DOWNLOAD PDF SCIENTIFIC EXAMINATION OF ART

Chapter 1 : Conservation-restoration of cultural heritage - Wikipedia

The Scientific Examination of Works of Art on Paper Paul Whitmore, Director, Research Center on the Materials of the Artist and Conservation, Carnegie-Mellon University Scientific Examination of Photographic Art: Why and How.

Ken Schwab, retired art teacher Here is a list of topics that will be on the final: FORM - has depth, 3-D, forms are solid objects. Also called the center of interest, focal point. RHYTHM - the position of shapes, colors and values that work well with each other and help to produce directional movement. BALANCE - the use of common elements throughout the format so that one area is not left without some of these elements. Color, values, textures, objects can be balanced. All of the objects and things in the world can be simplified to these forms. This is how you can draw more complicated forms by looking at the basic forms with in the objects and how they are constructed. Thick and thin line produce variety. This can be created with a pencil by changing the pressure on the paper and by using small circular movements. A gradation can be made by overlapping soft layers of two colors. Every color has a complement and every complementary pair has a warm color and a cool color. It is called browns and is the source of a more natural color in nature. It can also be used to create shadows. The Tempera paint can be thinned with water and with a heavy application of crayon the paint will resist the areas of crayon and go into the spaces left blank. Flattens to 2-d, shapes instead of forms. The closer the lines or dots are together the darker the area will become. You can use any combination of lines to produce a drawing. Always start with the darkest area first. The aesthetic center of interest is located directly in the middle of the format. Green, yellow and red are the primary colors. The color wheel is another way of showing the Chromatic scale. A contour line is a single line that describes the outside edge of the object. A shape is flat and 2-dimensional. Yellow-green is an intermediate color. Negative space is the area you would call the background. Color Theory can be broken down into 3 groups. Texture is an element of design. There are 10 principles of good design. Rhythm between shapes or objects helps create directional movement. The Crayon Resist project was taken from Gothic Illuminations. The focal point, or an area of emphasis are two very different things in design theory. Value refers to dark and light. Tempera Paint mixed with water will not resist crayon or wax. Asymmetrical balance is also called informal balance. Black and white are in the chromatic scale. Color is not an element of design. Please fill in the blank spaces with a word that makes the sentence true. How do you spell my last name?

Chapter 2 : Scientific Examination of Art: Modern Techniques in Conservation and Analysis

The scientific examination of works of art on paper utilizes tools from the very simple to state-of-the-art analytical instrumentation, depending in large part on the question that is the objective of the investigation. Identifying pigments or paper fibers is straightforward, constrained only by the.

Page v Share Cite Suggested Citation: Scientific Examination of Art: Modern Techniques in Conservation and Analysis. The National Academies Press. Sackler was educated in the arts, sciences, and humanities at New York University. These interests remained the focus of his life, as he became widely known as a scientist, art collector, and philanthropist, endowing institutions of learning and culture throughout the world. He felt that his fundamental role was as a doctor, a vocation he decided upon at the age of four. After completing his internship and service as house physician at Lincoln Hospital in New York City, he became a resident in psychiatry at Creed-moor State Hospital. There, in the s, he started research that resulted in more than papers in neuroendocrinology, psychiatry, and experimental medicine. He considered his scientific research in the metabolic basis of schizophrenia his most significant contribution to science and served as editor of the Journal of Clinical and Experimental Psychobiology from to In he started publication of Medical Tribune, a weekly medical newspaper that reached over one million readers in 20 countries. He established the Laboratories for Therapeutic Research in , a facility in New York for basic research that he directed until As a generous benefactor to the causes of medicine and basic science, Arthur Sackler built and contributed to a wide range of scientific institutions: His pre-eminence in the art world is already legendary. According to his wife Jillian, one of his favorite relaxations was to visit museums and art galleries and pick out great pieces others had overlooked. True to his oft-stated determination to create bridges between peoples, he offered to build a teaching museum in China, which Jillian made possible after his death, and in opened the Arthur M. In a world that often sees science and art as two separate cultures, Arthur Sackler saw them as inextricably related. In a speech given at the State University of New York at Stony Brook, Some reflections on the arts, sciences and humanities, a year before his death, he observed: In the artsâ€¦ I find the emotional component most moving. In science, it is the intellectual content. Both are deeply interlinked in the humanities. Sackler Colloquia at the National Academy of Sciences pay tribute to this faith in communication as the prime mover of knowledge and culture. Page vii Share Cite Suggested Citation:

Chapter 3 : Forensic science - Wikipedia

This work includes articles from the Arthur M. Sackler Colloquium on the Scientific Examination of Art: Modern Techniques in Conservation and Analysis held at the National Academy of Sciences Building in Washington, D.C., March , The articles appearing in these pages were contributed by.

