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X-rays and old masters. The art of the scientific connoisseur

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The wealth of American millionaires, the greed of Nazi art collectors and a positivist faith in the authority of laboratory science all contributed to the emergence of conservation science as a new discipline. Yet, not before the aftermath years of the Second World War was scientific expertise accepted as valid knowledge by both art critics and the general public. Becoming an expert depended not only on knowledge and skills, but also on the successful negotiation of the vested interests of a wide range of stakeholders. The creation of museum laboratories proved to be decisive in making space for science in the world of art.

During the final decades of the nineteenth century, art criticism was in a state of renewal due to a new generation of iconoclastic scholars, skeptical of long standing traditional views and attributions of paintings. The Italian scholar Giovanni Morelli (1816–1891) introduced a system to investigate the style of artists by looking attentively at small details from which the characteristic 'hand' of the artist could be recognized. One of his most important followers was the Lithuanian born American Bernard Berenson (1865–1929), who became the world's foremost specialist on Italian Renaissance Art and an icon of modern art connoisseurship. But also the more academic art historical approach of Giovanni Battista Cavalcaselle (1819–1897) attracted many students. When from the beginning of the twentieth century on the wealthy American art market turned increasingly towards the acquisition of Old Masters from impoverished European collections, the influence of the art connoisseurs became even more pronounced. As they often worked in close collaboration with art dealers and their customers, their testimony had important implications for the monetary value of art objects. Art connoisseurs did not always agree among themselves, but their disputes, full of personal and esthetic judgments, strengthened the position of their scholarly community in the art world.

The rise of art criticism went hand in hand with a new appraisal of the cultural heritage of European art. Both in private collections and public museums, the material conservation of artifacts had been primarily a rather empirical activity, where preference was rather given to the experience of skillful artisans than to the purist or romantic intellectual attitudes of art critics. Restoration practices became the focus of conflicting notions on art. Restorers defended their professional right to apply their own esthetic judgments in 'improving' deteriorated works of art. At the same time, the reappraisal of the artistic heritage, the installation of state commissions to administer the care of art works and the growth of the art market for medieval and Renaissance artifacts led to a growing attention to the 'authentic' in works of art. Correct attributions and the documentation of stylistic characteristics gained more prominence and reformed the practice of professional restorers. For some, works of art were to be considered as historical source documents which ought not to be obscured by restoring damaged parts, a view which conflicted with the demands of art lovers preferring the aesthetic enjoyment of a fully rehabilitated object. Others would ask for the removal of darkened varnishes in order to appreciate the original which was underneath. This elicited the reaction of critics who considered the patina of ages an essential element of the aesthetic appearance, and maybe even part of the original intentions of the artist.[1]

A special topic in the field of art criticism was the problem of forgeries. Forgery or improper attributions was (and still is) a widespread practice in the commerce of antiquities, but it was equally an important part of the art market. In some cases, forgers would simply overpaint the original signature and replace it with another better suited to attract buyers. It also happened that able artists created entire new masterpieces attributed to Old Masters. The exposure of famous forgeries, such as the expensive Flora bust in the Berlin Kaiser Friedrich Museum in 1909, attributed to Leonardo da Vinci but in fact sculpted by an English sculptor, made art collectors nervous and suspicious. As the art market expanded and more and more works of art were shipped to the United States, the problem became more acute as many American collectors had to rely on the indirect evidence provided by art dealers. Deceived buyers were not easily convinced: contentions of authenticity would spread out into discussions on the vagueness of attributions or the extent of material alterations during restoration and conservation processes. Art connoisseurs were called in to defend the rights and the honor of the new owners.

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[1] There is a growing literature on the history of restoration practices. For broad overviews, see Allessandro Conti, *History of the Restoration and Conservation of Works of Art* (Amsterdam, 2007); María José Martínez Justicia, *Historia y Teoría de la Conservacion y Restauración Artística* (Madrid, 3rd edition, 2008).

