

Step 2 Make a pencil

Start by making a pencil that you can use to draw on the Stage.

Open the 'Paint box' Scratch starter project.



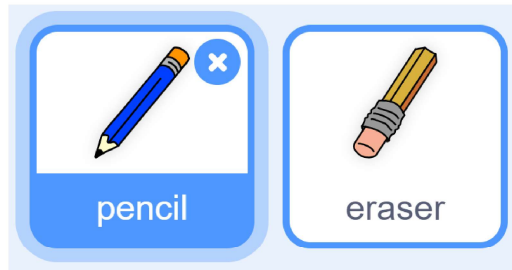
Online: open the starter project at rpf.io/paint-box-on (<http://rpf.io/paint-box-on>)

If you have a Scratch account you can make a copy by clicking **Remix**.

Offline: open the **starter project** (<http://rpf.io/p/en/paint-box-go>) in the offline editor.

If you need to download and install the Scratch offline editor, you can find it at rpf.io/scratchoff (<http://rpf.io/scratchoff>)

In the starter project, you should see pencil and eraser sprites:



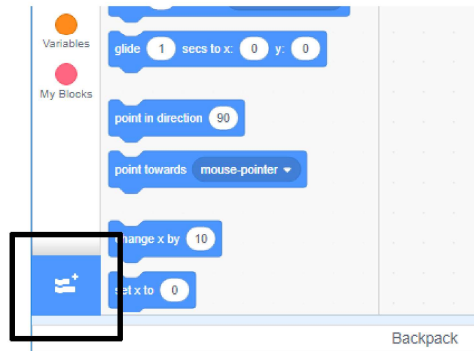
Add the Pen extension to your project.



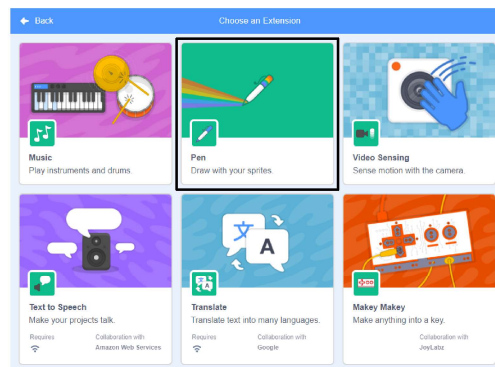
How to add the Pen extension

To use the Pen blocks in Scratch, you need add the **Pen extension**.

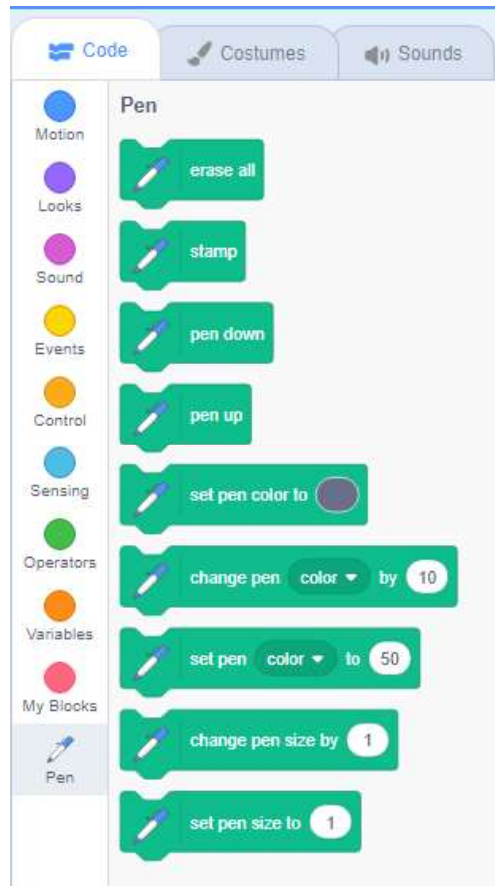
- Click on the **Add extension** button in the bottom left-hand corner.



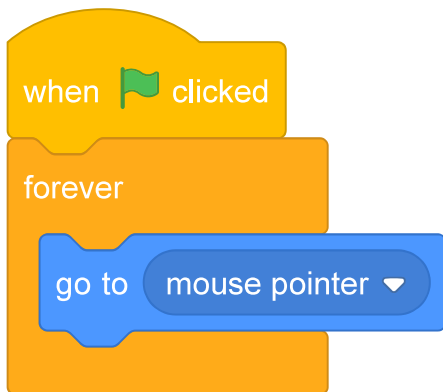
- Click on the **Pen** extension to add it.



