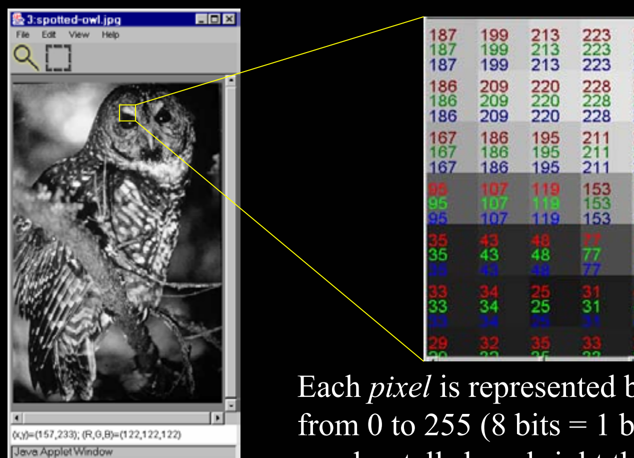
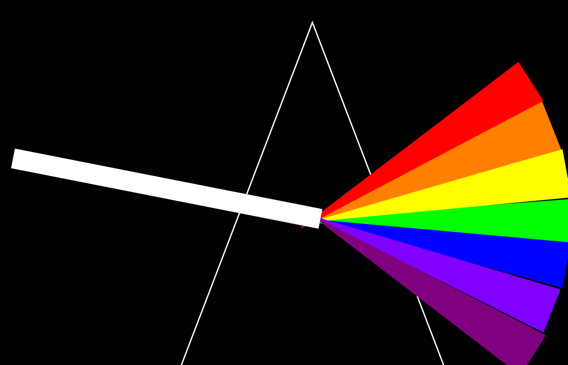
Greyscale Images

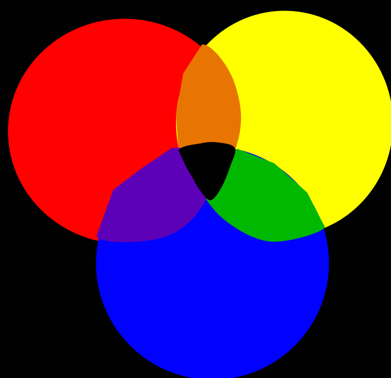


Each *pixel* is represented by a number from 0 to 255 (8 bits = 1 byte). This number tells how bright the pixel is

Color Mixing

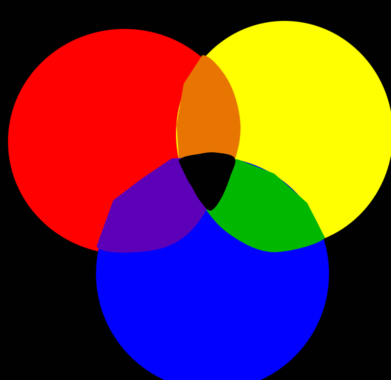


Primary Colors

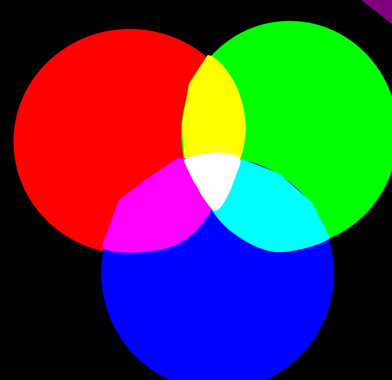


Paint mixing primaries
(Subtractive)

Primary Colors

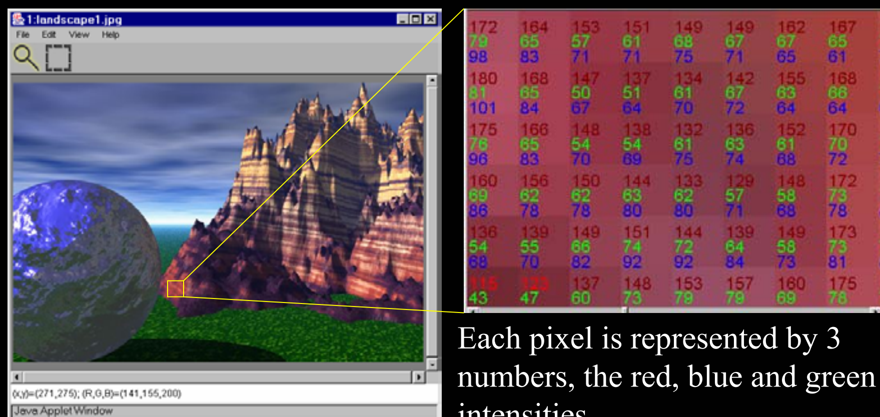


Paint mixing primaries
(Subtractive)



