

Interactivity in Computer Science

**EPIC Workshop
July 2018**

👋 **Hi** 👋

I'm Carol



Carol Willing

Research Software Engineer, Cal Poly SLO

Project Jupyter, Steering Council

Python Software Foundation Fellow

Python Core Developer

Open Source Hardware and Software

Every day, I am a beginner at something.

Learn. Build. Share.



Why Computer Science?

Help people

Why Interactive?

- Creative
- Expressive
- Fun



HOW DO WE TALK TO
COMPUTERS?

My Goals for this workshop

- Hands-on
- Explore JavaScript and Python
- Inspire to do more
- Share

What do we need today?

- Computer (or Smartphone or Tablet)
- Browser (Chrome)
- Web
- You



Schedule



Time

1:10 pm

1:20 pm

1:30 pm

1:45pm

2:30 pm

2:45 pm

Project

People

Careers

Design at Google

JavaScript: p5.js

Python: Jupyter and mybinder.org

Next steps

Project 1



People & Teams



who uses computer science?

Teammates Padmini Pyapali, Jesus Medrano, Paulina Gómez and I launched Uber Eats Android in Toronto. They were the first to order smoothies ordered from Paulina's favorite juice bar using their app.

Task

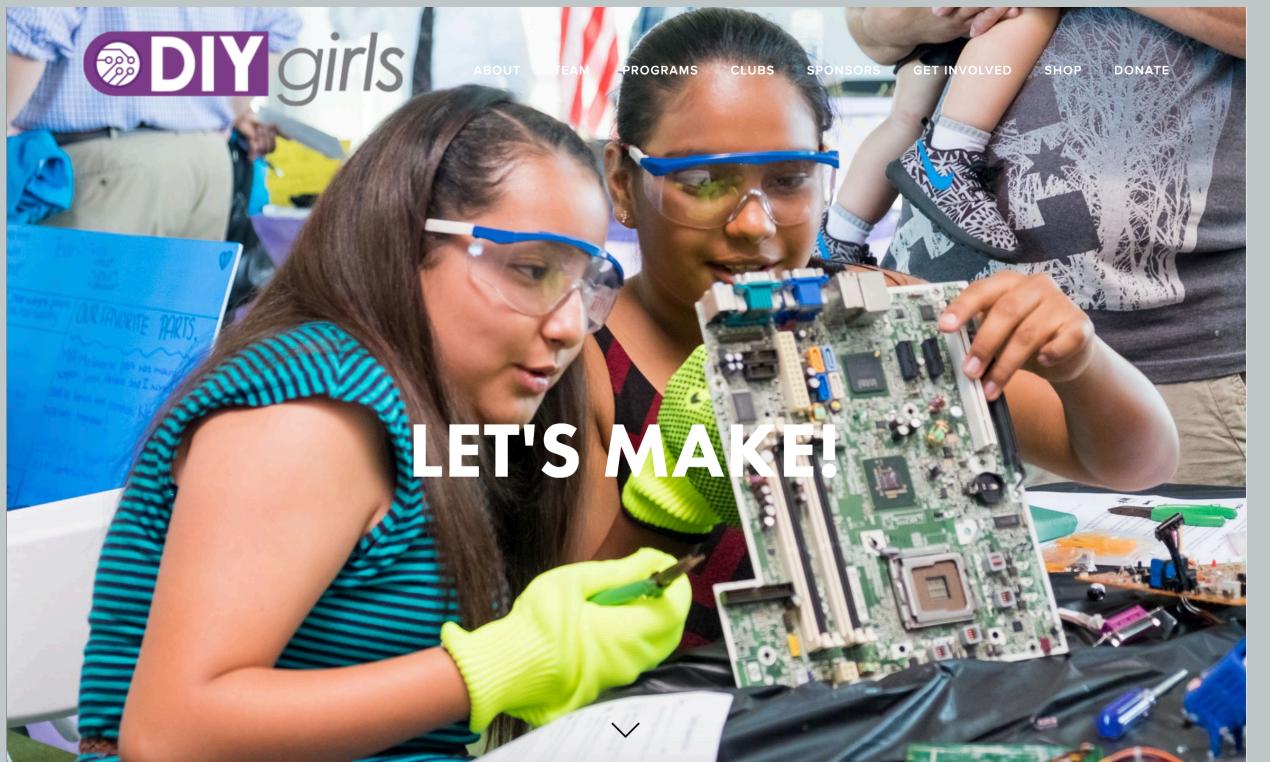
Choose someone who you would:

- want on your team
- like to meet
- like to ask a question

Luz Rivas

**California 39th District,
Assembly**

DIY Girls, Founder



Jesus Medrano

Uber Eats, Software Engineer



From left to right: Teammates Padmini Pyapali, Jesus Medrano, Paulina Ramos, and Hilary Karls first launched Uber Eats Android in Toronto. They celebrated their launch by drinking smoothies ordered from Paulina's favorite juice spot through their app.

Omoju Miller

GitHub, Data Scientist



About Omoju

"On learning AI: The myth of innate ability in tech."

Limor Fried Ladyada

Adafruit, Founder
and CEO
Electrical Engineer



Ana Ruvalcaba

Project Jupyter,
Operations
Manager



Bryan Liles

Heptio, Engineer

Cognitive Bias Talk

GitHub - Bryan Liles



Overview Repositories 179 Stars 147 Followers 298 Following 7

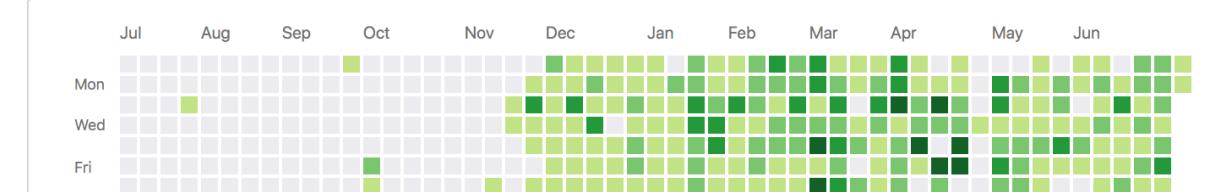
Popular repositories

doit This tool have moved: https://github.com/digitalocean/doctl Go ★ 59 7	zshkit Forked from bkerley/zshkit My way-overdone zsh config scripts ★ 37 9
ha-minio Python ★ 33 3	simple-daemon SimpleDaemon is a lightweight daemon module for Ruby. Use it to add daemon functionality to your Ruby script. Ruby ★ 25 7
FakeCamera A fake camera for the Android Emulator Java ★ 21 7	vimconfig Vim script ★ 15 3

Organizations



1,355 contributions in the last year



Less More

Learn how we count contributions.

