Authenticating Art and Artifacts

An Introduction to Methods and Issues

by

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1 INTRODUCTION

This book is an introduction to standard methods and issues in the identification, authentication, fake and forgery detection of art, artifacts and collectibles. This includes everything from ancient artifacts and famous paintings to antique toys and trading cards. Authentication involves many aspects and perspectives, from science to connoisseurship, and this book is written for all those invested or interested in the topic, including scientists, museum workers, historians, appraisers, lawyers and connoisseurs.

Each specific area-- 1800s impressionist paintings, 1900s trading cards, Ming vases, antique diamond rings, other-- requires a specialized knowledge and hands on experience with the objects. Thus, this book cannot and does not intend to *cover it all.* Rather, it is a general survey, though with many specific examples and case studies.

There are other books on the science of forgery detection. While they are good in their way, they are too narrow to work as introductory or general books. They focus strictly on advanced, 'cutting edge' scientific methods in the examination of highly rarified works (Vermeer paintings, priceless relics, etc). This book covers the advanced methods such as carbon dating, spectroscopy and chromatography and looks at high end objects. However, not only are connoisseurship, elementary scientific examination and basic research essential parts of authentication and forgery detection, experts are asked to investigate objects ranging from postcards to military medals to trading cards to kids' toys. The New York Metropolitan Museum of Art owns a collection of baseball trading cards, the Louvre has exhibited advertising posters, and historical and cultural museums hold objects of every

type and genre. And what is today considered a priceless ancient cultural relic was originally someone's drinking cup or normal everyday farming tool.

2 AN OVERVIEW OF THIS BOOK

This chapter gives a brief summary of the key points and ideas of the book.

Identification, authentication and fake detection are about making educated judgments about identity and age, and involve looking at an item from many perspectives. The perspectives include a knowledge and study of the history of the area and objects, stylistic analysis and connoisseurship, hands on experience with the objects, physical examination of the objects and performing scientific tests. Often times experts with specialties in different areas work together-- say an art historian with a chemist--, and experts regularly seek input and opinions from other experts.

Looking at and taking into consideration all the information and perspectives, many items can clearly be identified, dated and authenticated, and many items can quickly and easily be identified as fakes or reproductions. However, even the top experts are not omniscient. There will be items that are unidentified, missing key information (which perhaps will be uncovered with future research) or where the opinion is not entirely certain.

A key in authentication is knowledge, research and experience of the particular area (1800s British paintings, early trading cards, other). This includes knowledge of the history, what are the important guide books and references, hands on experience, knowing who are respected experts and dealers and who are not, and what are the common fakes, reproductions and scams.

A common and traditional way of judging the age of supposedly old items is looking for signs of aging. This includes rust, deterioration, patina, dryness, fungus and discoloration. These signs can provide important evidence old age and authenticity. However, aging can be faked or caused by other reasons, such as poor storage conditions and handling, so must be examined and considered closely.

Being able to identify and understand materials is an essential part of identification. Because specific materials were often used during a specific period and certain artifacts are known to be made with specific materials, fakes and forgeries are regularly identified because the material is inconsistent, if not impossible, with the item being genuine. Further, the material is often an integral part of an item's identity and value, such as with a diamond ring, gold coin or a porcelain vase.

As with materials, being able to identify and understand the processes used to make items is essential to authentication and fake detection of items. Processes include the type of printing used to make a poster, whether a glass figure is blown or mold made, whether a textile is machine made or handmade, and how an ancient arrowhead was formed. Authentic items must be made with processes consistent with the genuine item. Many fakes and reproductions are identified because they were made with incorrect processes, including processes introduced after the genuine item would have been made. As with materials, the process is often an integral part of an item's identity, such as with Rembrandt etching and a hand carved figure.

There are a wide variety of scientific tests and methods used to examine objects and provide information about date and identity. They range from simple and elementary to advanced and expensive. Elementary, yet still important, tests include measuring weight and size, observing colors and texture. Advanced tests include radiometric dating to measure age, thermoluminescence testing to date when items such as ceramics were last heated, and spectroscopy to identify chemicals and compounds in a material.

Multiple scientific tests are done on an object, combining the elementary with the advanced.

Provenance-- a documented history of ownership and related information-- is helpful in providing information about objects, establishing age and giving supporting evidence towards authenticity. If an item is documented as being around for years, that at the least rules it out as a recent forgery. However, provenance documentation itself has to be verified, as it can include errors or even itself be forged.

There are margins of error and other limits with scientific testing. While scientific testing often identifies fakes, it must be combined with other knowledge for authentication. For example, radiometric dating identifying that a painting dates to Rembrandt's lifetime is important information for identifying a painting as having been made by Rembrandt. However, it does not prove that the painting was made by Rembrandt. The painting could have been made by another painter from the time period, including one of his students who regularly copied his works as part of their studies. Other tests and examination, including the artistic and historical analysis by art historians, must be used for verification that the artist was Rembrandt.

There are a variety of social and psychological forces that corrupt the authentication processes. These include owners who want to ‘protect their investments’ by trying to suppress or distort information, collectors and dealers misusing and misinterpreting expert opinions, and people who have cognitive biases and blind spots.

3 UNDERSTANDING AUTHENTICITY, FAKE AND OTHER TERMS

This chapter is a look at essential terms and ideas, including authenticity and authentication, identification, fake and forgery.

3.1 Identification

Identification should be a largely self evident term and idea. It involves, well, identifying what is something-- the essential identity and elements. This includes what type of object it is, its age, who was the maker. In cases, the material and process used to make the object are important elements of its identity and value, such as a diamond ring, ivory figure or handmade figure. In other cases, how the item was used or who it belonged to is important, such a medal or sword that belonged to a famous military figure or a baseball bat that was used in a famous game.

In many cases, the item is largely identified but missing some information. For example, you may be able to identify and date a photograph but not know the photographer. Or you may know the date and photographer but not know the identity of the image subject. For some objects, further research must still be done, and in cases the identity of the person in the photograph will always remain a mystery.

3.2 Authenticity/Authentic

In all areas, from vintage teddy bears to oil paintings, something is authentic if its true identity is described accurately and sincerely. There is truth in advertising.

If you pay good money for an "original 1930 Greta Garbo photograph by the famed Hollywood photographer George Hurrell" you expect to receive an original 1930 Greta Garbo photo by George Hurrell. You do not expect a 1970 reprint or a photo by an unknown photographer.

An item does not have to be rare, expensive or old to be authentic. It just has to be accurately and sincerely described. A cheap 2013 reprint can be authentic if described as a cheap 2013 reprint.

I use the word ‘sincerely’ to give no cover to sellers who try to pull the wool over the potential buyer’s eyes with intentionally confusing, ambiguous, vague or/or diverting language in an attempt to sell something they know is a reprint. One can both be “technically correct” and deceptive, and one can lie by omission--and judges in false advertising cases are the first to know this.

At sale or auction, errors in the description of an item are considered significant when they significantly affect the financial value or reasonable non-financial expectations of the buyer. An example of the reasonable non-financial expectations would involve a collector who specializes in real photo post cards of her home American state of Iowa and makes it clear to the seller that she only wants postcards depicting Iowa. Even if there is no financial issue, she would have reason to be disappointed if the purchased postcard turned out to show Oklahoma or Minnesota.

Many errors in description are minor and have little to no material effect. If that 1930 Greta Garbo photo turns out to be from 1932, it may not affect the financial value or desirability to the purchaser. Many will file that under “no harm, no foul.”

Authentication is the act of determining that the item is authentic, that the item’s label and description matches its true identity.

3.3. Common terms

Counterfeit: a reprint or reproduction that was intentionally made to fool others into believing it is original.

Forgery: an item that was intentionally made to fool others into believing it is something it is not. This includes counterfeits, but also fantasy or made up items. An example of a fantasy would be a 1958 Bowman Mickey Mantle baseball card. Bowman did not make baseball cards after 1955, so a 1958 Bowman Mantle never existed.

Fake: an item that is majorly misidentified in identity and/or age. This includes forgeries and counterfeits. It also includes items that are innocently misidentified by collectors or sellers who are uninformed.

When in doubt about a seller or maker's intent, it is best to call a bad sale or auction item a fake instead of a forgery or counterfeit. All three words mean an item is not genuine, but forgery and counterfeit implies intentional illegality.

3.4 How Fakes and Reproductions Are Identified

Fakes and reproductions are identified because they have things that are inconsistent or impossible with it being authentic.

Some fakes, forgeries and reproductions are commonly known. Reproductions are sometimes even made and advertised as reproductions, though this identity can be lost in the ownership shuffle over the years.

In other cases, there are clear things that show the item cannot be original. The following are examples:

A reproduction of an antique with a modern copyright date printed on the back or bottom

A Rudolph Valentino “autographed” currency bill where the treasurer listed on the bill served after the silent movie actor’s death. This illustrates how a little google or Wikipedia research can identify a forgery.

An Ancient Egyptian painting on canvas. Canvas wasn't introduced for painting until centuries later.

A photograph "signed" in sharpie by Abraham Lincoln. The sharpie pen was invented long after Lincoln's death.

In other cases, the incongruities are clear but less obvious and take expertise to uncover. Examples of these include:

A 1700s advertising poster printed with a 1900s century printing process that is identified under a microscope.

A 1920s movie poster printed on Post-World War II paper

An antique "ivory" figure that is identified as being made from recently invented synthetic ivory

A diamond ring that is identified as really being lead crystal glass.

In scarce cases, it takes advanced scientific testing using expensive equipment and trained scientists to uncover the inconsistencies. An example includes an otherwise genuine looking "ancient" artifact that is determined to be modern via thermoluminescence testing or carbon dating. Another example is a "centuries old" painting that has fooled many art historians, but where spectroscopy examination of the paint identities modern chemicals not available to the artist.

3.5 How Items Are Identified and Authenticated

Authentication and fake detection are related but not the same. You could say authentication is like fake detection at a deeper level.

If a postcard says "reprint" on the back, you don't have to be an expert to identify it as a reprint. However, if the postcard does not say "reprint" on back, does that mean it's original? Of course not. Most forgeries and fakes have no reprint designation on back. We have all said at one time or another about a item, "I don't see

anything obviously wrong, but I wish there is some way I could be certain it was genuine."

Along with hands on experience, general knowledge of items, input from fellow experts and historical research, the expert uses a variety of techniques to authenticate the items. Some techniques are simple, such as comparing the postcard to known genuine postcards from the issue. Some techniques, such as print and card stock identification and dating, are so advanced that an expert can date and authenticate a postcard she has never even seen before.

3.5 Identification and Authentication Are About Making Learned Judgments Not Being Omniscient

Being an authentication expert is not about becoming omniscient or gaining supernatural authentication powers. It is about forming sound opinions based on knowledge, experience, tools, resources, tests and common sense.

With many items you will be confident to certain they are genuine. With many items you will be confident to certain are fake, reproductions or otherwise have significant errors in description. You may know an item is a well known reprint or the item is original but the seller has misidentified or misdated it.

For a good number of items you won't be able to make a definitive opinion. Perhaps the item is outside your area of expertise. Perhaps the item has something strange about it, but not strange enough to prove it fake. Perhaps you strongly believe the esoteric object is old, but are not sure what it is of the exact age.

There is nothing wrong with being stumped every once in awhile or not knowing all the details. Even the top experts at Sotheby’s and the Louvre sometimes scratch their heads and seek outside opinions. Some items have mysteries about them and there are many debates about what they are or their authenticity.

Always be wary of the self described expert who is certain of everything. Knowing and acknowledging the limits of your knowledge are signs of wisdom.

3.6 QUESTIONS

What is the difference between a fake and a forgery?

Is an authentication expert able to be identify and authenticate everything?

When something is authentic, what does that mean?

Are items always fake due to dishonesty?

Can all items be identified or authenticated?

Why is authentication more in depth than fake detection?

Can something be a fake and still be valuable?

4 GENERAL KNOWLEDGE AND RESEARCH IN THE AREA

Seasoned collectors of ancient American Indian artifacts will tell you that a flint fishhook is necessarily a modern fake. Not only has no known example been discovered from archeological sites, but flint would be a bad material for a fishhook because it is not strong enough under tension to catch a fish. Genuine ancient fish hooks were made of bone or antler, stronger and more flexible materials.

4.1 Overview

Whether it is 1800s trade cards, 1700s paintings or early 20th century photography, being steeped in the history and facts of the area, and having hands on experience with the items, are essential parts of being an expert. Some will call this connoisseurship, being an aficionado or a historian. Due to their hands on experience and keen interest, collectors are often as knowledgeable as academics in a specific area.

Knowledge includes knowing the history of the area: the dates, the artist, makers, personalities. An expert in Civil War memorabilia will not only have a knowledge of the artifacts, but of

the history, culture, the geography and individuals. A Hollywood movie photography dealer will not only be an expert in photography, but of the movie stars, studios and movies. Many fakes are identified by the historian who can detect historical inconsistencies. Many old sports photographs are in part dated not by the photograph expert, but by a sports historian who can date the subject in the image by the uniform, equipment and stadium.

A baseball historian or equipment collector could date this image by the style of uniforms and equipment.

Knowledge of the collecting community is essential. This includes knowing what are good information resources (reference guides, websites, hobby chatboards), who are the reliable experts, dealers and auction houses and who are not. The seasoned collector will know the commonly known fakes and reproductions, what are common scams and scamming techniques. The seasoned collector and dealer will know a lot of practical, elemental information about the objects that the university scientist assigned to do carbon dating and thermoluminescence does not. A collector can often identify an item as a common fake or scam long before the university chemist has set up his microscope.

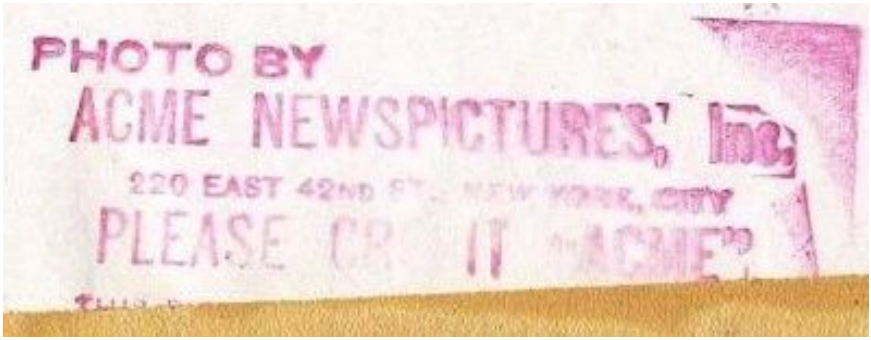
Experienced collectors in sports photography know that the left stamp will appear on a vintage 1930s photography by the famous photographer George Burke, while the right stamp will appear on a later reproduction.

4.2 Homework Assignment: Doing Basic Online Research

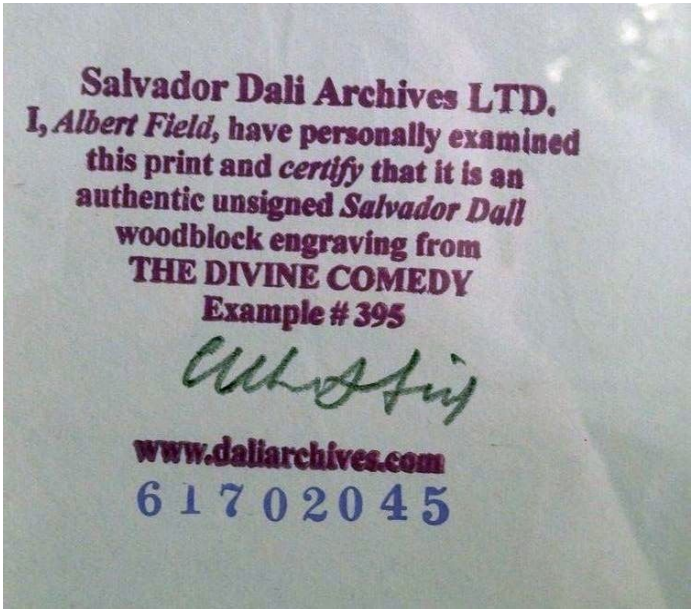
Much research and identification involve basic online research, whether finding historical information and dates, finding out who is a respected authentication expert or trying to identify an object through google images searches.

Doing online searching, answer the following questions as best you can.

1) A photograph with a 1930s image subject is donated to your museum. The back of it has this stamp. Is this stamp consistent with that photo being original?



2) A Salvador Dali print is donated anonymously to your museum. The back has this authentication stamp. Research the stamp and decide if you think the issuer is reliable or not.



3) When was the Polaroid photograph invented?

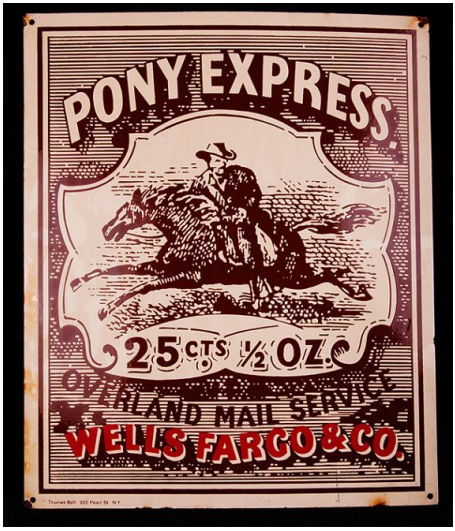
4) What is a 'Harper's woodcut'?

5) Are there reprints of Superman comic book #1?

6) What were ancient Egyptian canopic jars and what were they made of?

5 BASIC IDENTIFICATION AND UNDERSTANDING OF MATERIALS

This chapter is an introduction to how materials identification is essential to authentication and fake detection.



This sign is identified as a modern reproduction in part because it is porcelain. Porcelain signs technology was not developed until the early 20th century, while the Pony Express existed in the 1860s.

5.1 Overview

Materials (ceramics, wood, metal, fur, plastic, paper, etc) is a massive, ongoing area of study and research. There have been volumes of literature written just on diamonds, a university professor may spend her career studying paper and a New York art gallery may sell artworks made only of glass.

For authentication, the use of being able to identify and date materials in art, memorabilia and collectibles should be obvious. A '1660s toy boat' cannot be made out of 1920s plastic. An auctioned '1800 map' has to be made from the kind of paper used in the time period. A trinket made of gold will be worth more than one made from brass. Many fakes, forgeries and genuine items are in part identified by identifying the material, and, at the least, the examiner should determine that the material is consistent with the identity and age of the item.

There are authentication limits in materials identification. Many materials have known invention dates and specific periods of use, which is important for dating an object. However, some materials were used for long periods of time and their identification won't pinpoint a time period. Some antique materials, such as lucite, are still used today, and some current hobbyists and artists have reintroduced old materials and processes for aesthetic or historical recreation reasons. In these cases, looking for other qualities, such as signs of aging, is essential to judging age.

This 1800s tobacco pin is made out of celluloid, an antique form of plastic that hasn't been used commercially for decades. Identifying it as celluloid helps show that the pin is original and not a recent reproduction.

A real Major League Baseball World Series ring awarded to a player or team employee will be made of diamonds and precious metals (silver, gold, platinum), while a collectible sold to the general public or a salesman sample will not. Being able to identify the stones and metals of the ring is an integral part of authentication.

Beyond authentication and fake detection, the material is often an integral part of an item's identify and value, as with a diamond ring, gold coin, oil painting and antique table made of exotic wood.

Made using different chemicals and formulas, glass comes in many types and varieties. The highly collectible cobalt glass is made with cobalt salts and is identified by its deep blue color.

While advanced scientific tests are used to not only identify material but the exact chemical makeup, general material identification is done by basic examination. Materials are readily identified by qualities such as weight, color, texture, opacity and even smell. Seasoned collectors and dealers are often excellent at materials identification in their area.

A materials reference guide book is *Identifying Common Materials in Antiques: A Pocket Guide* by David Cycleback (Hamerweit Books)

The following three chapters show the basic methods of identifying three types of material: antique plastics, paper and precious metals. It is followed by an assignment where you research the basic qualities and information on different materials.

5.2 Questions

How does materials identification help in authentication and fake detection of an object?

What are the limitations of materials identification in authentication of an object? How can these limitations be overcome?

6 IDENTIFYING MATERIALS CASE STUDY: COMMON PLASTICS IN ANTIQUES

This chapter is an example of the basic identification of materials by looking at elemental qualities

6.1 Overview

Antique celluloid windup toy

Just as buyers want to know if an antique table is made of oak or maple, a wedding ring is gold or brass, and a statue is steel or bronze, serious collectors of antique plastic toys, trinkets, figures and jewelry want to know the what type of plastic is an item. Some vintage plastics, including Bakelite and Celluloid, are highly collectible these days.

Beyond general interest, identifying an item as being made from certain plastics shows that it is indeed old, or at least consistent with being old. Bakelite and Catalin, for examples, were discontinued decades ago and will only appear in an old toy or piece of jewelry.

Trophy with a Bakelite base

This following shows how to identify the five most common plastics used to make many vintage and antique collectibles: **Celluloid, Bakelite, Catalin, Casein and Lucite.**

6.2 How to tell plastic from other materials

Most people have a good feel for what is plastic, but glass, crystal, rubber and other materials are sometimes mistaken for plastic. This is particularly true if the item is small, such as a button on a coat, or embedded into a larger object.

Plastic is warmer to the touch than glass, crystal and most gemstones. Just put the object to your cheek to test. Plastic is also

usually much lighter. Glass items, such as a wine glass, will have a distinct sound when clicked with the fingernail that plastic does not. Plastic often has a seam, but rubber and glass can too.

The sometimes used 'hot needle test' will often reveal the identity. A red hot needle won't pierce glass or gemstone, but can enter plastic and often gives a distinct plasticy smell. Rubber will give off a rubber smell. Wood will often give off a burnt wood smell. The hot needle test is destructive, meaning it will leave a small mark, so it should be done with care, if at all, and only in discrete areas such as on the bottom. Many collectors do not use the hot needle test due to the destructive nature.

6.3 Celluloid (Made: 1800s to early/mid 1900s)

Celluloid football bulldog

Celluloid is the trade name for a plastic that was widely used in the 1800s and early/mid 1900s to make pins, buttons, fountain pens, buttons, toys, dolls and many other collectible products. If you follow antique auctions you will often hear the name mentioned. It was commonly used as an ivory substitute to make fake ivory toiletry boxes, billiard balls, handles and backings for hand mirrors, combs and brush handles. If you ever see the name

'French ivory' or 'Ivorine,' those are other names for antique faux-ivory celluloid. Anne Frank wrote her famous WWII diary with a celluloid pen and even describes it in the diary. Many valuable late 1800s and 1900s advertising, political and tobacco pins are celluloid.

Celluloid was often made to resemble ivory

Anne Frank wrote her diary with a celluloid pen

Though widely used in its day, drawbacks to celluloid are it is flammable, fragile and deteriorated with time. Celluloid often has cracking and crazing to the surface, along with toning and yellowing. Due to the common decomposition, antique celluloid in top condition is prized today.

Though celluloid is sometimes used today to make guitar parts, guitar picks and ping pong balls and, sometimes in recent decades, for rock and political pins, it was discontinued for most everything else decades ago. No modern made toy, figurine or toiletry item will be made of celluloid. If a vintage appearing pin, figure or trinket is made out of celluloid, it is likely indeed vintage.

Identifying celluloid: Antique celluloid tends to be much thinner and lighter in weight than other period plastics. For an antique fake ivory celluloid box, the top and sides will often be noticeably very thin, and the plastic surface to celluloid pints is noticeably thin. You can often see right through the plastic when held it is held up to a bright light.

The easy and reliable test for celluloid is to place it under hot water for a few seconds, then smell it. Or you can rub it vigorously with your finger or a cloth to get the smell. Celluloid smells like camphor. If you want to know what celluloid smell like after heat or friction, smell a ping pong ball or Vick's Vapor Rub. Rubbing your finger on a plastic item then taking a sniff if quick and simple. You can do it right there in an antique store or at an estate sale.

6.4 : Bakelite and Catalin (Made: 1907 to WWII)

Bakelite and Catalin are trade names for closely related plastics that are popularly collected today in the form of old timey radios ('Catalin radios'), colorful jewelry, toys, trophies and more.

Bakelite and Catalin are both made from phenol and formaldehyde, and are phenol formaldehyde resins. Because of this they have many of the same characteristics. However, the two were made in different ways so also have distinct differences.

brown bakelite pin

Bakelite was made from 1907-27. It used a filler of cloth, paper, cotton and even sometimes asbestos. This meant the plastic was heavy, strong, opaque and came in only dark colors. Bakelite usually came in only black and dark brown, and was used often used for ‘utilitarian’ purposes, including pipe fittings, coffee pot handles, electrical outlets and the bases to antique trophies.

When Bakelite’s patent ran out in 1927, the process was picked up by the American Catalin Company which called their version of the plastic Catalin. The American Catalin Company used the same phenol formaldehyde chemicals, but made the plastic in a different way. In particular, no fillers were used. This meant that, unlike the dark and dreary Bakelite, Catalin was often translucent and made in a wide variety of bright colors and interesting designs, including a marble of different colors. Catalin was used for more fun, decorative and collectible items, including jewelry, toys, trinkets, decorated boxes, brightly colored radios. Catalin tended to shrink with age, which explains the sometimes warped and shrunken frames for Catalin radios. Catalin was made from 1928 to about World War II.

Bright yellow and light green vintage Catalin radios are popularly collected

6.4.1 Collectors and dealers mixing up the names.

As the plastics are so closely related, collectors and dealers often get the names mixed up, calling Catalin Bakelite, and Bakelite Catalin. Most so-called 'Bakelite jewelry' on the market actually is Catalin. Some sellers on eBay and elsewhere play it safe and call it 'Bakelite Catalin.'

The good thing is both plastics are vintage (1907-WWII), so if you know it is one of the two but are not sure which, you can be at least confident the item is old. You can even use the catch all 'phenol formaldehyde resin' to cover them both, though that might not sound as romantic at sale.

