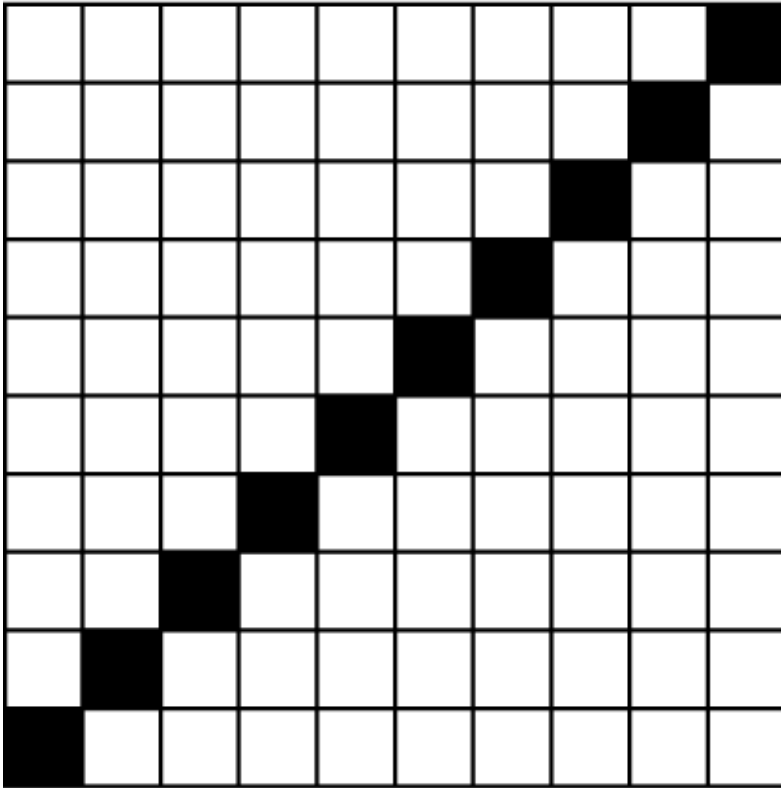


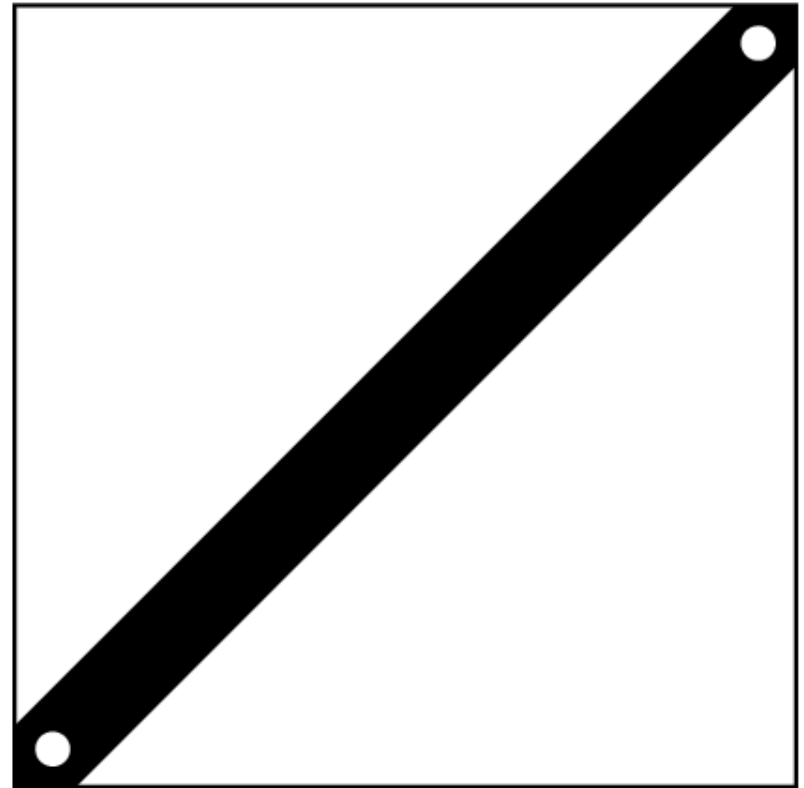
Graphics

Chapters 17-19

Raster



Vector



Vector Art

Infinitely Scalable

Formats:
PDF, EPS, SVG, AI

Pixel Art*

Set pixel dimensions

Formats:
PNG, JPEG, TIFF, BMP

CMYK

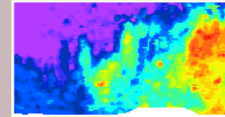


Color printed matter

Almost any figure
in a printed paper

WAVLAPTFA⁶⁵YGFKV
WAALAPTLAYGFKV
WVSLITSLSYGGKC
WPTLVTTFSYGVQC
PYLLSHILGYGYH
PLLIGPNLGYGFYQ
YDIITTAFOYGFVRV
FDIVSVAFSYGNRA