You



Project 1

People & teams

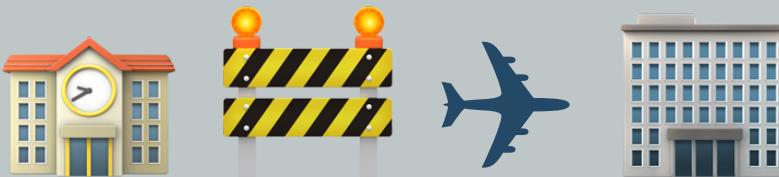
- Teamwork is important
- Find a role model
- Ask questions

😊 **Completed** 😊

Project 2

Computer Science

Careers



Project

WE HAVE ONLY 1 EARTH.
SAVE **Coding**
is one of many CS careers.

If you like ... Organizing, Planning Events

- Community Manager
- Operations Manager
- Project Manager
- Business Owner



If you like ...

Art

- Designer
- Computer Human Interaction Engineer
- Animator
- Web developer

If you like ...

Math

- Data Scientist
- Research Engineer



If you like ...

Writing

- Product Manager
- Documentarian
- Game Developer
- Web Content Engineer

If you like ...

Music

- Sound Engineer
- Special effects
- Computer Generated Musician

Task

What interests you?

Explore coding and the many other Computer Science careers.

Lifelong learning is important in Computer Science.



Project 2

Computer Science careers

- Find your interests
- Learn which career you may like
- Understand many careers in CS beyond coding

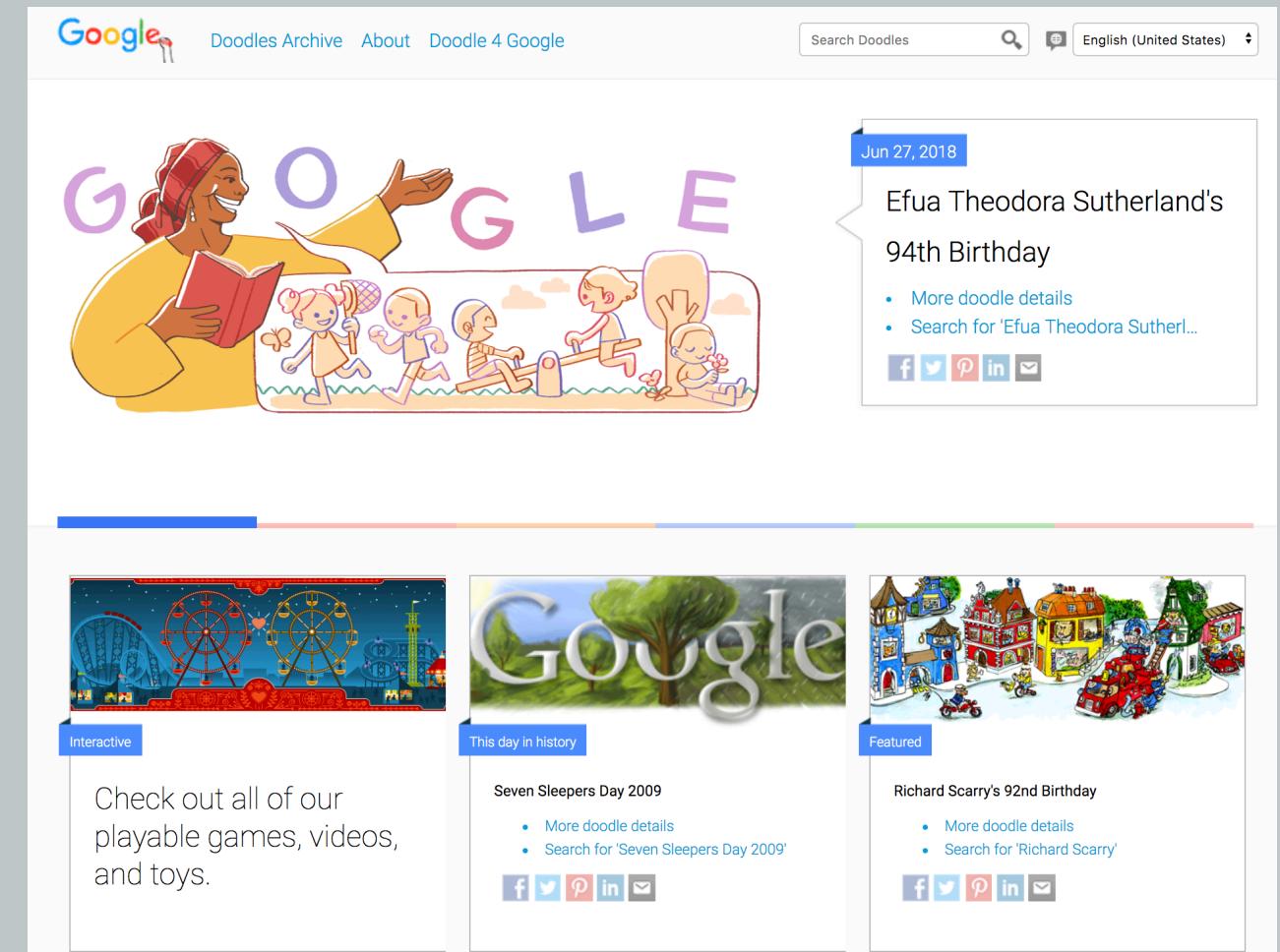
😊 **Completed** 😊

Project 3

Design at Google



Google Doodles



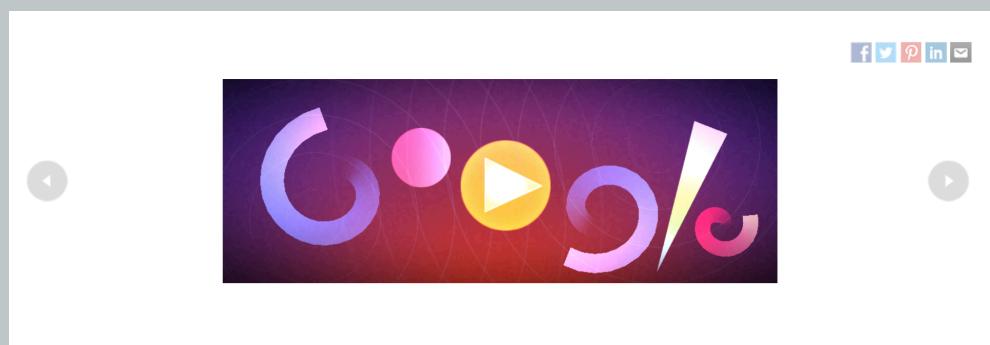
See the [Google Doodles](#) page.

