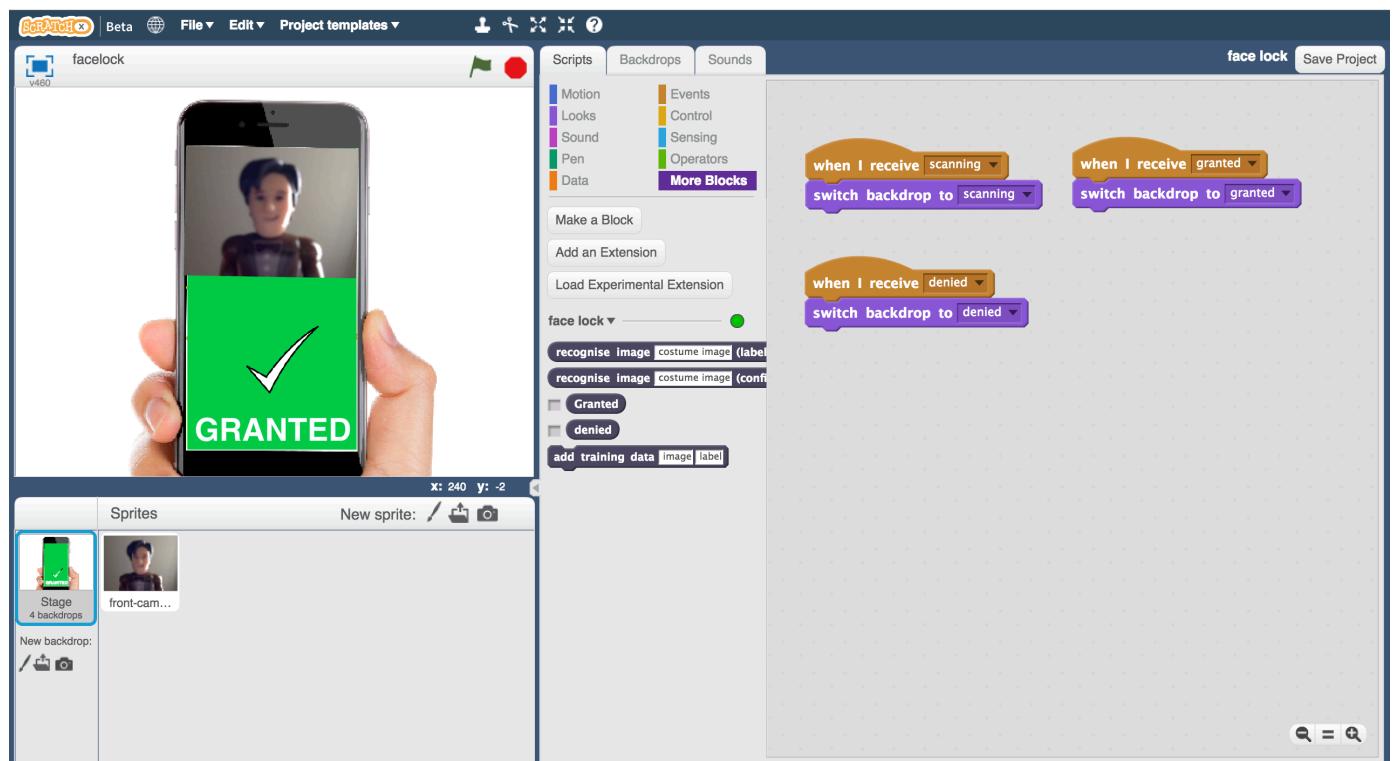


Face Lock

In this project you will make a Scratch project that can unlock a virtual phone using your face.

You'll train a machine learning model to be able to recognise a face so that it only unlocks the phone for the right person.



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This worksheet was contributed by Jasmine Crisp and Daniel May, from Mountbatten School.

