2D Shapes

Creative Coding & Generative Art in Processing 2

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Review: Drawing Basics

- **Canvas**
  `size(width, height)`
- **Drawing Tools**
  `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)`
  `arc(x, y, width, height, startAngle, endAngle)`
  `curve(cpx1, cpy1, x1, y1, x2, y2, cpx2, cpy2)`
  `beginShape()`
  `endShape(CLOSE)`
  `vertex(x, y)`
  `curveVertex(x, y)`
- **Colors**
  grayscale [0..255], **RGB** [0..255],[0..255],[0..255], **alpha** [0..255]
  `background(color)`
- **Drawing & Shape Attributes**
  `smooth(), noSmooth()`
  `stroke(color), noStroke(), strokeWeight(pixelWidth)`
  `fill(color), noFill()`

Simple Program Structure

```
// Create and set canvas
size(width, height);
smooth();
background(color);

// Draw something
…
// Draw something else
…
// etc.
```

Simple Program Structure

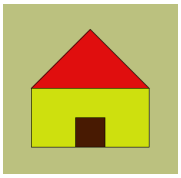
```
// Draw a simple house
// Create and set canvas

size(300, 300);
smooth();
background(187, 193, 127);

// wall
fill(206, 224, 14);
rect(50, 150, 200, 100);

// Draw Door
fill(72, 26, 2);
rect(125, 200, 50, 50);

// Draw roof
fill(224, 14, 14);
triangle(50, 150, 150, 50, 250, 150);
```



Variables: Naming Values

- **Values**
  42, 3.14159, 2013, "Hi, my name is Joe!", true, false, etc.
  - **Numbers**
    - **Integers**
      ```
      int meaningOfLife = 42;
      int year = 2013;
      ```
    - **Floating point numbers**
      ```
      float pi = 3.14159;
      ```
  - **Strings**
    ```
    String greeting = "Hi, my name is Joe!";
    ```
  - **Boolean**
    ```
    boolean keyPressed = true;
    ```

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Variables have a Type

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    - **Floating point numbers**
      ```
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    ```
    String greeting = "Hi, my name is Joe!";
    ```
  - **Boolean**
    ```
    boolean keyPressed = true;
    ```

Variables: Naming Rules & Conventions

- Names begin with a letter, an underscore (_), or a dollar sign ($)

  Examples: `weight`, `_meaningOfLife`, `$value`
- Names may include numbers, but only after the initial character

  Examples: `value1`, `score5`, ~~`5bestFriends`~~
- No spaces are permitted in names

  Examples: ~~`value 1`~~, ~~`dollar sign`~~
- Processing Conventions
  - Names begin with a lowercase letter

    Example: `meaningOfLife`, `highestScore`
  - Constants are written in all caps

    Example: `DAYS_IN_WEEK`, `PI`

Variables: Declarations & Initialization

- Declaring variables

```
int meaningOfLife;
int year;
float pi;
String greeting;
boolean keyPressed;
```

- Initializing values in declarations

```
int meaningOfLife = 42;
int year = 2013;
float pi = 3.14159;
String greeting = "Hi, my name is Joe!";
boolean keyPressed = true;
```

The color type

- Processing has a type called color

```
color firebrick = color(178, 34, 34);
color chartreuse = color(127, 255, 0);
color fuchsia = color(255, 0, 255);
```

```
fill(firebrick);
rect(50, 100, 75, 125);
```

Expressions: Doing Arithmetic

- **Assignment statement**

  <variable> = <expression>;

  Examples:

```
meaningOfLife = 42;
area = length * height;
perc =statePop/totalPop*100.0;
```

- **Operators**

+	(addition)
-	(subtraction)
*	(multiplication)
/	(division)
%	(modulus)

Example:

```
mouth_x = ( (leftIris_x + irisDiam)/2 + eyeWidth )/4;
```

Using Variables

```
// Draw a simple house
// Create and set canvas

size(300, 300);
smooth();
background(187, 193, 127);

// wall
fill(206, 224, 14);
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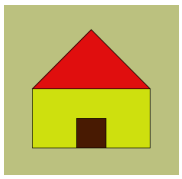
```



A Better House Sketch

```
// Draw a simple house
int houseX = 50;                // bottom left corner of house
int houseY = 250;

int houseHeight = 200;          // overall width and height of house
int houseWidth = 200;

int wallHeight = houseHeight/2; // height of wall is 1/2 of house height
int roofHeight = houseHeight/2;
int doorHeight = houseHeight/4;
int doorWidth = houseWidth/4;

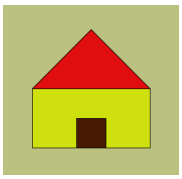
// Create and set canvas

size(300, 300);
smooth();
background(187, 193, 127);

// wall
fill(206, 224, 14);
rect(houseX, houseY - wallHeight,
     houseWidth, wallHeight);

// Draw Door
fill(72, 26, 2);
rect(houseX + houseWidth/2 - doorWidth/2, houseY-doorHeight,
     doorWidth, doorHeight);

// Draw roof
fill(224, 14, 14);
triangle(houseX, houseY - wallHeight,
         houseX+houseWidth/2, houseY-houseHeight,
         houseX+houseWidth, houseY-wallHeight);
```



