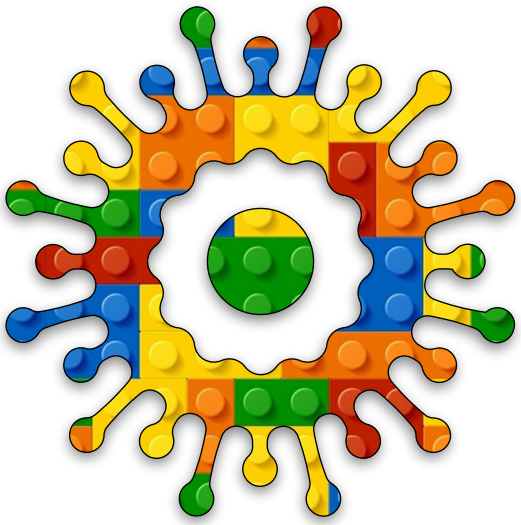
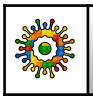
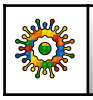
Making Games Module A Unit #4 space invaders





Content

Module A Unit #4 space invaders



Introduction to space invaders

This is an attempt to replicate the classic Space Invaders game. Possibly the most known of the early video games. This is not the complete, finished, and polished game but provides a platform to improve and add features at a later date as you learn more about coding.

But there is plenty to get your teeth into. So follow along and learn by doing; hopefully, you will think of your own unique game, and this may prove a useful foundation. It isn't by any means the finished article, but that is for you to do, but there was enough code to have 90% of the game.

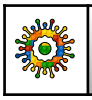
I am assuming, to a small degree, that you have already completed the Flappy Bird game. This game introduces new concepts building on the previous game.

Step 1

Create three more files:
ship.js
alien.js
particle.js

Step 2

Add them into the index.html file as shown in Flappy Bird.



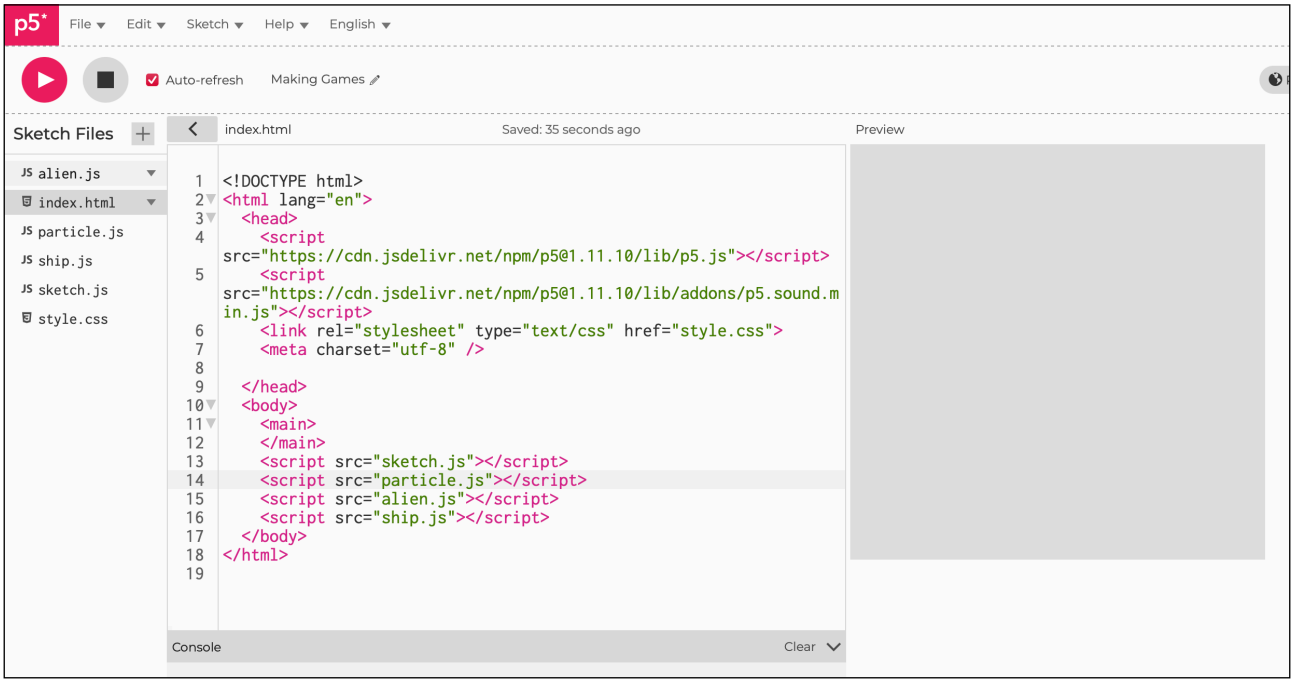
The index.html file

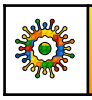
If you have landed here, I strongly suggest looking at the first few pages of the Flappy Bird unit and learning how to add files.

index.html

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <script src="https://cdnjs.cloudflare.com/ajax/libs/p5.js/1.10.11/p5.js"></script>
    <script src="https://cdnjs.cloudflare.com/ajax/libs/p5.js/1.10.11/addons/p5.sound.min.js"></script>
    <link rel="stylesheet" type="text/css" href="style.css">
    <meta charset="utf-8" />
  </head>
  <body>
    <main>
    </main>
    <script src="sketch.js"></script>
    <script src="particle.js"></script>
    <script src="alien.js"></script>
    <script src="ship.js"></script>
  </body>
</html>
```

Figure 1: html.index





Sketch A4.1 creating the ship class

❗ we start with our ship.js file

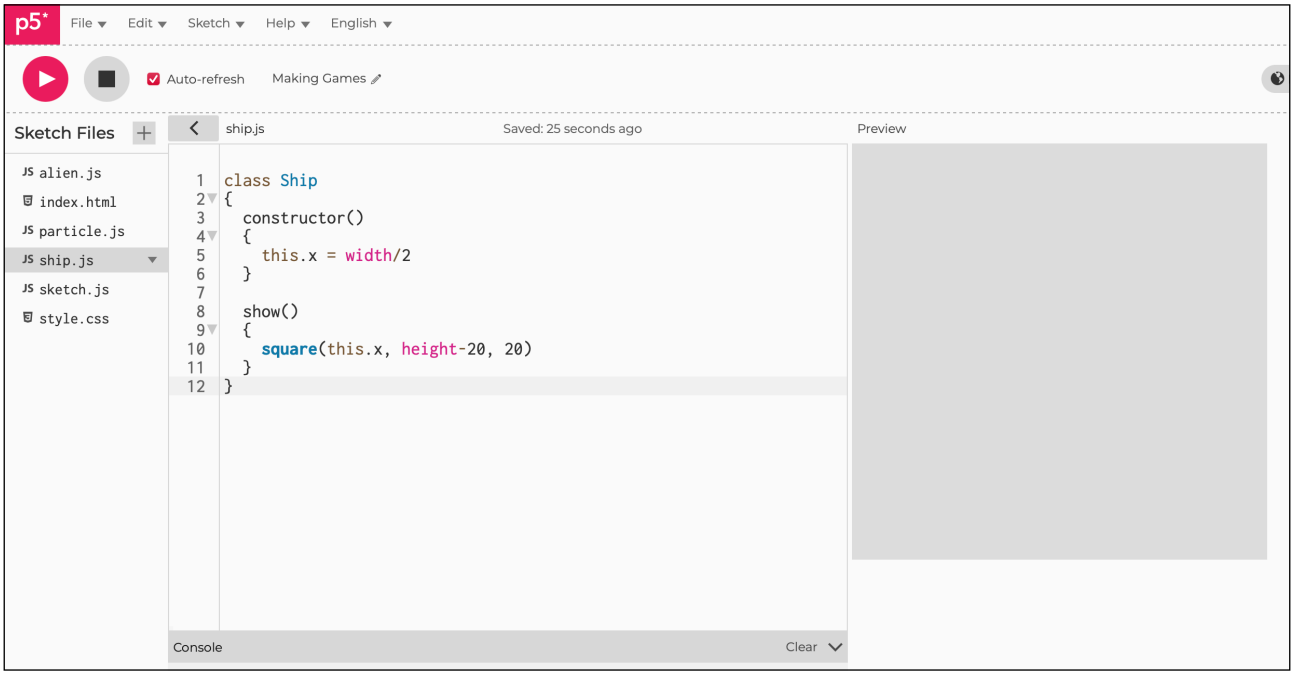
Open the `ship.js` file and type in the start code for the ship. For the moment, we use simple shapes; we will add more interesting shapes later.

ship.js

```
class Ship
{
  constructor()
  {
    this.x = width/2
  }

  show()
  {
    square(this.x, height-20, 20)
  }
}
```

Sketch A4.1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File
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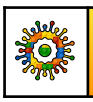
Sketch
Help
English
Auto-refresh
Making Games
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
ship.js
Saved: 25 seconds ago
Preview
class Ship
{
constructor()
{
this.x = width/2
}
show()
{
square(this.x, height-20, 20)
}
}
Console
Clear



Sketch A4.2 now to create a ship

❗ sketch.js

This is our start `sketch.js`. We are including the ship in the main sketch.

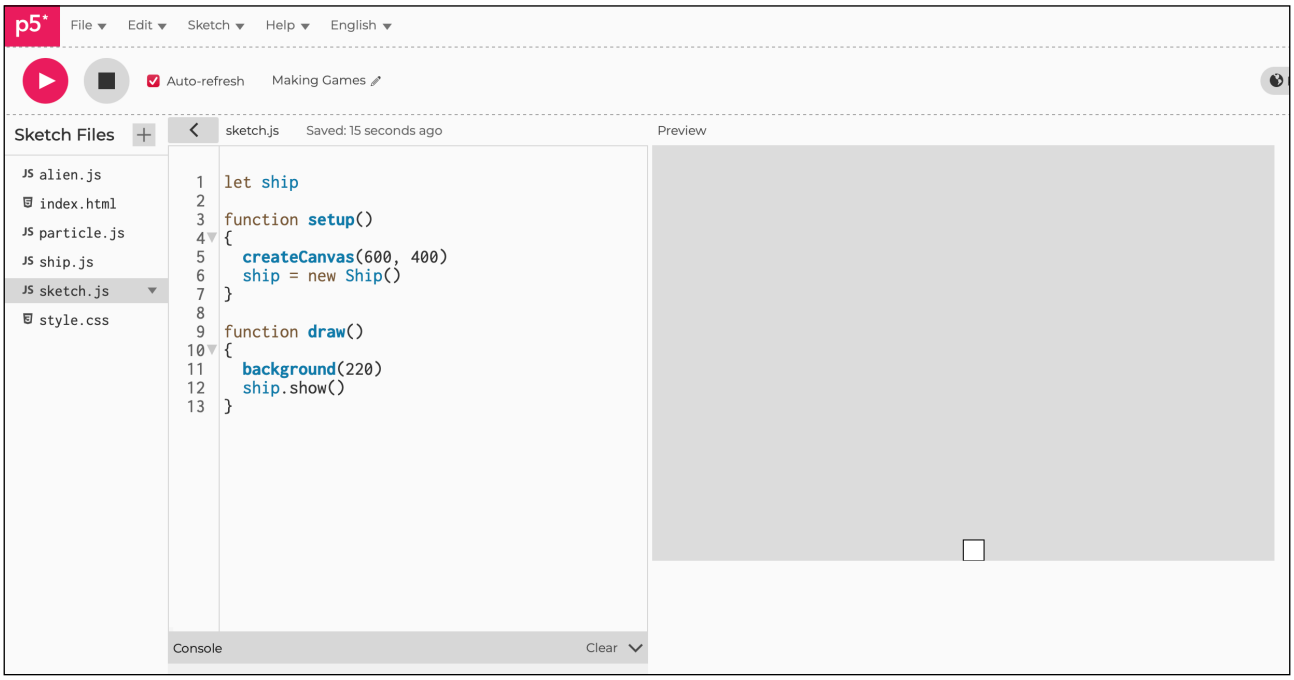
sketch.js

```
let ship

function setup()
{
  createCanvas(600, 400)
  ship = new Ship()
}

function draw()
{
  background(220)
  ship.show()
}
```

Notes

As you can see we have a ship, well, of sorts!

Figure A4.2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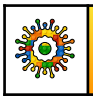
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: 15 seconds ago
Preview
let ship
function setup()
{
createCanvas(600, 400)
ship = new Ship()
}
function draw()
{
background(220)
ship.show()
}
Console
Clear

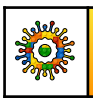


Sketch A4.3 arrow keys (part 1)

Here, we will move the ship left and right with the arrow keys. An argument of `1` moves it to the right one pixel, and `-1` moves it to the left one pixel. The `move()` function will be added in the `ship.js` file.

sketch.js

```
let ship

function setup()
{
  createCanvas(600, 400)
  ship = new Ship()
}

function draw()
{
  background(220)
  ship.show()
}

function keyPressed()
{
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(1)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-1)
  }
}
```



Sketch A4.4 telling the ship to move

❗ ship.js

Adding the `move()` function to the ship.js, you will see it move one pixel every time you press one of the arrow keys (remember to click on the canvas beforehand). This is very, very slow. We will make some improvements in the sketches.

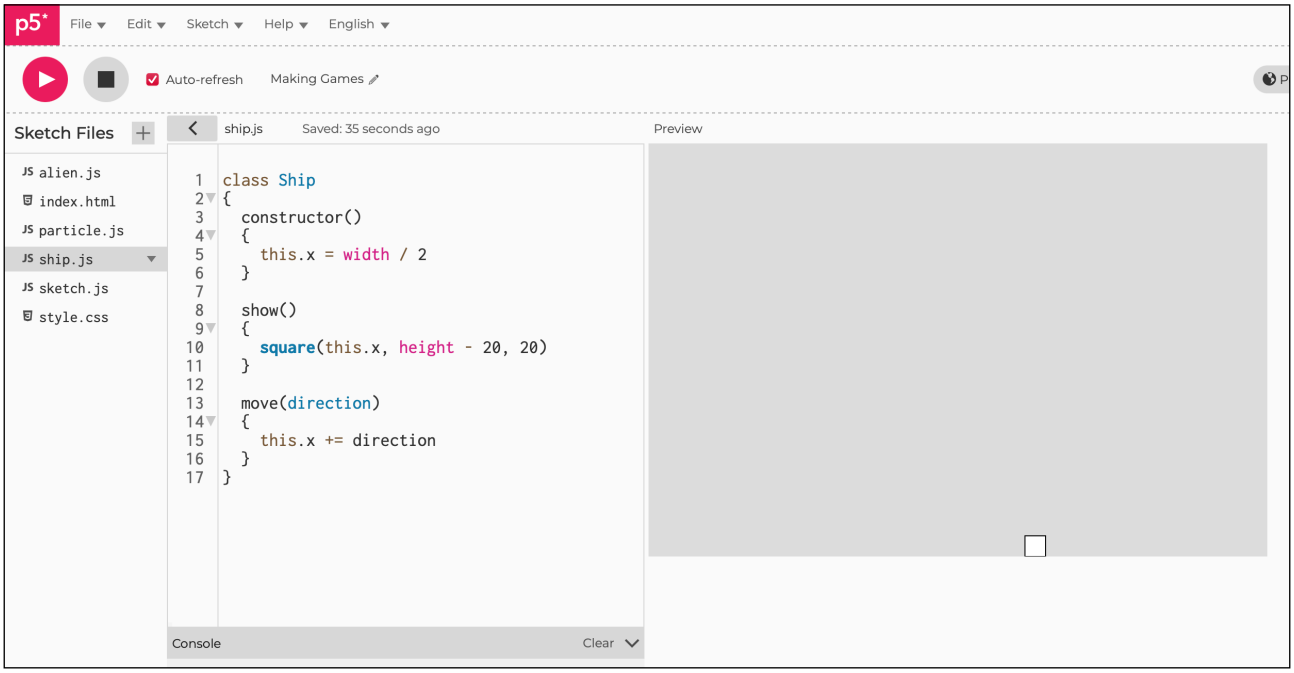
ship.js

