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359

29 March 2024



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Mona Lisa back to the Louvre (1914)

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Direction of publication:	Pierre Naquin
Editor-in-Chief:	Carine Claude Stéphanie Perris Gilles Picard Clément Thibault
Editorial office:	Carine Claude Stéphanie Perris
Authors:	Carine Claude Antonio Mirabile Pierre Naquin
Translation:	Fui Lee Maisha Schimpelsberger
Graphic design:	Pierre Naquin
Layout:	Pierre Naquin
Proofreading:	Stéphanie Perris Laura Archer
Image editing:	Pierre Naquin
Contact:	news@artmediaagency.com
Distribution:	275,000+ digital subscribers

CONTEMPORARY

Rose bushes under the trees (1905), Gustav Klimt

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WILDFIRE



Virgin and child (15th century), Paduan school

Photo Irwin Leullier, © Musée de Picardie



THE NEBULA OF CULTURAL GOODS TRAFFICKING

In response to the trafficking of artworks, the art market getting organised to combat the funding of terrorism and money laundering. This complex endeavour involves both states and industry professionals.

Cultural goods trafficking is reportedly the third largest form of illicit trade globally, following arms and drugs, according to Corinne Chartrelle, former deputy director of the French Central Office for Combating the Illegal Trafficking of Cultural Goods (OCBC). In 2020 alone, over 850,000 cultural items were seized, with more than half of these in Europe, as per Interpol data [see box p.63]. These significant figures likely represent just the tip of the iceberg.

In 2015, the looting of museums and archaeological sites in Syria and Iraq, publicised and utilised for terrorist purposes by the Islamic State, served as a stark warning to the international community. Circulating on the black market, some stolen cultural goods ended up being laundered through a completely legitimate art market, highlighting the extent of the trade in “blood antiquities” and prompting states to legislate against money laundering and terrorism financing (AML/CTF). OCBC, as the principal investigative body, has since been determining responsibilities in the sale of hundreds of antiquities from looting in countries destabilised by the “Arab spring”. “Since the 2008 crisis, there has been increased surveillance of financial markets, yet the art market has become more opaque, raising fears of illicit financial assets shifting from the financial sector to the art market,” wrote researcher Morgane Ferrari in her 2016 article *Art and money laundering* published in *Global Security Review* [see box p.15].

This phenomenon is not new. The plunder and trafficking of artworks have been documented since antiquity, with the audacity of thieves often

matched by their creativity in devising break-in techniques [see p.60], as described by Bénédicte Lhoyer for the pharaonic era in *Archaeological evidences of plundering in Egyptian tombs* (2016). More than three millennia later, the trafficking of Egyptian antiquities continues to be relevant, as demonstrated by the astonishing case of the Louvre Abu Dhabi and its fake certificates of origin for pharaonic pieces, which led to the indictment of Jean-Luc Martinez, former president-director of the Louvre, in May 2022. This is the same Jean-Luc Martinez who had previously authored a report on the restitution of African artworks at the request of the French President of the Republic...

On the front line

Provenance, traceability, transparency... Art dealers are often on the front line in the battle against the illegal market. In France alone, money laundering is estimated to amount to around €50 billion each year. The extent of art trafficking's contribution is hard to quantify. Subject to AML/CTF obligations,

professionals do not always have the means to comply. Not all entities in the art market are international auction houses or mega-galleries equipped with the legal arsenal of “compliance” procedures and the necessary staff to carry out all the required checks before and after transactions. With its myriad of small galleries, antique dealers, second-hand goods dealers, brokers, and various intermediaries, the art market galaxy appears particularly vulnerable to laundering risks: “Several factors make art a preferred target for laundering capital: a culture of discretion inherent to the art world; a strong international component; negotiable and subjective prices; easy transport of artworks; intense competition among players,” lists specialised lawyer Olivier de Baecque.

Despite illegal practices, art professionals maintain vigilance

Although illicit practices exist, they remain marginal among art professionals who, by tradition, have cultivated a culture of vigilance regarding the artworks in their care. Illegal activities are more often the work of criminals outside the market aiming to liquidate their stolen goods. However, a 2022 report by U.S. Treasury highlighted the art market’s vulnerability to illegal activities due to “the high value of these goods, the traditional opacity of the art market, the instability and subjectivity of price setting, the ease of transporting certain works across borders, the difficulty for authorities to trace these movements and appraise the works, the use of multiple intermediaries (dealers, consultants, decorators,

shell companies...) and the anonymity of their clients.”

At the 8th annual conference of the Responsible Art Market (RAM), an interprofessional initiative launched in 2015 in Geneva by the Art Law Foundation, Anthony Meyer, a specialist in Oceanic and Eskimo art, raised concerns about the challenges faced by his profession: “We are overwhelmed by Kafkaesque and time-consuming administrative and legal obligations, many of which are impossible to implement without diverting from our main goal, which is to buy and sell art. Another example concerns AML-TF regulations related to money laundering, for which, as a small business, we are entirely unprepared, yet we are held accountable.”

“Thefts, looting, and expropriations exist, but they represent only a tiny part of the market. And we are systematically vigilant. The vast

On the red list

ICOM red lists of endangered cultural objects are practical tools designed to prevent the illicit trafficking of cultural objects. These lists categorise cultural objects at risk of theft and trafficking. They assist individuals, organisations, and authorities, including the police and customs, in identifying endangered objects and preventing their illegal sale or export. A red list is not a list of stolen objects; rather, it catalogues items from the collections of recognised institutions. These lists illustrate the categories of cultural goods most vulnerable to illicit trafficking. ICOM has been publishing red lists since the year 2000, with the scientific collaboration of national and international experts and the unwavering support of sponsors, covering the world’s most vulnerable areas in terms of illicit trafficking of cultural objects. The lists are published in various languages, depending on the theme of each list. Among other success stories, these tools have contributed to the identification, recovery, and restitution of thousands of cultural objects from Iraq, Afghanistan, and Mali. Red lists are available for free in digital format.

majority of objects are legally exported and acquired,” also asserts Alexandre Giquello, president of Drouot, who recently prepared a policy paper for the government on provenance. This assertion is confirmed by the U.S. Treasury report, which notes that “while the level of money laundering through this channel is significant, it is far outweighed by other criminal activities such as fraud and scamming, drug trafficking, or cybercrime.”

“Criminals seek to exploit the sector’s history of confidentiality and the use of third-party intermediaries, while terrorist groups may use cultural objects from areas where they are active to fund their operations,” analyses the 2023 report from the Financial Action Task Force (FATF), an intergovernmental organisation aimed at fighting financing of terrorism and money laundering. It takes care not to target all professionals in the art market:

“There is a kind of fantasy surrounding the financing of international terrorism through the art market. The arms trade is estimated at \$1.2 trillion, the drug trade at \$700 billion. The trafficking of antiquities would be around \$300 million. These are not at all on the same scale.

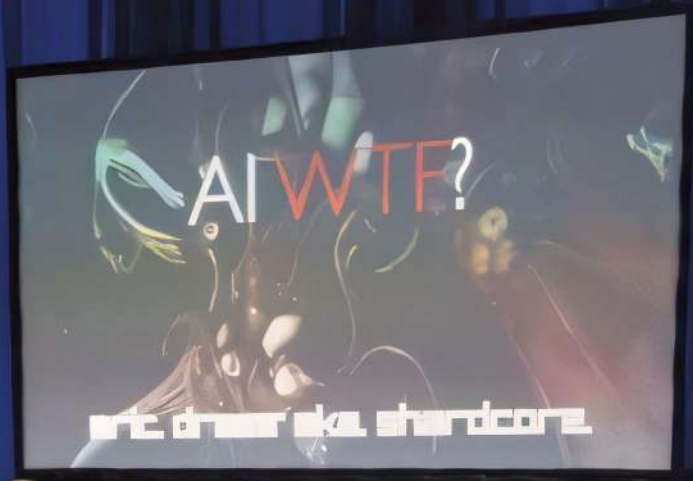
— Alexandre Giquello





Responsible Art Market 2024

Courtesy Responsible Art Market



art. dream aka. shardcore.





(1889)
Van Gogh over de
tijd, ging Vincent in
de richting van
de Provence
aan. Dit deed hij
omdat hij
vroegere
aanpakken
van de
kunstenaar te
verlaten.

(1890)
Naar het zuid van
Frankrijk, naar
de Provence, naar
de dorp van
Arles. Hij
zocht naar
een plek waar
hij zichzelf
als een
kunstenaar
kon presenteren.

25

“The vast majority of market participants have no ties to illicit activities, but there are risks associated with these markets, and many jurisdictions lack sufficient knowledge and understanding of them. This results in a lack of resources and expertise for investigation, as well as difficulties in conducting cross-border investigations.”

A profession for the future

In the global context, the quest for provenance of artworks is becoming more structured and is on the verge of establishing itself as a separate sector and discipline within the art world, akin to conservation or restoration. At the Metropolitan Museum of Art in New York, a new position for a provenance researcher has been created in response to the meticulous review of the 1.5 million items in the museum’s collection. The urgency was clear: assets worth tens of millions of dollars belonging to the Met have been seized for restitution in recent years. Art market professionals are also taking action. The Professional Committee of Art Galleries (CPGA) has added an entire chapter on provenance research to its Code of Ethics, listing practical advice and a directory of databases available for researching the origin of a work. Earlier in 2022, the National Institute of Art History, Drouot, and the Council of Voluntary Sales organised a symposium, “Provenance research: a new requirement for the art market”, bringing together a panel of art market professionals to discuss the urgency of agreeing on and structuring practices.

The delicate question of looted goods

The search for provenances is not new. It has its roots and fundamentals in the restitution of goods looted from Jews during the

Second World War, when the first researchers attempted to reconstruct the fragmented memory of objects and establish their changes in ownership between 1933 and 1945 [see p.34]. A slow, complex, and painful process of restitution began at the end of 1944 and continues today, supported by legislative texts and international commitments. In 1998, an international conference was organised in Washington where representatives from 44 governments adopted a set of principles to assist

the heirs of Jewish owners in recovering artworks looted by the Nazis. The foundational “Washington principles” advocate several measures: countries should strive to open their archives and simplify research; cultural goods confiscated by the Nazis should be reported, and this information should be centralised; the requirement for proof must take historical circumstances into account; when an artwork is recognised as looted, a “fair and just solution” should be quickly found.

Fighting money laundering

A highly publicised technique of financial crime, money laundering involves concealing the origin of money obtained illegally by converting it into a legitimate source. Whether through arms or drug trafficking, human trafficking, mafia activities, tax fraud, or the theft and looting of artworks, money laundering of “dirty money” was estimated at \$1.6 trillion globally in 2009, according to the United Nations. This estimate is difficult to pinpoint accurately, not to mention the exponential development of cryptocurrencies, which since then may facilitate the transfer of illegal income into an ostensibly legal economy.

Efforts to combat tax havens, lift banking secrecy, enforce antitrust laws, or track offshore shell companies stacking false invoices — recalled by the Panama Papers — are employed by states to combat money laundering. Free ports are also targeted. Since the undermining of banking secrecy in 2008, free ports, “real offshore fortresses”, have provided a lucrative alternative for the wealthy, according to researcher Morgane Ferrari: “They would have massively invested their liquidity in the art market. The causal link is evidenced by the increase in speculation in this market following the lifting of banking secrecy.” This is where Anti-Money Laundering (AML) regulations come into play, injecting more transparency into practices that are sometimes legal but verge on opacity, as in the case of free ports. The 5th Anti-Money Laundering and Counter-Terrorism Financing Directive, adopted by the European Parliament and the Council of Europe in 2018, aimed to harmonise the surveillance practices of member states. Applied since 2020 in France, it mandates that as intermediaries, art market professionals are obligated to declare and verify any art sale exceeding €10,000, except in the cases of furniture, numismatics, or philately. In France, professionals exposed to risks, including those in the art market, are required to file suspicious activity reports with Tracfin (Intelligence Processing and Action Against Illicit Financial Circuits) whenever they identify suspicious behaviour among their clients. Enhanced controls that compromise the confidentiality of their activities have caused some professionals to grumble...

Europe focuses on high-tech

Launched in December 2022, an action plan by the European Commission aims to intensify the European Union's fight against the illegal trade in cultural goods. At the table, governments, Europol, national authorities of customs, police, justice, and culture of the member states have implemented a series of non-legislative measures, as well as community funding for the development of high-tech projects to track stolen or traffic-risk cultural objects [see p.42].

AI and cutting-edge technologies are becoming indispensable in the fight against trafficking. Developed as part of the PREVISION H2020 project by the Research Centre of the National Police School, in collaboration with PARCS, the Michael Culture Association, and the CNRS, the Arte-Fact application promises an innovative approach in the detection and prevention of cultural goods trafficking. It addresses a challenge: given the abundance of complex data on the market, dark web, and social networks, how can one quickly identify a cultural item and determine if it has been stolen? How can surveillance work in the field, especially for customs services, be facilitated? The application offers two main features. Firstly, the identification through image analysis of objects suspected to have been stolen, comparing data with those from cultural institutions, police, and commercial sites. Secondly, web monitoring, with the capability to program automated queries to detect any suspicious activity. At the slightest alert, a report is automatically sent to the user. In the international fight against trafficking, every link in the art market chain is called upon to contribute.





