



ViMM Virtual Multi-Modal Museum

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This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.



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1 EXECUTIVE SUMMARY

The goal of WP5 is to fulfill the objectives of ViMM by providing a holistic representation of the up to date state of the art of various technologies for Virtual Museums and by presenting examples of excellence from various fields. These examples are presented through case studies that have been selected for their quality and suitability within the scope of each Thematic Area (TA).

As mentioned in the previous deliverable D5.3, these case studies have to meet some criteria in order to support the claim of representing excellence:

1. Relevance of the topic
2. Structure of the content
3. Targeting a wide audience

A total of 50 case studies, covering the broad field of digital culture heritage, have been uploaded up to date to the ViMM platform. These excellence studies have been published according the schedule planned in the previous deliverables D5.2 and D5.3 and can be found at :

<https://www.vi-mm.eu/case-studies/>

The case studies have been created by researchers and innovators with a broad range of expertise, covering the demands of a wide audience.

Two deliverables have already been produced by WP5. This deliverable acts as a final report on the publication of case studies and the presentation of excellence within the project.

Each Thematic Area (TA) produced at least 7 case studies. A detailed table is depicted in section 3.

2 INTRODUCTION

The main objective of the “case studies” is to contribute to this project by providing Informative content concerning the state-of-the-art of technologies for Virtual Museums (VM) and by identifying examples of reliable integration.

The task of WP5 is to organize the collection of the case studies produced by all the partners and to produce guidelines for their presentation and publication.

These examples of excellence are being published continuously on the ViMM platform and include various case studies of VM and the latest innovations and advances in state-of-the-art in VR/AR for VM.

This report outlines the third and last phase of the “Representation of excellence”, identifying of best practice examples through the preparation of 50 case studies up to date.

2.1 ROLE OF THIS REPORT IN THE PROJECT

This Deliverable provides an update of the Excellence representation task and depicts the final outcome of the case studies’ publication. It presents a complete list, summarizing the total number of case studies published in the platform for the whole duration of the project.

3 OBJECTIVES OF WORK PACKAGE 5 AND RELATED TASKS

The main objective of the WP5 is to enliven and update the process of discussion and consensus building in ViMM by providing a flow of interesting representations – in a variety of formats - of excellence and relevant cases which can illuminate challenges and issues identified by ViMM. The tasks within this work-package included:

Task 5.1 A delivery schedule for partners in each Thematic Area (TA) of candidate case study and representations, provided in D5.1.

Task 5.2 Collaboration obtained with key institutions in the VM field in compiling these representations throughout the Action.

Task 5.3 The selected representations have been modified as necessary for web presentation and, where appropriate, made a focus of discussion through the ViMM communication platform and the project events which have taken place throughout the Action.

4 WORK CARRIED OUT

4.1 Tasks achieved year 1

- ✓ Preparation of guidelines for the presentation of the cases and a schedule for their delivery
- ✓ Compilation of 11 examples
- ✓ Proposition of a layout for the web publication (D5.2)

4.2 Tasks achieved year 2

Improvement of the presentation of the examples and the formatting of elements for web presentation

- ✓ Adaptation of the case studies for web presentation
- ✓ Implementation of the new templates (gallery for the CS collection + the structure of a single CS)
- ✓ Compilation of 25 examples during the second period

4.3 Tasks achieved year 3

- ✓ Compilation of 14 examples during the third period
- ✓ Implementation of the new template with the decision-making tool which provides a more detailed context of the CS

TA/Partner	Period 1 (6 months)	Period 2 (12 months)	Period 3 (6 months)	Total
TA1 / CUT	01	04	02	07
TA2 / KIBLA	01	05	01	07
TA3 / SPK	02	03	02	07
TA4 / FORTH	02	03	02	07
TA5 / UPF	01	04	02	07
TA6 / UNIGE	02	03	02	07
TA7/ 7REASOND	02	03	03	08
	11	25	14	50

The numbers of CSs, as allocated to the partners throughout the project and planned since the first period.