1. Go to <https://machinelearningforkids.co.uk/> in a web browser

2. Click on “**Get started**”

3. Click on “**Log In**” and type in your username and password

If you don't have a username, ask your teacher or group leader to create one for you.

If you can't remember your username or password, ask your teacher or group leader to reset it for you.

4. Click on “**Projects**” on the top menu bar

5. Click on the “**+ Add a new project**” button.

6. Name your project “face lock” and set it to learn how to recognise “**images**”

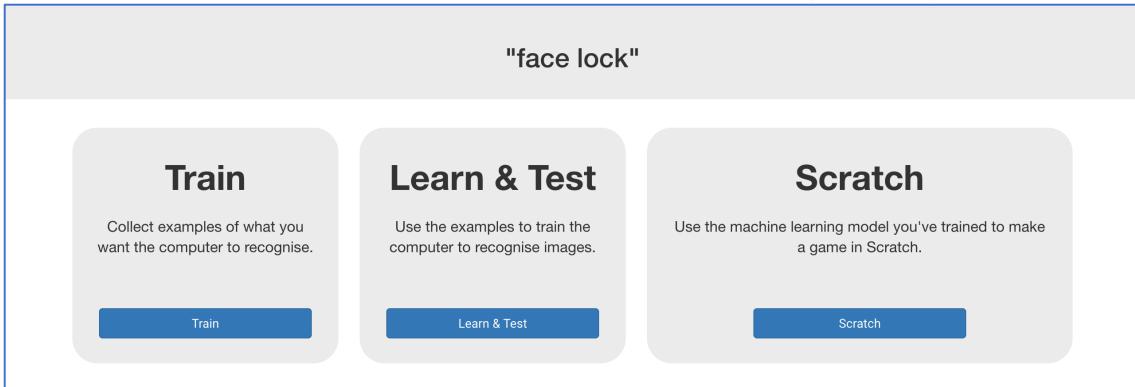
The screenshot shows a dialog box titled "Start a new machine learning project". It has two main input fields: "Project Name *" containing "face lock" and "Recognizing *" containing "images". To the right of the "Recognizing" field is a dropdown menu with the following options:

- What type of thing do you want to teach the computer to recognise?
- For words, sentences or paragraphs, choose "text"
- For photos, diagrams and pictures, choose "images"
- For sets of numbers or multiple choices, choose "numbers"

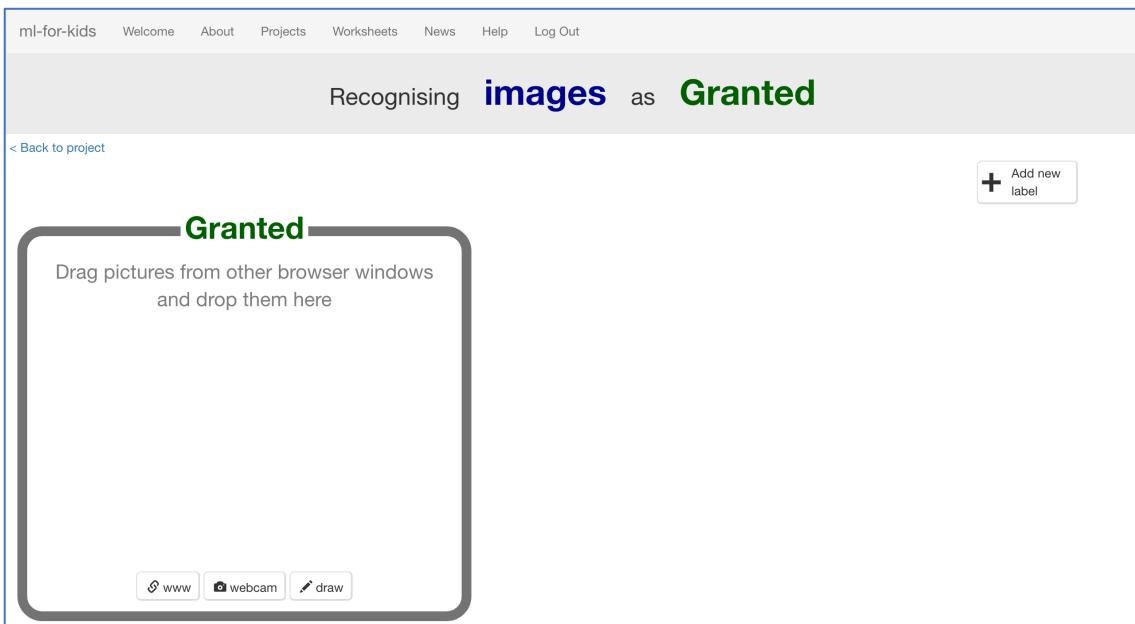
At the bottom right of the dialog are "CREATE" and "CANCEL" buttons.

