

Storytelling of a coin collection by means of RTI images: the case of the Simoneschi collection in Palazzo Blu

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Abstract

This paper presents the interactive system developed for the virtual presentation of the coin collection of Ottavio Simoneschi of the Museum Palazzo Blu. Taking advantage from the integration of multimedia data and Reflectance Transformation Imaging and from the new technology for the 3D content publication on the Web, the kiosk allows the user to improve its knowledge about the coins in an interactive and easy way using all the capabilities of the RTI image manipulation, especially the interactive change of the light direction on the coin surface.

Introduction

Reflectance Transformation Imaging (RTI) [3][4] is a computation photography technique that captures a subject's surface shape and color and enables the interactive re-lighting of the subject from any light direction. Starting from a set of photographs acquired with a fixed camera under varying lighting conditions, RTI encodes the acquired data in a compact way, using view-dependent per-pixel reflectance functions, which allows the generation of new images using any light direction in the hemisphere around the camera position.

In the last years, RTIs have been employed in several projects [4]: for the study of high relief fossils and ancient stone tools; in the analysis of the surface textures of oil paintings; in the study of Cuneiform tablets; in the documentation of large numismatic collection; in the study of the Antikythera mechanism. At the same time, different solutions have been proposed for the acquisition of different kind of objects: computer controlled dome of lights; methods based on an acquisition plane or on the tracking of the highlights on a glossy sphere by manually moving the light around the object [4].

Although until now this technique is being used to aid Cultural Heritage specialists in the virtual inspection and interpretation process, the recent advances in the 3D Web visualization are increasing our capability to open this new visual manipulation method of the artifact to the ordinary public.

In this context, the ancient coins are a very interesting kind of artifacts to acquire and virtually explore by means of RTI images. Typically, a coin is a very small artwork, which in a standard museum exposition is presented to the public from a distance and only from one side. This distance does not allow to the visitors to note some small and interesting details on its surface. Furthermore, coins have a lot of hidden knowledge that is difficult to transfer to the visitors in an easy and effective manner.

In this paper, we present the use of RTI images for the digitalization and virtual presentation of the coin collection of the Museum Palazzo Blu (Pisa, Italy). The main goal was to provide an improved access of ordinary people (visitors of the museum or Web surfers) to the exposed numismatic materials. The result is an interactive kiosk that, integrated with the existing traditional museum exhibition, allows the visitors to interact and virtually explore every coin taking advantage from the possibility to change the light direction in real-time and to appreciate all the details on its surface. The kiosk is currently installed inside the Museum Palazzo Blu in Pisa and it is available online (<http://vcg.isti.cnr.it/PalazzoBlu/>).

The Simoneschi Collection

The numismatic collection of Ottavio Simoneschi (1890-1960) [5] was acquired by *Fondazione Pisa* in 2007, but the study of its materials has begun in 2012. First, an accurate inventory of the pieces was drawn up and accompanied by digital photographs for an effective identification. The exemplars of greatest numismatic, historical and artistic interest were then identified and those pieces in most urgent need of restoration were set aside for attention. This preliminary work has been necessary and useful for the preparation of the permanent exhibit, realized in 2013.

The Simoneschi Collection comprises more than 3,300 pieces ranging from coins to medallions. It is not clear through what channels – acquisitions, inheritance, gifts or finds – he was able to assemble such a vast number of pieces, although some of the more valuable can be retraced, through their labels and the catalogues in his library to auctions, held by prestigious coin traders of the time.

The greater part of the collection is devoted to coins from Antiquity: ancient Greece, Magna Grecia and Etruria. The main body of the collection, however, consists of a vast selection of pieces from Republican and Imperial Rome, including medallions of great rarity and beauty. Also of interest are some examples of the famous counterfeiter's art produced in recent centuries. The coins from medieval and modern Italy are also of significant interest, in particular various series issued by the mints of Florence and Milan. Beautiful exemplars produced by the Republic of Venice during the course of her history from the Middle Ages to the early modern era stand out, including the splendid *oselle* commissioned by the doges in the 16th century. The Simoneschi Collection therefore offers not only an overview of the history of coin making, but also a window on the history and art in Italy and in the Mediterranean from the 6th century BC to the end of the 19th century.

For these reasons those coins and medallions chosen for permanent display have been arranged to illustrate the principal chapters in the history of coinage in Italy and the Mediterranean between Antiquity and the beginning of the contemporary era, while at the same time retaining the unique characteristics of the original collection which reflect the tastes of Ottavio Simoneschi.

