CSCI-UA-4-005

Intro to Web Design + Computer Principles

Raster Graphics

Professor Emily Zhao

M/W 12:30PM – 1:45PM

Agenda

- **Raster Graphics**
  - Print vs Digital
  - Raster vs Vector
  - Resolution
  - Web Formats
  - Intro to Photoshop
  - Non-Destructive Editing Techniques
- **Introduce Assignment #4**

Raster Graphics

Binary Files

All files can be categorized into one of two file formats:

- Text
- Binary

When you write code, that is a text file.

An image file, on the other hand, is a binary file.

Binary files typically contain a sequence of bytes, or ordered groupings of eight bits.

Binary files store data in a format that is not meant to be human-readable, unlike text files.

Raster Graphics

Raster Graphics, also referred to as “bitmap” graphics, are binary files.

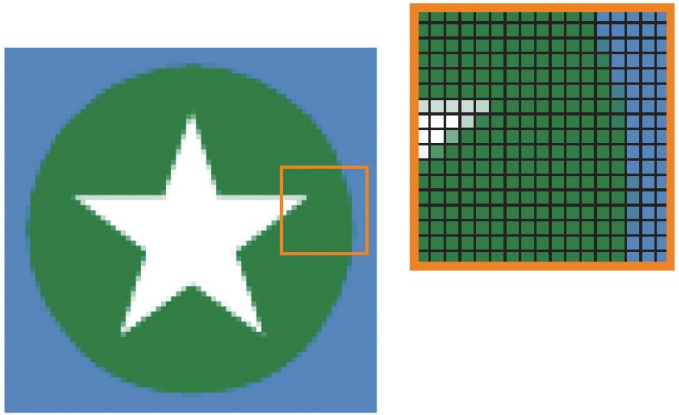
Raster graphics consist of a grid of picture elements, pixels, each of which contain color and brightness information.

Pixels can be changed individually or as a group with program algorithms.

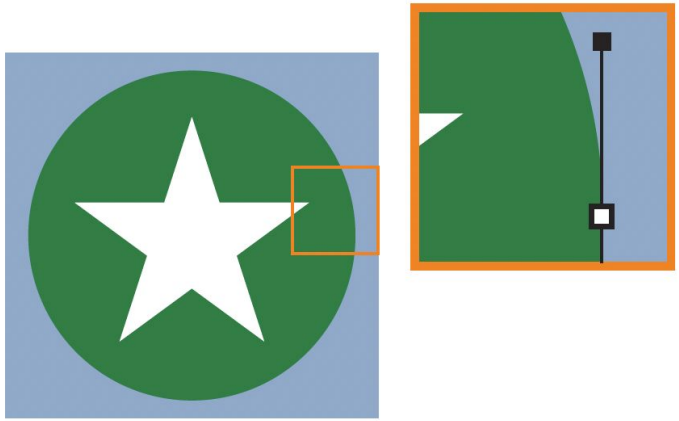
This is contrast to vector graphics, which describe points and lines.

Show Image in TextEdit

Raster vs Vector



Bitmapped images are made up of a grid of variously colored pixels, like a mosaic.

