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ANTHROPOLOGICAL ANALYSIS OF LEONARDO DA VINCI'S FINGERPRINTS

ABSTRACT: Leonardo's writings, drawings and paintings contain many fingerprints representing the only biological traces of the genius, and of the world surrounding him. These fingerprints were produced by ink, by biological fluids (saliva, blood), and possibly food (oil, fats?). The topographic distributions or the completeness of the prints show the manual ability of the genius, and the presence of some sort of disturbance (joint or neuro-muscular disease) having occurred during the last part of his life. The authors reconstruct the left thumb print released on manuscripts and its perfect correspondence to the print on the examined canvases.

KEY WORDS: Fingerprints – Biological traces – Renaissance masters

INTRODUCTION

We are only familiar with a small part of Leonardo da Vinci's life work: most of his papers (presumably 12–15,000 sheets) were scattered and lost after his death (about 7,000 pages remain, written on almost 4,000 sheets), all of the devices he built (including the famous flying-machines and theatrical equipment) rapidly vanished, and we have relatively few examples of his pictures and frescoes. Even so, what has survived of his scientific and artistic work shows that he was one of the greatest geniuses of all times. He developed the concepts behind some devices centuries before they were built, for example helicopters and tanks, and specialists are still discussing the true nature and possible uses of some of the more mysterious machines he imagined; the scientific and artistic interpretation of his lifework will probably never be completed. But what do we know about the biology of this extraordinary man? We have largely incomplete biographic information, and few biological or anthropological data. Indeed, the many fingerprints he left on his papers and paintings are among the only biological traces of the man (Vezzosi 1977: 123).

Fingerprints on Leonardo's paintings are the natural consequence of his pictorial technique: he used both his

brush and his fingertips to apply glazings and shadings of colour. On his papers, he left his fingerprints in various ways. First of all, in many cases he tried to remove inkblots with a fingertip, and in doing so instead left fingerprints on the paper (*Figures 1a* and *1b*). In other cases the colour of the fingerprint is quite different from the colour of the ink; in these cases substances present on his fingertips produced the fingerprints when he was handling the papers (*Figure 2a*). In some of these cases the substances on his fingertips penetrated the paper rapidly, probably because of their high viscosity (oils, fats?), producing spot enlargements on the curved lines that make up the fingerprints (*Figures 2b* and *2c*). We have no information on the chemical nature or the true origins of these substances, but suspect that they derive from organic liquids (saliva, sweat, and blood), and from foods Leonardo handled before or while working on the papers. One of us has developed an official scientific program to analyse the qualitative aspects of Leonardo's fingerprints through non-destructive spectrometry, though obtaining the necessary permissions has been a lengthy process. The program has shown that Leonardo's writings and drawings registered not only his ideas and observations, but also information about the world surrounding him.

