Processing Basics

CS 110

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Software

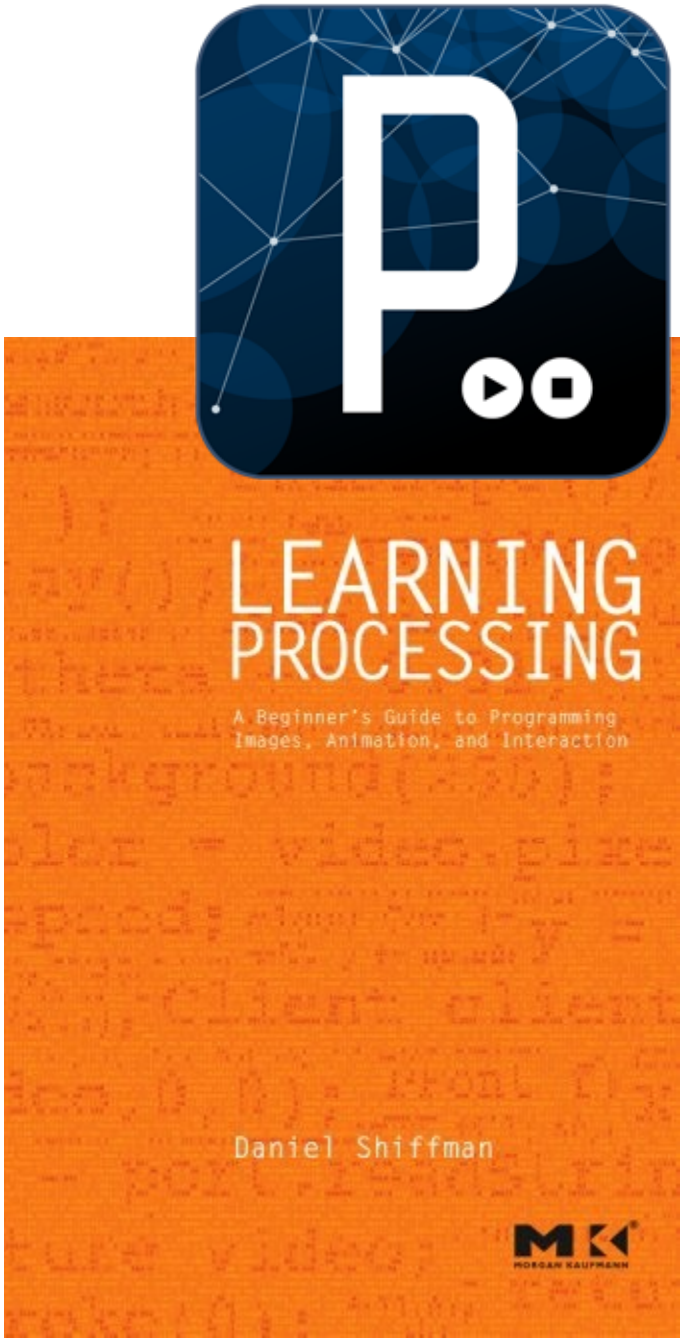
Processing

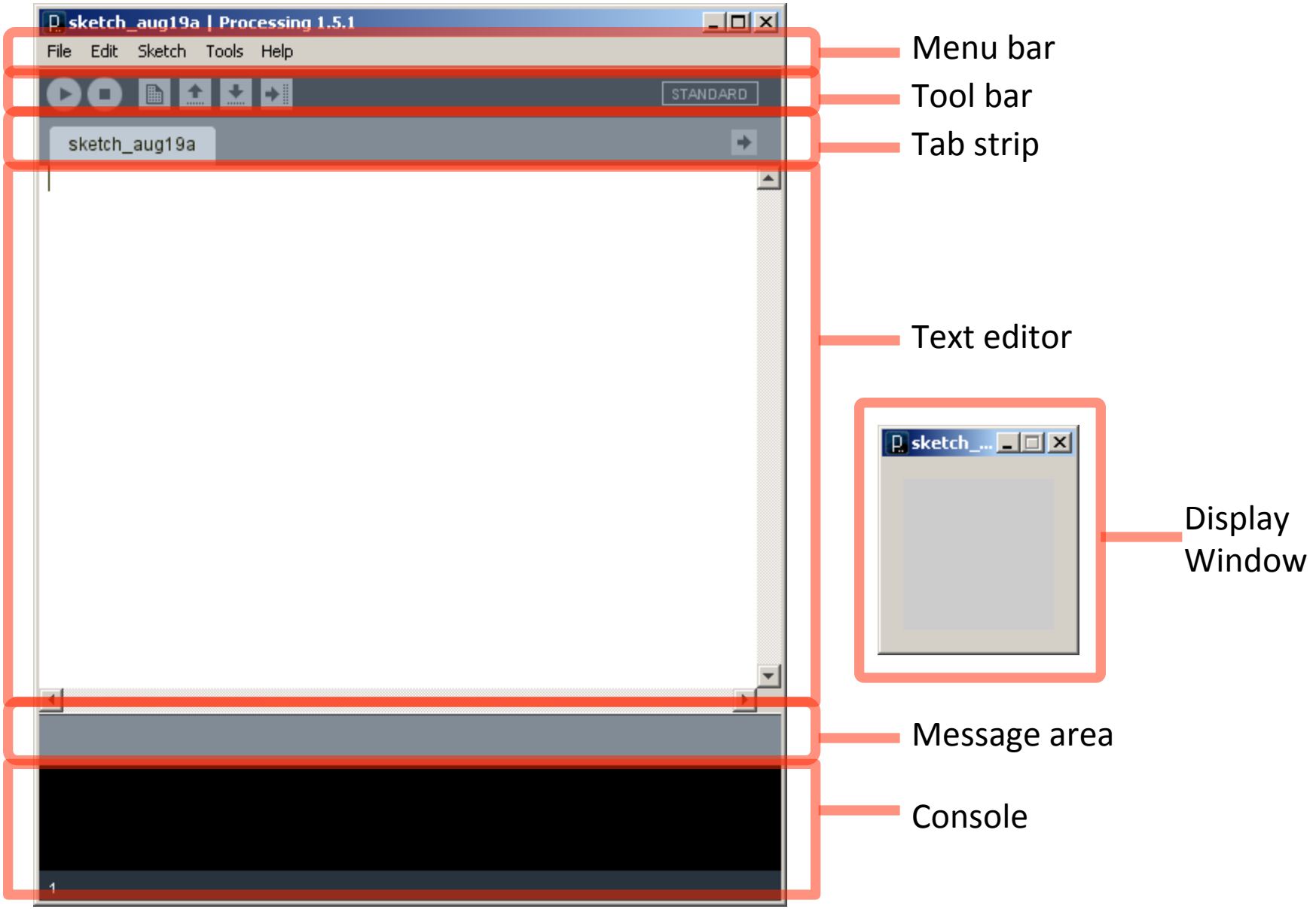
- Already installed in the CS Lab
- Also available for your own computer @ www.processing.org
- Processing == Java

Book

Learning Processing: A Beginner's Guide to Programming Images, Animation, and Interaction by Daniel Shiffman, Morgan Kaufmann Publishers, 2008. Available at the Campus Bookstore.