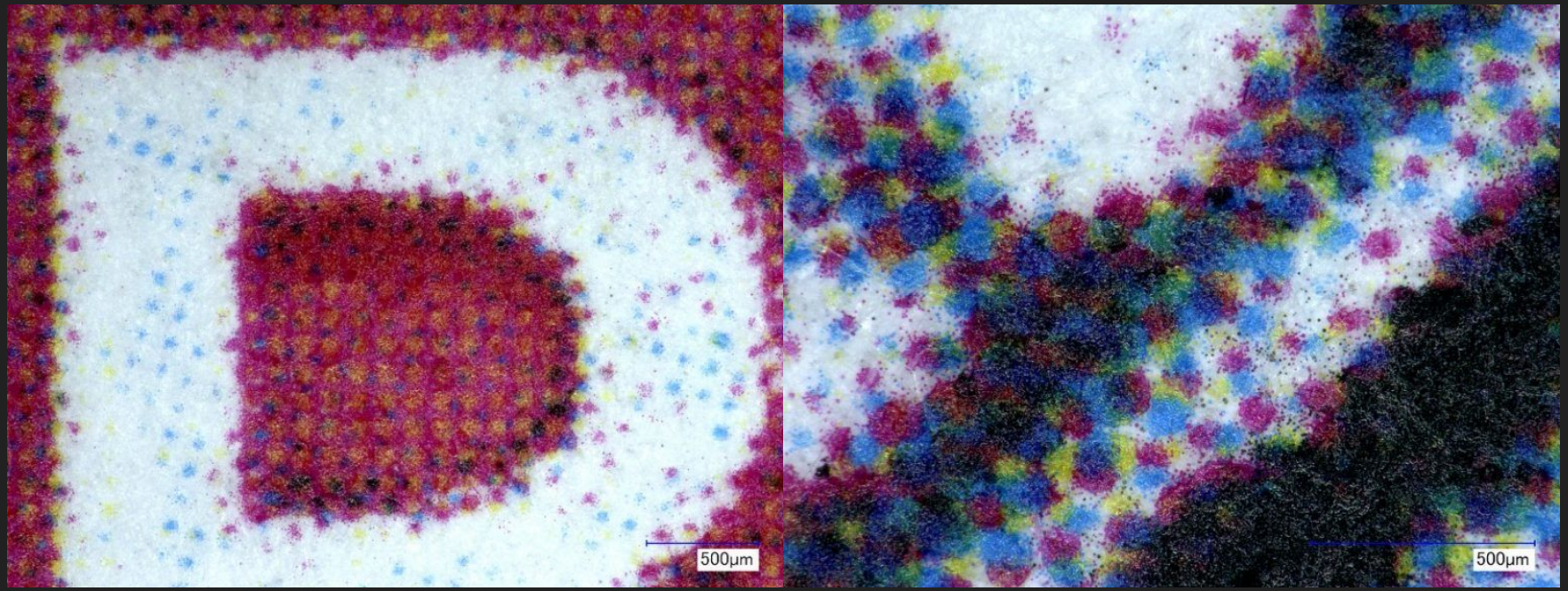


Vector images use mathematical equations to define shapes.

Print Resolution

DPI (Dots per inch)

DPI (Dots per inch)

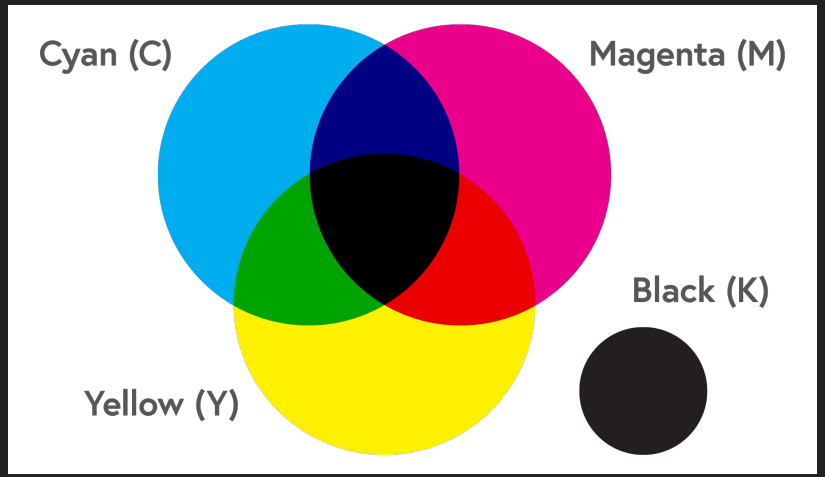


Color

CMYK CYAN, MAGENTA, YELLOW, BLACK (KEY)

The standard color mode for anything that will be printed

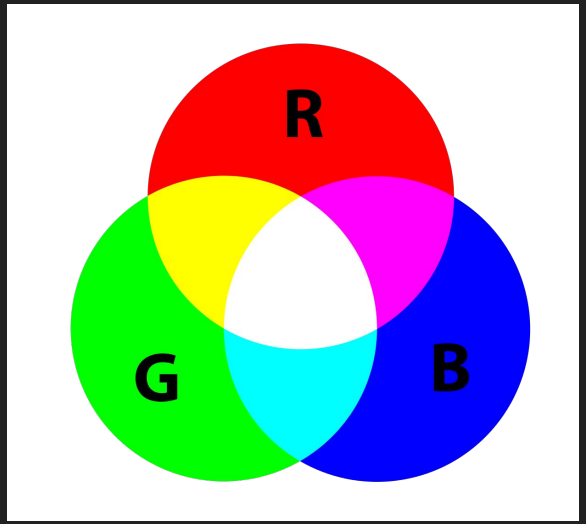
- Subtractive color: light is removed as ink is added
- 100% of each makes black
- 0% of each makes white
- Values for CMYK are specified as a percentage between 0 and 100



RGB RED, GREEN, BLUE

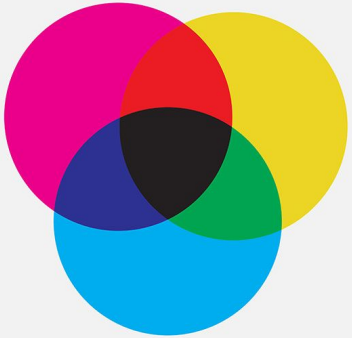
The standard color mode for anything that will be viewed on a screen

- Additive color: light is added together
- 100% of each makes white
- 0% of each makes black
- Values for RGB are specified as a number between 0 and 255



FOR PRINT

CMYK



CYAN

MAGENTA

YELLOW

"KEY" BLACK

FILE FORMATS

EPS

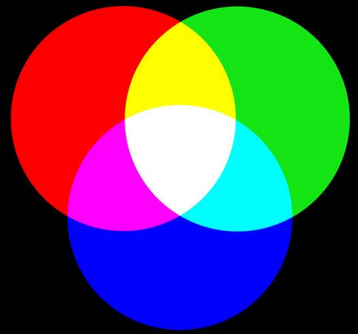
AI

PDF

We Make Design Work

FOR SCREENS

RGB



RED

GREEN

BLUE

FILE FORMATS

JPG

PNG

PSD

www.thevisualpro.com

HEX

A pair of digits and letters that represent R, G, B values

- Each digit represents a number between 0 and 255
- These hex color codes are composed of 16 possible values for each digit (0-9 and A-F), allowing for a total of 256 possible colors (16^6) in the web-safe palette

