

History of Photographic Technologies

By Dan Hyde



Camera equipment for wet-plate collodion photography (1851) – George Eastman Museum

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Photography is one of the visual arts with roots in drawing and painting.

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Etching Technology of 1700s

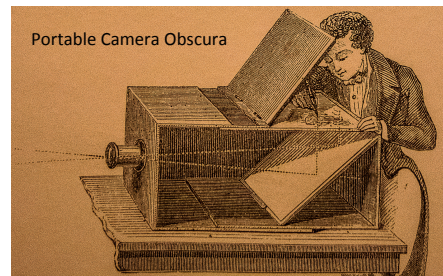
Etching by Albrecht Dürer
The Cannon, 8" x 13", 1518

- Etching is a method of making prints. Well established by 1500s.
- Start with a **copper plate**. Place on acid-resistant ground (used **bitumen**, a natural asphalt).
- With a sharp tool (pointed etching needle), the design is scratched into the ground exposing the copper.
- Use a strong acid to etch the plate which eats away the areas of the plated unprotected by the ground, forming a pattern of recessed lines.
- The remaining ground is cleaned off. The plate is inked all over, and then the ink wiped off the surface, leaving only the ink in the etched lines.
- These lines hold the ink, and when the plate is applied to moist paper, the design transfers to the paper making a finished print.

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Portable Camera Obscura

- **Aristotle** in 4th century BC knew the principles of **Camera Obscura** - light through a **pinhole** in a dark room forms an inverted image of outside scene on a surface.
- By 16th century **lenses** had replaced the **pinhole** creating a brighter and more focused image. A mirror was added to reverse the image.
- In 17th century the **Camera Obscura** was combined with a tent and made portable.
- During 18th century artists and draftsmen regularly used the instrument to trace or sketch the projected image on paper.
- A key element for photography had evolved but needed a way to capture image.

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- For photography one needs a substance sensitive to light. Effects of light on object such as tanning skin were well known. Alchemists had identified many substances sensitive to light such as **salts of silver**.
- In the decade before 1800, several researchers created photos but they all faded over time. One needs a way to fix the process and stop the image from fading.
- Above image "View from the window at Le Gras" taken by French inventor **Joseph Nicéphore Niépce** in 1826 is oldest surviving photograph. He used techniques and materials, e.g., **copper plates** and **bitumen**, from mature **etching** technology to produce his first photos. The exposure time for the above photo is estimated to be several days!

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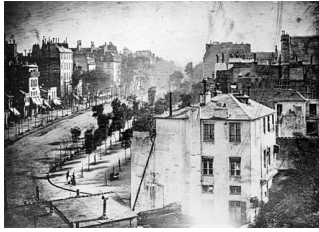


- In spring 1834 Englishman **William Henry Fox Talbot** employing silver compounds on paper found a 'fixer,' a way to stabilize the image. He produced durable silver chloride camera **negatives** on paper and conceived the two-step **negative-positive** procedure used in most non-digital photography up to the present.
- Image of 'Byronia dioca-The English Wild Vine' (c. 1839) by Talbot using his process.
- But Talbot didn't make his discovery public!

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Daguerreotype 1838

- In 1829, **Joseph Nicéphore Niépce** entered in partnership with Parisian showman **Louis Daguerre**, who was trying to devise a method for taking photographs but without success. Unfortunately, Niépce died in 1833 but Daguerre continued the effort to create the **Daguerreotype**.
- In 1838, Daguerre made a breakthrough when he discovered that **iodized silver plates** could be developed using mercury producing **direct positives**. Being a showman, he exhibited the Daguerreotype process and tried to sell it with no success. Above is first photo with a person – taken by Daguerre, 1838.
- On August 19, 1839, now known as **World Photography Day**, the Académie des Sciences announced Daguerre's invention and that the French government purchased the right to it for the world! This allowed anyone to use the process!

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THE DAGUERRETYPE PROCESS

Ag – Silver
Au – Gold
Cu – Copper
I – Iodine
Hg – Mercury

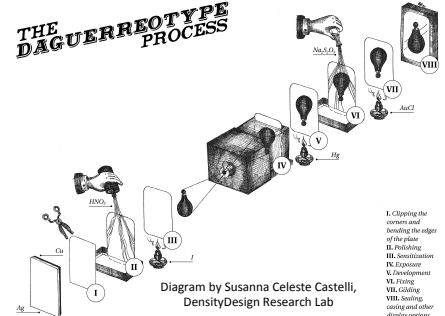


Diagram by Susanna Celeste Castelli, DensityDesign Research Lab

I. Clipping the corners and bending the edge of the plate
II. Polishing
III. Sensitization
IV. Exposure
V. Development
VI. Fixing
VII. Cleaning
VIII. Printing using red and other dyes or cyanine

- Daguerreotype** was the first commercially successful method of photography. It was used from 1839 until other better methods eclipsed it around 1855.
- While **Daguerreotype** images were quite stunning, the process was complicated, requiring the practitioner to possess not only a working knowledge of chemistry but the sensibility of an artist. Initially, needed 15 minutes exposure time.
- The image needed to be exposed within a very short time of sensitization and required a darkroom on site, whether in the studio or on location.
- Process produced a one-of-a-kind positive image but image was reversed.



