5. EUreka3D case studies

5.3. CRDI

5.3.3. THE 3D DIGITISATION OF THE PRE-CINEMA COLLECTION

The experience in digitising the photographic and audiovisual collections of the CRDI has yielded highly appreciated results from the audience in previous projects and experiences. The digital transformation of the archive has been a lengthy process that has provided significant professional learning while also representing a substantial change in the way the organisation interacts with its working environment. The archive is primarily a space for preservation and physical storage, but it is also a space for discovery, knowledge, experimentation, and creation. The amplification of these values is closely associated with the technological possibilities of the moment, increasingly well used by a sector that has also learned how to transform itself.

On this journey, we must now consider the possibilities offered by 3D digitisation, which allows the representation of volumetric elements to provide a faithful representation for analysis, research, and entertainment. The digitisation of 99 daguerreotypes from the collection in 2022 was CRDIs first experience in this regard. This endeavour served to explore the benefits of 3D digitisation in the heritage field but also to identify the challenges posed by such an initiative.

The EUreka3D project has precisely addressed these challenges and made progress in the right direction, enabling this technology to accelerate a small new revolution in the process of CH transformation. As explained in this publication, archives and heritage institutions in general face the challenge of achieving high-quality digital reproduction that goes beyond the proper selection and application of technology. It requires skilled professionals, a working methodology, the ability to analyse the complexity of the objects to be reproduced, and criteria to assess the results. We also face the challenge and the commitment of making these materials accessible, which requires not only well-documented objects, something we are already skilled at, but also a specific infrastructure that meets access, security, authenticity, and custody needs.

Finally, we have the challenge of preservation, which goes beyond the provision of the aforementioned infrastructures and requires the adoption and selection of file formats, and above all, rich documentation of the production context, meaning paradata documentation.

These are the challenges that CRDI has had to face within the framework of this project, which we explain below in order to share an experience that we believe can be beneficial for other institutions with similar characteristics. The work carried out has been possible within the framework of an European project and thanks to the valuable contribution of top-level technological partners who have validated the entire process. The resulting 3D assets, accessible on the portal, allow critical assessment and research. In this sense, we believe that the CRDI's experience in this project constitutes a case study to be considered by other projects or CH institutions following the same approach.

5.3.3. PREPARATORY WORKS

This case study focuses on the 3D digitisation of 50 objects from the Cinema Museum in Girona, using digital photogrammetry. The work was carried out by CRDI over the course of two years, from 2023 to 2024.

Figure 46. Exhibition rooms at Museu del Cinema - Col·lecció Tomàs Mallol, where 3D digitised objects within EUreka3D are exhibited

The first step was to select 50 objects for digitisation as a representative sample of the heritage elements preserved at the Cinema Museum, showcasing the diversity, quality, and uniqueness of an extensive cinematographic heritage. All items are movable objects and were digitised indoors, within the facilities of the Museum. The objects belong to the following categories: image projection, capturing and viewing still images of the real world, image animation, optical illusions and visual tricks, and amateur cinema. Below is a list of the digitised objects grouped into these five categories (Tables 2-6):

Table 2. Projection of images

IDENTIFIER	NAME	DESCRIPTION
MC00604	Magic lantern Lapierre (1875 ca.)	This is one of the most popular models of magic lanterns produced by Lapierre.
MC00613	Magic lantern (1903).	This magic lantern for domestic use, with a ceramic body and beautiful illustrations.
MC01111-1	Magic lantern slide (1870 ca.)	Glass slide for magic lantern of the choreutoscope type, made by the English firm Charles Baker.
MC02557	Magic lantern slipping slide (1840-1875)	Glass slides for a magic lantern with moving images.