IN THE



Amulet in the shape of an Isis knot

Photo André Longchamp. © Gandur Foundation for the art

“ORPHANED ARTWORKS MUST BE BROUGHT OUT OF OBSCURITY.”

Having studied at the prestigious French School at Athens, this erudite specialist in Greco-Roman antiquity passionately manages the rich archaeological and tribal collections of the Gandur Foundation in Geneva. Isabelle Tassignon explores a lesser-known aspect of provenance research: the fate of orphaned artworks.

She has successfully highlighted the forgotten fate of these orphaned artworks. Belgian archaeologist and historian Isabelle Tassignon, curator of the Archaeology and Ethnology collections at the Gandur Foundation, has initiated a comprehensive study on the issue of works with incomplete archives from public and private collections. These works raise historical, legal, and ethical provenance concerns. This crucial topic, a sort of blind spot at the intersection of law and art history, led to the 2021 symposium “What future for orphaned works?” organised by the Gandur Foundation, the Art Law Centre at the University of Geneva, and UNIDROIT. The proceedings were recently published. “It is urgent to find solutions to protect these works and to make them visible,” she stated at a conference last March at the gallery of Parisian dealer Anthony Meyer, a renowned expert in Oceanic and Eskimo arts, where she presented her collections and research.

What academic path have you followed?

I completed all my studies at the University of Liège, initially with a degree and a teaching qualification in history — equivalent to a master’s degree — but my main interest was in field archaeology. At 16, I had the chance to participate in the excavation of a Gallo-Roman villa in Belgium. That’s when I fell in love with archaeology, the excitement of fieldwork, and the thrill of discovery. However, I was advised that it was difficult to secure a job in this field; thus, I turned to history. I completed a thesis in ancient history, then pursued further studies in art history and archaeology of antiquity — because that was truly my passion — and wrote a second thesis on Gallo-Roman iconography focused on Dionysus in Belgian Gaul.

What other research areas interested you?

I was intrigued by many topics during my studies. I had the opportunity to excavate in Syria. I wanted to do my PhD on the Roman East and conducted my dissertation on Dionysus in Asia Minor, while also studying the history of religions, a somewhat Belgian tradition... A few years after my doctorate, I became the Belgian member of the French School at Athens. Belgians have had a reserved position at the school since its inception, providing an opportunity to join the work of the school and engage in its excavations. It was an incredible opportunity for me to integrate the French teams, benefit from the extraordinary library of the French School at Athens, and participate in their excavations.

What sites did you work on?

In the early years, I worked in Albania and at the site of Philippi, but my most significant project, for which I am still co-responsible, is in Cyprus, at the site of Amathus. I worked on the Agora, then on the Palace project with my Belgian colleague Thierry Petit, professor at Laval University in Quebec, and my Swiss colleague,

Béatrice Blandin, curator at the Museum of Art and History in Geneva. We still need to publish this excavation. These are aspects of my work that I have not been able to pursue much since joining the Gandur Foundation. I must admit, I somewhat miss field archaeology...

How did you come to join the Gandur Foundation?

My friend and colleague Béatrice Blandin had noticed a job posting and mentioned it to me, quite simply. The Foundation was looking for someone with knowledge of the classical world, iconography, and the history of religions, which matched my profile perfectly. That's how I met Jean Claude Gandur, a rather unconventional collector, who has been collecting with passion for a long time.

was already quite substantial when I arrived. And there was just one Oceanic piece!

These areas are quite different from your usual fields...

In the early 20th century, there was a tradition in the history of ancient, particularly Greek, religions, of explaining certain ritual practices through tribal practices. That's why I became interested in Oceanic tribal art. Moreover, I loved Oceanic works, aesthetically speaking. So, I embraced it. Of course, I'm self-taught in this area and I don't claim to be an ethnologist, but I did all the necessary reading to bring myself up to speed and published a lot of Oceanic objects on our website. But my perspective is still that of an archaeologist looking at tribal art objects, actually. Perhaps that's my speciality.

plus the exhibitions, publishing. The Swiss Army knife analogy is quite apt!

How did you become interested in the issue of orphaned works?

It came quite naturally, because I was initially faced with objects that, while not orphaned, were acquired at a time when market conditions were very different from today. I wondered what could be done with all these artefacts that sometimes have a black hole in their pedigree.

What do you mean?

There are several types of orphaned works. Some have no archives at all, others lack the documentation one would want to meet current standards. Others have been passed down within families, by grandparents or great-grandparents. Some people do not want to disclose

“In the past, provenance was a bit like the icing on the cake. Collectors, dealers, and museums were primarily interested in the quality of the object and mainly wanted to be sure it wasn't a forgery. Today, the truth is that provenance has become almost more important than authenticity. There has been a kind of reversal of the situation. It's thanks to work like that initiated by Isabelle Tassignon and her colleagues that this world is changing, and we must change with it. **— Anthony Meyer**

What responsibilities were you given?

Jean Claude Gandur had never had a curator specialised in the classical world before. He had always worked with an Egyptologist, more focused on the late period. He needed someone to review the entire collection, which was continually growing, with the aim of publishing it. Initially, it involved verifying and conducting retrospective provenance research. As part of the Foundation's proposal, I was also tasked with managing the pre-Columbian archaeology collection, which

You're about to celebrate your own ten years at the Foundation!

Yes, time flies! The foundation was inaugurated in 2011 and I joined in 2015. There have been many achievements, in the field of archaeology, but also in fine arts, where my colleagues have developed a lot of activities, exhibitions, partnerships. These years have been very, very full.

You're a bit of a Swiss Army knife...

Indeed, there's all the research, monitoring, study of the works,

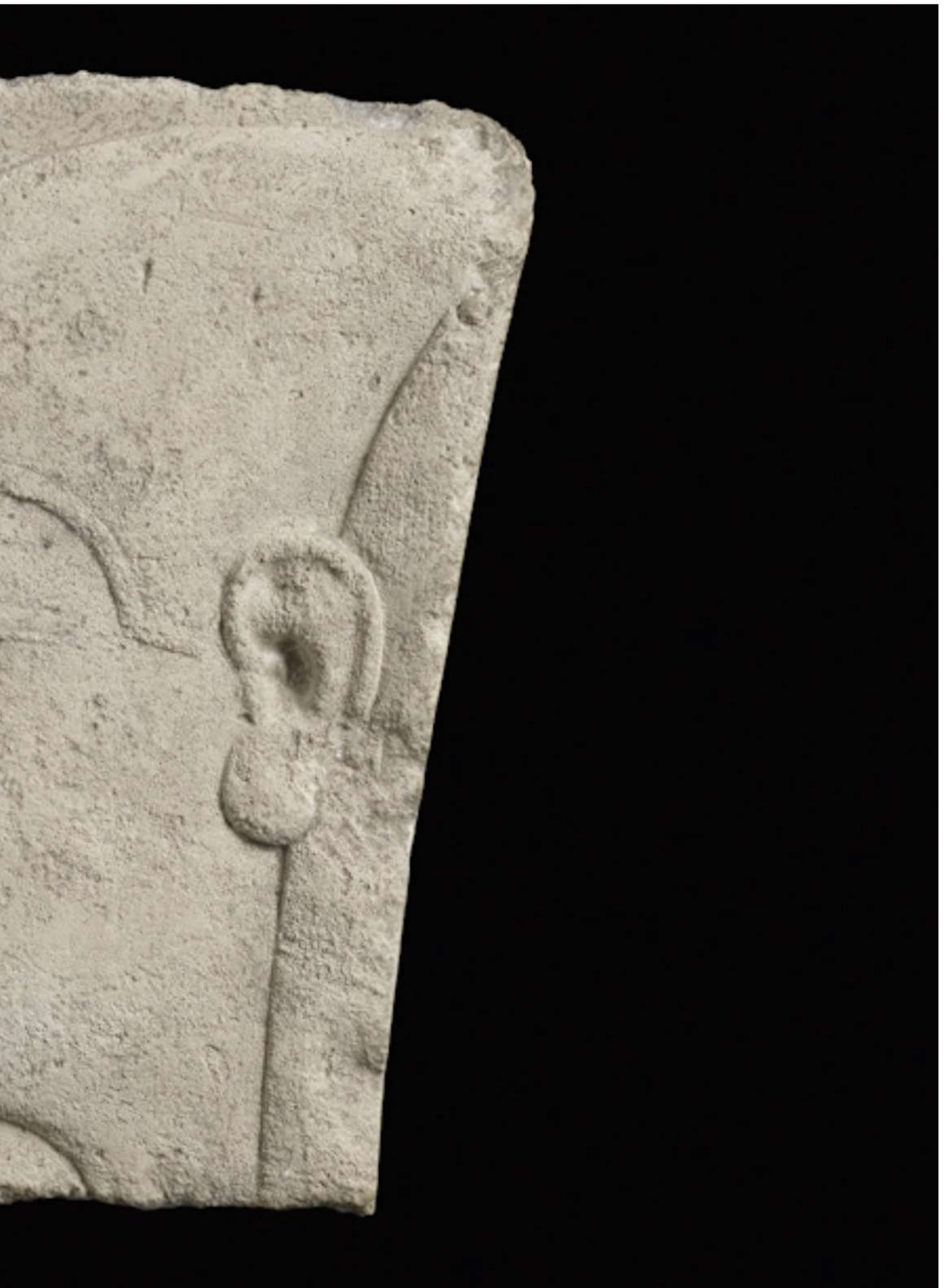
their works because they lack proof. The problem is that we can neither display nor scientifically study these poorly or undocumented objects, not to mention the art market. So, what do we do with these objects? Do we let them sleep in their closet? Do we lose them completely on the pretext that they lack a document, or that we don't have physical proof that they were indeed on the market? Or do we try to display and publish them? Because these works belong to humanity's heritage, just like the well-documented ones. They cannot



Isabelle Tassignon
Photo Grégory Maillot



Sculptor's model representing
a Pharaoh (4th century BC)
Photo Sandra Pointet. © Gandur Foundation for the art



“Provenance research is a long-term endeavour, and building a provenance archive is a fundamental task that is constructed every day. — *Anthony Meyer*”

remain clandestine. They cannot stay in this grey area. We must find a system or procedure, at all costs, that allows them to be visible.

Why can't we show or publish them?

In peer-reviewed scientific journals, researchers do not take the risk of publishing objects whose provenance is unknown, because there is always the fear that they might be from illicit trafficking. But that is not always the case. Scientifically speaking, they escape the radar. I wanted to get people thinking about these issues. Another problem arises for owners of such objects who have become unsellable. Galleries and auction houses can no longer take the responsibility of selling objects for which there is no pedigree. Thus, these objects are doomed to clandestinity. My final thought is to say “What a loss for history!” Because among all these objects, some could change the view we have on certain historical points. Yet, we continue to publish and republish always the same things, because we turn to the objects in museum collections that do not pose any problem. We are thus depriving ourselves of a whole part of the heritage.

Tell us about the 2021 symposium...

Works without archives are not necessarily from illicit trafficking. It was necessary to convince scientists, the art market, but also customs and magistrates — who ultimately make

the decisions — and try to find multidisciplinary solutions to these issues. Reflecting on these questions, I convinced Jean Claude Gandur to organise a symposium on this topic. To do this, I surrounded myself with two very competent people in the field: Marina Schneider, who is the custodian of the 1995 Unidroit Convention — therefore the convention that imposes a duty of diligence on the buyer — and Marc-André Renold, a lawyer specialising in art law and holder of the UNESCO Chair of Art Law at the University of Geneva. We organised the symposium in February 2021, unfortunately in the midst of Covid. It was a first step.

What were the main themes discussed during the symposium?

The idea was to bring together different stakeholders, such as historians who are accustomed to working on collecting. It was necessary to put the acquisition process into context. For instance, we could question whether all collectors in the past were motivated by the idea of proof. Did the compulsive purchasing of collectors always accompany actual acquisition traces systematically noted in an inventory? We also wanted to gather lawyers, customs officials, museum curators, ICOM, collectors, and especially dealers who are faced with provenance issues, to show how they go about tracing the biographies of works and ultimately finding provenances, and how they handle these issues on a daily basis.

It's also about protecting collectors...

There's no reason why collectors, who have made their acquisitions in good faith and performed their due diligence with the means of the time, should be penalised. As Mr Gandur stated during a conference he gave a few years ago at Unidroit in Rome: “The collector is often the last link in the chain.”

What risks might they face?

There are several risks. Some pedigrees are completely fabricated, with fake provenances. Dealers must commit to the archives they provide. But all of this can create a climate of mistrust in the market and slow down acquisitions. There's also the fear that people who still want to buy may turn to the underground market, with the consequence that the objects disappear again.



Antheistria Chous (late 5th century BC)
Photo Grégory Maillot. © Gandur Foundation for the art

FOCUS



The light of the world (1750), François Boucher

Photo Alain Basset



WHEN PROVENANCE RESEARCHERS CONDUCT INVESTIGATIONS

Provenance researchers, the real Sherlock Holmeses of heritage, have become key figures in the field of art identification and the securing of their acquisitions. In France, they have recently launched their first professional association. A testimony.