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The Science of Art

In 1864 the French chemist Louis Pasteur (1822–1895) inaugurated his course on the applications of science to the arts at the Ecole des Beaux Arts in Paris with the observation that this type of lectures had no tradition to follow up to. Nowhere before, as far as he knew, had such lectures been given to art students. Pasteur felt there was an urgent need to instruct art students in the material aspects of their work. The topics to be taught to artists were many: the characteristics of various paint media, the influence of humidity and sunlight, the behavior of oil, solvents and varnishes, the physical and chemical characteristics of the different materials, and much more. But chemists appeared not to be interested. Only a few chemists were involved in teaching to art students. In 1879 Sir Arthur Herbert Church (1834–1915) was appointed Professor of Chemistry in the Royal Academy of Arts in London. His textbook *The Chemistry of Paints and Painting* (1890) remained a classic textbook for decades.

Although chemists only rarely took up teaching positions in art schools, there were several attempts by chemists to improve on the artistic techniques of their contemporaries. The 1909 Nobel Prize laureate Wilhelm Ostwald (1853–1932), himself a respectable amateur painter, published popular books on painting technique.[2] In 1870 the hygienist Max von Pettenkofer (1818–1901) invented a regeneration process of opaque varnishes without having to remove them manually. The process proved to be a big success and was enthusiastically taken up by many restorers, who welcomed the support of scientific legitimation. Soon it became clear, however, that the effects were only temporary and that the method did contain high risks for damaging the original paint. The renown of the Pettenkoffer method now turned against the legitimacy of scientific approaches. The influential Italian art critic Angelo Conti wrote that 'this word *regeneration* is, in the present instance, synonymous with destruction. A German chemist, Pettenkofer, furnished the destroyers with the arms [...] and this is how one wrecks Italian paintings'.[3]

Arthur Pillans Laurie (1861-1949) was a world expert on painters' methods and materials. Image courtesy of Heriot-Watt University Archive, Records Management and Museum Service.

A more successful approach was taken by the Scottish chemist Arthur Pillans Laurie (1861–1949). Influenced by the Pre-Raphaelites' interest in the techniques of medieval and Renaissance painters, Laurie started a systematic investigation of the painting materials. He made use of microchemical analysis of pigments, as well as of literary sources and microphotographs, revealing the intimate details of the brush strokes of the Old Masters. When Laurie succeeded Church in the Chair at the Royal Academy of Arts in 1912, he immediately demonstrated the value of his scientific research to art criticism by denouncing several art works to be forgeries. His measuring rod was a list of pigments and the dates at which they had come into use or had died out, compiled from the careful analysis of undoubted sources.[4]

In the United States Maximilian Toch (1864–1946), a lecturer on organic chemistry at Columbia University and president of Toch Brothers Inc., was appointed professor of the chemistry of artistic painting at the National Academy of Design in 1924. Toch warned American collectors that their art objects were in danger, as they were held in too

[2] Wilhelm Ostwald, *Malerbriefe. Beiträge zur Theorie und Praxis der Malerei* (Leipzig, 1904).

[3] Quoted in Conti, *op. cit*., p. 348.

[4] Among Laurie's many books and papers may be mentioned *Material Used in the Painters' Craft from the Earliest Times to the End of the 17th Century* (1911) and *Painters' Methods and Materials* (1926).

humid or too smoky atmospheres. His warnings were taken over by Edward W. Forbes (1873–1869), director of Harvard's Fogg Art Museum, who stated that 'the American public is under a heavy responsibility' and used Toch's arguments to plead for better technical care of the paintings.[5] Toch made headlines in 1931 when he announced that at most one of the more than 25 paintings in the Metropolitan Museum attributed to Rembrandt was genuine. He furthermore asserted that many of the Old Masters had been damaged beyond repair because of successive restorations and bad climate conditions.