Step 1: Try the Doodles

Fischinger doodle

Hip Hop

Snake Game



A screenshot of a Google search results page for "snake game". The main feature is a "Play Snake" button with a blue snake and a red apple on a green checkered field. Below it, there's a snippet from Coolmath-Games.com with instructions. To the right, there's a sidebar with links to "Super Snake HD", "Snake", and "JavaScript Snake Game". Further down, there are sections for "People also search for" with icons for Slither.io, Pac-Man, Breakout, Tetris, and Agar.io.

Step 2: Design/UX Review

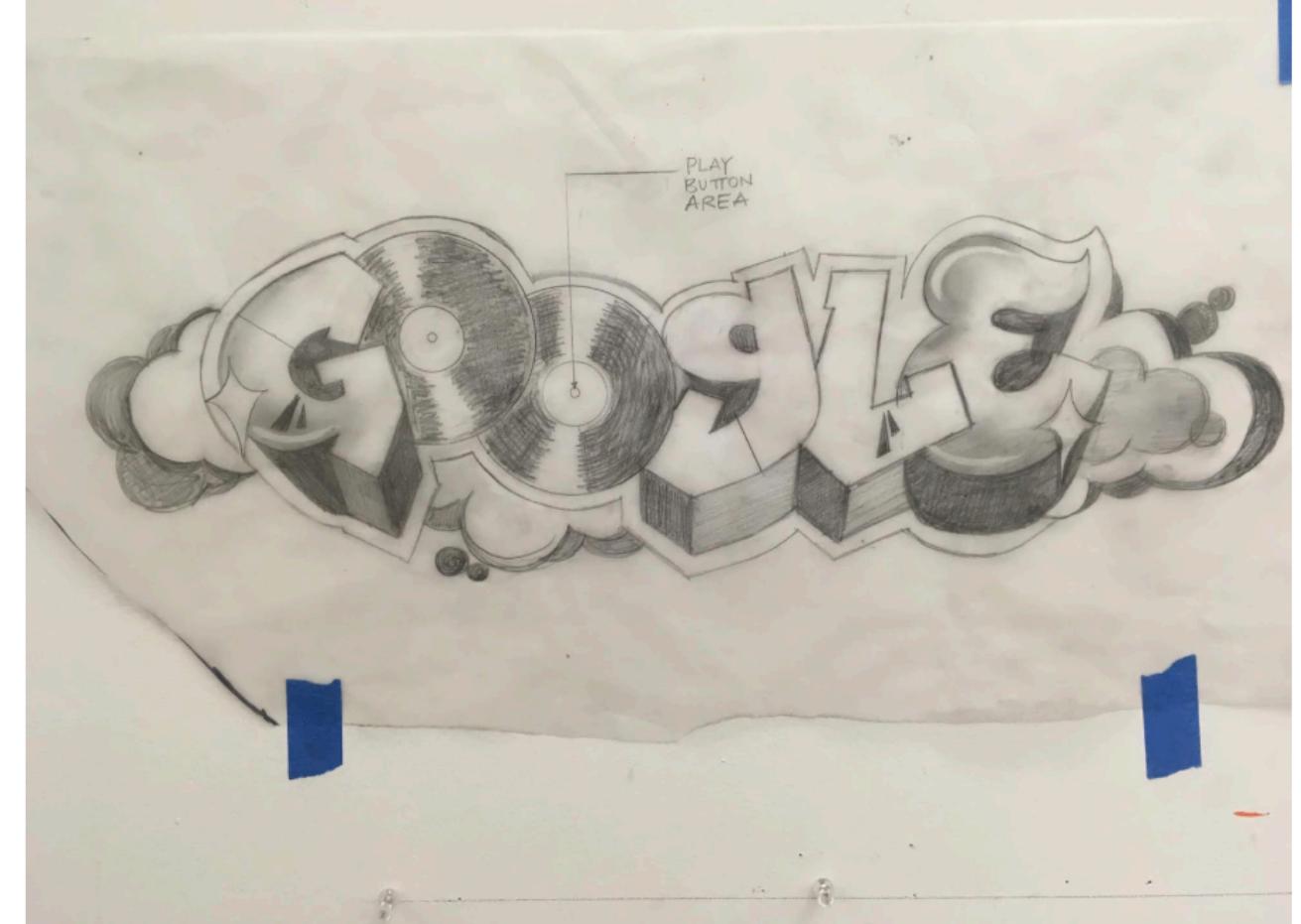
Choose a Google Doodle.

- What things were *interactive*?
- How did it *start*?
- How did it *end*?
- What do you *like* best?
- What would you *change*?

 **UX** = User Experience 

Step 3: Sketch a new doodle

- Sketch
- What would be interactive?
- Theme/Subject of doodle
- Share with someone



Early logo design sketch by Cey Adams



Extra: Developer tools

Inspect doodle web page with Chrome Developer tools.

- View → Developer → View source
- View → Developer → JavaScript Console
- View → Developer → Developer tools

Google Web documentation

 JavaScript documentation from Mozilla 

Project 3

Design at Google

Skills used:

- Product research
- User Interface and UX
- Computer Human Interactions

 **Completed** 

Project 4

Get started with JavaScript

p5.js

[Download](#) * [Start](#) * [Reference](#) * [Libraries](#) * [Learn](#) * [Community](#)

Hello! p5.js is a JavaScript library that starts with the original goal of Processing, to make computer accessible for artists, designers, educators, and beginners, and reinterprets this for today's web.



Using the original metaphor of a software sketchbook, p5.js has a full set of drawing tools. However, you're not limited to just a canvas; you can think of your whole browser page as your sketch! For this, p5.js has addon **libraries** that make it easy to interact with other HTML5 objects, including text, input, video, webcam, and sound.

p5.js is a new interpretation, not an emulation or port, and it is in active development. An official editing environment is coming soon, as well as many more features!