IDENTIFIER	NAME	DESCRIPTION
MC05948	Phantasmagoria magic lantern (1850 ca.)	It was the first model of lantern mass-produced for commercialisation.
MC07155	Magic lantern that depicts a polychromed Chinese Mandarin (1875 ca.)	A rare example of a magic lantern for family use.
MC15176	Magic lantern Lerebours et Secretan (1849)	Extraordinary specimen of magic lantern for phantasmagoria shows (phantoscopes).
MC27790	Magic lantern Lapierre (1890 ca.)	This is one of the most embellished and worked-out models of the Lapierre factory.
MC08001	Bronze figures of a travelling magic showman and showwoman (1880 ca.)	
MC3248	Film projector Lumière (1897)	
MC00210	Film projector Pathé baby super (1926)	An amateur cinema projector model commissioned by Pathé Cinéma. They used 9.5 mm film.
MC00448.jpg	Film projector Eastman Kodak Co. 16 mm (1923-1926)	The first camera and projector of the 16 mm film format.
MC00804	Film projector Ambroise François Parnaland (1898).	This was a rare projector for 35 mm films with Lumière perforation.

Table 3. Capturing and viewing still images of the real world

IDENTIFIER	NAME	DESCRIPTION
MC02057-1	Travel photographic camera (1890 ca.)	Travel camera for 24 x 18 cm plates.
MC02122	Camera obscura (1800 ca.)	
MC02132-02	Medicine cabinet with chemical products for developing daguerreotypes. It belongs to a laboratory for daguerreotypes Lerebours. (1850 ca.)	

IDENTIFIER	NAME	DESCRIPTION
MC02132-03	Device for securing daguerreotype plates for polishing. It belongs to a laboratory for daguerreotypes Lerebours. (1850 ca.)	
MC02132-04	Mercury box for developing daguerreotypes. It belongs to a laboratory for daguerreotypes Lerebours. (1850 ca.)	
MC02132-05	Alcohol lamp. It belongs to a laboratory for daguerreotypes Lerebours. (1850 ca.)	
MC02132-05	Mercury pot. It belongs to a laboratory for daguerreotypes Lerebours. (1850 ca.)	
MC02132-06	Support for heating or drying the daguerreotype plate. It belongs to a laboratory for daguerreotypes Lerebours. (1850 ca.)	
MC02132-08	Box for sensitising a daguerreotype plate with vapours of iodine crystals. It belongs to a laboratory for daguerreotypes Lerebours. (1850 ca.)	
MC02132-09	Colour palette. It belongs to a laboratory for daguerreotypes Lerebours. (1850 ca.)	
MC02134	Daguerreotype camera (1850 ca.)	
MC07649	Photographic camera Eastman Kodak núm.1 (1888)	It is the first photographic camera that used a roll of celluloid.
MC03262	Studio photo camera Voigtländer & John (1860-1880)	
MC01147	Peep show box, polyorama panoptique (1849)	Device for family use.
MC01163	Peep show box (1775-1825)	Peep show box to observe an optical view placed inside it.

IDENTIFIER	NAME	DESCRIPTION
MC01165	Statuette of a peep show box showman with woman and child (1757-1766)	
MC01275-1	Peep show box for translucent photographs (1866 ca.)	
MC02190	Stereoscopic photograph viewer Negretti & Zambra (1860 ca.)	
MC02192	Stereoscopic photograph viewer taxiphote, by Jules Richard (1900 ca.)	
MC00762	Film camera NBell & Howell (1939)	One of the most used cameras by war reporters during World War II.
MC00791	Film camera-projector Gaumont (1897 ca.)	
MC00837	Film camera-projector Jules Carpentier. Cinématographe Lumière (1896)	
MC00859	Film camera Pathé Cinéma (1908)	A 35 mm camera.
MC00426.jpg	Film camera Eastman Kodak Co. Cine-Kodak, model A (1923)	The first camera and projector of the 16 mm film format.
MC00558.jpg	Tinfoil phonograph, by Eugène Ducretet (1881)	This machine could record and reproduce sound.