This is a profession that did not exist just a few years ago. Provenance research, long conducted empirically by curators, experts, and art dealers, is becoming a fully-fledged academic discipline. This shift is likely due to the pressure from current events related to restitution demands and the strengthening of international regulations aimed at curbing art trafficking in a world beset by all kinds of conflicts. But it is a fact: an increasing number of museums are establishing dedicated departments. Orsay, the Louvre, and now the Metropolitan Museum of Art in New York, which has recently hired Lucian Simmons, former head of Sotheby's restitution department, as its first head of provenance research. On the academic side, the University of Paris Nanterre launched its new University Diploma (DU) titled "Provenance Research of Works of Art" in February 2022. And since the start of the 2023 academic year, the École du Louvre has been offering a Master's degree in "Sensitive Goods, Provenances, and International Issues". These developments prove that this emerging profession is becoming increasingly professionalised.

Thus, last February, the Multidisciplinary Collective for Provenance Research (CPRProvenances), created at the University of Nanterre, transformed into a professional association. "The birth of this association happened in two stages, first in June 2023 at the initiative of the first DU cohort," recounts Léopold Vassy, a legal expert in art market law, who himself graduated from this brand-new program. He recalls: "At the end of the year, the Rose Valland cohort wondered what could be done for the future of provenance research. The creation of a collective thus emerged as an interesting initial response. Despite its major role,

the development of this discipline as a profession is still in its infancy, and its foundations are fragile. Hence, the idea of banding together also includes that of mutual support. Later, the idea of creating an association took root after the collective was contacted by external professionals: its goal was to open its doors to as many as possible."

However, unlike in Switzerland [see p.18] or Germany [see box p.31], there was not yet a professional association of provenance researchers in France. "It responded to a real need, if only to structure the profession. Until then, France had no such organisation. While Astres [see box p.28] supports research on anti-Semitic spoiliations, and since last year on provenance in general, it is not strictly speaking a professional association."

In the spotlight

The topic is newsworthy and with good reason. In 2022, the indictment of former president of the Louvre, Jean-Luc Martinez, in the case of illicitly procured Egyptian objects purchased by the Louvre Abu Dhabi had the effect of a tsunami

[on 15 November 2023, the Court of Cassation rejected the appeal of the former Louvre head, ed.]. Promptly, the Ministry of Culture commissioned a report from Christian Giacomotto, Marie-Christine Labourdette, and Arnaud Oseredczuk to “improve the security of acquisitions of national museums.” In light of these events, the issue of provenance research became a top concern to meet due diligence requirements during the acquisition of works, for museums as well as the market, against the backdrop of a tightening of European and international regulations to combat money laundering and terrorism financing.

Astres association launches its prize

Founded by Dominique Schnapper and Marcel Wormser in 2019, the Astres Association (Association for the Support of Research Work on Spoliations) emerged from an observation: due to the lack of a real research programme, the owners of the 2,000 works and art objects found in Germany after World War II and listed as MNR (Musées Nationaux Récupération, [see box p.55] have not yet been identified, even though France committed, during the 1998 Washington Conference, to finding solutions for the restitution of the works. Initially dedicated to supporting research on the provenance of cultural goods looted between 1933 and 1945, the association broadened its scope of action in May 2023 and now covers artworks stolen, obtained from illicit excavations, seized during periods of colonisation by the occupying power, or illicitly exported. To give visibility to young provenance researchers, Astres created the Marcel Wormser Award last year to support work on the traceability of cultural goods. The first two laureates announced in December 2023 are Coline Desportes and Virginie Cardoso, the former a doctoral student at the School for Advanced Studies in the Social Sciences for her investigation into the cultural — and diplomatic — relations between France and Senegal, and the latter for her work on Nazi spoliation beyond the Rhine.

With the strengthening of European regulations, provenance research concerns the entire art market chain. This issue is no longer just the concern of historians but affects all stakeholders: from dealers to experts, auctioneers, and even collectors.

— *Léopold Vassy*

Multidisciplinary

The association now aims to develop its network and reach all professions involved in provenance research. “This multidisciplinaryity is essential: it offers, on the one hand, the possibility of bringing together actors with complementary skills,” explains Léopold Vassy. On the other hand, it is hoped to facilitate access to archives, whose sometimes difficult accessibility is the stumbling block of research. Lastly, this pooling of resources will be coupled with a desire to establish a dialogue with institutions. The association thus aims to be a place for exchange and sharing. It will particularly promote fundamental research, that is, research that does not limit its field of study to a targeted object but, more broadly, strives for a better understanding of a segment or period of the market.

Led by Lucile Paraponaris, responsible for provenance research at the Army Museum — Hôtel national des Invalides, the new association also focuses on scientific multidisciplinaryity. Even though tools for researching the owners of looted goods are multiplying — databases, networks, social platforms, applications for identifying works... — the intricacies and methodologies of provenance research remain complex to grasp. “Provenance research has multiple virtues,” explains Léopold Vassy. “We all think first, of course, of restitution, the duty of memory and knowledge, but it is also a bulwark against the trafficking of cultural goods. In an attributive approach, it can finally be a formidable weapon to stem the proliferation of forgeries, a real scourge of the market, especially for sensitive segments, such as that of African artefacts or Russian *avant-garde*.”

Navigating archives can be quite complex as Léopold Vassy, who has conducted research within private collections as well as in the context of a university project on François Boucher’s MNR painting *La lumière du monde* exhibited at the Museum of Fine Arts in Lyon, explains: “My experience, albeit modest, has made me aware of all the difficulty and rigour that documentary research imposes: navigating through archives is complex and time-consuming. Initially, one must know where to search and then, grasp very specific documents whose complex reading sometimes must also be done in other languages.”

A challenging journey

Is the profession of provenance researcher then a career of the future for budding art historians? Not so obvious, according to Léopold Vassy: “It is important to note the encouraging



David Zemanek

Courtesy Zemanek-Münster



Apollo, Charles Meynier

© Louvre, Domaine de Vizille, Musée de la Révolution française

dynamics that the discipline is experiencing, with the recent creation of several positions. However, it must be acknowledged that most of our museums still do not have a dedicated department or researcher attached to their structure. While provenance research is not neglected, it is, however, carried out under conditions that, given the stakes, might need to

a solid network,” testifies Léopold Vassy. Yet, researcher in provenances appears to be a promising career path for art history students, often short of opportunities. “There is no lack of work, there is a colossal task to be undertaken. And this perspective can only grow with the new legislative body relating to the restitution of human remains, colonial cultural

goods, and those looted between 1933 and 1945. Today, provenance research in museums is mostly conducted by curators and librarians. They have experience and know-how but do not necessarily have the time or specific skills to carry it out.” Both a discipline and a profession, provenance research becomes a new, essential challenge for young researchers.

Provenance research is a collective enterprise. The one who conducts it must not only know where and how to search, but often must have the support of a myriad of actors.

— Léopold Vassy

be reconsidered. The practice of institutions sporadically calling upon independent researchers precarious the profession while providing a rather partial response to a fundamental issue: museum introspection must shed light on current collections, but also on those that will enrich them. It is an endeavour that, like that of Sisyphus, truly knows no end.”

Yet, art market professionals are not left behind. CPGA (Professional Committee of Art Galleries) has incorporated a whole chapter on provenance research into its Code of Ethics, listing a number of practical tips and a directory of databases that can be consulted to research the origin of a work. Earlier in 2022, the National Institute of Art History, Drouot, and the Conseil des ventes volontaires organised a symposium titled “Provenance research: a new requirement for the art market” bringing together a panel of art market professionals to discuss the urgency of agreeing on and structuring practices.

So, how does one make oneself known when starting out? “Young researchers go into the field but often face rejections, especially for accessing archives, all the more so when they are private, which can be frustrating. Hence the importance of building

3 questions to... David Zemanek

David Zemanek is an expert in tribal art and co-founder of the German auction house Zemanek-Münster.

Provenance research and transparency are currently hot topics of discussion worldwide. What's the situation like in Germany?

In 2009, I completed my doctorate on provenance research. At that time, the subject garnered little interest among researchers. Today, when I teach at the university, I can clearly see my students' enthusiasm for this field. Provenance research is crucial for determining whether an item has been looted, stolen, or legitimately acquired. It's fundamental for museums. My view is that anything proven to have been looted in the public domain should be unconditionally returned to states. However, if ownership isn't clear, especially in the case of private collections, that's a different matter. In Germany, the regime of private property takes precedence, which can complicate restitution efforts.

Does this hinder the art market in Germany, particularly the trade in African works?

The issue is crucial. Many young collectors, those who have the time and resources to start a tribal collection, sometimes face public opinion and people who believe they are buying looted art. This problem also affects German museums, which tend to limit their exhibitions of African art lately. There's a sort of omertà on the issue. Yet art is universal, and African works are ambassadors for these cultures; they should be displayed and used to educate people to help them understand the richness, cultural significance, and artistic value of these items.

How do art professionals respond to these issues?

One of the major challenges in the art market is transparency, the issue of provenance, the issue of research. We have already taken these issues very seriously and we will continue to improve by furthering our work with researchers, investing in in-depth research on traceability and the history of items. I believe clients are becoming increasingly aware of these issues and expect dealers to be able to provide reliable information. It's a matter of collective responsibility. If we want to change something, we need to start with ourselves. It's the same with the market. How can we improve quality? How can we enhance transparency and how can we educate so that people understand African art is not wall decoration, but the expression of entire cultures.



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AMIN

La come d'or, matin (detail, 1907), Paul Signac

ARR



THE LABYRINTH OF PLUNDER

In the lengthy roster of grim chapters penned during the World War II, the plunder of Jewish cultural assets has been acknowledged slowly and painfully.

On 18 April 2023, in a ceremony marked by solemnity under the guidance of Rima Abdul Malak, then French Minister of Culture, two paintings and a sculpture looted by the Nazis were returned to the rightful heirs of the families of Agathe and Ernst Saulmann, and Harry Fuld Junior. The chosen date was significant: it coincided with Yom HaShoah, the memorial day for the victims of the Holocaust. While plunder and expropriation have been historically documented since antiquity, their sorrowful memory resonates in France with the thousands of acts of looting, theft, confiscation, and forced sales implemented by the Vichy authorities and the Nazi regime under the “Aryanisation” policies.

From the initial days of Occupation, German authorities organised to seize works and properties belonging to Jews, primarily under the direction of the German Embassy in France. A service tasked with the confiscation of the cultural assets of Jews and Freemasons in the territories occupied by the Reich was then established in September 1940, the Einsatzstab Reichsleiter Rosenberg (ERR). This ERR initially gathered the works in a few rooms of the Louvre Museum and then, due to lack of space, at the Jeu de Paume. Swiftly, the General Commissariat for Jewish Affairs enacted the “Aryanisation” of Jewish properties with the sale of all their movable and immovable goods, including the trade funds of art and antiquities dealers and the personal belongings of collectors. This marked the first step towards the widespread looting of the 70,000 residences seized in France, which were emptied until July 1944, including 38,000 in Paris alone. According to the Ministry of Culture,

the number of artworks and artefacts looted is commonly estimated at around 100,000 pieces for France alone. This number is clearly an underestimate, as many families did not report their loss at the Liberation.

Journey

The restitutions of April 2023 exemplify the intricate journey of artworks stemming from Nazi plunder [see p.36]. Ernst and Agathe Saulmann possessed an extensive collection of antiques, sculptures, Old Master paintings, majolica, tapestries, 19th-century paintings, furniture, and art objects, distributed between their Erlenhof villa in Germany and their Florence villa. In 1936, their art collection, confiscated by the German authorities, was sold at five auctions by the Weinmüller auction house in Munich, in collaboration with art dealer Julius Böhler. However, the two paintings returned in 2023 — a Paduan *Madonna with child* and a Florentine *Battle scene* from the 15th century — were not part of these plunderous sales. It took the investigation of researcher Katharina Hüls-Valenti to trace the missing paintings in the historical archives

of the Florence export office, the photo library of the German Institute for Art History, and other archives. During Occupation, the works changed hands multiple times. They passed through German art dealer Walter Bornheim, who worked in Paris on behalf of Hermann Göring. Göring eventually came into possession of the two paintings, which ended up in his depot at Berchtesgaden. Sent to France just after the war, the two paintings were selected from the 15,000 last works returned from Germany and not restituted, thus becoming “National Museums Recovery” (MNR) works [see box], later housed at the Louvre and the Angers Museum.

A long list

The Saulmann/Fuld restitutions followed other widely publicised returns of looted assets in recent years. This includes *La corne d'or, matin* by Paul Signac and *Gelée blanche, jeune paysanne faisant du feu* by Camille Pissarro, two paintings stolen by Occupation forces and returned in 2018 by the State to the heirs of Gaston Lévy. In 2020,

a drawing by Ernest Meissonier, *Chess players*, was returned to the heirs of Marguerite Stern, from whom it had been stolen during the same period. Lastly, in 2021, the Musée d'Orsay and the Ministry of Culture initiated a voluntary restitution procedure for Gustav Klimt's *Rose bushes under the trees* to the heirs of Nora Stiasny (1898-1942), ratified by the law of 21 February 2022. Yet, restitutions are rarer and more complex to implement than the media attention might suggest. “Since 1950, 181 works categorised as National Museums Recovery have been restituted, the three works returned today bring this number to 184,” stated the Minister of Culture during the April 2023 ceremony. “The establishment of a working group since 2013 has accelerated the pace, with 73 restitutions made in ten years, including 50 initiated by public institutions themselves.” A figure that seems modest considering the massive scale of the injustice.

