Cameras We Cannot Picture

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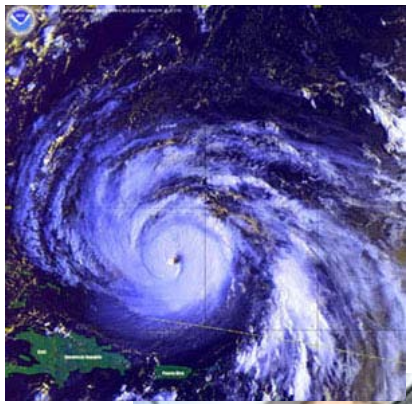
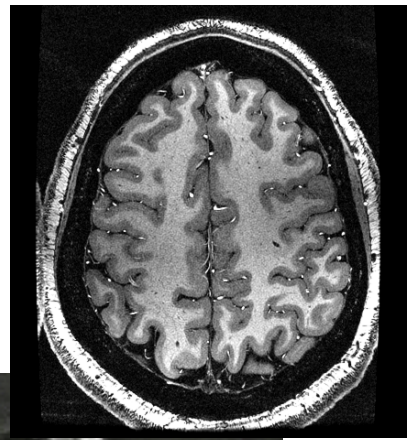
Outline

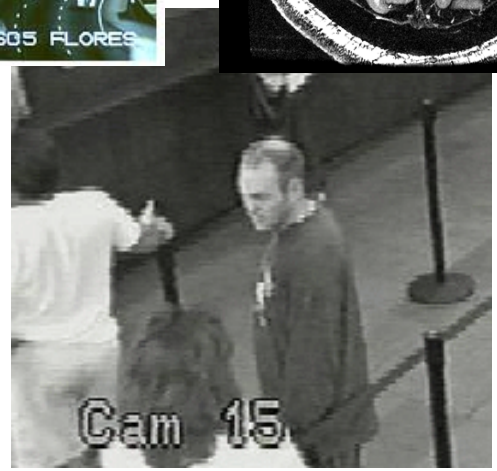
- History of Camera: important milestones
- Modern milestones:
  - **Invention of photographic film**
  - **Invention of CCD semiconductor sensor**
- New directions in camera design:
  - **Cameras + computers**
- Future

A world reliant on imaging

- You are probably carrying a camera right now
- It is likely you have been imaged at least once **TODAY!**
- Have you received information today communicated by an image?
- You or someone close to you is alive today because of an image
- 1/3 or brain processing devoted to vision







Images (clockwise from upper left) from US Govt Agencies: NOAA/NCEP; NASA ; NIH; FBI,; USAID

Natural Observations

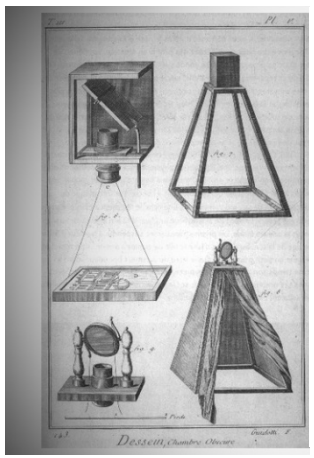
Images of the sun during a solar eclipse through the leaves of a tree. October 3, 2005, St Juliens, Malta.