Such claims made by chemists were easily ignored by the art connoisseurs. An example of this can be found in the famous Duveen–Hahn law case, which attracted international attention during the 1920s. Joseph Duveen was a colorful English art dealer, who made his fortune in the early twentieth century by providing wealthy American millionaires with Old Masters paintings from European collections. In 1920 Duveen heard of a painting, offered for sale to the Kansas City Art Institute by Mrs. Andrée Hahn, the French wife of an American airman. The painting, called *La Belle Ferronnière*, was claimed to be an original work by Leonardo da Vinci. At that moment, there was no Leonardo painting in America, so the news created a big sensation. Duveen immediately dismissed the claim of Mrs. Hahn, even without having seen the picture. Mrs. Hahn consequently sued Duveen for slander, as his comments damaged all possibilities of selling the picture. In February 1929 the case went to court. Both parties presented expert witnesses. In his analysis of the case, John Brewer interprets the opposition between the Duveen and the Hahn camp as an opposition between the expertise of art connoisseurs and scientific evidence.[6] He found that the art experts employed by Duveen were 'deeply hostile to technical tests, regarding it as ungenteel, too scientific, and too academic'. He observed that 'Berenson repeatedly poured scorn on technical knowledge of pigments, X-rays, and chemical analysis as matters beneath a gentleman connoisseur'. When asked whether he thought that 'knowledge of the technique of painting and of pigments is necessary to the expert', Duveen firmly responded 'No'. The Hahn–Duveen would prove to be the endgame of the classical art connoisseur. But it was not yet the beginning of the expert scientist. Scientific evidence presented during the case was equally discarded as inconclusive.[7]

X-ray revolution

The breakthrough of scientific expertise came about in the 1920s, first of all as the result of the use of X-rays in the examination of paintings (as well as of archeological artifacts). Already in 1896, only a few months after the announcement of the discovery by Wilhelm Roentgen, the first attempts were made to apply X-ray analysis to the study of paintings. August Toepler in Dresden and Walter Koenig in Frankfurt made X-ray studies of paint, producing so-called shadowgraphs of paintings. Occasionally, X-rays were used to detect forgeries or hidden signatures. But in general, before the First World War there was no systematic effort to explore this field of applications. Radiological techniques were mainly developed for medical applications and their reliability was too low to guarantee accurate interpretations. After the introduction of more reliable X-ray tubes, a new interest in the radiography of paintings emerged. In 1913 the Weimar radiologist Alexander Faber made a systematic investigation of the absorption characteristics of paints and studied the influence of layer densities on the X-ray image. In 1914 he took a patent on his new examination procedure, but the war interrupted any further developments.[8]

During the war, radiology became a widespread tool for medical diagnosis and treatment. Many doctors, equipped with easily transportable X-ray apparatus, learned how to make reliable radiographs and to interpret the resulting images. Apart from Faber in Germany, Leo Gerard Heilbron in Amsterdam, André Chéron in Paris and Guido Holzknecht (1872–1931) in Vienna were among the pioneers to apply X-ray technology to the examination of paintings. By 1920 X-ray radiographs were made in all the important European museums, often with the help of a nearby hospital or a physics laboratory. The first X-ray apparatus in a German museum was installed in 1924 in the *Bayerischen Staatsgemäldesammlungen* in Munich but had to be removed due to the patent rights still held by Faber. In 1931 Philips and Siemens–Reiniger–Veifa put X-ray apparatus for examination of paintings on the market and opened a public office in Berlin where paintings could be X-rayed. These initiatives proved to be very successful, and suggest that the often imputed negative impact of the Faber patent was probably rather limited.[9]

The belief that X-rays were actually the solution to all questions of uncertain attributions and forgeries was strongly accepted by the general public. Sometimes forged signatures could be demonstrated, and overpainted details could be restored to their original status. In 1928, the Viennese radiologist Eduard Peteril declared that about 75% of all paintings submitted to him for examination were not what they claimed to be. The Louvre X-ray service refused to examine any paintings but its own, in order to avoid the expected contentions after forgeries or deteriorations would have established.