- The Pen section then appears at the bottom of the blocks menu.



Add some code to the pencil sprite to make the sprite follow the mouse pointer **forever** so that you can draw:



Click the flag and then move the mouse pointer around the Stage to test whether your code works.



Next, make your pencil only draw **if** the mouse button is being clicked.

Add this code to your pencil sprite:



```
when green flag clicked
  forever loop
    go to mouse pointer
    if mouse down? then
      pen down
    else
      pen up
```

Test your code again. This time, move the pencil around the Stage and hold down the mouse button. Can you draw with your pencil?

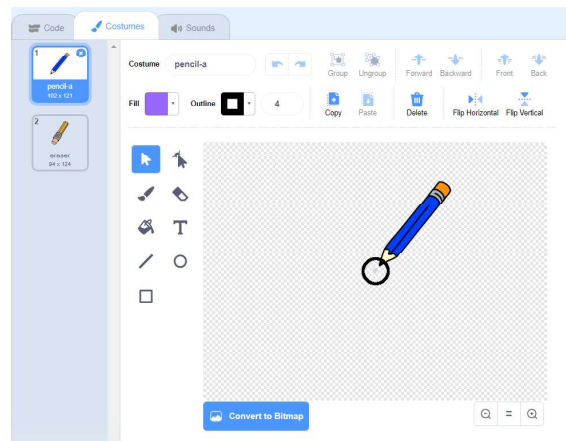


i Does your pencil not draw from its tip?

If the line your pencil draw looks like it is coming from the pencil's middle, you need to change your pencil sprite's so the tip is the sprite's centre.

Click on the pencil sprite, and then click on the **Costumes** tab.

Move the costume's so the tip of the pencil is **just above** the centre.



Now move the pencil around on the Stage and draw. The pencil should now draw a line from its tip.

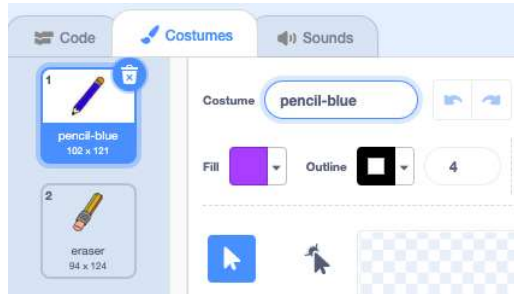
Step 3 Coloured pencils

Now you're going to add different coloured pencils to your project and allow the user to choose between them.

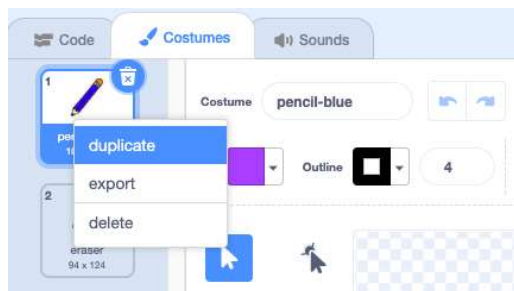
Click on the Costumes tab of the 'pencil' sprite.



Rename the pencil-a costume to pencil-blue



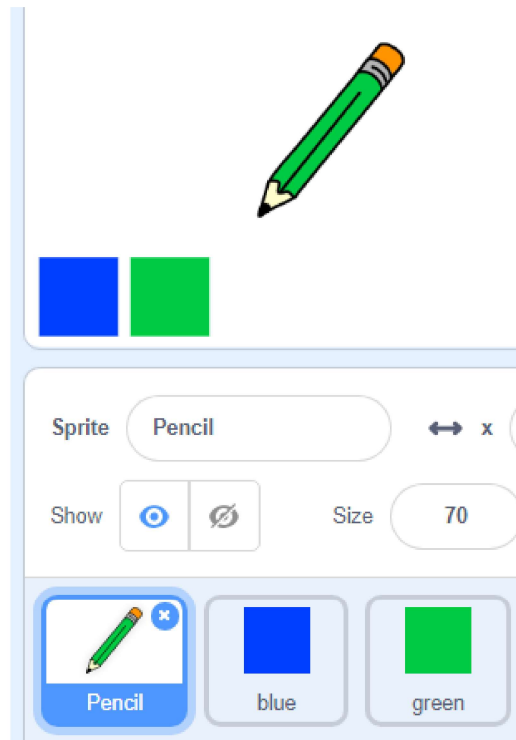
Right click on the pencil-blue costume and select **duplicate**.



