the Biblioteca Marciana; the recording, re-materialisation and printing of the Mappa Turchesca

http://www.factumfoundation.org/pag/1362/scanning-the-mappa-turchesca

The Ottoman-Venetian heart-shaped map of the world now preserved in the Biblioteca Marciana was found in 1795 in the Criminal Archive of the Council of Ten, in the Doges’ Palace in Venice, at which time 24 prints were made. Dating to the second half of the 16th century, it has traditionally been attributed to the Hajji Ahmed (from Tunisia), although recent studies have suggested that it was a multi-author project conceived in Venice in 1559-60. The map carries text in Ottoman Turkish and must be understood within the context of commercial relations between the Republic of Venice and the Ottoman empire; at that period Constantinople was making frequent cartographic requests of Venice, and this map was probably designed for the Ottoman market.

The object preserved by the Biblioteca Marciana is the map’s matrix, comprising six carved wooden blocks measuring 106 x 110 cm. The matrix depicts a cordiform (heart shaped) projection, with place names written in Arabic characters and a 292-line text in Ottoman Turkish to left and right. The text is divided into five sections: prologue, introduction, description of the continents, descriptions of the twelve main provinces of the world and of the seven great lords, and epilogue. In the lower part of the map are an armillary sphere and two celestial spheres –subjects found at the same time in the work of Albrecht Dürer. Map, text, and spheres are framed by a string of floral motifs, broken only at the top by the title, “Kemâîyle naqš olunmuş jümle jihân nümûnesî,” (Perfect and complete engraving and description of the whole world).

In 2019, the Biblioteca Marciana started a project concerning a new philological study of the Heart-shaped map of Hajji Ahmed, involving IUAV and the Academy of Fine Arts. In February 2019, Factum Foundation collaborated with the IUAV CIRCE Photogrammetry Lab to record the original woodblocks in high-resolution. The recording was part of an initiative led by ARCHiVe that was framed as a

The photogrammetric survey was conducted using a Nikon D800 reflex with a 50mm lens, with the data processing employing the Agisoft Metashape Pro Software. A Range 7 triangulation laser scanner, employing both a telephoto lens and a wide-angle lens (precision ± 40 microns), was then used to re-record the map. Alignment for the laser scanner was performed using Geomagic Studio software. Finally, the map was recorded with the Lucida 3D Scanner, which is designed for the acquisition of 3D information from objects with a 2.5D surface, such as paintings or bas-reliefs. At the end of the investigation, a section (10 x 10 cm) of the data collected from the different systems was printed in 3D. The information acquired through the Lucida Scanner was found to be the most suitable for the purposes of creating a faithful copy of the product. The scanned data was CNC milled and new printing blocks have been produced, from which one copy of the map has been made that is currently on display in Bologna.

The pear-wood blocks used to make the matrix of the Ottoman-Venetian map have aged and cracked since they were first made; using the 3D data and with reference to the original prints taken from the blocks, it is possible to restore the blocks providing information for the conservation of the original object. Thanks to the data acquired by the Lucida Scanner, a meaningful digital restoration can be carried out. IUAV is also undertaking a restoration on a wireframe model – the results will also be compared. Factum Foundation’s work at ARCHiVe is developing a coherent approach to digital restoration. This collaboration with IUAV and the Biblioteca Marciana is leading to discussions about other objects in their collection.
1.2 Ongoing Projects and Future Prospects

The Recording of Stradivarius violins

https://www.factumfoundation.org/pag/1426/

A project that will have implications for ARCHiVe’s Baschenis initiative is the recording of Stradivarius violins and the creation of a specialised archive with the collaboration of Robert Brewer Young, a world-class luthier and authority working with J&A Beare, London. We are having ongoing discussions with Robert Brewer about conducting digital documentation of the Stradivarius violins which pass through his hands in London - he currently has access to the largest single group of Stradivarius violins in the world.

Initial tests have already been conducted using photogrammetry and the Lucida scanner, and have compared favourably to earlier CT scans. We are now making a photogrammetric recording of one violin and are now seeking funding to document as many of these instruments as possible.

The Recording of Paintings in the Cini Collection – First Stage: San Vio

Luca Massimo Barbero and Alessandro Martoni have given their approval for the digitisation of the paintings in the Palazzo of San Vio, Vittorio Cini’s residence in Venice. A selection of the main works has been made and their recording in colour and 3D was scheduled to start in November 2019. The three paintings previously recorded by Ercole de’Roberti have resulted in the exhibition about the Polittico Griffoni (on display for the rest of this year at Palazzo Fava in Bologna). The recording of these paintings has led to a new controversy about their location within the altarpiece.

Digitisation will initially focus on the paintings but will then extend to other types of works in the collection. The Lucida scanner, photography and photogrammetry will be used to record the works of art, which will be and important and ongoing part of Factum’s work in ARCHiVe. Alessandro Martoni has proposed a digital gallery, to make the works available online.

Initially, recording was scheduled to start in Autumn 2019 and last for several months while San Vio was closed for restoration. Due to the floods and then the Covid-19 lockdown it was not possible to keep to this schedule. Work will start with the lifting of the lockdown.
In August 2019, a team of 3D recording and high-resolution panoramic photography specialists from Factum Foundation carried out the recording of the Raphael Cartoons at the V&A, which have been loaned by HRH the Queen from the Royal Collection. This project was one of Factum Foundation’s most ambitious digitisation works undertaken to date and was partly carried out by the team working at ARCHiVe.

Over a period of five weeks, three teams worked around the clock to digitise the 115 sqm of the Cartoons’ surface, recording them in colour, infra-red and 3D at a resolution of up to 10,000 points/cm². On any day in August, up to four Lucida 3D scanners were to be found at work in the Raphael Gallery, poised on scaffolding three metres above the ground, and by night the space was lit up by the flash as thousands of macro photographs were taken. It was a project which required meticulous planning and recording innovations to suit the specific requirements of the artworks, as well as close coordination with the teams from the V&A, Royal Collection Trust and Momart. The data has now been processed in Factum Foundation’s Madrid workshops and supplied to the V&A: hundreds of overlapping 3D scans were stitched together, and the datasets for colour and 3D merged to produce multi-layer records of the seven cartoons. The results set new standards for cultural heritage documentation, allowing these masterpieces of Renaissance art to be seen up close as never before. This is the first time that such large-scale paintings on paper have been recorded in 3D - the impact on scholarship and preservation will emerge over the coming years.

The work we carried at the V&A has attracted the interest of Microsoft and we are seeking ways to link Microsoft’s interest to ARCHiVe - negotiations started in November and will hopefully come to a conclusion soon. The focus of the negotiation is on Microsoft’s Azure platform, machine learning, AI and archiving. We are discussing access to hardware and software as well as partnerships and sharing human resources.

Scope of collaboration with Microsoft:

- Machine learning to improve and systematise the 2D processing from the recorded data, including the stitching of the data and the 3D mapping. This involves the implementation
of a scalable model and would result in a significant improve in workflow, while the level of human intervention and monitorisation would remain critical.

- Depth map processing using Geographical Information Software (GSI) in Microsoft’s Virtual Machine clusters. This involves the use of Microsoft’s Azure platform and related services and a collaboration with Microsoft Libraries and Museums entity
- Facsimile augmentation with Microsoft HoloLens and projected visual layers
- Automated Multi-layered viewer process and publishing
- Exploring Microsoft solutions in terms of long-term data archiving with experts from Microsoft

Plans for the Recording of the Island of San Giorgio Maggiore – A complete ARCHiVe project involving all the partners.