Printed image with
no annotation



300 DPI print; 100 DPI Web

RGB

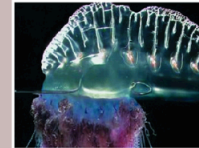


Web display,
presentations

Diagrams for Web
or presentations



Photo without annotation



300 DPI print; 100 DPI Web

Grayscale

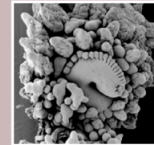


Images without color,
with tonal range

Almost any use,
print or projected



Photo without color
or annotation



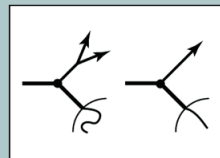
300 DPI print; 100 DPI Web

Black & White



Images without color,
without tonal range

Line drawings



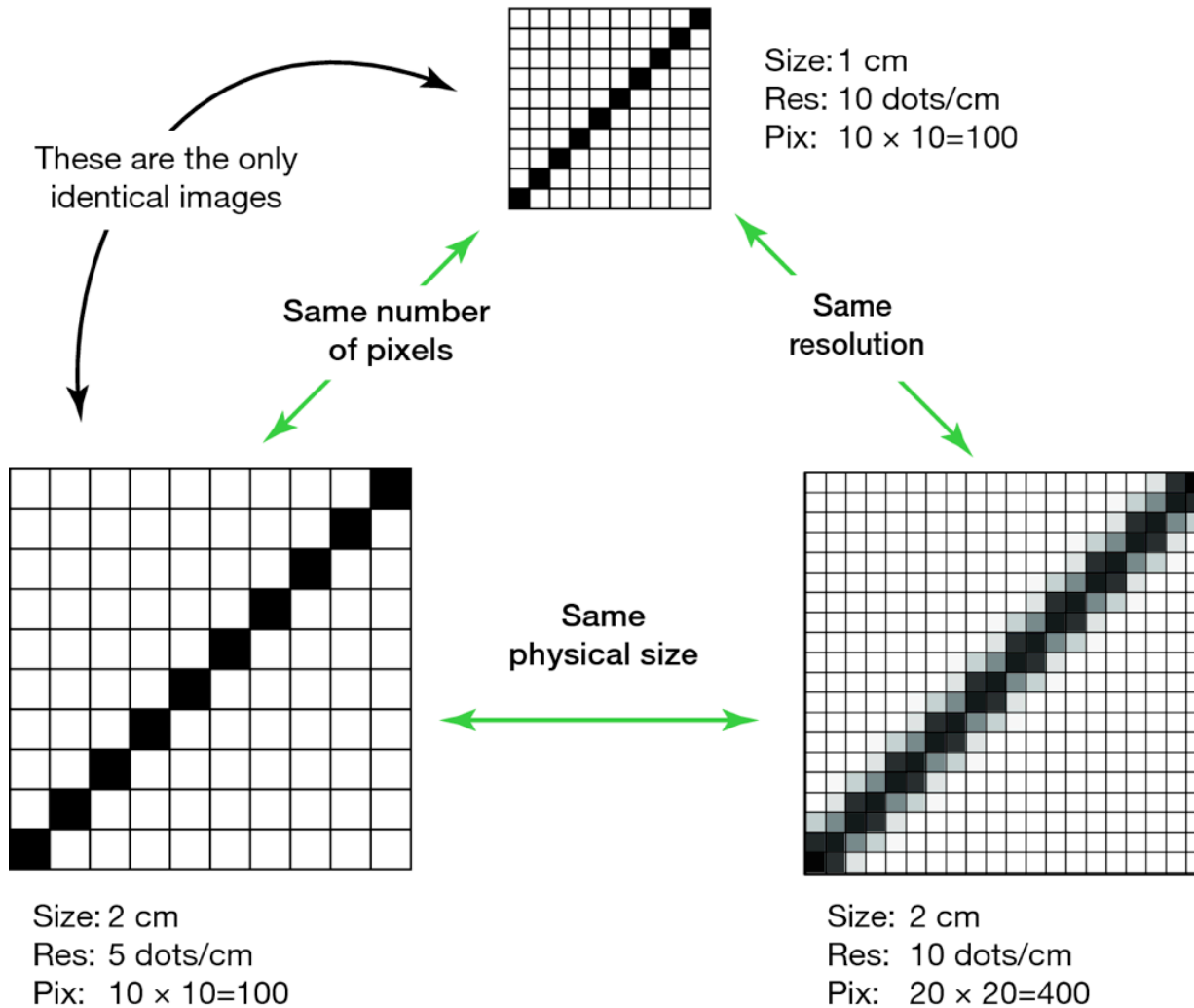
Scanned Text

Rosacea.
pattern o
Praya an

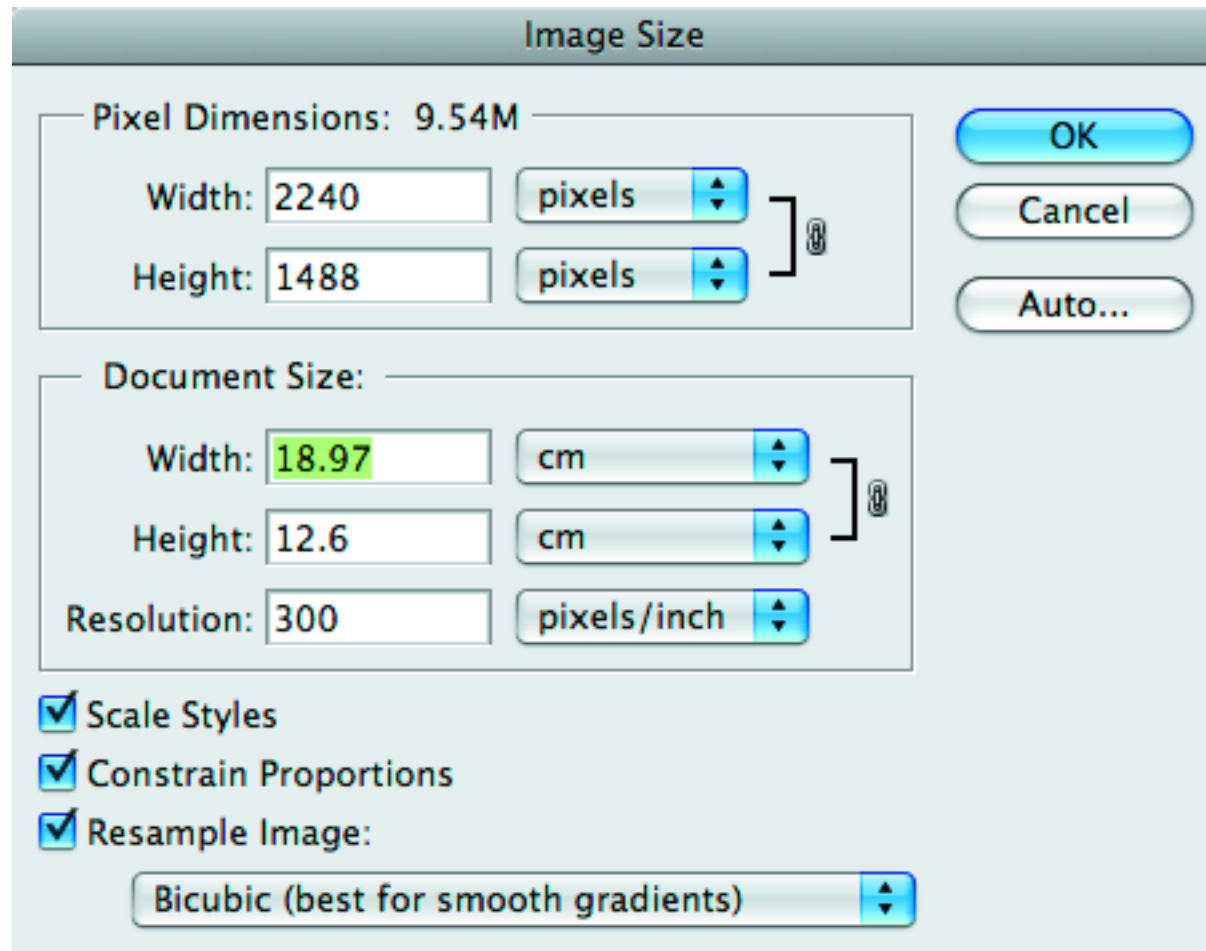
Final resolution:
600 DPI for print
100 DPI for Web

*Note that pixel art can be included as an object within vector art compositions,
but the rules of resolution still apply

Image resolution



Resampling

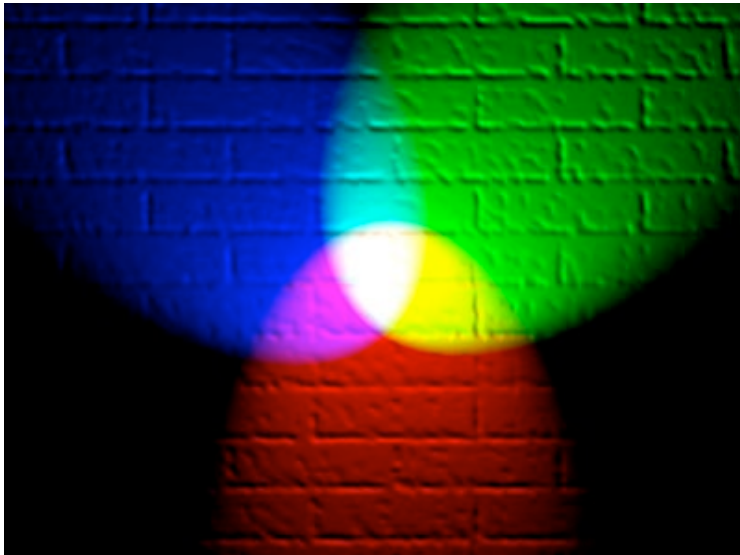


Color models

Additive

RGB

(TVs, projectors, etc.)