Name the new costume 'pencil-green', and colour the pencil green.



Draw two new sprites: one blue square and one green square. These are for choosing between the blue and green pencil.

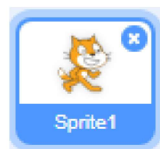


Rename the new sprites so that they are called 'blue' and 'green'

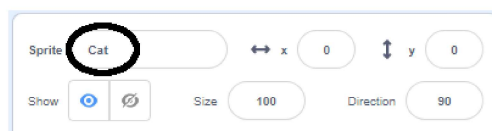


Rename a sprite in Scratch

To rename a sprite in Scratch, click on the sprite:

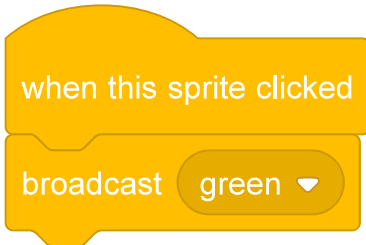


The information about the sprite will be displayed above:



Edit the name of the sprite.

Add some code to the 'green' sprite so that when this sprite is clicked, it **broadcasts** the message "green".



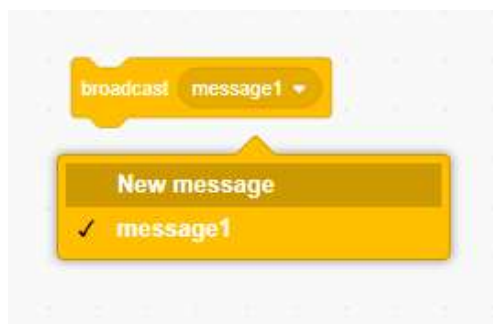
Broadcast a message in Scratch

A **broadcast** is a way of sending a message which can be heard by all sprites. Think of it like an announcement made over a loudspeaker.

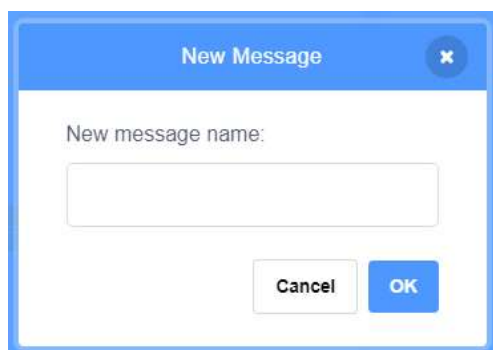
Broadcasting spells: Use the magic wand to click on the buttons and cast spells. What does each spell do to the characters? **See inside** (<https://scratch.mit.edu/projects/518413238/editor>)

You can create a message to be **broadcast**. The message text can be anything you like, but it is useful to give it a sensible description.

- Find the **broadcast** block under **Events**
- Select **New Message** in the drop-down menu.



- Then type your message



Send a broadcast

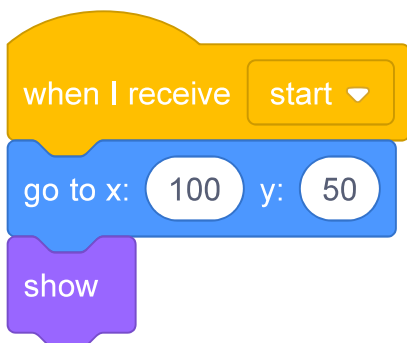
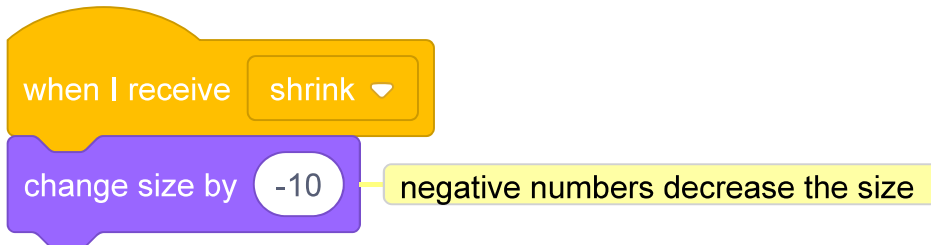
You can decide when to **broadcast** your message. For example:



Receive a broadcast

Sprite can react to a **broadcast** by using a **when I receive** block. Multiple sprites can respond when they receive the same message.

