

TALKING IMAGES VOICES FROM THE OPEN FRONTIER OF IMAGING

ART FROM INSIDE: THE APPLICATION OF DIAGNOSTIC IN ART

Isabella Castiglioni

Is there a relationship between diagnostic medicine and art? Absolutely yes, art and science have always been related, and there are many examples and studies about this tight union!

Welcome to everybody. My name is Isabella Castiglioni, I'm Full Professor in Applied Physics at the University of Studies of Milano-Bicocca, and co-founder of DeepTrace Technologies. My academic, research and industrial interests are in the field of medical imaging and data analytics.

Today, in this episode of Talking Images, a podcast powered by Bracco Imaging, I have the pleasure to accompany you in a short journey during which we will know how diagnostic imaging techniques developed for radiology can be effectively used also by the world of art. We can say that both are investigative tools on the nature of human beings.

With us, in this journey, it's a pleasure:

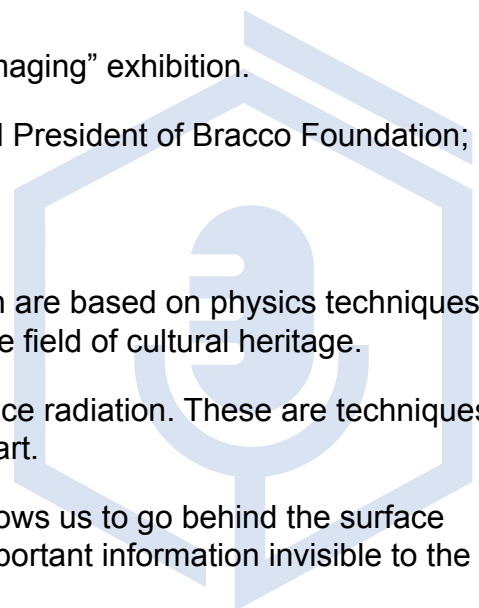
- **Francesca Cappelletti:** Director of Galleria Borghese in Rome. She has dedicated herself for years to the study of Italian-art-collecting from the Renaissance to the 19th century.
- **Marco Malagodi:** Associate Professor in Chemistry for Cultural Heritage at University of Pavia, and Scientific Head of Arvedi Laboratory of non-Invasive Diagnostics for the study of historical music instruments.
- **Mauro Belloni:** the Creative Director of "the Beauty of Imaging" exhibition.
- **Diana Bracco:** Chairman and CEO of Bracco Group and President of Bracco Foundation;

Isabella Castiglioni

Today the techniques of diagnostic medical imaging, which are based on physics techniques of interaction of radiation with matter, are regularly used in the field of cultural heritage.

We must think for example on X-ray, infrared or fluorescence radiation. These are techniques that can be applied to different fields: medicine as well as art.

In the case of art paintings, diagnostic medical imaging allows us to go behind the surface of the painting in a non-invasive way and discover very important information invisible to the naked eye, in the same way it does for the human body.



Francesca Cappelletti tells about the work that has been done on the artist Michelangelo Merisi, better known as Caravaggio, an extremely complex artist who lived the early 17th centuries working between Milan, Rome, Naples, Malta and Sicily.

Francesca Cappelletti

Caravaggio attracted the digital research already some 30 years ago when a campaign was started to know not only his technique but always trying to define his catalogue.

This is not only regarding Caravaggio but it's true that for Caravaggio this issue is bigger, because we know for some of his composition two or three different versions.

So, I think that at the beginning the idea of investigating on more scientific grounds the paintings by Caravaggio was in the idea of be able to define the originals and to distinguish them from the copies.

So, we managed to know better this artist, he was an inventor not only of a new style, he was a revolutionary painter because he used to paint directly from the model, "dal naturale", from nature.

He was also someone who invented a new technique, he was not drawing in a traditional way, I mean doing a lot of sketches and drawings and using cartoons, but he was probably drawing using the painting directly on the canvas.

And for this reason, X-ray and all the other technique of digital imaging are so important, relevant for Caravaggio paintings because we can understand better his technique, we can find these sketches drawn directly on the canvas and we got familiar with this way he had of putting some lines, some incision we called them on the canvas to mark the figures, to sketch the entire composition on the canvas and after to use the painting to define the final characters of his composition.

We need to know better the techniques of the contemporaries, of the fellow painters of Caravaggio both in Rome and in Naples, because otherwise we don't have the possibility to say okay this technique is typical of Caravaggio, is typical of his roman years, it's typical of his Neapolitan years.