Because his principal interest was in the coins and medallions of Rome and those produced by the mint of Venice, considerable space is therefore devoted, both in the display cases and in the kiosk, to this part of the collection arranged in the two main sections, *Roman coins and medallions* and *Coins, oselle and medals of Venice*.

Alongside his comprehensive collections of ancient Roman and republican Venetian coins, Simoneschi acquired pieces produced by the principal mints of antiquity located around the Mediterranean and those active between the Middle Ages and the modern era on the Italian peninsula. An ample selection has been chosen to illustrate the variety and aesthetic range of the coin maker's art and the eloquent testimony they can provide on the history and culture of Europe. They are organized in other two sections: *Coins of the Mediterranean in Antiquity* and *Italian coins, medieval to modern*.

In order to give the public the opportunity to view as much of this collection as possible, alongside the permanent display, rotating temporary exhibits have been arranged, for both the exposition and the kiosk, beginning with *Animals on coins, from the real to the fantastical*.

All the coins illustrated within the kiosk (40 specimens, divided into four thematic and chronological permanent sections, plus one for temporary exhibitions) have been selected for some particularities either of the type (iconography and legends) or of the blanks (type of minting, trace of use) and, more in general, for their historical background, so they can be better illustrated and explained.

The RTI Processing

The first step of the project was the acquisition and the generation of the RTI images of the selected coins of the Simoneschi collection.

The digitalization has been done with a dome of lights (Figure 1). The dome is composed by four aluminium shells that can easily assembled and disassembled to simplify the transport. It has 116 cold white LEDs (6 Watt, 750 lumen) and an overhead high-resolution reflex camera (Nikon D5200, 24Mpixel). The dome is computer controlled to allow a completely automatic acquisition by synchronizing the switching on of each LED with the shutter of the camera. For each coin, the acquisition takes about 10 minutes, required to shot and store 232 photos (116 photos for each side). The coins were digitalized in two days inside the museum.

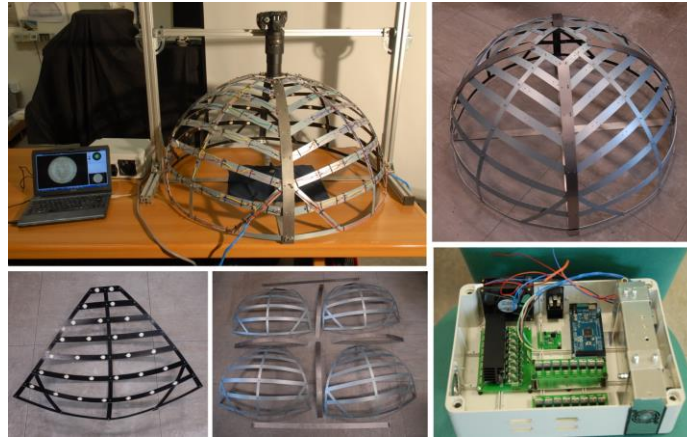


Figure 1. Dome used for the RTI acquisition

The acquired photos have been processed in two steps to create the final RTI images. We generated an RTI images for each coin side using the Hemispherical Harmonics (HSH) format, which guarantees a better reproduction of material with specular reflection like gold and silver. We used the tools provided by Cultural Heritage Imaging Corporation [1]. Then the RTI images have been used to generate a multiresolution Web format that permits an efficient and asynchronous loading of the image. In the specific, it subdivides the RTI image in nine layers, one layer for each HSH coefficient (Figure 2), where the i -th layer contains the i -th coefficient of the three RGB colour channels. Then for each layer it creates a multiresolution quad-tree and produces a tile for each node of the tree (Figure 3). Finally, it saves each tile in a different JPG image. With this format to visualize a specific pixel, we need to load the nine JPG images that contain its HSH coefficients. The main advantage is the out-of-core loading of the node of the quad-tree making immediately available the interaction with the coin without awaiting the complete loading of the data. This means that at the beginning the user interacts with a low-resolution version of the coin, which is progressively refined as soon as the higher resolution data are loaded. The loading of the tiles at the different resolutions is guided by the zoom and pan operation of the user. The generation of the RTI images took about 7 hours of automatic processing.