The goal will be to record as much as possible of the exterior of all the buildings at a resolution that will allow a detailed condition monitoring of the changes happening on the island. It will be part of EPFL’s Venice Time Machine project and will launch an ambitious exercise to document the whole city in high-resolution 3D and colour. Venice has been at peril for many years, but rising sea levels and climatic change are accelerating the problems. ARCHiVe is ideally placed to carry out this work. Funding is now being sought with Anna Somers Cocks, former editor of the Art Newspaper. We will initially focus on the outside of each building. In the first phase we will only record a few interiors that will be agreed beforehand. We are currently finalising access to the Church, the lower level of the Manica Lunga and the monastic parts of the island.

Methods that will be used:

Lidar: for buildings and general architectural spaces - the LiDAR recording in Ferapontov is a good example of a large-scale recording. https://www.factumfoundation.org/pag_fa/1412/lidar-scanning

We merge Lidar and photogrammetry to increase the resolution where required - different parts of the recording require different resolution for different applications.

Photogrammetry: we specialise in high resolution photogrammetry of both large and small objects https://www.factumfoundation.org/pag_fa/1345/photogrammetry.
This work will be linked to the ARCHiVe project to record of paintings, collections and sculptures in the Cini Collection.

**Other scanning systems that will be used to record these objects:**
https://www.factumfoundation.org/pag_fa/1478/lucida-3d-scanner
https://www.factumfoundation.org/pag_fa/1478/lucida-3d-scanner

In a separate but related initiative Factum Foundation and the French company ICONEM are in discussion with the European Commission about the creation of a series of guidelines in 3D recording. The objective of this project is to produce a “Study on quality in 3D digitisation of tangible cultural heritage: mapping parameters, formats, standards, benchmarks, methodologies, and guidelines”.

Factum Foundation is also working on a project involving the topographic and architectural survey of the Al Nouri complex, including the remains of the Al Nouri Mosque, the Al Hadba Minaret and annexed buildings. The complex, constructed in the second half of the XII century, was destroyed by ISIS in 2017. Within the framework of its initiative “Revive the Spirit of Mosul”, UNESCO contacted Factum Foundation for the recording of the entire complex, ahead of its reconstruction which will be carried out with local partners.

**Questions and thoughts relating to ARCHiVe’s recording activities**

- What recording methodologies and systems will replace those currently in use, in the near future? Will Leica replace Faro as preferred LiDAR system? Will drone-based photogrammetric recording become more widely used with a relaxation of permit requirements? Will photometric-stereo replace Lucida?
  
  A conversation has been initiated with Karin Kauffman at Leica to work on the support and sponsorship for LiDAR systems and cameras. Research into photometric stereo is ongoing.

- What is the appropriate resolution for the different applications? Assuming high-resolution recording is necessary for image and 3D recording, what is the required resolution? Is it different for images and type? How do the results of Optical character recognition software vary?
  
  The answer to this is embedded in the guidelines being prepared for the EU and UNESCO as part of the projects mentioned above.

- How can ARCHiVe become a reference in the global conversation about methods of long-term storage of information? Should we dedicate specific people or resources to establish productive links with the institutions and individuals who are innovating the ways of preserving the world’s culture? All the above examples engage with this question but what is the next step?

  Factum is engaging the heritage community and leading the debate on the practical and theoretical application of technology. A lot more work needs to be done and the team needs to grow.
ARCHiVe's approach to training has the potential to transform the landscape of graduate education in the field of digital technology. Based on the vast teaching experience by the ARCHiVe team and, specifically, looking at the innovative workshops carried out recently in collaboration with national and international universities, it is becoming very clear that ARCHiVe can fill an important gap that universities cannot. By teaching at IUAV since 2012, at Columbia since 2016 and ISIA Urbino since 2019 (among other institutions), Factum Foundation is demonstrating that a learning-by-doing approach is essential to train students in the real issues that will face in their careers – A genuine polytechnic approach is proving it has a real place in an increasingly commercialised educational sector. Most universities, even the higher-ranked programs, lack the resources and the technical understanding of what is required to digitise heritage. Even if adjunct faculty usually share teaching with other professional activities, departments have difficulties in closing the gap between professional and academic training. The vast resources that are needed to run specific programs are usually misdirected in a way that does not incorporate the real practical assets and skills that are needed in the realisation of actual projects. The course that Factum Foundation taught in IUAV in 2012 introduced the students to close-range, high resolution scanning systems with demonstrable results. Two of the graduates from this course make an important part of Factum’s team. More are about to join from the last two years at Columbia.

The collaboration with Columbia University’s Historic Preservation program has had a radical effect in how digital preservation is understood by students and faculty. Since the first collaboration in 2016, the emphasis has been on incorporating the students into real projects, making them part of a multidisciplinary team, with different skills, working towards solving practical issues. In addition to providing the students with the necessary training and equipment to record and process information (Lucida 3D Scanner, close-range photogrammetry, LiDAR 3D scanning, panoramic photography), the courses put the focus on discussing the reasons for employing technology: why it is important to incorporate digital recording in any preservation process, what is the necessary system and settings for each specific case, what are the roles of facsimiles in preservation, what is the meaning of technology in today’s cultural environment. As the questions proliferate the need for ARCHiVe increases. Today everyone can get online tutorials to learn to use particular hardware or software. The sustainability of increasingly expensive higher education is coming into question.
Foundation and ARCHiVe’s mission is to ensure that students develop a critical attitude towards technology, questioning many of the generally accepted concepts that are spread by the media and academia alike (the definition of “high resolution” or the concept of “copies” are clear examples). Since Factum Foundation started collaborating with Columbia University, students have had the opportunity to be part of real projects from the early stages of planning an onsite recording survey to fabricating exact replicas of the captured data. These (and all the steps in between) have been taught by experts who are in close contact with everyday practices of digital preservation, so the exercises and lessons are specific to encourage creative problem-solving capacities.

Since 2016, students have developed an end-of-year exhibition in which a 1:1 scale physical output was presented as the results of the work (image above). This has been a radically different approach to most architectural schools’ programs, in which drawings, renders or sale models are the last stage of the student projects. In our approach, the end result is both virtual and physical - an approach that has the capacity to re-constitute many of the characteristics of the original object (from a work of art to architectural elements). Students are demonstrating that digital recording, far from being “just a preliminary stage of documentation” is the actual core of the preservation work: making sure that the original artefact can be securely archived, shared, studied and transmitted to future generations. This approach means that the courses in Columbia are dependent on the hardware and software that we supply in order to carry out the work. Apart from providing specialist recording equipment, Factum Foundation has advised the School in acquiring new computers and software capable of processing large files, it has pushed the limits of the fabrication workshops to be able to produce high resolution surface prototypes and has given access to the students to unique sites and artworks in Spain and Italy, thanks to the network of contacts and international reputation. The last year in which the students worked in ARCHiVe clearly generated the best results both in terms of quality of the gathered information and depth of the arguments elaborated by the students.
Over the years, a small community of alumni has been growing that share similar interests in the use of digital technology with meaningful applications for Cultural Heritage. Their careers and the influence they will bring into their respective professional and research areas are the best reward to our efforts, and a guarantee that the principles of non-contact digital preservation will spread in the future. Halley Ramos, one of the first students who spend a short research period in ARCHiVe (in Summer 2018) has formed her own company with partner André Jáuregui, dedicated to digital recording and mixed reality applications: www.soe.studio

Travis Brock Kennedy, who joined Halley in her research stay in ARCHiVe, focused on the work of John Ruskin in Venice, was admitted to the Doctor of Philosophy programme in Economic and Social History at Oxford University. At Oxford, he plans to build upon the work he began in his HP thesis at Columbia, seeking to understand the intersections of labour, economics, and aesthetics in John Ruskin’s theories of preservation and architecture. Rob Kesack, whose excellent work was a reference for his class in 2018, is now part of Integrated Conservation Resources, a multi-disciplinary group based in New York offering a broad range of architectural conservation services for historic buildings and monuments: www.icr-icc.com. He has expressed interest in joining ARCHiVe.

