

Photography & Technology

Part One

Part I:
Photography is
Technology

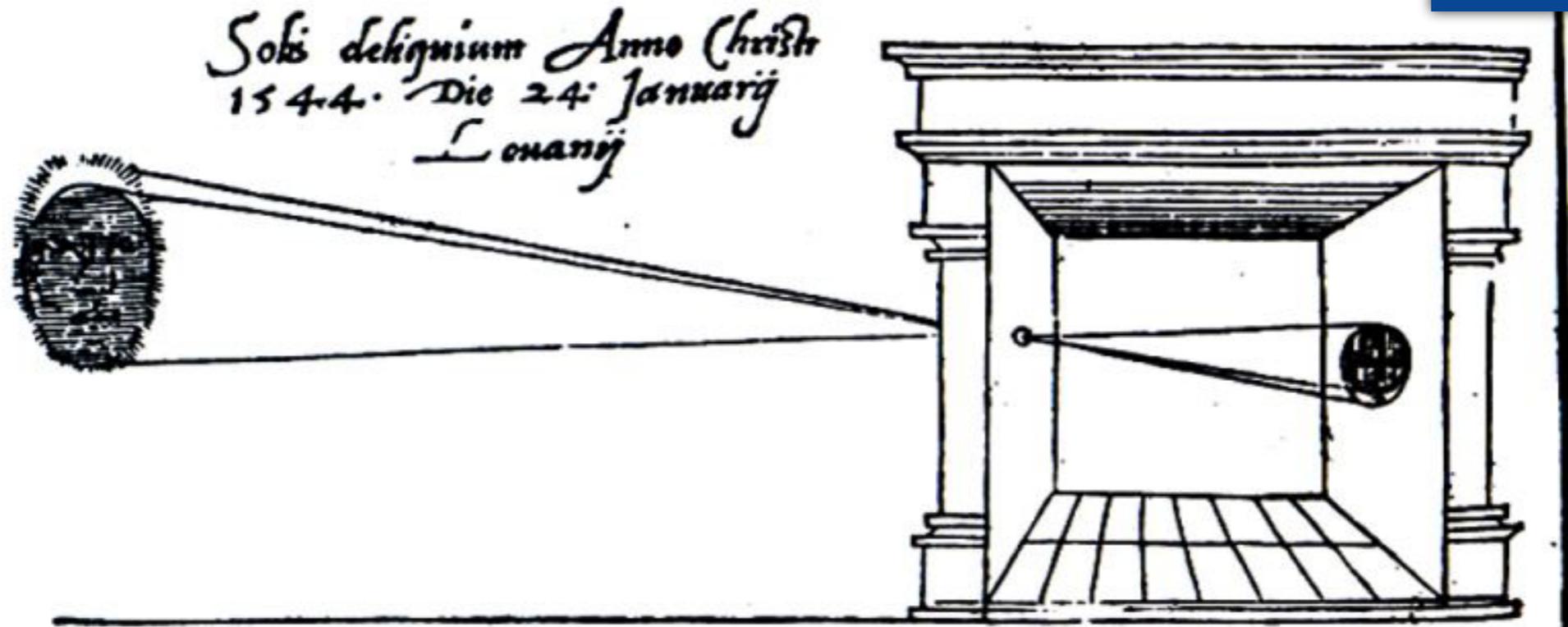
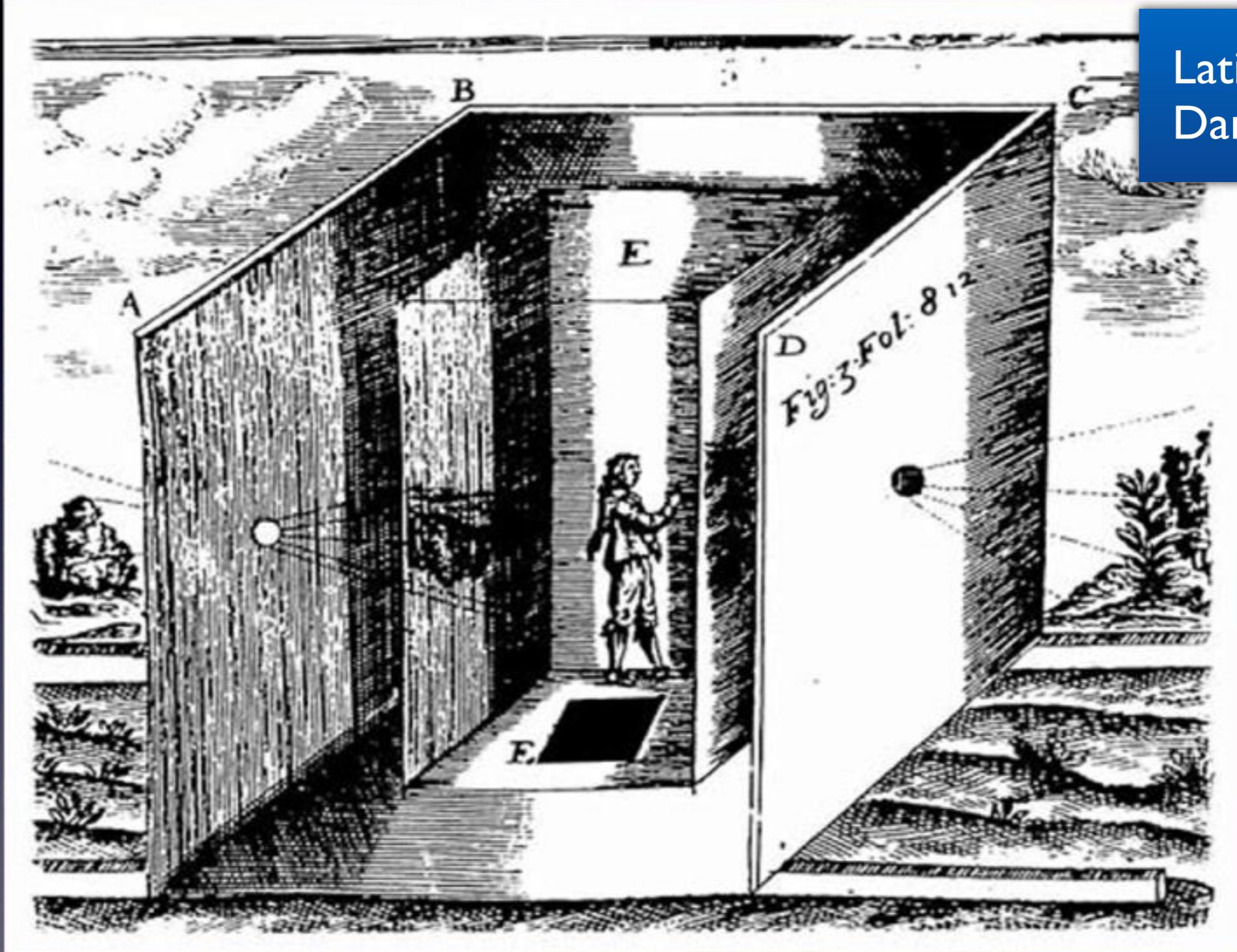


Figure 1-2. Rainer Gemma-Frisius. The first published illustration of a camera obscura showed its use to observe a solar eclipse in 1544 AD. Courtesy of Harry Ransom Humanities Research Center, The University of Texas at Austin.

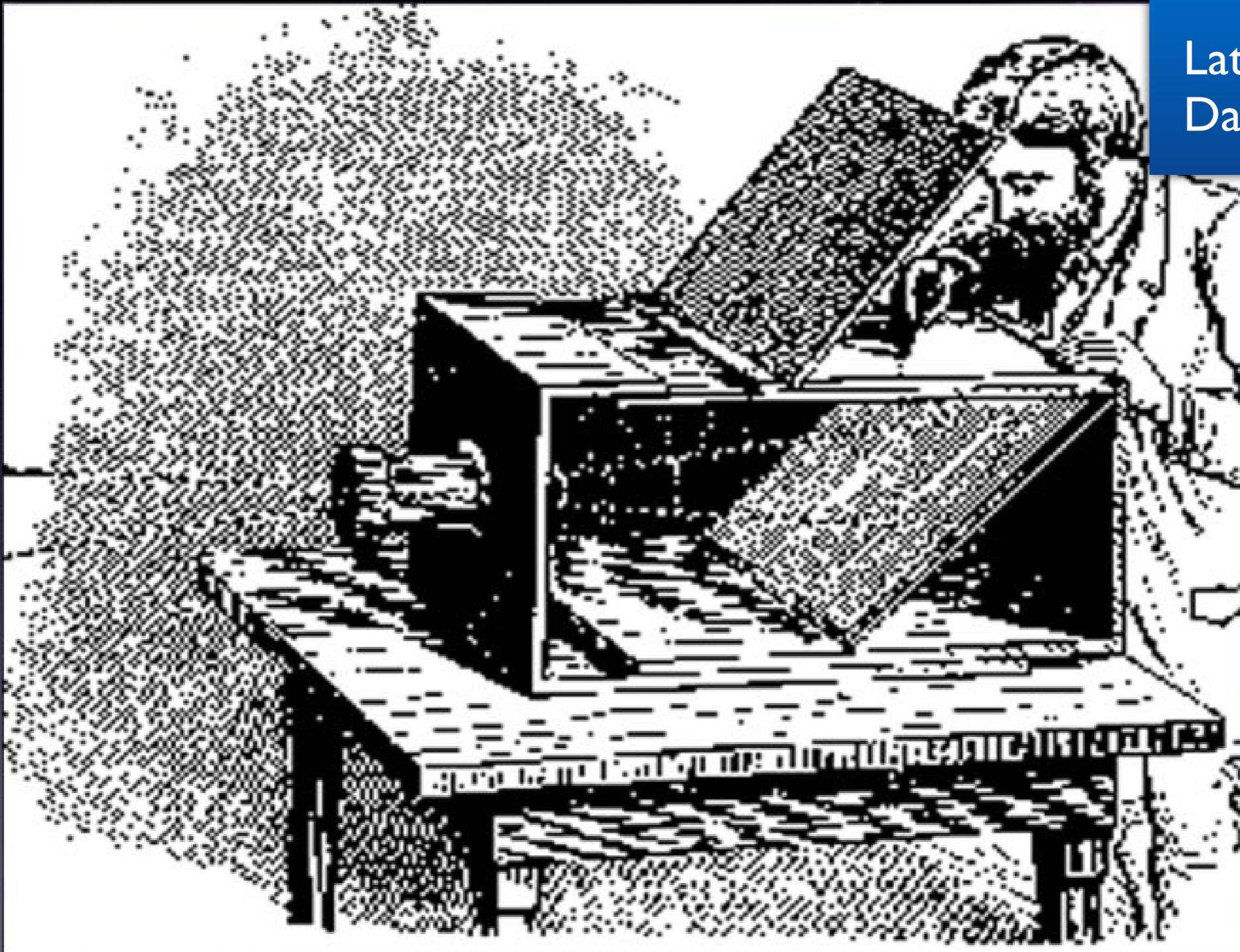
The Camera Obscura

Latin for
Dark Room



The Camera Obscura

Latin for
Dark Room



The Camera Obscura

Light-Sensitive Elements

- 100 years before the first permanent photograph, Johann Heinrich Schulze discovered that light - not heat - darkened silver salts
- Responsible for the accidental creation of first light-sensitive compound
 - The concept later became the basis for modern traditional photography



Johann Heinrich Schulze, 1687-1744

Chemical Capture

- Thomas Wedgwood - son of the famous English Potter - teamed up with British Scientist Humpfrey Davy
- This was the first noted successful attempt at capturing the image chemically
- At this point, they could not “fix” the image

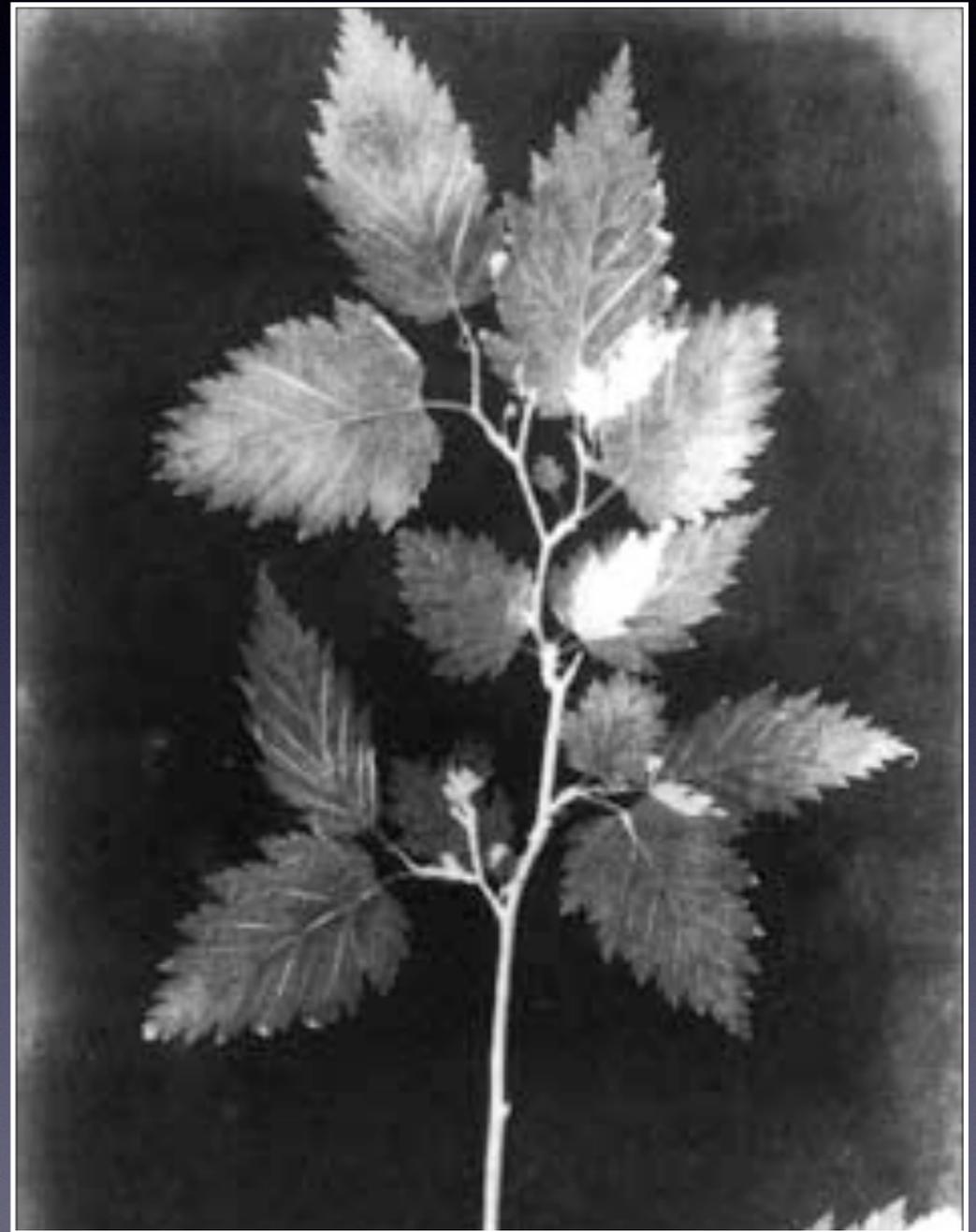


Henry Fox Talbot : *Botanical Specimen, 1839 photogram*

Photograms

Henry Fox Talbot, 1834

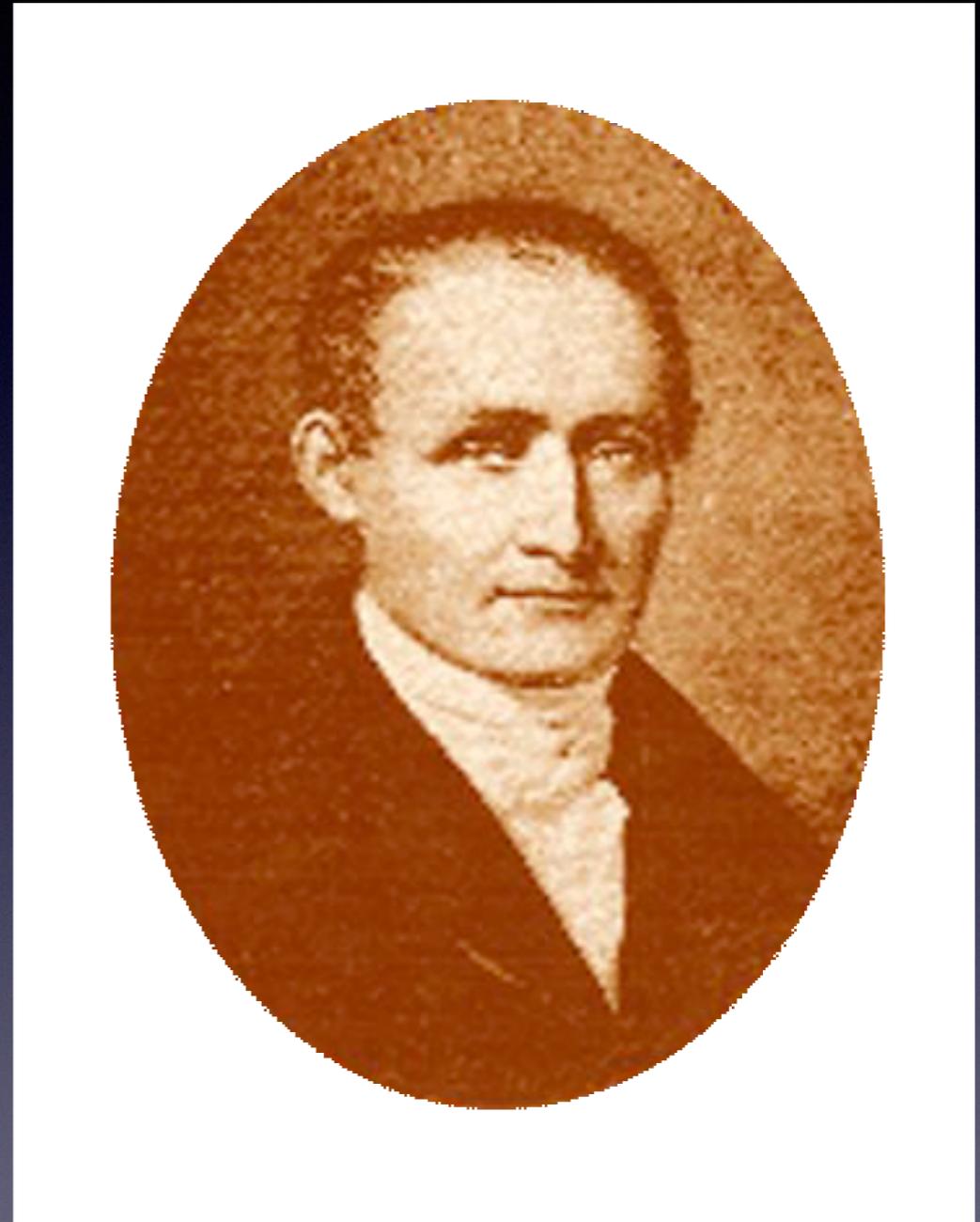
“These natural images” that Talbot referred to were “...the inimitable beauty of the pictures of nature’s painting, which the glass lens of the camera (obscura) throws upon the paper in its focus - fairy pictures, creations of a moment, and destined as rapidly to fade away.”