Isabella Castiglioni

Thank you Francesca for your interesting testimoniance, going further to discover the past truth by keep the underlying hidden layers is the key activity of the art historian, who often has to go behind the intention or the will of the artist himself who has given us his final finished workpiece without often leaving us many details.

The medical imaging techniques, such as ultraviolet-induced visible fluorescence imaging, optical microscopy, X-ray based imaging and spectroscopy, allows us to go further.

With such techniques it is possible today to discover the work organization, manufacturing strategies and the materials used by the artists in their artworks. All to better preserve them, but also to improve our knowledge and current capabilities on the artist.

We talk about it with Marco Malagodi, who deals with the study of ancient and beautiful musical instruments, such as the Stradivari violin.

Marco Malagodi

Non-invasive diagnostics is very important procedure in studying the artworks. Why? Because we use those instruments without touching the artwork, the manufacture, even the violin in this case using a source with electromagnetic radiation and we use those radiation to have an effect in the atoms and molecular softer materials and we have an answer we studied the answer and we get the information on the material for instance if there is an oil, if there's a resin or even information regarding the inorganic materials, pigments, souls that are present in the manufactures.

This is very important because we can get the information regarding the original material that were used from the artist or violin makers in construction procedures, and we try to answer to some questions: which kind of material they used? Which kind of colorants or pigments they use? Which kind of medium they use? So, this is very important because we can get information that, in many cases, we lost regarding the construction procedures.

At the same time, we get information with those techniques of non-invasive diagnostic on the alteration process, degradation process that are present on manufactures and this is very important because our data our results can be very useful for restorer that they have to work of course on the manufactures. It's very important that they know before what's going to happen to those materials and those manufactures.

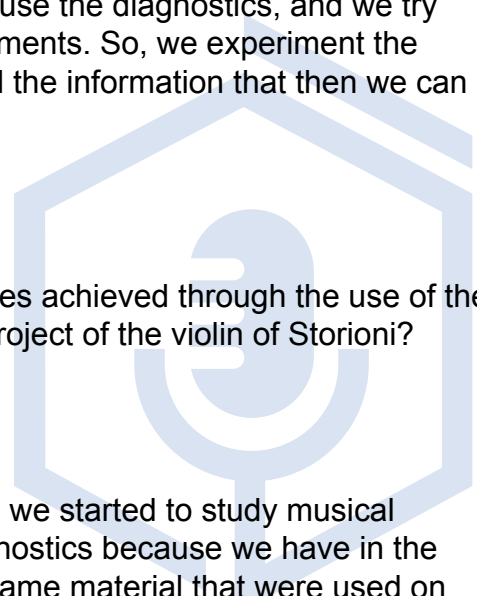
Moreover, we have normally experimental process, so we use the diagnostics, and we try to increase the information that we can get by those instruments. So, we experiment the diagnostic on mockups, laboratory mockups, and we try all the information that then we can use directly on the artwork or manufactures.

Isabella Castiglioni

Very interesting, but what are the most important discoveries achieved through the use of these non-invasive techniques? Can you tell us a bit about the project of the violin of Storioni?

Marco Malagodi

The research started to study those manufactures not so late, we started to study musical instruments since 15 years and we have to adapt the diagnostics because we have in the musical instruments, particular in the violins we have the same material that were used on artworks in general so paintings for instance or frescos but they are used in a different way.



So, the material that for instance is on painting that is the polychrome film, here in the field of musical instrument, must be transparent so we have to see the base of the instrument that is the wood, and we have a transparency in the medium and this application is totally different from the other manufactures.

Why? Because the wood on somehow becomes the most important aesthetic value of the instrument, you can see the characteristic of the wood and you can announce them by the same material that are used on painting like oil painting or resin but here are used in a different way and so we had to adapt all the techniques that already were used generally in the cultural heritage we had to adapt them to the particular case of musical instruments, especially for violins.

One of the most important projects that we had founded by Fondazione Bracco was the restoration on a Piccolo, Violino Piccolo di Lorenzo Storioni. This instrument was a very particular case and a very important case of study because this instrument was made at the end of the 18th century for a child so being for a child, made for a child this small instrument was preserved by other restoration in the next centuries, so that's why we could analyze original materials without any adding or any restoration, it was an incredible case of study because we got information regarding revarnishes that were made by linseed oil and resin, like mastic, and at the same time we could get a lot of information from the treatments of the wood and we discovered, there, that one of the most important treatment that the violin makers performed on wood was made by glues from animals, from the skin of the animals.

