History of Photographic Technologies

By Dan Hyde

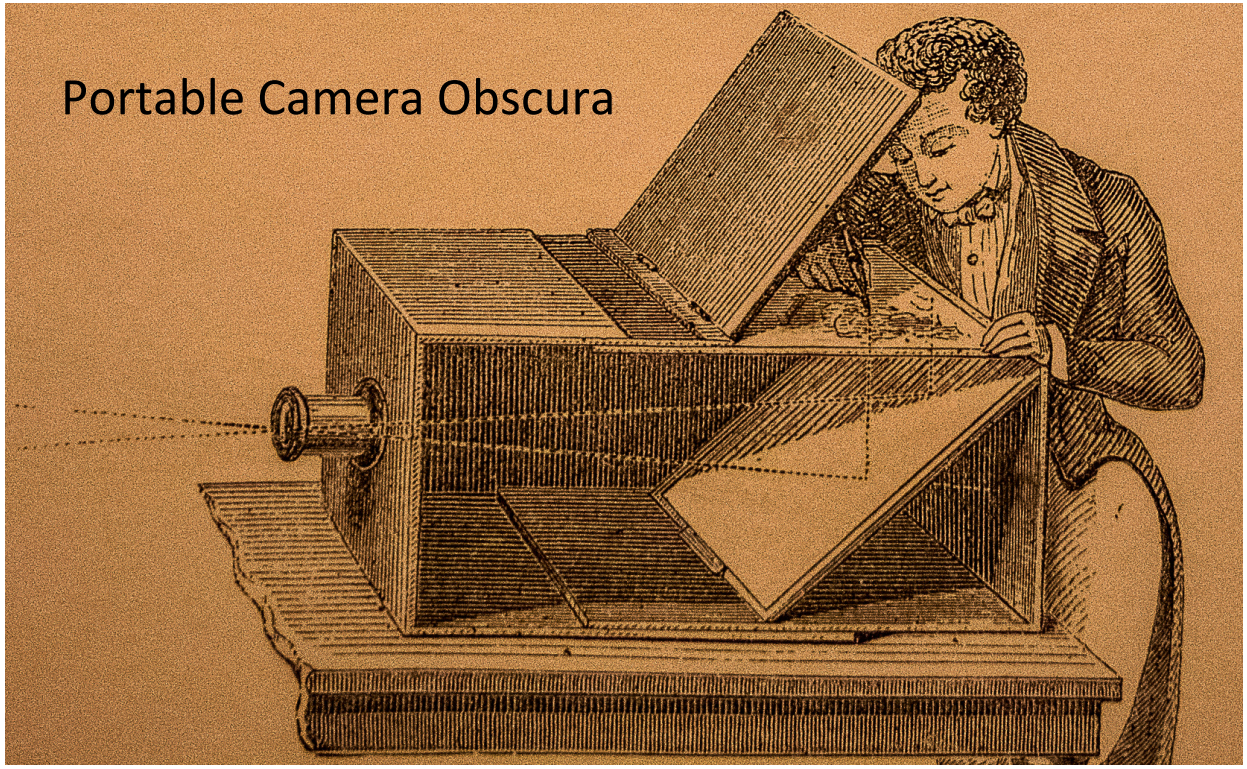
Camera equipment for wet-plate collodion photography (1851) – George Eastman Museum

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

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.



- Aristotle in 4th century BC knew the principles of Camera Obscura - light through a pinhole in a darken 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.

- 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!

- 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!

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 breakthough 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!

THE DAGUERREOTYPE PROCESS

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

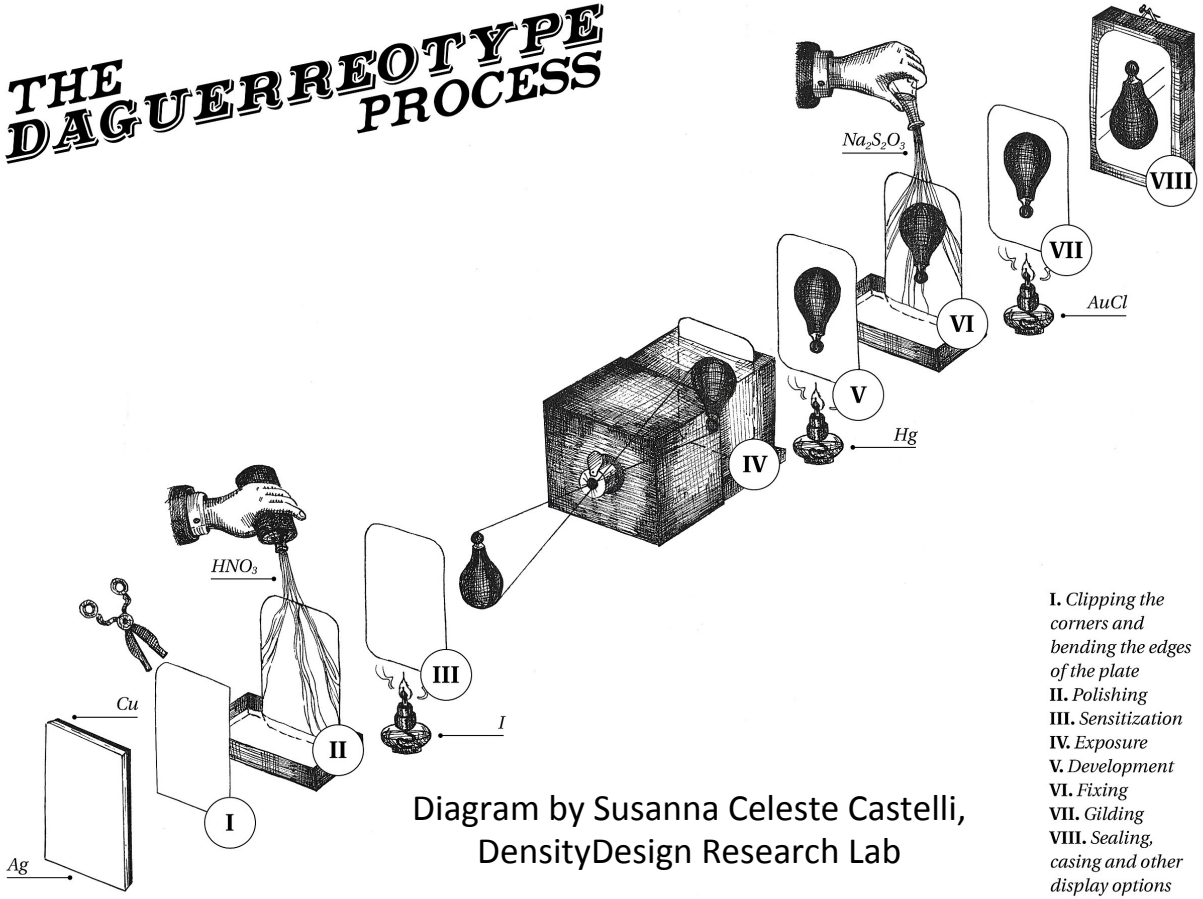


Diagram by Susanna Celeste Castelli, DensityDesign Research Lab

I. *Clipping the corners and bending the edges of the plate*
II. *Polishing*
III. *Sensitization*
IV. *Exposure*
V. *Development*
VI. *Fixing*
VII. *Gilding*
VIII. *Sealing, casing and other display options*

- 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.

Cartes-de-visite of Napolean 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.

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).

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.

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.

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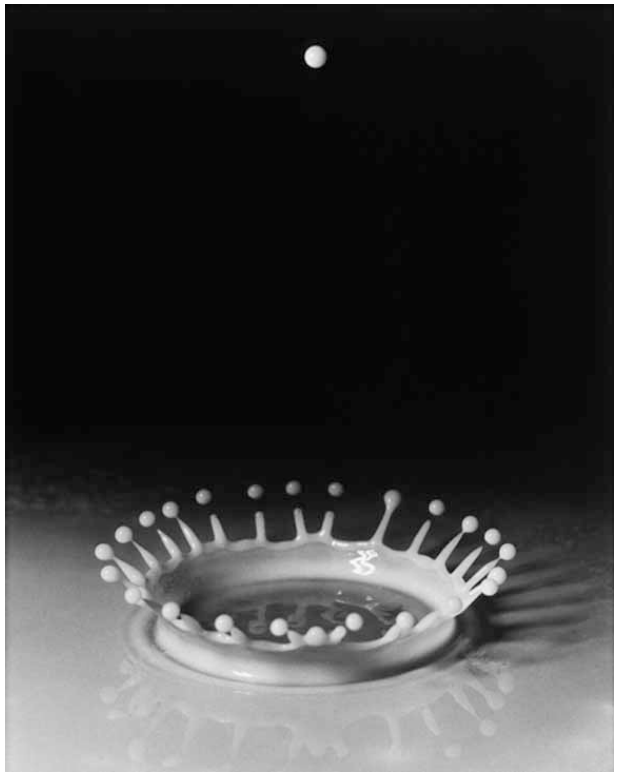
- Great video on different chemical processes used in photography during 1800s. https://www.britannica.com/technology/technology-of-photography

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.

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.



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

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.

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

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.

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.

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.

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

References

1. *Photography: The Whole Story*, editor Juliet Hacking, Thames & Hudson Publisher, 2012, 575 pages. A gem of a book written by over 30 contributing experts and containing over 1000 photographs.

2. Photos of exhibits at George Eastman Museum in Rochester, NY.

3. Timeline for Photography Technology on Wikipedia: https://en.wikipedia.org/wiki/Timeline_of_photography_technology