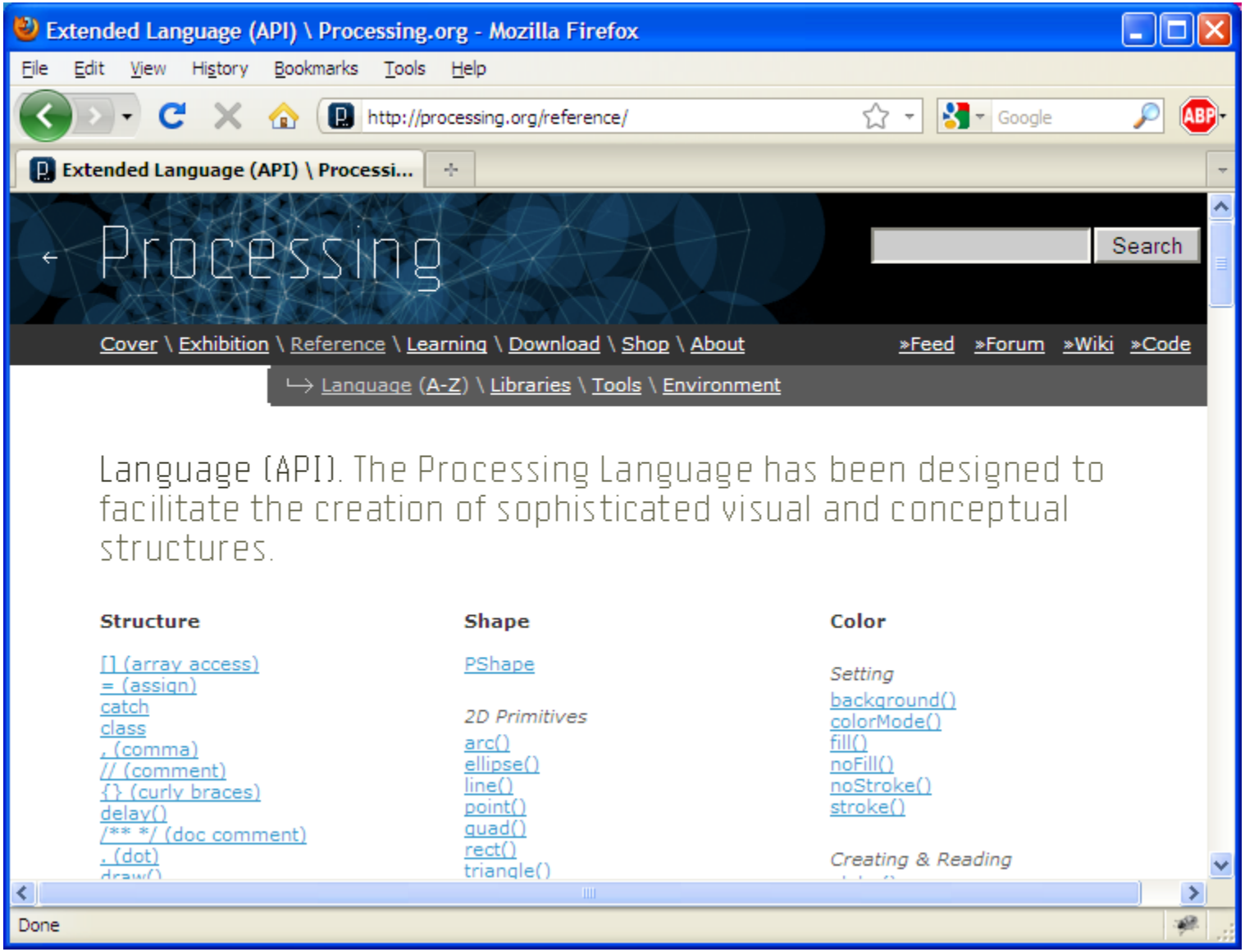
http://www.learningprocessing.com/




sketch_aug19a | Processing 1.5.1
File Edit Sketch Tools Help
STANDARD
sketch_aug19a
1
Menu bar
Tool bar
Tab strip
Text editor
sketch_...
Display Window
Message area
Console

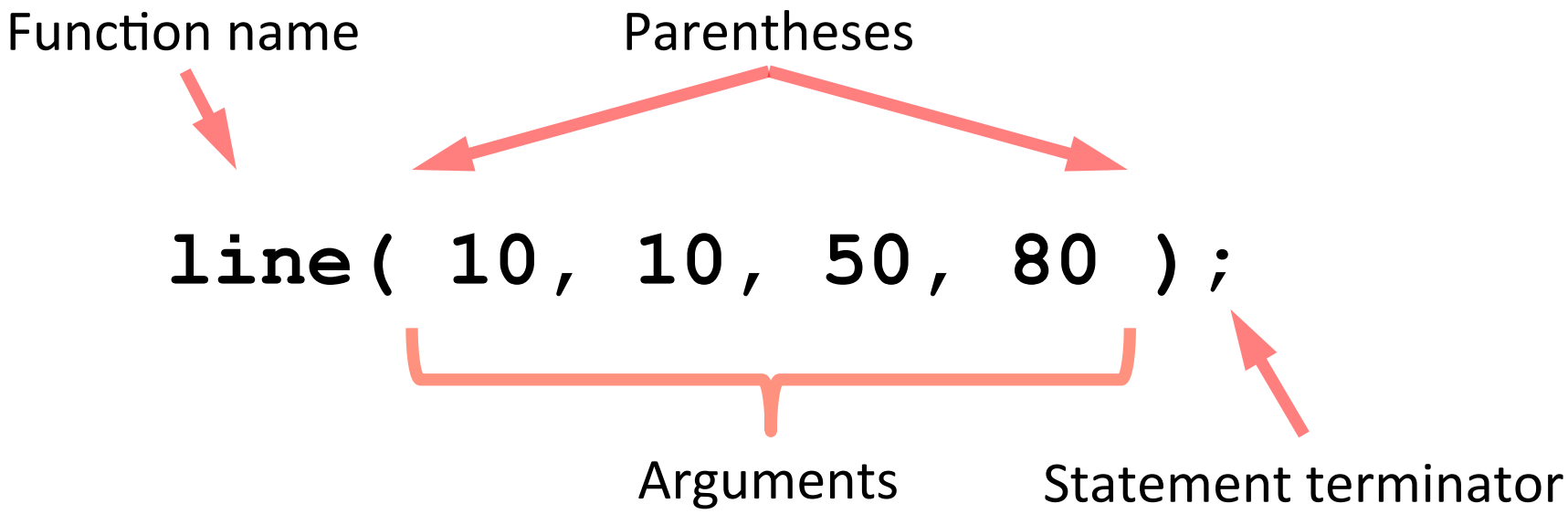
Primitive 2D Shapes

- point
- line
- triangle
- rect (rectangle)
- quad (quadrilateral, four-sided polygon)
- ellipse
- arc (section of an ellipse)
- curve (Catmull-Rom spline)
- bezier (Bezier curve)

