# Motion

## **Review**

#### **Linear motion:**

Position = position + speed // speed is a constant value

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + speedX;**  **circle(x, height / 2, 50);**  **}** |  |

But it doesn’t need to be!

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **circle(x, height / 2, 50);**  **console.log(frameCount);**  **}** |  |

We can use this variable to move things:

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = frameCount;**  **circle(x, height / 2, 50);**  **console.log(frameCount);**  **}** |  |

But we can also use this variable to accelerate things (you can create your own acceleration variable too)

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + frameCount;**  **circle(x, height / 2, 50);**  **console.log(frameCount);**  **}** |  |

It’s super fast, so let’s reduce it:

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + frameCount\*0.1;**  **circle(x, height / 2, 50);**  **console.log(frameCount);**  **}** |  |

## Oscillation and Angular Motion

Inspiration

Memo Akten

Alexander Chen

## **Angles:**

Radians and Degrees

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(500,500);**  **}**  **function draw() {**  **//convert degrees to radians**  **console.log(sin(PI/2));**  **//console.log(sin(radians(90)));**    **// angleMode(DEGREES);**  **// console.log(sin(90));**  **}** |  |

## **Oscillation:**

**Example1:** Position = position + speed //speed is not constant, it is a sin value

Let’s start by converting frameCount to radians

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + sin(radians(frameCount));**  **circle(x, height / 2, 50);**  **}** |  |

What if we don’t convert it?

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + sin(frameCount);**  **circle(x, height / 2, 50);**  **}** |  |

Let’s increase the amplitude

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + 10\*sin(frameCount);**  **circle(x, height / 2, 50);**  **}** |  |

Let’s decrease the angle

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + 10\*sin(frameCount\*0.1);**  **circle(x, height / 2, 50);**  **}** |  |

Now with what you know so far, try to move it this way:

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400,400);**  **x = width/2;**  **y = -25;**  **}**  **function draw() {**  **background(0);**  **x = x + 10\*cos(frameCount\*0.1);**  **circle(x, y, 50);**  **y = y+3;**  **// Put it back!**  **if(y > height+25){**  **y = -25;**  **}**  **}** |  |

#### 

**Example 2:** position = startingPos (constant) + speed //speed is not constant, it is a sin value

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **x = width/2 + 10\*sin(frameCount\*0.1);**  **circle(x, y, 50);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **}** |  |

Kind of the same result but we can now control better the amplitude

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **x = width/2 + 100\*sin(frameCount\*0.1);**  **circle(x, y, 50);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **}** |  |

And the frequency by multiplying the variation of the angle (frameCount)

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **x = width/2 + 100\*sin(frameCount\*0.05);**  **circle(x, y, 50);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **}** |  |

100 is the amplitude and the angle is the frequency of the movement

The function SIN always moves in a range between -1 and 1, so if the Amplitude is 100 the ball will move from -100 to 100 from the starting position. But what if we want to move it in a different range?  
  
We can use the function **map** to make it easier (slide23)

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **x = width/2 + 100\*sin(frameCount\*0.05);**  **fill(255);**  **circle(x, y, 50);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **let x2 = map(sin(frameCount\*0.1),-1,1,0,400);**  **fill(255,0,255);**  **circle(x2, y, 50);**  **}** |  |

When is this useful too? When we need to translate a range of values into another one.  
For example we want to change the background color according to the mouse position  
Mouse position range of values: 0 to width

Color range of values: 0 to 255

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **x = width/2 + 100\*sin(frameCount\*0.05);**  **fill(255);**  **circle(x, y, 50);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **let x2 = map(sin(frameCount\*0.1),-1,1,0,400);**  **let c = map(sin(frameCount\*0.1), -1, 1, 0, 255);**  **fill(c, 0, 255);**  **circle(x2, y, 50);**  **}** |  |

A bit more fun with HSB colors ( hue(like the tone), saturation, brightness) <https://p5js.org/reference/#/p5/HSB>

CHECK THE EXTRA SLIDES ABOUT COLORS!