Learn about p5.js

<https://hello.p5js.org/>

Explore

Reference | Referencia



The screenshot shows the p5.js website interface. At the top right, there are language selection buttons for "EN" (English) and "ES" (Spanish). The main header features a large red asterisk icon followed by the text "p5.js" and the tagline "la intuición de Processing x el poder de JavaScript". Below the header, a navigation menu includes links for "Inicio" (Home), "Descargar" (Download), "Empezar" (Get Started), "Referencia" (Reference), "Bibliotecas" (Libraries), "Aprender" (Learn), "Ejemplos" (Examples), "Libros" (Books), and "Comunidad" (Community). To the right of the menu is a search bar with the placeholder "Busca en la API" (Search the API). A note below the search bar says, "¿No encuentras lo que buscas? Quizás debas revisar en [p5.dom](#) o [p5.sound](#). Puedes descargar una versión de la referencia [aquí](#)". Further down, there are category links for "Color", "Data", "Image", "Shape", "Constants", "Environment", "Lights, Camera", "Structure", "Conversion", "Events", "Math", "Transform", "DOM", "IO", "Rendering", and "Typography". At the bottom left of the page, there are links for "Foro" (Forum) and "GitHub".

Try the editor

<https://alpha.editor.p5js.org/>

 Auto-refresh Secret low 

> sketch.js •

Preview

```
1 function setup() {  
2   createCanvas(400, 400);  
3 }  
4  
5 function draw() {  
6   background(220);  
7 }
```

Console

Clear

New

Save

⌘+s

Secret low ⚡

Examples

sketch.js



Preview

```
1< function setup() {  
2   createCanvas(400, 400);  
3 }  
4  
5< function draw() {  
6   background(220);  
7 }
```

Console

Clear ▾



Auto-refr



> sketch.js

```
1  /*  
2   * @name Wavemaker  
3   * @description T  
4   * from particles  
5   * Contributed by  
6   */  
7  
8   let t = 0; // time  
9  
10  function setup() {  
11    createCanvas(600,  
12      noStroke();  
13      fill(40, 200, 40);  
14  }  
15  
16  function draw() {  
17    background(10,  
18  
19      // make a x and  
20      for (let x = 0;  
21      for (let y = 0;  
22        // starting  
23        let xAngle =  
24        let yAngle =  
25        // and also
```

Console

Open a Sketch

INTERACTION.TEACH.Z

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM



Interaction : reach1

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM

Interaction : Wavemaker

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM

Interaction : snake

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM

Interaction : Follow3

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM

Interaction : Follow2

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM

Interaction : Follow1

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM

Interaction : Tickle

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM

Sketch Editor Help Sketch Editor Help Sketch Editor Help

May 2, 2018 1:02 PM

May 2, 2018 1:02 PM

Interact

- Move mouse over image
- Change | Run | Change | Run

Project 4

Get started with JavaScript

- Use a new language
- Help with Reference
- Try the editor
- Run an example

 Completed

Project 5

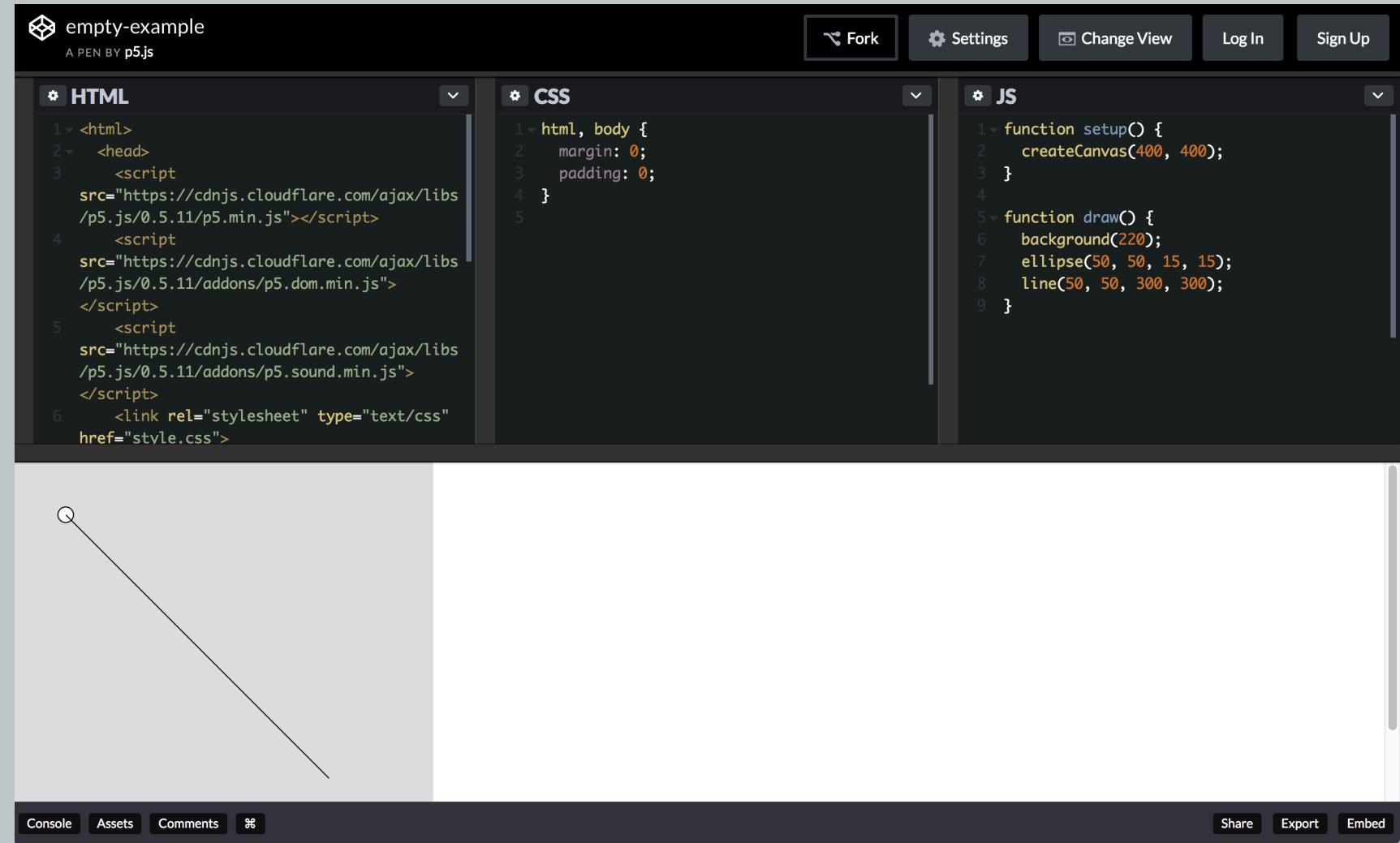
Drawing

Modern websites

In general:

- HTML → Structure
- CSS → Style
- JavaScript (.js) → interactivity

 [codepen.io](#) to test code 



The screenshot shows a CodePen interface with the title "empty-example" by p5.js. The interface is divided into three main sections: HTML, CSS, and JS.