Finally, Jessica Betz, from the class of 2016, is the Andrew W. Mellon Fellow at The Michael C. Carlos Museum at Emory University specialising in object conservation. She has worked as a conservator at the Museum of Modern Art, the Smithsonian Museum Conservation Institute, and the Hirshhorn Museum and Sculpture Garden. Additionally, she has done archaeological conservation work at Gordion, Turkey. Jessica was recently selected as the runner-up recipient for the 2018 Murtagh-Graham Prize awarded by US/ICOMOS.

The different training workshops on digital preservation are one of the main activities carried out by Factum Foundation at ARCHiVe. Based on a learning-by-doing approach, a series of formative initiatives and traineeships have been carried out in collaboration with graduate centres like Columbia University-GSAPP, IUAV School of Architecture, Ca’Foscari University, ISIA Urbino or the University of Edinburgh. In all cases students have had the opportunity to be part of a team of experts working on real projects, gaining from ARCHiVe’s facilities and Factum Foundation’s digital equipment. These initiatives will continue and expand next year. This has been identified as a potential growth area for ARCHiVe. In every case Factum has been asked to repeat the courses and offer more opportunities for the transfer of skill and knowledge. The list of universities will soon increase, with plans to work with ETH Zurich, Lucca MTI, University of Genoa, the University of Alcala de Henares, UCL, Oxford University and Cape Western Reserve University are all discussing ways of collaboration.

Once every 3-4 months, Factum Foundation organises and teaches an intensive digitisation workshop in ARCHiVe. Graduate students from international university programs participate in week-long theoretical and practical training sessions on digital technology applied to the conservation of Venetian Heritage. This training model is providing career-changing experiences for tomorrow’s digital preservationists.

ISIA Urbino workshop

http://www.factumfoundation.org/pag/1486/workshop-with-isia-urbino

where: Palazzo Grimani; Abbazia San Gregorio; Fondazione Cini
when: 10-14 June 2019
university: Istituto Superiore per le Industrie Artistiche, Urbino
program: Diploma Accademico di secondo livello in Fotografia
instructors: Carlos Bayod, Otto Lowe, Guendalina Damone (Factum Foundation) with the assistance of trainee Rashmi Gajare (Ca’Foscari University)
students: 10
background: photography, design, etc.
technology used: Lucida 3D Scanner, photogrammetry
partners: Palazzo Grimani; Colnaghi Foundation

Carlos Bayod, Guendalina Damone and Otto Lowe from Factum Foundation’s 3D scanning department organised and taught an intensive five-day workshop focusing on non-contact recording technologies for cultural heritage to ten students from the Photography MA course from the design university ISIA Urbino. This is the first time that this type of course, focused on learning-by-doing, was put in practice in this master. The experience meant a true immersion in the field of Heritage digitisation, involving the students in actual documentation projects with real applications. Theory sessions took place at ARCHiVe’s studios with the help of Andrea Barbon, Emilio Quinté and the rest of the ARCHiVe team. The workshop format followed Factum’s ethos of always providing practical training on real digitisation projects, an experience that gives students a better insight into the realities of on-site work. In this case, participants carried out fieldwork recordings at various institutions around Venice and the valuable data they obtained could give rise to larger projects for ARCHiVe.

Fieldwork:
Students employed close-range photogrammetry to record a series of classical busts and statues at the Domus Grimani exhibition held at Palazzo Grimani (curated by Venetian Heritage), demonstrating the potential of high-resolution photogrammetric scanning with reflective materials. Under the guidance of Otto Lowe (Factum Foundation’s expert on photogrammetry) students recorded two porphyry busts, a series of Maiolica pottery and a small terracotta head by Antonio Canova at the exhibition The Grand Tour organised by Colnaghi at Abbazia di San Gregorio. Finally, at the Fondazione Giorgio Cini, the Lucida 3D Scanner was used to record high-resolution data for the surface of a painting on canvas by Brusaferro. Students also had the chance to learn more about ARCHiVe and the Venice Time Machine project, visited the IUAV’s Photogrammetry Lab, and spoke to Rashmi Gajare, about OCR analysis of Sanskrit texts.

Outcomes:
Factum Foundation brought the link with ISIA Urbino to ARCHiVe through the workshop in June 2019. After this first experience, ISIA has expressed interest in continuing the collaboration with ARCHiVe. In May 2020, a second teaching course is being organised online by Andrea Barbon to which Guendalina Damone is contributing. She will discuss “Mass digitisation and archiving”, to complement the course on “3D recording” carried out last year. This online course is specific for registered ISIA Urbino students. The majority of the ARCHiVe Online Academy sessions are free and open to the public. Further teaching workshops with ISIA Urbino will be proposed for next year when onsite fieldwork activities in Venice are possible again.
Personal stories:

Two of the students who participated in the workshop, Noemi La Pera and Rosario Terranova, have joined ARCHiVe as collaborators and recently taught courses on “Photographic recording and post-production” as part of the “ARCHiVe Online Academy”.

Columbia University workshop

where: Palazzo di Malta, Venice
when: 7-11 October 2019
university: Columbia University, New York
school: Graduate School of Architecture, Planning and Preservation
program: Master in Historic Preservation - Advanced Preservation Technology Studio
instructors: Adam Lowe, Carlos Bayod, Otto Lowe, Guendalina Damone, Gabriel Scarpa (Factum Foundation) with the assistance of Emanuele Zampieri (IUAV) and Lucy Killoran (Edinburgh University)
students: 10
background: architecture, archaeology, art history, etc.
technology used: Lucida 3D Scanner, photogrammetry, Faro 3D Scanner, colour photography
partners: Sovereign Order of the Knights of Malta in Venice; IUAV’s Photogrammetry Lab

Graduate students from Columbia University’s Graduate School of Architecture, Planning and Preservation (GSAPP) spent the week of 7th-11th October recording elements of the Prioral Palace and Church of the Order of Malta in Venice and processing the resulting data at the ARCHiVe headquarters on the island of San Giorgio Maggiore. The fieldwork forms part of the Advanced Preservation Technology Studio, an annual course taught by Carlos Bayod and Adam Lowe at GSAPP, with the participation of other Factum Foundation experts during the practical fieldwork in Venice. Previous cohorts have recorded at San Marco in Venice, the Casa de Pilatos in Seville, and the chapel of San Baudelio in Soria in northeast Spain. This year, the students benefitted for the first time from the unique teaching and processing facilities available at the ARCHiVe offices.
The 10 course participants, together with two Factum Foundation experts and several interns, used the Lucida 3D Scanner, close-range photogrammetry, panoramic composite photography and a LiDAR 3D scanner to document a series of artworks and architectural elements in palazzo di Malta. Thanks to extraordinary team work, over just a few days they were able to digitise, among other artefacts, an altarpiece by Bartolomeo Bergamasco (previously located in the church of San Gimignano in St. Mark’s square), a series of tombstones in a state of rapid deterioration, a set of 14th-century frescoes, and the painting of the Baptism of Christ by Giovanni Bellini. In collaboration with IUAV’s Photogrammetry Lab, the main spaces in the complex were also recorded in 3D. Two new workstations were installed in the ARCHiVe’s studios as well as specific software, capable of processing large amounts of data from the recording. A workflow was put in practice that demonstrated successful for the workshop: on-site recording the first half of the day, followed by processing and theoretical lessons in ARCHiVe’s studios in the afternoon, proved to work efficiently.

