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Portraits of Leonardo da Vinci - by Amelia Carolina Sparavigna

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A special event at the Reggia di Venaria, Torino, is the exhibition "Leonardo, the Genius the Myth", from November 2011 to January 2012 [1]. The famous self-portrait in red chalk (**Figure 1**) will be on display along with works by other artists inspired over the centuries by the Leonardo's genius. The original Leonardo's drawings can be admired in a special shrine designed by Dante Ferretti, two times awarded by the Academy for Best Art Direction. Besides the famous self-portrait, the visitors can see the Codex on the Flight of Birds, opened at the pages where, according to Carlo Pedretti, an Italian historian expert on the life and works of Leonardo, there is a self-portrait of the genius, made when he was young [2,3]. The Codex on the Flight of Birds, as the self-portrait in red chalk, is usually held at the Biblioteca Reale of Turin. The Codex is a relatively small note-book, dated approximately 1505. Since Leonardo recycled the paper for its note-book, the portrait is older for sure.

The up-left panel of **Figure 2** shows the drawing in the Leonardo's note-book. We can see what looks like a portrait partially hidden by Leonardo himself, who wrote on it. This drawing remained unappreciated for 500 years before being noticed by Piero Angela, an Italian scientific journalist. On Saturday February 27, 2009, during a prime-time entertainment show of the RAI broadcaster on history and science [4], Angela explained how he noticed it. The journalist said that when he was observing a copy of the Codex on the Flight, he saw what looked like a nose underneath the text. The fact that the drawing was made by a left-hand artist, as the directions of the sketching lines indicate, reinforced the supposition of a self-portrait of the artist. Comparing this drawing with the Leonardo self-portrait in red chalk, Angela said that the two men were looking like brothers.

As previously told, a well-known researcher on Leonardo works, Carlo Pedretti, agrees in considering the image as a self-portrait. In 1975, Pedretti proposed a "photographic restoration" of this drawing [2]. By removing the handwritten words with a negative-positive procedure on a photographic plate, he obtained a quite interesting result. However, it is just in 2009 that the portrait becomes popular because of its "digital restoration" proposed by Piero Angela. The digital restoration was obtained by enhancing the red-chalk sketch on a high resolution digital image. The graphic designers gradually cancelled the text revealing the drawing beneath: after months of micro-pixel work, the portrait of a young Renaissance man appeared (see the result at the site [5]). As I discussed in [6,7], this was a very important discovery, demonstrating that the image processing is a fundamental tool for a new kind of restoration, not made on the document itself but on its digital image.

In Reference 6, I have proposed a simple approach to the restoration of the portrait in the Codex of Flight. This approach is based on the interpolation over nearest neighbouring pixels. Let me shortly repeat what was the procedure (for more details, see [6]). Each pixel of a colour digital image can have red, green and blue tones (RGB) with numerical values ranging from 0 to 255. Because the portrait is in red-chalk and the writing almost black, we can choose a threshold value to remove the darkest pixels and replace them with white pixels. The new image is shown in Figure 2, up-right panel. We can work further on it by means of an algorithm that replaces the white pixels with pixels having a colour tone, given by an averaged value of neighbouring pixels. After applying this algorithm we have the image in Figure 2, down-left panel [6]. A further processing of this image by means of a wavelet filtering program, Iris [8,9], gives us the image in the down-right panel. This is the portrait of a young man that we can try to compare with the self-portrait in red chalk (Fig.1). To this purpose, we use another freely available image processing tool, the GIMP [10]. It allows the merging of images on several layers, each having its proper transparency level. With GIMP we superimpose the two portraits, Figures 1 and 2, and we have the final result in Figure 3. From the superposition, we see that the two faces are quite

coincident: in particular, the relative distances of eyes, nose and mouth are the same.

After the image processing, we have a portrait, that of **Figure 3**, where Leonardo looks younger than in the self-portrait of Figure 1. Is this a faithful portrait of Leonardo? That is, have we the possibility to compare it with the true appearance of the middle-aged Leonardo? The answer is positive, because there is a painting, the "School of Athens" by Raphael, where the Italian Renaissance artist depicted Leonardo da Vinci as the philosopher Plato. The "Scuola di Atene", one of the most famous paintings by Raphael, was created between 1510 and 1511. This fresco decorates the wall of one of the rooms, the "Stanza della Segnatura", in the Apostolic Palaces of Vatican. The great Greek philosophers are represented inside a classic architecture. At the central position of this masterpiece, we see two philosophers, Plato on the left and Aristotle, his student, on the right. Plato is shown as a wise-looking man (see Figure 4). It is usually accepted that Raphael based the Plato's face on the features of Leonardo da Vinci [11]. The two artists probably had established a direct interaction when Raphael spent a period of his life in Florence, perhaps from about 1504 to 1508 [12-14]. Leonardo da Vinci returned to Florence from 1500 to 1506: therefore, if the image of Plato is a portrait of Leonardo, this means that Raphael depicted him when Leonardo was 52 or 54 year old.

