



fRamework for safE, opEn, collaboratiVe And inclUsive digitisAtion and management of cultural heritagE

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Executive summary

Deliverable D4.4 presents the first release of the cultural asset reuse productions and applications developed within the REEVALUATE project (Grant Agreement No. 101132389). Building on the planning established in Deliverable D4.1, this document reports on the current state of the reuse productions across three pilot scenarios, the shared technical enablers underpinning them, and the legal and ethical framework governing the reuse of digitised cultural heritage.

The three REEVALUATE pilots address distinct cultural heritage domains:

- Fashion
- Olympic Games and Music
- Historic Site of Aquileia

Pilot 1 (Fashion) centres on a gamified application — the “Fashion Time Machine” — and a physical garment creation showcase, drawing on digitised artefacts from the MoMu collection in Antwerp. The technical implementation by CERTH utilises the SMPL-X body model and a Unity-based clothing pipeline, while FFP is responsible for merging the partner contributions into the bespoke gamified application. The first published output — a modernised sewing pattern derived from a 1920s MoMu collection piece — is available for purchase on the FibreMood platform.

Pilot 2 (Olympic Games and Music) will produce an advertising film for the planned immersive exhibition at the Olympic Museum of Thessaloniki, combining visual artefacts from the Olympic Museum with ethnomusicological material from the Ethnologisches Museum of Berlin (SMB/SPK). The pilot is expected to expand beyond its original scope if the consortium manages to implement more within the allocated person months.

Pilot 3 (Aquileia) focuses on site-level digitisation of the Titus Macer Domus and artefacts from the National Archaeological Museum, resulting in an interactive virtual tour accessible both on-site and remotely.

The shared enablers - including the DLT-based Asset Tokenisation & IPR Management Enabler, the Context Validation Enabler, the AI-driven Contextualisation Enabler, and the Collaboration Enabler — are being tested across all three pilots to support copyright management, contextual validation, and cross-institutional workflows. Following the bankruptcy of NURO, the original lead beneficiary, FFP assumed responsibility for this deliverable in close collaboration with CERTH.

The deliverable also addresses the legal and regulatory framework for cultural asset reuse, covering intellectual property rights and data protection rules applicable to digitised artefacts and avatars (see Section 3.8). The results presented here will be refined and extended in the second release (D4.4 R2, due M29), incorporating the outcomes of the second pilot phase and a more comprehensive evaluation of the reuse applications in public-facing settings.



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Abbreviations

Abbreviations	Full name
AI	Artificial Intelligence
API	Application Programming Interface
CH	Cultural Heritage
CHI	Cultural Heritage Institution
DLT	Distributed Ledger Technology
EAB	External Advisory Board
ECCCH	European Collaborative Cloud for Cultural Heritage
F2F	Face-to-Face
GA	General Assembly (GA)
GUI	Graphical User Interface
KAOS	Knowledge Acquisition in automated specification (Keep All Objectives Satisfied) goal modelling method
KPI	Key Performance Indicator
UI	User Interface
UML	Unified Modelling Language
WP	Work Packages
W3C	World Wide Web Consortium

1 Introduction

This document provides the first release of the cultural asset reuse productions and applications for the REEVALUATE project. The development and documentation of these productions and applications is the primary output of Task 4.4 (Cultural Asset ReUse Productions & Applications, M13–M29). This deliverable (M25, January 2026) documents the digitisation processes, asset production methods, and application development undertaken across the three pilots and will be followed by a final updated release in M29 (May 2026).

1.1 Transition of Lead Beneficiary Responsibilities

On 1 November 2025, NURO — the partner originally responsible for the development of the Fashion Time Machine gamified application and lead beneficiary of this deliverable — entered bankruptcy proceedings and ceased all project activities. As a consequence, FFP assumed full responsibility for the coordination and delivery of D4.4 and the related WP4 tasks, including the application development previously assigned to NURO. This transition required FFP, with the guidance and support of CERTH, to establish direct communication with all partners involved in the work package — 3DR, EFHA, SMB, MoMu, OLYMPIC, ARTHUR, and AQUILEIA — in order to assess the current status of each pilot, collect outstanding contributions, and ensure continuity of work. We would like to express our sincere thanks to CERTH at this stage for their invaluable guidance throughout this process. A coordination meeting was held in Thessaloniki on 28 November 2025 to align on the revised roles and path forward. FFP began work on this D4.4 deliverable as soon as the situation was clarified following the Thessaloniki Meeting. FFP and CERTH have since established a close and productive working partnership to consolidate the deliverable and drive the development of the reuse applications. For Pilot 1 (Fashion), FFP has taken over NURO's role in developing the "Fashion Time Machine" — a gamified application allowing users to interact with digitised historical fashion from the MoMu collection. FFP will test whether NURO's original vision can be maintained as the application is built on top of CERTH's enabler engine. Alongside the gamified application, the second showcase — a physical garment creation experience using sewing patterns derived from MoMu collection items in cooperation with FibreMood — continues as originally planned. FFP and CERTH are now working closely together to deliver the application and remain on track for the second release of this deliverable (D4.4 R2, due M29).

1.2 Deliverable Outline

The productions and applications are being carried out and tested within WP4, specifically in Task 4.5, with subsequent assessment and evaluation in Task 4.6.

The primary purpose of this document is to describe the specific Cultural Heritage (CH) asset reuse applications that are being developed and prepared for testing in the pilot phase. Each pilot case requires a unique production or application that creatively reuses digitised artefacts, developed by the industry pilot partners (FFP, 3DR, and formerly NURO) to test and validate the enablers of the REEVALUATE framework:

- Pilot 1 (Fashion): A gamification application — the "Fashion Time Machine" — and a physical garment creation showcase.
- Pilot 2 (Olympic Games and Music): A video production utilising digitised artefacts from the Olympic Museum of Thessaloniki and SMB.
- Pilot 3 (Aquileia): A 3D tour application of the historic site.

The document is structured as follows:

- Section 1 describes the transition of lead beneficiary responsibilities from NURO to FFP and CERTH, who took over the tasks of NURO. As we were limited with little to no prior documentation and code, we had to start from step 1.
- Section 2 introduces the deliverable goals, its relation to other deliverables, and provides an overview of each pilot, including the dataset and storage approach and the legal framework for reuse.
- Section 3 details each pilot individually, covering the themes, partners, and cultural heritage assets involved; challenges and approaches related to creative reuse; and current digitisation and reuse status.
- Section 4 documents the reuse applications and productions, covering 3D asset production and digitisation methods per pilot, application development status and functionality, and the plan for the next period (R2).
Section 5 provides conclusions and an outlook on upcoming work.

1.3 Deliverable Goals

The purpose of this deliverable is to detail the cultural heritage reuse applications and productions planned and undertaken within WP4. It serves as a crucial element for the success of the work package, as it provides the necessary resources and documentation for the subsequent evaluation of the pilots, which in turn forms the basis for evaluating the enablers developed within REEVALUATE.

Specifically, this deliverable aims to illustrate the digitisation processes applied to cultural artefacts used for validating the project's enablers, and to document the development of software applications that showcase the creative reuse of cultural heritage. The document covers the current status of digitisation, asset production methods, and application development across all three pilots. It is expected that the follow-up release (R2) will contain updates reflecting progress made, organisational details that were not yet available at the time of this writing, and a deeper examination of the results and outcomes of the creative reuse applications.

1.4 Relation with other deliverables

This deliverable translates the pilot plans established in D4.1 (Definition and planning of pilots) into concrete creative productions and reuse applications. It builds upon the digitisation activities documented in D2.1.R1 (Cultural Items Identification & Digitisation), which provides a detailed overview of the artefacts selected, the digitisation approaches and technologies adopted, and the resulting digital assets available across all three pilots. As the activities under Task 2.1 remain ongoing, the asset base continues to evolve and expand.

The reuse applications described herein integrate enablers developed in WP2 and WP3, and are aligned with the user needs and usage scenarios identified in D1.3. The deliverable also draws on the integrated platform work documented in D4.3, which brings together the technical components required for pilot execution. The follow-up release (R2) will reflect further progress across these work packages and incorporate any additional developments available at that time.

1.5 Notes on the Approach

Each of the three REEVALUATE pilots is carried out with dedicated cultural heritage partners and uses a different format to present digitised content: an online activity (Pilot 1), a physical museum exhibit



(Pilot 2), and a self-guided tour through a historic site (Pilot 3). This spread of formats ensures the project's enablers are validated across distinct, non-overlapping use-cases.

The first pilot centres on fashion heritage and involves, as content providers and cultural heritage partners, primarily MoMU and EFHA, working together with FibreMood. This pilot deals exclusively with virtual assets in an online presentation context. While the activities within the pilot may involve and actively encourage the creation of physical fashion items by users, the resulting garments fall outside the direct scope of the project deliverables and are considered a secondary outcome of the reuse experience.

The second pilot addresses the intersection of music and the Olympic Games and involves the Olympic Museum of Thessaloniki and SMB as its cultural heritage partners. The core objective is to produce video content using digitised artefacts from both collections, which will subsequently form the basis of a physical exhibition at the Olympic Museum. The production plan follows the scope outlined in the proposal; should the content prove sufficient or the production process more efficient than anticipated, additional material may be delivered within the available person-months.

The third pilot involves Fondazione Aquileia as the cultural heritage partner and centres on the historic archaeological site. It presents digital artefacts within the physical environment of the location itself, enriching the visitor experience through supplemental contextual information that connects the physical remains with their historical significance.

As the three pilots are largely disjunct in terms of both scope and cultural heritage partners involved, this document presents each pilot individually. Nevertheless, all pilot descriptions follow an identical structure in order to ensure consistency and comparability across the different domains and presentation formats.

1.6 Pilot 1 - Fashion

The first pilot activity involves a collaboration between EFHA, the MoMu – Fashion Museum Antwerp, and the Belgian company FibreMood. The pilot began with the digitisation of various fashion heritage artefacts from MoMu, including garments, accessories, and sketches. These digitised artefacts underwent a collaborative contextualisation process involving the general public, stakeholders, and experts from the fashion and creative industries. The pilot itself consists of two different showcases.