Table 4. Animation of images

IDENTIFIER	NAME	DESCRIPTION
MC01332	Filoscope (1898)	The filoscope, which is also called a flick book or flip book, was a novelty item to animate a drawn or photographic image.
MC01360	Mutoscope Gaumont (1898)	The mutoscope was based on the technique of the folioscope.
MC01292	Kinora (1911 ca.)	It was the most popular way in Britain for watching movies at home.

Table 5. Optical illusions and visual tricks

IDENTIFIER	NAME	DESCRIPTION
MC00964	Phenakistoscope (1868)	This type dispensed with the use of the mirror to observe the images.
MC01114	Zograscope (1790 ca.)	Optical device used in the family setting to observe optical views.
MC10841	Zoetrope (1914-1925)	Mounted on a turned wooden foot.
MC01247	Toy shadow theatre. Ombres chinoises (1920 ca.)	

Table 6. Amateur cinema

IDENTIFIER	NAME	DESCRIPTION
MC01701	Toy cinema projector (1933)	Film projector for children that used a system similar to that of mutoscopes to create a moving image.
MC01750	Toy cinema projector (1942)	The projector used a 35 mm wide opaque paper film.
MC04782	Toy cinema projector NIC (1931)	The first cartoon projector, manufactured by a Catalan company, designed to be used by children.
MC06430	Toy cinema projector NIC (1932)	Children's film projector manufactured by the American company NIC Projector Company.

CRDI was committed to digitise all these objects and so, the next step was to contract a company working with the appropriate technology for 3D digitisation and the capacity to accomplish with the requirements written at VIGIE 2020/654 Study for quality digitisation. For this reason, we issued a tender, which was awarded to La Tempesta Media, a comprehensive digital services company that creates, designs, and develops digital mediation and new media tools for CH, knowledge, and content-based organisations and their communities. They have a multidisciplinary team, including developers, designers, documentalists, humanists, and social scientists, working throughout Europe, with offices located in downtown Barcelona.

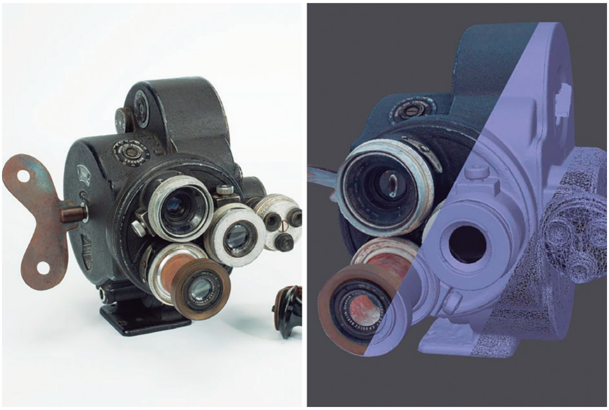

Figure 47. Cinematographic camera. Bell & Howell, 1940. Museu del Cinema - Col·lecció Tomàs Mallol. Digitised model by CRDI - Ajuntament de Girona, in collaboration with La Tempesta Media EUreka3D project/CRDI-Ajuntament de Girona

Before starting with digitisation, we have to consider the legal issues, especially those related to intellectual property rights (IPR) as it determines the reuse. It should be noted that these rights referring to creativity are similarly regulated in different European countries. In all countries signatories of the Berne Convention, 70 years after the death of the author the works belong to the public domain.

In this case study, there are no copyright issues related to these objects, as the original ones that could be protected for the Spanish law are all in the public domain. For this reason, we labelled them with the PDM from the Creative Commons licences.[1] Therefore, they cannot be subject to restrictions because of rights issues. However, it is possible and reasonable for the private sector to charge for the acquisition of a digital 3D reproduction. It is important to consider that in the private sector there is a business around the heritage and that these companies invest in

1 http://creativecommons.org/publicdomain/mark/1.0/deed.ca

the processing and preservation of this heritage. Therefore, they must be economically sustainable and so the business model differs necessarily from centres financed with public funds, like CRDI.