Forensics in antiquity The ancient world lacked standardized forensic practices, which aided criminals in escaping punishment. Criminal investigations and trials heavily relied on forced confessions and witness testimony. However, ancient sources do contain several accounts of techniques that foreshadow concepts in forensic science that were developed centuries later. Song Ci ruled regulation about autopsy report for court, [8] how to protect the evidence in the examining process, the reason why workers must show examination to public impartiality. He realized it was a sickle by testing various blades on an animal carcass and comparing the wound. Flies, attracted by the smell of blood, eventually gathered on a single sickle. In light of this, the murderer confessed. For example, the book also described how to distinguish between a drowning water in the lungs and strangulation broken neck cartilage , along with other evidence from examining corpses on determining if a death was caused by murder, suicide or an accident. In ancient India , [14] some suspects were made to fill their mouths with dried rice and spit it back out. Similarly, in ancient China , those accused of a crime would have rice powder placed in their mouths. It is thought that these tests had some validity[citation needed] since a guilty person would produce less saliva and thus have a drier mouth; the accused would be considered guilty if rice was sticking to their mouths in abundance or if their tongues were severely burned due to lack of shielding from saliva. In 16th-century Europe, medical practitioners in army and university settings began to gather information on the cause and manner of death. Two examples of English forensic science in individual legal proceedings demonstrate the increasing use of logic and procedure in criminal investigations at the time. In , in Lancaster , John Toms was tried and convicted for murdering Edward Culshaw with a pistol. She had been drowned in a shallow pool and bore the marks of violent assault. The police found footprints and an impression from corduroy cloth with a sewn patch in the damp earth near the pool. There were also scattered grains of wheat and chaff. The breeches of a farm labourer who had been threshing wheat nearby were examined and corresponded exactly to the impression in the earth near the pool. James Marsh was the first to apply this new science to the art of forensics. He was called by the prosecution in a murder trial to give evidence as a chemist in The defendant, John Bodle, was accused of poisoning his grandfather with arsenic-laced coffee. Marsh performed the standard test by mixing a suspected sample with hydrogen sulfide and hydrochloric acid. While he was able to detect arsenic as yellow arsenic trisulfide , when it was shown to the jury it had deteriorated, allowing the suspect to be acquitted due to reasonable doubt. He combined a sample containing arsenic with sulfuric acid and arsenic-free zinc , resulting in arsine gas. The gas was ignited, and it decomposed to pure metallic arsenic, which, when passed to a cold surface, would appear as a silvery-black deposit. He first described this test in The Edinburgh Philosophical Journal in He noticed a flaw in the bullet that killed the victim and was able to trace this back to the mold that was used in the manufacturing process. The French police officer Alphonse Bertillon was the first to apply the anthropological technique of anthropometry to law enforcement, thereby creating an identification system based on physical measurements. Before that time, criminals could only be identified by name or photograph. Although his central methods were soon to be supplanted by fingerprinting , "his other contributions like the mug shot and the systematization of crime-scene photography remain in place to this day. While working for the Indian Civil Service , he began to use thumbprints on documents as a security measure to prevent the then-rampant repudiation of signatures in Henry Faulds , a Scottish surgeon in a Tokyo hospital, published his first paper on the subject in the scientific journal Nature , discussing the usefulness of fingerprints for identification and proposing a method to record them with printing ink. He established their first classification and was also the first to identify fingerprints left on a vial. Having been thus inspired to study fingerprints for ten years, Galton published a detailed statistical model of fingerprint analysis and identification and encouraged its use in forensic science in his book Finger Prints. He had calculated that the chance of a "false positive" two different individuals having the same fingerprints was about 1 in 64 billion. Juan Vucetich , an Argentine chief police officer, created the first method of recording the fingerprints of individuals on file. In that same year, Francisca Rojas of Necochea was found in a house with neck injuries whilst her two sons were found dead with their throats cut. Rojas accused a neighbour, but despite brutal interrogation, this neighbour would not confess to the crimes. Inspector Alvarez, a colleague of Vucetich, went to the scene and found a bloody thumb mark on a door. She then confessed to the murder of her sons. A Fingerprint Bureau was established in Calcutta Kolkata , India, in , after the Council of the Governor General approved a committee report that fingerprints should be used for the classification of criminal records. Haque and Bose were Indian fingerprint experts who have been credited with the primary development of a fingerprint classification system eventually named after their supervisor, Sir Edward Richard Henry. Sir Edward Richard Henry subsequently achieved improvements in dactyloscopy. Faurot, an expert in the Bertillon system and a fingerprint advocate at Police Headquarters, introduced the fingerprinting of criminals to the United States. The test represented a major breakthrough and came to