

DRAWING

绘图 | DRAWING

Drawing is a visual art that relies on the use of lines and tones to create an illusion (realistic or abstract picture) on a two- dimensional surface.



计算机图形 | COMPUTER GRAPHICS

Computer graphics are the generation and presentation of images on a computer display.

There are two methods for refining computer graphics:

Raster

Vector



位图 | RASTER GRAPHICS

Raster graphics, sometimes referred to as bitmaps, are defined as a grid (matrix) of pixels on a computer display or dots on a printed page.

Rasters are best suited for images that are photographic in nature.

However, rasters suffer from loss of quality when enlarged.



矢量图 | VECTOR GRAPHICS

Vector graphics define images as a set of points, lines and geometric shapes.

Vectors can scale cleanly to any size without suffering a loss of quality.

For this reason, vectors are best suited for illustrations including logos and typography.

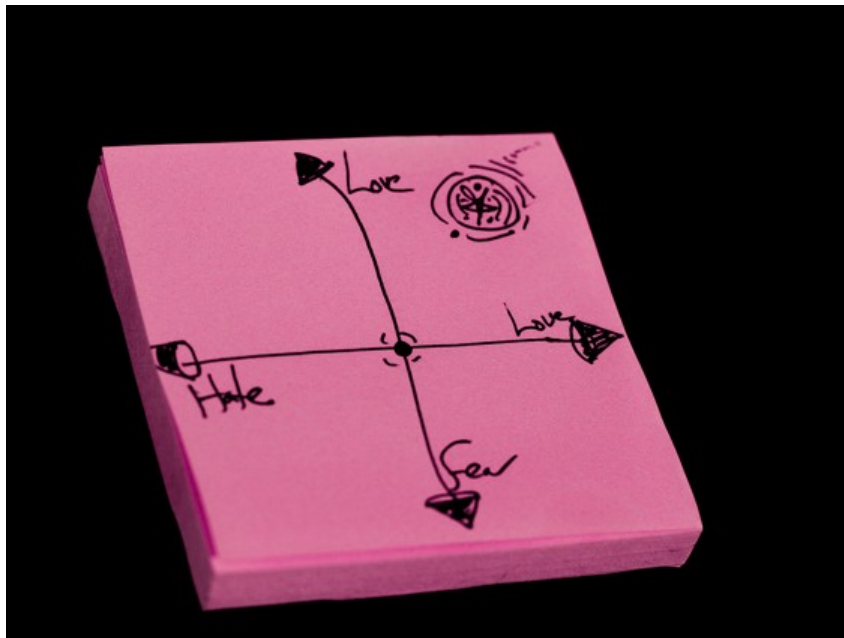


坐标系 | COORDINATE SYSTEMS

Coordinate systems are used to uniquely determine the position of something within a space.

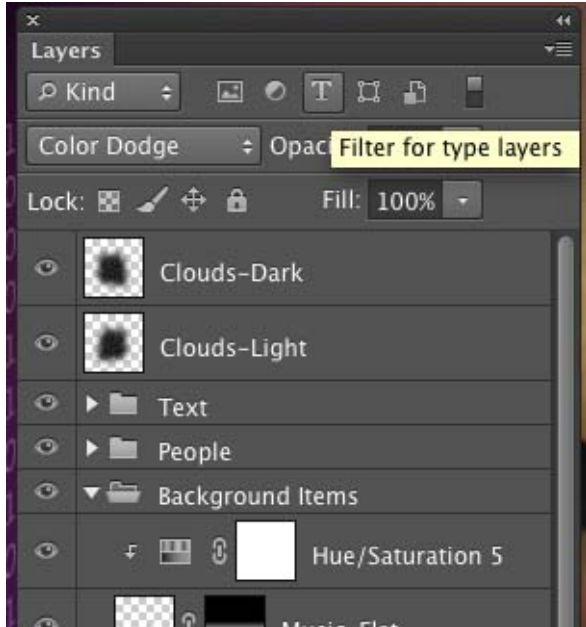
The coordinate system used in computer graphics differs from the Cartesian coordinate system used in mathematics.

The Computer graphics coordinate system begin (0,0) at the top left corner instead of in the center.



绘图顺序&图层

DRAWING ORDER & LAYERING



Graphic elements like shapes, images, and text are created one at a time in your program.