```
class Ship
{
  constructor()
  {
    this.x = width / 2
  }

  show()
  {
    square(this.x, height - 20, 20)
  }

  move(direction)
  {
    this.x += direction
  }
}
```

Notes

Painfully slow as it moves one pixel every time we press the arrow key, don't worry, we will speed everything up in due course.

Figure A4.4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Auto-refresh
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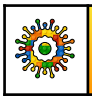
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
ship.js
Saved: 35 seconds ago
Preview
class Ship
{
constructor()
{
this.x = width / 2
}
show()
{
square(this.x, height - 20, 20)
}
move(direction)
{
this.x += direction
}
}
Console
Clear



Sketch A4.5 increase speed

❗ sketch.js

Increasing the speed to 5 pixels and putting the co-ordinates in the centre of the square with `rectMode(CENTER)`.

sketch.js

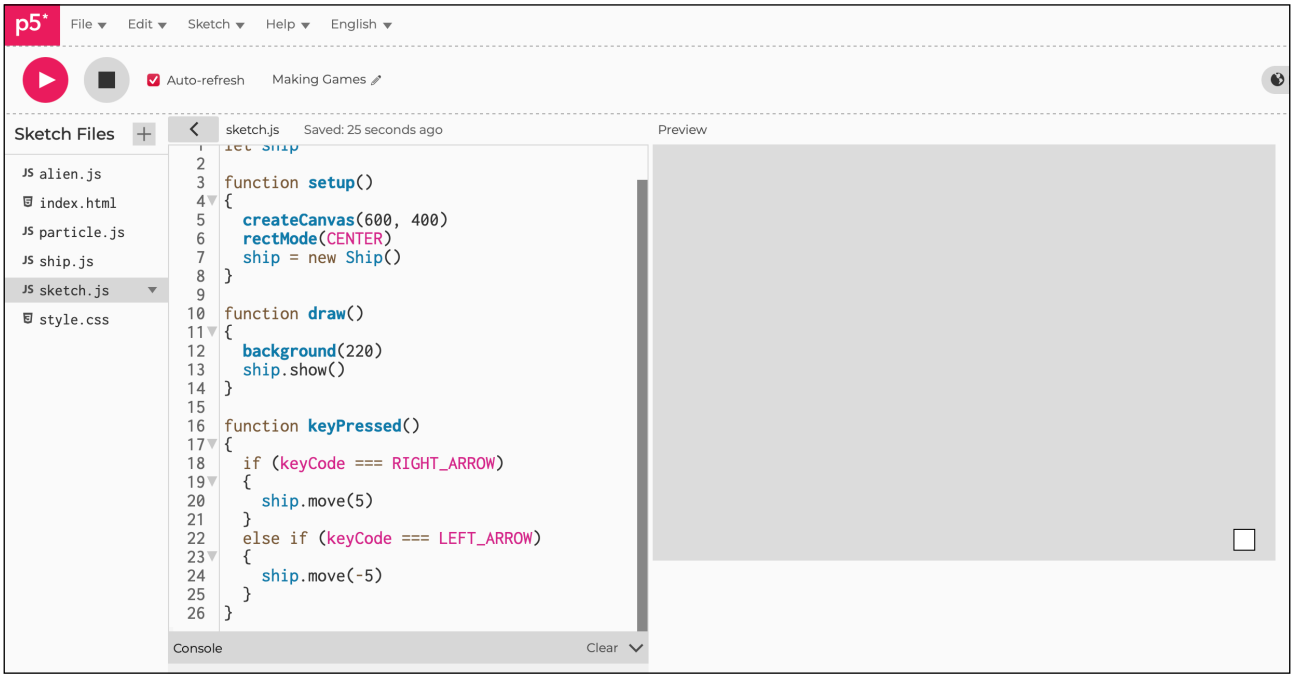
```
let ship

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
}

function draw()
{
  background(220)
  ship.show()
}

function keyPressed()
{
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
```

```
}
```

Notes

You will have to tap continually to make it move left and right; remember to click on the canvas first. Also the ship is now off the ground. An improvement but we can do even better than that.

Figure A4.5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Auto-refresh
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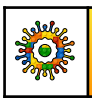
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: 25 seconds ago
Preview
let ship
function setup()
{
createCanvas(600, 400)
rectMode(CENTER)
ship = new Ship()
}
function draw()
{
background(220)
ship.show()
}
function keyPressed()
{
if (keyCode === RIGHT_ARROW)
{
ship.move(5)
}
else if (keyCode === LEFT_ARROW)
{
ship.move(-5)
}
}
Console
Clear



Sketch A4.6 bigger ship

❗ ship.js

In `ship.js`, we will make it into a rectangle and a bit bigger.

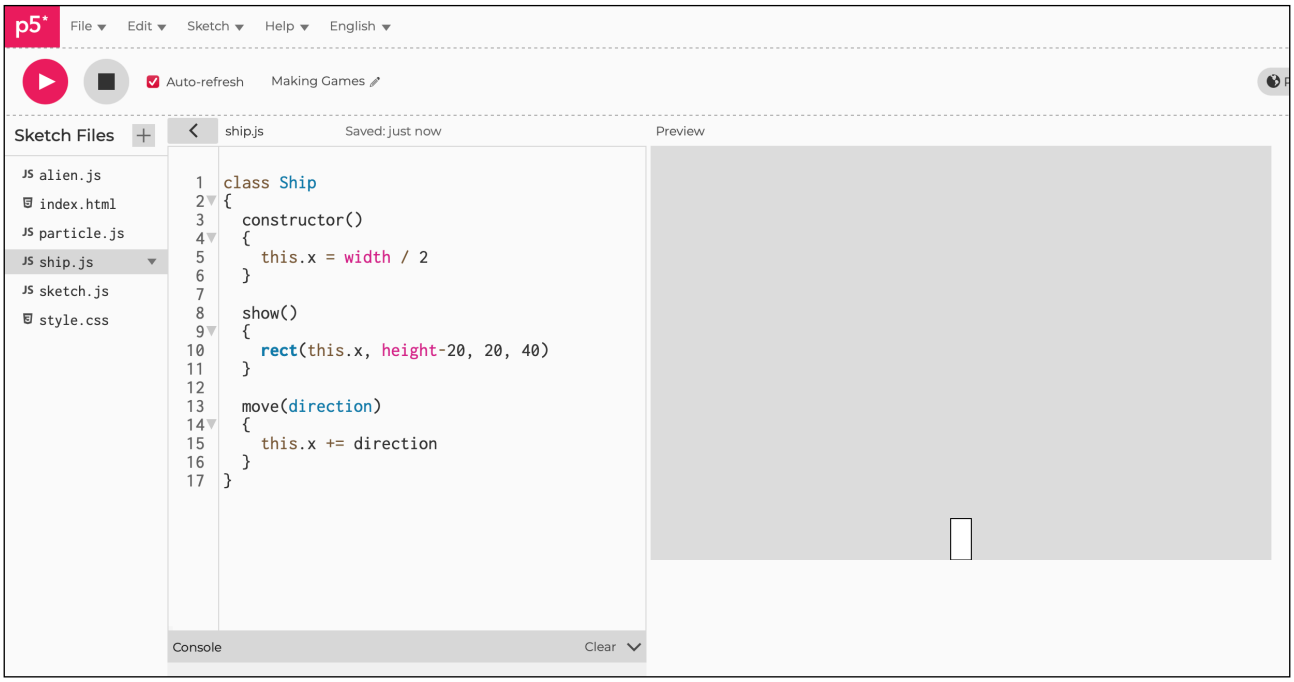
ship.js

```
class Ship
{
  constructor()
  {
    this.x = width / 2
  }

  show()
  {
    rect(this.x, height-20, 20, 40)
  }

  move(direction)
  {
    this.x += direction
  }
}
```

Notes

Now a rectangle and we can still move it.

Figure A4.6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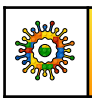
Help
English
Auto-refresh
Making Games
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
ship.js
Saved: just now
Preview
1 class Ship
2 {
3 constructor()
4 {
5 this.x = width / 2
6 }
7
8 show()
9 {
10 rect(this.x, height-20, 20, 40)
11 }
12
13 move(direction)
14 {
15 this.x += direction
16 }
17 }
Console
Clear



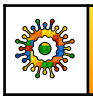
Sketch A4.7 creating the alien class (part 1)

❗ alien.js

This is the start code for the alien.js file. Next, we will create an array of aliens in `sketch.js`. The aliens are just circles for the present.

alien.js

```
class Alien
{
  constructor()
  {
    this.x = width/2
    this.y = 50
  }

  show()
  {
    circle(this.x, this.y, 50)
  }
}
```



Sketch A4.8 an array of aliens

❗ sketch.js

Here is the array of aliens (five of them).

sketch.js

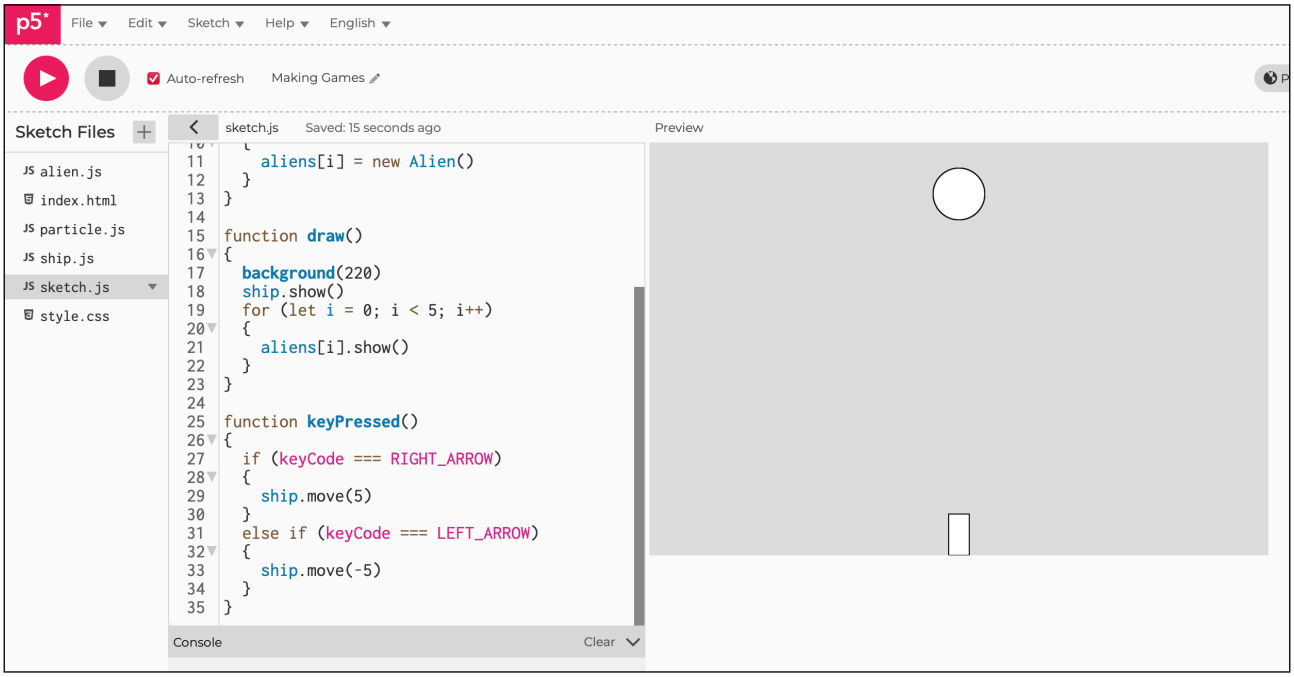
```
let ship
let aliens = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 5; i++)
  {
    aliens[i] = new Alien()
  }
}

function draw()
{
  background(220)
  ship.show()
  for (let i = 0; i < 5; i++)
  {
    aliens[i].show()
  }
}

function keyPressed()
{
```

```
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

🗒️ Notes

It will look like below, for the moment!

Figure A4.8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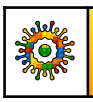
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: 15 seconds ago
Preview
aliens[i] = new Alien()
}
}
function draw()
{
background(220)
ship.show()
for (let i = 0; i < 5; i++)
{
aliens[i].show()
}
}
function keyPressed()
{
if (keyCode === RIGHT_ARROW)
{
ship.move(5)
}
else if (keyCode === LEFT_ARROW)
{
ship.move(-5)
}
}
Console
Clear



Sketch A4.9 spacing the aliens

❗ alien.js

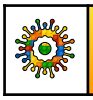
To spread the aliens out rather than all in one place, we add an `x, y` argument to the `alien.js` sketch for the `constructor(x, y)` function.

alien.js

```
class Alien
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
  }

  show()
  {
    circle(this.x, this.y, 50)
  }
}
```

📝 Notes

You will get an error message, we haven't finished yet.



