Painting: John Peter Russell, "Portrait of Vincent van Gogh", 1886. Photo: Gambler94 / Unsplash.

INTO THE TEXTURE OF A PAINTING WITH X-RAYS TO REVEAL ITS PAST. AND MAYBE EVEN THE FUTURE!

> All the world is made of matter. Information on matter provides an invaluable opportunity to understand who we are, what we are made of, what the environment and the objects contained in it are made of. Toward this research tale, in the time of a coffee break, we are going to discover the little contribution of a PhD student in this huge field.

A RESEARCH TALE BY

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All nature around us is made of small bricks, called atoms. Some of them are equal to each other, called elements, and all the elements together form all the tangible objects we have experience with. The wall of our houses, trees, animals, water, and stars are made of them.
The knowledge of the elements compounding an object, as a coffee cup, represents one valuable way to have information about its history, present, and sometimes its future as well. And it is demanded in many cases, for example in food production, material industry, and heritage sciences. Especially in this last case, it is a common practise to analyse artefacts in order to achieve their original composition for restoration processes, sometimes to attest their provenance, or even their authenticity.
Special devices are needed to detect the presence and nature of specific elements. My PhD project consists in the realization of an instrument for the study of the elemental composition of objects and usable in the archaeological field, in museums and conservation centers, exploiting the potential of a discipline that seems extremely distant from cultural heritage: physics. Its etymology is "nature", and in fact it studies the constituents forming the basis of matter: for this reason it is also useful for our purposes.

Let's think, for example, about a painting. It could have been made in different periods, by different artists and sometimes a painting is actually two or more works of art overlapped one to another. In order to study and to conserve the secret on a canvas, or a panel, physical analysis can reveal the materials used, excluding or confirming the provenance of the painting. Another important class of examples is ceramic. Ceramics can have a lot of story behind them, as their manufacturing process, that can be reconstructed by their constituents, the elements present in them. What is needed and how we can carry out that analysis and therefore to extract the information we want?

Depending on who they are, the atoms of different elements, if properly stimulated, "tell'' us who they are, for example a metal, as gold, or a compound as chlorine in salt. The technique is called X-ray emission which occurs naturally, if the matter is stimulated with a suitable source and an appropriate detection system.

The goal of my PhD project is to develop the different parts of the device and, then, assemble them together. It involves studying the technical properties of the parts and to find the best way to combine them together. For instance, it could be exciting to be able to carry out the mapping of the objects, allowing an analysis of the surfaces of the heritage objects to study. However, even though it seems a rather technical project, it has a lot of application in the world of heritage science, and further questions are expected while exploring this field.

However, is this technique alone enough to provide all the information we want to achieve on an artefact? The answer is obviously "No". Many objects in fact have a complex internal structure, such as inlays on fine furniture or the interior of wooden boards, which cannot be described from the elemental composition of the object. To fill this gap, we will explore the possibility of integrating more than one technique into the same tool. Radiography for example, which provides information about the interior of objects, rather than their surface composition, may provide complementary information on specific case studies. We are therefore thinking, as a next step, of compacting the two techniques into a single instrument. Is it possible to do that? And will the resulting tool be able to unlock all the secrets of cultural heritage objects?

Stay tuned and we'll find out together in the next story!