Digital Media Basics

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Coordinates

Whether you're drawing on a screen, printing to a page, or modeling in three-dimensional space, you need to orient any point, line, or shape at a distance from a point of origin.

Typically, the upper left corner of the docuement or screen is the point of origin.

A position is comprised of an x-coordinate and a y-coordinate. The x-coordinate is the horizontal distance from the origin and the y-coordinate is the vertical distance. If you're drawing in three-dimensions, a third parameter would give the position of the z-coordinate.

In an 800 pixel wide by 600 pixel high window, [0, 0] is the upper-left pixel, [400,300] is right in the middle, and the last visible pixel in the lower-right corner of the screen is at [799, 599]
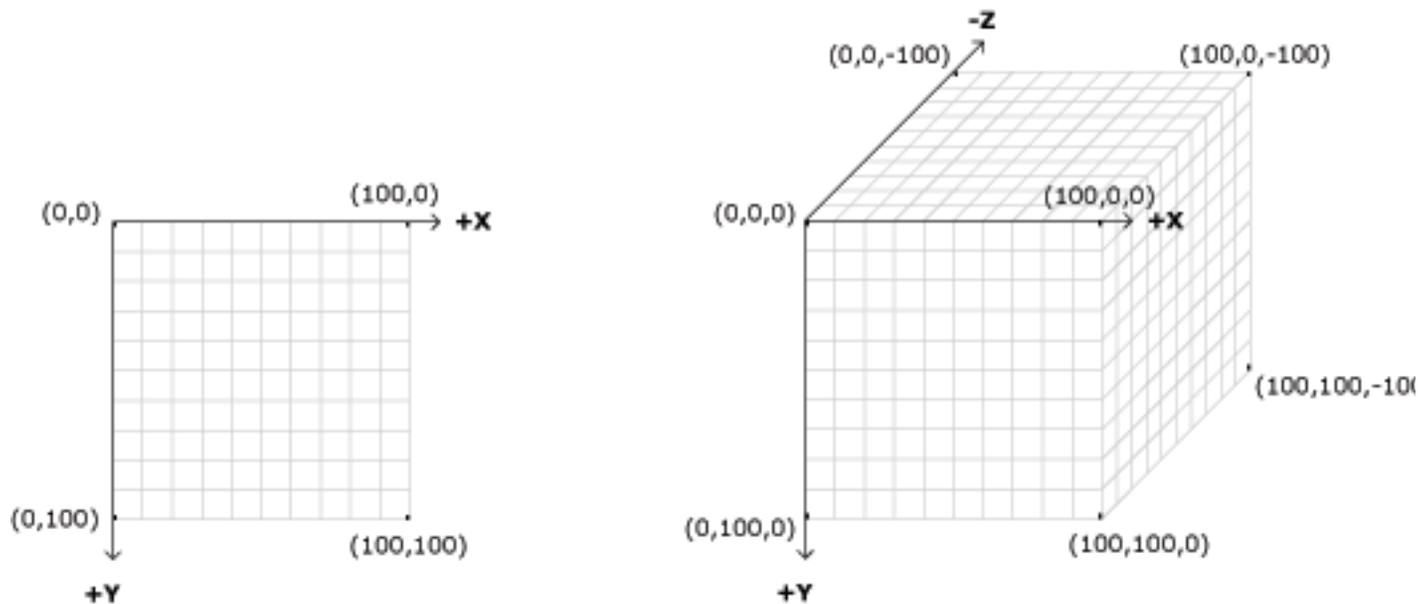
Raster and Vector

There are two primary methods for drawing shapes and images in digital media.