Forgotten in time

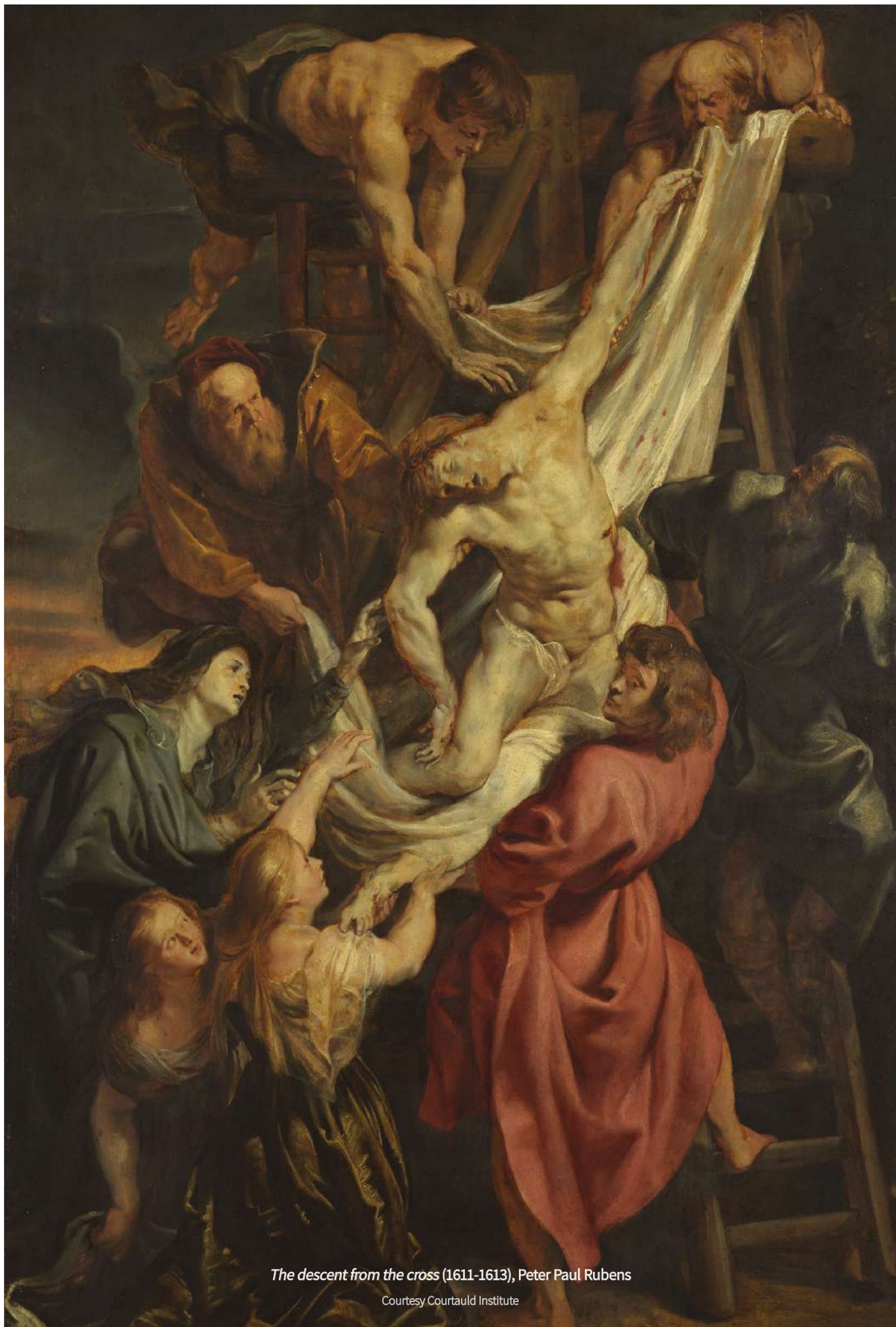
In fact, the issue of looted assets gradually fell into oblivion at the

dawn of the “Trente glorieuses” in the post-war euphoria: only four MNR objects were restituted between 1955 and 1993. However, the Government had established as early as November 1944 an Art Recovery Commission (CRA). Rose Valland, the head of the mission in Germany and curator of the Jeu de Paume, who facilitated the rescue of thousands of works through her clandestine exchanges with Jaujard and the resistance by compiling meticulous inventories of looted goods, organised an extraordinary repatriation. Between 1945 and 1954, the French art recovery services enabled the repatriation of 61,233 objects and the restitution of 45,441 of them to their owners or rightful heirs. Of the 15,000 objects not claimed by families, 2,200 works of art became “National Museums Recovery” (MNR), recorded on provisional inventories and entrusted to the care of the national museums.

The resurgence of interest in looted cultural goods is rooted in the geopolitical changes of the 1990s, with the fall of the Berlin Wall. Access to Eastern archives and questioning the role of states during the global conflict brought to the forefront the issue of the organised plunder of Jewish assets. In 1997, the “Study Mission on the Plunder of Jews in France”, known as the Mattéoli mission, investigated anti-Semitic plunder and led, two years later, to the creation of the Foundation for the Memory of the Holocaust and the Commission for the Compensation of Victims of Spoliations resulting from anti-Semitic legislation in force during the Occupation (CIVS). In 2019, the Ministry of Culture established within its structure the Mission for Research and Restitution of Cultural Property looted between 1933

Looted cultural goods

There are several categories of looted cultural goods: goods held by private individuals, sometimes circulating on the art market; a portion of the “National Museums Recovery” (MNR) works entrusted to the care of national museums — though not all MNR works are necessarily looted works — and goods belonging to public collections. MNR works, which do not belong to the national collections, can be restituted based on an administrative decision in the event of spoliation. Among the 2,200 MNR works repatriated from Germany and entrusted to the care of national museums after the war, some are the result of plunder, but others were “regularly” sold on the art market during Occupation. The provenance of most works remains unclear. Sometimes, museums and libraries retain works and books purchased or received as donations and bequests through regular procedures, but which are discovered, after their entry into the collections, to have been looted prior to this entry. Their identification is not necessarily straightforward, as the research on the provenance of public collections is a recent discipline [see p.26].



The descent from the cross (1611-1613), Peter Paul Rubens

Courtesy Courtauld Institute

Virgin of mercy (15th century), Gil de Siloé
Photo Thierry Ollivier. © Louvre



The plunder and expropriation of the assets of Jews in Germany, France, and throughout occupied Europe [...] in many cases preceded deportation and extermination, in a dual process of erasure and destruction. These dispossessions were true rendings from both personal and collective history. To identify and recover these cultural assets and to return them to the victims' rightful heirs is to act in the name of justice today, but also in the name of memory, to enable the descendants of the plundered Jewish families to reclaim their history. — *Rima Abdul Malak*

and 1945, a specific service tasked with shedding light on cultural goods of dubious provenance held by public institutions, whether these are works classified as MNR (National Museums Recovery), looted books, or works entered into permanent collections. To accelerate the process, Rima Abdul Malak had presented a bill aimed at facilitating the restitution of cultural property belonging to the public domain that had been looted in the context of anti-Semitic persecutions by Nazi Germany and the Vichy regime. A first species-specific law enabled the restitution in 2022 of fifteen works from French public collections, looted or acquired under dubious circumstances, including a Klimt painting from the Musée d'Orsay returned to the heirs of Nora Stiasny, a Chagall painting from the National Museum of Modern Art returned to the heirs of David Cender, and an Utrillo painting from the collections of the town of Sannois, returned to the heirs of Georges Bernheim.

New law

Definitively adopted on 13 July 2023, the new law simplifies the restitution procedures and introduces an exception to the principle of inalienability of goods belonging to the public domain when the works were looted in the context of anti-Semitic persecutions between 1933

and 1945. This represents a turning point in the history of public collections and the involvement of museums in provenance research. Thus, in September 2023, a few months after the promulgation of the spoliation law, art historian and Germanist Ines Rotermund-Reynard was appointed as the research officer for provenance at the Musée d'Orsay, a newly created position, the second in a French museum after that of the Louvre, which concretises decades of research conducted by French museums on the provenance

of works from art recovery. Supported by the Ministry of Culture's Mission for Research and Restitution of Cultural Property looted between 1933 and 1945 and the Commission for the Compensation of Victims of Spoliations (CIVS), the Musée d'Orsay, which has 145 MNR paintings under its care, has already developed tools for tracing the history of works and has dedicated an entire section of its library to provenance research and the spoliation of cultural goods. In the face of the duty of memory, investigating the history of works becomes a collective responsibility.

A commission rules on Rubens paintings

Three contested paintings by Peter Paul Rubens will remain in the possession of the Courtauld Institute in London rather than being distributed to claimants. This was the decision issued at the end of March by the UK's Spoliation Advisory Panel, which resolves claims from those whose cultural property was looted by the Nazis and is now in British national collections. The decision is based on the fact that the Rubens paintings were not technically stolen by the Nazis. Originally, they were part of the collection of German banker Franz Wilhelm Koenigs, who had used them as collateral for a loan from a Dutch bank. This bank later went into voluntary liquidation, at which point Wilhelm Koenigs opted to cede the paintings to the bank rather than settling his loan debt.

The bank sold the paintings to a collector who subsequently donated them to the Courtauld Institute. Since the change of ownership occurred before the Nazi invasion of the Netherlands, the Spoliation Commission ruled that the paintings do not constitute Nazi loot and must therefore remain in the museum's collection.





A train boxcar containing art taken by the Nazis and Göring

Photo William Vandivert

MONTE

Hungarian National Museum
Courtesy Hungarian National Museum



AURORA: EUROPE BETS ON TECH TO COMBAT ART TRAFFICKING

In the face of trafficking, the traceability of artworks is of paramount importance. Employing nanotechnologies, AI, and blockchain, European project AURORA is developing a highly discreet digital tracking system to trace art objects.

Pillaging and smuggling of cultural goods are scourges. However, the illicit trafficking of artworks poses another threat to the stolen items: the loss of the object's memory. Termed "dissociation", the vanishing of information related to cultural goods as they move through underground networks is a significant, albeit lesser-known, consequence of trafficking. Provenance, identification, location... Deprived of the necessary information for their identification even when recovered, objects can quickly become "orphans" [see p.18]. Not to mention items plundered or stolen that appear on the market with false provenances. To counteract this phenomenon, the European project AURORA aims to fill this gap by employing cutting-edge technologies for marking and tracking artworks.

Invisible to the naked eye

"The AURORA proposal for authentication and tracking relies on several technological pillars such as blockchain, advanced imaging, miniaturised electronics, nanomaterials research, and artificial intelligence," lists D' Lujza Varga, head of the department responsible for international cooperation, project coordination, and exhibitions at the Hungarian National Museum, one of the project's partners [see box p.44]. Chemical tracers, miniaturised digital devices, and platforms based on the cloud and blockchain... these combined non-destructive and non-invasive methods are presented as cost-effective and efficient solutions to combat illegal activities. And importantly, they are invisible to the naked eye. "Each of these methods is currently under development to extend their applicability in real-world scenarios," she continues. "The ultimate goal is to achieve a robust process for authenticating artworks and tracking cultural goods."

The aim? To democratise these new technologies by making them available to professionals and cultural heritage institutions without the need for expensive equipment or advanced technological knowledge. Lujza Varga reveals: "We cannot say too much at this moment, as we are in the midst of researching and developing crucial components, however, we can state that the AURORA solution will be non-invasive to the associated artwork and that the overall solution is likely to facilitate exchanges and collaborations between artistic institutions, as well as their management."

All-round cooperation

An active member of the Task Force against Heritage Crimes led by the OSCE (Organisation for Security and Co-operation in Europe) — an international team of experts aimed at combating heritage crimes, especially the illicit trafficking of art objects — this historian is intimately familiar with the intricate complexities of protecting cultural goods, from disaster risk management for cultural heritage to peace-building activities and post-conflict recovery of cultural heritage. "We believe that to

ENIGMA and ANCHISE

AURORA is not the only European project envisioning new methods based on the latest technologies to preserve artworks from illicit trade. Launched concurrently with AURORA as part of the European Community's action plan to intensify the fight against the trafficking of cultural goods in late 2022, the ENIGMA and ANCHISE projects also utilise consortia comprising universities, experts, laboratories, museums, as well as police and customs services.

Funded with €3,993,500 until 31 December 2025, ENIGMA is developing a tool to analyse police and ICOM databases for stolen or looted items. The project focuses on technologies that improve the identification, traceability, and provenance research of cultural goods, as well as the safeguarding and monitoring of endangered heritage sites. Meanwhile, ANCHISE, coordinated by the French School at Athens and endowed with €4 million in European grants, offers a sort of "toolbox" combining a multitude of technologies, such as 3D photogrammetry for site monitoring, spectral fluorescence signature for object authentication, and AI for artwork identification at border checks.

effectively respond to these threats, ongoing cooperation and a common strategy are necessary across various domains, including cultural, technical, enforcement, military, humanitarian, and administrative sectors, both private and public," she states. Ultimately, the systems developed by AURORA will indeed assist police, customs officers, dealers, collectors, auction houses, or cultural institutions to easily verify the authenticity and provenance of artworks, as well as monitor their movements.