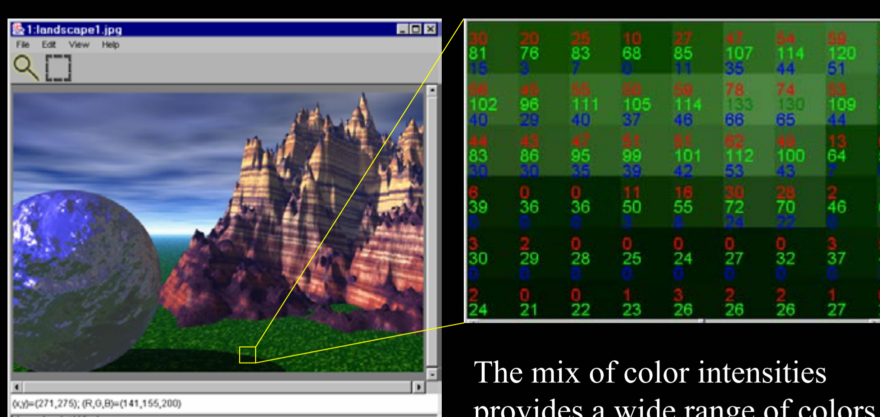
Lighting primaries
(Additive)
RGB

Color Images



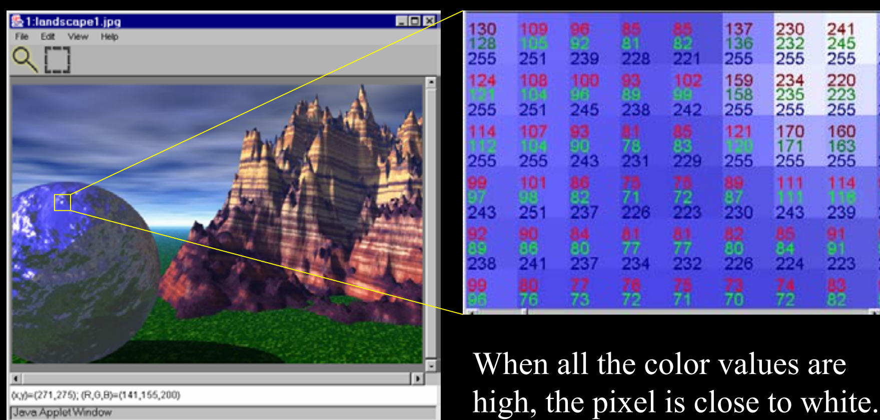
Each pixel is represented by 3 numbers, the red, blue and green intensities.

Color Images



The mix of color intensities provides a wide range of colors

Color Images



When all the color values are high, the pixel is close to white.

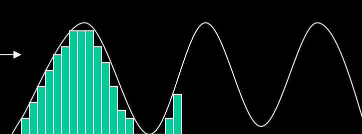
Compression

- Most image formats *compress* the pixel information
- One simple method is *Run Length Encoding*
- *5, 3, 8, 8, 8, 8, 8, 8, 8, 1, 1, 9, 9, 9, 9, 2*
  is shortened to
  *5, 3, *, 5, 8, 1, 1, *, 4, 9, 2*
  *(The * means "the next 2 numbers are a run, the first number is the length, the second is the value.")*

More Bytes = More Colors

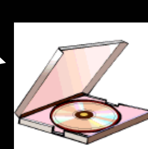
- 8 bits = 256 colors
- 24 bits = “Millions of colors”
  - 3 color *channels* (red, blue, green)
  - 1 byte per channel

What is a Digital Representation



Records store analog information

16, 21, 35, 56, 57, 56, 44, ...



CDs store digital information

Analog Representation

- Examples: Vinyl record/watch dial
- Continuous
  – An infinite number of possible values
- Accuracy
  – Can (potentially) represent with infinite accuracy
  – Error prone (in real life)

Digital Representation

- Examples: CD/Digital watch
- Discrete
  – Only a few possible values
- Accuracy
  – Can only represent an approximation
    - (e.g. audio sampling)

Advantages of Digital Reps.

- Easy to manipulate
  - Discrete symbols limit complexity
- General
  - For example: the compression algorithm described earlier applies to <u>any</u> data represented digitally
- Accurate copying
  - Examples: DNA, Napster