4.3.1 Decision making tool

The Decision-Making Tool (DMT), developed in WP4, contains four different categories of information, as shown in the picture below, and has been applied to provide more detailed material and a full methodological analysis to a selection of the excellence case studies in the third period of the project. The relevant examples are:

- David Bowie Is app (TA2 – KIBLA)
- Adventure soil life - a virtual journey through an unknown world (TA3 -SPK)
- The Roman Maastricht VR Project (TA7 – 7 Reasons)
- Hauger, Haller, Hav: the permanent exhibition of the Midgard Viking Centre in Borre, Norway (TA7- 7 REASONS)

The images below provide an example of the implementation of the DMT in one of the latest CS, as it appeared on the ViMM platform.

I. IDEA GENERATION & CONCEPT

Stakeholders	-Internal and external actors involved in this phase (e.g. Board of Directors, cultural managers, operational managers, project managers and coordinators, curators, technology experts and administrators, marketing experts or departments, media and social media experts, financial departments). -Type of participation (e.g., hired, museum staff, subcontracted, volunteer...)	Archeological Service of the City of Maastricht, Hotel Derlon, Gilbert Soeters (Coordination & Archaeological Interpretation), 7Reasons GmbH /Vienna (media & technology experts), Financial Department of the City of Maastricht
Asset Valorisation	-Cultural assets to be used, expected scientific value, commercial and public benefit/impact estimation, draft requirements for the scientific study and project design...	Digitalisation of the remains of the Roman sanctuary (7Reasons), scientific contents (Gilbert Soeters, Centre Ceramic Maastricht, Panhuysen) Project design: 7 Reasons GmbH
General Objectives	-Overall objectives for cultural assets, exhibition, institution, audiences. -Estimate time frame for different phases (scientific studies, design, implementation, operation) -Main challenges and risks.	Overall objectives: Virtual exhibition for Site Visitors (all ages and groups of interest) Time frames: 2 Month technical and content planning, 12 month realisation (scientific studies, digitalisation & virtual reconstruction) Main challenge: producing a sustainable mobile application for a broad audience with state of the art technology implemented
Budget	-Initial estimate budget for different phases/items (scientific studies, design, implementation, operation, maintenance updating, marketing and promotion...) -Measures to prove the direct and indirect economic and social impact and transform it into financial return.	Overall budget: approx. 30.000 euro
Technologies	-Technologies to be used: stability, robustness, innovation. -Commercial and operational planning adaptation.	Mobile application for IOS & Android, IVR & Augmented reality implementation, robust setup for G4 devices and above, adaptive content framework for future implementations, dissemination activities carried out by the city of Maastricht and the tourist office.

II. ELABORATION OF DESIGN, STUDY, & PLANNING

Stakeholders	<ul style="list-style-type: none"> -Internal and external actors involved in this phase (e.g. Board of Directors, cultural managers, operational managers, project managers and coordinators, curators, technology experts and administrators, marketing experts or departments, media and social media experts, financial departments). -Type of participation (e.g., hired, museum staff, subcontracted, volunteer...) 	Archeological Service of the City of Maastricht, Hotel Derlon, Gilbert Soeters (Coordination & Archaeological Interpretation), 7Reasons GmbH /Vienna (media & technology experts), Financial Department of the City of Maastricht
Business Plan	Detailed business plan including: organizational structure, IPR issues, marketing and promotion plan, relevant costs and efforts, requirements of resources and skills for operation, update and maintenance, contracts with the technology developers including liability and guaranties.	Archeological Service of the City of Maastricht, Hotel Derlon, Gilbert Soeters (Coordination & Archaeological Interpretation), 7Reasons GmbH /Vienna (media & technology experts), Financial Department of the City of Maastricht
Budget	<ul style="list-style-type: none"> -Income management and provisions for design, study & planning. -Income/expenses balance follow up. 	A predefined Budget was given by the financial department of the City of Maastricht,
Technologies	-Technical decisions. Changes due to deviations, failures, technology changes, to be examined and approved.	Technical decisions where proposed and taken by 7 Reasons