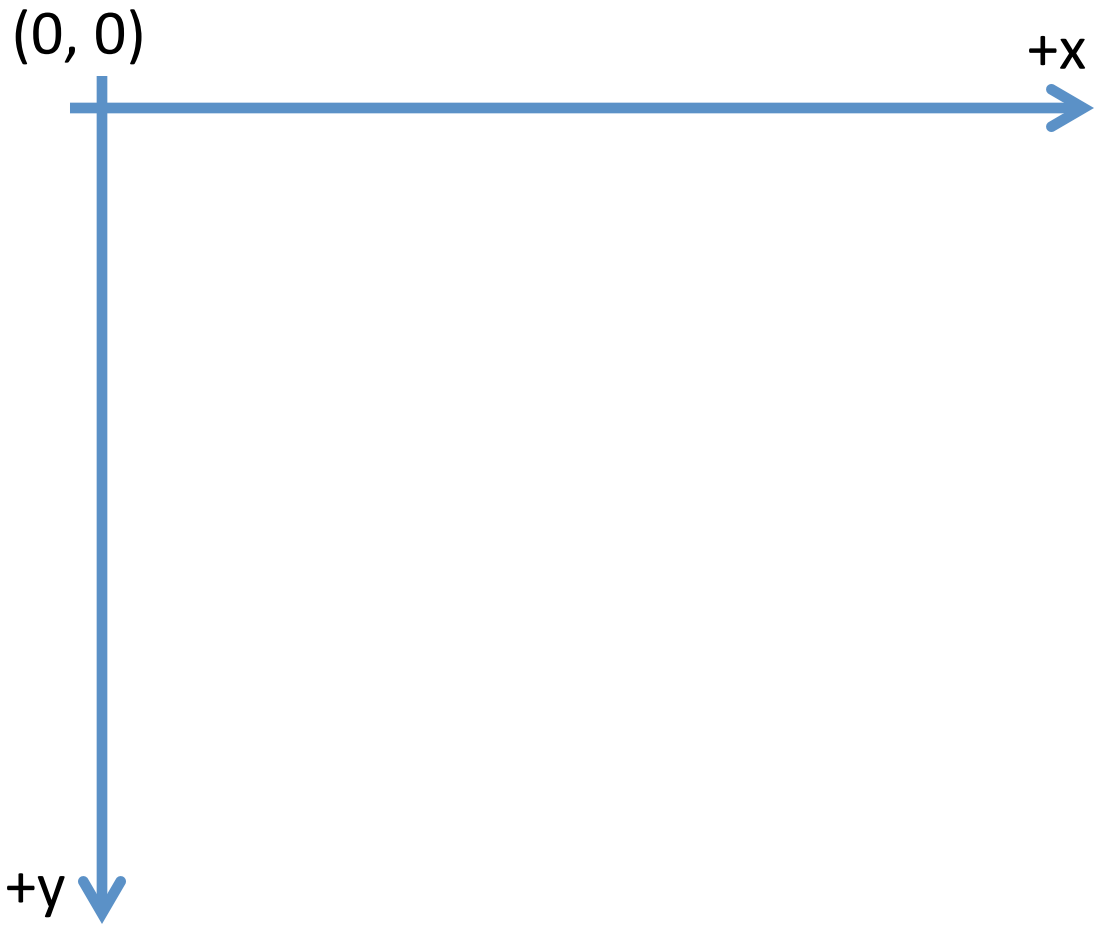


http://processing.org/reference/

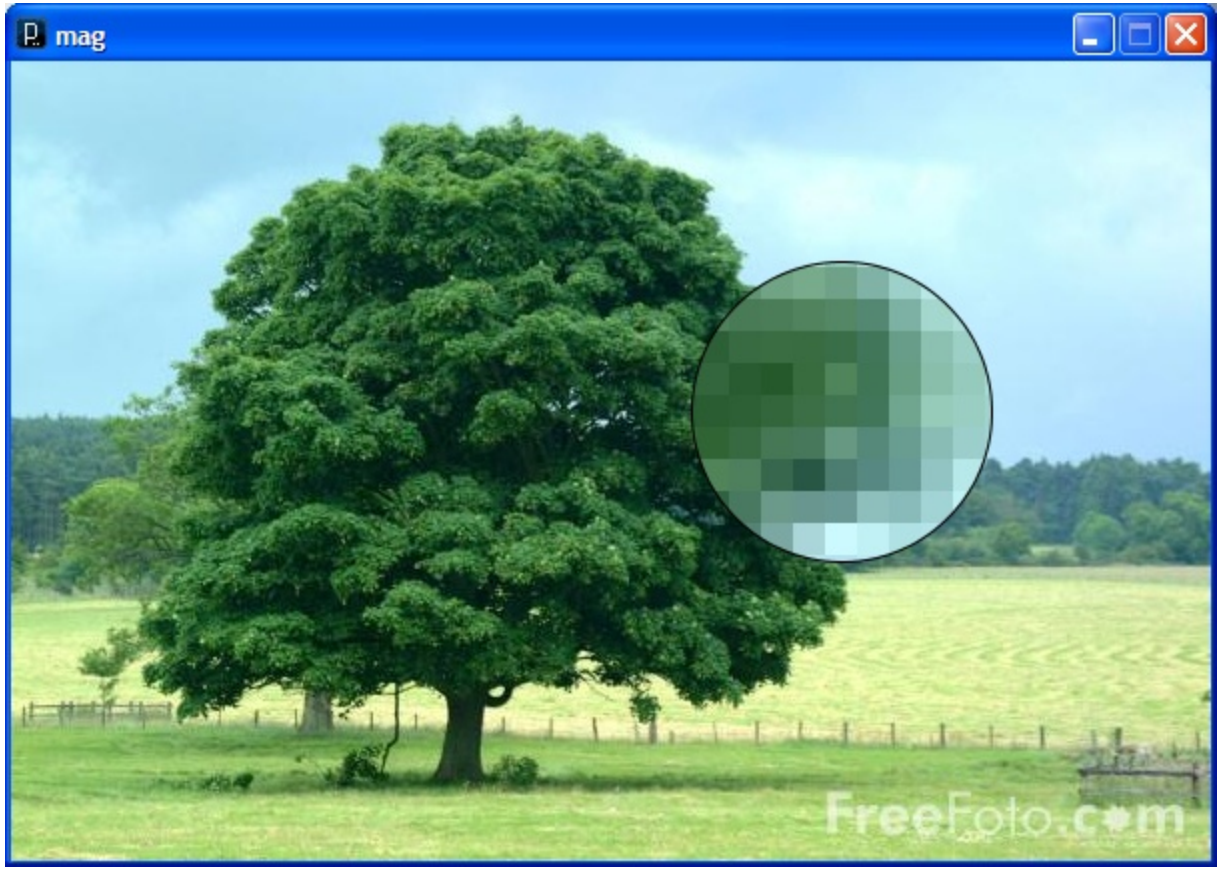
Anatomy of a Function Call



Coordinate System



Pixels



Processing Canvas

`size(` *`width, height`* **`);`**

Set the size of the canvas.