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **colorMode(HSB, 100);**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **x = width/2 + 100\*sin(frameCount\*0.05);**  **fill(100);**  **circle(x, y, 50);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **let x2 = map(sin(frameCount\*0.1),-1,1,0,400);**  **let c = map(sin(frameCount\*0.1), -1, 1, 0, 100);**  **fill(c,100,100);**  **circle(x2, y, 50);**  **}** |  |

**Example 3:** position = startingPos (constant) + speed //speed is not constant, it is a sin value

We can use another variable to change the angle, we don’t need to use frameCount, but we need a variable that is updating, for example y

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **colorMode(HSB, 100);**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **x = width/2 + 100\*sin(y\*0.05);**  **fill(100);**  **circle(x, y, 50);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **}** |  |

Other things you can change with sin speed:

Try to change the size!

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **colorMode(HSB, 100);**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **x = width/2 + 100\*sin(y\*0.05);**  **fill(100);**  **let s = map(sin(y\*0.05), -1,1, 10,100);**  **circle(x, y, s);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **}** |  |

## Noise:

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **colorMode(HSB, 100);**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **let noiseVal = noise(frameCount\*0.02);**  **console.log(noiseVal);**  **x = width/2 + 100\*sin(noiseVal);**  **fill(100);**  **let s = map(sin(y\*0.05), -1,1, 10,100);**  **circle(x, y, s);**  **y = y+3;**  **if(y > height+25){**  **y = -25;**  **}**  **}** |  |

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **colorMode(HSB, 100);**  **createCanvas(400,400);**  **x = width/2;**  **y = 0;**  **}**  **function draw() {**  **background(0);**  **// x = width/2 + 100\*sin(y\*0.05);**  **// fill(100);**  **// let s = map(sin(y\*0.05), -1,1, 10,100);**  **// circle(x, y, s);**  **// y = y+3;**  **// if(y > height+25){**  **// y = -25;**  **// }**  **let noiseVal = noise(frameCount\*0.02);**  **console.log(noiseVal);**  **x = width/2 + 100\*sin(noiseVal);**  **fill(100);**  **let s = map(sin(y\*0.05), -1,1, 10,10);**  **circle(x, y, s);**  **y = y-1;**  **if(y < -25){**  **y = height-25;**  **}**  **}** |  |

#### **Circular motion**

Angle = angle + speed (Position = position + speed)

x = width/2 + cos(angle) \* radDist;

y = height/2 + sin(angle) \* radDist;

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(500, 500);**  **background(255);**  **}**  **function draw() {**  **background(0);**  **x = width / 2 + cos(frameCount\*0.1) \* 100;**  **y = height / 2 + sin(frameCount\*0.1) \* 100;**  **circle(x, y, 50);**  **}** |  |

Spiral motion is the same but the amplitude is variable, can you do that?

|  |  |
| --- | --- |
| **let x, y;**  **let a = 0;**  **function setup() {**  **createCanvas(400, 400);**  **background(255);**  **}**  **function draw() {**  **//background(0);**  **x = width / 2 + cos(frameCount\*0.1) \* a;**  **y = height / 2 + sin(frameCount\*0.1) \* a;**  **circle(x, y, 20);**  **a = a + 0.3;**  **}** |  |

Can you change the color? Can you draw another shape instead? Experiment!

|  |  |
| --- | --- |
| **let x, y;**  **let a = 0;**  **function setup() {**  **colorMode(HSB,100);**  **createCanvas(400, 400);**  **background(0);**  **}**  **function draw() {**  **//background(0);**  **x = width / 2 + cos(frameCount\*0.1) \* a;**  **y = height / 2 + sin(frameCount\*0.1) \* a;**  **let c = map(cos(frameCount\*0.1), -1,1,0,100);**  **stroke(c,50,100);**  **//noStroke();**  **line(width/2,height/2, x, y);**  **a = a + 0.3;**  **}** |  |

## Linear motion:

Position = position + speed // speed is a constant value

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + speedX;**  **circle(x, height / 2, 50);**  **}** |  |

How do you make it bounce?