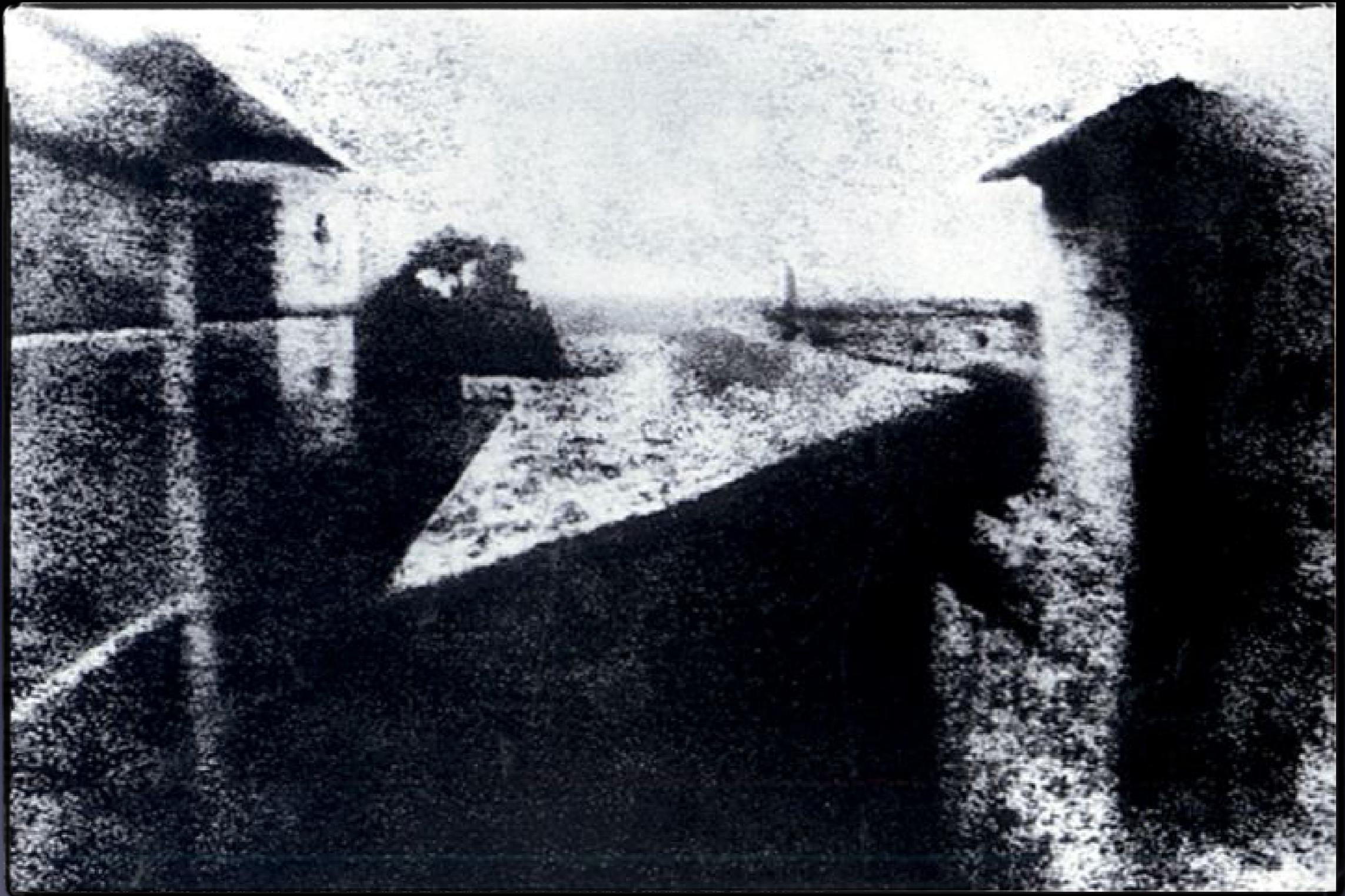
Henry Fox Talbot : *Botanical Specimen, 1839 photogram*

Retinas

- In 1816 he produced some of the first negatives from a camera obscura on coated paper
- Called these images “retinas”
- In 1826 he created the first known photograph on pewter



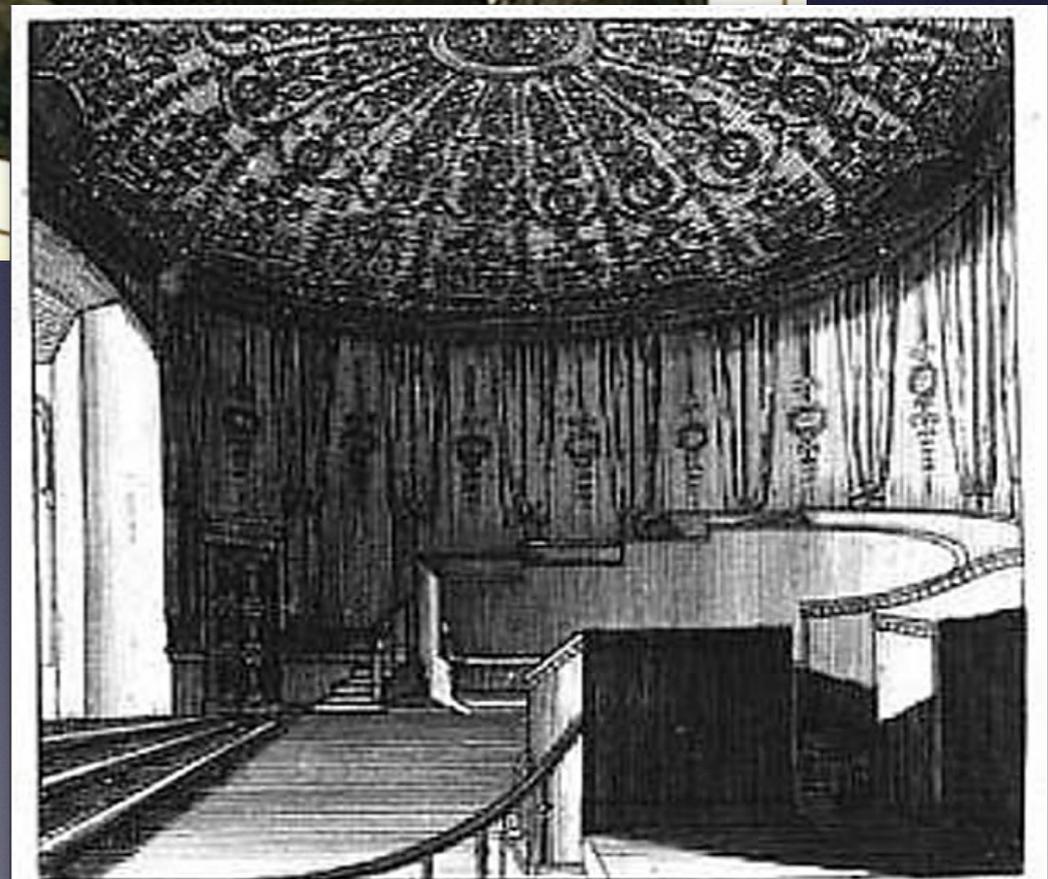
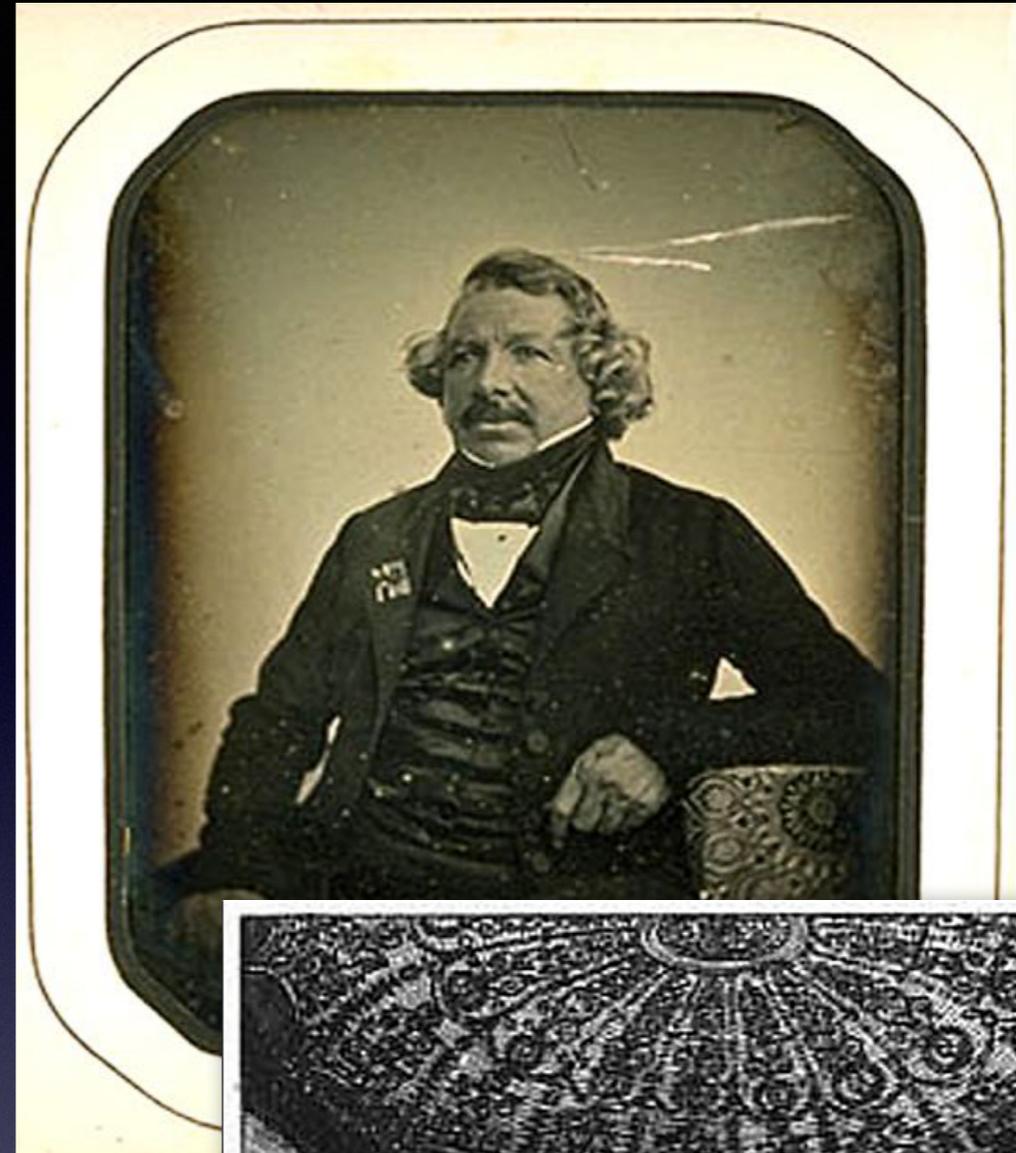
Joseph Niepce



This shows a view from Niepce's attic workroom and is generally regarded as the world's earliest surviving photograph.

A Catalyst

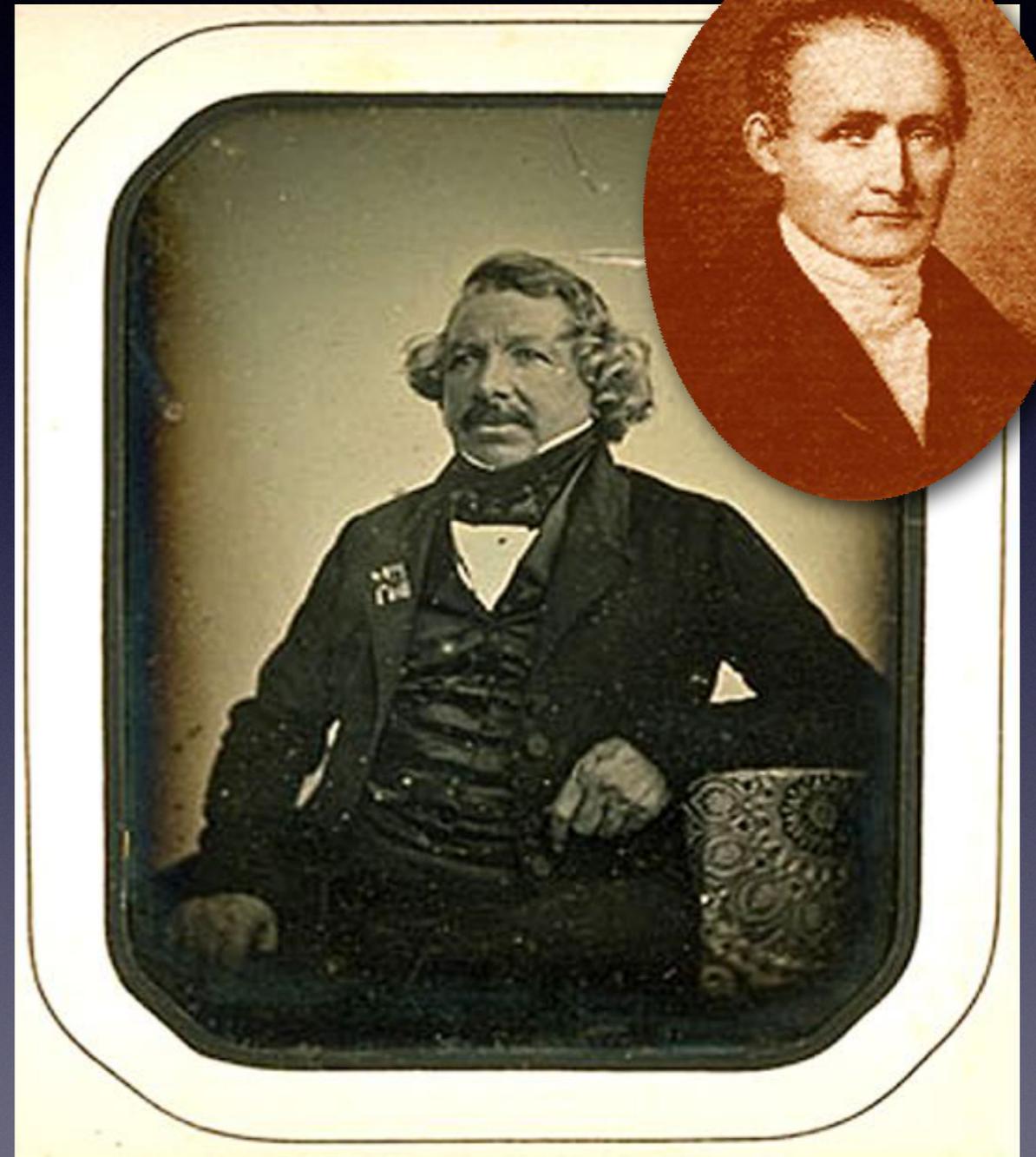
- Louis Daguerre was a showman famous for his sensational dioramas in Paris theaters
- He recognized that projected photographs could greatly enhance his dioramas, as opposed to having painters create the scenes