A Better House Sketch

```
// Draw a simple house
int houseX = 50;                // bottom left corner of house
int houseY = 250;

int houseHeight = 100;          // overall width and height of house
int houseWidth = 100;

int wallHeight = houseHeight/2; // height of wall is 1/2 of house height
int roofHeight = houseHeight/2;
int doorHeight = houseHeight/4;
int doorWidth = houseWidth/4;

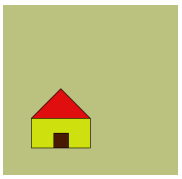
// Create and set canvas

size(300, 300);
smooth();
background(187, 193, 127);

// wall
fill(206, 224, 14);
rect(houseX, houseY - wallHeight,
     houseWidth, wallHeight);

// Draw Door
fill(72, 26, 2);
rect(houseX + houseWidth/2 - doorWidth/2, houseY-doorHeight,
     doorWidth, doorHeight);

// Draw roof
fill(224, 14, 14);
triangle(houseX, houseY - wallHeight,
         houseX+houseWidth/2, houseY-houseHeight,
         houseX+houseWidth, houseY-wallHeight);
```



Arithmetic with int and float values

```
int x = 42;          vs     int x = 42.0;

float x = 42.0       vs     float x = 42;

float x = 7/2;       vs     float x = 7.0/2.0;
```

Arithmetic with int and float values

```
int x = 42;          vs     int x = 42.0;       // error

float x = 42.0       vs     float x = 42;       // same 42.0

float x = 7/2;       vs     float x = 7.0/2.0; // 3.0 vs 3.5
```

- Type of variable is important and determines the value that can be assigned to it.
- Result of division depends upon operands

`int/int`	yields an integer result
`float/int`	yields a float result
`int/float`	yields a float result
`float/float`	yields a float result

Processing: Predefined Variables

- **`width`**, **`height`**
  The width & height of the canvas used in the sketch
- **`PI`**, **`HALF_PI`**, **`TWO_PI`**
  For different values of π. Note that

```
HALF_PI = PI/2
TWO_PI = 2*PI
```

- **`displayWidth`**, **`displayHeight`**
  The width and height of the monitor being used. This is useful in running fullscreen sketches using:

```
size(displayWidth, displayHeight);
```

- **`mouseX`**, **`mouseY`**
  The current mouse location in sketch (…coming soon!)

Extra: Drawing Text

`text(string, x, y);`
Draws string with bottom left corner at x, y

`textSize(fontSize);`
Can be used to specify font size

`fill()` can be used to specify color

See Reference for using fonts and other options.


```
size(300, 300);
background(185, 216, 153);

textSize(32);
text("Processing", 25, 100);
textSize(40);
fill(40, 62, 17);
text("Processing", 25, 150);
textSize(50);
fill(160, 20, 5);
text("Processing", 25, 200);
```

Program Structure: Dynamic Mode

Most Processing programs we will write will have the following structure:

```
<Declare variables>

void setup() {

   <initial canvas set up goes here>

} // setup()

void draw() {

   <drawing stuff goes here>

} // draw()
```


Program Structure: Dynamic Mode

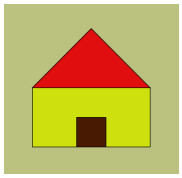
Most Processing programs we will write will have the following structure:

```
// Draw a simple house
void setup() {
  // Create and set canvas
  size(300, 300);
  smooth();
  background(187, 193, 127);
} // setup()

void draw() {
  // Wall
  fill(206, 224, 14);
  rect(50, 150, 200, 100);

  // Draw Door
  fill(72, 26, 2);
  rect(125, 200, 50, 50);

  // Draw roof
  fill(224, 14, 14);
  triangle(50, 150, 150, 50, 250, 150);
} // draw()
```



Processing: Dynamic Sketches

```
// Draw a simple house
void setup() {
  // Create and set canvas
  size(300, 300);
  smooth();
  background(187, 193, 127);
} // setup()

void draw() {
  // Wall
  fill(206, 224, 14);
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  // Draw roof
  fill(224, 14, 14);
  triangle(50, 150, 150, 50, 250, 150);
} // draw()
```

Code Block:
{
…
…
}

Processing: Dynamic Sketches

```
// Draw a simple house
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  // Draw roof
  fill(224, 14, 14);
  triangle(50, 150, 150, 50, 250, 150);
} // draw()
```

setup() block:

Commands here are executed once each time a sketch is played.

draw() block:

Commands here are repeated ~60 times/sec.

Processing: Dynamic Sketches

```
// Draw a simple house
void setup() {
  // Create and set canvas
  size(300, 300);
  smooth();
  background(187, 193, 127);
} // setup()

void draw() {
  // Wall
  fill(206, 224, 14);
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  // Draw Door
  fill(72, 26, 2);
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  // Draw roof
  fill(224, 14, 14);
  triangle(50, 150, 150, 50, 250, 150);
} // draw()
```

But…

What are these???

For now…
Necessary syntax

More later…

Something More Interesting…

```
color color1 = color(227, 220, 0);
color color2 = color(37, 220, 0);
color color3 = color(0);

void setup() {
  // create and set canvas
  size(300, 300);
  smooth();
  background(color1);
} // setup()


void draw() {
  stroke(color3);
  fill(color2);
  ellipse(mouseX, mouseY, 40, 40);
} // draw()
```