

Preliminary results obtained by multi-spectral imaging (MSI) on a sheet with dedication and drawing by Giorgio de Chirico

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Abstract

The sheet with a drawing and a dedication by famous painter Giorgio de Chirico that is the object of the present research was subjected to a series of investigations that included the use of the multi spectral imaging (MSI) as well as a series of measurements with a grazing light microscope. Thanks to the obtained results it was possible to prove that the dedication and the drawing were made at the same time.

I. INTRODUCTION

The subject of the present study is a signed dedication sheet and a drawing by Giorgio De Chirico. This sheet, belonging to a book by Giorgio De Chirico, was sold at auction, and on that occasion someone claimed that the drawing was not authentic but had been added later. The question was posed by Prof. Paolo Baldacci, president of the "Archivio dell'Arte Metafisica" and expert on Giorgio de Chirico's works [1].

The top left-hand corner of the sheet bears a dedication and in the lower part a drawing depicting two horses on the seashore with a small temple in the background, signed "G. de Chirico" in the lower right-hand corner.

The sheet with dedication and drawing appears to have been detached from the 1929 "folio" edition (288 copies) of Giorgio de Chirico's novel "Hebdomeros" belonging to the Belgian writer René Gaffé and put up for sale at an auction in Paris in 1956.

On December 1996, forty years later, de Chirico's letter to René Gaffé and the drawing with the dedication, separated from the book and framed, reappeared at an auction in Paris in the same sale.

The Giorgio and Isa de Chirico Foundation in Rome (disregarding the fact that in the book sold in 1956, in addition to the dedication, there was also a drawing) claimed and maintains that the dedication is authentic and that the drawing would have been added to the sheet at a recent date (without specifying when).

It was therefore decided to carry out diagnostic investigations on the dedication and the drawing to see if they were coeval. Thanks to a multi-spectral imaging (MSI) approach and through USB microscope observations using polarized light, it was possible to prove that the dedication and the drawing were made at the same time and that the drawing was definitely not added at a later stage.

II. EXPERIMENTAL

The drawing was made on paper with the watermark 'Pannekoek Holland' measuring 192 x 175 mm.

The top left-hand corner of the sheet bears the dedication "à René Gaffé / très cordialement / G. de Chirico / Brussels 19 - 12 - 31", and in the lower part a drawing depicting two horses by the sea with a small temple in the background, signed "G. de Chirico" (see Fig. 1).



Fig. 1. The sheet with drawing and dedication by Giorgio de Chirico (1929)

Multispectral imaging measurements were carried out using a multispectral camera with a 28 megapixels APS-C BSI sensor 28mm 1:2.8 lens and a set of sources and high-pass or low-pass filters as follows:

- 365nm LED UV source for UV Fluorescence and UV Reflection;
- 440nm Blue LED source for Blue induced Fluorescence;
- Visible/IR source with Tungsten filament for IR Reflectography;
- Red source for Visible Induced Luminescence;
- No UV no IR "hot mirror" filter for Visible and UV-induced Fluorescence;
- High-pass filter 950 nm for IR reflectography;
- UV Band Pass Filter for UV Reflection

Furthermore, a USB microscope with a 5 Mpixels sensor and includable/excludable polarising filter was utilised. Finally, Visible/IR source with Tungsten filament was used for grazing light imaging.

III. RESULTS

It is known that the artist Giorgio De Chirico has always posed numerous problems for art historians, not only because he has been one of the most falsified painters since the early 1940s, but also because he has disregarded numerous works, especially of metaphysical subjects, executed by him in the 1910s, 1930s and 1940s [2].

Having to decide which analytical techniques to use in order to highlight any differences between the dedication and the drawing, we turned to multispectral analysis because some preliminary analysis performed by XRF (X-ray fluorescence analysis) did not reveal any differences between the paper and the graphite-covered areas, the graphite line being too faint.

Multispectral imaging (MSI) and hyperspectral imaging are powerful tools in art analysis [3-6]. They are very simple, low-cost techniques that do not require special skills to be understood even by non-specialist audiences. In some specific cases this kind of techniques turned out to be very powerful methods in order to disclose the chemical nature of pigments. For example VIL, photo-induced luminescence methods, among which there is the visible-induced infrared luminescence, is able to play a key role in identifying old materials that are luminescent [7]. The VIL technique, in particular, can be used to detect Egyptian blue since this pigment, if enlightened with visible light, has a peculiar and particularly intense luminescence emission in the near infrared region. Multispectral imaging is a non-invasive imaging technique in which images are captured of an object illuminated using ultraviolet, visible and infrared light, allowing the identification of features that are imperceptible to the naked eye [8]. The technique allows also to obtain other kinds of images such as false colour images [9].

