

## Swarms, schools, and flocks

Create a game that uses clones to make swarms, schools, flocks, or another group of animals.



### Step 1 You will make

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Create a game that uses clones to make swarms of insects, schools of fish, flocks of birds, or any group of animals that you want.

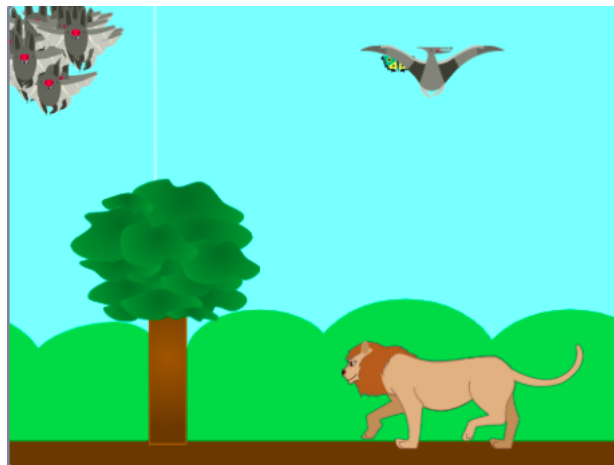
**Groups of animals** such as swarms, schools, and flocks will often move together in what might appear to be random ways, but when you look at the entire group, there will be some order in their movements.

You will:

- Use clones to generate a group of animals
- Use the random operator to allow clones to act individually
- Give clones a game-like objective

Get ideas

You are going to make some design decisions to create your game. See inside the example projects in or Scratch 3: Clones examples Scratch studio <https://scratch.mit.edu/studios/29971894/>{target="\_blank"}.



## Step 2 Create your scrolling scene

Create a new scene and then have it scroll with the mouse motion.



Open a new Scratch project (<https://rpf.io/scratch-new>), Scratch will open in another browser tab.



### Working offline

For information about how to set up Scratch for offline use, visit our 'Getting started with Scratch' guide (<https://projects.raspberrypi.org/en/projects/getting-started-scratch/1>).

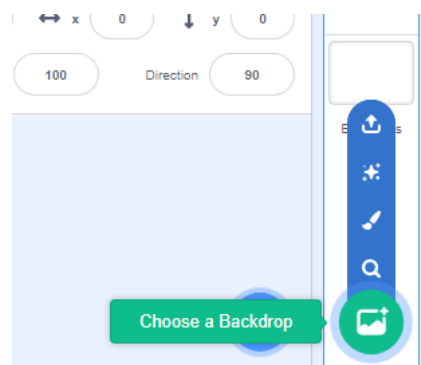
Think about what type of scene you will create. You can choose a few sprites now, to give yourself some inspiration. Then choose a backdrop that you think will fit the scene you are imagining.

Choose a fitting backdrop for your scene, one that matches the environment where your animals would live.

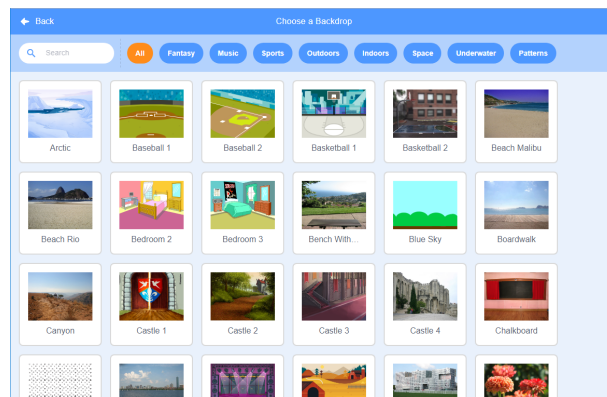


### Add a backdrop from the Backdrop Library

Click on Choose a Backdrop in the bottom right-hand corner of the screen to open the Backdrop Library:



You can search for a backdrop, or browse for one by category. Click on a backdrop to add it to your project.