Enthusiasm rose when interesting discoveries were made. Leo Van Puyvelde, Chief Curator of the Belgian Royal Museum of Art of Belgium, proudly announced in 1929 the discovery through X-ray examination of a beautiful Nativity scene under a coarsely drawn portrait medaillon of Hélène Fourment in a picture by Daniel Seghers. At the Metropolitan Museum in New York, X-ray photographs of an intact mummy nearly 4,000 years old revealed a unique collection of Egyptian jewelry, along with two mice who had probably found their way into the bandages before the process of embalming was completed. X-ray examinations were also increasingly used in law suits, although

[5] Maximilian Toch, *Materials for Permanent Painting* (1911); Edward W. Forbes, 'The technical study and physical care of paintings', *The Art Bulletin* 2 (1920), pp. 160–170.

[6] John Brewer, *The American Leonardo. A 20th Century Tale of Obsession, Art and Money* (London, 2009).

[7] The case was finally settled with an off-court agreement.

[8] Charles F. Bridgman, 'The amazing patent on the radiography of paintings', *Studies in Conservation* 9 (1964), pp. 135–139.

[9] Michael Graf von der Goltz, *Kunsterhaltung – Machtkonflikte. Gemälde-Restaurierung zur Zeit der Weimarer Republik* (Berlin, 2002), pp. 90–92.

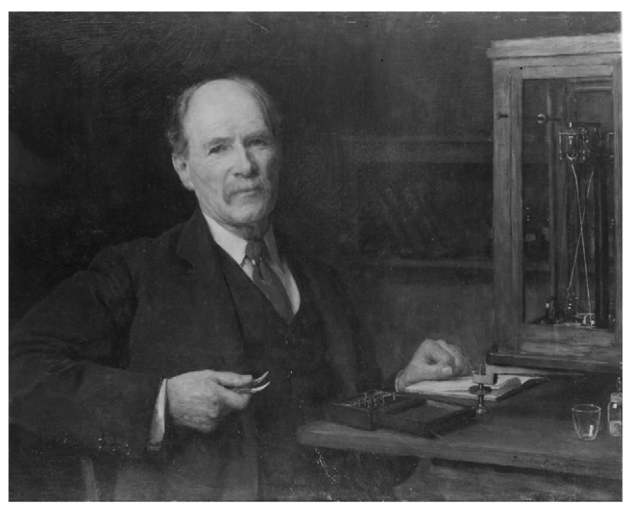
their value was rather inconclusive and easily dismissed by competent lawyers. Some experts still entertained grave reservations about the use of X-rays. The Berlin director of the Kaiser Friedrich Museum, Wilhelm von Bode, compared X-rays to the infamous 'divining rod' and simply considered it nonsense ('Mumpitz'). But these reactions were heard as voices of the past.

A major turning point in the history of X-ray examinations came in 1925 when Alan Burroughs (1898–1965), then curator at the Minneapolis Museum of Art, started a large scale research project at the Fogg Art Museum in Harvard to form a library of X-ray shadowgraphs. Burroughs visited numerous museums in the United States and Europe with a portable X-ray apparatus, gathering and cataloguing pictures of mainly Italian, Dutch and Flemish Masters. When he wrote up his research results in 1938, Burroughs had collected some 3200 radiographs.[10] The study of X-ray shadowgraphs, Burroughs maintained, "includes interpretation of alterations, classification of materials, study of methods, and revelation of brushwork." The results were not easy to evaluate, "since it demands as complete a sympathy for the artist's point of view as does the most sensitive of descriptive and appreciative efforts." But X-rays added new information which was crucial to the art critic. In particular, as shadowgraphs revealed the underpainting of the artist at work, X rays provided the most intimate picture of the artist's intentions. The 'expeditions' of Burroughs stimulated large scale and systematic X-ray research in European museums. They also signaled the shift in X-ray expertise from physicians to scientists and professional restorers. The first widely used textbook on chemical analysis of paintings, written by the Dutch restorer and chemist A. Martin De Wild, included a final chapter on X-rays.[11]