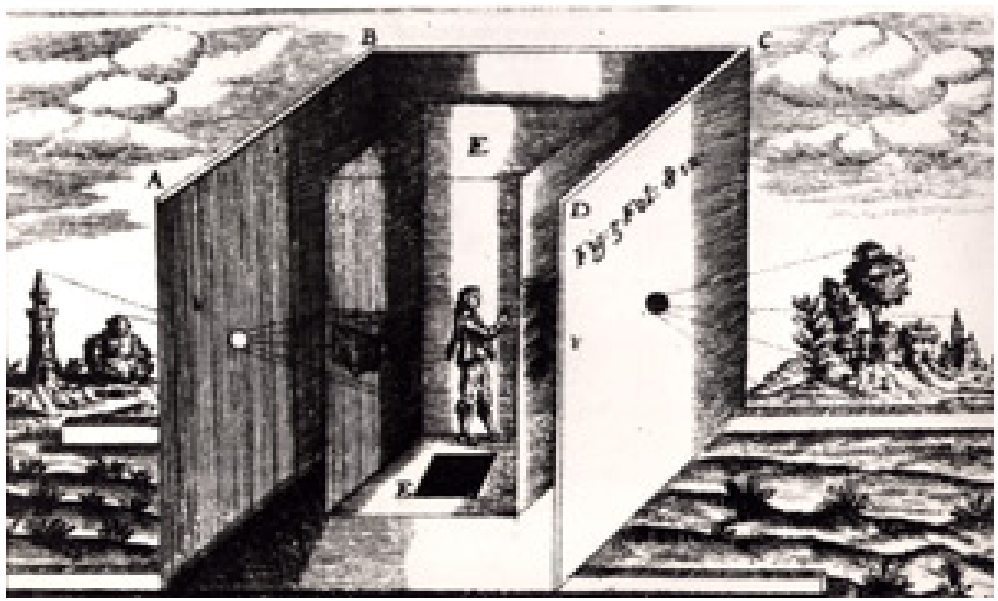
Image courtesy of Steve took it on Flickr.

Historical Milestones – Early Contributors

400-500 BC: Chinese philosophers, Aristotle
Observation of pinhole images

1011-1012: Alhazan; ***"Book of Optics"***
First scientific study of light combining philosophical aspect with experimental observations.
- Constructed first "pinhole camera"
- Elaborated laws of reflection and refraction





World's Largest Pinhole Camera (July 2006)

- Six photographers captured an image measuring **8.5 X 32 meters** of the decommissioned El Toro Marine Corps Air Station in Irvine, Calif., and unveiled the slightly fuzzy image Wednesday.
- The black-and-white shot was recorded on a massive sheet of light-sensitive fabric about **eight storey tall** and **one-third the length of a football field**.
- The photographers began the project in order to memorialize the base, which had been used for more than 50 years. Since 2002, the team has been working on what it calls the Legacy Project, a long-term photographic study of the base, scheduled to be turned into a giant urban park.

Images from the Legacy Photo Project removed due to copyright restrictions.
See http://www.legacyphotoproject.com

Historical Milestones: Optical Instruments - I

* Spectacles first appeared in 1270 as visual aid even though their principle of operation was not well understood.

* Spectacles are biologically inspired and a mechanical solution to a packaging problem.

Historical Milestones: Optical Instruments - II

1590: compound microscope (Janssen)
first multi-element optical instrument

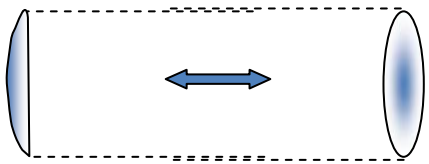
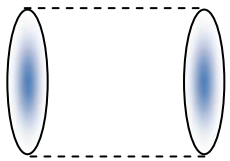
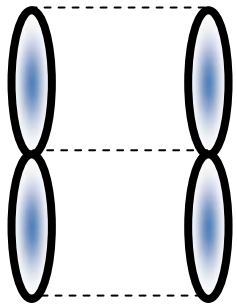


Image: US HHS.
See http://micro.magnet.fsu.edu/primer/museum/janssen.html

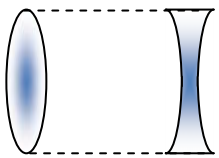
Within 20 years several new optical instruments were produced.



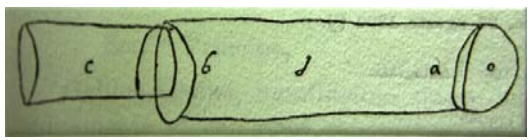
1608: Lippershey telescope



1608: binocular



1609: Galilean telescope



http://galileo.rice.edu/images/things/porta_sketch.gif

Earliest known illlustration of a telescope included in an August 1609 letter written by Giovanpattista della Porta.

