Art by Numbers

Creative Coding & Generative Art in Processing 2
Ira Greenberg, Dianna Xu, Deepak Kumar

Our Goal

- Use computing to realize works of art
- Explore new metaphors from computing: images, animation, interactivity, visualizations
- Learn the basics of computing
- Have fun doing all of the above!

Let's get started…

Administrivia

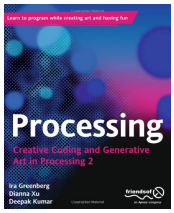
Software

Processing 2.X

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

Book

Creative Coding & Generative Art in Processing 2 by Ira Greenberg, Dianna Xu, Deepak Kumar, friendsofEd/APress, 2013. Available at the Campus Bookstore or amazon.com or other vendors.



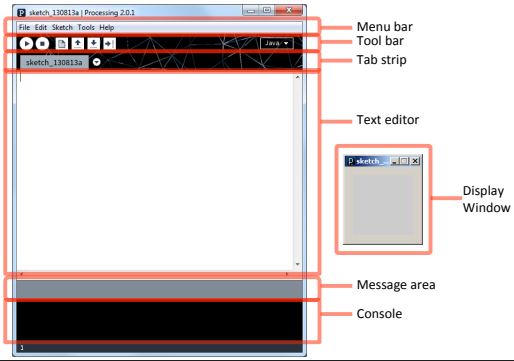
Homework

- Go the CS Computer Lab (Room 231 PSB)
- Log in
- Start the Processing application (Make sure it is Version 2.x)
- In a web browser, go to the Tutorials section of processing.org

  http://www.processing.org/tutorials/gettingstarted/

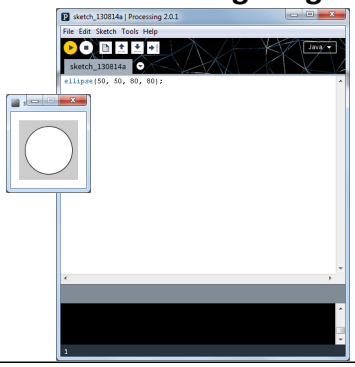
- Read the Getting Started tutorial (by Casey Reas & Ben Fry) and try out the two examples of simple Processing programs presented there
- If you'd like, install Processing 2.x on your own computer
- Read Chapter 1 (Read pages 1-12, skim 12-32)

Processing 2.0 IDE



First Processing Program

First Processing Program



Drawing Basics

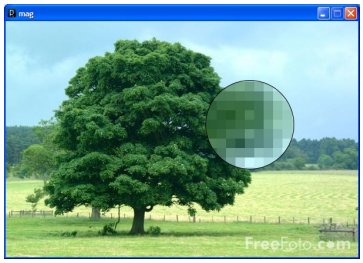
- Canvas
- Drawing Tools
- Colors

Drawing Basics

- Canvas – computer screen
- Drawing Tools – shape commands
- Colors – grayscale or RGB

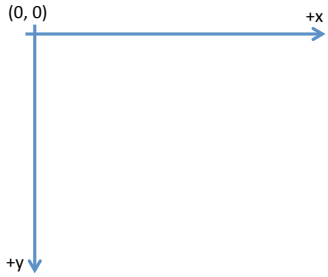
Canvas – Computer Screen

- Pixels



Canvas - Computer Screen

- Coordinate System



Canvas - Computer Screen

Processing Commands

- **Canvas:** Create a 400x400 pixel drawing area

```
size(400, 400);
```

Canvas - Computer Screen

Processing Commands

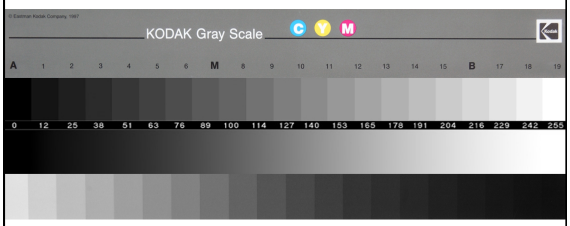
- **Canvas:** Create a 400x400 pixel drawing area

```
size(400, 400);
```