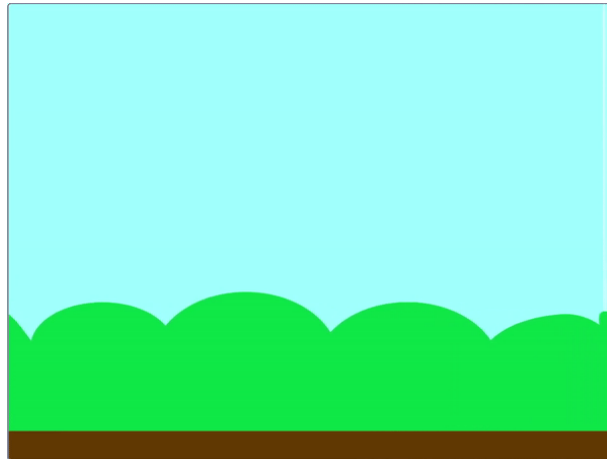


You want it so that moving the mouse will allow scrolling behaviour in your game. You can either make the foreground sprites move, or you can turn the backdrop into a sprite and have this move.

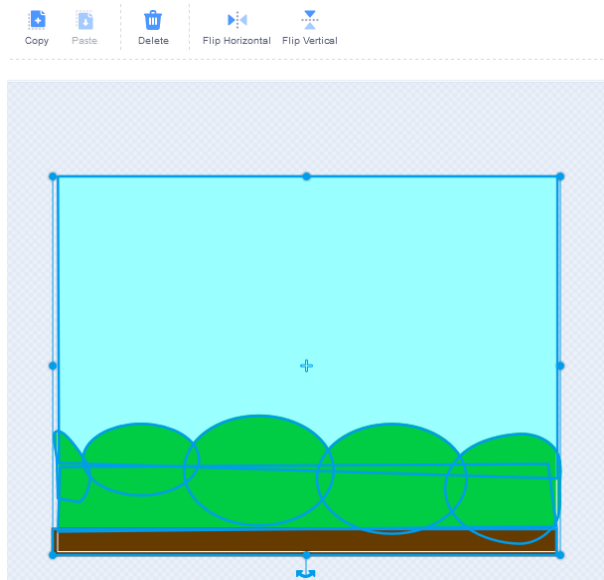
Either add additional sprites to your scene, which scroll when the mouse is moved, or convert your backdrop into a sprite and have this scroll when the mouse moves.



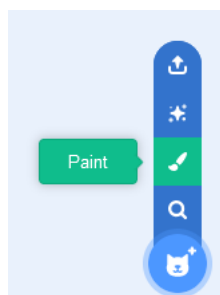
Convert a backdrop and make it scroll



In the Backdrops paint editor, select the entire backdrop and then use the Copy menu item to copy the entire backdrop.



Paint a new sprite and paste the backdrop scene into the new sprite so it becomes one of the costumes.



To add scrolling behaviour to your new sprite, you can use the following scripts. You will need some way to say whether the sprite is moving left or right. In the example, a broadcast is used, but this could be mouse position or key/button presses.

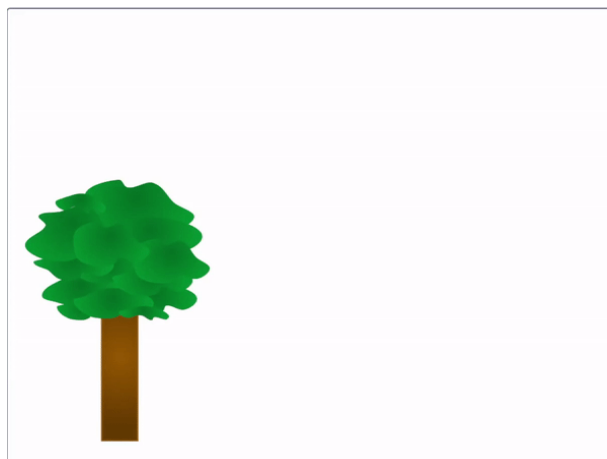
```
when I receive left
change x by 3
```

```
when I receive right
change x by -3
```

```
when I receive start
go to back layer
go to x: 0 y: 0
create clone of myself
change x by 460
broadcast scroll
```

```
when I receive scroll
forever
if x position > 460 then
set x to -460
if x position < -460 then
set x to 460
```