6.4.2 Identification of Bakelite and Catalin

First will be shown the tests to used to identify phenol formaldehyde–- meaning both Bakelite and Catalin. Then, once something is identified as phenol formaldehyde, we'll look at how to differentiate between the two.

Bakelite/Catalin general appearance: Bakelite and Catalin are both heavy and clunky. They make a distinct sound when two pieces are clinked against each other. Visually, there should be no seams or mold marks. There is no pure white, as the whites formed a yellowish patina with time.

Bakelite/Catalin hot water and rub test: Hold the plastic under hot water for perhaps 15 seconds, then smell it. If it smells strongly like medicinal chemicals, then it likely is Bakelite/Catalin. Though it doesn't work as well, you instead can rub the plastic with your fingers and sniff for the strong medicinal smell.

'French Bakelite' is a mostly modern made faux-Bakelite that is Casein (described later).

Bakelite/Catalin polish test: The common metal polisher called Simichrome Polish can help identify Bakelite/Catalin. If you rub a q-tip with simichrome polish on Bakelite or Catalin, the polish on the q-tip will turn yellow. Simichrome polish is available at many hardware stores and online. The same test works with Dow Bathroom Cleaner or 409. Only do the test in a discreet area.

6.4.3 So, then, is it Bakelite or Catalin?

If you can determine an item is phenol formaldehyde, the next question is it Bakelite or Catalin. If you know the date of the item, then it is easy. Bakelite: 1907-1927. Catalin: 1928-1940s. Bakelite only comes in dark colors, usually black or dark brown. Catalin can come in a wide variety of color colors, including bright colors and marbling. Bakelite is opaque, while Catalin is often translucent. If the item is brightly colored jewelry or other items, it is more than probably Catalin.

6.5 : Casein (1800s to today)

Casein plastic was a popular plastic developed at the end of the 1800s and used throughout the 1900s. Casein is a powdered milk. For Casein in plastic form, the powder was mixed into a paste then hardened by putting it in formaldehyde.

Casein was originally made in Europe and sometimes called **galalith,** a name you still see from time to time. Casein was hard, could be polished and colored to imitate materials such as ivory. Casein was used for jewelry and fountain pens, but is most commonly found in the form of knitting needles and buttons.

Casein buttons

Casein is easily identified by putting it under hot water for a few seconds, as it will smell like burnt milk.

As Casein was used over such a long period of time, its presence won't prove an item old, but you at least know it was available in antique times.

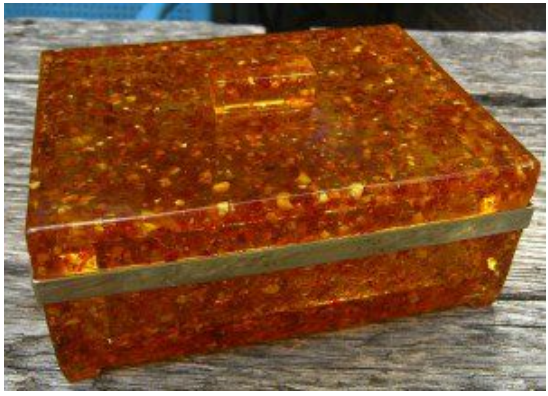
6.6 Lucite

Lucite was a popular early form of plastic that is still used today. While transparent in its natural state, Lucite can be made opaque and translucent, dyed many possible colors, molded and embedded with objects, so comes in a wide and sometimes wild variety of colors and looks. In vintage times, it was used to make everything from plastic toys to jewelry.

Identifying Lucite

Lucite has a slick feel and is fairly lightweight. It is lighter in weight than Catalin. If you put Lucite under hot water or rub it vigorously, it has no smell.

Vintage pendant with plant leaves embedded in transparent lucite



Vintage confetti Lucite box with confetti and shavings embedded in the Lucite

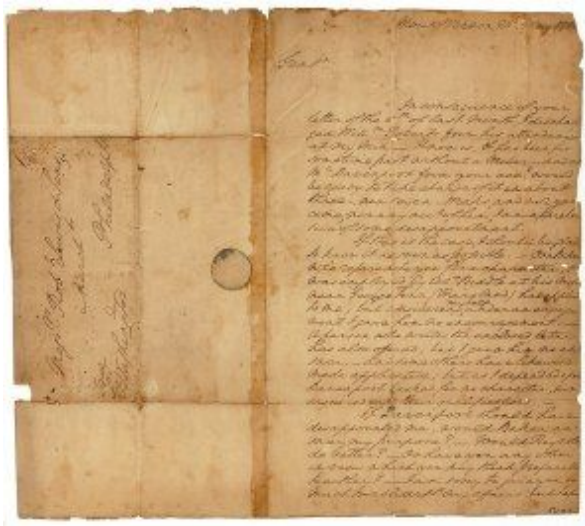
As Lucite was made for over a long time, it can be hard to be sure if a Lucite item is old or know. The most common way to identify vintage Lucite is by the style. Vintage styles include marble and granite-style Lucite (has a distinct marble or granite multi-coloring), clear Lucite with objects embedded in it (such as plants, bugs, trinkets), confetti Lucite which is clear Lucite with glitter inside objects inside, and moonglow which seems to glow under light.

Vintage lucite could be colored and molded into many shapes and designs. This is a vintage bracelet.

7 MATERIALS IDENTIFICATION CASE STUDY : PAPER

This chapter is a second example of the basic identification of materials by basic qualities.

7.1 Overview



George Washington letter

Having a basic knowledge of paper is important to identification and authentication. Many fakes and reprints are identified as the paper is too modern or the wrong type for the print, poster or manuscript to be original.

While the type and age of the paper can help determine the authenticity of a print, it is not in and of itself proof. Some forgers use old paper.

This following a brief look at some important types of paper throughout history.

For an original Picasso print, it is often known exactly what kind, brand of paper and even watermark he used. Thus, many fakes are easily identified.

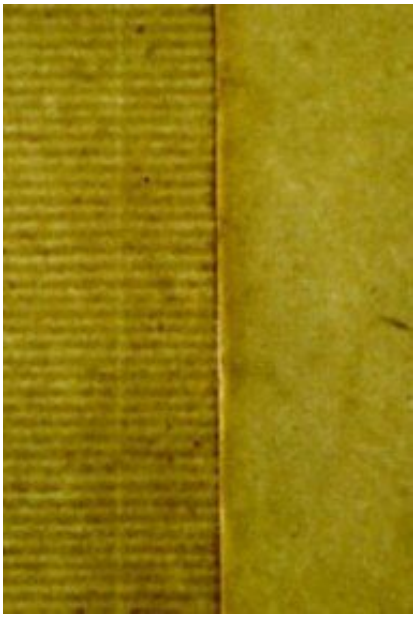
7.2 The standard types of paper.

Laid paper: Until the 1750s, all paper was laid paper. It was made on a mesh consisting of strong wires about an inch apart, with finer wires laid close together across them. This gridiron pattern can be seen when the paper is held to the light. Today, some writing paper is still laid, though the pattern being more of a decoration.

closeup of old laid paper with the gridiron pattern and watermark

A paper print from the 1500s or 1600s has to be on laid paper.

Wove paper: About 1755, wove paper was invented. Wove paper is made on a finely woven mesh, so the paper does not have the rigid lines pattern of laid paper. Laid and wove paper are easily differentiated when held to the light. Most of today's paper, including computer printer and typing paper, is wove. No print from before 1750 could be on wove paper.



laid paper (left) next to wove paper

Rag versus wood pulp. In the early history paper was made from rags. Starting about the mid 1800s, rag pulp began to be replaced by wood pulp. Wood became a popular choice due to the scarcity of rags and because wood pulp paper was cheaper to manufacture.The first successfully made American wood pulp paper was manufactured in Buffalo, New York, in 1855. By 1860, a large percentage of the total paper produced in the U.S. was still rag paper. Most of the newspapers printed in the U.S. during the Civil War period survived because they were essentially acid-free 100% rag paper, but the newspapers printed in the late 1880s turn brown because of the high acid content of the wood pulp paper. In 1882, the sulfite wood pulp process, that is still in use today, was developed on a commercial scale and most of the high acid content paper was used thereafter in newspapers, magazines and books.

Counterintuitively, modern paper, especially in books, letters and newspapers, is much more likely to turn brown and brittle than paper from before the American Civil War. For the beginning

collector, the paper on an early 1800s print can be surprisingly fresh and white.


EXTRA The Durham Herald-Sun EXTRA

JAPAN LAUNCHES UNDECLARED WAR ON UNITED STATES

PLANES BLAST HAWAII, MANILA

President Orders Secret Defense Plan Into Action

U. S. Battleship Oklahoma Also

It is the wood pulp in 20th century newspapers that makes them turn brown

7.3 Chronology of Paper

The following is a brief chronology of paper history.

105AD: Papermaking invented in China.
610: Papermaking introduced to Japan.
770: The earliest instance of text printing on paper.
868: Earliest printed book.
900: First use of paper in Egypt.
1228: First use of paper in Germany.
1282: Watermarks first used in Europe.
1319: Earliest use of paper money in Japan.
1450-55 Johann Gutenberg's forty Bible produced.
1470: First paper poster.

1662: First English newspaper introduced
1869: The first 'Dutch Gilt' papers made in Germany.
1750: Cloth backed papers introduced.Used for maps, charts
1755: Wove paper introduced
Early 1810s: Practical papermaking machines developed
1824: First machine for pasting sheets of paper together is introduced. Cardboard is first formed.
1830s: Coated paper introduced. This paper is usually coated with China clay, which makes it white and smooth, sometimes glossy. It is most often used in art and illustrated books.
1842: Christmas card invented.

The first commercially produced Christmas card.

1844: First commercial paper boxes made in America.
1854: Paper made from chemical wood pulp patented.
1862: Tracing paper introduced commercially
1871: Roll toilet paper introduced.
1875: First instance in U.S. of paper coated on both sides.
1903: Corrugated cardboard introduced, replacing many wooden boxes.

corrugated cardboard

1905: Glassine paper introduced

translucent glassine envelopes are used to hold stamps, greeting cards, etc

1906: Paper milk-bottles introduced

1909: Kraft paper introduced

kraft paper bag

7.3 Some common fine art paper terms

Blind stamp: an embossed sealed used to identify the artist, publisher, printer or collector.

blind stamp

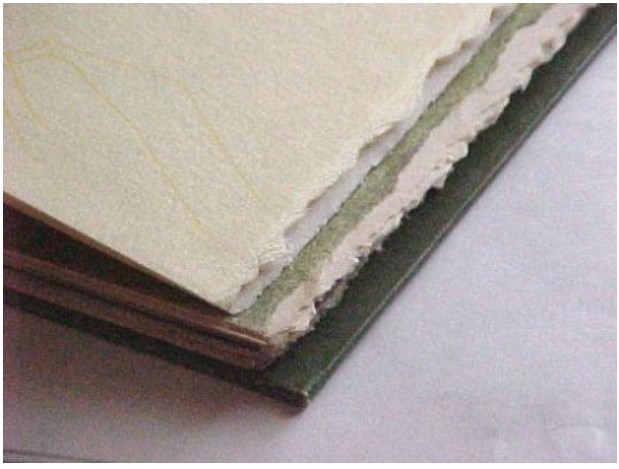
China Paper: a soft paper made in China from bamboo fiber.

Chine appliqué,or chine collé: A chine appliqué is a print in which the image is pressed into a thin sheet of China paper

which is backed by a thicker and stronger paper. Some proof prints are chine appliqués.

Cold pressed: A paper with slight surface texture made by pressing the finished paper between cold cylinders. In between rough and hot pressed papers.

Deckle edge: the rough, almost feathery edge on handmade paper.



paper with deckle edges

Drystamp: blindstamp.

Embossment:A physically raised or depressed design in the paper.

Enameled paper: any coated paper, though usually coated in a smooth white substance.

Glassine paper: A super smooth, semi-transparent paper that is often used to make the envelopes that hold stamps

Hand made Paper: Paper made by hand in individual sheets.

Hot Pressed: A paper surface that is smooth.Made by pressing a finished paper sheet through hot cylinders.

India paper: an extremely thin paper used primarily in long books to reduce the bulk.

Machine Made Paper: Made on a machine called a "Fourdrinier." Produces consistent shape and textured paper.

Marbling: a decorative technique of making patterns on paper.

Mouldmade Paper: paper that simulates hand made paper, but is made by a machine.

Parchment: An ancient form of paper made out of animal skin. It is smooth and semi-translucent

Plate Finish: A smooth surface made by a calender machine.

Rag Paper: Made from non-wood fibers, including rags, cotton or linen pulp.

Rough: a heavily textured paper surface.

Tooth: A slight surface texture.

Vellum: a modern version of parchment, with the same dense, animal skin-like appearance.A slightly rough surface and is semi-translucent.Some drafting paper is called vellum.

Velox: Black and white paper print for proofing or display.

7.4 Watermarks

For centuries paper manufacturers have often distinguished their product by means of watermarks. A watermark is a design in paper made by creating a variation in the paper thickness during manufacture. The watermark is visible when the paper is held up to a light. Watermarks can sometimes give important information about the age of the paper and the authenticity of the print.

Watermarks are known to have existed in Italy before the end of the 13th century. Two types of watermark have been produced. The more common type, which produces a translucent design when held up to a light, is produced by a wire design laid over and sewn onto the sheet mold wire (for handmade paper) or attached to the "dandy roll" (for machine-made paper). The rarer "shaded"

watermark is produced by a depression in the sheet mold wire, which results in a greater density of fibers–hence, a shaded, or darker, design when held up to a light. Watermarks are often used commercially to identify the manufacturer or the grade of paper. They have also been used to detect and prevent counterfeiting and forgery.

rarer shaded watermark on a Malaysian bank note

Examples of how watermarks help identify prints:

If a Salvador Dali print has a watermark consisting of the word "ARCHES" with an infinity sign (sideways '8') beneath, the print is a fake. Dali used ARCHES brand paper, but in 1980 ARCHES added the infinity sign to the watermark. 1980 was past Dali's working career and Dali himself stated that he never used the 'infinity' paper. While this watermark is easily identified, some enterprising forgers and dealers, picked the 'infinity' paper where the watermark was near an edge so they could conveniently cut off the infinity. A simple rule of thumb for collectors is to make sure that you buy a Dali print on Arches paper where the watermark is entirely on the paper and away from an edge.

For John James Audubon's large size "Birds of America" prints, the presence of a "J. Whatman" watermark is strong evidence that the print is original. No known reprints or later restrikes are on paper with that watermark.

1835 J Whatman watermark on an Audubon print

Pablo Picasso sometimes used paper with his personal watermark.

8 BASIC MATERIALS IDENTIFICATION CASE STUDY: PRECIOUS METALS

This chapter is another example of how materials are identified

8.1 Overview

There are both scientific tests and more informal ways of identifying gold, silver and platinum. The first part of this case study looks at the quick-and-dirty, in-the-antique-store methods, methods. The second part of the will show the scientific acids tests.

As precious metals can have high monetary value, this is an area where getting an educated second opinion can be a good idea. A jeweler, experienced collector or dealer can identify and grade the metal for you.

8.2 Informal quick tips for identifying gold, silver and platinum

* Look at different metals to get an eye for the look. Though somewhat similar in color, gold looks different than brass and copper. Silver looks different than pewter and aluminum. An experienced eye is helpful.

Gold

* Gold is a shiny yellow color and does not corrode or rust. Very old gold can look shiny brand new. Gold is both soft and heavy.

an ancient gold coin can still be bright and shiny

* Gold is not attracted to a magnet. This is not a definitive test as other metals are also not magnetic

* Many people do the simple test of running gold along raw porcelain tile. If the mark that is left is yellowish-gold the metal is real. If the mark is black the item is not.

* It is 2.5 -3 on the mohs hardness scale (See chapter 28.7: Mohs scale of hardness)

Various Colors of Gold There are various factors that determine the color of the gold. One is the alloy used to combine with gold. The color does not affect the caret, with each of the colors coming in different purities.

Yellow Gold. It is the natural color of gold.

White Gold. Fine gold is combined with a big percentage of silver, together with the nickel and zinc to achieve a white color.

Pink or Rose Gold. Has a rose tinge, and is made up of gold combined with a percentage of copper, zinc and silver. There is also a brighter version called bright red gold.

Deep Green. Has copper, zinc and silver it to give it a green tinge.

Silver

* Silver is, well, silvery colored. It looks slightly different than steel, though steel kitchen utensils are often mistaken for steel.

*Silver is not magnetic. Some but not all steel is magnetic. A refrigerator magnet is excellent at identifying many steel kitchen utensils and bowls that can be mistaken for silver.

*Silver has a naturally dull finish. Only silver-plated is shiny. Steel is often shiny.

* Silver often gets a brownish/blacking tarnish with age. It can be polished off.

tarnished silver

* Steel is colder than silver. Touch it to the side of your face.

* Rub a clean, white polishing cloth over a silver piece. Real silver and silver plate will turn the cloth black.

* Is 2.5-3 on the mohs hardness scale. This is soft. Softer than steel and glass.

Platinum

* Platinum does not tarnish or degrade, including very old pieces.

* Platinum is the heaviest precious metal, noticeable heavier even than gold.

* Platinum is usually not magnetic. However, some forms are if other metals are incorporated.

* Is 4-4.5 on the mohs hardness scale

8.3 Precious metals acid testing kit

acid test kit with clearly labeled bottles

There is an inexpensive and easy to use kit to identify and test the grade precious metals. These kits can be bought at amazon, ebay and other places. The kit includes the testing acids in little eye drop bottles, a testing stone and instructions. You don't have to be a chemistry expert or have lab experience to do the tests. Be careful with the acids as they can stain or worse your hands, and keep it away from your eyes.

Testing Gold with the acid kid

There are clearly labeled bottles of 9kt, 14kt, 18kt and 22k testing acids in the kit.

The process is simple. Scratch or rub the metal in an inconspicuous area onto the testing stone so there is a little streak of metal. Place a drop of the closest acid to the karat you estimate the metal to be. If the acid dissolves the metal it is less than the karats on the bottle and you should try again with lower level acid. If it dissolves the metal slowly, it is possible you would have a bit less than the karat of the acid in the bottle.

If the metal stays it's most likely the karat of the acid in the bottle.

Platinum

The streak of metal on the stone should stay and not dissolve under the platinum acid.

Silver:

Make a little metal streak on the stone, apply a drop of the acid and wait until a color appears.

0.999 pure silver will turn bright red color

0.925 sterling silver will turn dark red color

0.800 silver will turn brown color

0.500 silver will turn green

8.4 Metal Hallmarks

A hallmark is an official mark or series of stamps on precious metals. In modern times, hallmarks are usually legally required to appear on precious metal items.

Authentic hallmarks and other stamps help identify the metal, purity, era and origin of the item. As hallmarks can be faked and sometimes missing due to wear or repair, a hallmark should not be used as the sole identifier of the metal. Hallmarks are often in obscure symbols and have varied from country to country and time

period to time period. It is a foreign language, and identifying specific hallmarks can take much time and effort. Useful link on Hallmarks:

http://www.gold-traders.co.uk/hallmarks/
http://en.wikipedia.org/wiki/Hallmark
http://en.wikipedia.org/wiki/Silver_hallmarks
http://www.sterlingflatwarefashions.com/
http://www.925-1000.com/

9 MATERIALS IDENTIFICATION ASSIGNMENT

Searching online, answer the following questions:

1) Is iron magnetic or non-magnetic?
2) How do you tell the difference between sandstone and limestone?
3) What is the difference between watercolor and gouache paints?
4) What is static electricity test for identifying amber?
5) What are the physical differences between earthenware and stoneware?
6) What is the opacity test for identifying porcelain?

10 IDENTIFYING AND UNDERSTANDING PROCESSES

This chapter illustrates how processes identification is integral to authentication and fake detection.

10.1 Overview

Tempera paint is thin in consistency, translucent and dries very fast. This means in tempera painting the artist painstakingly paints in careful, thin brush strokes, brush stroke by brush stroke, and slowly adds up the paint lines to create the overall detail. When you look closely at a tempera, the graphics are usually made up of thin lines, often overlapping and cross hatching to build up color and detail. These lines mean the painting often closely resembles a fine color pencil drawing.

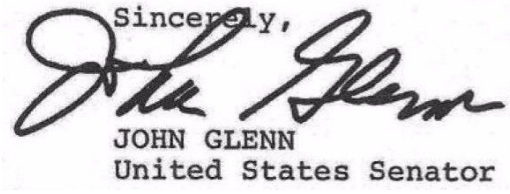
As with materials, being able to identify, understand and know the dates of processes is essential to identification and fake detection. Sometimes going hand-in-hand with materials (as with tempera

paint and tempera painting, a process sometimes uses specific materials), processes include printing and photographic processes (lithography, etching, engraving, digital), glass making processes (blown, mold made, cut), and whether a textile was handmade or machine made.

As with materials, authentic items are made with processes consistent with its identity and age. Fakes, forgeries and reprints are regularly identified because the process is inconsistent, if not impossible, with the genuine item. This includes advertised as old items made with modern processes.

As some old processes can still be used today, a process may be consistent with but not proof that an item is from the original period. For example, an original Rembrandt painting would be an oil painting, but artists today still make oil paintings. Artists still make handblown glass the same way it was made centuries ago. This is why supplemental tests and historical/stylistic knowledge is important-- such as determining if the 'Rembrandt' painting is consistent in style, provenance, has genuine signs of aging and the correct chemical makeup. However, at the least, process identification is an integral step in authentication, and quickly weeds out many fakes.

The following are examples of process and how they relate to authenticity and identity.



This signature is by autopen, written by machine rather than hand. As hand signatures have significantly more value, this difference in process is significant.

The left shows the seem on mold made glass (made in a mold), while the right shows the pontil, or 'blow mark,' on blown glass. The pontil mark is where the tube was attached to the glass and where the artist blew into a tube to help form the shape of the molten glass. Whether a glass item is mold made or blown can be relevant to identifying its age and financial worth.

Antique nails, such as above, were not machine made but handmade, and have irregular handmade shapes. The presence of handmade versus the modern machine made nails helps to date furniture.

In some cases, famous artists had personally distinct processes and methods. This includes an artist starting with background sketches on the canvas to a painting, and painting over old paintings. Fakes have been identified because they are made with methods (such as lack of background sketching, discovered by X-ray or infrared analysis), and paintings have been identified

as forgeries in part because the processes and methods are consistent with the artist. As you can see, this area combines both science and connoisseurship.

10.2 Online Resources Process Identification Examples

As there are so many areas and processes, this book cannot provide resources to all processes in all areas. However, the following are some useful links:

In depth look at photographic processes at Rochester Institute of Technology
http://www.graphicsatlas.org/

Old not update but still excellent digital print process identification
http://cool.conservation-us.org/coolaic/sg/emg/juergens/

Book on identifying antique commercial printing processes, including etching, lithography, etc.:
'Identifying Antique Commercial Printing Processes, and the Basics of Authenticating Antique and Art Prints' (Hamerweit Books) by David Cycleback

Historic processes of making coins
https://www.fleur-de-coin.com/articles/ancient-minting

The historic processes and materials of sword making
http://io9.gizmodo.com/5831683/a-brief-history-of-the-ancient-science-of-sword-making

Brief look at rug making
http://www.danscarpet.com/a-short-history-of-rugs-and-rug-making/

History of glass perfume bottles

http://blog.cmog.org/2014/09/02/a-brief-history-of-the-glass-perfume-bottle/

10.3 Questions

How does process identification help in authentication and fake detection?

What are some limitations in using process identification in authentication? What can be done to help overcome them?

11 PROCESS IDENTIFICATION CASE STUDY: INTAGLIO PRINTS

Reprinted from the book *Identifying Antique Commercial Printing Processes, And the Basics of Authenticating Antique and Art Prints*, this section is an example of how processes are identified.

11.1 Overview

Early 1800s engraving

Being able to identify the printing process is an essential part of authenticating and identifying antique prints and prints by famous

artists. After all, if you don't know how to identify an etching, how can you authenticate an original Rembrandt or Dali etching? And, as with oil versus watercolor paintings and mold versus blown glass, the process is an integral part of the identity and value. The processes create a different look and style, and the artists pick the process to meet their aesthetic desire.

This focus shows how the general area of intaglio printing is identified, which includes etching, engraving, drypoint, aquatint and mezzotint. The print and process have the same name. An engraving print is made by the engraving process, etc.

Normally pronounced *intaylio* with a silent 'g,' intaglio is a major category of prints. It has been used to make fine art prints by Rembrandt, Albrecht Durer and Salvador Dali, but also many commercial and mass-produced prints including US currency, antique tickets, stock certificates, postcards and magazine pictures.

Intaglio printing involves cutting away part of the surface of a printing plate, which is almost always metal. It is identified by general traits and styles, but also by looking at tell tale signs and qualities, including at the magnified level.

The difference from relief printing (woodcuts, wood-engraving-etc) is that the ink is placed in the lower parts, or recesses, of the plate. During the printing process it takes great pressure to get the ink from the recesses onto the paper, and prints are usually on soft matte paper.

11.2 Keys to identifying Intaglio Prints

As a general category, intaglio prints are identified by several qualities caused by the unique way they are printed. These qualities include the following:

Plate mark: Many intaglio prints have a plate mark a distance away from the printed image. These appear as an noticeable if light indentation larger than the printed image. The plate mark can resemble a pressed in area such as when after a food tray is pressed into a shag rug. If you see a plate mark you can

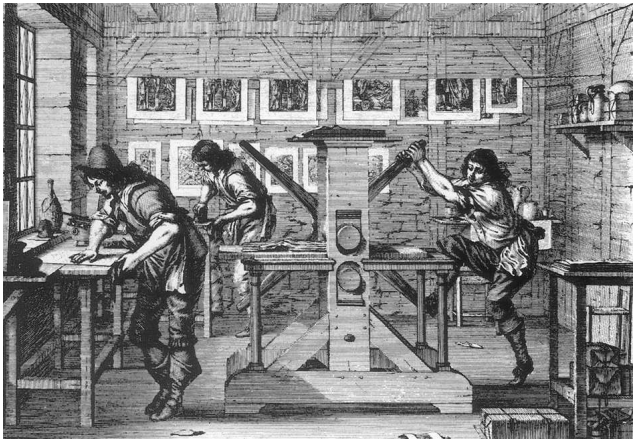
be confident the print is some form of intaglio print. The only task after seeing a plate mark is to determine which kind of intaglio it is.