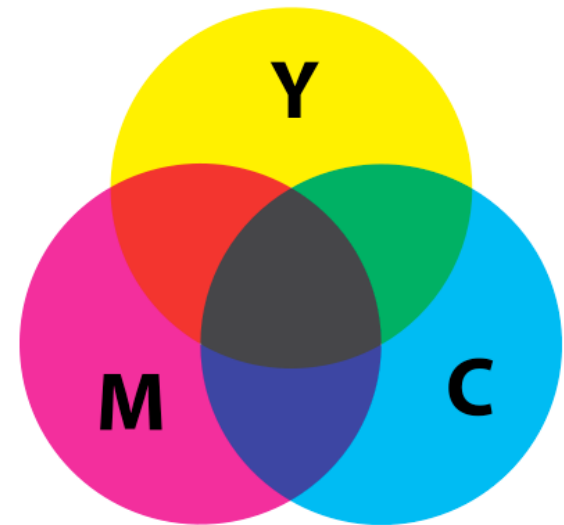


http://en.wikipedia.org/wiki/Image:RGB_illumination.jpg

Subtractive

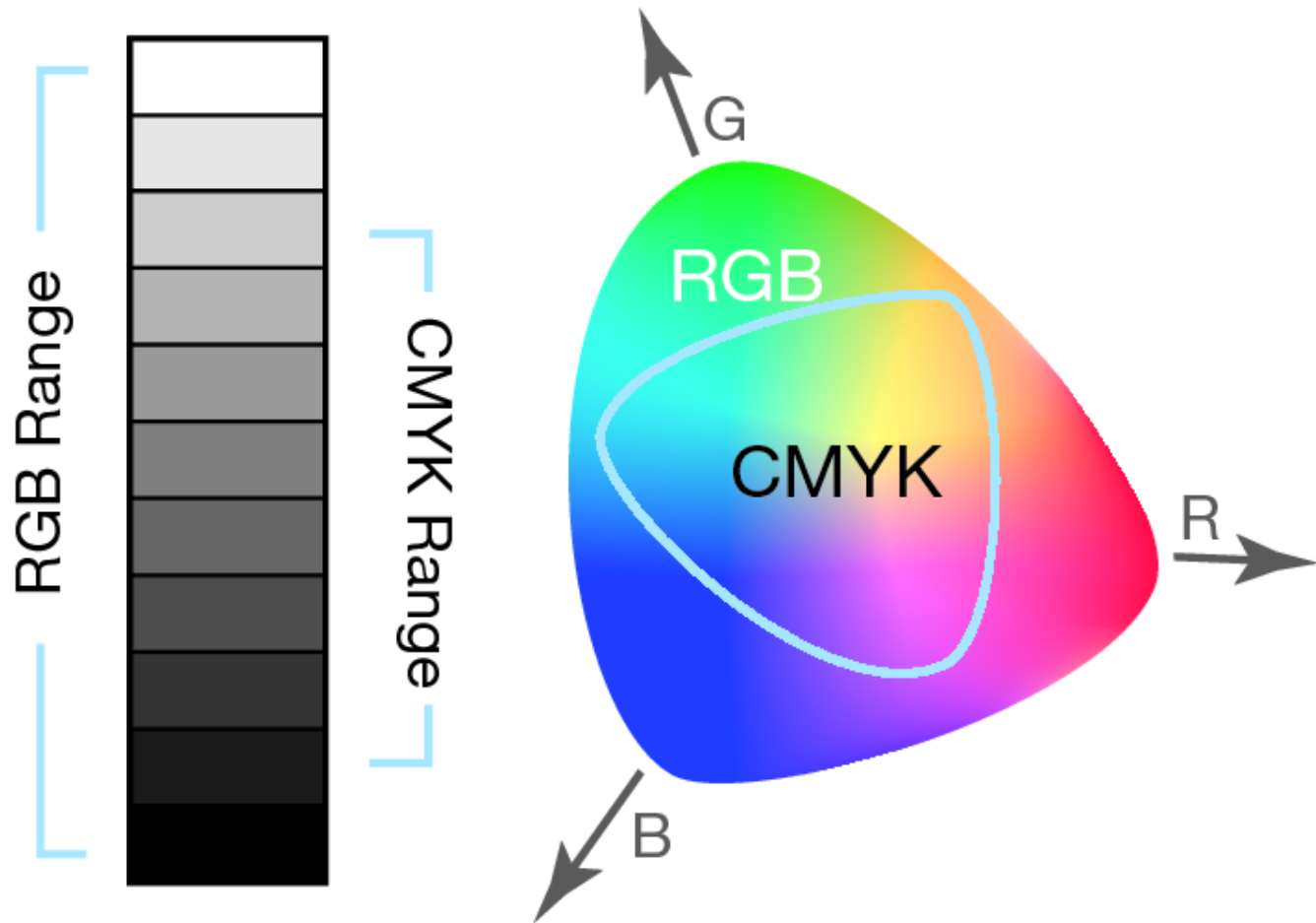
CYM(K)

(Inks, printed)