7. You should see “face lock” in your list of projects. Click on it.

8. Click the “Train” button to start collecting examples



9. Click on “+ Add new label”. Create a bucket called “Granted”

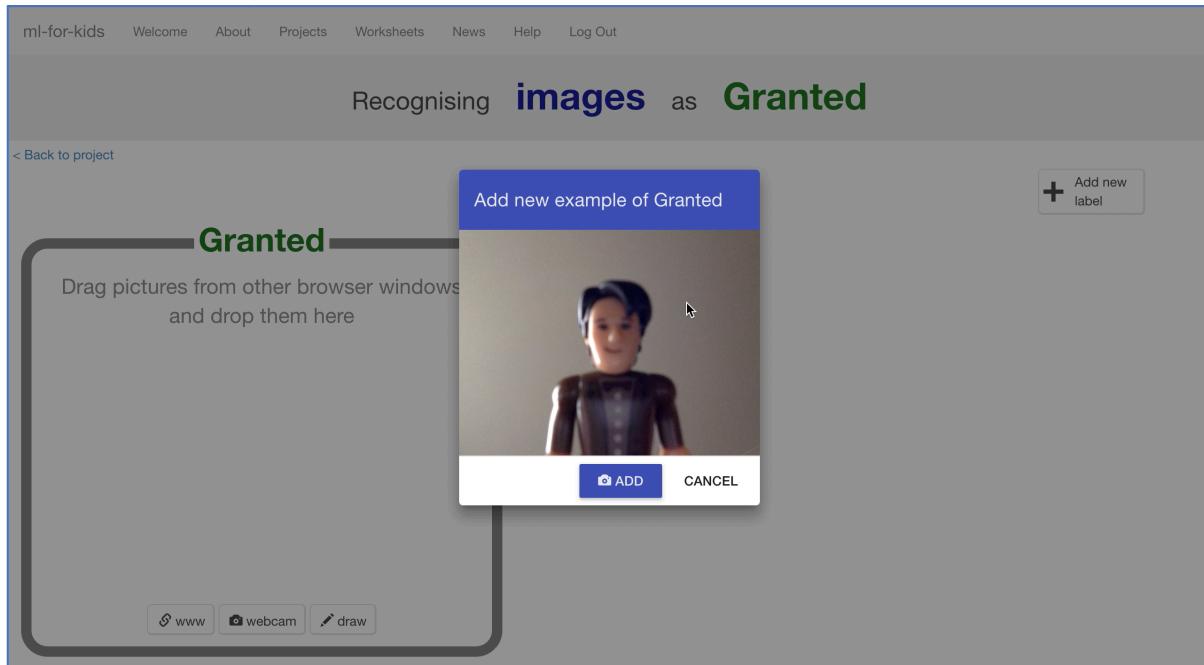


10. Click “webcam”.

A preview window will show the current view from your webcam.
You will need to click “Approve” or “Allow” if your web browser asks permission to use your webcam.