Once the digitisation company was decided, it was time for coordination with the Museum staff, in order to reduce as much as possible, the logistical effort of the stakeholders. This implies establishing the data capture days and determining which items should be digitised on each journey. This was a subject of great matter, as the objects are part of the permanent exhibition of the Museum. So, the time the collection objects spent out of the exhibition rooms and showcases should be minimised.

5.3.3. OBJECT'S COMPLEXITY ANALYSIS

To understand the complexities of digitisation, we organised a technical visit to the collection facilities with all the stakeholders and mainly the professionals responsible for the 3D digitisation. The aim of the visit was to observe and analyse the environment and the objects to be digitised, to plan the data capture process, and to anticipate any potential issues or difficulties.

The first task was therefore a detailed study of the materials composing the objects, and in this sense, it was necessary to prepare a conservation report on the materials by a restorer. In order to accomplish this conservation report, we created a descriptive sheet with detailed information on the various components of each object. For wood, technical details described colour, grain, fibre, and texture, with a classification to distinguish between coniferous and leafy types, along with information on finishes. For metals, the sheet specified whether they were magnetic or not, the type (iron, steel, copper alloy, etc.), and information on finishes. Regarding paper and cardboard, we made distinctions between handcrafted and industrially produced materials, with categories including coated, vegetable, newsprint, cardboard, photosensitive, and details on finishes (priming and protective layers, polychromy, printed, manual, etc.). For glass, the classification focused on differentiating lenses, mirrors, and plain glass. Additionally, for all materials, the descriptive sheet included observations to describe nuances and the conservation status of each piece.

With this report, we were able to anticipate potential difficulties during digitisation, especially considering that reflections from metals and the transparency of glass would be the primary challenges to address. These difficulties would require extensive work during the post-processing phase to reconstruct the mesh and textures, ensuring that the final model for dissemination had the most accurate appearance and material behaviour possible.

To increase efficiency with the process, we grouped the objects to be digitised based on their measurements. Objects exceeding 50 cm on any side were labelled as “large”. This distinction was crucial as it affected the data capture method. Images of large items had to be taken by orbiting around the object, while smaller objects could be captured on a rotating base. In an 8-hour session, we could capture a maximum of two large objects. Small and medium-sized objects, depending on their details and complexity, required up to one hour and a half each, averaging five objects per day. This timeframe only refers to the capturing process.

Other factors could also affect the quality of the digitisation. The main issue was that some objects had movable parts. Under the supervision of the museum conservators, these parts were fixed so that they didn’t move, without damaging the objects.

Following the visit, the professionals from the digitisation company identified the most suitable equipment and tools for the entire digitisation process, taking into account the conservation requirements and the specific characteristics of the museum collection. With this preparation, they were ready to deploy the digitisation equipment in the museum’s workspace to streamline the process.

5.3.3. DIGITAL CAPTURE AND PROCESSING

Two professionals from La Tempesta Media participated in the core processes of the project: preparation, photographic capture, and post-processing. The team comprised a photographer and a 3D photogrammetry technician, who worked in continuous coordination with the CRDI and Cinema Museum staff. Photographing the museum objects is a labour-intensive task for the photographer, primarily due to the previously mentioned challenges related to the objects' materials. Using photogrammetric techniques to build a 3D model requires capturing images from various angles and positions, repeatedly rotating the object to minimise reflections and glare. Another major challenge is the varying sizes and thicknesses of the museum objects, which sometimes have moving parts. Effectively applying the photogrammetric technique addressed these challenges, yielding optimal results efficiently. Below is a detailed list of instructions executed for data acquisition, grouped into three core processes, provided by La Tempesta Media professionals.

Figure 48. 3D digitisation process of pre-cinema collection of the Cinema Museum in Girona using photogrammetry by CRDI - Ajuntament de Girona

Preparation tasks

- Equip the camera with a polarising filter to minimise light reflections.

- Set appropriate illumination for the object.
- Adjust the manual camera settings:
    - Fix the ISO to the lowest possible value (100) to avoid digital noise.
    - Use higher f-values to achieve a high depth of field for sharp images, resulting in better mesh and texture quality.
    - Set the exposure time as short as possible to reduce digital noise. However, for larger or highly reflective objects, longer exposure times are necessary due to softer lighting.
- Place the scale bar next to the object for use in digitally scaling the model later.

