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A. Bucciero, B. Fanini, H. Graf, S. Pescarin, and S. Rizvic (Editors)

Poster

Prototyping Care: Two Case Studies

A. Clay[1], G. Trumpy[2], M. Weinmann[3] and R. Wetzel[1]

[1]Lucerne University of Applied Sciences and Arts, Switzerland - [2]Norwegian University of Science and Technology, Norway
[3] Delft University of Technology, the Netherlands

1. Introduction

To enable a richer presentation of cultural heritage and its needs, a shift in how artworks are exhibited is necessary. This paper explores two case studies that highlight the significant role of reproductions in showcasing restoration processes and associated technologies. This approach raises awareness about concepts of care and authenticity and their impact. It goes beyond merely displaying restored digital images that fail to capture the true state of the artworks or the artist's original intent. To achieve this, we propose employing glass layers or lenticular print technology, allowing a restored version of the artwork's original state while maintaining the ability to view the original artwork and restoration process separately.

The proposed overlay structure consists of three layers: The Current Image Plate, which consists of a high-resolution digital print of the case study in its present condition. The Compensation Plate, providing reconstruction data for missing areas or color corrections, is then placed over the Current Image Plate to complete the restoration. The Target Image Plate is, in actuality, a clear glass plate prepared with varnish so that viewing the combination is like viewing an original Autochrome. Since a layering scenario is inherent in the Autochromes, it seemed natural to utilize the concept of layered transparency and apply that knowledge to restore damaged visual artwork. In the following, we discuss the application of this concept to two respective case studies.

2. Case Study 1: Autochromes

The Autochrome Lumière was an early color photography process patented in 1903 by the Lumière brothers in France and first marketed in 1907. Autochrome was an additive color "mosaic screen plate" process and was recognized for its aesthetic appeal. It was one of the principal color photography processes in use in the early twentieth century before the advent of subtractive color film in the mid-1930s [Pé13]. The image held by an Autochrome plate is made up of two main overlapping elements: a uniform color mosaic pattern and a silver-based emulsion containing the photographic image. Dye fading takes place over time and is a typical type of degradation affecting Autochrome plates [LGC*13].

The virtual restoration approach adopts spectral imaging techniques [BHJ*23,CCS*23] to separate the information corresponding to the two overlapping elements of the Autochrome plates (Figure 1). Once the optical properties of the color dyes have been separated from the photographic image, their original concentration can be selectively restored before being recombined. The virtual restoration can be presented in a tactile experience with a set of layers representing the photographic image and the color dyes, where the latter can be replaced from one representing the current state to one representing the restored version.

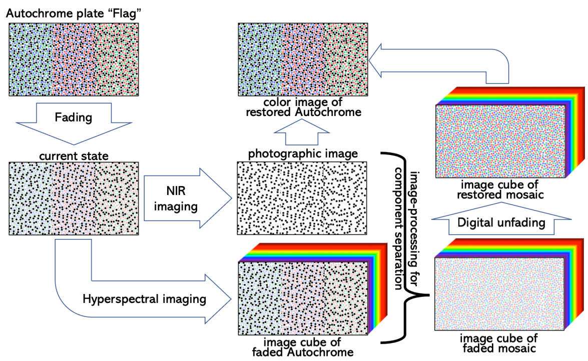

Figure 1: *Illustration of the imaging techniques used to obtain the layers for the proposed presentation of the digital restoration of faded Autochromes.*

While dye fading is the most typical form of damage with Autochromes there are several other types of damage which can occur such as cracking of the plates, greening, tanning, silver mirroring, spotting, and missing emulsion. Although in our case study we have shown the use of a compensation plate to solve the problem of dye fading, it is also possible to add additional compensation plates addressing the other forms of damage.

3. Case Study 2: Mosaic

The second case study is focused on the restoration of the Alexander Mosaic in the MANN museum in Naples, which is based on a Hellenistic painting of the late fourth century BC attributed to Philoxenus of Eretria. The current state of this mosaic is partially lacking the tesserae layer (Tessellatum lacunae) as shown in the current plate in Figure 2. In order to reconstruct the parts of the

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mosaic that are missing, a reference source with content related to the Mosaic becomes necessary, so that it can be used to make an authentic restoration.