11. Put your face in front of the webcam, and click “Add” to take a picture of it.

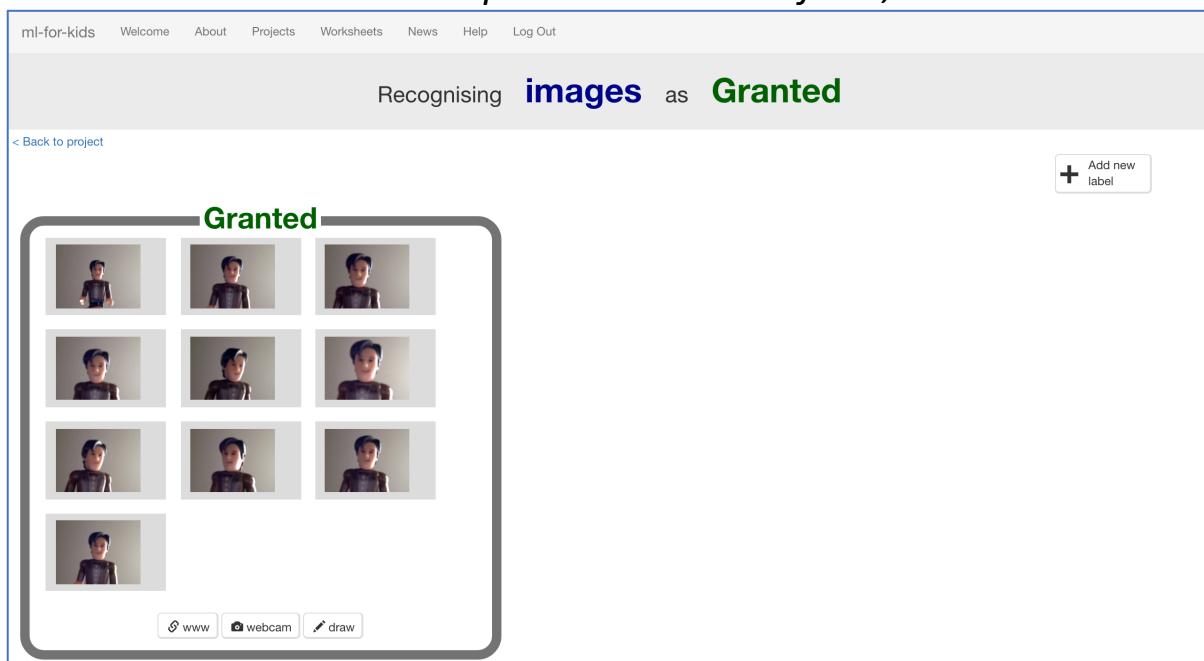
Make sure you have permission to upload photos of your face. If you don't, use a toy with a face like we've done here.



12. Repeat until you've got at least 10 examples of your face.

Try to get pictures with different backgrounds, angles, focuses, and distances from the webcam.

The more variation the computer has to learn from, the better.



13. Click “+ Add new label” and create one called “denied”

14. Use the “webcam” button in the “denied” bucket to take 10 photos of other people’s faces

Try to vary these pictures in the same way that you varied your first set.

Recognising **images** as **Granted or denied**

< Back to project

Granted

denied

www webcam draw

www webcam draw

15. Click on the “< Back to project” link

16. Click the “Learn & Test” button

17. Click the “Train new machine learning model” button

Machine learning models

< Back to project

What have you done?

You have collected examples of images for a computer to use to recognise when images are Granted or denied.

You've collected:

- 10 examples of Granted,
- 10 examples of denied

What's next?

Ready to start the computer's training?

Click the button below to start training a machine learning model using the examples you have collected so far.

(Or go back to the [Train](#) page if you want to collect some more examples first.)

Info from training computer:

Train new machine learning model

18. Wait for the training to complete.

This might take a few minutes. You'll know when it's done when it gives you the opportunity to test the model. Why not try doing the quiz?

What have you done so far?

