

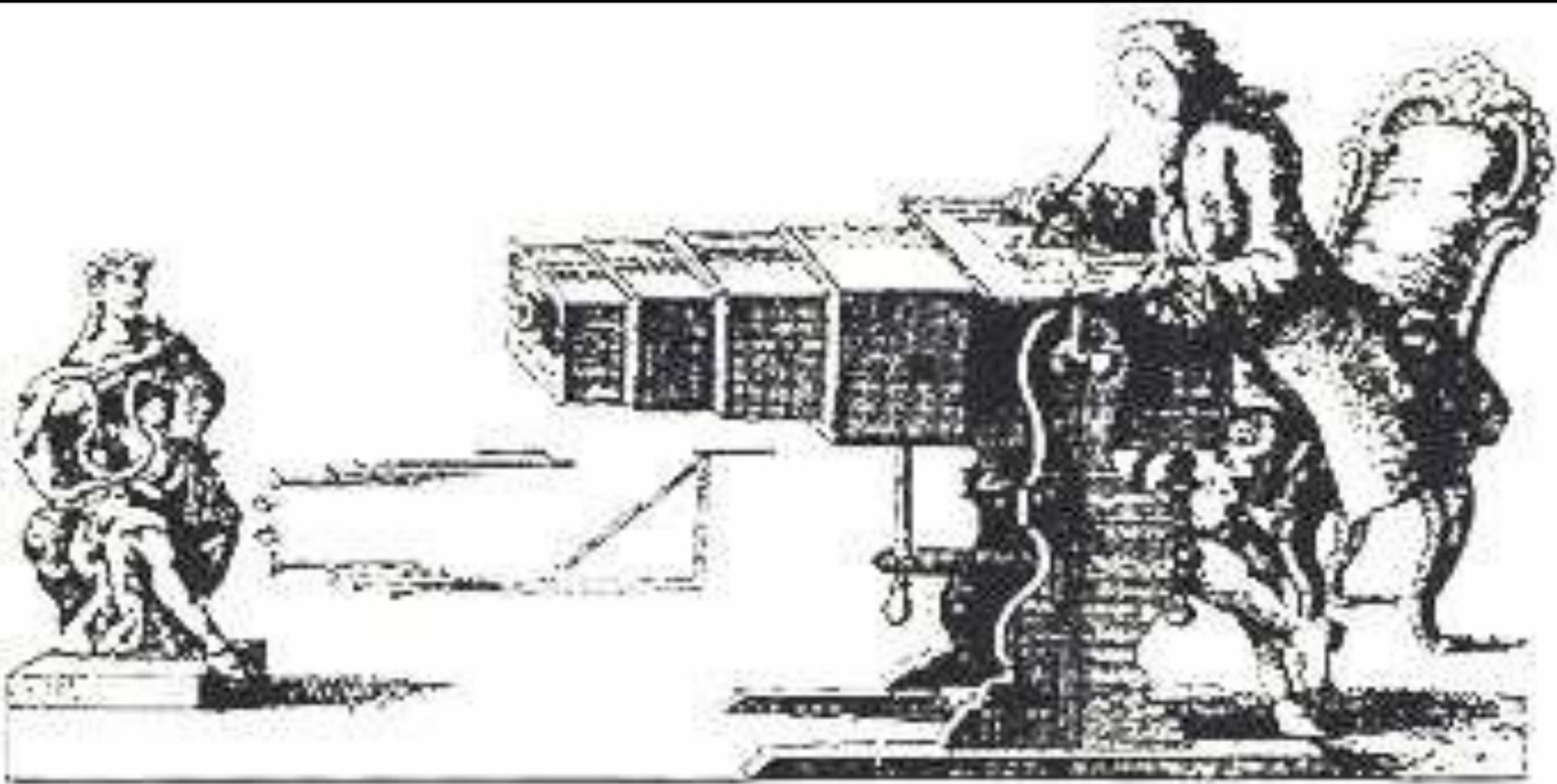
Technology of Photography

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Based on [Alex Sirota](http://iosart.com/photography-art-or-science)