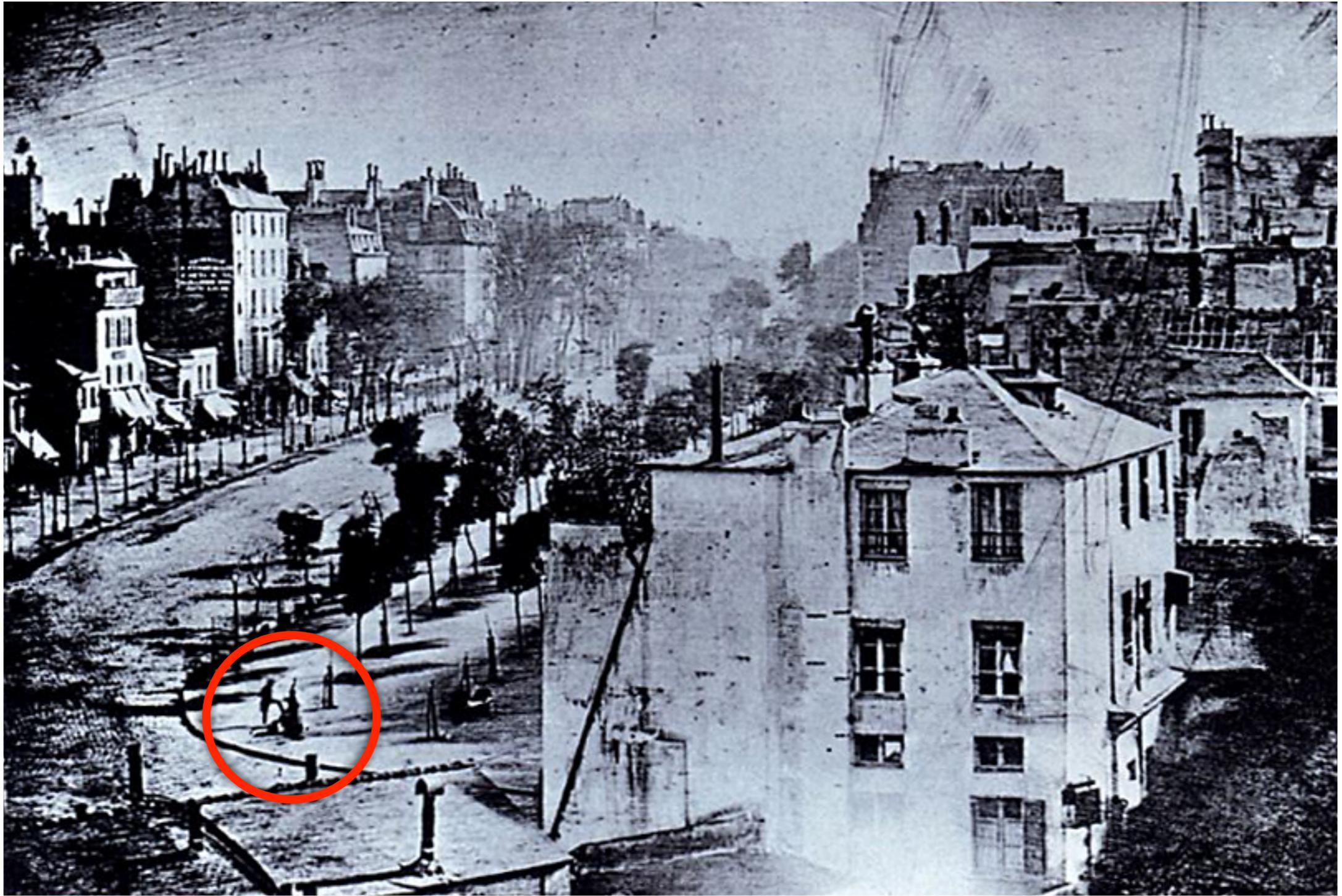


Vue intérieure de la Salle du Diorama

A Catalyst

- Louis Daguerre & Joseph Niepce worked together to invent what is known as the Daguerrotype:
 - Silver-plated copper
 - Fumed in iodine-vapor
 - Processed in mercury vapor



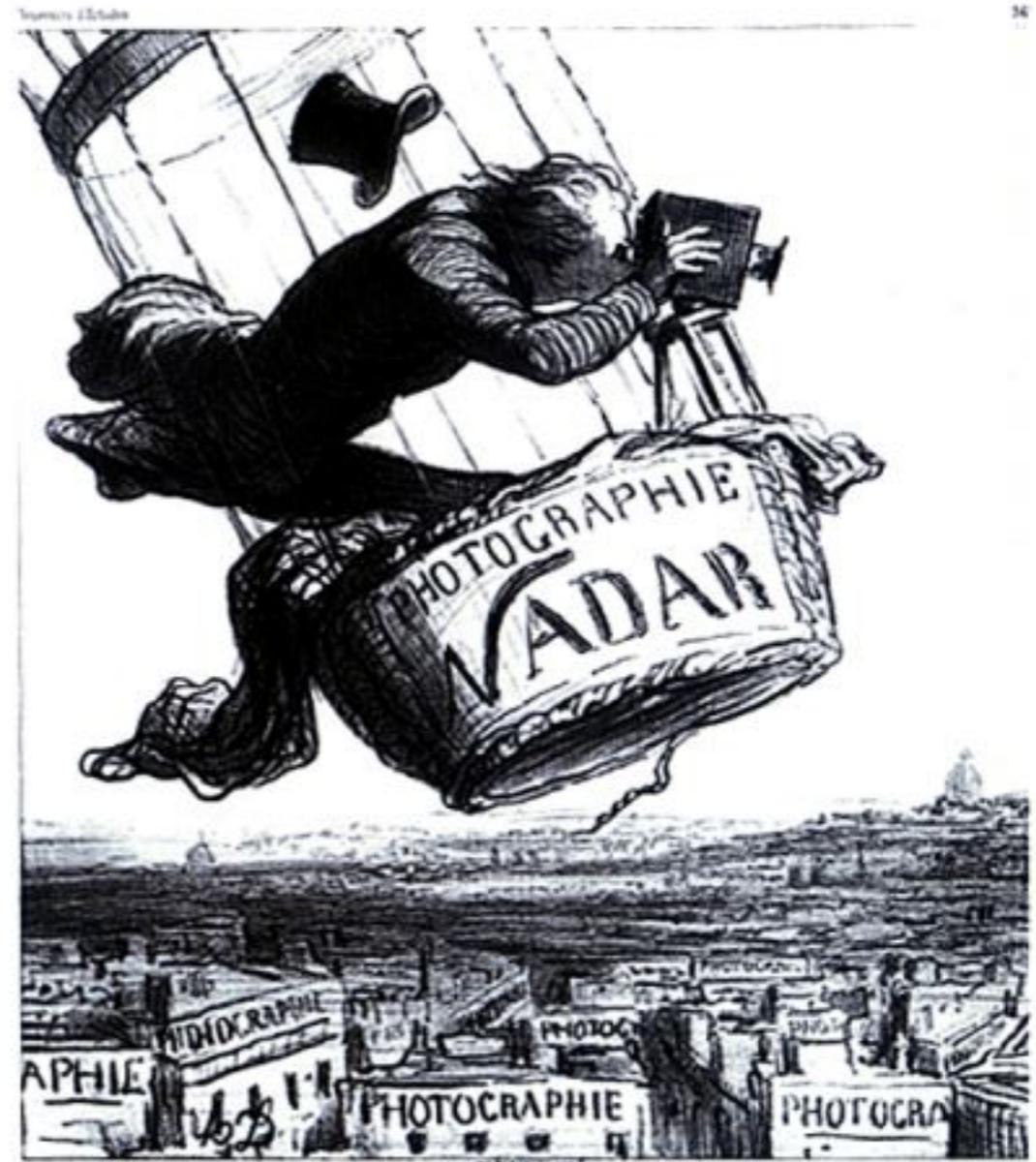


Paris Boulevard, 1839

Premier Résultat de
Photographie aérostatique
Applications: Cadastre, Stratégie, etc.
Cliché obtenu à l'altitude de 5000
par **NADAR** 1858.



Figure 1-4. Gaspard-Felix Tournachon—or Nadar. "A View of Paris." 1858. First aerial photograph made from a balloon hovering at an altitude of 1600 feet. Cliché Bibliothèque nationale de France, Paris.



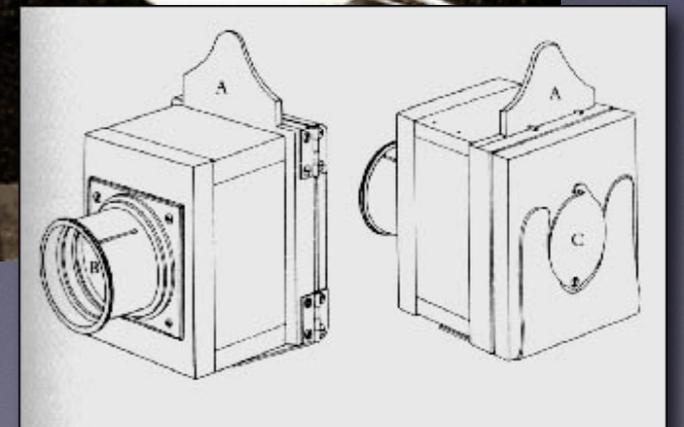
NADAR. élevant la Photographie à la hauteur de l'Art.

Figure 1-5. Honoré Daumier. "Nadar Elevating Photography to a High Art," 1862. Nadar's photographic feats, including aerial shots from a balloon, inspired this lithograph. Courtesy George Eastman House.

Daguerrotype mania
By 1853, 100 studios in New York City

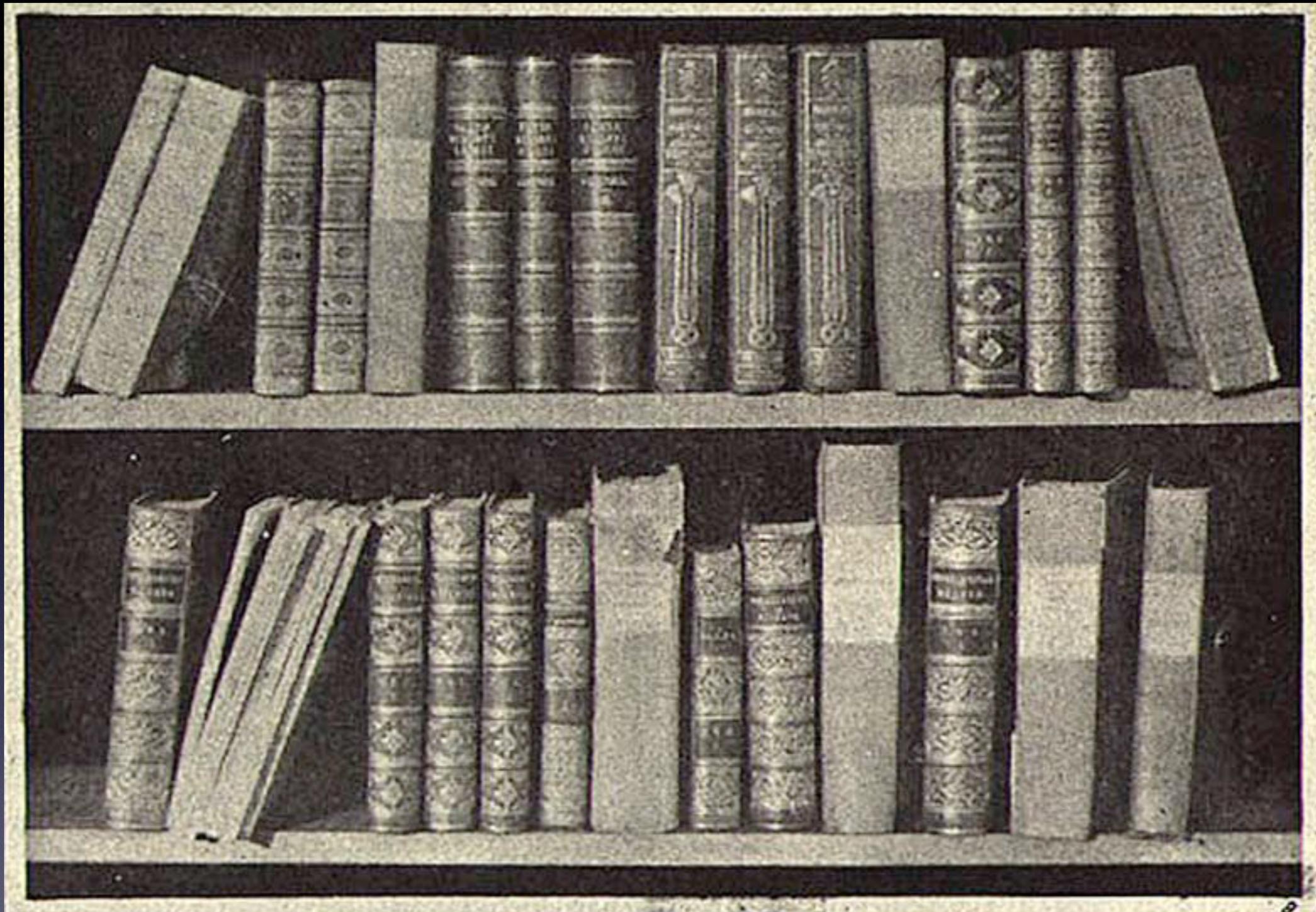
Henry Fox Talbot

- Eclipsed by the Daguerrotype, he continued to work alone
- In 1841 he invented the Calotype, a wet-plate process
- Wet-negatives mean faster exposures, but also must be processed immediately
- This was the first negative-positive process





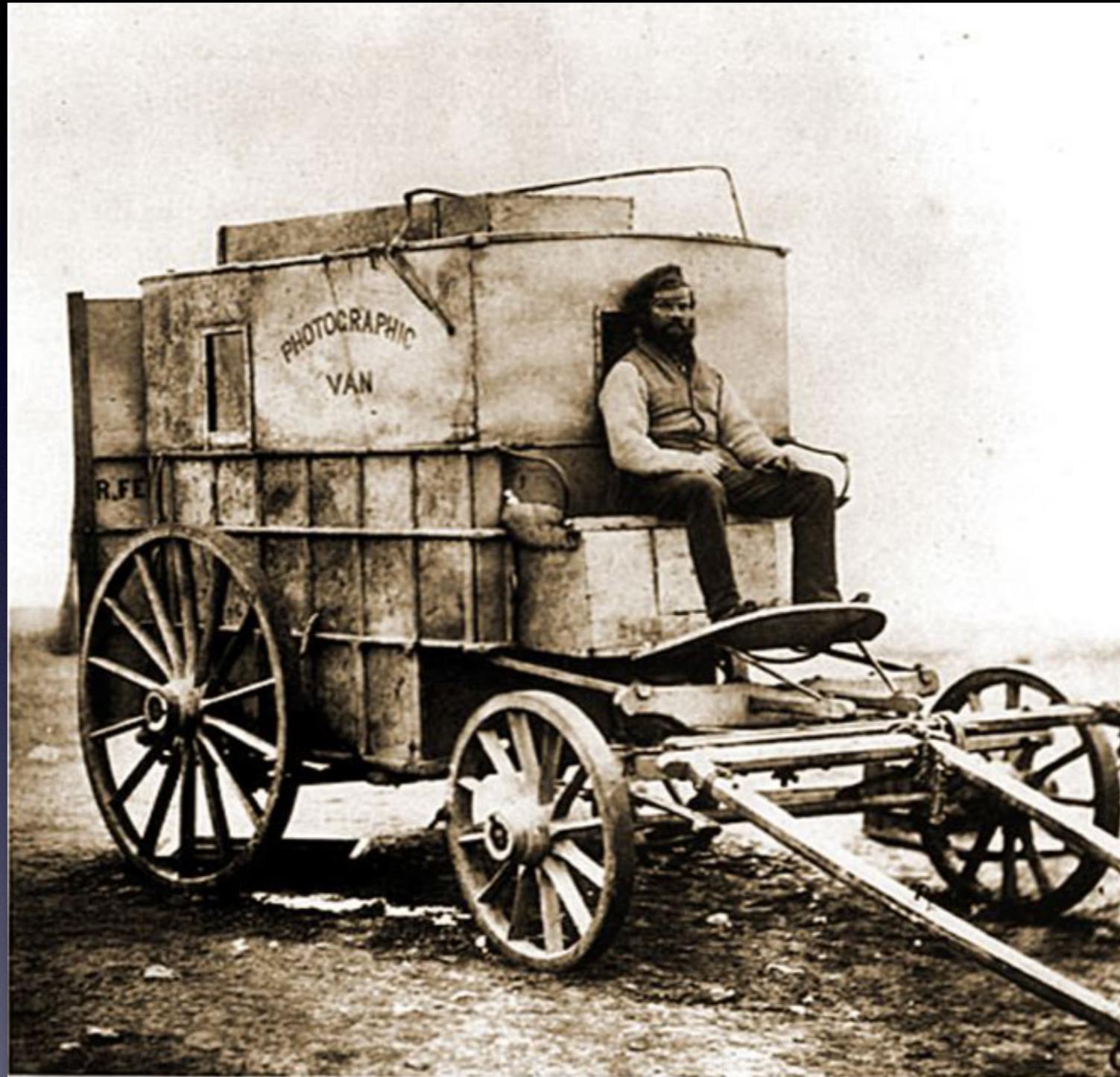
Henry Fox Talbot Calotypes: negative and positive



- Henry Fox Talbot, 1844, from Pencil of Nature



- Henry Fox Talbot, 1844, "The Broom"