have tremendous importance in forensic science. It was developed by Sir Alec Jeffreys , who realized that variation in the genetic code could be used to identify individuals and to tell individuals apart from one another. The first application of DNA profiles was used by Jefferys in a double murder mystery in the small English town of Narborough, Leicestershire in A year-old school girl by the name of Lynda Mann was raped and murdered in Carlton Hayes psychiatric hospital. The police did not find a suspect but were able to obtain a semen sample. In , Dawn Ashworth, 15 years old, was also raped and strangled in a nearby village of Enderby. Forensic evidence showed that both killers had the same blood type. Jefferys was brought into the case to analyze the semen samples. He concluded that there was no match between the samples and Buckland, who became the first person to be exonerated using DNA. Jefferys confirmed that the DNA profiles were identical for the two murder semen samples. To find the perpetrator, DNA samples from the entire male population, more than 4, aged from 17 to 34, of the town were collected. They all were compared to semen samples from the crime. A friend of Colin Pitchfork was heard saying that he had given his sample to the police claiming to be Colin. Colin Pitchfork was arrested in and it was found that his DNA profile matched the semen samples from the murder. Because of this case, DNA databases were developed. European Network of Forensic Science Institutes. These searchable databases are used to match crime scene DNA profiles to those already in a database. By the turn of the 20th century, the science of forensics had become largely established in the sphere of criminal investigation. Scientific and surgical investigation was widely employed by the Metropolitan Police during their pursuit of the mysterious Jack the Ripper , who had killed a number of prostitutes in the s. This case is a watershed in the application of forensic science. Large teams of policemen conducted house-to-house inquiries throughout Whitechapel. Forensic material was collected and examined. Suspects were identified, traced and either examined more closely or eliminated from the inquiry. Police work follows the same pattern today. Initially, butchers, surgeons and physicians were suspected because of the manner of the mutilations. The alibis of local butchers and slaughterers were investigated, with the result that they were eliminated from the inquiry. Whitechapel was close to the London Docks , [46] and usually such boats docked on Thursday or Friday and departed on Saturday or Sunday. Handbook for Coroners, police officials, military policemen was written by the Austrian criminal jurist Hans Gross in , and is generally acknowledged as the birth of the field of criminalistics. The work combined in one system fields of knowledge that had not been previously integrated, such as psychology and physical science, and which could be successfully used against crime. Gross adapted some fields to the needs of criminal investigation, such as crime scene photography. This Institute was followed by many similar institutes all over the world. Edmond Locard , became known as the " Sherlock Holmes of France ". He formulated the basic principle of forensic science: In , he founded what may have been the first criminal laboratory in the world, after persuading the Police Department of Lyon France to give him two attic rooms and two assistants. He remains a great inspiration for forensic science, especially for the way his acute study of a crime scene yielded small clues as to the precise sequence of events. He made great use of trace evidence such as shoe and tire impressions, as well as fingerprints, ballistics and handwriting analysis, now known as questioned document examination. In many of his reported cases, Holmes frequently complains of the way the crime scene has been contaminated by others, especially by the police, emphasising the critical importance of maintaining its integrity, a now well-known feature of crime scene examination. He used analytical chemistry for blood residue analysis as well as toxicology examination and determination for poisons. He used ballistics by measuring bullet calibres and matching them with a suspected murder weapon. This means that every contact by a criminal leaves a trace. Locard was also known as the "Sherlock Holmes of France". Alexander Lacassagne, who taught Locard, produced autopsy standards on actual forensic cases. Alphonse Bertillon was a French criminologist and founder of Anthropometry scientific study of measurements and proportions of the human body. He used anthropometry for identification, saying each individual is unique and by measuring aspect of physical difference, there could be a personal identification system. He created the Bertillon System around , which was a way to identify criminals and citizens by measuring 20 parts of the body. In , there was over repeat offenders caught through the Bertillon system. Fingerprinting became more reliable than the Bertillon system. Frances Glessner Lee, known as "the mother of forensic science," [57] was instrumental in the development of forensic science in the US. She lobbied to have coroners replaced by medical professionals, endowed the Harvard Associates in Police Science, and conducted many seminars to educate homicide investigators. She also created the Nutshell Studies of Unexplained Death, intricate crime scene dioramas used to train investigators. They are still in use today. Alec Jeffreys invented the DNA profiling technique in Alec Jeffreys pioneered the use of DNA profiling in forensic science in He realized the scope of DNA fingerprinting, which uses variations in the genetic code to identify individuals. The method has since become important in forensic science to assist police detective work, and it has also proved useful in resolving paternity and immigration disputes.