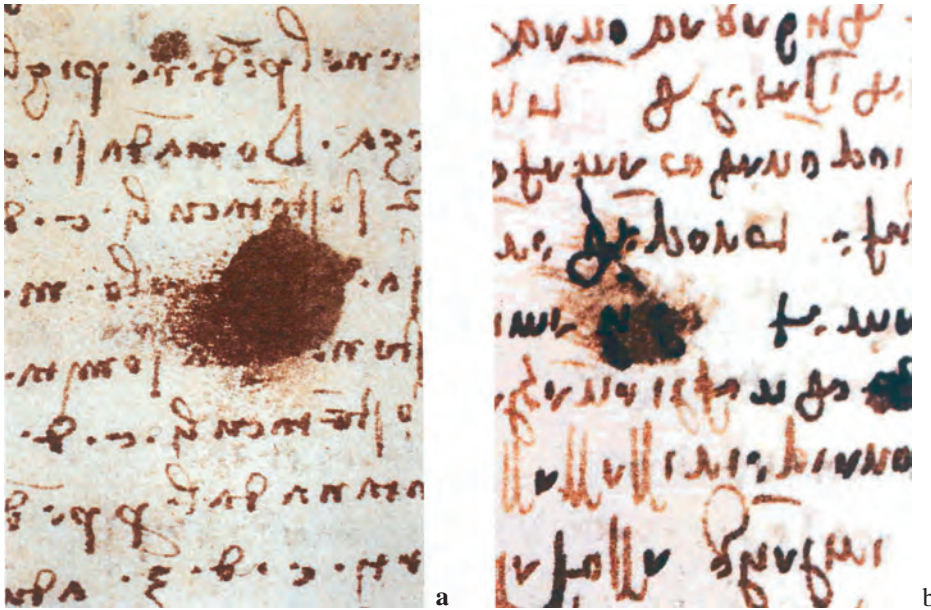


FIGURE 1. Fingerprints of Leonardo da Vinci produced by his attempt to remove or rub out an inkblot with his left thumb.

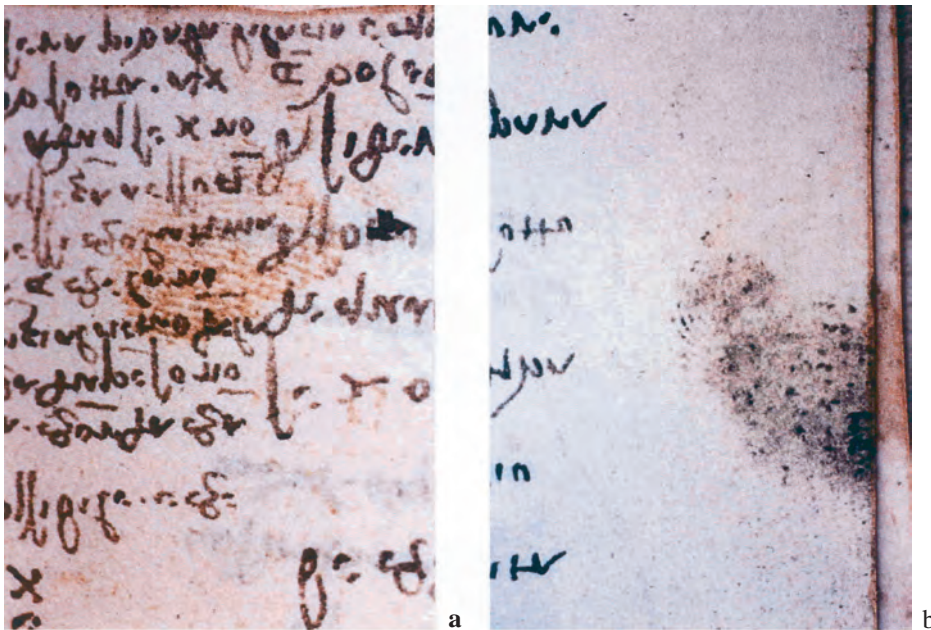
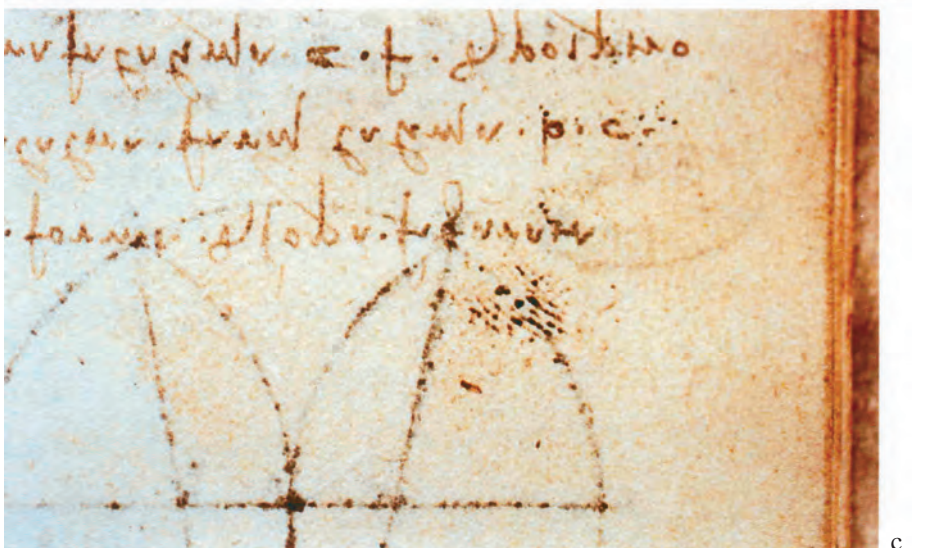


FIGURE 2. Fingerprints produced by substances that were present on the fingertips: the colour of the fingerprints is quite different than the colour of the ink (a), and the substances penetrate the paper locally, creating a small rounded patch (oil? fat?) (b, c).