Sketch A4.10 spaced out

❗ sketch.js

Spacing out the aliens and making six of them. You should avoid hard-coding the numbers for array loops, so changing it from `5` to `aliens.length` is much better practice.

sketch.js

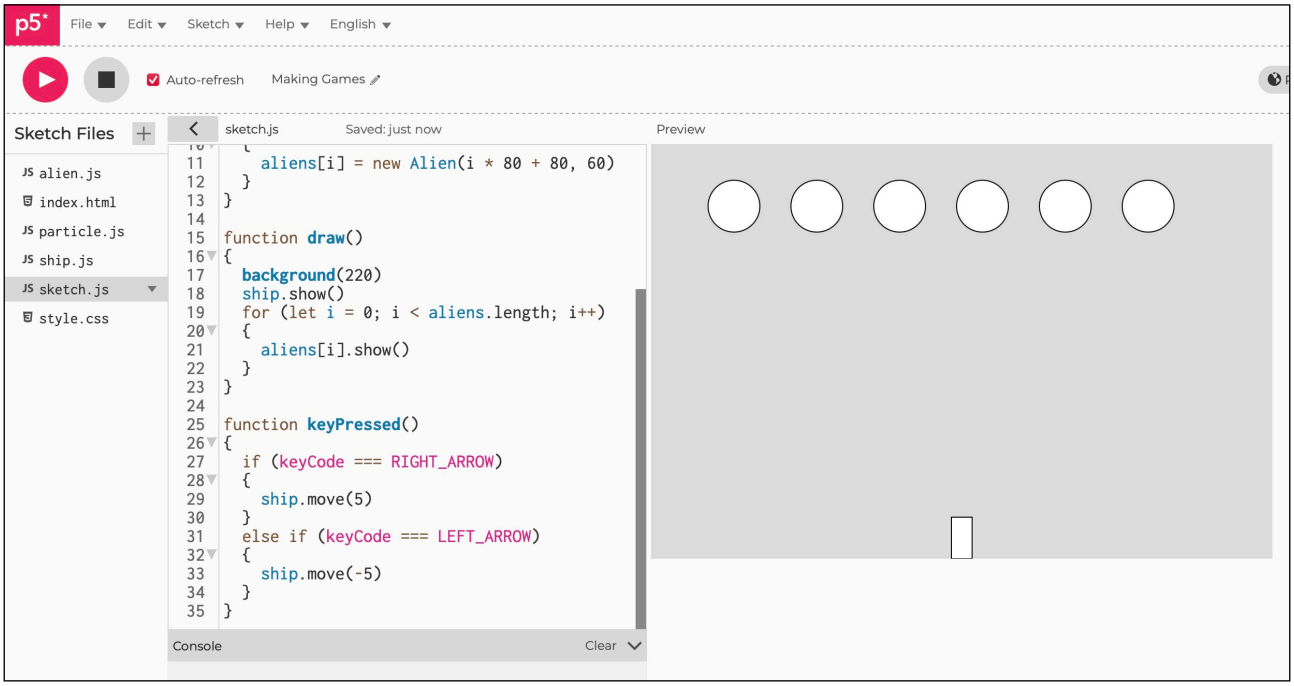
```
let ship
let aliens = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
  }
}

function keyPressed()
```

```
{
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

Notes

Now it looks more like it, with six aliens nicely spaced out.

Figure A4.10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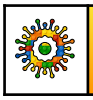
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: just now
Preview
11 aliens[i] = new Alien(i * 80 + 80, 60)
12 }
13 }
14
15 function draw()
16 {
17 background(220)
18 ship.show()
19 for (let i = 0; i < aliens.length; i++)
20 {
21 aliens[i].show()
22 }
23 }
24
25 function keyPressed()
26 {
27 if (keyCode === RIGHT_ARROW)
28 {
29 ship.move(5)
30 }
31 else if (keyCode === LEFT_ARROW)
32 {
33 ship.move(-5)
34 }
35 }
Console
Clear



Sketch A4.11 adding the lasers

❗ particle.js

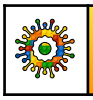
Adding the laser particles with a new file called particle.js.

particle.js

```
class Particle
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
  }

  show()
  {
    circle(this.x, this.y, 10)
  }

  move()
  {
    this.y -= 1
  }
}
```



Sketch A4.12 the devastating laser!

❗ sketch.js

To start with, we just want to make sure it all works for one particle.

sketch.js

```
let ship
let aliens = []
let particle

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  particle = new Particle(width/2, height - 20)
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  particle.show()
  particle.move()
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
  }
```

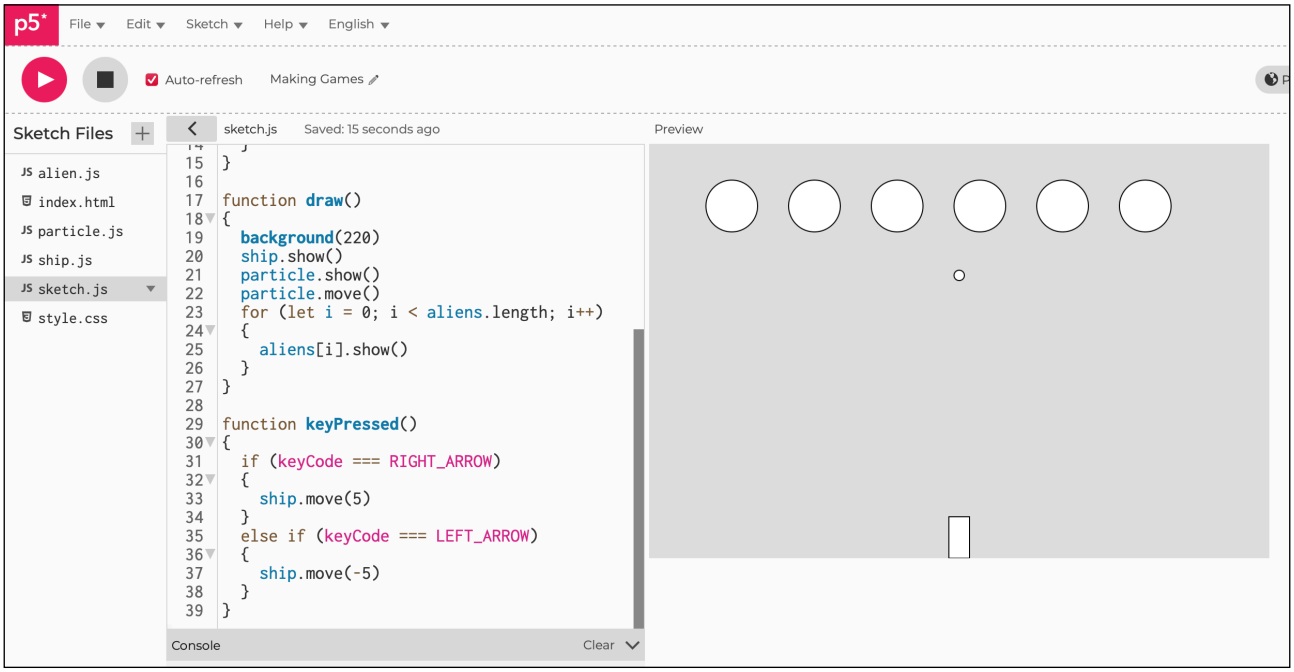
```
}

function keyPressed()
{
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

🗒️ Notes

A particle will leave the ship and travel slowly upwards, this may not look much but it is a start.

Figure A4.12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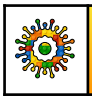
ship.js
sketch.js
style.css
sketch.js
Saved: 15 seconds ago
Preview
}
function draw()
{
background(220)
ship.show()
particle.show()
particle.move()
for (let i = 0; i < aliens.length; i++)
{
aliens[i].show()
}
}
function keyPressed()
{
if (keyCode === RIGHT_ARROW)
{
ship.move(5)
}
else if (keyCode === LEFT_ARROW)
{
ship.move(-5)
}
}
Console
Clear



Sketch A4.13 array of particles

Adding an array of particles that are generated when the space bar is pressed. You should get a stream of particles every time you press the spacebar.

❗ Remove all reference to the particle in `sketch.js` and replace with the highlighted particles below.

sketch.js

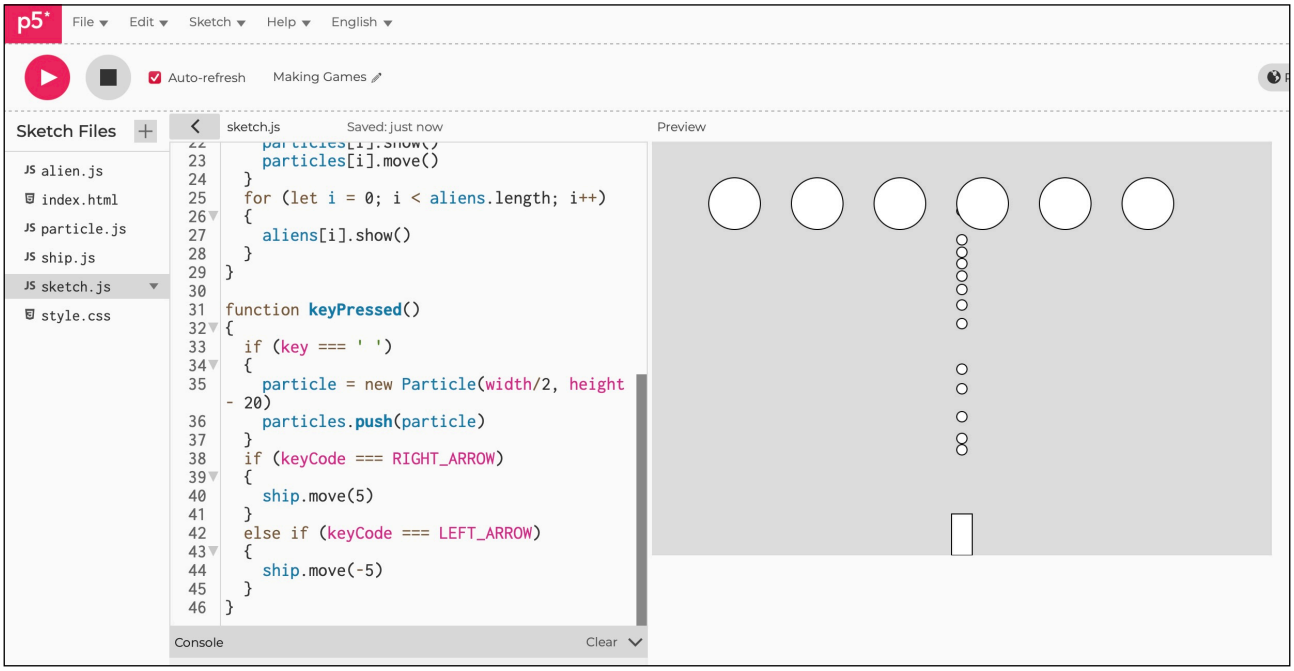
```
let ship
let aliens = []
let particles = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
```

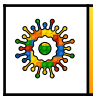
```
  }
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
  }
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(width/2, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

🗒️ Notes

Click on the canvas first, and then the spacebar to produce a stream of particles (lasers). When you click on the spacebar, you get the particles released.

Figure A4.13


p5*
File
Edit
Sketch
Help
English
Auto-refresh
Making Games
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: just now
Preview
particles[i].move()
}
for (let i = 0; i < aliens.length; i++)
{
aliens[i].show()
}
}
function keyPressed()
{
if (key === ' ')
{
particle = new Particle(width/2, height - 20)
particles.push(particle)
}
if (keyCode === RIGHT_ARROW)
{
ship.move(5)
}
else if (keyCode === LEFT_ARROW)
{
ship.move(-5)
}
}
Console
Clear



Sketch A4.14 originate from the ship

The particles need to originate at the ship. You can move the ship left and right, and when you press the space bar, the particles will always emit from the new position of the ship.

sketch.js

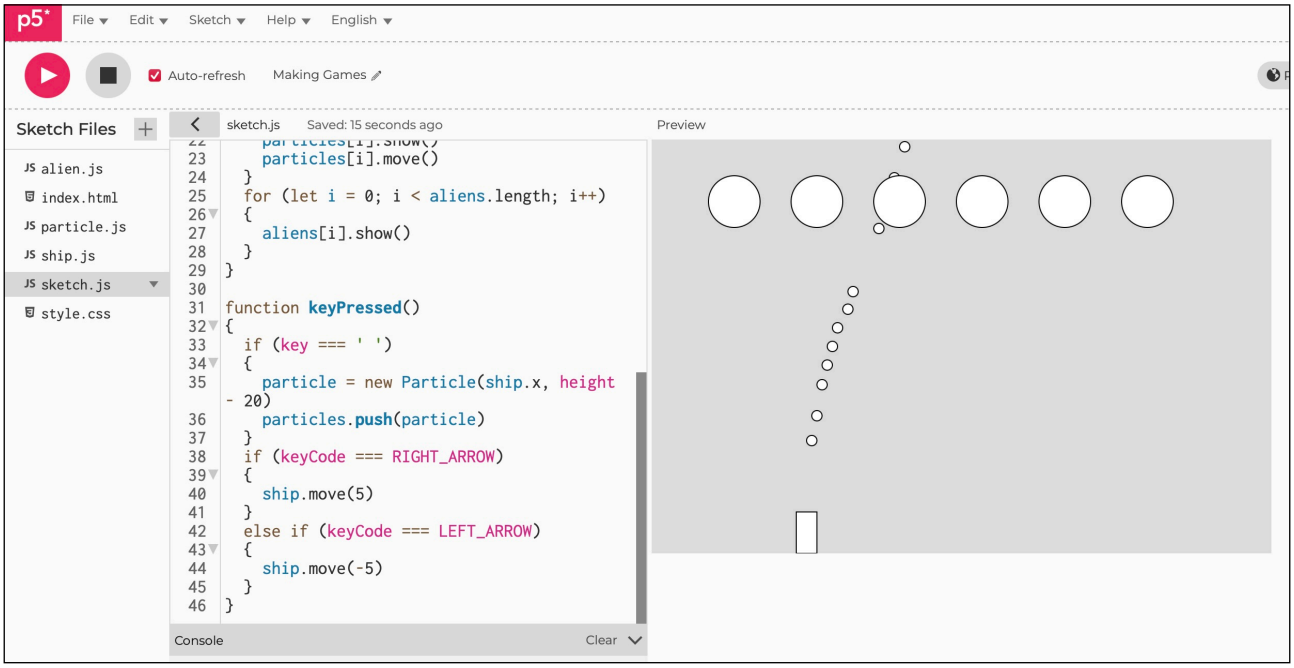
```
let ship
let aliens = []
let particles = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
  }
  for (let i = 0; i < aliens.length; i++)
  {
```

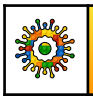
```
    aliens[i].show()
  }
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

Notes

Now when you move the ship and fire (spacebar), the particles originate from the ship.

Figure A4.14


p5*
File
Edit
Sketch
Help
English
Auto-refresh
Making Games
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: 15 seconds ago
23 particles[i].move()
24 }
25 for (let i = 0; i < aliens.length; i++)
26 {
27 aliens[i].show()
28 }
29 }
30
31 function keyPressed()
32 {
33 if (key === ' ')
34 {
35 particle = new Particle(ship.x, height - 20)
36 particles.push(particle)
37 }
38 if (keyCode === RIGHT_ARROW)
39 {
40 ship.move(5)
41 }
42 else if (keyCode === LEFT_ARROW)
43 {
44 ship.move(-5)
45 }
46 }
Console
Clear
Preview



Sketch A4.15 hitting the aliens

We want the particles to interact (hit) the aliens. We create a `hits()` function in `particle.js` which checks the distance between the particles' `x` and `y` coordinates and the aliens' `x` and `y` coordinates. Changes are made to the `alien.js` and `sketch.js` to console log whether the particles are hitting anything.