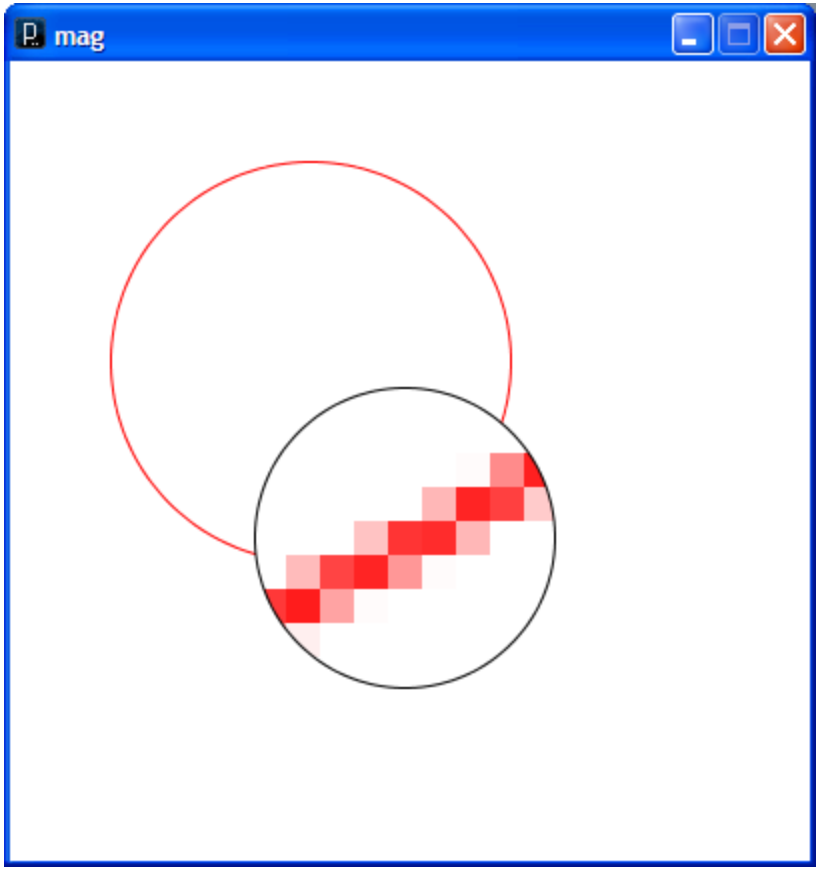
`background(` *`[0..255]`* **`);`**

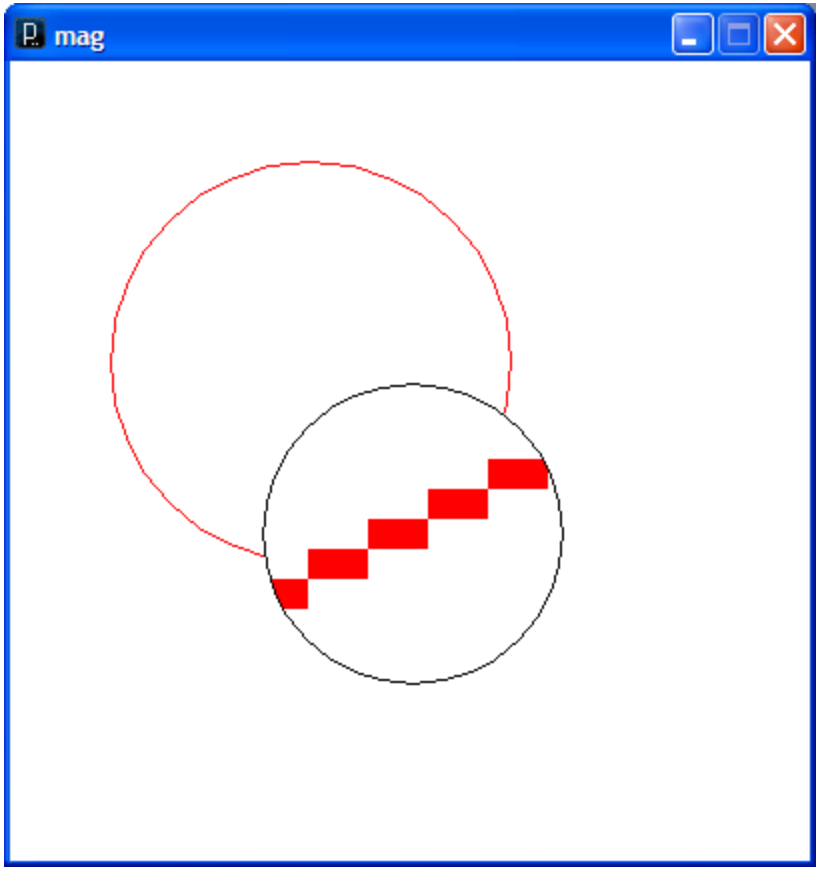
Set the background grayscale color.

Drawing Primitives

```
point( x, y );

line( x1, y1, x2, y2 );

triangle( x1, y1, x2, y2, x3, y3 );

quad( x1, y1, x2, y2, x3, y3, x4, y4 );

rect( x, y width, height );

ellipse( x, y, width, height );
```

smooth() vs. noSmooth()





Colors

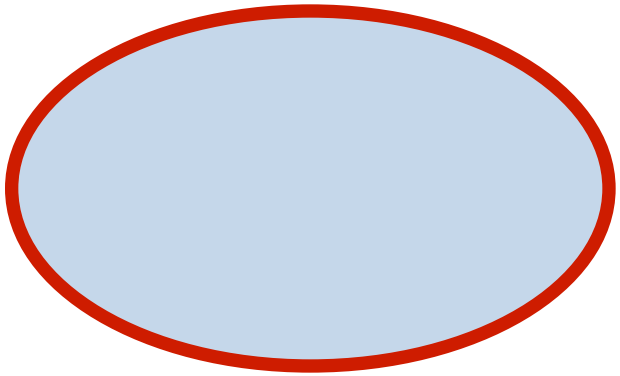
Composed of four elements:

1. Red
2. Green
3. Blue
4. Alpha (Transparency)

Why 0 .. 255?

Shape Formatting

1. Fill color
2. Line thickness
3. Line color



These are properties of your <u>paintbrush,</u> not of the object you are painting.