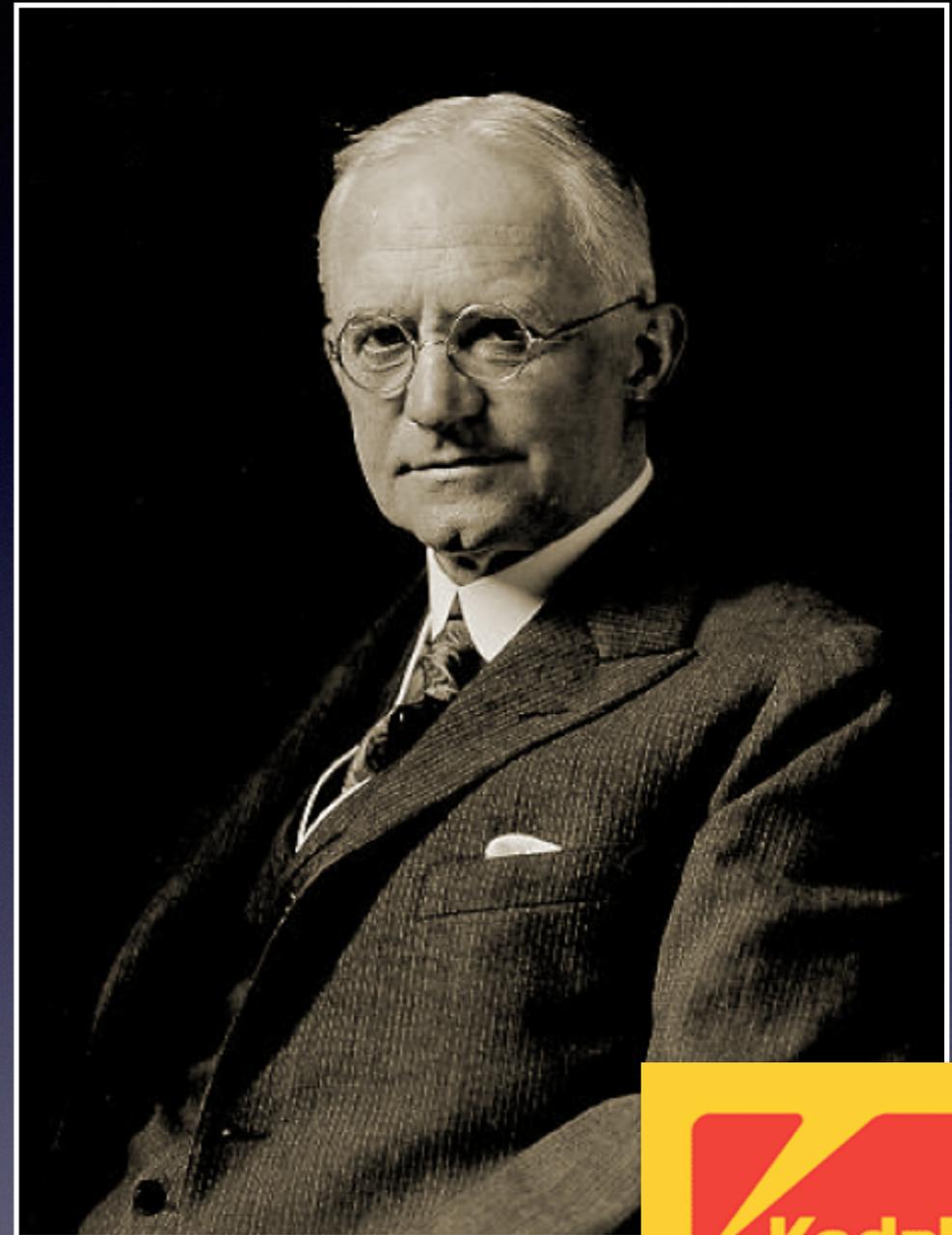
Circa 1855, Photographic Van
for Wet-Plate Processes



Circa 1877, Portable Wet Plate Darkroom
Collodion Wet-Plate Process Tent & Equipment

George Eastman

- Invented the film-based camera
- Combined ease of use and accessibility which resulted in a cultural explosion
- Anyone could use the camera: just push a button, send it away to be processed. No knowledge necessary.

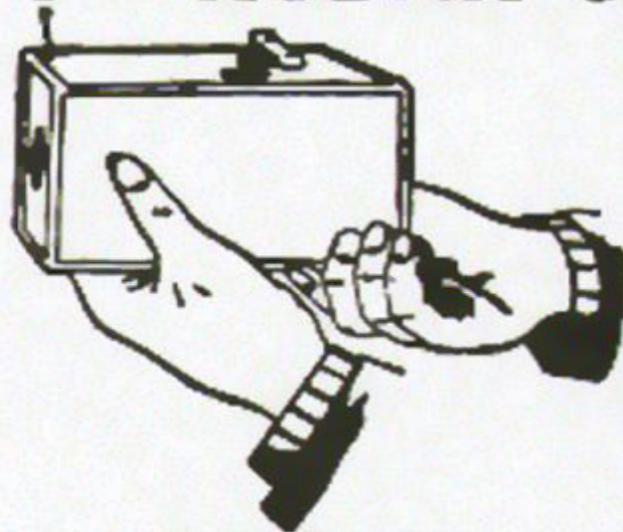




No. 1 Kodak Portrait of
George Eastman



THE KODAK CAMERA



**100
Instantaneous
Pictures!**

Anybody can use it.

No knowledge of
photography is
necessary.

The latest and
best outfit for ama-
teurs.

Send for descrip-
tive circulars.

Price \$25.00.

**The Eastman Dry Plate & Film Co.
ROCHESTER, N. Y.**

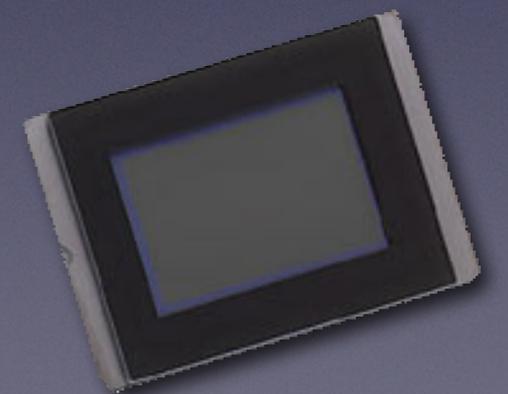
1888



No. 1 Kodak

So what is digital photography?

- The most basic change between traditional and digital photography is the type of image capture:
 - Digital photography responds electronically to light and captures an image via a Digital Imaging Sensor
 - Traditional photography responds chemically to light and captures the image via light-sensitive crystals with traces of silver



CANON CMOS SENSOR

Film responds chemically

- Emulsion on film is filled with light-sensitive crystals with traces of silver
- Exposure to light causes the impurities in these crystals attract the silver atoms in microscopic clumps. The stronger the light, the larger the clumps
- Development enlarges the clumps further making them visible

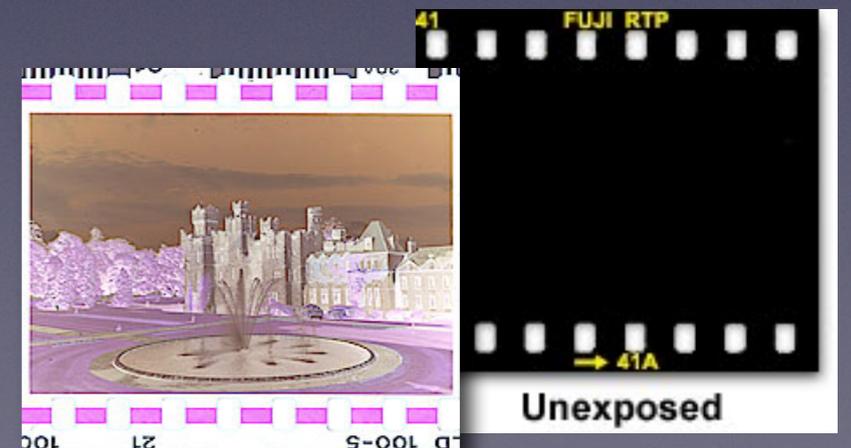
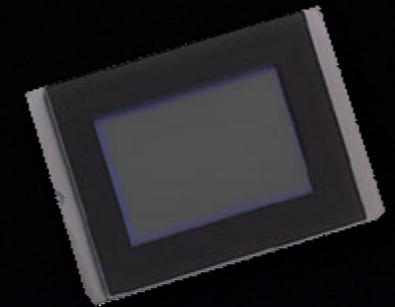
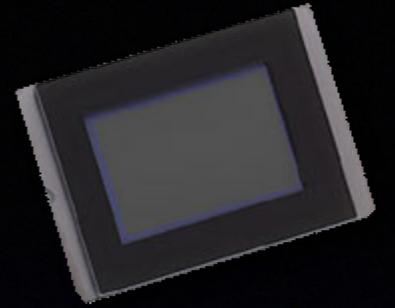


Image Sensor responds Electronically



- The sensor is a layer of silicon covered with a grid of square electrodes. The silicon is filled with negatively charged particles or electrons.
- When light passes through these electrodes, they scatter. Voltage applied to the electrodes attracts the free electrons into clusters called photosites.
 - Stronger light and higher voltage at a specific electrode translates to more electrons per site.
- A digital converter counts the electrons at each site and sends the data out to the logic board for processing.
- The electrons are then released back into the silicon and the image sensor is ready to use again.

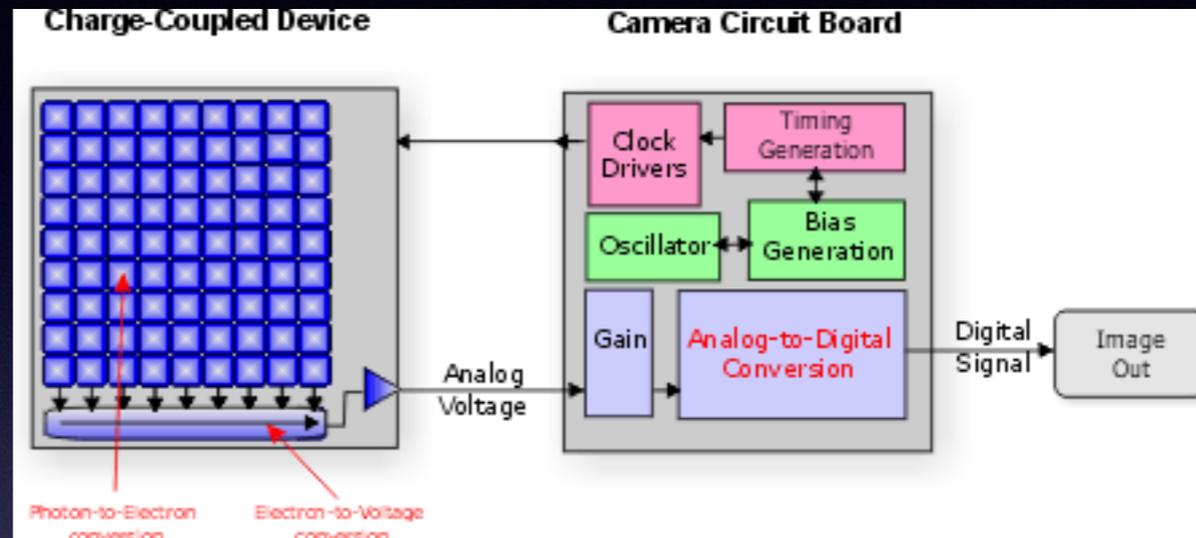
Types of Image Sensors



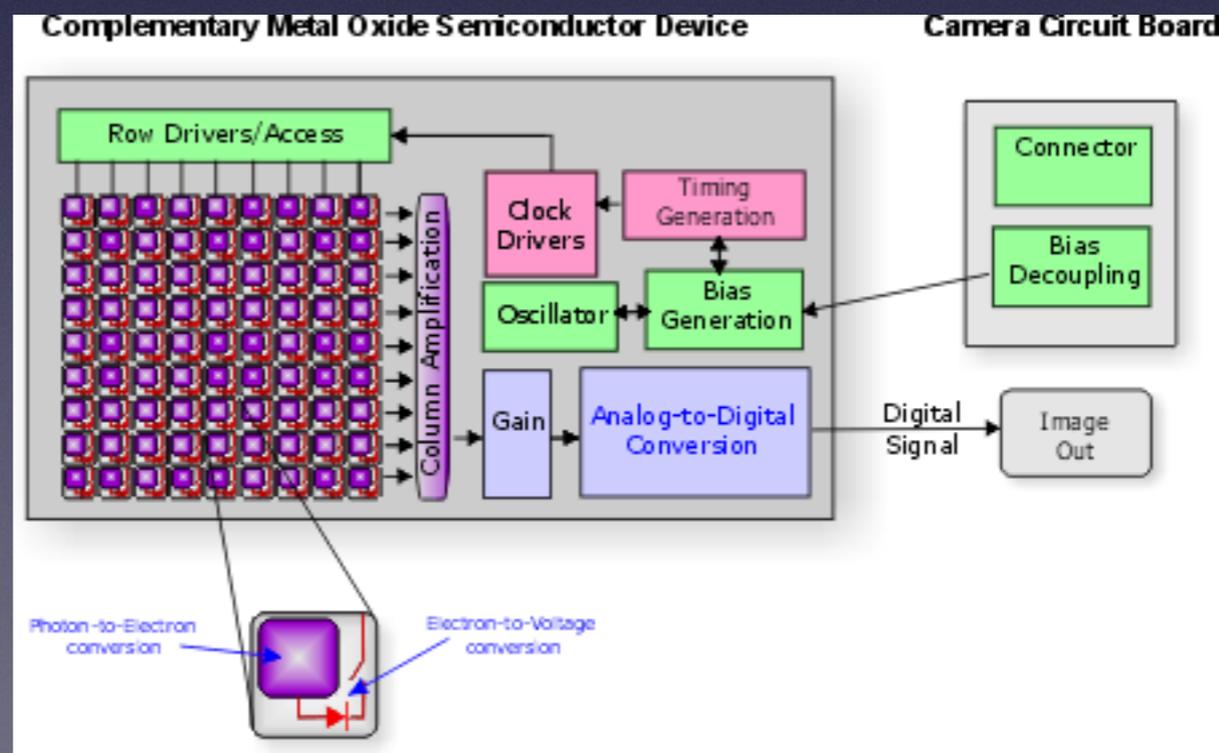
- Currently two main technologies are used:
 - CCD - Charge Coupled Devices
 - CMOS - Complementary Metal Oxide Sensors
- CCD
 - Originally created in the 1960 as an alternative to vacuum tubes. Now the most common computer chips in production-used in camcorders, scanners, electronic telescopes and medical instruments. Cons include high consumption of energy and that it is relatively expensive to manufacture.
- CMOS
 - This imaging technology features paramount quality, low noise and low power consumption at low production costs
 - Main reason camera prices have dropped while image quality has gone up

Imaging Sensor Processing

CCD

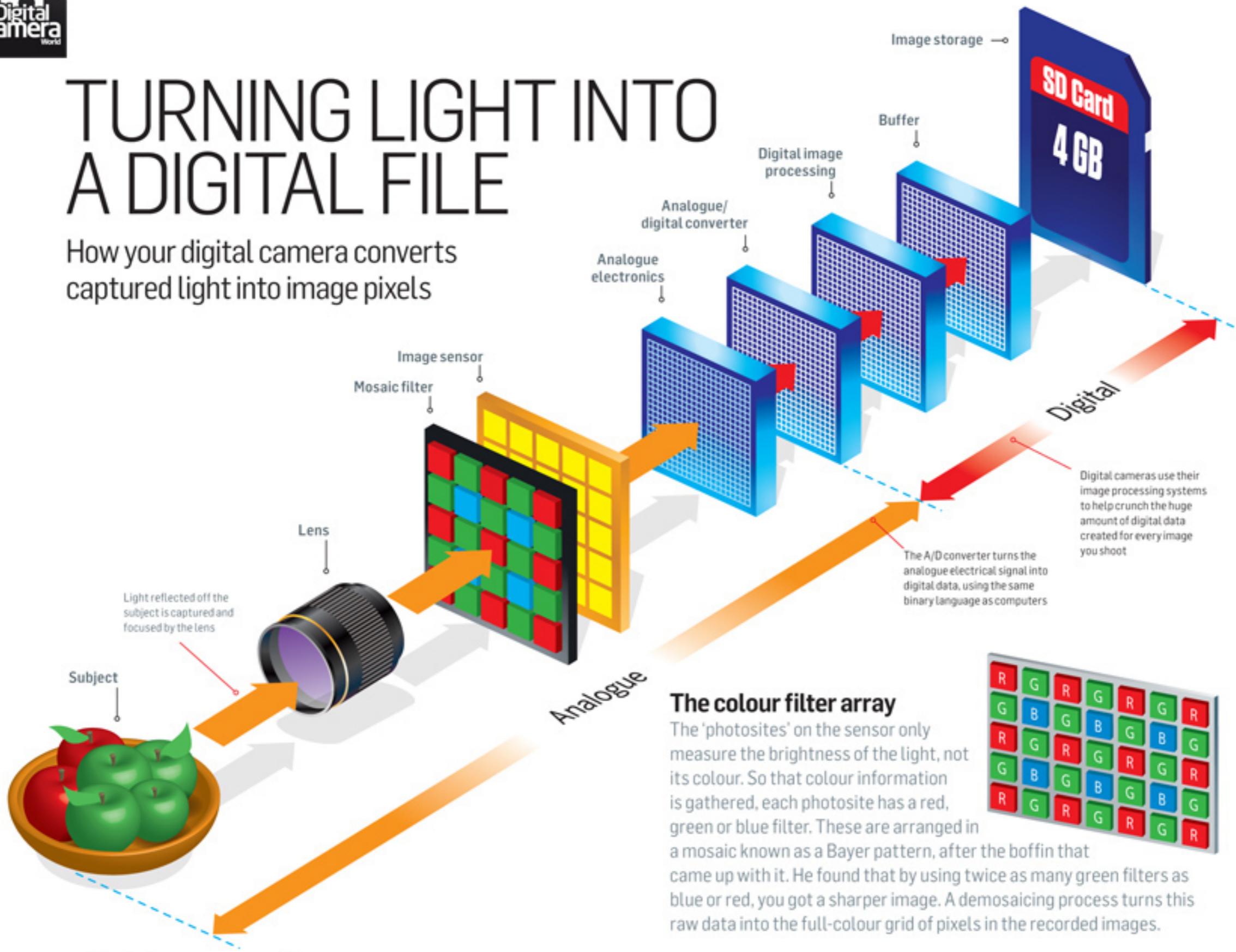


CMOS



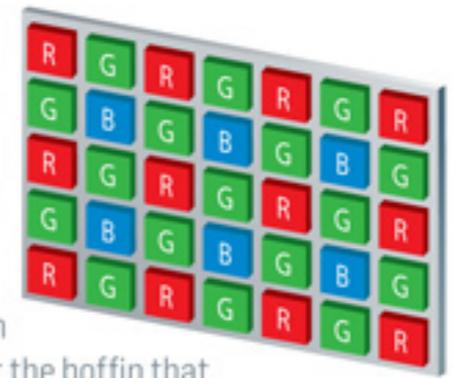
TURNING LIGHT INTO A DIGITAL FILE

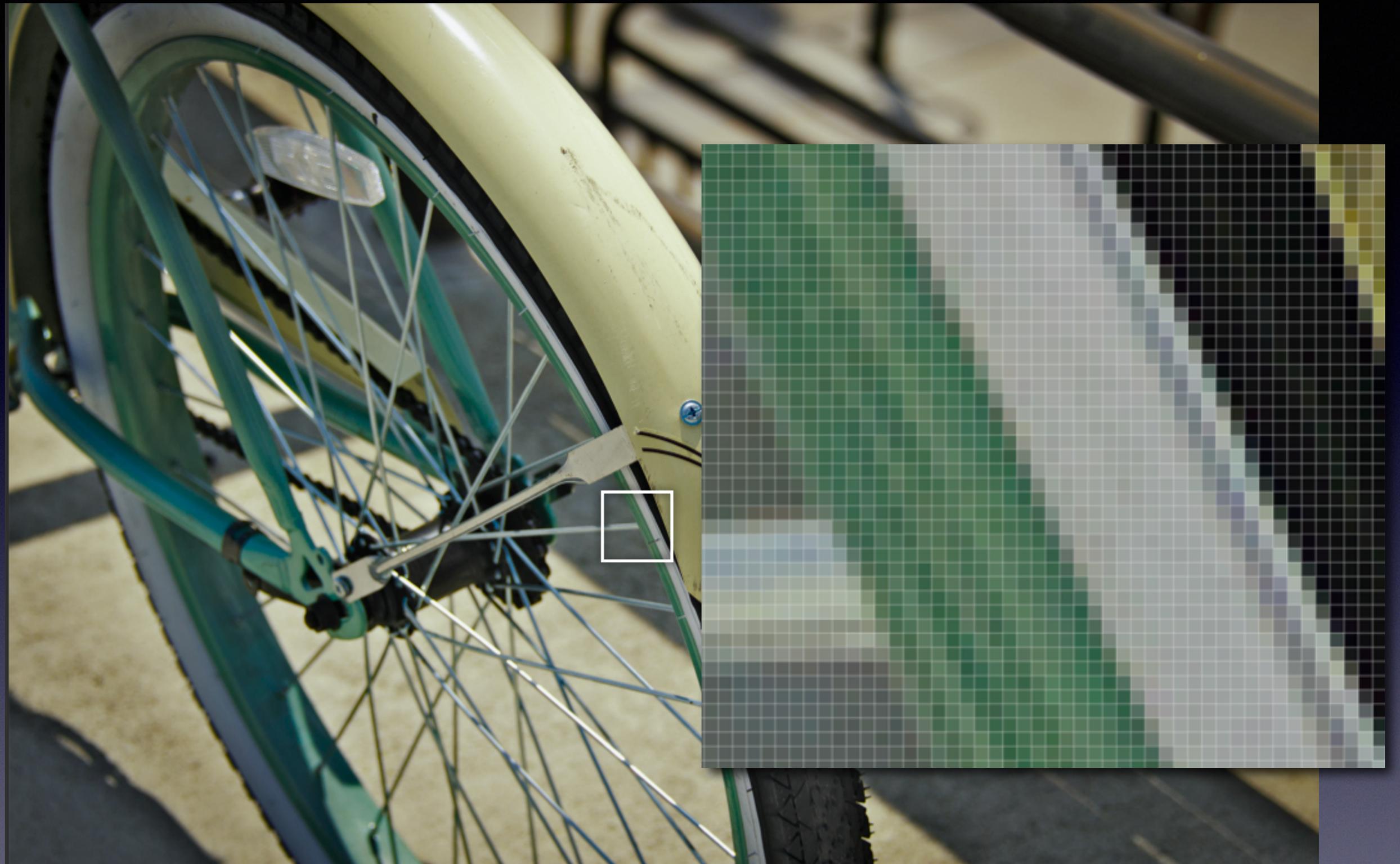
How your digital camera converts captured light into image pixels



The colour filter array

The 'photosites' on the sensor only measure the brightness of the light, not its colour. So that colour information is gathered, each photosite has a red, green or blue filter. These are arranged in a mosaic known as a Bayer pattern, after the boffin that came up with it. He found that by using twice as many green filters as blue or red, you got a sharper image. A demosaicing process turns this raw data into the full-colour grid of pixels in the recorded images.





Pixels

Dots that form an image

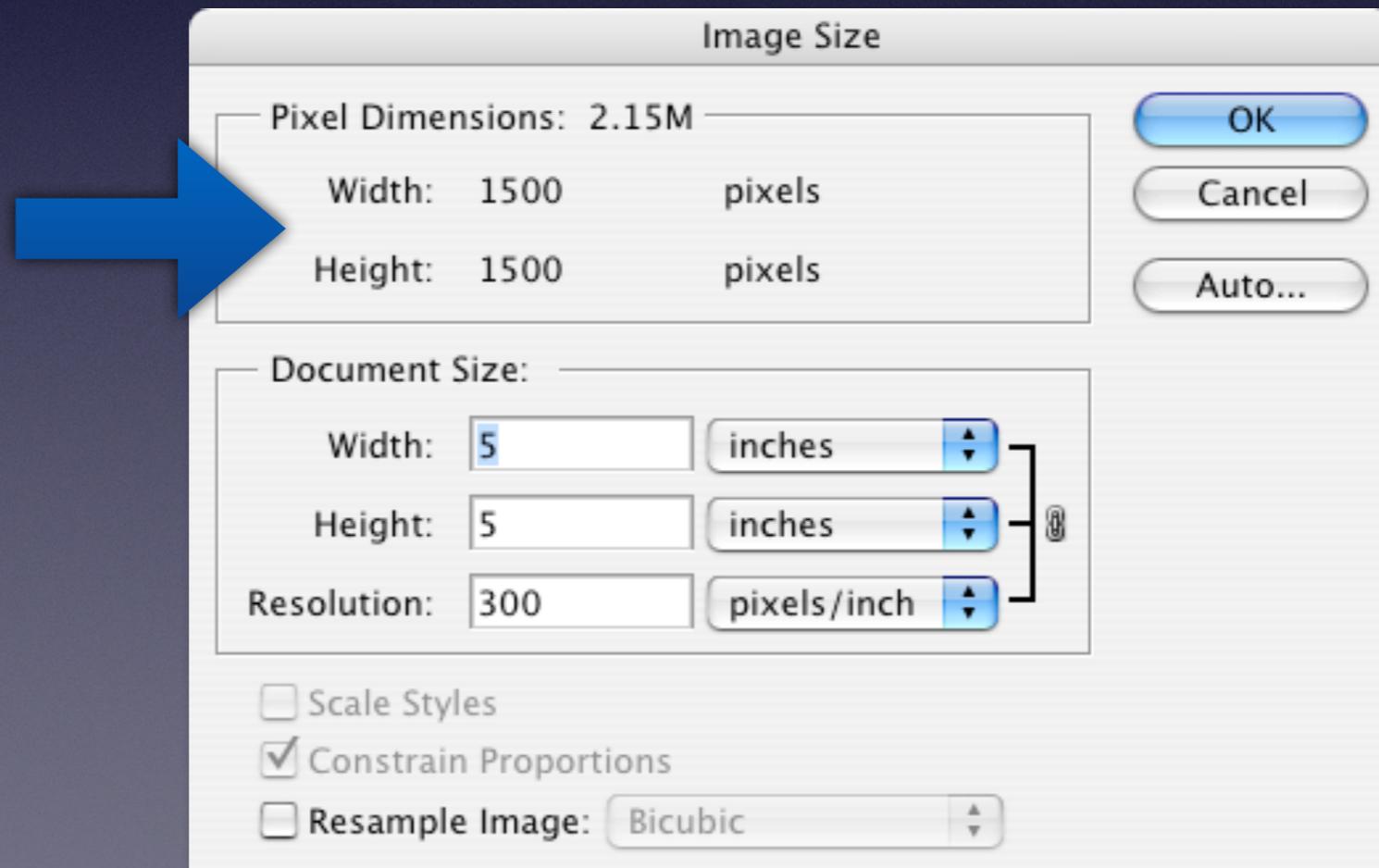
Pixels

- Pixels are tiny squares that contain values for three channels: Red (R), Green (G) and Blue (B)
- Resolution is the number of pixels packed into each inch
 - Standard screen resolution is 72 ppi (pixels per inch). This means that in every inch of the computer screen, there are 72 pixels containing RGB values. Images for the web should be 72 ppi.
 - Printing resolution may vary by machine, but is generally 300 ppi. This means that there are 300 pixels of information per inch. Images destined for printing should be at least 300 ppi.
- Despite what your resolution is set to, your true image quality is relative to your pixel dimensions. The more pixels, the higher quality the image.

Pixels

- To determine your Pixel Dimensions, multiply your width and height by your resolution.
- For example: if you have a 5" x 5" document at 300 pixels/inch, your pixel dimensions are 1500 pixels x 1500 pixels.
 - $5'' \times 300\text{px} = 1500\text{px}$

Or just open
Image > Image Size. Pixel
Dimensions is located at
the top.

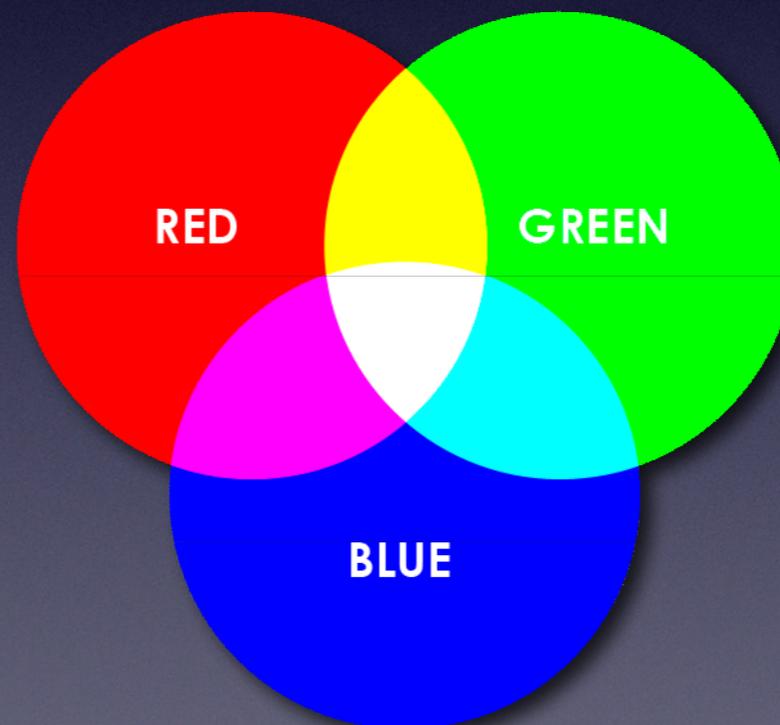


Color Modes

- What color mode does your computer screen, camera and scanner operate in?

RGB is an additive color mode meant for viewing images with light. This means that when you add all the colors together, you get white.

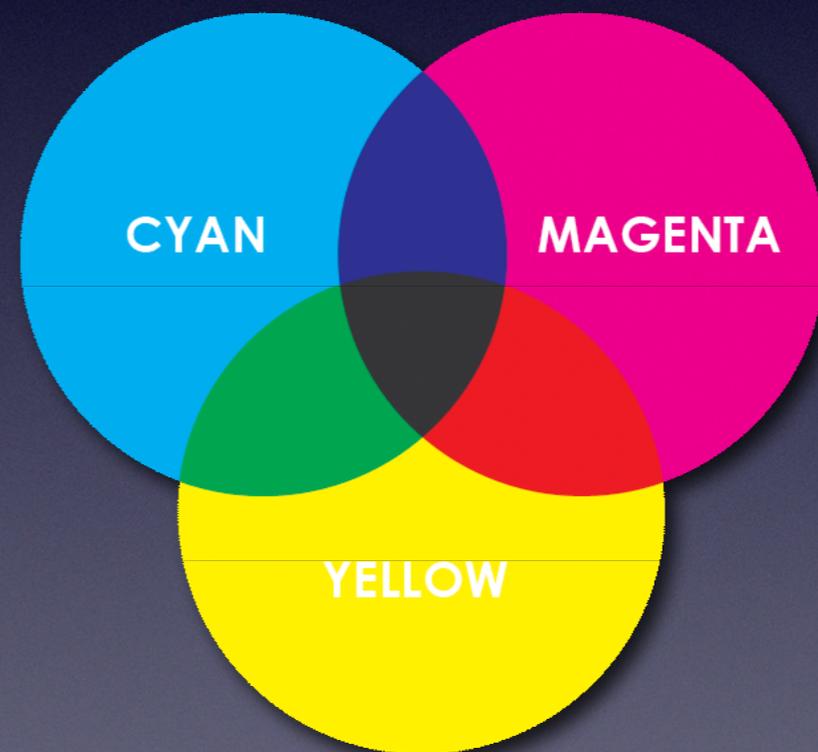
To remember this, think of daylight- it contains all colors but is perceived as 'white light.'



Color Modes

- What color mode is used for images destined for the printing world?

CMYK is a subtractive color mode meant for viewing with inks and pigments. If we print cyan, magenta and yellow inks on white paper, they absorb the light shining on the page. Since our eyes receive no reflected light from the paper, we perceive black.

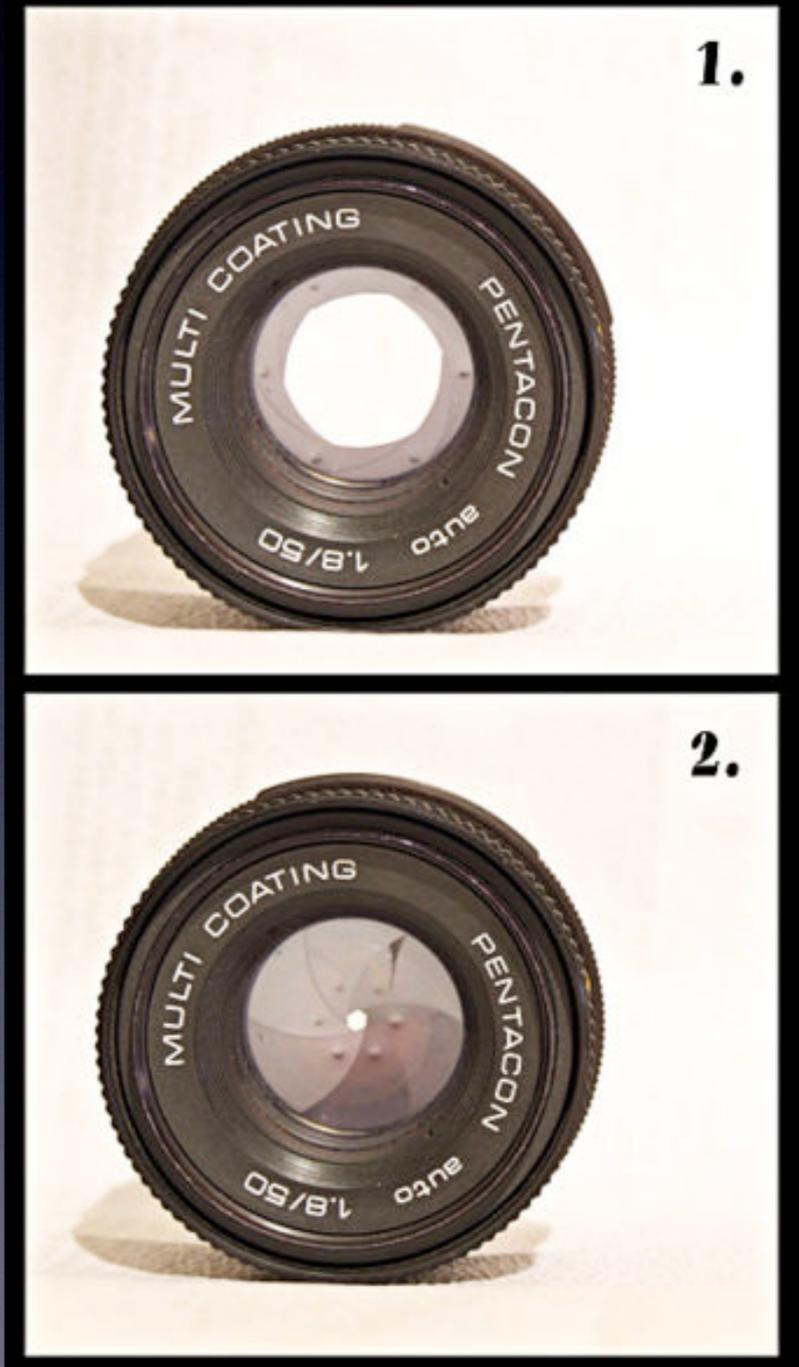


The “K” in CMYK

- In practice, inks contain impurities that prevent them from absorbing light perfectly
- In order to get decent dark colors, black ink is added in increasing proportions, as the color gets darker and darker
- This is the "K" component in CMYK printing
- K is used instead of B to avoid a possible confusion over blue ink