In the present study in order to establish whether the dedication and the drawing (see Fig. 1) present on the examined sheet were coeval, a series of images in different spectral ranges were acquired by means of the experimental set up previously described.

By varying the illumination source and placing a series of filters on the camera lens, different types of images were acquired. From the comparison of the different portions examined on the dedication with the artist sign and on the drawing, no differences have been highlighted and nothing has emerged to suggest that the drawing and dedication were not made at the same time. In particular in Fig. 2 as an example it is shown the photography acquired using a blue source and measuring visible fluorescence. Shown on the right side of the image are some pigments used as references. Fig. 3 shows an enlargement of Fig. 2, in the area of the dedication, in which parallel lines can be clearly seen: these lines correspond to the marks left by the wire rods i.e., the metal wires, usually made of brass, that were attached along the longer side of the loom used for the handmade papermaking process.

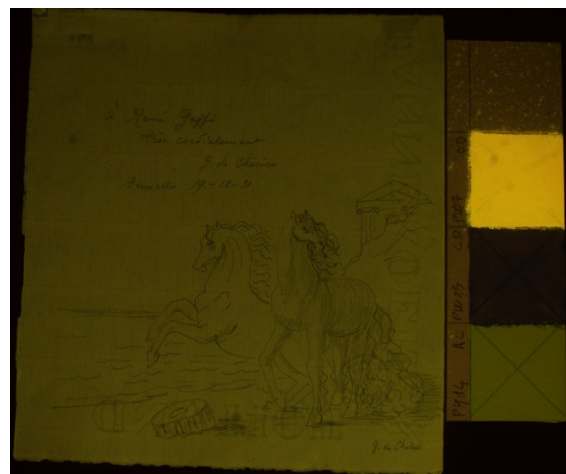


Fig. 2. Visible fluorescence image induced by Blue source (440 nm)

In Fig. 4 the reflectography image is reported while in Fig. 5 UV reflection is shown. Again, no significant differences are observed in the different areas of the design that would suggest later interventions.

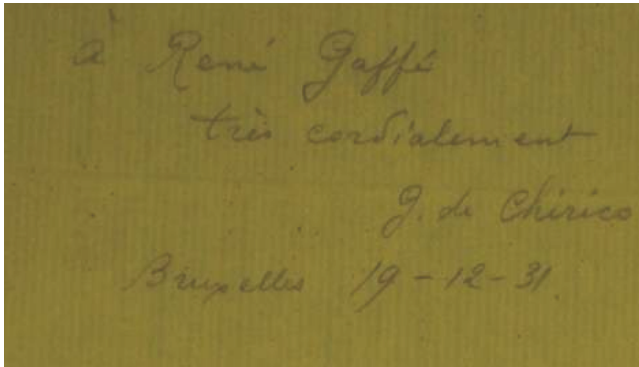


Fig. 3. Visible fluorescence image induced by Blue source (440 nm)

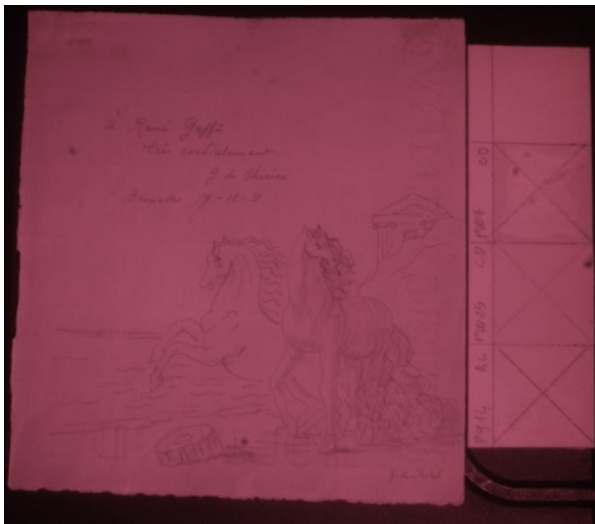


Fig. 4. IR reflectography from 930 to 1000 nm



Fig. 5. UV reflection

A further investigation can be carried out by using a USB microscope equipped with a polarizer. In this way it was possible to acquire:

- images in which only the diffuse reflection component is visible (obtained by inserting the polariser which reduces the specular component).
- images in which the specular component prevails (obtained without polarisation of the incident radiation).
- images in grazing light.