MATERIAL AND METHODS

We initially examined about 200 fingerprints from about 52 papers (working from professional quality photographs), and determined that in only a few cases did Leonardo leave a complete fingerprint (*Figure 4a*). In most cases

the fingerprints are partial and are attributable to the left thumb (*Figures 3a and 3b*). This indicates that Leonardo probably moved the papers using his left hand, a conclusion consistent with the left-handed-habits typical of the genius (Vezzosi 1977: 123).

FIGURE 3. Most of the fingerprints Leonardo left were partial and can be identified as the radial half of the left thumb.

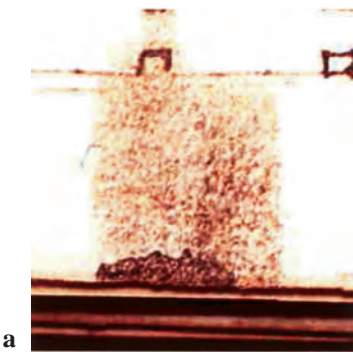
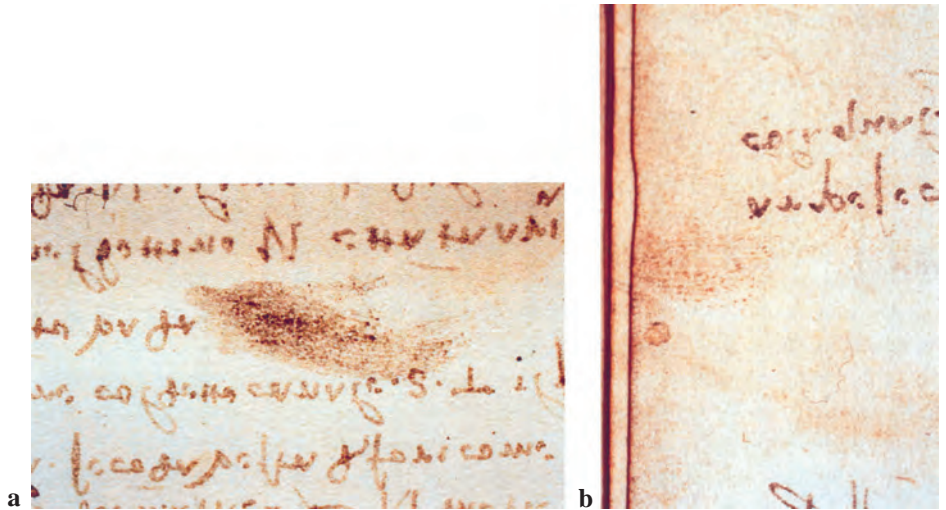


FIGURE 4. Leonardo da Vinci's left thumbprint is characterized by a single central vortex.