The first showcase is a gamified application titled "Fashion Time Machine." In this application, users will be able to interact with digitised historical fashion pieces, garments, and collections, exploring fashion heritage through playful challenges. The original concept envisaged different levels based on various fashion eras, style challenges, and social sharing features; FFP will test whether this initial vision can be maintained as the application is built on top of CERTH's enabler engine. Following the transition of lead beneficiary responsibilities described in Section 1, FFP has taken over development of this application in close collaboration with CERTH, who are providing the technical engine for avatar creation, motion transfer, and digital clothing.

The second showcase allows users to create their own physical garments, based on sewing patterns derived from items in the museum's collection. This enables users to produce their own personalised version of a historical garment. The showcase has been developed in cooperation with FibreMood and extends an earlier collaboration with that company in the domain of fashion-making as a social media-based and supported activity.

1.7 Pilot 2 - Olympic Games and Music

The second pilot showcases the potential of the REEVALUATE framework to address the challenges associated with the digitisation of cultural heritage artefacts and their creative reuse within the advertising and creative industries sector. The pilot involves FFP, the Olympic Museum of Thessaloniki, and the Ethnological Museum of Berlin (SMB).

The pilot involved the digitisation of a selection of artefacts from both institutions — including audio material from the Ethnological Museum of Berlin and artefacts related to the Olympic Games from the Olympic Museum of Thessaloniki. The digitisation process incorporated appropriate copyright tagging and acquisition to ensure effective management of the artefacts' intellectual property rights, using the DLT-based asset tokenisation and IPR management enabler developed within the project.

The central production of this pilot is an advertising film developed by FFP utilising digitised assets from both institutions and their respective collections. The original concept envisioned a commercial featuring diverse athletes from different parts of the world, highlighting their unique backgrounds and cultures through digitised cultural artefacts. During the production phase, this concept evolved towards a broader scope: the film now serves to promote the upcoming immersive experience that the Olympic Museum of Thessaloniki intends to pursue, drawing on the digitised artefacts to convey the cultural richness and historical significance of its collection.

The Context Validation Enabler will be used to verify that the digitised artefacts are not been misused or taken out of context within the production, ensuring adherence to the contextualisation and copyright frameworks established through the project's enablers.

1.8 Pilot 3 - Historic Site of Aquileia

The third pilot, led by 3D Research (3DR), centres on the ancient city of Aquileia — continuously inhabited since 181 BC and of exceptional archaeological significance. 3DR digitised key sites and artefacts, producing the assets for a virtual tour of the Titus Macer Domus. The tour aims to raise awareness of the site among both local residents and visitors to northern Italy.

The tour includes immersive experiences accessible through tablets or VR viewers, on-site QR codes for accessing additional online content, and interactive touch screens. It primarily supports self-guided visits through Aquileia, while also being available as a purely virtual online tour for remote users.

1.9 Dataset & Storage

Certain activities carried out in the course of the project — most notably in the context of WP6 — are aimed at mapping the datasets produced by various partners in their respective project activities. Given the conclusions and guidelines provided under Deliverable D6.3 Data Management Plan and Regulatory, Social, Gender (GEP) and Ethical Issues Report.R1, partners are expected to maintain datasets from their respective pilots in accordance with those guidelines and to adhere to the FAIR principles and the relevant ethical standards. Up to M24, approximately 20 datasets have been identified using the dedicated Data Monitoring Tool, and the responsible partners have been asked to confirm their adherence to the defined principles and standards.

The following table lists the datasets pertinent to D4.4 and the pilot activities:

WP	Dataset	Responsible Partner
WP2	Olympic Museum Collection Dataset	Olympic Museum
WP2	Study collection dataset MoMu	MoMu
WP2	Synthetic Historical Audio Recordings	CERTH
WP2	Public Sensing & Thematic Prioritization Data	HYP (Lead), supported by CERTH
WP2	past digitised models	Aquileia
WP2	new digitised models	3DR
WP2	description of objects	Aquileia
WP3	Creative Reuse Dataset	FS
WP3	Information Retrieval Dataset	KU Leuven
WP3	Matchmaking Dataset	KU Leuven
WP4	Artefacts and their relevant metadata featured in Marketplace	Aquileia
WP4	FONDAZIONE AQUILEIA - interview/questionnaire (PILOT 3)	Aquileia
WP4	Olympic Museum Collection Dataset	Olympic Museum
WP4	Study collection dataset MoMu	MoMu
WP4	SMB BERLIN	SPK Berlin

Table 1: Extract from the Data Monitoring Tool

Responsible partners are asked quarterly to review and update details of their datasets and provide responses to contextual questions. All historic versions of the Data Monitoring Tool are stored for reference.

1.10 Framework & Legal Background of Reuse

1.10.1 Aim & scope

This section provides a high-level overview of applicable intellectual property rights (IPR) – in particular copyright – and personal data protection legal frameworks as they pertain to the use of digitised artefacts and the creation and use of avatars. In doing so, this section builds upon the analysis introduced in D1.1 Comprehensive guide of the benefits, opportunities, risks and gaps in the management of cultural heritage and D6.3. Whilst it presents the generally applicable principles, it does not address any specific use cases.

In scope of this section are IPRs related to the reuse of digitised artefacts, as well as data protection rules applicable to the creation and reuse of such artefacts, including avatars. Outside its scope are matters such as the reuse of original artworks (for example, historic artefact pieces or fashion items), which have already been partially addressed under T1.3 User needs and usage scenarios. Additionally,

personality rights (such as image rights and the commercial use of personal identity elements) and the reuse of data, datasets, or databases are also not considered here.

1.10.2 Intellectual property rights in the digitised artefacts

Generally, any work that (1) is fixed (i.e., is expressed in a fixed way, as opposed to being a mere idea) and (2) is the author's own intellectual creation will be protected by copyright. As a result, the copyright owner will have certain exclusive rights, such as the right to make reproductions or adaptations of the work (however, anyone may refer to copyright works, nonetheless). There exist certain exceptions or permitted uses where it is not necessary to obtain the author's permission; however, such exceptions are limited and concern the use of a copyright work by incidental inclusion, or in the course of research, for example.

Such exclusive rights granted to the copyright owner mean that, in practice, anyone wishing to reuse or exploit a digitised artefact must obtain authorisation unless their activity clearly falls within these narrowly defined exceptions. This principle is particularly relevant in the REEVALUATE context, where the reuse of digital artefacts is subject to the rights holder's permission. In other words, if anyone (such as an end user) wants to use a digitised artefact, they should obtain permission from the relevant copyright holder (presumably the creator of the digitised artefact, such as the museum).

Moreover, the increasing integration of artificial intelligence into the creation and use of digital artefacts introduces further complexity, as lawmakers still have not defined the approach to two key questions, amongst others:

1. Are works generated by AI copyrightable?
2. Does training of large language models (LLMs) on copyright works constitute their lawful use?

Regarding the former, in the EU, copyright protection is granted to authors who can show that the work is their own intellectual creation. The standard requires that the work reflect the author's personality by expressing their creative abilities through free and creative choices.¹ The Court of Justice of the European Union (CJEU) has opined that there is no room for free and creative choices where the work was dictated by technical considerations, rules, or constraints.² As a result, one may argue that works that are entirely generated by AI may not qualify for copyright protection. Uncertainty, however, remains in the case of work created *with the aid of* AI. The human-centric nature of EU law, as well as the ongoing uncertainty regarding AI-generated works, has also been recently confirmed and highlighted by the European Parliament's July 2025 study on *Generative AI and Copyright*.³

Regarding the latter, under current EU law, training large language models (LLMs) on copyright-protected works may be lawful when carried out under the text and data mining (TDM) exceptions in Articles 3 and 4 of the DSM Directive,⁴ if any opt-out by rights holders is respected. These exceptions permit acts of reproduction and extraction for analysis, but do not extend to redistributing datasets

¹ Case C-145/10 Painer v Standard Verlags GmbH et al [2012] ECDR 6

² Case C-604/10 Football Dataco v Yahoo! UK Ltd [2010] 2 CMLR 24

³ European Parliament, 2025. Generative AI and Copyright. European Parliament's Policy Department for Justice, Civil Liberties and Institutional Affairs. Page 92. Available at [https://www.europarl.europa.eu/RegData/etudes/STUD/2025/774095/IUST_STU\(2025\)774095_EN.pdf](https://www.europarl.europa.eu/RegData/etudes/STUD/2025/774095/IUST_STU(2025)774095_EN.pdf). Accessed on 11 December 2025.

⁴ Directive (EU) 2019/790 of the European Parliament and of the Council of 17 April 2019 on copyright and related rights in the Digital Single Market and amending Directives 96/9/EC and 2001/29/EC ('DSM Directive')

or reproducing protected content in outputs. Recent case law⁵ confirms that memorisation during training is generally permissible, whereas generating outputs that replicate copyrighted material constitutes infringement.⁶ Additionally, compliance with transparency and opt-out obligations under the AI Act⁷ is essential to mitigate legal risk.

1.10.3 Privacy rights in avatars

Pilot 1 possibly might envision allowing users to create a digital look-alike avatar based on an image of their face. Whilst such a feature enhances user experience, it presents a personal data issue that needs to be addressed. *Personal data* includes and refers to any information that can identify an individual.⁸ In the context of REEVALUATE, this will often involve usernames, IP addresses, or images of individual users' faces, as in this pilot.

Processing of personal data is lawful only if it is based on a valid legal ground, such as consent, necessity for contract performance, or legitimate interests pursued by the controller. Where consent serves as the legal basis, it must be a "*freely given, specific, informed, and unambiguous indication of the data subject's wishes, by which he or she, by a statement or by a clear affirmative action, signifies agreement to the processing of personal data relating to him or her.*"⁹ For this pilot project, consent is probably the most suitable legal basis for taking, uploading, using, creating avatars from, storing, or otherwise processing a user's picture. As a result, the responsible partner must obtain proper consent, such as asking users to sign a consent form in line with the above requirements.

Aside from obtaining valid consent, the responsible partner who will determine the means and purposes of the processing of the data (i.e., the *controller*)¹⁰ will be required to comply with a number of additional obligations under the GDPR. In particular, they will be required to implement appropriate technical and organisational measures to ensure security of the processed personal data,¹¹ and maintain a record of processing activities reflecting the categories of processed personal data, purposes of such processing, details of any third parties with whom they share the data, and details of the technical and organisational security measures in place.¹² They will also be required to provide to the user certain details about how the user's data is processed, as well as details concerning some of their rights with respect to the data¹³ – including the right to withdraw consent, right of access to data processed by the controller, right not to be subject to automated individual decision-making, and the right to complain to national supervisory authority. Those details must be provided to the individual user when

⁵ Hamburg Regional Court (2024–2025) – LAION Dataset Cases, GEMA v. OpenAI (2025), Like Company v. Google Ireland (C-250/25, pending before CJEU)

⁶ Similarly, in the UK, a recent judgement in *Getty Images v Stability AI [2025] EWHC 2863 (Ch)* has distinguished between the training phase and the output phase, and focused on whether models embody infringing copies, generally finding they do not, while leaving output-related infringement as the primary risk.

⁷ In particular Article 53 of Regulation (EU) 2024/1689 of the European Parliament and of the Council of 13 June 2024 laying down harmonised rules on artificial intelligence and amending Regulations (EC) No 300/2008, (EU) No 167/2013, (EU) No 168/2013, (EU) 2018/858, (EU) 2018/1139 and (EU) 2019/2144 and Directives 2014/90/EU, (EU) 2016/797 and (EU) 2020/1828 (Artificial Intelligence Act)

⁸ Regulation (EU) 2016/679 of the European Parliament and of The Council of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation, GDPR), Art. 4(1)

⁹ *Ibid.*, Art. 4(11)

¹⁰ *Ibid.*, Art. 4(7)

¹¹ *Ibid.*, Art. 32

¹² *Ibid.*, Art. 30

¹³ *Ibid.*, Art. 13

personal data is obtained, so it would be appropriate to include them in the consent form. In parallel with these ongoing considerations, it is important to note the most recent initiatives at the EU level, particularly the European Commission's Digital Package¹⁴ and the Digital Omnibus¹⁵ presented within it. The Digital Omnibus introduces a suite of legislative updates aimed at harmonising and modernising digital regulations across the EU, with a strong focus on fostering innovation and ensuring robust safeguards for users. Notably, while the package includes proposed amendments to the GDPR, these changes are largely tailored to address personal data processing in the context of artificial intelligence. As such, they are unlikely to materially affect the specific data protection requirements outlined above for the creation and use of personalised avatars within the pilot, as the amendments do not directly alter the core principles or obligations relevant to this context.

In conclusion, while the integration of AI and digital technologies within REEVALUATE pilots offers significant opportunities for innovation and user engagement, it also introduces complex legal and ethical considerations, particularly regarding copyright and personal data protection. Aiming to comply with EU copyright and data protection laws and to embrace recent regulatory developments will be crucial for fostering trust and safeguarding the rights of all participants. As these pilots' progress, ongoing vigilance and adaptability will remain essential to navigate the evolving landscape and to fully realise the potential of these pioneering digital initiatives.

2 Pilots

2.1 Introduction to Fashion Pilot

Pilot 1 brings together EFHA, MoMu – Fashion Museum Antwerp, and FibreMood around the digitisation and creative reuse of fashion heritage. As reported in D4.1, work began with digitising selected artefacts from MoMu's collection — garments, accessories, and sketches — which were then contextualised collaboratively with input from the public, stakeholders, and fashion industry experts. The pilot is structured around two showcases.

The first showcase is a gamified application titled "Fashion Time Machine." Users will interact with digitised historical fashion by possibly even creating personalised avatars, dressing them in garments from the collection, and exploring fashion heritage through playful challenges. The original concept envisaged different levels based on various fashion eras, style challenges, and social sharing features; FFP will test whether this initial vision can be maintained as the application is built on top of CERTH's enabler engine. As outlined in Section 1, following the bankruptcy of NURO (originally responsible for the application development), FFP has taken over development in close collaboration with CERTH.

The second showcase enables users to create their own physical garments, based on sewing patterns derived from items in the museum's collection, allowing them to produce personalised versions of historical designs. This showcase has been developed in cooperation with FibreMood and extends an earlier collaboration with that company in the domain of fashion-making as a social media-based and

¹⁴ [European Commission, 2025. Digital Package. Publications Office of the European Union. Available at https://ec.europa.eu/commission/presscorner/api/files/attachment/881887/Factsheet%20Digital%20Package.pdf](https://ec.europa.eu/commission/presscorner/api/files/attachment/881887/Factsheet%20Digital%20Package.pdf). Accessed on 11 December 2025.

¹⁵ Proposal for a Regulation of the European Parliament and of the Council amending Regulations (EU) 2016/679, (EU) 2018/1724, (EU) 2018/1725, (EU) 2023/2854 and Directives 2002/58/EC, (EU) 2022/2555 and (EU) 2022/2557 as regards the simplification of the digital legislative framework, and repealing Regulations (EU) 2018/1807, (EU) 2019/1150, (EU) 2022/868, and Directive (EU) 2019/1024 (Digital Omnibus)

supported activity. The first pattern — based on MoMu collection item ST2202 — has completed the full workflow from selection and research through pattern creation, adaptation and grading by FibreMood, photoshoot and working instructions, to publication on the FibreMood platform. Communication, dissemination and merchandise activities have commenced. Four additional patterns are planned to follow the same pipeline.

2.1.1 Enabler Integration Status

The following table summarises the current integration status of the REEVALUATE enablers within Pilot 1. Enabler descriptions are based on D4.1; status updates reflect partner input as of 10. February 2026.

Enabler	Description (from D4.1)	Status	Responsible	Expected
AI-Driven Creative Reuse Enabler	Assists players in generating new designs using generative AI, creatively reusing digitised assets from MoMu's collection to create new outfits and clothing designs within the Fashion Time Machine	Not yet started; pending receipt of digitised assets and applications from CERTH and MoMu	Fraunhofer (development), FFP (integration)	TBD
Collaboration Enabler	Facilitates discovery and reuse of digitised fashion artefacts through registration, multimodal search (text, image, combined), and matchmaking between MoMu, FFP, and FibreMood	In progress; MoMu preparing ingestion of ~1,000 study collection records into the Knowledge Graph with KU Leuven and LINKS	KU Leuven / LINKS (development), MoMu (testing)	End of February 2026
Contextualisation Enabler	Enriches MoMu fashion artefacts with contextual descriptions extracted from curatorial notes and external sources, integrating them into the REEVALUATE Knowledge Base via the CACAO ontology	In progress; dependent on Knowledge Graph ingestion; MoMu internal testing team of 3–5 people ready	LINKS (development), MoMu (testing)	End of February 2026
DLT/IPR Management Enabler	Smart contracts governing reuse agreements between MoMu and its partners (FFP, FibreMood), ensuring appropriate copyright agreements are in place before creative reuse of artefacts	In progress; Marketplace upload of content planned; procedure being finalised with Fraunhofer	CERTH (development), MoMu (testing)	End of February 2026
Context Validation Enabler	Validates that digitised artefact are not misused	Not yet tested at pilot level	CERTH (development)	TBD

	<p>or taken out of context; detects inappropriate content including violence, nudity, hate speech, crime scenes, and deep fakes</p>		
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2.1.2 What are the challenges and approaches in terms of reuse

To ensure the successful execution of Pilot 1, it is essential to identify potential risks that could impact the Fashion pilot. In addition, key stakeholders for all pilots have been identified and described. The main challenges related to reuse can be summarised as follows:

- Selecting inappropriate cultural assets:** There is a risk of choosing content that lacks appeal, storytelling potential, visual quality, or is difficult to adapt for reuse.
 Action: Implement a careful and thorough selection process involving project partners and stakeholders with proven expertise. MoMu’s Study Collection provides a strong foundation for selection, supported by two iterations to refine the process.
- Intellectual Property Rights:** Copyright restrictions or claims may limit the use and reuse of cultural assets. Action: Prioritize objects from the Study Collection that are available for creative reuse. Select assets with no identifiable copyright holders or older content. Establish open-license agreements with creators producing new assets during the reuse process.
- Technical digitisation workflow:** As detailed in the following section (cf. infra), creating Pilot 1 is complex and requires creativity, craftsmanship, and advanced digital skills.
 Action: The workflow builds on previous collaborations and experiments¹⁶, rather than starting from scratch. MoMu’s partnership with Fibre Mood leverages earlier projects, making the reuse of cultural assets for the “Pattern Pilot” a familiar process.
- Engaging stakeholders to test enablers:** Enablers can only be validated if sufficient stakeholders interact with the pilot. Action: This challenge is manageable, as MoMu and Fibre Mood have extensive networks of users and visitors, along with diverse communication channels to promote the pilot.

2.1.3 Reuse status, assets digitisation status

Of the five objects selected for inclusion in the “Pattern Pilot,” one asset has been chosen to serve as a prototype during the first iteration phase. This cultural asset (see Figure 1) is a 1920s silk evening dress embroidered with sequins (<http://data.momu.be/ark:34546/mn0318>).

The dress evokes the vibrant atmosphere of the Jazz Age and was clearly worn for a festive occasion, offering rich opportunities for storytelling. It symbolises the freedom and emancipation of women in the 1920s, while its exuberance and touch of decadence allow for a narrative bridge to the Great Depression, which ushered in a very different fashion era. As the object is approximately 100 years old, and bears no name tag, it can be considered free of identifiable copyright holders, making ST2202 a

¹⁶ <https://doi.org/10.3389/ejcmp.2025.14770> Examples of digital reuse of MoMu collection in collaboration with digital artists.

low-risk candidate for open reuse. Conveniently, its cutting pattern is relatively simple, lowering the threshold for creative reinterpretation.



Figure 1 MoMu Dress #1



Figure 2 MoMu Dress #2

For the Pattern Pilot, the MoMu team created new digital assets, including:

- A historically accurate cutting pattern
- A full-page contextual story highlighting the artefact's historical significance
- Additional images
- A 3D replica using CLO3D digital design software

Fibre Mood reused the original object, its historically correct 2D pattern, and the other digital assets created by MoMu, reworking and reinterpreting them to design a new dress and pattern called “Mildred” (see Figure 2). This is not a replica but a modernised version of the 1920s dress, retaining the Jazz Age aesthetic while adapting to contemporary materials, techniques, and sizing. The pattern is available for purchase online via Fibre Mood’s webshop¹⁷.

The dedicated Fibre Mood webpage (available in four languages) features the pattern (sizes XS–XXL), detailed descriptions, instructions, sizing tables, recommended fabrics, material lists, and user reviews. A professional photoshoot was organized showcasing the modern interpretation of the dress worn by a fashion model.

As part of the collaborative framework for this project, CERTH has received a 3D fashion asset from the pilot partner EFHA, digitised from the MoMu collection. This asset serves as the foundational garment for integration into the Fashion Time Machine gamified application. Using the SMPL-X body

¹⁷ <https://www.fibre mood.com/en/product/1672-25723-mildred-dress#/200-version-digital>



model and Unity-based clothing pipeline developed by CERTH (see Section 5.1.8), the digitised garment is rigged to parametric avatars, enabling users to visualise historical fashion pieces on their own animated digital characters. This cross-partner workflow — from museum digitisation (MoMu/EFHA) to technical integration (CERTH) to application development (FFP) — exemplifies the REEVALUATE re-use chain in practice.

2.2 Olympic Games and Music

2.2.1 Introduction Pilot 2

The pilot use case showcases the potential of the REEVALUATE framework in addressing the challenges associated with the digitisation of cultural heritage artefacts and their exploitation for sustainable CH management within the Creative Industries and particularly Advertising. The pilot involved the digitisation of selected artefacts from both institutions, including historical photographs, art pieces, and artefacts related to various cultures of the world and the Olympic Games. The digitisation process included appropriate copyright tagging and acquisition to ensure that the artefacts' copyrights are managed effectively.

Pilot 2 reuses artefacts and sound in a creatively conceived film that visualises and makes audible aspects of the Olympic Games from antiquity to today. The film serves as an advertisement for the planned immersive experience at the Olympic Museum in Thessaloniki. The production draws on audio material from the Ethnological Museum of Berlin (SMB/SPK) and artefacts from the Olympic Museum of Thessaloniki, combining visual and auditory heritage in a contemporary advertising format.

The Olympic Museum of Thessaloniki selected and provided artefacts from its rich collections for digitisation, ensuring that the most significant symbols of Olympic history are represented. The museum's curators and historians actively contributed to the collaborative contextualisation of the digitised artefacts, working with citizens to co-create narratives that connect historical objects to contemporary values and lived experiences. They used their expertise in Olympic history to provide essential insights and interpretations that anchor the exhibition in authenticity and credibility. Additionally, they ensured that the copyright manager enabler was applied appropriately to manage the copyrights of the digitised artefacts. Beyond content, the Olympic Museum also acts as the physical stage, orchestrating the immersive design of the five rooms and shaping how visitors engage with the Olympic legacy in a dynamic, participatory manner.

The ethnomusicological department of the Ethnologisches Museum (SMB/SPK) provided a selection of digitised assets related to music and sports from its collections, suggested a storyboard for a chapter for the planned immersive production on music in the Olympic Games, and participated in the testing of enablers (Public Sensing Prioritisation Enabler, AI-driven Contextualisation Enabler (text, image, audio), Collaboration Enabler, Context Validation Enabler, DLT-based Asset Tokenisation & IPR Management Enabler).

2.2.2 Enabler Integration Status

The following table summarises the current integration status of the REEVALUATE enablers within Pilot 2. Enabler descriptions are based on D4.1; status updates reflect partner input as of 10 February 2026. Both the Olympic Museum of Thessaloniki and SMB/SPK are actively engaged in enabler testing,

with the REEVALUATE Marketplace having become available on 4 February 2026. The video production by FFP remains in the concept development phase, pending receipt of digitized assets from 3DR, expected by the end of February 2026.

Enabler	Description (from D4.1)	Status	Responsible	Expected
Public Sensing Prioritisation Enabler	Interactive campaigns via social media to engage audiences and identify cultural heritage assets of primary public interest; includes involvement of marginalised groups in the selection process	Campaigns active on social media at both OLYMPIC (completion expected 8 February 2026) and SMB (10 participants engaged)	LINKS (development), OLYMPIC / SMB (testing)	February 2026
Contextualisation Enabler	Enriches Olympic and music-related artefact metadata based on provided text and images, integrating contextual information into the REEVALUATE Knowledge Base to support exhibition design	In progress at both institutions; OLYMPIC uploading artefact list to Marketplace (available since 4 February), testing from 15 February; SMB in testing phase	LINKS (development), OLYMPIC / SMB (testing)	OLYMPIC: 15 February 2026; SMB: 15 April 2026
Collaboration Enabler	Makes digitised artefacts available to FFP and others for creative reuse; supports multimodal search to discover and explore Olympic and music-related artefacts	In progress; OLYMPIC working with 3DR on digitisation delivery (end of February); SMB in progress	KU Leuven (development), OLYMPIC / SMB (testing)	OLYMPIC: End of February 2026; SMB: 15 April 2026
DLT/IPR Management Enabler	Ensures appropriate copyright agreements are in place before creative reuse of artefacts through DLT-based asset tokenisation and smart contracts	SMB received Marketplace access this week; enabler testing to follow	CERTH (development), OLYMPIC / SMB (testing)	TBD
Context Validation Enabler	Validates that digitised artefacts are not misused or taken out of context within the exhibition and video production; detects inappropriate content including violence, nudity, hate speech, crime scenes, and deep fakes	Not yet tested at pilot level	CERTH (development)	TBD

2.2.3 Assets used

The Olympic Museum provided 18 artefacts, from which FFP selected a subset to integrate into the advertisement to promote the digital experience. SMB/SPK made a selection of 18 audio pieces from the archive, which were combined based on the following criteria: use instrument types used in the ancient Olympic Games (flutes, trumpets, lyres, percussion) relate to the assets selected by the Olympic Museum are ethically and legally sourced and easy to clear for an exhibition in Thessaloniki and

are well-documented. On the left, the assets of the Olympic Museum are presented; on the right, sounds from SMB/SPK are linked with images meant to provide orientation for the project partners. The Contextualisation and Collaboration Enabler served a similar function at a later stage in the project. The Context Validation Enabler and the DLT/IPR Management Enabler will also be tested to ensure appropriate use of assets within the exhibition project.



Figure 1: Mood boards for Pilot 2

2.2.4 What are the challenges and approaches in terms of reuse

The Pilot 2 digitised artefacts were made available for creative reuse by FFP, which was tasked with developing a video clip utilising these artefacts, expressing its commitment to promoting respect and unity through sports and encouraging viewers to join in this mission.

Below are the potential risks associated with the reuse of artefacts, which were mitigated through the integration of the available enablers.

- Accurate copyright status/tagging (All Rights Reserved) The use of the DLT-based Asset Tokenisation & IPR Management Enabler will ensure that the appropriate copyright agreements are in place before the creative reuse of the artefacts, preventing any out-of-context or misuse of the digitised artefacts.
- Cultural sensitivity and misrepresentation
- Recontextualisation risks
- Inconsistent metadata
- Balancing creative freedom with curatorial integrity

The Context Validation Enabler will be used to check and validate that the digitised artefacts are not misused or used out of context within the video clip developed.

2.2.5 What are the challenges and approaches in terms of reuse for music

Museums are often geared towards the visual (e.g., photos of collected objects) and existing infrastructure is often not specialised for sound, audio, or video. Today, museums generally — not only collections specialised in music — have an interest in using images as well as audio and video to contextualise the objects in their collections. In other words: while music collections have an evident need to employ audio and video in addition to photos of musical instruments, these media are also useful

for material culture collections not focusing on music. Copyright legislation is theoretically independent of the medium (music, photo, painting, etc.), but de facto and in practice, jurisdiction in the music/audio domain does not always follow the conventions in other domains such as photography. This makes music and audio licensing often unfamiliar, especially in the museum world, and requires specialised expertise. Hence, negotiations over licensing often take a long time. Example: The last change to German copyright law simplified the reuse of photos of objects which are in the digital domain and now are almost automatically also in the public domain. Similar simplifications do not exist for the audio/music domain in Germany. Data protection laws and the rights of personality pose similar challenges and constraints.

We represent an ethnographic collection which faces additional ethical constraints. Some of our collections were acquired under colonial or quasi-colonial circumstances and hence their reuse is often subject to additional ethical constraints. Ideally, most reuse should be cleared for appropriateness with the communities of origin, which is extremely labour-intensive.

2.2.6 Deviation from Proposal

Originally, the REEVALUATE proposal envisaged only the creation of an advertising video as part of Pilot 2. However, in order to test the REEVALUATE platform in a more practical and realistic museum environment, the consortium decided to expand the scope of the pilot. The revised approach involved setting up an immersive exhibition at the Olympic Museum in Thessaloniki, allowing the enablers to be tested in a real-world museum context while also producing an advertising video for the exhibition. The Olympic Museum contributed the exhibition space, projection equipment, and other services in addition to the REEVALUATE project funds. FFP created additional video material beyond the advertising video, utilising the same digitised assets. Advancements in AI-based video creation over the course of the project enabled FFP to produce more video content than originally planned within the same budget. Furthermore, the original concept — which featured a focus on diverse athletes — was evolved towards a more generalist scope, centring the narrative on the broader cultural and historical significance of the Olympic Games rather than individual athletic stories. This shift allowed for a richer integration of the ethnomusicological material from SMB/SPK alongside the visual artefacts from the Olympic Museum.

2.3 Pilot 3 – Historic Location of Aquileia

2.3.1 Introduction

This pilot case showcases the potential of the REEVALUATE framework in empowering a small community with strong connections and bonds to its cultural heritage to take an active role in the management of their CH digitisation. Moreover, the appropriate contextual use of the CH artefacts has been validated, reflecting the identity of the community and history-enthusiastic people. The final result is a virtual tour.

2.3.2 Enabler Integration Status

The following table summarises the current integration status of the REEVALUATE enablers within Pilot 3. Enabler descriptions are based on D4.1; status updates reflect partner input as of 10 February 2026. Notably, the Public Sensing campaign has been completed with 96 participants, and 3DR's virtual tour of the Titus Macer Domus is in active development with an expected completion of April 2026.

Enabler	Description (from D4.1)	Status	Responsible	Expected
Public Sensing Prioritisation Enabler	Promotes active engagement of the public in the prioritisation of cultural heritage artefacts for digitisation; young students living in Aquileia participate in the selection of assets to be digitised, ensuring diverse voices and perspectives are heard	Complete; 96 participants engaged in asset selection campaign	LINKS (development), Fondazione Aquileia (testing)	Complete
Contextualisation Enabler	Combines storytelling and 3D content creation to engage different publics with the heritage of Aquileia; professional stakeholders (archaeologists, historians, experts) contribute contextual knowledge integrated into the REEVALUATE Knowledge Base	In progress; stakeholder engagement ongoing	LINKS (development), Fondazione Aquileia (testing)	31 March 2026
Context Validation Enabler	Verifies that contextualisation content produced for the virtual tour is correct, consistent, and scientifically acceptable; assesses appropriate use of context through automated validation	Not yet started	CERTH (development), Fondazione Aquileia (testing)	TBD
DLT/IPR Management Enabler	Ensures appropriate copyright agreements are in place between Fondazione Aquileia and 3DR before creative reuse of digitised artefacts through DLT-based asset tokenisation and smart contracts	Not yet started	CERTH (development), Fondazione Aquileia (testing)	TBD



Figure 3: Aquileia aerial picture



2.3.3 Location vs. Artifacts incl. Challenges for Reuse

When choosing between a site and an artefact for digitisation, the main differences lie in scale, context, and the type of digital assets produced, which in turn introduce distinct challenges. Both are important to allow a fully immersive experience for visitors. Selecting a site or an artefact depends mainly on the project goals and the intended use of the digital assets. Choosing a site means prioritising contextual value and public engagement. A site is often selected when the aim is interpretation, accessibility, or storytelling at a territorial scale, for example, to support virtual visits, on-site interpretation, or landscape analysis. The challenge of this choice lies in managing complexity: higher costs, longer acquisition times, multidisciplinary workflows, and the need to balance accuracy with usability due to very large datasets. An artefact, instead, reflects a focus on precision, research, and conservation. Artefacts are often preferred when resources are limited or when the goal is detailed analysis, monitoring of conservation state, or scholarly comparison. The challenge here is deciding the appropriate level of detail: higher resolution increases scientific value but also impacts data size, processing time, and long-term sustainability.

An artefact is a discrete and self-contained object with visible and tangible dimensions. Its digitisation can usually be carried out in controlled conditions, allowing for higher precision and repeatability. The main challenge is capturing fine geometric details, surface texture, and material qualities accurately. The digitisation process can be carried out by setting up a well-organised environment, placing lights, diffusers, and instruments for measuring and colour recording. Resulting digital assets are generally more focused and homogeneous, such as high-resolution 3D models, detailed textures, and documentation useful for conservation, analysis, and comparison, and can be optimised in terms of resulting mesh and visual properties.

A site is inherently complex and extensive. It includes multiple elements, stratigraphic relationships, and a strong connection with the surrounding landscape. Digitising a site, therefore, means dealing with large areas composed of modern and ancient buildings, vegetation, heterogeneous data, and variable environmental conditions such as light, weather, and accessibility. The challenge is not only technical but also conceptual: the digital representation must preserve spatial relationships and convey the historical and environmental context. The metrology is relevant to the right representation of the environment, considering the resulting experience should simulate the real-life size of the buildings in order to give the visitors a more realistic exploration. Digitising an outdoor environment means the collection of heterogeneous datasets from multiple sources and instruments that must be homogenised, integrating with the georeferencing and spatial measurements, and processed with a higher level of computational resources. As a result, site digitisation typically produces large and diverse digital assets, such as territorial 3D models, orthophotos, DEMs, GIS layers, and interactive or narrative virtual tours.

Digital assets derived from a site are highly reusable across interpretative and educational contexts. The same datasets can support virtual tours, on-site digital mediation, landscape analysis, planning, and comparative studies over time. However, their reuse is often constrained by scale and specificity: site models are tightly linked to a location and usually need simplification or repurposing to be reused effectively in different platforms or audiences. Artefacts, on the other hand, tend to be more modular and flexible: high-quality 3D models of objects can be reused in exhibitions, catalogues, academic research, gaming, replicas (including 3D printing), and digital storytelling across multiple contexts.

3 Reuse Applications and Production

3.1 3D asset production and digitisation methods

During the initial phases, a mapping of CHIs was carried out for the collection of a set of representative assets to be used as a showcase and for the initial testing and mapping phase. Three diverse domains were identified: fashion heritage, Olympic and ethnographic collections, and Roman archaeology. A comparative analysis of all selected objects allowed for mapping recurring metadata fields and establishing a harmonised structure suitable for integration within the REEVALUATE platform, emphasising the relevance and the needs for each collection. More precisely, the results showed that N. 5 objects from each pilot were collected and stored in the shared project working platform.

	Pilot 1	Pilot 2	Pilot 3
Type of objects	<i>Dresses, clothes and digital patterns</i>	<i>Museum objects and audio tracks</i>	<i>Archaeological finds</i>
Domain	<i>Historical Fashion Heritage</i>	<i>Cultures in Olympic Games and music</i>	<i>Archaeology</i>
Collection	<i>Already digitised</i>	<i>Already digitised and to be digitised</i>	<i>To be digitised</i>
Final Format File	<i>Images and patterns</i>	<i>Images, 3D models, audio tracks</i>	<i>3D models, images</i>
Metadata associated	<i>Creator, material, ID, location, description, technical spec.</i>	<i>Description, material, category, technical spec., condition, date</i>	<i>Material, historical context, provenance, comparison with similar objects, aim</i>

Table 2. General classification of the three Pilots.

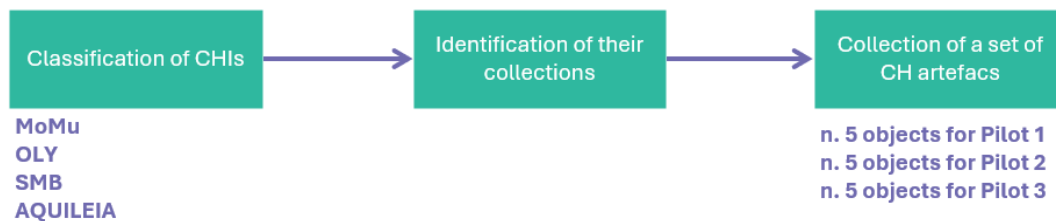


Figure 4. Mapping of activities carried out for D2.1.R1.

Each object comes with a representative image and a description or a metadata profile provided by the CHIs and rearranged in a spreadsheet. It was possible to systematically group and analyse the information related to the cultural artefacts that each partner intended to share for the REEVALUATE project. The shared objects, though differing in typology, format, and thematic focus, were analysed across several dimensions: type of media, available metadata, available descriptions and categorisation, domain, and intended use within the project. The multimedia diversity enables the project to address both tangible and intangible heritage dimensions. In the figure below, the collected representative set of objects is shown from all the Pilots. Each image (or object) is accompanied by a description and the general information about the related cultural asset. Considering the nature of the

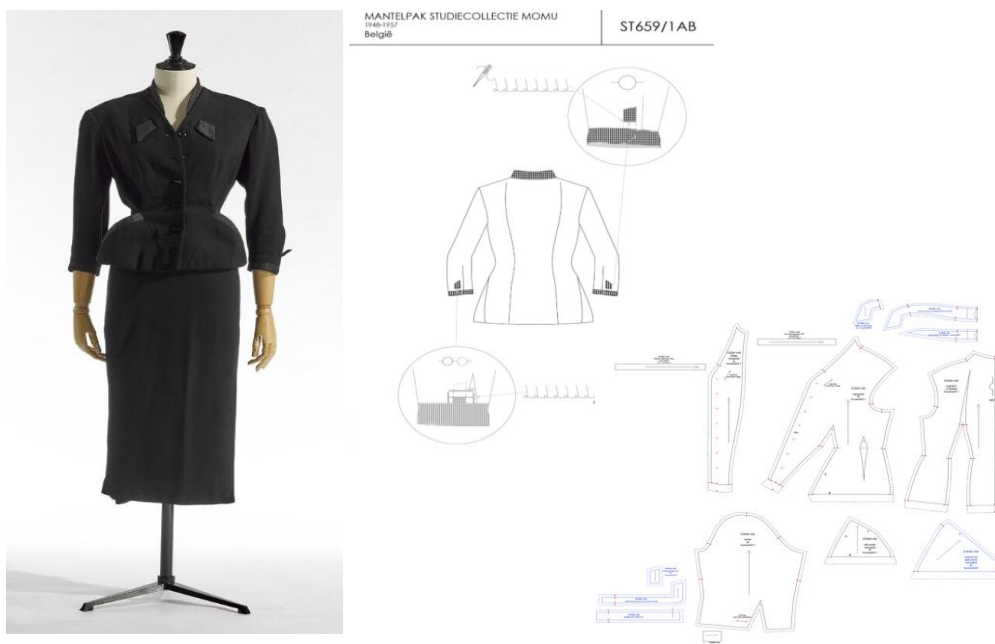
artefacts, several digitising techniques were investigated. Generally, the digitisation of Cultural Heritage encompasses a multidisciplinary suite of techniques and methodologies aimed at the accurate documentation for precise monitoring of geometries and textures. For objects analysed within CHI's collections, two main distinctions were identified:

Digital capture that relies on high-resolution 2D recording, such as digital photography, which enables the precise recording of complex superficial patterns and colour fidelity; A combination of metrological-grade 3D scanning workflows to generate accurate virtual models of three-dimensional objects. The instrumentation and the workflow can vary with object compositions, for example using LiDAR scanning and unmanned aerial vehicle (UAV) for archaeological areas, or photogrammetry by camera and 3D scanners for single objects.

Looking at the materials selected by each Pilot, a precise mapping of instruments and techniques was identified. The most common process involves the setup of a scanning technique with several measurements and recordings taken via support instrumentation.

3.1.1 2D digitising

A scientific imaging workflow requires multiple coordinated elements to accurately represent an object without distortions or colour shifts. Setting up a photographic digitisation station involves carefully planning the lighting, camera equipment, positioning, and environmental conditions to obtain high-quality, consistent, and repeatable results. This typically includes using a high-resolution DSLR or mirrorless camera with a precision lens, mounted on a stable tripod or copy stand to maintain identical framing. Lighting is fundamental: a controlled, diffused setup—usually achieved with continuous LED panels or studio strobes paired with softboxes or diffusers—helps eliminate reflections, shadows, and hotspots. A neutral, non-reflective background further prevents colour contamination. Camera settings are fine-tuned for optimal quality, relying on low ISO, a suitable aperture for the required depth of field, and manual focus to ensure maximum sharpness. Capturing images in RAW format preserves full detail and enables accurate colour and exposure corrections during post-processing.



Resource ID	Access	Contributed By					
71231	Open	Stany Dederen					
GENERAL							
Publisher	Category	Source Material Type	Inventory	Creator	Artwork Date	External note	Color or b/w
MOMU	MOMU, MOMU/Studiecollectie, MOMU/Studiecollectie/O bjectfoto	Original digital capture of a real life scene	ST659/1AB	Stany Dederen	1948 / 1957	Voor meer info en beeldmateriaal, surf naar https://commons.wikimedia.org/wiki/File:Mantelpak_(ST659_1AB_01)_-_Kostuum_-_MoMu_Antwerp.jpg	Color
COPYRIGHT							
License	Copyright Owner	Copyright notice	Credit				
CC BY	Stany Dederen	© Stany Dederen	© Collectie Modemuseum Antwerpen, schenking Frieda Dauphin-Verhees, foto Stany Dederen				
TECHNICAL DATA							
Creator tool	File format	File size	Original time & date	Original filename	MD5 checksum	Camera make/model	
Capture One 10 Macintosh	TIFF at different resolution	8,5 MB 2401 x 3543 px (maximum)	05 December 17 @ 16:16	0412201741619.tif	c1b3421791b16ae3fb3bdc807e07789d	Credo 40	
TMS INFO							
TMS object ID	TMS object name	TMS Description	TMS dated	TMS medium	TMS classification		
54636	mantelpak / jacket	Black coat suit. A. Jacket in black wool, closing with plastic buttons in the centre front, with accents of black fabric with interwoven block pattern. Made of this are the small shawl collar, pocket turn-ups, sleeve cuffs and two flaps at neckline level (optical ends of a scarf or tie). The slanted side pockets are partially incorporated into a seam and emphasise the shape of the hips. No lining. B. Black wool calf-length skirt with waistband, at the back at the bottom there are two pleats turned inwards. Closes with press-studs.	1948-1957	wool; plastic; synthetic fibre; fabric; metal			
REF LINK							
https://heron.libis.be/momu/s/studiecollectie/item/mjdf0			https://museumstichting.resourcespace.com/pages/view.php?ref=71231&k=6dfbb4b8f				
EXTRA INFO							
current permanent location	department						
LZ.UNIT.90	Studiecollectie						

Figure 5. Object ST659-1AB.¹⁸

Contacts	Place	Date	Dimensions	Condition	WEIGHT
Olympic Museum Collection	ATHENS	1906	31 x25 cm	GOOD CONDITION	911 gr



¹⁸ Source: Studiecollectie website – Pilot (<http://data.momu.be/ark:34546/mjdf0>).

ID No.	Prev. No.	Categ.	Description	Perm. position	Material	Collection Works	of
OM-00000061	0865 Σ072Ai i	CUP	<p>Cup awarded as a prize in the Marathon Race of the “Athens 1906” Intercalated Games. Front view inscription “INTERNATIONAL OLYMPIC GAMES IN ATHENS 1906”.</p> <p>Back view inscription “ENTHYMEMA MARATHONIOU” (SOUVENIR OF THE MARATHON RUN)</p> <p>The Cup – Marathon Race Commemorative was a key document of the Exhibition: “Olympism. A Modern Invention, an Ancient Heritage” (24.04 – 16.09.2024) implemented by the Louvre Museum in collaboration with the French School of Athens in the framework of the Olympic and Paralympic Games “Paris 2024”.</p>	Permanent Exhibition 1900 – 1956	made of a base metal binary alloy Cu-Zn, known as brass, with an amalgam of silver (Ag) and mercury (Hg) to its surface in order to give the silver appearance	ARTEFACT, EXHIBIT	

Figure 6. Object ST659-1AB.¹⁹

Object	Provenance	Date	Description/historical relevance
Stone wellhead	Found (and still located) within the Domus (belonging to the archaeological area of the Cossàr Fund)	I century BC-I century AD	The well was located in the <i>atrium</i> of the domus, the “public” part of the house. In the center of the atrium there was the <i>impluvium</i> basin (now rebuilt) with a well. The wellhead, i.e., the protective balustrade closed around the hole of a well, was partially found. The missing part was then reconstructed with 3D printing techniques.

¹⁹ Source: Studiecollectie website – Pilot (<http://data.momu.be/ark:34546/mjdf0>).

			The well was not very deep because the aquifer in Aquileia is almost at ground level.
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Materials	Aim	Comparison with similar "objects" of other areas outside Aquileia	Picture rights
Stone	Rainwater collection for the domus	The wellheads in Roman world are very different from each other, but the general shape is functionally the same	©FondazioneAquileia/Ikon/Nudesign for the 3D reconstruction ©A. Buldrin for the second image ©G. Baronchelli for the third image

Figure 7. Object OM-0000061.20

3.1.2 Photogrammetry

The setup relies on a calibrated digital imaging system, either a dedicated photogrammetric camera or a high-resolution DSLR/mirrorless camera, operating in a controlled environment with uniform, diffuse lighting to prevent harsh shadows, reflections, and uneven illumination. The object is photographed from multiple overlapping viewpoints, typically maintaining 60–80% overlap between consecutive images to ensure reliable feature detection and matching during 3D reconstruction. For small or medium-sized objects, a motorized turntable or a tripod-mounted camera rig can be used to standardize the capture workflow, while larger artefacts, architectural elements, or archaeological contexts may require handheld or pole-mounted photography to achieve full coverage. A structured acquisition plan is essential: consistent camera-to-object distance, stable exposure, and careful coverage of occluded or complex geometry significantly improve reconstruction accuracy. Depending on the project, colour calibration charts and scale bars may also be introduced to ensure metric integrity and faithful colour reproduction. The captured dataset is then processed through a dedicated photogrammetry pipeline using Structure-from-Motion (SfM) and Multi-View Stereo (MVS) algorithms to produce a sparse point cloud, a dense 3D point cloud, and subsequently a textured mesh or high-resolution orthophoto. Advanced workflows may include mesh optimisation, PBR texture generation, reflectance transformations, or integration with GIS/CAD systems to support documentation, analysis, or digital conservation tasks.

²⁰ Source: Olympic Museum Thessaloniki.

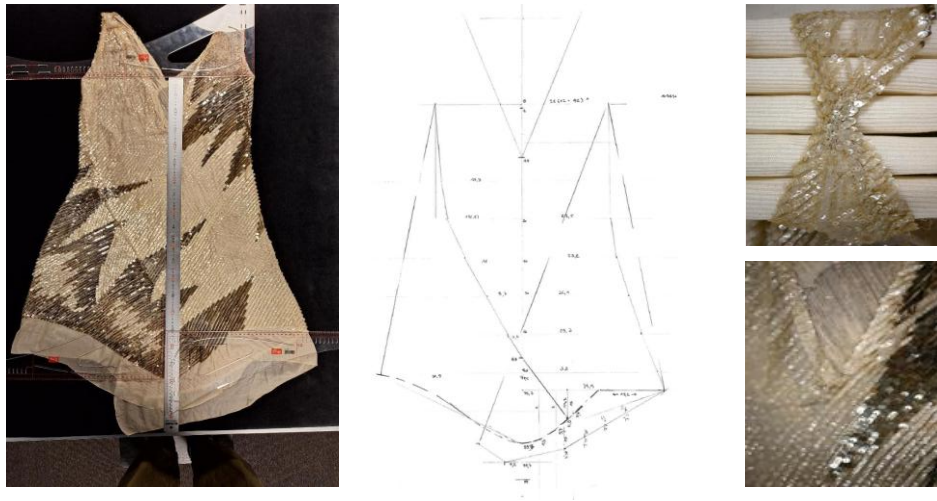


Figure 8. Test on the Digital Objects n. 1 (ST2202). On left: measurement and overall recording of the dress. On center: digitised pattern. On right: details acquired²¹.

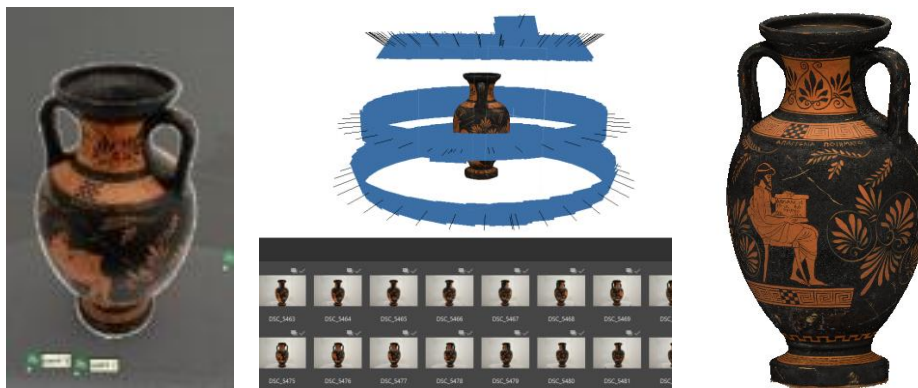


Figure 9. 3D digitising of a vase by photogrammetry during a previous activity by 3DR

3.1.3 Structured Light Scanner

For small to medium-sized objects, structured light scanning requires the careful configuration of both hardware and software components to generate precise, high-resolution 3D models. The core setup consists of a structured-light projector paired with one or more high-resolution cameras. During acquisition, the projector casts a sequence of coded or phase-shifted patterns onto the object, while the cameras record how these patterns deform across the surface. By analysing these deformations, the system reconstructs highly accurate 3D geometry through triangulation. The scanner can be mounted on adjustable stands to maintain stability, though in many workflows an operator manually positions the device to ensure full coverage. For larger artefacts or objects with complex geometry, multiple scans must be taken from several angles. These individual scans are then aligned, registered, and merged within dedicated post-processing software to create a seamless and watertight 3D model. Additional steps—such as noise reduction, mesh optimisation, texture mapping, and metric verification—may be performed to enhance the final dataset for archival, analytical, or visualisation purposes.

²¹ Source: <http://data.momu.be/ark:34546/mn0318>



Figure 10. 3D Light structured scanner by Artec 3D (on left); example of digitising of a statue (on right).

After digitising, datasets are processed following a common workflow. In detail, the process required:

- Filter and align scans to obtain a single model from multiple sources;
- Process and optimise the scans and the aligned data in terms of geometry and details;
- Fix minor superficial and structural problems such as small holes;
- Prepare for the delivery of a ready-to-use 3D model in GLB format.

Several file formats can be used to deliver 3D models, each with its own strengths depending on the intended use. OBJ is one of the most established formats, widely supported across 3D software. It stores geometry, UVs, and basic materials, but requires multiple files (OBJ + MTL + textures) and does not support modern PBR materials. PLY is commonly used in scientific and research workflows, especially in 3D scanning; it efficiently stores geometry and vertex-based colour, making it suitable for detailed datasets but less ideal for animation or advanced rendering. FBX, developed by Autodesk, is the standard for animation, rigging, and game development pipelines. It supports a wide range of data, from meshes to animations and cameras, but can be heavy, complex, and inconsistent between software. In contrast, GLB/GLTF has emerged as the modern standard for distribution and visualisation. Designed by the Khronos Group, it integrates geometry, textures, and PBR materials in a single compact file. It is optimised for web, mobile, XR, and real-time applications, offering quick loading, high compatibility, and efficient performance.

Considering the output from all three Pilots and the need to store the files simply and compactly, the preferred structure can match the need to manage a single file for each cultural asset in a one-to-one relationship. This also avoids complexity in the storage and the recalling of the digital objects via the knowledge graph or other pointing systems that use the asset for running, for example, the experience.

Starting from the assumption that GLB is also a binary representation of GLTF, so a more compact and efficient storage system, also called “JPEG of 3D”, the delivery format chosen for assets is GLB. For

most general-use cases, especially online display or interactive applications, that are the output for Pilots' development, GLB is the best all-around delivery format.

3.2 3D asset production and digitisation methods Pilot 1

The workflow for the creation of the assets to be used during the Pilot execution is a 'reverse engineering' pipeline that starts with the selection of digital objects as images of clothes and their patterns. The pattern is first made on paper and traces the different parts of which a garment is composed. Digitisation of these patterns requires two steps: scanning the paper pattern (which creates a raster/pixelated image (e.g., a JPEG) and consequently vectorising the image (tracing the pattern image, which results in a scalable vectorised format (e.g., SVG format) that can be uploaded in design applications. This means that a 2D representation can be used for a successive 3D representation through proper 3D design software, such as CLO3D (<http://www.clo3d.com>), that allows designers to create, visualise, and simulate garments in a virtual environment. Enabling realistic garment draping, pattern design, and fitting on customisable avatars, it helps streamline the apparel design process from concept to production. Widely used in the fashion and apparel industries, CLO3D reduces the need for physical samples, saving time and materials. Patterns become three-dimensional, texturizable models ready for deployment to virtual products.



Figure 11. Test on the Digital Objects n. 1 (ST2202). Top left: digital pattern of the dress. Top right: pattern upload in CLO3D. Middle: creation of a 3D model. Bottom: 3D textured model²².

²² Source: <http://data.momu.be/ark:34546/mn0318>

The general workflow followed is as follows:

- Selection of the relevant garment to be digitised (with pilot partners);
- Creation of the 2D pattern on paper;
- Digitisation (and vectorisation) of the paper pattern;
- Conversion from 2D pattern to 3D textured model;
- Polycount suitability for performance in virtual environments;
- Lighting, shading, texture resolution, and size compatibility;
- Rigging and skeletal structures (if applicable);
- Standardisation and export in neutral formats (e.g., FBX, GLB, OBJ);
- Deliverable of the file and assessment & recommendation document outlining findings and next steps for further development.



Figure 12. Some of the asset produced from OLY collections.

3.2.1 3D asset production and digitisation methods Pilot 2

Assets were produced for Pilot 2 and reflect the aim of the experiences developed, involving a complete set of objects from the Olympic Museum collection and audio tracks from SMB collections. Regarding the OLY collection, a total number of 20 objects was digitised in 2D and 3D techniques.

The production of the assets required both processing and optimising 3D models, and generating some models starting from photographs and measurements in a direct modelling environment. This difference aimed to generate a 3D model also for objects that could not be digitised using one of the techniques presented above.

3.2.2 3D asset production and digitisation methods Pilot 3

Assets produced for Pilot 3 were digitised both from AQUILEIA archaeological area, or the House of Titus Macer, and from National Archeological Museum where objects related to the area are stored.

N. 20 digital assets were produced for Pilot development, in a combination of bronze statues, ceramic oil lamps, marbles, amphoras and coins. Apart, of course, the most important building of the Domus itself was delivered as single asset that can be split into several rooms and digital objects such as the hoven, the well and the mosaic room.

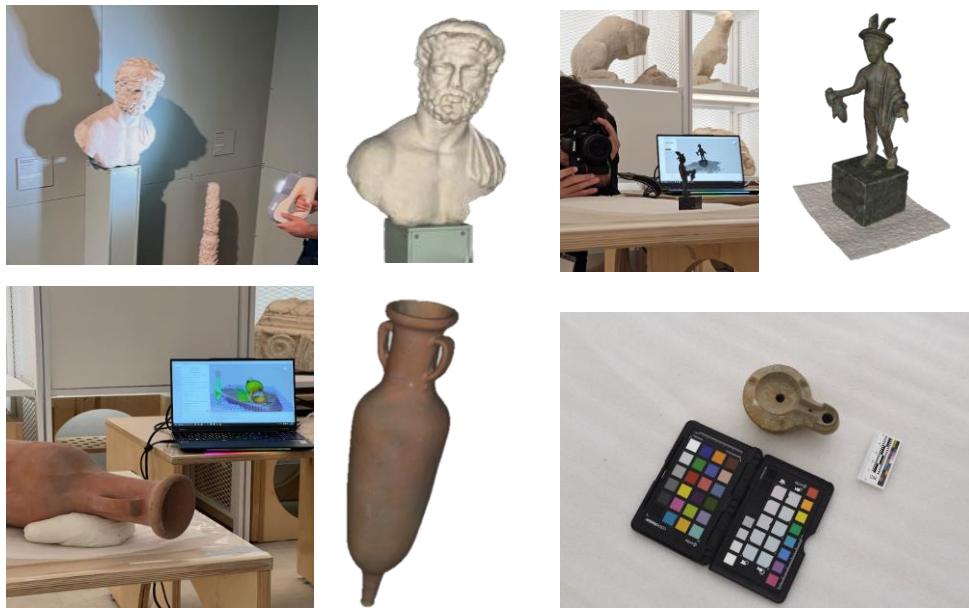


Figure 13. CH artefacts during the digitising process and after digitising from AQUILEIA



Figure 14. Some of the 3D assets produced from the archaeological area of AQUILEIA.



Figure 15. Some of the 3D assets produced from the Museum of AQUILEIA.

3.3 Pilot 3 App Development

At the end of the digitisation process and after the delivery of all the assets, a virtual tour of the Titus Macer Domus has been created. This immersive experience allows users to freely explore and navigate the archaeological site, interacting with the digital assets and their descriptions. The tour is narrative and interactive, accessible on-site via a QR code that links directly to the digital reconstruction, and remotely through a website. The main structure and interaction model of the virtual walkthrough includes the following characteristics:

- Users starting directly within the reconstructed area of the Domus or in the position according to the QR code;
- Basic movement controls via keyboard inputs and via touch interface (forward, backward, left, right, click);
- View manipulation through mouse movement and touch interface, enabling users to look around fluidly.
- Object interaction through mouse clicks and touch interaction, triggering pop-up windows containing detailed and narrative information such as provenance, typology, and function;
- Optimized 3D models, with refined mesh topology and texture resolution, ensuring high fidelity while maintaining real-time performance.

The 3D environment and secondary elements (terrain, vegetation, ambient assets) have been completed and delivered as new digital assets, even if not related to CH. The core interaction mechanics (walking, rotating, grabbing, and selecting) have been seamlessly integrated. Digitised museum objects have been placed within the virtual archaeological setting, providing contextualised scenarios that reflect their everyday use in the Roman period, informed by the prioritisation and contextualisation enablers.

This phase continued until the full interactive experience was developed, balancing educational content with engaging entertainment. The approach aligns with the concept of edutainment.

Some key features of the application in development are:

- ATON framework is used for app development. Allows for easy distinction between normal scene elements and scene elements with semantic content (used to distinguish environment models and interactive 3D models);
- Three.JS is the JavaScript library for creating 3D contents in web/XR environments;
- Three-mesh-UI is the JavaScript library that facilitates the creation of spatial interfaces integrated into the 3D scene. It is used to create panels that appear when interacting with objects.

The virtual scene was created via an editor whose main functionalities are the import of assets as "ground" elements and other assets placed in specific positions. The representation of the scene can also be opened via JSON, in which the relation between the main building, the objects placed inside, and the semantic mask can be observed, allowing users to read the description and narrative contents.

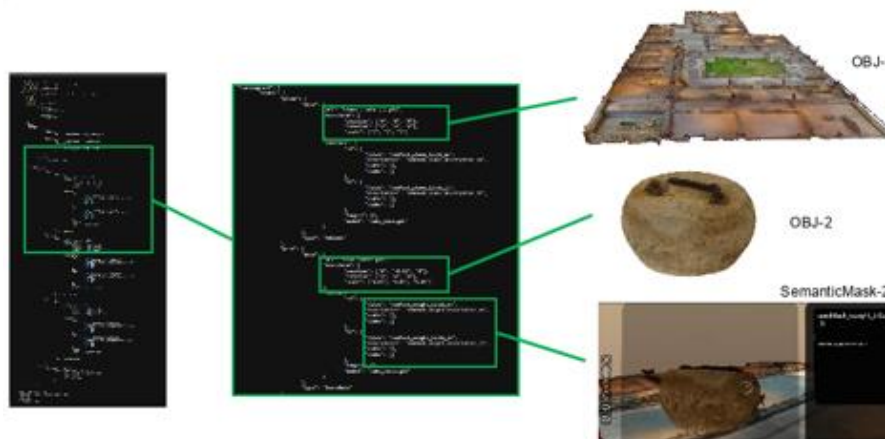


Figure 16. Representation via JSON of the virtual scene with objects placed and interactive panels.



Figure 17. Virtual environment prototype testing in VR environments (on left) and web view (on right).

3.4 Virtual Museum

Developed under Task 4.2, a key demonstrator of the REEVALUATE framework is a virtual museum prototype created by CERTH. This immersive 3D environment showcases the practical and creative reuse of digitised Cultural Heritage (CH) artefacts, presenting a curated collection where each item is accompanied by detailed descriptions and directly linked to the REEVALUATE Marketplace for further engagement and reuse. To enhance the thematic cohesion and atmosphere, the prototype leverages Generative AI to produce contextual floor and wall textures, aligning the entire virtual space

with the exhibition’s narrative. This application stands as a tangible example of how digitised CH assets can be repurposed into engaging, interactive experiences that extend their cultural and educational value beyond traditional archives.

3.5 Fashion App

CERTH has designed a comprehensive development pipeline centred on motion and motion transfer, serving as the critical engine for the gamified experience. The pipeline transforms user-generated video into animated, customisable 3D avatars through three technical phases.

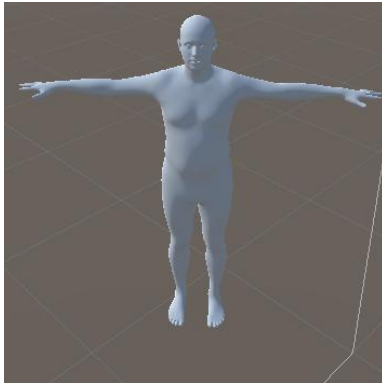


Figure 18. SMPL-X body.



Figure 19. SMPL-X bodies fitted with clothes.

The process begins with Foundation & Setup, integrating the SMPL-X statistical body model into the Unity game engine and creating a properly configured humanoid avatar essential for high-fidelity motion retargeting. The SMPL-X model provides a realistic, skinned, and parametric 3D human mesh with blend shapes for body shape, pose, and facial expression, offering a more efficient and robust approach than manipulating a static mesh. The Core Animation Phase focuses on a robust system to acquire, retarget, and blend diverse motion data (dance, walk, etc.) onto the avatar skeleton. Finally, the Integration Phase incorporates dynamic digital garments from the fashion pilot, ensuring clothing reacts convincingly to both body shape and motion.

CERTH's engine will provide the following core capabilities to the application:

- Avatar creation and customisation: Using the SMPL-X model (Fig. 18), the engine generates parametric 3D human avatars with realistic body shape, pose, and expression.
- Motion transfer: The engine extracts motion data from user-provided video or text prompts and retargets it onto the avatar skeleton, enabling personalised animations.
- Digital clothing simulation: The engine integrates digitised garments from the fashion pilot, applying a hybrid clothing pipeline (skinned meshes, blend shape adaptation, and physics simulation) so that clothing reacts convincingly to both body shape and motion (Fig. 19).
- Data Submission: The application sends the user’s video, avatar parameters, and selected garment data to the CERTH reuse enabler API.
- Cloud Processing: The enabler processes this input to extract motion data from the video, generate a corresponding SMPL-X avatar, dress it with the selected garments, and transfer the user’s motion to the digital character.
- Result Delivery: The enabler returns the final 3D asset (animated avatar with clothing) to the application.

- **Visualisation & Gamification:** The application renders the user's personalised avatar performing their own motions. This result can be viewed in AR/VR, rendered in a 3D scene, shared on social media, or submitted to in-app style and motion competitions.

FFP will receive CERTH's engine and build the gamified layer of the Fashion Time Machine on top of it. The application will likely include features such as garment selection from the digitised collection, social sharing, and AR/VR viewing, though the final feature set will be determined as development progresses.

4 Conclusions & Outlook


This deliverable reports on the current state of cultural asset reuse productions and applications being developed across the three REEVALUATE pilots. Each pilot pursues a distinct approach to the creative reuse of digitised cultural heritage, while relying on a shared set of technical enablers developed within the project by our team partners.





Pilot 1 (Fashion) centres on a gamified application — the "Fashion Time Machine" — and a physical garment creation showcase, both drawing on digitised artefacts from the MoMu collection. The technical implementation by CERTH, utilising the SMPL-X body model and a Unity-based clothing pipeline, demonstrates how heritage assets can be transformed into interactive digital experiences. FFP will then exemplify the REEVALUATE reuse chain in practice by merging the contributions from museum digitisation (MoMu/EFHA) and technical integration (CERTH) to create the bespoke gamified application. The first tangible output of the pilot — a modernised sewing pattern ("Mildred") derived from a 1920s MoMu collection piece — has been published on the FibreMood platform and is available for purchase.

Pilot 2 (Advertising) will produce content for the planned immersive exhibition at the Olympic Museum of Thessaloniki, combining visual artefacts from the Olympic Museum with ethnomusicological material from the Ethnologisches Museum (SMB/SPK). The pilot could expand beyond its original scope — from a single advertising video to a broader immersive exhibition concept — if the team can produce more within the allocated person months. This would reflect the consortium's ambition to test enablers in a realistic museum environment. Pilot 3 (Aquileia) focuses on site-level digitisation of the Titus Macer Domus and artefacts from the National Archaeological Museum, resulting in an interactive virtual tour that will be accessible both on-site and remotely. The shared enablers — including the DLT-based Asset Tokenisation & IPR Management Enabler, the Context Validation Enabler, the AI-driven Contextualisation Enabler, and the Collaboration Enabler — are being tested across the pilots and will prove instrumental in managing copyright, validating contextual use, and facilitating cross-institutional collaboration.

Following the transition of lead beneficiary responsibilities from NURO to FFP (see Section 1), the consortium has successfully consolidated this deliverable and maintained the project timeline. CERTH has played a key role in supporting both the technical implementation and the coordination effort. The results presented in this deliverable will be refined and extended in the second release (D4.4 R2, due M29), which will incorporate the outcomes of the second pilot phase and provide a more comprehensive evaluation of the reuse applications in public-facing settings.

Partners

PARTNER	SHORT NAME	
	CENTRE FOR RESEARCH & TECHNOLOGY HELLAS	CERTH
	FRAUNHOFER INSTITUTE FOR OPEN COMMUNICATION SYSTEMS FOKUS	FOKUS
	FROMSCRATCH DESIGN STUDIO BV	FS
	FONDAZIONE LINKS - LEADING INNOVATION & KNOWLEDGE FOR SOCIETY	LINKS
	FFP FILM- & FERNSEHPRODUKTION GMBH	FFP
	GVAM GUIAS INTERACTIVAS SL	GVAM
	STIFTUNG PREUSSISCHER KULTURBESITZ	SPK
	HYPERTECH	HYP
	OLYMPIAKO MOUSEIO	OLYMPIC
	ARTHUR'S LEGAL BV	ARTHUR
	KATHOLIEKE UNIVERSITEIT LEUVEN	KULeuven

 <p>MOUMUSEUM ANTWERPEN</p>	<p>AG CULTURELE INSTELLINGEN ANTWERPEN/ ERFGOED</p>	<p>MoMU</p>
 <p>EUROPEAN FASHION HERITAGE ASSOCIATION</p>	<p>EUROPEAN FASHION HERITAGE ASSOCIATION</p>	<p>EFHA</p>
 <p>3D RESEARCH</p>	<p>3D RESEARCH SRL</p>	<p>3DR</p>
 <p>FONDAZIONE AQUILEIA</p>	<p>FONDAZIONE AQUILEIA</p>	<p>AQUILEIA</p>