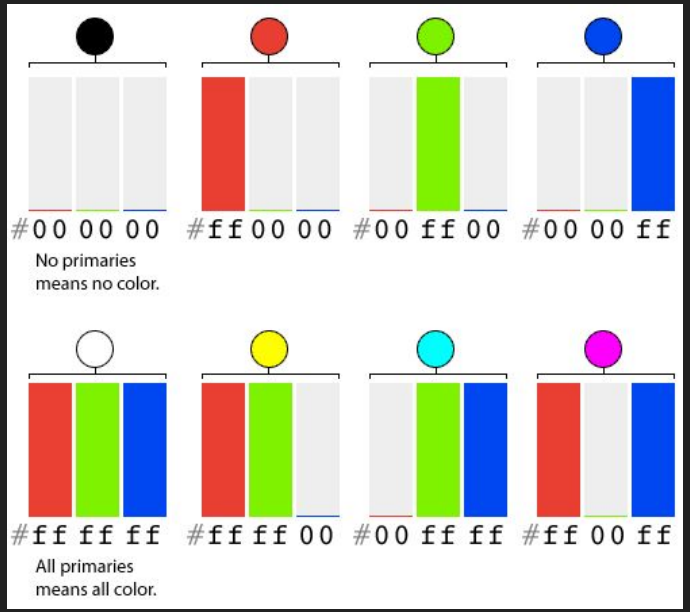
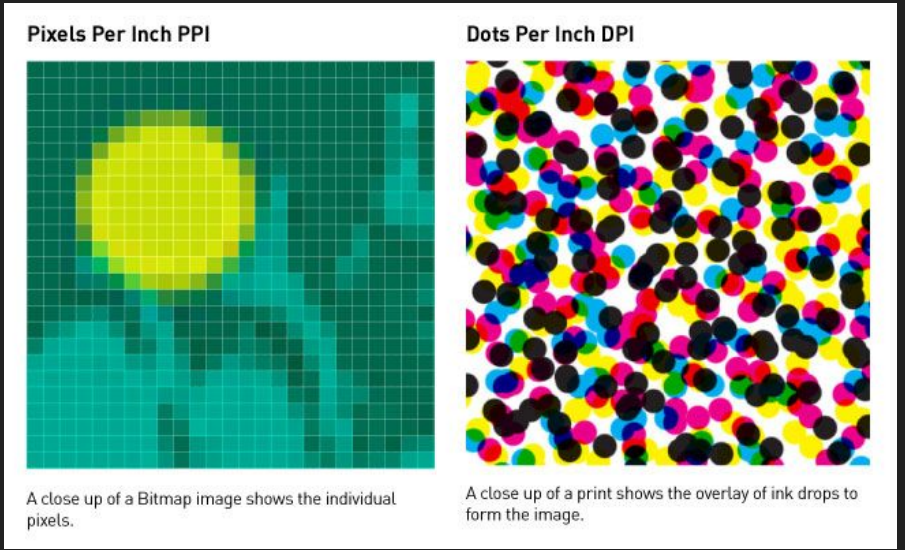


Image + Screen Resolution

PPI vs DPI

PPI (Pixels per Inch) and DPI (Dots per Inch) are often used interchangeably, but they refer to different things.

- PPI indicates how many pixels are contained in one inch of the image or screen
- DPI measures how many ink dots can be placed within one inch on a printed document