In fact, if you aren't certain what kind of intaglio it is (etching? mezzotint? engraving? combination?), it is fair to simply label it an intaglio print and leave it at that.

For art-style prints there should be a plate mark, but some prints have had the edges plate mark has been cut off. For example, there are no plate marks on US currency even though they are engravings.

When you look closely you can see the pressed in 'plate mark' surrounding the graphics on this 1812 etching.

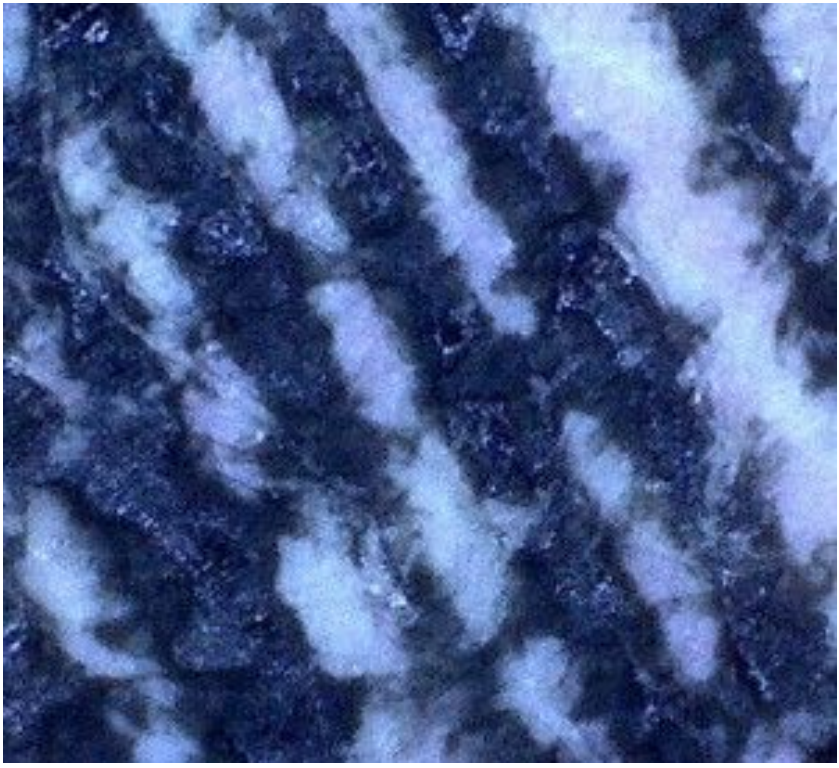
Plate mark around the graphics



1700s printing studio with an intaglio printing press. Notice how much force is being used by the worker on the press.

Raised ink levels. Unlike with relief and lithography printing, the ink on an intaglio print can be physically raised from the paper. This is because the ink comes from inside the recesses of the printing plate. To make dark areas of a print, the printing plate is cut deeper to allow thicker ink. In the lighter areas of a print, the cut in the printing plate is shallow. This means that the physical height of the ink in an intaglio is most easily detected in the areas of dark ink. Sometimes the ink can be felt by softly rubbing a finger across the printing or by looking very closely with the naked eye. In other cases, a microscope is needed. If the paper surface is rough or wrinkled, it may be difficult to identify.

As it views in three dimensions, a stereomicroscope is helpful for identifying raised ink.



Under the microscope you can see how the ink on an engraving is piled up in areas.

Varying tone within a line: Within a single line or mark, lithography and relief can only create one tone of ink. Due to the varying levels of ink applied, the tone along an intaglio line can vary, meaning it can become darker or lighter.

* * * *

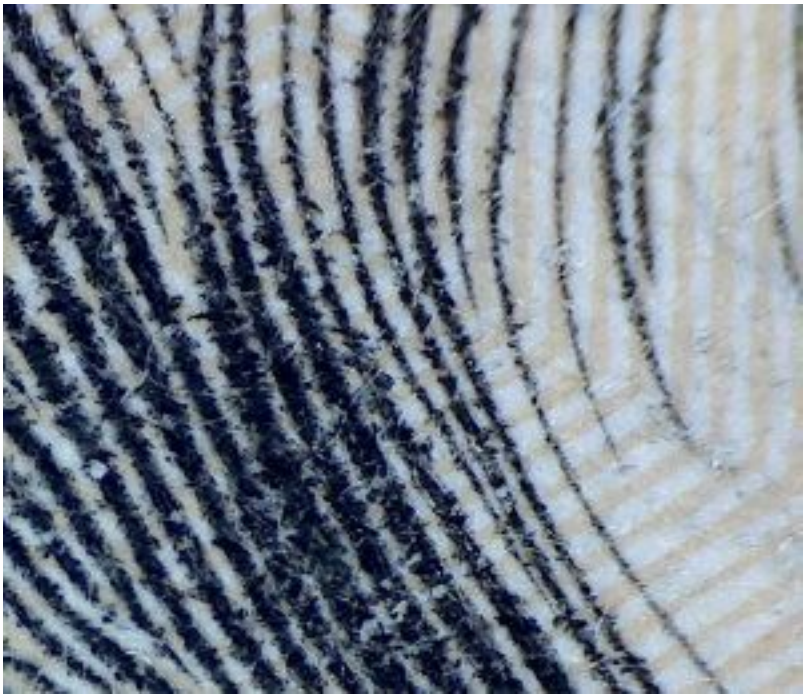
The following are the major types of intaglio prints. Each has a distinct look.

11.3 Engraving

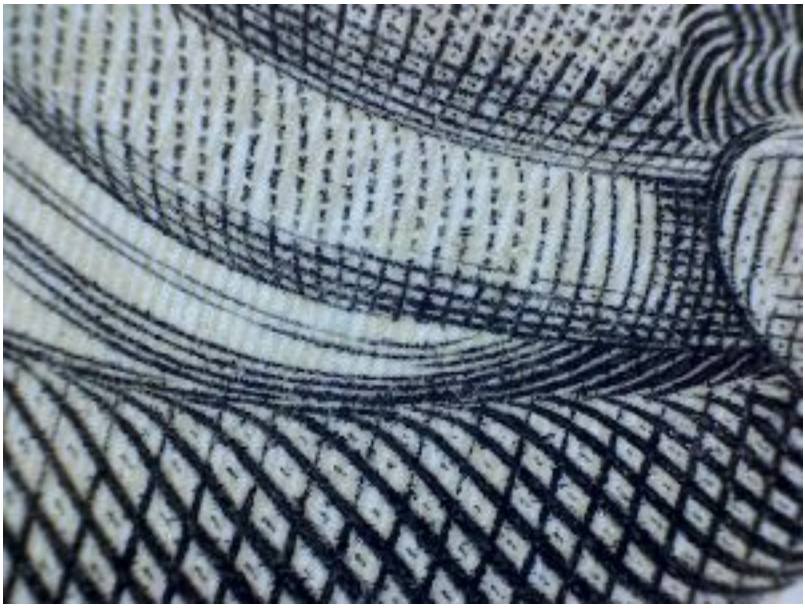
Classic example of an engraving: The US$1 bill. Engravings tend to have stoic, conservative lines and a overall formal look.

Engraving was the first form of intaglio printing, invented in the early 1400s.

In engraving, the engraver carves a design into a steel or copper plate. The carving tool is called a burin and has a sharp V-shaped section. The engraver holds the burin almost parallel with the plate, pressing the point into the surface and scooping out a sliver of metal. This is difficult work and the result is a conservative, steady line with crisp edges. The line also tends to be pointed at each end where the burin is first dipped into the copper the lifted out at the other end. If the engraver goes back over the line, the 'v' ending can be blunted, but usually at least one edge has a pointed, v shape.



Up close: the pointed ends of engraving



Engraving under the microscope: Parallel and orderly cross-hatching lines

Engraving is usually made up of many parallel lines and curves. There are different ways to give an appearance of tone. One way is to lessen or increase the pressure of the burin when carving the line. This makes the line thinner in some areas and wider in others. Engraving can also have cross-hatched lines, sometimes with dots or flicked spots added to the middles of the resulting diamonds. This is called the dot and lozenge technique. There is also stipple engraving which is discussed later.

Identification of engravings. Along with the general intaglio traits (physically raised ink, plate mark. etc), engraving has a formal look created by the stoic and controlled lines.

11.4 Etching

Etching is a form of intaglio printing that first appeared in the early 1500s. Etching was easier than engraving for the artist. With engraving, the artist has to perform the difficult task of cutting the

grooves into the steel plate. With etching, the artist draws the art onto the plate, then acid creates the grooves in the plate. Not only does this make it easier on the artist, but the final print has a different, freer look than engraving.

Rembrandt self-portrait etching showing the free, sketch-like lines of etching

The etching process is as follows. The metal printing plate is heated and wax is rubbed over the surface to create a thin and even coating. This coating is known as the ground. After it is cooled and hardened, the ground is impervious to acid. If acid was poured on the ground, the plate would be unmarked. The etcher creates lines or other marks through the ground, exposing the plate in these areas. When the plate is submerged in acid, the acid will eat away those exposed areas. The longer the plate is submerged, the deeper and broader a line will become, and the darker the printed line. By varying the length of exposure of one area over another, the etcher can change the comparative darkness. Commonly, the etcher will place varnish on areas that are dark enough, preventing any more acid exposure. This is called stopping out. After stopping out, the unvarnished areas are exposed more, making them darker. This stopping out can be done numerous times, allowing for subtle

lines. Another way to create different types of lines is to add lines in the ground after the others have already been made. The later lines will be lighter, while the earlier ones will be darker.

Etching was commonly used with other processes, including engraving and drypoint.

Identification of etching. Along with the general intaglio traits (physically raised ink, plate mark, etc), etching has the following specific traits. While engraving is known for its stoic careful lines, etching has much more freely drawn lines. Etchings often resemble ink sketches.

Etching uses a rounded needle to make the line, and the end should be more blunt than the sharp end of an engraving. The edges of the line should be less clean than that of an engraving. The combination of the crumbling wax and acid can create uneven edges.

Rembrandt etching of a golfer

11.5 Stipple, Crayon and Chalk Engraving

These techniques are commonly used with engraving and etching. Similar appearing techniques were used in other process, most notably lithography. These are centuries old techniques that are still used today by artists.

Stipple. The stipple technique was first used in engraving in the 1500s, and was later used in other types of printing including etching. Stipple engravings were especially popular around the turn of the 19th century. Stipple involves using many dots or small marks of varying size and shape to create tonal areas not possible with lines alone. Various tools could be used to make the marks in the plate. Often times both engraving and etching were used together. For example, the general design could be made with etching, then the stipple mark could be engraved. In general, the engraved stipple dot will look more like a flick, or short line, while the etched stipple mark will be more like a dot.

The dots in stipple engraving, intended to give shading and tone

Though called engraving, this is more often used in etching. This technique gives the appearance of a crayon or chalk drawing. A tool called a roulette is used. The roulette is a metal wheel with sharp points that created a seemingly random series of dots along a line, which appeared much like a chalk line. Different sized roulettes produced different effects.

Detail of a crayon and chalk engraving. A bit resembles a chalk or crayon sketch, though the plate mark will identify it as intaglio.

11.6 Drypoint

drypoint is an engraving method. A pointed tool scratches the design into the metal printing plate. This scratching often throws up a ridge of metal on the edges of the scratched line. This ridge is called a burr. When ink is added to the plate, the burr will hold ink, often giving the printed line a distinct fuzziness. This fuzziness can disappear over several printings. Due to the violent nature of the scratching into metal, the drypoint line is often violent and angular. drypoint is most often used with other printmaking techniques.

The violent, angular lines of a drypoint, with areas of heavy ink from the bur,

drypoint was first popularized in the late 15th century and is used by modern artists.

drypoint showing the distinct ‘bleeding ink’ look

11.7 Mezzotint

Also known as black manner, mezzotint is a form of intaglio printing that produces subtle and rich gradations in tone not possible with most other forms of manual intaglio. It was invented in the 1600s.

While engraving and etching can create only light or dark at a specific point, Mezzotint can create black, white and any shade in between. Mezzotints often have a rich, black velvety look. It was used alone or with other intaglio prints. For example, etching may be used to create the basic outline, while mezzotint is used to create the shading.

The rich, velvety tones of a mezzotint

The printing plate is created by pricking the surface with many, many tiny holes that hold ink, and make large areas of dark tone during printing. Different tools can be used to prick the plate. A roulette is a small wheel with sharp points. A rocker is a tool with a toothed edge that, when cutting the plate, creates rough edges. These edges are called burs. The burs are scraped away in places intended to be white in the finished print.

The mezzotint is identified by the thin and often cross-hatching lines in the grey tones. These are made from the scraping of the toothed edge tool. These lines also appear at the edges of the print. The mezzotint will typically have plate marks and raised ink levels typical to intaglio prints. Early mezzotint

plates were prone to heavy wear. This means that later prints can be substantially lighter than earlier ones.

Closeup detail of a mezzotint showing cross-hatching lines

In the twentieth century new methods have been used. Many of these look like old mezzotints, but lack the richness and do not have the just described lines in the grays.

An early mezzotint showing the distinct dark-to-light tonal qualities

11.7 Aquatint

Aquatint is a variety of etching techniques used by printmakers to make a wide range of tonal effects. The prints often resemble wash sketches. The technique consists of exposing the metal printing plate to acid through a layer of granulated resin or sugar. The acid bites away the metal only in the spaces between the resin or sugar grains, leaving an evenly pitted surface that creates broad areas of tone when the plate is printed. An infinite number of tones can be achieved by exposing various parts of the plate to acid baths of different strengths for different periods of time. Etched or engraved lines are often used with aquatint.

Aquatint by the famed artist Goya

11.9 Summary

Many intaglio prints are identified by the distinct plate marks around the images. For many collectors, identifying that it is an intaglio (as opposed to a lithograph or relief print) is enough. Most intaglio prints are etchings and engravings, with their distinct looks. Engravings have a stoic, conservative look, while etching have the free form lines of sketches. Drypoints have sharp, jagged lines and ink bleed, while mezzotints and aquatints have tones and

shading. The processes can sometimes be combined together in prints, which is also a reason why people often use the generic ‘intaglio’ label. Intaglio is an old time form of printing that only skilled printers and artists can make. Identifying an otherwise old looking print as an intaglio held identify it as antique.

12 PROCESS IDENTIFICATION CASE STUDY: HALFTONE PRINTING

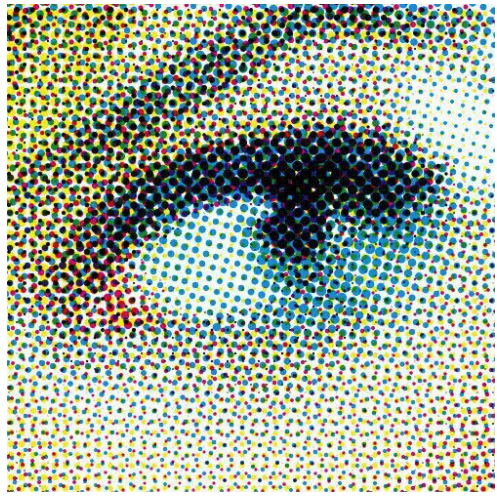
This chapter is another example it how processes are identified, and how it is important to dating and authentication.

12.1 Overview

While we take for granted the printed photorealistic images on everything from magazine covers to advertising postcards to pictures printed from our home digital printers, the ability to create such printed photorealistic images is a relatively recent invention.

Until the late 1800s, prints were 'handmade,' meaning the designs were made by handheld tools directly onto the printing plates, and there were no mass production ink-and-printing press methods to make photorealistic looking reproductions of art or photographs. If you look under magnification at an 1800s newspaper old woodcut or art lithograph, you will see it is made up of solid lines and marks. Original fine art prints by Renoir, Chagall and Picasso were also made using these handmade methods.

Introduced commercially in the late 1800s, the halftone process reproduced images-- whether a painting, handmade print or photograph-- by translating them into a fine pattern of ink dots. For a color image the dots are many colors, while for a monotone image the dots are one color. At the naked eye view, the dots meld together into a detailed, photorealistic image, but the dot pattern is visible under strong magnification.



Under magnification, the fine halftone dot pattern that gives away many prints as modern reprints

Many reproductions and counterfeits of original art and antique prints are quickly identified by the halftone pattern.

On the wall, this looks like a large, framed oil painting. It is even on canvas and has an impasto texture. However, under magnification the halftone dot pattern shows that it is a digital reproduction.

12.2 Dating color halftone printing by the primary colors of the dots

As some halftone prints are antique, it is important to be able to tell the difference between old and new halftone printing. One way is to look at the color of the dots.

Luckily, for color halftone prints-- meaning halftone printing used to reproduce color photos, sketches and painting into true color prints-- the primary printing colors were changed over time. This allows us to determine that an advertised as '1930s' or '1940s' color halftone print really is from that period and not modern.

Most of us were taught in school that the primary colors were red, blue and yellow, and, in fact, early half-tone lithographs used these colors, often along with black. Each of the tiny dots of an early halftone is one of these colors. By overlapping these colors or placing them side-by-side, all colors could be created from pink to purple to green at the naked eye level.

Starting in about the 1950s, the primary printing colors were changed. Red was replaced by magenta (purplish pink) and blue was replaced by cyan (light blue). With rare exceptions, these are the primary colors used today, including with laser printers, photocopiers and inkjet printers.

These color rules apply only to the color halftone area. The solid borders or below text of a poster or trading card, for examples, do not follow the same rules. They can be printed in any color. Also, monotone images can be any color.

For prints from the 1950s it is hard to predict which primary color will be found on a particular print. However, with few if any exceptions, the half-tone prints from the 1940s and before will use red, blue and yellow, while modern reprints and forgeries will use magenta, cyan and yellow.

To figure out which primary colors were used on a print, a microscope is needed. I find that the difference between red and magenta is much more obvious than between blue and cyan. This means that under the microscope I try to isolate a red or magenta dot. It is best to find an area where there isn't dense color. Avoid

areas where the dots overlap, as overlapping colors will create different colors. Magenta combined with yellow creates red, so looking in a busy area on a modern print can deceive. In a white area in an image, there will be fewer and isolated ink dots. When a proper dot is isolated, the difference between red and magenta should be obvious. With some prints, the printing is so dense that individual dots cannot be found isolated and this test cannot be made.

Identifying primary colors is advanced stuff and takes practice, but it is a great technique for proving a print is a reprint or original.

In conclusion, if you find that a suspect “1909” or “1920” halftone print uses magenta and cyan dots in the halftone, this is near definitive proof that it was printed recently.

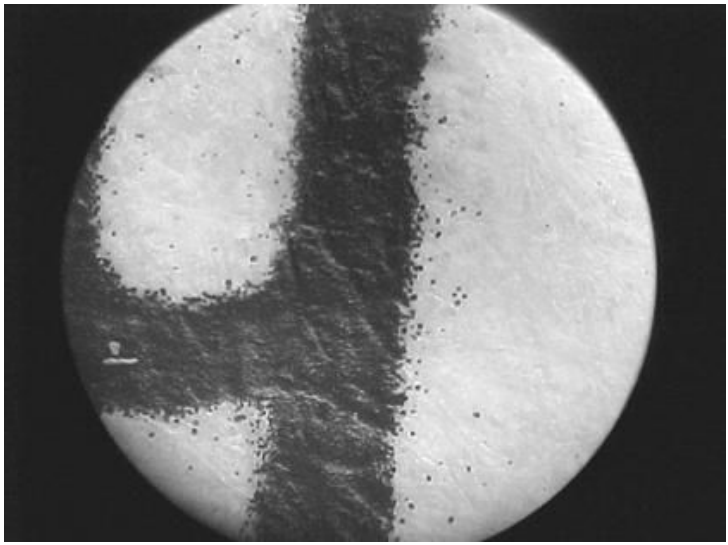
12.3 Modern digital prints

Many reproductions and counterfeits are made with computer printers. They will create a halftone dot pattern and use the modern magenta, cyan and yellow colors. Ink jet prints look very similar to lithographs, with little splotches or dots ink. However, laser prints, photocopies and Xeroxes have a unique look under the microscope.

Laser prints, color photocopy and Xeroxes all use electrostatic or electrographic printing. Under the microscope, the resulting prints are easily identified. The graphics are made up of many tiny dust-like grains of pigment. Electrostatic printing doesn't use ink, but dry dusty toner. The graphic design is electrostatically charged, attracting the toner to the area where it is fused (heated and melted) into place. However, not all of the grains of pigment make it the intended area, so the print is identified by the many stragglers outside the lines. Under the microscope it looks like it needs a dusting.

It should go without saying that no 1800s or early 1900s tobacco card, advertising sign, postcard or similar print was made with a laser printer or color photocopier, so the identification of

electrostatic print confirms an 'antique' print is a modern reproduction or fake.



Laser print with the tell tale dusty appearance

13 CASE STUDY: JUDGING THE AUTHENTICITY OF PRINTS BY FAMOUS ARTISTS

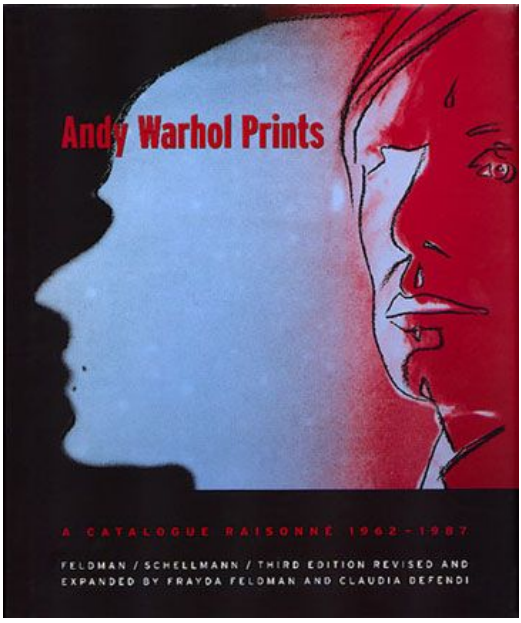
This focus shows how materials and processes identification, along with other basic research is used in authentication.

Fine art prints-- such as an original etching by Picasso or a signed limited edition numbered Dali lithograph--, fetch high prices and are highly collectible. They are also a magnet for forgeries and reproductions. Luckily, authenticating prints by famous artists is straightforward, in major part due to extensive scholarly reference documentation of their works.

The following are the basic steps for identifying genuine prints by famous artists such as Warhol, Picasso and Chagall.

1) Have a knowledge of paper and printing. Be able to identify the different kinds of paper as covered earlier, and the different printing processes, including lithography, engraving, etching, woodcut, linocut. Know how to tell the difference between handmade printing processes and the halftone reproductive methods used to make cheap reproductions.

2) Have access and refer to the artist's catalogue raisonne. These are scholarly books made by experts in the artists, and list and picture known authentic prints and give the essential information: dimensions, type of paper and printing, editions, if and how signed and numbered, etc.



Prints catalogue raisonne for Andy Warhol, readily available at many bookstores.

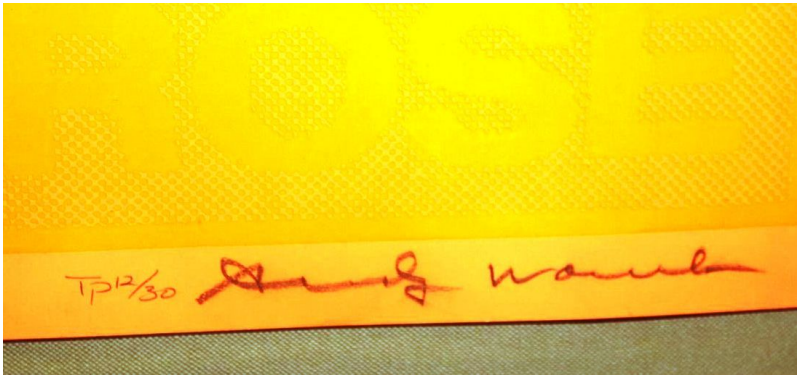
The essentialness of a catalogue raisonne is that it shows what prints are recognized as genuine works by the artist. While there will be some legitimate uncatalogued prints, for the most part the collector should stick to what is catalogued. If a print for sale is not listed and detailed in a catalogue raisonne or called genuine by other substantive source (expert opinion, authoritative article), the collector should not buy.

The catalogues raisonne will often also discuss known fakes and reproductions, and give samples of the artist's signatures.

If the least that collectors of the world did was to determine if a for sale print is listed as authentic in the catalogue raisonne and that the bare basics (size, signature, numbering, etc) match the catalogue listing, the sale of forgeries and fakes would be reduced by about 90 percent.

These books are often available at amazon.com and other online bookstore, but some are hard to find. Some can be found in online versions.

4) Examination of the signature. An expert in the artist will have a good feel for the signature. There are also other reputable autograph experts who will give opinions. A later chapter covers autographs and handwriting in more detail.



The bottom border of an Andy Warhol limited edition serigraph, hand signed by Warhol and limited edition numbered 'TP 12/30'. This detail also shows the screen pattern from the screen print.