Outcomes:
The organisation of complex and intense workshops like these, involving the participation of different institutions, have demonstrated to be successful thanks to the equipment and facilities in ARCHiVe. Back in New York, students could continue the processing of their acquired data and produced virtual and physical re-materialisations of sections of the altar and tombstones in high resolution, at 1:1 scale. The work resulted in a temporary exhibition in Columbia University campus that restituted part of the altar in shape, texture and colour. Additionally, students developed experimental concept projects to propose ways of applying digital technology to the preservation and dissemination of Venice’s Heritage.

Personal Stories:
One of the concept projects proposed by Bingyu Lin and Qian Xu, two of the students who participated in ARCHiVe’s workshop in October 2019, consisted on the implementation of an Augmented Reality application to make visible the effects of acqua alta in the lower parts of a selection of buildings in an itinerary between St. Mark’s Square and Palazzo di Malta. The project was selected to be presented in a Climate Summit held in Columbia University, and will be developed beyond the Master’s program as a presentation in the next APT Conference (Association for Preservation technology) in Canada in late 2020. Moreover, graduate Bingyu Lin will enrolled in a Master in Computer Science in an American University, after being exposed to the concepts and methods discussed during her time in ARCHiVe. Back in Europe, the architect in charge of the preservation of the Palazzo di Malta, Anna Maria Pentimalli, requested to do an internship period with Factum Foundation to take place in Madrid and Venice. This period was interrupted because of covid-19 but it will resume as soon as it is possible. She remains in charge of the conservation of the Palazzo di Malta (especially the series of tombstones that are badly damaged due to environmental issues and rising water levels) and the work carried out by the Columbia students in ARCHiVe will be considered as part of the preliminary technical study of the pieces.
Above: An image of the exhibition display put together by the students in Columbia, in which they reproduced surface and colour elements of the altar in Palazzo di Malta in 1:1 scale. Based on the information gathered on-site in Venice and processed in ARCHiVe, it was possible to create prototypes in the school’s fabrication workshop in New York.

**IUAV workshop**

**what:** Heritage digitisation workshop  
**where:** ARCHiVe; IUAV  
**when:** 14-16 January 2020  
**university:** Istituto Universitario di Architetttura di Venezia  
**program:** Master in Digital Architecture  
**instructors:** Carlos Bayod (Factum Foundation) with the assistance of Emanuele Zampieri (IUAV)  
**students:** 30  
**background:** architecture, design, etc.  
**technology used:** Lucida 3D Scanner

Factum Foundation’s collaboration with IUAV’s Master in Digital Architecture began in 2012 with a 75-hour theoretical and practical module to introduce state-of-the-art scanning systems and methodologies. Since then, two Master students every year have participated in Factum Foundation’s projects in Madrid, Venice and other locations, some of whom, like Francesco Cigognetti and Voula Natsi, have become permanent members of the team. Since the creation of ARCHiVe, this connection has continued through collaboration in common projects (like the Mappa Turchesca at the Biblioteca Marciana or the LiDAR 3D recording of Palazzo di Malta) as well as new training initiatives. The workshop organised for January 2020 was an intensive three-day long seminar to introduce the students in the concept and use of the Lucida 3D Scanner.
**Fieldwork:**
Most of this course took place in ARCHiVe’s facilities, combining theoretical sessions with practical recording and processing exercises with the Lucida 3D Scanner. Theory lessons included: 1) Introduction to digital preservation; 2) Introduction to facsimiles; 3) Input: recording methods; 4) Surface scanning; 5) Introduction to digital restoration; 6) Output: fabrication methods; 7) Introduction to craft techniques. The practical training involved the use of the Lucida 3D Scanners in groups of two students to record a canvas painting from the Cini collection, and the processing (editing, stitching, blending) of 3D data previously captured by the Factum Foundation. This way, each student had the opportunity to understand the logic of the complete workflow, from the planning of the scanning session and preparation of the painting, to the management of the files and processing in different output formats. The last day of the workshop took place in IUAV’s Tolentini campus for theory lessons and a lecture open to the rest of the university about the work of Factum Foundation and ARCHiVe, followed by a conversation among students and faculty. The participation of Emanuele Zampieri was very important for the success of this initiative.

**Outcomes:**
Further collaborations will be explored between ARCHiVe and IUAV, not only for training workshops as part of the Master in Digital Architecture, but also for digitisation projects involving the Circe Photogrammetry Lab. Providing fieldwork experience to recent graduates who are unemployed will become more important as an ARCHiVe’s mission. As has been demonstrated before, the involvement of local teams in the digitisation of their own Heritage could be central to the sustainability of these initiatives. In upcoming projects involving the digital documentation of urban, architecture and art elements in Venice (beginning in 2020 with the island of San Giorgio), the formation of diverse teams of local operators will be additional asset to implement.

**Personal Stories:**
Emanuele Zampieri, IUAV’s Master of Digital Architecture graduate, has become an active part of the ARCHiVe team. After helping Carlos Bayod in the workshops with Columbia University in October 2019
and IUAV in January 2020, he carried out the LiDAR 3D recording of the façade of the Oratorio dello Spirito Santo in Bologna. Working with Guendalina Damone, the recording was done as a live event within the Notte Bianca (‘White Night’ open museums event), to disseminate the importance of digital recording for preservation of Cultural Heritage. Also from ARCHiVe, Emanuele has been helping in the development of the exhibition in Palazzo Fava in Bologna, from the earlier stages of design to the assembly of the show and opening in May 2020. He will continue to play an important role for Factum Foundation and ARCHiVe’s projects, like the upcoming 3D recording of the buildings and exterior spaces of the island of San Giorgio.

Questions and thoughts relating to ARCHiVe’s training activities

- Which training formats are more efficient for provoking a true change of mindset in the students? What is the appropriate duration, practice-theory balance, fieldwork activity, subjects, etc.?
- How could we reinforce collaboration with national and international graduate schools? How can ARCHiVe’s experts, equipment and facilities reshape the way schools teach digital preservation is taught in schools?
- How can we improve the communication among current and past trainees and researchers in ARCHiVe to promote the formation of a “community” to keep links among people after graduation?
- How to take advantage of the current crisis to improve the training activities? De-localised workshops and remote access are key concepts, but what is a good balance between online and offline training?
- It is Factum and ARCHiVe’s priority to ensure that all the content generated be freely accessible to the widest audience possible, and continuously updated, especially for those students’ involvement in previous university related courses or training.
3. DISSEMINATION AND OUTREACH

3.1 Completed Projects and Ongoing Presence

The recording of original art collections and historic archives is an essential step towards their preservation. The data, once archived, is being made available and shared. One of Factum Foundation’s main challenges in ARCHiVe, the development of specific online applications for the inspection of 3D and colour data in high-resolution, has resulted in the multi-layered browser, a unique tool merging colour, XRay, infrared and historical images with dimensionally accurate 3D data. Some examples can be seen here:


After the project with the Tretyakov Gallery, more connections have emerged in Russia that will bring the possibility of the scanning of a private collection’s 30+ paintings near Cambridge, where ARCHiVe’s team and resources could be used.


https://vimeo.com/335860204

https://www.factumfoundation.org/pag/1406/a-3d-scan-of-fra-angelicos-annunciation

Following the recording request from the Museo del Prado to scan Fra Angelico’s predella of the Annunciation for its exhibition *Fra Angelico and the Rise of the Florentine Renaissance*, a 3D surface facsimile was created and featured in *The Materiality of the Aura* show in the context of the works generated by ARCHiVe.

Raphael Cartoons: Not yet released by the V&A but fully processed and prepared for circulation. Now that all the cartoons have been recorded and the browser version has been completed for the V&A, once published this will allow for a study of the pieces in a new light and in full.
Many things are happening in Bologna that have a direct connection to ARCHiVe. One of the great strengths of ARCHiVe is that it can act as a catalyst for interconnected projects and actually make them happen.