Screen Resolution vs Image Resolution

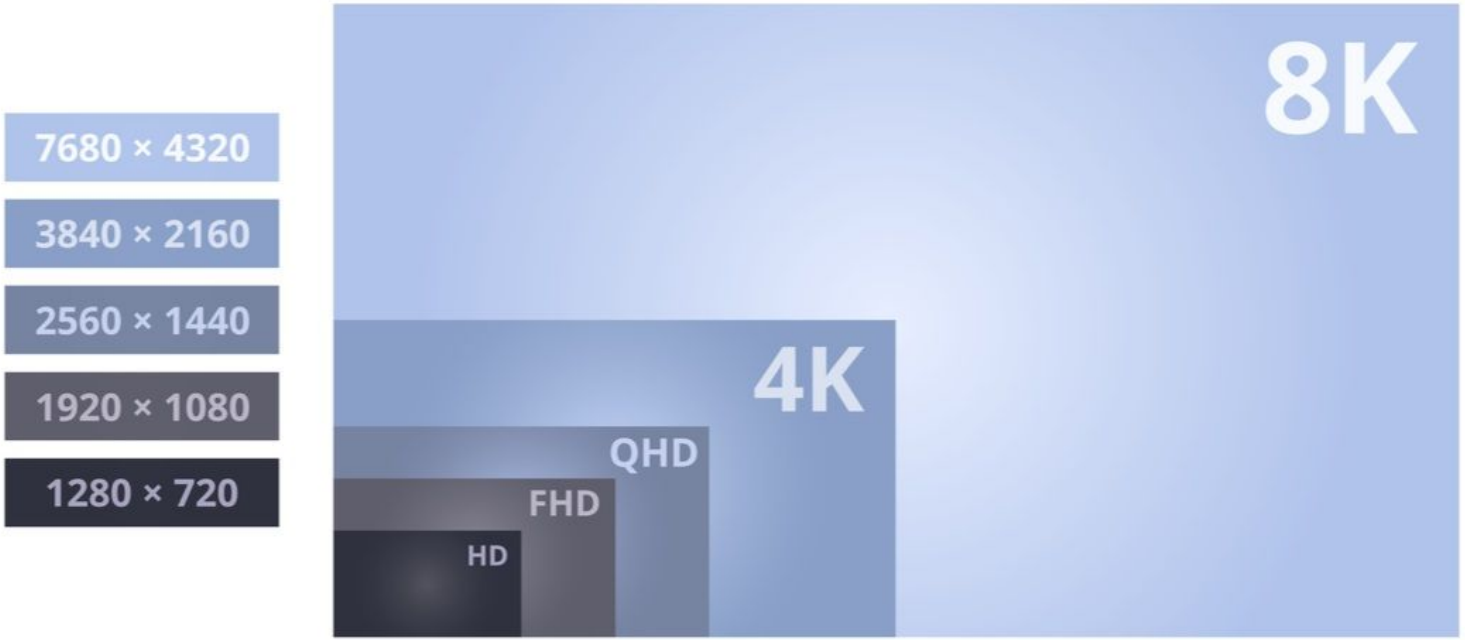
Screen resolution refers to the number of pixels displayed on a screen, typically measured in pixels horizontally and vertically (e.g., 1920x1080 pixels for Full HD).

Image resolution in digital images refers to the total number of pixels in an image, determined by its dimensions (width and height).

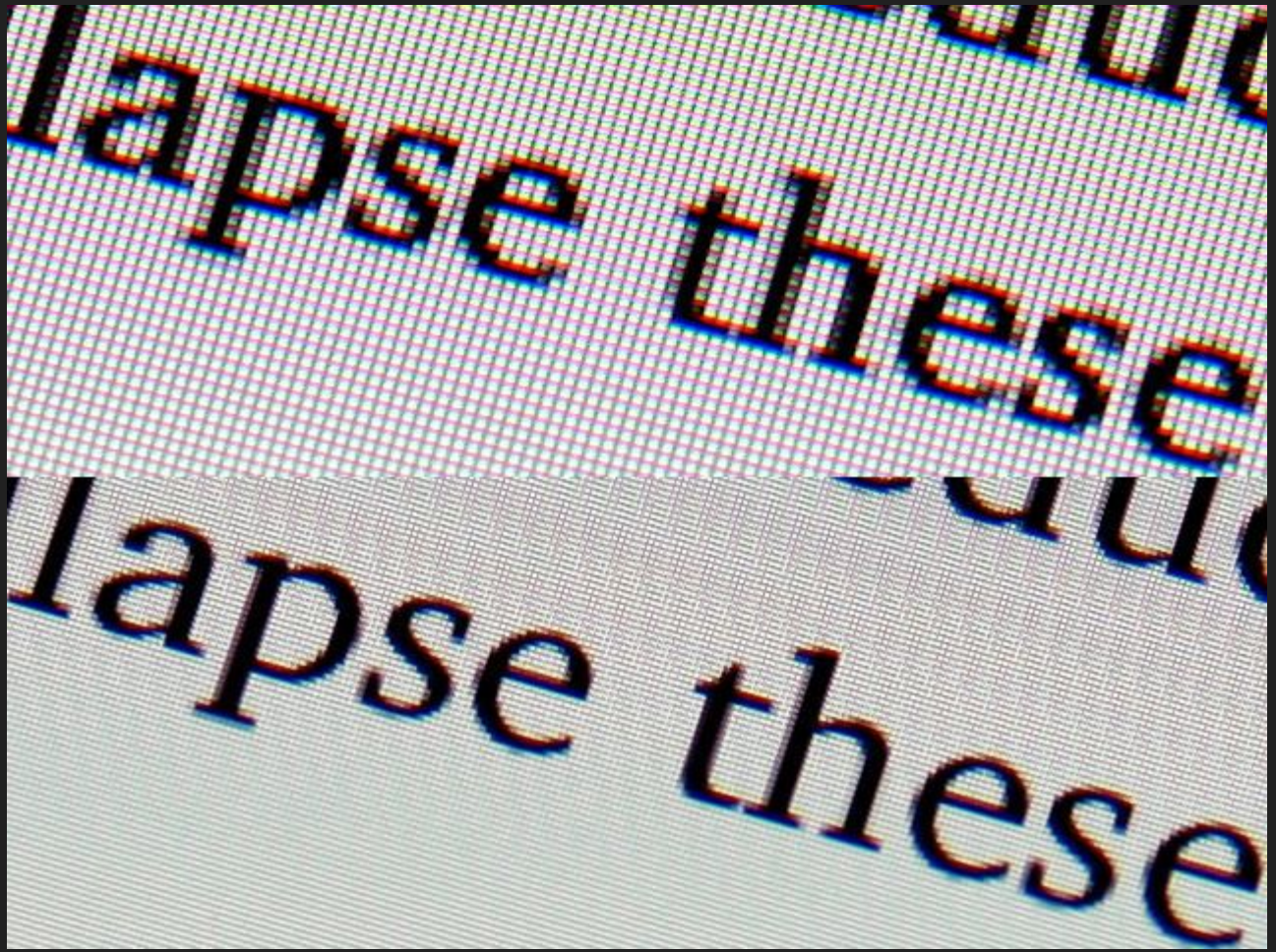
While screen resolution is fixed by the display device, image resolution is flexible and can be adjusted based on the image's intended use, such as for web display or printing.