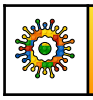
sketch.js

```
let ship
let aliens = []
let particles = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
```

```
    {
      if (particles[i].hits(aliens[j]))
      {
        console.log('HIT')
      }
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
  }
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

🗒️ Notes

But before we can test it, we need to create the `hits()` function in `particle.js`.



Sketch A4.16 they're a hit

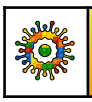
❗ particle.js

We need to give the alien a radius, actually the diameter, hence we divide by 2.

particle.js

```
class Particle
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 10
  }

  show()
  {
    circle(this.x, this.y, this.r)
  }

  hits(alien)
  {
    let distance = dist(this.x, this.y, alien.x, alien.y)
    if (distance < this.r/2 + alien.r/2)
    {
      return true
    }
    else
    {
      return false
    }
```

```
  }

  move()
  {
    this.y -= 1
  }
}
```



Sketch A4.17 ouch!

❗ alien.js

Repeat in `alien.js` and you should get a result in the console.

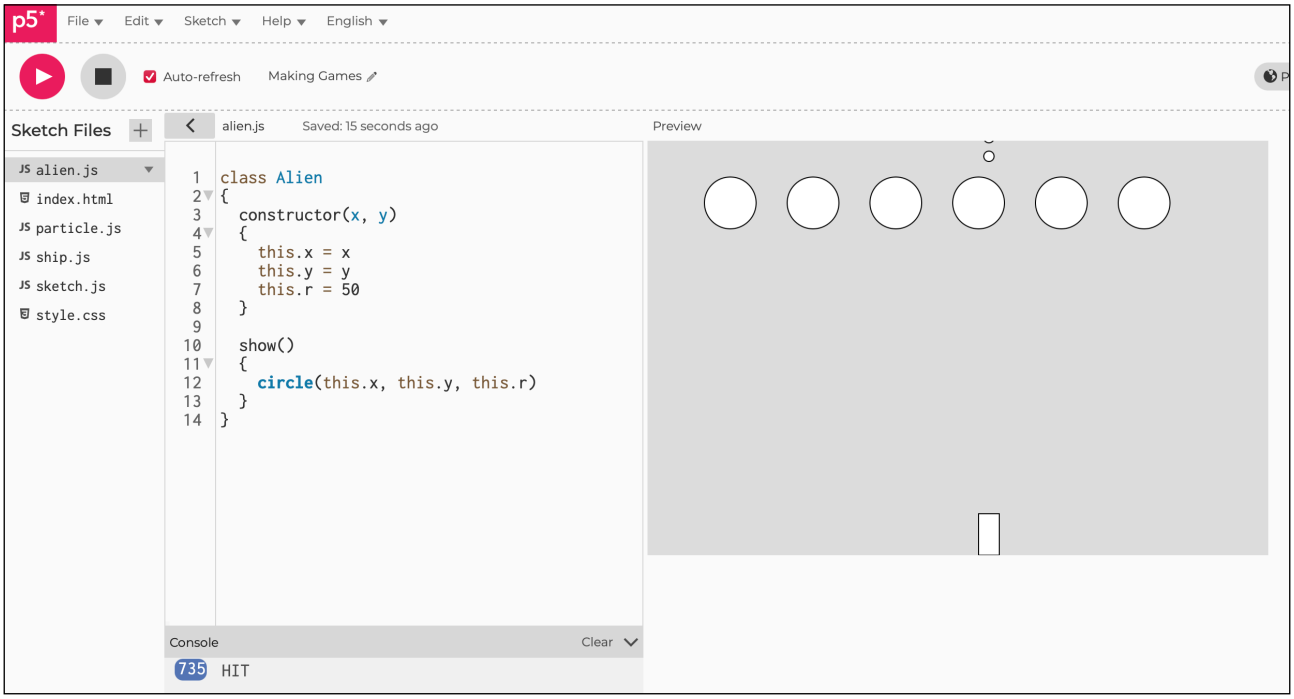
alien.js

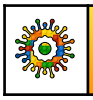
```
class Alien
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 50
  }

  show()
  {
    circle(this.x, this.y, this.r)
  }
}
```

Notes

You will notice that it reports lots of hits; this is because it intersects at the edge of the circles and keeps on intersecting as it passes through.

Figure A4.17


p5*
File
Edit
Sketch
Help
English
Auto-refresh
Making Games
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
alien.js
Saved: 15 seconds ago
Preview
1 class Alien
2 {
3 constructor(x, y)
4 {
5 this.x = x
6 this.y = y
7 this.r = 50
8 }
9
10 show()
11 {
12 circle(this.x, this.y, this.r)
13 }
14 }
Console
Clear
735 HIT



Sketch A4.18 deleting alien and laser

❗ sketch.js

We are now going to remove the particle and the alien as soon as there is an intersection with a toDelete function returning a boolean true if there is an intersection (or hit). Don't worry about error messages until you update the particle.js and alien.js.

sketch.js

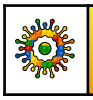
```
let ship
let aliens = []
let particles = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
```

```
    {
      if (particles[i].hits(aliens[j]))
      {
        aliens[j].remove()
        particles[i].remove()
      }
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
  }
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyPressed()
{
  if (key === ' ')
  {
```

```
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

🗒️ Notes

Don't forget to remove the `console.log()`.



Sketch A4.19 deleting the particle

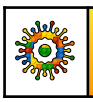
❗ particle.js

Now for the particle.js amendments.

particle.js

```
class Particle
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 10
    this.toDelete = false
  }

  remove()
  {
    this.toDelete = true
  }

  show()
  {
    circle(this.x, this.y, this.r)
  }

  hits(alien)
  {
    let distance = dist(this.x, this.y, alien.x, alien.y)
    if (distance < this.r / 2 + alien.r / 2)
    {
      return true
```

```
    }
    else
    {
      return false
    }
  }

  move()
  {
    this.y -= 1
  }
}
```



Sketch A4.20 deleting the alien

❗ alien.js

And for the `alien.js`, we do something exactly the same.

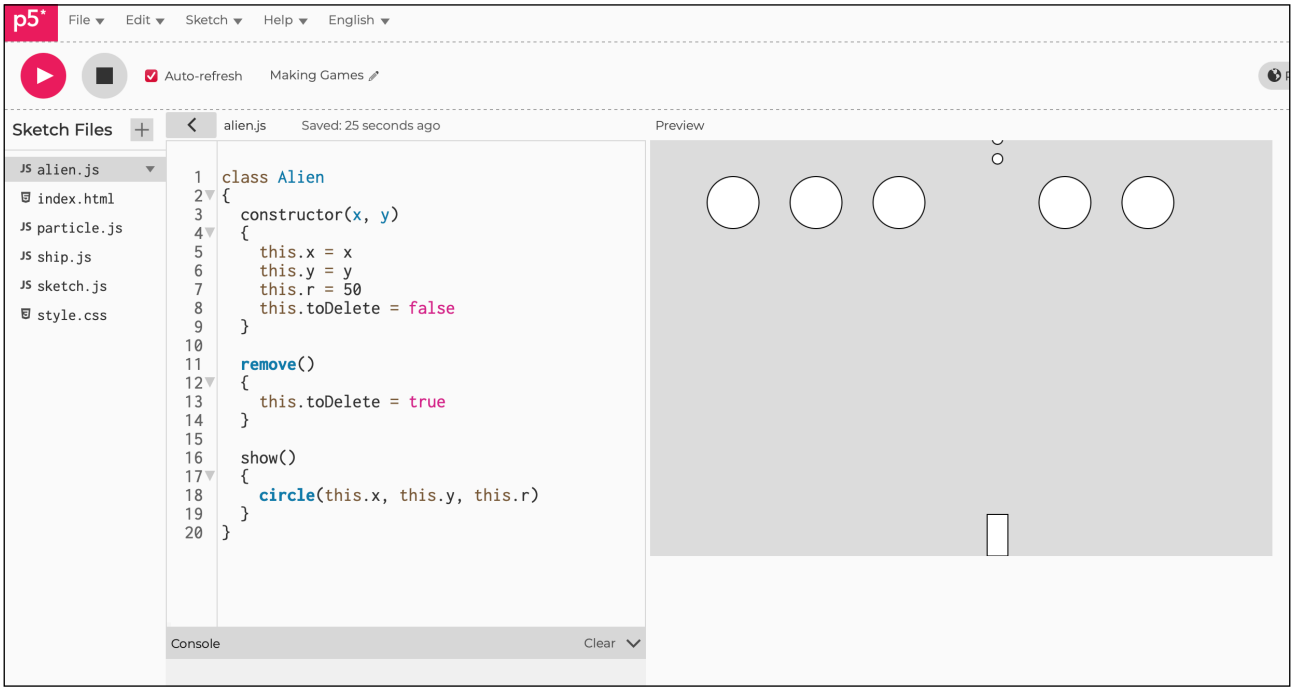
alien.js

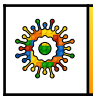
```
class Alien
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 50
    this.toDelete = false
  }

  remove()
  {
    this.toDelete = true
  }

  show()
  {
    circle(this.x, this.y, this.r)
  }
}
```

Notes

Move the ship backwards and forwards and fire with the spacebar; the aliens should disappear.

Figure A4.20


p5*
File
Edit
Sketch
Help
English
Auto-refresh
Making Games
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
alien.js
Saved: 25 seconds ago
Preview
class Alien
{
constructor(x, y)
{
this.x = x
this.y = y
this.r = 50
this.toDelete = false
}
remove()
{
this.toDelete = true
}
show()
{
circle(this.x, this.y, this.r)
}
}
Console
Clear

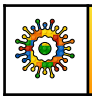


Sketch A4.21 moving the aliens

We will move the aliens in alien.js sideways, then downwards altogether. It should now work reasonably well deleting one alien. It won't move just yet till we update sketch.js.

alien.js

```
class Alien
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 50
    this.toDelete = false
    this.xdirection = 1
  }

  remove()
  {
    this.toDelete = true
  }

  move()
  {
    this.x = this.x + this.xdirection
  }

  show()
  {
    circle(this.x, this.y, this.r)
  }
}
```



Sketch A4.22 sideways and downwards

❗ sketch.js

Here we make reference to it in `sketch.js`; the aliens will exit stage right and disappear.

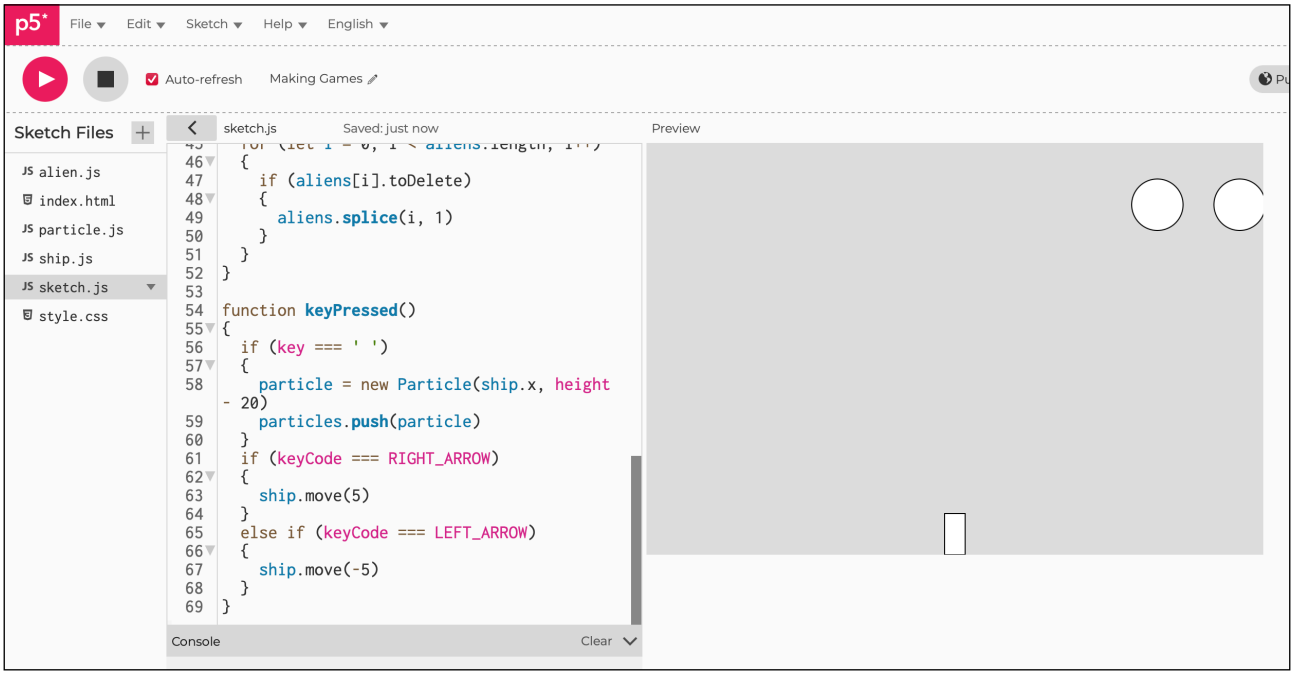
sketch.js

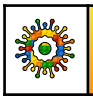
```
let ship
let aliens = []
let particles = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
    {
```

```
      if (particles[i].hits(aliens[j]))
      {
        aliens[j].remove()
        particles[i].remove()
      }
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
    aliens[i].move()
  }
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyPressed()
{
  if (key === ' ')
  {
```

```
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

Figure A4.22


p5*
File
Edit
Sketch
Help
English
Auto-refresh
Making Games
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: just now
Preview
46 {
47 if (aliens[i].toDelete)
48 {
49 aliens.splice(i, 1)
50 }
51 }
52 }
53
54 function keyPressed()
55 {
56 if (key === ' ')
57 {
58 particle = new Particle(ship.x, height - 20)
59 particles.push(particle)
60 }
61 if (keyCode === RIGHT_ARROW)
62 {
63 ship.move(5)
64 }
65 else if (keyCode === LEFT_ARROW)
66 {
67 ship.move(-5)
68 }
69 }
Console
Clear



Sketch A4.23 right hand edge check

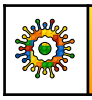
❗ alien.js

Now to check when the alien hits the right-hand edge of the canvas, move down and move left. This is harder than you think. We will create a function called `shiftDown()`.

alien.js

```
class Alien
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 50
    this.toDelete = false
    this.xdirection = 1
  }

  remove()
  {
    this.toDelete = true
  }

  shiftDown()
  {
    this.xdirection *= -1
    this.y += this.r
  }

  move()
  {
    this.x = this.x + this.xdirection
```

```
  }

  show()
  {
    circle(this.x, this.y, this.r)
  }
}
```



Sketch A4.24 across and down

❗ sketch.js

Now include it in the `sketch.js`; you should see it move across and down.

sketch.js