Chapter 4 : The scientific examination of Vermeer's Girl with a Pearl Earring - AMOLF

The state of the field --Overview / John Winter --Material innovation and artistic invention: new materials and new colors in Renaissance Venetian paintings / Barbara H. Berrie and Louisa C. Matthew --The scientific examination of works of art on paper / Paul M. Whitmore --Changing approaches in art conservation: to the present / Joyce.

Play media An early video showing some activities in a conservation laboratory at the Rijksmuseum A temporary windowed partition along restoration work area in the cloister of the Church of St. Trophime, Arles The care of cultural heritage has a long history, one that was primarily aimed at fixing and mending objects for their continued use and aesthetic enjoyment. During the 19th century, however, the fields of science and art became increasingly intertwined as scientists such as Michael Faraday began to study the damaging effects of the environment to works of art. Louis Pasteur carried out scientific analysis on paint as well. The society was founded by William Morris and Philip Webb , both of whom were deeply influenced by the writings of John Ruskin. Since , Harvard University wraps some of the valuable statues on its campus, such as this " Chinese stele ", with waterproof covers every winter, in order to protect them from erosion caused by acid rain. He not only developed a scientific approach to the care of objects in the collections, but disseminated this approach by publishing a Handbook of Conservation in In the United Kingdom, pioneering research into painting materials and conservation, ceramics, and stone conservation was conducted by Arthur Pillans Laurie , academic chemist and Principal of Heriot-Watt University from Alexander Scott in the recently created Research Laboratory, although he was actually employed by the Department of Scientific and Industrial Research in the early years. The creation of this department moved the focus for the development of conservation theory and practice from Germany to Britain, and made the latter a prime force in this fledgling field. In the United States , the development of conservation of cultural heritage can be traced to the Fogg Art Museum , and Edward Waldo Forbes, its director from to He encouraged technical investigation, and was Chairman of the Advisory Committee for the first technical journal, Technical Studies in the Field of the Fine Arts, published by the Fogg from to Importantly he also brought onto the museum staff chemists. Rutherford John Gettens was the first of usch in the US to be permanently employed by an art museum. He worked with George L. Stout , the founder and first editor of Technical Studies. Gettens and Stout co-authored Painting Materials: A Short Encyclopaedia in , reprinted in This compendium is still cited regularly. Oliver Brothers is believed to be the first and the oldest continuously operating art restoration company in the United States. The focus of conservation development then accelerated in Britain and America, and it was in Britain that the first International Conservation Organisations developed. The International Institute for Conservation of Historic and Artistic Works IIC was incorporated under British law in as "a permanent organization to co-ordinate and improve the knowledge, methods, and working standards needed to protect and preserve precious materials of all kinds. Art historians and theorists such as Cesare Brandi have also played a significant role in developing conservation science theory. In recent years ethical concerns have been at the forefront of developments in conservation. Most significantly has been the idea of preventive conservation. This concept is based in part on the pioneering work by Garry Thomson CBE , and his book the Museum Environment, first published in Although his exact guidelines are no longer rigidly followed, they did inspire this field of conservation. These take the form of applied ethics. Ethical standards have been established across the world, and national and international ethical guidelines have been written. One such example is: American Institute for Conservation Code of Ethics and Guidelines for Practice [16] Conservation OnLine provides resources on ethical issues in conservation, [17] including examples of codes of ethics and guidelines for professional conduct in conservation and allied fields; and charters and treaties pertaining to ethical issues involving the preservation of cultural property. As well as standards of practice conservators deal with wider ethical concerns, such as the debates as to whether all art is worth preserving. Collections care Many cultural works are sensitive to environmental conditions such as temperature , humidity and exposure to visible light and ultraviolet radiation. These works must be protected in controlled environments where such variables are maintained within a range of damage-limiting levels. For example, watercolour paintings usually require shielding from sunlight to prevent fading of pigments. Collections care is an important element of museum policy. It is an essential responsibility of members of the museum profession to create and maintain a protective environment for the collections in their care, whether in store, on display, or in transit. A museum should carefully monitor the condition of collections to determine when an artifact requires conservation work and the services of a qualified conservator. Work of preventive conservation in a rock wall with prehistoric paintings at the Serra da Capivara National Park. The work consists of filling the cracks to prevent the fragmentation of the wall. Interventive conservation[edit] Furniture conservation â€" Re-glueing loose element of solid nut marriage chest probably Italy, 19th century A principal aim of a cultural conservator is to reduce the rate of deterioration of an object. Both non-interventive and interventive methodologies may be employed in pursuit of this goal. Interventive conservation refers to any direct interaction between the conservator and the material fabric of the object. Interventive actions are carried out for a variety of reasons, including aesthetic choices, stabilization needs for structural integrity, or cultural requirements for intangible continuity. Examples of interventive treatments include the removal of discolored varnish