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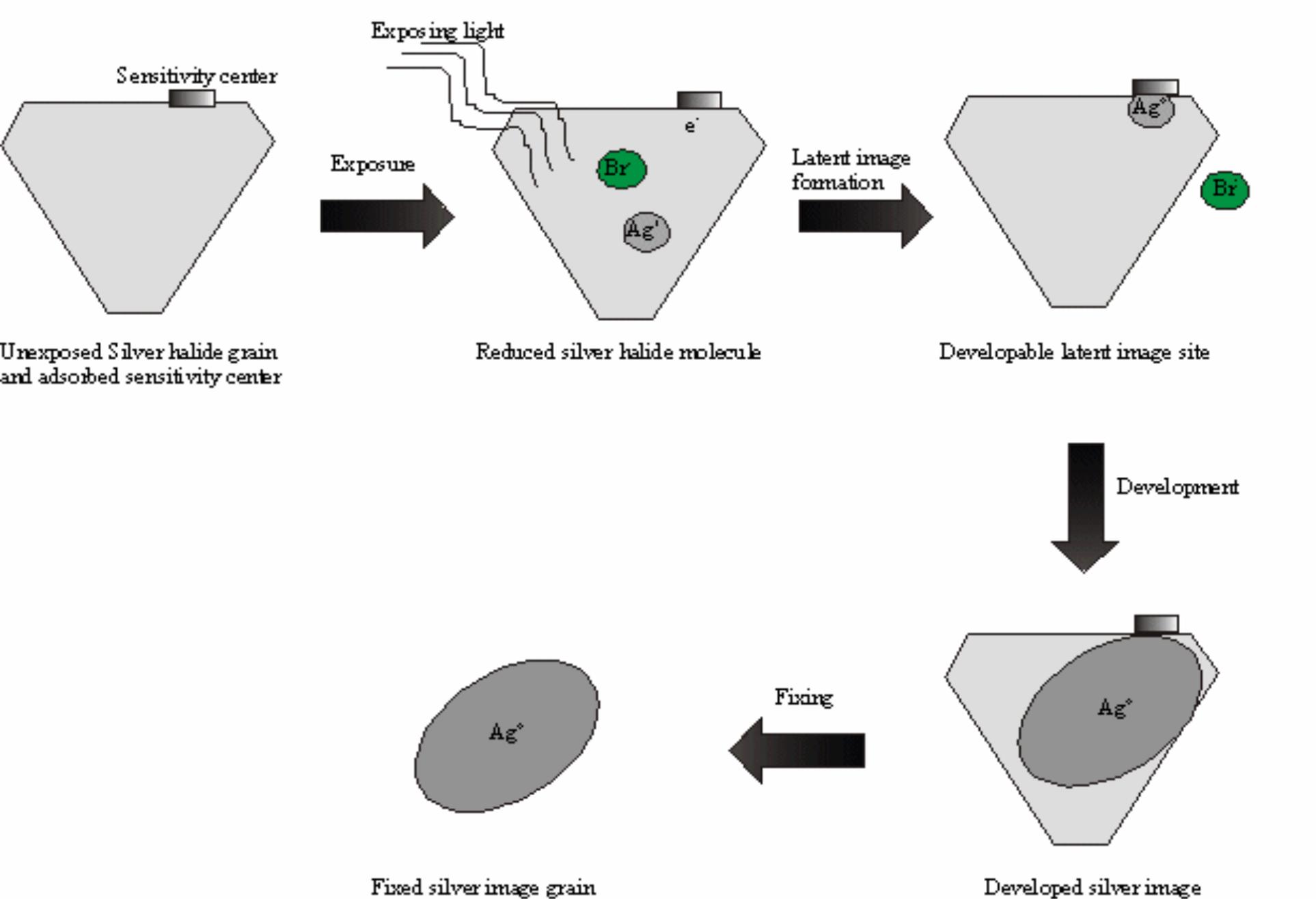
Camera Obscura



Camera Obscura, Georg Friedrich Brander (1713 - 1785), 1769

Light Sensitive Materials

- After the camera obscura had been invented and its use widely popularized, many dreamt of capturing the images obtained by the camera obscura permanently.
- For hundreds of years before photography was invented, people had been aware that some colors are bleached in the sun, but they had made little distinction between heat, air and light.
- In 1727, Johann Heinrich Schulze (1687-1744), a German scientist found that silver salts darkened when exposed to sunlight and published results that distinguished between the action of light and heat upon silver salts.
- Even after this discovery, a method was needed to halt the chemical reaction so the image wouldn't darken completely.



A Simplified Schematic Representation of the Silver Halide Process

First Permanent Picture

Joseph Nicephore Niepce (1765-1833), a French inventor, was experimenting with camera obscura and silver chloride.



- In 1826, he turned to bitumen of Judea, a kind of asphalt that hardened when exposed to light.
- Niepce dissolved the bitumen in lavender oil and coated a sheet of pewter with the mixture.
- He placed the sheet in the camera and exposed it for eight hours aimed through an open window at his courtyard.
- The light forming the image on the plate hardened the bitumen in bright areas and left it soft and soluble in the dark areas.
- Niepce then washed the plate with lavender oil, which removed the still-soft bitumen that hadn't been struck by light, leaving a permanent image.
- Niepce named the process **heliography** - Greek, helios - "sun", graphos - "drawing".