Fill Color

```
fill(gray);
fill(gray, alpha);
fill(red, green, blue);
fill(red, green, blue, alpha);

noFill();
```

Stroke (Line) Color

```
stroke(gray);
stroke(gray, alpha);
stroke(red, green, blue);
stroke(red, green, blue, alpha);

noStroke();
```

strokeCap()

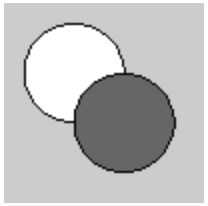
```
smooth();
strokeWeight(12.0);
strokeCap(ROUND);
line(20, 30, 80, 30);
strokeCap(SQUARE);
line(20, 50, 80, 50);
strokeCap(PROJECT);
line(20, 70, 80, 70);
```

strokeWeight()

```
smooth();
strokeWeight(1);   // Default
line(20, 20, 80, 20);
strokeWeight(4);   // Thicker
line(20, 40, 80, 40);
strokeWeight(10);  // Beastly
line(20, 70, 80, 70);
```

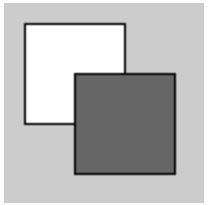
http://processing.org/reference/strokeCap_.html
http://processing.org/reference/strokeWeight_.html

ellipseMode



```
ellipseMode(CENTER);
ellipse(35, 35, 50, 50);
ellipseMode(CORNER);
fill(102);
ellipse(35, 35, 50, 50);
```

rectMode



```
rectMode(CENTER);
rect(35, 35, 50, 50);
rectMode(CORNER);
fill(102);
rect(35, 35, 50, 50);
```

http://processing.org/reference/ellipseMode_.html
http://processing.org/reference/rectMode_.html

`random(high);`

`random(low, high);`

Generate a random number in the range

low (or 0) to *high*

`mouseX`

`mouseY`

Built-in predefined variables that hold the current mouse X and Y locations

`print( something );`

`println( something );`

Print something to the Processing console.

```
void setup()
{
  // Called once when program starts
}

void draw()
{
  /* Called repeatedly
     while program runs */
}
```

randomEllipse

```
void setup()
{
  size(300, 300);
  smooth();
}

void draw()
{
  fill(random(255), random(255), random(255));
  ellipse(mouseX, mouseY, 30, 30);
}
```

Controlling draw()

`frameRate(`*`fps`*`);`

Sets number of frames displayed per second.

i.e. the number of times draw() is called per second. Default = 60.

`noLoop();`

Stops continuously calling draw().

`loop();`

Resumes calling draw().

```
void mousePressed() {
   // Called when the mouse is pressed
}

void mouseReleased() {
   // Called when the mouse is released
}

void mouseClicked() {
   // Called when the mouse is pressed and released
   // at the same mouse position
}

void mouseMoved() {
   // Called while the mouse is being moved
   // with the mouse button released
}

void mouseDragged() {
   // Called while the mouse is being moved
   // with the mouse button pressed
}
```

```
void keyPressed() {
   // Called each time a key is pressed
}

void keyReleased() {
   // Called each time a key is released
}

void keyTyped() {
   // Called when a key is pressed
   // Called repeatedly if the key is held down
}
```

keyCode vs. key

key

- A built-in variable that holds the character that was just typed at the keyboard

keyCode

- A built-in variable that hold the code for the keyboard key that was touched

All built-in keyboard interaction functions …

- Set *keyCode* to the integer that codes for the keyboard key
- Set *key* to the character typed
- All keyboard keys have a *keyCode* value
- Not all have a *key* value

ASCII - American Standard Code for Information Interchange

	0	1	2	3	4	5	6	7	8	9
30				!	"	#	$	%	&	'
40	(	)	*	+	,	-	.	/	0	1
50	2	3	4	5	6	7	8	9	:	;
60	<	=	>	?	@	A	B	C	D	E
70	F	G	H	I	J	K	L	M	N	O
80	P	Q	R	S	T	U	V	W	X	Y
90	Z	[	\	]	^	_	`	a	b	c
100	d	e	f	g	h	i	j	k	l	m
110	n	o	p	q	r	s	t	u	v	w
120	x	y	z	{	|	}	~		€	
130	‚	ƒ	„	…	†	‡	ˆ	‰	Š	‹
140	Œ		Ž			‘	’	“	”	•
150	–	—	˜	™	š	›	œ		ž	Ÿ
160		¡	¢	£	¤	¥	¦	§	¨	©
170	ª	«	¬	-	®	¯	°	±	²	³
180	´	µ	¶	·	¸	¹	º	»	¼	½
190	¾	¿	À	Á	Â	Ã	Ä	Å	Æ	Ç
200	È	É	Ê	Ë	Ì	Í	Î	Ï	Ð	Ñ
210	Ò	Ó	Ô	Õ	Ö	×	Ø	Ù	Ú	Û
220	Ü	Ý	Þ	ß	à	á	â	ã	ä	å
230	æ	ç	è	é	ê	ë	ì	í	î	ï
240	ð	ñ	ò	ó	ô	õ	ö	÷	ø	ù
250	ú	û	ü	ý	þ	ÿ				

More Graphics

arc(…)

curve (…)

bézier(…)

shape(…)

Arcs

```
arc( x, y, width, height, start, stop );
```

An arc is a section of an ellipse

`x, y, width, height`

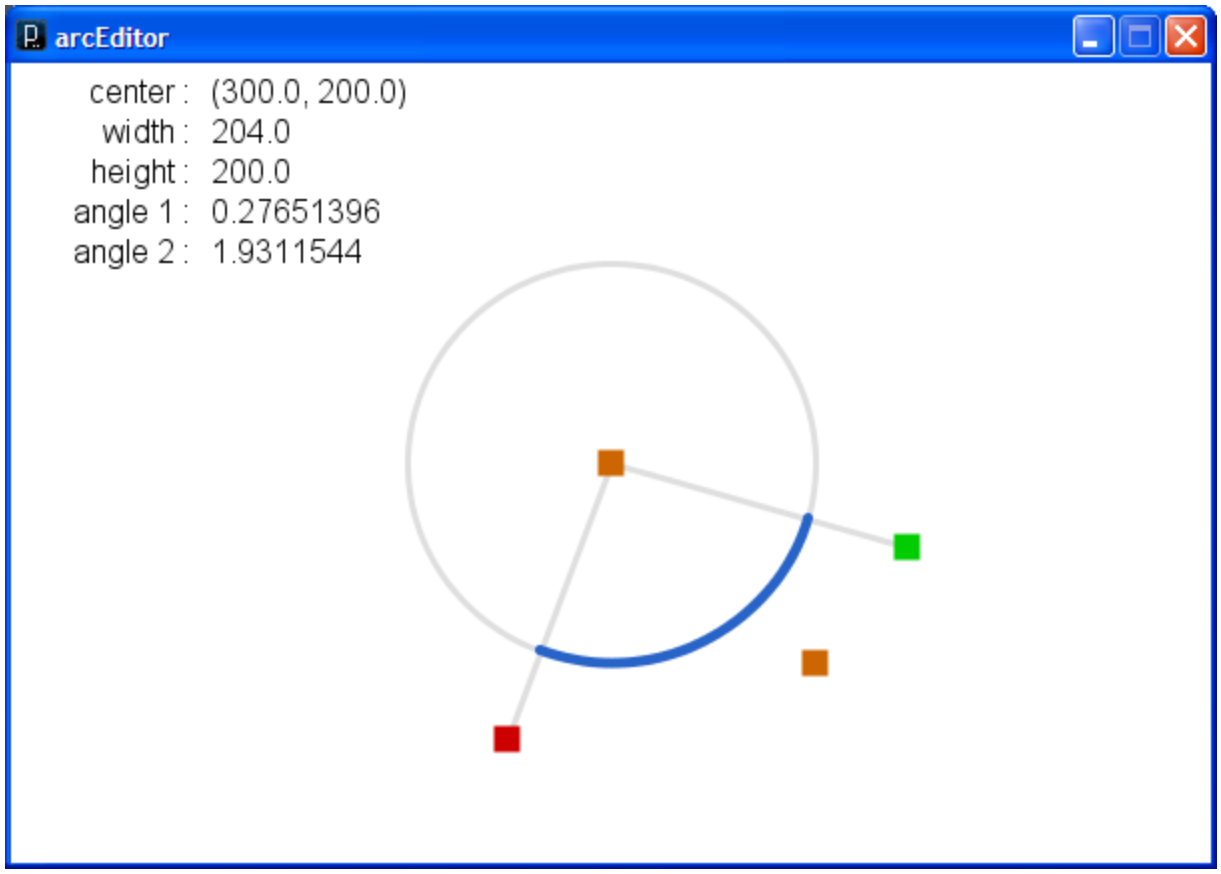
location and size of the ellipse

`start, stop`

arc bounding angles (in radians)