from a painting, the application of wax to a sculpture, and the washing and rebinding of a book. Ethical standards within the field require that the conservator fully justify interventive actions and carry out documentation before, during, and after the treatment. Although this concept remains a guiding principle of the profession, it has been widely critiqued within the conservation profession [19] and is now considered by many to be "a fuzzy concept. Conservation laboratories[edit] The Lunder Conservation Center. Conservation staff for both the Smithsonian American Art Museum and the National Portrait Gallery are visible to the public through floor-to-ceiling glass walls that allow visitors to see firsthand all the techniques that conservators use to examine, treat and preserve artworks within a functioning conservation Laboratory. Conservators routinely use chemical and scientific analysis for the examination and treatment of cultural works. The modern conservation laboratory uses equipment such as microscopes , spectrometers , and various x-ray regime instruments to better understand objects and their components. The data thus collected helps in deciding the conservation treatments to be provided to the object. The results of this work was the report A Public Trust at Risk: The report made four recommendations: Institutions must give priority to providing safe conditions for the collections they hold in trust. Every collecting institution must develop an emergency plan to protect its collections and train staff to carry it out. Every institution must assign responsibility for caring for collections to members of its staff. Individuals at all levels of government and in the private sector must assume responsibility for providing the support that will allow these collections to survive. The document listed the following as priorities for the next decade: Museums will fulfil their potential as learning resources pp 7â€" Museums will be embedded into the delivery of education in every school in the country. Understanding of the effectiveness of museum education will be improved further and best practice built into education programmes. Museums will embrace their role in fostering, exploring, celebrating and questioning the identities of diverse communities pp 11â€" The museum sector must continue to develop improved practical techniques for engaging communities of all sorts. Government and the sector will find new ways to encourage museums to collect actively and strategically, especially the record of contemporary society. The sector will develop new collaborative approaches to sharing and developing collections and related expertise. Find more varied ways for a broader range of skills to come into museums. Improve continuing professional development. Museums will work more closely with each other and partners outside the sector pp 23â€" A consistent evidence base of the contribution of all kinds of museums to the full range of public service agendas will be developed. There will be deeper and longer lasting partnerships between the national museums and a broader range of regional partners. The conservation profession response to this report was on the whole less than favourable, the Institute of Conservation ICON published their response under the title "A Failure of Vision". The original consultation paper made quite extensive reference to the importance of collections, the role of new technologies, and cultural property issues, but this appears to have been whittled away in the present document. A national survey to find out what the public want from museums, what motivates them to visit them and what makes for a rewarding visit. A review of survey results and prioritisation of the various intrinsic, instrumental and institutional values to provide a clear basis for a year strategy HR consultants to be brought in from the commercial sector to review recruitment, career development and working practices in the national and regional museums. A commitment to examine the potential for using Museum Accreditation as a more effective driver for improving recruitment, diversity, and career development across the sector. DCMS to take full account of the eventual findings of the current Commons Select Committee enquiry into Care of Collections in the final version of this document The adoption of those recommendations of the recent House of Lords enquiry into Science and Heritage which have a potential impact on the future of museums. Art conservation training Training in conservation of cultural heritage for many years took the form of an apprenticeship , whereby an apprentice slowly developed the necessary skills to undertake their job. For some specializations within conservation this is still the case. However, it is more common in the field of conservation today that the training required to become a practicing conservator comes from a recognized university course in conservation of cultural heritage. Conservation of cultural heritage is an interdisciplinary field as conservators have backgrounds in the fine arts , sciences including chemistry , biology , and materials science , and closely related disciplines, such as art history , archaeology , studio art , and anthropology. They also have design, fabrication, artistic, and other special skills necessary for the practical application of that knowledge. Within the various schools that teach conservation of cultural heritage, the approach differs according to the educational and vocational system within the country, and the focus of the school itself. This is acknowledged by the American Institute for Conservation who advise "Specific admission requirements differ and potential candidates are encouraged to contact the programs directly for details on prerequisites, application procedures, and program curriculum". Associations and professional organizations[edit] Main article: Conservation associations and professional organizations Societies devoted to the care of cultural heritage have been in existence around the world for many years. One early example is the founding in of the Society for the Protection of Ancient Buildings in Britain to protect the built heritage, this society continues to be active today. These organizations exist to "support the conservation professionals who preserve our cultural heritage". International cultural heritage documents[edit] Year.