View from the Window at Le Gras, Joseph Nicephore Niepce, 1826

Daguerreotypes

News of Niepce's work had reached another Frenchman, Louis Jacques Mande Daguerre (1787-1851) who had been experimenting to capture camera obscura images.



- In 1829 **Niepce** and **Daguerre** became partners, a partnership which lasted until Niepce's death in 1833.
- Daguerre perfected the process, reducing the exposure time from eight hours to half an hour. He found that an image could be made permanent by immersing it in salt.
- In 1839 he announced the new process which he named "**daguerreotype**" before the French Academy.
- A French newspaper praised the process: "What fineness in the strokes! What knowledge of chiaroscuro! What delicacy! What exquisite finish!... How admirably are the foreshortenings given: this is Nature itself!"
- Almost immediately after the announcement, hundreds of daguerreotype studios were opened to provide "Sun Drawn Miniatures" to the public.
- By 1853 an estimated three million daguerreotypes per year were produced in the United States alone.



Still Life in Studio, Louis Jacques Mande Daguerre, 1837 The earliest known daguerreotype

Daguerreotype of Couple Holding Daguerreotype, Unknown Artist, 1850

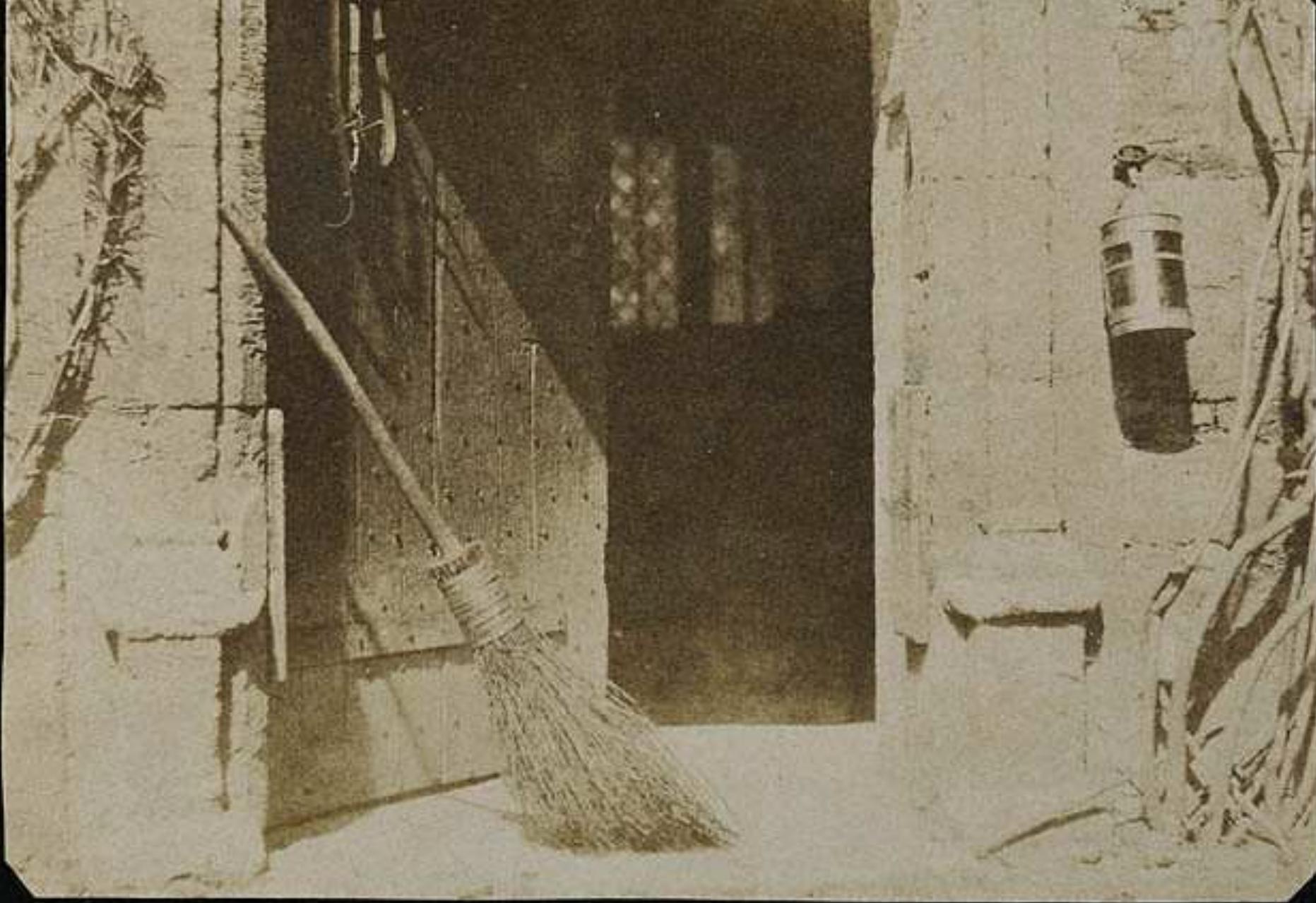


Emily Dickinson at 17,
Unknown Artist, 1847



Following Achievements

- Daguerreotypes had one major drawback, there was no way of producing copies of the original plate.
- In June 1840, an English amateur scientist **Henry Fox Talbot** (1800-1877) announced a technique which became the basis of modern photography. He called it "calotype" (Greek for "beautiful picture").
- The great advantage of Talbot's method was that the process involved both a negative and a positive. The negative image, the **calotype**, was repeatable indefinitely in a positive print, finally allowing multiple prints.