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + speedX;**  **circle(x, height / 2, 50);**  **//conditionals!**  **if(x > width || x < 0){**  **speedX = -speedX;**  **}**  **}** |  |

How do you make it return as in the gif?

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + speedX;**  **circle(x, height / 2, 50);**  **//conditionals!**  **if(x > width){**  **x = 0;**  **}**  **}** |  |

We can also use a variable to change the speed interactively:

|  |  |
| --- | --- |
| **let x;**  **let y;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(220);**  **circle(x,height/2, 50);**  **x = x + mouseY/20;**  **if(x > width){**  **x = 0;**  **}**  **}** |  |

In these examples the speed is constant, but it doesn’t need to be!

|  |  |
| --- | --- |
| **let x;**  **let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **circle(x, height / 2, 50);**  **console.log(frameCount);**  **}** |  |

We can use this variable to move things:

|  |  |
| --- | --- |
| **let x;**  **//let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = frameCount;**  **circle(x, height / 2, 50);**  **console.log(frameCount);**  **}** |  |

But we can also use this variable to accelerate things (you can create your own acceleration variable too)

|  |  |
| --- | --- |
| **let x;**  **//let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + frameCount;**  **circle(x, height / 2, 50);**  **console.log(frameCount);**  **if(x > width){**  **x = 0;**  **}**  **}** |  |

It’s super fast, so let’s reduce it:

|  |  |
| --- | --- |
| **let x;**  **//let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + frameCount\*0.1;**  **circle(x, height / 2, 50);**  **console.log(frameCount);**  **if(x > width){**  **x = 0;**  **}**  **}** |  |

What type of variable have we been using so far?  
Do you remember another type of variable?  
String, Integer, Float, Boolean

## GENERATIVE ART and RANDOMNESS

**How computational generative art aligns or contrasts with the artworks you've created for Mini Projects 1 and 2.**

**What is your understanding of Generative Art?**

**What does the function random(); do?**

What if we let the computer decide where the ball is going to start moving?

|  |  |
| --- | --- |
| **let x;**  **//let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = random(0, width);**  **console.log(x);**  **}**  **function draw() {**  **background(255);**  **x = x + frameCount\*0.1;**  **circle(x, height / 2, 50);**  **}** |  |

**Let’s try to do it with the y axis:**

|  |  |
| --- | --- |
| **let x;**  **//let speedX = 5;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **}**  **function draw() {**  **background(255);**  **x = x + frameCount\*0.1;**  **circle(x, random(0, height), 50);**  **}** |  |

**We only the computer choose one at the beginning**

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400, 400);**  **x = 0;**  **y = random(0, height);**  **console.log(y);**  **}**  **function draw() {**  **background(255);**  **x = x + frameCount\*0.1;**  **circle(x, y, 50);**  **}** |  |

What if the speed is random?

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400, 400);**  **x = width/2;**  **y = random(0, height);**  **console.log(y);**  **}**  **function draw() {**  **background(255);**  **x = x + random(-frameCount\*0.01,frameCount\*0.01);**  **circle(x, y, 50);**  **}** |  |

Add movement in the Y axis too.

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400, 400);**  **x = width/2;**  **y = random(0, height);**  **console.log(y);**  **}**  **function draw() {**  **background(255,5);//transparency**  **x = x + random(-frameCount\*0.01,frameCount\*0.01);**  **y = y + random(-frameCount\*0.01,frameCount\*0.01);**  **fill(0);**  **circle(x, y, 10);**  **}** |  |

Can you change other variables too? Size, color?

|  |  |
| --- | --- |
| **let x, y;**  **function setup() {**  **createCanvas(400, 400);**  **x = width/2;**  **y = random(0, height);**  **console.log(y);**  **colorMode(HSB,100);**  **background(0);**  **}**  **function draw() {**  **//background(255);**  **x = x + random(-frameCount\*0.01,frameCount\*0.01);**  **y = y + random(-frameCount\*0.01,frameCount\*0.01);**  **stroke(random(100), 50,100);**  **noFill();**  **circle(x, y, random(1,40));**  **}** |  |

**What’s the difference between this movement and movements in nature?**

How would you keep it inside the canvas?

