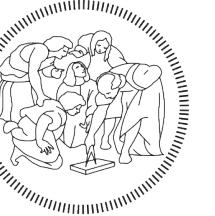


POLITECNICO
MILANO 1863

Digital Art

2020

Introduction to **processing**

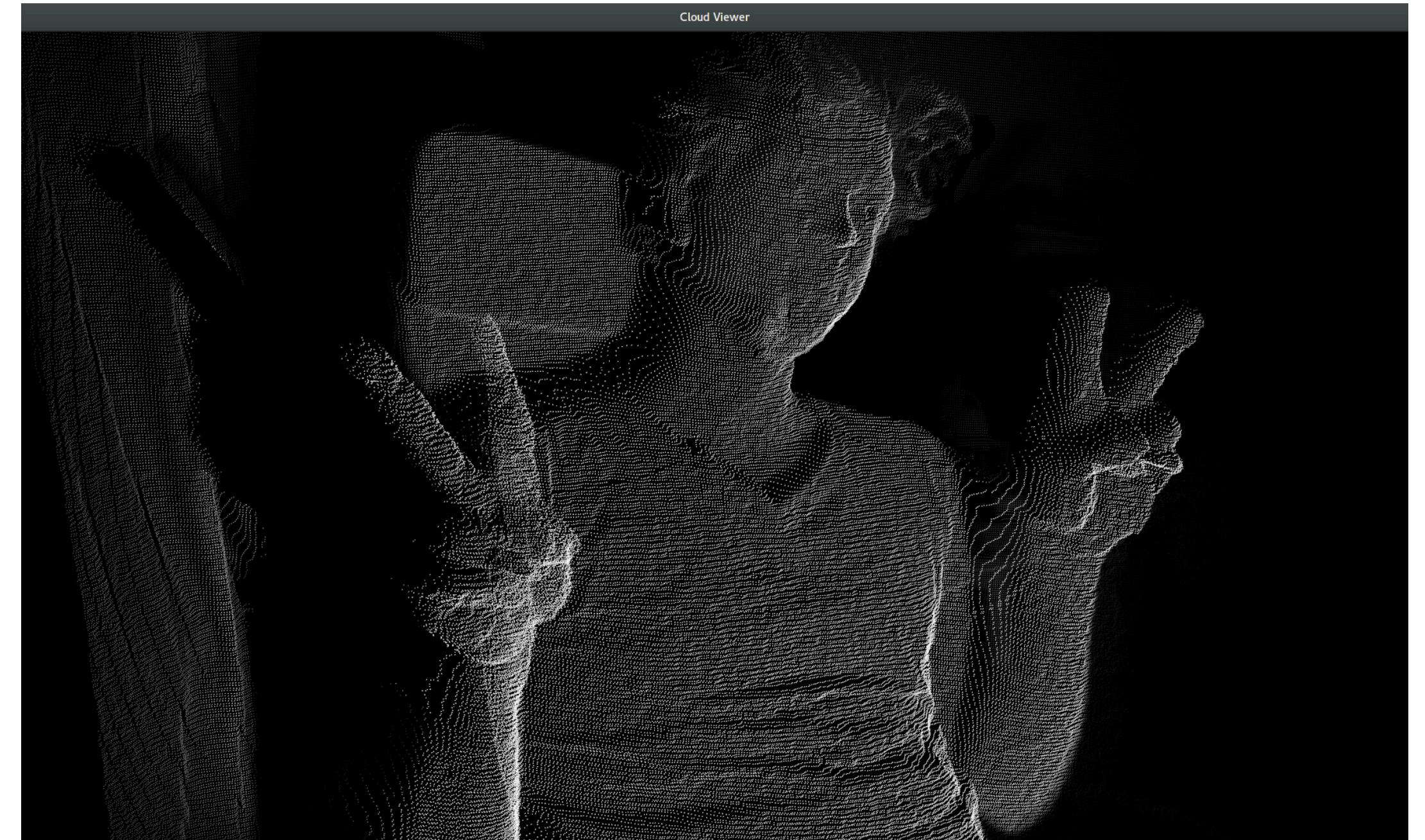


What is Processing?

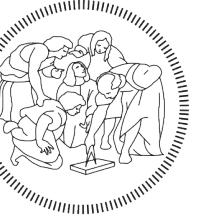
When they started Processing in 2001, the goal was to **bring ideas and technologies out of MIT and into the larger world.**

They called this sketching with code.

Processing emerged directly from the **Aesthetics and Computation Group** [ACG], a research group started at the Media Lab by John Maeda in 1996.



<https://medium.com/processing-foundation/a-modern-prometheus-59aed94abe85>



Sketching?

A Processing program is called a sketch.

This is more than a change in nomenclature, it's a different approach to coding.

The more traditional method is to resolve the entire plan for the software before the first line of code is written.

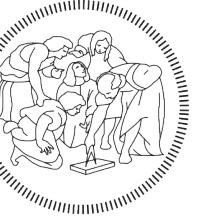
This approach can work well for well-defined domains, but when the goal is exploration and invention, it prematurely cuts off possible outcomes.

Through sketching with code, unexpected paths are discovered and followed.

Unique outcomes often emerge through the process.

```
void setup(){
    size(400,400);
    background(200,255,100);
} // end of setup

void draw(){
    smooth();
    strokeWeight(3);
    rect(85,100,30,65); // x, y, width, height
    ellipse(100,100,50,50); // x, y, width, height
    ellipse(90,95,20,20); // left eye
    ellipse(110,95,20,20); // right eye
    ellipse(100,115,10,5); // mouth
    line(115,120,130,160); // right arm
    line(85,120,70,160); // left arm
} // end of draw
```



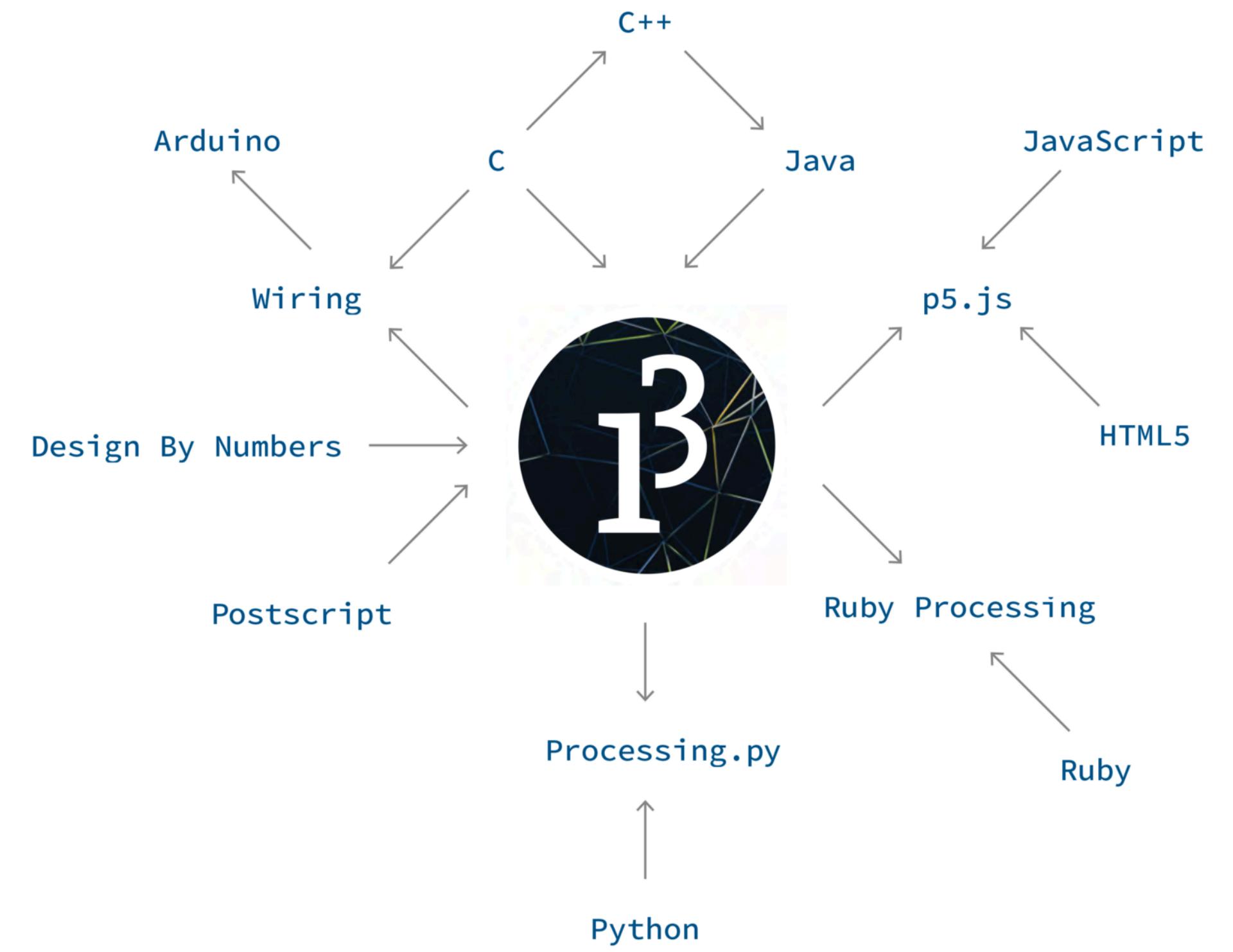
What's for?

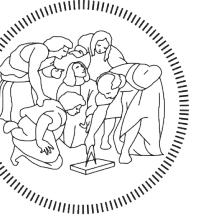
The original mission of Processing was to create software that made learning to code accessible for visual people (designers, artists, architects) and to help a more technical audience work fluidly with graphics.

From the original Processing software, the Foundation is now supporting a range of different projects.

The **p5.js** project is a JavaScript reimagining of Processing within the context of contemporary web browsers.

Processing.py it's now a Mode for the Processing 3 editor. Additionally, **Processing for Android** as a Mode for Processing 3, Processing 3 running well on **Raspberry Pi** and **CHIP hardware**, and there is a library to read and write directly to the I/O pins.





Download

_ On **Windows**, you'll have a .zip file.

Double-click it, and drag the folder inside to a location on your hard disk. It could be Program Files or simply the desktop, but the important thing is for the processing folder to be pulled out of that .zip file. Then double-click processing.exe to start.

_ The **Mac OS X** version is also a .zip file.

Double-click it and drag the Processing icon to the Applications folder. If you're using someone else's machine and can't modify the Applications folder, just drag the application to the desktop. Then double-click the Processing icon to start.



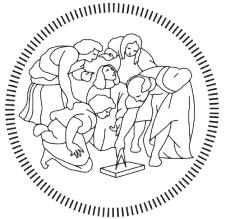
<https://processing.org/download/>

Download

Download

This Git with slides and examples

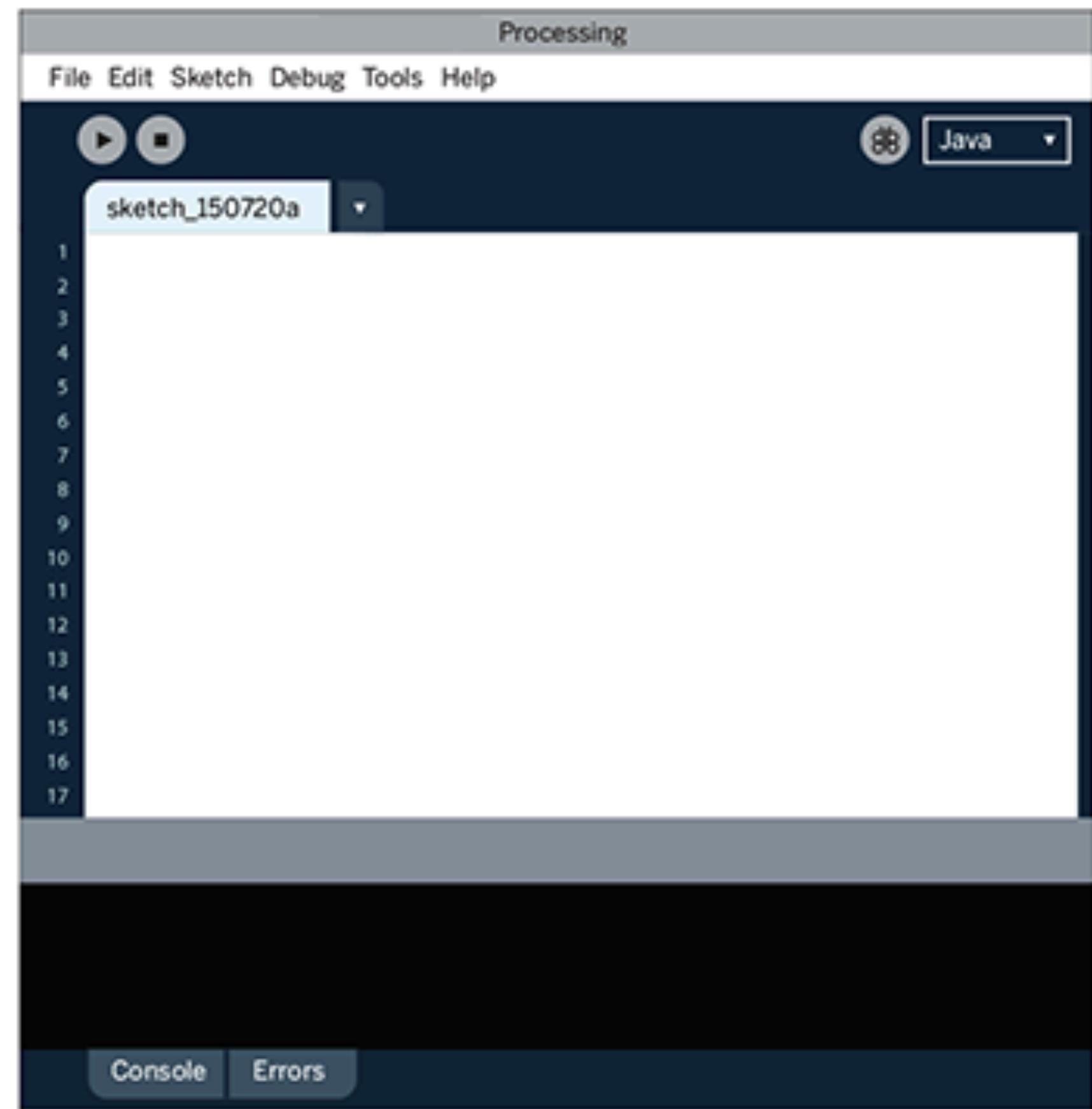
<https://github.com/giulioriot/creativeCoding>



Hello, I'm Processing



Display Window



Menu

Toolbar

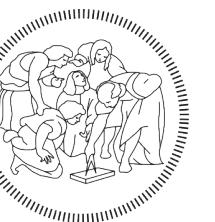
Tabs

Text Editor

Message Area

Console

Console Errors



How it works?

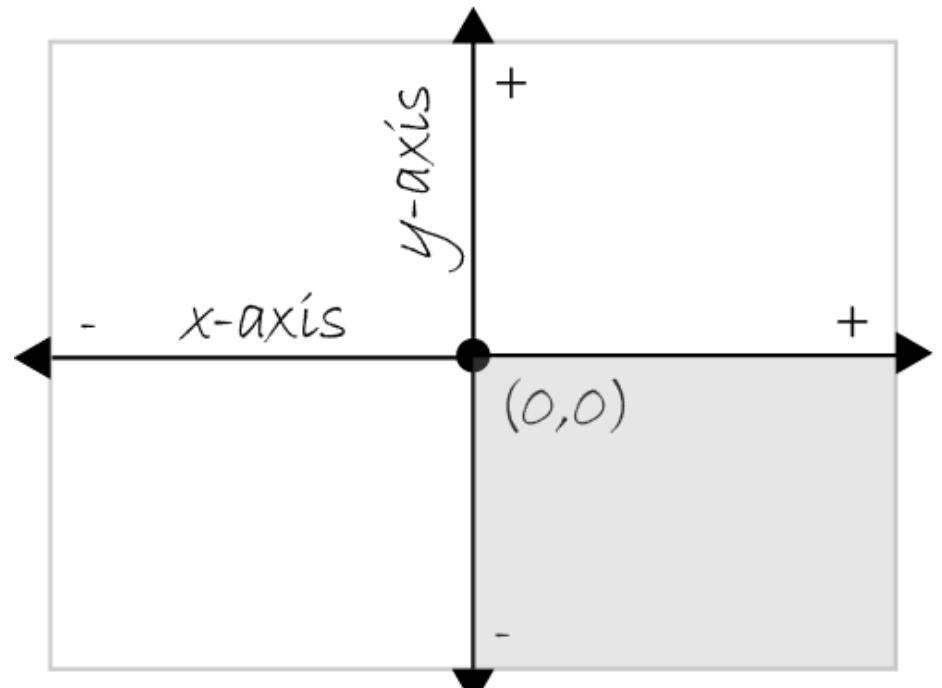
A journey of a thousand miles begins with a single step.

—Lao-tzu

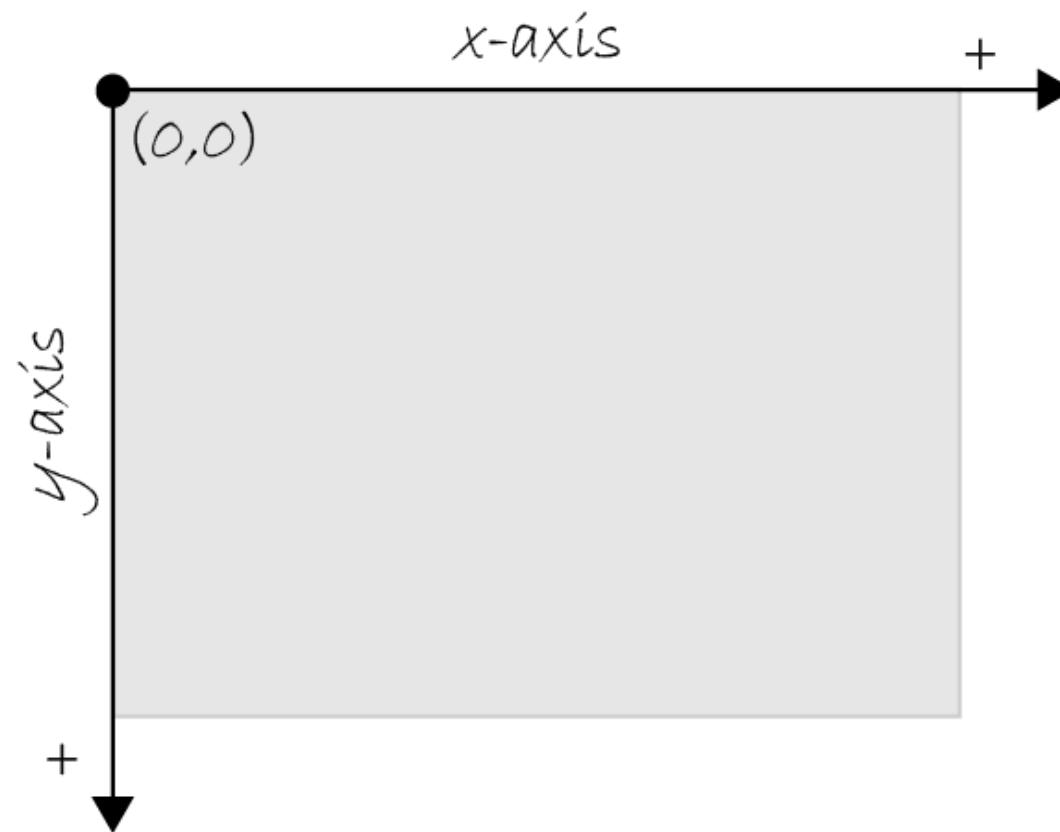
PIXELS

Digital is made by pixels, when you have to create something on a display you have to specify where you want it...

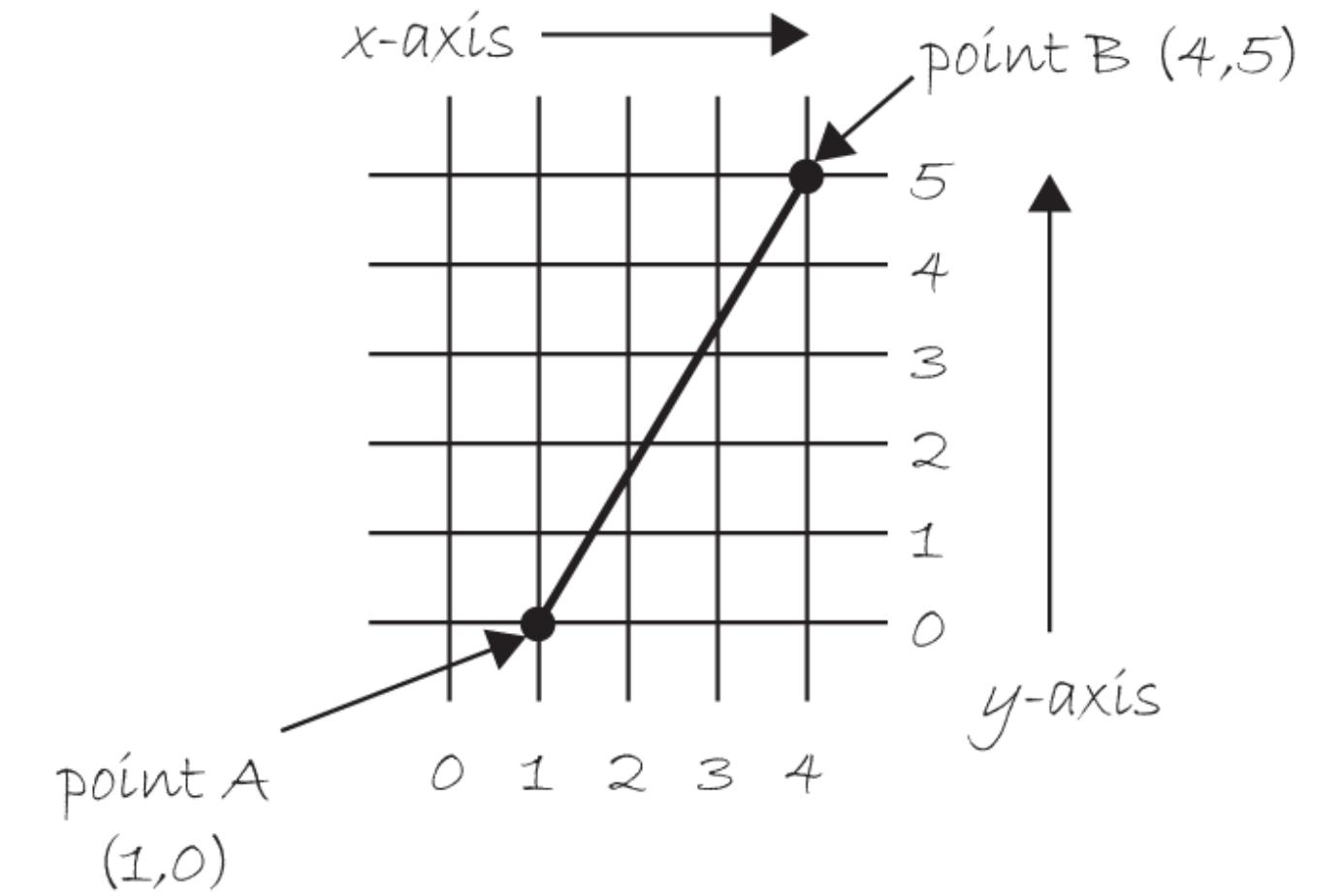
Computers thinks by pixels



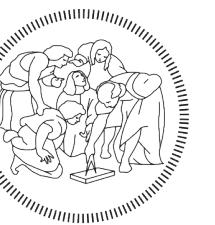
graph paper



computer



This figure shows a line between point A [1,0] and point B [4,5]. If you wanted to direct a friend of yours to draw that same line, you would say "draw a line from the point one-zero to the point four-five, please."



How it works?

*'I try to apply colors like words that shape poems, like notes that shape music'*¹

—Joan Miró

COLORS

Color is defined with a range of numbers.

The simplest case: black and white or grayscale.

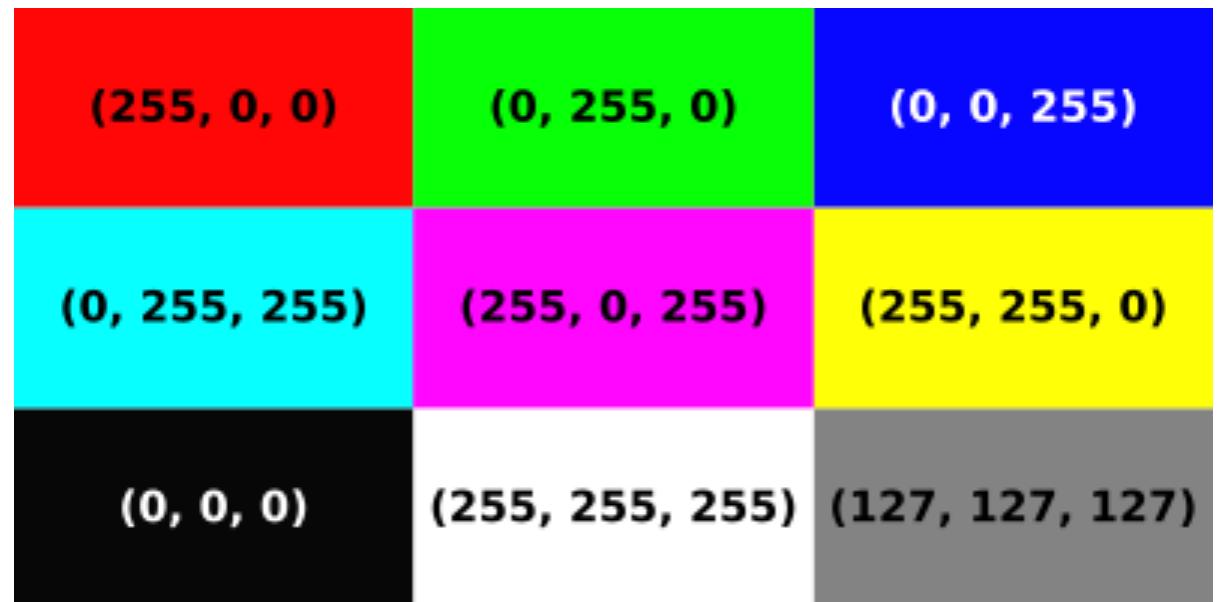
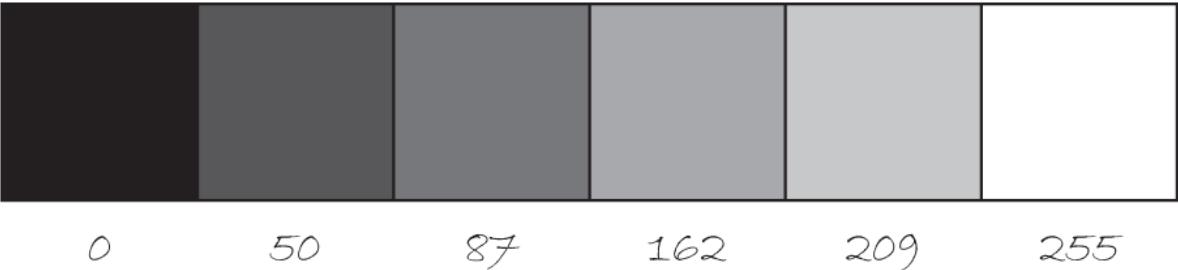
To specify a value for grayscale, use the following:

0 means black, 255 means white.

In between, every other number — 50, 87, 162, 209, and so on — is a shade of gray ranging from black to white.

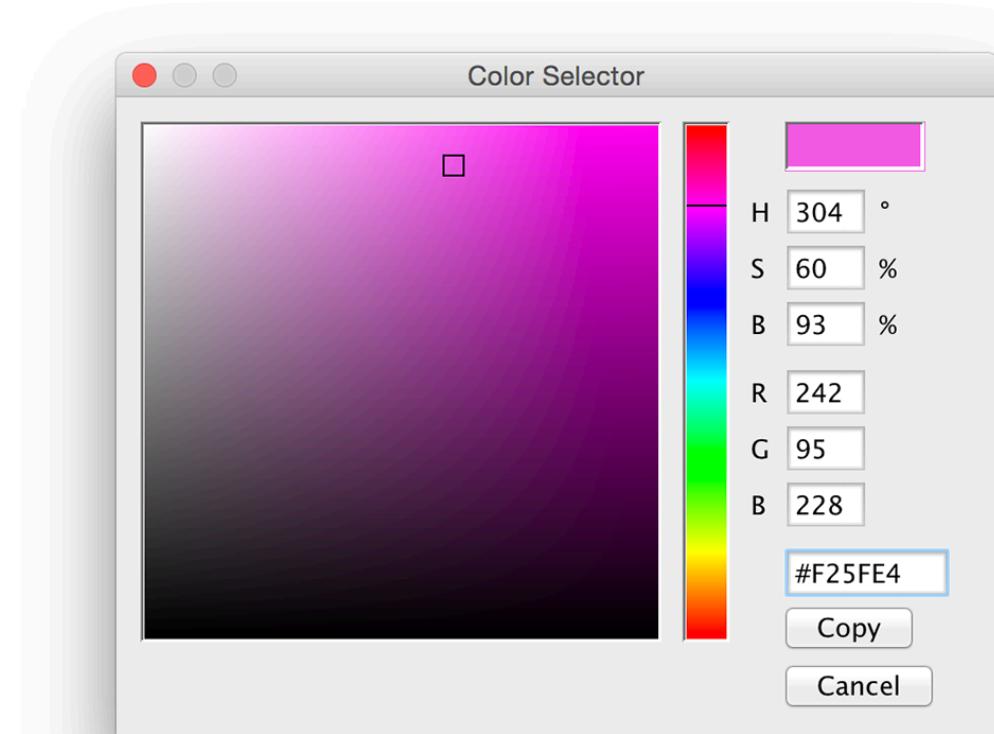
```
fill(0);
fill(255,0,0);
fill(0,255,0);
fill(0,0,255);
```

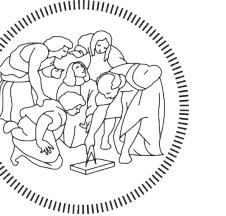
Syntax fill(rgb)
 fill(rgb, alpha)
 fill(gray)
 fill(gray, alpha)
 fill(v1, v2, v3)
 fill(v1, v2, v3, alpha)



Processing also has a color selector to aid in choosing colors.

Access this via "Tools" (from the menu bar) → "Color Selector."





Always;

The console in the lower part shows you errors

the most frequent error is a missing semicolon one, so

remember :

A screenshot of the Processing IDE interface. The code editor window shows a sketch named 'BASICS'. The code includes a setup function that sets the size to 800x600 and sets the background to black. The draw function contains a single brace '}'. The console at the bottom shows two red error messages: 'Syntax error, maybe a missing semicolon?' and 'expecting SEMI, found '}'. Handwritten annotations explain the code structure: 'Function name' points to 'void setup()', 'Arguments in parentheses' points to '(0,0,200,200);', and 'Ends with semi-colon' points to the final ';' in the argument list.

```
// I am a comment, you can use double slash (//) to create a
void setup(){
    size(800, 600); //size is measured in pixel, I choose 800x600
    background(0); //background is the color of the background, :
}

void draw(){
}
```

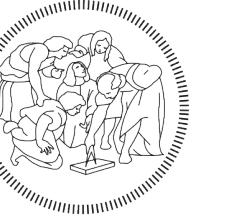
Syntax error, maybe a missing semicolon?
expecting SEMI, found '}'
Syntax error, maybe a missing semicolon?

everything you need is here:

<https://processing.org/reference/>

A screenshot of the Processing reference website. The top navigation bar includes links for 'Processing', 'p5.js', 'Processing.py', 'Processing for Android', 'Processing for Pi', and 'Processing Foundation'. The main content area features a dark background with a network of yellow lines. On the left, there's a sidebar with links like 'Cover', 'Download', 'Donate', 'Exhibition', 'Reference', 'Libraries', 'Tools', 'Environment', 'Tutorials', 'Examples', 'Books', 'Overview', 'People', 'Forum', 'GitHub', 'Issues', 'Wiki', 'FAQ', 'Twitter', 'Facebook', and 'Medium'. The right side is a detailed table of contents organized into categories: Structure, Shape, Color, Creating & Reading, Curves, Image, and Loading & Displaying. Each category lists various Processing functions.

Category	Functions
Structure	{} (parentheses), (comma), .(dot), /* (multiline comment), /** (doc comment), // (comment), ; (semicolon), = (assign), [] (array access), {} (curly braces), catch, class, draw(), exit(), extends, false, final, implements, import, loop(), new, noLoop(), null, pop(), popStyle(), private, public
Shape	createShape(), loadShape(), PShape
Color	Setting, background(), clear(), colorMode(), fill(), noFill(), noStroke(), stroke()
Creating & Reading	alpha(), blue(), brightness(), color(), green(), hue(), lerpColor(), red(), saturation()
Curves	bezier(), bezierDetail(), bezierPoint(), bezierTangent()
Image	createImage(), PImage
Loading & Displaying	Loading & Displaying



Lets create a sketch

The keyword **void** indicates a function with no value.

If you don't know what a function is...

void setup(){

is the space in which I setup my sketch

Everything you write in the SETUP will run just once

}

void draw(){

is the space in which I draw in my sketch

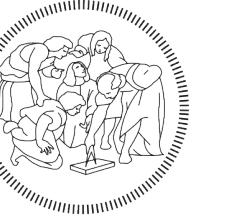
Everything you write in the DRAW, will run in an infinite loop

}

The screenshot shows the Processing 3.5.3 IDE interface. The title bar reads "BASICS | Processing 3.5.3". The code editor window displays the following Java code:

```
1 void setup(){
2
3 }
4
5 void draw(){
6
7 }
```

The code editor has a dark theme with syntax highlighting for keywords like "void" and "setup". The Processing logo is visible in the top right corner of the window. At the bottom of the screen, there is a toolbar with icons for "Console" and "Errors", and a status bar indicating "Updates 5".



Basics

```
// open the folder of examples
```

```
BASICS
```

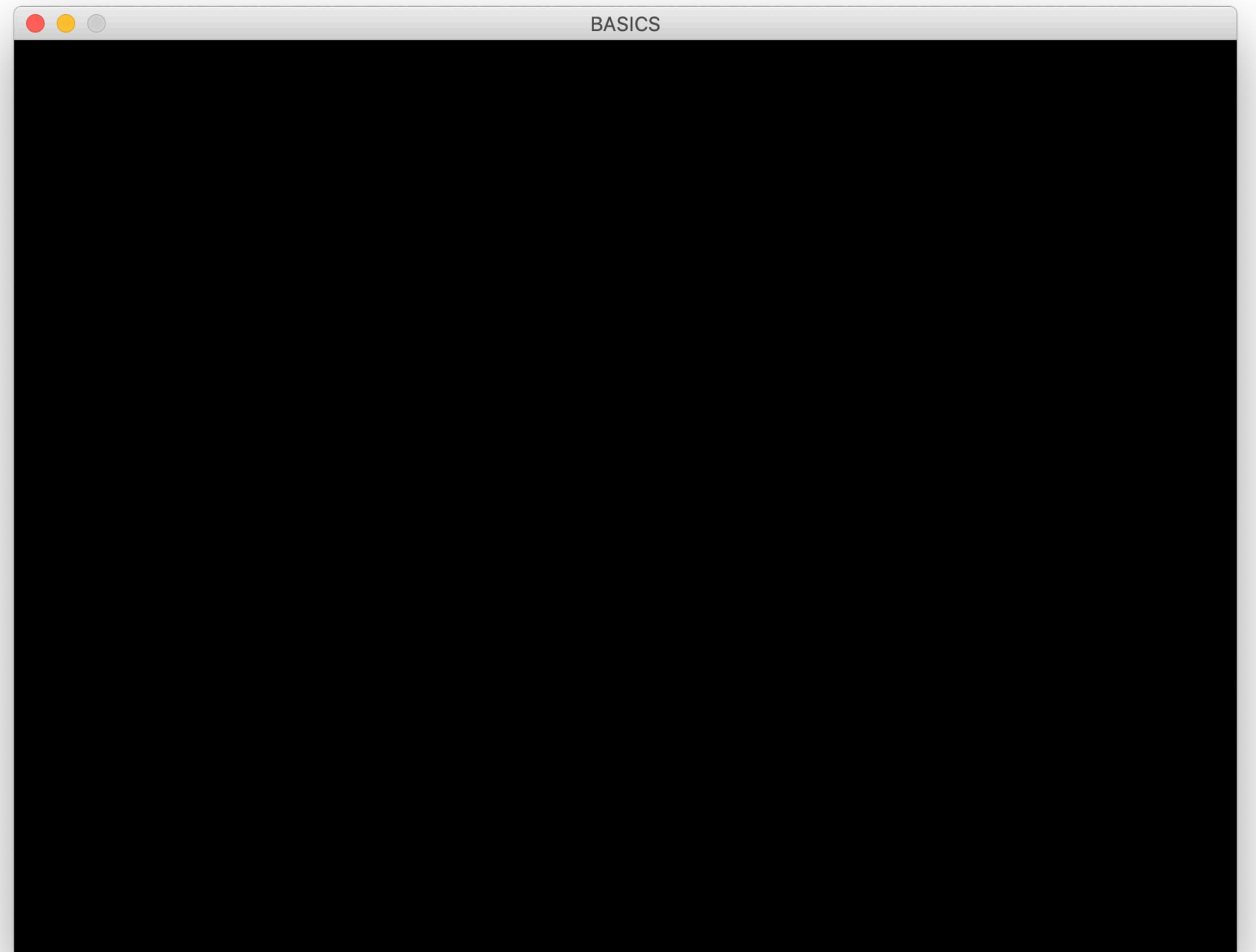
here you find

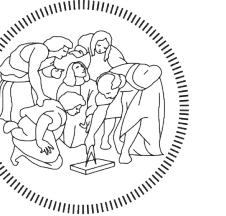
A black blank page

our hello world

tips:

try to change the size of the sketch and the background color at line 6 and 7





Shapes

```
// open the folder of examples
```

```
BASIC_SHAPES
```

here you find

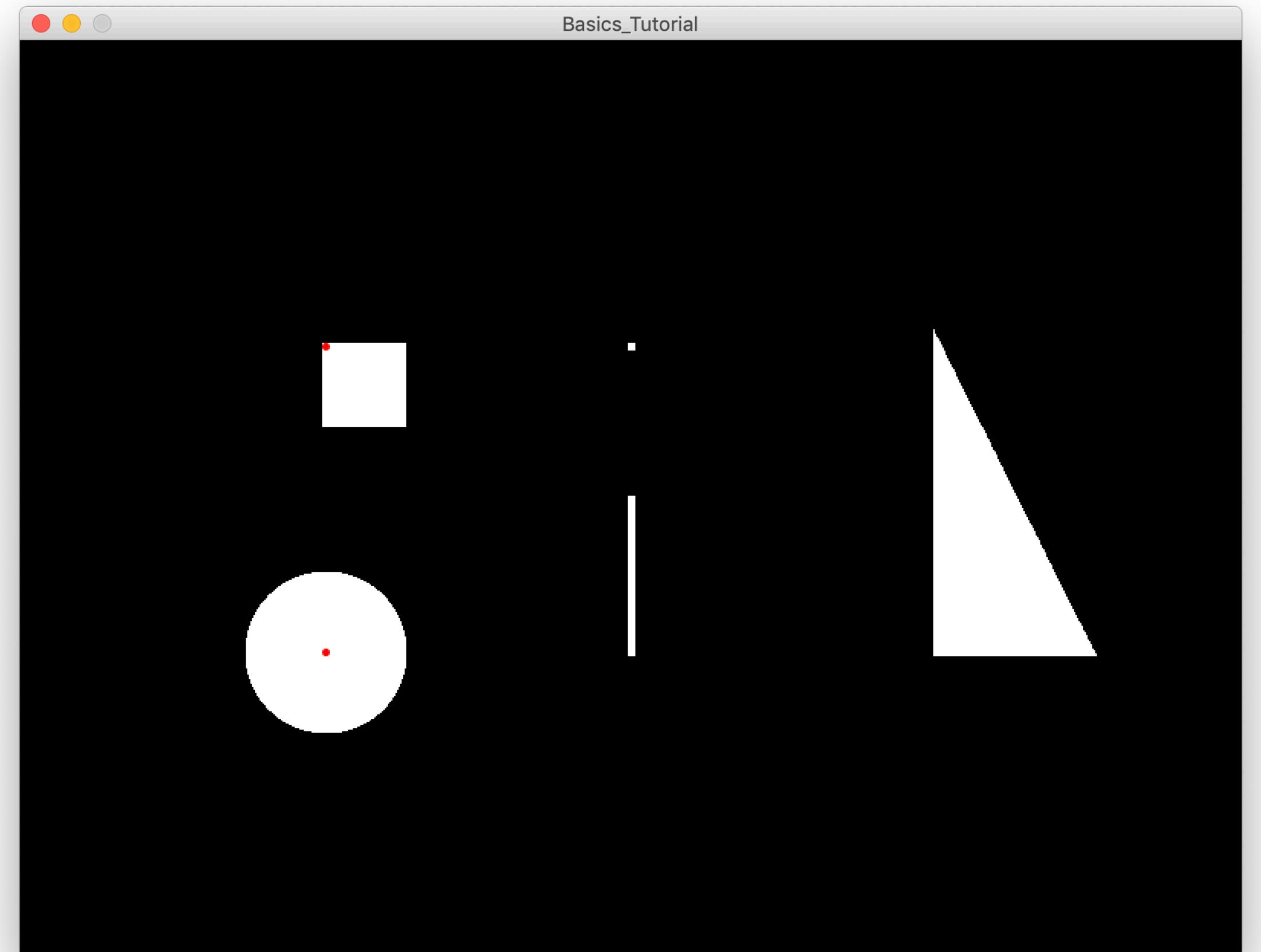
Primitive shapes

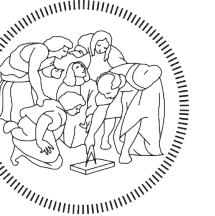
to understand how to draw by code

tips:

change from a grayscale color to rgb at line 9

try to modify the triangle shape at line 19





Stickman

```
// open the folder of examples  
  
STICK_MAN
```

here you find

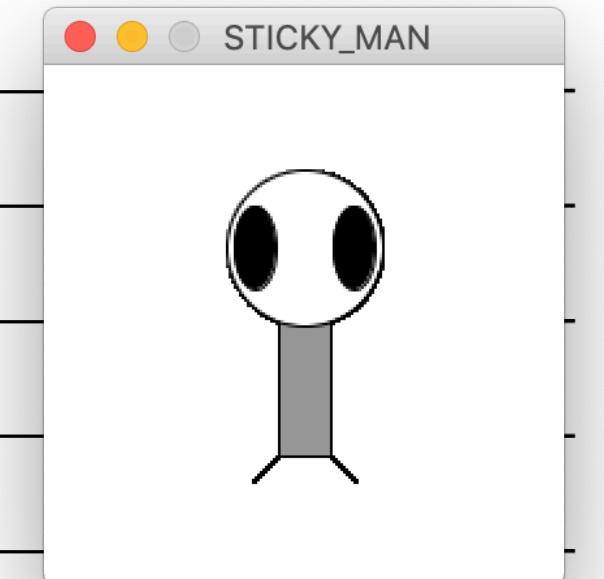
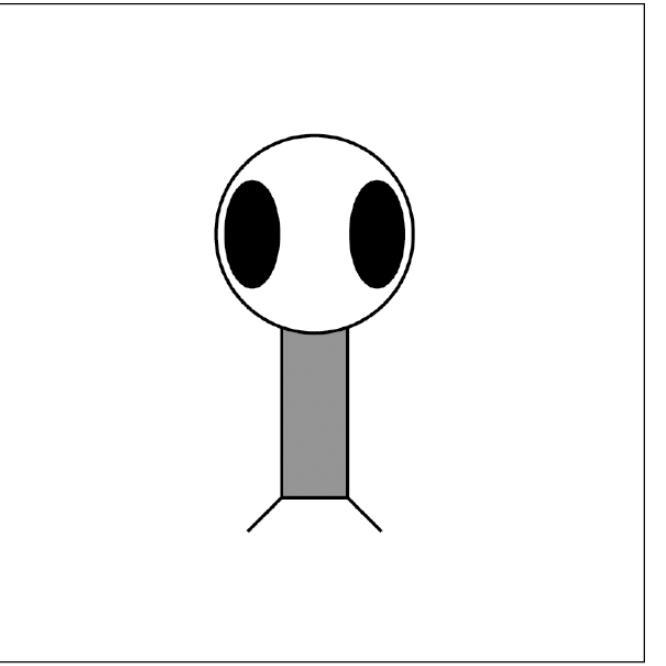
A simple stickman

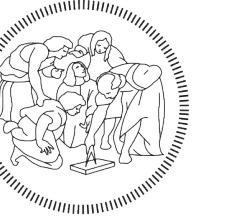
hack and modify code to obtain a personal output

tips:

try to add arms and details, be creative!

```
background(255);  
ellipseMode(CENTER);  
rectMode(CENTER);  
stroke(0);  
fill(150);  
rect(100, 100, 20, 100);  
fill(255);  
ellipse(100, 70, 60, 60);  
fill(0);  
ellipse(81, 70, 16, 32);  
ellipse(119, 70, 16, 32);  
stroke(0);  
line(90, 150, 80, 160);  
line(110, 150, 120, 160);
```

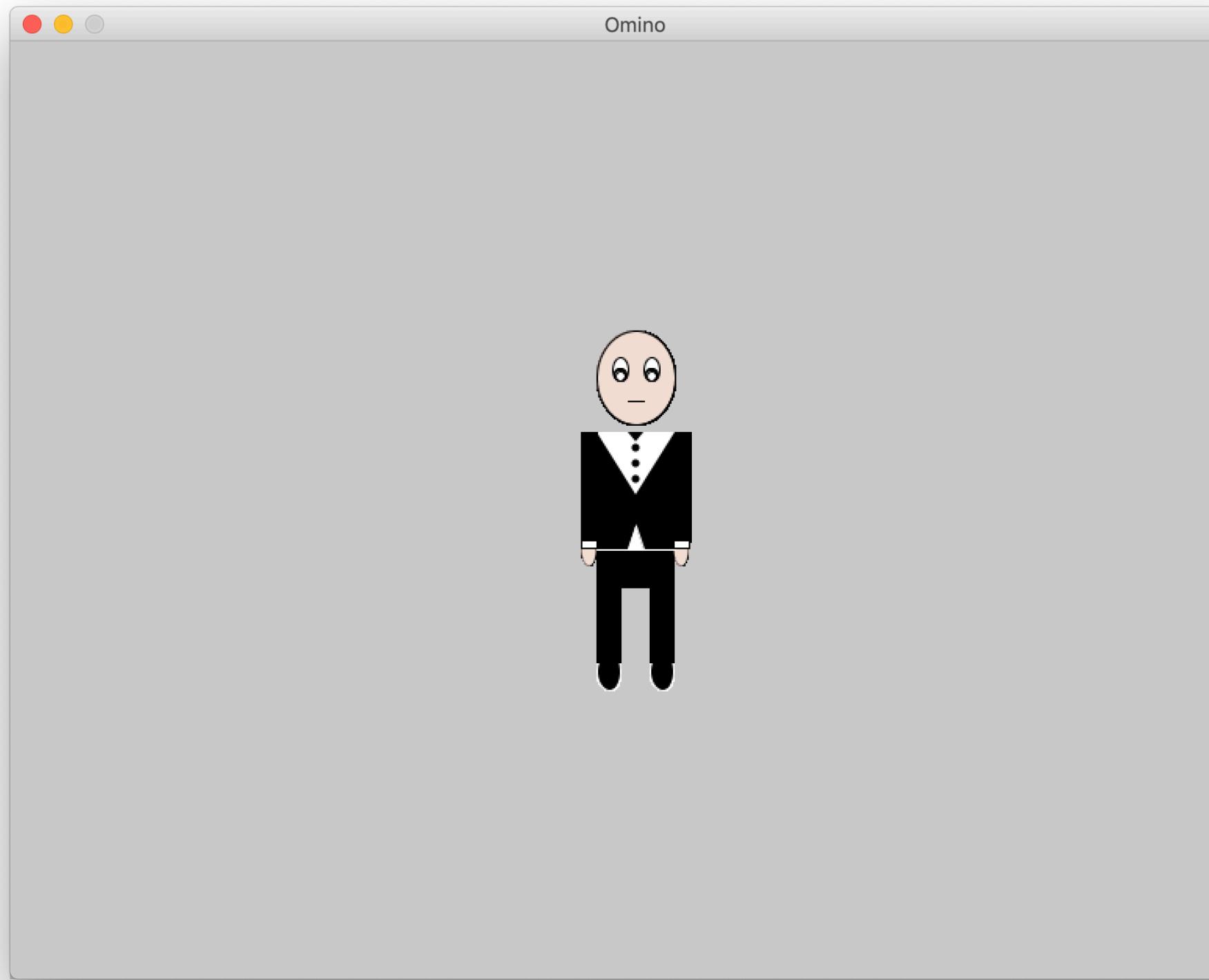




Be creative!

Let's create your own

that was my exercise some years ago

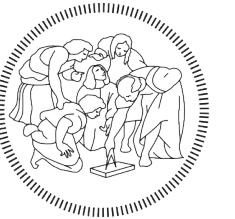


Omino | Processing 3.5.3

```
//C O M P U T E R - V I S I O N
//Accademia delle belle arti di Catania
//Docente: Giovanni Maria Farinella
//Studente: Giulio Interlandi
//Esercizio per esame di CV
// 04/07/2014

void setup() {
    size(800,600);
}
void draw() {
    noStroke();
    //body
    fill(0);
    rectMode(CENTER);
    rect(400,300, 50,100);
    fill(255);
    triangle(375,250,400,290,425,250);
    fill(0);
    ellipseMode(CENTER);
    ellipse(400,270,5,5);
    ellipse(400,280,5,5);
    ellipse(400,260,5,5);
    triangle(395,250,400,256,405,250);
    //arms
    strokeWeight(0.1);
    stroke(0);
    fill(240,220,210);
    ellipse(370,325,9,21);
```

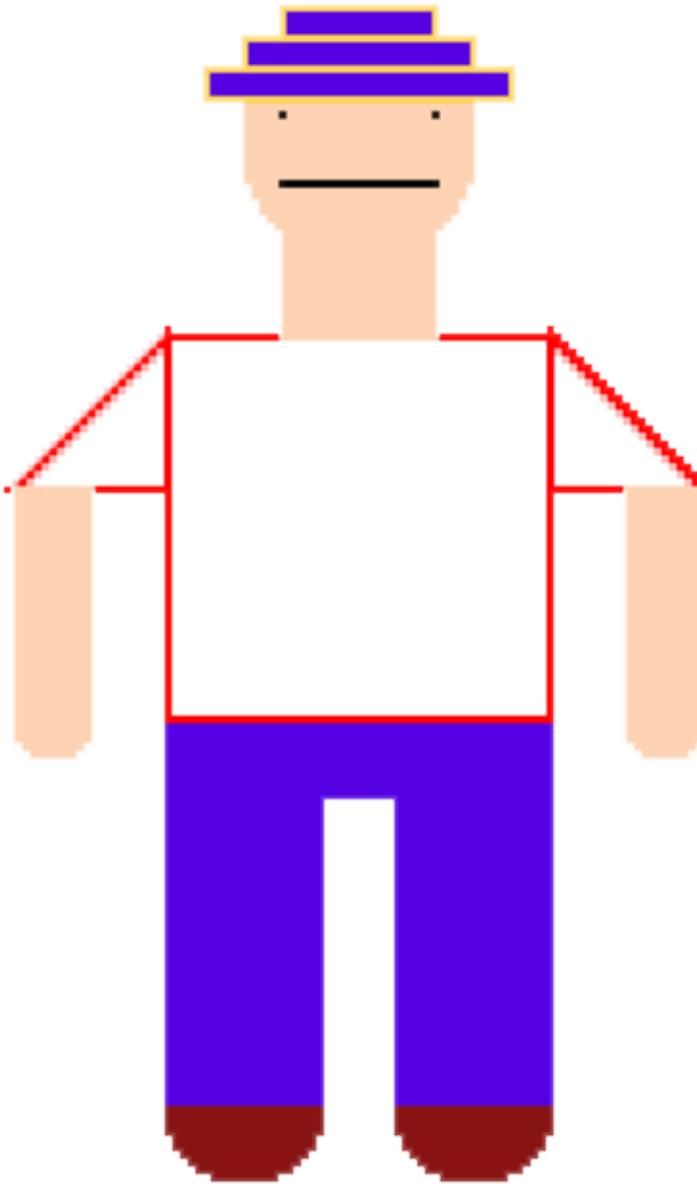
Console Errors Updates 5



Be creative!

Let's create your own

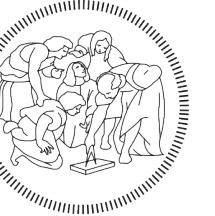
this is a funny sketch done by a student last year.



```
// feet
stroke(133, 21, 24);
fill(133, 21, 24);
ellipse(385, 475, 20, 20); // left foot (center X, center Y, width, height)
ellipse(415, 475, 20, 20); // right foot (center X, center Y, width, height)
// trousers
stroke(84, 21, 222);
fill(84, 21, 222);
rect(375, 425, 50, 10); // pacco (starting X, starting Y, width, height)
rect(375, 435, 20, 40); // left leg (starting X, starting Y, width, height)
rect(405, 435, 20, 40); // right leg (starting X, starting Y, width, height)

// face
stroke(252, 211, 181);
fill(252, 211, 181);
rect(390, 355, 20, 20); // neck (starting X, starting Y, width, height)
ellipse(400, 350, 30, 30); // face (center X, center Y, width, height)
stroke(0);
fill(255);
point(390, 346); // left eye
point(410, 346); // right eye
line(390, 355, 410, 355); // mouth (starting X, starting Y, ending X, ending Y)
// cap
stroke(252, 211, 102);
fill(84, 21, 222);
rect(380, 340, 40, 4); // cap down (starting X, starting Y, width, height)
rect(385, 336, 30, 4); // cap middle (starting X, starting Y, width, height)
rect(390, 332, 20, 4); // cap middle (starting X, starting Y, width, height)
```

Credits: Luca Ghezzi



Lets create a sketch

// open the folder of examples

DRAWING TOOLS

here you find

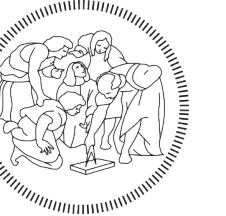
Drawing principles

to understand how to connect and draw by mouse input,
if [key pressed] case

tips:

delete or comment the background at line 18 and the
rectangle at line 20

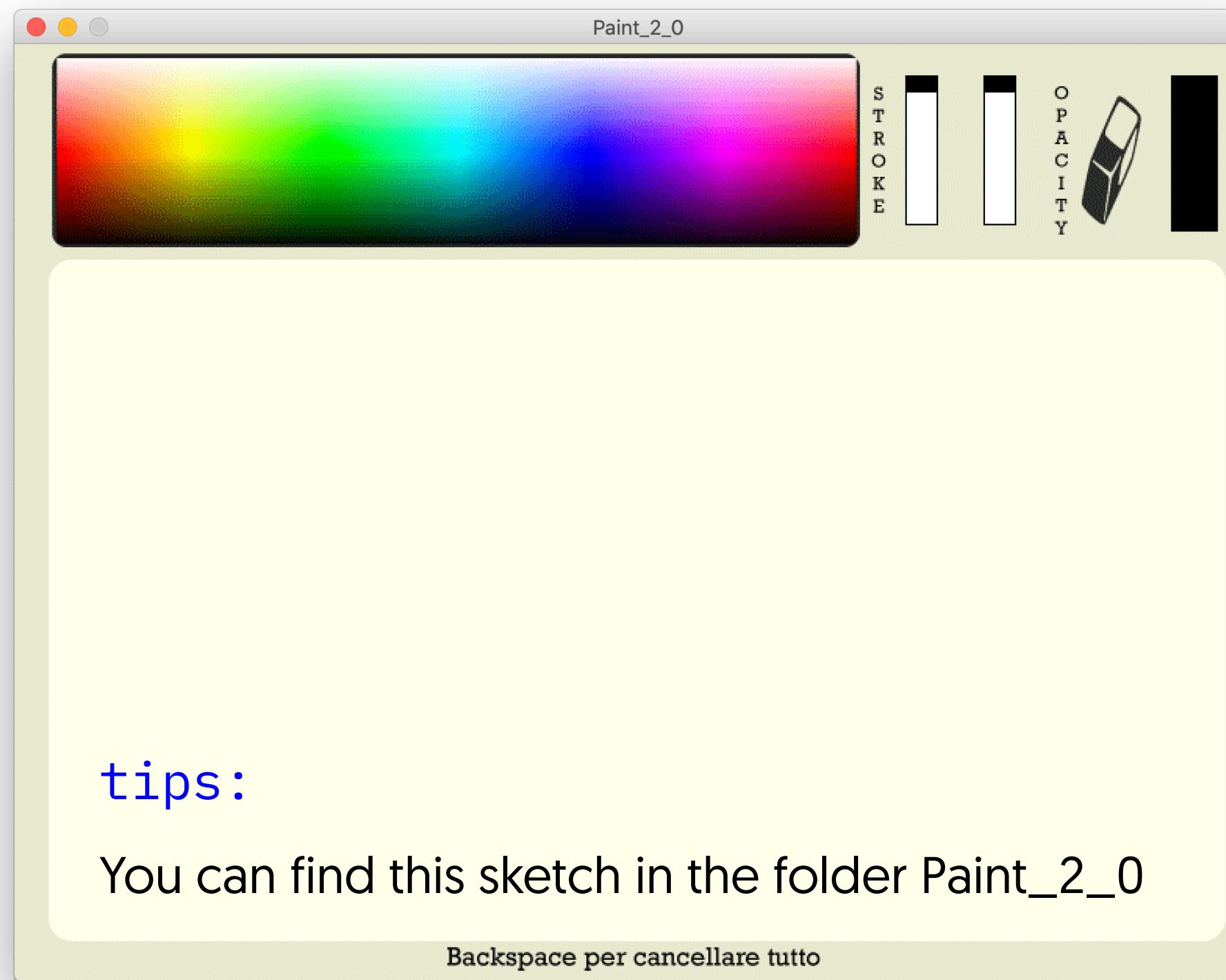




Be creative!

Let's create your own

that was my exercise some years ago



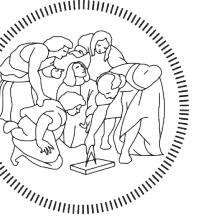
tips:

You can find this sketch in the folder Paint_2_0

The screenshot shows the Processing IDE with the sketch 'Paint'. The code is as follows:

```
1 //C O M P U T E R - V I S I O N
2 //Accademia delle belle arti di Catania
3 //Docente: Giovanni Maria Farinella
4 //Studente: Giulio Interlandi
5 //Esercizio per esame di CV
6 // 04/07/2014
7
8 PImage layout;
9
10 float move = 20;
11 float move2 = 20;
12 float spessore;
13 float opacita2;
14 color c;
15 color gomma;
16
17 void setup() {
18     size (800, 600);
19     background(255);
```

Below the code, a message says 'Auto Format finished.' At the bottom, there are tabs for 'Console' and 'Errors'.



Lets create a sketch

```
// open the folder of examples
```

```
RANDOM_RELATIVE_POS
```

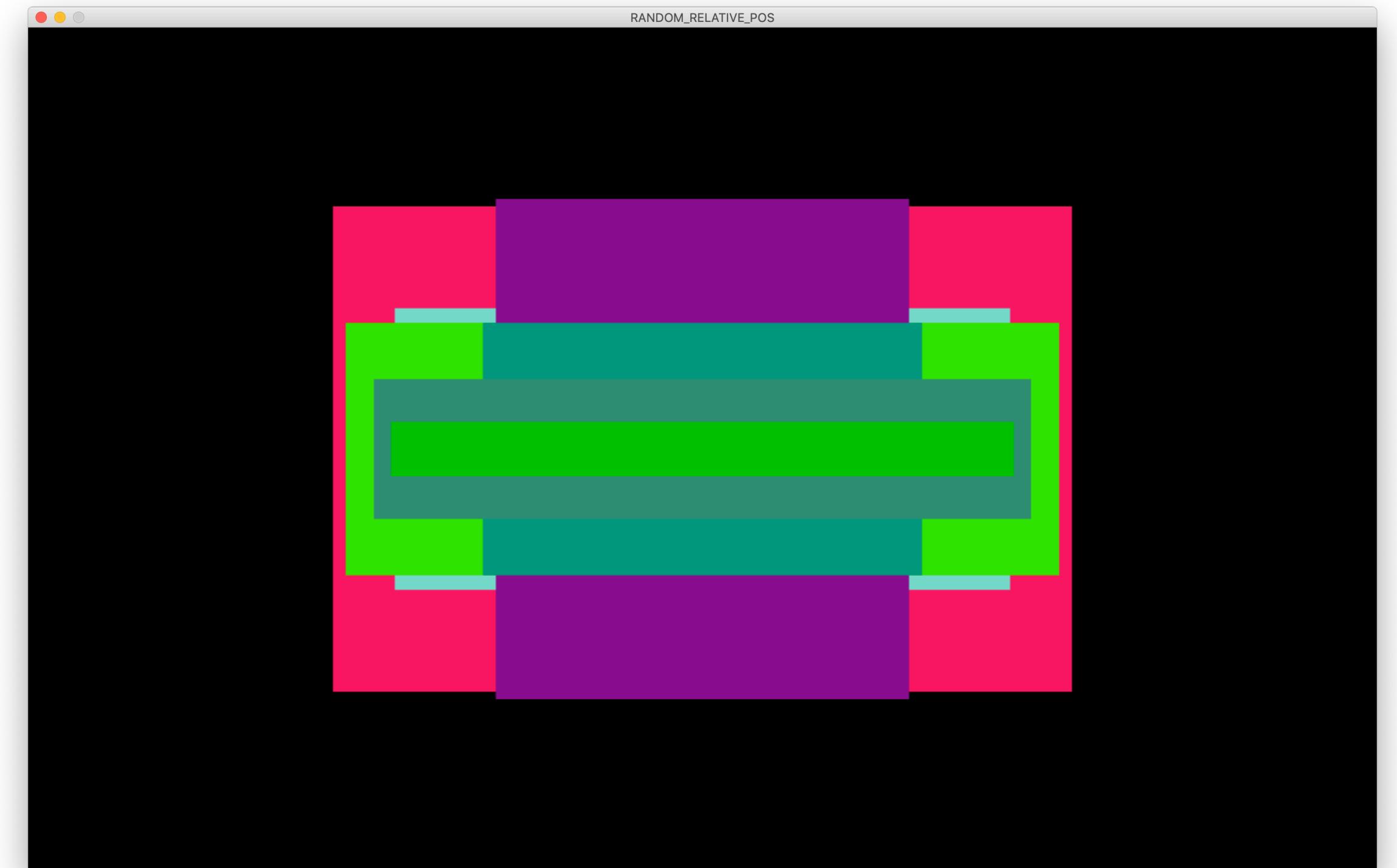
here you find

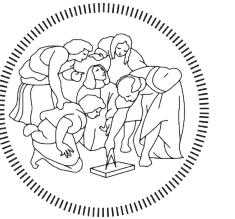
Random principles and coordinates

to understand randomness and positioning shapes
without writing pixel

tips:

try the filter at line 10 and delay at line 11





Sound Reactive

In order to work with sound information in Processing, we first need to install an extension library since Processing doesn't natively support this feature.

It can be simply installed by opening:

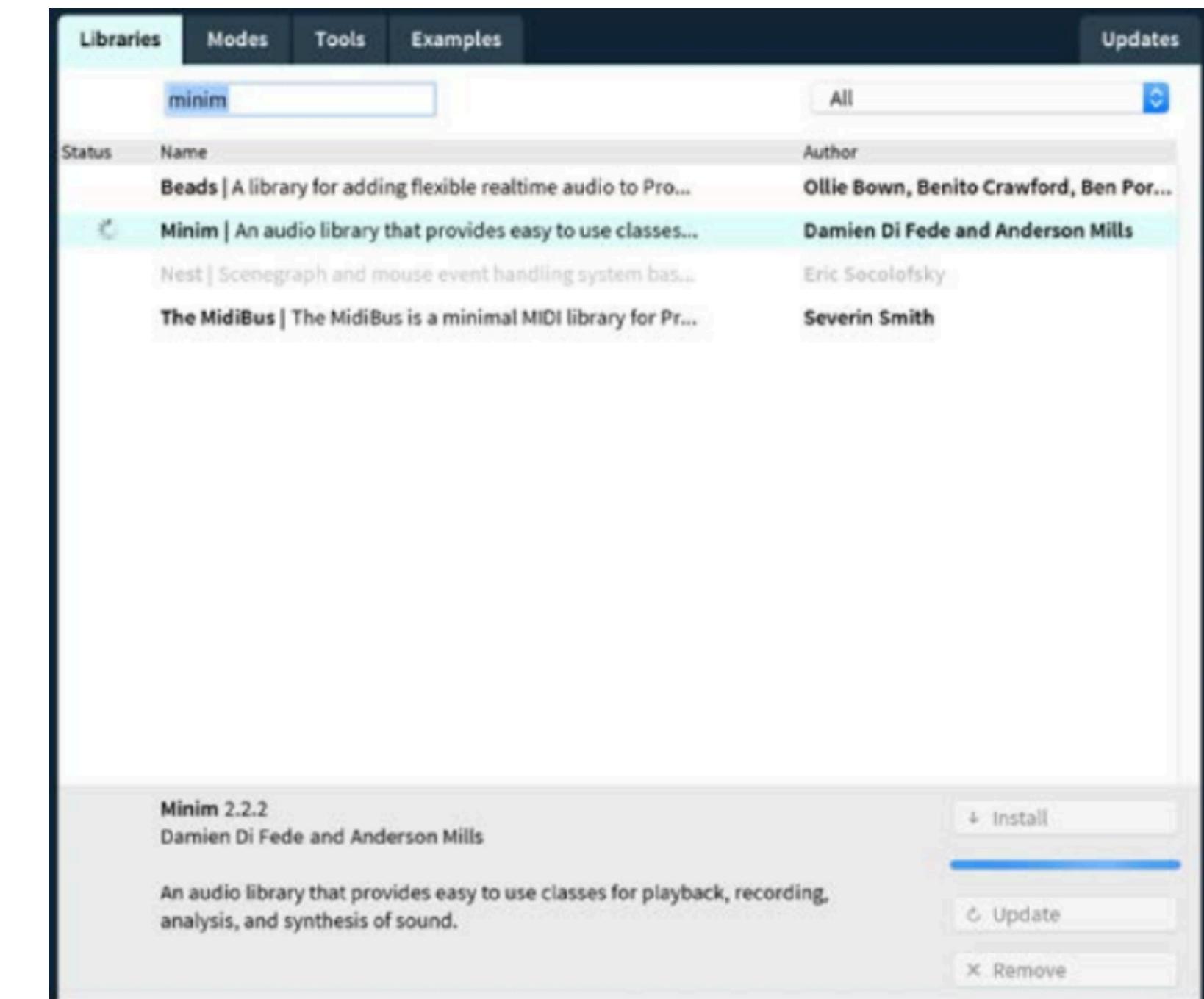
Sketch

→

Import Library

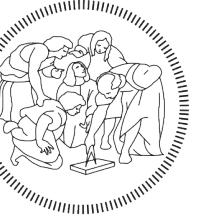
→

Add Library, typing 'minim' into the search field and then clicking on 'Install'.



You can find more in the document:

[Processing-Generative_Design_Tutorial_soundmapping](#)



Sound Reactive

Use this code before void setup:

```
import ddf.minim.*; //import the library
Minim minim; //declare we are using minim
AudioInput in; //choose audio input mode
```

Use this code inside void setup:

```
minim = new Minim(this);
in = minim.getLineIn();
```

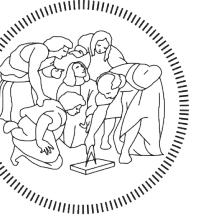
Use this code inside void draw:

```
float sound = 0;
for(int i = 0; i < in.bufferSize() - 1; i++) {
    sound += in.left.get(i);
}
```

```
Basic_Audio_Input_
1 import ddf.minim.*;
2 Minim minim; //declare we are using minim
3 AudioInput in; //choose audio input mode
4
5 void setup(){
6     size(800, 600);
7     minim = new Minim(this);
8
9     // use the getLineIn method of the Minim object to get an AudioInput
10    in = minim.getLineIn();
11 }
12
13 void draw(){
14     background(0);
15     stroke(255);
16
17     float sound = 0; //this is our sound value, it's just a variable
18
19     // here is where the magic happens, we create a cycle in which we connect our variable to detect audio input
20     for(int i = 0; i < in.bufferSize() - 1; i++)
21     {
22         sound += in.left.get(i);
23         //sound += in.right.get(i);
24     }
25
26
27     ellipse(width/2, height/2, 50+sound*100, 50+sound*50 );
28     ellipse(width/4, height/4, 50+sound*50, 50+sound*50 );
29     ellipse(3*width/4, 3*height/4, 50+sound*50, 50+sound*50 );
30     ellipse(3*width/4, height/4, 50+sound*50, 50+sound*50 );
31
32     ellipse(width/4, 3*height/4, 50+sound*50, 50+sound*50 );
33
34     ellipse(3*width/4, height/4, 50+sound*50, 50+sound*50 );
35
36     ellipse(width/4, 3*height/4, 50+sound*50, 50+sound*50 );
37 }
```

Connect audio input

now you can connect
the variable sound you
just created to your
shapes



Equalizer

```
// open the folder of examples
```

```
BASIC_AUDIO_INPUT
```

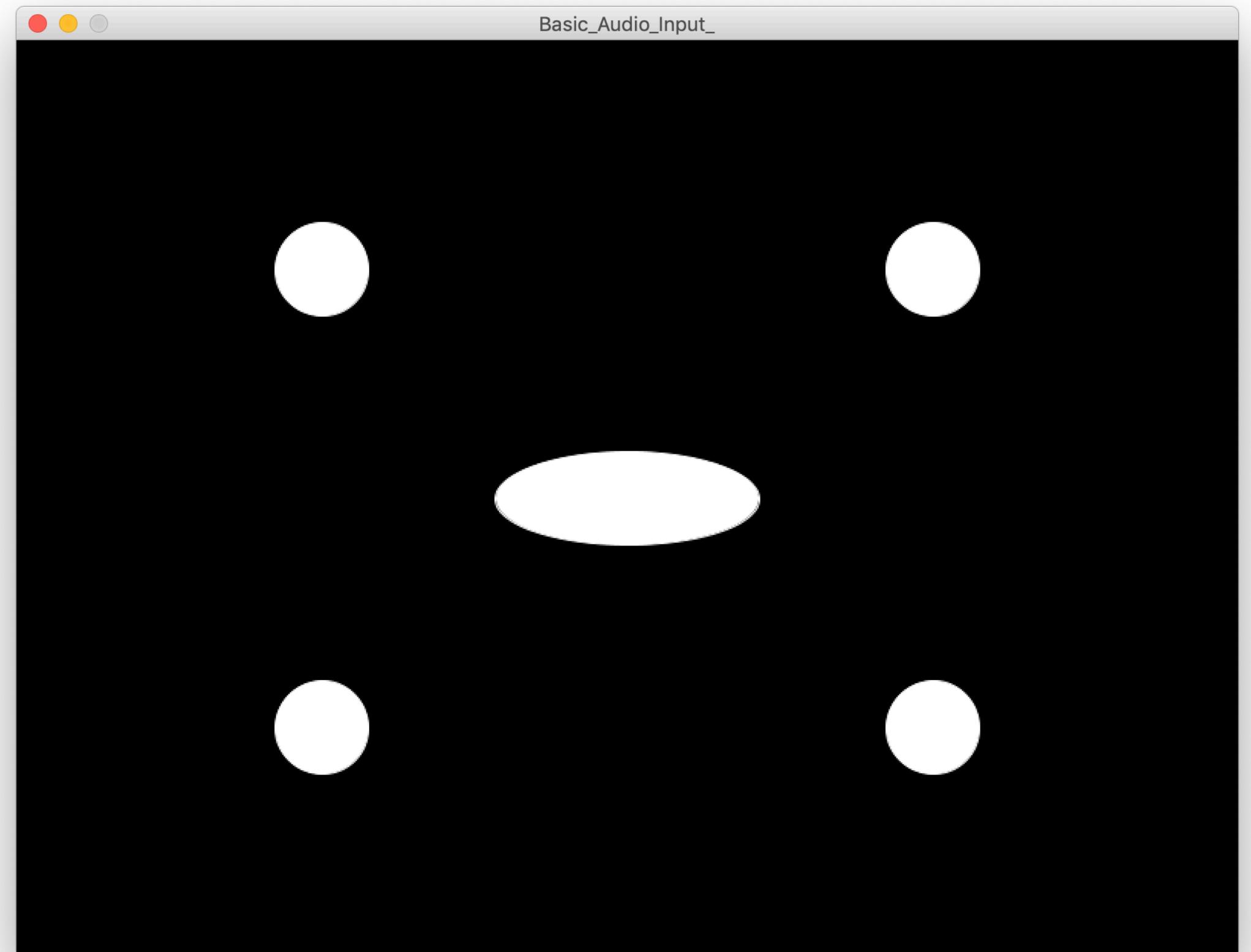
here you can find

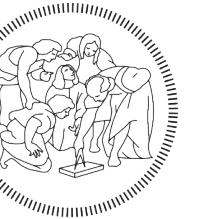
Basic principles of sound reactivity

to understand how to import a library and how to implement sound reaction in shapes

tips:

try to have different reactions for different shapes, using math to adjust sensibility

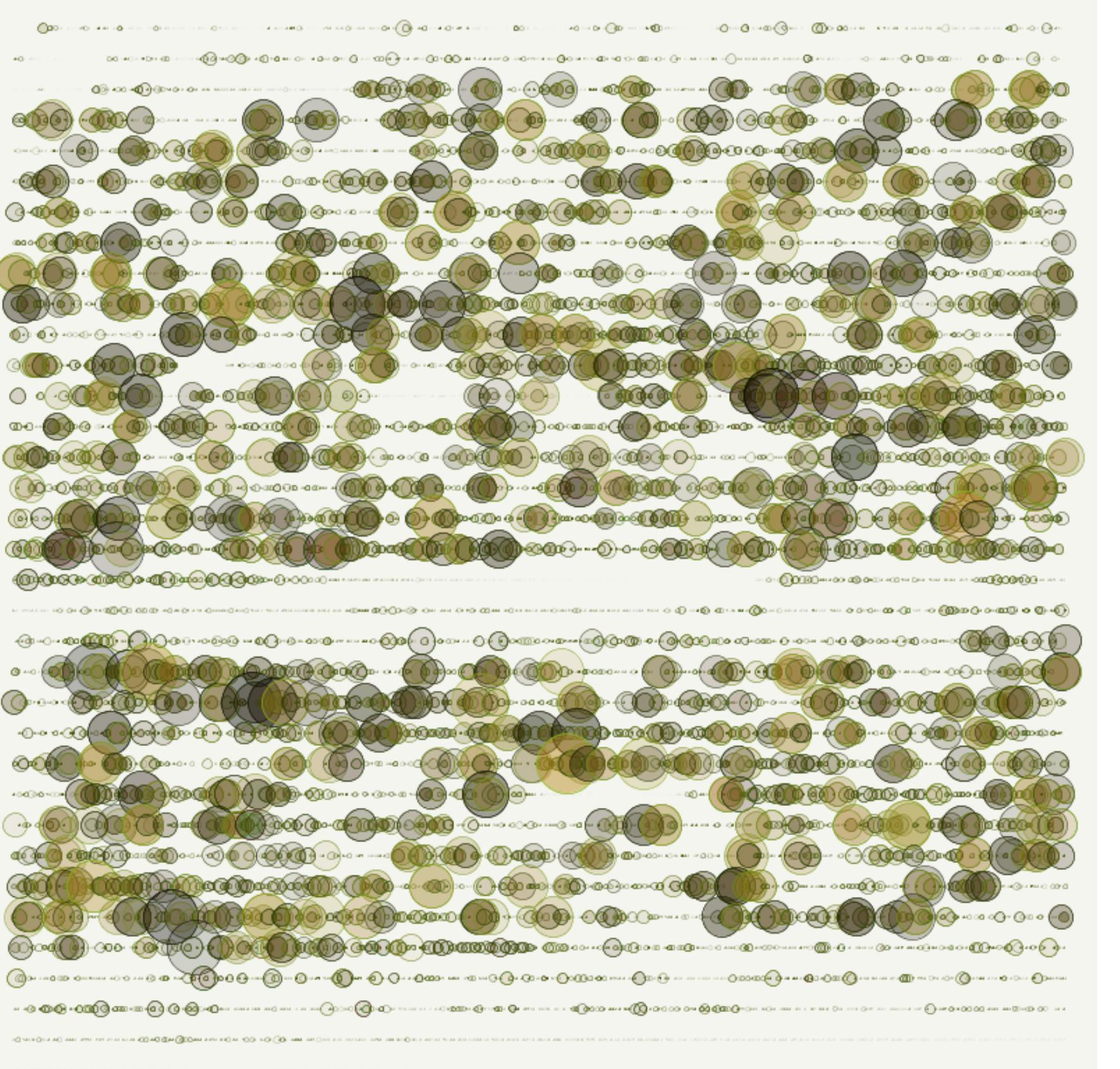
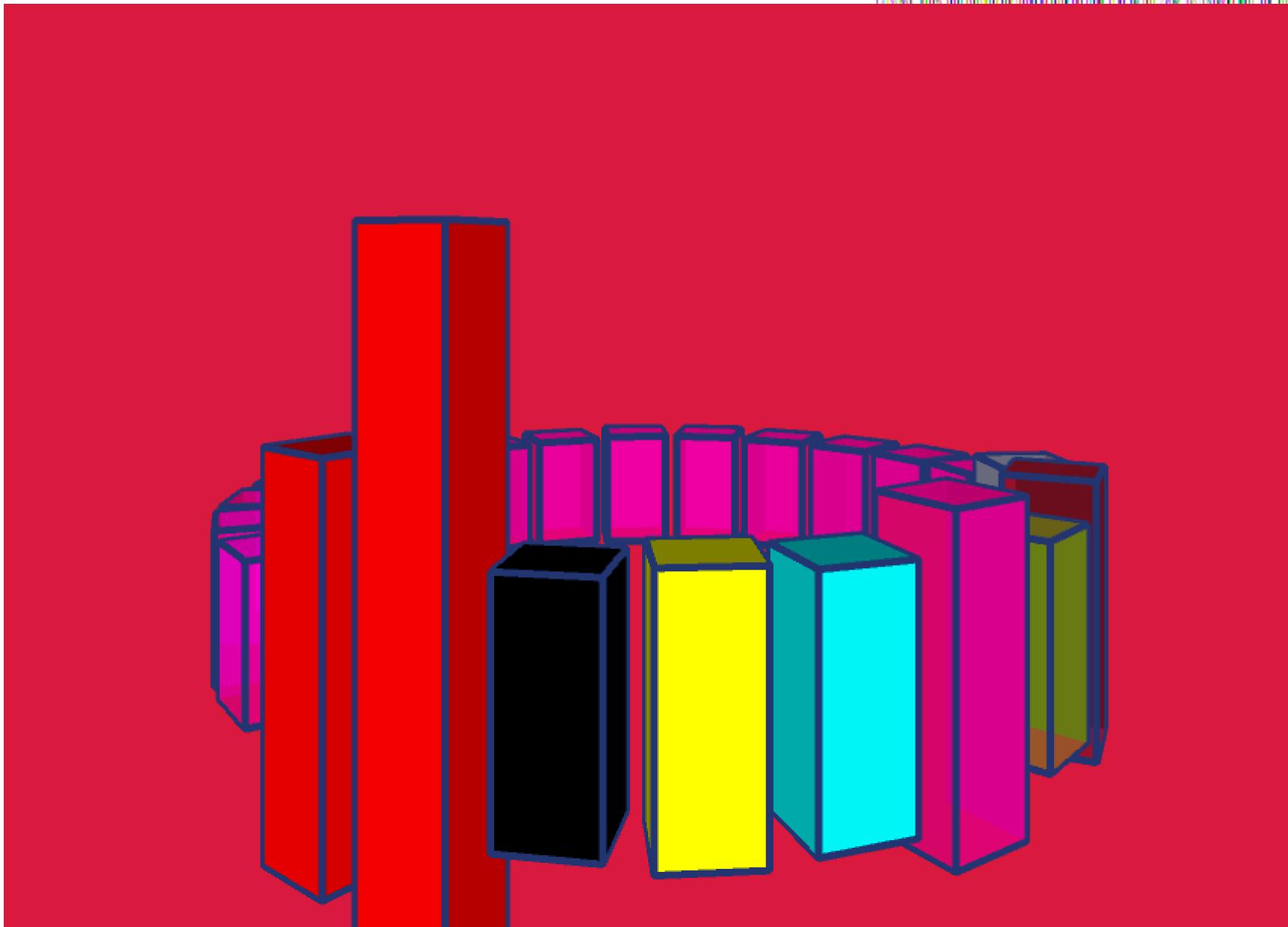




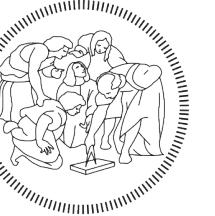
Be creative!

Let's create your own

these are some sketches done by
student from last year.



Credits: Luca Ghezzi, Andrea Zito



Kinect

Kinect® is a **motion sensing input device** produced by Microsoft. It was initially developed as a **gaming accessory**, but artists, third-party developers and researchers found several after-market uses because of its **low-cost and advanced features**. There are 2 versions of Kinect commercially available, and a [Kinect Azure Development Kit](#) recently became available on the market.

OpenKinect is one of the libraries for interfacing the Kinect to Processing. It can be simply installed by opening:

Sketch

→

Import Library

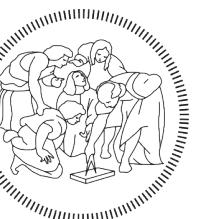
→

Add Library, typing 'kinect' into the search field and then clicking on 'Install'.



You can find out more on:

<https://shiffman.net/p5/kinect/>



Kinect

How it works:

Kinect sensors can detect a three dimensional area thanks to its **infrared** technology. It works by projecting infrared dots on the scene, and calculating their distortion on the projected surface. The Kinect has 1 RGB camera, 1 infrared camera, one infrared emitter, and a microphone array.

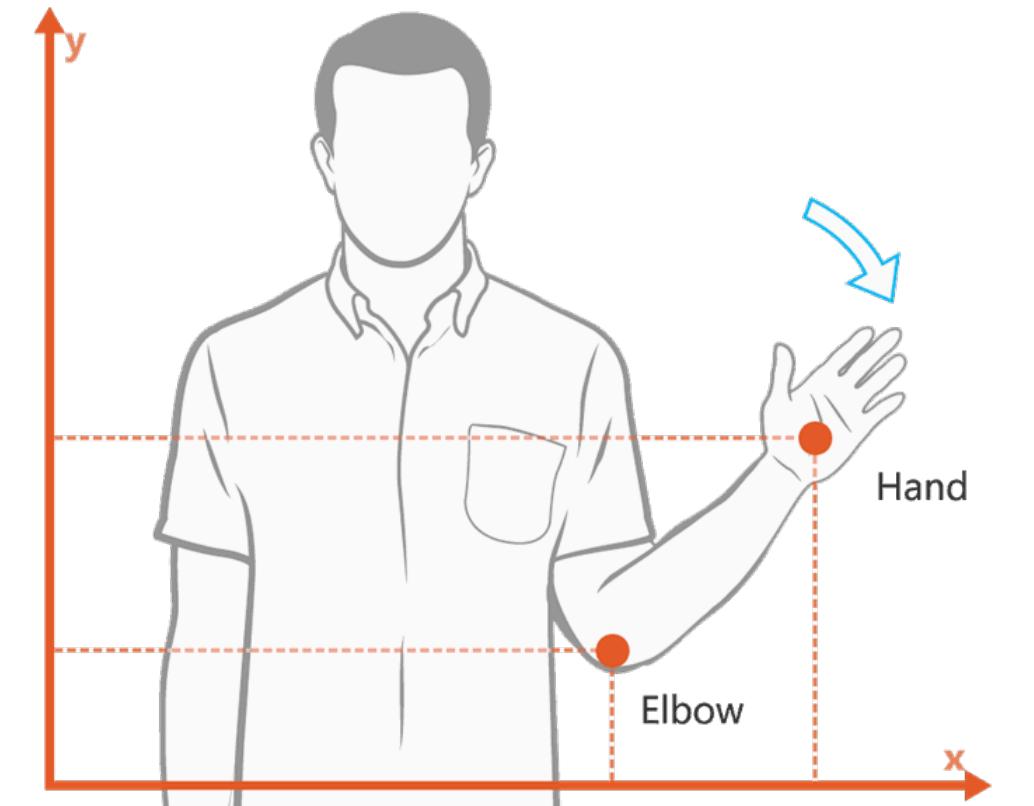
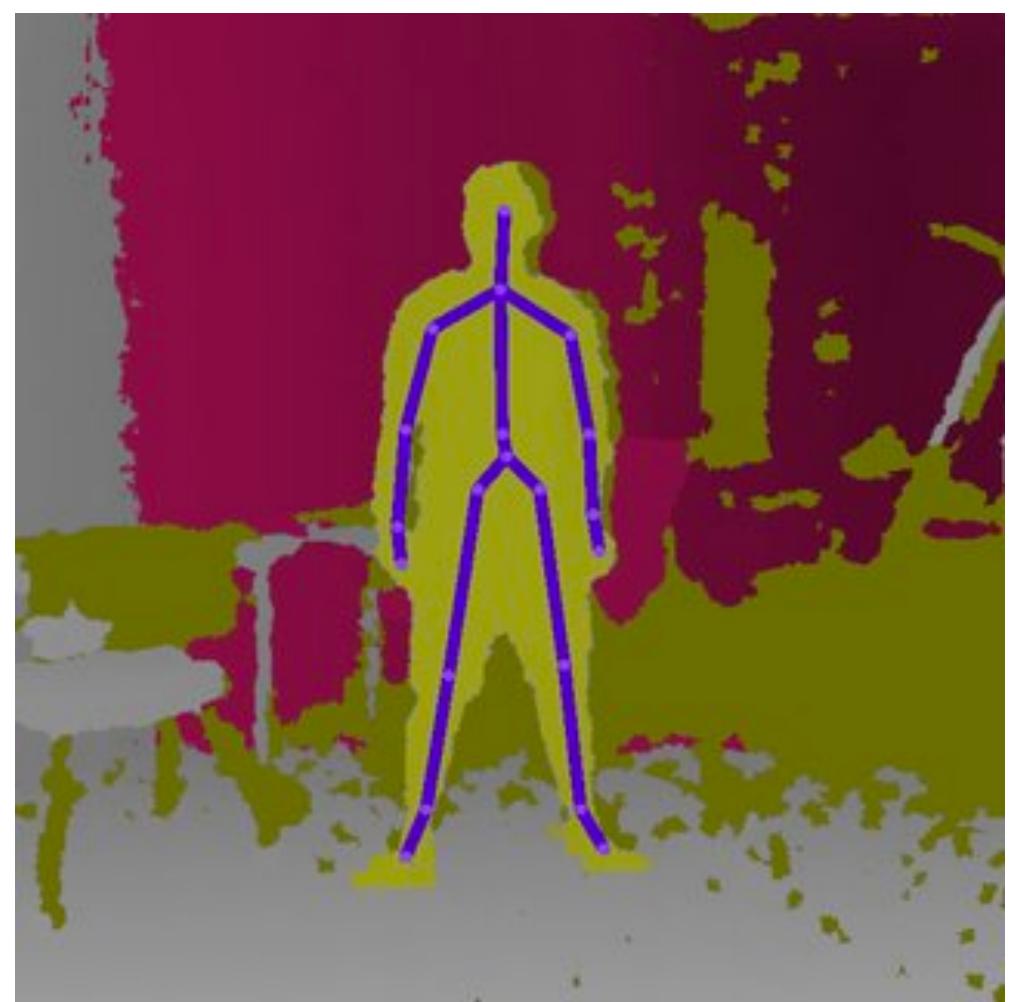


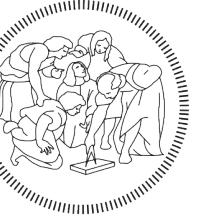
Features:

Depth map, it's possible to detect the depth of a scene in order to visualise silhouettes at a given distance.

Skeleton feature, is available for up to six users depending on the Kinect version.

Hands and Gestures recognition.





Kinect to Syphon

```
// open the folder of examples
```

```
KINECT_SYPHON_2020
```

here you can find

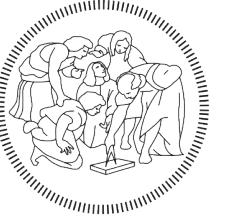
Kinect depth feed to Syphon

to understand how to use the Kinect Depth Map feature and how to output it through a video sharing framework, in our case Syphon, and use it in a media server or mapping software (MadMapper, Resolume Arena).

tips:

try and change the minimum and maximum tilt and threshold values; these are very useful in the calibration process.





POLITECNICO
MILANO 1863

Thank You

for any help

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