SCREEN RESOLUTION

Comparison Chart



High Density Displays



4k image
Dimensions: 5,472 x 3,648
Retina Display ~227ppi
Macbook 14": ~2560 x 1600
Full HD Display
Dimensions: 1920 x 1080

NYU Law Logo
Dimensions: 100x100

Retina Display ~227ppi
Macbook 14": ~2560 x 1600

Full HD Display
Dimensions: 1920 x 1080

NEW YORK UNIVERSITY
FERSTARE ET PRÆSTARI
MDCCCXXXI

Standard Resolutions

- Standard resolution for **screen-based** images is 72 ppi (pixels per inch)
- Standard resolution for **print** is 300 dpi (dots per inch) or higher
- Document or Canvas size specifies the height and width of an image but does not refer to the image’s resolution

* **We want the highest resolution images, but quality is usually proportional to file size**

The bigger the file sizes, the longer it takes for images to load, the slower our website runs!

Bits + Bytes

1 Bit	=	Binary Digit
1 Byte	=	8 Bits
1 Kilobyte (KB)	=	1024 Bytes
1 Megabyte (MB)	=	1024 KB
1 Gigabyte (GB)	=	1024 MB
1 Terabyte (TB)	=	1024 BG

* Standard images for the web should be as small as possible (~5-500KB)
* Images can get up to several hundred megabytes in size

Images

PNG	2 – 4 kB
GIF	6 – 8 kB
JPG	9 – 12 kB

Documents

DOCX	4 – 8 kB
PDF	18 – 20 kB

Media Files

eBook	1 – 5 MB
MP3 song	3 – 4 MB
DVD Movie	4 GB
HD Movie	5 – 8 GB
Blu-Ray	20 – 25 GB

File Size

Image file size is determined by:

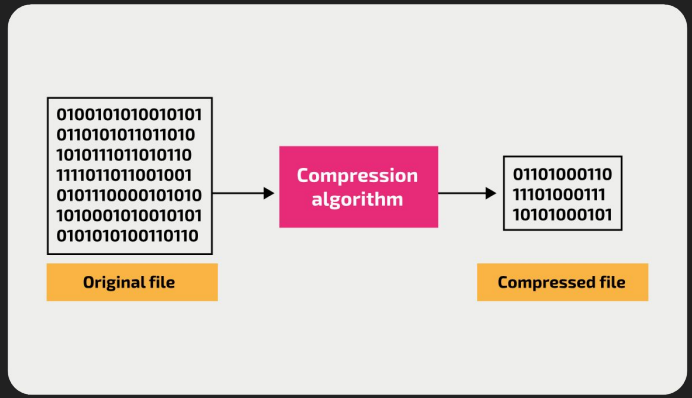
- **Bit depth:** The number of bits used to indicate the color of a single pixel. Higher bit depths allow for more colors but also result in larger file sizes.
- **Image dimensions**: The width and height of the image in pixels. Larger dimensions generally result in larger file sizes because there are more pixels to store.
- **File type**: The format in which the image is saved, such as JPEG, PNG, GIF, or TIFF. Different file formats use different compression techniques, which can affect the file size.

File Compression

- Compression is when algorithms minimize your file size
- Different file types use different compression algorithms

Lossy: some data is discarded and approximated resulting in smaller file size

Lossless: original data is reconstructed resulting in a more accurate file with a larger file size



Web Formats

JPEG	“Joint Photographic Experts Group”
PNG	“Portable Network Graphics”
GIF	“Graphic Interchange Format”
WebP	Newer web image format that is gaining solid browser support
AVIF	New, open-source image format for still and animated image

size | **transparency** | **compression** | **browser support**

JPEG

Joint Photographic Experts Group

- Great for photographs
- Capable of displaying millions of colors in RGB space
  - 24 bit color (RGB all defined with 8 bits of information)
- Lossy compression

👍 Works well with gradient and blended colors

👎 Struggles with flat colors and hard edges

PNG

Portable Network Graphics

- Newest image format (meant to replace GIF)
- Preserves transparency
- Lossless compression
- 24-bit (PNG-24): millions of colors
- 8 bit (PNG-8): 256

👍 Good for flat color (logos, line art, icons)

👎 Works for photos but won’t be saved as efficiently, resulting in larger files sizes

GIF

Graphic Information Format

- First image format supported by web browsers
- Supports animation
- Preserves transparency
- Lossless compression
- 8-bit: only 256 colors