- HTML:**

```
1 <html>
2 <head>
3   <script
4     src="https://cdnjs.cloudflare.com/ajax/libs/
5       p5.js/0.5.11/p5.min.js"></script>
6   <script
7     src="https://cdnjs.cloudflare.com/ajax/libs/
8       p5.js/0.5.11/addons/p5.dom.min.js">
9   <script
10    src="https://cdnjs.cloudflare.com/ajax/libs/
11      p5.js/0.5.11/addons/p5.sound.min.js">
12    <link rel="stylesheet" type="text/css"
13      href="style.css">
```
- CSS:**

```
1 html, body {
2   margin: 0;
3   padding: 0;
4 }
```
- JS:**

```
1 function setup() {
2   createCanvas(400, 400);
3 }
4
5 function draw() {
6   background(220);
7   ellipse(50, 50, 15, 15);
8   line(50, 50, 300, 300);
9 }
```

The preview window below shows a simple sketch with a single black line drawn from the top-left corner to the bottom-right corner of the canvas.

sketch.js is a JavaScript file

sketch.js

```
function setup() {  
    // put setup code here  
}  
  
function draw() {  
    // put drawing code here  
}
```

index.html

```
<!DOCTYPE html>

<html>

<head>

<meta charset="utf-8">

<meta name="viewport" width=device-width, initial-scale=1.0, maximum-scale=1.0, user-scalable=0>

<style> body {padding: 0; margin: 0;} </style>

<script src="../p5.min.js"></script>

<script src="../addons/p5.dom.min.js"></script>

<script src="../addons/p5.sound.min.js"></script>

<script src="sketch.js"></script>

</head>

<body>

</body>

</html>
```

Canvas

The canvas coordinates are different than in math class.

- top left $(0, 0)$
- bottom right $(\text{width}-1, \text{height}-1)$

```
createCanvas(300, 100); // Canvas width is 300 pixels, height is 100 pixels
```

For example:

- top left $(0, 0)$
- bottom right $(299, 99)$

Draw an ellipse and circle

```
ellipse(centerPixelsFromLeft, centerPixelsFromTop, width, height);
```

Example

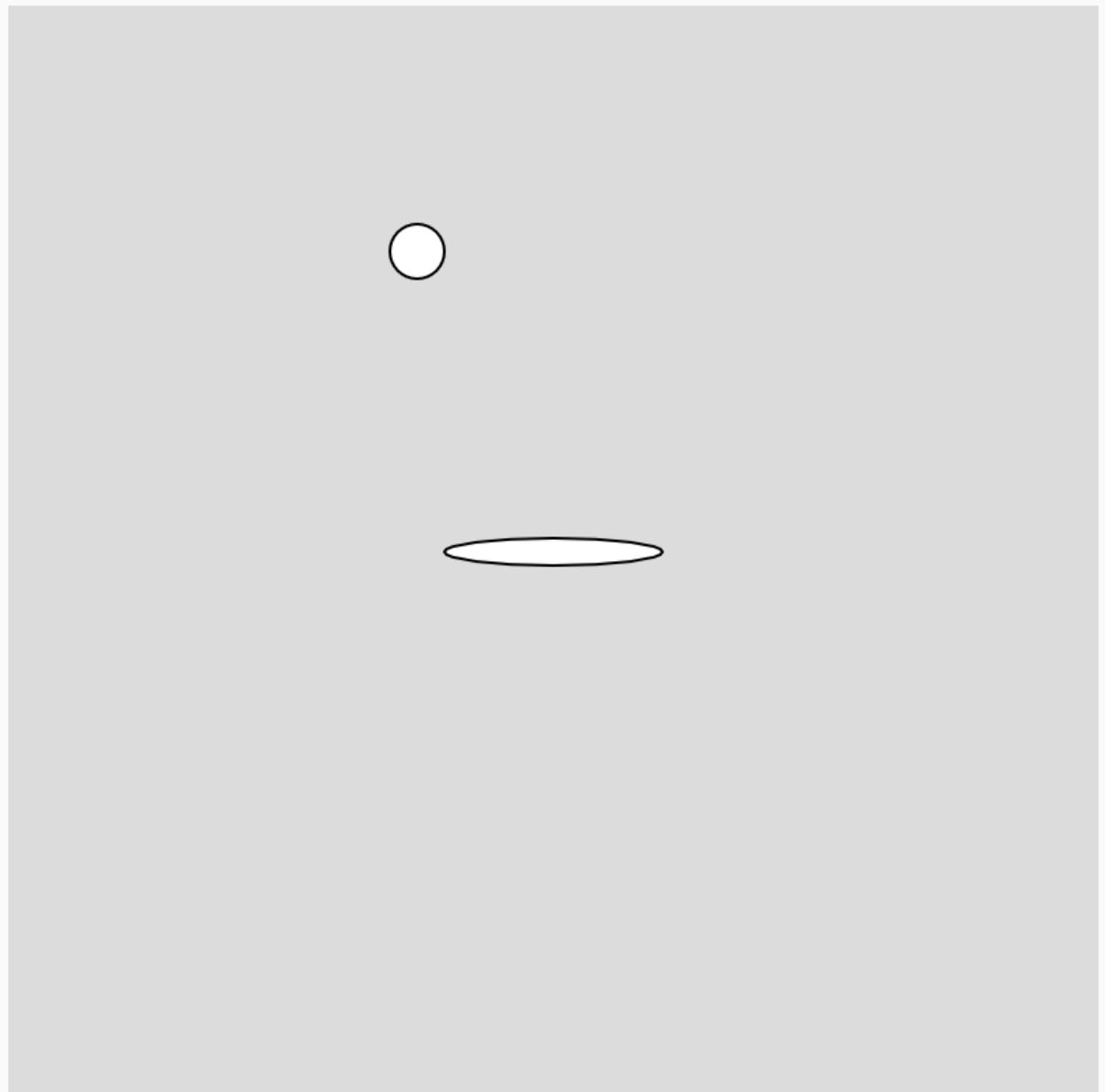
```
function setup() {  
  createCanvas(400, 400);  
  
}  
  
function draw() {  
  
  ellipse(150, 90, 20, 20); // Draw a circle (width=height)  
  
  ellipse(200, 200, 80, 10); // Draw an ellipse  
  
}
```