Calotype 1844

- In late 1840, **Henry Fox Talbot** improved his technique that used durable silver chloride camera **negatives** on paper. This time he told the world!
- His **calotype** process patented in 1841 provided the first really practical **negative-positive** photography. Practitioner could now make a **negative** and print many copies of a **positive**. This **calotype** image "The Haystack" is by Talbot in 1844.
- Commercially important for enterprising photographers who could now take a shot of famous landmarks such as the pyramids and sell many copies.

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Cartes-de-visite of Napoleon III 1859
2.5" by 4"
1854-1873



Cabinet card 4.25" by 6.5" 1866-1914



Stereoview 3.5" by 7" 1860-1920

- With the introduction the **negative-positive** approach to photography, advances were needed in enlarging the **negative's** image and printing the **positive**.
- In the later half of 19th century, the most common type of printing the **positive** was the **Albumen print**. They are a variety of photographic paper print in which a finely divided silver and gold image is dispersed in a matrix of **egg white**.
- In 1850, **Louis Désiré Blanquart-Evrard**, greatly improved the **Albumen printing** process and brought it to its most useful and historically important form. By 1855 it was the dominant printing process. Better printing processes appear in 1895.
- Popular **Albumen** formats were **cartes-de-visite**, **cabinet cards**, and **stereoviews**.

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Wet-Plate Collodion Process

- In 1848 **Frederick Scott Archer**, dissatisfied with the resolution of Talbot's **calotype**, began experimenting using glass as the support for light-sensitized materials. In 1851 he describes his **wet-plate collodion process** in an article.
- Collodion** is a clear, sticky compound that was used in field of medicine as a bandage adhesive.
- His process is wet, messy, and time sensitive requiring a darkroom on location but produced a glass-plate **negative** better than **calotype's** paper **negative**.
- The collodion process had other advantages. It was a relatively inexpensive process. The polishing equipment and fuming equipment needed for the **Daguerreotype** could be dispensed with entirely. The support for the images was glass, which was far less expensive than silver-plated copper, and was more durable than **calotype's** paper negatives. It was also fast for the time, requiring only seconds for exposure.
- By the end of 1850s, the wet-plate collodion process replaced **Daguerreotypes**.
- The collodion process was used for making glass **negatives** but also **ambrotypes** (next slide) and **tintypes** (two slides away).

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Ambrotype-Whaling ship in Honolulu Harbor, 1857

- The **Ambrotype** process was patented by an American photographer, **James Ambrose Cutting** in 1854. It's a variant of the **wet-plate collodion process**. One side of a clean glass plate was coated with a thin layer of iodized **collodion**, then dipped in a silver nitrate solution. The plate was exposed in the camera while still wet. Exposure times varied from five to sixty seconds. The plate was then developed and fixed. The resulting **negative**, when viewed by reflected light against a black background, appears to be a positive image. This effect was facilitated by backing the plate with black velvet or by coating one side of the plate with black varnish. To protect the fragile emulsion side a second piece of glass was put over it and the whole mounted in a metal frame and kept in a protective case.

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Tintype

- A **tintype** is a photograph made by creating a negative on a thin sheet of blackened, lacquered iron using a variant of the **wet-plate collodion process**. Like the **Ambrotype**, the resulting negative, when viewed by reflected light against the black background, appears to be a positive image.
- **Tintypes** were sturdy and did not require mounting in a protective hard case like **ambrotypes** and **daguerreotypes**. Since the iron support was resilient and did not need drying, a **tintype** could be developed and fixed and handed to the customer only a few minutes after the picture had been taken. Great for fairs and carnivals.
- **Tintypes** enjoyed their widest use during the 1860s and 1870s.

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Dry Plate Process

- In 1871, **Dr. Richard L. Maddox** invented the **dry plate process**, also known as the **gelatin process**. In **dry plate** a glass plate is coated with a gelatin emulsion of silver bromide. It can be stored until exposure, and after exposure it can be brought back to a darkroom for development at the photographer's leisure. These qualities were great advantages over the **wet-plate collodion process**, in which the plate had to be prepared just before exposure and developed immediately after.
- By 1879 the **dry plate process** was used by so many photographers that the first **dry plate** factory had been established. Instead of creating their own **dry plates**, photographers could now buy them ready made.
- George Eastman developed a machine to coat plates in 1879 and opened the Eastman Film and Dry Plate Company reducing the cost of photography.

✱

- Great video on different chemical processes used in photography during 1800s. <https://www.britannica.com/technology/technology-of-photography>

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Kodak Camera 1888

- In 1888, **George Eastman** introduced the **Kodak box camera**, the first easy-to-use camera, with the slogan, "You press the button, we do the rest."
- The **Kodak** for \$25 was loaded with a roll of film that could take 100 pictures. After the person shot their pictures, they returned the camera with \$10 and they received their negatives, prints, and their camera with new film loaded.
- George Eastman was a genius at marketing.
- In 1889, the first commercially available **transparent celluloid roll film** is introduced by the **Eastman Company**, later renamed the **Eastman Kodak Company** and commonly known as **Kodak**.