You're started to train a computer to recognise pictures of you.

Instead of trying to write rules to be able to do this, you are doing it by collecting pictures of yourself. These examples are being used to train a machine learning “model”.

This is called “supervised learning” because of the way that you are supervising the computer’s training.

The computer will learn from the patterns in the photos you’ve taken. Hopefully this will mostly be the facial features and hair, but beware that it might also include the clothes and background!

19. In the training page, click the “< Back to project” link.

Then click the **Scratch** button.

20. Click the **Open in Scratch** button.

Using machine learning in Scratch

< Back to project

Open in Scratch

Your project will add these blocks to the **More Blocks** tab in Scripts.

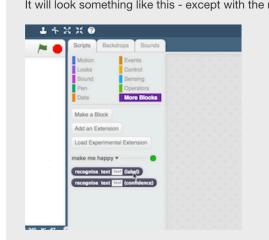
recognise image [costume image] (label)
Put Images in the input for this, and it will return the label that your machine learning model recognises it as.

recognise image [costume image] (confidence)
This will return how confident your machine learning model is that it recognises the type of images. (As a number from 0 - 100).

Granted **Denied**
These blocks represent the labels you've created in your project, so you can use their names in your scripts.

costume image
This block is in the Looks palette for Sprites and will return the image of the currently selected costume.

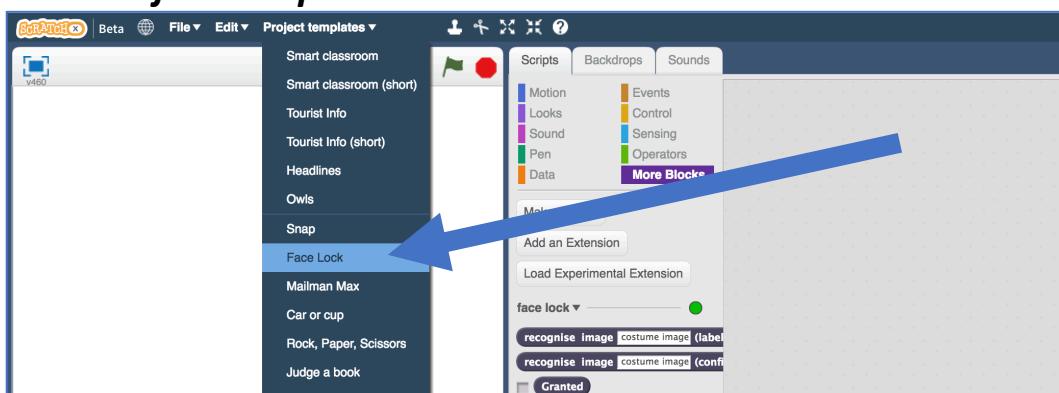
It will look something like this - except with the name of your project.



The coloured circle next to your project name tells you if your machine learning model is okay.