With a community funding of €3,466,354 under the European cultural programmes Horizon, the AURORA project (acronym for Artwork Unique Recognition and Tracking through chemical encoded data, miniaturised devices and blockchain alliance) commenced on 1st January 2023 for a duration of three years. "The project coordinator is AVVALE, based in Italy, represented by Domenico Romano," Lujza Varga specifies. Partners of AURORA include the Balkan Museum Network, Lviv Polytechnic National University, Antonio Mirabile [see p.68], Tyndall, beWarrant, CSGI, University College Cork, OTID (One True ID), and of course, the Hungarian National Museum.

Boasting a collection of approximately 3.8 million objects spanning the history of Hungary and the surrounding region from the Neolithic to the present day, the Hungarian National Museum (HNM) plays "a leading role" in Europe in archaeological exploration, coordination of museum digitisation, as well as in postgraduate training and higher education activities in the fields of heritage management and museology. With its central position in the heart of Europe, Hungary is squarely on the trafficking routes coming from the Middle East. "Given its responsibilities, the HNM must identify certain threats to cultural heritage," Dr Lujza Varga explains. "Therefore, our institution faces the

3 questions to... Lujza Varga

Lujza Varga is head of department at the Hungarian National Museum.

What have been the main technical challenges that AURORA had to overcome?

Given the mix of technologies AURORA employs and their application context, there are several challenges stemming from various factors. One of the most significant is adapting AURORA's technologies to a field where they are not usually applied so extensively, which is essential to make AURORA's outcomes truly operational for art professionals and institutions. Moreover, we must pay special attention and consider specific constraints when handling cultural heritage objects, conducting thorough testing and research to make any potential impact on the artwork negligible. Harmonising these different, usually unrelated technologies, each with its own limitations and potentials, is crucial.

What are the links between AURORA and the ANCHISE and ENIGMA projects?

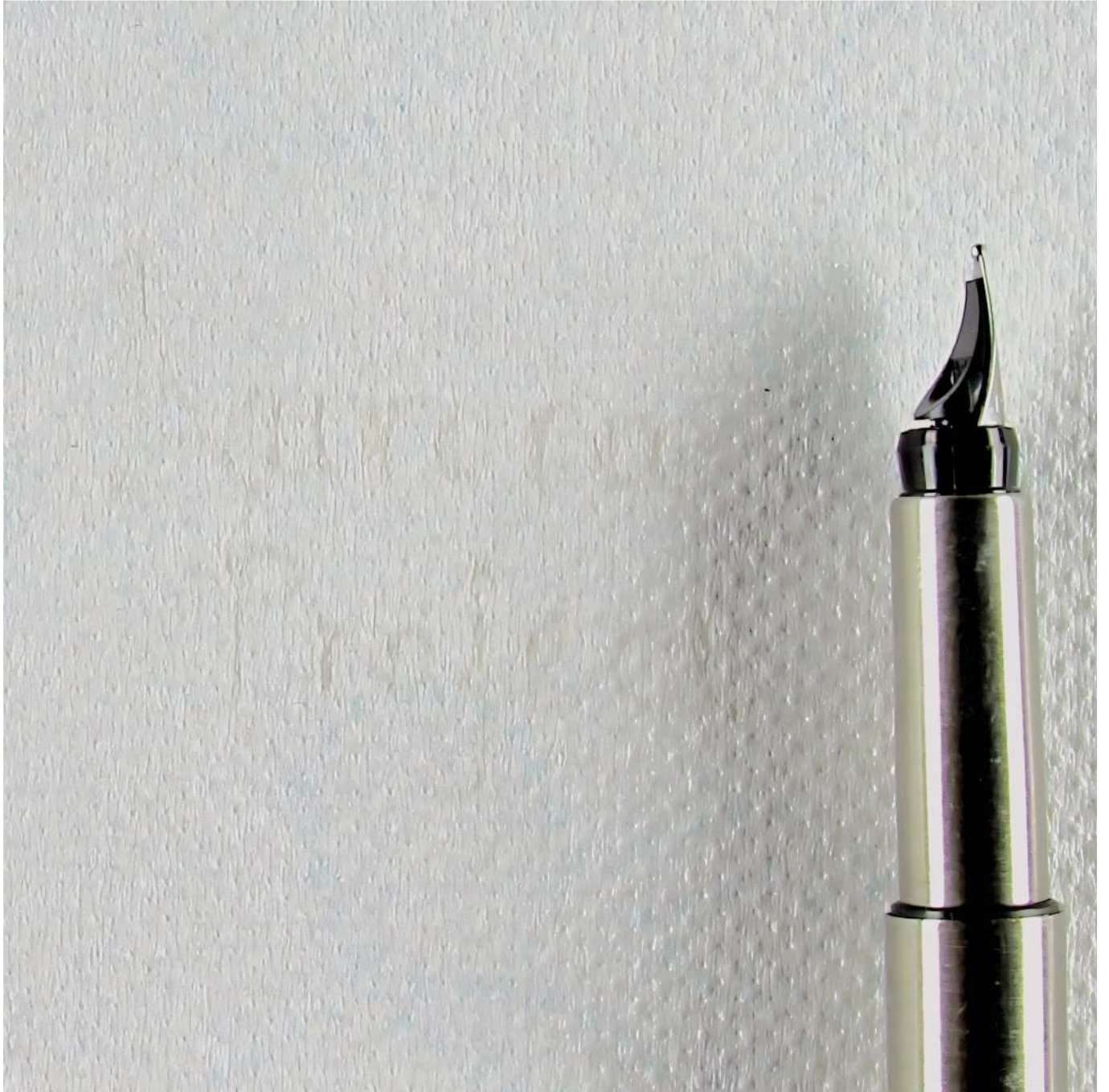
As the three projects are European Union-funded solutions against the illicit trafficking of cultural goods, they can be considered sister projects tackling these tasks from different perspectives. Therefore, the teams closely follow each other's work, participate in each other's events, and hold joint meetings occasionally to coordinate and aid their collective efforts. We can also talk about joint dissemination: for instance, last year, the Hungarian National Museum hosted its annual MuseumDigit conference, and in the section "Safeguarding and storage of digital content in times of crisis", Klaudia Klára Tvergyák (Hungarian National Museum), Axel Kerep (PARCS SOLUTIONS), and Marco Fiore (Michael Culture Association) held a joint presentation on the work done by the AURORA and ANCHISE projects.

How will the project continue beyond 2025?

During the three years of the project, AURORA will demonstrate that its proposal is practically viable on the selected types of artworks. Afterward, it will be important to expand the range of artworks on which the AURORA solution can be tested and verified, taking into account that each type of artwork has its peculiarities that require specific studies and tests. Future development will focus on enhancing technological integrations and minimising impacts on the artworks, thereby further reducing the technological knowledge requirements of artistic institutions.

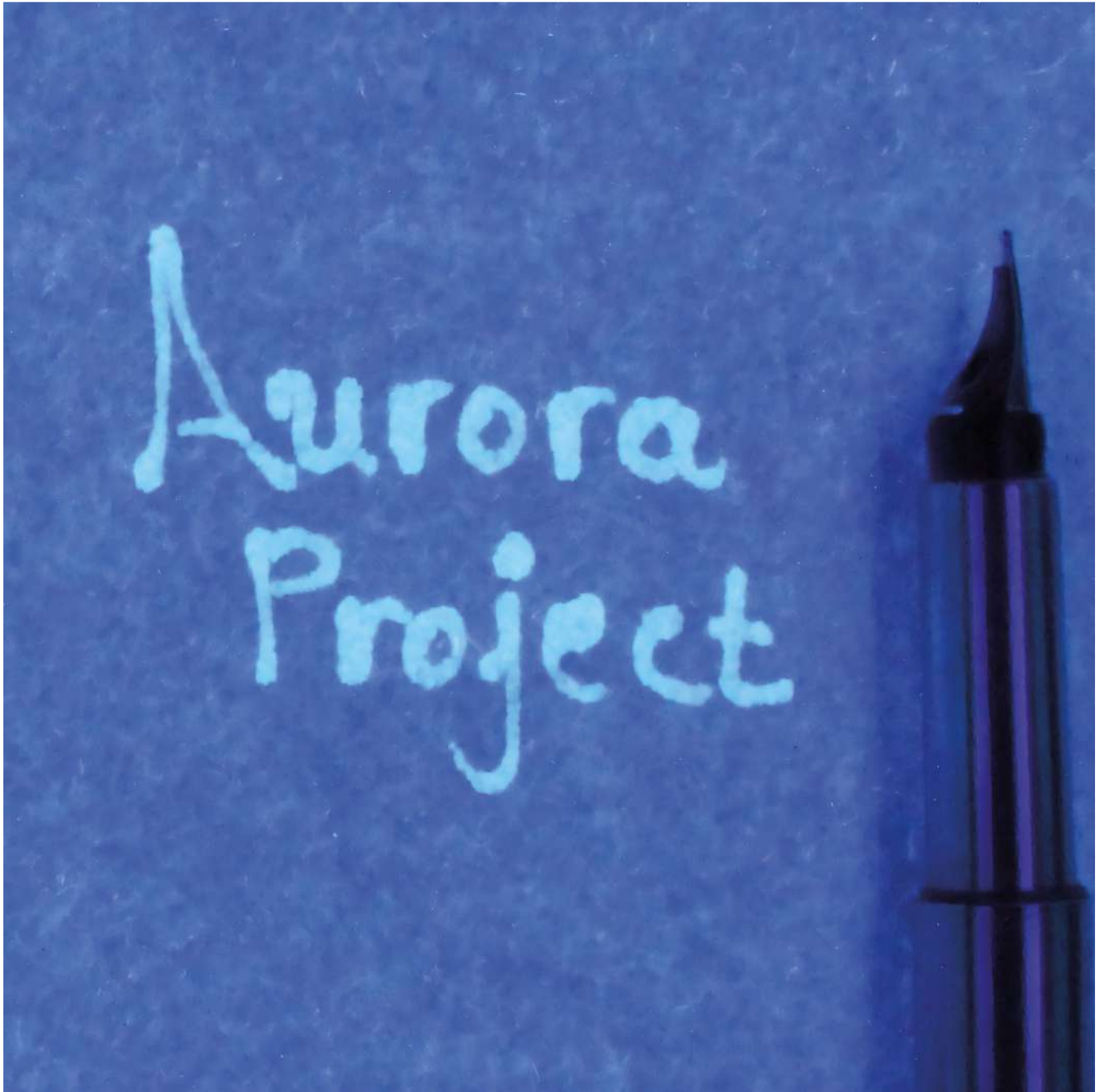


Dr. Lujza Varga
Courtesy Lujza Varga



Writing with the invisible fluorescent ink on paper under visible light

Courtesy AURORA project



Writing with the invisible fluorescent ink on paper under UV light

Courtesy AURORA project

“We believe that museums can play an active role in this fight and go beyond protecting their own collections by actively participating in a broader initiative to preserve universal cultural heritage. — *Dr Lujza Varga*

complex problem of illegal excavations, pillaging, thefts, and illicit trafficking of art objects.”

Crack team

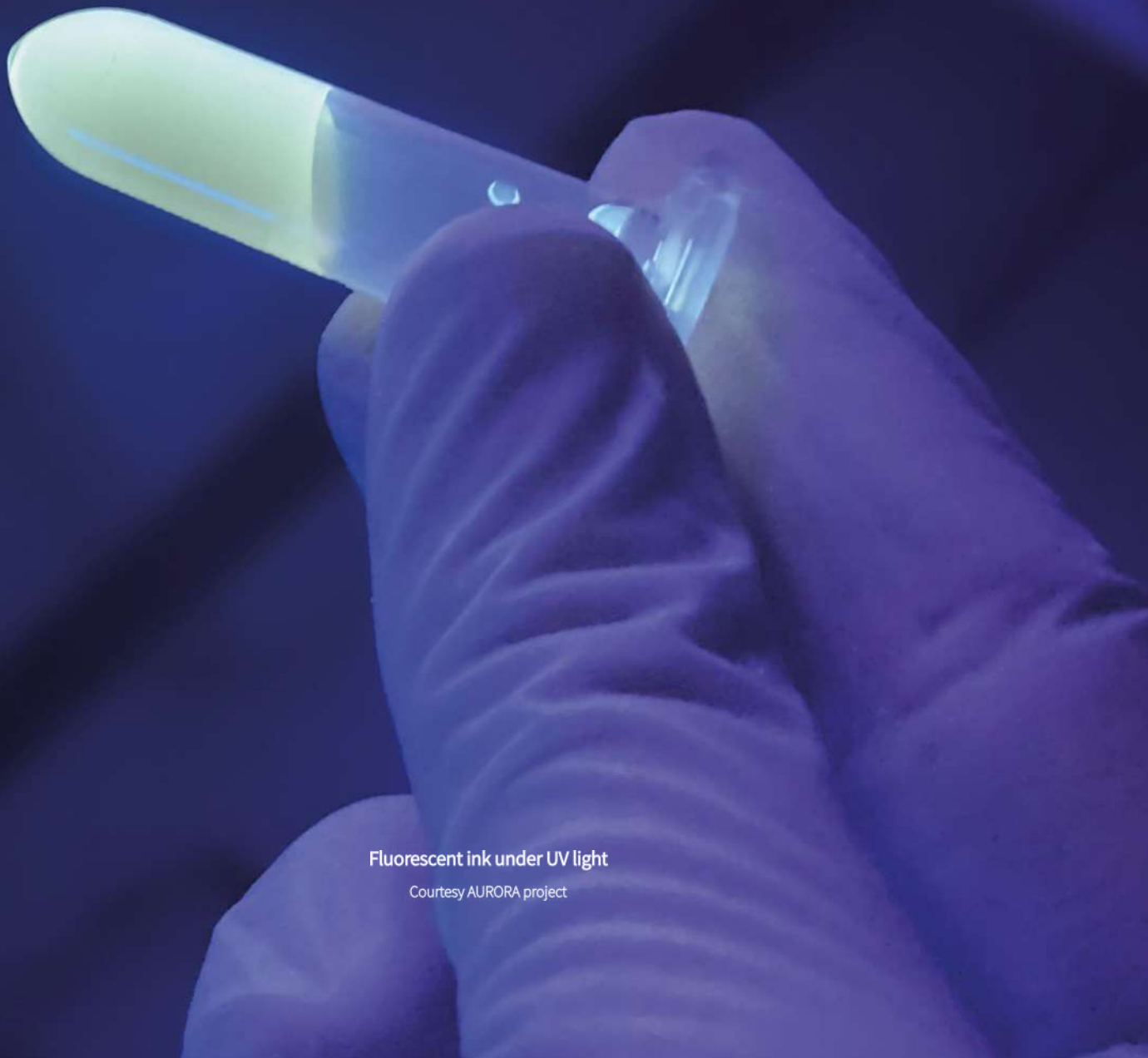
The Hungarian museum, which has already participated in several cooperation, research, and innovation projects focused on very practical issues of heritage protection such as database development and eco-friendly storage and conservation, thus joined the AURORA consortium from its launch.