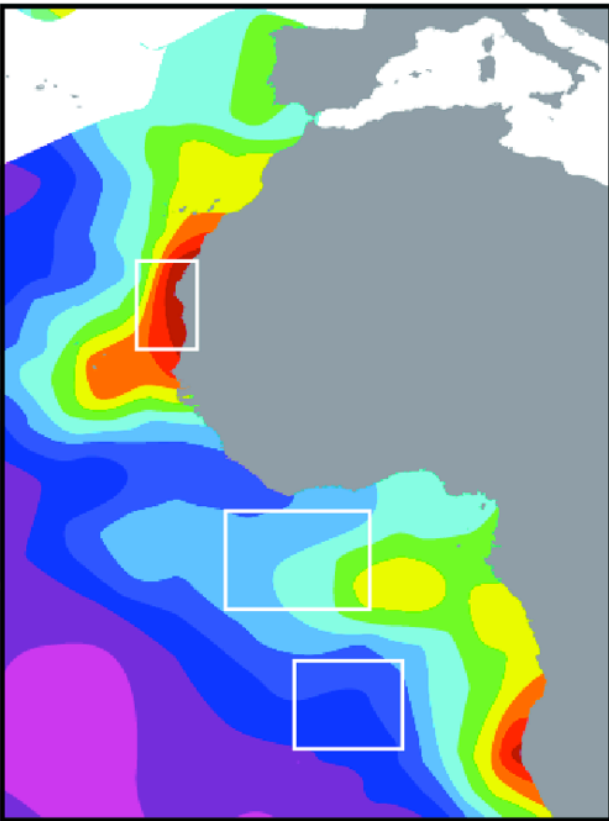


<http://en.wikipedia.org/wiki/File:SubtractiveColor.svg>

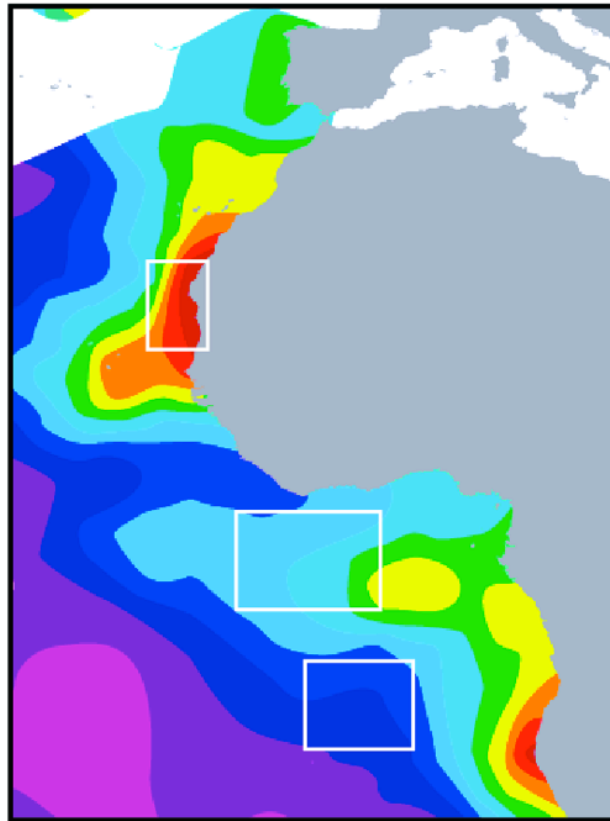
Color space



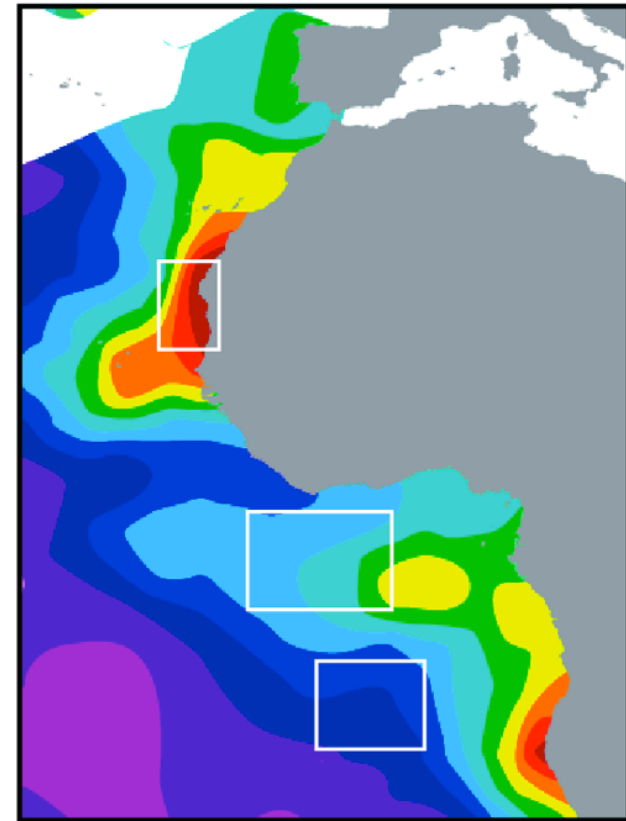
Color space conversion



RGB



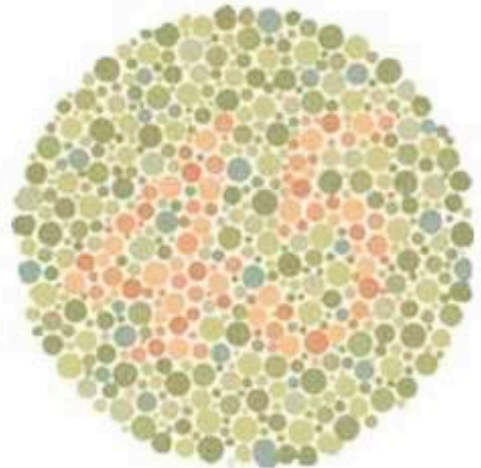
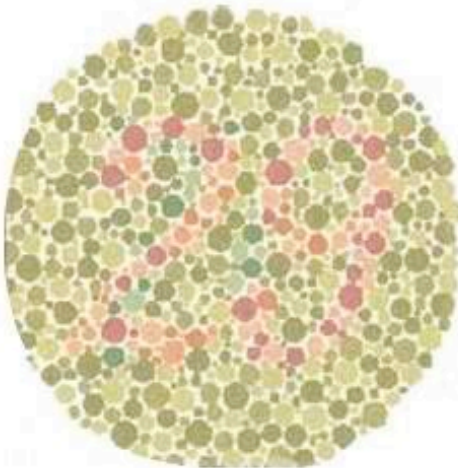
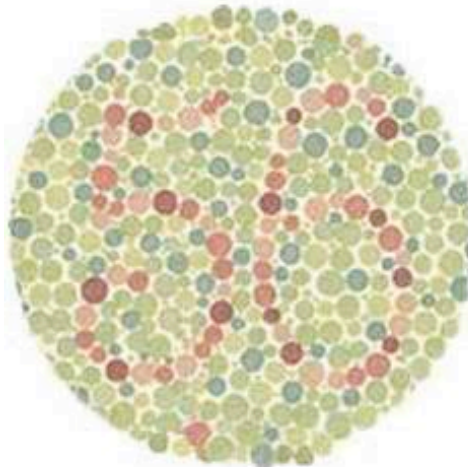
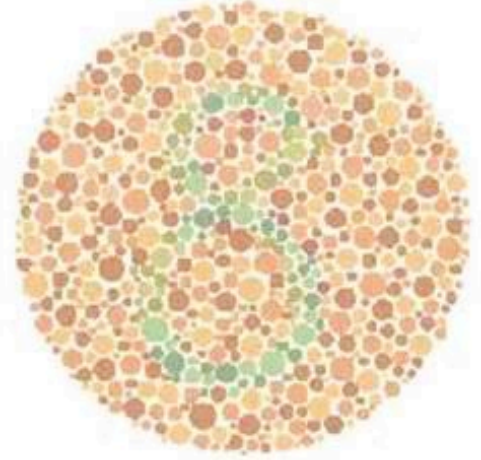
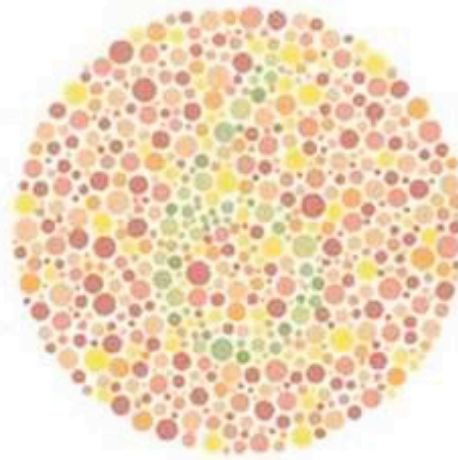
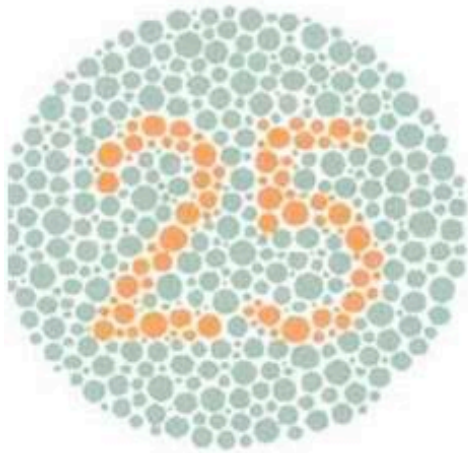
CMYK
Coated paper



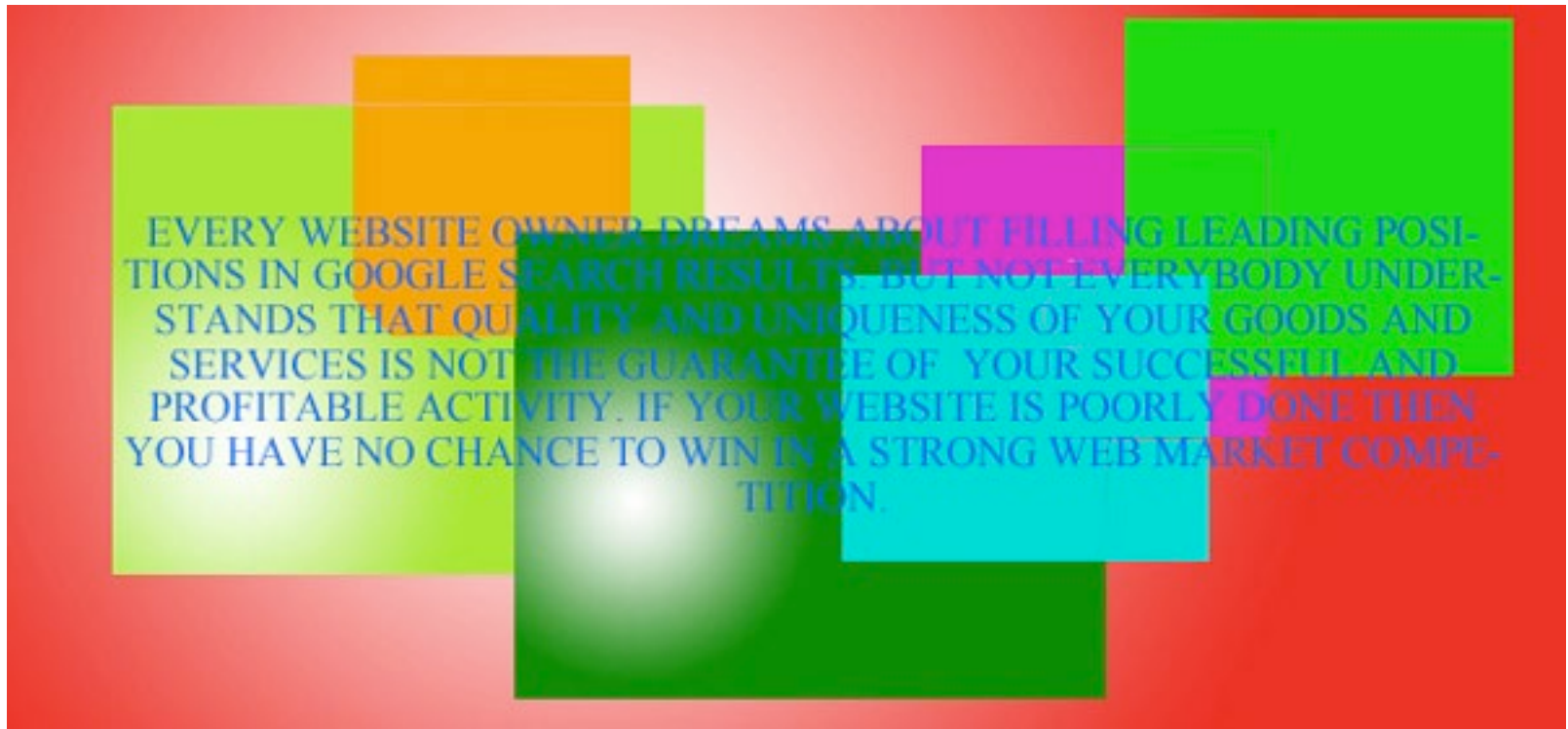
CMYK
Uncoated paper

See the version on p. 333 of the text

Color Selection: Color Blindness



Color selection: Taste & visibility



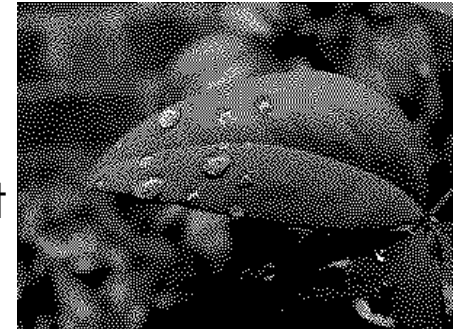
<http://designwebkit.com/web-and-trends/color-combinations-hell-death-sentence-designs/>

Color Depth

Number of bits used to indicate the color of a single pixel in a bitmapped image or video frame.