- By 1840, a convenient "**dry plate**" process was developed, allowing very fast development and opening the field to the general public.



The Open Door, William Henry Fox Talbot, 1843



Xie Kitchin with Umbrella, Lewis Carroll, 1875

Roll Film

Much of the credit for popularizing photography goes to **George Eastman** (1854-1932). He began as a bank clerk in Rochester, NY, and built his Eastman Kodak Company into a great enterprise it is today.



- In 1884 **Eastman** invented the equipment to mass produce roll film. “Eastman’s American Film” was a roll of paper coated with thin gelatin emulsion.
- **Roll film** made possible a new kind of camera - inexpensive, light and simple - that made everyone a potential photographer.
- In the early years of the company, film base was manufactured and coated on long glass tables.



Royal Gold Kodak film, 1994



Kodak Camera

- Kodak camera was introduced in 1888. Their slogan was “You push the button, we do the rest”.
- The Kodak camera became an international sensation almost overnight.
- A new photographic era, of simple light cameras and easy to handle roll film had begun.



SPORTING GOODS 46

New Kodak Cameras.
“You press the button, we do the rest.”
(OR YOU CAN DO IT YOURSELF.)
Seven New Styles and Sizes
ALL LOADED WITH
Transparent Films.

For Sale by all Photo, Stock Dealers.
THE EASTMAN COMPANY, Rochester, N. Y. Send for Catalogue.

Kodak camera advertisement, 1890

The first Kodak camera, 1888



George Eastman with a
Kodak camera, Fredrick
Church, 1890

Color - First Steps

One of the first successes in color photography was demonstrated in 1861 by the Scottish physicist James Clerk Maxwell (1831 - 1879).

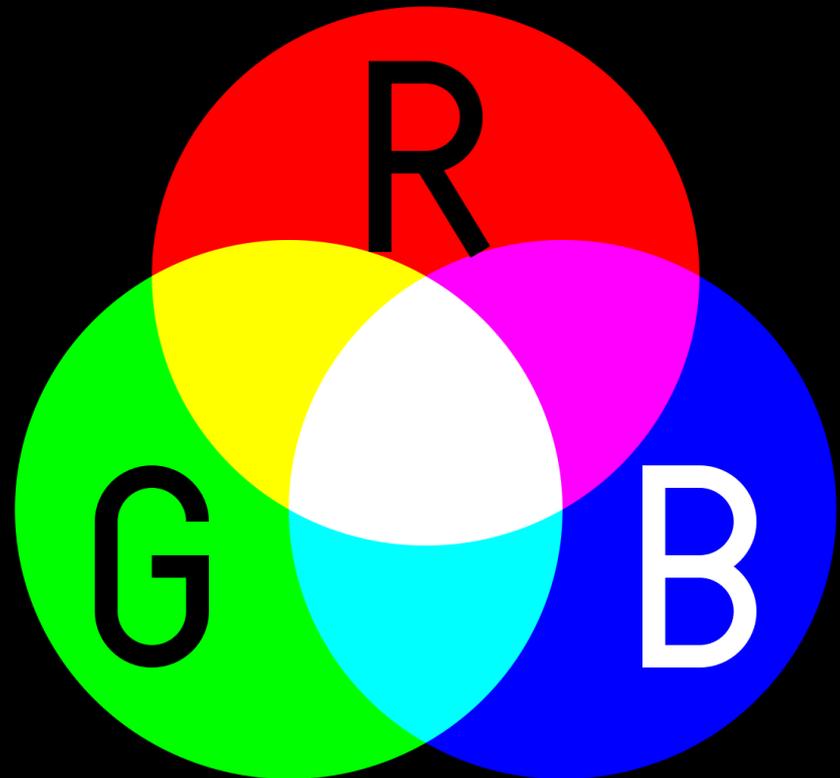


Maxwell devised a way to recreate the colors of a tartan ribbon. He had three negatives of the ribbon made, each through a different color filter - red, green and blue.