Raster images, also called *bitmap*, provide a complete description of what is shown at every pixel shown on-screen for a given resolution. Each pixel is defined by its position (x,y) and its color. In raster images, there is always a finite number of pixels, and each pixel has one color. The number of pixels is defined by the image's size and resolution.
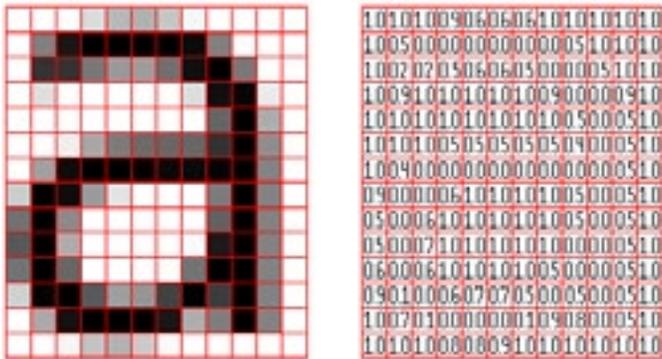

raster image map
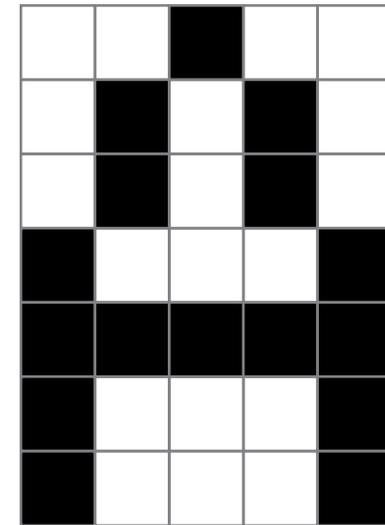
raster

Vector images make use of algorithmic formulas that connect individual points with (x,y) positions by straight or curved lines. If several points are connected by lines that close an area, they create a shape. Because vector lines and shapes are controlled mathematically, they can scale up or down infinitely without losing any image quality.
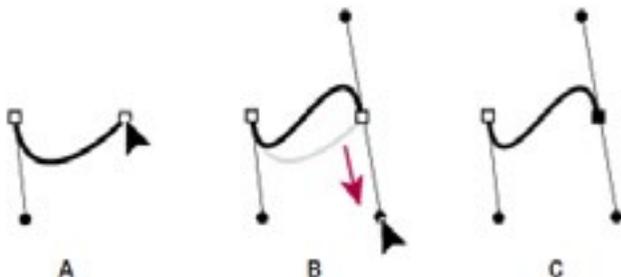

creating Bezier curves
in vector drawing
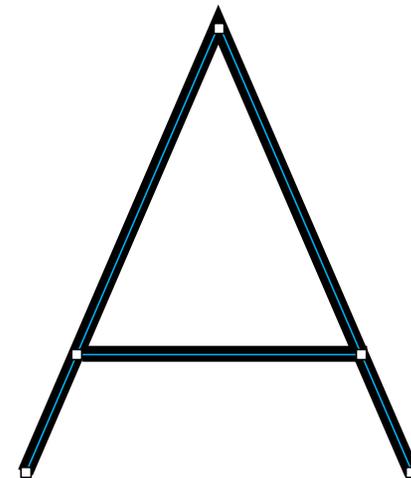
vector

Resolution & Size

The display *resolution* of a computer monitor or display device is the number of distinct pixels in each dimension that can be displayed. It is usually quoted as width × height, with the units in pixels: for example, "1024 × 768" means the width is 1024 pixels and the height is 768 pixels. An image's *resolution* and its *size* are different but related concepts. You can think of resolution as a series of colored tiles that make up an image. To make that image sharper, you either use more tiles and make those tiles smaller (increase the resolution while the size stays the same) or you can move farther away from it (make the image smaller with the same resolution).

The resolution of an image is based on the density of pixels over a given area. This is measured as Dots Per Inch or DPI. Typically, images for screen use are created at a resolution of 72dpi. For high quality printing, image resolution is typically 300dpi (sometimes higher). For standard printing, 150dpi is a decent image resolution.

