Why Digital Imaging?*
  – Immediacy
  – Connection to the moment
  – Control over results
  – Versatility
  – Accuracy
FROM LIGHT TO PIXELS

- The Digital Path*
  - Scene
  - Camera Lens
  - Silicon Sensor
  - Pixels
  - Analog to Digital Converter
  - Binary Data
FROM LIGHT TO PIXELS

- Digital Path

- From Stephen Johnson’s *On Digital Photography*
Sensors*

- Light-sensitive silicon sensor
- The electronic “film” of the camera
- In a digital camera, the resolution is defined by the number of sensing sites on the sensor
- Two main types:
  - Charged Coupled Device (CCD)
  - Complimentary Metal Oxide Semiconductor (CMOS)
Sensors

- Film-based cameras record on silver-salt coated material. Digital devices capture light through electronic light sensors. Both use Red, Green, Blue filters to record color information.
Sensor types*

- **Charged Coupled Device (CCD)**
  - Solid-state light sensor with photographic capabilities - convert light photons to electrical currents using light-detecting silicon
  - Invented by Bell Labs scientists, 1969
  - Passive pixel sensor - separate image sensor and processor (slower image processing)
  - Technology used in many professional digital cameras and scanners
Sensor types*

- Complimentary Metal Oxide Semiconductor (CMOS)*
  - Uses an active pixel sensor - combines image sensor and image processor in same circuit
  - Simpler to manufacture than CCD sensors
  - Quality not as good as CCD
  - Used in consumer level digital cameras and on mobile devices, webcams, etc…
A/D Converter*
- Converts the electrical signals coming from the sensor into binary data (zeroes and ones)
- Binary data records the brightness values on a scale of 0 (black) to 255 (white)
- Camera system then saves this data as a file format
- You have now a bitmap image!
CAPTURE DEVICES

- The silicon sensor allows for the digital capture of originals
  - Types of sensors
  - Color handling
  - Resolution
  - Dynamic range

- The following digital capture devices are available:
  - Digital camera
  - Digital camera back
  - Scanner
Sensor resolution*
- Determines the detail the sensor is capable of recording
- Measured in megapixels, or millions of sensors

Two types of resolutions:
- Optical resolution*
  - The real resolution of the sensor, based on the physical number of sensing sites available
- Interpolated*
  - Computer generated resolution, fake, resampled
- Identifying the Original
- Capture Devices
- Digital Cameras
- Scanning backs
- Scanners
- Computer Hardware requirements
IDENTIFYING THE ORIGINAL

- The source for your image will determine the digital capture method*

- Originals can come from different sources which may need to be converted to digital format
  - Conventional photograph
  - Flat art
  - Video capture
  - Screen capture
  - Digital photo of scene/subject*
  - Existing digital image file*
    *already digital
IDENTIFYING THE ORIGINAL

- Conventional photographs*
  - Film
    - 35mm negatives, 4x5 and large format negatives, slide positives
    - Original film needs to be scanned
  - Prints
    - Standard sizes (4x6, 5x7, 8x10, etc…) can be scanned
  - Large format prints can be photographed with a scanning back camera
IDENTIFYING THE ORIGINAL*

- Flat art*
  - Paintings & prints
    - Small formats can be scanned, photographed with scanning back camera
    - Large format should be photographed with scanning back
  - Due to the fragile nature of some paintings, scanning is no longer recommended.
IDENTIFYING THE ORIGINAL

- **Video capture**
  - Video can be digitized through a video capture card
    - Special video card that allows a signal from a video camera or TV to be sent to your computer
      - Signal can be analog and/or digital, depending on card
    - The signal can be recorded with video capture software
IDENTIFYING THE ORIGINAL

- Screen Capture
  - Still shot of a computer screen
  - Use special applications to capture low or high quality screenshots
  - Shortcuts
    - Windows – Press *Print Screen* button. Image is copied to memory
    - Mac – Hold down *Command+Shift+3*, image is placed on desktop
CAPTURE DEVICES

- Digital Cameras*
Digital Cameras*

- A camera that captures images digitally through an electronic image sensor
  
  *Consumer level*  
  - Available in most digital electronic stores  
  - Compact, Subcompact (point and shoot)
  