Chapter 5 : About - Cultural Heritage Science Open Source

In March , the National Academy of Sciences Arthur M. Sackler Colloquia presented the Scientific Examination of Art: Modern Techniques in Conservation and Analysis at the National Academy of Sciences Building in Washington, DC.

Perhaps it is what you do not see which makes it valuable. X-ray use has become a common practice among art authenticators. Not only does it unlock secrets underneath paintings, but it helps to establish authenticity. Types of paper, materials, preparatory sketches, changes to the composition, and other clues can be discovered through the use of an x-ray to prove the nature and origin of a painting. X-rays can also be used to detect traces of minerals and other elements within the paint. These traces can be clues to when the painting was executed and where. These brighter areas on the x-ray show where Vermeer used white, therefore creating the luminous glow that this picture has become famous for. Even though this is unmistakably a Vermeer, this specific applied technique confirms the painting was produced at the time when lead was in use. Through x-ray research, it was revealed that this painting initially started as an old woman with her head bent over. While Ultra-Violet examinations can be done in-house; heavy duty x-ray photography must be done at the laboratory level. Art authenticators have been using x-rays to identify and authenticate paintings for more than years. The first documented use of x-rays in art authentication was in in Frankfurt, Germany. So how do x-rays work in the art authentication world? There are two types of x-rays used in art authentication: Each type of x-ray can show different things in a painting that would otherwise not be seen. But instead of flesh, these x-rays see different layers of paint. X-rays can show where touch-ups have been made, or where places were painted over. Old Man x-ray, Painting by Mildred Peel, Oil on Canvas, In order to create a new picture of the layers of the painting, the rays pass through the painting and create a negative of the darker areas on film. Think of it as reversed photography. After the rays are passed through the painting, old layers of paint can be seen and the investigation can begin. Is this consistent with the known preparation and painting method of the artist? Are the hidden compositions similar to the style that the artist used? In order to find these "hidden paintings", the x-ray technician will apply a certain amount of kilovoltage. The kilovoltage is basically a measurement of how intense or weak the x-ray beam is. The more kilovoltage is applied, the more it reveals of the paintings underneath. It can be compared to changing the contrast on a television set when it goes from white to black. The more kilovoltage that is used, the better you can see the picture underneath. It has been said that kilovoltage is used by the radiographer to "paint" the picture Graham and Eddie. Time is also an element that radiographers use to make x-ray exposures. In the same way that you can under or over expose film in a camera, the same can be said for x-rays. Radiographers use a short x-ray exposure to show the deepest layers. The longer the exposure, the shallower the x-ray will be. Generally, art laboratories use a series of "soft" x-rays known as the grenz rays. These wavelengths are long, but less intense, and are ideal for art authenticators. To produce these grenz rays, and to use them in a way that is convenient for authenticators, typically a machine like the Gilardoni Radiolite x-ray machine is used. Gilardoni Radiolite Radiographers must stand very far away when conducting x-rays with this machine, due to the possible radiation exposure. Amazing things can be seen with the x-ray technique. For example, this painting "A Spanish Grandee" by El Greco shows that underneath the painting of this aristocrat is a layer showing a portion of a still life. What we see as a landscape was originally a portrait of a man. Rembrandt, Tobias and the Angel Scan of Tobias and the Angel Through a combination of Morellian analysis, documentary research and x-ray examinations, authenticators can determine if a painting is the genuine article. For example, it is well-known that most artists would recycle their canvases. Painting over a rejected picture was a common practice. Red flags would go up for an art authenticator if there were no sketches, modifications pentimenti , or anything at all below the surface of a painting. Some painters though, did not prepare a sketch. In general, however, a perfect composition may indicate that the painting is a duplicate or a copy. The original is of icebergs, and the surface painting is a different climate. An educated authenticator with a very trained eye can distinguish styles and methods with the use of x-rays. They are especially useful for examining paintings on panel wood. From x-rays and other forensic technology to systematic comparative analysis, to archival research, we use all the tools and methods available to authenticate paintings. We are now offering Mobile X-ray Examinations at your home or office location in the following areas:

Chapter 6 : Color Science in the Examination of Museum Objects: Nondestructive Procedures

å›¾ä¹¦Scientific Examination of Art ä»‹ç»•ã€•ä¹¦è¯„ã€•è®ºå•›å•ŠæŽ¨è••. The National Academy of Sciences is a private, nonprofit, self-perpetuating society of distinguished scholars engaged in scientific and engineering research, dedicated to the furtherance of science and technology and to their use for the general welfare.

Whitmore Research Center on the Materials of the Artist and Conservator Carnegie Mellon University Pittsburgh, Pennsylvania ABSTRACT The scientific examination of works of art on paper utilizes tools from the very simple to state-of-the-art analytical instrumentation, depending in large part on the question that is the objective of the investigation. Identifying pigments or paper fibers is straightforward, constrained only by the size of the samples that can be removed for destructive analysis. Inks are more difficult because of the lack of pronounced chemical differentiation between the ink types and because of possible interferences in the analyses from the paper substrate. Paper can be characterized easily to an extent, in identifying a watermark or the risk of deterioration from a high acid content, but the monitoring of the condition and degradation of paper remains an extremely difficult challenge. The assessment of light sensitivity, which is not easy to determine by merely identifying material composition, has been made straightforward by the development of a device that allows rapid, essentially nondestructive fading tests. Those tests are now being exploited to survey groups of objects to determine whether one may make generalizations about their exhibition needs. The further adaptation of nondestructive or micro-scale destructive analytical tools in the study of works of art on paper promises to allow even more extensive investigations of the creation and preservation of these objects. Page 28 Share Cite Suggested Citation: Scientific Examination of Art: Modern Techniques in Conservation and Analysis. The National Academies Press. Artifacts are examined in order to answer art historical questions about the origin of a work, namely, where, when, and by whom a work was created. The scientific examinations seeking to answer these questions generally require identification of the materials and working methods used to craft the object. Other studies seek to answer basic questions about the care of the artifact: Technical studies of paper-based artifacts tend to resemble the study of paintings, because many paper objects actually are paintings that just happen to be executed on a paper support. Manuscript illuminations, watercolors, lithographic printsâ€”these objects could easily be viewed as paintings, amenable to analyses of the colorants, paint media, or layer structure of paints observable in cross-sections. Apart from the occasional thinness of the paint layer itself, as in watercolor paintings, or binder-poor paint layers, such as in pastels, these paper-based paintings can often be studied as one would study any other painting. Despite this similarity, many works of art on paper present special circumstances that constrain analyses or warrant unusual examination techniques. Paper artifacts tend to be small: The sheets were traditionally made in molds that could be manipulated by people, and these sheets were then cut down for use. For this reason, analytical methods that require removal of paint samples are often not feasible, for the damage to the artifact can sometimes be visible upon close inspection. Nondestructive tools, particularly optical spectroscopic or imaging techniques, are more widely used to study these objects. Another distinction between paper-based objects and traditional paintings is the use of the paper substrate as part of the image itself. Particularly with such graphic art as drawings and prints but also with printed text or even thinly painted watercolors, the paper substrate is exposed and is part of the image. Thus, the color of the paper and its surface texture are important contributors to the appearance and visual appeal of the object, and study of the paper and its preservation is of great importance. Occasionally in historical times and more frequently in the twentieth century, paintings too have been created with unpainted canvas as part of the image. For these objects the concern about the appearance and stability of the canvas is of course shared. A complication in studying objects in which the paper is so intimately associated with the drawing media is the discrimination between the two, so that many analyses must have very small spatial or depth resolution, or contributions to the detected signal from the paper must be subtracted. Paper-based collections in museums are known to pose some of the most Page 29 Share Cite Suggested Citation: Because paper was inexpensive and widely available through much of history, it has seen use for many purposes, a primary one being for communication and recording of information.