You can add blocks below a **when I receive** block to tell the sprite(s) what to do when they receives the message.



The pencil sprite should listen for the “green” message and change its costume and pencil colour in response.

Switch to your pencil sprite. Add some code so that when this sprite receives the **green** broadcast, it switches to the green pencil costume and changes the pen colour to green.



```
when I receive green
  switch costume to pencil-green
  set pen color to green
```

To set the pencil to colour to green, click the coloured square in the **set pen color** block, and then click on the green square sprite.

Then to a similar thing so that you can switch the pencil colour to blue.

Click on the blue square sprite and add this code:



```
when this sprite clicked
  broadcast blue
```

Then click on the pencil sprite and add this code:



```
when I receive blue
  switch costume to pencil-blue
  set pen color to blue
```

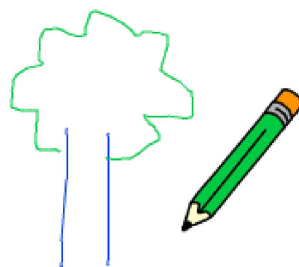
Finally, add this code to tell the pencil sprite which colour to start with, and to make sure that the screen is clear when your program starts.



```
when clicked
  erase all
  switch costume to pencil-blue
  set pen color to blue
  forever
    go to mouse pointer
    if mouse down? then
      pen down
    else
      pen up
```

If you prefer, you can start with a different colour pencil.

Test your code. Can you switch between the blue and green pencil colours by clicking on the blue or green square sprites?



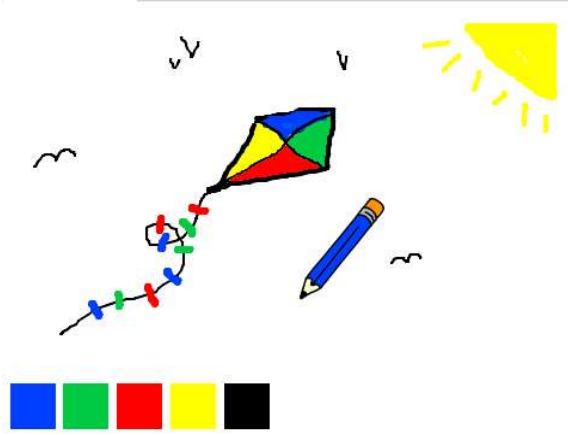


Challenge!

Challenge: more pencils


Can you add red, yellow, and black pencils to your paint program? Take a look at the earlier steps if you want a reminder of how to do this.

Can you use your pencils to draw a picture?



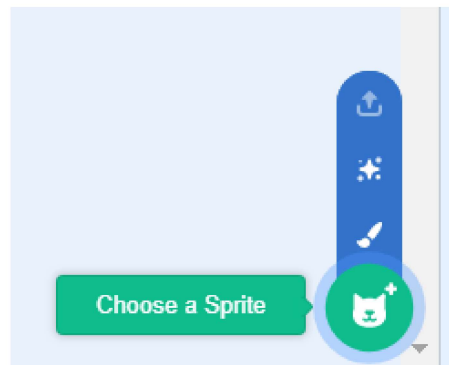
Step 4 Undo mistakes

Sometimes mistakes happen, so add a 'clear' button and an eraser button.

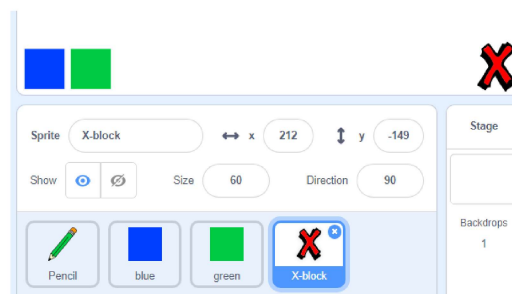
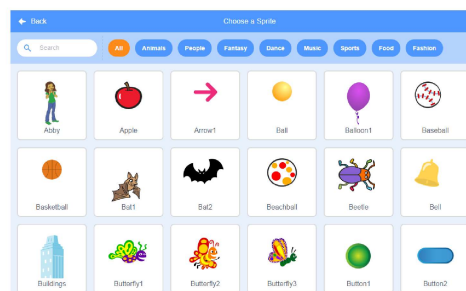
Add the 'X-block' sprite from the library's letters section. Colour the sprite's costume in red and make it a little smaller. This sprite is the 'clear' button. 