A detail of the sheet acquired in grazing light is shown in Fig. 6.

An interesting phenomenon that has been observed is that of paper foxing which consists in the appearance of stains attributable to iron oxide. This allowed further observations to be made on the contemporaneity of the dedication and the drawing.

The phenomenon of paper foxing is not yet well known. A first hypothesis is that this phenomenon is due to the action of some microorganisms while according to others the stains are formed due to the oxidation of some iron impurities that are present in the paper.

In Fig. 7 the same detail is shown with and without light polarization. The red spots due to foxing are visible in Fig. 6 and Fig. 7.

In both the images reported in Fig. 7, showing only the diffuse component (on the top) and both the specular and the diffuse component (on the bottom), it is very well observable that the graphite drawing is placed above the spots due to paper foxing. The same kind of observations were made on a detail of the horse's head.



Fig. 6 Grazing light image of a detail of the dedication

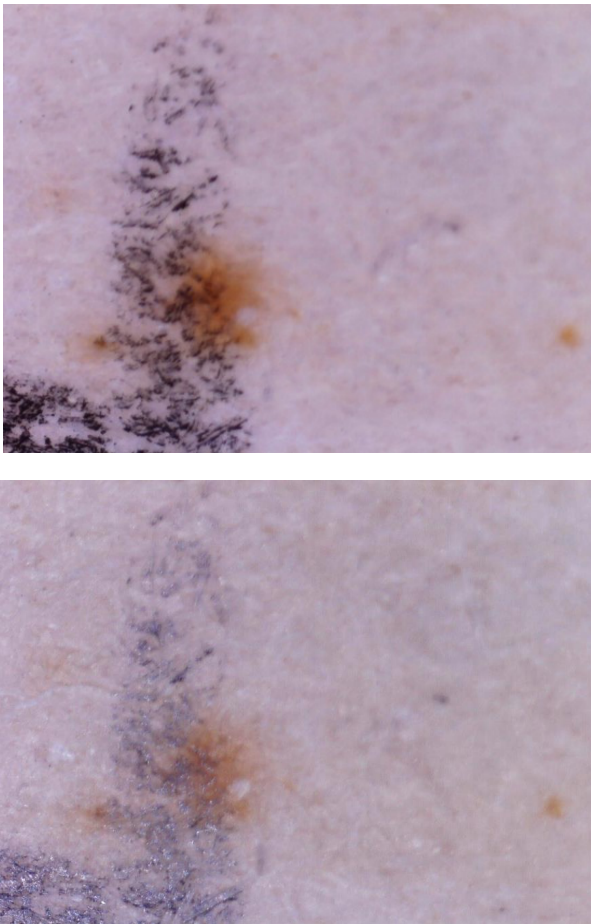


Fig. 7 A detail of the dedication with light polarization and without polarization (top and bottom images respectively)

In summary, on the basis of all the investigations carried out (both by means of multi-spectral analysis and a by a microscope equipped with a polariser), no differences were observed between the various areas of the drawing and their dedication. The graphite line appears in each of the points observed above the stains present on the paper that were thus formed before the dedication and drawing were applied. These results, together with what highlighted by MSI investigation have made it possible to observe that there is no evidence to suggest that the signed dedication and the drawing were not made at the same time.

It is worth noting that in the present study a powerful and low cost technique such as MSI has been successfully applied. MSI nowadays is increasingly being applied to cultural heritage objects even if there is a lack of documentation regarding what this process actually entails [8].

IV. CONCLUSIONS

In the field of heritage preservation, multi-spectral imaging (MSI) analysis is a suitable technique due to its non-destructive nature and its versatility. It combines imaging in different spectral ranges allowing to acquire valuable information by means of a low cost system. This technique, based on the use of digital cameras to capture images of the object with wavelength selection provided by narrowband sources and camera filters, is becoming increasingly powerful for the study of cultural artifacts such as manuscripts, documents and paintings. MSI could become increasingly a valuable system to carry out investigation on works of arts for curators, conservators and collection managers.

Notwithstanding there are several applications of the MSI technique, to date there are few papers published in the scientific literature on this topic.

In the specific case study, thanks to multi-spectral imaging and through a USB microscope, some analyses were carried out on the dedication and the drawing present on a sheet signed by Giorgio de Chirico. It was possible to prove that the dedication and the drawing were made at the same time and that the drawing was definitely not added at a later stage.

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