

**Proposal for Case Study in 3D Spatial and Spectral  
Documentation of Material Cultural Heritage**

## **Title of the Case Study**

Digitization of Romanian Cultural Heritage and Virtualization based on  
Museum Visitors Empowerment

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## Description of the object/site

The proposed case study is intended to be **exploratory** and aims to deliver 3D models of Romanian Cultural Heritage objects, involving museum visitors in the process of virtualization. The case study is planned to take place between September 2014 and March 2016. Even though the applicability of the project will be versatile enough so as to apply to many heritage sites or museums, for this particular case, as benchmark, the main working site will be the **Romanian National History Museum (MNIR)** located in Bucharest, Romania.

The MNIR holds a collection of around 25 **painted icons** (out of which 20 on wood and 5 on canvas) and a vast number of **archaeological objects** of both Romanian and European cultural significance (made of ceramics, marble, stone, copper, gold and silver) covering historic periods dating from Prehistory to Modern Age. All the artifacts are significant for the Romanian history and they are an authentic testimony for the evolution of the national culture and the culture of the Balkan area as well. Also, the MNIR is undergoing works of renovation for some years, so most of the artifacts in its collection are not available to public visits. Nonetheless, improving the digitization process of the artifacts by innovative techniques might reveal new information hidden to the naked eye and previous traditional studies.

As the collection of the museum is very numerous, the selection will be made according to the list of priority of the objects that need to be restored and as well according to their importance for research and display to the general public through virtual exhibitions. A preliminary selection was made in agreement and collaboration with the MNIR and it comprises of 3 icons painted on wood and 4 ceramic vases, as displayed in Appendix 1.

## Rationale and purpose of the case study

The motivation for this case study is to bring diversity and novelty to the digitization techniques that are used so far in the MNIR. So far, the generated 3D models that were made in the museum were based on photogrammetry using consumer digital camera and mainly open-source software.

My proposal is to add more **advanced, non-invasive** techniques in terms of image capturing of the artifacts, using both spectral and spatial object documentation. The spectral techniques are perfectly suitable for the painted icons, where **multispectral** or **hyper-spectral** acquisitions could provide significant information about the material, pigments, underlying drawings or the techniques of the artist that could help in the process of dating, restoration, reconstruction and sometimes, author identification. For

the archaeological artifacts, laser scanning will be used as well in addition to the photogrammetry technique already implemented by the museum and thus, the results of two spatial techniques can be compared in parallel.

Another purpose of this case study is to explore the contribution of the visitors of the museum, either they are part of a public with education and interest in cultural heritage (students of Archaeology, Arts, History) or part of general public. The visitors can be involved in the action of conservation by taking part in a **workshop with guided assistance from an expert in imaging science**. During the workshop, the visitors will have the chance to capture images of replicas of artifacts and they will learn how to create a 3D model. Thus, through this process, the public will grasp more knowledge about the potential damage the objects have gone through and the difficulties that appear during reconstruction. This technique is a good strategy for interacting with the public and making the visitors an active party in the process of conservation of their national cultural heritage and national history. In other words, the museum visitors will reinforce their **national historical identity** by creating 3D models with their own photographs. This will raise **awareness** about the cultural heritage artifacts and about the high importance of their preservation.

### **Contribution to the COSCH project**

The case study intends to bring contribution to the following Working Groups: Spectral Object Documentation, Spatial Object Documentation and Visualization of CH Objects and its Dissemination. Thus, as regards COSCH, the objectives planned to be covered are:

- Multispectral and hyper-spectral imaging;
- Comparative measurements (two or more spatial techniques applied to a single CH object);
- Scholarly and educational applications (including virtual museums);
- Guidelines and specifications for best practice in all the performed activities of the case study.

As regards end-users, the following points are followed:

- Educate on recent and alternative spatial and spectral reconstruction techniques by means of the conference, the hands-on workshop and the permanent exhibition;
- Offer access to objects in the virtual MNIR museum that are otherwise not available for public visit in the actual museum.

### **Target users and their needs**

A first group of target users refers to the **museum curators**. The museum will firstly benefit from this case study because the novelty of the techniques will reveal new

details or information of historic and cultural significance.

A second group of target users is represented by the **museum visitors** that will have the chance to create their own virtual souvenir, based on replicas of objects to which they wouldn't otherwise have access to (since the museum is undergoing works of reconstruction). Not to mention the fact that virtual museums facilitate a faster access and people from different places around the world will be able to see as realistic as possible the historical objects from the MNIR.

Virtual archaeologists and **cultural heritage researchers** form another group of target users. The conference of dissemination about the alternative methods of reconstruction will increase awareness among specialists around the entire network of cultural heritage researchers in Romania.

Last but not least, the **cultural heritage artifacts** will benefit as well from the proposed case study, because the 3D models allow a low number of manipulations on the physical objects. Restoration ideas (regarding the best material choice or best algorithm choice) will be simulated firstly on the virtual 3D model and run through various optimization scenarios before the changes will be applied to the artifact itself.