```
let ship
let aliens = []
let particles = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
    {
      if (particles[i].hits(aliens[j]))
```

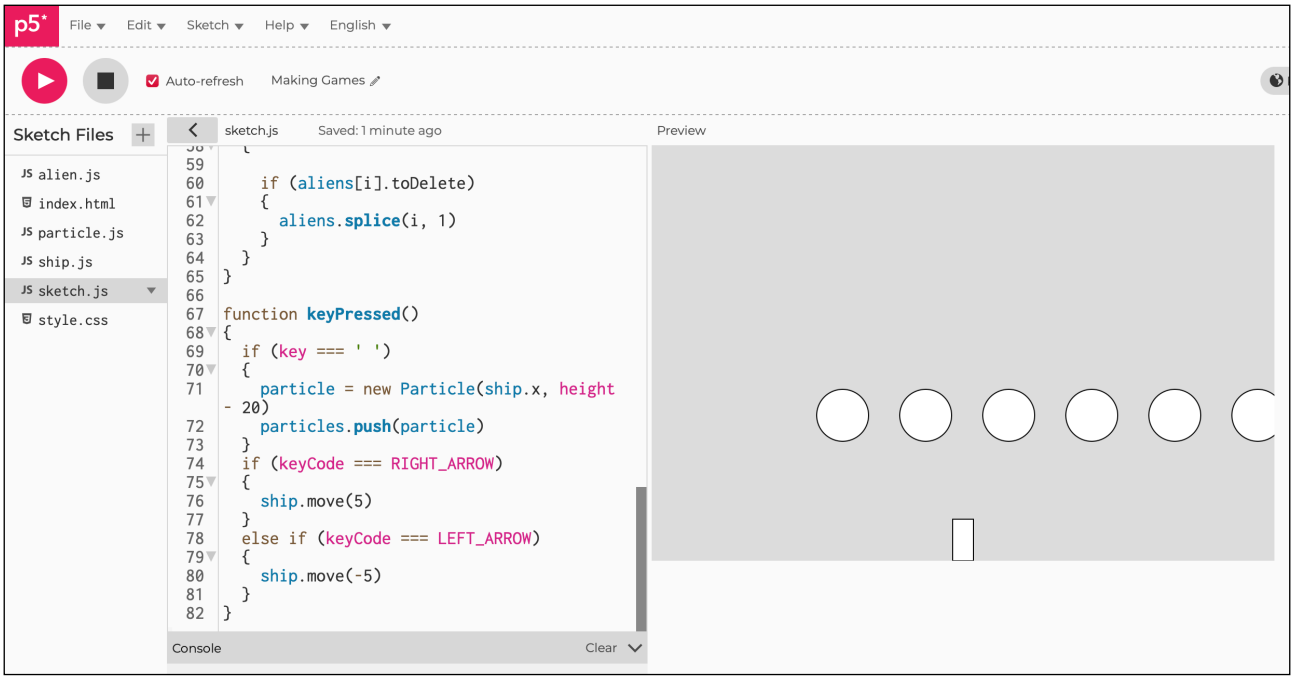
```
      {
        aliens[j].remove()
        particles[i].remove()
      }
    }
  }
  let edge = false
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
    aliens[i].move()
    if (aliens[i].x > width || aliens[i].x < 0)
    {
      edge = true
    }
  }
  if (edge)
  {
    for (let i = 0; i < aliens.length; i++)
    {
      aliens[i].shiftDown()
    }
  }
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
```

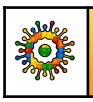
```
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.move(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.move(-5)
  }
}
```

🗒️ Notes

You should see the lines of circles (aliens) move sideways, hit the edge of the canvas, and then move down until they disappear at the bottom of the canvas. They now move across from side to side and then move down.

Figure A4.24


p5*
File
Edit
Sketch
Help
English
Auto-refresh
Making Games
Sketch Files
alien.js
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: 1 minute ago
Preview
59 {
60 if (aliens[i].toDelete)
61 {
62 aliens.splice(i, 1)
63 }
64 }
65 }
66
67 function keyPressed()
68 {
69 if (key === ' ')
70 {
71 particle = new Particle(ship.x, height - 20)
72 particles.push(particle)
73 }
74 if (keyCode === RIGHT_ARROW)
75 {
76 ship.move(5)
77 }
78 else if (keyCode === LEFT_ARROW)
79 {
80 ship.move(-5)
81 }
82 }
Console
Clear



Sketch A4.25 continuous movement

❗ ship.js

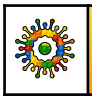
Moving the ship continuously rather than tapping it repeatedly. So in `ship.js` we create a `setDirection()` function. It does, however, keep moving in that direction even after released, but that will be sorted in a moment.

ship.js

```
class Ship
{
  constructor()
  {
    this.x = width / 2
    this.xdirection = 0
  }

  show()
  {
    rect(this.x, height - 20, 20, 40)
  }

  setDirection(direction)
  {
    this.xdirection = direction
  }

  move(direction)
  {
    this.x += this.xdirection
  }
}
```

Notes

Nothing should work just yet.



Sketch A4.26 smooth ship

❗ sketch.js

In sketch.js, we make the following changes:

sketch.js

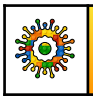
```
let ship
let aliens = []
let particles = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  ship.move()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
    {
```

```
    if (particles[i].hits(aliens[j]))
    {
      aliens[j].remove()
      particles[i].remove()
    }
  }
}

let edge = false

for (let i = 0; i < aliens.length; i++)
{
  aliens[i].show()
  aliens[i].move()
  if (aliens[i].x > width || aliens[i].x < 0)
  {
    edge = true
  }
}

if (edge)
{
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].shiftDown()
  }
}

for (let i = 0; i < particles.length; i++)
{
  if (particles[i].toDelete)
  {
```

```
      particles.splice(i, 1)
    }
  }

  for (let i = 0; i < aliens.length; i++)
  {

    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.setDirection(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.setDirection(-5)
  }
}
```

🗒️ Notes

This works better but you will notice that it doesn't stop when you release the arrow key. This needs to be fixed and it will be!



Sketch A4.27 release and stop

Stopping the ship on release of the arrow keys.

sketch.js

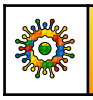
```
let ship
let aliens = []
let particles = []

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
  ship.show()
  ship.move()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
    {
      if (particles[i].hits(aliens[j]))
```

```
    {
      aliens[j].remove()
      particles[i].remove()
    }
  }
}
let edge = false
for (let i = 0; i < aliens.length; i++)
{
  aliens[i].show()
  aliens[i].move()
  if (aliens[i].x > width || aliens[i].x < 0)
  {
    edge = true
  }
}
if (edge)
{
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].shiftDown()
  }
}
for (let i = 0; i < particles.length; i++)
{
  if (particles[i].toDelete)
  {
    particles.splice(i, 1)
  }
}
for (let i = 0; i < aliens.length; i++)
{
```

```
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyReleased()
{
  ship.setDirection(0)
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.setDirection(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.setDirection(-5)
  }
}
```

🗒️ Notes

That is so much better and satisfying.



Sketch A4.28 faster laser particles

❗ particle.js

The particles (lasers) are too slow, speeding up the particles.

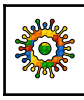
particle.js

```
class Particle
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 10
    this.toDelete = false
  }

  remove()
  {
    this.toDelete = true
  }

  show()
  {
    circle(this.x, this.y, this.r)
  }

  hits(alien)
  {
    let distance = dist(this.x, this.y, alien.x, alien.y)
    if (distance < this.r / 2 + alien.r / 2)
    {
      return true
```

```
    }
    else
    {
      return false
    }
  }

  move()
  {
    this.y -= 5
  }
}
```

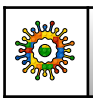
Notes

This game is far from complete. It is a basic model and shows how much goes into creating what seems like a very simple game.



Refinements

We will give the shapes some character, reading a PNG of the ship to replace the rectangle and some proper alien instead of circles.



Creating a png of the alien

Save what you have done already, open a new sketch and call it `alien.png` because we are going to create a PNG image of the alien used in the original game. You will be saving it onto your desktop so that you can later drag and drop it into `sketch.js`.

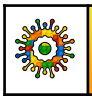
So delete all the default code because you only need two functions: `setup()` and `mouseClicked()`. There is no background (and that is important). I found an image and drew a grid over it. Then coloured each square/rectangle in p5.js - the result is what you can see below.

It may seem a bit tedious to copy out all the lines of code but you can copy and paste bits of it as you go along.

However, think of it as creating your own bit of artwork. You can create any image. The reason we are creating a PNG is because it has a transparent background (hence no background in the sketch).

You do not need to write the comments bit but they will help you keep track!

When you are finished just click on the image in the canvas and it will download it somewhere onto your computer. Wherever it is, move the image onto the desktop for the next stage.



Sketch A4.29 Creating an alien png image

This is the code for the alien.png, a completely new sketch.

Alien PNG sketch

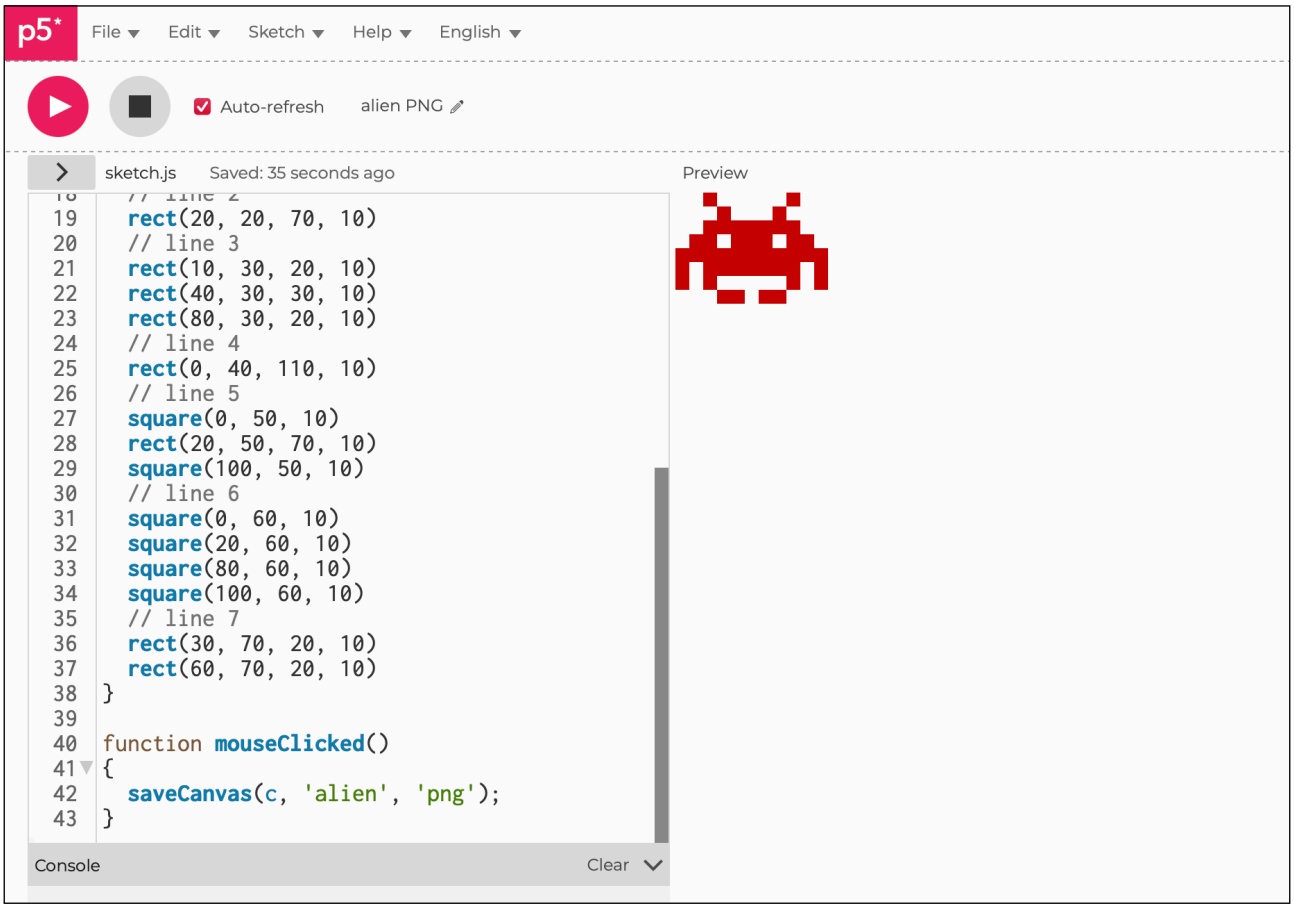
```
let c

function setup()
{
  c = createCanvas(110, 80)
  noStroke()
}

function draw()
{
  fill(200, 0, 0)
  // line 0
  square(20, 0, 10)
  square(80, 0, 10)
  // line 1
  square(30, 10, 10)
  square(70, 10, 10)
  // line 2
  rect(20, 20, 70, 10)
  // line 3
  rect(10, 30, 20, 10)
  rect(40, 30, 30, 10)
  rect(80, 30, 20, 10)
  // line 4
  rect(0, 40, 110, 10)
  // line 5
  square(0, 50, 10)
```