Factum is working with the Association of Museums in Bologna and with the local government to launch a municipal centre for digital recording. The fact that Factum have been working there for 10 years will be key to linking this centre to ARCHiVe - this should have been concluded following the opening in Bologna of the Factum Foundation exhibition and the publication of the book, but discussions will reopen imminently.

Prior to the opening of the exhibition at Palazzo Fava, both Roberto Grandi, President of the Association of Museums and Osvaldo Panaro, Head of Culture of the Comune di Bologna visited Factum and have shown interest in further collaborations with Factum and ARCHiVe.

As part of the “Bologna Art City” on January 25th, Factum Foundation held a live recording of the façade of the Oratorio dello Spirito Santo, where Guendalina Damone presented the Foundation’s works and achievements in employing new technologies to record and archive cultural heritage, its processes and the potential of digital restorations.
Proposal for an ARCHiVe recording studio in the Bodleian Library
prepared for Helen Hamlyn Trust
27th April 2020

ARCHiVe (with the support of Helen Hamlyn Trust) offers the Bodleian a collaboration that will install a Replica scanner and a Lucida scanner into the Bodleian with a PhD level teacher/researcher working on ways to prepare the data to be used with Machine Learning and AI software within the IIIF initiative guidelines.

We would supervise the training of students or members of the Bodleian team to operate the system and record specified parts of the Bodleian Library collections and prepare them for analysis, dissemination, study and condition monitoring. The loan would initially be for a specified period of time, which can be renewed if the scanners are in demand; alternatively, they can be moved to another institution when their tasks are complete. The project will need a space of about 250sq feet.

A collaboration between ARCHiVe and the Bodleian Library will establish a digital recording studio focusing on high resolution digital documentation at the highest possible resolution.

The Bodleian is already an active member of the IIIF initiative. IIIF (International Image Interoperability Framework) has the following goals:

- To give scholars an unprecedented level of uniform and rich access to image-based resources hosted around the world.
- To define a set of common application programming interfaces that support interoperability between image repositories.
- To develop, cultivate and document shared technologies, such as image servers and web clients, that provide a world-class user experience in viewing, comparing, manipulating and annotating images.

Following the collaboration with the V&A it has become apparent that the International Image Interoperability Framework cannot incorporate 3D recording into image-based or multi-layered archives incorporating several types of information captured in different ways. The goal of the collaboration would be to record large amounts of image and 3D data while developing interfaces that can add to the tools already offered by IIIF.
Useful links:

Lucida 3D scanner - http://www.factumfoundation.org/pag_fa/1478/lucida-3d-scanner
Layered Archives - https://www.factum-arte.com/pag/12/Layered-archives

If desired, we can also offer manuscript scanners:

Fixed scanner: http://www.factumfoundation.org/pag_fa/1329/photographic-manuscript-scanner
Portable scanner: http://www.factumfoundation.org/pag_fa/1339/portable-manuscript-scanner

Other information if required:

Over recent years Factum has done a number of projects with the Bodleian - especially with David Howell (Head of Heritage Science, Bodleian Libraries) and Maddy Slaven (Head of Public Engagement)

These include:

- The recording in Colour and 3D of the front and back of the Gough Map - Part of a research project with David Howells: http://www.factumfoundation.org/pag/658/scanning-the-gough-map-and-the-selden-map-at-the-bodleian-library-oxford
- The creation of Middle earth as an interactive display for the Tolkien Exhibition https://www.factum-arte.com/pag/1230/Tolkien-Maker-of-Middle-earth

Questions and thoughts relating to ARCHiVe’s dissemination activities

- What is the role of online publicly available discussions like The Art Newspaper’s series? What can be learnt from the experience? Could ARCHiVe host the next series of dialogues among multi-disciplinary guests, with a focus on Venetian Heritage and its preservation/digitisation challenges?
- Could ARCHiVe provide (through a website or platform) access to high-resolution browsers, archival databases, etc. that could attract the attention of experts and general public?
- Since it looks like IIIF is becoming the ubiquitous platform for sharing databases from collections and libraries, how can ARCHiVe build on it by providing new tools or functions to make it more interesting?
4. RESEARCH AND DEVELOPMENT

The ongoing development of new tools for digital recording and processing, carried out or supervised by Factum Foundation’s engineers, include: new 3D scanning system based on photometric stereo recording mixed with RTI technology; AI software for pattern-recognition of surface information in paintings is being developed in a research project with Case Western University; new 3D processing tools for managing and handling 3D surface data (extracting the skin from the topography; and many others with direct applications to research and heritage preservation projects.

http://www.factumfoundation.org/pag_fa/1341/in-development-photometric-scanner

- The improvements made in Factum’s scanners lead us to propose to the Bodleian Library and the HHT the acquisition of two of our scanners, Replica and Lucida, for the effective digitisation of its collection. The budget and proposal is being developed to be present to the board as soon as possible.

  Factum is also liaising with Michael McMaster, who is involved with the Graph Analysis project in Columbia and recently finished a PhD. He is currently based in Eindhoven and had proved that he is an ideal candidate to lead the training and the work.

- Software and browser improvements - this is an important part of the ARCHiVe work and a detailed report is being compiled - both technical and practical. (This needs more time due to Covid-19)

- The launch of Machine Learning applied to graph-analysis of 3D scanned data with Case Western Reserve University, Cleveland. This is awaiting news on a major grant award that is being submitted by Betsy Bolman and Ken Singer between Case Western’s physics department and the Cleveland Museum of Art. (A full report will be supplied soon). For detailed information please see The Materiality of the Aura, pp. 135-139.
• Designing and testing different systems of 3D recording. We have been investigating the use of confocal microscopy and focus stacking systems to scan the detailed surfaces of historic metal printing type (with the London Type Archive and the Natural History Museum). Initial tests have led to 3D models at 10x magnification, and the data is precise enough that we have been able to rout new “type” and print from it.

• Continued development of photometric stereo (at an advanced stage) and advancements in photogrammetry.

ManuCapture

http://www.factum-arte.com/pag/1337/MANUCAPTURE

ManuCapture is a free, opensource software designed by Factum. It has several features that make it a user-friendly and straightforward application that adheres to international metadata standards. These include: dual camera live view for camera alignment; editable page sequence (allows the user to repeat, add or delete images from a sequence); storage of RAW and TIFF image formats for long-term preservation (AIP).

The software was conceived for a two-camera system similar to the Replica 360 Recto/Verso system designed for ARCHiVe and the manuscript scanner that was custom-made for to record fragile manuscripts in Dagestan. It is compatible with over 240 different camera models and can be configured for continuous light source or for flash-to-camera flash synchronisation. ManuCapture uses an Arduino-based trigger board to synchronise dual-camera image capture, as well as for image preview, storage processes, and to support multiple shutter configurations.

ManuCapture was designed to be opensource and the software itself can be used free of charge. However, given that it is currently in Beta, we have not been offering the option to download it directly from our website. The code could be made available from our GitHub project page, but we do consider that at present, any installation of ManuCapture would require a period of implementation and collaboration with us.
• ManuCapture is an open-source application based on Linux operating system, designed by Enrique Esteban at Factum Foundation to work with all of our camera-based book and manuscript recording systems.
• The development of this app is currently in Beta phase. It largely works very well, but it still has some bugs that need to be ironed out.
• Theoretically the app can work with any camera setup using Gphoto. Sony for example doesn’t work with Gphoto, but it does have all of its command functions available to the general public.
• The app is simple to use that streamlines the workflow, increases the speed of recording and reduces operator error.
• Metadata is written from command prompts that pop up as you go. It contains enough information for most institutions, but has the capacity for more metadata inputs.
• Raw files are extracted from tethered cameras.
• The cameras and flashes are controlled by an Arduino.
• Metadata is stored as an xmp ‘sidecar’ file to the images.
• The app does not contain a photo editing software, this must be done outside of the application in Lightroom or similar. This necessitates operators having a knowledge of other photo-editing software.
• Files are stored in Raw, Tiff and JPG formats. (JPG are small and easy to visualise, Tiffs are high resolution, Raws contain the Raw data)
• A 100TB storage can store up to 767,500 individual pages in Raw, Tiff and JPG

The typical setup with the book scanner involves 2 Canon DSLR cameras, either 5D (24mpx) or 5DSr (50mpx). The lenses affixed to these are Canon brand of varying focal length (mainly 50mm or 35mm since these provide minimal optical distortion).