  *Prosumer level*  
  - Available in some digital electronic stores  
  - Compact, Bridge cameras
  
  *Professional level*  
  - Available at photography stores, some digital electronic stores  
  - D-SLR
CAPTURE DEVICES

- **Consumer level***
  - Compact, small, portable cameras
  - For the general market
  - CMOS sensors, usually
  - Sensor resolution range
    - 3MP – 16MP
  - Medium bit depth
CAPTURE DEVICES

- **Prosumer level***
  - Compact, SLR-like cameras (Bridge cameras)
  - For the serious amateur, hobbyist
  - CCD or CMOS sensors
  - Sensor resolution range: 3MP – 16MP
  - Medium bit depth
CAPTURE DEVICES

Professional level*
- Digital SLR (single lens reflex)
- For professionals
- CCD sensors, generally
- Sensor resolution range: 3MP – 24MP
- High bit depth
Digital Camera Back*
- A digital sensor attached to the back of a camera in place of a film holder
- Allows cameras designed for film to take digital shots
- For professionals only!
- CCD sensors
- Sensor resolution range: 20MP – 65MP
- Very high bit depth
CAPTURE DEVICES

- Scanners
**CAPTURE DEVICES**

- **Scanners***
  - Device that optically scans an image or document through the use of a linear array electronic sensor and creates a digital file
  - Types of scanners
    - Drum
    - Flatbed
    - Film
**Drum scanner**

- Used for images to be enlarged, archiving, or high-end publishing
- Very high resolution:
  - up to 12,000 ppi, optical
- Use Photo-multiplier Tubes (PMT) sensors (not CCD or CMOS)
- Up to 64-bit depth
- Very expensive
CAPTURE DEVICES

- Flatbed scanner*
  - Originals mounted face down on a flat bed and scanned by a linear array sensor (CCD) that moves across the image
  - High resolution- up to 6,400 ppi, optical
  - Up to 48-bit depth
  - Relatively inexpensive
CAPTURE DEVICES

- **Film scanner**
  - Originals is scanned by a linear array sensor (CCD) that moves carefully and slowly across the image
  - High resolution - up to 8,000 ppi, optical
  - Up to 48-bit depth
  - Moderately priced
COMPUTER HARDWARE REQUIREMENTS

- System Requirements*

![Computer Hardware](image)
COMPUTER HARDWARE REQUIREMENTS

- **System Requirements**
  - Processor
  - Operating system
  - Memory
  - Hard drive
  - Monitor
  - Video card

*Based on Adobe Photoshop CS5 requirements
COMPUTER HARDWARE REQUIREMENTS

- Processor (CPU)*
  - Windows
    - Intel® Pentium® 4 or AMD Athlon® 64 processor
  - Mac
    - Multicore Intel processor
COMPUTER HARDWARE REQUIREMENTS

- Operating System*
  - Windows
    - Microsoft® Windows® XP with Service Pack 3; Windows Vista® Home Premium, Business, Ultimate, or Enterprise with Service Pack 1 (Service Pack 2 recommended); or Windows 7
      - 64-Bit recommended
  - Mac
    - Mac OS X v10.5.7 or v10.6 (Leopard, Snow Leopard)
      - 64-bit recommended
COMPUTER HARDWARE REQUIREMENTS

- **Memory***
  - Windows & Mac
    - 1GB of RAM
    - 32-bit system allows a maximum of 3GB
    - 64-bit system is theoretically infinite
    - With more RAM, Photoshop processes info faster
COMPUTER HARDWARE REQUIREMENTS

• Hard Drive*
  – Windows & Mac
    • 1GB-2GB of available hard-disk space for installation; additional free space required during installation (cannot install on removable flash-based storage devices)
    • Recommend two hard drives- one for installing the program (the C drive or Macintosh hard drive). Another hard drive to use as a **scratch disk**- a disk that is used for temporary files.
**COMPUTER HARDWARE REQUIREMENTS**

- **Monitor & Video Card***
  - Windows & Mac
    - 1024x768 display (1280x800 recommended)
    - 256MB Video Card
    - Recommend wide screen monitor or a two-monitor setup, one monitor for palettes & tools, one for the images
Companies & websites

- www.epson.com
- www.betterlight.com
- www.phaseone.com
- www.hasselblad.com
- www.dpreview.com