```
  rect(20, 50, 70, 10)
  square(100, 50, 10)
  // line 6
  square(0, 60, 10)
  square(20, 60, 10)
  square(80, 60, 10)
  square(100, 60, 10)
  // line 7
  rect(30, 70, 20, 10)
  rect(60, 70, 20, 10)
}

function mouseClicked()
{
  saveCanvas(c, 'alien', 'png');
}
```

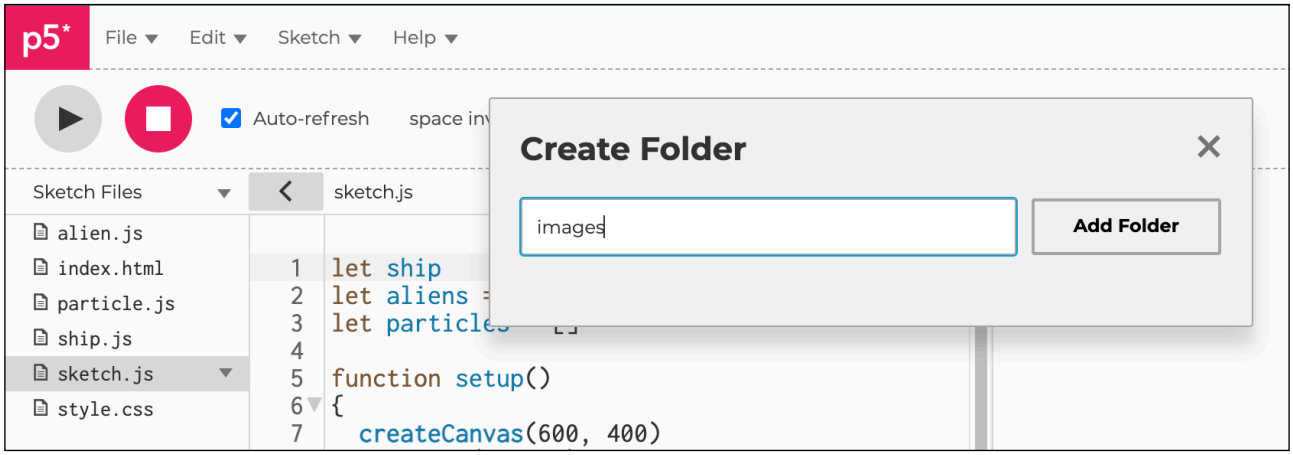
Notes

Open a new sketch and create an alien, click on the image to download it as a PNG image.

Figure 1: an alien



Create a folder called images



Now you will need to go back to your sketch for the Space Invaders game that you saved.

Step 1

Under the tab Sketches (where you created your files for alien.js, particle.js and ship.js), but this time click on Create Folder.

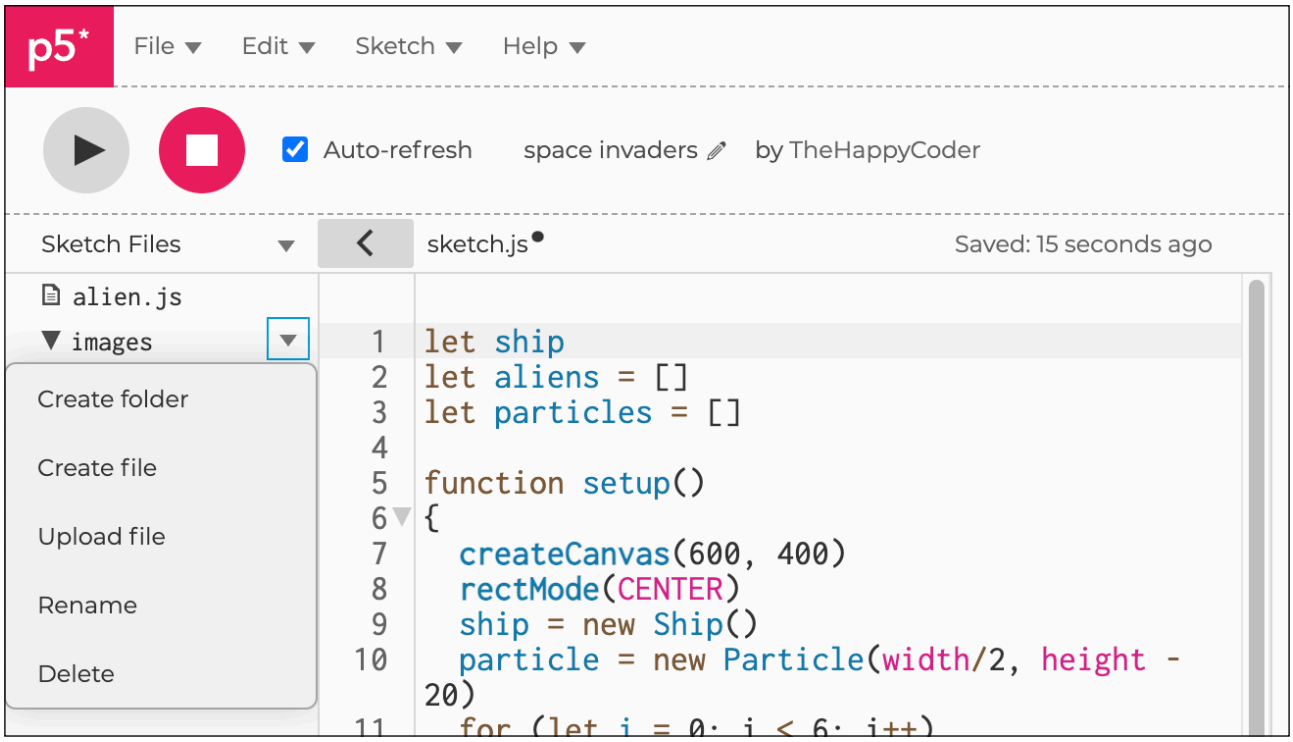
Step 2

Give it the name images.

Step 3

After you have done that, head over to the list of sketches on the left-hand side. You will see a folder called images; click on it. There will be a small triangle (on the right of the name); click on that and you will get a drop-down menu. Select Upload file. Now drag and drop the image from your desktop.

Click on images and the drop down menu appears, click on upload file



Step 4

The name of the image will now appear in that folder with the extension PNG. If the name is not the one you want, then rename it either in its own drop-down box or rename it on the desktop and redo the drag and drop.

Step 5

I have called mine `alien.png`, yours should be the same, although if you have made several copies, it might have an index number as well. The name that appears here is important for what you put in the sketch next.

Drag and drop the file and it will be uploaded,
the name appears in the column on the left under images

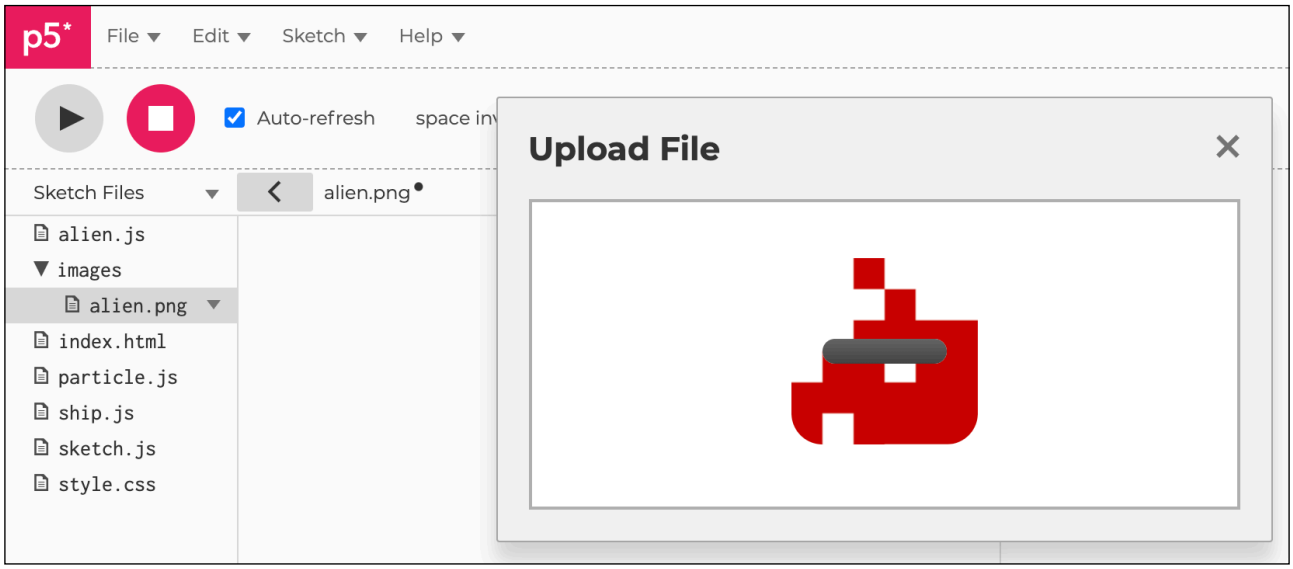
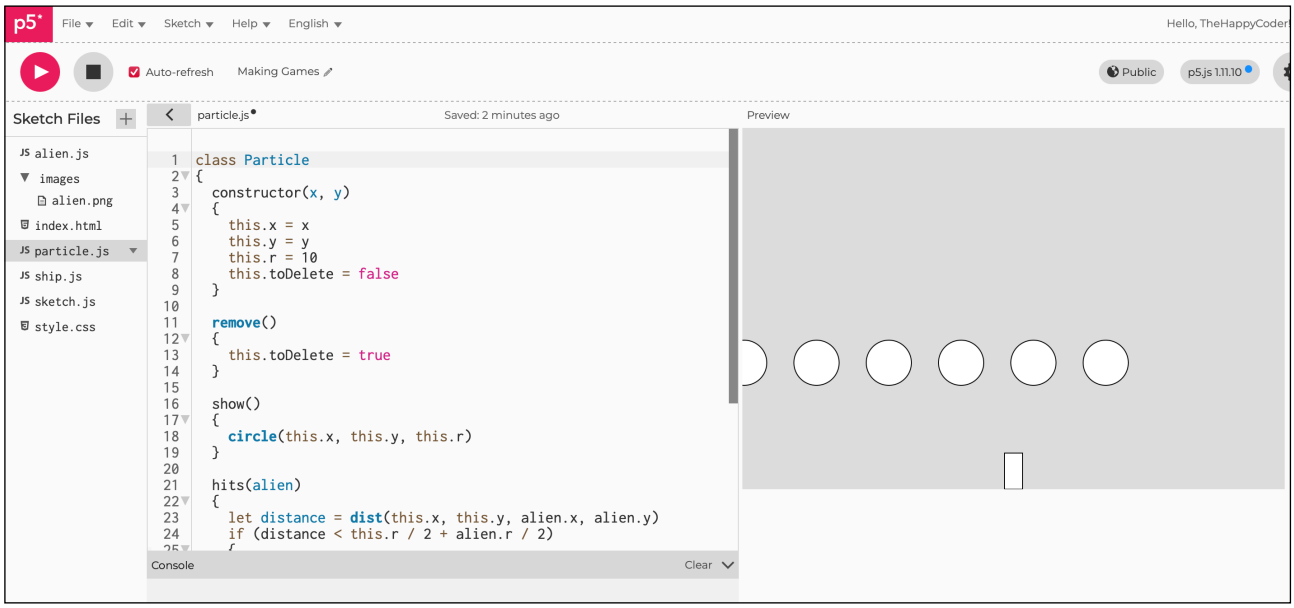
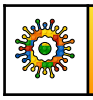


Figure 2: uploaded PNG





Sketch A4.30 adding the alien png

❗ sketch.js

The `preload()` function is to make sure the alien image is loaded properly before starting the game. The commented-out bit can be uncommented to make sure that the image is there before we replace the circle with the alien image.

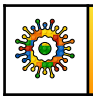
sketch.js

```
let ship
let aliens = []
let particles = []
let imgAlien

function preload()
{
  imgAlien = loadImage('images/alien.png')
}

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(220)
```

```
ship.show()
ship.move()
for (let i = 0; i < particles.length; i++)
{
  particles[i].show()
  particles[i].move()
  for (let j = 0; j < aliens.length; j++)
  {
    if (particles[i].hits(aliens[j]))
    {
      aliens[j].remove()
      particles[i].remove()
    }
  }
}
let edge = false
for (let i = 0; i < aliens.length; i++)
{
  aliens[i].show()
  aliens[i].move()
  if (aliens[i].x > width || aliens[i].x < 0)
  {
    edge = true
  }
}
if (edge)
{
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].shiftDown()
  }
}
```

```
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyReleased()
{
  ship.setDirection(0)
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.setDirection(5)
```

```
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.setDirection(-5)
  }
}
```



Sketch A4.31 they are here!

❗ alien.js

Replacing the circle with our alien PNG.

alien.js

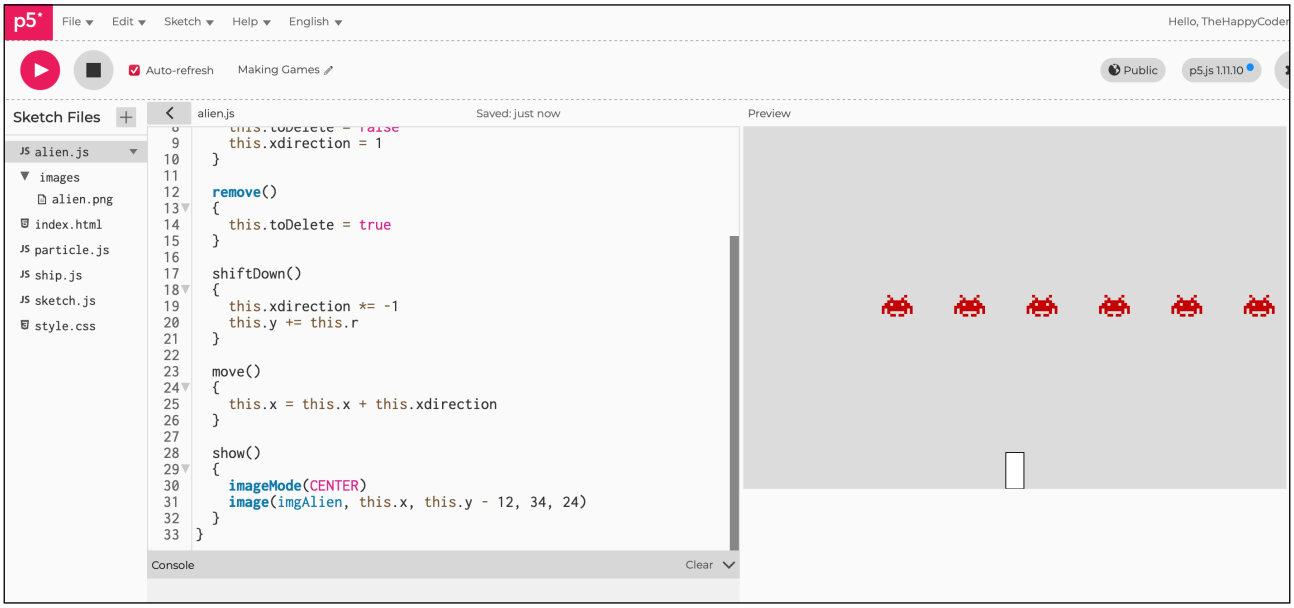
```
class Alien
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 50
    this.toDelete = false
    this.xdirection = 1
  }

  remove()
  {
    this.toDelete = true
  }

  shiftDown()
  {
    this.xdirection *= -1
    this.y += this.r
  }

  move()
  {
    this.x = this.x + this.xdirection
  }
```

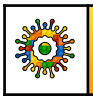
```
  show()
  {
    imageMode(CENTER)
    image(imgAlien, this.x, this.y - 12, 34, 24)
  }
}
```

🗒️ Notes

This is what you should have, below.

Figure A4.31


p5
File
Edit
Sketch
Help
English
Hello, TheHappyCoder
Auto-refresh
Making Games
Public
p5.js 1.11.10
Sketch Files
alien.js
images
alien.png
index.html
particle.js
ship.js
sketch.js
style.css
alien.js
Saved: just now
Preview
this.xdirection = 1
}
remove()
{
this.toDelete = true
}
shiftDown()
{
this.xdirection *= -1
this.y += this.r
}
move()
{
this.x = this.x + this.xdirection
}
show()
{
imageMode(CENTER)
image(imgAlien, this.x, this.y - 12, 34, 24)
}
}
Console
Clear



Sketch A4.32 Creating a png of the ship

Following the same procedure, creating the PNG sketch for the ship, remember to change the name of it.

Ship PNG sketch