The amount of memory an image requires to be stored is a direct result of the size multipled by the resolution of an image. Higher resolution yields bigger image files.
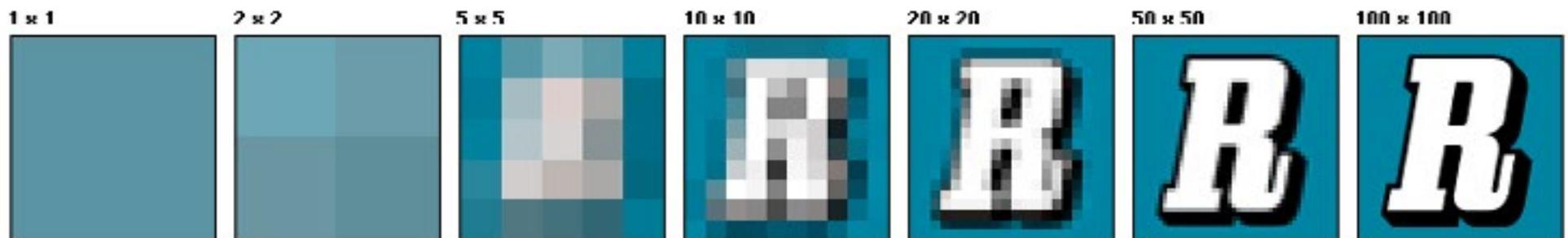
Units of Measure

When working across various media, it's important to keep track of size relationships that use different units of measure. Paper sizes are typically measured in inches, screen-based images are typically measured in pixels, and typography is measure in points or picas.

The relationship between number of pixels and number of inches is dependent on the resolution. For example, an image that is 1" x 1" with a resolution of 10dpi will have 100 pixels total (10x10). An image that is 1" x 1" with a resolution of 100dpi will have 10,000 pixels total (100x100).

Points and picas are used to measure typography. The size of a letter form is determined by its *point size*. One pica comprises 12 points. There are 6 picas in one inch and 72 points in one inch.

Note that the point size cannot be measured directly from the letter. The point size includes the fullest distance form ascender to descender with some additional padding. However, if you are measuring the leading on a block of text, you can measure it in points from baseline to baseline. For example a block of text set at 9/12 ("nine over twelve") means the type size is 9pt and the leading is 12pt. The letter forms themselves will be all shorter than 9pt, but the distance from of one baseline to the next will be 12pt.
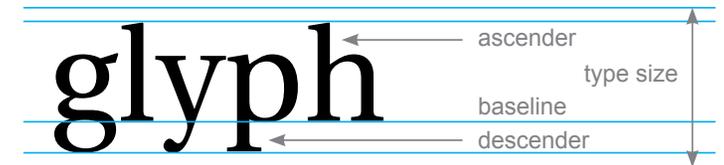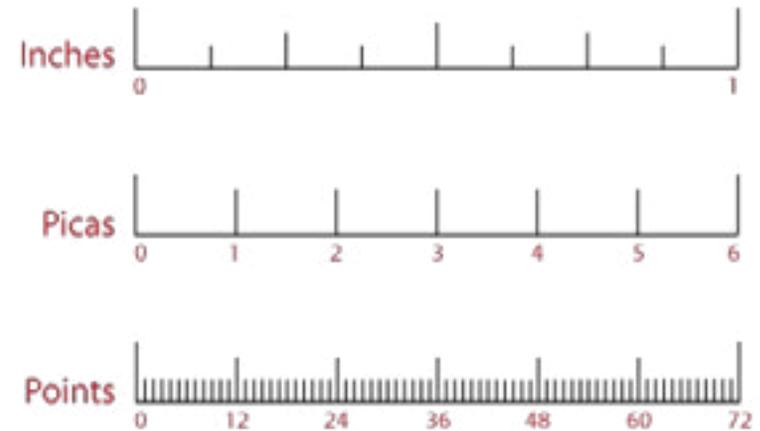
Color

Light makes things visible—on-screen as in the physical world. There are several different modes through which the qualities of light are translated onto a screen, in print, or with other reproduction methods.

Two common color modes used in screen and print media are RGB and CMYK.

On screen displays typically use an RGB color mode. This is an additive color system, which means the more color you add, the closer you get to white (as in natural light). Additive color systems mix the three primary colors red, green, and blue to create a broad range of colors. In a typical 24-bit color depth, each color has a value ranging from 0 to 255, defined by (red value, green value, blue value). Combined this allows for 16, 777, 216 possible colors. For example, pure red has a value of (255,0,0), pure yellow has a value of (255,255,0), white has a value of (255,255,255), and black has a value of (0,0,0).