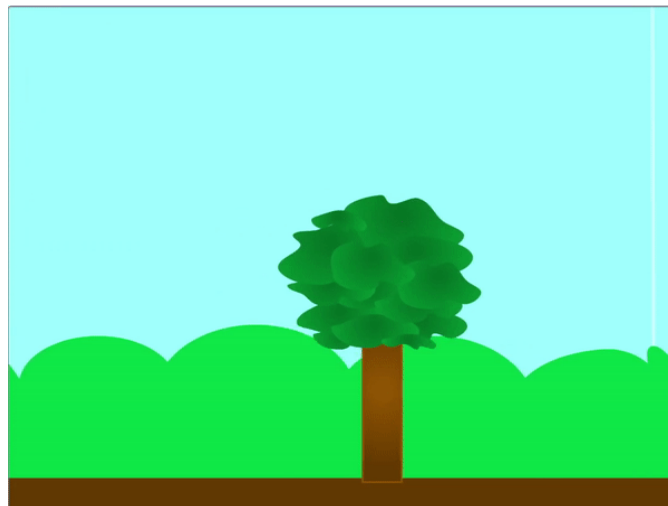
**i** Make sprites scroll with mouse motion




Add the following code to your foreground sprite to make it scroll left and right as the mouse is moved to either side of the screen. You can adjust the numbers to your liking.

```
when green flag clicked
  go to x: 0 y: -80
  forever
    if mouse x > 200 then
      change x by -10
    if mouse x < -200 then
      change x by 10
    if x position > 290 then
      set x to -280
    if x position < -290 then
      set x to 280
```

If you like, you can combine the two techniques.

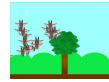


 Save your project

### Step 3 Add your clones

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In this step, you will make some clones that will swarm, flock, or school together.



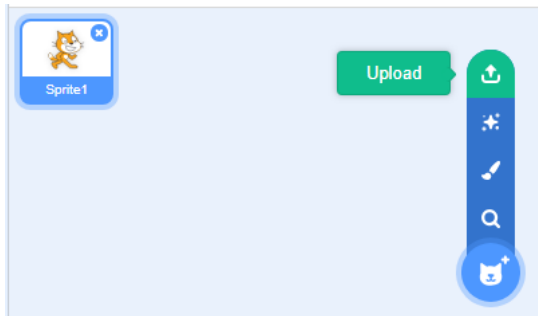
Social animals tend to live in groups. Some examples can be found in species of bees, ants, birds, fish, and mammals such as cows and sheep.



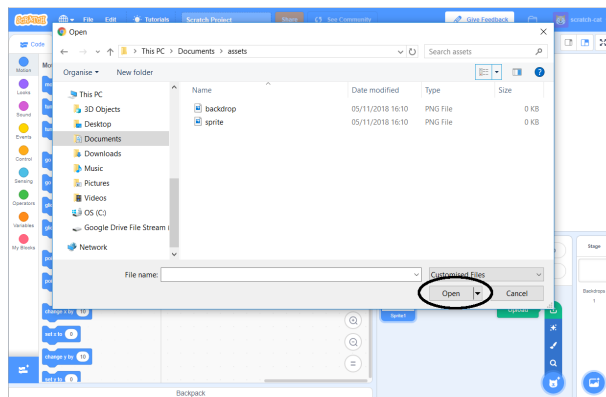
Choose: Choose an animal sprite. It is best to choose a sprite that represents a social animal, but the choice is up to you. If you prefer, you could draw your own sprite, or upload one to Scratch from a picture you have found online.

**i** Adding a sprite from a file

- Click Upload from the sprite menu to open up a file browser.

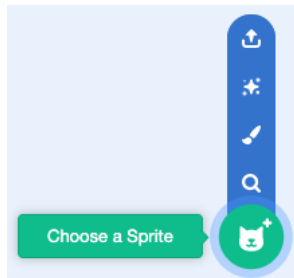


- Choose a file and click on Open when you are done.