## **Description, techniques and schedule of the work**

On a preliminary basis, the proposed case study has three main parts:

- Alternative Data Acquisition using a multispectral camera set-up and other devices, such as structured light scanners. Alternative devices can be brought to the museum - a connection can possibly be made with the photogrammetry camp in Jurilovca organized by MNIR in collaboration with the 3D Optical Metrology lab at Fondazione Bruno Kessler in September 2014. **Duration:** 1 week.
- Organization of the dissemination workshop and guided assistance where visitors will have the chance to work with replicas of the objects, simulate data acquisition and create their own reconstructions of the replicas of the object. **Duration:** between 6 months and 1 year.
- Processing of the data collected from both the alternative capturing methods and creation of archival methods. **Duration:** this step is the most progressive, as it will evolve along with the case study. Also, this step has the strongest component for **follow-up work**, as it is there where further results will be published.  
A more detailed plan of the tasks that will be carried out along with the partners involved is presented in the table below:

	<b>Task</b>	<b>Partners Involved</b>	<b>Start Date</b>	<b>End Date</b>
<b>1</b>	<b>Decide on the equipment to use for data acquisition</b>	Myself, MNIR	September 2014	December 2014
<b>2</b>	<b>Data acquisition process</b>	MNIR, NIPNE	January 2015	May 2015
<b>3</b>	<b>Data analysis and interpretation</b>	All partners	June 2015	August 2015
<b>4</b>	<b>Organize workshop and conference for dissemination</b>	Myself, MNIR	September 2015	October 2015
<b>5</b>	<b>Prepare final digitized objects</b>	Myself	November 2015	December 2015
<b>6</b>	<b>Publish results on website and exhibition</b>	Myself, MNIR	January 2016	February 2016

## Financial instruments

Even though with complementary funding, the proposed case study will dispose of more intellectual, logistic and technical resources, the project can also be carried out in a self-sustained manner, with basic set-ups and technology [1], [2], [3]. Nonetheless, we will try as much as possible to bring added value to the project and increase its performance with state-of-the-art equipment and technology. Some of the financial instruments we could use are enumerated below:

- **COSCH Short-Term Scientific Missions** – An expert/PhD student from the Norwegian laboratory could come in a STSM to the MNIR to exchange good practice of spectral and spatial documentation, to be involved in the process of image acquisition, data processing or in the workshops and conference for the interaction with the visitors;
- **Outsourcing** or borrowing equipment from companies – A way to get professional equipment that we do not have is to convince several professional companies to cope with us and lend us the equipment;
- Application for **EEA Grants** that support bilateral projects between Norwegian and Romanian Institutions regarding the conservation and revitalization of the cultural heritage [4]. Application due in 2015.

## Earlier relevant research and projects

Spectral imaging techniques offer the possibility of a non-destructive and non-invasive analysis of cultural heritage items. So far, multispectral imaging has been used for art

reconstruction in VASARI (archiving and retrieval of images) and CRISATEL (illuminant simulation) projects [5], [6]. A color pigment mapping was performed for Edward Munch's "The Scream" painting based on a hyper-spectral capture[7]. A series of imaging analysis are being conducted on Van Gogh paintings at the homonym museum in Amsterdam with the purpose of reconstructing colors where the pigments faded and that of studying the painting technique within REVIGO research project [8]. The museum holds a permanent exhibition where they display the results of the research and give explanations on the used research instruments.

## References

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- [5] Ribes A., *Calibration and Spectral Reconstruction for CRISATEL: an Art Painting Multispectral Acquisition System*, 2005.
- [6] Visual Arts System for Archiving and Retrieval of Images  
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- [8] Reassessing Vincent Van Gogh: research into colours and discolourization  
<http://www.vangoghmuseum.nl/en/about-the-museum/research-projects/revigo>

## APPENDIX 1

Selection of objects to be studied from MNIR

Nr.	Nume	Poza
1	Icon painted on wood „Saint Michael and Gabriel”	 A rectangular icon on wood depicting two winged figures. The figure on the left is Saint Michael, shown in a red and gold robe, holding a sword. The figure on the right is Gabriel, shown in a blue and gold robe, holding a scroll. A small white label with the number '88220' is visible at the bottom of the icon.
2	Icon painted on wood „Saint Paraschiva”	 A rectangular icon on wood depicting a dark, central figure, likely Saint Paraschiva, surrounded by other figures in a dark, atmospheric setting. A small white label with the number '88223' is visible at the bottom of the icon.
3	Icon painted on wood “Saint Mary”	 A rectangular icon on wood depicting a central figure, likely Saint Mary, with a halo, surrounded by other figures. The icon is framed by a reddish-brown border. A small white label with the number '88224' is visible at the bottom of the icon.
4	Fikellura amphora, with anthropomorphic decorations	 A large, two-handled amphora with a perforated neck. The body is decorated with anthropomorphic figures, possibly representing the Fikellura figures. The amphora is shown against a white background.

5	Vase from the Pre-Cucuteni era			
6	Biconical bowl			
7	Amphora with biconical body			