Let us then compare the portrait in Figure 3, which we obtained using the image processing of the two Leonardo's self-portraits, with the Raphael's portrait (**Figure 4**), that is, the image of Plato. **Figure 5** shows them side by side. Before discussing the comparison, let me remark that we are looking at two images obtained from originals created by artists who used different techniques and a different rendering of the head position. Moreover, there is another fact, which is in my opinion quite important, that the two portraits are showing a distinct side of the face. And we know very well that the two sides are not equal and that the existing small differences create the "good" and "bad" side of our faces [16]. Let us remember that for all the living creatures, the bilateral symmetry [17] of the body is an approximate symmetry: the two halves, left and right, of the body and then of the face, are not perfectly symmetrical. The symmetry of human faces is a subject of several studies. Some researchers are supporting the idea that more symmetry means more beauty and freedom from diseases [18-20]. On the other hand, a face, which is too symmetric, gives the impression of being unnatural [21].

The fact that the two sides are different is quite relevant if we are comparing a self-portrait with a portrait, because we must be sure to compare the same side of the face. For the explanation, let me use **Figure 6**. Let us consider two canvasses, having on them a self-portrait and a portrait, with the head depicted in the same position, the two paintings are showing a different side of the face. When the artist is depicting a self-portrait, he is looking at the face in a mirror. When it is another artist depicting the portrait, he is looking at the face directly. For this reason, if the face on the canvas has the same position, the depicted sides turn out to be different. Therefore, if the left image of Figure 5 is a self-portrait and the right image is a portrait, it is necessary to reflect one of them, to point out that we are seeing different sides. I decided to change the Raphael's image with a reflection. Moreover, I made a small rotation of it and converted the colours in grey tones, to avoid the vision of different hues. **Figure 7** gives the result. Is the figure showing the same person? I guess that there is this possibility, but further studies are necessary. Let me then avoid a direct answer and just write some conclusions.

Using the image processing we had compared portraits having quite different origins. This is telling that several processing tools, some of them freely available, can help in the study of history, archaeology and arts. For what concerns the specific case, it seems from Figure 7, that the structure of the two faces, in particular of nose and cheekbones, is quite similar. We can also see that one of the eyes is a little bit larger in both images. According on the previous discussion on portrait and self-portrait (Figure 6), I tend to consider the Raphael's Plato based on a direct interaction between Raphael and Leonardo, when Raphael was in Florence, and then on a previous portrait or drawing that Raphael made of Leonardo.

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11. Raffaello, presentato da Mchele Prisco, Milano, Rizzoli Editore, 1966.

12. Cecil Gould, The Sixteenth Century Italian Schools, National Gallery Catalogues, London 1975.

13. Raphael, <http://en.wikipedia.org/wiki/Raphael>,

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15. It is thought that Leonardo drew the self-portrait in red chalk at the age of 58 or 60. The Wikipedia page, Cultural depictions of Leonardo da Vinci, tells that this well-known drawing is not universally accepted as a self-portrait, because the depicted face appears to be quite old, suggesting that Leonardo represented his father or grandfather. Another possibility is that Leonardo altered himself, in order that Raphael might use it for his Plato. However, Plato does not look so old in the painting by Raphael.

16. I have read on the Glamour Magazine about a simple experiment by P. Gugliemetti, Do You Have A Good Side And Bad Side Of Your Face?, 11-13-2008. The author writes "At a party over the summer, I mentioned to someone how I have a good side and bad side, and she thought I was just being dramatic. So I had her take a photo of each side and we showed the shots to random people in the room, asking them to vote on which side was my prettier one. Every single person voted right! Then we tried this on other people, lining them up one-by-one against a white wall, shooting their sides, and having people vote. Only a couple had equally attractive sides."

17. Bilateral symmetry of a body means that there exists a plane which is dividing the body into two mirror image halves. An operation of reflection shows that the two halves coincide.

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