III. DEVELOPMENT & IMPLEMENTATION

Stakeholders	<ul style="list-style-type: none"> -Internal and external actors involved in this phase (e.g. Board of Directors, cultural managers, operational managers, project managers and coordinators, curators, technology experts and administrators, marketing experts or departments, media and social media experts, financial departments). -Type of participation (e.g., hired, museum staff, subcontracted, volunteer...) 	Archeological Service of the City of Maastricht, Hotel Derlon, Gilbert Soeters (Coordination & Archaeological Interpretation), 7Reasons GmbH /Vienna (media & technology experts), Financial Department of the City of Maastricht
Technical Implementation	<ul style="list-style-type: none"> -Detailed implementation and development process: technology, time frame, resources, collaborations, etc. -Verification of achievement of a full operational level, as foreseen in the design, following testing, pilot operation, adjustment and acceptance, before mass launching. -Selection of the operational personnel, training and implementation of the operational structure before the completion of the project implementation. -Risk management and alternatives 	Technology involved: Mobile Application for IOS & Android with 3d Realitme Scenes, Augmented Reality & IVR (Immersive reality) included. 2 Month of debugging and pre release to choosen texter groups, final version was published 14 month after contract assignment. Several updates where implemented after the first publication.
Budget	<ul style="list-style-type: none"> -Income management and provisions for development and implementation. -Income/expenses balance follow up. 	The pre-given Budget was split according to the financial plan and respected.
Technologies	<ul style="list-style-type: none"> -Technical decisions and quality control. -Changes due to deviations, failures, technology changes, lack of knowhow, to be examined and approved. 	2 Month of debugging and pre release to choosen texter groups, final version was published 14 month after contract assignment. Several updates where implemented after the first publication.

IV. OPERATION & MAINTENANCE

Stakeholders	<ul style="list-style-type: none"> -Internal and external actors involved in this phase (e.g. Board of Directors, cultural managers, operational managers, project managers and coordinators, curators, technology experts and administrators, marketing experts or departments, media and social media experts, financial departments). -Type of participation (e.g., hired, museum staff, subcontracted, volunteer...) 	Archeological Service of the City of Maastricht, Hotel Derlon, Gilbert Soeters (Coordination & Archaeological Interpretation), 7Reasons GmbH /Vienna (media & technology experts), Financial Department of the City of Maastricht
Time and Management Process	<ul style="list-style-type: none"> -Detailed operation and management process: technology, time frame, resources, collaborations, marketing and promotion, relevant costs and efforts... -Maintenance: issues arisen, hardware & software updates, operational and maintenance personnel, risk management and alternatives. -Operational monitoring: personnel, resources involved. 	2 Month of debugging and pre release to chosen texter groups, final version was published 14 month after contract assignment. Several updates where implemented after the first publication.
Budget	<ul style="list-style-type: none"> -Income management and provisions for operation & maintenance. -Income/expenses balance follow up. 	The pregiven Budget was split according to the financial plan and respected.
Technologies	<ul style="list-style-type: none"> -Measures, tools and personnel devoted to prove the direct and indirect economic and social impact and transform it into financial return, etc. 	Summary of downloaded applications and personal feedback of the users were used to steer the updates, technoligical updated were made in the course of the availability of new technology.

5 INVOLVEMENT OF BENEFICIARIES AND RESULTS







Partners completed the requirements for the delivery of the case studies. All the examples have been delivered on time according to the schedule and with respect to the proposed guidelines. As the project has proceeded a growing proportion of excellence studies have been were supplied directly by external contributors.


5.1 PARTNER INVOLVEMENT IN PRODUCING CASE STUDIES DURING THE PERIOD








Thematic Area (TA)	Lead Partner	Number of case studies during the period	Total up to date
TA 1 – Definitions	CUT	02	07
TA 2 – Directions	KIBLA	01	07
TA 3 – Documentation	SPK	02	07
TA 4 – Dimensions	FORTH	02	07
TA 5 – Demand	UPF	02	07
TA 6 – Discovery	UNIGE	02	07
TA 7 – Decisions	7 REASONS	03	08





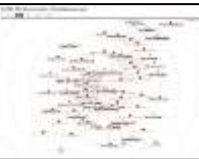

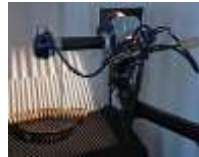
5.2 COMPILATION OF CASE STUDIES

For each TA, the range of the implemented examples are presented for the whole duration of the project, with keywords illustrating the diversity of the topics covered. The first part of each table shows the contribution of each partner during the third period.