Check the video in the slides: [Coding Challenge #52: Random Walker](https://www.youtube.com/watch?v=l__fEY1xanY)

# Q&A

## How can I make something happen only once and stay on the canvas after pressing the mouse?

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **if(mouseIsPressed == true){**  **circle(width/2, height/2, 100);**  **}**  **}** |  |

Here is when boolean variables are useful!

|  |  |
| --- | --- |
| **let showCircle = false;**  **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **if(mouseIsPressed == true){**  **// == for checking condition**  **showCircle = true;**  **// = for assigning value**  **}**  **if(showCircle == true){**  **circle(width/2, height/2, 100);**  **}**  **}** |  |

If we have another event that makes the boolean variable false again, we can make something else happen

|  |  |
| --- | --- |
| **let showCircle = false;**  **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **if(mouseIsPressed == true){**  **showCircle = true;**  **}**  **if(keyIsPressed==true){**  **showCircle = false;**  **}**  **if(showCircle == true){**  **circle(width/2, height/2, 100);**  **}else{**  **//same as if(showCircle == false)**  **background(220);**  **}**  **}** |  |

## How can I draw something but at the same time move something?

The issue is that when we draw we need to remove the canvas to see what we drew previously, but when we want to see something moving, we don’t want to see what we drew previously, so we draw the background to not see it.

How can we have both?  
This can happen with something we haven’t learned yet: **createGraphics**, but if you want to get an idea, here there is an sketch: <https://editor.p5js.org/mg3273/sketches/Z78zubLE4>

Additionally, you can see this video:

[2.6: createGraphics() - p5.js Tutorial](https://youtu.be/TaluaAD9MKA?si=L2UqzavjJaSt4eJj)

# VARIABLES, CONDITIONALS & INTERACTION

## **Review**

How can we place a square of size 100 in the middle of the screen?

Let’s draw a rectangle in the middle of the screen

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **rectMode(CENTER);**  **rect(width/2,height/2, 100, 100);**  **}** |  |

How can we update the position in the X axis of the rectangle?

|  |  |
| --- | --- |
| **//declare!**  **let x;**  **function setup() {**  **createCanvas(400, 400);**  **//assign value**  **x = width/2;**  **}**  **function draw() {**  **background(220);**  **rectMode(CENTER);**  **//use!**  **rect(x, height/2 , 100, 100);**  **//update**  **x = x + 1;**  **}** |  |

How can we make it move in the Y axis too?

|  |  |
| --- | --- |
| **//declare!**  **let x;**  **let y;**  **function setup() {**  **createCanvas(400, 400);**  **//assign value**  **x = 50;**  **y = 50;**  **}**  **function draw() {**  **background(220);**  **rectMode(CENTER);**  **//use!**  **rect(x, y, 100, 100);**  **//update**  **x = x+2;**  **y = y+3;**  **}** |  |

#### 

What type of variable have we been using so far?  
Do you remember another type of variable?

What type of motion is this?  
  
Linear motion:

Position = position + speed // speed is a constant value

We update the position, but there are other ways to update it. We just need something that changes over the time:

## FrameCount

Slide 9

|  |  |
| --- | --- |
| **//declare!**  **let x;**  **let y;**  **function setup() {**  **createCanvas(400, 400);**  **//assign value**  **x = 50;**  **y = 50;**  **}**  **function draw() {**  **background(220);**  **rectMode(CENTER);**  **//use!**  **rect(x, y, 100, 100);**  **//update**  **x = x+2;**  **y = y+3;**  **console.log(frameCount);**  **}** |  |