- **Canvas Color:** Canvas is gray in color

```
background(125);
```

256 Shades of Gray!



- 0 = black
- 255 = white

Drawing Basics

- **Canvas** – **computer screen**
  `size(width, height);`
- **Drawing Tools** – **shape commands**
- **Colors** – **grayscale or RGB**
  `background(125);`

Drawing Tools - Basic Shapes

- Point
- Line
- Triangle
- Rectangle
- Ellipse
- Arc
- Quad
- Polygon
- Curve

Drawing Tools - Basic Shapes

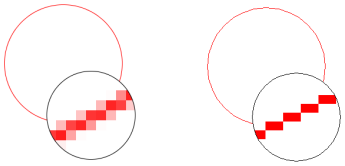
- Point — point(x, y);
- Line — line(x1, y1, x2, y2);
- Triangle — triangle(x1, y1, x2, y2, x3, y3);
- Rectangle — rect(x, y, width, height);
- Ellipse — ellipse(x, y, width, height);

Drawing & Shape Attributes

- **Anti-aliasing**
  - smooth();
  - noSmooth();
- **Stroke**
  - noStroke();
  - strokeWeight(<pixel width>);
  - stroke(<stroke color>);
- **Fill**
  - noFill();
  - fill(<fill color>);

Antialiasing

- smooth();
  vs noSmooth();



Stroke Attributes

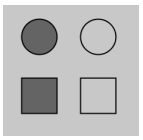
- stroke();
  vs noStroke();

- strokeWeight(1);
  vs strokeWeight(5);

- stroke(125);
  vs stroke(0);

Fill Attributes

- fill(100);
  vs noFill();



Drawing & Shape Attributes

- **Anti-aliasing**
  - smooth();
  - noSmooth();
- **Stroke**
  - noStroke();
  - strokeWeight(<pixel width>);
  - stroke(<stroke color>);
- **Fill**
  - noFill();
  - fill(<fill color>);

Drawing Tools - Basic Shapes

- Point point(x, y);
- Line  line(x1, y1, x2, y2);
- Triangle  triangle(x1, y1, x2, y2, x3, y3);
- Rectangle  rect(x, y, width, height);
- Ellipse  ellipse(x, y, width, height);

Modes

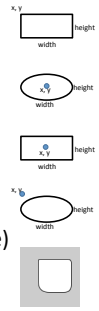
- rect(x, y, width, height);

  ellipse(x, y, width, height);

- rectMode(CENTER);

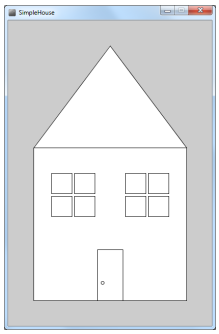
  ellipseMode(CORNER);

- Also CORNERS (see Reference)
- Also rounded rectangles (see Reference)



Structure of a basic program

```
// Sketch: Simple House
// Sketch: Simple House
// Purpose: Generates Figure 2-5 in text
// Using Processing's 2D primitives.

size(400, 600);
smooth();
// house
rect(50, 250, 300, 300);

// roof
triangle(50, 250, 350, 250, 200, 50);

// door
rect(175, 450, 50, 100);
// door knob
ellipse(185, 515, 6, 6);

// left windows
rect(85, 300, 40, 40);
rect(130, 300, 40, 40);
rect(85, 345, 40, 40);
rect(130, 345, 40, 40);

// right windows
rect(230, 300, 40, 40);
rect(275, 300, 40, 40);
rect(230, 345, 40, 40);
rect(275, 345, 40, 40);
```