3) Assess the provenance, seller and any other documentation

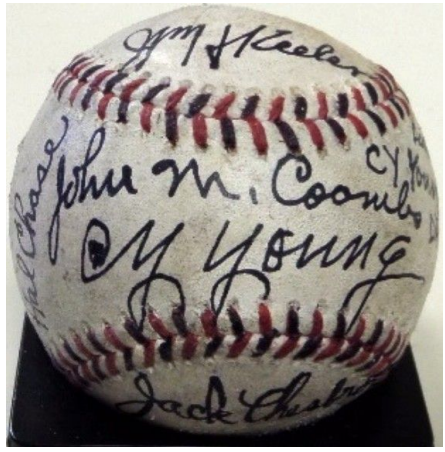
When buying an expensive original print by a famous and often forged artist, it is important to purchase from a reputable and well respected dealer or auction house. Documentation of previous good provenance is also useful.

Some prints come with certificates or letters of authenticity. It is important to know who are the real experts. "Expert" opinions vary greatly in any area of collecting, and fake items often come with worthless certificates.

It is also important to buy with a good authenticity and return guarantee, and from a seller who will back it up. With a good authenticity and return guarantee from a reliable seller, errors are no longer so life and death.

16 SIGNS OF AGING

This chapter looks at a standard and age old method of identifying old items



One key indication that this 'early 1900s' autographed baseball is a forgery is that the signatures show no signs of aging. It looks as if the names were signed just recently--because they were!

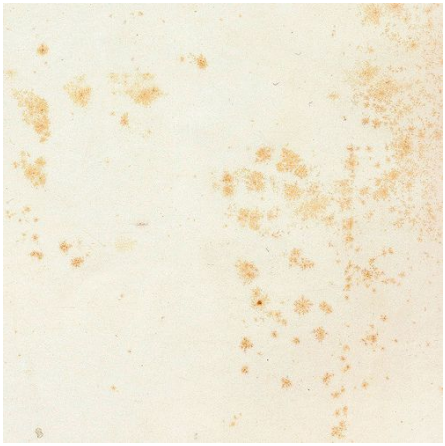
14.1 Overview

Studying and identifying the signs of aging is an essential part of authenticating and dating old items. This was the standard method of dating objects before such scientific methods as carbon dating and thermoluminescence.

Many materials gain physical qualities as they age. Examples include rusting on some metals, toning and foxing on paper, fading and discoloration to inks and paints, drying out of paper and leather, gaining a patina.

As certain aging is distinct to certain materials, the aging signs are often useful in identifying the material. Silver is well known for the distinct blackish tarnish it gainst with age.

The following are examples of signs of aging.



Toning and foxing (age spots) on the back of paper

Rusty staples and rust stains on the paper in an old staple bound book

Worm holes in antique furniture

Oxidation on a mid 1800s daguerreotype photograph

Mineral deposits and patina on an ancient American Indian arrowhead. These qualities were gained by being in the ground for centuries.

While some aging signs happen only over a long time, some can happen not due to long years but poor storage-- toning or fungus on paper, foxing, rust. This is why aging signs should be considered only one of many qualities to look at during examination. If the item adds up as old in other aspects (correct material, process, style, provenance), that there is evidence of aging is a piece in the puzzle.

Due to proper care and storage over the years, some items do not have standard signs of aging, and this can fool beginners into believing the item is fake or a reproduction. If a small antique print neatly stored in a book on a bookshelf all those years, it may not

have the wear and paper toning collectors expect to see on an authentic item. However, an expert who not only knows that antique items can occasionally be found in pristine condition, but is able to identify and date the material, printing process and inks, will be able to verify it as genuine.

14.2 Forged of signs of aging

Aging on modern fakes is often faked. This including staining or baking paper to make it appear toned, drying out paint, adding fake crackling to a painting (one fake Brugel had the crackling painted on), adding a false patina, adding general wear and tear, drilling holes into furniture to mimic wormholes.

Often this faked aging is obvious to someone experienced in the area. Also, the object itself is usually identified as fake-- wrong material, process, etc. However, for very expensive or historically valuable items, close examination of the aging signs is made. Advanced scientific tests covered later in this book can confirm the qualities as genuine or faked. For example, spectroscopy can identify the chemical makeup of questioned rust or patina. Ultraviolet light can identify genuine versus fake patina. The mineral deposits on ancient American Indian artifacts are verified via a stereomicroscope.

14.3 Questions

What are a few examples of aging signs?
Give some examples of how aging signs are forged?
How can an item with forged aging sings be identified as a modern fake?

15 FOCUS: IDENTIFYING AND DATING PHOTOGRAPHS

This focus shows how photographs are identified by materials and processes identification, examining signs of aging, style analysis and historical knowledge.

1864 albumen photograph by Julia Margaret Cameron

Photography has become a major area of art and collecting, and long has been an integral documentation of history and cultures.

As photographs are found unidentified, reproduced and forged, being able to identify and date them is an important and often sophisticated technical task.

The first major part of authentication involves being knowledgeable about photography and its many historical trends and changes in styles and processes.

Photographic process: The way in which a photographic image is made. A particular process is distinguished by its unique use of chemicals, substances and methods.

Photographic print: The image created by the photographic process. A particular print is made by a particular process. For example, the albumen print is created by the albumen process, while the gelatin-silver process creates the gelatin-silver print.

Photographic style or type: The combination of the photographic print and the manner in which it is displayed. The cabinet card is a style of photograph which is comprised of a photographic print pasted to a larger cardboard mount measuring about 4-1/2" X 6-1/2". The panorama is a different style, with a long photographic print usually giving a sweeping view of a town, stadium or line of people.

Photography is the process of creating an image on a chemically sensitized surface by interaction with light. The resulting image is usually called a photographic print (though there are a few photos that aren't prints).

Over history there have been many different photographic processes. Some processes were used long ago, some recently, some had a long duration, some short, some processes were widely used, while others were obscure. Each process produces a unique photographic print that can be identified. Qualities such as color, surface texture and type of aging help us distinguish one type of print from another. For example, the cyanotype has a bright blue image on matte paper, while the cibachrome has a true color image on ultra glossy paper.

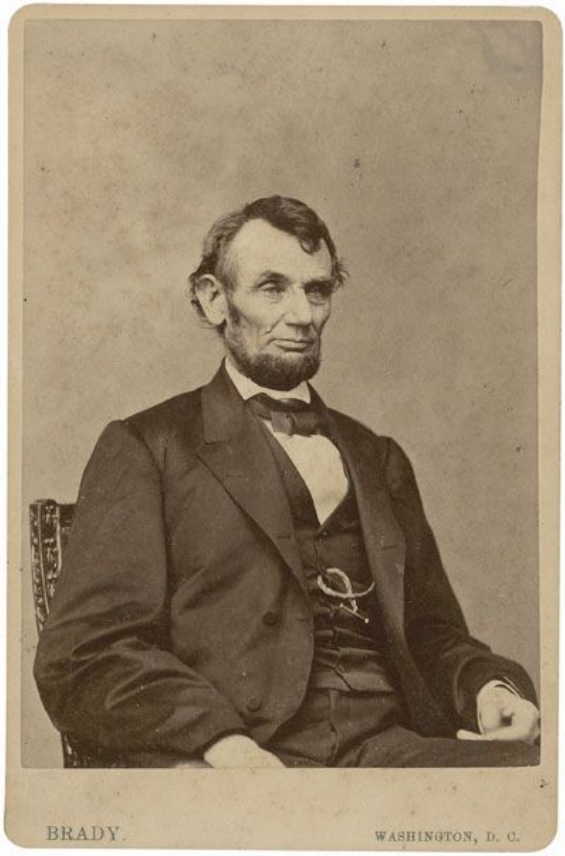
The image can also be examined under a microscope in order to uncover tiny clues. For example, the 1800s albumen print the fibers can be seen under the microscope, while with the gelatin silver print the fibers are hidden from view.

Under the microscope, the paper fibers can be seen in an albumen print. A key to authenticating an 1800s photo

A particular process and its print share the same name. The gum bichromate print was produced by the gum bichromate process, the platinotype process produced the platinotype print.

Photographs come in various styles and types. The style or type is determined by many things, including size, shape, parts and use. For example, a real photo postcard (a postcard with a photographic image on the back) is a style obviously distinct from a 20 by 20 inches photo that is matted, framed and hung from the wall.

As with processes and prints, each style of photograph has its own history, usually influenced by a combination of fashion, necessity and technology.

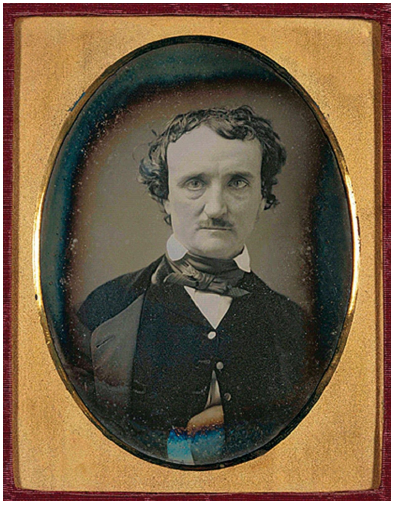


1860s Mathew Brady cabinet card photograph of Abraham Lincoln. With the photographic print affixed to a cardboard backing, the cabinet card was a popular form or style of photograph in the 1800s and early 1900s. The style of the cabinet card changed over time, including in color, thickness, lines and style of writing-- allowing the cabinet card to be narrowed down in date even further.

Many prints and styles could be interchanged. For example the carte de visite (an early style where a small photographic print was pasted to a card) usually used the albumen print, but it sometimes used different types of prints.

1948 snapshot photo of Joe Louis. Snapshots have been a popular style of photograph since the late 1800s, with this particular deckle edge style distinct to the 1940s-50s era.

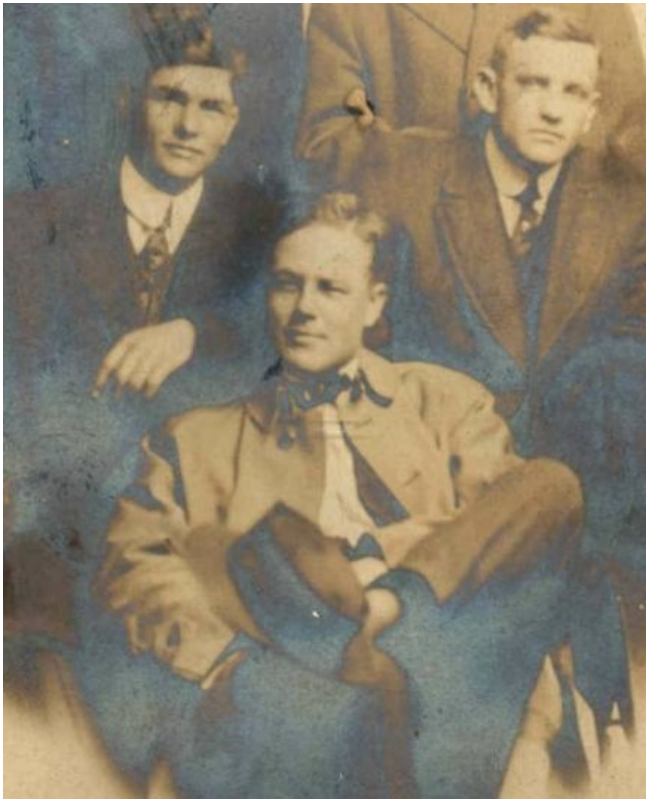
Many early photographs weren't made of paper, but glass and metal. Well known metal and glass photographs include the 1800s Daguerreotype (image on silver coated copper), ambrotype (image on glass), tintype (image on iron resembling tin) and glass negative (negative image on glass). These are popular with collectors and, due to their non-paper material, easy to identify.



1800s Daguerreotype photo of Edgar Allen Poe, with the image on steel coated copper

Identifying and dating photographs

Photographs are identified and dated by looking at all the qualities of the photograph. This includes the image subject (celebrity, building, style of clothes, geography, etc), photographic style, photographic process and indications of age. Indications of age can include deterioration to the image, paper toning, foxing and wear.

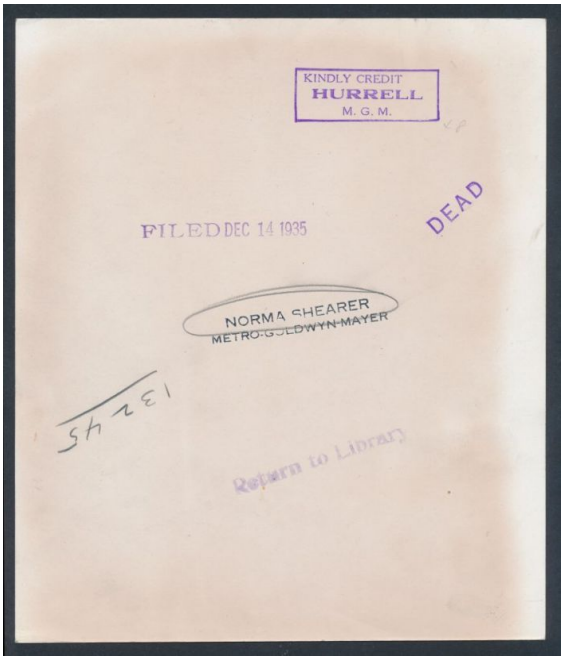


Silvering, or silver mirroring, is a natural deterioration to old gelatin-silver and albumen photos. It appears as a silver patina in the dark areas of the image and happens only over many decades. While a deterioration, it is desirable to collectors and dealers at a sign of old age.

Photographic processes and styles have distinct histories that help us to date a photograph. For example, almost all albumen prints are from the 1800s, while the Polaroid was invented in 1963. The American real photo postcard was introduced in 1901, while

the cabinet card was used in the 1800s and early 1900s. Knowledge of processes and styles is essential to identify and dating photographs.

Many photographs have stamps, tags and stickers that help in dating identification. These can identify the photographer, issuer (magazine, sports team, other) and help give a date. If the authentic stamp is from a photo agency that went out of business in 1940, that would show that the photograph was made in 1940 or earlier. If the back of a '1920s' Jim Thorpe 8x10 photo has 1990s Kodak photo paper printing, the photo is identified as a modern reprint.



This photograph has the photographer's name (famed Hollywood portraitist George Hurrell) and the date stamp. The toning is an aging sign consistent with the 1935 date.

Antique real photo postcards are in part dated by the styles and text in the upper right stampbox where the postage stamp would be placed. The stampbox text identifies the type of paper, while the overall style was regulated by US Law. Postally used postcards will have a dated postmark.

If the subject of the photograph is from the 1880s, the style is from the 1880s, the photographic process is the kind used in the 1880s and there are genuine signs of aging, it would appear the photograph is from the 1880s.

Particularly at sale or auction, the photograph will already be labeled and you will judge whether or not the label is accurate. If the seller says the baseball photo is from the 1860s, you look at the player's uniform and equipment and style of cabinet to determine if the sport and date is accurate. If the seller is a well known and respected photograph dealer, her opinion may hold great weight. You may feel that the seller is more of an expert on the particular sport than you. If the eBay seller has horrible feedback and no history of selling photographs, you will be skeptical of his word.

Forgeries and reprints are identified because qualities of the photograph are in major conflict with each other. If the image is of Charlie Chaplin in the 1920s but the paper is modern, the photo is a reprint.

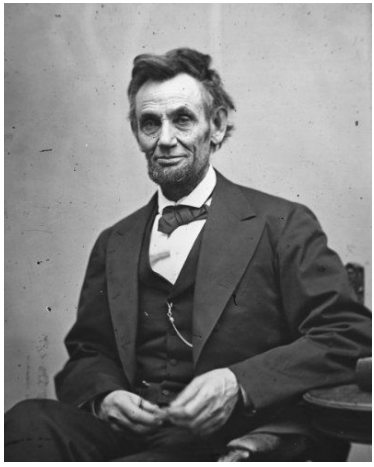
Many fakes are genuine photographs that are significantly misidentified. Many 'baseball tintypes' are genuine 1800s tintypes but do not picture a baseball player. It may picture an 1870s fireman, firemen of the time having similar uniforms as baseball

players. The seller with a case of wishful thinking may call a farmer's heavy work glove a baseball glove.

While an on sale photo may be an original cabinet card of a boxer, the seller may have misdated it. Considering an 1860s cabinet card is rarer than a 1910s cabinet card, the misdating may affect value.

Many fakes are digital reprints that are identified by the fine dot pattern under magnification. Real photographs are made by chemical reaction and have no dots or other ink and printing press pattern.

As detailed later, the blacklight (longwave ultraviolet light) helps in judging the age of the photopaper and can quickly identify modern reprints of early photographs.



This photograph sold as “original” of Abraham Lincoln in the 1860s was easily identified as modern by the modern style (unmounted, 8x10 inches), thick resin coated paper paper (resin-coated photopaper was introduced in the 1960s), the stark black and white tone (most original paper photos of Lincoln will be sepia), blacklight examination of the paper and microscopic examination showing that it is a digital print.

Historical knowledge and facial recognition analysis of the image subject is integral, as the subject is often a major part of the value and importance, and often an integral part of dating.

This is a genuine early 1860s photo, but, despite what the seller claimed, not of Abraham Lincoln. It is a common cognitive bias to see someone famous in someone who is not. As you can see, a fake can be an original photograph correctly dated, but the subject in the image is misidentified.

Further reading

Judging the Authenticity of Photographs (5th Edition, Hamerweit Books) by David Cycleback

16 SCIENTIFIC METHODS INTRODUCTION

There is a wide variety of scientific methods used to examine art and artifacts, from simple to complex, inexpensive to expensive. These are advancing as time goes by and more will be added and perfected.

The following chapters show many but far from all of the methods.

It should be noted that the most advanced methods are usually reserved for big mysteries and very expensive items. Coupled with connoisseurship, the basic and even elemental science testing is usually enough for the majority of items. Readers should not think that everything must be carbon dated or thermoluminescent tested by a big university laboratory to be deemed authentic. Much of what we have already been talking about in this book--, connoisseurship, process identification, basic identification of materials and signs of aging-- will identify many to most fakes and real items.

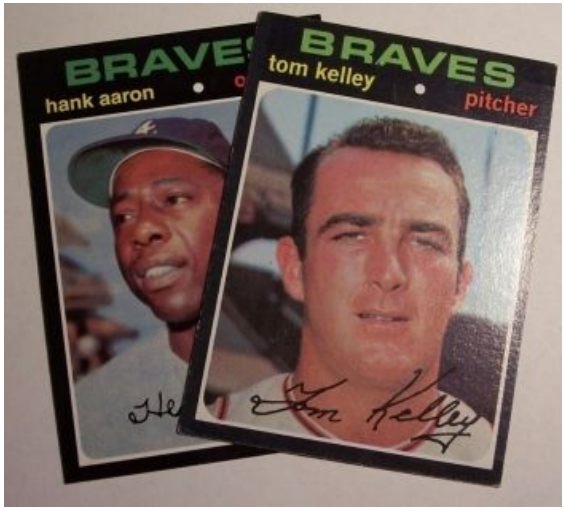
17 BASIC SCIENTIFIC EXAMINATION

While we often think of scientific examination as advanced and using expensive equipment and laboratories, much useful scientific information is simple and commonplace. This includes basic observations and documentation of weight, thickness, gloss, shape, colors and size. Even many non-experts know that solid gold is soft, silver often tarnishes, diamonds are harder than glass, chrome is shinier than steel, granite is heavier than wood. Many would classify this information as “common knowledge,” yet it is still invaluable. Much materials identification involves such simple knowledge as this, and even academic scientific documentation involves formal documentation of such basic information.

The following chapter is an example of this type of simple examination in action, and how it is invaluable in authentication and fake detection.

18 BASIC SCIENCE CASE STUDY: IDENTIFYING FAKE TRADING CARDS BY COMPARING WITH GENUINE CARDS

Reprinted from the book "Judging the Authenticity of Early Baseball Cards," this text shows how simple, examination of basic qualities is done by collectors and dealers to judge authenticity.



1971 Topp baseball cards: from this picture, both cards look good. However, the Hank Aaron on the left is a later reprint. In subsequent pictures you will see the cards differ in distinct ways.

A standard and highly effective way to detect trading cards counterfeits and reprints is by directly comparing the card in question with one or more known genuine examples. Granted, it is uncommon for the collector to already own duplicates, especially

if it is a 1933 Goudey Babe Ruth or 1965 Topps Joe Namath. However, good judgment is often made when comparing a card to different cards from the same issue. Comparing the Ruth to a bunch of Goudey commons and the Namath to a handful of other 1965 Topps.

A T206 Ty Cobb, and even a T206 Honus Wagner, was printed on the same sheet as T206 commons. The printers did not bring out special cardstock and VIP inks for the superstars. When you are studying the qualities of T206 commons, you are also studying the qualities of the T206 Honus Wagner and Ed Plank.

If there are cards insufficient in number or of extra poor quality (caught in the backyard thresher), techniques discussed later in this guide will be essential.

In nearly all cases, counterfeits and reprints are significantly different than the real card in one and usually more than one way. However, in many cases, even though a difference or two is identified (cardboard a bit thinner and lighter in color), this doesn't answer whether the difference is due to fakery or is a genuine variation. Techniques from later in this guide will be needed.

Comparing cards is highly effective in identifying counterfeits of cards from all eras. If you know how to properly compare cards, you should be able to identify a fake 1986-7 Fleer Michael Jordan and 1979-80 OPC Wayne Gretzky.

Before examination, the collector should be aware of variations within an issue. A genuine 1956 Topps baseball cards can be found on dark grey or light grey cardboard. While the 1887 Old Judges are usually sepia in color, pink examples can be found. The examiner must also take into consideration reasonable variations due to aging and wear. A stained card may be darker than others. An extremely worn or trimmed card may be shorter and lighter in weight than others in the issue. A card that has glue on back will allow less light through when put up to the light. The collector will often have to make a judgment call when taking these variations into effect. This is why having experience with a variety of cards is important.

Qualities to compare

The following is a short list of things to look at. You are welcome to add your own things to the list.

Obvious Differences: This can include text or copyright date indicating the card is a reprint, major size difference, wrong back. The front text on many T206 reprints is a different font than on the originals. Many of these problems are obvious even in an online picture.

If you are experienced with an issue, perhaps you've collected Goudeys for the last few years, most reprints and counterfeits within that issue will obvious. They simply will look bad. The experienced eye is a sophisticated collector's tool.

Dimensions of face and back: This can do be done through comparison with numerous other cards. Price guides will list the size for standard issues.

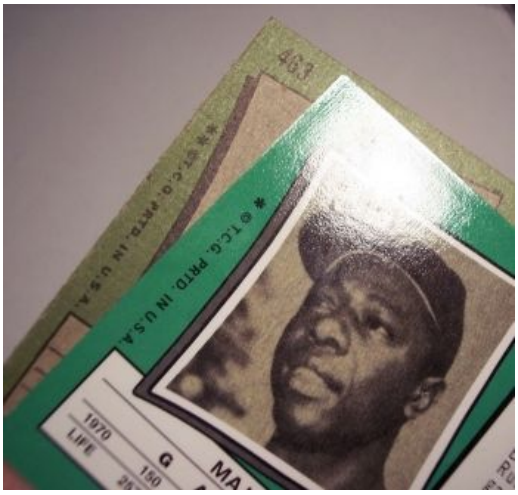
Dimensions of printing: This includes size of the image, borders and text. Most counterfeits made by photocopiers will have correct measurements. However, a counterfeit of the 1956 Topps Willie Mays card had the correct card measurement but the print itself, including the image of Mays, was too large. This created borders around the image that were too thin.

Solid areas: With a magnifier or microscope, compare which areas are solid and which are not. On a genuine T206, the border around the player picture and the player's name and team below is solid. While many reprints will also have these areas solid, many will not.

On the 1971 Topps cards, the faux signatures in the front player pictures are solid black. On many reprints the faux signature will be made up of a dot pattern.

Weight: Significant differences in card weight can be important, signifying that a different cardstock was used. Small differences are less significant and could be due to natural variation.

Appearance of card stock and surfaces: This includes color, texture, feel, etc. The correct gloss is very hard to duplicate on a reprint, and most reprints will have different gloss than the original. Make sure to check both sides. A T206 and 1951 Bowman, for examples, have different textures front versus back. Make sure to check the width, color and appearance of the card's thickness or edge. The edge often shows the cardstock to be different.



The reprint 1971 Hank Aaron has a different gloss and coloring than the original card.

Font and size of lettering and border lines: Some reprinters go to the effort of recreating the lettering and border lines, making them solid as with the originals. In many of these reprints, the font of the lettering is noticeably off. This includes the thinness of the lines, height of the letters, and the distance between lines of lettering. In a few cases, the counterfeiter left out entire words from the text. If you are familiar with an issue, the lettering on one

of these reprints will be strikingly different on first glance. Similarly, the border lines and designs may be noticeably different.

Unnatural signs of reproduction: In some cases, thoughtless errors appear on a forgery that has been photocopied or computer scanned. If a piece of lint or dirt was on the photocopier or scanner, it may appear on the reprint. A photocopy forgery of the 1952 Bowman card of Mickey Mantle has a small white mark on his chin that doesn't appear on genuine cards.

The genuine card used for reproduction may have a crease or scrape which can literally felt on the genuine card, but is only reproduced on the reprint.

Opacity: Opacity is measured by the amount of light that shines through an item, or the 'see through' effect.

Cardstock and ink vary in opacity. Some allow much light through, some allow none, while the rest will fall somewhere in between. Most dark cardboard will let through little if any light. White stocks will usually let through more. While two cardboard samples may look identical in color, texture and thickness, they may have different opacity. This could be because they were made they were made in different plants, at a different time and/or were made from different substances.

Testing opacity is a good way to compare cardstock and ink. The same cards should have the same or similar opacity.

Opacity tests should be done with more than one card from the issue. Comparisons should take into consideration variations due to age, staining, soiling and other wear, along with known card stock variations in the issue. It must be taken into consideration that normal differences in ink on the card will affect opacity. If one genuine T206 card has a darker picture (a dark uniformed player against dark background), it should let less light through than a genuine T206 card with a lighter picture (a white uniformed player against a light sky).