Adding a Scratch sprite from the Library

- Click **Choose a sprite** to see the library of all Scratch sprites.



- You can search or browse sprites by theme. Click on a sprite to add it to your project.

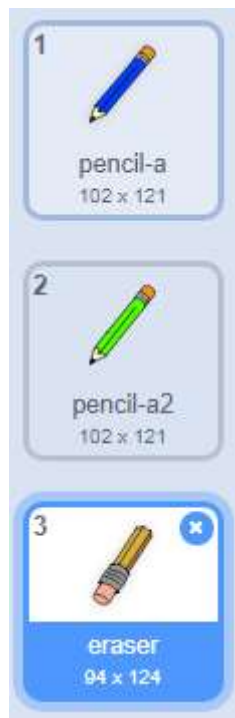


Add code to the 'X-block' sprite to clear the Stage when the sprite clicked.



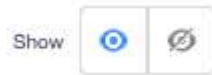
You don't need to use a **broadcast** to clear the Stage, because the **erase all** block does that job.

Do you see that the pencil sprite includes an eraser costume?

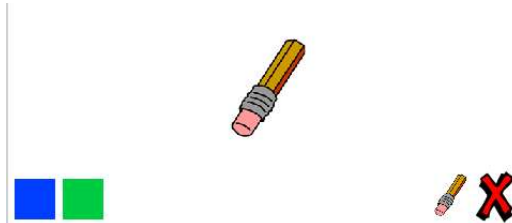


Your project also includes a separate eraser sprite.

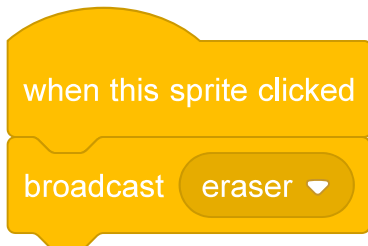
Click on this eraser sprite and then select **show**.



Here is how your Stage should look now:



Add code to the eraser sprite to send an **'eraser' broadcast** when the eraser sprite is clicked.



When the pencil sprite receives the 'eraser' message, it should switch its costume to the eraser and switch the pen colour to white, which is the same colour as the Stage!

Add some code to create the eraser.



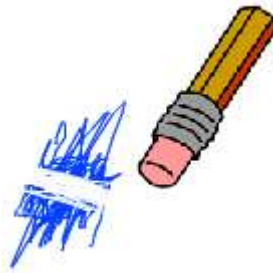
I need a hint

Here is what the code should look like:



```
when I receive eraser
switch costume to eraser
set pen color to white
```

Test your project to see if you can clear the Stage and erase pencil lines.



There's one more problem with the pencil: you can draw anywhere on the Stage, including near the 'clear' and eraser buttons!



To fix this, change the code so that the pen is only down if the mouse is clicked **and** the **y** position of the mouse pointer is greater than **-120**:



```
when clicked
  erase all
  switch costume to pencil-blue
  set pen color to blue
  forever
    go to mouse pointer
    if mouse down? and mouse y > -120 then
      pen down
    else
      pen up
```

Test your project. You now should not be able to draw near the buttons.



Step 5 Change the pen width

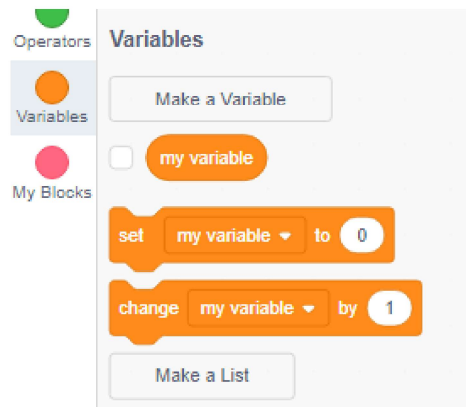
Next you will add code to allow the person using your program to draw things with different pen widths.

First, add a new variable called **width**.