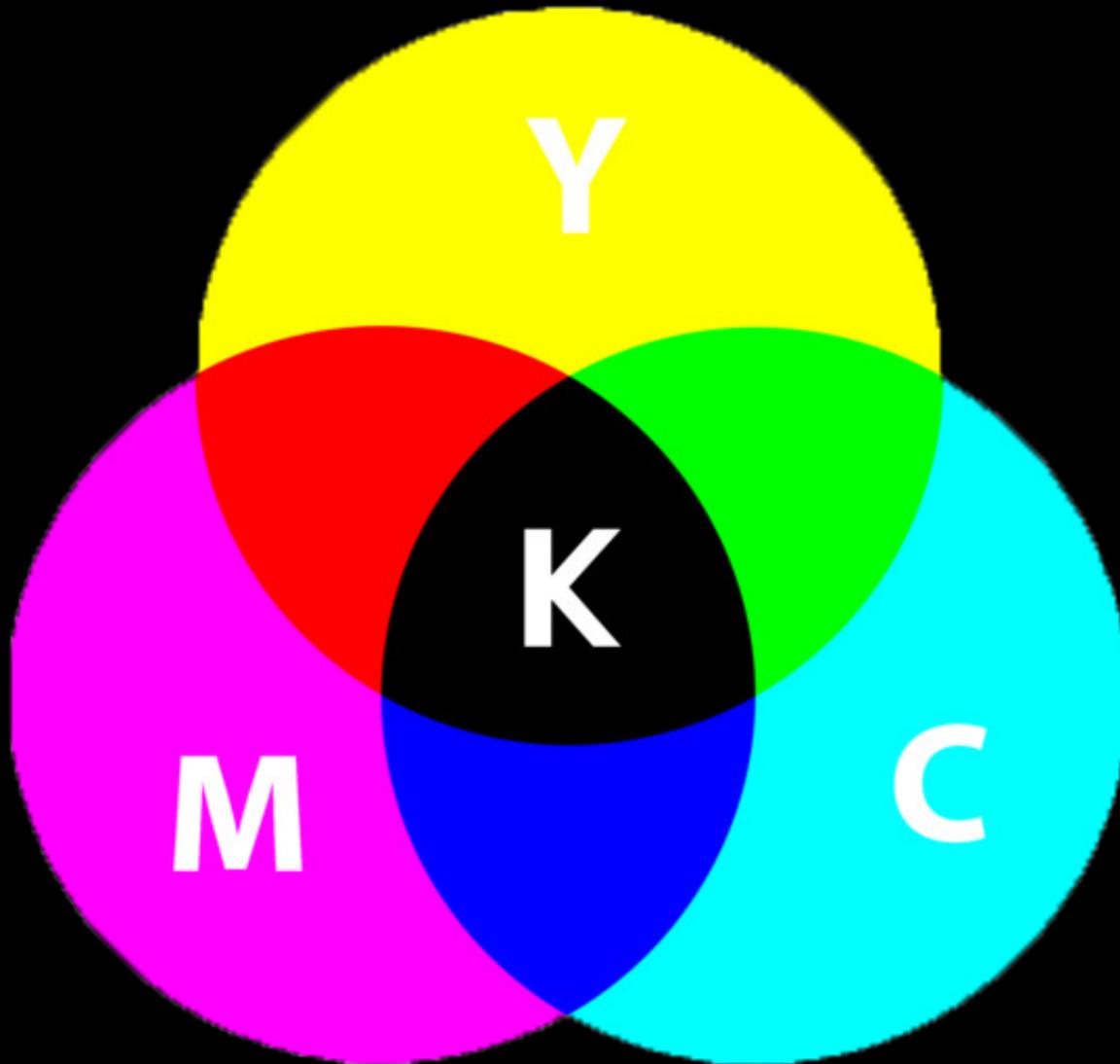
- Positive black and white transparencies were made of the three negatives. While projected superimposed through three color filters like those on the camera, the three positives produced an image of the ribbon in its original colors.
- This technique is called “**additive color mixing**”. Colors are produced by adding together varying amounts of red, green and blue.



Maxwell's tartan ribbon



Subtractive Color Mixing



Subtractive Color Mixing

- In 1869, Louis Ducos du Hauron (1837-1920) and Charles Cros (1842-1888), two Frenchman working independently announced their research on subtractive color mixing.
- In **subtractive color mixing**, which is the basis for modern color photography, colors are created by combining **cyan, magenta and yellow dyes** (the complements of red, green and blue). The dyes are subtract colors from “white” light that contains all colors.

Herbarium - reproduction of the leaves & petals of flowers from three vegetables
from which the perfume has been extracted, and preserved in a glass at a
pressure of the steam of Etheric Acid - 1869!