👍 Smaller file size, great for simple graphics

👎 PNG can do everything the GIF can and better (except animation)

WebP

Web Picture Format

- Developed by Google intended as a replacement for JPEG, PNG, and GIF file formats.
- Preserves animations and transparency
- Can produce smaller file sizes than JPEG
- Supports both lossless and lossy compression

👍 “the Swiss Army knife of image formats”

👎 Not well supported (yet)

TABLE 23-1. Choosing the best bitmapped (raster) file format

If your image...	use...	because...
Is graphical, with flat colors	8-bit PNG or GIF	PNG and GIF excel at compressing flat color.
Is a photograph or contains graduated color	JPEG	JPEG compression works best on images with blended colors. Because it is lossy, it generally results in smaller file sizes than 24-bit PNG.
Is a combination of flat and photographic imagery	8-bit PNG or GIF	Indexed color formats are best at preserving and compressing flat color areas. The pixelation (dithering) that appears in the photographic areas as a result of reducing to a palette is usually not problematic.
Requires transparency	GIF or PNG-8	Both GIF and PNG allow on/off transparency in images.
Requires multiple levels of transparency	PNG-24 or PNG-8	Only PNG supports multiple levels of transparency. PNG-24s with alpha transparency have a much larger file size, but it is easier to find tools to create them. WebP also supports alpha transparency, and may be a better option once it is better supported.
Requires animation	GIF	GIF is the only supported format that can contain animation frames. APNG and WebP may be better options in the future.

Raster Graphic Editors

Photoshop

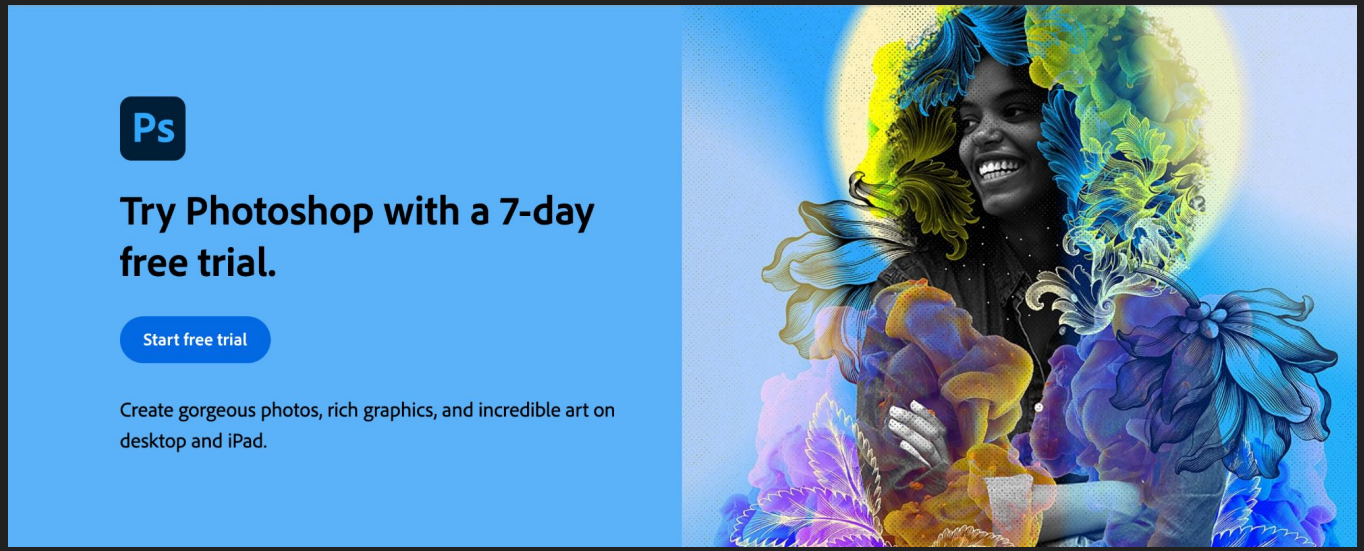
Gimp

Affinity Photo

Photoshop

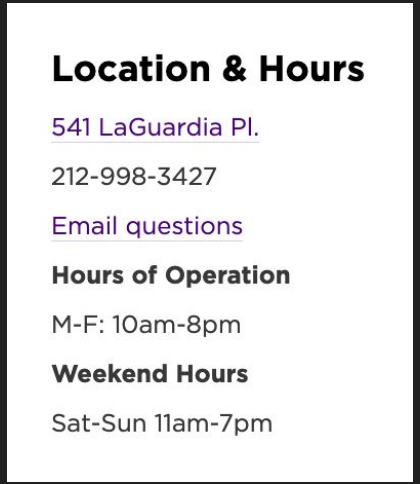
- Created in 1987 by Thomas Knoll, then a PhD student at the University of Michigan.
- It was originally called “Display.”
- Its purpose is to manipulate and create digital images
- Tools and metaphors from darkroom photography (such as Dodge, Burn, Crop)
- Mostly uses raster or bitmap graphics
- Images are made up of pixels