- ▶ 1-bit color ($2^1 = 2$ colors): monochrome, often black and white, compact Macintoshes, Atari ST.
- ▶ 2-bit color ($2^2 = 4$ colors): CGA, gray-scale early NeXTstation, color Macintoshes, Atari ST.
- ▶ 2 bits (4 colors)
- ▶ 4-bit color ($2^4 = 16$ colors)
- ▶ 8-bit color ($2^8 = 256$ colors): most early color Unix workstations.
- ▶ 16-bit color ($2^{16} = 65536$ colors)
- ▶ True color (24-bit = 16,777,216 colors)
- ▶ Deep color (30/36/48-bit)

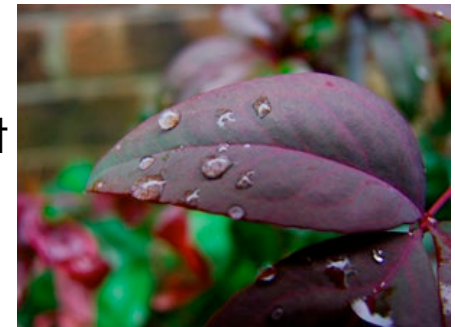
1-bit



2-bit



24-bit



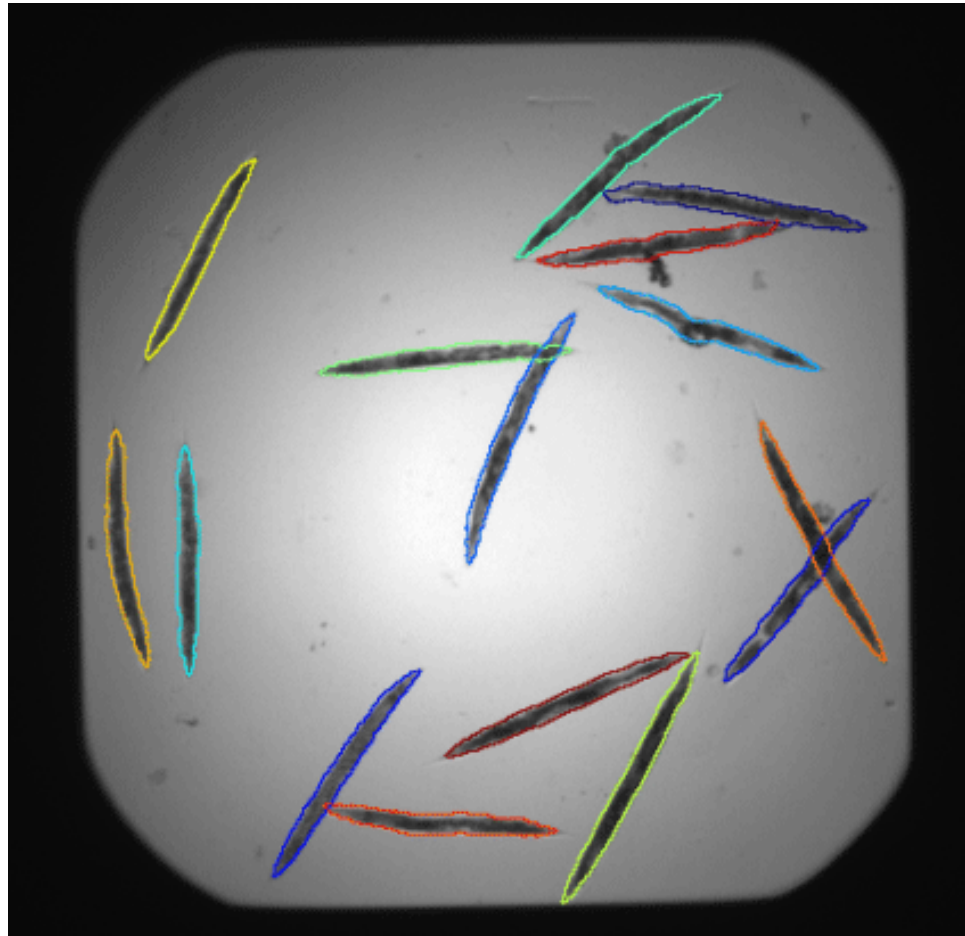
Scripting your graphics

- ▶ PyQtGraph
- ▶ Matplotlib
- ▶ Lots more: see

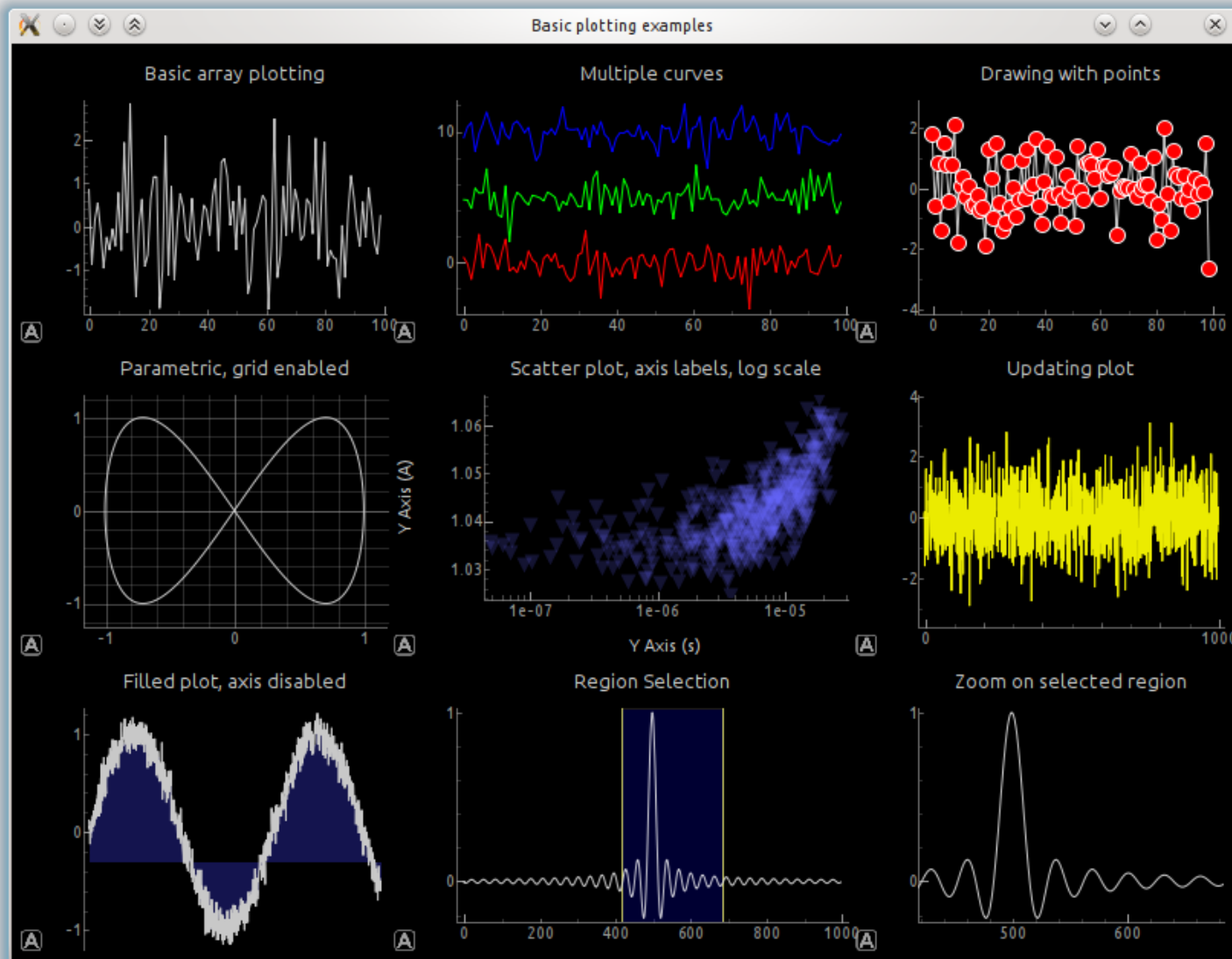
<http://wiki.python.org/moin/NumericAndScientific/Plotting>