Then we can use this to update position for example

|  |  |
| --- | --- |
| **//declare!**  **let x;**  **let y;**  **function setup() {**  **createCanvas(400, 400);**  **//assign value**  **x = 50;**  **y = 50;**  **}**  **function draw() {**  **background(220);**  **rectMode(CENTER);**  **//use!**  **rect(x, y, 100, 100);**  **//update**  **x = frameCount;**  **y = y+3;**  **console.log(frameCount);**  **}** |  |

Maybe to change something else

|  |  |
| --- | --- |
| **//declare!**  **let x;**  **let y;**  **function setup() {**  **createCanvas(400, 400);**  **//assign value**  **x = 50;**  **y = 50;**  **}**  **function draw() {**  **background(220);**  **rectMode(CENTER);**  **//use!**  **rect(x, y, frameCount, 100);**  **//update**  **x = x+2;**  **y = y+3;**  **console.log(frameCount);**  **}** |  |

String, Integer, Float, Boolean

## **Boolean Variables & Conditionals**

Boolean Variables: Slides 12

Conditionals: Slide 17

A conditional statement is based on a concept of if / then / else.

#### **Operators**

Boolean variable **==** true

Boolean variable **>=**   
Boolean variable==false **&&**

So, let’s try to keep the square inside the window:

|  |  |
| --- | --- |
| **//declare!**  **let x;**  **let y;**  **let sx = 2;**  **let sy = 3;**  **function setup() {**  **createCanvas(400, 400);**  **//assign value**  **x = 50;**  **y = 50;**  **}**  **function draw() {**  **background(220);**  **rectMode(CENTER);**  **//use!**  **rect(x, y, 100, 100);**  **//update**  **x = x + sx;**  **y = y + sy;**    **if(x > width-50 || x<50){**  **sx = -sx;**  **}**  **if(y > height-50 || y<50){**  **sy = -sy;**  **}**  **}** |  |

#### Can you make something fall or go up repeatedly?

|  |  |
| --- | --- |
| **//declare!**  **let x;**  **let y ;**  **function setup() {**  **createCanvas(400, 400);**  **//assign value**  **x = width/2;**  **y = height;**  **}**  **function draw() {**  **background(220);**  **fill(200,0,255);**  **noStroke();**  **circle(x-20, y, 50);**  **circle(x+20, y, 50);**  **triangle(x-43, y+12, x+43, y+12, x, y+50);**  **y = y -3;**    **if(y < 0){**  **y = height+50;**  **}**  **}** |  |

## INTERACTIONS

#### **Mouse**

mouseX

mouseY

pmouseX

pmouseY

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **background(220);**  **}**  **function draw() {**  **line(pmouseX, pmouseY, mouseX, mouseY);**  **}** |  |

#### **mouseIsPressed**

**mouseIsPressed is an environment variable that stores the current state of the mouse button as a boolean value, true for pressed and false for not pressed.**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **background(220);**  **}**  **function draw() {**  **if (mouseIsPressed == true) {**  **ellipse(mouseX, mouseY, 10, 10);**  **}**  **}** |  |

#### **keyIsPressed**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **background(220);**  **}**  **function draw() {**  **if (mouseIsPressed == true) {**  **ellipse(mouseX, mouseY, 10, 10);**  **}**  **if (keyIsPressed == true) {**  **fill(255,0,0);**  **console.log(key);**  **}**  **}** |  |

**How to stop it?**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **background(220);**  **}**  **function draw() {**  **if (mouseIsPressed == true) {**  **ellipse(mouseX, mouseY, 10, 10);**  **}**  **if (keyIsPressed == true) {**  **fill(255,0,0);**  **console.log(key);**  **}**  **else{**  **noFill();**  **}**  **}** |  |

**Changing color according to the key pressed**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **background(220);**  **}**  **function draw() {**  **if (mouseIsPressed) {**  **ellipse(mouseX, mouseY, 10, 10);**  **}**  **if (keyIsPressed == true) {**  **console.log(key);**  **if (key == "r") {**  **fill(255, 0, 0);**  **}**  **if (key == "g") {**  **fill(0, 255, 0);**  **}**  **} else {**  **noFill();**  **}**  **}** |  |