The opacity test can detect many restored expensive cards. In the past, some genuine but low grade star cards (1933 Goudey Ruth, T206 Cobb, etc) have been restored in part by having the rounded corners rebuilt with paper fibers from other cards and glue. When held to the light, the built up corners are often seen as they let through a different amount of light than the rest of the card.

When held to a normal desk lamp, the Aaron lets through much more light than the Tom Kelley.

Conclusion

Usually, the differences between a questioned card and genuine examples will be significant enough that the collector will be nearly certain it is a fake. If that 1984 Topps Dan Marino rookie has a significantly different gloss, thickness, fluorescence and opacity from genuine commons in the issue, the card is more than probably a reprint.

* * * *

While the previous example is about trading cards, this type of comparison study is done in other “mass produced” areas including paper, art prints, posters, porcelain figurines and tea cups.

19 BASIC SCIENCE ASSIGNMENT

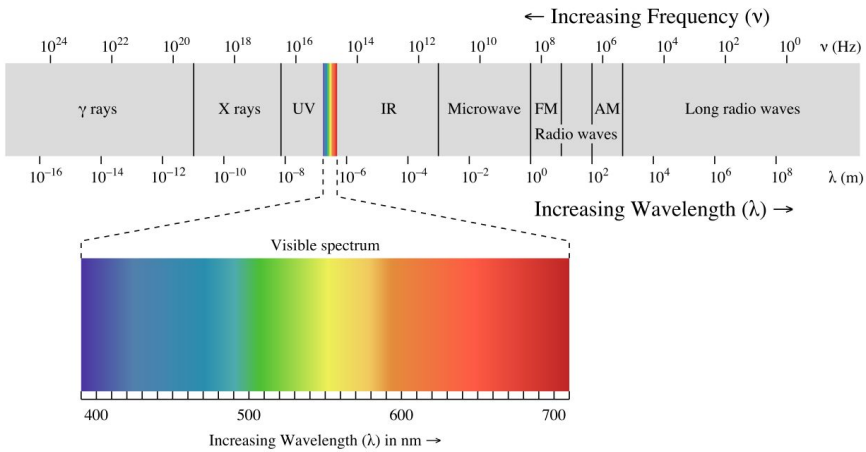
Find identical or very similar mass produced items and list some of the physical qualities. This can include snapshots from the same photo development, or two copies of the same book, magazine or advertising flyer. It can be pieces of computer paper from the same package. If there are any differences, list those too.

Take two different items-- such as two different magazines, books or pieces of paper, and detail the similarities and differences in physical qualities, such as weight, gloss, thickness, tone and opacity.

20 ELECTROMAGNETIC RADIATION: USING LIGHT

This book is an introduction to the use of light in authentication.

20.1 Overview



Electromagnetic radiation spectrum (courtesy of Wikipedia.org)

The most common way to examine items is through light from the electric radiation spectrum-- visual light, X-rays, infrared, ultraviolet and gamma rays.

There are countless ways to use light, from elemental to highly advanced. In fact, we have already been using visual light in the earlier parts of this book. The chapter on trading cards comparison showed basic visual light examination-- looking at and comparing tone, gloss, opacity, etc. This type of naked eye/visual light examination is a constant part of science.

The rest of this chapter shows three standard uses of electromagnetic radiation in art and artifact examination: ultraviolet fluorescence, infrared reflectrography and x-radiography. Other chapters and sections throughout the book will show other uses of electromagnetic radiation.

20.2 Ultraviolet (UV) fluorescence

Ultraviolet light (UV) in the longwave (UVA, 'blacklight") and shortwave (UVC) is commonly used in the identification, authentication and fake detection. Some of the biggest forgery cases have been solved in part due to ultraviolet light examination. These include the infamous Hitler diary fakes of the 1980s and the forged photos of photographer Man Ray. Simple black light examination showed these forgeries were made with materials too modern for the subject.

Ultraviolet light is invisible to the human eyes, but when shined on a material the material will often fluoresce in the visual light range. The fluorescence ranges in color and brightness, depending on the material. The quality of the fluorescence originates at the atomic level of the material. The key is it can show qualities and difference in materials that are unseen under normal daylight, and this allows one to examine and often identify material.

The following are some examples of how blacklight is used:

Many materials have known specific colors and brightnesses of fluorescence, sometimes different under UVA and UVB, and ultraviolet is useful in identification. These materials include gems, minerals, ivory, plastics, inks, paints art glass, textile thread and cloth.

The collectible antique glass called uranium glass fluoresces a bright yellow green under UV.

UV is commonly used to identify modern fakes and reproduction of antique paper and cardstock items, including posters, art prints and manuscripts, as chemicals added to many post World War II paper stocks fluoresce a bright light blue under blacklight.

The brightly fluorescing flower petals show that the kimono was made after World War II.

UV is commonly used to identify altered and restored items, with the added glue, paper, paint or other material fluorescing differently from the original material. Forged signatures on paintings are often identified this way.

Restoration to this ceramic is easily visible under blacklight

Due to the different materials used, reproductions or counterfeits of mass-produce items, such as postage stamps and trading cards, will often fluoresce differently from the original item in side by side comparison.

Postage stamps, currency, passports, licenses and credit cards often have authenticating markers or tags that are identified under UV.

Further reading: 'Ultraviolet Light and Its Uses' by David Cycleback (bookboon.com)

20.3 Infrared (IR) reflectography

As with ultraviolet, infrared is a frequency of light that cannot be seen with human eyes and is commonly used to examine materials. It is just to the right of the color red on the electromagnetic spectrum, with infra meaning 'beyond.'

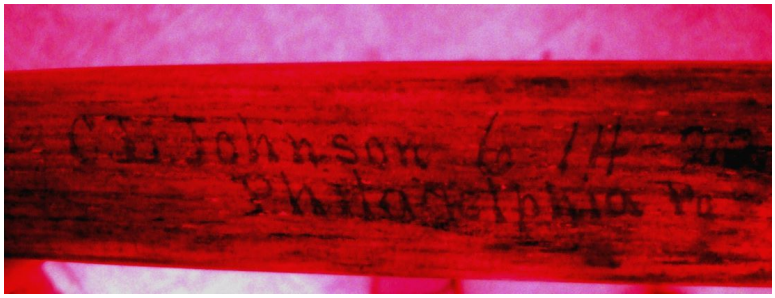
In infrared reflectography, infrared does not make material fluoresce as with ultraviolet. Rather, examiners use infrared viewers or cameras that translate infrared light into a visual image on the screen, allowing humans to view details and qualities in the infrared range. With an infrared camera, you can take an infrared photograph. In fact, infrared photography is a popular form of art photography, as it gives a different, surreal view of the world.

There are various kinds of infrared viewers, from advanced and expensive to normal digital cameras that have been converted and allow you to download the infrared images to your computer. Cameras normally have a filter to block infrared light, but they can be converted by having the infrared blocking filter removed

In the historical art and artifact world, infrared viewers are best known for their ability to view through the top layer of paint on a painted item. Art historians and museum conservators view through the paint to see any background sketches or earlier versions of the art. They do this to learn about how the painting was made and how the artist worked, planned and changed things.

Studying the style and types of changes and background images are useful in determining if a painting was by a famous painter— his habits and techniques already being known. Forgeries have been discovered because they were painted over paintings of modern subjects, and genuine paintings deemed authentic in part because the hidden sketching matched the habits of the painter.

Certain ink and pencil writing on old documents that have become invisible to nearly invisible in daylight can be sometimes be read in the infrared range, so infrared viewers are often used to examine ancient manuscripts and art.



Hidden writing revealed on a 1922 game used baseball bat. The grease pen text, faded to unreadable to the naked eye but seen with the infrared camera, was written by a worker at the famed bat manufacturer Hillerich & Bradsby of Louisville Kentucky when the Philadelphia Athletics player returned the broken bat to receive new ones. The text gives the player's name, team and the date the bat was returned, and helps in authenticating the bat as game used by the player.

The added materials for restoration and other alterations can sometimes be seen in the infrared range. An infrared viewer can help in identifying some items that have been repainted or touched up. The touched up area may be unnoticeable in visible light, but stands out in the infrared range.

As with ultraviolet, infrared is used to inspect and compare materials. A reproduction and an original will often look different in tone in the infrared range due to them being made out of different materials. Ink and paint examiners use it to compare and identify inks, as different inks will often look different in the infrared range.

Normal digital camera that has been converted to infrared

20.4 X-Radiography and the 'see through' effect of X-rays

X-ray machines examine paintings and other objects in a similar way that they are used to examine human bodies at doctor's offices and hospitals.

As with ultraviolet and infrared light, X-rays are a form of light invisible to human eyes. X-rays pass straight through some materials, but are reflected or absorbed by others. In the physician's office, the X-ray machine shoots X-rays at the patient and has X-ray sensitive photographic film on the other the other side of the patient (Duly note that 'film' is an old-fashioned term and technology as even X-ray machines have hit the digital age.) The X-rays pass through the patient's skin and flesh and go to the film, but are absorbed by the bones. The result is the X-ray photograph shows the inside bones, allowing the doctor to examine the inside of the body.

Art historians get a similar inside look at paintings and artifacts as X-rays go through some paints, cloth and other materials but are absorbed or reflected by others.

For paintings, it often shows what was painted underneath the first level graphics that we see with our naked eyes. Famous artists are known to have had standard ways and personal styles in how they constructed their paintings, which helps the historian in judging the authenticity, and some paintings started out as dramatically different designs. X-rays have shown that Picasso's famous 'The Old Guitar Player' started off as an old woman instead of an old man, and an El Greco portrait started as a still life.

It has also been used to identify altered and restored artifacts, including artifacts made together of many separate pieces. The outside of the altered artifact often is repainted or revarnished to hide the alterations from visual light/naked eye view, but the X-rays can see inside.

Computed tomography, also known as CT scan, is a computerized X-ray procedure that creates three dimensional

images of objects, and can offer ‘slices’ of the object for examination. It is normally used in medicine but is also used to examine artifacts.

There have been recently developed digital X-ray techniques for analyzing the weave of painting canvases. This can identify where the canvas for questioned painting matches the canvases of known authentic paintings for an artist

20.5 Question

Give three examples of how ultraviolet, infrared and/or X-rays are helpful in authentication and fake detection.

21 CASE STUDY: AUTHENTICATING UNITED STATES CURRENCY

This chapter shows the standard methods used to authenticate modern US currency, including ultraviolet fluorescence and infrared reflectography.

US currency was intentionally designed to be authenticated. There are numerous methods used for identifying counterfeit United States currency bills, including the use of visual light inspection, infrared and blacklight. Note that this section is only a brief and general introduction. Currency is regularly changed and updated by the US Government, and it is likely that there will be changes within a few years of the publication of this guide. Newly issued currency does not make old currency disappear. Old currency is floating around for many years. If you find a 1930 US$1 bill it is valid currency.

Counterfeits vary in quality, but the following techniques should help identify most counterfeits. The following looks at specific techniques of counterfeit detection. It is important to understand that a single correct does not quality authenticate a bill. For example, some counterfeiters bleach genuine $1 bills and make them into fake $20 bills. That the paper itself is genuine does mean that these fakes authentic.

Pay attention to your currency

Observe your bills before you get counterfeits. Look at the printing, the Presidential portrait, examine the details, get a feel for

the paper. A common way a counterfeit bill is found suspect is that it looks and feels “off,” different from other bills. The image may look funny and unclear, the color may be off, the paper may feel different.

Real bills have high quality, detailed printing. Check the details and lines in the portrait and in the background lines. The detail in reprints is often lacking and muddled.

The printing is engraving, as described in Chapter 11.

Closeup details on US currency bill

Compare a suspect bill to known genuine bill of same denomination and year. Again compare the feel and general look. Compare specific, close up details, such the President's eye or the points on a seal. Compare all the designs and text. Again, remember that the design and text changed and changes over the years on genuine bills, so you want to compare bills from the same year.

Take into consideration that there can be natural differences between genuine bills. One genuine bill can be crisp and unused, while another genuine bill can be worn, wrinkled and dirty. This is why comparing to numerous bills is a good idea.

Blacklight test #1: fluorescent vertical bands.

Some recent currency above the $1 denomination has vertical bands that fluoresce under blacklight. Under normal visible light, the bands can be seen when the bill is held up to a light. The presence of these is very strong evidence of authenticity.

Fluorescence of bands:

$100 Pink/Orange
$50 Yellow
$20 Green
$10 Red
$5 Blue

These bills also have infrared bands that are visible with an IR viewer.

Blacklight test #2:

Authentic currency does not have optical brighteners in the paper. Many, but not all, counterfeits are made with normal paper and will fluoresce brightly. One has to be careful with this test, because many laundry detergents contain optical brighteners. Bills can fluoresce if they were accidentally run through the wash.

Visible light watermarks. Modern higher currency bills have a visible light watermark to the side of the bill. The authentic watermark is not seen until it is held up to a light. It will be a smaller portrait of the president on the bill or the currency number, and can be seen when viewing from both sides.

US$5 bill held up to the light, showing '5' watermarks

US $20 bill with matching Andrew Jackson portrait and watermark

Fibers in the paper. Some modern currencies have thread-like fibers of different colors in the paper. Some counterfeits will look like they have the threads, but close examination under a microscope or high magnification shows the fibers real on a real currency.

Microprinting: Microprinting is very, very small text that appears in some parts of some but not all currency. It is readable under magnification and very hard to reproduce in a counterfeit. In most counterfeits, the microprinting will be all blurred under magnification.

Color shifting ink on higher than $5 currency: On modern higher currency, there is a distinct color shifting ink used on the front right. It has a metallic finish and is used on two right symbols. It changes color, from green to black, when you change the angle of the bill. This is hard to duplicate in counterfeits.

Minute multi-color dot pattern as identifier of counterfeits. When you examine a genuine bill under good magnification, you will see the images, lettering and design are comprised of solid monotone lines and marks. Some, but not all, counterfeits are identified by a minute multi-color dot pattern in the printing. Many digital computer prints will have this pattern.

Raised notes. Some genuine notes are altered to give them a high denomination. For example, a forger may take a $1 bill and paste '$10' on the corners. This is identifying by knowing which presidents appear on which bills. George Washington appears only on a $1. Also, the correct denomination is spelled out just below the President's portrait.

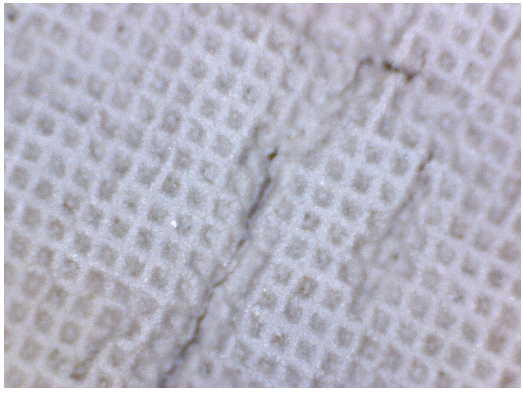
Paper testing pen. There are inexpensive commercially available pens that test the paper. Genuine currency is fiber based, while some counterfeits are on wood based paper. Common computer paper is wood-based. The pen contains iodine that makes a black stain on wood-based paper, but not on fiber-based. The black stain shows that the bill is counterfeit. Realize that some counterfeits are made on fiber-based paper, including bleached genuine currency, so the pen won't identify all counterfeits. Many foreign currencies

are on fiber based paper, so the pen will work with the European Euro. Mexican Peso, Argentine Peso, Indian Rupee, Greek Drachma, German Mark, French Franc, British Pound, Russian Ruble, Japanese Yen and numerous other paper currency.

22 MICROSCOPY

This chapter looks at some standard microscopes and their uses.

22.1 Overview



Microscopic view of the machine pattern of fake leather. Under the microscope, it is easy to identify real versus synthetic leather, parchment and vellum.

Whether with a simple magnifying glass used to get a closer look at a ring inscription or a high priced microscope, magnification gives the examiner the ability to see details hidden from the naked eye. In the advanced use of microscopy, scientists can examine things in three dimensions, at the atomic level and combine microscopes with other advanced techniques such as spectroscopy and colorimetry.

There are different kinds of microscopes, but even inexpensive ones from online stores are useful.

22.2 The basic, inexpensive microscope

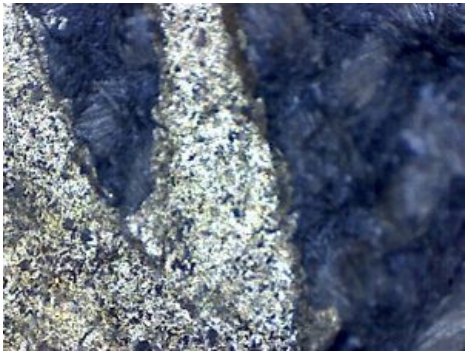
The most commonly used microscope is a handheld model that can be purchased online at amazon, ebay and other places for well

under $20. They require batteries, have a built-in light, and can be carried with you wherever you go.

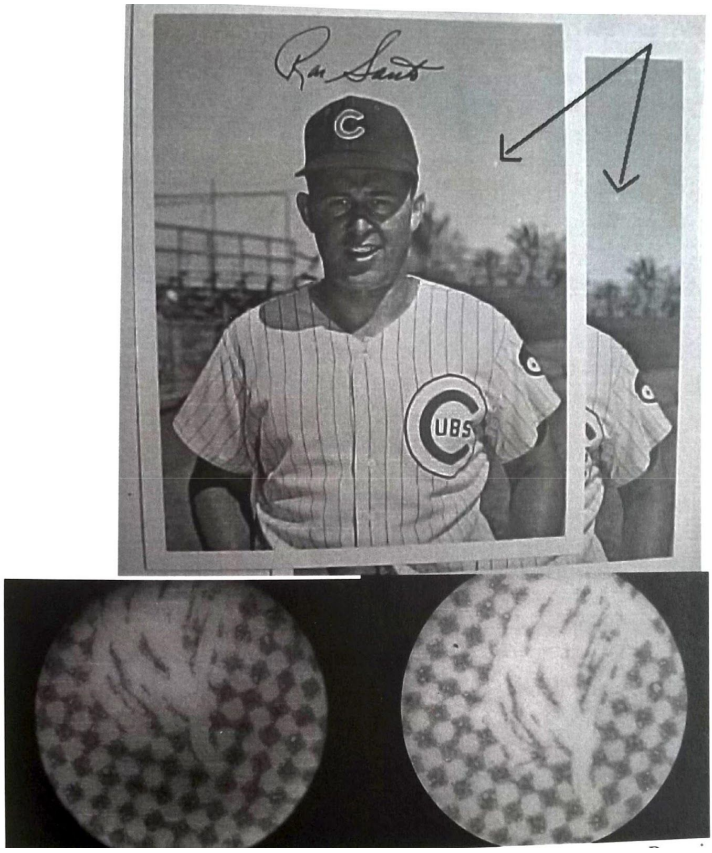
There are also affordable digital microscopes that plug into computers. You see the microscopic image on your computer screen, and are able to take microscopic pictures and even movies. This is important if you want to post or send online images for a second opinion.

Inexpensive handheld microscope on the left and a digital one on the right

This book has already shown examples of where images from these microscopes are used to identify processes and details. The following are a few more examples.



Microscopic image of flaky gold gilding on a book cover, consistent with the book being antique. Modern metallic embellishments are stamped on and have a solid 'gold bar' appearance under the microscope.



Microscopy can find matching minute marks in the printing that identifies prints made from the same printing plate.

22.3 Stereomicroscope

The stereomicroscope does not have high magnification, but views the object and details in three dimensions. This is useful for examining the surfaces of solid subjects, such as paintings, ceramics, textiles, sculptures and coins.

For paintings it is useful for studying painting techniques, layers, brushwork, cracks and signatures. Close up three dimensional views of cloth and threads are important for comparison and identification. Coin graders use stereoscopes to

judge condition. Ancient artifacts examiners use stereoscopes to authenticate mineral deposits that come from being in the ground for centuries, a strong sign of old age and authenticity.

Stereomicroscopes are useful for examining three dimensions, such as the surfaces of coins

Stereomicroscopes are used to authenticate centuries old mineral deposits on ancient American Indian arrowheads.

22.4 Polarized light, or petrographic, microscopy

Polarized light microscopy, also called petrographic microscopy, uses a microscope equipped with a rotating stage and Polaroid filters for illumination of a sample with polarized light. It creates

great contrast that allows clear examination of things that are normally hard to see using other methods. An example is it is used to see different kinds of fibers in a tapestry or paper sample where normally the fibers would visually meld together. Polarized and other forms of microscopy can be used to identify the pigments in paint and inks.

Polarized light means, unlike normal light, the wavelengths are in the same plane. Many of us have seen through polarizing lenses, including polarizing sunglasses, and know how clear things can be and how it stops glare, as on the surface of a lake.

The polarizing microscope examines material and its substances by shining different polarized light from different angles, which increases the quality of image contrast. Qualities, as small as a few micrometers, that can be seen include size, shape, color, surface texture, opacity and crystal structures. It has traditionally been used by geologists and mineralogists, but is useful in the identification and examination of wood fibers, paper and textile fibers, ink, paint and pigment.

Very short video explaining polar light microscopy of materials:
https://www.youtube.com/watch?v=W6v7JdK4sps

Online articles on polarized light microscopy
https://www.penn.museum/sites/artifactlab/2012/12/12/polarized-light-microscopy/
https://www.mccrone.com/mm/polarized-light-microscopy-conservation-painting/
http://www.microscopemaster.com/polarizing-microscope.html

22.5 Scanning Electron Microscopy (SEM)

The scanning electron microscope (SEM) uses electrons instead of light to get extremely high magnification of up to 1 million times magnification.

Due to the wavelengths sizes of visual light, the regular microscope has a limited magnification of about up to about 1000x (one thousand times). Electrons have much shorter wavelengths, enabling better resolution and much higher magnification, up to 1,000,000X (one million times). The examination is done with the object in a vacuum, and is used to used examine objects and material at the smallest level. It is used to examine many different materials, including metals, pigments and inks.

Youtube video on SEM
https://www.youtube.com/watch?v=GY9lfO-tVfE

Excellent overview of SEM
https://serc.carleton.edu/research_education/geochemsheets/techniques/SEM.html

A brief article about the use of scanning electron microscopy in ancient artifacts authentication
https://www.sciencedaily.com/releases/2014/11/141112083837.htm

22.6 Other microscopy links

Microscopy looking at paint
http://www.webexhibits.org/pigments/intro/microscopy.html

Pigments:
https://www.mccrone.com/mm/the-microscope-in-art-conservation-and-authentication-studies/

22.7 Questions

What is the practical advantage of the stereomicroscope?
What is the practical advantage of the scanning electron microscope (SEM)?
What is the practical advantage of the polarized light microscope?
What is polarized light?

How does the scanning electron microscope get such larger magnification than the visual light microscope?
Give some examples of how simple magnification, such as with an around the house magnifying glass or jeweler's loupe, is helpful in identification, including in your daily life.

23 SPECTROSCOPY

This chapter looks at an advanced scientific method used to analyze and identify materials.

mass spectrometer

23.1 Overview

In its most general sense, spectroscopy (often called spectrometry) is the science of examining and measuring electromagnetic radiation (light) as it interacts with or is emitted by matter, and includes such basic things as measuring light passing through a prism and observing with our eyes the colors of objects. When you shine a blacklight on an object to see the color and brightness of the fluorescence, observe a painting's texture with raking light or

examine an object through the manipulated (magnified) light of a microscope, those are basic forms of spectroscopy.

In art and artifacts authentication and forgery detection, however, spectroscopy involves various highly advanced methods of analyzing the molecular structure of material and objects by shining infrared, X-rays, gamma rays and lasers at the material and analyzing the electromagnetic radiation that is returned.

Whether reflected, fluoresced or scattered from a material, the returned light is determined by the molecular makeup of the material, and the advanced forms of spectroscopy can be used to not only identify the material, but identify the material's exact chemicals and compounds and their concentrations.

Knowing the material, chemicals and compounds is invaluable in authentication and forgery detection, and has identified some of the most sophisticated and famous forgeries. Many sophisticated forgeries have been identified because the chemicals and compounds identify the material as being from the wrong time and even originating from the wrong place. Spectroscopic analysis can go as far as identifying the geographical origins of pigments, ivory and gems.

23.2 Colorimetery: the scientific identification of colors

A basic method of spectroscopy it is called colorimetry. Colorimetry measures the visual color of materials and objects.

The most basic form of colorimetery, and spectroscopy, is when we judge the color of something with our own eyes. Under white light, we see a ball as red or a coffee mug as blue. We identify different kinds of wood, in part, by their different shades of brown. The color of the light we see is determined by the atomic makeup of the material.

However, human vision is inexact and subjective. As demonstrated by color vision tests at the optometrist, it varies from person to person, and even person's eye to the other eye.

Colorimetry uses a scientific instrument called a colorimeter to measure color at a precise and objective level.

Identifying color at such a precise level is important in numerous areas and for many reasons, including when examining inks, paints, dyes and gems. In cases of court contested documents, such as wills and contracts, alterations to the writing are often discovered because a colorimeter identities by the color that different inks were used. The colorimeter identifies very slight differences in color of the inks that are unnoticeable to the naked eye, and can be hooked up to a microscope (microcolorimetry) for very close magnification.

Chinese Purple, sometimes known as Han Purple, was a manufactured pigment used by ancient Chinese. Made from the metals barium and copper, along with the element silicon, their most famous use was on the Terracotta Army. Being able to identify colors and knowing when they were introduced and used is important in dating items.

Colorimetry is commonly used in the examination and identification of pen inks on questioned documents.

Further reading on colorimetry:

Lengthy explanation of colorimeters
https://www.qualitydigest.com/inside/metrology-news/how-measure-color-differences.html#

Interesting article on colors in the past
https://www.thoughtco.com/ancient-pigments-our-colorful-past-169888

23.3 Infrared, Raman, Mass and X-Ray Spectroscopy

As mentioned, advanced spectroscopy shines different ranges of electromagnetic radiation on the material and examines the light that is returned. These methods use an expensive device called a spectrometer, which can be a stand alone, but is often hooked up to a computer and sometimes a microscope. They range in size from handheld to large complex-looking systems.