A 50mpx sensor on a 5DSR using a 50/1.4 lens records 34mpx of detail onto a 50mpx sensor (according to DxO’s Modulation Transfer Function (MTF) graphs of various Canon and Sigma lenses).

**ManuCapture Improvements in Development**

Raw files and metadata are a subject we have been exploring. Metadata can’t be written directly to a Raw file, but must instead be stored as a sidecar .xmp file. This means that if the name (or other parameter) of either the raw file, or the xmp is changed, then the metadata won’t be read. This can make handling large numbers of files precarious since metadata can be easily lost in reorganisation.

Native ‘Raws’ have an additional problem, which is that camera companies sometimes change them, making older versions unusable. Maintaining backwards compatibility is an essential task of archive management.

Adobe’s DNG raw format is a potential answer. Metadata is written directly into the Raw file and can be amended and adjusted from there. Adobe designs DNG to be backwards compatible, so it is a lot less likely to become unreadable in future.

There are very few Camera manufacturers that use Adobe DNG as a Raw format, with most preferring to stick to their proprietary brand where they maintain most control for their own purposes. The ones that do use DNG as their native format are:

• Leica
• Pentax/Ricoh
• Sigma
Native Raw files can be converted to DNG format using Adobe software such as Lightroom, Bridge or RawConverter. This means that Raw files can be retroactively converted to DNG, meaning existing scans are still valid and there is no need to repeat scans already done.

Moving to DNG could potentially maximise storage space in servers, since it would eliminate the need to store the files in Raw, Tiff and JPG format as is currently the case. Instead, only the DNG would need storing and it would contain all of the metadata information and JPG thumbnails in one file. In theory, this could almost double the number of digitised pages that could be stored on a 100TB storage server.

Aside from the file format, Factum Foundation is considering the possibilities for using mirrorless camera systems over DSLRs. DSLRs require an extra step in the Arduino to lock the mirror up before image capture in order to avoid the slap of the mirror coming down from affecting the image. Mirrorless cameras do not have this problem. Mirrorless cameras are also often cheaper (a 50mpx Canon 5DSR costs €5,000 while a 47mpx Panasonic S1R costs €3,600) and have better lenses available. Additionally, the mechanism controlling the mirror in a DSLR can often break after extensive use. DSLRs are usually guaranteed up to 100,000 images. Mirrorless cameras thus have a longer natural life-span than a DSLR.

**Summary of ManuCapture**

The app as it currently stands is a very capable tool, which can be used with all of our manuscript and book scanners, creating a good common framework for archiving images.

Factum Foundation is actively exploring new options to make the scanners even more streamlined and effective.

The three priorities for the next generation of book and manuscript scanners:
- Switch cameras from DSLR to Mirrorless
- Incorporate the use of Adobe DNG instead of native Raw files
- Incorporate a photo-editor, or automate the processing of images.

**Collaborations with PIQL**

Factum is involved in an ongoing collaboration with PIQL to find long-term data capturing, processing and storage solutions based on analogue film medium. This will be relevant for ARCHiVe in the preservation of its data physically but minimally spatially in a series of projects.

**Horizon 2020**

**Participation in European call for grants "Horizon 2020"**

By invitation from PIQL, Factum Foundation has joined an international network of institutions to present a European project proposal in March 2020. The project was titled "Autonomous Content Enrichment for Digitized Cultural Heritage" (ACE-DCH) and was submitted to the "Horizon 2020" call for European grants under the theme "Curation of digital assets and advanced digitisation".

The primary objective of the ACE-DCH project is to lay the necessary foundations to become the first European platform for Autonomous Content Enrichment of Digitized Cultural Heritage and develop methodologies for:
the necessary large-scale digitisation technologies and activities for tangible and intangible cultural heritage data;

- standardisation of metadata to create consolidated data models merging annotated data from different data types as well as language agnostic, characteristic object data to find correlated data;

- an active data concept leading to autonomous enrichment of correlated metadata across heterogeneous object data repositories to boost annotation quality and correlation of data across different data types bridging different languages;

- ubiquitous and pervasive 3D-centered, web-based data curation, analysis and preservation tools to validate potentially correlated data and enable access to and concurrent scientific work on already digitised objects available in cultural heritage sites;

- consolidated data experiences, integrating digital objects from all around Europe and the world to create more attractive, engaging and comprehensive access to cultural heritage for a variety of target user groups and their use cases using disruptive new technologies;

Along with Factum Foundation, the participant institutions included: Fraunhofer-Gesellschaft Zur Foerderung Der Angewandten Forschung E.V (De), Consiglio Nazionale Delle Ricerche (It), Centre National De La Recherche Scientifique Cnrs (Fr), Universität Basel (Ch), Norges Teknisk-Naturvitenskapelige Universitet Ntnu (No), Technoport Sa (Lu), Connecting Archaeology And Architecture In Europe (Ie), Stichting Europeana (Nl), Hyperborea Srl (It), Friedrich-Schiller-Universität Jena (De), Hungarian National Museum (Hu)

Microfilms from Beijing Imperial Library (with Fondazione Giorgio Cini)

ARCHiVe is developing a project to create facsimiles of lost manuscripts in the Beijing Imperial Library that are stored on Microfilm in the Cini Foundation. Through our conversations with PIQL and their expertise in microfilm storage we can not only help with the long-term digital storage of the microfilm but can also improve access and image quality. [https://www.piql.com/wp-content/uploads/Alternative-Storage-Technologies-Piql-Whitepaper-1.pdf](https://www.piql.com/wp-content/uploads/Alternative-Storage-Technologies-Piql-Whitepaper-1.pdf).

This initiative could be a source of income for ARCHiVe as the replication of these ancient books will have a large appeal in the Chinese market.

Agreement with Toledo Cathedral's Library and Archives
A framework agreement was signed early 2020 between the Toledo Cathedral's Library and Archives for the application of digital technology to the recording of a series of objects in their collection. The first project will involve the high-resolution recording of one of the few existing manuscript copies of Dante's Divine Comedy by Boccaccio (see picture attached). The recording will be used to provide new digital repository of the book for study and dissemination, as well as for the reproduction of a physical copy to be on display in the Cathedral while the original travels to Florence for the upcoming celebration of Dante's anniversary in 2021. Other works including books, maps and, most importantly, specific paintings by El Greco will be recorded as part of this collaboration.

Questions and thoughts relating to ARCHiVe’s R&D activities

- How to measure and evaluate the ongoing hardware and software developments around ARCHiVe (Manucapture software, Replica scanner, manuscript scanner, character-recognition software...) in comparison with other systems available in the market or implemented by other research centers?
- How to improve communication among members of ARCHiVe (in Venice, Madrid and Lausanne) about the progress of their respective R+D projects? How to make sure that everyone is aware of the research in progress, achievements, failures or changes of direction?
- How to communicate to current and potential collaborators the research in progress in ARCHiVe? Should we consider the creation of a monthly newsletter with highlights? Other formulas?
Re-defining a new form of cultural tourism will be essential in the near future. Factum Foundation has been working on an approach based on proposing unexpected connections among originals and facsimiles, physical and virtual elements, old and new, remote access and immediate experience, and the open description of the processes involved. This is a major growth area for ARCHiVe.