```
let c

function setup()
{
  c = createCanvas(110, 60)
  noStroke()
}

function draw()
{
  fill(0, 200, 0)
  // line 0
  square(50, 0, 10)
  // line 1
  rect(40, 10, 30, 10)
  // line 2
  rect(40, 20, 30, 10)
  // line 3
  rect(10, 30, 90, 10)
  // line 4
  rect(0, 40, 110, 10)
  // line 5
  rect(0, 50, 110, 10)
}

function mouseClicked()
```

```
{
    saveCanvas(c, 'ship', 'png');
}
```

🗒️ Notes

Repeat the same process for the ship as you did with the alien. Not the most exciting ship ever, but nice and simple. You could create a better one, and please do.

Figure 1: ship PNG

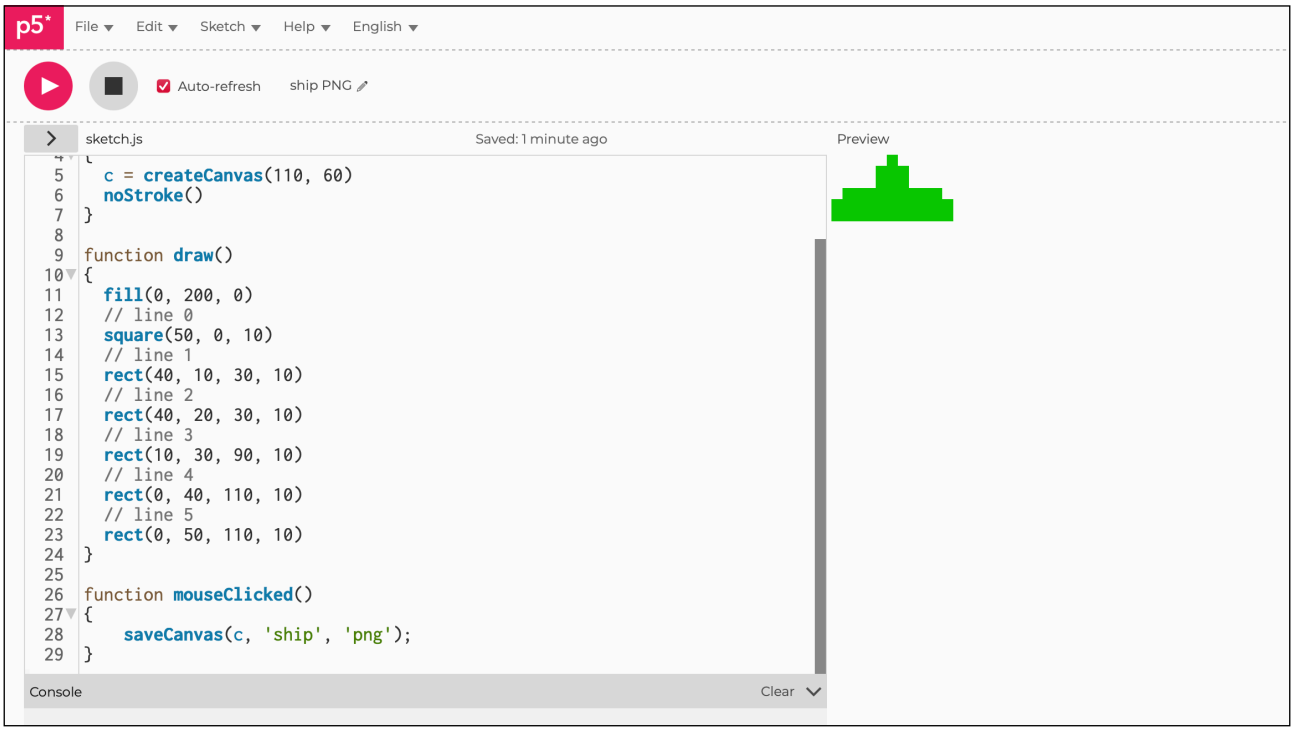
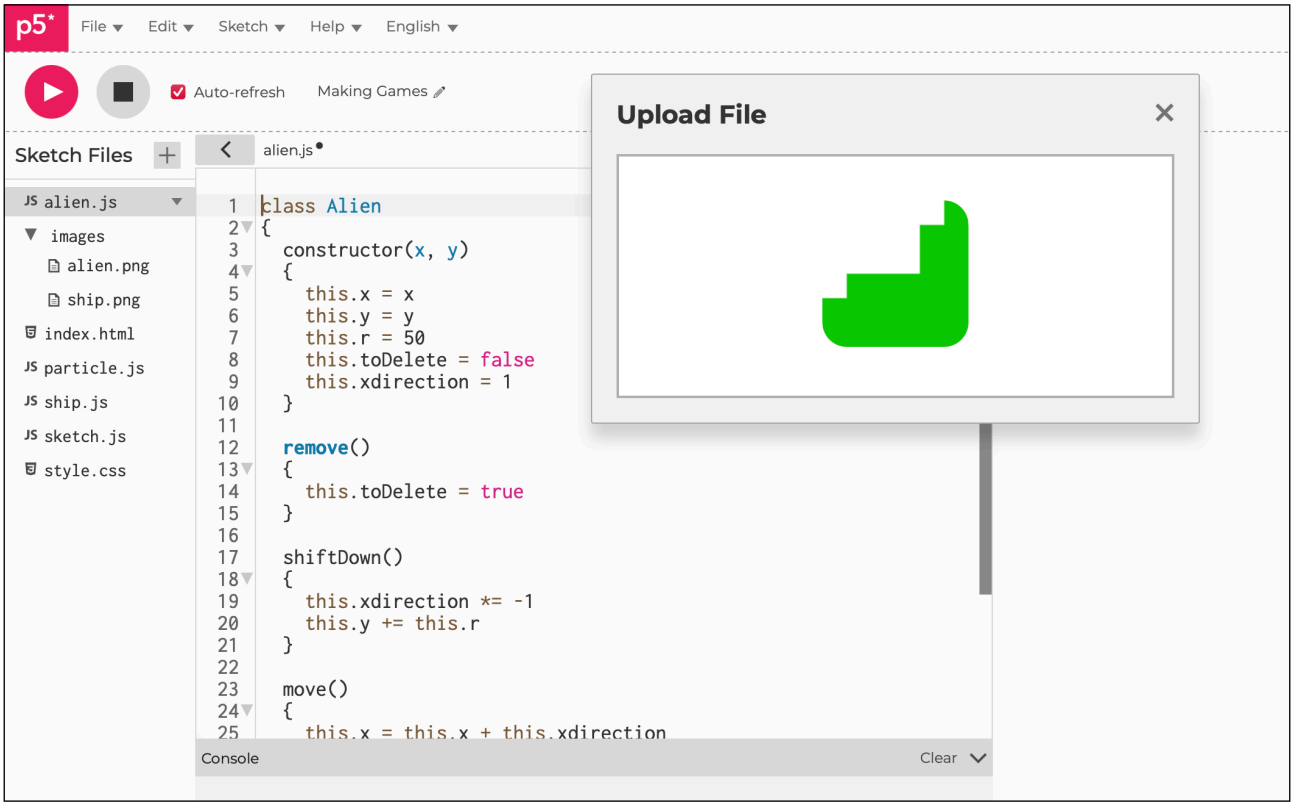
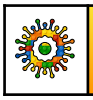


Figure 2: uploading ship





Sketch A4.33 adding the ship png

❗ sketch.js

Return to the Space Invaders sketch.js, remember to upload the new image PNG into the folder images.

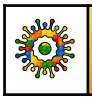
sketch.js

```
let ship
let aliens = []
let particles = []
let imgAlien
let imgShip

function preload()
{
  imgAlien = loadImage('images/alien.png')
  imgShip = loadImage('images/ship.png')
}

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
```

```
background(220)
ship.show()
ship.move()
for (let i = 0; i < particles.length; i++)
{
  particles[i].show()
  particles[i].move()
  for (let j = 0; j < aliens.length; j++)
  {
    if (particles[i].hits(aliens[j]))
    {
      aliens[j].remove()
      particles[i].remove()
    }
  }
}
let edge = false
for (let i = 0; i < aliens.length; i++)
{
  aliens[i].show()
  aliens[i].move()
  if (aliens[i].x > width || aliens[i].x < 0)
  {
    edge = true
  }
}
if (edge)
{
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].shiftDown()
  }
```

```
  }
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyReleased()
{
  ship.setDirection(0)
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 20)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.setDirection(5)
```

```
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.setDirection(-5)
  }
}
```



Sketch A4.34 the ship has landed

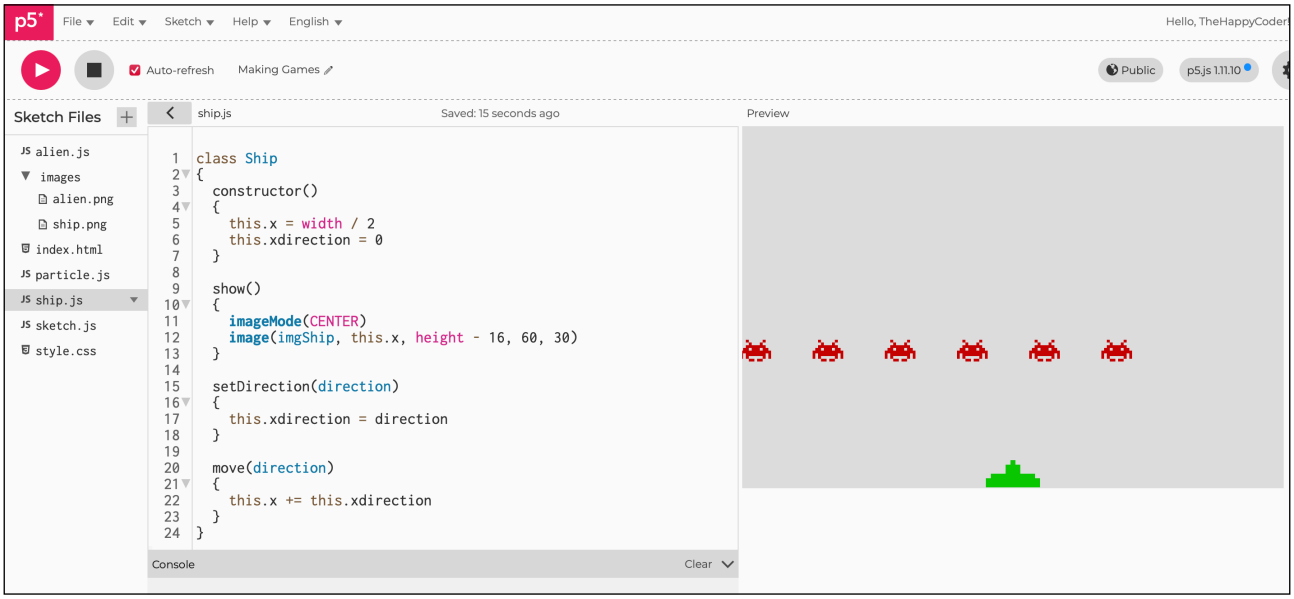
❗ ship.js

In ship.js, replace the rectangle with the ship.png.

ship.js

```
class Ship
{
  constructor()
  {
    this.x = width / 2
    this.xdirection = 0
  }

  show()
  {
    imageMode(CENTER)
    image(imgShip, this.x, height - 16, 60, 30)
  }

  setDirection(direction)
  {
    this.xdirection = direction
  }

  move(direction)
  {
    this.x += this.xdirection
  }
}
```

Figure A4.34


p5*
File
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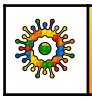
Auto-refresh
Making Games
Public
p5.js 1.11.10
Sketch Files
alien.js
images
alien.png
ship.png
index.html
particle.js
ship.js
sketch.js
style.css
ship.js
Saved: 15 seconds ago
Preview
1 class Ship
2 {
3 constructor()
4 {
5 this.x = width / 2
6 this.xdirection = 0
7 }
8
9 show()
10 {
11 imageMode(CENTER)
12 image(imgShip, this.x, height - 16, 60, 30)
13 }
14
15 setDirection(direction)
16 {
17 this.xdirection = direction
18 }
19
20 move(direction)
21 {
22 this.x += this.xdirection
23 }
24 }
Console
Clear



Sketch A4.35 some improvements

❗ sketch.js

Making some improvements, moving the particles' starting position, and creating a black background.

sketch.js

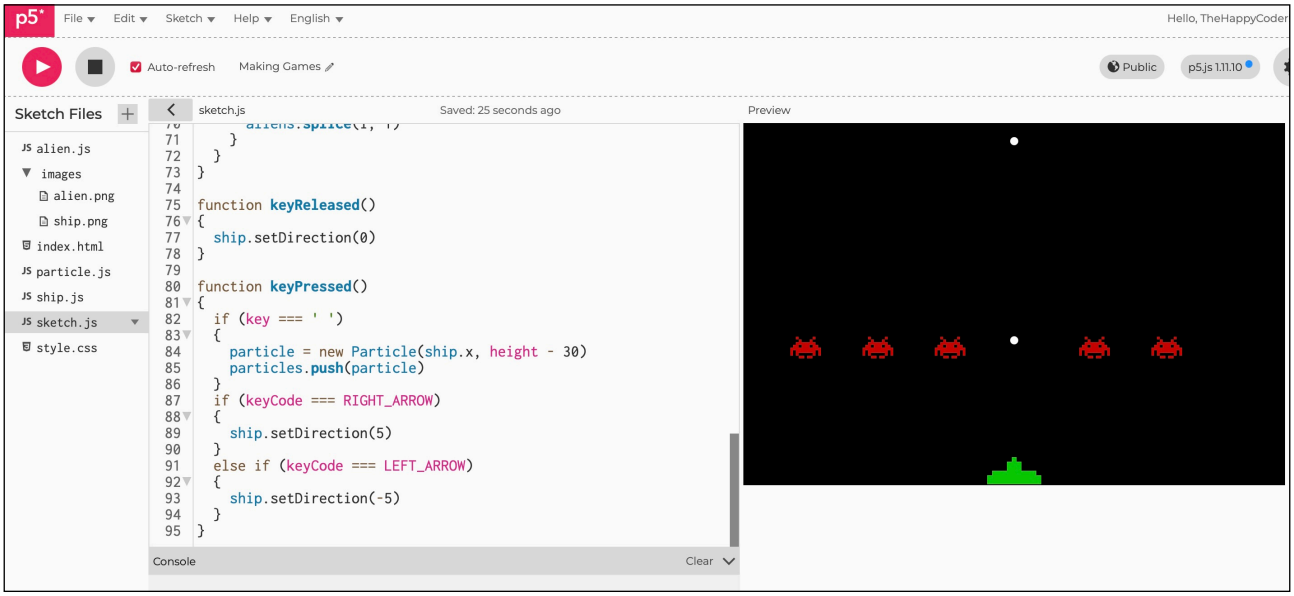
```
let ship
let aliens = []
let particles = []
let imgAlien
let imgShip

function preload()
{
  imgAlien = loadImage('images/alien.png')
  imgShip = loadImage('images/ship.png')
}