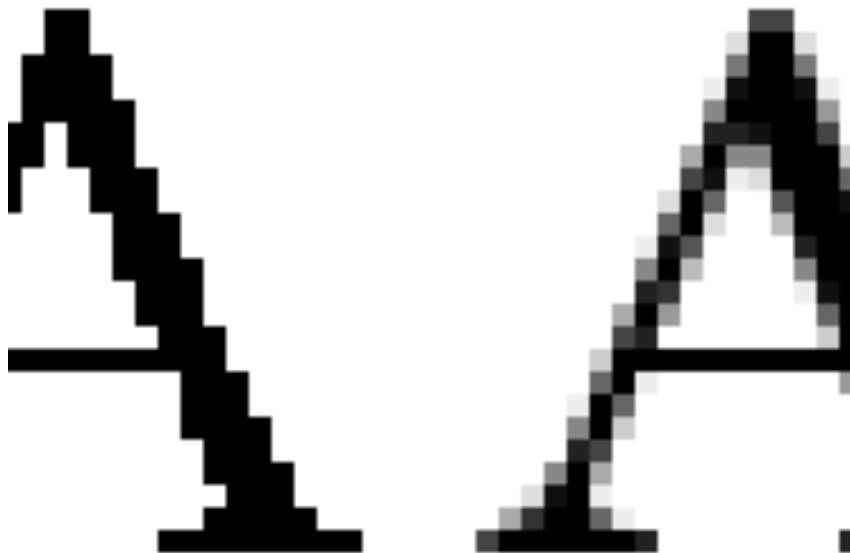
A graphic element created later in your program will appear on top of an element created earlier in your program if they occupy the same coordinates.

抗锯齿 | SMOOTHING

Computer graphics systems use a process called anti-aliasing to smooth jagged transitions between graphic elements that would otherwise be visible on a low resolution computer display.

This smoothing can be turned on or off in Processing.

Having smoothing on generally looks better, but it can have negative consequences for performance.



图元 | 2D PRIMITIVES

Processing has commands for drawing simple shapes called 2D Primitives.

To draw a circle you would use the `ellipse()` function, passing in the x and y coordinates as well as the width and height.

The drawing functions require that different values be provided, corresponding to various attributes of the shape, such as position or size.



图元 | 2D PRIMITIVES

The types of shapes that can be drawn using Processing's built-in 2d Primitive Shape drawing functions are:

- Points
- Lines
- Curves
- Triangles
- Rectangles
- Quadrilaterals
- Ellipses
- Arcs

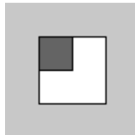
绘图模式 | DRAWING MODE

You can use the `rectMode()` or `ellipseMode()` functions to control where the point of origin will be for shapes that you draw.

The options for `rectMode()` and `ellipseMode()` are `CORNER`, `CORNERS`, `CENTER`, or `RADIUS`.

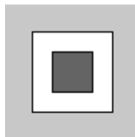
Name `rectMode()`

Examples



```
rectMode(CORNER); // Default rectMode is CORNER
fill(255); // Set fill to white
rect(25, 25, 50, 50); // Draw white rect using CORNER mode
```

```
rectMode(CORNERS); // Set rectMode to CORNERS
fill(100); // Set fill to gray
rect(25, 25, 50, 50); // Draw gray rect using CORNERS mode
```



```
rectMode(RADIUS); // Set rectMode to RADIUS
fill(255); // Set fill to white
rect(50, 50, 30, 30); // Draw white rect using RADIUS mode
```

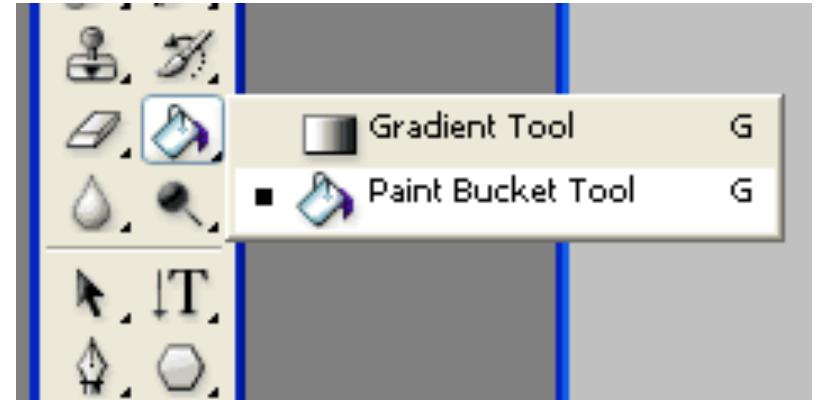
```
rectMode(CENTER); // Set rectMode to CENTER
fill(100); // Set fill to gray
rect(50, 50, 30, 30); // Draw gray rect using CENTER mode
```

描边&填充 | STROKE & FILL

Vector shapes can be defined with a stroke, sometimes called a path or outline, and a fill, or interior color.