Figure 2. Hemispherical Harmonics layer decomposition

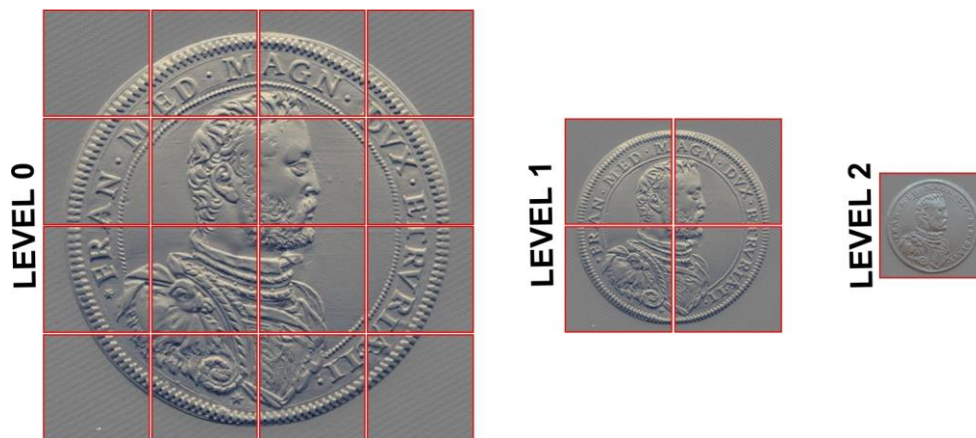


Figure 3. Multiresolution quad-tree encoding

The kiosk

The main features of the developed system are the possibility to organize the coin in several subset and the virtual inspection of each coin by RTI manipulation. For this purpose, the kiosk is composed by two parts: a presentation section of the collection and the interactive viewer of RTI images. It was developed in HTML5, using the HTML and JavaScript languages for the general structure and WebGL [2] for the RTI visualization, and it was designed to be deployed either by a museum kiosk or by a Web site.

The first part contains a general presentation of the project and the organization of the coins into different subsets, using historical and thematic criteria, to provide a better and easy presentation of the coins to the public. All the content is store in XML files that are loaded via JavaScript in the HTML template of the kiosk, making the system completely customizable.

Starting from the first page, the user can enter in the kiosk, read the credits or see a video that shows the main features of the interactive system (Figure 4, top-left). Inside the kiosk, the use can access several information accessible with the menu on the left (Figure 4, top-right). From the top, there are: the presentation of the project; the presentation of the figure of Ottavio Simoneschi; the access to the four historical subsets of coins and to the temporary exhibitions of the coins with a specific theme; finally the possibility to explore all the coins in the kiosk directly in the RTI viewer. For each section, the content is distributed in several pages that the user can browse. Furthermore, for each coin subset the

user can navigate its coins, organized in the scrollable bar on the left (Figure 4, bottom-right). By clicking on a coin in this bar, the user can open the visualization of the relative RTI image.

The interactive viewer shows the RTI image in the middle and a description of the coin on the left (Figure 5). This description contains several info among which the name, the issue date, the metal, the weight, the size, the number of the place of the coin in the showcase of the exhibition and a general description of the two sides. The viewer allows the virtual manipulation of the image using the toolbar in the bottom. The user can change the direction of light in real time (Figure 6, top), to navigate on the coin with basic operations like pan and zoom, to flip the coin to interact with the reverse, to enable the visualization of the hotspot to explore small areas of interest on the surface of the coin. By clicking on an hot-spot, the user displays the multimedia data associated to it which provide additional information about the most interesting and important technical, historical and artistic features of the coin (Figure 6, bottom-right). The visualization of the hot-spot's content is preceded by an automatic zoom animation to better highlight the detail associated to it. The user can also read a glossary definition for the technical term used in the text by clicking on the relative word (Figure 6, bottom-left).