The Materiality of the Aura: New Technologies for Preservation:
https://vimeo.com/418977928
https://www.factumfoundation.org/pag/1598/the-materiality-of-the-aura-new-technologies-for-preservation

The Factum Foundation exhibition in Bologna and the Polittico Griffoni exhibition (in conjunction with Palazzo Fava, Genus Bononiae and the Cini with 8 other museums and collections) will be the catalyst for many new projects - both opened on Monday (18th May) and have been extended until December.

The Recording of two of the panels of the Polittico Griffoni at the Cini, those of Saint Catherine and Saint Jerome on occasion of the Bologna exhibition, has opened an art historical and curatorial debate about their belonging to the original polyptych, something which further brings to light the importance of material analysis of pieces for their recognition and depth of their understanding, and thus ARCHiVe’s labour’s relevance in current art historical developments.

The exhibition and its development resulted in the publication of The Aura in the Age of Digital Materiality, an essential compilation of ideas and works in progress that will help focus the debate and conversation for the next years.
Other Exhibitions and Publications


- Following its successful exhibition in Palazzo Abatellis, Palermo at the end of 2019, Factum is looking into the possibility organising an exhibition on the Mystery of the Lost Paintings series in the Casa delle Esposizioni in the town of Illegio, Fruili, Italy. The exhibition in Illegio will present the recreations of eight paintings by Vermeer, Monet, Van Gogh, Franz Marc, Klimt, Lempicka, Sutherland and Caravaggio destroyed, stolen or lost during the 20th Century.

- The book, *Antonio Canova. Atelier*, tells the story of the ongoing collaboration between Factum Foundation and the Musei Civici di Bassano del Grappa, a project which is transforming the conservation and display of drawings and sculptures by the neoclassical sculptor Canova. The new volume tells the story of these artworks from their creation in the late 18th and early 19th centuries to their technological transformation today.

Questions and conclusions to consider in ARCHiVe’s Exhibitions and Publications:

- Could we consider the possibility of establishing a permanent exhibition on the island of San Giorgio to communicate the work and projects done by ARCHiVe, becoming part of the itinerary of the visit to the island? Could this exhibition have an online equivalent to attract off-site visitors? The exhibition in Bologna could well become the basis for this permanent showroom, which would grow with time.
- Would it be possible to find external resources to design and print a yearly report (similar to the Letter of San Giorgio) including information and photos of selected works in progress?
- How can ARCHiVe be more present in Biennales and other international hubs of creative speculation?
People linked to Factum directly involved in ARCHiVe since 2019

- Halley Ramos - Columbia University
- Travis Kennedy - Columbia University
- Mario Costa - IUAV
- Fabio Martinello - IUAV
- Rashmi Gajare - Ca’Foscari
- Lucy Killoran - Edinburgh University
- Emanuel Zampieri - IUAV
- Tess Tomassini - Factum Foundation

What are ARCHiVe’s prospects for sustainability?

Following the Covid-19 pandemic the future for ARCHiVe looks very promising - there is clearly a growing awareness of the importance of High-resolution recording, documentation, archiving and digital access to information. ARCHiVe has a headstart, it is situated within a major research institution in a city that is in peril. It has respectability and all the partners have proven track records in this area of work. Other organisations like ICONEM are asking to partner with Factum on EU funding applications (on a Study on quality in 3D digitisation of tangible cultural heritage: mapping parameters, formats, standards, benchmarks, methodologies and guidelines), UNESCO has contacted Factum Foundation for a project involving the topographic and architectural survey of the Al Nouri complex in the old city of Mosul (Factum is currently working on the proposal to be presented to UNESCO’s Iraq Office), the ReACH initiative with the V&A is still developing.

If ARCHiVe has the right management structure and the collaboration between the three partners can create a mutually supportive structure with a clear agenda ARCHiVe can establish itself as one of Europe’s most independent and innovative centres devoted to digital preservation leading to better practice in the recording and analysis of cultural heritage.

Does it have sufficient funding to meet its goals in the coming years?

Not as it stands but it is in a much better place than it was 12 months ago...It will be sustainable if we can finalise some external independently funded projects and continue developing and realising innovative preservation and archiving projects.

How will progress be affected by the flooding and coronavirus?

The flooding in Venice and the rising sea levels that cannot be stopped by MOSE help to focus on the importance of ARCHiVe. The conclusion to the book The Aura in the Age of Digital Materiality is a summary of Factum Foundation’s position.

In the next months and years Coronavirus will change the way we live and work socially. It will change the way people have access to an experience all forms of culture. It has serious financial implications for Factum but we are working to turn these into an advantage. Factum has been working to use technology to protect and preserve heritage since the recording work in Seti I set new standards in 2001.
The thing that is most needed in ARCHiVe is an electrical/engineering workshop. Francesco Cigognetti, Factum’s main engineer has now moved to live in Padua and will be based in ARCHiVe. With decisive action this will happen in the near future.

**Conclusion**

ARCHiVe’s goals have proved to be more necessary than ever. Over the past weeks the Covid-19 crisis has changed many things. There is no precedent in recent times. The consequences are unknown and will unravel.

ARCHiVe is developing and applying the tools that can support existing library and archive practice. The goal is:

- To record more material at better resolutions and in different ways
- To make the date more accessible to more people in more different formats
- To ensure it can be studied both by humans and with machine learning and artificial intelligence
- To ensure secure long-term digital archiving in different forms - both digital and physical
- To help provide access to the holdings of the library

The model of ARCHiVe is clear. Each of the three partners contributes different things towards a common goal:

- Cini Foundation provides the best possible location on the island of San Giorgio, a reference library, an archive and a reputation as one of the most respected cultural institutions in Europe. It has rich collections of diverse materials all requiring digital recording and archiving.
- Factum Foundation develops the technologies for different types of recording in high-resolution. They ensure the data is downloaded correctly with the correct metadata so the data can be searched, used and stored.
- DHLAB (EPFL) closes the circle by extracting new knowledge out of the data provided by Factum and the team working in Venice.

The success of ARCHiVe depends largely on promoting active collaborations with institutions for the development of the different activities.
A series of online discussions about

NEW TECHNOLOGIES AND THE PRESERVATION OF CULTURAL HERITAGE

Organised by THE ART NEWSPAPER and FACTUM FOUNDATION

1-3 May 2020

DISCUSSION 1 - THE AURA IN THE AGE OF DIGITAL MATERIALITY  Rethinking the role and value of culture in the shadow of an uncertain future.

https://www.youtube.com/watch?v=PUO57HHCK0M

The role of the physical museum is changing and the roles of the objects within it are changing too. Facsimiles and new digital display technologies are bringing in new audiences, allowing us to tell new stories, and asking us to look at the material world with new eyes. This panel discusses the “aura” of the original versus the copy, and the new, potentially shifting landscape of display.

Chair: Sir Charles Saumarez Smith, CBE, former Secretary and Chief Executive, Royal Academy of Arts

Participants: Mark Jones, Andras Szanto, Mari Lending, Marina Warner, Neil MacGregor

QUESTIONS FROM AUDIENCE:

Cresa Pugh

Given the potential reality of long-term social distancing and decline in museum visitation, has there been reconsideration of restitution since visitation is an argument for retention?

Katherine Boon

Cast court at the V&A are a brilliant example of how replicas can inspire.

Frances Forbes-Carbines

Maybe in the future people will have 3D printers at home and museums can help them recreate sculptures and suchlike at home? Can you ask the panel please?