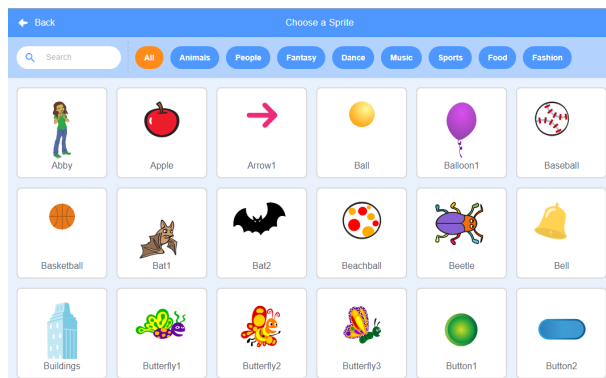


**i** Add a sprite from the Sprite Library

Click on Choose a Sprite to open the Sprite Library:



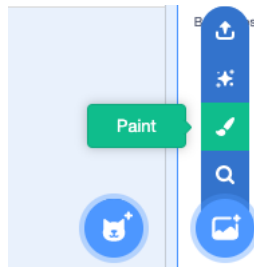
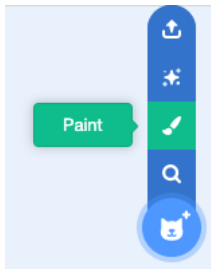
You can search for a sprite, or browse for one by category. Click on a sprite to add it to your project.



**i** Create backdrops and sprites using shapes

You can create backdrops and costumes for sprites in the Paint editor, using just shapes.

Go to the Choose a Sprite or Choose a Backdrop menu and choose the Paint option:



Select which tool(s) to use to make the shape(s) that you want:

- Circle: Click on the Circle tool to draw a circle. Press and hold the **Shift** key on your keyboard to draw a perfect circle.



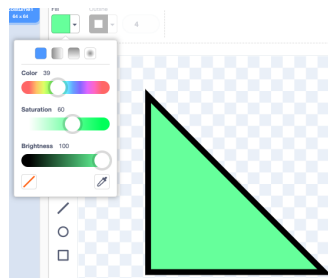
- Rectangle: Click on the Rectangle tool to draw a rectangle. Press and hold the **Shift** key to draw a square.



- Triangle: Use the Rectangle tool to draw a rectangle or a square. Click on the Reshape tool and select the corner that you want to remove. Click on the Delete tool to turn your shape into a triangle.



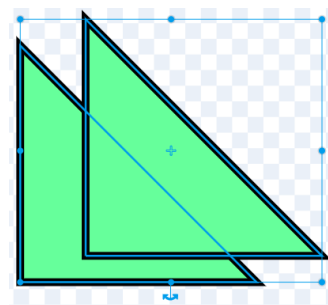
You can use the Fill tool to change the colour of a shape:



You may need to use the Forward and Backward tools to move your shapes forward or backward so that they are positioned correctly within your image:



You can select all the shapes and Group them together so that you can adjust them or move them as one shape:



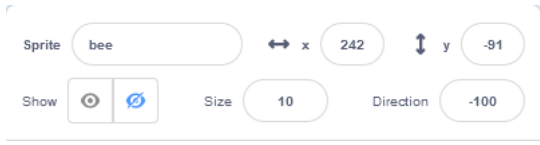
Here is an example of a sprite created with the Circle and Rectangle tools:

Pig: See inside (<https://scratch.mit.edu/projects/495903163/editor>).

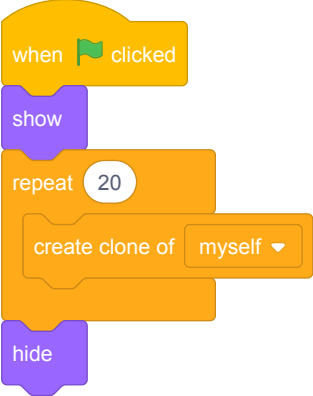
Remember to name the costumes and backdrops that you create in the Paint editor.

This sprite will have lots of clones, so it might be a little too big for the stage to begin with.

Change the size property of the sprite to a value you think is sensible. ✓



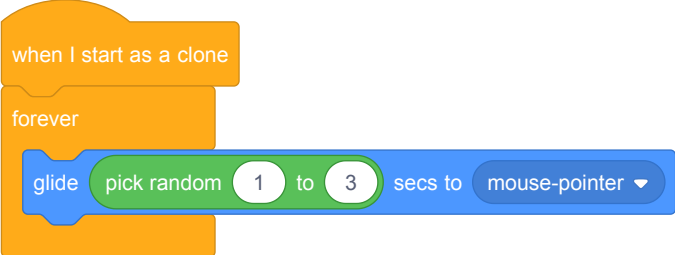
When the flag is clicked, your animal sprite should generate some clones, and then hide itself. Choose: You can choose how many clones are generated. ✓



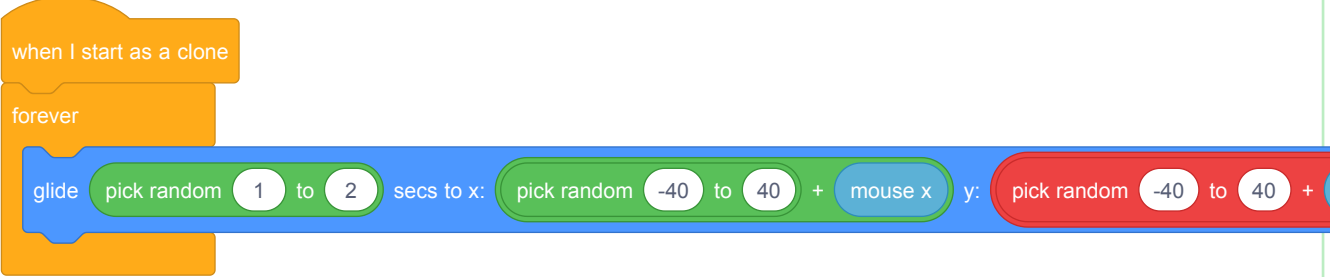
Your cloned animals now need to gather some food. To help them out, you can use your mouse-pointer to guide them.

Add blocks so that the clones move towards the mouse-pointer in a random fashion. ✓

**i** Gliding over a random time  
The following code will have the clones glide towards the mouse-pointer in a random time.



**i** Gliding to the mouse-pointer with a random position  
The following code will have the clones glide towards the mouse-pointer, but will add some randomness to the position.



Test: Have a go at running your code. Do your clones behave as you expect? Do you need to alter the number of clones that are made, or the way they move? ✓



Save your project

## Step 4 Feed your clones

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Now it's time to feed your animal clones; the player needs to guide them to a food source so they can collect it.



Choose, upload, or draw a sprite to represent the food your animals will eat.





Make the food appear on the screen. It could appear in a random position and at random times. It might move randomly around the screen. Maybe your animals' food does not move around, but it should scroll with the rest of the scenery.

**i** Make a sprite appear in a random position for a random time

Adjust the **random** ranges to change how often the sprite disappears and reappears.

```
when clicked
  forever
    hide
    wait pick random 1 to 10 seconds
    show
    go to random position
    wait pick random 1 to 10 seconds
```

**i** Move a sprite randomly around the screen

Adjust the **random** range to change how quickly the sprite moves around the screen.

```
when clicked
  forever
    glide pick random 1 to 2 secs to random position
```

**i** Make sprites scroll with mouse motion

Add the following code to your sprite to make it scroll left and right as the mouse is moved to either side of the screen.

```
when green flag clicked
  go to x: 0 y: -80
  forever
    if mouse x > 200 then
      change x by -10
    if mouse x < -200 then
      change x by 10
    if x position > 290 then
      set x to -280
    if x position < -290 then
      set x to 280
```

Test: You need to test your code to make sure the scrolling speed is not too fast or too slow. Also make sure that the sprite leaves and reenters the screen correctly, as the values will be different depending on the size of your sprite.

Now that your animals have something to eat, you can guide them with your mouse-pointer to their food. The question is, what should happen when they reach the food?