While there are many different kinds and variations of advanced spectroscopy used for many purposes and in many areas, the ones most commonly used to examine art and artifacts are **infrared spectroscopy, Raman spectroscopy, X-ray fluorescence spectroscopy** and **mass spectrometry.**

Infrared spectroscopy shines infrared light and measures the inter-atomic bond vibrations. It is based on the fact that

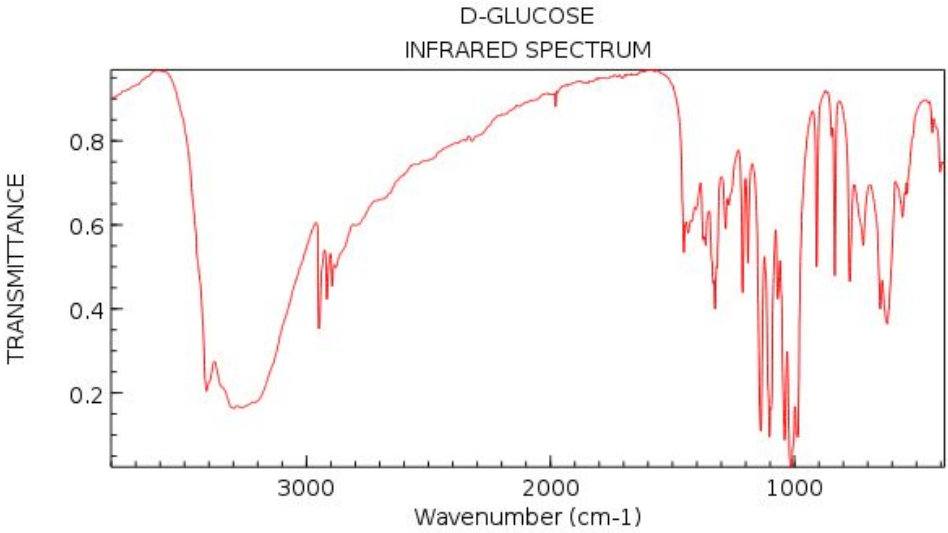
molecules absorb frequencies depended on their chemical structures.

Named after the 1930 Physics Nobel Prize winner C. V. Raman, **Raman spectroscopy** shines a laser beam of light, and measures slight energy changes to some of the scattered back light that is caused by material's molecular vibrations. Raman was the first to publish a paper on this vibrational scattering, which is called *Raman scattering* or the *Raman effect*.

X-ray fluorescence spectroscopy measures the X-ray fluorescence given off from a material when shortwave X-rays or gamma rays are shined on the material. The shined X-rays or gamma rays add energy to the atoms. The atoms can hold this energy only for a short time before having to give it off. The atoms give off the energy in a different form than received– a longer wavelength of X-rays that is the fluorescence. You can see how this is related to ultraviolet or blacklight fluorescence, where the black light causes the material to give off a visible light fluorescence.

Done in a vacuum, **mass spectrometry** ionizes the atoms of the material and measures the mass-to-energy ratio. Francis Aston and J. J. Thompson won Physics Nobel Prizes for their work in this area.

These different types of spectroscopy examine and measure different aspects of the materials and create different spectrum charts. Shown on a computer screen, each spectrum is based on the molecular makeup of the material and serves as a fingerprint for identifying the chemicals or compounds in the material. Each chemical or compound will have its own, unique spectrum.



Infrared spectroscopy spectrum for d-glucose. This spectrum is unique to the sugar, and serves as a fingerprint for identification.

The spectrometer has software that contains a library of the spectrums that will match up the tested material's spectrum and tell you what is the compound or chemical.

The process can be as simple as shining the spectrometer on the material, and the software telling you on the screen that the material is iodine, aspirin, gold or whatever it is. Handheld spectrometers are used at recycling centers to immediately identify the scrap metal compositions, and at airports to quickly identify mysterious substances, such as pills and powders.

Further, the height of the peaks of the on the spectrum tells you the concentration of the chemicals in the material.

Certain ranges of light interact better with certain chemicals, so the different types of spectroscopy are often used to complementarily each other when examining a material. For example, infrared spectroscopy is better at reading a certain range of chemicals, while Raman spectroscopy a slightly different range, so they may both be used to examine an ancient fresco.

This analysis can be non-destructive— meaning no sample has to be removed from the object– and can often be done on sight. The scientist can bring the Raman, infrared or X-ray fluorescence spectrometer to the huge painting on the wall of the museum, rather than having to bring the painting to the lab.

The exception is with the mass spectrometer that requires a sample, in part because the process takes place in a vacuum.

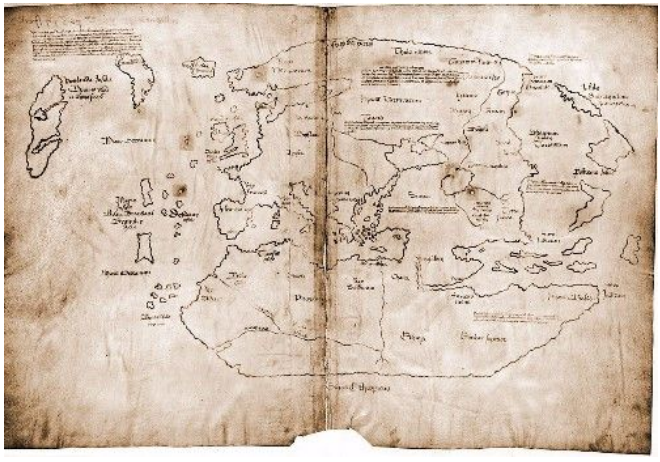
handheld X-ray fluorescence spectrometer

23.4 Why being able to identify the chemicals and compounds is important to authentication and forgery detection

Knowledge of the materials and their chemical makeups in an artwork or artifact is important to authentication and forgery detection in many ways. There is much known, and continuous research, about the invention, chemical makeup and historical use and making of materials. It is sometimes even known where artists and cultures obtained the materials to make their objects– such as the imported minerals used to make paint or local stone to make artifacts. Thus, spectroscopic analysis of a questioned object can identify materials, chemicals and compounds in it that are consistent with the item being genuine and of the correct age, and,

conversely, compounds or materials inconsistent, if not impossible, with the item being genuine. The following are examples:

- A painting forger used the correct type of lead white for an Old Master's painting, but the specific compounds used to make the paint came from a geographical source unavailable to the original painter.
- Forgeries of Man Ray's photographs were identified due to too modern chemicals in the photopaper.
- By identifying the specific chemicals, spectroscopy can tell the difference between natural and synthetic diamonds and identify the geographic origins of ivory and gems.
- It has identified sophisticated forgeries of ancient precious metal relics, because, while the correct metal was used in the forgeries, the specific compounds of the metals were different than used by the original peoples.
- Spectroscopy identified the crystal anatase in the ink used on the Vinland Maps, with anatase being unknown in use that early.



the long disputed Vinland Map

- The Hitler Diaries were identified as forgeries in part because the binding material was identified as a modern synthetic and the paper contained chemicals that were introduced after World War II.

Spectroscopy is an invaluable source for historical evaluation of objects and for gathering information for future authentication and fake detection. Many objects and materials, from paintings to ancient stone artifacts to photographic paper, are currently being analyzed and documented via spectroscopy for future reference. This should still be done in other areas.

23.5 Further reading and videos

Quick summary of mass spectrometry
http://www.jeolusa.com/DesktopModules/Bring2mind/DMX/Download.aspx?EntryId=285&Command=Core_Download&language=en-US&PortalId=2&TabId=337

Explanation of infrared spectrometry
https://chem.libretexts.org/Core/Physical_and_Theoretical_Chemistry/Spectroscopy/Vibrational_Spectroscopy/Infrared_Spectroscopy

Explanation of X-ray fluorescence spectrometry
http://archaeometry.missouri.edu/xrf_overview.html

Explanation of Raman spectroscopy
http://www.kosi.com/na_en/products/raman-spectroscopy/raman-technical-resources/raman-tutorial.ph

Excellent explanation of raman spectroscopy
https://www.youtube.com/watch?v=yQ1MctWU9Mg

23.6 Questions

What is the purpose of using spectroscopy on a work of art or an artifact? What kind of information does it produce?

How is this information useful in authentication and forgery detection?

Why is Raman spectroscopy and infrared spectroscopy often used together when examining and artwork?

How did Raman spectroscopy get its name?

24 RADIOMETRIC DATING

This chapter looks at the advanced dating method called radiometric dating.

24.1 Overview

Radiometric dating is a highly advanced method used to date things from rocks to fossils to paintings to paper objects. It was invented by legendary British nuclear physicist Ernest Rutherford, and University of Chicago professor Willard Libby won the 1960 Nobel Prize for physics for his work in the area. The best known form of radiometric dating is carbon dating, but there are methods using other chemicals.

24.2 The science

The scientific logic behind radiometric dating is straightforward. When something is living, certain chemicals are known to be in balance at certain proportions to each other. When the thing dies, the chemicals decay into their decay byproducts (For example, uranium decays, or transforms, into lead) but at different rates. Some chemicals decay very slowly, while other decay more quickly. For examples, the chemical rubidium has a half-life of 50 billion years (decaying, or transforming ,to strontium), while carbon-14 has a half-life of 5730 years (decaying into nitrogen), while lead-210 has a half-life of 22 years. Measuring the current proportions of chemicals (the original chemical and its decay byproduct) and knowing the rate of decay, scientists can calculate the date of an object, whether it is a rock or a painting.

Many paintings and artifacts have been identified as modern fakes or having materials consistent with being authentic via

radiometric painting. Famous items that have been dated with radiometric dating include the Dead Sea Scrolls, the Shroud of Turin, the Vinland Maps and the Mona Lisa.

24.3 Issues and margins of error

Testing requires a small, often tiny, piece of the item to be removed or tested. For many valuable items, the piece is very small and can often be repaired by a conservator.

Depending on various conditions, there is an often large margin of error in radiometric dating. However, even with a very large margin of error it is useful in identifying if a questioned ancient Chinese vase or Medieval painting is actually old or a modern concoction. Also, for a billion year old rock, plus or minus thousands years is a relatively minor margin of error.

The items to be dated had to have been originally alive, and the dating only tells you the age of the material itself. A forged item can be made from old material-- such an old piece of wood, ancient brick or rock. Additional analysis and judgment must be done on these, including stylistic analysis. Analysis of outer signs of aging (see chapters *14 Signs of Aging* and *24 Spectroscopy*) is also helpful in identified altered items.

24.4 Carbon dating

The most common and well known form of radiometric dating is Carbon 14 dating, often simply referred to as carbon dating.

Carbon is common on earth, and many materials and objects contain it, including bone, wood, paper, parchment, vellum, fabric, leather, lake muds and soil, hair, eggs, meteorites, pottery, blood, coral and shells, glues and even water.

Carbon dating can date anything with carbon from 50 or 60 thousand years old to today. Due to 1940s-50s nuclear bomb testing and its spreading of carbon radiation, materials and items can be accurately dated in the modern era.

There are numerous places where one can send an item, or samples from an item, to be carbon dated.

Two of the best known places are two at the University of Arizona (physics.arizona.edu/ams/) and Geochron Laboratories in Cambridge MA (geochronlabs.com)

The following is a long list of places that do carbon dating around the world:

http://www.radiocarbon.org/Info/Labs.pdf

24.5 Lead 210 Dating

With a relatively short half life, lead (Pb) 210 dating is form of radiometric dating well known for dating famous paintings. White lead paint has been a common element of paint, and the test has been used to help authenticate and identify modern fakes of old paintings. Carbon dating is also often used to date the wood and canvas on paintings.

24.6 Further reading and videos

A very useful site for both introductory and detailed information about radiocarbon dating is http://www.c14dating.com/

The following is a short youtube video explaining radiocarbon dating:
https://www.youtube.com/watch?v=2io5opwhQMQ

Identification of fake painting by famous cubist Fernand Leger
https://phys.org/news/2014-02-carbon-dating-uncovers-forged-cubist.html

24.7 Questions:

What does radiometric dating identify?
What are some limits in radiometric dating?
How can an artifact pass a radiometric dating test yet still be a modern made fake?

25 CASE STUDY: THE OLD MASTERS FORGER, HAN VAN MEEGEREN

The Dutch Han van Meegeren (1889-1947) was one of the most infamous forgers, having forged numerous paintings of Old Masters, most notably Jan Vermeer. Formally trained and commercially successful as a painter, he seethed when critics labeled his work as cliched. Wanting to prove his artistic genius, he set out to fool the experts.

Van Meegeren went to great lengths to try to perfect his forgeries. He studied the artists' biographies, works and materials, even visiting where they lived. He used old canvas, made his paints from scratch using the original recipes, and artificially aged the paintings using sophisticated methods.

At the time, the 1930s-40s, paintings were judged as original by connoisseurship, provenance and the relatively primitive scientific tests available at the time.

Van Meegeren's creations came out of the blue, which should have raised provenance questions. However, genuine Vermeers had popped up recently and the fine art community was half-waiting for more to appear. The preeminent art historian of the time, Abraham Bredius, predicted that newly discovered Vermeer paintings would be of religious themes, expectations that van Meegeren was happy to meet.

A standard scientific test to determine if an oil painting was old was to rub alcohol on a small portion of the paint and apply a needle. Oil paint is very slow drying, and if the needle could not go through the paint that meant the painting was at least decades old. If the needle went through, the painting was deemed less than fifty

years old. To beat this test, van Meegeren added the hard drying plastic Bakelite and baked the paintings. Further, he rolled the painting to gain the cracklature common to old paintings.

Though his paintings look artistically clumsy to today's art eyes, his forgeries fooled many people and van Meegeren made millions of dollars.

His greatest success was the 'Supper at Emmaus.' The 1936 painting was hailed as a Vermeer masterpiece by Bredius. Some people had doubts and Bradius was in his eighties at the time. However, Bredius' word was considered gospel and the art community went along with it.

Supper at Emmaus (1936)

The problem for van Meegeren arose after World War II when a Vermeer was found in the possession of Nazi leader and art collector Hermann Göring, and the painting's sale was traced back to van Meegeren. In Meegeren's Netherlands, selling a national

treasure to the enemy during wartime was treason, with the penalty being death. In court the terrified van Meegeren said the painting was not a real Vermeer, and he knew because he painted it. This defense stunned the court, and van Meegeren was forced to make a painting to prove his talents. It did and he was convicted of the lesser crime of forgery and fraud.

The court commissioned an international team of experts to look into the paintings, and further examinations have been done through the years. Beyond van Meegeren's confession and modern stylistic opinions, extensive scientific analysis identified authenticity problems with his works.

Tests identified the Bakelite used in his paints. In fact, a bottle of Bakelite was found in van Meegeren's studio. As Bakelite was invented in 1907, its presence in the paint automatically identified the painting as a fake.

While the Bakelite and baking served to beat alcohol needle test, it made the paint so rock solid that scientists determined that it was too hard to have come that way naturally. Further, ink was found in the cracklature and close examination showed that the cracklature was not of natural design.

Van Meegeren purposely used the white lead paint Vermeer used. However, radiometric lead-210 dating showed that the white lead paint was too modern.

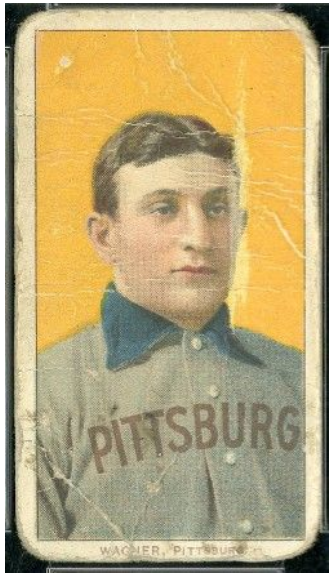
Questions

What lessons do you see from this story?

Even the 'alcohol needle test' was beaten by van Meegeren. Do you think it is still a useful test?

26 CASE STUDY: AUTHENTICATING THE MOST VALUABLE TRADING CARD IN THE WORLD

This chapter shows how a famous collectible is authenticated using different methods, including basic science, process and material identification, microscopy and ultraviolet fluorescence.



The 1909 T206 tobacco card depicting American baseball great Honus Wagner is the world's most famous and expensive tobacco and trading card in the world. It is often referred to as the Holy Grail and Mona Lisa of tobacco cards. There are perhaps fifty

known examples in various conditions, with top condition examples selling for millions of dollars each. As you may expect it is one one of the most reprinted and counterfeited cards, with thousands of reprints per authentic example.

While the average collector should only purchase the card from a well known and reputable seller (only in part because of the amount of money involved), and most people will only buy one that has been authenticated and graded by one of the top independent card graders (in part because condition effects to the value), the authentication of the card is straightforward for the print expert.

The T206 was issued by the American Tobacco Company as part of a set of over 500 different cards, with the little colorful cards inserting into various brands of cigarette packs. Most of the cards are easily found, but there are several rare ones, including the Wagner.

There are many different cards in the T206 set.

The Wagner was made using the same printing methods and cards stock as the other cards. In fact they were printed many cards

per sheet. The printers did not bring out VIP inks and cardstock for the Wagner and other rarities. This means that the plentiful cards can be used for direct comparison. Many of the common cards in lower condition are quite affordable, so the collector can have many different samples for comparison and hands on study.

Chapter 18 showed how direct comparison between cards from the set can be made and this can be done with the T206s. T206 reprints and counterfeits will usually be easily identified this way.

Many reprints and counterfeits are quickly identified by black light. Not only is the black light useful in the comparison of a questioned T206 with known genuine cards, but many modern reprints will fluoresce brightly due to the optical brighteners commonly found in post World War II paper stock.

The following are some specific qualities of the T206s, including the Wagner:

T206s are on thin, off-white card stock. If you hold them up to a light, light will shine through.

The fronts and the backs of T206s have different textures and glosses, and the front white borders are whiter than the backs. T206 backs have a fibrous feel of raw card stock and are off-white or toned. To make the front graphics more colorful and crisp, before printing the front of the card stock was coated in a white substance. It gives the front borders a sort of white washed or enameled appearance and feel. The white borders have a distinctly smoother and whiter appearance and feel than the off-white, fibrous backs. The fronts are not glossy, but have more of a gloss than the matte backs.

If the front and back of a T206 have the same gloss and texture, assume that it’s a reprint.

The rounded corner on this original T206 shows the white coating placed on the front of the cardstock.

T206 reprints will have a fine multi-color halftone dot pattern in the player image area, and often throughout the entire card (Refer to *Chapter 12 Process Identification Case Study: Halftone Printing*).

With some professionally made reprints, only the player image area has the dot pattern and the front black border line around the player image and front and back text will be solid ink. However, most cheap home computer reprints will have the dot pattern throughout the whole card, front and back.

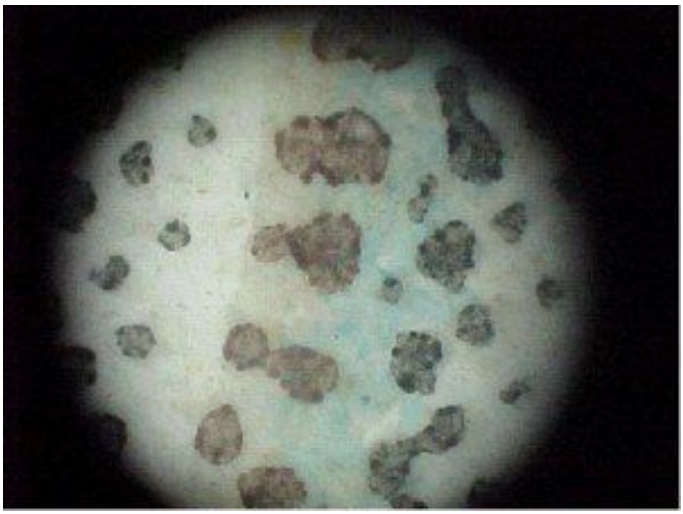
Realize that some forgeries paste a computer reprint front to a real common back, so make sure to examine both sides.

Under the microscope, the original T206 printing and ink is distinctly different than reprints

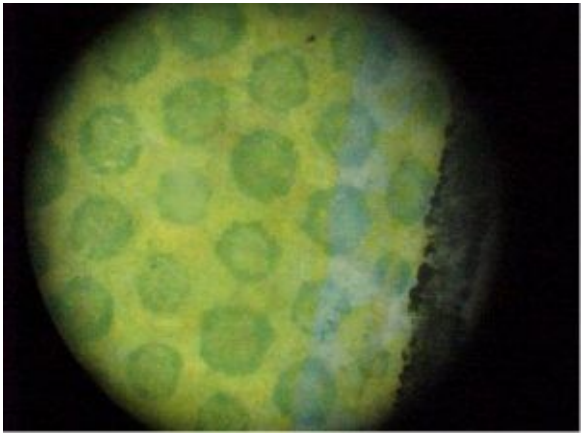
The original cards were made with early color lithography. Unlike with the fine dot patterns of a reprint, the ink patterns in the player image will be irregular, transparent in areas and overall resemble a watercolor painting. There will be splotches of ink here, irregular dots there, large areas of color. It will resemble a watercolor painting. Quite simply, there is no mistaking the original T206 printing and ink for the modern fine dot pattern. Examine a real T206 and you will see for yourself.

Under the microscope, the ink on a real T206 often has a distinct irregular dark rim around the edge of the ink. This typical

irregular dark rim will also appear on much of the black borders and text below the player's picture. As the back of the card usually has a rough texture, there is usually no detectable rim there. It is best to examine the printing on the smooth front.



Real T206 under the microscope: Notice the irregular pattern, thin watery ink consistency and irregular borders to the ink.



Real T206 under the microscope: Notice the irregular dark rim around the dots.

Real T206 under the microscope: The front text letter has the distinct irregular dark rim around the edge. A tell tale sign on a real T206.

Notice the dark edges on the black border line

Off registration of colors

A common problem in the printing of early 1900s color lithograph cards was registration. The printers had a tough time lining up the colors during the printing process, with each color printed from its own printing plate. It is not uncommon for a T206 card to have the colors at the border or edge of the player's body or head to overlap. Sometimes the overlapping is obvious in an online picture.

If the overlapping ink is solid, that is a strong sign that your card is genuine. In a cheap home computer reprint, where someone prints out a digital scan of the card, it will have the tell-tale dot

reproduction of the registration. From afar it may appear like genuine overlapping colors. However, upon close examination you will see the tell-tale multi-color dot pattern.

Overlapping solid ink colors on a real T206

Use a reputable grading company for authentication

Thereare a few reputable trading card grading companies that can authenticate the card-- and most sales will re require such independent grading. However, not all graders are made equal and it is essential to find out who are the good ones.

"Will printing ever become so advanced that a perfect counterfeit could be made?"

A concern I often hear from collectors is that computer and digital printing technology is getting so advanced that some day they will be able to make, for example, a counterfeit T206 Honus Wagner completely indistinguishable from the original.

The answer is no, this is not correct.

Modern digital printing indeed looks better and better and is more and more detailed at the naked eye, holding-the-card-in-your-hand level. However, it looks less and less like the original 1909 T206 lithography at the microscopic level. And it is at the microscopic level that printing is identified and dated and such cards are ultimately authenticated.

The paradox with printing technology and the duplication of old prints is that the more closely it looks like the original at the naked eye level, the less it looks like the original at the microscopic level. Today's computer printers use a fine pattern of tiny dots to reproduce graphics, with the finer the dot pattern the more detailed and realistic the reproduced graphics at the naked eye level. However, this fine dots maze looks very different under the microscope from the original, antiquated T206 printing–and the finer the dot pattern gets, the less it looks like the original printing at the microscopic level.

And printing would only be half of the perfect counterfeit, as the counterfeit would still have to duplicate the original cardstock.

Now, if a forger wanted to make a forgery using original techniques it would be possible-- and, in fact, the antique processes are still used by fine artists--, but it would have to be of a new, fantasy item. This is why a keen eye on new items has to be there. An examination of the paper, printing, evidence of aging and provenance is important.

Questions

Would spectroscopy be useful in authenticating the T206 Honus Wagner? If so how would it be done?

Would carbon dating be a useful test for this card? If it could be done, do you think it would be practically useful for this card or overkill?

27 THERMOLUMINESCENCE TESTING

This chapter is a look at an advanced dating method.

27.1 Overview

Ancient Greek ceramic

Thermoluminescence Testing (TL) is an advanced scientific method used to help date ceramics, clay, lava and some bronzes. It measures the natural accumulation of radiation in the item since it was last fired at high temperature, such as when ceramics were originally made or during a volcano eruption.

Depending on the conditions, it has a margin of error of about 7% to 50%. However, even at the high margin of error, it is useful in determining if a vase or ceramic figure is really ancient or a modern fake.

27.2 The science of thermoluminescence testing

Most natural minerals, such as the quartz and felspar contained in clay and ceramics, have the property of thermoluminescence where they retain energy from natural radioactive decay in and around the mineral. The retained energy is in the form of trapped electrons. The energy increases at a steady rate over time. Raw (unfired) clay in the ground has had an accumulation of this radiation energy from millions of years.

When a high amount of heat– such as when firing clay to make a ceramic bowl, a big fire or a volcanic eruption–, this energy is released from the material as thermoluminescence. Thermoluminescence literally translates to 'heat light', and it is given off in the form of a faint blue light. The more energy accumulated in the material, the brighter the light. This heating that releases all the thermoluminescence sets the material's "thermoluminescence clock" to zero. The material then again slowly accumulates the radiation from that zero point.

ancient lava stone formed at extreme heat

The second heating– the thermoluminescence test done in a laboratory– releases the thermoluminescence that the material

has gained since the first firing, and this thermoluminescence is measured.