Some of these artifacts, such as books, were meant to last for a long time, but others, such as newspapers, announcements, or letters, were often not created with posterity in mind. Thus, it is not uncommon for museums and archives to have paper artifacts that are delicate or deteriorating because of their creation with impermanent materials or techniques. Preservation problems are common, particularly with those objects that were not made as art objects. This review will survey the examination techniques of paper-based objects that are used both for art historical investigations as well as for preservation studies. Some of those techniques are routine and can be found in many well-equipped museum laboratories; others are less widely available and have not found widespread use. This survey will conclude with a description of a relatively new tool developed to detect a particular vulnerability, the susceptibility of colored materials to fade from light exposure, and illustrate its use for the study of Japanese woodblock prints. For this, the routine analytical tools of polarizing-light microscopy, X-ray diffraction, and elemental analyses by X-ray fluorescence are commonly employed, usually on samples of the paint that have been removed from the artifact. Descriptions of these tools can be found in accounts of painting examinations, or in reference books devoted to pigment identification Feller, ; Roy, ; FitzHugh, Nondestructive techniques can also sometimes be used to identify pigments on paper objects. Open-air X-ray fluorescence is used for elemental analyses of pigments, and Raman spectroscopy and Raman microscopy have been found useful for examining both pigments in paints and dyes in colored paper Bell et al. Some pigments have distinctive features in the visible spectrum Schweppe and Roosen-Runge, ; Leona and Winter, , while others, like Indian yellow, can be detected by their peculiar fluorescence observable under ultraviolet light illumination Baer et al. Drawing materials can also be studied, although they present some difficulties. Inks are more problematic, with the exception of iron gall inks, which can be distinguished by the presence of iron in X-ray fluorescence or Page 30 Share Cite Suggested Citation: Inks can also be analyzed for the trace elements they contain, introduced in the ink ingredients or as residues from the printing process. Inks in early books such as a Gutenberg Bible have been examined for these trace elements by synchrotron-excited X-ray fluorescence in the hope of distinguishing books produced in the early German printing shops Mommsem et al. Other organic inks, such as sepia cuttlefish ink , bistre from soot , or such black drawing media as charcoal, bone black, lamp black, ivory black, or graphite cannot usually be distinguished by their elemental composition although bone black is often detected by the presence of phosphorus , nor do the infrared spectra of these inks usually present characteristic features useful for their identification. Polarizing-light microscopy remains a common tool to discriminate between inks on the basis of their particle morphologies. The media used as pigment binders for drawing and painting materials can be identified by analyzing the organic composition of micro-samples. Paper is usually differentiated by its fiber composition, its physical characteristics, and its manufacturing method. The fibers can be studied with optical microscopy, and the plant origin of the component fibers can be determined by appearance or by reaction to certain stains, such as Hertzberg or Graff C stains. The fiber type, length, and heterogeneity can all be distinctive, as can such physical dimensions as sheet thickness. Watermarks, the decorative patterns often woven into the wire molds or embossed on the cast sheets, are also the most obvious characteristic patterns of the paper manufacture. The evidence of chain and laid lines and watermarks can be captured in any of a number of ways, with transmitted light photography or with beta or soft X-ray radiography, and various image processing tools have been applied to enhance such records erasing interferences from the printing, for example and making them more useful for indexing and retrieval for comparison in a reference database Brown and Mulholland, The presence of sizing a water-resistant finish on the surface of the paper can be determined by infrared spectroscopy or colorimetric methods Barrett and Mosier, , and fillers typically finely ground minerals or clays added for increased opacity of the sheet can be identified by optical or electron microscopies Browning, Page 31 Share Cite Suggested Citation: The cohesive strength of a sheet of paper is derived from the strength of its constituent fibers and of the bonds between the fibers. Aging tends to reduce the fiber strength, and old weak papers are usually seen to fail from broken fibers rather than by unraveling from weakened interfiber bonds. The reduction of fiber strength is in turn a result of the breakdown of cellulose, the natural polymer of glucose that composes plant fibers. Chemical degradation breaks cellulose chains, which reduces the average molecular weight but more importantly also breaks the connections between the highly crystalline cellulose zones. This progressive rupture of the tie chains, the amorphous cellulose chains connecting the crystallites and imparting the cohesive strength to the fiber, is the underlying aging chemistry leading to physical failure of the paper sheet. Unfortunately, there are no analytical tools that can allow detection of such deterioration in a paper artifact without destructive analysis of unacceptably large portions of paper. Typically for degrading polymers, nondestructive tools such as infrared spectroscopy do not have the sensitivity to detect the production of the very small concentrations of new chain ends in the degrading cellulose. Recent studies suggest that production of glucose or xylose residues Erhardt and Mecklenberg, or low molecular weight acids Shahani and Harrison, may be easier to track as some measure of cellulose reaction, but these techniques have not