Photographic capture

- Take photos of the object from all angles, ensuring at least 66% overlap between consecutive images. Objects without restrictive issues (such as fragility or physical instability) should be turned or laid down so that the part in contact with the surface can also be digitised.
- For large and highly detailed objects, use the focus stacking technique. This means taking multiple images from the same viewpoint, each with the focus set at different distances. This additional process was implemented to achieve improved final results, particularly in mesh details and texture quality.

Post-processing and data storage

- Import the RAW image data to the hard drive and store it in the corresponding folders.
- Rename all images with their corresponding IDs, and identify the ColorChecker calibration images. Label colour calibration images as ID_colorchecker_01 and ID_colorchecker_02. Rename the rest of the images as ID_0001, ID_0002, ID_0003, etc.
- Convert the ColorChecker image containing the colour scale into DNG format, as the software does not recognise Canon's proprietary CR2 file format.
- Create the camera colour profile, name it under the corresponding ID_profile, and store it in the RAW folder.

- Develop the RAW images into JPEG format using Adobe Camera RAW, assigning the colour profile and white balance beforehand.
- Save the JPEG images in their corresponding folder. Identify focus-stacking images and set them apart.
- Process the focus stacking images in Adobe Photoshop. From each point of view, only one image should remain. For example, if four photos were taken from the same camera position with different focusing points, the result should be one final image that merges and stacks the sharp parts of the photos while discarding the blurry ones. Save the resultant JPEG with the other images, indicating the original photos it is composed of. For instance, if an image is a result of stacking ID_0025, ID_0026, and ID_0027, the merged photo will be named ID_0025-27.
- Upload all the JPEG images into the Agisoft Metashape file. If the object was turned upside down or laid down during the data capture process, the images should be separated into different “Chunks” (the software’s term for work layers) to maintain consistent alignment between the object and the environment.
- Align the images, build the mesh, and apply the textures. If there is more than one “Chunk”, this process must be repeated, initially masking the environment to eliminate inconsistencies.
- Once the model is textured, it is ready for export. This will be the RAW 3D model, called “Master”. The export is done in the .OBJ format. Considering the complexities of the collection, the “Master” model often contains some mesh irregularities, distortions, and holes.
- The next step is to automatically decimate the RAW model in Metashape, setting the polygon count to 150,000, creating the “Low resolution” model. UV mapping and textures must be rebuilt. Export it to its corresponding folder.
- Import the “Low resolution” model into the 3D modelling software Blender. Manual post-processing is performed to correct irregularities, close holes, remove noisy polygons, and reconstruct metallic, glass, lenses, and reflective surfaces.

- Export the model and import it back into Metashape. Then, reproject the texture and UV map, a post-processing technique for photogrammetry known as texture reprojection.
- Export the 3D model in .OBJ format to the Dissemination folder.
- Conduct a second layer of non-destructive post-processing, preserving the previous post-processed model labelled as “dissemination basic”. Apply PBR materials to give the object a photorealistic appearance with lighting, adjusting values such as roughness, transmission, metallic, or alpha channel, among others. Export the resultant 3D model in .GLB format, naming the file to indicate the added PBR material, such as “lens” or “glass”.
- The final step is video rendering. This process is done in Blender, which has excellent rendering engines. Set an environment and illumination beforehand. The environment is designed as a grayscale pattern to maintain the CH item’s context. The video includes tracing camera movements and animations, initially showing an overall preview of the object followed by close-up views of its unique features and details.
- Export the output as an .MP4 file. If necessary, make further adjustments using video editing software DaVinci Resolve.

For the data storage, there was a need of 1.5 TB (a total of 46.182 files). All of this data is preserved at the Girona City Council repository, an infrastructure owned by the City Council and managed by the IT Department. The servers are already used for digital archiving and so, they accomplish well with all authenticity, security and preservation requirements.