Joseph Kopta

A question for any of the speakers: how might the issues of art objects that are not strictly two-dimensional (such as sculpture in the round, 4-D works, manuscripts) be experienced digitally?

Kate Colleran
The painting of *The Marriage at Caana* (say) will have aged as much as it will; how long will the facsimile remain true to the original? What do we know about the material changes of the facsimiles?

**Maurice Davies**

Mark Jones gave a convincing (and brilliant) account of the decline in popularity of copies in the 2nd half of the C19, but I wonder if the invention of photography played a role in some way, too?

**Corinne Erni**

"Authenticity is in the eye of the beholder"

**Sarah Hardy**

Does digital engagement lessen the aura, or excitement, or desire for the real object and a physical experience with it? Does it add value to the original, or render it valueless?

**Olivia M**

Question: don't you think that such a trend would lead to take original artworks away from public museums and leave them exclusively to private collectors?

**Susan Dee**

It seems to me that there is an overlapping in these discussions of the issues of authenticity and age, or historicity. Authenticity may be in the eye of the beholder, but the age of something is not. I know in my subjective experience, being in the presence of objects that are ancient helps me to feel a connection to that time period, and the people who lived then. How can the digital age deal with this issue?

**Ross Burnett**

What are the issues when a copy becomes almost as celebrated as the original? - such as Dippy the dinosaur from the Natural History Museum

**Kate Fitz Gibbon**

Question: Any question of replication’s role in restitution needs to be far broader. How can art best be shared? Not, 'who owns it?' Shouldn't policy be based on source countries greatest needs?

**Jan Gadeyne**

Romans copied a lot of Greek work for aesthetic as well as other reasons. Copies were often also not "photocopies" of the originals.

**Nathan Tallman**

Copies played a critical role in preserving textual works over the centuries. Scribes did it for centuries and we owe them many thanks.
Robert Checchi

There's another type of duplication for Michelangelo’s David. I have created an augmented reality version to be used in the classroom. Bringing the full-size artwork to students anywhere in the world.

JJ Allerton

Look at all the cultural destruction as a result of war- just recently, the Bamiyan Buddhas, the temple in Palmyra, etc. Isn't copying technology needed as an insurance policy against future vandalism?

Frances Forbes-Carbines

I'm a frequent visitor to museums & find the digital add-ons add nothing to my experience but detract from the pleasure of objects. Graphics date badly & we have enough screen time as it is. Agree?

Kate Colleran


J Miku

What would be panelists' position about use/showing of replicas in aim of conservation in the museums, considering their one of possible role for offering visitors an experience of true objects?

Ed Duncan

Agree about "aura", and think that so much of the experience of an object is bound up in its provenance, its patina, it's social history, the people who touched it, coveted it, stole it.

Maria SD

The Raphael Cartoon at the Biblioteca Ambrosiana has a powerful aura which is amplified, I think, by the technical information displayed in the same room.

Eliot Wilson

Digital technology should only ever be there if it enhances & deepens appreciation & understanding of an object; or allows preservation. If we use it to tempt people in, that's maybe all they want?

Gus Moffat

The (uncopiable) Benin Bronzes functioned within an illustrated oral history overwritten by their appropriation. How to repair this auratic function if we are only ‘loaning’ the Bronzes back to Edo?

Rashmi Gajare

How would you monetize online museum tours?
Robert Kesack

"Virtual copies" are a limited solution to overwhelmed museums in this time of social distancing. What about potential for physical pop-ups, engaging artists & craftsmen, in the vein of Factum's work?

Molly Seiler

Q: Can you comment on issues such as droit morale and VARA. Who ultimately will have the right to say if the copy adequately replicates the original?

William Owen

Neil MacGregor talked about the role of the object. What was/ the role of objects within a museum and what is and will be that role? And how then, will that role be facilitated by technology?

DISCUSSION 2 - THE POLITICS OF RECORDING, TRAINING, PRESERVING AND SHARING

https://www.youtube.com/watch?v=3iP058JgPt4

For museums and other cultural heritage institutions, digital technologies open up unprecedented possibilities for sharing and collaboration, but they also give rise to new responsibilities. This panel asks how the international heritage community can best work to create accurate records and share knowledge with audiences across the world.

Chair: Simon Schaffer, Professor of History of Science, Cambridge University

Participants: Anaïs Aguerre, Jerry Brotton, Richard Kurin, Hartwig Fischer, Bonnie Greer

QUESTIONS FROM AUDIENCE:

Thomas Murray

Question: Digital technology rapidly becomes obsolete...plaster copies of sculptures, painted and drawings do not become lost with a change of computer language.

Amarilis M. Corrêa

What projects are happening in Brazil towards cultural heritage and/or digitisation? Unique assets were lost at the National Museum and there wasn't a digital reproduction for most of them.

Neil van der Linden

The topic is objects. What about the politics of indeed recording and then preserving and sharing of intangible cultural heritage? Music, oral epics and poetry.

Rebecca Levitan
How are you working with local populations at these sites (Mosul etc)? Do they feel that they have access to the objects in your collections through digital platforms? Is this something they desire?

A O’Carroll

What are the challenges and opportunities for (and why have we not yet seen) adopting of reproduction practices to facilitate the repatriation of sensitive or valued artefacts?

(returning originals which have integral material and historical value to the community while museums maintain the original?)

Andrew Ormston

How do you create a national digital collection without it being a nationalist collection?

Cat A

But who owns the digital information?

Melanie Hayes

Those interested in intangible cultural heritage ownership - Charlotte Waelde and Mathilde Pavis are great resources for critical reading. The WIPO also has interesting frameworks on traditional cultural expression and traditional knowledge frameworks as sorts of intellectual property rights

DISCUSSION 3 - NEW TECHNOLOGIES GENERATING NEW KNOWLEDGE

https://www.youtube.com/watch?v=I2-yavfw6Q

This discussion focuses on the technologies which are creating new knowledge about cultural heritage – on where we are now, and where we go next. Among the subjects to be discussed are new possibilities for image and information analysis, new technologies of display, and new directions in digital archiving.

Chair: Sir Ian Blatchford, Director and Chief Executive of the Science Museum Group

Participants: Sarah Kenderdine, Brian Cantwell Smith, Fréderic Kaplan, Carol Mandel, William Owen

QUESTIONS FROM AUDIENCE:

Neil van der Linden

Dear experts, what would be the ideas about Artificial Intelligence in a near future in museums of the future. AI as curator, interactive library and interface between the art works and the audience.

Elizabeth Markevitch
The Venice Time Machine is a brilliant project. Are you planning an app for the general audience while walking through the city where infos could pop-up in real time?

Elizabeth Markevitch

How do you see all these great data resources become also just a visual/emotional experience, not only about knowledge in order to become more accessible, as an entry door.

Jevgenija Ravcova

Interesting point from William. At the same time there is a lot of criticism leveled at museums about how much of their collections is inaccessible and how digitising them is a way to do that.

Michael McMaster

For the panel, when you consider recording a museum object, say a painting to sculpture...what information is relevant (color, texture, size), and what traps can a person fall into when recording?

Michael Klein

Will a curator need to think digitally; work to create exhibitions that can be viewed through devices as opposed to the museum gallery?

Nancy Turner

In museums where stewardship of objects has been seen as being core mission, what is the role of the museum conservator in this discussion, if digital is now seen to come first?

Beth Mckillop

Good to highlight the library/museum approaches - since both institutions need to reimagine how their collections and their finding aids will be used in future.

Jevgenija Ravcova

What about the value judgement - what is chosen to be recorded, digitised, studied, and what is overlooked? How is this judgement made, by whom and based on what?

Maria SD

Bonnie Greer's comments on the relevance of and access to digital projects to museum audiences are vital to keep in mind in this conversation. "How can we make what we do mean something to somebody?"