

Detecting forgery, down to the letter

Author: Debra Shepherd

Before the commodification of art as a store of wealth, forgeries were not as big a deal as they are today. In Renaissance Italy, for instance, successfully passing your work off as ancient was a legitimate test of an artist's skill. As a young man, Michelangelo excelled in this form of misrepresentation. Even our contemporary collective image of Julius Caesar is based on a 'fraud' whose status as such only came to light more than 150 years after being purchased by the British Museum in 1818. During the time that the sculpture was considered legitimate, it was reproduced so often that this image of the Emperor had bored itself into our minds permanently. Similarly, neither "Morte d'Arthur" or "King Lear" would exist had it not been for the creative sourcing of Geoffrey of Monmouth leading to (what is now considered a fictitious) History of the Kings of Britain.

The imitation game

How things have changed, illustrated poignantly by the famous case of Rembrandt's etching, "Christ Healing the Sick", of which six individual prints were produced: the first was taken directly from Rembrandt's plate; the second was a vague press from the exact matrix produced after Rembrandt's death; the third print was of similar quality to the second but revived with brush and ink; the fourth print was made once the plate itself had been reworked by a later artist; the fifth was produced on an entirely different plate and copied to look like the original; and, lastly, the sixth print was made from a plate cut by another artist's hand from a photogravure of Rembrandt's original plate. Today, each plate's market value is different, but not because of a factor of their closeness to the original image but, rather, because of a factor of their similarity to the original printing process. In other words, the market is faced with the choice between "expensive fidelity to the plate and cheap fidelity to the image".

A good forgery need not be an exact replica of an existing piece of work but, rather, an entirely new piece that plausibly fits within the artist's existing body of work. As in Rembrandt's case, an exact copy can be directly compared to the original, while a good imitation just needs a believable backstory. A painting's backstory adds significant value to the work (as much as 15% in some cases), especially if the previous owner was someone of note. In the secondary art market (where the artwork was not purchased directly from the artist or their dealer), this backstory is known as provenance; it is the unbroken chain of custody that accompanies a valuable piece of art. When a new piece of art emerges, it must ideally be backed up with a provenance that leads all the way back to the artist themselves.

Feelings versus facts

While this may be an effective shorthand for determining whether the piece is the real deal, it is far from foolproof. In fact, not too long ago, nine of Van Gogh paintings previously dismissed as fakes were reattributed to the artist. This represents an impressive growth in the artist's oeuvre, having shrunk significantly in the 1990s when 45 of his paintings were suspected as fakes. This story marks an overall shift in how forgeries are nowadays being determined: where previously provenance reigned supreme, with attributional issues being determined by individual experts who made judgements based on connoisseurship, today this is fast becoming the domain of scientists. There is a lot of work to be done: About half of all fine art in global circulation is suspected fraudulent. With the formal industry generating an estimated \$60+ billion annually, this means the fake industry is worth about \$30+ billion. As the Roman poet Horace once put it, "He who knows a thousand works of art, knows a thousand frauds."

Blast from the past

Scientists have been using radiocarbon dating to determine art forgeries for some time now. In the 1940s it was found that, through analysing the isotopic makeup of organic matter, one could determine with relative accuracy, its age. However, crafty forgers—such as Robert Trotter—have undermined this science by painting their knockoffs over

antique canvases, making it that much harder to detect. But science, as always, catches up. In a paper published last year, a team of researchers from Switzerland, Germany and the US were able to identify one of Trotter's now infamous forgeries using no more than a canvas fibre the width of a human hair, and a paint chip hardly bigger than a pinpoint. Testing the microscopic material using radiocarbon dating, the researchers were able to identify exactly when the painting was created relative to the cold war nuclear experiments of the mid-20th century. It is generally the case that, since the atomic bomb tests of the 1940s, the number of carbon 14 isotopes in the earth's atmosphere have increased dramatically. This means that artworks produced prior to the 1940s, before what is now known as the 'bomb peak', have fewer isotopes embedded in their raw materials; in other words, artworks carry both the authentic signature of the artist, and the atomic signature of the world post-World War II.

Out of the blue

It's not all hard science though. In many cases, the craft of detecting forgery remains a fine art. Van Gogh is currently one of the most sought-after artists for discerning collectors, with his paintings famously fetching sums in the range of hundreds of millions. At these prices, knowing whether you are about to own the genuine article has to be priceless. Researchers have discovered that it was only because Van Gogh was so desperately poor that the wealthiest today are able to certain of whether they possess an original piece or just some imitation. This fact is somewhat poetic in its irony. As detailed in the letters with his brother, Theo, Vincent couldn't afford the local pigments of cobalt blue. Present in letters to each other is confirmation that Theo had access to several suppliers offering different variations of the pigment, which he would then purchase and send on to Vincent. Through analysing the actual paintings, researchers were able to corroborate that several varieties of the pigment were used. Specifically, cobalt blue is generally a compound of cobalt, oxygen and aluminium known by the chemical name cobalt oxide-alumina. Of the masterpieces in which cobalt blue was present, several other elements were discovered alongside aluminium and oxygen, including nickel, silicon and phosphorus. All are present or absent to different degrees in different artworks, including his now famous *The Bedroom* and *Self-portrait in a straw hat*.

This kind of research has meant that, in 2013, a painting thought to be fake was reattributed to the artist. The painting in question seemed to have disappeared after being transferred from Theo van Gogh's personal collection. The work was sold in 1901, only to re-emerge in the collection of a Norwegian businessman upon his death in 1970. Following his death, the collector's family reached out to the Van Gogh museum where, in 1991 and through subjective judgment, it was determined a fake. A reassessment a decade later found that the cobalt blue (amongst other colours) used in the painting was indeed of the kind the artist "habitually had on his palette at this time".

Putting the artificial in art

In recent days, science has been cast in a new role in the world of art forgeries. Rather than detecting the forgery, AI and 3D printing are helping to recreate masterpieces. The Computer Science and Artificial Intelligence Laboratory of MIT has developed a new AI-based 3-D printing technology, RePaint, which can accurately reproduce works of art. Rather than applying a continuous field of colour, RePaint dispenses 10 layers of ink via a method known as half-toning (using tiny ink dots). Central to this new method, now called "color-contoning", is the deep learning algorithm that determines what combination of ink shades would produce the best result. Soon, galleries may even lock away original pieces for safekeeping and rather display the 3D copy. If effective, this could mean that forgeries will be the thing to bring down art crime. And although the technology is at least four times more accurate than any other method, it apparently still struggles to accurately produce one colour: a good cobalt blue.