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
```

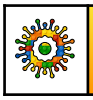
```
background(0)
ship.show()
ship.move()
for (let i = 0; i < particles.length; i++)
{
  particles[i].show()
  particles[i].move()
  for (let j = 0; j < aliens.length; j++)
  {
    if (particles[i].hits(aliens[j]))
    {
      aliens[j].remove()
      particles[i].remove()
    }
  }
}
let edge = false
for (let i = 0; i < aliens.length; i++)
{
  aliens[i].show()
  aliens[i].move()
  if (aliens[i].x > width || aliens[i].x < 0)
  {
    edge = true
  }
}
if (edge)
{
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].shiftDown()
  }
```

```
  }
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyReleased()
{
  ship.setDirection(0)
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 30)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.setDirection(5)
```

```
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.setDirection(-5)
  }
}
```

Figure A4.35


p5*
File
Edit
Sketch
Help
English
Hello, TheHappyCoder
Auto-refresh
Making Games
Public
p5.js 1.11.10
Sketch Files
alien.js
images
alien.png
ship.png
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: 25 seconds ago
Preview
}
}
}
function keyReleased()
{
ship.setDirection(0)
}
function keyPressed()
{
if (key === ' ')
{
particle = new Particle(ship.x, height - 30)
particles.push(particle)
}
if (keyCode === RIGHT_ARROW)
{
ship.setDirection(5)
}
else if (keyCode === LEFT_ARROW)
{
ship.setDirection(-5)
}
}
Console
Clear



Sketch A4.36 improved particle

❗ particle.js

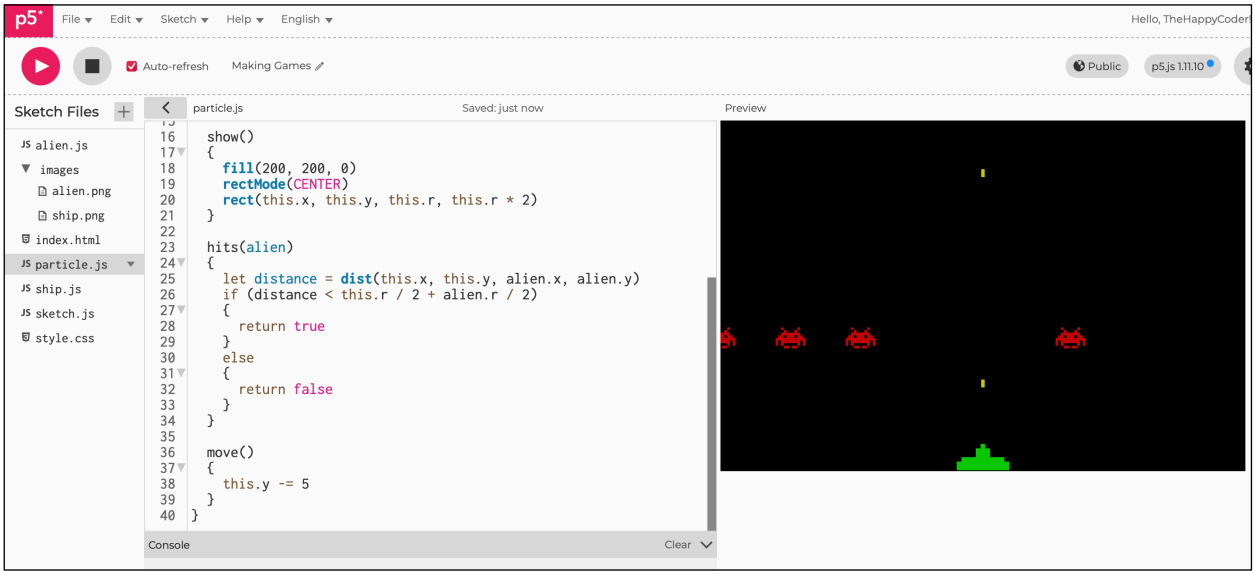
Improvements to the particle.

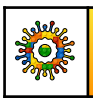
particle.js

```
class Particle
{
  constructor(x, y)
  {
    this.x = x
    this.y = y
    this.r = 5
    this.toDelete = false
  }

  remove()
  {
    this.toDelete = true
  }

  show()
  {
    fill(200, 200, 0)
    rectMode(CENTER)
    rect(this.x, this.y, this.r, this.r * 2)
  }

  hits(alien)
  {
    let distance = dist(this.x, this.y, alien.x, alien.y)
    if (distance < this.r / 2 + alien.r / 2)
```

```
    {
      return true
    }
    else
    {
      return false
    }
  }

  move()
  {
    this.y -= 5
  }
}
```

Figure A4.36


p5*
File
Edit
Sketch
Help
English
Hello, TheHappyCoder
Auto-refresh
Making Games
Public
p5.js 1.11.10
Sketch Files
alien.js
images
alien.png
ship.png
index.html
particle.js
ship.js
sketch.js
style.css
particle.js
Saved: just now
Preview
show()
{
fill(200, 200, 0)
rectMode(CENTER)
rect(this.x, this.y, this.r, this.r * 2)
}
hits(alien)
{
let distance = dist(this.x, this.y, alien.x, alien.y)
if (distance < this.r / 2 + alien.r / 2)
{
return true
}
else
{
return false
}
}
move()
{
this.y -= 5
}
}
Console
Clear



Sketch A4.37 stopping at the edges

❗ sketch.js

Adding an edge stop for the ship.

sketch.js

```
let ship
let aliens = []
let particles = []
let imgAlien
let imgShip

function preload()
{
  imgAlien = loadImage('images/alien.png')
  imgShip = loadImage('images/ship.png')
}

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
}

function draw()
{
  background(0)
```

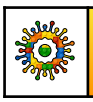
```
  ship.show()
  ship.move()
  ship.edge()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
    {
      if (particles[i].hits(aliens[j]))
      {
        aliens[j].remove()
        particles[i].remove()
      }
    }
  }
  let edge = false
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
    aliens[i].move()
    if (aliens[i].x > width || aliens[i].x < 0)
    {
      edge = true
    }
  }
  if (edge)
  {
    for (let i = 0; i < aliens.length; i++)
    {
      aliens[i].shiftDown()
    }
```

```
  }
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyReleased()
{
  ship.setDirection(0)
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 30)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.setDirection(5)
```

```
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.setDirection(-5)
  }
}
```

🗒️ Notes

You'll get an error message until we build the function.



Sketch A4.38 ship does not stray

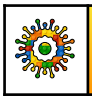
❗ ship.js

Stopping the ship at the edges of the canvas in ship.js.

ship.js

```
class Ship
{
  constructor()
  {
    this.x = width / 2
    this.xdirection = 0
  }

  show()
  {
    imageMode(CENTER)
    image(imgShip, this.x, height - 16, 60, 30)
  }

  setDirection(direction)
  {
    this.xdirection = direction
  }

  move(direction)
  {
    this.x += this.xdirection
  }

  edge()
  {
```

```
    if (this.x <= 0)
    {
      this.x = 0
    }
    if (this.x >= width)
    {
      this.x = width
    }
  }
}
```



Sketch A4.39 twinkling stars

❗ sketch.js

For a finishing flourish, add some twinkling stars.

sketch.js

```
let ship
let aliens = []
let particles = []
let imgAlien
let imgShip
let stars = []

function preload()
{
  imgAlien = loadImage('images/alien.png')
  imgShip = loadImage('images/ship.png')
}

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
  for (let i = 0; i < 50; i++)
  {
    stars[i] = createVector(random(width), random(height))
  }
```

```
}

function draw()
{
  background(0)
  for (let i = 0; i < 50; i++)
  {
    stroke(255, random(255))
    strokeWeight(random(3))
    point(stars[i].x, stars[i].y)
  }
  ship.show()
  ship.move()
  ship.edge()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
    {
      if (particles[i].hits(aliens[j]))
      {
        aliens[j].remove()
        particles[i].remove()
      }
    }
  }
  let edge = false
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
    aliens[i].move()
```

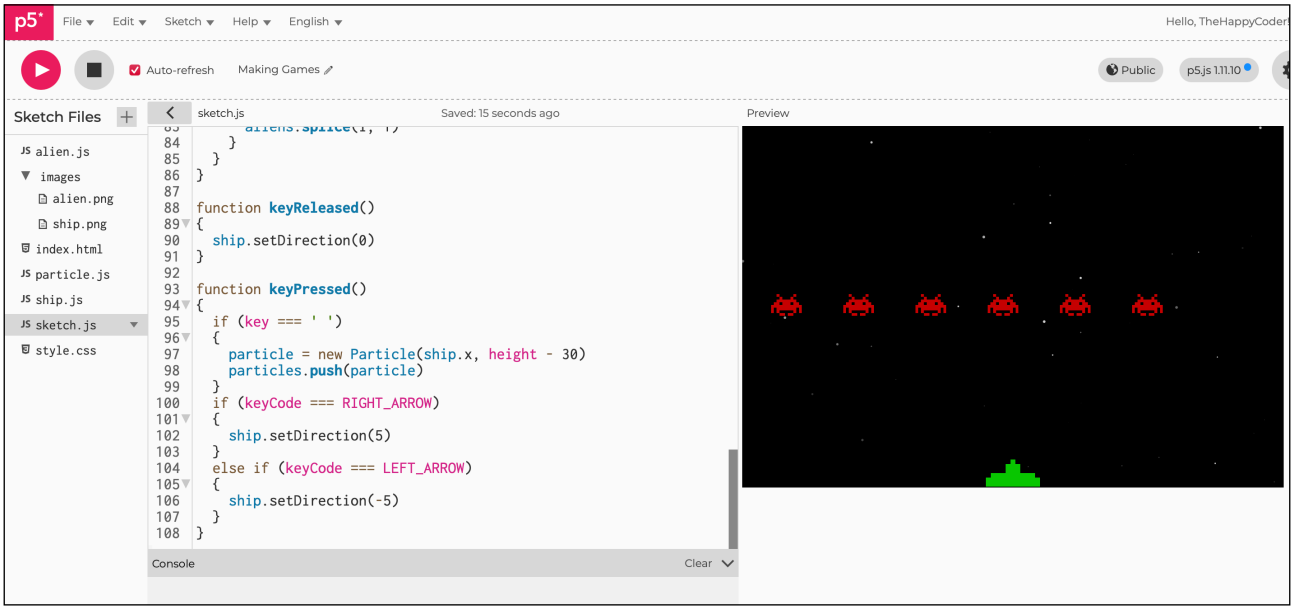
```
    if (aliens[i].x > width || aliens[i].x < 0)
    {
      edge = true
    }
  }
  if (edge)
  {
    for (let i = 0; i < aliens.length; i++)
    {
      aliens[i].shiftDown()
    }
  }
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }

  for (let i = 0; i < aliens.length; i++)
  {
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
}

function keyReleased()
{
  ship.setDirection(0)
```

```
}

function keyPressed()
{
  if (key === ' ')
  {
    particle = new Particle(ship.x, height - 30)
    particles.push(particle)
  }
  if (keyCode === RIGHT_ARROW)
  {
    ship.setDirection(5)
  }
  else if (keyCode === LEFT_ARROW)
  {
    ship.setDirection(-5)
  }
}
```

🗒️ Notes

Something like this, a nice effect.

Figure A4.39


p5*
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Sketch Files
alien.js
images
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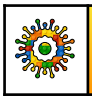
ship.png
index.html
particle.js
ship.js
sketch.js
style.css
sketch.js
Saved: 15 seconds ago
Preview
}
}
}
function keyReleased()
{
ship.setDirection(0)
}
function keyPressed()
{
if (key === ' ')
{
particle = new Particle(ship.x, height - 30)
particles.push(particle)
}
if (keyCode === RIGHT_ARROW)
{
ship.setDirection(5)
}
else if (keyCode === LEFT_ARROW)
{
ship.setDirection(-5)
}
}
Console
Clear



Sketch A4.40 and finally

Just another thought to try: this time everything is done from the mouse, the movement (move the mouse) and the firing (click the mouse).

sketch.js

```
let ship
let aliens = []
let particles = []
let imgAlien
let imgShip
let stars = []

function preload()
{
  imgAlien = loadImage('images/alien.png')
  imgShip = loadImage('images/ship.png')
}

function setup()
{
  createCanvas(600, 400)
  rectMode(CENTER)
  ship = new Ship()
  for (let i = 0; i < 6; i++)
  {
    aliens[i] = new Alien(i * 80 + 80, 60)
  }
  for (let i = 0; i < 50; i++)
  {
    stars[i] = createVector(random(width), random(height))
  }
```

```
}

function draw()
{
  background(0)
  for (let i = 0; i < 50; i++)
  {
    stroke(255, random(255))
    strokeWeight(random(3))
    point(stars[i].x, stars[i].y)
  }
  ship.show()
  ship.move()
  ship.edge()
  for (let i = 0; i < particles.length; i++)
  {
    particles[i].show()
    particles[i].move()
    for (let j = 0; j < aliens.length; j++)
    {
      if (particles[i].hits(aliens[j]))
      {
        aliens[j].remove()
        particles[i].remove()
      }
    }
  }
  let edge = false
  for (let i = 0; i < aliens.length; i++)
  {
    aliens[i].show()
    aliens[i].move()
```

```
    if (aliens[i].x > width || aliens[i].x < 0)
    {
      edge = true
    }
  }
  if (edge)
  {
    for (let i = 0; i < aliens.length; i++)
    {
      aliens[i].shiftDown()
    }
  }
  for (let i = 0; i < particles.length; i++)
  {
    if (particles[i].toDelete)
    {
      particles.splice(i, 1)
    }
  }
  for (let i = 0; i < aliens.length; i++)
  {
    if (aliens[i].toDelete)
    {
      aliens.splice(i, 1)
    }
  }
  mouseMove()
}

function mouseMove()
{
  let d = mouseX - ship.x
```

```
  let c = map(d, -width/2, width/2, -10, 10)
  if (d >= 0)
  {
    ship.setDirection(c)
  }
  if (d <= 0)
  {
    ship.setDirection(c)
  }
}

function mousePressed()
{
  particle = new Particle(ship.x, height - 30)
  particles.push(particle)
}
```

To Finish

Make your own improvement and have fun, share with your friends, get them to test it out and make recommendations.

Challenges

1. Create more aliens, smaller faster moving
2. Have the aliens attacking
3. Add more levels
4. Add a score/life
5. Sound!
6. Delete the particles when they go off the canvas
7. Taller canvas