RGB

Printing typically works with a CMYK color mode. CMYK is a subtractive color system, so the more color you add the closer you get to black. The CMYK color mode is based on a 4-color printing process using the ink colors of cyan, magenta, yellow, and black. To create "full color: imagery (for example, raster images), these 4 colors are printed as dots in close proximity to one another to create a wide range of potential colors. CMYK color systems work on a scale of 0 to 100. For example, pure yellow would be C:0 Y:100 M:0 K:0, a medium green would be C:100 Y:100 M:0 K:0, black would be C:0 Y:0 M:0 K:100, and *rich black* would be C:100 Y:100 M:100 K:100.
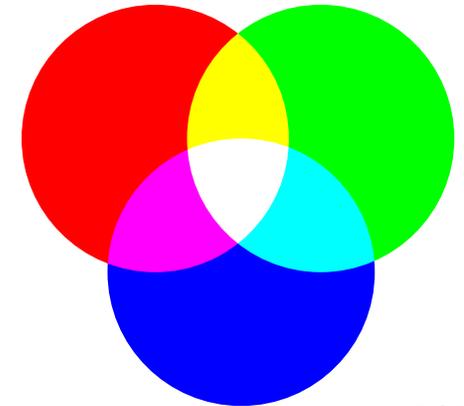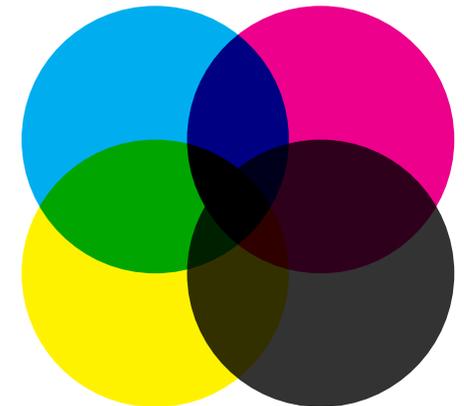
CMYK

File Types

In the world of digital medai, there are many, many different file types. Each file type has different specifications and capacities. Below are a few of the most common files types you'll encounter.

Raster Files
.psd Photoshop source file, may contain layers and is editable
.tif Uncompressed file that may contain layers (good for print)
.jpg Compressed file with no layers (good for screen, web)
.gif Compressed file with no layers (good for screen, web)
.png Compressed file with transparency butno layers (good for screen, web)

Vector Files
.ai Illustrator source file, may contain layers, is editable and scaleable
.svg Scaleable Vector Graphic, vector image that is indefinitely scaleable

Multimedia
.indd InDesign source file, multiple pages with links to raster, vector, audio/ video elements, remains editable with layers
.pdf Portable Document Format, compressed with embedded vector, raster, & font information, can be multiple pages and contain audio/video elements, may be printable (high resolution) or interactive (low resolution)

.pde Processing sketch, must be opened and run in Processing to execute
.app Self-contained application that runs on MacOS
.exe Executable, self-contained application that runs on Windows

File Management

There are two commom and fundamentally distinct methods for structuring data digitally: a hierarchical file system and a flat, nonhierarchical network.

The flat model, known commonly from the World Wide Web, assumes that every object lives on the same level (non-hierarchical), and that everything can be connnected to everything else via a unique address: *the hyperlink.*

A hierarchical file system, common in operating systems, organizes all data into the structure of a hierarchical system of folders. When retrieving data, the document or user requesting the data must know where to find it within the structure. For example, you may have a structure like this for your assignments in this class:
Documents/School/DES150/Assignment01/...

When working with placed files in Illustrator and InDesign (such as raster or vector images) or data assets in Processing (such as fonts, shape files, or images), the structure between document and assets needs to remain consistent or the placed files will be "lost." If you move files, you'll run into trouble.

Specific to Processing, all of your documents must live within the "Processing" folder (called the *Sketchbook*), and each .pde file must live within a *sketch* folder with the same name as that file. All data assets will live in a folder called "data" within the sketch folder.

Processing ▸	DES150 ▸	Assignment01 ▸	Assignment01.pde
		Assignment02 ▸	data ▸
		Assignment03 ▸	