Knowing the annual rate of thermoluminescence accumulation for the material, the time since the original heating can be calculated. This means that, with the margin of error, it can be determined how long ago the ceramic was made or the lava was formed by the volcanic eruption.

The simple equation for this is:

Age = accumulated thermolominence / rate of thermoluinensce gain per year

Though this sounds straightforward, there are the mentioned margins of error.

In the ideal situation– such as when the item is taken directly from the site of an archaeological dig or where there is original dirt still affixed to the object– other objects and surrounding dirt and clay can be taken for testing comparison. In these cases, the margin of error is at the low end: say 7-10 percent.

However, some items are tested without any original material for comparison, and this raises the margin of error.

Further, there are environmental and other causes that make the equation's rate of accumulation timeline less than linear, also raising the margin of error. Exposure to heat, light and X-rays (such as at airports or during conservation) can make the line less linear.

In extreme cases, the margin of error can be 50%.

However, even with a margin of error of 50%, that is usually enough to determine if the material is really ancient or modern. The object has usually already been examined and judged by historians and other experts for stylistic, material and other related evidence of age and authenticity, and the thermoluminescence test is the final piece to the authentication

puzzle. Even at the high margin of error range, it determines if the material is “old or new.”

thermoluminescence testing equipment

27.3 Other problems and issues in thermoluminescence dating

There are a number of issues that must be taken into consideration, including attempts by forgers to trick the system.

The test requires that small samples be taken from the item, though they are usually taken from inconspicuous areas and the spots can be neatly restored afterwards.

Some forgeries involve putting together separate pieces. A piece can be made from different ancient parts, or a combination of ancient and modern parts. A common forgery involves putting a modern fake on top of an ancient base from a broken piece. This is problematic, because the testing samples are often taken from the inconspicuous places, such as the bottom.

Some forgeries are modern carvings made out of old material, such as carving a figure out of an ancient Chinese brick. Even though it is a forgery, the thermoluminescence test will say the carving is old, because the material is old.

This is why it is ideal to take samples from different parts of the object, and thermoluminescence testing should be used in conjunction with other tests and examination, including a historian's stylistic analysis and historical knowledge, X-ray/uv/ir examination to identify any restoration or alterations, looking for alterations to patina, and looking for glue or adhesive where parts are affixed.

As discussed in the chapter on spectroscopy, spectroscopy can identify modern added materials, alterations to patina, and has been demonstrated to be useful in identifying items recently reworked from old material.

Tang Dynasty pottery horse

Since the test is destructive, porcelain, should not be thermoluminescence tested except for special reasons. This test is usually only done for porcelain in cases such as court dispute or insurance valuation of a broken piece.

Some have wondered if forgers will try to beat the test by artificially adding thermoluminescence by their own heating. However, experts consider this type of deception far fetched because getting the right "date" would take great technical

expertise and expensive equipment that only advance laboratories have.

27.4 Getting an object thermoluminescence tested

These tests are done in a laboratory with expensive equipment and trained scientists. There are numerous places around the world that do this testing, often universities, but also a number of private institutions. Amongst the most prominent testing sites are:

Oxford Authentication in Oxford England:
http://www.oxfordauthentication.com/

Daybreak Aecaemoetric Lab in Connecticut USA:
http://daybreaknuclear.us/bortolot_daybreak_frameset.html

References:

https://www.artexpertswebsite.com/authentication/materials-dating.php
http://www.antiqueauthentication.com/TL_testing2_eng.html
https://www.brown.edu/Departments/Joukowsky_Institute/courses/greekpast/4929.html

27.5 Questions:

What types of items are thermoluminescence testing used on?
What are some examples of items the test would be useless for?
What are some examples of things that raise the margin of error in the test?
Even when the margin of error is large, in what cases and circumstances is thermoluminescence still useful

28 SOME OTHER SCIENTIFIC METHODS

This chapter gives examples of other scientific methods.

28.1 Overview

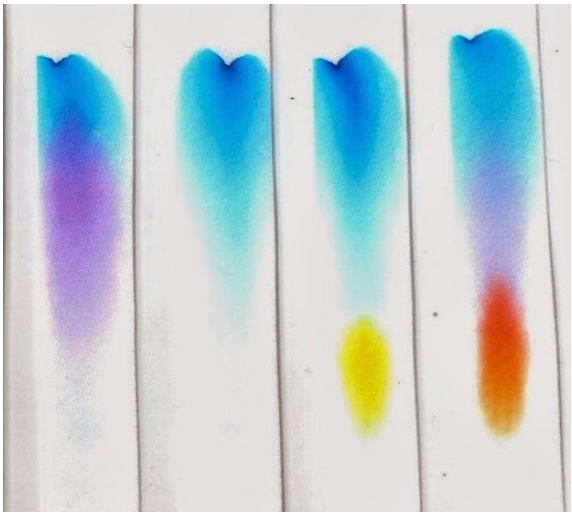
There are hundreds of different scientific methods and tools used in authentication and identification, big to small, cutting edge to age old. The following is just a small sampling to give an idea of the scope.

28.2 Chromatography

Chromatography includes a number methods used to separate the chemicals in a substance. This helps in examining the substance as a whole, and for identifying the individual chemicals. It is used for examining and identifying a wide variety of materials in many fields, including medicine, biology, forensic science and chemistry. In art and artifacts it is regularly used to examine inks, dyes paints and varnishes.

A common version called **paper chromatography** involves putting a sample(s) of the substance (such as ink from a marker) on a strip of chromatography paper, then putting one end of the paper below the sample spot in a solvent such as isopropyl alcohol. As the dissolving liquid slowly climbs the chromatography paper, it separates the chemicals and other components in the substance and spreads them out along the paper in a pattern called a chromotogram.

If the tested substance is ink from a pen, the process will separate the ink into its individual substances, including of different colors. A black ink may separate into colors of blue, brown and purple.



Examples of different chromatograms for different inks, showing the separation of the individual components in the forms of dyes.

Thin layer chromatography is similar to paper chromatography, except it first dissolves the substance (such as ink or paint that has been dried hard) in a dissolving liquid, takes a small bit of that dissolved substance and puts it on the substance such as silica gel, then has another dissolving liquid separate the chemicals and components of the tested substance. It also creates a chromatograph of the separated individual components, usually of different colors.

In both of these types of chromatography, the pattern of the chromatogram is unique to the particular ink. Inks from different brands of pen on a letter may look identical to the naked eye, but chromatography will identify that they are different. Ink samples in questioned document cases (contested wills, forged checks, etc) are often compared this way to see if different inks were used.

Ink chromatograms can be compared to the International Ink Library, a United State Secret Service database containing chromatograms of thousand of inks made since the early 1900. This can identify the exact make and brand used. The individual

components of the inks can also be identified, such as through spectronomy.

In **gas chromatography,** gas (usually helium or hydrogen) is the solvent that separates the chemicals across a microscopic layer of liquid, polymer, or some sort of solid support inside a tubing column. Gas chromatography is done with expensive laboratory equipment.

Gas chromatography is often used to separate the chemicals and components of paint or varnish for the individual chemicals so that they can be identified via mass-spectromy. This is called *gas chromatography-mass spectronomy,* and you will often hear of this term in relationship to the authentication and forgery detection of famous old paintings. **Pyrolysis gas chromatography** (pyrolysis gas chromatography-mass spectrometry) is a specific version that you often will hear of in relation to the examination of paintings.

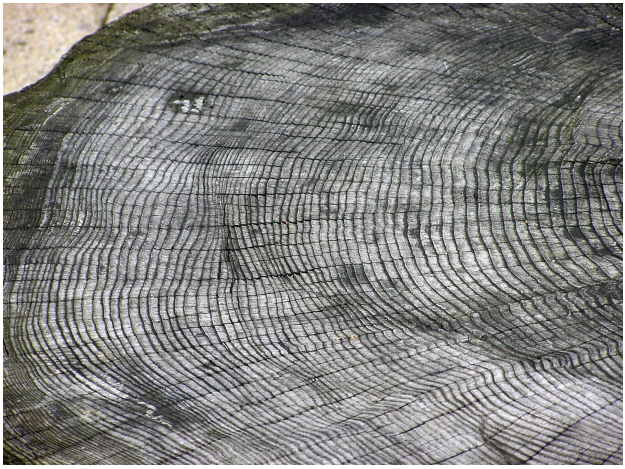
28.3 Solvent testing ink dryness

As handwritten pen ink dries with age, the age of writing on documents can be judged by how dry is the ink. This is done by seeing how long it takes from a small sample of the ink to dissolve in a solvent. If the ink on a old document is not dry enough, it can be determined that it is a forgery or recent addition.

Similar tests can be done with printing inks, paints and varnishes. Oil paints are very slow to dry, and the old time test was the ‘alcohol needle test.’ Alcohol would be rubbed on a small patch of the painting and a needle would be pressed to it. If the needle could not be pressed through, that would be an indication that the paint was at least decades old. However, as described in the section on Han van Meegeren, the forger tricked this test by using hard drying Bakelite plastic in his paint. Similarly, pen ink can be artificially dried.

28.4 Dendrochronology

Dendrochronology is the dating of growth rings in trees. It is used in authentication to date wooden artifacts and works of art, including wood panel paintings, figures, bowls, tools and buildings. Before canvas, paintings were usually painted on panels of wood. By the study of historical environmental conditions--such as fires, heavy rains or drought--, wood be can dated to an exact year.



Growth rings in wood

The margin of error for art and artifact authentication is that items could have been made from older wood. Buildings were sometimes made from reused wood from other buildings, and a carving could be made from an old piece of driftwood found on a beach.

Further reading

Lengthy article from the Cornell University Tree-Ring Laboratory
https://dendro.cornell.edu/articles/kuniholm2000.pdf

28.5 Morellian Analysis

Giovanni Morelli was a 19th century Italian physician who used his anatomist's eye to identify otherwise seemingly trivial, minute and unnoticed habitual stylistic details in paintings in order to identify the artists. The artists themselves were often barely conscious of these habits in how they formed details and made brushstrokes. A forerunner of modern scientific analysis, 'Morellian analysis' is still used in art authentication, and was referenced numerous times by another famous 19th century detective, Sherlock Holmes. Many would call it as much connoisseurship as science, or a combination of the two.

Related techniques are used by autograph and handwriting experts to identify small unconscious habitual details in a person's handwriting, and Morellian analysis can also be done on sketches.

The Morellian analysis has been important for authentication and identifying later made forgeries. It has also been important considering that many Old Masters had students who learned by copying the works of their famous teachers, with the teachers sometimes even signing the copies for resale. The students would give their teacher the paintings as payment. The dates and subjects of these student copies, and often the types of materials and canvas, will match or be very similar to that of the original paintings by the Masters, so Morellian and other stylistic analysis are essential in separating the wheat from the chaff.

28.6 Computer software for analyzing paintings and sketches

Something of an artificial intelligence version of the Morellian analysis, computer scientist have been developing various forms of computer software to identify stylistic patterns in sketches and paintings. Examples of this software have been surprisingly good, if imperfect, at identifying known original versus known fakes of famous artists, including even the abstract art of Jackson Pollock. It has also differentiated between famous artists, such as Picasso versus Matisse, by minute stylistic differences alone.

Another type of computer analysis method creates luminosity histograms of paintings to study the distinct luminosity trends used by artists. Luminosity histograms are statistical analyses of luminosity and are often employed by digital photographers in creating the best lighting and colors for their photos.

Further reading:

https://arstechnica.com/science/2015/02/computer-algorithm-can-accurately-identify-jackson-pollock-paintings/

http://www.artfixdaily.com/news_feed/2015/02/16/2887-computer-algorithm-can-authenticate-jackson-pollock-paintings

http://www3.cs.dartmouth.edu/~rockmore/pnas-rev.pdf

https://www.researchgate.net/publication/311094302_Seeing_double_Leonardo's_Mona_Lisa_twin

28.7 Mohs Scale of Hardness

The Mohs scale of hardness is an age old method used to identify the relative hardness of a material, from copper to glass to alabaster. The scale is based on the ability of a harder substance to scratch a softer. Diamond is able to scratch steel, steel is able to scratch wood, wood is able to scratch chalk.

In the Mohs scale, materials are assigned a level of hardness 1 through 10, with one being the softest material (talc) and 10 being the hardest (diamond). If a material has a Mohs hardness of 5, that would mean it would scratch a material with a hardness of 3. If a stone as advertised as diamond (supposed to have a hardness 10) is scratched by steel (hardness 5), then it clearly is a fake. You've probably seen this diamond test done before in movies.

Along with other tests and observations (color, shine, weight, etc), the Mohs test is often used to identify a material and weed out imposters.

You can buy inexpensive Mohs testing kits on eBay and at Amazon. The kits simply contain nine different minerals with a mohs hardness of 1 through 9.

The American penny has a Mohs hardness of 3

You can also use many items around the house or office for quick reference, including glass, nails and pennies.

The following is a 1 through 10 list of different substances..

1 (softest): talcum, chalk
1.5: tin, lead, graphite
2: gypsum, plaster of Paris
2.5-3: human fingernail, magnesium, gold, silver, aluminum, zinc, Jet (lignite)
3: calcite, US penny, copper, arsenic, antimony, thorium, dentin
4: fluorite, iron, nickel, iron nail
5: apatite, tooth enamel, volcanic glass
5.5-6.5: window glass
6: titanium
7: quartz, steel file, ceramic tile
7.5-9: emerald, hardened steel, tungsten, garnet
8: topaz, cubic very similar
9: ruby
10 (hardest): Diamond

28.8 Fingerprint and DNA analysis

For relevant art and artifacts, some people try to find fingerprints or DNA that match the artist. For example, there may be a fingerprint in the paint of a painting or on the back of the canvas, or there may be a hair on an artifact. Some artifacts are valued because they belonged to a famous person-- a piece of clothing, a sword or even a locket of hair, and DNA and fingerprint analysis can be done to tie the object to the person.. Clearly, known genuine samples and information on the DNA have to be available.

28.9 Some tools

The following are just a few basic tools used in authentication and fake detection.

The **glossmeter** measures the gloss of surfaces, and is useful in documenting and examining objects ranging from prints to paints to vases. Many objects have distinct glosses, and gloss is difficult to perfectly match on a reproduction or forgery. Many forgers don't even think about matching the gloss.

Diamond testers test the heat and electrical conductivities of stones to quickly and easily identify real versus synthetic diamonds.

Manufactured for police departments and the FBI, **forensic light sources** shine a wide range of light (uv, ir, different visible colors) and use filters to find details and qualities hidden under normal light.

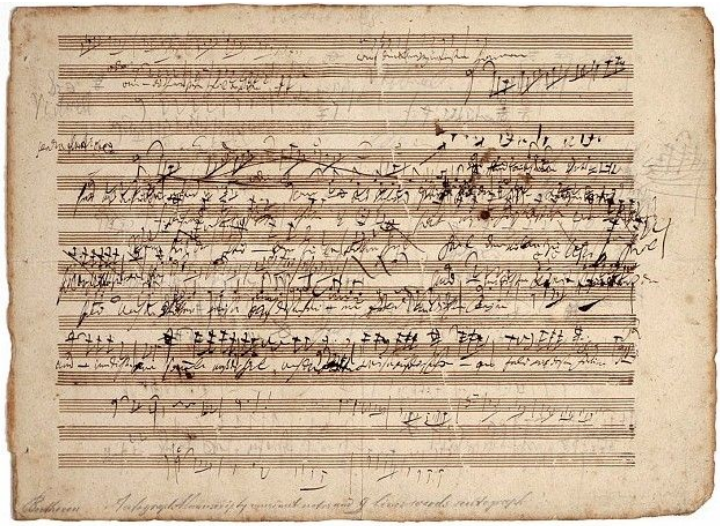
Opacity meters (also known as light meters, transparency meters and clarity meters) measure the opacity (how much light shines through material), which is an essential quality in authenticating many items. Cataloging the opacity of materials and objects is important documentation.

28.10 Question

What are some other tools, tests or methods used to test and identify objects? These can include simple ones you use in your daily life.

29 FOCUS: HANDWRITTEN DOCUMENTS

Handwriting authentication is a combination of materials and process identification, scientific testing, historical and stylistic analysis.



Beethoven handwritten music

Handwritten documents is a major area of study and examination, and ranges from celebrity autographs to important historical documents to court contested wills. Many artworks are hand signed by the artist and verification of the signature is an integral part of authentication of the entire artwork. Even provenance documents for valuable items are examined for authenticity.

While many fakes and forgeries can be identified definitively, handwriting authentication is one of the most problematic areas of authentication. While inks and paper can be examined scientifically, handwriting analysis is a far from an exact science and even the top autograph experts say there is a margin of error and matter of opinion in judging handwriting as authentic.

In part due to the plethora of celebrity autograph forgeries on the market, some autograph experts say that one should approach a potentially valuable autographed assuming that it is fake and must be proven as real-- rather than the other way around.

Celebrity photographs are popularly collected and often forged.

The following are some keys to judging the authenticity of autographs

Determine if the signed item is consistent with the signature being

Is the signed item (paper, book, poster, photo, baseball, other) consistent in age and type with what the signer would sign? If it is on paper, is the paper from the period? If it is a photograph, is the photograph the right age? If you are not a photograph expert, perhaps you should ask one. Does it have signs of aging consistent with the proper age-- such as toning foxing or very similar to with paper?

Many forgeries are given away because the item signed is incongruent if not impossible with a genuine signature. Hitler's Diaries were in part identified as forgeries because the paper and binding material were made from paper too modern.

However, forged handwriting can be on an appropriate item. That the item is period is not proof itself that the autograph is authentic. Forgers often purposely find old paper and other items on which to forge their signatures.

Writing Medium and Ink Analysis

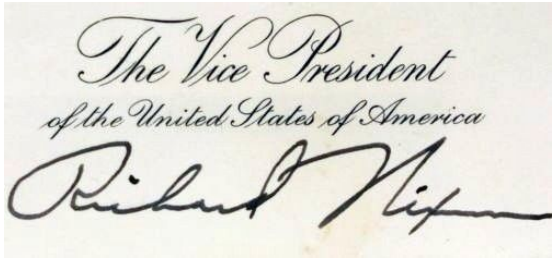
The writing medium and ink must be consistent with signature.

The first question to answer is if it really is a hand signature. Some documents have rubber stamped or printing press signatures. Many official documents are stamped, while many celebrity signatures have signatures that are stamped or lithographed. These were rarely made to deceive, but their identity can be lost over time.

These stamped or ‘pre-printed’ signatures are usually obvious upon inspection. Stamps have a dark rim around the edges where the ink was pushed to the edge. Machine or printing press signatures are solid ink without the flow and changes in density of a real pen signature.

1920s ‘fan photo’ of silent movie actress Bebe Daniel with a pre-printed signature in the photographic image, and with the original mailing envelope from the movie studio.

There are autopen signatures that are signed by a machine holding a pen. These are often used by politicians and celebrities. As these were written in pen and are based on the person's real signature, they can be deceptive. As with the just stamped and pre-printed signatures, these are rarely done to deceive, but are often mistaken for handwritten signatures by celebrity autograph collectors and dealers.



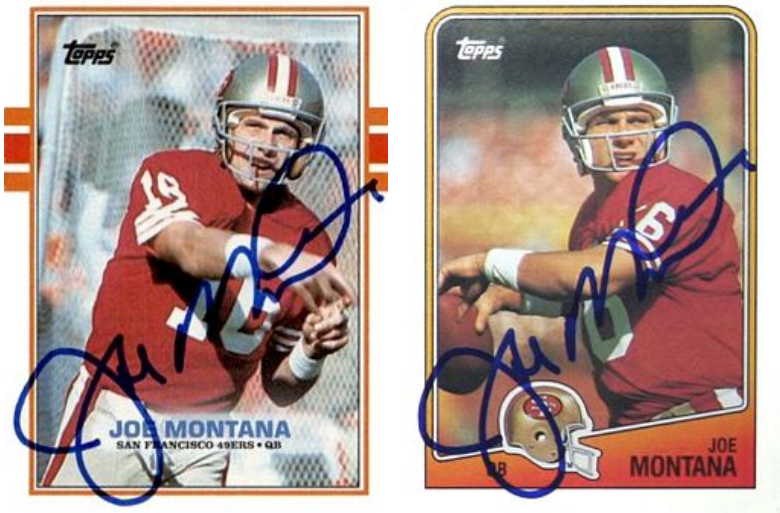
Due to the volume of documents and autograph requestions, politicians such as Richard Nixon often used autopen.

Autopens signatures are usually of the same thickness and pressure throughout, and resemble a signature in black felt tip pen. Many autopen signatures are shaky due to the movement of the

machine. The signatures also often come to an abrupt start and stop, as the machine lifts and lowers the pen straight down and up.

As the autopen is based a previous signature, if you find two exact autographs, they are autopens. Collectors and autograph authenticators keep libraries of known autopens.

A good way to avoid an autopen is to buy a personalized item ("Hi John," "Best wishes, Sally")



American football star Joe Montana autopen signatures that are exactly alike. Also notice how the thickness and pressure are the same throughout.

The next question is if the pen/ink is from the right period. A George Washington document could be signed in quill pen but not ballpoint pen. An Abraham Lincoln pen cannot be in sharpie.

For an older document, the ink should show signs of aging. Long ago applied ink has often seeped into the paper, has fading, visible cracks under the microscopes and there may be signs of aging (foxing, other) that covers over, as opposed to under, the ink. Solvents can be used to identify the dryness of the ink, with ink drying out with age.

Scientific tests can be done on the ink. These can include colorimetry analysis of the ink, UV fluorescence, infrared viewer,

chromatography and spectronomy. In cases the very pen brand can be identified. It can also identify when different pens were used, such as with forged bank check where the amount of money is changed. Identifying that different inks were used is often used as evidence of forgery in court cases.

Analysis of Handwriting

Handwriting analysis uses techniques similar to the Morellian Analysis of paintings and sketches. Along with looking for general qualities such as handwriting slant, size, spacing and general style, the expert looks for minute habits that even the signer is often unaware. Magnified and microscopic examination of the writing can identify direction, pressure and speed of the writing. Natural handwriting is quick and easy, while forgeries are often identified due to the slow, evenly applied nature of the ink.

Autograph experts will accumulate libraries of genuine autograph samples used for comparison.

However, and as already mentioned, handwriting analysis can be an art more than a science. You could call it connoisseurship. There is margin of error and there have been many cases where respected experts have made mistakes.

Forensic handwriting analysis is not always accepted by court judges. A judge has the authority to decide if the handwriting expert is admissible and whether the examiner is a credible witness.

Provenance

Knowing the documented history of the item can be helpful in authentication. Some autographs come with good supporting material-- such as the original date postmarked envelope, proof that it came from the person's estate or at least evidence that is has been around a while and is not a recent concoction. Some autographs have witness evidence of their signing, such as notarized contracts or authentication organizations that are

designed to witness and certify celebrity autographs with the celebrity under contract to sign.

Knowing who are reliable and expert dealers is essential. There are respected autograph experts and dealers, but there are also scam artists whose opinion is not worth the paper the letter of authenticity is printed on.

Further, celebrity autograph experts are often not doing a full scientific examination, but a quick opinion.

Further reading:

The Hitler diaries forgeries, an elaborate hoax that fell apart. Identified as fakes in part due to too modern material, bad signatures, historical inaccuracies in the text, and suspect provenance
http://www.newyorker.com/books/page-turner/diary-of-the-hitler-diary-hoax

The Howard Hughes Autobiography forgery
https://en.wikipedia.org/wiki/Clifford_Irving

The hotly debated Vinland Map has gone through extensive advanced testing by world renowned specialists
http://www.econ.ohio-state.edu/jhm/arch/vinland/vinland.htm
http://www.webexhibits.org/vinland/?
https://en.wikipedia.org/wiki/Vinland_map

Article:"How Self Appointed Experts Rule the Autograph Industry."
http://www.dallasobserver.com/news/how-self-appointed-experts-rule-the-autograph-industry-6432261

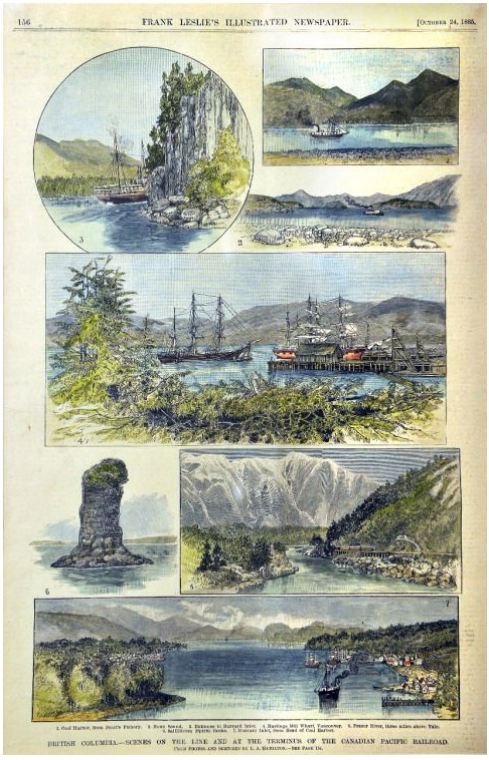
30 ALTERED FORGERIES

This chapter looks at forgeries made via alterations.