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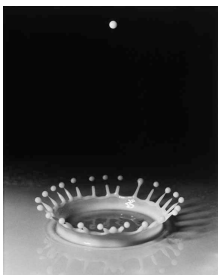
Autochrome 1903

- The **Autochrome** is the first commercially successful color photography process patented in 1903 by the **Auguste and Louis Lumière** in France and first marketed in 1907. It used tiny, dyed grains of potato starch to create a color image on glass. It was the principal color photography process in use until the mid-1930s when Kodak and Agfa began to produce multi-layer subtractive color films (**Kodachrome** and **Agfacolor Neu** respectively).
- Because of the cost, wide spread use of color photography had to wait until 1950s.

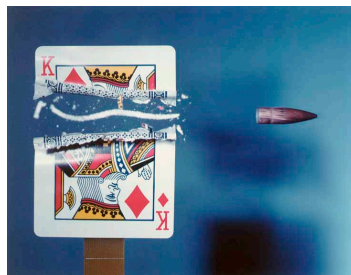
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Milk Drop Coronet - 1936



Bullet rips a playing card

- In 1927, MIT's **Harold Edgerton** invents **xenon flash lamp** for strobe photography.
- Used in built-in camera flashes, Speedlites, and studio strobes today.
- One of Edgerton's milk-drop photographs, titled "Coronet," was included in the Museum of Modern Art's **first** photography exhibition in 1937.
- In 1940, MGM invited Edgerton to make a stroboscopic high-speed motion picture with comedian Pete Smith. The ten-minute short, *Quicker 'n a Wink*, won an Oscar. https://www.youtube.com/watch?v=gspK_Bi0aoQ

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Polaroid's model 95 Land Camera

- The invention of commercially viable **instant cameras**, which were easy to use, is generally credited to American scientist **Edwin Land**, who unveiled the first commercial **instant camera**, Polaroid's model 95 Land Camera, in 1948, a year after unveiling **instant film** in New York City.

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Advances in Lenses

- Since lenses were used in telescopes, microscopes, camera obscuras, and eye glasses, much scientific development was made before photography.
- Many advances were made in the 1800s for reducing **distortions** and overcoming **optical aberrations** by improving the **quality of glass**, increasing the **number of elements**, and applying **coatings**.
- In 1994, the unnamed 38-105mm f/4-7.8 lens built into the Nikon Zoom-Touch 105 VR (Japan) 35mm point-and-shoot camera was the first consumer lens with built-in **image stabilization**.
- Excellent article on photographic lens design at https://en.wikipedia.org/wiki/History_of_photographic_lens_design

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Digital Revolution



- **Steven Sasson**, an engineer at Eastman Kodak, invented and built the first self-contained electronic camera that used a charge-coupled device image sensor in 1975. The 8 pound camera recorded 0.01 megapixel B&W photos to a cassette tape. The first photograph took 23 seconds to create. To play back images, data was read from the tape and then displayed on a television set.
- In 1986, Japanese company Nikon introduced the **first digital single-lens reflex (DSLR) camera**, the Nikon SVC. In the mid-to-late 1990s, DSLR cameras became common among consumers.
- In 2000, Sharp introduced the world's first **digital camera phone**, in Japan.

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Other Technological Advances in Photography - Digital Processing software

- In 1987, around the time when digital cameras started to appear, **Thomas Knoll**, a PhD student at the University of Michigan, started working on a program to display gray scale images on a monochrome display.
- Thomas' brother **John** recommended turning the program into a program for **image editing** purposes. The two worked on the program named **Photoshop**.
- John Knoll traveled to Silicon Valley to demonstrate the product to Apple and Adobe engineers. Both demonstrations were a success, and eventually the **Photoshop** license was purchased for distribution by Adobe in 1988.
- Two years later in 1990, **Photoshop 1.0** was released for Macintosh.
- The effect **Photoshop** had on photography is unbelievable. It made photo manipulation easier, allowed people to spend less time editing, and to get better results.

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Other Technological Advances in Photography

1. Between 1960 and 1973, Leitz (Leica) patented an array of **autofocus** and corresponding sensor technologies. The first mass-produced **autofocus** camera was the Konica C35 AF, a simple point and shoot model released in 1977.
2. First camera to embed **location information** in a captured image, or **geotagging**, was the Nikon Coolpix P6000 compact in 2008 with **built-in GPS**.
3. Computation-based features like **auto photo tagging** of people, animals, and objects.
4. **Photography-based smartphone apps** for maps, weather, tides, waves, sun rises, sunsets, angle of the sun and moon, etc. have raised photography to a new level.

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Future Developments

- 2009 – FujiFilm launches world's first **digital 3D camera** with **3D printing** capabilities.
- We may project photos as **holograms**, especially with 3D holographic display technologies.
- **Many small lenses** combined to form an image. Light's pocket-size L16 replaces one big lens with 16 small ones, plus some super-smart software. See <https://www.wsj.com/articles/this-crazy-camera-is-the-future-of-photography-1506527521>

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