Arcs

```
arc( x, y, width, height, start, stop );
```



Spline Curves

```
curve( x1, y1, x2, y2, x3, y3, x4, y4 );
```

Spline: A smooth line drawn through a series of points

A curve is a Catmull-Rom (cubic Hermite) spline defined by four points

`x2, y2` *and* `x3, y3`

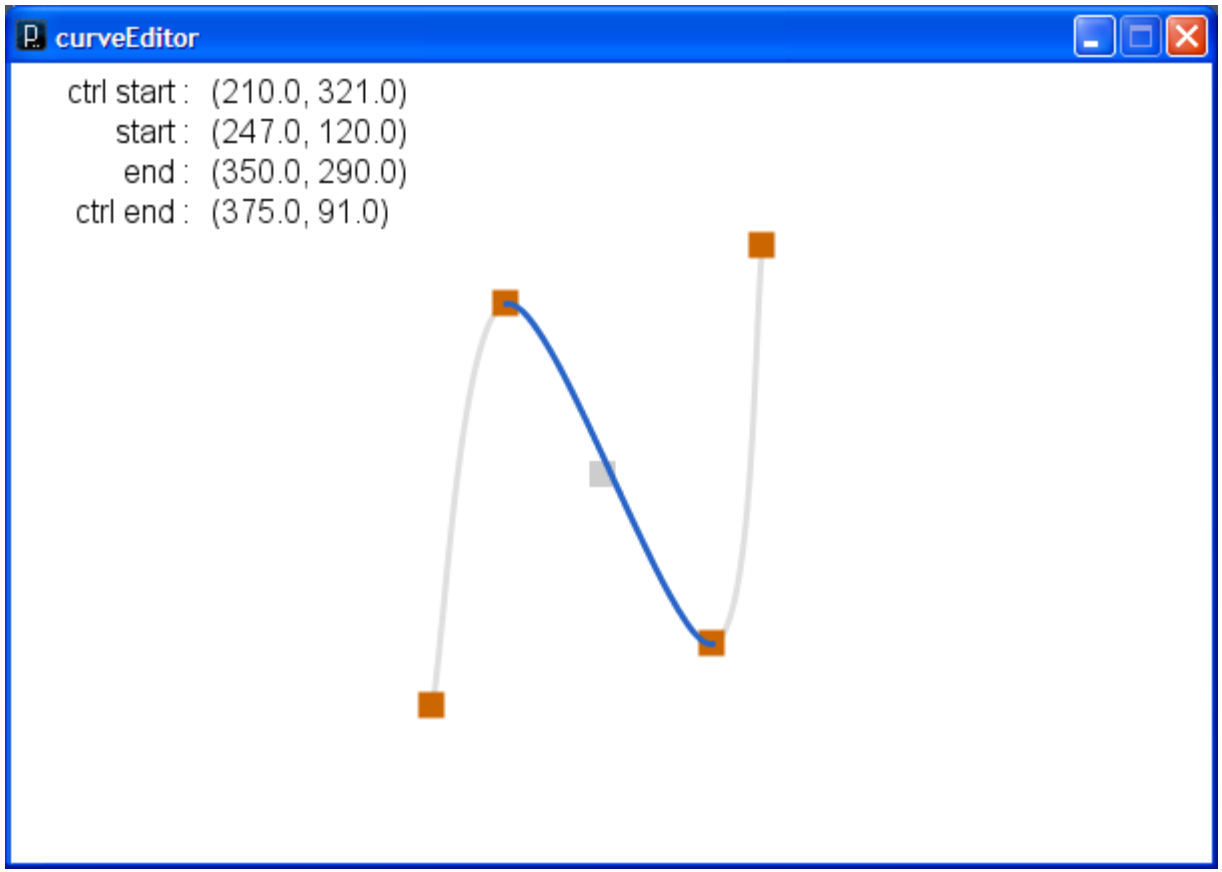
beginning/end points of visual part of curve