Museum laboratories

Scientific art expertise emerged as major factor in the emergence of scientific art expertise with the establishment of museum laboratories. Although the first such laboratory was installed as early as 1888 in Berlin,[12] the creation of laboratories greatly accelerated in the 1920s when the British Museum set up a laboratory for the treatment of art works which had suffered from their emergency storage during the war. At the British Museum, the Kaiser Friedrich Museum and the Louvre temporary laboratory services were set up in the early '20s, soon to grow into permanent institutions. The official installation of the Louvre museum laboratory in 1930 was heralded in the press somewhat inaccurately as the 'first laboratory for scientific research in the field of painting', although it was certainly one of the finest of its time, due to generous private donations. Most prominent in its research was the use of X-rays, UV rays and oblique light photography.[13] In particular X-rays became the hallmark of any museum laboratory work.

Although the museum laboratories were originally conceived as extensions of the conservation workshops, university educated scientists were engaged to work with museum curators and conservators. As the laboratories grew, the scientists would often gain leadership of the institution. At the British Museum, the chemist Dr Alexander Scott FRS (1853–1947) was charged in 1919 with an inquiry into the state of deterioration of the objects stored in the London Underground during World War I. Although this assignment was explicitly stated to be of a temporary nature, Scott developed his laboratory facilities at the Museum into a permanent institution. In 1924 Harold Plenderleith (1898–1997), a chemist with a PhD of University College, Dundee, was recruited to carry out investigations on archeological findings. At the Fogg Art Museum of Harvard, Edward Forbes appointed Rutherford John Gettens (1900–1974), a Harvard educated chemist, as a staff member of his Department of Technical Research. In 1931, the chemist Arthur H. Kopp established a laboratory at the New York Metropolitan Museum of Art. At the Royal Museums of Art and History in Brussels, the young chemist Paul Coremans (1908–1965) was recruited by the Egyptologist Jean Capart to create a laboratory for physical and chemical research. Coremans' laboratory would soon make his laboratory evolve into the Central Laboratory of Belgian Museums. Although most scientists employed in the museum laboratories were chemists, the physicist F. Ian G. Rawlins (1895–1969) was appointed Scientific Advisor to the London National Gallery in 1934.



Portrait of Dr Alexander Scott (1853-1947), first Head of the Research Laboratory at the British Museum. Painting by H A Olivier.

The creation of museum laboratories drastically changed the attitude of scientists with relation to the world of art. Whereas earlier scientists in their position as university professors or academic researchers often approached the topic of art with a lofty view on improvement, scientists in the museum laboratories were hired on a permanent basis to do research on paintings and artifacts. As such they were framed in a continuous debate with restorers,

10 Alan Burroughs, *Art Criticism from a Laboratory* (London, 1938).

11 A.M. De Wild, *The Scientific Examination of Pictures* (London, 1929). The book was actually a translation of his PhD thesis at the Technical University of Delft.

12 The first museum laboratory was set up for the conservation of archeological artifacts. See Josef Riederer, 'The Rathgen Research Laboratory at Berlin', *Studies in Conservation* 21 (1976), pp. 67–73.

13 Raymond Lécuyer, 'Le laboratoire du Musée du Louvre', *Le Figaro* (18 August 1930), p. 1; Idem, 'Comment sont examinés les tableaux dans le laboratoire du Louvre', *Le Figaro* (29 August 1934), p. 5.

curators and art critics. Although not trained in art criticism, scientists were part of the museum staff and made their career explicitly in connection with art studies. At the age of 80, Harold Plenderleith recalled the essential characteristics of working in the museum laboratory. 'It was a great privilege to be part of the British Museum. As the laboratory was within the precincts I had direct access to the national library, then known as the Department of Printed Books. Also my colleagues in the Museum were all leading world authorities in their own fields of study, and it was always possible to consult directly on scholarly matters and, with their help, to have access to objects either in the exhibition rooms or in store for comparative purposes'.[14]

Conservation of paintings at the Kaiser-Friedrich Museum in Berlin ca. 1930. © Imagno/Hulton Archive/Getty Images