 Auto-refresh Wiry nut 

sketch.js •

```
1 function setup() {  
2   createCanvas(400, 400);  
3 }  
4  
5 function draw() {  
6   background(220);  
7   ellipse(150, 90, 20, 20); // Draw a circle (width=height)  
8   ellipse(200, 200, 80, 10); // Draw an ellipse  
9 }
```

Preview



Draw more shapes

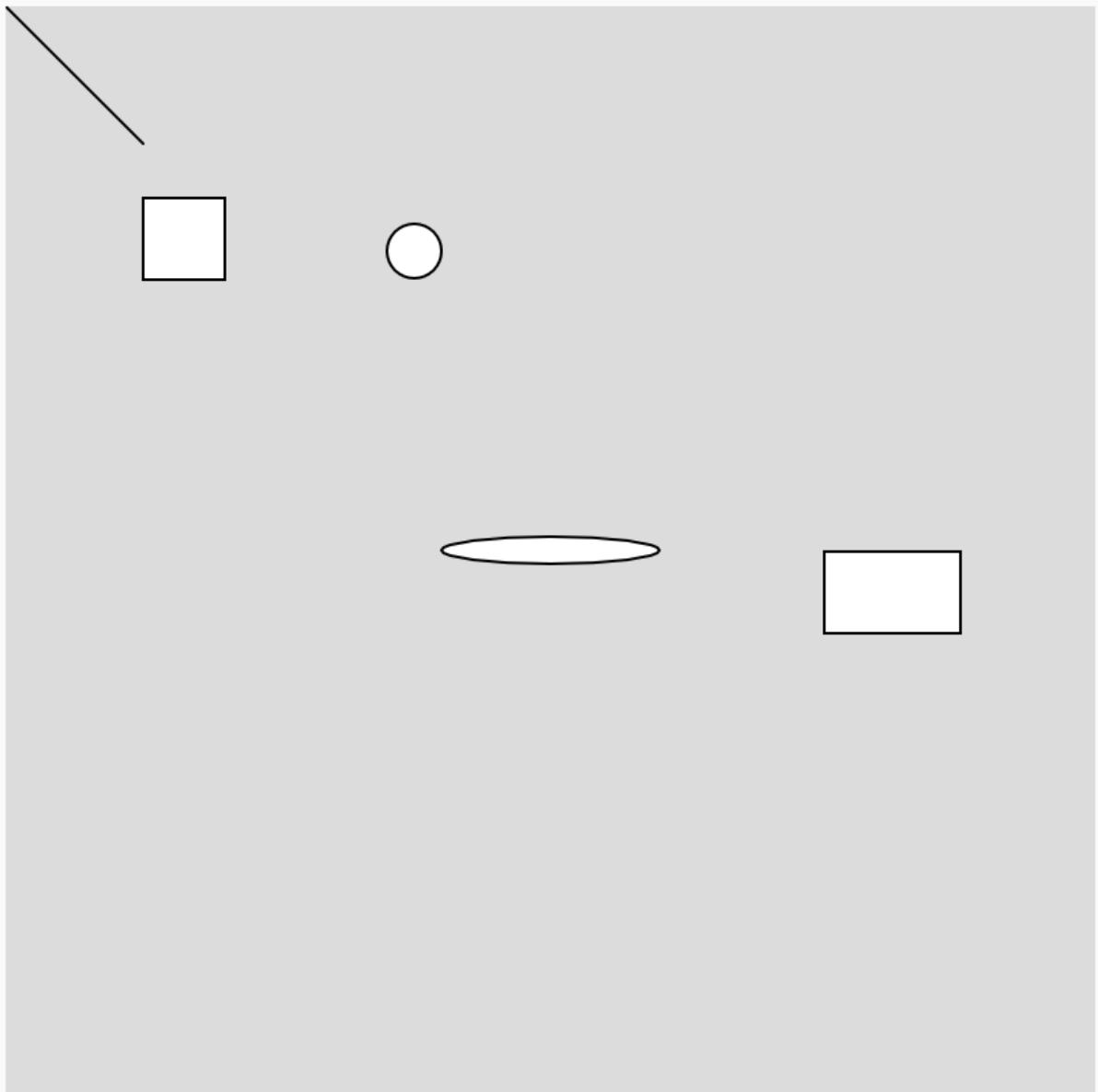
```
function setup() {  
  createCanvas(400, 400);  
}  
  
function draw() {  
  ellipse(150, 90, 20, 20); // Draw a circle (width=height)  
  ellipse(200, 200, 80, 10); // Draw an ellipse  
  line(0, 0, 50, 50);  
  rectangle(300, 200, 50, 30);  
  rectangle(50, 70, 30, 30);  
}
```

 Auto-refresh Wiry nut 

sketch.js •

```
1 function setup() {
2   createCanvas(400, 400);
3 }
4
5 function draw() {
6   background(220);
7   ellipse(150, 90, 20, 20); // Draw a circle (width=height)
8   ellipse(200, 200, 80, 10); // Draw an ellipse
9   line(0, 0, 50, 50);
10  rect(300, 200, 50, 30);
11  rect(50, 70, 30, 30);
12 }
```

Preview



Explore

- Change values
- Add a shape
- Run examples

Project 5

Drawing

- Learn about HTML, CSS, JS files
- Understand canvas
- Code a shape
- Code multiple shapes



Project 6

Interactivity

Interactivity 1

Color

Red (r)

Green (g)

Blue (b)

A color is a mix of red, green, blue.