yet been applied to artifacts. Other efforts to develop micro-scale molecular weight analyses for cellulose have reduced the amount of paper needed Rohrling et al. Thus, even if the analytical procedure can be adapted, the slow deterioration of the cellulose may not be easily tracked by successive measurements of individual fibers over time. While the deterioration of paper artifacts may be difficult to detect directly, many years of investigation of cellulose degradation have clearly indicated that there are other materials that may be reliable indicators of instability in the paper. Acidity is well established as a catalyst for the hydrolytic breakdown of cellulose, the most important of the known degradation chemistries. It is much easier to determine the presence of these sensitizing agents in paper than to track the slow deterioration of the cellulose, so the study of artifact materials often does not go beyond a pH measurement, the detection of lignin with phloroglucinol stain or an infrared spectrum, or the analysis for iron or copper impurities by a technique such as electron spin resonance spectroscopy Attanasio et al. Iron present not as a paper impurity but as an ink component is also a well-known and easily identifiable risk factor for the preservation of manuscript and print materials. The maintenance of the image-forming materials, particularly the colored paints and inks used to create the image, is another objective of preservation strategies. Light exposure is the most common hazard to the pigments and dyes used on art objects. In contrast to preserving the paper support, in which the deterioration is difficult to monitor and easier to predict by detecting the presence of destabilizing components, the loss of color is easy to monitor by periodic color measurements but difficult to predict. The light stability of a pigment depends not only on the material but also on its preparation, particle size, and prior fading history. None of these is easy to determine from study of the pigments, and until recently the only means to detect light sensitivity was to monitor the damage inflicted by light exposure. Recently a new device has been developed to determine the risk of future fading from light exposure Whitmore et al. That device operates as a reflectance spectrophotometer using a very intense focused beam from a xenon lamp as the illumination for the measurement see Figure 1. By making rapid repeated spectral measurements while the material is illuminated by the intense light, very slight degrees of fading can be detected in light-sensitive materials in only a few minutes see Figure 2. Because of the high precision of the spectrum acquisition, extremely small amounts of fading are easily recorded, and the test can be stopped before perceptible changes to the art object have been produced. All of the different color areas on a work of art can be tested, and the overall sensitivity of the object can be judged by the fading rate of the most light-sensitive color see Figure 3. These tests can be used to develop exhibition requirements that are tailored to the needs of the object, with the very light-sensitive objects receiving greater care less frequent exhibition at lower light levels so that they do not suffer from fading damage caused by inappropriate display. These same tests, done with filtered illumination, can also be used to test the effectiveness of different lighting in reducing fading rates. By performing the tests in air or under an inert gas, the efficacy of oxygen-free housings for slowing the fading of works of art can also be assessed see Figure 4. It has been found that this fading test can also be used to identify pigments, not by their elemental or chemical constitution but rather on the basis of their photochemical reaction. Reprinted from the Journal of the American Institute for Conservation, vol. Page 34 Share Cite Suggested Citation: The fading tests of Prussian blue using the tester described above demonstrated this peculiar reversible fading behavior on a cyanotype, an early photographic process used to create blueprints see Figure 5 Whitmore et al. In addition to these fading tests designed to evaluate individual artifacts, current studies are measuring the fading rates of particular colorants in Japanese woodblock prints from different eras, printed at different depths of color, and of varying degrees of prior fading. Results of such a population study will reveal whether there is general consistency or a wide variation in light sensitivity for particular materials. If there is widely varying behavior, fading tests must be performed on each object in order to determine the sensitivity and light exhibition needs. This formulation of new rules of thumb, based on actual fading sensitivities observed in a large population of objects, will bring a new level of intuition about how to preserve objects. The results of tests on a large number of Japanese woodblock prints indicate that the fading of the colorant dayflower blue aobana is very regular, and its sensitivity can probably be safely estimated without individual fading tests see Figure 6a. By contrast, yellow passages on the Japanese prints vary greatly in their light Page 35 Share Cite Suggested Citation: Page 36 Share Cite Suggested Citation: Solid lines are fading measured during light exposure; dashed lines represent period of recovery, and return of blue color smaller color difference in the dark. Reprinted from Tradition and Innovation: Advances in Conservation, eds. These materials will require individual testing in order to assess their fading risks. CONCLUSION The scientific examination of works of art on paper utilizes tools from the very simple to state-of-the-art analytical instrumentation, depending in large part on the question that is the objective of the investigation. Identifying pigments or paper fibers is relatively easy, while inks are more challenging because of the lack of pronounced chemical differentiation between the ink types and because of possible interferences in the analyses from the paper substrate.

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