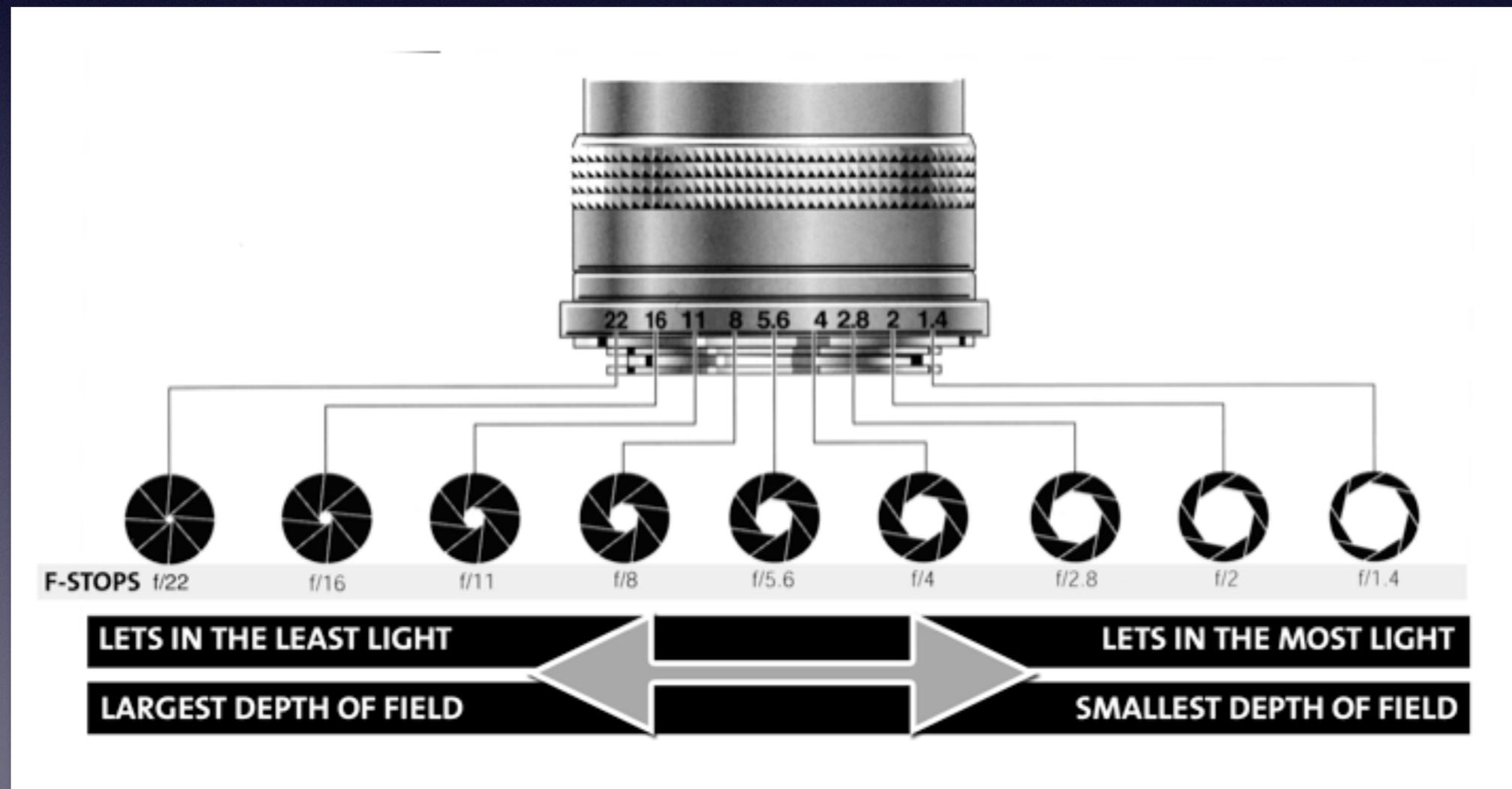
What is the Aperture?

- The aperture is the opening through which light enters the camera.
- The aperture can be large or small and its diameter is measured in field stops, more commonly known as f-stops
- F-stops are measured in fractions. In example: $f/2.8$, $f/5.6$ and $f/16$.



Depth-of-Field

- The distance range in which objects appear in sharp focus
- Depth-of-field is controlled by the f-stop setting



What is the shutter?

- The shutter is the device on the camera that regulates the amount of time light is exposed to the film or imaging sensor
- The shutter is measured in seconds
 - In example: 1/60 sec, 1/500 sec, 1/4 sec



Media and Capacity

- Media is referred to anything used to store information.
- Capacity is the ability to hold images.
- Film capacity is measured by exposures.
- Digital capacity is measured in BYTES.
- BYTE- a sequence of eight numbers
 - Thousand bytes = Kilobyte
 - Million bytes = Megabyte
 - Billion bytes = Gigabyte

Types of Image Compression

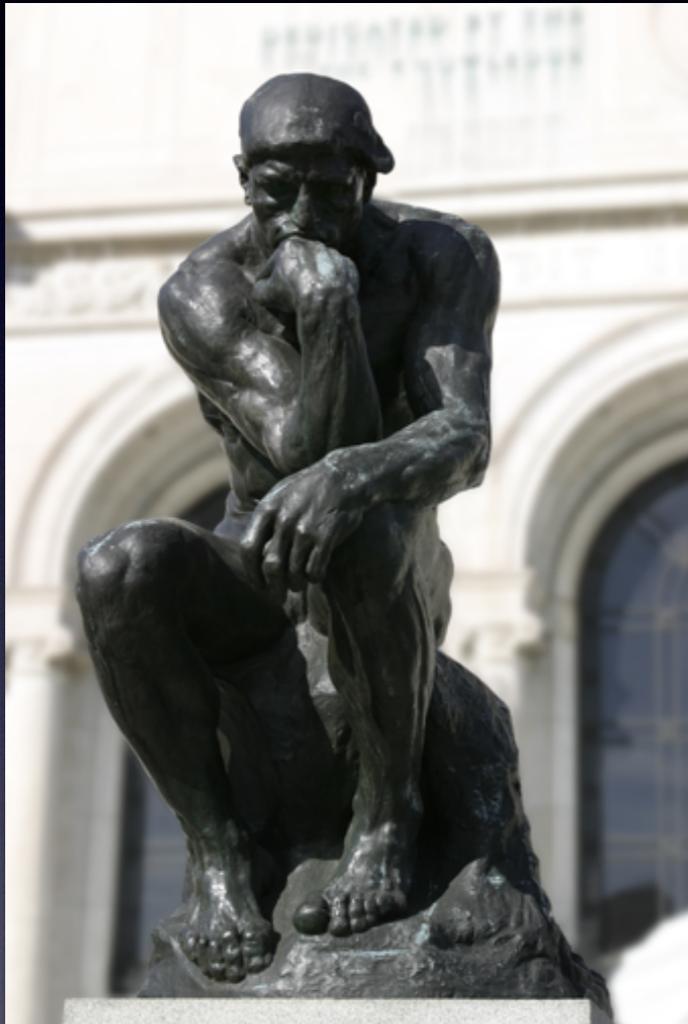
- Lossless
 - Removes only redundant image data
 - Very little image quality lost (lose less)
 - .psd, .tif
- Lossy
 - Removes more data resulting in smaller files
 - Reduced image quality
 - .jpeg, .gif, .bmp, .png, .tga

Lossy

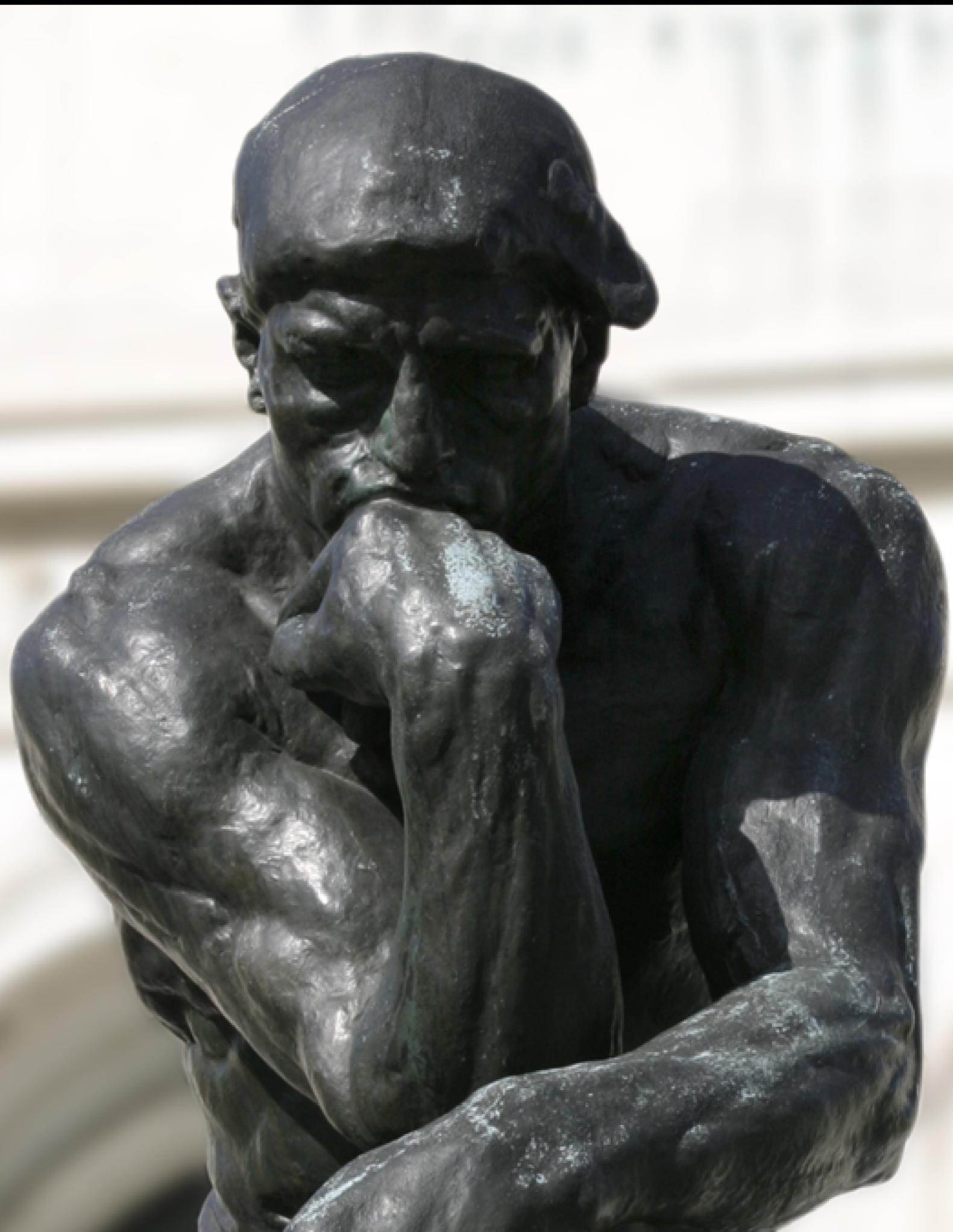


- Lossy compression throws data away and compresses information into cells
- The size of the cells is relative to the level of compression chosen

Lossless



- Lossless compression retains image quality and does not eliminate data



File Formats

- **JPEG / JPG**
- Offers twelve levels of compression, greatly reduces file size
 - Multi-platform, primarily used for web or small images
- **PNG**
 - Supports lossless image compression, but is intended for web use, not print photographs
 - Supports transparency, unlike JPG
- **TIF**
 - Lossless when selecting “none” or “LZW” compression
- Supports Photoshop layers and effects
- High-quality, multi-platform, used for print
- **PSD**
 - Photoshop’s native format with no compression
- **Raw - Canon’s .CRW and .CR2, Nikon’s .NEF, etc.**
 - Digital photography's equivalent of a negative in film photography: it contains untouched, "raw" pixel information straight from the digital camera's sensor

Part 2:
Photography is the
Capture of Light

The importance of light

- Photography is literally the capture of light
- Quantity of light allows you to make an exposure, but the quality of light can make or break a photo
- Before you take your next picture, take a minute to observe the light around you. What is the light source? What is its direction? How does it change throughout the day? Is there anyway you can manipulate the light to enhance your photo, either by moving or manipulating the light?

Characteristics of Light

Source

- Natural Light
- Artificial Light

Quality

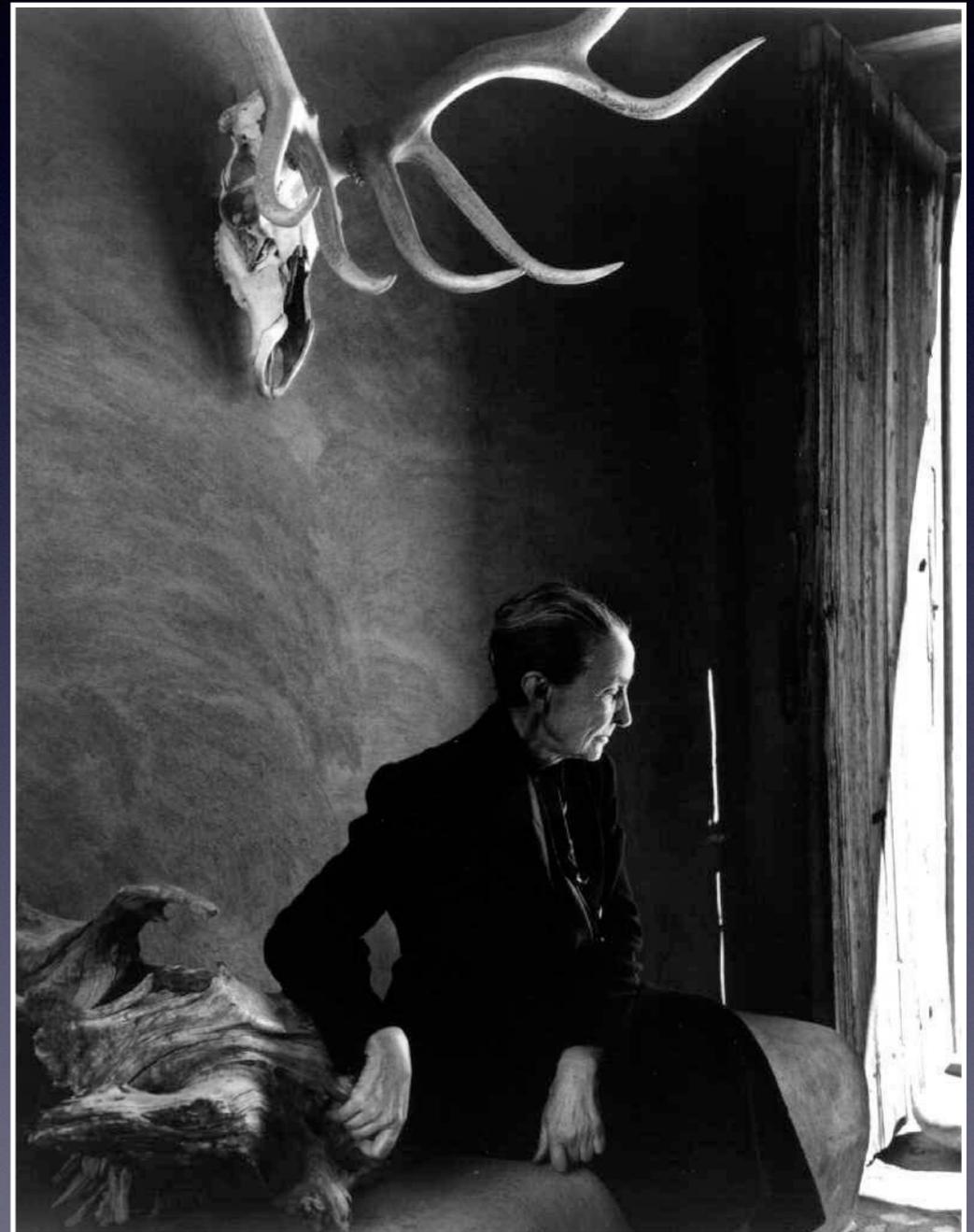
- Soft Light
- Hard Light

Direction

- Above
- Front
- Side
- Back
- Below

Source: Natural Light

- Sunlight or moonlight
- Can be direct, or ambient
- Window lighting, or light coming through a window, makes for great soft, yet directional light



Source: Natural Light

Timing

- Consider the direction your subject faces and choose the proper time of day for your shoot

Avoid mid-day lighting

- Approx 12pm to 3pm generally has harsh, bad lighting

Plan ahead

- Train your eye to recognize lighting at different times of day from different directions