To set the stroke color use the `stroke()` function.

To set the fill color use the `fill()` function.



描边宽度 | STROKE WEIGHT

The stroke, or outline of a shape, can be thin, thick or anything in between.

Strokes can also be hidden completely.

Set the stroke weight by using the `strokeWeight()` function.

Use the `noStroke()` function to remove the stroke altogether.



COLOR

Color can be set in Processing by several different methods using different color systems and forms of notation:

- Grayscale
- RGB Color
- Hexadecimal Color



PHOTO BY
NATHAN RUPERT

灰度图 | GRAYSCALE

Grayscale is a color system used in computer graphics which defines images based on a range of gray shades from white to black.

Grayscale colors are defined using a single value from 0 to 255.



RGB COLOR

The RGB color system is an additive color system in which three primary colors (red, green and blue) are mixed to create all available colors.

RGB colors can be defined using three values, one each for red, green, and blue between 0 and 255, or by using a hexadecimal triplet.



HEXADECIMAL COLOR

Color can also be expressed using hexadecimal numbers, from 00 to FF.

Hexadecimal triplets are six-digit three-byte values prefixed by a hash mark (#) or 0x.

Some hexadecimal color values:

- #000000
- #0000FF
- #FFCC00



COLOR MIXING

Color mixing involves adding the three primary colors, red, green, and blue in the case of light (additive color) and cyan, magenta, and yellow in the case of pigment (subtractive color), to create secondary and tertiary colors.

Refer to a color wheel or use a color picker if you need a visual aid:

- color.adobe.com



BACKGROUND COLOR

You can define the background color for your sketch by using the `background()` function.

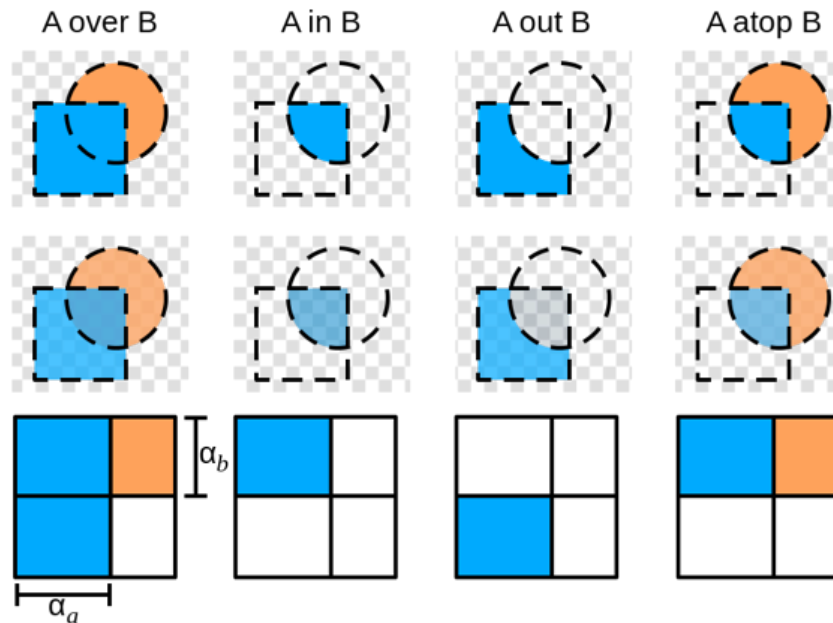
Keep in mind that the `background()` function clears the entire window and fills it with the background color specified.



TRANSPARENCY / OPACITY / ALPHA

Transparency and opacity are inverse qualities that express the ability to see through something to reveal whatever lies behind.

This property can be controlled by specifying the alpha value after the color itself.



COLOR EXAMPLE

```
size(200, 200);  
background(150, 0, 150);  
stroke(150);  
fill(255, 0, 255);  
rect(10, 10, 55, 55);  
noStroke();  
fill(0, 255, 0, 150);  
rect(100, 10, 55, 55);
```