Bringing the laboratory into the museum not only greatly facilitated research, it also brought a new focus to the scientific study of artworks. Laurie and Ostwald typically wrote their books for the instruction of contemporary painters, to explain how paints and canvases would deteriorate over time, and how the artists could improve their technique by applying chemical principles. In doing so, their work was a mixed outcome of scientific research and personal esthetic preferences. As it emphasized general principles, it was of less importance to the professional restorer, faced with the actual complexity of aged artifacts. The modern laboratory chemist working on the museum floor now addressed himself systematically to the same problems of restoration and conservation as his museum colleagues. Henceforth, the role of science was not to teach and to decide, but to add and to interpret. The laboratory chemist developed an interest in the standardization of techniques and in finding the best solutions to what were basically the same problems everywhere. The laboratory served for the apprenticeship of restorers, who then went on to work in other museums. An international network of museum laboratories was formed with strong ties of collaboration across borders. The American chemist Rutherford John Gettens of the Fogg Art Museum, together with the museum's restorer George L. Stout started the first journal entirely devoted to conservation and restoration science, *Technical Studies in the Field of the Fine Arts*, which appeared from 1932 to 1942. Museum laboratories in fact were highly instrumental in the creation of a professional community of researchers.

Controversies and public visibility

Professional restorers did not always welcome the growing importance of scientific advisers. In his book on the history of restoration practices in Germany, Michael Graf von der Goltz observed that at least part of the escalating frictions between the Munich art restorer Max Doerner and the chemist Alexander Eibner can be ascribed to their different backgrounds and the intellectual authority associated with it. Even ideological opposition was to be reckoned with. When the Nazi's came to power, they favored the practical approach of Doerner above the international and more fundamentally oriented research of Eibner. Eibner's institute was closed upon his retirement.

The Second World War would provide a new occasion to further the acceptance of scientific expertise in the art world. The damage done to art objects during the war and the recuperation of looted art works implied much technical care and restoration. It provided good publicity for the new laboratories which could demonstrate their skills and expertise. Two particular cases that caught the public attention, would underscore the authority of the new scientific expertise. In the summer of 1945, the Dutch painter and art dealer Han van Meegeren was arrested and brought to trial on suspicion of having sold a Vermeer painting to Reichsmarschall Goering. Van Meegeren had made a fortune already before the war by acting as a middle man for an impoverished Italian family, who owned a large collection of seventeenth century Dutch art. By selling paintings from this collection to the enemy, he could be convicted for collaboration. Van Meegeren then surprised everyone by stating that these pictures did not come from an Italian collection, but that he had made them himself. Van Meegeren's confession suddenly made him a national hero, having made a fool of the hated Goering. However, his claims were difficult to believe: the paintings were considered to be important works by Vermeer and

[14] Harold Plenderleith, "A History of Conservation," *Studies in Conservation* 43 (1998), 129–143.

were as such ascertained by the best art connoisseurs of the time.[15]

Paul Coremans as an expert witness at the Van Meegeren trial. © Joel Yale/Time & Life Pictures/ Getty Images.

As it was clear that the Dutch art connoisseurs had failed when they certified Van Meegeren's pictures before the war, the court appointed an international commission of mainly foreign experts to investigate the authenticity of the pictures. Head of this commission was the Belgian chemist Paul Coremans. The appointment of a commission of scientists meant a huge break with the classical testimonies given by art connoisseurs. Scientific investigations were carried out by Coremans in his laboratory in Brussels, and by A.M. De Wild and Willem Froentjes in the forensic laboratory of the Department of Justice in The Hague.[16] In March 1946, the Commission concluded that the paintings were recently fabricated works possibly made by Van Meegeren. Van Meegeren was found guilty of deceptive transactions and sentenced to one year's imprisonment. He died, however, before he could serve his sentence.[17]