Programming Principle#1

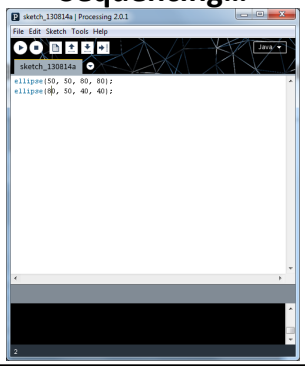
- **Sequencing**

  do this
  and this
  and this
  and this
  …

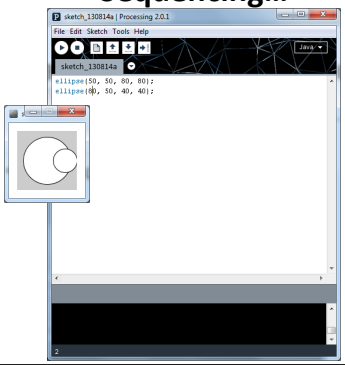
```
// left windows
rect(85, 300, 40, 40);
rect(130, 300, 40, 40);
rect(85, 345, 40, 40);
rect(130, 345, 40, 40);

// right windows
rect(230, 300, 40, 40);
rect(275, 300, 40, 40);
rect(230, 345, 40, 40);
rect(275, 345, 40, 40);
```

All commands are carried out in the order they are written.

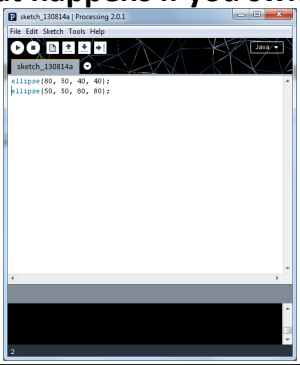
Sequencing…



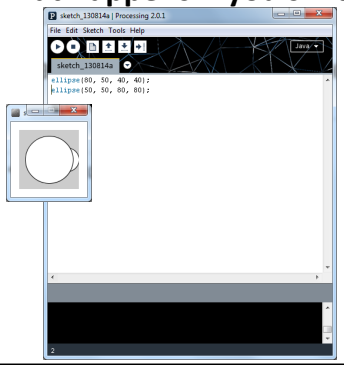
Sequencing…



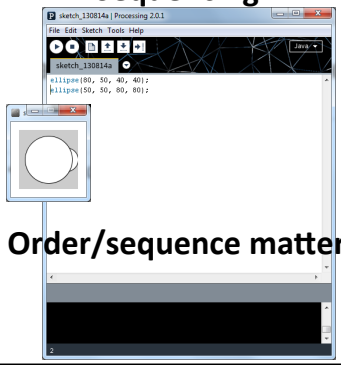
What happens if you switch?



What happens if you switch?



Sequencing…



Order/sequence matters!

Programming Principle#2

- **Syntax is important!**

Function name Parentheses

```
line( 10, 10, 50, 80 );
```

Arguments Statement terminator

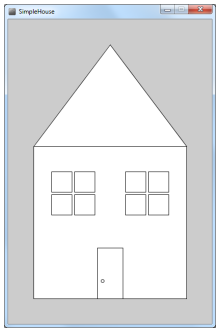
CS Principle: Algorithms

An **algorithm** is an effective method for solving a problem expressed as a finite sequence of instructions. For example,

Put on shoes
- left sock
- right sock
- left shoe
- right shoe

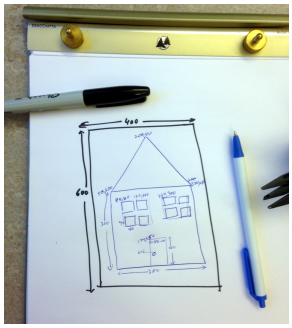
CS Principle: Algorithms

Draw a simple house
- draw the front wall
- draw the roof
- draw the door
- draw the windows