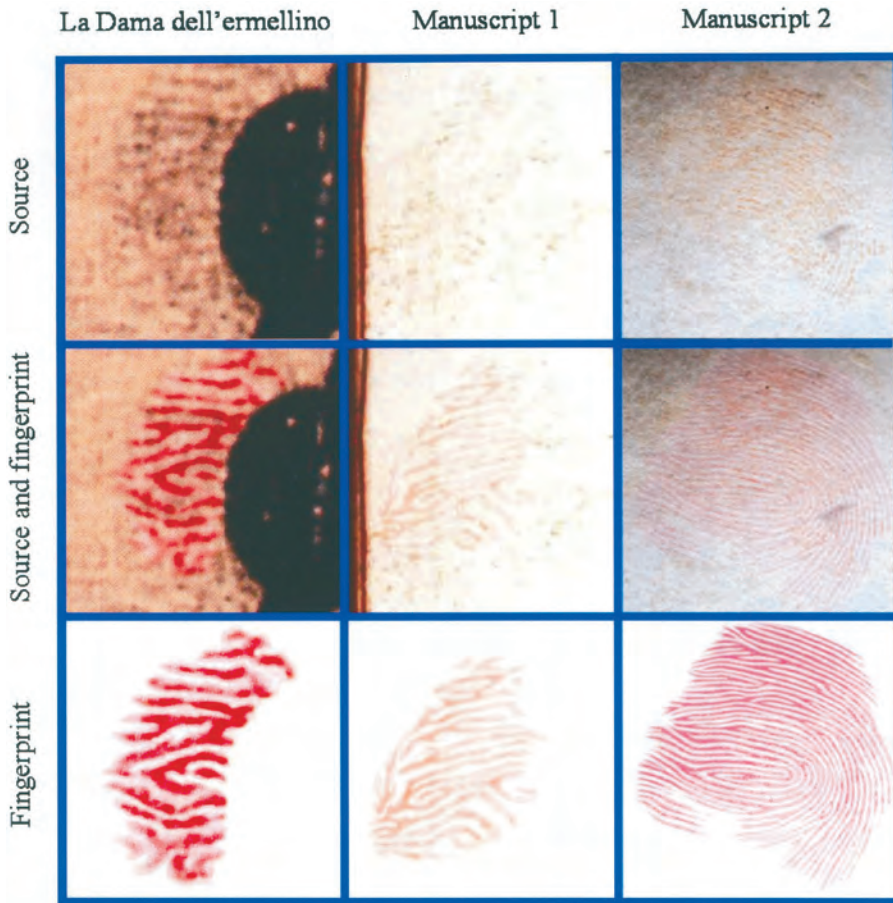


FIGURE 5. The morphology of the left thumbprint is consistent in the *La Dama dell'ermellino* necklace shadows and in all the papers examined (Manuscript No. 1: see figure 2a; Manuscript No. 2: see figure 2b), and has been reconstructed by computer, merging numerous partial prints (©2003 by L. Capasso).

DISCUSSION AND CONCLUSION

We know that he suffered from a chronic disease that also interfered with his muscular activities, especially towards the end of his life, and it is interesting to note that the last manuscripts (such as the papers written in France before his death) do not present complete fingerprints; this shows that handling them became more difficult for him as he grew older.

From a typological standpoint, one should note that many people left their fingerprints on the papers Leonardo

wrote and drew upon. Indeed, it is theoretically possible that other people touched Leonardo's papers during his lifetime. Following his death, many people handled these papers and surely left their fingerprints. To identify Leonardo's fingerprints with certainty we began by examining the fingerprints produced by attempts to remove ink blots, which he undoubtedly left as he was handling the papers. The morphology of this type of fingerprint is constant, and primarily involves the left thumb (*Figures 1a* and *1b*). Integrating this print with other clearer and more complete fingerprints (*Figures 4b* and *4c*), and integrating



FIGURE 6. Leonardo da Vinci used his fingertips to apply the finishing touches to the black paint used for the necklace shadow in the *La Dama dell'ermellino*, and thus left his fingerprints on the canvas.

the observed data with a computer graphic study (*Figure 5*), we can describe the fingerprint of Leonardo da Vinci's left thumb. It is a typical vortex figure, with a central closed elliptic area whose major diameter follows the longitudinal axes of the finger, and is surrounded by a series of concentric dermal crests. There is a typical triradium (Naffah 1977: 681) at the peripheral level of the radial side of the vortex (*Figure 5*). It is worth noting that this is the most common structure for the thumb in the modern European population (Holt 1968).

Leonardo left his fingerprints not only on his papers but also on his paintings. For example, when he painted the stones' shadows of the black necklace shown in the *La Dama dell'ermellino* (kept in the Czartorysky Museum in Cracow, Poland), he applied the finishing touches of colour directly with his thumb and index fingertips, and as a result we can observe the morphology of the above-described thumbprint on the canvas (*Figure 6*). Since he

did leave his prints on his canvases, it may be possible to use them to confirm the authorship of paintings that have been attributed to him with reservations.

The study of Leonardo da Vinci's fingerprints opens a new path of discussion, which merges anthropological aspects with historical data, and allows the application of modern medical technologies to one of the most interesting Renaissance masters.

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