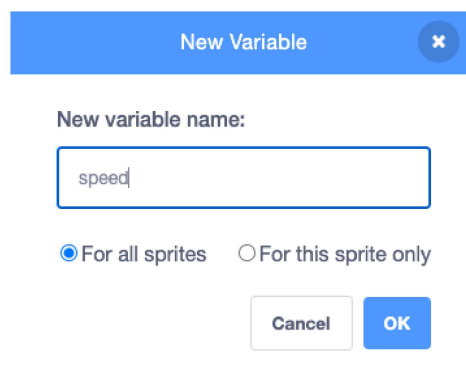


Add a variable in Scratch

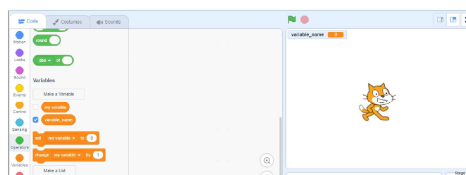
- Click on **Variables** in the Code tab, then click on **Make a Variable**.



- Type in the name of your variable. You can choose whether you would like your variable to be available to all sprites, or to only this sprite. Press **OK**.



- Once you have created the variable, it will be displayed on the Stage, or you can untick the variable in the Scripts tab to hide it.



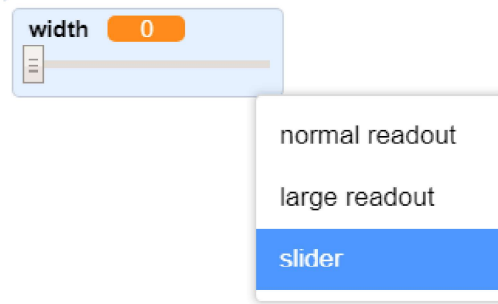
Add this line **inside** the **forever** loop of the pencil sprite's code:



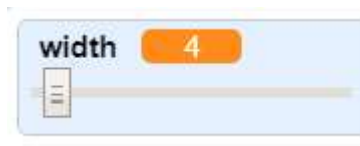
```
when clicked clicked
erase all
switch costume to pencil-blue
set pen color to blue
forever
  go to mouse pointer
  set pen size to width
  if mouse down? and mouse y > -120 then
    pen down
  else
    pen up
```

The pen width now repeatedly gets set to the value of the **width** variable.

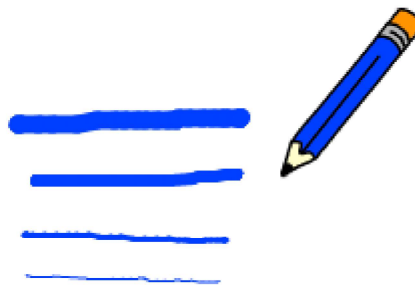
Right-click on the **width** variable displayed on the Stage, and then click on **slider**.



You can now drag the slider that is visible below the variable to change the variable's value.



Test your project and see if you can change the pen width.





Challenge!

Challenge: keyboard commands

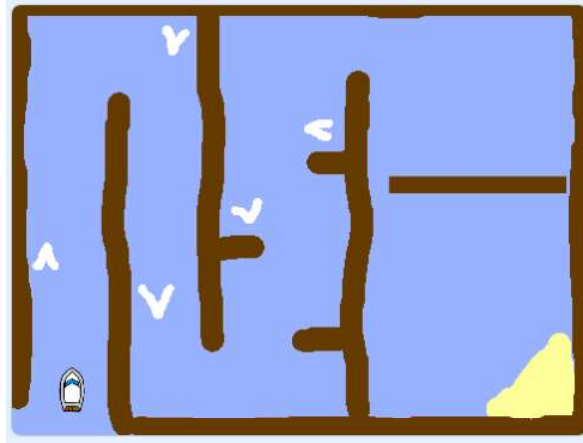
Can you add code so that, instead of clicking on the coloured squares or buttons on the Stage, you can make things happen by pressing keyboard keys? For example:

- b = Switch to blue pencil
- g = switch to green pencil
- e = switch to eraser
- c = clear screen

If you want to, you can also add code so that pressing the arrow keys changes the pen width.

Step 6 What next?

Now that you have completed the 'Paint box' project, try **the 'Boat race' project** (https://projects.raspberrypi.org/en/projects/boat-race?utm_source=pathway&utm_medium=whatnext&utm_campaign=projects), which helps you make a game where you have to stir a boat around obstacles.



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View project & license on GitHub (<https://github.com/RaspberryPiLearning/paint-box>).