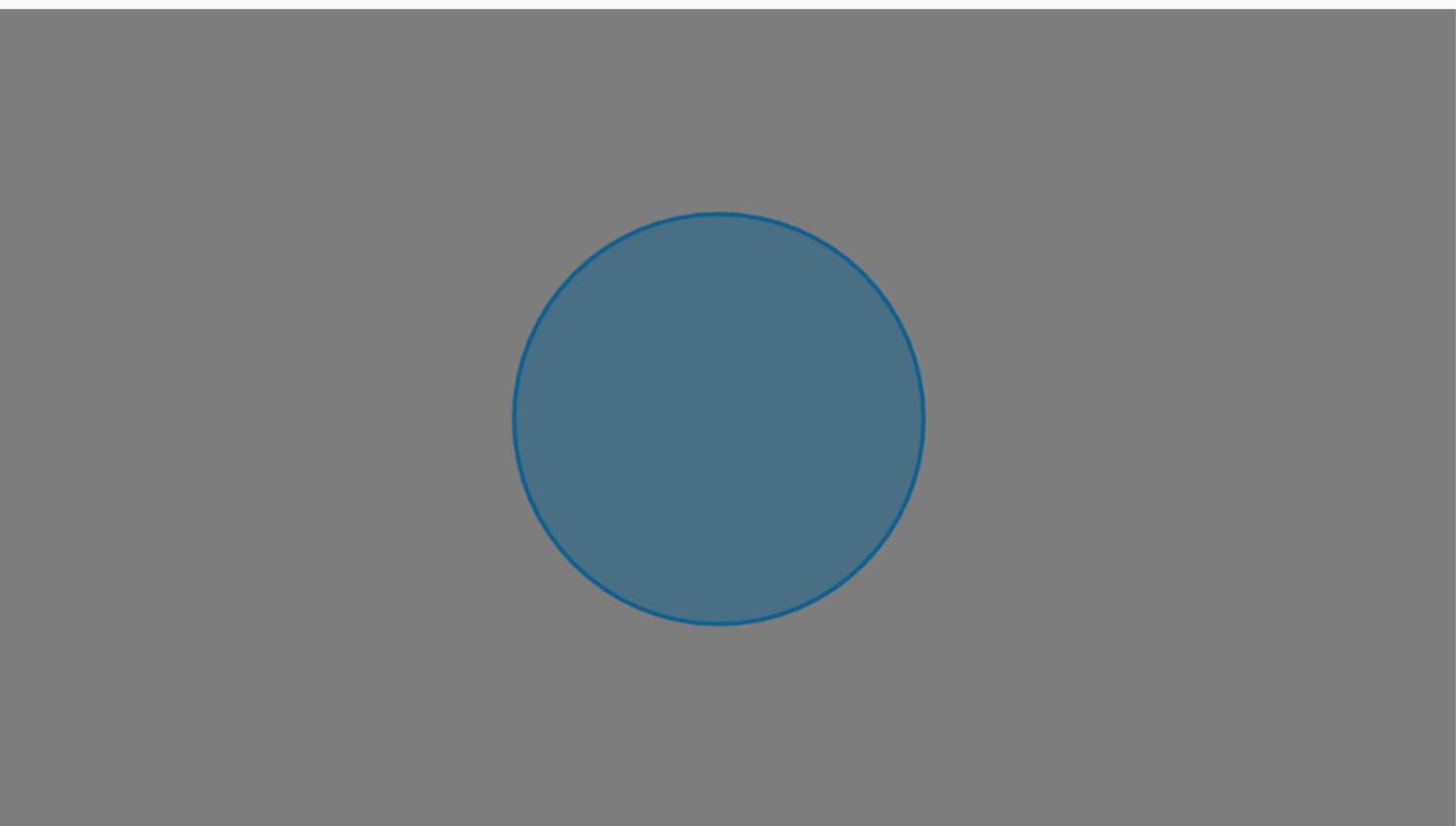
Color value: 0 to 255

 Auto-refresh Hello P5: interactivity by p5

> sketch.js

```
5  * <p><em><span class="small"> To run this example locally, you will need the
6  * <a href="http://p5js.org/reference/#/libraries/p5.dom">p5.dom library</a>.
7  * </em></p>
8  */
9
10 // for red, green, and blue color values
11 var r, g, b;
12
13 function setup() {
14   createCanvas(720, 400);
15   // Pick colors randomly
16   r = random(255);
17   g = random(255);
18   b = random(255);
19 }
20
21 function draw() {
22   background(127);
23   // Draw a circle
24   strokeWeight(2);
25   stroke(r, g, b);
26   fill(r, g, b, 127);
27   ellipse(360, 200, 200, 200);
28 }
29
30 // When the user clicks the mouse
31 function mousePressed() {
32   // Check if mouse is inside the circle
33   var d = dist(mouseX, mouseY, 360, 200);
34   if (d < 100) {
35     // Pick new random color values
36     r = random(255);
37     g = random(255);
38     b = random(255);
39   }
40 }
41 }
```