Source: Natural Light
Joakim Eskildsen





Source: Natural Light



Source: Natural Light

Lago di Garda



Source: Natural light

Dominik Banasik



Source: Natural light

Michael Robinson

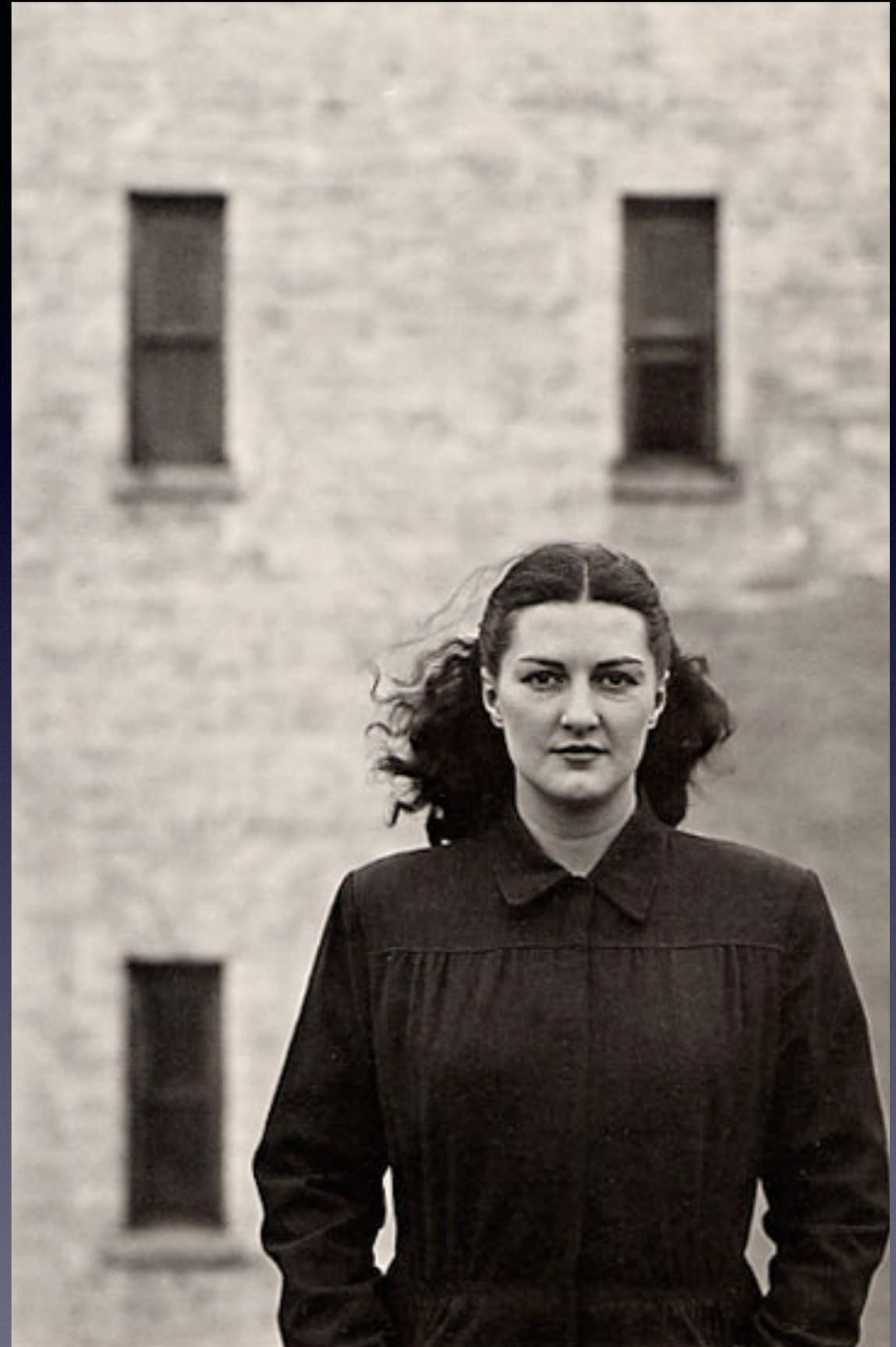


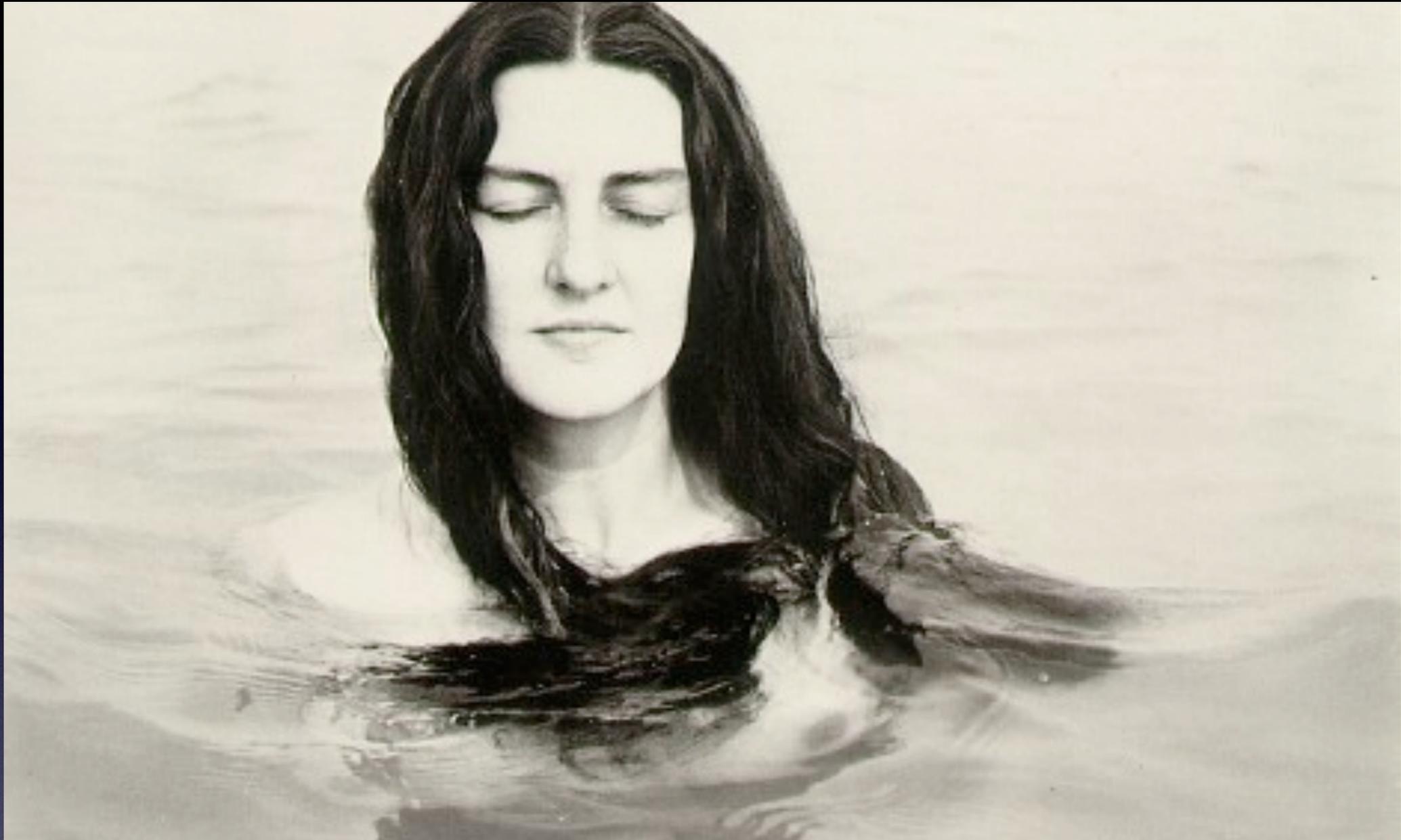
Source: Natural light

Michael Robinson

Source:
Natural light

Harry Callahan



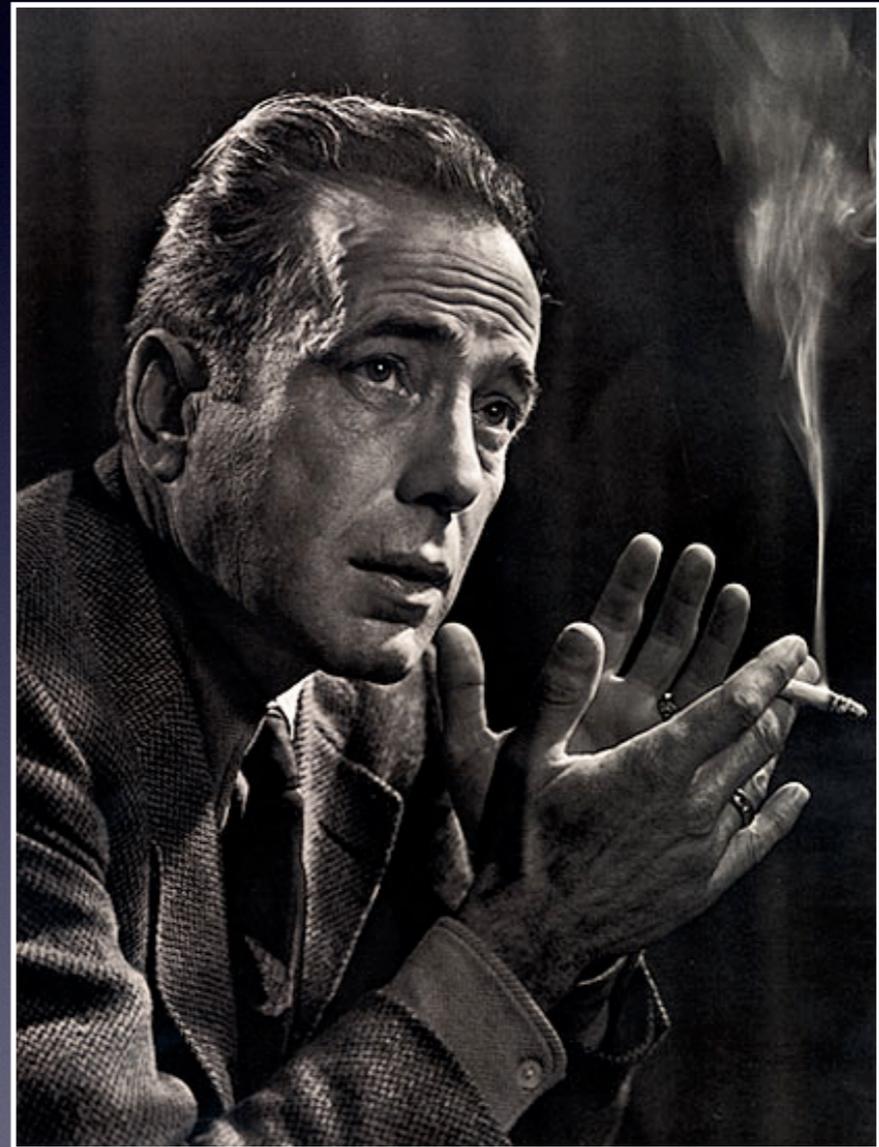


Source: Natural Light

Harry Callahan

Source: Artificial light

- Artificial light sources may include lamps, strobes, on-camera flash, tungsten lights, candlelight, flashlights, etc.
- Some artificial light may be easily controlled or modified, while others may be part of the landscape
- Consider your options



Direction of Light

- Above
- Front
- Side
- Back
- Below



Source: Artificial light

Julia Fullerton-Batten



Source: Artificial Light

FJNY



Source: Artificial light

Julia Fullerton-Batten



Source: Artificial light

Miss Anelia



Source: Artificial light

Steve Stanton



Source: Artificial light

Trey Ratcliff



Source: Artificial light

Direction: Above

- Very dramatic, leaves a “butterfly” shadow under nose and shadow under chin
- Reveals form and shape





Direction: Above

Cole Thompson



Direction: Above

Brandon Hoover

Direction: Above

Gordon Parks



Direction: Front

- Generally flattens the image instead of revealing form
- Can create a very tight shadow around the subject matter





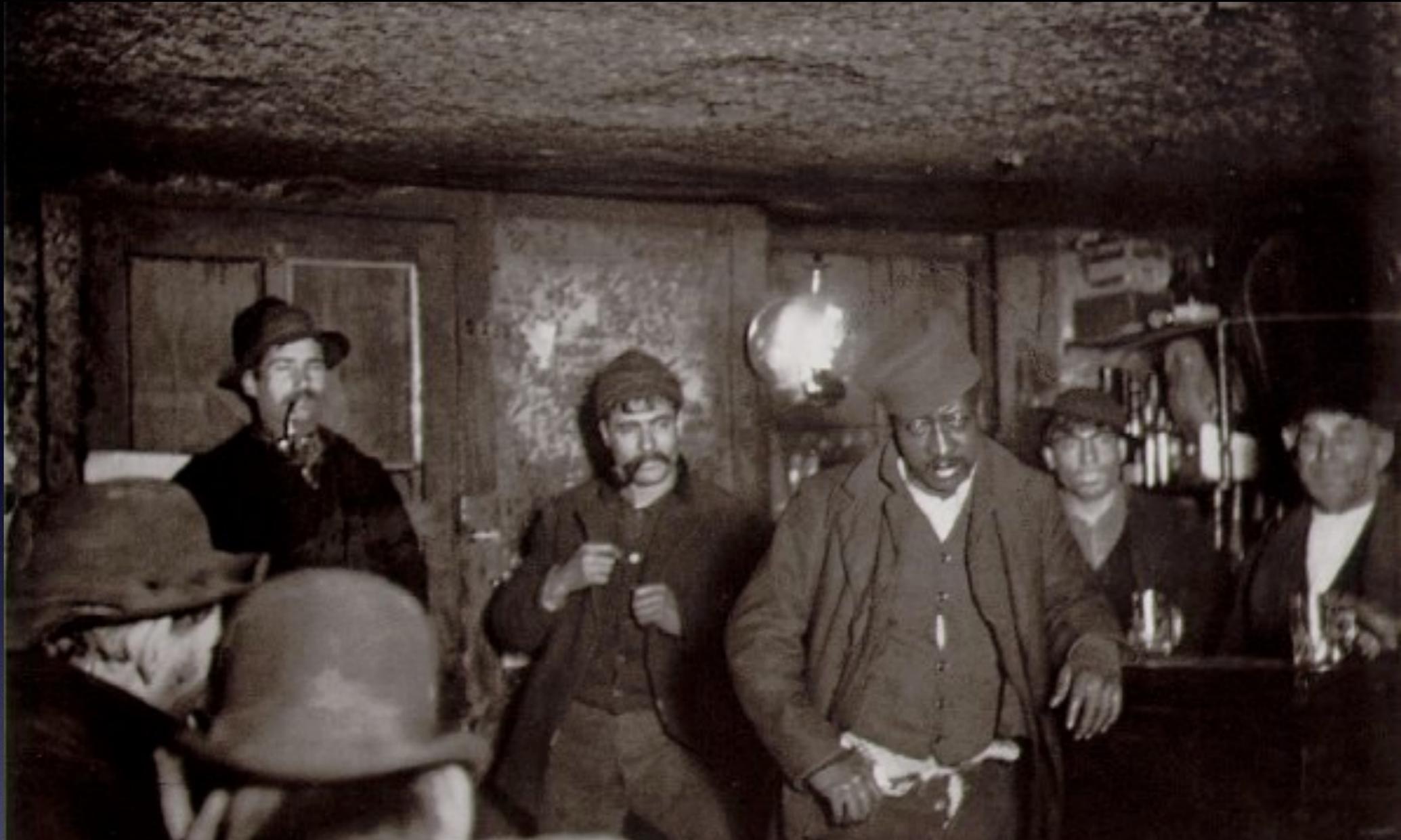
Direction: Front

Gage Young

Direction: Front

Oat Vaiyaboon





Direction: Front

Jacob Riis

Direction: Side

- Reveals form and texture in subject
- Can be used to create “Rembrandt” lighting





Direction: Side

Annie Leibovitz



Direction: Side

Michael Robinson



Direction: Side

Jehad Nga

Direction: Side

Hendrik Kerstens



Direction: Back

- Can emphasize shape with a silhouette
- Can create rim-lighting which emphasizes edges
- May add strong shadows
- May illuminate the subject