It's very interesting because they filled all the wood with this kind of glue and that was very important because in the next application of revarnish couldn't be absorbed by the woods so they pretreated the woods with this kind of material and we found the same treatment even in more important instrument like those made by Antonio Stradivari or Guarneri del Gesù and this is a very important information regarding this instrument that now is called Violino Bracco Piccolo by Lorenzo Storioni because of course the whole project was founded by Bracco foundation.

Isabella Castiglioni

Study the past, preserve it in the present and learn better techniques for the future.

"Leonardo and the Madonna Litta", was an innovative exhibition that brought the famous "Madonna Litta" back to Milan from the Hermitage in St. Petersburg, after almost thirty years, to the Poldi Pezzoli Museum on the occasion of the 16th century celebrations of the anniversary of Leonardo's death.

Around this masterpiece, I had the opportunity to work with my team on a very select nucleus of works performed by Leonardo and his closest pupils, coming from collections all over the world, including Antonio Boltraffio, Marco d'Oggiono, Francesco Napoletano.

A unique exhibition, characterized by a multidisciplinary dimension of the event which saw a sharing of knowledge, the involvement of international institutions, the enhancement of the relationship between science and art.



Thanks to the support of the Bracco Foundation, it was possible for us to launch a detailed campaign of diagnostic analyzes on some of the exhibited works, through a collaboration between the Institute of Bioimaging and Molecular Physiology of the National Research Council, the University of Milan, the University of Milano-Bicocca and the IUSS spinoff DeepTrace Technologies.

Hyperspectral spectroscopy, imaging diagnostics, radiography, reflectography, UV light photography, false colour infrared are just some of the analyses performed according to a common protocol, which have given rise to interesting and unprecedented comparisons.

From the wood used to the drawing underlying the pictorial layers to the pigments, binders and varnishes used, the analyses have allowed us to highlight the *modus operandi* of the artists who worked in Leonardo's laboratory, in close contact with each other, at the end of the fifteenth century in the years of the Master's presence in Milan.

Scientific studies have in fact made it possible to characterize the type of wood used for the support, the materials of the base preparation, of the priming, of the pigments, binders and varnishes. But they have also revealed some fascinating details not visible to the naked eye of the experts, belonging to an earlier version such as, for example, some variations of the posture and the positions of the hands or feet of the Virgins or of the children, or of the backgrounds of the internal and external environments painted in the works, or, even more intriguing, the traces of the artist's fingerprints left on the preparatory drawing before the final application of the pigments.

What are the next steps? What can we do to better understand art, thanks to the techniques of diagnostic medicine?

Francesca Cappelletti

Art history is asking more from the science, because we need in a sense something that is objective, we are looking always for the truth and we think that science can help us in this respect to give us a less controversial opinions and less controversial data.

We can make theories and hypothesis, but it's really impossible even with the help of the science to understand the old process but it's the researcher's spirit is that you have always to try, and to invent new ways of researching and to go deeper and deeper and to be able to reconstruct the past and to understand the past.

Marco Malagodi

Diagnostics can help the professionals who work in the field of cultural heritage for instance restorers and violin makers in this case sharing with them the results that diagnostics got from materials.

Discussing with violin makers, meetings with violin makers are very important as meeting with the restorers or the conservators because what is important in these cases is sharing this

information is they can understand what is going to happen to that, in the case of restorers for instance going to happening on the manufacts and is a very important information to plan the main correct procedures of restauration.

At the same time, for violin makers all that information is really important because they can learn how to build how to make the musical instrument, the violins, on the basis of a past's recipe for instance that we got from our analysis that can reproduce today and that maybe they can increase in the application with the new technology that they can use today.

Isabella Castiglioni

All these testimonies prove how medical diagnostics, in particular diagnostic imaging, can be applied to the non-invasive study of many different artistic works and for different purposes, which include the study and the research but also the conservation of artworks.

These are all examples that show how science, in these cases represented by medical imaging, allows us to better understand and give values to art.

But this relationship also has other aspects. After all, they are both acts of investigation that have man as focus.

We talk about it with Mauro Belloni who conceived an exhibition precisely called the Beauty of Imaging. A truly example of how science can be represented through artistic language and to be more easily understood.

Mauro Belloni

The Beauty of Imaging started as an idea of showcase in what diagnostic imaging represents today in modern medicine. The challenge was that the location that we chose for the exhibition was Triennale Milano, which is considered to be one of the design homes in Italy and probably all across Europe.

So, the big challenge we were facing, me and the design studio which it was JoForma Milan, was how we going to get people into an exhibition which talks about a medical subject. Most of the time again when people approach diagnostic imaging, they are in a patient state of mind let's put in this way their frame of mind is that they approach the subject because they have an issue, they have a problem they have to deal with.

So, our goal was to completely turn this perception upside down.