*Plantation culture - leaves & petals in this process
are also in contact with the steam of etheric acid, and these are
preserved in a glass at a pressure of the steam of Etheric Acid - 1869!*

Louis Ducos du Hauron
Leaves and Flower Petals, 1869

Commercial Color Photography

The first commercially successful color process was developed by Antoine and Louis Lumiere, two French brothers, in 1907. It was an additive process called “Autochrome”.



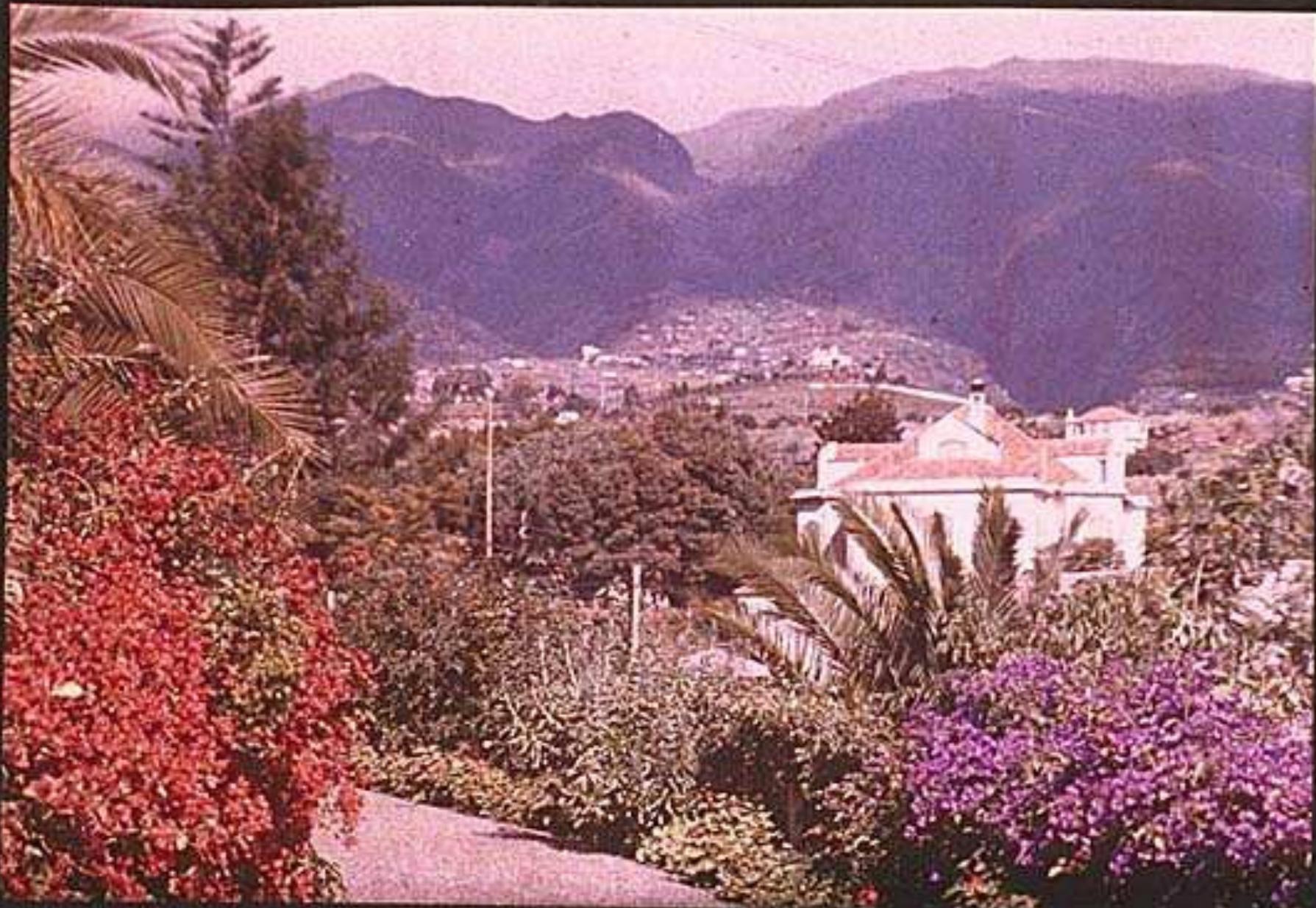
Jean-Baptiste Tournassoud (1866-1951), Autochrome, Early 20th century.

Autochrome

- A glass plate was covered with tiny grains of potato starch dyed red-orange, green and violet in a layer only one starch grain thick.
- Then a light sensitive emulsion was added. Light struck the emulsion after passing through the colored grains. The emulsion behind each grain was exposed by light from the scene that was the same color as that grain.
- The result was a full color transparency.



Jean-Baptiste Tournassoud, Autochrome, Early 20th century.