Installing Photoshop

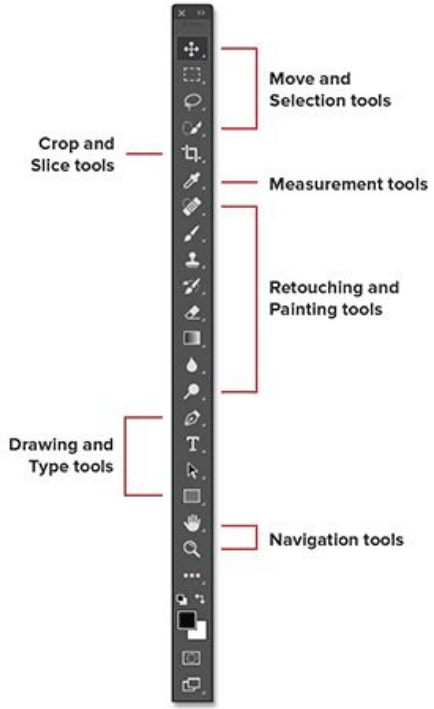


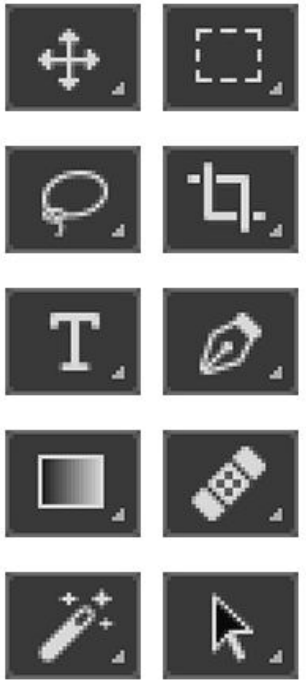
https://www.adobe.com/products/photoshop/free-trial-download.html

* Photoshop is also available on the computers at the LaGuardia Student Technology Center

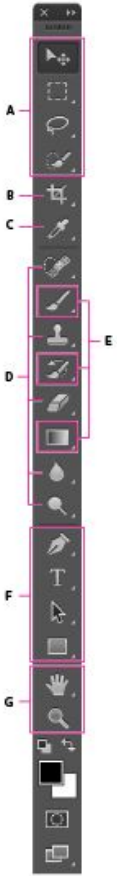


Photoshop Tools Layout





Tools Panel Overview



A Selection tools

- **Move (V)***

Rectangular Marquee (M)
Elliptical Marquee (M)
Single Column Marquee
Single Row Marquee

- **Lasso (L)**

Polygonal Lasso (L)
Magnetic Lasso (L)

- **Quick Selection (W)**

Magic Wand (W)

B Crop and Slice tools

- **Crop (C)**

Perspective Crop (C)
Slice (C)
Slice Select (C)

C Measuring tools

- **Eyedropper (I)**

3D Material Eyedropper (I)
Color Sampler (I)
Ruler (I)
Note (I)
Count (I)

D Retouching tools

- **Spot Healing Brush (J)**

Healing Brush (J)
Patch (J)
Content Aware
Red Eye (J)

- **Clone Stamp (S)**

Pattern Stamp (S)

- **Eraser (E)**

Background Eraser (E)
Magic Eraser (E)

- **Blur**

Sharpen
Smudge

- **Dodge (O)**

Burn (O)
Sponge (O)

E Painting tools

- **Brush (B)**

Pencil (B)
Color Replacement (B)
Mixer Brush (B)

- **History Brush (Y)**

Art History Brush (Y)

- **Gradient (G)**

Paint Bucket (G)
3D Material Drop

F Drawing and type tools

- **Pen (P)**

Freeform Pen (P)
Add Anchor Point
Delete Anchor Point
Convert Point

- **Horizontal Type (T)**

Vertical Type (T)
Horizontal Type Mask (T)
Vertical Type Mask (T)

- **Path Selection (A)**

Direct Selection (A)

- **Rectangle (U)**

Rounded Rectangle (U)
Ellipse (U)
Polygon (U)
Line (U)
Custom Shape (U)

G Navigation tool

- **Hand (H)**

Rotate View (R)

- **Zoom (Z)**

■ Indicates default tool * Keyboard shortcuts appear in parenthesis

NOOOOO lol

honestly, I might use that image as inspiration for my photoshop tutorial

HAHAH

yes

Do it

Non-Destructive vs Destructive Editing Techniques

Non-Destructive Editing (NDE) is a method of editing in Photoshop that allows you to make changes to an image without losing the original image information.