**Specific keys but changing the shape**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **background(220);**  **}**  **function draw() {**  **if (keyIsPressed == true) {**  **if (key == "e" || key == "E") {**  **ellipse(mouseX, mouseY, 50, 50);**  **} else if (key == "r" || key == "R") {**  **rect(mouseX, mouseY, 50, 50);**  **}**  **}**  **}** |  |

**keyCode:**

**UP\_ARROW, DOWN\_ARROW, LEFT\_ARROW, RIGHT\_ARROW, BACKSPACE, DELETE, ENTER, RETURN, TAB, ESCAPE, SHIFT, CONTROL, OPTION, ALT**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **background(220);**  **}**  **function draw() {**  **if (keyIsPressed) {**  **if (keyCode == BACKSPACE) {**  **background(220);**  **}**  **}**  **ellipse(mouseX, mouseY, 50, 50);**  **}** |  |

#### **Exercise**

**Draw a circle in the middle of the screen**

**Now move the shape with the arrows**

**UP\_ARROW, DOWN\_ARROW, LEFT\_ARROW, RIGHT\_ARROW (slide 93)**

|  |  |
| --- | --- |
| **let x ;**  **let y ;**  **function setup() {**  **createCanvas(400, 400);**  **background(220);**  **x = width/2;**  **y = height/2;**  **}**  **function draw() {**  **if (keyIsPressed) {**  **if (keyCode == UP\_ARROW) {**  **y = y - 1;**  **} else if (keyCode == DOWN\_ARROW) {**  **y = y + 1;**  **} else if (keyCode == LEFT\_ARROW) {**  **x = x - 1;**  **} else if (keyCode == RIGHT\_ARROW) {**  **x = x + 1;**  **}**  **}**  **ellipse(x, y, 50, 50);**  **}** |  |

# GENERATIVE ART & VARIABLES

## **Recitation**

Problems you faced in the last exercise?

What do you think about drawing with code so far?

## **Review**

Order of execution (slides)

## **How to know what’s going on?**

#### **Errors and debugging**

Slides 52

#### **console.log();**

For example, difference between setup and draw

|  |  |
| --- | --- |
| **function setup() {**  **console.log("hello");**  **}**  **function draw() {**  **}** |  |

|  |  |
| --- | --- |
| **function setup() {**    **}**  **function draw() {**  **console.log("hello");**  **}** |  |

Now with a variable

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **console.log(width);**  **}** |  |

**width** and **height** are **Environment Variables**. They store the size of the canvas  
But we can create our own variables:

|  |  |
| --- | --- |
| **let x = 0; //declare+initialize**  **function setup() {**  **console.log(x);**  **}**  **function draw() {**  **x = x + 1; //update**  **}** |  |

|  |  |
| --- | --- |
| **let x = 0; //declare+initialize**  **function setup() {**    **}**  **function draw() {**  **console.log(x);**  **x = x + 1; //update**  **}** |  |

## **Variables:**

Slide 59 - 65

Variables are containers for storing values.

#### **Environment Variables**

What if I want my shape in the middle?

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(500,500);**  **background(255);**  **}**  **function draw() {**  **//face big circle**  **circle(250,250, 200);**  **//eyes**  **fill(0);**  **circle(250-40, 250, 10);**  **circle(250+40, 250, 10);**  **//mouth**  **noFill();**  **arc(250, 250+10, 20,20, 0, PI);**  **}** |  |

But what happens if I change the canvas size?

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(800,800);**  **background(255);**  **}**  **function draw() {**  **//face big circle**  **circle(250,250, 200);**  **//eyes**  **fill(0);**  **circle(250-40, 250, 10);**  **circle(250+40, 250, 10);**  **//mouth**  **noFill();**  **arc(250, 250+10, 20,20, 0, PI);**  **}** |  |

We can use instead width and height as variables

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(500,500);**  **background(255);**  **}**  **function draw() {**  **circle(250,250, 200);**  **// circle(width/2, height/2, 200);**  //I can continue drawing in function of these variables  **fill(0);**  **circle(width/2-40, height/2, 10);**  **circle(width/2+40, height/2, 10);**  **noFill();**  **arc(width/2, height/2+10, 20,20, 0, PI);**  **}** |  |