Script raster image processing

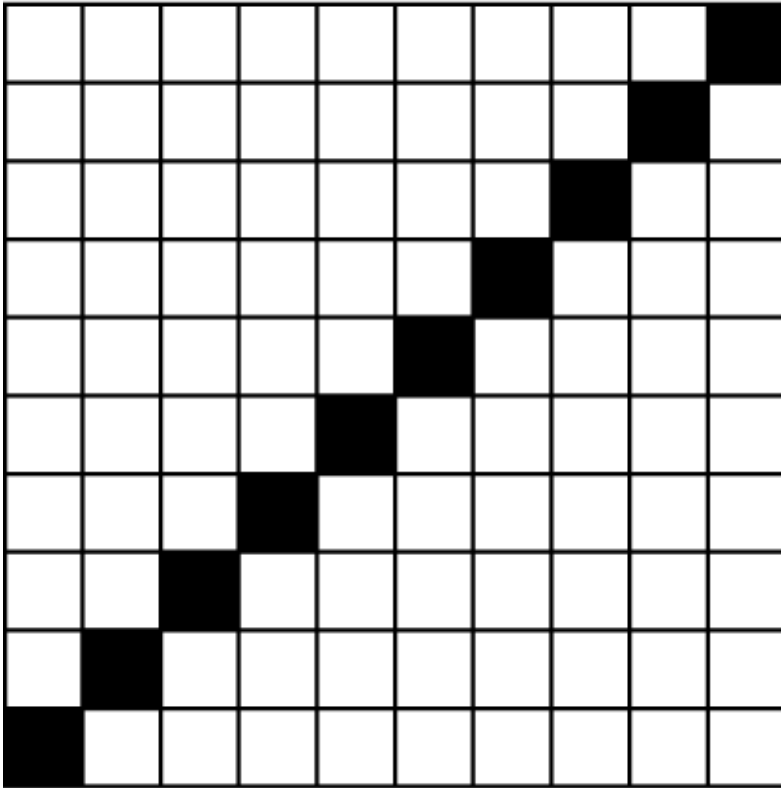
- ▶ Python: PIL, etc.



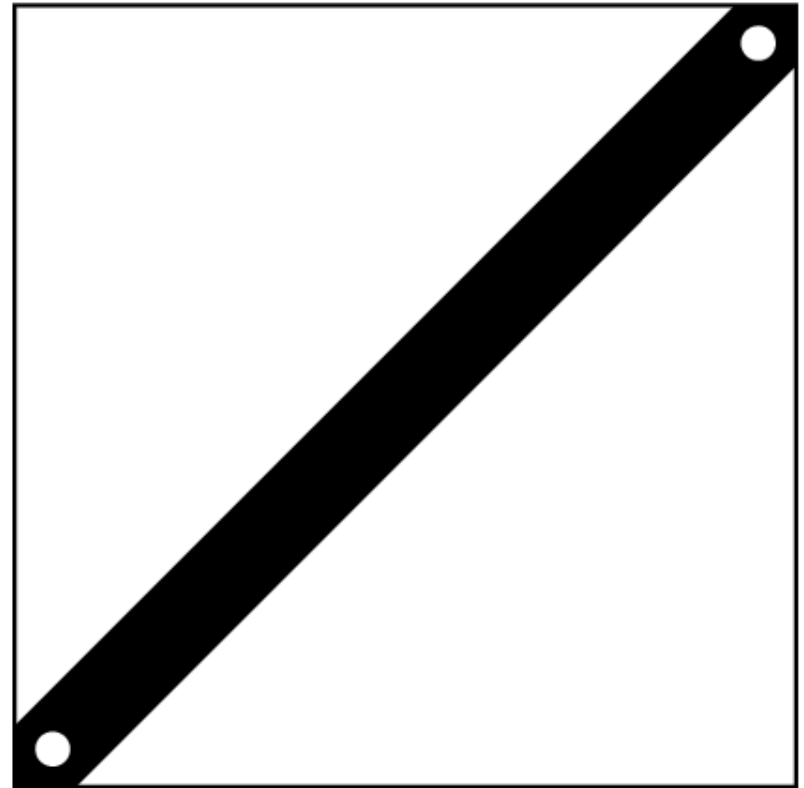
Scripting your graphics



Raster



Vector





Common applications: Vector Art

- ▶ Adobe Illustrator
- ▶ Inkscape
- ▶ There are many free and paid
- ▶ Different features
- ▶ Graphs, phylogenetic trees, and other graphics made by science software is often vector based

Common applications

- ▶ Adobe
 - Photoshop-Pixel
 - Illustrator-Vector art



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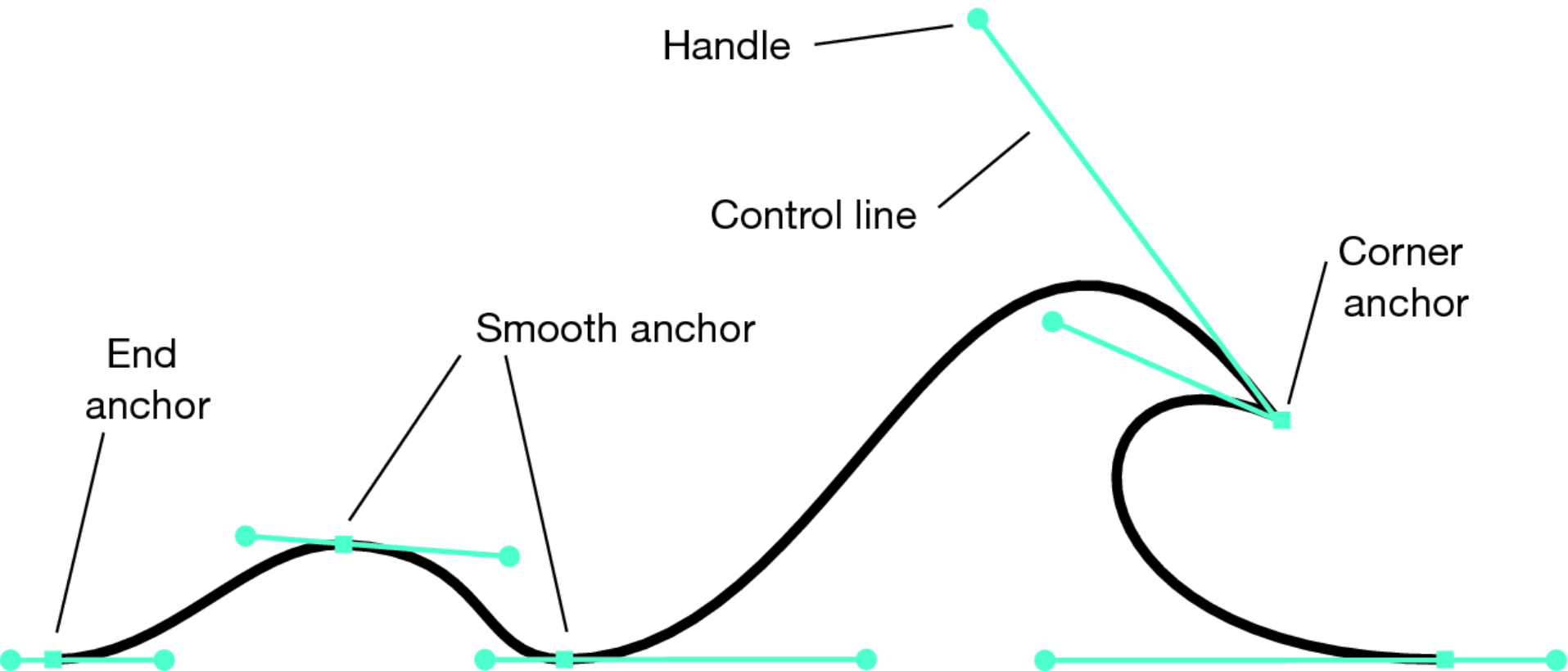
Adobe@UFApps is a UFIT service providing special UF student pricing on the Adobe Creative Cloud suite. With Adobe@UFApps, students can purchase access to select Adobe CC software available within UFApps for \$35 for the license period, February 25, 2016 thru February 22, 2017.