Regarding the organisation of all these data, the files have been organised in folders using the object IDs as main identifiers. Each model has a unique name based on its ID, which is also included in the name of all its dependent folders and files.

Every item has an initial layer of five main folders, where data is separated according to its type:

- 01_ID_Dataset: contains image data in RAW and JPEG formats.

- 02_ID_Process: contains the photogrammetry software native file format (Agisoft Metashape, .PSX), with the entire saved process.
- 03_ID_Exports: contains the 3D models in three separate folders:
    - 01_ID_Master: contains the unaltered 3D RAW data, with no post processing. This means that, due to the presence of glass, metals, and mirrors, the mesh geometry and textures may contain unwanted holes and irregularities. Exported in .OBJ format.
    - 02_ID_Low_resolution: Contains the same model, but decimated to 150,000 polygons. This is the optimised RAW data. Exported in .OBJ format.
    - 03_ID_Dissemination: Contains the 3D model optimised and ready for publication. It includes manually adjusted post-processing. Typically, the model has two versions: one without material behaviour adjustments (metal, glass, roughness, etc.), labelled as "basic", and one with those adjustments, labelled as "lens" or "glass" to indicate its alterations. Exported in .OBJ format, and also in .GLB format for models with material adjustments, as .GLB saves transmitting materials such as lenses.
- 04_ID_Postprocess: Contains the 3D modelling native file format (Blender, .blend). The extent of post-processing work varies depending on the model's complexity. This folder includes the dissemination model and the video rendering process.
- 05_ID_Render: Contains the rendering video in .MP4 file format.

Regarding digitisation costs, the project allocated a subcontracting budget of €15,000, dedicated exclusively to these tasks of capturing and post-processing the images of the heritage objects. The Girona City Council's tender outlined all the technical requirements agreed upon in the project. Two companies participated in the process, both possessing the necessary technological capabilities and proven experience. Ultimately, the contract was awarded to La Tempesta Media S.L. for €13,000.

5.3.3. PARADATA AND METADATA

Paradata becomes a main issue for a project like this and so, following the VIGIE 2020/654 Study report recommendations, we gathered all the technical information regarding the tools for digitisation, the process, the professionals working on it and the environmental conditions for the capture. In the text below, we just provide the specific information regarding equipment and software used for digitisation and editing. The complete set of paradata was published in Europeana with a specific document related to each object.

Data capture equipment

- Reflex camera: Canon EOS 5DS with Full Frame CMOS sensor (36 x 24 mm), 50.6 megapixels.
- Camera lens: Canon EF 50mm f/1.4.
- BENRO Camera Tripod 1.45m max extension.
- NEEWER LED panel bicolour CRI 96+, 3200-5600K (2 units). Individual continuous lighting of each object for its photographic reproduction.
- BENRO UD 58 MM. Polarising filter to minimise light reflections. Reflections interfere with the processing of the model, bringing digital noise and errors in photo alignment.
- Remote Control camera trigger.
- AOMDOM Branché: Electric Semi-Automatic Remote Control Rotation Base. 42 cm, 100 Kg max weight. It speeds up the digitisation process for the small and medium size objects.
- Study Lightbox Orangemonkie Foldio 3 (60 x 60 cm). This box is to give the proper lighting to the object and minimise hard shadows. With the lightbox we could fake the background as wanted and made possible shorter exposure times while working with high f numbers.
- ColorChecker Passport Photo 2. Colour and Grey Scale Charts.
- Scale bar: necessary to semi-automatically scale the 3D model, as the regular algorithm has no accurate auto measures.

Hardware

- ASUS TUF GAMING F15 computer: 32 GB RAM, Intel Core i5, Nvidia GEFORCE RTX 3050. The processing computer. For photogrammetry and 3D modelling high processing capacity computers are needed.
- SanDisk SD card 128 GB. Deep memory card to store +4000 RAW images.
- WD Elements 4 TB capacity. Hard Drive to store all the data, as 3D projects are dense in weight.
- WD Elements 2 TB capacity. Backup Hard Drive to keep the data as emergency backup.