Add code so that your animals can eat their food. Eating the food should make it disappear; here are some ideas for what happens next and how it could help your animals.

1. Generate more clones
2. Increase the size of your clones
3. Increase a score

### Eat the food

A small addition to your code will make the food disappear when it is touched by a clone.

On your animal sprite, add blocks so that when a clone touches the food sprite, it broadcasts a message.



```
when I start as a clone
  forever
    if touching animal? then
      broadcast eaten
```

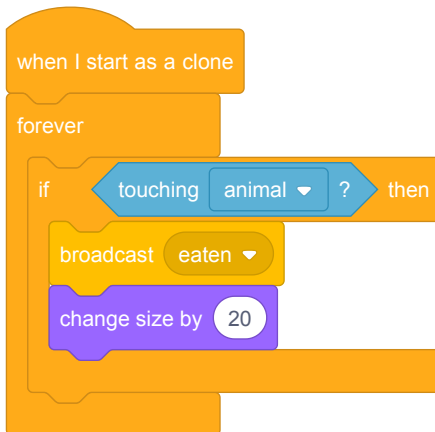
Then, on the food sprite, hide it when it receives the broadcast.



```
when I receive eaten
  hide
```

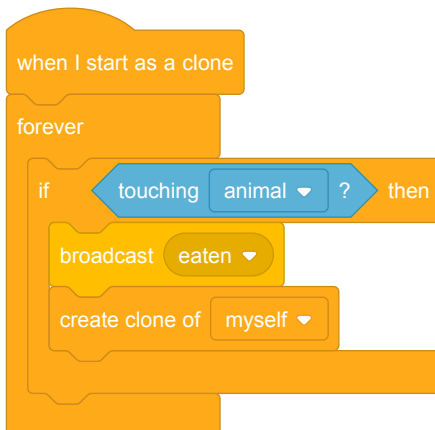
### Grow a clone, make a new clone, or increase a score

This code will allow the clones to increase in size each time they eat some food.



```
when I start as a clone
  forever
    if touching animal? then
      broadcast eaten
      change size by 20
```

This will generate a new clone each time they eat some food.



```
when I start as a clone
  forever
    if touching animal? then
      broadcast eaten
      create clone of myself
```

This will increase a score when some food has been eaten.

```
when green flag clicked
  set score to 0
```

```
when I start as a clone
  forever
    if touching animal ? then
      broadcast eaten
      change score by 10
```

## Step 5 Add a predator

Now you can add a predator that will be able to eat a few of the clones.



You need to decide on the type of predator you want to choose, as this may affect the way it will move.

A land-based predator might move randomly back and forth along the ground, but a flying predator might move randomly through the air.

Choose, upload, or paint your predator sprite.



Add scrolling to your predator sprite, so that it appears to move as the background moves. You can change the `change x by` values to change the predator's speed.



```
when green flag clicked
  go to x: 0 y: -80
  forever loop
    if mouse x > 200 then
      change x by -3
    if mouse x < -200 then
      change x by 3
```

Animate your predator so that it moves randomly on the Stage, in addition to the scrolling.



**i** Animate a randomly flying sprite

The following blocks will cause a sprite to fly randomly around the Stage. You can adjust the values to change the speed of the sprite.

```
when green flag clicked
  set rotation style to left-right
  forever loop
    point in direction to pick random 0 to 360
    repeat 10
      wait 0.1 seconds
      next costume
      move 20 steps
      if on edge, bounce
```

**i** Animate a randomly walking sprite

The following blocks will make a sprite move randomly along the x axis (horizontally). You will need a variable to store if the sprite is moving left or right.

```
when green flag clicked
  set rotation style to left-right
  forever loop
    set left-right to pick random -1 to 1
    if left-right > 0 then
      point in direction 90
    else
      point in direction -90
    repeat 10
      wait 0.1 seconds
      next costume
      move 20 steps
      if on edge, bounce
```

To finish off, you can make the clones disappear when they come into contact with the predator. If you chose to add a score variable, then maybe the score is reduced each time. If you chose to make the clones increase in size when they eat some food, then maybe they can be reduced in size.



```
when I start as a clone
  forever
    if touching predator ? then
      change score by -10
      change size by -10
      delete this clone
```

Choose this to reduce the score

Choose this to reduce the size

Choose this to remove the clone



## Upgrade your project

If you have time, you can upgrade your project.