<p>TA 1 / Definitions</p>	<p>Cyprus University of Technology (CUT)</p>
	<p>A cognition-centered approach for delivering personalized cultural-heritage experiences Keywords: cultural heritage, cognition, personalization, adaptation, user modeling</p>
	<p>DIGITAL CULTURAL AND HISTORICAL HERITAGE OF PLOVDIV MUNICIPALITY PROJECT, BULGARIA Keywords: DIGITAL CULTURAL , HISTORICAL HERITAGE, PLOVDIV MUNICIPALITY, PROJECT, BULGARIA, National Library, Archeological Museum, Ethnographic Museum, Historical Museum, City Gallery of Fine Arts, Ancient Plovdiv, monuments of national importance</p>
	<p>CEPROQHA: Cost-Effective Preservation Of Qatar Cultural Heritage Through Advanced Holoscopic 3D Imaging And Data Science Keywords: Cultural Heritage, Digital Heritage, Deep Learning, CEPROQHA Project, Artificial Intelligence</p>
	<p>Asinou multiple-uses of 3d models of a historic monument Keywords: cultural heritage, architecture, documentation, 3D models, HBIM, gamification, augmented reality</p>
	<p>An e-book as an Interactive Digital Heritage Experience Keywords: interactive technology, interactive books, motion sensor, touch, projection, immersive experience, education.</p>
	<p>Secrets of the Past: Dion Keywords : Video Games, Simulation, Archaeology, Cultural Heritage, Photogrammetry</p>


	<p>Towards holistic digital documentation</p>
<p>Keywords : holistic documentation, 3D model, Geometric documentation, Orthoimage, Structure from Motion, UAV</p>	







<p>TA 2 / Directions</p>	<p>Association for Culture and Education KIBLA</p>
	<p>David Bowie Is App</p> <p>Keywords: AR exhibition, Augmented reality, VR, 3D images, 3D_scanning, digital museum show, cultural heritage, music, David Bowie Heritage, David Bowie Archive, Sony Music Entertainment</p>
	<p>Into the Wild: An Immersive Virtual Adventure</p> <p>Keywords: Mixed reality, AR, VR, Tango, Google, Singapore’s Art Science Museum, immersive storytelling, museum experience, preservation, education, science, technology.</p>
	<p>Invisible Cities - Invisible Italy 360</p> <p>Keywords: 3D model , 360-degree video, digital storytelling, laser scanning, web VR, user experience, user-interface design, art, interior & exterior way finding, HD image, virtual reality, real-time mapping, VR navigation, interaction design, VR headset, art&design, narrative, art history, cultural heritage, intergenerational learning, education</p>
	<p>ArtLens App at the Cleveland Art Museum</p> <p>Keywords: image-recognition software, gallery, interaction design, iPad, iPhone, motion-tracking technology, interactive video wall, user interaction.</p>
	<p>Meeting Rembrandt: Master of Reality</p> <p>Keywords: Digital storytelling, user experience, user-interface design, art, 3D model, HD image, virtual reality, interactive real-time, VR platform, education, art&design, narrative.</p>
	<p>Modigliani VR Experience: The Ochre Atelier</p> <p>Keywords: Digital storytelling, user experience, user-interface design, art, 3D model, HD image, virtual reality, interactive real-time, VR platform, education, art&design, narrative.</p>
	<p>Meet Vincent Van Gogh Experience</p> <p>Keywords: Digital storytelling, user experience, user-interface design, art, 3D model, HD image, virtual reality, interactive real-time, VR platform, education, art&design, narrative, interactive installation</p>



<p>TA 3 Documentation</p>	<p>STIFTUNG PREUSSISCHER KULTURBESITZ (SPK)</p>
	<p>The Contributions of Computational Imaging Methods in Archaeology: A Case Study in Termessos (Turkey)</p> <p>Keywords: Digital Heritage, Photogrammetry, RTI, <i>SfM</i>, Documentation, Termessos, Archaeology</p>
	<p>“Adventure Soil Life” – A virtual journey through an unknown world</p> <p>Keywords: Virtual reality, VR experience, Senckenberg Museum of Natural History Görlitz, HTC Vive, user experience, soil animals, subterrestrial life</p>
	<p>Bode 360° - A virtual tour of the Berlin Bode-Museum</p> <p>Keywords: Virtual tour, panorama, museum, small-/ medium-sized museums, cultural heritage, 3D, virtual, low-cost, smart phone, mobile, web-app, krpano, HTML 5, Flash, photography, virtual reality</p>
	<p>3-Dimensional Computed Tomography Scanning of Musical Instruments</p> <p>Keywords: Three-dimensional Computed Tomography, 3D-CT, Musical Instruments, Museum, Quality Standards, Conservation, Restoration</p>
	<p>Virtual Reconstructions in Transnational Research Environments – the Web Portal: Palaces and Parks in Former East Prussia</p> <p>Keywords: architecture, cultural heritage, documentation, 3D reconstruction, semantic 3D models, virtual museum, virtual research environment</p>
	<p>Citizen Science in Humanities Unlocking the Knowledge of the Crowd</p> <p>Keywords: participation, citizen science, crowd, crowdsourcing, cultural heritage, motivation, research, digitisation, humanities, data, data collection, transcription</p>
	<p>Documenting challenging objects in archaeology</p> <p>Keywords: 3D, 3D scanning, documentation, archaeology, digitisation, mass-digitisation, waterlogged artefacts, organic materials, wood, laser scanning, vacuum freeze-drying</p>






TA4 /Dimensions	Foundation for Research and Technology Hellas (FORTH)
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	<p>True Augmented Reality Virtual Characters for Digital Cultural Heritage Applications</p> <p>Keywords: True Augmented Reality, 3D Virtual Character, Digital Cultural Heritage Application, Animation</p>
	<p>Literary Myths in Mixed Reality</p> <p>Keywords: digital humanities, mixed reality, comparative literature, neoromanticism, sense of presence</p>
	<p>Case study for mobile, rapid reconstruction for VR heritage simulation</p> <p>Keywords: Rapid reconstruction, Virtual Reality (VR), Agisoft Photoscan software, Fast Avatar Capture application, Occipital Structure Sensor</p>
	<p>Case Study for True Augmented Reality (AR) application in Industrial Museum and Cultural and Educational Center in Thessaloniki</p> <p>Keywords: Virtual Reality, Augmented Reality, Holographic Augmented Reality, True Augmented Reality, Virtual Museum</p>
	<p>Holographic and Augmented Reality simulations for cultural heritage</p> <p>Keywords: Holographic Reality, Augmented Reality, cultural heritage simulation, Microsoft Hololens, MetaioSDK, ARKit</p>
	<p>Case Study For Virtual Reality (VR) Application Of Gamified Restoration Of Archaeological Sites</p> <p>Keywords: Virtual Reality, Archaeological Site, Series of Actions, Gamification, Error Tracking, Holographic Representations, Cooperative Mode, Analytics Engine, Cultural Heritage</p>
	<p>Case Study For Augmented Reality (AR) Application Of Portals For The Preservation Of Cultural Heritage</p> <p>Keywords: Augmented Reality, Portals, Real World, Virtual World, ARCore, Mobile Devices, Cultural Heritage</p>

<p>TA 5 / Demand</p>	<p>Universitat Pompeu Fabre (UPF)</p>
	<p>EMOTIVE PROJECT: THE EXPLORATION OF EGALITARIANISM DIGITAL EDUCATION KIT*</p> <p>Keywords: Off-site cultural heritage experiences, emotions, 3D printed objects, chatbot, storytelling</p>

	<p>EMOTIVE HUNTERIAN MUSEUM DIGITAL STORYTELLING ABOUT THE ANTONINE WALL*</p> <p>Keywords: On-site/off-site cultural heritage experiences, emotions, storytelling, 3D printed objects, authoring tools</p>
	<p>ULLASTRET, 250 B.C. a Virtual reconstruction of an Iron Age town</p> <p>Keywords: Iberian Culture, Virtual Reconstructions, Immersive storytelling experiences, Social impact.</p>
	<p>Apropa cultura: an online platform for the accessibility to culture of social groups at risk</p> <p>Keywords: culture, social work, online platforms, accessibility, impact assessment</p>
	<p>Private foundations in digital heritage: the case of Mon Sant Benet (Sant Fruitos de Bages, Catalonia)</p> <p>Keywords: digital heritage, private initiatives, immersive experiences, impact assessment</p>
	<p>“We hunters” – interactive digital experience at the “abric de l’ermita” center for the interpretation of rock art (Uldecona, Catalonia)</p> <p>Keywords : Rock Art, multi-user surfaces, impact assessment</p>
	<p>Co-Design of a Virtual Heritage Experience</p> <p>Keywords: Augmented Reality, World-as-Support interaction paradigm, co-design strategies, Virtual Heritage</p>

<p>TA 6 / Discovery</p>	<p>University of Geneva (UNIGE)</p>
	<p>Virtual Lady Ada, an interactive museum exhibition</p> <p>Keywords: cultural heritage, digital documentation, 3d reconstruction, se-mantic annotation, virtual humans, animation, clothes.</p>
	<p>Meet Nadine, one of the world's most human-like robots</p> <p>Keywords: Social Robotics, Human-Computer Interaction, Human-Robot Interaction</p>

	<p>3D Image Based Scanning: Case study for Virtual Human creation</p> <p>Keywords: 3D Image Based Scanning, Digitization process, 3D scanner, Body modelling, Avatar creation</p>
	<p>Motion capture for Tai-Chi: Case study for Animating Virtual Human</p> <p>Keywords: Motion capture, Digitization process, 3D reconstruction, movement modelling, Avatar animation</p>
	<p>Building Knowledge graphs to access and understand historical scientific manuscripts</p> <p>Keywords: Digitization, Digital Humanities, Historical Ontologies, Semantic web interface</p>
	<p>An EEG-based evaluation for comparing the sense of presence between virtual and physical environments</p> <p>Keywords: Virtual Reality, Presence, EEG, Immersion</p>
	<p>Understanding digitization of cultural heritage objects</p> <p>Keywords: Digitalisation, acquisition techniques, documentation, ontologies</p>

TA 7 – Decisions	7 REASONS
	VR Reconstruction of Tel-el-Daba, a Puzzle in 4D
	The 4D-CH Calw Project Keywords : CH VR, VR, AR, Mobile Applications, Reconstruction, Photogrammetry, Historic Reconstructions, Virtual Archaeology,
	The Roman Maastricht VR Project Keywords: digital archaeology; augmented reality; 3D Reconstruction; Digital Cultural Heritage Applications;
	Karlskirche IVR, a questionnaire on a VR user experience Keywords: Immersive reality, photogrammetry, laser scan, virtual reality, museums, sites, vr -headsets, questionnaire, user experience, real -time applications.
	The new permanent exhibition of the prehistory department of the Museum of Natural History in Vienna Keywords Virtual Museum, Virtuality in Museums, Museum, Augmented Reality, VR, AR, XR, Projections, Display, Virtual Reconstructions
	Hauger, Haller, Hav The permanent exhibition of the Midgard Viking Center in Borre, Norway Keywords: Augmented Reality, Large Scale Projections, Replicas, 180° Projections, Virtual Environments
	Carnuntum Augmented Reality mobile application Keywords: Virtual Tours, VR, AR, Immersive Reality, Archaeology
	Immersive VR/AR Museum Guide Keywords: Immersive reality, photogrammetry, laser scan, virtual reality, museums, sites, vr -headsets, questionnaire, user experience, real -time applications