#### **JavaScript Variables**

|  |  |
| --- | --- |
| **let x = 200;**  //declare+initialize  **function setup() {**  **createCanvas(500,500);**  **background(255);**  **}**  **function draw() {**  **circle(width/2, height/2, x);**  //use it!  **fill(0);**  **circle(width/2-40, height/2, 10);**  **circle(width/2+40, height/2, 10);**  **noFill();**  **arc(width/2, height/2+10, 20,20, 0, PI);**  **x = x + 1;**  //update  **console.log(x);**  **}** |  |

**How can I increase the speed?**

**x = x + 5;**  //update

|  |  |
| --- | --- |
| **let x = 200;**  //declare+initialize  **function setup() {**  **createCanvas(500,500);**  **background(255);**  **}**  **function draw() {**  **circle(width/2, height/2, x);**  //use it!  **fill(0);**  **circle(width/2-40, height/2, 10);**  **circle(width/2+40, height/2, 10);**  **noFill();**  **arc(width/2, height/2+10, 20,20, 0, PI);**  **x = x + 5;**  //update  **console.log(x);**  **}** |  |

**Why am I seeing the circle repeated?**

#### **JavaScript Variables Types**

Slide 71

#### **Naming variables**

Slide 77

#### **JavaScript Variables Global and Local**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(500, 500);**  **background(255);**  **let x = 200; //declare+initialize**  **}**  **function draw() {**    **circle(width / 2, height / 2, x); //use it!**  **fill(0);**  **circle(width / 2 - 40, height / 2, 10);**  **circle(width / 2 + 40, height / 2, 10);**  **noFill();**  **arc(width / 2, height / 2 + 10, 20, 20, 0, PI);**  **x = x + 1; //update**  **console.log(x);**  **}** |  |

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(500, 500);**  **background(255);**  **}**  **function draw() {**  **let x = 200; //declare+initialize**  **circle(width / 2, height / 2, x); //use it!**  **fill(0);**  **circle(width / 2 - 40, height / 2, 10);**  **circle(width / 2 + 40, height / 2, 10);**  **noFill();**  **arc(width / 2, height / 2 + 10, 20, 20, 0, PI);**  **x = x + 1; //update**  **console.log(x);**  **}** |  |

**Why isn’t the value X increasing?**

# DRAWING WITH CODE

Let’s draw a circle (ellipse also works) in the middle of the screen:

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **circle(200,200,10);**  **}** |  |

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **circle(100,150,10);**  **}** |  |

Another one

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **circle(100,150,10);**  **circle(300,150,10);**  **}** |  |

What about a rectangle?

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **circle(100,150,10);**  **circle(300,150,10);**  **rect(100,200,200,20);**  **}** |  |

We can use comments to organize our code. These are like mental notes, so we will use our language and not the computer language. But we need to hide that from the computer by using **//**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **//these are the eyes**  **circle(100,150,10);**  **circle(300,150,10);**  **//this is the mouth**  **rect(100,200,200,20);**  **}** |  |

Tip: place the cursor in any line or select many lines and use **COMMAND KEY+ /** to comment them faster

What if we want to make teeth? We can draw several rectangles and move them in the X axis:

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **// these are the eyes**  **circle(100,150,10);**  **circle(300,150,10);**  **//this is the mouth**  **rect(100,200,20,20);**  **rect(120,200,20,20);**  **rect(140,200,20,20);**  **rect(160,200,20,20);**  **rect(180,200,20,20);**  **rect(200,200,20,20);**  **rect(220,200,20,20);**  **rect(240,200,20,20);**  **rect(260,200,20,20);**  **rect(280,200,20,20);**    **}** |  |

Let’s use the arc shape instead of a rectangle:

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **// these are the eyes**  **circle(100,150,10);**  **circle(300,150,10);**    **//this is the mouth**  **// rect(100,200,20,20);**  **// rect(120,200,20,20);**  **// rect(140,200,20,20);**  **// rect(160,200,20,20);**  **// rect(180,200,20,20);**  **// rect(200,200,20,20);**  **// rect(220,200,20,20);**  **// rect(240,200,20,20);**  **// rect(260,200,20,20);**  **// rect(280,200,20,20);**  **arc(200,200, 50,50,0, PI);**    **}** |  |

Visit the references and find the way to close the arc, so there is an horizontal black line closing the arc.  
<https://p5js.org/reference/#/p5/arc>

Can we get rid of the outline?  
Can we get rid of the inside color?

How can we change colors?

Removing the outline: **noStroke();**

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **// these are the eyes**  **circle(100,150,10);**  **circle(300,150,10);**  **noStroke();**  **//this is the mouth**  **// rect(100,200,20,20);**  **// rect(120,200,20,20);**  **// rect(140,200,20,20);**  **// rect(160,200,20,20);**  **// rect(180,200,20,20);**  **// rect(200,200,20,20);**  **// rect(220,200,20,20);**  **// rect(240,200,20,20);**  **// rect(260,200,20,20);**  **// rect(280,200,20,20);**  **arc(200,200, 50,50,0, PI);**    **}** |  |

Removing the inside color: noFill();

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **// these are the eyes**  **circle(100,150,10);**  **circle(300,150,10);**  **noFill();**  **//this is the mouth**  **// rect(100,200,20,20);**  **// rect(120,200,20,20);**  **// rect(140,200,20,20);**  **// rect(160,200,20,20);**  **// rect(180,200,20,20);**  **// rect(200,200,20,20);**  **// rect(220,200,20,20);**  **// rect(240,200,20,20);**  **// rect(260,200,20,20);**  **// rect(280,200,20,20);**  **arc(200,200, 50,50,0, PI);**    **}** |  |

But, how can we change colors? [Check the extra slides about color!](https://docs.google.com/presentation/d/1WupcUMCAJhNmw9282I51Dsp7eHVGR2ptnP7hsmmcKzY/edit?usp=sharing)

The function stroke() will change color

The function strokeWeight() will change the thickness of the line

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **// these are the eyes**  **circle(100,150,10);**  **circle(300,150,10);**  **noFill();**  **stroke(255,0,255);**  **strokeWeight(4);**  **//this is the mouth**  **// rect(100,200,20,20);**  **// rect(120,200,20,20);**  **// rect(140,200,20,20);**  **// rect(160,200,20,20);**  **// rect(180,200,20,20);**  **// rect(200,200,20,20);**  **// rect(220,200,20,20);**  **// rect(240,200,20,20);**  **// rect(260,200,20,20);**  **// rect(280,200,20,20);**  **arc(200,200, 50,50,0, PI);**    **}** |  |

Now if you want to change the inside color you can use fill()

And if you want to get rid of the stroke you can use noStroke()

|  |  |
| --- | --- |
| **function setup() {**  **createCanvas(400, 400);**  **}**  **function draw() {**  **background(220);**  **// these are the eyes**  **circle(100,150,10);**  **circle(300,150,10);**  **noStroke();**  **fill(255,0,255);**  **//this is the mouth**  **// rect(100,200,20,20);**  **// rect(120,200,20,20);**  **// rect(140,200,20,20);**  **// rect(160,200,20,20);**  **// rect(180,200,20,20);**  **// rect(200,200,20,20);**  **// rect(220,200,20,20);**  **// rect(240,200,20,20);**  **// rect(260,200,20,20);**  **// rect(280,200,20,20);**  **arc(200,200, 50,50,0, PI);**    **}** |  |

Can you make this?

|  |  |
| --- | --- |
|  |  |

Find colors easily using the color picker: <https://g.co/kgs/CgiibVL>

Check the extra slides about color: [1.2extra Colors | F24](https://docs.google.com/presentation/d/1WupcUMCAJhNmw9282I51Dsp7eHVGR2ptnP7hsmmcKzY/edit?usp=sharing)