Preview



Interactivity 2

Sliders and Widgets

 Auto-refresh

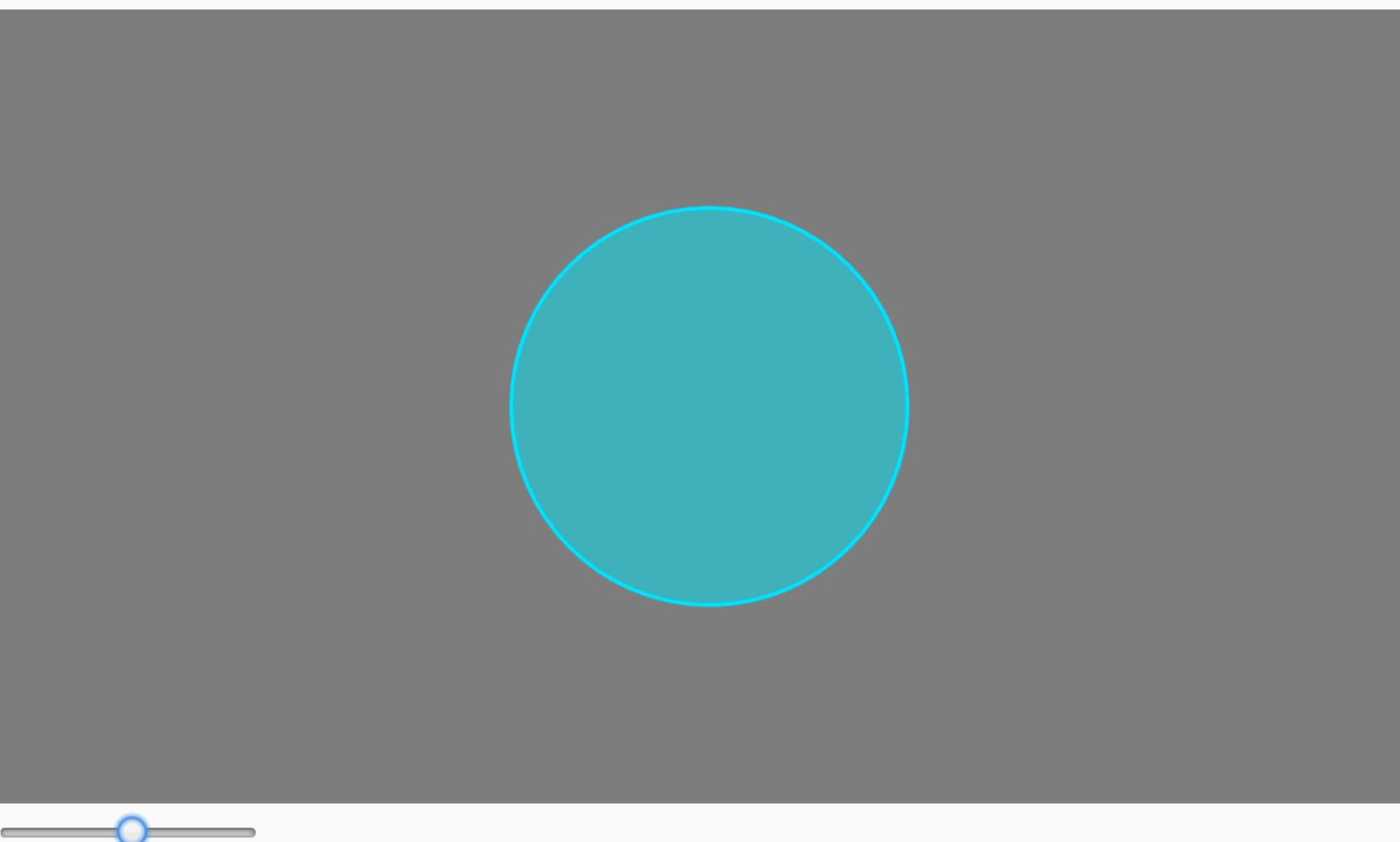
Hello P5 : interactivity by p5



> sketch.js

```
1  /*
2   * @name Interactivity 2
3   * @frame 720,425
4   * @description The circle changes color when you move the slider.
5   * You will need to include the
6   * <a href="http://p5js.org/reference/#/libraries/p5.dom">p5.dom library</a>
7   * for this example to work in your own project.
8   */
9
10 // A HTML range slider
11 var slider;
12
13 function setup() {
14   createCanvas(720, 400);
15   // hue, saturation, and brightness
16   colorMode(HSB, 255);
17   // slider has a range between 0 and 255 with a starting value of 127
18   slider = createSlider(0, 255, 127);
19 }
20
21 function draw() {
22   background(127);
23   strokeWeight(2);
24
25   // Set the hue according to the slider
26   stroke(slider.value(), 255, 255);
27   fill(slider.value(), 255, 255, 127);
28   ellipse(360, 200, 200, 200);
29 }
```

Preview



Project 6

Interactivity

- Use widgets
- Control using mouse clicks

 **Completed** 

Project 7

Python, Jupyter, & Binder

Python

<https://python.org>

Press the yellow button.

The screenshot shows the Python Software Foundation website at https://www.python.org. The page features a dark blue header with the Python logo and navigation links for Python, PSF, Docs, PyPI, Jobs, and Community. Below the header is a search bar and a "Socialize" button. A central content area displays a Python code snippet for generating a Fibonacci series up to n=1000, with the last two numbers (987 and 610) highlighted in yellow. To the right of the code is a section titled "Functions Defined" with a brief description of Python's function definition capabilities. At the bottom of the page, a call-to-action states: "Python is a programming language that lets you work quickly and integrate systems more effectively. [» Learn More](#)".

The screenshot shows the Python Software Foundation website at <https://www.python.org>. The page features a dark blue header with navigation links for Python, PSF, Docs, PyPI, Jobs, and Community. Below the header is a large Python logo. A search bar with a magnifying glass icon and a "GO" button is positioned next to it. To the right of the search bar is a "Socialize" button. A horizontal menu bar below the header includes links for About, Downloads, Documentation, Community, Success Stories, News, and Events. The main content area contains a black terminal window displaying a Python session:

```
Python 3.6.0 (default, Jan 13 2017, 00:00:00)
[GCC 4.8.4] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>> print('Python is a calculator')
Python is a calculator
>>> 500 * 12345
6172500
>>> 
```

Below the terminal window, a small white text box reads "Online console from [PythonAnywhere](#)". The bottom section of the page has a teal background with the text "Python is a programming language that lets you work quickly and integrate systems more effectively. [» Learn More](#)".

Use Python as an interactive calculator.

Jupyter and Binder

<https://jupyter.org>

<https://try.jupyter.org>

<https://mybinder.org>

The screenshot shows the official Jupyter website at <https://jupyter.org>. The main content area displays the Jupyter Notebook interface with a Lorenz Differential Equations example. It includes code cells, parameter sliders, and a 3D plot of the Lorenz attractor. Below the interface, there's a brief description of the Jupyter Notebook's capabilities. At the bottom, there are two orange buttons: "Try it in your browser" and "Install the Notebook".

The Jupyter Notebook

The Jupyter Notebook is an open-source web application that allows you to create and share documents that contain live code, equations, visualizations and narrative text. Uses include: data cleaning and transformation, numerical simulation, statistical modeling, data visualization, machine learning, and much more.

Try it in your browser Install the Notebook

</> Language of choice Share notebooks Interactive output Spark Big data integration



Install About Us Community Documentation NBViewer Widgets Blog

Try Jupyter

You can try Jupyter out right now, without installing anything. Select an example below and you will get a temporary Jupyter server just for you, running on mybinder.org. If you like it, you can [install Jupyter](#) yourself.

Try Jupyter with Python



A tutorial introducing basic features of Jupyter notebooks and the IPython kernel.

Try JupyterLab



JupyterLab is the new interface for Jupyter notebooks and is ready for testing. Give it a try!

Try Jupyter with Julia



A basic example of using Jupyter with Julia.

Try Jupyter with R



A basic example of using Jupyter with R.

Try Jupyter with C++



A basic example of using Jupyter with C++.

<https://try.jupyter.org>

Project 7

Python, Jupyter, & Binder

- Interactivity in the Real World
- Python programming language
- Project Jupyter - interactive notebooks
- Binder - sharing notebooks



what's next?

Try new applications

AI and Machine Learning Examples

AI Duet

Sound-Maker

Tutorials

<https://hello.p5js.org/>

<https://hello.processing.org>

<https://learn.adafruit.com>

School classes

- College ready curriculum
- Ask questions
- Remember, you can 😊

Great job!

🎉 Your accomplishments 🎉

Number	Project
1	People
2	Careers
3	Design at Google
Javascript: p5.js	
4	Getting started
5	Draw
6	Interactivity
7	Python: Jupyter and mybinder.org
8	Next steps

Thank you

willingc AT gmail DOT com

Attributions

Photos:

Videos: