Institution: Cranfield University

Unit of Assessment: 12

Title of case study: Countering art crime and protecting global cultural heritage

Period when the underpinning research was undertaken: 2010 - 2019

Details of staff conducting the underpinning research from the submitting unit:

Name(s):	Role(s) (e.g. job title):	Period(s) employed by submitting HEI:
Andrew Shortland	Professor of Archaeological Science	2005- present
Dennis Braekmans	Senior Lecturer	2017-present
Kelly Domoney	Lecturer	2012-2016

Period when the claimed impact occurred: Aug 2013 – July 2020

Is this case study continued from a case study submitted in 2014? N

1. Summary of the impact (indicative maximum 100 words)

Countering art crime and protecting global cultural heritage requires the ability to discern the provenance of culturally significant objects. Cranfield has developed non-destructive analytical / materials characterisation techniques, employed in a unique manner, to aid UK and European police, museums, collectors, major international art fairs, auction houses and militaries in countering the illicit trade in art smuggling, forgeries and copies. Since August 2013, the application of these techniques has confirmed the value (and provenance) of items worth over £10 million, helping re-build trust in the valuation system, while limiting a known channel for criminals and terrorist groups to launder money and raise funds.

2. Underpinning research (indicative maximum 500 words)

In 2010 Cranfield University invested GBP1,100,000 in development of a new Forensic Laboratory, primarily focused on research into new techniques in material characterisation, with a specialisation in non-destructive analysis techniques (of particular importance where evidence has to be returned to the court). These forensic science techniques enable identification of small differences in trace level elements within an object, offering evidence of location of origin and date when objects can be compared with data from similar objects of confirmed provenance.

The Team, led by Professor Andrew Shortland focused on the potential of such analysis to examine high-value art objects, providing evidence that could be used for criminal prosecutions against forgers and smugglers. A particular challenge was identified as determining how to carry out non-destructive analysis of valuable and ‘complete’ museum art (where it is not possible to examine fragments or samples) such as early glass and glazed porcelain objects. The Forensic Laboratory has consequently pioneered the use of the latest low or non-destructive analytical approaches, normally used in crime scene investigations, in this important field; in particular:

- X-Ray Fluorescence spectroscopy (XRF), where elements in an object are identified via induced emission of characteristic X-Rays;
- Environmental Scanning Electron Microscopy (SEM), allowing for imaging and analysis of objects in their natural, uncoated state, and;
- Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS), where a laser is used to obtain micro-samples (very minimally destructive) from an object for highly accurate analysis of trace elements [R1].

Reflecting the success and impact of this work, other Universities have now explored the methods and have purchased LA-ICPMS equipment, enabling very accurate characterisation of sample composition.

Importantly, Cranfield researchers were the first to use the material characterisation techniques described above to establish an underpinning baseline database for specific types of dated objects. Objects were sought from established museum and private collections where there was full confidence in correct dating. Creation of a body of data enabled a timeline of different compositions for different parts of objects such as bodies, glazes and pigment decorations to be produced. Throughout the history of the manufacture of the object type, these compositions change, so when an object of questioned date is compared to the timeline of compositions, it can be assigned its most likely date; a process known as 'indirect' or 'relative' dating.

Initial analysis employing the aforementioned suite of characterisation techniques was carried out on Meissen porcelain from the Hoffmeister collection, one of the largest and best dated collections in the world [R2]. This was then expanded to include Sevres and English porcelain. The successful results from this work in terms of assessing authenticity led to support for a project to research into Chinese blue and white and *famille rose* porcelain [R3 & R4].

The Cranfield forensic methods were then applied to glass from the very beginning of glassmaking in 1500 BC right through to 19th century, and to modern copies of earlier work [R5]. A general understanding of archaeological materials and the way they work was also derived from the research.

Overall, for more than 40 years, the fine art sector had been looking for an easier and more trustworthy means of ensuring authenticity. The use of technology has been rare, both due to unreliability and the destructive nature of available analysis techniques. These limitations in technology and ability to provide evidence of criminal activity undermined trust and confidence in how the sector was governed [R6]. Cranfield's unique work has provided an opportunity to solve these issues, bringing cutting-edge materials analysis capability to the important arena of ensuring the authenticity of our cultural heritage.

3. References to the research (indicative maximum of six references)

[R1] Casadio, F., Bezur, A., Domoney, K., Eremin, K., Lee, L., Mass, J.L., Shortland, A.J., & Zumbulyadis, N., (2012), X-ray fluorescence applied to overglaze enamel decoration on eighteenth- and nineteenth-century porcelain from Central Europe, *Studies in Conservation*, 57(1), 61-72

https://doi.org/10.1179/2047058412Y.0000000047

[R2] Domoney, K., Shortland, A.J. & Kuhn, S., (2012), Characterisation of 18th century Meissen porcelain using SEM analysis, *Archaeometry*, 54(3), 454-74.

https://doi.org/10.1111/j.1475-4754.2011.00626.x

[R3] Giannini, R., Freestone, I.C., & Shortland, A.J., (2017), European cobalt sources identified in the production of Chinese *Famille Rose* porcelain, *Journal of Archaeological Science,* 80, 27-36.

https://doi.org/10.1016/j.jas.2017.01.011

[R4] Shortland, A.J., 2017, A cobalt from the blue, *Antique collecting magazine.*

(See copy included in Corroborating Sources zip file)

[R5] Scott, R.B., Shortland, A.J., Degryse, P., Power, M., Domoney, K., Boyen, S., & Braekmans, D., (2012), In situ analysis of ancient glass: 17th century painted glass from

Christ Church Cathedral, Oxford and Roman glass vessels, *Glass Technology – European Journal of Glass Science and Technology Part A,* 53(2), 65-73.

http://www.scopus.com/inward/record.url?partnerID=yv4JPVwI&eid=2-s2.0-84860870228&md5=65d9f22a04bd1dccfb878db608ce620f

[R6] Shortland, A.K., & Shortland, A.J., (2019), Governance under the shadow of the law: trading high value fine art, *Public Choice*, 184(1), 157-174 https://doi.org/10.1007/s11127-019-00719-y

Details of the impact achieved to date (indicative maximum 750 words)

In 2019, trading in the global art market was estimated to have been worth in excess of GBP50,000,000,000. Increasingly, it is a market continuously challenged and exploited by criminals. Art is portable and the workings of the market are opaque with many transactions being completed in cash or in kind, making art a vehicle for money laundering and 'capital flight' (a means of moving wealth out of a country during periods of economic instability). The FBI has estimated that thieves steal art objects worth between $4 to 6,000,000,000 (03,2021) worldwide every year, raiding and damaging cultural assets, and identified art as the third biggest criminal market after drugs and weapons. Looted antiquities have been acknowledged by law enforcement bodies as a significant source of insurgent and terrorist funding.

The situation means a significant human institution, a basis of human culture and cultural identity made up of international networks of institutions such as museums, galleries, public exhibitions, and auction houses, is blighted by crime. A survey of industry professionals conducted by Deloitte in 2016 reported that *"around 75% of all stakeholders surveyed agree that 'authenticity, lack of provenance, forgery, and attribution' are the biggest threats to credibility and trust in the art market."*

Despite the well-known prevalence of problems with forgeries, fakes and smuggled art objects, only limited resources have been targeted by policing operations to deal with art crime. This has meant a greater pressure on business and cultural institutions to ensure that they are dealing in works with established provenance. Cranfield's work in demonstrating the effectiveness of using forensic / material characterisation techniques applied to art and building a reliable database for comparisons of materials [S1] has led to significant societal benefits and impact in terms of upholding law and public trust; helping preserve the integrity of commercial and cultural bodies.

Cranfield's pioneering analysis of ancient and historical materials came to the attention of Bonhams auctioneers in 2010. They were interested in a large collection of high value European porcelain from the Hofmeister collection. Bonhams did not know whether some of the most important pieces in this important, historical collection might be 19th century copies rather than early 18th century originals (a difference in value meaning copies would be worth thousands rather than tens of thousands of pounds for originals). From analysing hundreds of 'proprietary sensitive' items, Cranfield was able to identify which were original and which were later copies.

> *"XRF-analysis…. a then little-used tool in the study of 18th-century porcelain….proved beyond doubt that many of the suspect boxes were not genuine. This had implications for the study and understanding of the field. Bonhams was able to publish this research and so establish a new degree of certainty in attributions, which in turn provided a higher degree of confidence to collectors and scholars in the field. This ground-breaking research and the increased certainty it brought resulted in remarkable results when the collection was sold, including a world-record price for a porcelain snuff box."* [S2] (Bonhams, European Ceramics Department).

As a result, Bonhams sponsored Cranfield to undertake further specific work in this area, leading to analysis of very high value and controversial pieces.

This success led to work with auction houses spreading in 2013 to Christies and Sothebys, as well as other minor auction houses. It also led to vast number of commercially sensitive commissions for the non-destructive technologies to be used with more than 20 museums and collectors worldwide, including the Ashmolean and Victoria and Albert Museum, and institutions in North America and Europe.

The range of focus was expanded to identifying the authenticity of other European wares in museums such as majolica, Limoges enamels, Islamic glass and early and Roman glass. A particular challenge for the art world has been Chinese porcelain, where booming demand over the past 30 years has meant the problem of deliberate modern copying of early wares is rife. [S5].

> *"We have incorporated several technologies pioneered for us by Cranfield into our analytical procedures, ….which now enable unequivocal and robust commercial decision-making across the wide variety of Works of Art which Bonhams auctions. …There is no forensic-science facility….which offers such robust methodology to justify the science behind the analyses they undertake"* [S3] (Bonhams).

The reliability of the approach developed by Cranfield researchers has resulted in the team being commissioned to undertake analyses of objet d'arts prior to many major London auctions, to ensure authenticity of questioned items (often not fraudulent, but instead simply a commercial product which might appear similar to an earlier piece). The total value of objects vetted for auction houses since 2013 has routinely exceeded GBP200,000 per year, and the highest value object worked on was a price of Chinese porcelain, which sold on the London market for several million pounds. Further impact includes benefits to the reputation of the auction houses utilising our techniques and to the overall integrity of the London art market.

Recognition of the work on fakes and copies led to relationships with police and trading standards bodies nationally from 2016, centred around a relationship with the Metropolitan Police Arts and Antiques Unit, which saw Cranfield's forensics material characterisation team as its primary source of scientific advice and expertise on seized or discovered antiquities.

> *"Cranfield have regularly assisted in some of the most important cultural property investigations undertaken in British Policing"* [S4]. (AAU, Metropolitan Police)

This involved providing evidence of when an artwork smuggled into the UK is real (the common defence of smugglers being that the item is only a copy and therefore no criminal charge can be made), plus when and where it may have been stolen.

Cranfield materials characterisation research has been used routinely for Metropolitan Police AAU investigations and case-building on behalf of national operations. Examples of referrals undertaken by Cranfield and case outcomes include the Nimrud Genie (Iraq relief – case ongoing investigation), Deir-el-Zore (Assyrian Stele – prosecution trial to take place 2021 based on Cranfield's analysis), Hebrew decorative lintel, Syria (returned to owner, based on Cranfield's analysis), Viking Axe & Spearheads (ongoing investigation) and 3000 BC Egyptian Blue Lot (Lot declared as fake based on Cranfield's work) [S4].

5. Sources to corroborate the impact (indicative maximum of 10 references)

[S1] E&H Manners Ltd, Ceramics and Works of Art, Kensington, London

[S2] Bonhams, European Ceramics Department

[S3] Bonhams

[S4] Metropolitan Police Art & Antiques Unit, London

[S5] Sources to demonstrate relevant applications:
http://www.theartcollector.org/professor-andrew-shortland-qing-vase-mystery-solved/
https://www.theartnewspaper.com/news/european-cobalt-blue-imported-to-china-from-early-18th-century
https://www.cranfield.ac.uk/press/news-2019/cranfield-forensic-experts-support-masterpiece-london-art-fair