Historical Milestones: Photography

- **June/July 1827:** First permanent record, Niepce, (8 hour exposure)

  Basically silver salt sensitive medium, based on glass plate

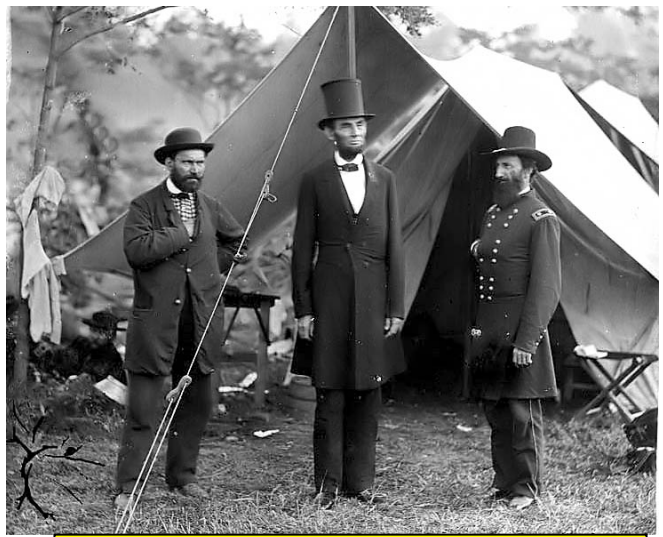
- **1888:** George Eastman, Emulsion coated on a paper, rolled.

  "You push the button, we do the rest"

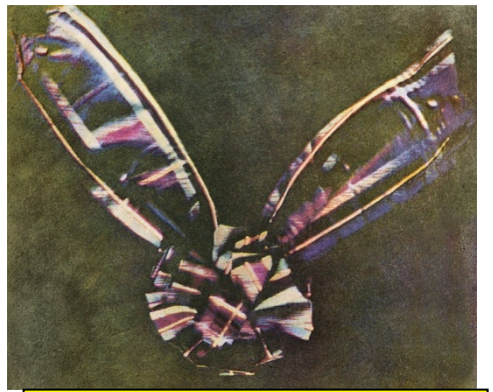
  Eastman-Kodak Company, Brownie camera, 1900; $1

- **1935:** Modern three color emulsion film – Kodachrome
- **1945:** Polaroid "instant" camera (30 second to 2 minutes)