“This project is a valuable cooperation for the HNM, as it aids the museum sector in achieving our goals, while the interdisciplinary team of AURORA, composed of well-prepared experts and wonderful people, also inspires us.”

While the AURORA consortium has not changed, the project team is expanding. It has begun to form an advisory council of external experts under the leadership of Domenico Romano and Antonio Mirabile.

Among the members of this advisory council is also Vanessa Boschloos, the executive assistant of Blue Shield Belgium, the NGO that protects cultural heritage in the manner of the Red Cross for humanitarian issues. “We are also working to expand this team,” adds Lujza Varga. “We are eager to foster a living dialogue among all stakeholders involved in the fight against illicit trafficking of cultural goods, hence private collections and foundations are more than welcome to join us and discuss our goals at various project events.”

Message relayed.



Fluorescent ink under UV light

Courtesy AURORA project

NON-FERROUS

THE WORDS OF WOES

Pillage, theft, expropriation, handling stolen goods, money laundering... The trafficking of cultural goods encompasses a multitude of fraudulent and illicit realities, each with specific legal definitions. A brief glossary attempt follows.

Cultural goods trafficking. The basis

Cultural goods trafficking refers to the illegal practice of acquiring, selling, exporting, or importing cultural and historical objects in violation of national or international laws. These cultural assets may include archaeological artefacts, artworks, ancient manuscripts, antique coins, sculptures, textiles, and other objects of historical, artistic, or cultural value. It assumes complex and varied forms such as archaeological looting, the production of fakes and counterfeits, illegal import and export of cultural objects between countries — often bypassing customs controls and exploiting loopholes in national and international regulations — and money laundering to inject funds from criminal activities such as drug trafficking, terrorism, or corruption into the legitimate economy.

Handling of stolen goods. ...with care

Handling stolen artworks refers to the act of knowingly possessing, acquiring, receiving, or selling a stolen, counterfeit, or otherwise illicitly obtained artwork, fully aware of its illegal origin. In other words, it involves profiting from or benefiting from an artwork known to have been acquired criminally or fraudulently. Handling stolen artworks is often considered a serious criminal offence in many legal systems, as the lure of profit is the primary motivation behind the initial theft, thus perpetuating the illicit market for cultural goods and encouraging criminal activities related to art.

Fake. ...but great!

Artistic challenge, prestige, snubbing the authorities, profitability... The motivations of forgers are often more complex than they appear. By definition, an artistic fake is a work intentionally created to resemble an authentic work of a renowned artist, a specific historical period, or a particular artistic movement but is, in reality, a fraudulent imitation. Forgers, often talented artists or skilled craftsmen, produce these counterfeits to deceive collectors, art dealers, or museums for financial gain. One of the most famous, Dutch painter Han van Meegeren, dubbed the “Vermeer forger”, deceived experts and buyers during World War II. A fake Vermeer by Han van Meegeren, *Christ and the Adulteress*, even ended up in the possession of Göring, who exchanged it for 200 genuine paintings seized from Dutch museums. Detecting fakes in art is often complex and demanding, involving thorough analyses of the work, including scientific examinations, provenance studies, historical research, and stylistic comparisons.

Art theft. The Thomas Crown affair

As defined by Article 311-1 of French Penal Code, theft is the fraudulent subtraction of someone else's property. In the context of art, the thief's motivations are as diverse as the methods of theft, which can occur opportunistically, through break-in, or even internally, as in cases where museum employees themselves commit the theft. In 2016, Interpol's database listed 49,000 stolen artworks worldwide. In France alone, 289 artworks were stolen from museums between 2000 and 2009. Beyond surveillance — which can take various forms including guarding, cameras, detectors, etc. — there are different mechanical systems to protect artworks: openwork frames designed to prevent the rear removal of paintings, insert screws against pulling, concealed or even invisible fixings, and for smaller works, large display panels that are difficult to transport. Among the most famous art thefts is that of the *Mona Lisa*. Stolen from the Louvre on 21 August 1911 by Vincenzo Perugia, an Italian worker at the museum, the *Mona Lisa* remained hidden in the thief's room for two years before he was caught by the police following his attempt to sell it to an Italian antiquarian. The case, which caused a sensation at the time, even saw Picasso and Apollinaire briefly suspected during the investigation.

Looting. Borderlands of art

Looting of artworks or archaeological objects refers to the act of illegally stealing, destroying, or displacing cultural and historical goods, including artefacts from monuments, museums, or archaeological sites, with the intent to resell them on the black market or use them for personal or political purposes.

In 2003, nearly 15,000 items were looted from the Baghdad museum at the start of the Iraq War before mostly appearing on the black market. In 2015, the Mosul museum was completely looted and vandalised by Daesh. The looting of artworks and archaeological objects is concerning as it results in the irreplaceable loss of cultural and historical assets, contributes to the impoverishment of global heritage, and harms the preservation of collective memory and cultural identity. Moreover, it fuels the black market for cultural goods, encouraging organised crime, funding terrorism, and other illicit activities.

Money laundering. White spirit

“Money laundering involves disguising the origin of funds obtained illegally so they appear to come from legitimate sources,” according to Interpol. It involves circulating illicitly obtained funds worldwide through banks, shell companies, intermediaries, and money transfer companies to reinject them into legal businesses and economies, such as the art market. Money laundering is often just one component of other organised crime offences, as in the case of art trafficking when it serves to fund criminal activities like terrorism. It involves using the art market to conceal the illicit origin of funds by investing the proceeds of criminal activities in the purchase or sale of artworks. This may involve techniques such as buying artworks with money from criminal activities, then reselling these works at inflated prices to legitimise the dirty money. Sometimes, the artworks themselves can be used as instruments to transfer money from one place to another, or to store wealth

anonymously and out of reach of regulatory authorities. Money laundering in the art domain is particularly difficult to detect due to the subjective nature of art's value and the complexity of transactions in the art market. Financial investigations thus aim to identify the origin, movements, and location of these funds and to expose the networks involved. Illegally obtained assets can then be frozen or confiscated, and the perpetrators of the initial offence and money laundering prosecuted.

Fraud, Tax evasion, and Tax optimisation.**For lovers of the common good**

The line between the three is sometimes blurred. While tax fraud is clearly illegal, i.e., deliberately avoiding paying taxes by manipulating, hiding, or falsifying financial information to artificially reduce one's tax burden, other practices “operate in a legal grey area”, according to French Directorate General of Public Finances (DGFiP). Thus, while tax optimisation is entirely legal — using existing tax laws to minimise one's taxes, even in cases of “aggressive optimisation” — evasion involves voluntary concealment, often offshore “like shifting profits to shell companies without economic substance.” By frequently using shell companies to escape income tax, billionaires worldwide have effective tax rates ranging from 0 to 0.5% of their wealth, according to the EU Tax Observatory. Some cases are sensational in the art market. After two acquittals in 2017 and 2018, the heirs of the Wildenstein art dealer family and their advisers were convicted on 5 March last year by the Paris Court of Appeal for particularly massive and elaborate tax evasion practices.



Sans titre (Faces of memory 2020), Igor Efimov
© Igor Efimov, Courtoisie Fraga

Interior view of Seoul's freeport

Courtesy The FreePort





The Last Supper (1939) painted by Han van Meegeren
in the style of Johannes Vermeer

© Nationaal Archief NL

Han van Meegeren in front of
Finding in the temple (1945)
in his prison cell
Photo Koos Raucamp



Expropriation. “What’s yours is now mine”

Art expropriation, refers to the act of illegally removing or appropriating artworks, often under conditions of conflict, war, occupation, or persecution, without the lawful owner’s consent. These acts can occur on various scales, from the theft of a single work to the large-scale systematic looting of cultural and artistic treasures. Art expropriations have often been perpetrated in the context of armed conflicts, world wars, colonisation, or military occupation, where cultural and artistic assets were looted, stolen, or forcibly displaced. For example, during World War II, Nazis organised the systematic looting of artworks in occupied territories, seizing thousands of artworks from private collections, museums, and cultural institutions. It is generally estimated that 100,000 artworks were looted in France during the Occupation and at least 5 million books were stolen. Art expropriation raises complex issues related to ownership, restitution, historical justice, and the preservation of cultural heritage.

Counterfeiting. Counterfeist

In the art world, counterfeiting refers to the illegal or unauthorised reproduction of an original artwork, typically with the intention of deceiving buyers or profiting from the reputation or value of a legitimate artwork. Counterfeiting can involve various types of artworks, including paintings, sculptures, engravings, drawings, and photographs. There are several “levels” of counterfeits. In the case of an exact copy, the reproduction seeks to be identical to the original work — with, generally, the clear intention of passing the copy off as the real thing. Conversely, some counterfeiters make only slight modifications to create a slightly different version while preserving the

general appearance of the original artwork. Lastly, famous among all, the falsification of the signature involves adding fake signatures or marks of the original artist to give the impression that the work is authentic. Thus, forgeries of Andy Warhol’s signature abound in the art market...

AML. ...aka “pain”

Anti-money laundering (AML) legislation comprises laws and regulations designed to prevent and detect the use of the financial system to disguise or legitimise income from criminal activities. These laws aim to identify, monitor, and report suspicious financial transactions to combat money laundering, terrorist financing, and other illicit activities. Since January 2020, the “5th Anti-Money Laundering Directive” applies to art market professionals in the European Union, as well as the United Kingdom. As intermediaries, art professionals are subject to reporting and verification obligations such as the identity of the buyer — including the status of politically exposed persons (PEPs) or “monitoring negative media coverage involving clients” — as well as the origin of the funds. In professions where confidentiality and discretion are paramount, these customer due diligence controls cause some teeth grinding...

National Recovery Museums (MNR). ok

After World War II, Allied forces found in Germany or in territories controlled by the Third Reich, artworks and objects from France, some of which were presumed looted. While the Art Recovery Commission (CRA) created in 1945 returned 45,000 to their rightful owners or heirs, about 2,200 unreturned works after the war, with no clearly identified owners, were entrusted to the care of national museums. These assets, known as “National Recovery Museums” (MNR), can be restituted by decision of the Prime Minister on the recommendation of the CIVS or the Ministry of Culture. As of 1st January 2024, the number of MNR assets restituted since 1950 amounts to “only” 172.

Freeport. Free porc

A freeport is a warehouse where goods, including artworks, can be stored duty-free, tax-free, and without customs controls. The main purpose of a freeport is to facilitate the storage, handling, and trade of goods without being subject to the usual customs taxes and regulations that would apply in other areas. In the art sector, freeports (Geneva, Singapore, Delaware, etc.) are often used to store valuable artworks for extended periods, particularly for reasons of security, privacy, or speculation.

UNESCO keeps a watchful eye

What to do in case of art theft? UNESCO recommends a checklist of actions to follow once the crime has been detected. Following a theft, the first step is to alert law enforcement authorities and provide them with all the necessary information. Once the crime scene procedures are completed, the central authorities or those responsible must inform the INTERPOL National Bureau of the theft so that the stolen item(s) can be listed in its database of stolen artworks. Several cooperation channels exist regarding the return of an object subject to illicit trafficking: administrative and informal assistance, judicial cooperation, negotiations, intervention by the Intergovernmental Committee for Promoting the Return of Cultural Property to its Countries of Origin or its Restitution in case of Illicit Appropriation (ICPRCP), and finally, legal action.





DATA



Pigeon with peas (1911), Pablo Picasso

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PABLO PICASSO

With Picasso, everything is on a grand scale, including when it comes to the theft of his paintings. With 560 artworks stolen, Picasso is not only the world's most expensive artist but also the most pilfered.

A favourite target for burglars, according to Interpol data [see box p.63], 560 of his works have been reported stolen since 1990 — a record. France is by far the most affected country, with an astonishing 470 works stolen (83.8% of the total), followed by Canada (15, or 2.5%), and then the United States, the Netherlands, and Germany, each with 10 stolen pieces (1.6%). Hardly a year passes without reports of stolen or recovered Picasso paintings or drawings, sometimes years after the theft.

Recently, in January 2024, a Picasso painting was recovered in a cellar in Antwerp, fourteen years after its theft in Israel. The incident dates back to 2010, when individuals managed to disable the security system of an abandoned art collector's villa in Tel Aviv. Entering undetected, the thieves broke into the safe, making off with \$680,000 worth of jewellery as well as valuable Chagall and Picasso paintings, then valued at \$900,000. In 2022, the CrimOrg unit of the federal judicial police in Namur was tipped off that a Belgian art dealer residing in Namur might be offering the two high-value paintings for sale. Authorities conducted a meticulous investigation to identify the suspect, trace his activities, relationships, and movements to quickly locate the stolen artworks. Eventually, they ascertained that the sought-after paintings were likely held by the suspect, an Israeli luxury watch dealer, or one of his associates. During a third search, investigators discovered the paintings in an Antwerp cellar, carefully packed in wooden crates to prevent any damage.

The majority of thefts occur in private homes, accounting for nearly 40% of all Picasso thefts. In 1999, *Portrait of Dora Maar*, also known as *Bust*

of a Woman (Dora Maar), valued at 25 million euros, was stolen from a Saudi sheikh's yacht moored in the port of Antibes on the French Riviera. This 1937 canvas depicts one of Picasso's lovers. Unfortunately, French investigators closed the case due to a lack of progress. However, they did not anticipate the intervention of the "Indiana Jones of Art", Dutchman Arthur Brand. In 2015, he discovered that a Picasso had been used for years as collateral in drug trafficking and arms deals. Although initially unaware that it was the *Portrait of Dora Maar*, Brand commenced his investigation. In March 2019, a businessman approached him with the painting under his arm, claiming to have received it in a transaction, unaware of its stolen origin. This painting is now displayed at the Musée Picasso in Paris.

The Picasso family has often been a prime target for thieves of all stripes. In 2007, two paintings and a drawing were stolen overnight from the home of his granddaughter Diana Widmaier Picasso. Valued 50 million euros but entirely unsellable, even on the black market, *Maya with the doll and the*

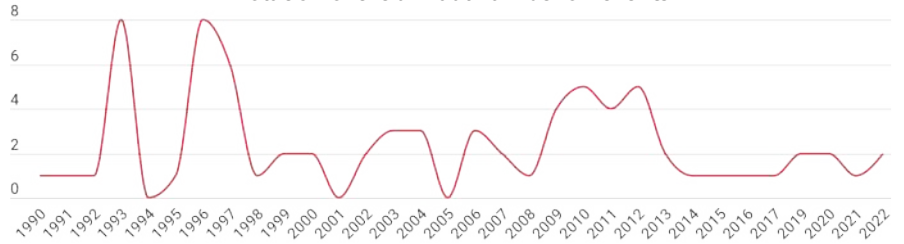
wooden horse, dated 22 January 1938, and *Portrait of Jacqueline*, Picasso's second wife, dated 11 February 1961, were recovered a few months later by the Brigade de répression du banditisme and the Central Office for the Fight Against Trafficking in Cultural Goods (OCBC) investigators. In 1989, twelve canvases, then valued at \$17 million, were stolen from the home of another granddaughter, Marina Picasso, on the French Riviera. Fortunately, these works were also recovered.

The Pierre Le Guennec case is also extraordinary. The former electrician for Pablo Picasso, he was accused along with his wife of stealing and concealing 271 works by the painter. He inadvertently exposed himself in 2015 when he contacted Picasso's son, Claude Ruiz-Picasso, to authenticate the paintings. Suspecting something was amiss, he turned to the courts. According to the couple, the artworks were gifts. Initially convicted, Pierre and Danielle Le Guennec had their sentence overturned on appeal in December 2016 in Aix-en-Provence on the grounds that it had not been proven that the works were stolen. However, a trial in Lyon reaffirmed the original verdict in 2019.

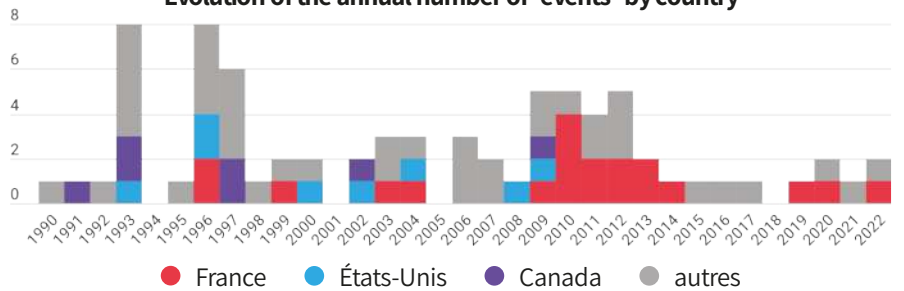
Museum thefts

Stories surrounding thefts of Picasso's works are numerous. The criminals often display neither a lack of boldness nor a sense of humour in committing their acts. Thus, in 2014, American customs intercepted a Christmas gift package from Belgium containing *The hairdresser*, a painting that the Centre Pompidou had reported stolen in 2001 — it had noticed its disappearance from the reserves when it wanted to loan it for an exhibition. The same museum also suffered another Picasso theft in 2004, a still life that was later recovered.

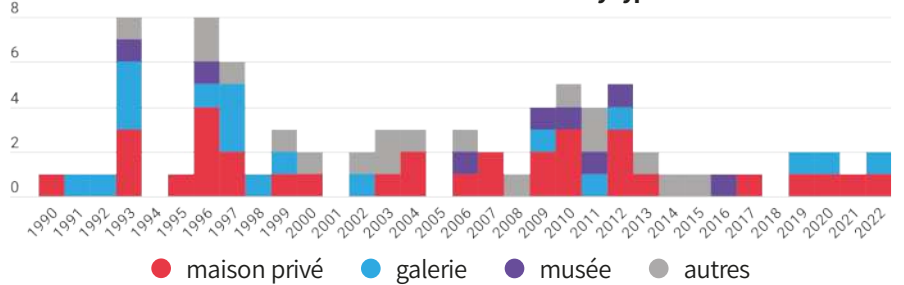
Evolution of the annual number of "events"



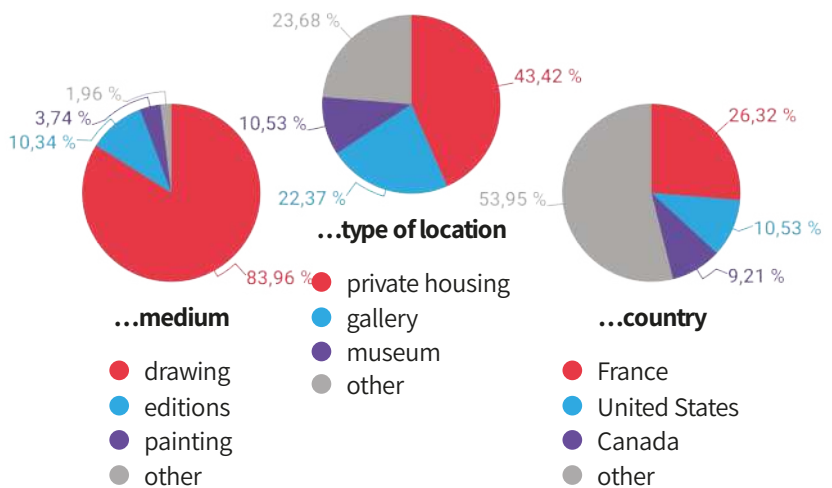
Evolution of the annual number of "events" by country



Evolution of the annual number of "events" by type of location

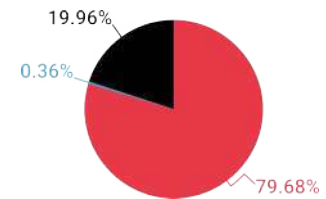


Distribution of the number of "events" by...



On the night of 19 to 20 May 2010, the Musée d'art moderne de la Ville de Paris was the scene of a spectacular theft. Works by great masters such as Matisse, Picasso, Léger, Modigliani, and Braque were stolen. These paintings, valued at a total of 100 million euros, have never been recovered despite the arrest of

the thief and his accomplices. Among them, *Pigeon with peas*, a 1911 oil on canvas in the style of analytic cubism, has never been found. The culprit, Vjéran Tomic, was sentenced to 8 years in prison. His accomplice, Yonathan Birn, confessed receiving the canvases, and claimed to have thrown them away, a version of



Status of the works

- stolen
- found
- deleted

Databases and apps for tracking art thefts

INTERPOL's database of stolen artworks lists 52,000 items with descriptions and photographs. Accessible upon request, it "serves as INTERPOL's main tool in combating the trafficking of cultural goods." It is the only international database containing police-certified information on stolen and missing art objects. In accordance with INTERPOL's strict data handling regulations, only information submitted by authorised entities (INTERPOL's National Central Bureaus and specific international partners such as UNESCO, ICOM, and ICCROM) can be entered into the database. Only fully identifiable items are recorded. In 2021, the organisation launched the ID-Art app to facilitate access.

The FBI also launched its own app in 2023 to track stolen artworks listed in its database, the National Stolen Art File (NSAF). Through keyword search, users can verify, for example before a purchase, that the artwork has not been stolen. Smaller than INTERPOL's, the FBI's database comprises 4,500 stolen artworks and antiquities categorised into 21 categories. An alert is triggered if an item is identified. The Italian police also have their own database and pioneering app since 2014, iTPC, with more than 5.7 million data entries! The public database of the German Lost Art Foundation concerns cultural goods that were looted during the Nazi era, the colonial period, or in the Soviet occupation zone and East Germany, as well as cultural objects that disappeared during World War II. The Foundation funds provenance research to determine whether items were seized illegally.

In 2015, the French Ministry of Culture created the Collections sur Mesure search engine dedicated to stolen or missing cultural goods. It filters according to the thematic criterion of "stolen, missing, unlocated, or unseen" artwork, querying simultaneously the databases Joconde (collections of museums in France), Palissy (movable objects classified or registered as historical monuments), Mémoire (photographs), Mérimée (protected buildings as historical monuments), RMN (photographs), and CNAP (catalogue of the national centre for plastic arts). An essential tool for provenance research, the Rose-Valland database contains a record for each MNR [see p.26]. Each record compiles the most relevant information available on the artwork's journey from its creation to its current location, inventory number, description, etc., along with photos.

With 700,000 entries, the Art Loss Register database is one of the largest private databases. Established in London in 1990, it is widely used in the art market, enabling both searches and registration of stolen property. ALR also offers services to help recover artworks. However, each search costs 90 euros, which is not inexpensive for a database.

events the police highly doubt. Alice Farren-Bradley, from the Art Loss Register [see box], considers this theft to be one of the greatest heists ever, given the value of the paintings, the stature of the artists, and the profile of the museum.

Museums are particularly vulnerable to the theft of Picasso's works. While institutions account for "only" 10.5% of all thefts, they record more stolen items than galleries (40 compared to 30), due to their exhibitions and the flow of visitors. In 2012, a 49-year-old bricklayer managed to steal a Picasso painting titled *Head of a woman* from the National Gallery of Athens in just seven minutes. To achieve his goal, he deliberately triggered the museum's alarm several times throughout the day, in order to distract the guards until they disabled the security system. Once his plan was executed, he simply jumped over a balcony to seize the artwork. This painting held particular significance, as Picasso had donated it to the Greek people in 1949, in homage to their resistance against Nazi invaders. On 29 June 2021, authorities finally apprehended the thief, who described himself as a "passionate art enthusiast". The painting was found wrapped in bubble wrap, abandoned at the bottom of a dried-up river, just a few kilometres from the museum. In 2009, a sketchbook containing drawings by Picasso, valued at around 8 million euros, was stolen



Arthur Brand in front of *Portrait of Dora Maar*

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“They had the Picasso, now valued 25 million euros, wrapped in a sheet and black rubbish bags. I hung the Picasso on my wall for a night, thereby making my apartment one of the most expensive in Amsterdam for a day. — Arthur Brand

from the Musée Picasso in Paris, which was undergoing renovations at the time and was somewhat vulnerable in terms of security. No alarm, no break-in. The sketchbook was stolen from the first floor of the museum from a display case, which, according to a museum employee's testimony to AFP, wasn't even locked... Drawings are indeed the most frequently stolen Picasso works: 84% of the total (470), followed by prints (60 works, or 10.3%) and paintings (20 paintings, representing 3.7% of all thefts).