Autochrome landscape of Madeira by Miss Sarah Angelina Acland, 1908-15

Kodachrome

- A **subtractive** color process called **kodachrome** made color photography practical.
- It was perfected by Leopold Mannes (1899-1964) and Leopold Godowsky (1900-1983), two musicians and amateur photographic researchers.
- Their collaboration with **Eastman Kodak** scientists led to the introduction of Kodachrome in **1935**. Kodachrome was a single sheet of film coated with three layers of emulsion, each sensitive to one primary color (red, green and blue). A single exposure produced a color image.



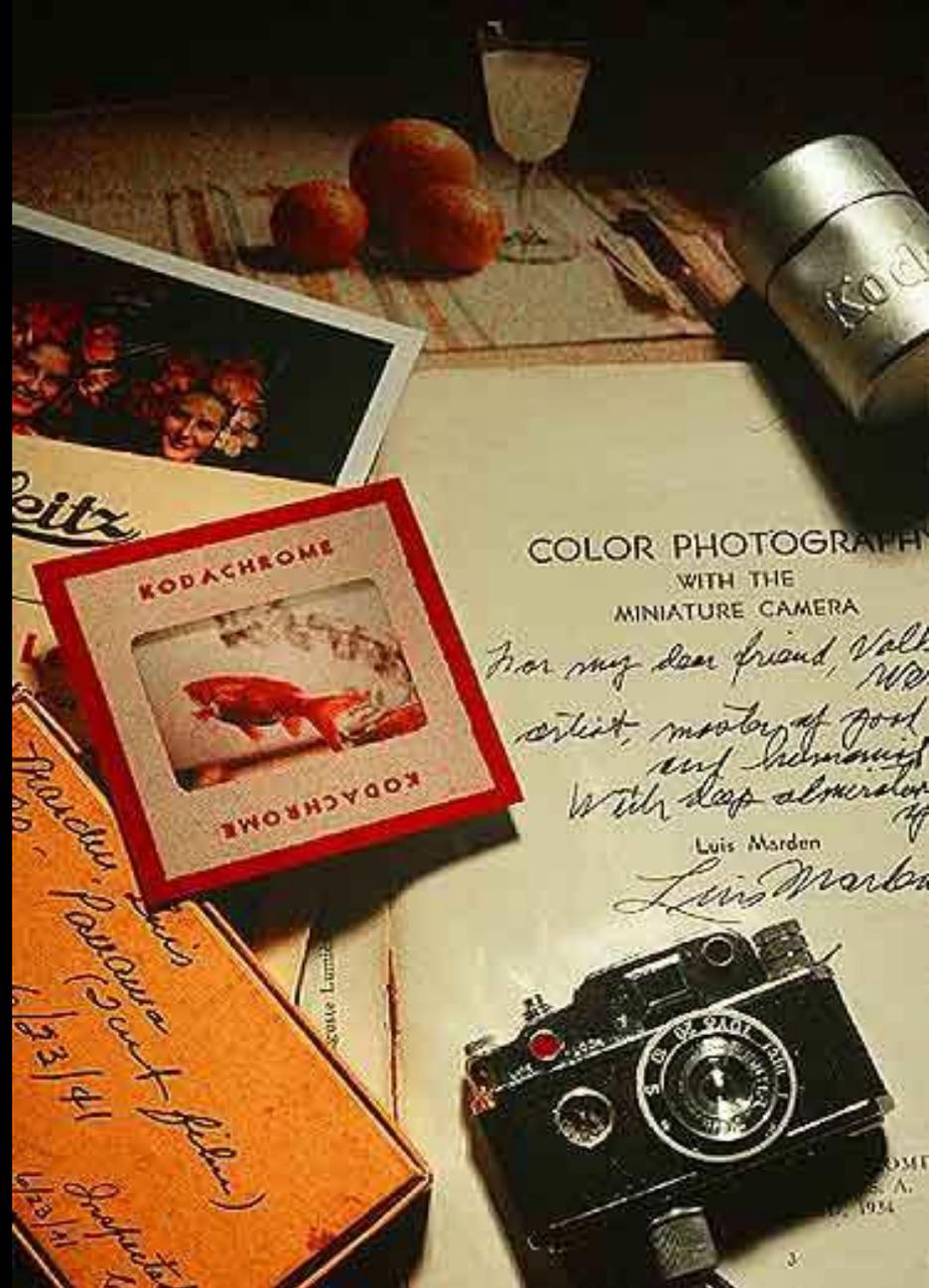
1935



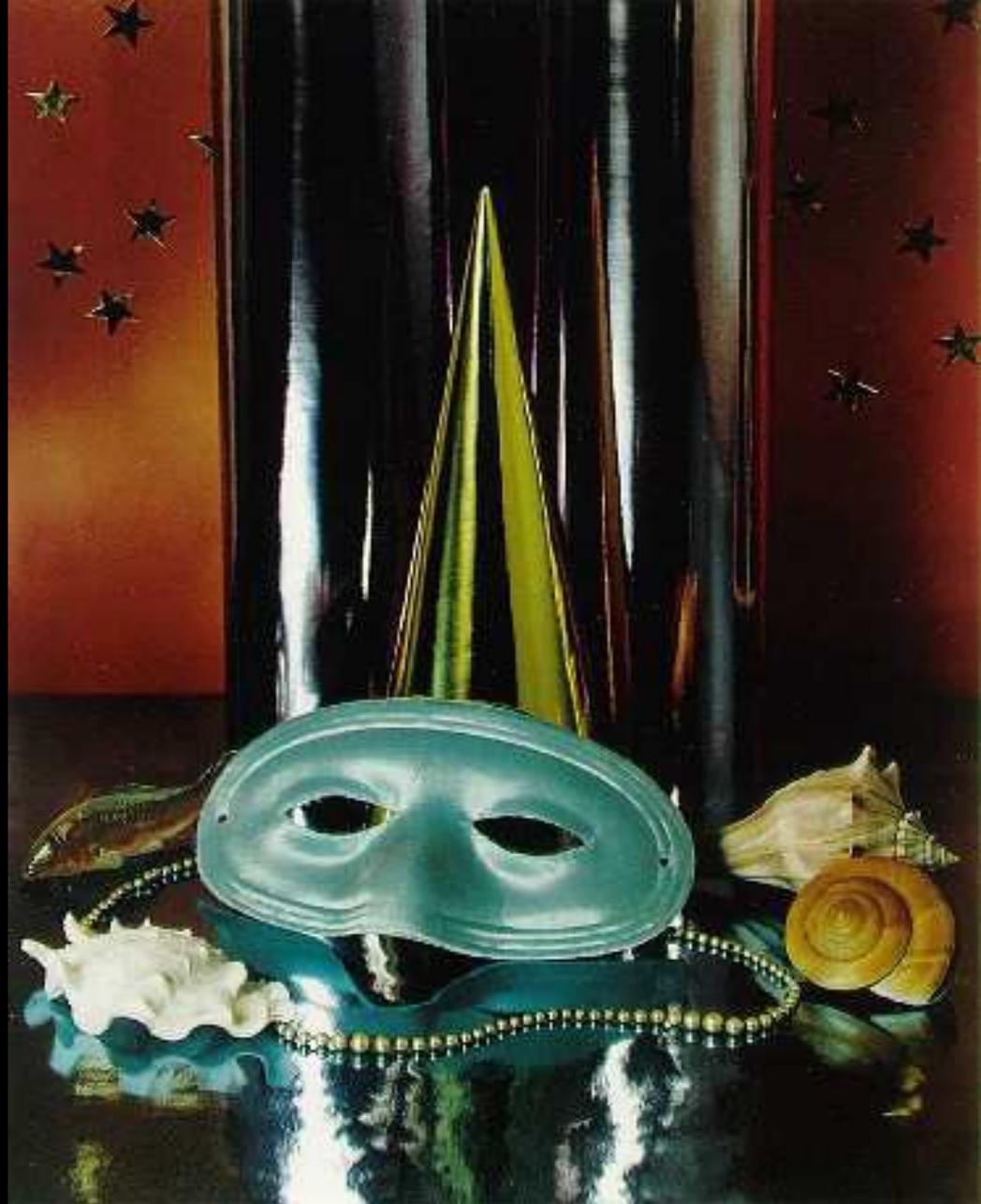
2000



Luis Marden, a great photographer working for the National Geographic Society was one of the first pioneers of the revolutionary new film.



Luis Marden Career Collage, Sarah Leen



Party-mask with Shells, Paul Outerbridge, 1936

Digital Photography

- In the mid 1970s, Kodak and other companies began investigating filmless technologies that could capture images with solid state circuitry
- In 1986, Kodak succeeded in creating a sensor that could record 1.4 million picture elements, or megapixels.
- In the 1990s the first digital cameras appeared for commercial use.



KODAK PROFESSIONAL DCS 760 Digital Camera,
6 million pixels, 2001

- The big difference between traditional film cameras and digital cameras is how they capture the image.
- Instead of film, digital cameras use a solid-state device called an *image sensor*, usually a charge-couple device (CCD).
- On the surface of each of these fingernail-sized silicon chips is a grid containing hundreds of thousands or millions of photosensitive diodes called *photosites*, *photoelements*, or *pixels*. Each photosite captures a single pixel in the photograph to be.

An image sensor sits against a background enlargement of its square pixels, each capable of capturing one pixel in the final image