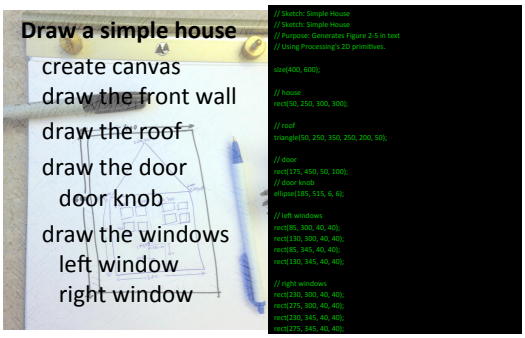


Algorithms to Pseudocode

Draw a simple house
- create canvas
- draw the front wall
- draw the roof
- draw the door
  - door knob
- draw the windows
  - left window
  - right window



Pseudocode to Code



CS Principle

To solve any problem on a computer
- First **analyze** the problem
- Then design an **algorithm**
- Write **pseudocode**
- **Code** it
- **Test** and **debug**

CS Principle

To solve any problem on a computer
- First **analyze** the problem
- Then design an **algorithm**
- Write **pseudocode**
- **Code** it
- **Test** and **debug**

Much work happens on paper!

Drawing Basics

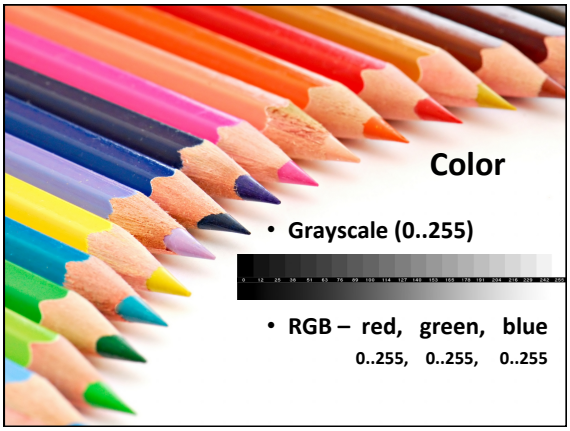
- **Canvas** – **computer screen**
  `size(width, height);`
- **Drawing Tools** – **shape commands**
- **Colors** – **grayscale or RGB**
  `background(125);`

Drawing Tools - Basic Shapes

- Point
- Line
- Triangle
- Rectangle
- Ellipse
- Arc
- Quad
- Polygon
- Curve

Drawing Tools - Basic Shapes

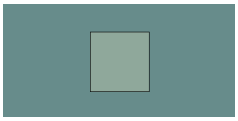
- Point — point(x, y);
- Line — line(x1, y1, x2, y2);
- Triangle — triangle(x1, y1, x2, y2, x3, y3);
- Rectangle — rect(x, y, width, height);
- Ellipse — ellipse(x, y, width, height);



Color

- Example:

```
size(400, 200);
smooth();
background(103, 140, 139);
fill(143, 168, 155);
rect(150, 50, 100, 100);
```



- Any command that takes a grayscale value, can also take RGB color values:

```
background(<grayscale value>);
background(R, G, B);
stroke (<grayscale value>);
stroke(R, G, B);
fill(<grayscale value>);
fill(R, G, B);
```

Color Transparency

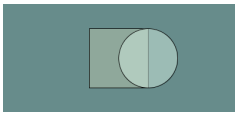
- Alpha values (0..255) specify transparency/opacity

  ALPHA = 0 means completely transparent
  ALPHA = 255 means completely opaque

```
background(<grayscale value>, ALPHA);
background(R, G, B, ALPHA);
stroke (<grayscale value>, ALPHA);
stroke(R, G, B, ALPHA);
fill(<grayscale value>, ALPHA);
fill(R, G, B, ALPHA);
```

- Example:

```
background(103, 140, 139);
fill(143, 168, 155);
rect(150, 50, 100, 100);
// Fill with alpha value
fill(208, 237, 222, 127);
ellipse(250, 100, 100, 100);
```



Why 0 .. 255?