The publicity surrounding the Van Meegeren case, fully exploited by the media-wise Paul Coremans, ensured that the discussion of scientific techniques in the authentication of art works reached a large audience. This message was reinforced by a second controversy, which sharply divided the art world. In 1947 the London National Gallery presented an exhibition of 70 pictures which had been cleaned since 1936. One of the recurring issues in the cleaning process was the treatment of the dark varnish covering the surface of the painting. The policy of the National Gallery was inspired by the German art restorer Helmut Ruhemann (1891–1973), who had come to England in 1933. Ruhemann had been Chief Restorer to the Kaiser Friedrich Museum in Berlin and one of the most prominent participants in the Rome conference of 1930, where scientific standards in art restoration and conservation had been discussed. Ruhemann was a strong advocate of 'radical cleaning' and the use of science whenever it could be used to improve restoring procedures.[18] He defended the complete removal of the dark varnish in order to present the pictures 'as nearly as possible in the state in which the artist intended them to be seen'.

When the exhibition opened, critical comments appeared in the newspapers. A controversy ensued, both in the press and in the professional journals, not only on the quality and the desirability of the actual restoration but also on the scientific principles guiding the restoration process. The controversy over the Cleaned Pictures Exhibition necessitated the National Gallery to install a scientific Commission to investigate whether the methods and materials used in the Gallery for cleaning were the best, and whether they had involved any risks to the pictures. The Commission was composed of Dr. J.R.H. Weaver, president of Trinity College, George Stout of the Fogg Art Museum, and again Paul Coremans of the Central Laboratory of the Belgian Museums.

The Weaver Commission concluded that 'the methods followed in cleaning the pictures were satisfactory so far as the safety factor is concerned'.[19] The report presented a purely technical narrative, but its publication could easily be read as urgent plea for better restoration procedures, for better training of restorers, for better laboratory facilities and, of course, for more scientific research. In particular, science was portrayed as the mediator between restorers and art connoisseurs, an essential ingredient of any responsible art criticism. The extreme opposition between art connoisseurs and art restorers was smoothly resolved through the intervention of science. Coremans wrote: 'Should we be going too far if we said that the methods of chemistry and physics may reconcile opinions which are in obvious conflict?' But as science finally found a secure home in the world or art, it was fully recognized that scientific analysis would not provide the ultimate answers to all questions of art. In the years after World War II, scientific evidence and art expertise were to go hand in hand to form the new discipline of conservation science.

[15] Among the many books on this case, see Jonathan Lopez, *The Man who made Vermeers. Unvarnishing the Legend of the Master Forger Han van Meegeren* (Orlando, 2008); Frank Wynne, *I was Vermeer. The Rise and Fall of the Twentieth Century's Greatest Forgers* (New York, 2006), which gives a short overview of the scientists' report.

[16] The report was published by Paul Coremans, *Van Meegeren's faked Vermeers and De Hooghs* (Amsterdam, 1949), complemented by W. Froentjes and A.M. De Wild, 'De natuurwetenschappelijke bewijsvoering in het proces Van Meegeren', *Chemisch Weekblad* 45 (1949), pp. 269–278.

[17] The report of the Commission was questioned by the Boymans Museum of Rotterdam, which owned a forged Vermeer. The case continued until 1955, but as the discussions turned around the interpretation of scientific evidence, the whole case reinforced the importance of science as the decider of authenticity. In the 1960s, Coremans' findings were corroborated by new research.

[18] On Ruhemann and the influence of German restorers, see Ulrik Runeberg, 'Immigrant Picture Restorers of the German-speaking World in England from the 1930s to the Post-war Era', in Shulamith Behr and Marian Malet (eds.), *Arts in Exile in Britain 1933–1945. Politics and Cultural Identity* (Amsterdam, 2005), pp. 339–371; Steven W. Dykstra, 'The artist's intentions and the intentional fallacy in fine arts conservation', *Journal of the American Institute for Conservation* 35 (1996), pp. 197–218.

[19] The report is printed as 'The Cleaning of Pictures' in *Museum* 3 (1950), pp. 109–176.