First photograph, Niepce



Abraham Lincoln at Antietem



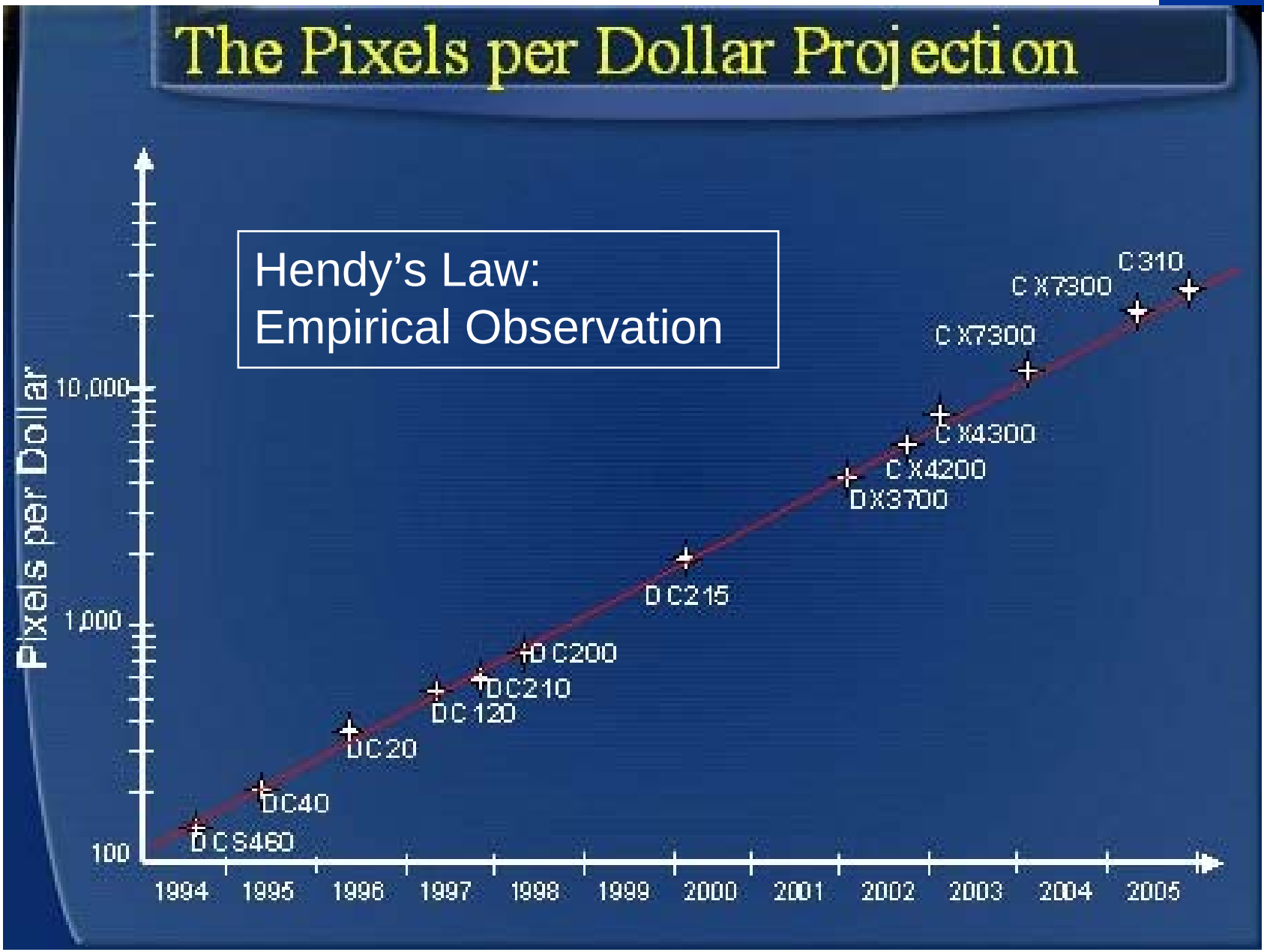
First color photograph
Maxwell, 1888

Historical Milestones: Electronic Recording

- **1908:** Proposed using Cathode Ray Tube for sensing and displaying images
- **1925-50:** Various tube designs with photocathodes, photoconductors (Farnsworth, Zworykin)
- **1969:** Charge Coupled Device (CCD) invented at Bell Labs
- The first recorded attempt at building a digital camera was in 1975 by Steven Sasson, an engineer at Eastman Kodak. It used the then-new solid-state CCD image sensor chips developed by Fairchild Semiconductor in 1973. The camera weighed 8 pounds (3.6 kg), recorded black and white images to a cassette tape, had a resolution of 0.01 megapixels (10,000 pixels), and took 23 seconds to capture its first image in December 1975.

Historical Milestones: Digital Camera Revolution

- **1981:** SONY Mavica ~ 0.25 Mpixel
- **1991:** Kodak DCS 100; 1 Mpixel, $20,000
- On June 11, 1997, Philippe Kahn instantly shared the first pictures from the maternity ward where his daughter Sophie was born, with more than 2000 family, friends and associates around the world. A sharing infrastructure and an integrated cell-phone and camera combo augured the birth of instant visual communications
- **2006:** Samsung introduces 10 Mpixel cell phone camera
- **22 June 2009:** **Kodak discontinues Kodachrome production**



Courtesy of Barry Hendry (Wikipedia)

Picture Gallery

http://www.dpreview.com/reviews/specs/sony/sony_fd73.asp

Sony Mavica

http://www.nikonweb.com/dcs100/

Kodak DCS 100

http://gizmodo.com/206422/samsung-sch+b600-has-a-10+megapixel-camera-inside

Samsung SCH-B600

http://www.letsgodigital.org/en/8687/omnivision_camerachip_ov6920/

OmniVision OV6920 sensor, 2.1 x 2.3 mm

http://www.medigus.com/CAMERA_1_8_mm/Camera.aspx

Medigus Introspicio Camera 1.8 mm, 326x382 pixels

Images removed due to copyright restrictions.

MAS.531 / MAS.131 Computational Camera and Photography

Fall 2009