To purchase access to Adobe@UFApps, students must visit the [UF Computing Help Desk](#) in [HUB 132](#). Due to university contract stipulations, this services is only available to the first 3,000 students who sign up.

Vector image formats

- ▶ PDF
- ▶ SVG
- ▶ EPS
- ▶ AI

Bézier curves



Common applications: Raster images

- ▶ Adobe Photoshop
- ▶ ImageJ

Selected Raster Image Formats

Image data can be stored, converted into various formats (ascii and binary), with metadata embedded in headers, and compressed or not

- ▶ **JPEG** – 8-bit grayscale images and 24-bit color images (8 bits each for red, green, and blue). Usually lossy.
- ▶ **JPEG 2000** -- lossless and lossy storage. Improved quality and compression ratios, requires more computational power to process. Not widely used for still images.
- ▶ **TIFF** – flexible and many implementations, but implementations are not always interoperable: 8 bits or 16 bits per color (red, green, blue) for 24-bit and 48-bit totals
- ▶ **RAW** – minimally processed data from the image sensor (digital negative); can differ by manufacturer; Adobe DNG raw format somewhat common – can be considered “archival”
- ▶ **PNG** – supports 8 bit paletted images, 24 bit true color (16 million colors) or 48 bit true color; patent-free replacement for GIF

Image compression

- ▶ Lossless
 - De-compresses to original values
 - LZW (TIFF)
 - JPEG 2000 (can be lossy)
- ▶ Lossy
 - Can't de-compress to original values
 - JPEG is very common web format – high compression ratio -> lower bandwidth; usually lossy, but can be lossless
- ▶ Lots of variation, exceptions

output01.jp2

261 kb



output05.jp2

1,302 kb



output2.jp2

5,166 kb



viburnum69-8bit

62,640 kb

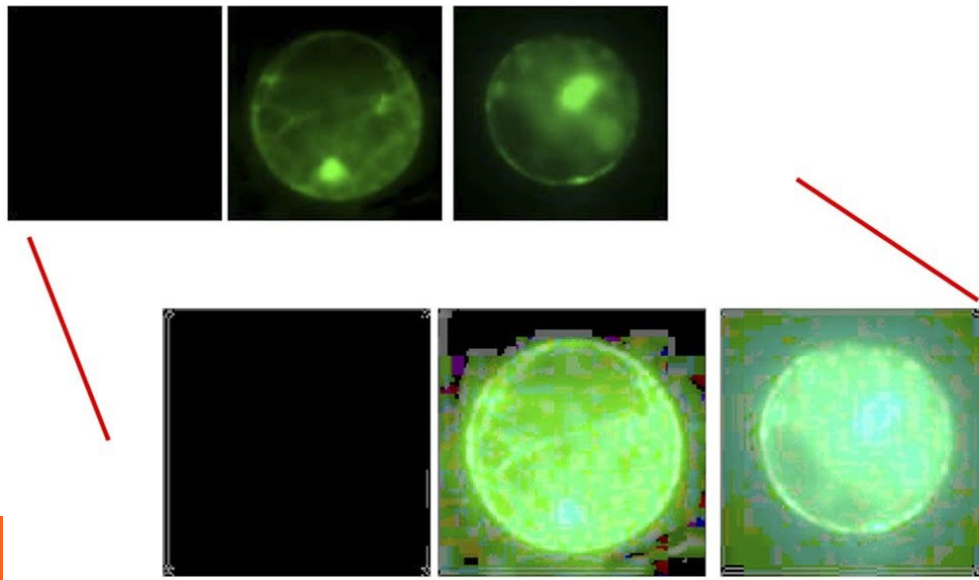


ImageMagick

- ▶ ImageMagick – open source software for displaying, converting, and editing raster image files.
- ▶ Command line, python (PythonMagick)
 - Format conversion
 - Compression
 - Filters
 - Color and metadata management

How much image correction can one do?

- ▶ Correct exposure?
- ▶ Remove dust?
- ▶ Crop to remove part of image
 - What if that has results counter to main conclusion?
- ▶ Clone portion of image and replicate



Martin and Blatt, 2013
(Plant cell)

Rossner & Yamada 2004 (J Cell Bio)

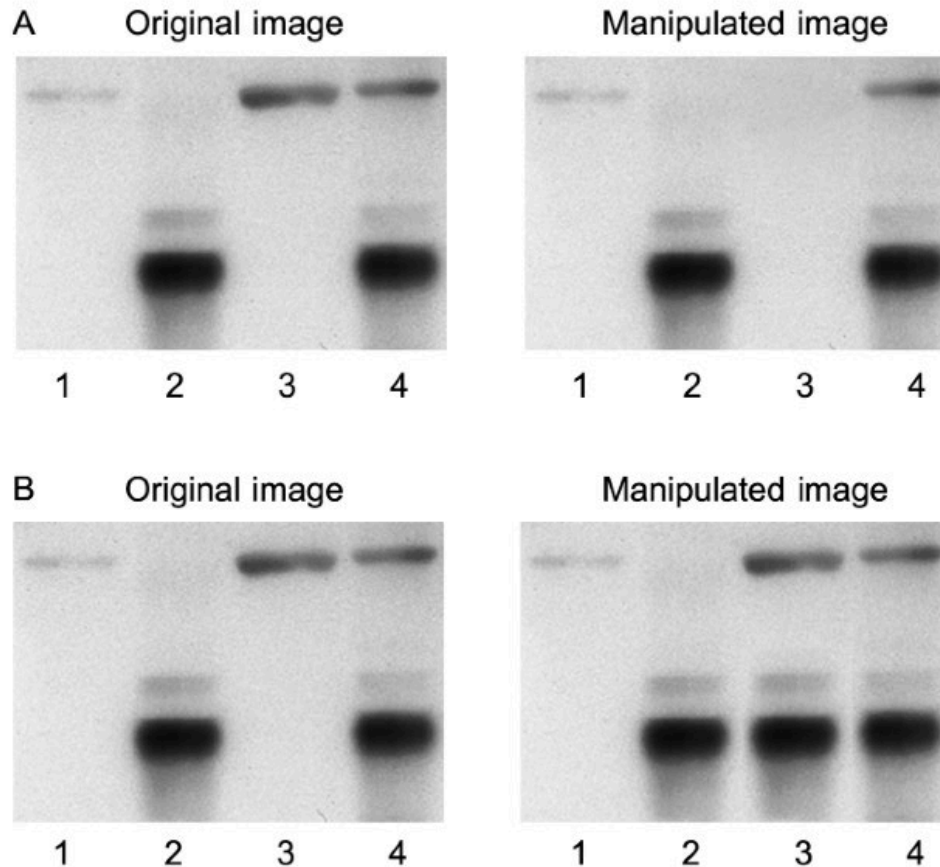


Figure 1. **Gross manipulation of blots.** (A) Example of a band deleted from the original data (lane 3). (B) Example of a band added to the original data (lane 3).

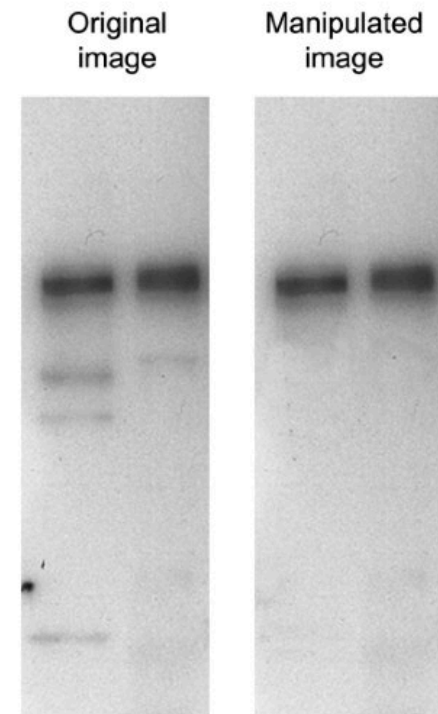
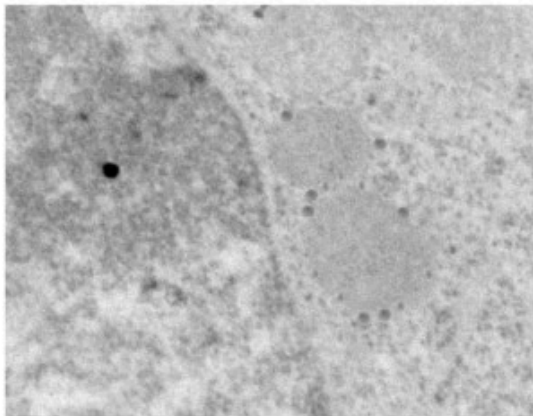


Figure 4. **Manipulation of blots: cleaning up background.** The Photoshop "Rubber Stamp" tool has been used in the manipulated image to clean up the background in the original data. Close inspection of the image reveals a repeating pattern in the left lane of the manipulated image, indicating that such a tool has been used.