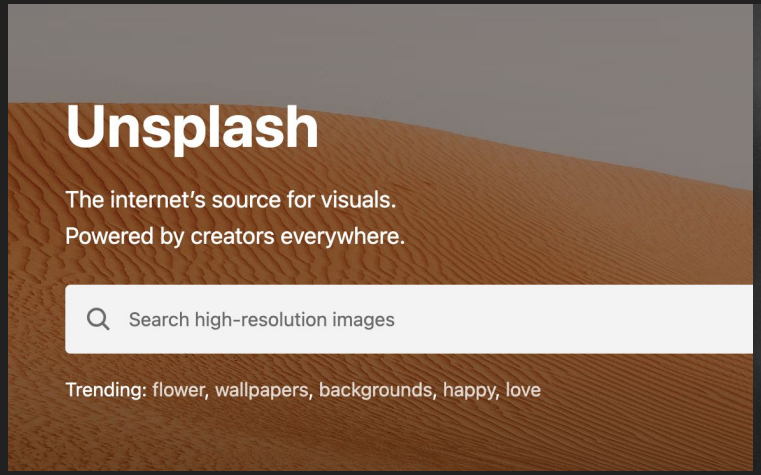
For example: using separate layers for text and brush strokes, layer masks, blending modes, layer styles, smart objects!

Destructive Editing is a method of editing in Photoshop where you are permanently changing the original image.

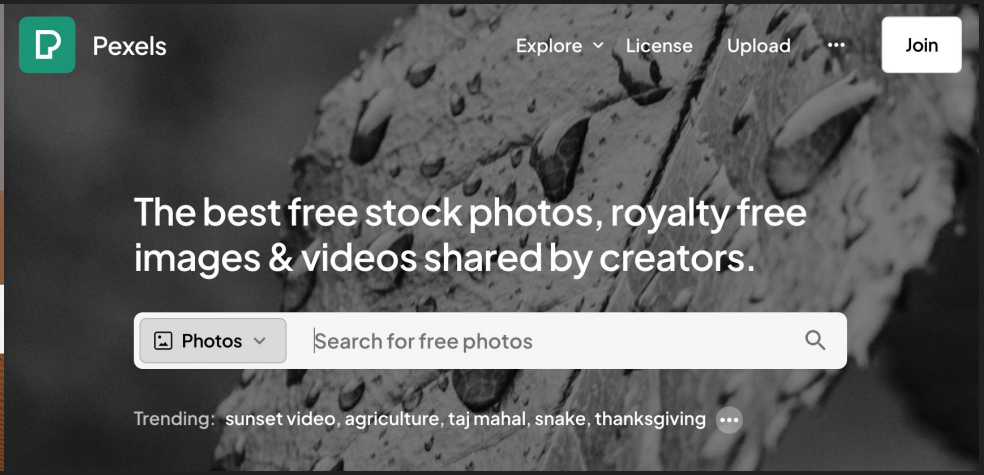
For example: merging layers, adding filters, deleting pixels with an eraser.

You can still ‘undo’ while you are actively editing the image and have the project open. However, once you save it, there is no going back!

Where to get your images



unsplash.com

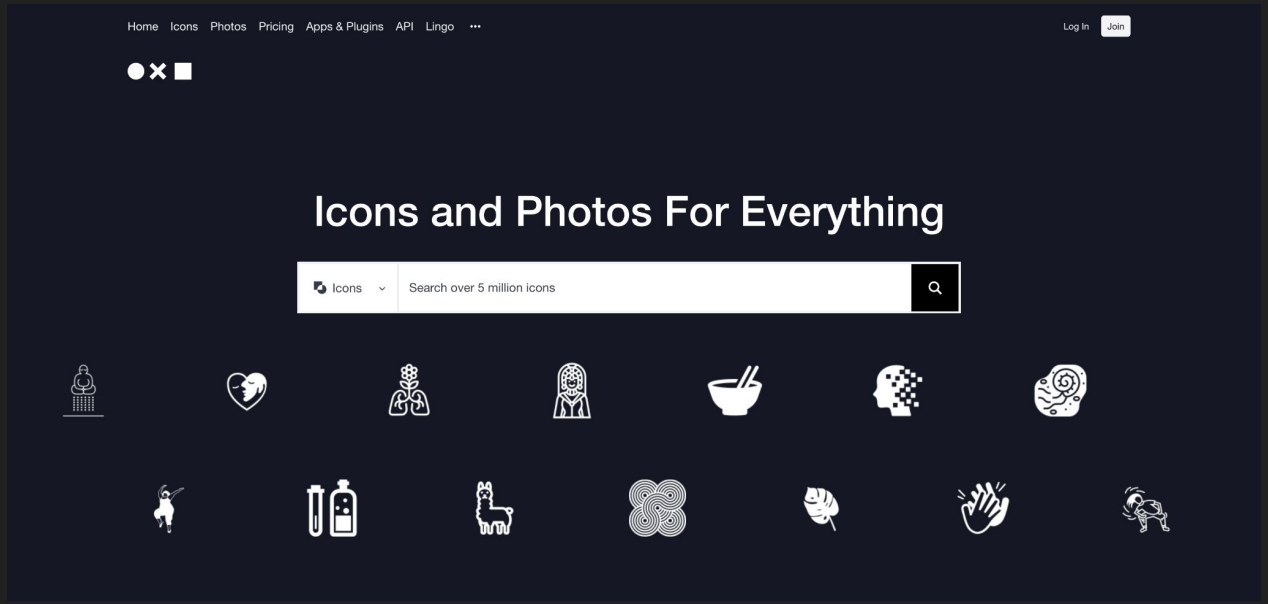


pexels.com

Where to get your images

[Wikipedia Commons]

Clip art



[The Noun Project]