So the beauty of Imaging came out in a very simple way, we were researching for the materials and we're sitting with some of the technician at the Diagnostic Center, Centro Diagnostico Italiano and we were looking through these images and the more we were looking across them the more we will get fascinated by the beauty of it because if you just look at these exams



you are doing something which is embedded into the human conscience which is the will and the desire to navigate through the human body this is something that we always have been attracted as human beings, you know, to understand and to see the insight of the human body and again if you don't think about the illness but you just look at what is in front of you you're just seeing this beautifully symmetrical, asymmetrical mechanism and the complexity of it, just it's mind-blowing even for a non-medical person like me.

So, we put together these elements and we realized also that some of these exams and some images produced by diagnostic imaging had a lot of fluo colors that reminded us of the pop culture in general of contemporary visual culture, so the connection was easy we put the dots together and basically all this pop colors feature the floor and the surroundings as in regards of the visual approach to the exhibition.

For what concerns the content, first of all I wasn't aware of the magnificent history of diagnostic imaging and by researching into it with the support of the people of Bracco, I realized that it's an amazing history and it's very much connected to the human history.

There are amazing examples related to how the scientists that were delving into the subject were sharing exams and knowledge and discourage at the same time you know as soon as Röntgen find out about the tiny reflection of an image he wanted to share with other scientist all across Europe so that was pretty amazing and this was around World War One so we are talking about a very high tension moment but still these scientists felt the need of sharing their knowledge and their discoveries and the history is beautiful so amazing figures of women radiologist who were not allowed to delving it.

So, we build this timeline and then we took each and every technology and we created an interactive journey where you can delve into the content of each and every technology from different angles, so what is used for what is the physics behind it and so on.

Just to complete the history of the project, at the end of the exhibition we felt that we needed some sort of recap video, so we created this installative project where we had two layers of projection one from the back and one frontal projection that was able to recreate this quite intriguing effect by you can see a human figure and the shape of it as if it was taken by an X-ray, so we have this double layers.

Isabella Castiglioni

Thank you, Mauro, and thank you Francesca and Marco, you have given us important testimonies on the way in which today technologies and methods of investigation medicine, such as medical imaging diagnostics, can add value to artistic and cultural heritage.

I would like to underline that none of this would have been possible if there had not been interest and subsequent action, an interest demonstrated by a group of people, by a company, able to involve and collaborate with academic, research and industrial partners at national and international level with a common interest in the cultural heritage as human heritage.



It's with pleasure that I would like now to ask Diana Bracco where and how her long-lived passion for promoting culture both in Italy and abroad was born.

Diana Bracco

Culture, in my opinion, is the glue of a community: culture represents a country's identity and allows it to hold its head up high and interact with vitality on the international stage.

Culture's universal message transcends geographic and linguistic barriers: the language of Beauty speaks to all of us. Especially in these hard times, we should keep in mind that culture is a great instrument to promote tolerance and peace, against the re-emergence of divisions and selfishness.

As Italians we grew up in a context of intertwined beauty, art, and landscape: creativity and innovation are intrinsic aspects of our national identity. In fact, the promotion of our cultural heritage is included in article 9 of our republican Constitution.

I believe also that a company should always embrace the cultures in which it operates.

With its deep-rooted history and heritage, Bracco has culture in its DNA. By using its resources to create meaningful cultural activities and CSR initiatives, we can create a positive impact and make a difference in the lives of the people we serve.

Isabella Castiglioni

For years now you have been at the head of a company operating in Life Sciences as well as of a foundation promoting cultural heritage, what is your vision regarding the union of culture and health?

Diana Bracco

I have always been convinced of the positive influence that cultural activities have on individual psychological well-being. Besides, it has been scientifically proven that art, of all types, figurative, musical, and performance, is beneficial to human beings both in spirit and body. This has been certified by the World Health Organization which has been publishing reports for several years now on the relationship between art and health and that promotes the alliance of culture and health with the Cultural Welfare Center.

For this reason, in Bracco we consistently promote art and culture in accordance with our Purpose which is to improve people's health and well-being.

As Maestro Abbado once said: "Culture is a common, primary good, like water; theatres,





libraries, and cinemas are like many aqueducts”, and we, at Bracco, are committed to ensuring that everyone can access and enjoy them.

Isabella Castiglioni

Thanks to Diana Bracco for the vision and of course thanks to all participants: Francesca Cappelletti, Marco Malagodi and Mauro Belloni.

Let us all promote culture as a resource for wellbeing by spreading this message. I'm Isabella Castiglioni, this was Talking Images a podcast powered by Bracco Imaging, goodbye.