Software

- ColorChecker Camera Calibration. Specific software of the Colour and Grey Scale Chart, used to calibrate the accurate colours, which are identified by Computer Vision and translated into a colour code, known as colour profile.
- Microsoft Power Rename: Windows extension to rename *en masse* high numbers of files and folders, to match them with the object IDs.
- Adobe DNG Converter. Used to convert RAW proprietary files (CR2) to exchangeable formats (DNG).
- Adobe Camera Raw. Used to apply grey and colour calibration and convert DNG to JPEG.
- Adobe Photoshop. Used for photo stacking to enhance photo alignment and textures.
- Agisoft Metashape. Specific photogrammetry software to align photos, build 3D mesh and apply textures.
- Blender. Open-Source Software to edit the web publishing 3D Models (dissemination) and produce video renderings and animations.
- DaVinci Resolve. Used to edit the video renders, as a post processing tool.

Metadata is essential for the understanding of the object, otherwise all the efforts for a quality digitisation are meaningless. It is important to work using international standards for archives, museums and sites. However, for a project like this, the main reference is the EDM. Local catalogues need to fit with EDM schema and they also need to be enriched using skosified vocabularies,[2] for hierarchical and semantic relations and multilingualism. CRDI bases its enrichment in the use of AAT (Art and Architecture Thesaurus), from the Getty Institute, and Wikidata.

Publishing on Europeana involves a process that includes metadata mapping and transformation through intermediate software that converts local metadata into EDM. For this project, the partners from EGI Foundation developed a schema and a tool for converting metadata to EDM and publishing it on Europeana. However, for partners already publishing in Europeana, such as CRDI, which has been using MINT -an infrastructure managed by Photoconsortium and owned by National Technical University of Athens (NTUA)- for over twelve years, the process is slightly different. In these cases, the process begins with the publication of an XML file formatted according to the structure and metadata standards agreed upon in the project. Metadata is then converted to EDM through mapping conducted in the MINT system. The process concludes when Europeana harvests the metadata and publishes it in its catalogue.

From this process, it is evident that an initial structuring of metadata based on universal standards and a high level of expertise in describing heritage objects significantly facilitates the work. Expertise in handling museum objects and adherence to standard references are essential foundations for successfully navigating the process.

5.3.3. DISSEMINATION AND REUSE

To better understand the use and reuse of pre-cinema objects, it is important to consider the approach of the Cinema Museum's permanent exhibition. The exhibition system goes beyond merely showcasing the most significant parts of the collection; it aims

2 https://www.w3.org/2001/sw/wiki/Skosify

to be interactive, engaging, and educational. To achieve this, the exhibition features various audiovisual projections and staged presentations that give visitors a sense of historical visual shows and the images that were projected during the pre-cinema and early cinema periods. Replicas of the artefacts allow visitors to handle them and learn more about their mechanisms. Many devices feature digitised images that replicate the functionality of the objects in an educational and entertaining manner, with some interactive touchscreens enabling visitor engagement.

This approach ensures that the exhibition is accessible and appealing to all audiences, regardless of age, cultural background, language, or level of interest in cinema. It offers a universal narrative on the roots of our audiovisual culture, making it a recommended experience for everyone.

