Behind the art

Art historians have joined forces with material scientists in order to better understand the objects of interest but also develop better conservation treatments and preservation approaches.

Not long ago, museums and art institutions were considered to be gloomy old buildings, sheltering centuries-old exhibits. This doesn't seem to be the consensus anymore. Museums have broadened their outreach, and have attempted to become more appealing to younger audiences. They have also started to attract to their workforce people who were trained in a very different context, that of materials science.

This month we explore the connection between science and art, and how well-trained researchers can apply state-of-the-art methodologies used in the chemistry or physics lab to see artefacts such as paintings or statues under a new light, reveal information about their origin and artistic conception, and ensure their preservation for future generations.

Philippe Walter and Laurence de Viguerie are analytical chemists from Sorbonne Université in Paris who employ many non-invasive techniques to study the materials properties of paintings. Back in 2010, they uncovered the technique that Leonardo da Vinci used to paint the *Mona Lisa*'s subtle smile through X-ray fluorescence spectroscopy[1]; da Vinci achieved his trademark *sfumato* ('smoky') shading by mixing different thicknesses of glaze, most likely with his fingers, a technique developed by fifteenth-century northern European oil painters such as Jan van Eyck. In their Commentary on page 106 of this issue[2], they showcase the progress achieved in the past 20 years in understanding the materials and processes used in paintings, thanks to tremendous advances in non-invasive instrumentation and the expansion of the community of materials scientists interested in cultural heritage. Combined efforts from material scientists and art historians under the umbrella of this so-called technical art history can reveal the ability of painters to create new pigments that expanded the palette of colours and textures available to express their creativity. Also, these studies may allow researchers to understand how pigments degraded with time, and virtually restore the colours of a masterpiece back to the original shades used by their creators.

Similar non-invasive techniques can of course be applied to other types of art such as statues, jewellery and textiles. *Nature Materials* spoke with two scientists working in the British Museum[3], Carl Heron, its director of scientific research, and Joanne Dyer, a trained chemist specializing in polychromy — the study of ancient painted surfaces (pictured). The team consists of about 20 scientists, with diverse training and expertise covering all the materials and techniques needed to study the eight million objects that constitute the full collection of the British Museum. The department takes pride in possessing state-of-the-art imaging equipment such as digital X-ray radiography and CT scanning facilities, suitable for imaging some of the largest objects in the collection. They also investigate organic colorants and their origin in ancient textiles through liquid chromatography–mass spectrometry; the scientists are able to precisely determine the plants or insects used to create the dyestuffs. This has implications not only for conservation but can also reveal the artistic and artisanal practices and possible trading routes in raw materials available in the ancient world. Similar valuable insight into the eating and cooking habits of ancient civilizations can be extracted from burial sites and cooking utensils. They are also investigating the use of lasers for conservation and cleaning of a plethora of objects, from metal pins to ceramic vases, terracotta statuettes and marble frescos. This approach allows them to learn more about previous preservation attempts and improve future conservation efforts.

The British Museum and many other European institutions are part of the IPERION CH consortium (https://iperionch.eu), an initiative from the European Union's Horizon 2020 Work Programme, with the aim of developing a Europe-wide research infrastructure that can support the restoration and conservation of cultural heritage through the development of relevant high-level scientific instruments and methodologies, and the precise training of scientists in this new context of art and heritage science. The consortium brings together teams from 12 European countries, offering them access to databases from European museums, galleries and research institutions, and the use of large-scale facilities such as synchrotrons and neutron sources and advanced mobile analytical instrumentation for non-invasive measurements of various objects.

Working in a Museum as a scientist[4] means being part of a truly interdisciplinary environment that brings together chemists, spectroscopists, material scientists, curators, conservators, art historians and archaeologists. While attracting well-trained scientists in very specific techniques, and training them in understanding the needs of the curators and the objects themselves are both non-trivial tasks, the most crucial point is appreciating the fragility of the artefacts themselves and the responsibility one's work holds for future generations. ❐

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Visible-induced infrared (VIL) and visible luminescence (VIVL) studies of a statuette from Canosa di Puglia reveal information about the pigments originally used to colour the object, that cannot be seen under visible (VIS) light[5].

References

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