Uncovering the real history of art using a graphene scanner

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Credit: INSIDDE

Museum curators, art restorers, archaeologists and the broader public will soon be able to learn much more about paintings and other historic objects, thanks to an EU project which has become a pioneer in non-invasive art exploration techniques, based on a graphene scanner.

Researchers working on INSIDDE, which received a EUR 2.9 million

investment from FP7 ICT Research Programme, have developed a graphene scanner that can explore under the surface of a painting, or through the dirt covering an ancient object unearthed in an archaeological dig, without touching it.

'As well as showing sketches or previous paintings that have remained hidden beneath a particular artwork, the scanner, together with post-processing techniques, will allow us to identify and distinguish brushstrokes to understand the creative process,' explained Javier Gutiérrez, of Spanish technology company Treelogic, which is leading the project.

Avoiding damage to the artwork

The challenge in this field is to develop advanced technologies that avoid damaging the artwork under examination. Solvents and their potential side effects are progressively being replaced by the likes of lasers, to removed dirt and varnish from paintings. Limestone-producing bacteria can be used to fill cracks in sculptures. INSIDDE is taking a step further in this direction by using terahertz, a frequency band lying between microwave and infrared in the electromagnetic spectrum.

Until graphene, considered to be one of the materials of the future, came along it was difficult to generate terahertz frequencies to acquire such detail. Graphene in this application acts as a frequency multiplier, allowing scientists to reveal previously hidden features such as brushstroke textures, pigments and defects, without harming the work.

Although X-ray and infrared reflectography are used elsewhere to carry out this type of study, they heat the object and cannot reach the intermediate layers between the gesso and the varnish in paintings, or other characteristic elements in ceramics. INSIDDE's device, using terahertz frequency, works in these intermediate layers and does not heat

the object.

In conjunction with a commercial scanner mapping the art's upper layers, it can generate full 3D data from the object in a completely non-intrusive way and processes this data to extract and interpret features invisible to the naked eye, in a way that has never been done before.

INSIDDE is developing this technology to benefit the general public, too. The 2D and 3D digital models it is producing will be uploaded to the Europeana network and the project aims to make the results available through a smartphone and tablet app to be exploited by local and regional museums. The app is currently being trialled at one of the partners, the Asturias Fine Art Museum in Oviedo. It shows the different layers of the painting the visitor is looking at and provides additional information and audio.

Unexpected results

Although the scanner is still in its trial and calibration phase, the project participants have already unveiled some promising results. Marta Flórez, of the Asturias Fine Art Museum, explained: 'Using the prototype, we have been able to distinguish clearly between different pigments, which in some cases will avoid having to puncture the painting in order to find out what materials the artist used.'

The prototype is also being validated with some recently unearthed 3rd Century pottery from the Stara Zagora regional history museum in Bulgaria. When the project ends in December 2015, one of the options the consortium is assessing is putting this cost-effective solution at the service of smaller local and regional museums without art restoration departments so that they too, like the bigger museums, can make important discoveries about their collections.

Provided by CORDIS