30.1 Overview

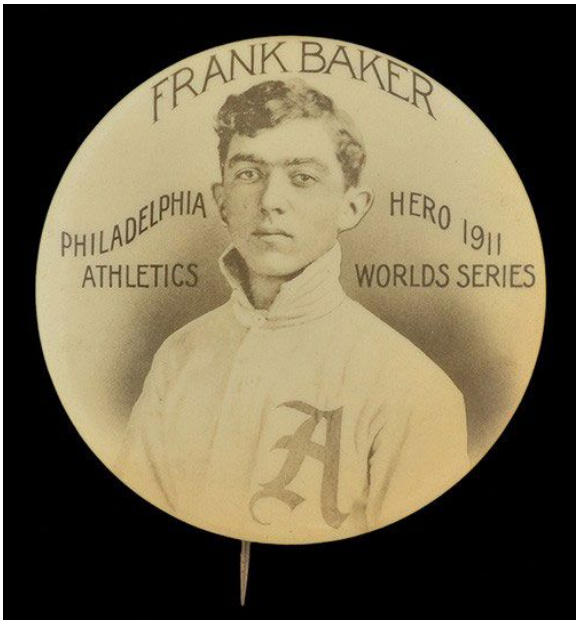
If disclosed, restoration and conservation of objects are often accepted and sometimes even important to preserving a delicate or deteriorating item. However, some items are covertly altered to change their perceived identity and, thus, are forgeries. This includes otherwise genuine items altered to be rare and valuable variations, forged signatures or inscriptions on otherwise authentic period items, and artifacts that are recreations from parts from different sources.

These examples illustrate that authentication requires examining an item from a variety of perspectives. One scientific test can point to the item being authentic and another (or the same test done in another spot) can point to the item being a modern forgery. This also explains why connoisseurs and scientists should work together, as both perspectives are needed. Sometimes it is the scientist who identifies an item as fake because the material tests as the wrong time period, while other times it's the art historian who identifies historical or stylistic incongruities.



With this 19th century print, it would be the art historian who would tell you that not only were the colors added later, but, due to the style, they were added recently. The historian knows that the print was issued in black and white, and the soft pallid colors are a product of modern misconceptions about conservative, Victorian aesthetic sensibilities. Original Victorian hand coloring would have been bold, bright and even gaudy.

The first key for identifying these is the historian or connoisseur who knows what to look for, what are the rarities and fakery to look out for, what items are supposed to look like: form, style, colors, etc. To these people, many recreated items will be stylistically incongruous or have historical errors. Many alterations will be obvious to their experienced eye, and they will know when a variation or unusual item is potentially of high value and should be inspected with extra care.



This 1911 pin was originally a pocket mirror. The back was a mirror and was changed into the pin. Perhaps the mirror glass broke at some point. This transformed item was identified immediately by collectors familiar with the mirror.

Other items require closer examination, including scientific testing.

Cabinet card photographs sometimes have a digital or modern real photo print of a valuable subject pasted to a genuine antique cabinet mount. All parts of the photograph have to be closely examined, because part of it is genuine.

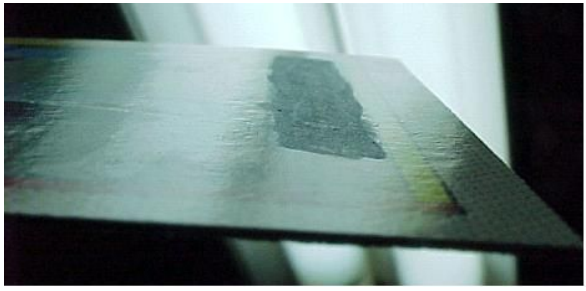
As mentioned in the chapter on thermoluminescence, some fakes have the fake placed on a genuine base, so if the thermoluminescence is done only on the bottom the test will come back as positive. Ideally, multiple samples will be made from different parts.

With trading cards, I have seen fake fronts put on genuine backs and fake backs put on genuine fronts. The authenticator has to examine all sides, not just one.

Broken authentic ancient American Indian artifacts are sometimes remade into fake whole artifacts. These are identified as fakes by stylistic analysis and by examining the patina and wear. The patina will be missing where the new carving was done. Ultraviolet light, spectroscopy, stereomicroscopy and naked eye examination are used to examine patina. Further, the original edges will be worn and dulled by age and exposure to the elements, while newly carved edges are sharp and clean.

Ancient figures are sometimes broken apart and reattached to make more desirable forms, and sometimes have parts attached from other objects. These are identified by the stylistic analysis and scientific tests. Ultraviolet and infrared can identify surface areas of restoration, X-rays can identify the inner damage. Spectroscopy and ultraviolet fluorescence can identify fake patina. Experts also look for adhesives where the parts are attached.

Alterations to prints are often easily visible to the naked eye. The tone of the altered area may be noticeably different. It may have a different texture and gloss, and the added material might be noticeable when the print is held up to a bright light. Black light is good for identifying the added paint, glue or paper that make up the alteration, as the foreign material will usually fluoresce differently than the rest of the item.



The alteration in the form of added paint on this print is obvious when viewed at a sharp angle to the desk lamp. The paint has a different gloss and texture.

Forged artists signatures or stamps are sometimes added to paintings, photos or prints. These can be identified as fake by

examining the overall item (the assigned artist may clearly not match the artwork, or it may be known that the artist did not sign that item), provenance, stylistic analysis of the handwriting, scientific examination of the paint or ink. Blacklight is excellent at identifying forged signatures on paintings, as the later added paint will often fluoresce distinctly different from the rest of the paint. Testing the dryness will often identify the added ink or paint of the signature to be recent.

Someone placed faked stamps and signatures of a famous early 1900s photographer on otherwise genuine photos. The problem is the forger was unfamiliar with photography and placed the 'vintage' stamps and signatures on photos that were genuine but too modern to be made by the photograph. When this forgery was discovered and the unique fake stamp design identified, all the fake photographs with that were easily identified.

30.2 Faked signs of usage

While many items are valued highest when in pristine condition, some items are valued in part for being used: a sword used in a battle, a tool used by prehistoric humans, a garment that was worn by a movie star in a famous movie. This means that both the item and the wear has to be authenticated.

Usage is authenticated by various methods. This first is identifying that the item itself is genuine. A sword used in a battle has to be the correct type and age, perhaps have relevant provenance. A garment used in a 1950 movie has to be from 1950, have the correct studio taggings, be the correct size for the actor. Items can sometimes be photo-matched, meaning there is a photo showing the exact item being used, or at least the same style of items.

Further, the wear is examined to be genuine and consistent with use. With ancient artifacts, old wear is differentiated from new by examining the patina. If the wear, such as a broken off piece or nick has the same old petunia as the rest of the item it is

old. If the wear is missing the patina, the usage is new. Blacklight is particularly useful in examining patina.

Game used sports equipment is a prime example of this area. Baseball bats, American football helmets, jerseys and caps worn in games by famous players in games are highly prized, with a jersey or baseball bat used by a legendary player such as Babe Ruth or Ty Cobb selling for upwards of hundreds of thousands of dollars a piece. The authentication experts must not only determine that the item was of the type the player would have used by examining size, tags, brand's, provenance, material, referring to records and old photos, but they must judge if the wear is consistent with genuine use. For forgeries, not only are tags, numbers and nameplates altered, but usage will be forged. A forger may dirty a jersey or go into the back yard and hit baseball with the baseball bat.

Forgers will often try to hide their handiwork by coating the item in a substance, such as resin or fake patina. Advanced scientific examination can identify a false patina, but simple knowledge of what is the normal gloss and feel is helpful. Again, blacklight is useful in identifying added gloss. A collector didn't notice the actual altered text of a trading card, but noticed the card had a distinctly different gloss than his other cards from the same set. Closer examination by an expert revealed the alteration and the addition of resin to try and hide the alteration.

This also explains why items should be examined when removed from any holder sleeve or glass. The holders or glass of a framed piece can alterations and damage.

Beyond forgery, alteration is often done to change the condition and do restoration. This is legal if mentioned at sale, but illegal if not disclosed. Because condition is an important part of financial value, much examination is done to identify this type of restoration.

30.3 Questions:

What are some ways to identify alterations and altered forgeries?

How can an artwork or artifact pass a specific scientific test, yet still be a forgery? What does the examiner do to counteract this and identify the item as a forgery?

31 PROVENANCE

This chapter looks at the 'paper trail' history of items.

1948 London Olympics middle distance runner Herbert Barten race worn number autographed by 45 Olympic team members, with Barten signed LOA and original photo of him wearing the number. (Courtesy of Michael Bowlby)

31.1 Overview

Provenance most often refers to the history of ownership of an item, and is documented by sales receipts, letters from owners and similar records. In the case of some famous paintings, the ownership can be traced back for centuries to the original owner.

In a broader sense, provenance includes other documentation of an item's history and identity. If a piece of memorabilia appears in an old auction catalog, is pictured or described in a magazine article or is documented as having been shown in a public exhibit,

that is documentation of its history. If you find a Getty photo showing an athlete player wearing the exact same jersey you bought at auction, that is a document of its history.

Letters of authenticity are considered by some to be a part of provenance. At the least, they are part of the paper trail and document its existence at the time of examination.

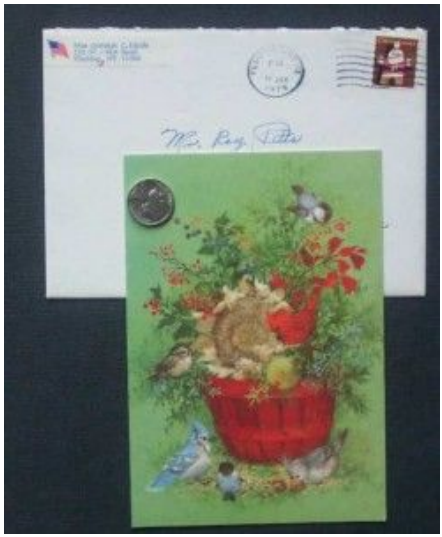
Sometimes excellent documentation of provenance already exists, while other times it needs to be researched.

31.2 Provenance can help establish age, identity and support authenticity

While provenance does not in and of itself prove authenticity, it can be useful evidence towards identifying and authenticating an item.

Clearly, a letter of provenance from a celebrity's estate or assistant helps establish the authenticity of an item having belonged to him or her. The auction catalog or sales receipt from a sale by a reputable auction house both establishes the sales history and documents that a reputable source thought it authentic.

Even simple documentation showing that an item has been around for years, such as an old newspaper clipping, rules it out as a recently made fake. In these days of recent and future forgeries, this in and of itself is one of the most important keys to provenance. It also shows why, with possible new methods of forgery and the potential for fakes to flood the market, it is important to document art and artifacts you have right now.



First woman to swim the English Channel Gertrude Ederle signed Christmas card with the original postally dated mailing envelope with her return address and forward address to famous autograph old time collector Roy Pitts. Not only does the envelope help authenticate the card and signature, but it displays well.

Provenance can help identify important facts. If research shows a photograph came from Humphrey Bogart's estate, this will help identify the photo as belonging to Bogart. The famous actor ownership is part of the photo's identity and value. Heck, a coffee cup documented as having belonged to Bogart will sell for a money on eBay.

If a photograph came from the files of the magazine a famous photographer worked for, that is evidence that the photo could be by the photographer.

Provenance is not infallible, is limited in what it says, and authentication requires looking at both the item itself and the provenance, not *just* the provenance. That a baseball bat came from baseball great Lou Gehrig's estate does not itself prove that it was used by him in a game. That a movie poster belonged to Alfred Hitchcock doesn't prove that the poster is original. Hitchcock could have own reprints just as anyone can.

Sometimes a famous person's letter of authenticity for a personal item gets details wrong. Memories can be fuzzy when recollecting the past and people can misidentify items, forget dates and places.

Provenance can be forged, and that is often revealed when examining the item. For every forged Beatles or Elvis Presley autograph on eBay, there is a made up story of how it was originally obtained. It is a running joke amongst vintage baseball card collectors how many modern computer counterfeits on eBay were "found in my grandmother's cabinet."

The reputation and expertise of the person who wrote the letter of authenticity is important. Not all LOAs are equal.

Again, authentication involves looking at all aspects of the item, not just a LOA or the seller's interesting story. In some cases the provenance itself must be authenticated, either through expert handwriting analysis or by online research to make sure the timeline matches up.

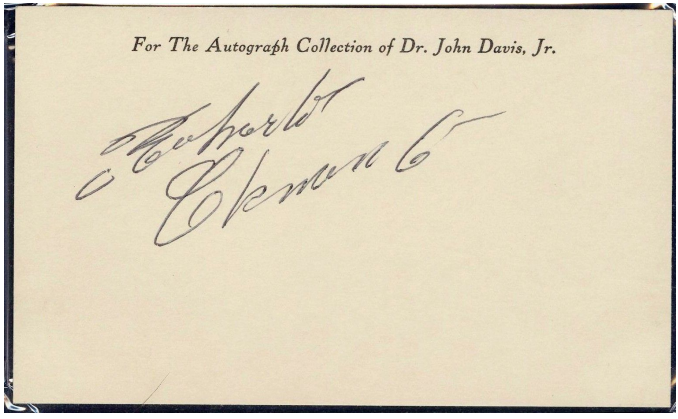
31.3 Good provenance enhances value

Solid documentation of history, a letter of authenticity from a team or estate, a sales receipt from a well known gallery, dealer or auction house will make future buyers more confident in the item and willing to spend more. Even when authenticity is not the issue, documentation proving ownership by someone famous or otherwise noted, having been exhibited at a gallery or museum, or appearing in a magazine or newspaper article will also add to the desirability. Buyers like that stuff.

Collectors will pay more for a 1985 New York Yankees team photo that hung at Yankee Stadium, as opposed to one that belonged to Joe Schmoe. Some collectors find the history of an item interesting in and of itself and will pay more where more details are known. Beyond helping authenticate a battle worn helmet, a photo showing a soldier wearing the same helmet is great for display.

A collector can help create her own good provenance by buying from reputable sellers. If you purchase an autograph or rare piece of memorabilia from a well known and respected seller, when you turn to sell you can show it was purchased from a well known and respected seller. Many game used sports uniform and equipment collectors go through photos and film, trying to find photo matches of their equipment. Many collectors and dealers say a photo match is more valuable than a letter of authenticity.

Respected autograph expert Jim Stinson says, "Always keep the bill of sale. As a long time buyer of vintage autographs I never ask to see a 'letter of opinion.' But I will often ask to see a bill of sale. Not to see what the item sold for but to track provenance. Even in cases where the seller is long ago deceased. A bill of sale from a reputable dealer is a solid resource."



Roberto Clemente autographed index card with the stamp of famed old time autograph collector Dr. John Davis Jr. Davis got his personalized index cards signed in person or through the mail.

31.4 Provenance can identify fakes, forgeries and alterations

In instances, the documented past of an item has shown that items in auctions are fake or altered. The following are just a few examples:

A major auction house auctioned a 'genuine 1920s Cleveland Indians Pro Model hat.' Looking at the auction catalog a collector

recognized the hat, because he had once owned it. He had bought it as part of a complete uniform, glove and bat from the estate of a small town player whose baseball team wore caps identical in style to the Indians. This provenance showed that the auction description was false. It was a nice vintage cap, just not a Cleveland Indians cap.

An auction house auctioned a rare and valuable 1800s century cabinet card photograph of a famous person. A collector recognized the cabinet card from a previous sale, and the previous sale's photos showed that, since that sale, the cabinet card had been extensively restored. The problem was the auction house made no mention of the restoration.

An online dealer auctioned several rare early 1900s lithographs. An earlier auction catalog showed that they had recently been cut from a large uncut sheet. The dealer made no mention of the recent alterations.

"Authentic autographs have a history or source … forgeries do not," Stinson states. "They just 'appear'."

Researching the history does not always find bad news. A collector bought a bronze medal that was advertised as having been owned by baseball great Jackie Robinson. The embossed text on the medal showed it came from an obscure small town Wisconsin medical organization, and the diligent collector wrote to the organization. After checking their files, the organization wrote back that not only did they have record that the medal was given to Robinson after he gave a speech to the group, but their letter included a photo showing Robinson receiving that very medal. This provenance not only proved the medal authentic but probably doubled or more the value.

31.5 Stolen items

In the high end art world, a legitimate concern is the sale of stolen art. This is a worry because there is much Nazi looted art around and because valuable art has been stolen from museums, galleries and homes. Some European countries require provenance

documentation before a high end artwork can even be sold, and many buyers want ownership history to establish that an item isn't stolen.

Stolen items are not only part of the European art world. Important memorabilia, autographs and photographs sold by major auction houses have turned out later been stolen from museums and libraries.

Realize that if you buy a stolen item, you don't own it. The sale wasn't legal and you may have to return it. The very least you want to do is to get a sales receipt at purchase so you can get your money back from that seller. The receipt is for your protection, and if you lose it or never got one you may be out of luck if the item turns out to be stolen.

To protect their history, some countries have passed laws to prevent the export of certain artifacts, usually antiquities. Egypt passed a law in 1983 and China passed a similar law in 2009. Certain classes of items exported past the respective country's date are considered stolen and the seller could get into legal trouble. However, if the artifact owner has documentation showing the item was obtained before the date, it is legal to own and sell. China also places red stickers on old items that are legal for export. The sticker doesn't authenticate the item, but demonstrates that the item is legal to own and resell.

On PBS's Antiques Roadshow, someone brought in a valuable ancient Egyptian figure. A sticker on the bottom showed that not only had it once been purchased from a well known and respected old time dealer of Egyptian antiquities, but that it was purchased before 1983 and was legal to own and resell. Good news for the guy who brought it to the show.

There will someday be a situation where a potential buyer wants proof that you own an item, or even accuses you of selling stolen items. You'll be glad if you kept your receipt.

31.6 Questions

How does provenance help in authentication?

How can an object's provenance help identify it as a fake?
What are some limits to provenance?
Why should authentic items be documented right now?
Are all letter of authenticity equal in worth? How do you determine if a letter writer is a worthy expert?
Does provenance in and of itself prove authenticity?

32 FINAL NOTES

32.1 Authentication as Judgment

Authentication is a matter of making a final judgment. It really is less "authentication" than "making a judgment about the authenticity." The judgment takes into consideration all the information and evidence, along with the expert's knowledge and experience.

In many cases an item is easily identified as authentic or as fake. In some cases, there will be uncertainties (large to small, important to minor), margins of error and unknown information.

An item can be identified as original even if some information is missing, including the exact date. A photograph can be identified as original, even when the photographer is unknown or the exact date it was made is unknown. Paintings are often known to be original, but the exact date is unknown. Photographs are often dated as, for examples, "circa 1880," "1860s-70s" or "early 1900s." Paintings in museums are often labeled as being from a period, say 1770-5.

As more information and studies are done over time, the description and label of the item may change. This is a normal part of academic study, though some lay people want and expect instant and exact answers.

The margin of error and uncertainty in identification and authentication must be expressed by the expert. If the expert is not sure, this must be expressed. This says that identifying and expressing the margin of error, the uncertainties and the limits of knowledge take expertise and good judgment. In science,

identifying and expressing the margin of error is considered an integral part of the science. It is the beginner who is 100% certain in his opinions and expects others to be 100% sure.

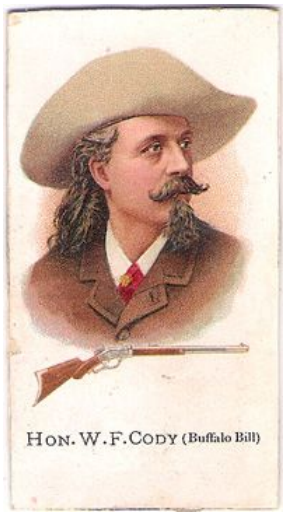
32.2 The limitations of science

Scientific tests have margins of error and each test tests just one thing: one quality, one part or layer of the item.

For example, not only do carbon dating and thermoluminescence have margins of error, but, even if they had no margin of error, they determine only the age of the material tested. They don't identify what is the item (a figure, a tool, a work of art), what it was used for, who was the artist or maker. Further, some forgeries are made from old material or assembled from separate parts Not only are other scientistic tests needed, but so is connoisseurship, historical knowledge and good old fashioned logical analysis of all the information and possibilities.

While science often identifies fakes, it cannot in and of itself authenticate items. With an advertised '1600s Rembrandt," if science identifies it as being as made out of 1900s material, this clearly identifies it as fake. However, if science shows that the material is from the correct period, and even correct geography, that does not prove it was painted by Rembrandt. Connesoeurthsip and other non-scientific information is needed to attribute it to Rembrandt.

Spectroscopy often identifies fakes as the item has chemicals or materials of the wrong time or place. However, if spectroscopy shows that the paint on a painting has the chemicals and substances commonly used by painters of the time, that does not prove one hundred percent that the paint and painting are of the correct type and age. It shows, if sometimes with very strong evidence, that the paint is consistent with the item being authentic and of the correct age. However, it must be supplemented with other scientific tests, historical and stylistic analysis.



Is this a genuine 1880s tobacco card? Printing and paper analysis would say it is from the 1880s (because it is). However, a knowledgeable tobacco card collector will inform you that it is not a trading card, but was cut from an 1880s advertising poster. The tobacco advertising poster pictured images of the cards one could pull from the packs of cigarettes. The collector identifies it as a cut out because the borders are rough cut, it is missing text that would appear on the real card, and the back is blank. This illustrates that science, even definitive and correct dating of the paper and ink, is not enough to identify and authenticate the item. Outside knowledge, including that of an average collector, is essential.

32.3 Cataloging physical qualities and inventing new identification tests should be a neverending process

Cataloging of the physical and other qualities of art and artifacts qualities should be a continual project. This can include advanced testing such as spectronomy, but also documentation of basic qualities of color, gloss, weight and thickness. Even such elementary qualities documentation is invaluable in authentication and fake detection. A number of simple tests used together can be as good as one big test.

Forgers will try to mimic a known quality but this will invariably change another quality. For example, if a forger tries to

match the original gloss (a difficult task in and of itself), this will likely change the ultraviolet fluorescence. This explains why having many qualities to check, and many different scientific tests, are invaluable. A forger having to have his creation match 20 qualities and pass 10 tests (each changing the result of another test) is a hard task-- especially when she doesn't know all of them and is trying to make the item look real to the naked eye.

Many areas have not yet had advanced testing cataloging, including spectroscopy analysis. Spectroscopy is expensive, but invaluable in the prevention of future authentication, and it should be done in more areas.

For many potential tests on an object, there will be less than definitive results. Perhaps there won't be consistency in gloss for a type of object, or there will be but with some extreme exceptions. Finding out the limits and margins of error of a test is important. Finding out that a scientific test is useless on a particular item is important to know.

Many of these tests-- such as cataloging weight or width-- do not require advanced scientific knowledge, but due diligence and care.

Having different tests is important for judging the accuracy of each test. If different tests on an object point to the same conclusion, that is good. If they conflict, that means there is an issue. Scientific tests have shown the errors of connoisseurship, and doing tests of known fakes is a great way to test the tests. Different tests work as double checks and quality control.

Examiners should always be thinking ahead. Knowing current and past forgeries and forgery techniques are important, but the expert should be anticipating and thinking about possible future forgery attempts and techniques.

This all means that authentication is a continual process. With time, new tests are created and honed, dates will be narrowed, errors big and small discovered.

As science advances, more current fakes will be scientifically identified. Fakes that fool people today will be identified

tomorrow. This gives new meaning the term ‘lifetime guarantee of authenticity.’

32.4 The Human Element

As all the information is analyzed, balanced and considered by a human, and the final judgment is a human judgment, there always is the human element.

Examiners must be aware of their biases and the limits of their knowledge. Common sense and good judgment are essential, and you will be amazed at the lack of it by some people.

There will always be mysteries and the unknowable, and people must accept this. Problems arise with people who psychologically need answers and hastily jump to conclusions.

32.5 Forces that can corrupt authentication

There are a variety of social, cultural and psychological forces that corrupt the authentication process.

In the old days, things were more academic and open, with regular discussions and debates about the identity and authenticity of artworks. However, as objects have become more financially valuable, some owners, sellers and others with dollar signs in their eyes have often tried to stifle this discussion.

While many owners and dealers welcome corrections, others only want to hear good things about their items. Even when correct, some experts are reticent about expressing their opinions for fear of lawsuit. The authentication boards of the Andy Warhol and Roy Lichtenstein Foundations disbanded for fear of lawsuits. The Warhol Foundation was sued by a disgruntled collector. Even though the Foundation won the lawsuit, it owed millions in dollars in legal fees.

Even when explicitly saying they are giving opinions, some authentication companies are sometimes loathe to admit or even correct mistakes. Though this is as much of their own fault as

anyone else's, as they advertise their authentication process and feel admitting mistakes is bad public relations.

Many buyers do not look at a letter of authenticity as an opinion, but as a form of insurance or piece of paper to facilitate sale. As an eBay authentication expert said about autographs on eBay: “It doesn't matter if it's authentic. It just matters that it’s been ‘authenticated.’”

Trying to protect the value of something they own or to sell a scam item, the dishonest will often cherry pick information and tests that support the verdict that they want. Some no doubt will even use that there is a margin of error in scientific tests as evidence that their item is real.

Some items have significant cultural value (religious icon, national treasure, political or historical artifact) that can similarly blind people and cause push against truth finding. As you might imagine, the debates about the age of the Shroud of Turin involved more than science.

The popular press often writes about authenticity issues, with journalists often giving equal weight to good and bad opinions, and readers who have no expertise but have firm opinions.

33 BOOK ENCOMPASSING QUESTIONS

The following questions judge your comprehension of the book, and includes questions already asked.

What is the difference between a fake and a forgery?

Is an authentication expert able to identify and authenticate everything?

When something is authentic, what does that mean?

What are a few examples of aging signs?

Can signs of aging be faked?

How can an item with forged aging sings be identified as a modern fake?

What is the practical advantage of the stereomicroscope?

What is the practical advantage of the scanning electron microscope (SEM)?

What is the practical advantage of the polarizing microscope?

What is the purpose of using spectroscopy on a work of art or an artifact?

How can an artifact pass a radiometric or thermoluminescent dating test and still be a modern made forgery?

What types of items are thermoluminescence testing used on?

From online research explain what is vegetable ivory and how it is identified.

How does process identification help in authentication and fake detection?

What does the colorimeter measure?

Name two ways ultraviolet light fluorescence is used in examination of art and artifacts

Can infrared viewers help in reading badly faded writing?

What does radiometric dating identify?

What are some limits in radiometric dating?

Give an example of a forgery by alteration.

What is provenance? How can it help in authentication? What are its limits?

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