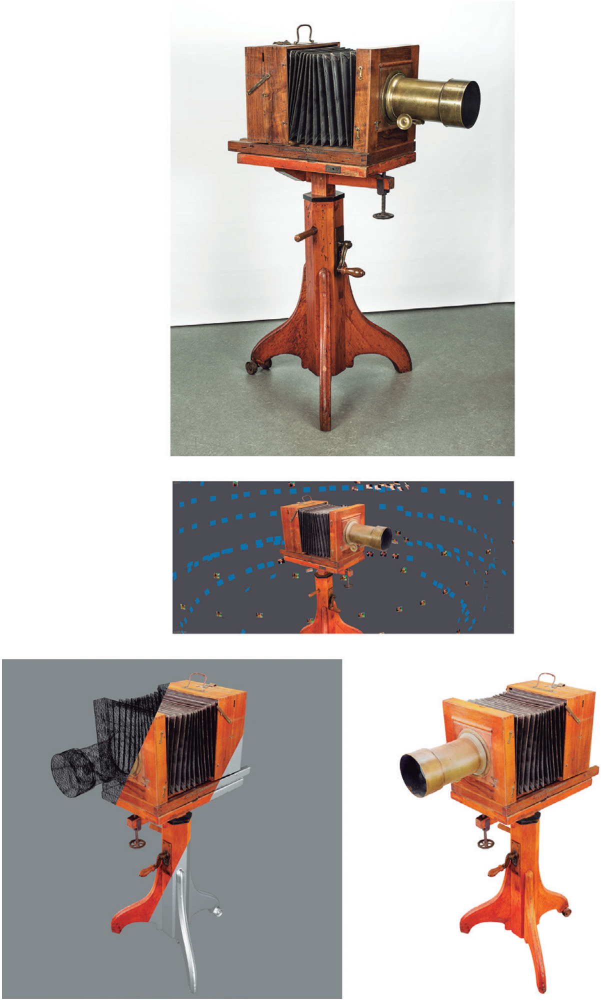

Figure 49. Camera for photography studio. Manufacturer unknown, ca. 1860-1880. The original object, the 3D model reconstruction, and the digitised model by CRDI - Ajuntament de Girona, in collaboration with La Tempesta Media. EUreka3D project/CRDI-Ajuntament de Girona

The overarching goal of the Museum of Cinema goes beyond its permanent exhibition. Its ultimate aim is to boost dissemination, education, and research on cinema and imagery in general. To fully achieve this goal, 3D digitisation is becoming increasingly crucial. It offers numerous opportunities for research and provides a more realistic approach to digital representation. Digitisation plays a key role in understanding and educating about the history of moving images, cinematographic techniques, and the evolution of cinema and photography. This is achieved through conservation, research, interpretation, and online exhibition, facilitated by the EUreka3D platform. This platform enables interaction with both researchers and end-users, aiming to reach a broader audience with more content than ever before.

5.3.3. CONCLUSION

Based on the experience and lessons learned from this case study, we can highlight three key aspects that should be considered for any 3D digitisation project undertaken by an archive or museum:

1. **Scientific Approach to 3D Digitisation**: 3D digitisation is a scientific process that requires careful measures to optimise work quality based on existing technology. Preparatory tasks, such as complexity analysis, are critical and influence the final outcome. A thorough preliminary study of working conditions is essential for achieving optimal results and objectifying work quality. In this context, having a technological partner is crucial. For this project, CUT has been the leading partner, and the VIGIE 2020/654 Study has served as our guide for ensuring quality digitisation.
2. **Understanding of the heritage objects**: The technical evolution of pre-cinema objects has had significant impacts on the social use of imagery. Detailed knowledge of the originals being digitised is vital for successful reproduction. The Pre-Cinema Collection allows us to trace and understand the development of motion picture technology and its associated shows. These objects provide insight into how moving images were represented before cinema and detail the technical processes leading to the invention of the cinematograph in 1895. It is essential to remember that the heritage is the core of the project, and technological innovations are meaningful only when they benefit this heritage.

3. **Reusability of 3D Digital Objects**: The 3D digital objects resulting from digitisation offer significant potential for reuse. Due to their nature, different parameters for dissemination and reuse need to be considered compared to traditional digital archives. This requires a new approach and an understanding that we are at the beginning of this evolving field. As we move forward, it is important to establish infrastructure, develop methodologies, and collaborate with technological partners. The approach taken during the EUreka3D project has yielded satisfactory results and encourages us to pursue new projects to advance the use of this technology, always keeping in mind the need for continuous innovation in the heritage sector.

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