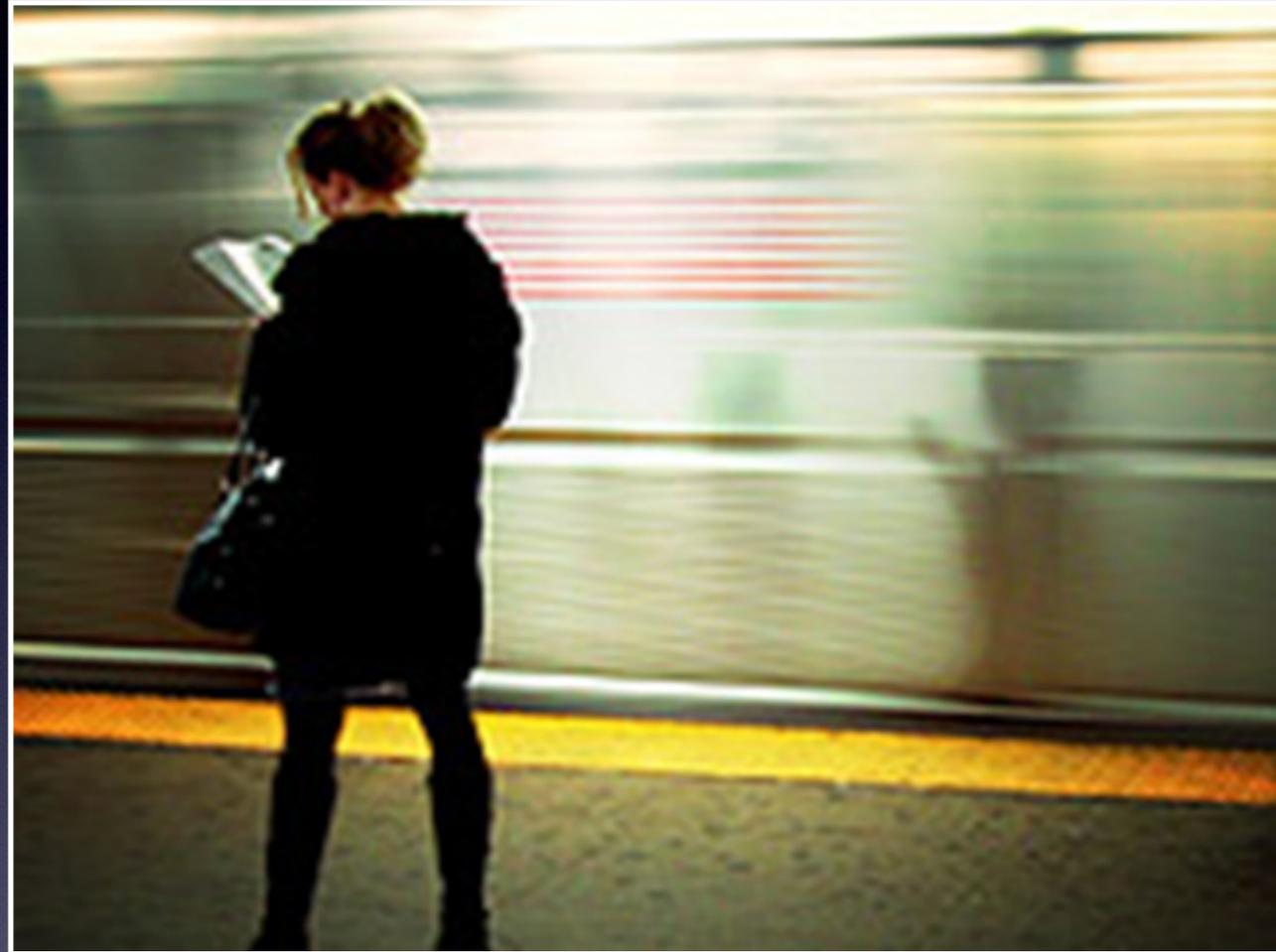
Direction: Back



Direction: Back

Jean Marie





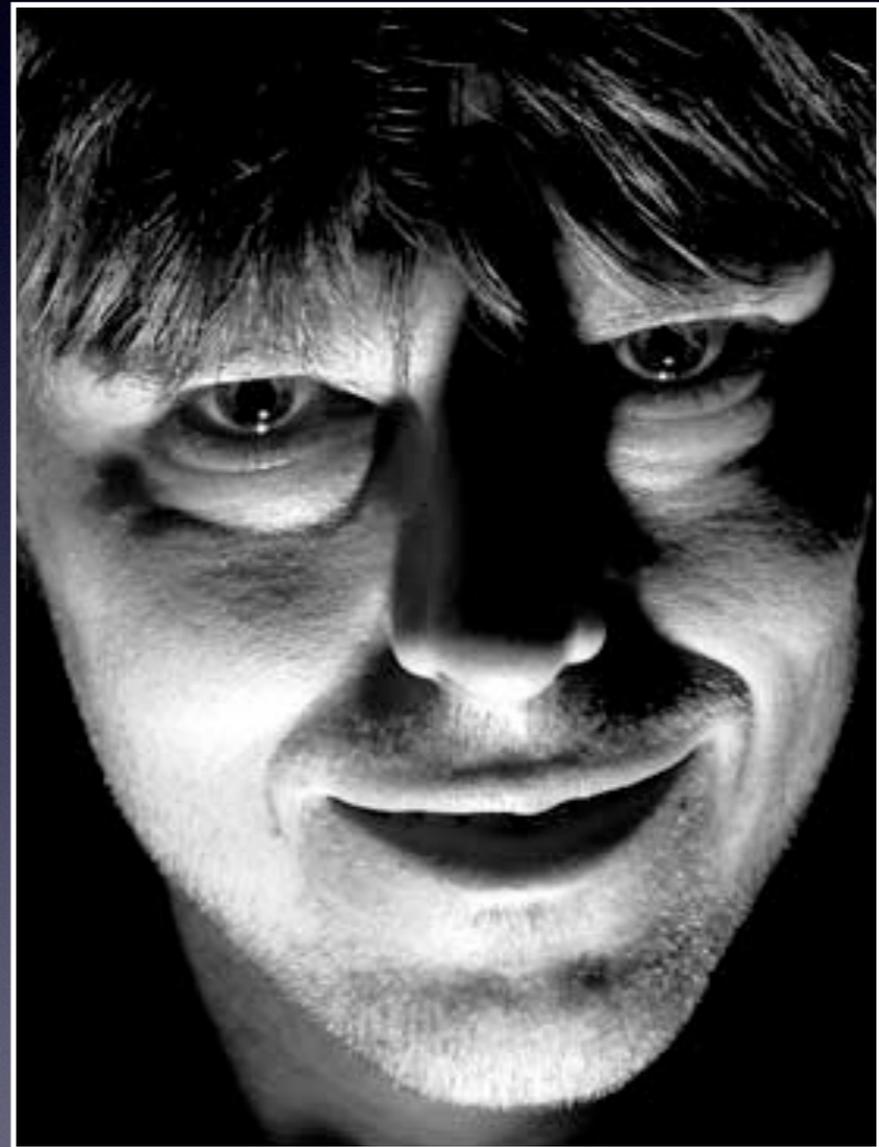


Direction: Back

Jason Swain

Direction: Below

- Adds a very dramatic effect
- Distorts features from how we are used to seeing them lit



Direction: Below

Nju



Quality: Soft Light

- Casts soft shadows
- Good for portraits
- Can be found in:
 - Diffused lighting
 - An overcast day
 - Shade or other ambient light





Quality: Soft Light

Gabriella Camerotti

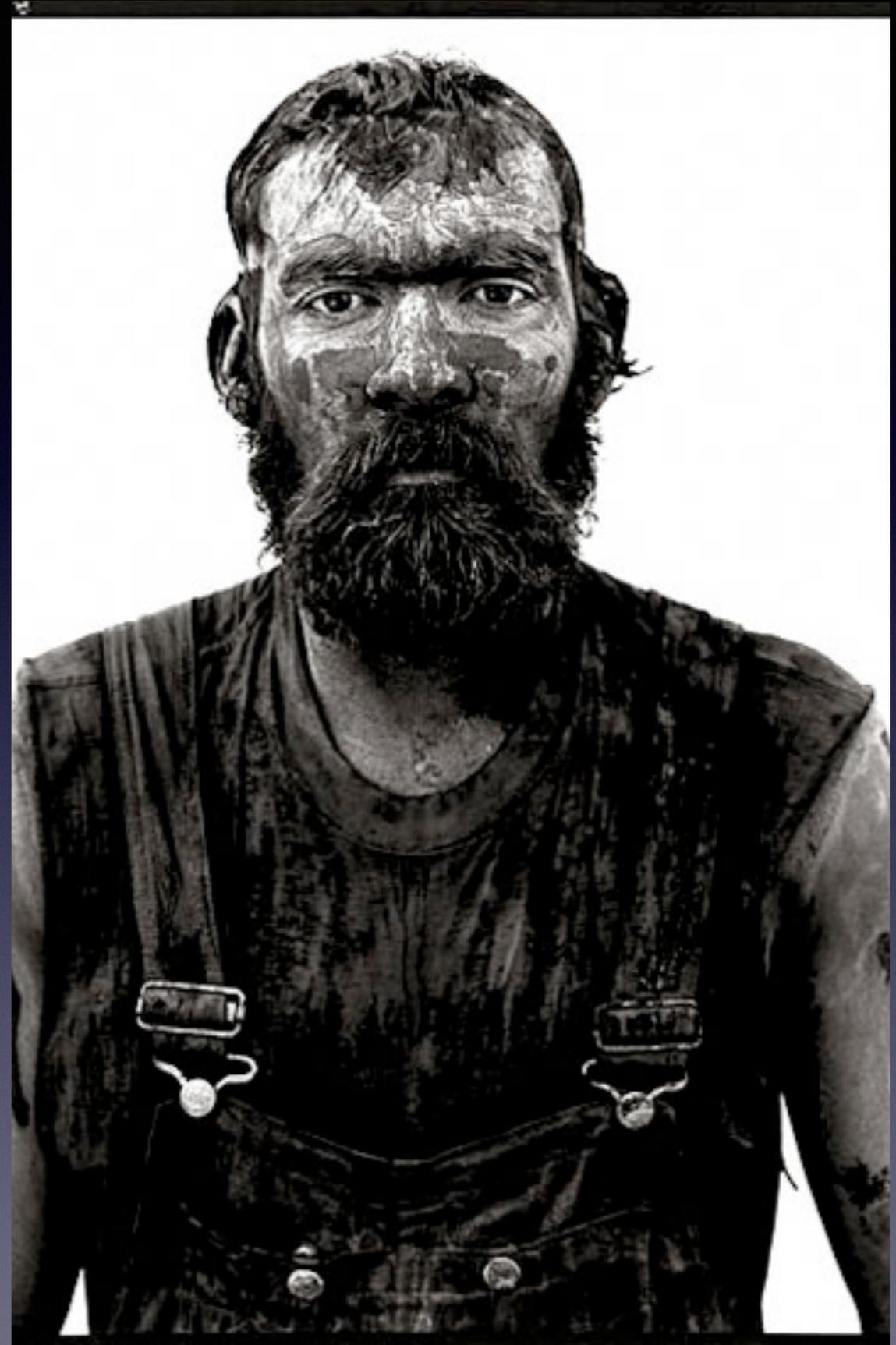


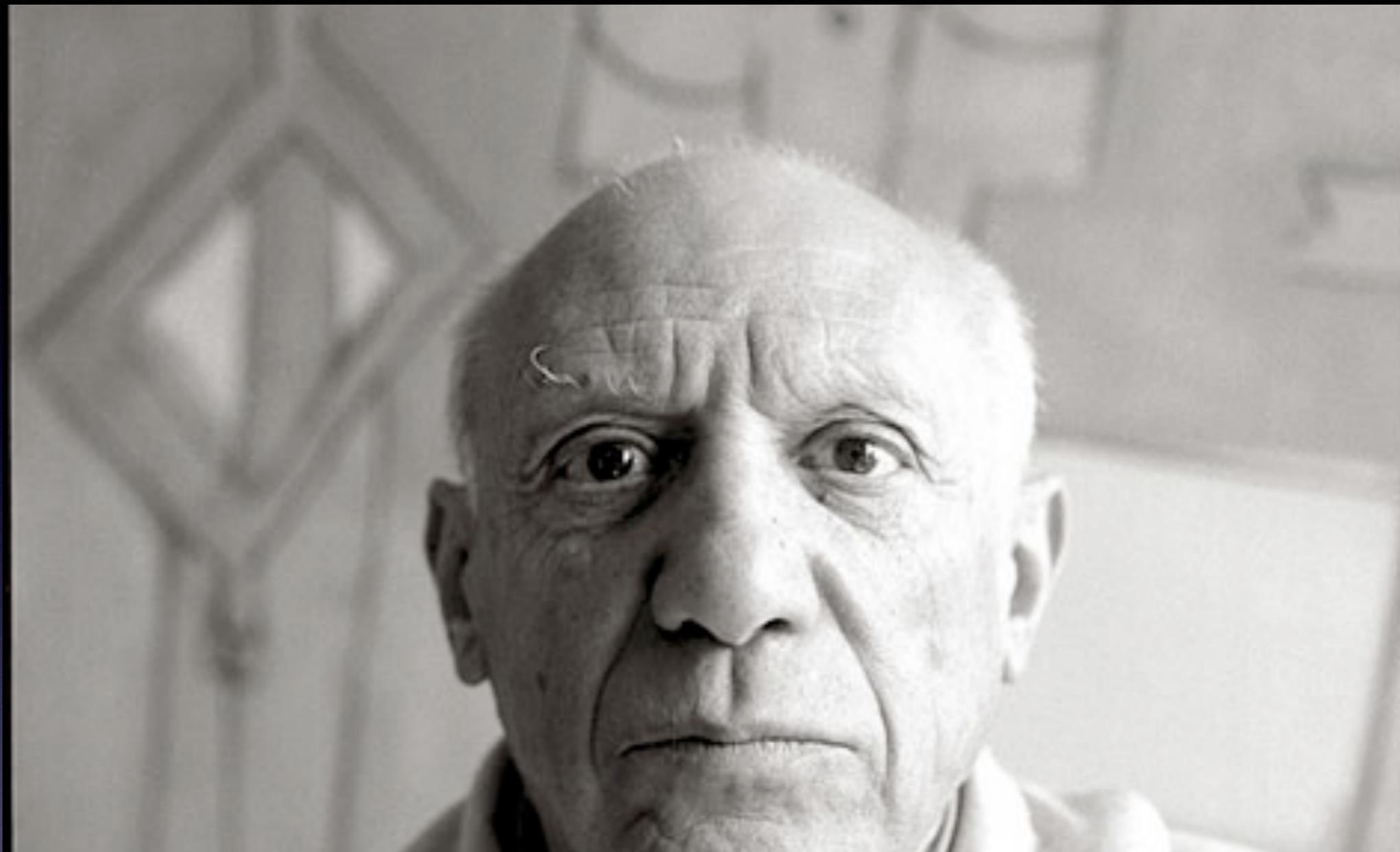
Quality: Soft Light

Gabriella Camerotti

Quality:
Soft Light

Richard Avedon





Quality: Soft Light

Richard Avedon

Quality: Soft Light

Ansel Adams



Quality: Hard Light

- Hard light creates hard shadows
- Reveals texture
- Can be unflattering
- Is found in:
 - Direct sunlight
 - Undiffused light



Quality: Hard Light

Immogen Cunningham





Quality: Hard Light

Irving Penn

Quality: Hard

Irving Penn



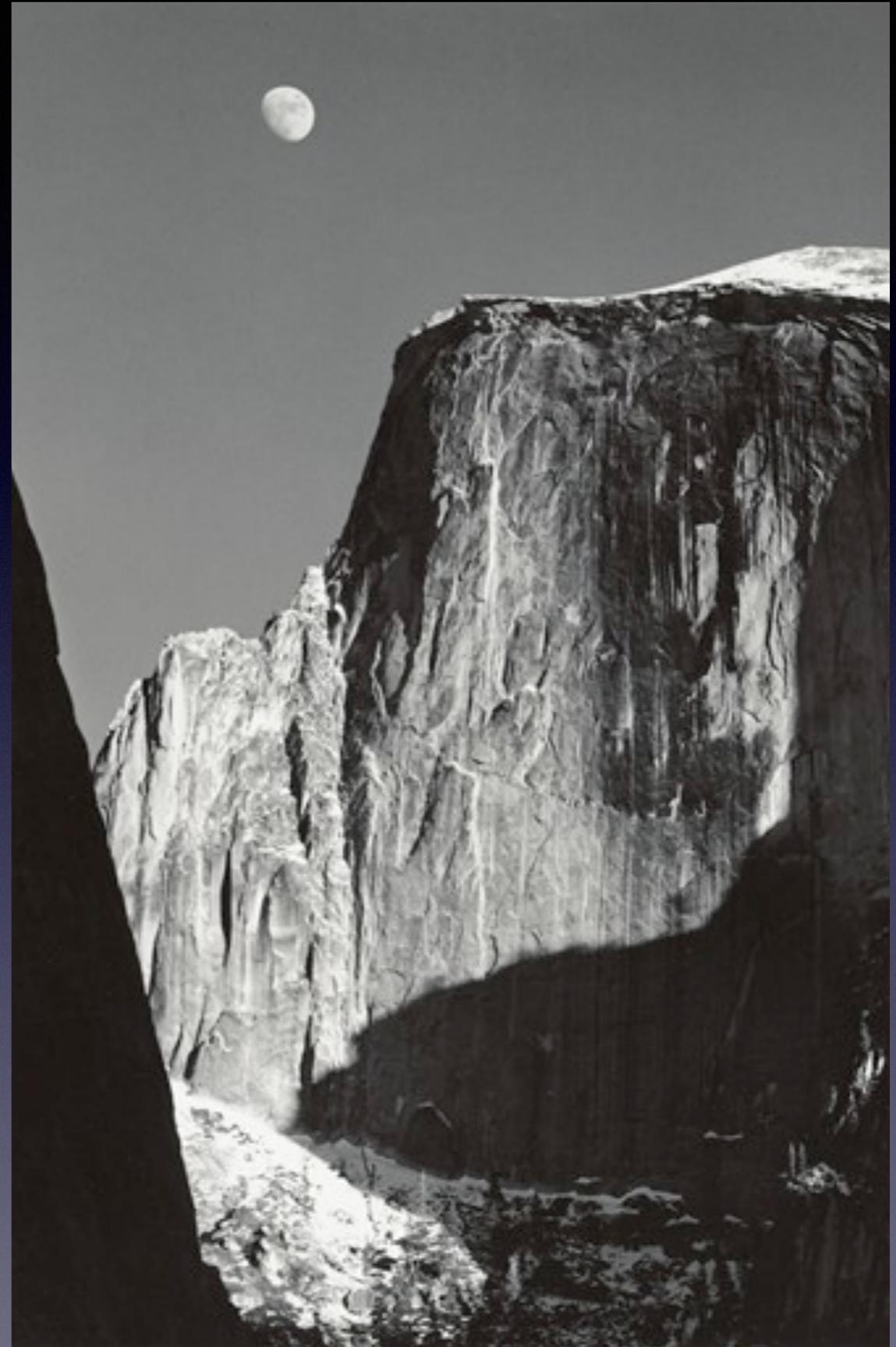
Quality: Hard Light

Ansel Adams



Quality: Hard Light

Ansel Adams





Quality: Hard Light

Ansel Adams