Original image



Manipulated image

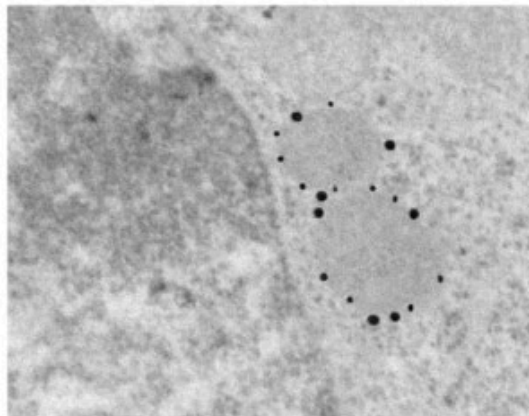
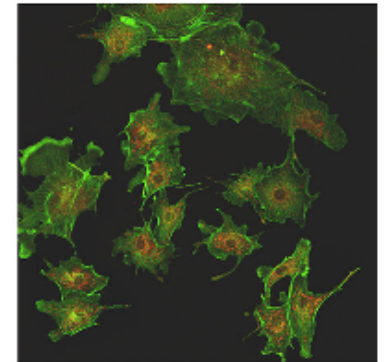


Figure 5. **Misrepresentation of immunogold data.** The gold particles, which were actually present in the original (left), have been enhanced in the manipulated image (right). Note also that the background dot in the original data has been removed in the manipulated image.

Manipulated image



Manipulation revealed by contrast adjustment

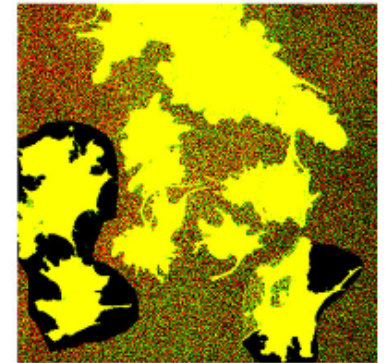
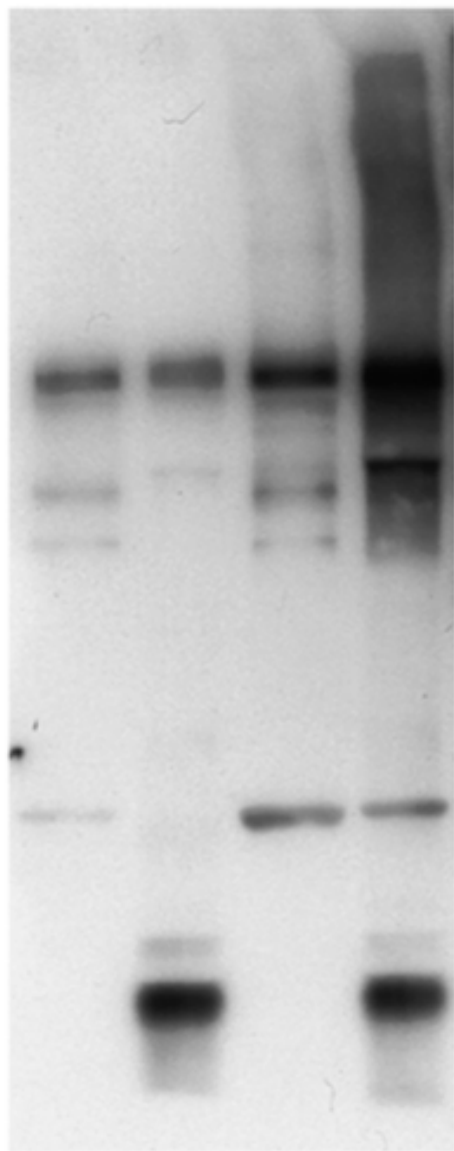
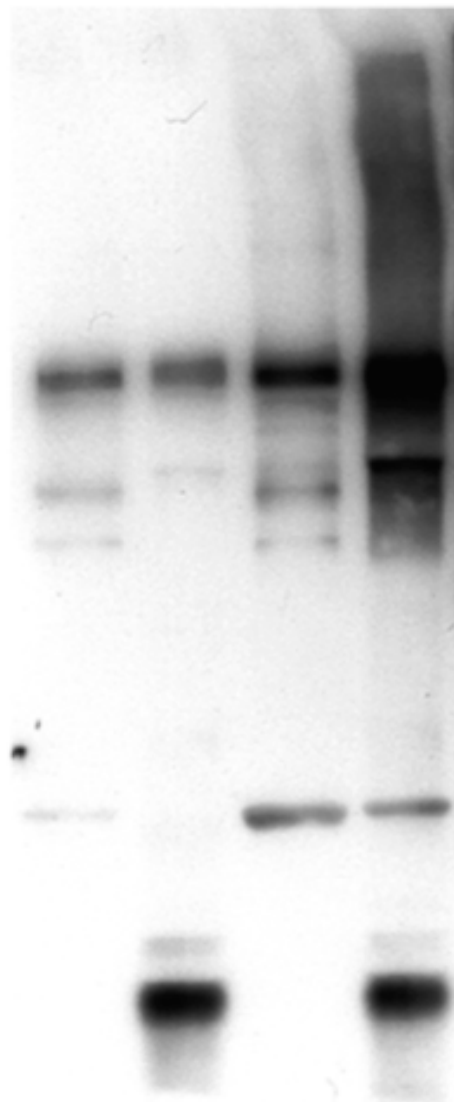


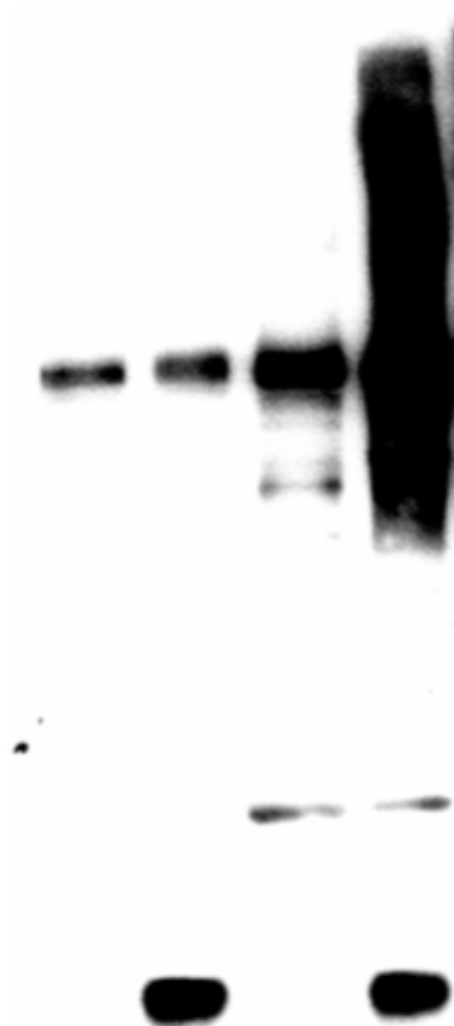
Figure 6. **Misrepresentation of image data.** Cells from various fields have been juxtaposed in a single image, giving the impression that they were present in the same microscope field. A manipulated panel is shown at the top. The same panel, with the contrast adjusted by us to reveal the manipulation, is shown at the bottom.



1



2



3

This article has been retracted. Please see:

Is retracted by - May 30, 2014

“For the 2004 Report ([1](#)), the Committee's findings can be summarized as follows: Lanes 3 and 4 in Fig. 1B were replicated from a figure in another paper ([3](#)). There was manipulation of gel images that constituted data falsification and fabrication in Fig. 2C; Fig. 3, B and C; Fig. 4, B and D; and panel A in fig. S5C.”