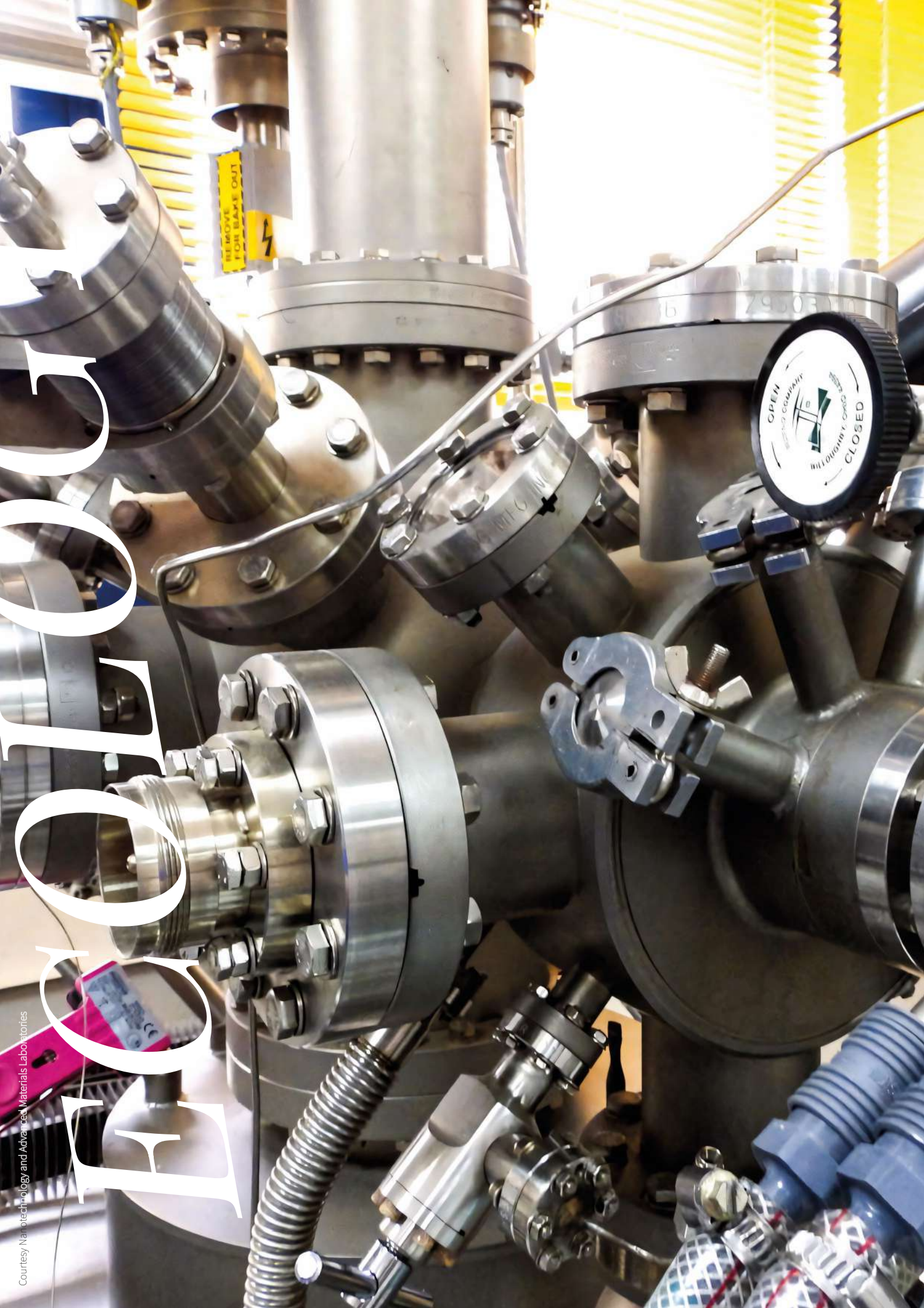
Sometimes, the thefts of Picasso's works are even more spectacular. In January 1976, no fewer than one hundred and eighteen Picasso paintings on display at the Palais des Papes in Avignon were stolen. After neutralising the guards, the thieves made their getaway in a van. The seven culprits were apprehended a few months later by police who had set a trap by pretending to repurchase the artworks. In some cases, thefts of Picasso's works have even been acts of militancy, such as in Australia in 1986 with the group known as the Australian Cultural Terrorists, who stole *The weeping woman* from the National Gallery of Victoria (Melbourne) and returned it fifteen days later by leaving it in a train station locker. Forty years on, stealing a Picasso remains almost as trendy.





Maya with the doll and the wooden horse (detail, 1938), Pablo Picasso

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SOLE



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MONITORING THE IMPACT OF ATMOSPHERIC CONDITIONS ON ART

Emeritus Professor of Chemical Engineering at the University of Patras in Greece, Costas Galiotis is delving into nanotechnologies and materials science to forge sustainable conservation solutions for cultural heritage institutions as part of the European GREENART project.

As a distinguished chemist, Greek researcher and academic Costas Galiotis is involved in GREENART, an international initiative launched by the European Union in October 2022. This project brings together scientists, conservators, and cultural institutions dedicated to the conservation and restoration of artworks. They are collaborating to develop new, green, and sustainable restoration products such as cleaners, protective varnishes, consolidants, and monitoring technologies. Within GREENART, Costas Galiotis's mission is to harness technologies associated with graphene and other two-dimensional materials such as sensors, harmful gas and moisture absorbers, and ultraviolet absorption membranes. This initiative aims to create tools for the end-users of the programme, namely cultural institutions and conservation professionals, to preserve artworks.

What is your professional background?

I am a chemist with a PhD in materials science from the Engineering Faculty at the University of London. Currently, I am a professor in the Department of Chemical Engineering at the University of Patras (since 2014) and a collaborating member of the Institute of Chemical Engineering Sciences (ICE-HT), one of eight university research institutes of the Foundation for Research and Technology-Hellas (FORTH).

What is your current role at the Foundation for Research and Technology — Hellas (FORTH) and in the within the GREENART project? GREENART project?

My present role at the Foundation involves studying graphene-related materials (GRM), 2D materials (production and properties), composites and polymers (structural, mechanical,

and spectroscopic characterisation of polymers and composites) and non-destructive testing of materials (a world leader in applying Raman laser spectroscopy for strain or deformation measurements in fibres and composites). My role in GREENART is to facilitate the end-use of technologies developed related to graphene and other two-dimensional materials such as sensors, harmful gas and moisture absorbers, ultraviolet absorption membranes, etc., by the end-users of the programme, who are the cultural heritage institutions (museums, galleries, academies, etc.).

We understand that you will be developing green technological solutions to monitor environmental conditions affecting cultural heritage. Could you tell us more about this?

It is well-known that atmospheric conditions can impact or even alter the materials used by artists, thereby damaging cultural heritage items. These atmospheric factors include changes in humidity and temperature or emissions from the items themselves due to their prolonged stay in enclosed spaces such as

display cases or storage boxes. For the latter, there is an increase in the concentration of various harmful gaseous pollutants, due to the gradual decomposition of the items, which further accelerates the degradation process. One of our main goals in the GREENART project is to develop green solutions to effectively monitor these essential environmental parameters. The proposed solutions include the development of sensors to record relative humidity, temperature, and pollutants such as acetic and formic acids. Subsequently, the developed sensors will be integrated into electronic and communication solutions for real-time monitoring of environmental variations. While this concept is not new, the innovation in our case lies in the use of green materials and sustainable methods to develop both the sensors and some of the electronic components necessary for their interconnection and communication.

Which other research institutes are collaborating with you within the GREENART project?

We have a close collaboration with various institutions from many European countries, boasting a wide range of knowledge and experience in the field of sensors. This includes material developers, electronics experts, and end-users. At FORTH (Greece), we have well-established expertise in nanomaterials, particularly graphene-related materials (GRM). We are working in collaboration with the Centre for Colloid and Surface Science (CSGI, Italy) and two institutes from the National Research Council (CNR, Italy): the Institute of Polymers, Composites, and Biomaterials (IPCB) and the Institute of Nanostructured Materials (ISMN). Together, we are developing various sensing materials through green approaches.

Additionally, in the development of sensor electrodes, the Tyndall National Institute at University College Cork (T-UCC, Ireland) is working with CNR-IPCB and CSGI to develop new polymer formulations suitable for creating porous electrodes. These electrodes are used by both FORTH and T-UCC in the final assembly of new green sensors. Another activity at T-UCC includes the integration of the developed sensors with electronic and communication solutions using an NFC antenna designed and developed specifically for GREENART. Finally, the produced sensors are validated and tested both in simulated environments at the University of Ljubljana (UL, Slovenia) and the University of West Attica (UNIWA, Greece), as well as in practical settings like at the Peggy Guggenheim Collection in Venice (Italy) or the Hungarian National Museum (HNM, Hungary).

What materials are these sensors related to?

Several innovative materials are being examined and utilised in the development of the sensors, which are either produced through green methods from natural raw materials or sourced from recycled materials and waste. However, graphene and its derivatives undoubtedly dominate all types of sensors. GRM are utilised in various parts of the sensor design, starting with the electrodes, which are produced through the laser graphitisation of biopolymers or natural materials, through to the detection layer where green graphene oxide (GO) is used for monitoring relative humidity. In addition to electrode development, biopolymers and natural materials such as cork are also employed in the development of substrates for sensors and NFC antennas. Furthermore, other 2D materials as well as metal oxides and chlorides have been tested for sensors detecting volatile organic compounds (VOCs) and temperature.

Are they already used in other fields?

Relative humidity and temperature fluctuations are among the primary environmental factors that are monitored and recorded daily in various application fields. In other words, these types of sensors can find applications in many areas outside GREENART, ranging from electronics to buildings, transportation, and industry. Regarding VOC sensors, we target specific pollutants that are harmful to heritage materials. However, they can also be produced from many other sources and some of them are extremely hazardous to living organisms and humans. Therefore, we believe our VOC sensors could find broad usage in a range of application fields.

How do they work?

Although the sensors differ from one another as they respond to various physical or chemical stimulus changes, they share common operational characteristics. The basic principle in all cases involves detecting changes or variations in a particular physical parameter, which are then converted into an electrical signal. Humidity sensors, for example, are designed to function like capacitors. Fluctuations in relative humidity cause the adsorption or desorption of water molecules in the detection area, thereby altering the sensor's capacitance. The measured capacitance change is then converted into relative humidity via a calibration curve. On the other hand, VOC and temperature sensors function like resistances. Indeed, when target molecules are detected by the detection area, the conductivity of the sensor changes, so that the recorded electrical signal can be converted into VOC concentration values. It should also be noted that a change in temperature leads to a change in the concentration of charge carriers in the graphene network, which results in a change in conductivity, which can then be converted into temperature.



Humidity sensors on ZFB archive box for museums

Photo Costas Gallotis

Graphene and its derivatives undoubtedly dominate all types of sensors. GRM are utilised in various parts of sensor design, which are produced through the laser graphitisation of biopolymers or natural materials. — *Costas Galiotis*

How is it innovative compared to existing materials?

The use of nanomaterials such as graphene and its derivatives and many of the methods used to develop the sensors (e.g., laser writing) can be characterised as cutting-edge technology. However, in our approach, the environmentally friendly development of the sensors, which includes all green materials and sustainable methods for their production, constitutes the main innovation compared to existing materials. The materials used for the sensors are either raw biomaterials (e.g., biopolymers) or recovered from recycled materials and waste, while the methods used for their production are either eco-friendly or lead to significant reductions in harmful chemicals, water, and energy waste.

Regarding sustainability, how can you monitor that the new materials are more eco-friendly?

For GREENART, we follow an integrated approach in terms of production methods and material development. Moreover, we provide all necessary information for the ongoing assessment of processes to project partners, such as the University of Venice, which handles safety and lifecycle sustainability evaluations. Additionally, we employ environmentally friendly production methods and use recycled materials/waste as ecologically compatible reactants to achieve our goals of developing green technological solutions for monitoring cultural heritage.

Are these sensors suitable for all types of environmental conditions and compatible with all types of cultural heritage materials?

Depending on the type of sensor, they are suitable for recording a wide

range of measured parameters. For instance, humidity sensors can monitor the entire relative humidity range from 0 to 100% and can operate from 0 to 40°C. Similarly, temperature sensors have been evaluated from 0 to 100°C. As you can see, these ranges are much higher compared to the environmental conditions under which cultural heritage materials are stored or displayed. However, there are certain environments where the sensors are not rated to operate (e.g., a wider temperature range) or cannot function primarily due to the materials from which they are made. For example, most biopolymers are destroyed at high temperatures. Finally, regarding the range of heritage materials, I must say that the operation and performance of all types of sensors are not affected by the nature of these materials. The only issue that could arise would be the requirement to record harmful pollutants other than those for which the sensor is designed to measure.

How do you work with cultural heritage institutions to assess and validate the new sensors?

For the validation of the green sensors, we work closely with two museums, the Peggy Guggenheim Collection and the Hungarian National Museum. Furthermore, all other cultural heritage institutions that partnered with GREENART are welcome to participate in the evaluation process. Additionally, we make efforts to disseminate our findings to cultural heritage institutions beyond members of the GREENART project; we are also in discussions with the Museum of Science and Technology at the University of Patras to evaluate the green sensors in their facilities.

Do you think they will be ready for production and sale at the end of the project?

Among the three different types of sensors, the GO-based humidity sensors are at the highest level of evaluation, as their validation in real environmental conditions has already begun. Although several other tests need to be carried out before the end of the project, we are optimistic about achieving all the set goals. On the other hand, the discussion regarding the production and sale of the sensors goes beyond these objectives. We have considered this, and it could be done, perhaps not at the end of the project, as there are additional steps required beyond sensor performance, but in the near future, it is something we would like to advance. The cost of the sensors is an additional advantage in this direction, where due to the use of the materials and methods I have mentioned above, it is significantly lower compared to competing sensors typically developed from non-recyclable and expensive metals such as platinum, gold, and silver.



Costas Galiotis

Courtesy Nanotechnology and Advanced Materials Laboratories





Costas Galiotis's team at Foundation
for Research and Technology-Hellas

Courtesy FORTH



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