`x1, y1` *and* `x4, y4`

control points that define curve curvature

Spline Curves

```
curve( x1, y1, x2, y2, x3, y3, x4, y4 );
```



Bézier Curves

```
bezier( x1, y1, cx1, cy1, cx2, cy2, x2, y2 );
```

A smooth curve defined by two anchor points and two control points

`x2, y2` *and* `x2, y2`

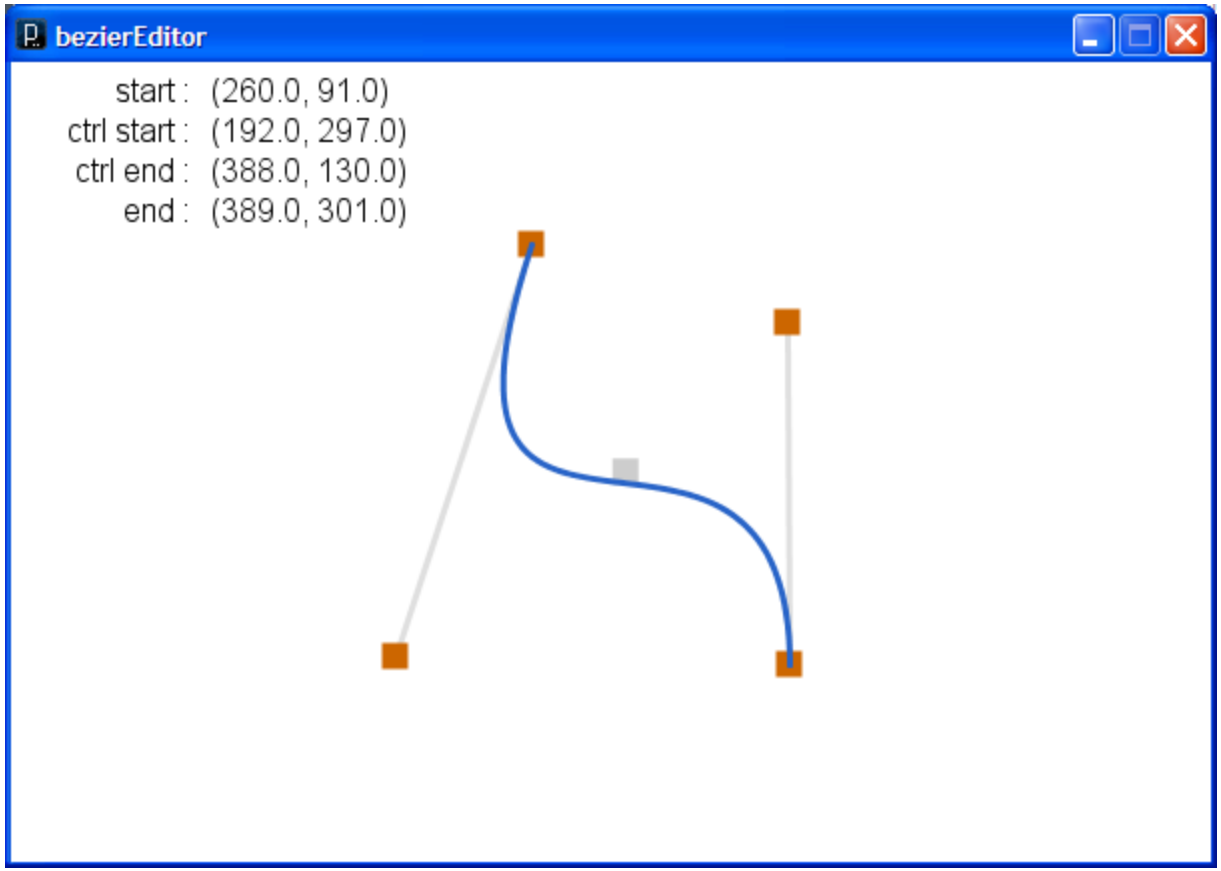
anchor points of bézier curve

`cx1, cy1` *and* `cx2, cy2`

control points that define curvature

Bézier Curves

```
bezier( x1, y1, cx1, cy1, cx2, cy2, x2, y2 );
```

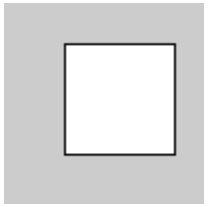


Custom Shapes

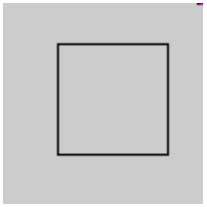
- Composed of a series of vertexes (points)
- Vertexes may or may not be connected with lines
- Lines may join at vertexes in a variety of manners
- Lines may be straight, curves, or bézier splines
- Shape may be closed or open

Custom Shapes

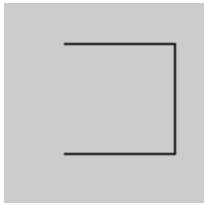
```
beginShape( [option] );

vertex( x, y );

curveVertex( x, y );

bezierVertex( cx1, cy1, cx2, cy2, x, y );

endShape( [CLOSE] );
```



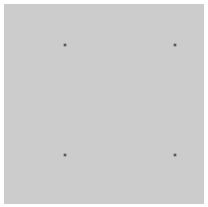
```
beginShape();
vertex(30, 20);
vertex(85, 20);
vertex(85, 75);
vertex(30, 75);
endShape(CLOSE);
```



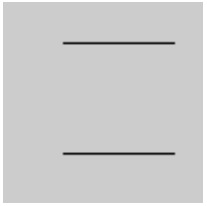
```
noFill();
beginShape();
vertex(30, 20);
vertex(85, 20);
vertex(85, 75);
vertex(30, 75);
endShape(CLOSE);
```



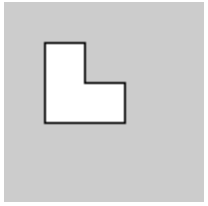
```
noFill();
beginShape();
vertex(30, 20);
vertex(85, 20);
vertex(85, 75);
vertex(30, 75);
endShape();
```



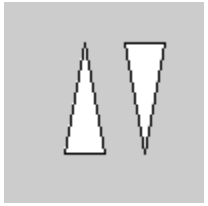
```
beginShape(POINTS);
vertex(30, 20);
vertex(85, 20);
vertex(85, 75);
vertex(30, 75);
endShape();
```



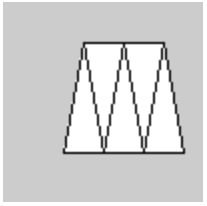
```
beginShape(LINES);
vertex(30, 20);
vertex(85, 20);
vertex(85, 75);
vertex(30, 75);
endShape();
```



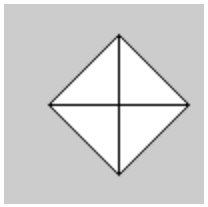
```
beginShape();
vertex(20, 20);
vertex(40, 20);
vertex(40, 40);
vertex(60, 40);
vertex(60, 60);
vertex(20, 60);
endShape(CLOSE);
```



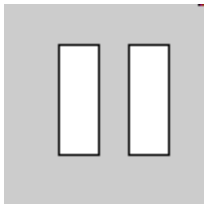
```
beginShape(TRIANGLES);
vertex(30, 75);
vertex(40, 20);
vertex(50, 75);
vertex(60, 20);
vertex(70, 75);
vertex(80, 20);
endShape();
```



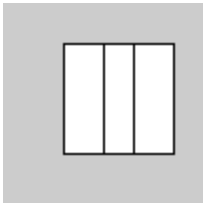
```
beginShape(TRIANGLE_STRIP);
vertex(30, 75);
vertex(40, 20);
vertex(50, 75);
vertex(60, 20);
vertex(70, 75);
vertex(80, 20);
vertex(90, 75);
endShape();
```



```
beginShape(TRIANGLE_FAN);
vertex(57.5, 50);
vertex(57.5, 15);
vertex(92, 50);
vertex(57.5, 85);
vertex(22, 50);
vertex(57.5, 15);
endShape();
```

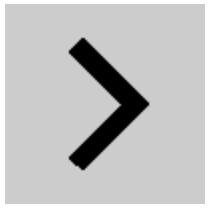


```
beginShape(QUADS);
vertex(30, 20);
vertex(30, 75);
vertex(50, 75);
vertex(50, 20);
vertex(65, 20);
vertex(65, 75);
vertex(85, 75);
vertex(85, 20);
endShape();
```

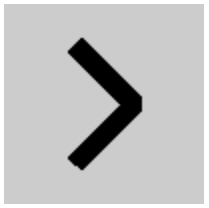


```
beginShape(QUAD_STRIP);
vertex(30, 20);
vertex(30, 75);
vertex(50, 20);
vertex(50, 75);
vertex(65, 20);
vertex(65, 75);
vertex(85, 20);
vertex(85, 75);
endShape();
```

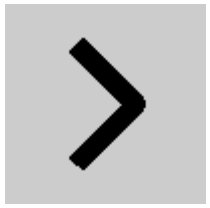
strokeJoin()



```
noFill();
smooth();
strokeWeight(10.0);
strokeJoin(MITER);
beginShape();
vertex(35, 20);
vertex(65, 50);
vertex(35, 80);
endShape();
```



```
noFill();
smooth();
strokeWeight(10.0);
strokeJoin(BEVEL);
beginShape();
vertex(35, 20);
vertex(65, 50);
vertex(35, 80);
endShape();
```



```
noFill();
smooth();
strokeWeight(10.0);
strokeJoin(ROUND);
beginShape();
vertex(35, 20);
vertex(65, 50);
vertex(35, 80);
endShape();
```