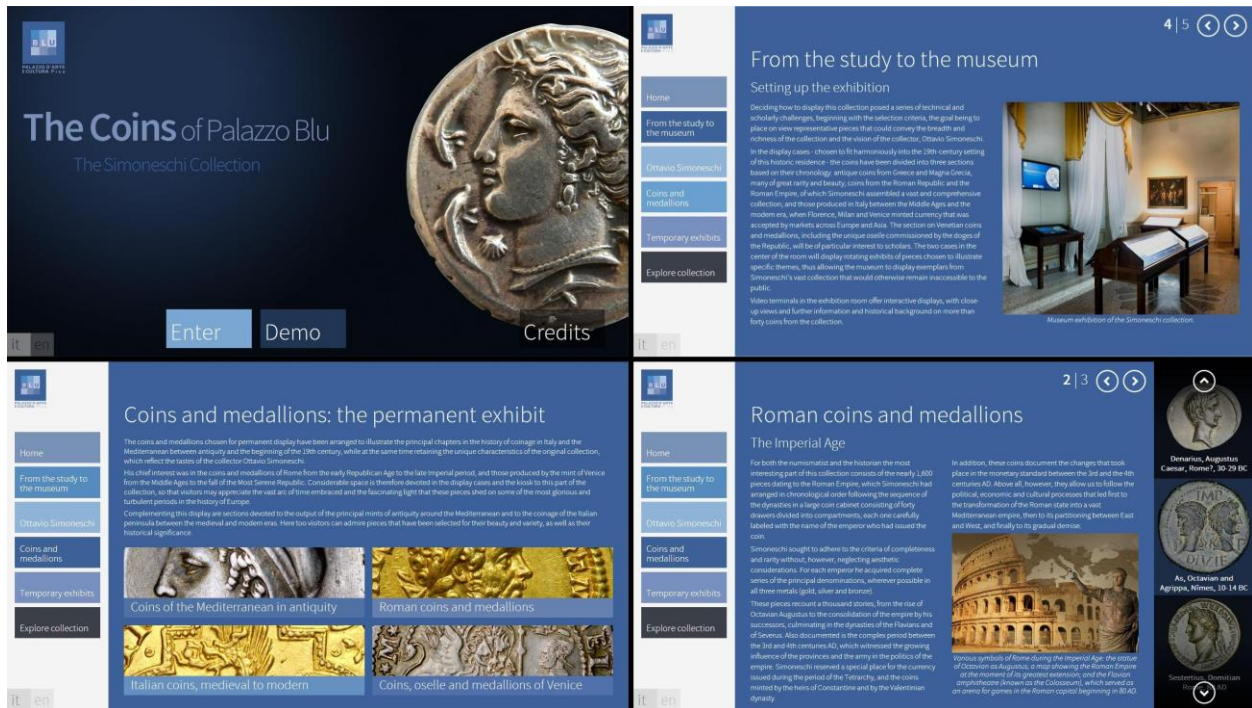


Figure 4. Presentation section of the kiosk

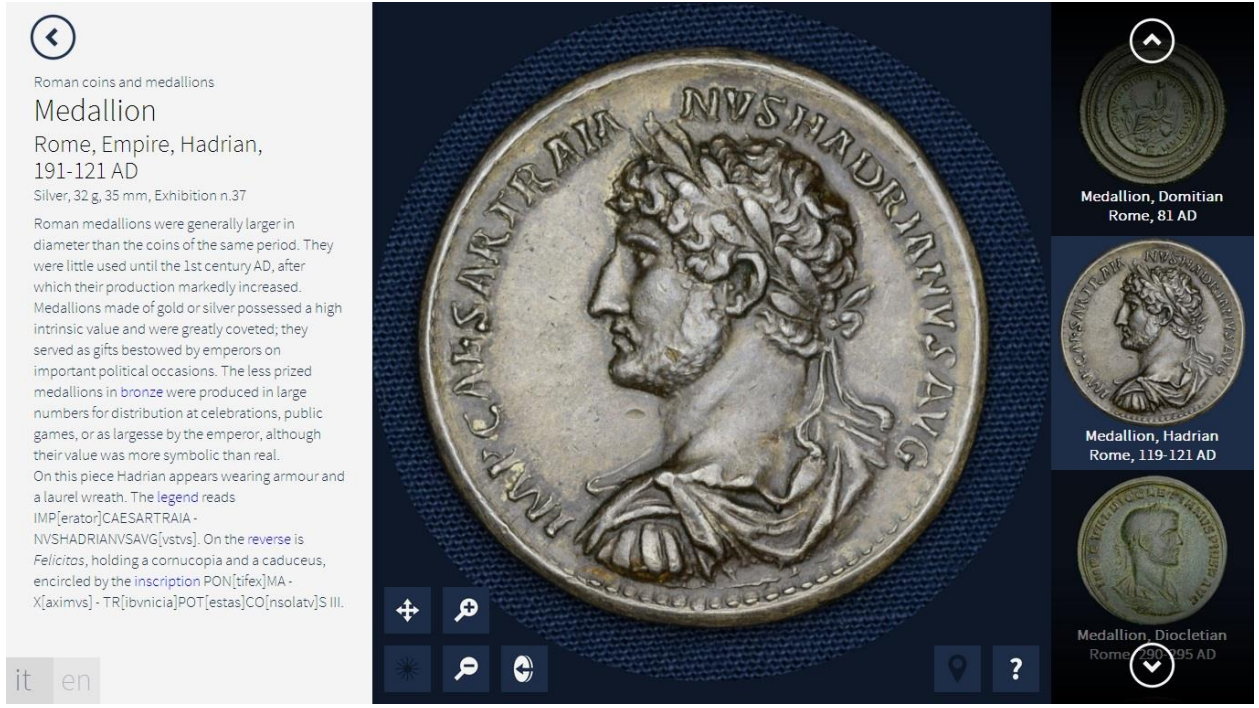


Figure 5. RTI interactive viewer

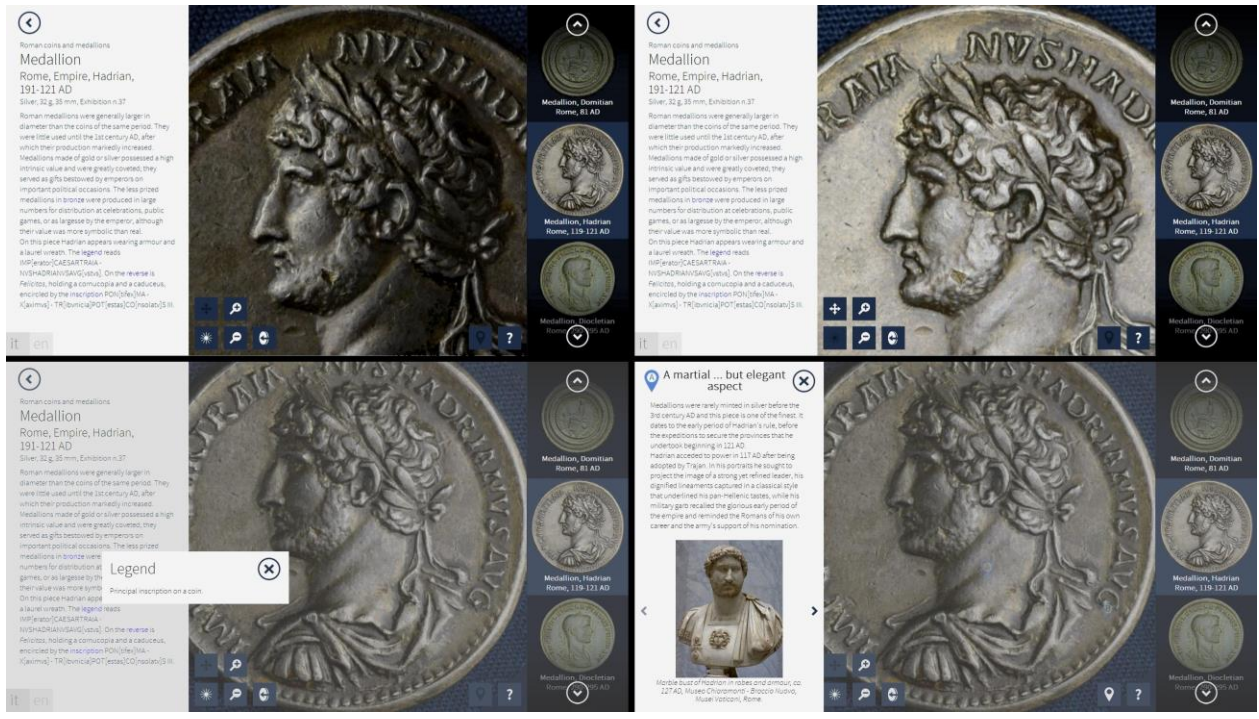


Figure 6. RTI interactive viewer details

Conclusion

We have presented a new interactive system to present at the public the Simoneschi's coin collection of the Museum Palazzo Blu in Pisa using multimedia data and RTI images. The kiosk is designed to be easy

and intuitive to use for the ordinary public of the museum and to transfer a part of the knowledge of the coins using multimedia data, with a combination of text, images and videos. The interaction is complete by the RTI manipulation of each coin, where the user can take advantage from the possibility to change the light direction in real-time in order to appreciate all the most interesting details depicted on the engrave decoration. The interactive kiosk is installed in the permanent exhibition of the museum, inside the room of the Simoneschi's Collection. The installation setup is composed by a 27-inch multi-touch screen, used for the user input and visualization, paired by a bigger screen set on the top that shows the same content of the touch screen, allowing a clean vision for the other visitors that do not interact directly with the kiosk. The kiosk is also available on the Web (<http://vcg.isti.cnr.it/PalazzoBlu/>).

Acknowledgement

The kiosk was commissioned and funded by the Fondazione Palazzo Blu. The research work for the Web viewer of RTI images was partly funded by the EU Community FP7 ICT under the V-MUST.net project (Grant Agreement 270404).

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