Here are some ideas you could try:

- Add some sound or graphic effects to your project, to customise it
- Add a timer to your project, so that after a minute the game ends, and the score is displayed
- Add a variable to store the number of clones at the start, which reduces each time one is eaten, so the game ends when there are no more clones
- Make your clones uneatable when they reach a certain size

Each example project in the Introduction [\[1\]](#) has a See inside link for you to open the project in Scratch and look at the code to get ideas and see how they work.



Save your project

## Share

If you're in a club, why not share your project with friends?

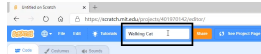
You could also show your family how your project works.

If you have a Scratch account, you can share your project through Scratch. You can send a link to people you know, and the whole Scratch community will be able to find your project and try it out.

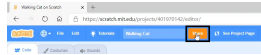
### Share your Scratch project

Please make sure that you do not share any personal information about yourself when sharing your Scratch projects.

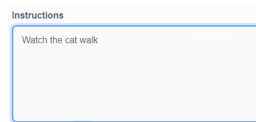
- Give your Scratch project a name.



- Click the Share button to make the project public.



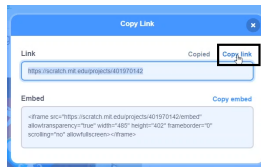
- If you like, you can add instructions in the Instructions box, to tell other people how to use your project.



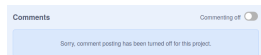
- You can also fill in the Notes and Credits box: if you have made an original project, you can write some short comments, or if you have remixed a project, you can credit the original creator.



- Click the Copy Link button to get the link to your project. You can send this link to other people by email or text, or on social media.



Scratch provides the ability to comment on your own and other people's projects. If you do not want to allow people to comment on your project, you should turn off commenting. To turn off commenting, set the slider above the Comments box to Commenting off.

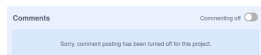


Why not invite your friends to create a project? Let them know how much fun you had.

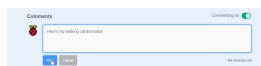
If you have a Scratch account, and have shared your 'Swarms, schools, and flocks' project, keep an eye out for comments that others may make about your creation. Feedback is a great way to reflect on your work. Ignore any comments that are unhelpful or irrelevant.

### Comments and feedback in Scratch

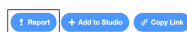
Scratch provides the ability to comment on your own and other people's projects. If you do not want to allow people to comment on your project, you should turn off commenting. To turn off commenting, go to the Project Page and set the slider above the Comments box to Commenting off:



If you are happy and feel safe to allow people to write comments on your project, you can leave the first comment:



If you think a comment or project is mean, insulting, too violent, or otherwise inappropriate, click the Report button to let the Scratch Team know about it. To report a comment, click the Report button above the comment. To report a project, click the Report button on the Project Page:



Read the Scratch Community Guidelines ([https://scratch.mit.edu/community\\_guidelines](https://scratch.mit.edu/community_guidelines)), so that you know how you and others can maintain a friendly and creative community.

Inspire the Raspberry Pi Foundation community with your project!



To submit your project to our Swarms, schools, and flocks – Community (<https://scratch.mit.edu/studios/30122177>), Scratch studio, please complete this form (<https://form.raspberrypi.org/f/community-project-submissions>).

What next?

If you are following the Further Scratch (<https://projects.raspberrypi.org/en/pathways/further-scratch>) pathway, you can move on to the Music maker (<https://projects.raspberrypi.org/en/projects/music-maker>) project. In this project, you will design your own digital music maker.



If you want to have more fun exploring Scratch, then you could try out any of these projects (<https://projects.raspberrypi.org/en/projects?software%5B%5D=scratch&curriculum%5B%5D=%201>).

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View project & license on GitHub (<https://github.com/RaspberryPiLearning/swarms-schools-flocks>).