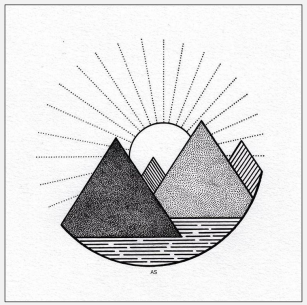
Fundamentals of Drawing

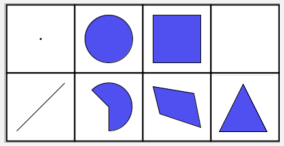
Ingredients



- what *shape* to draw
- *where* to draw the shape
- *how big* to make the shape
- what *color* to make the shape
  - fill
  - stroke

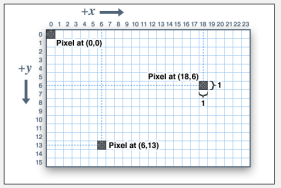
Ingredients – Primitives

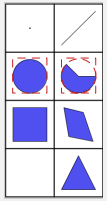
- what *shape* to draw
  - point, line
  - ellipse, arc
  - rectangle, quad
  - triangle



Ingredients – Coordinates

- *where* to draw the shape
  - (x,y) coordinates
  - (0,0) is the upper left corner of the drawing window
- *how big* to make the shape
  - units are in pixels

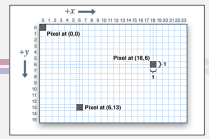




shape	position	size
point	location	
line	endpoints	
ellipse	upper left corner or center of bounding box	width, height of bounding box
arc	upper left corner or center of bounding box angle start and end	width, height of bounding box of full ellipse
rect	upper left corner or center	width, height
quad	four vertex points	
triangle	three vertex points	

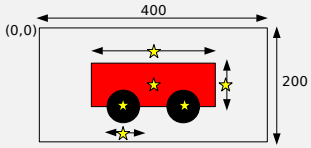
 https://learn.adafruit.com/adafruit-gfx-graphics-library/coordinate-system-and-units

Ingredients – Coordinates



Figuring out position and size –

- identify the quantities you need to find
  - point, line, triangle, quad – vertex points
  - ellipse, arc, rect – center or upper left corner
  - also need width and height for ellipse, rect
- label what you know
  - window width, height, upper left corner
- use what you know to figure out what you need
  - compute what you can from known quantities
  - eyeball relationships if needed

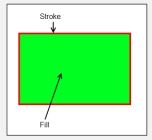


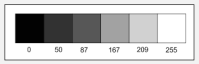
- rect looks centered in the window → compute center from window dimensions
- rect width looks like half the window width, rect height looks like 1/3 window height → compute rect dimensions from window dimensions
- ellipse height looks the same as rect height → compute ellipse dimensions from rect dimensions
- each ellipse looks centered left-to-right in half of the rect and vertically aligned with the bottom of the rect → compute ellipse centers from rect, ellipse dimensions

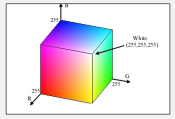
 https://learn.adafruit.com/adafruit-gfx-graphics-library/coordinate-system-and-units

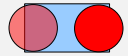
Ingredients – Color

- which *aspect* of the shape
  - fill
  - stroke
- what *color* to make it
  - grayscale value 0 (black) to 255 (white)
  - RGB color – red, green, blue components with values 0 (off) to 255 (fully on)
  - alpha – values 0 (fully transparent) to 255 (opaque)







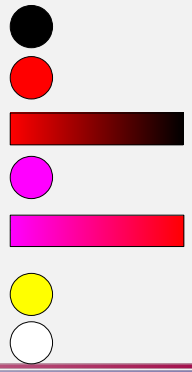


 https://stackoverflow.com/questions/4125152/difference-between-stroke-and-fill https://p5.readthedocs.io/en/stable/tutorials/color.html http://matlab.izmiran.ru/help/toolbox/images/color4.html

RGB Color

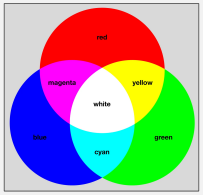
What color do you get when…

- ...no flashlights are on?
- ...only the red flashlight is on?
- ...you adjust the red dimmer?
- ...both red and blue are on?
- ...both red and blue are on, and you adjust the blue dimmer?
- ...both red and green are on?
- ...all the flashlights are on?



RGB Color

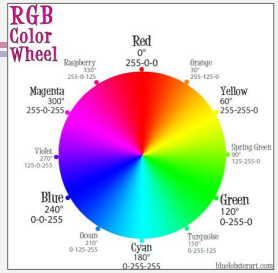
- RGB is an *additive* color model
- additive color mixing applies to light
  - for light, the color we see is the combined energy of the wavelengths present
  - all wavelengths combined makes white
- CMY(K) is a *subtractive* color model
- subtractive color mixing applies to pigments (paint, printer ink)
  - for pigments, some light energy is absorbed and some reflected – the color we see are the reflected wavelengths
  - all pigments combined makes black

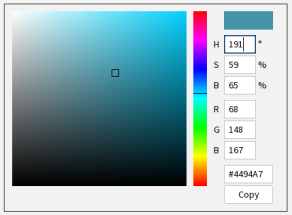


 https://www.britannica.com/science/RGB-colour-model

RGB Color

- learn the 8 basic colors – red, green, blue, cyan, magenta, yellow, white, black
- have a notion of what happens as you turn each component up or down
  - the effect of the dimmer switch
- to figure out other colors, experiment or use Processing's color selector tool





https://www.pinterest.com/pin/426012445987636198/