Whereas an original Hellenistic painting as a reference to recreate the missing parts in the mosaic would be the most viable approach for creating an authentic reconstruction, the painting (if it ever existed) has not survived. However, a replication of the mosaic from 1831 has survived, which offers a convincing interpretation of the content for the missing areas of the mosaic [Kru] (denoted as source image in the following).

A restored reproduction would therefore consist of an overlay structure based on the three glass plates given by (1) the Current Image Plate, which displays a high-resolution image of the mosaic in its present condition, (2) the Compensation Plate, which showcases a high-resolution image of the recreation of those parts of the mosaic that are present in the painting but missing in the mosaic, and (3) the Target Image Plate, which is not a printed layer but a clear glass sheet that tempers the light, allowing the viewer to see the results of combining the two other layers without glare or reflection.

During the generation of the compensation plate, the primary challenge revolves around the accurate identification of deterioration, specifically the detection of regions with missing tesserae layers. Furthermore, it entails the retrieval of essential information required for the restoration of the respective parts from alternative sources. Additionally, a significant aspect involves replicating the artistic style in adherence to the original manufacturing process, which encompasses utilizing appropriate tile shapes and colors. To approach this task, we propose an approach (see Figure 2) that involves (1) the alignment of the Current Image Plate and the source image based on image registration techniques [MJF*21], (2) the segmentation of regions with lost tesserae layer based on manual annotations, (3) the transfer of the annotation map to the source image and computation of respective mosaic regions for these areas based on mosaic simulation techniques [AS13, KS22] to get the compenstation plate, and (4) the final compensation of the deterioration effect in the Target Image Plate by combining the information from the Current Image Plate and the Compensation Plate.

4. Presentation

There are two possible forms of presentation of our three-plate-restoration process: glass panes and lenticular print. For the presentation of the mosaic on *glass planes*, each of the layers is printed onto 5mm acrylic glass and then placed into a sliding frame. Using this presentation form, visitors can slide each of the layers from the left or right to reveal the condition of the mosaic at the present time, what had to be added on to the compensation layer to complete the mosaic, and how the reconstructed mosaic looks after all layers have been combined. In contrast to the sliding glass planes scenario, the *lenticular print* method of presentation makes it possible to use just single piece of 5mm acrylic glass to show all the layers of the reconstruction of the mosaic., because the diverse layers are printed onto the acrylic glass sheet all together with each layer having a unique angle of viewing. So, to view a particular layer, the viewer must locate the correct angle to view the layer of interest: -45 degrees, 0 degrees, +45 degrees (see Figure 3).

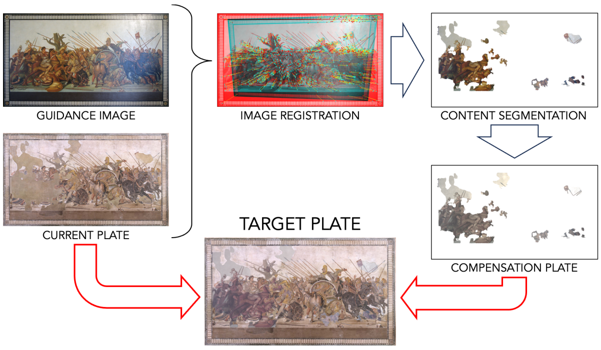

Figure 2: *Digital reconstruction of missing tesserae of the Battle of Issus (c. 100 B.C.) located at the National Museum of Archaeology in Naples, based on a picture painted in the years immediately after the discovery of the mosaic.*

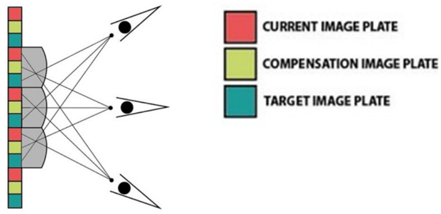

Figure 3: *The distribution of the layers of the replication on a lenticular print*

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