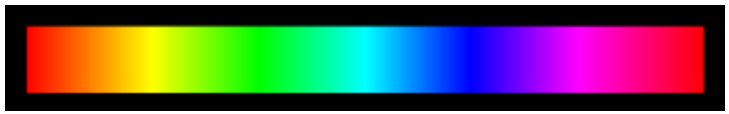
More Color

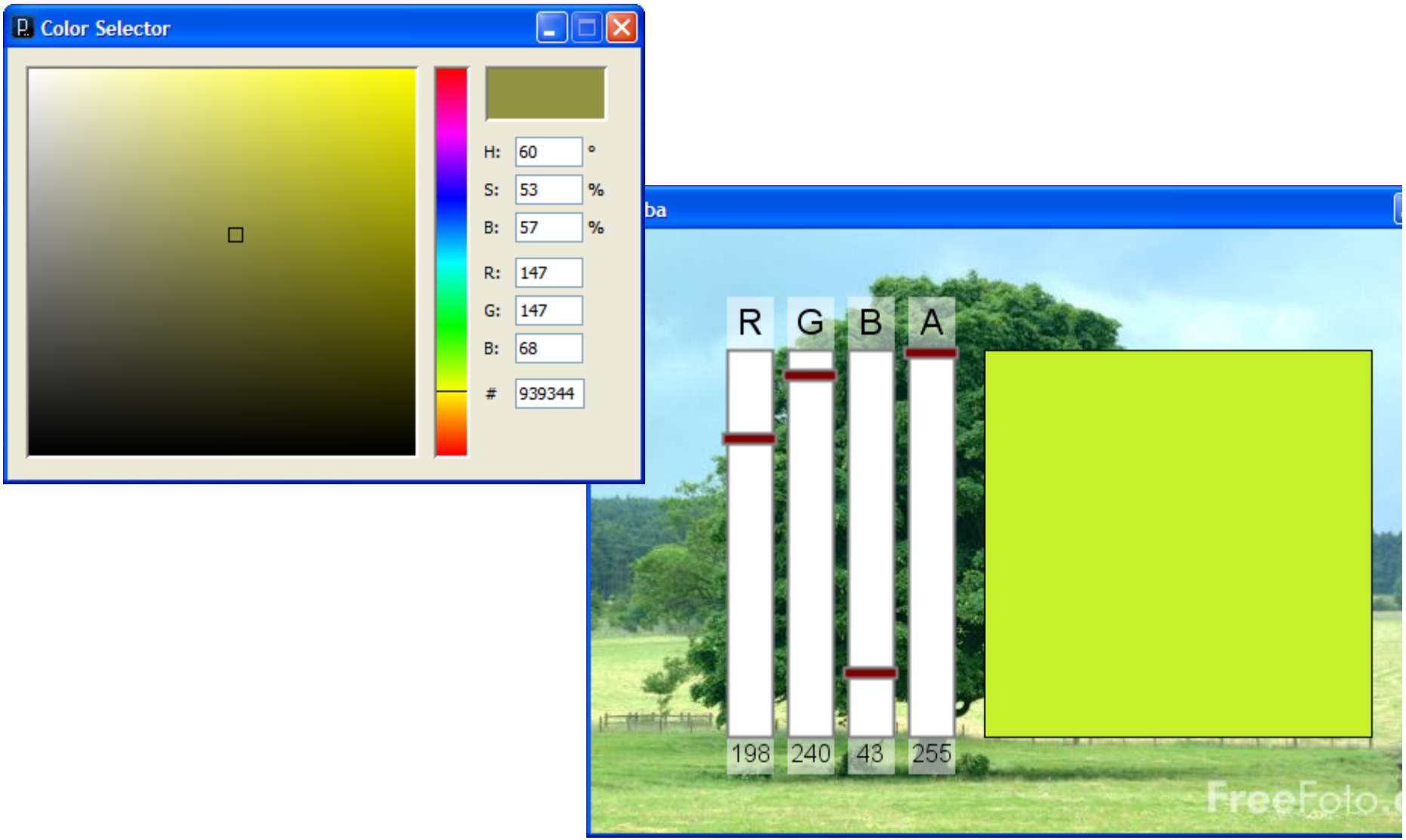
`colorMode(`*`RGB or HSB`*`);`

RGB: (red, green, blue)

HSB:

- hue
  - “pure color”
- saturation
  - “intensity”
- brightness
  - “lightness”




Color Selector
H: 60 °
S: 53 %
B: 57 %
R: 147
G: 147
B: 68
939344
ba
R
G
B
A
198
240
43
255

Decimal vs. Binary vs. Hexadecimal

Decimal	Hex	Binary
0	00	00000000
1	01	00000001
2	02	00000010
3	03	00000011
4	04	00000100
5	05	00000101
6	06	00000110
7	07	00000111
8	08	00001000
9	09	00001001
10	0A	00001010
11	0B	00001011
12	0C	00001100
13	0D	00001101
14	0E	00001110
15	0F	00001111
16	10	00010000
17	11	00010001
18	12	00010010

Images

`loadImage(`*`filename`*`);`

- Loads an image from a file in the *data* folder in sketch folder.
- Must be assigned to a variable of type PImage.

`image(`*`img, X, Y, [X2, Y2]`*`);`

- Draws the image *img* on the canvas at X, Y
- Optionally fits image into box X,Y and X2,Y2

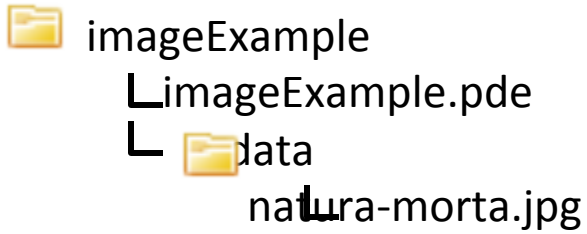
`imageMode(CORNER);`

- X2 and Y2 define width and height.

`imageMode(CORNERS);`

- X2 and Y2 define opposite corner.

Image Example




```
PImage img;

void setup()
{
  size(500, 400);
  img = loadImage("natura-morta.jpg");
  image(img, 50, 40);
}
```

Example Sketches...

- LadyBug1
- Monster1
- Ndebele
- Penguin1
- SouthParkCharacter1
- Sushi
- GiorgioMorandi

OpenProcessing

http://www.openprocessing.org/

- Bryn Mawr and SMU student sketches

Dropbox

- https://www.dropbox.com/

Processing.JS

- A Javascript implementation of Processing
- Runs in any modern web browser
  - Does not run well in IE8 and under
- Most of Processing is implemented
  - Images are processed slowly
  - No file IO
- http://processing**js**.org

Studio Sketchpad

- Collaboratively edit, run and chat about a Processing.js program

- http://sketchpad.cc/