21. Load the Face Lock template project

Click **Project templates** -> **Face Lock** as shown below

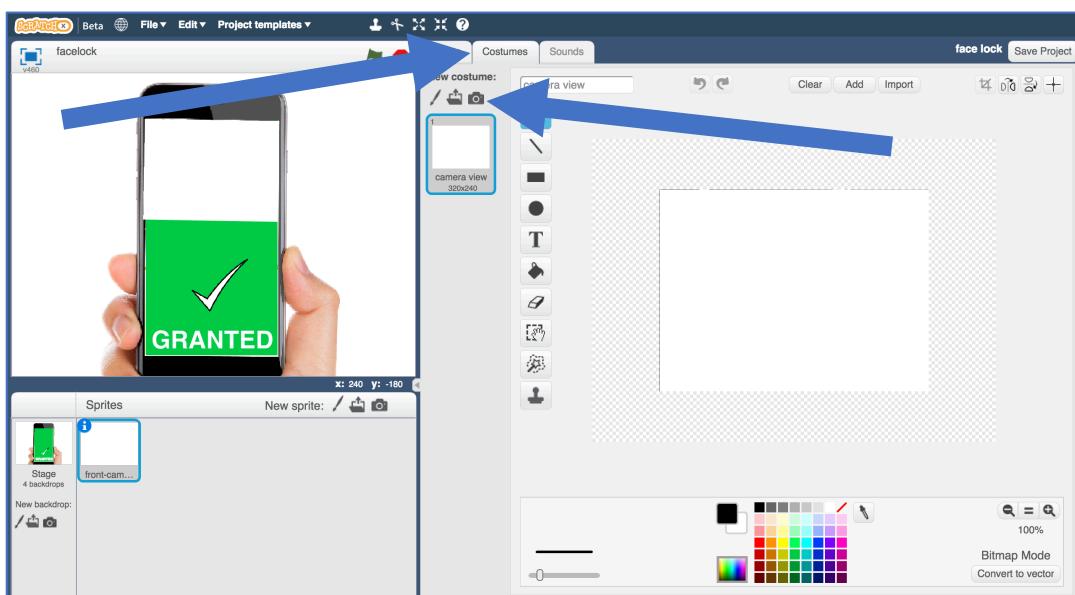


22. Create this script

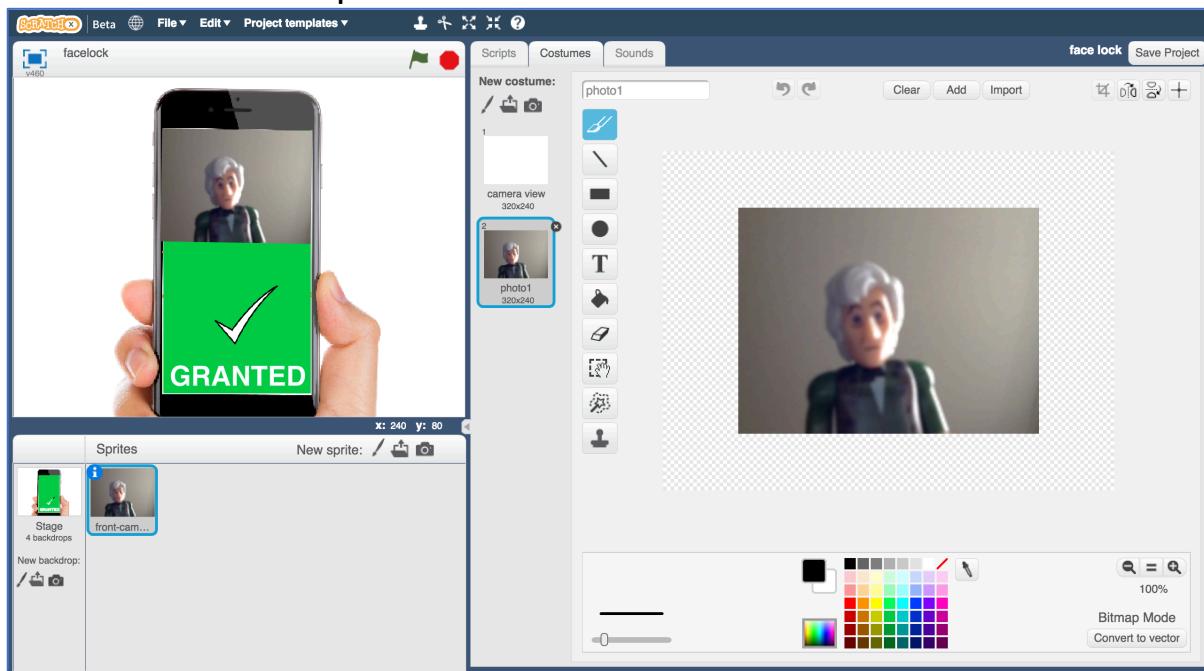


23. Click on the “Costumes” tab,

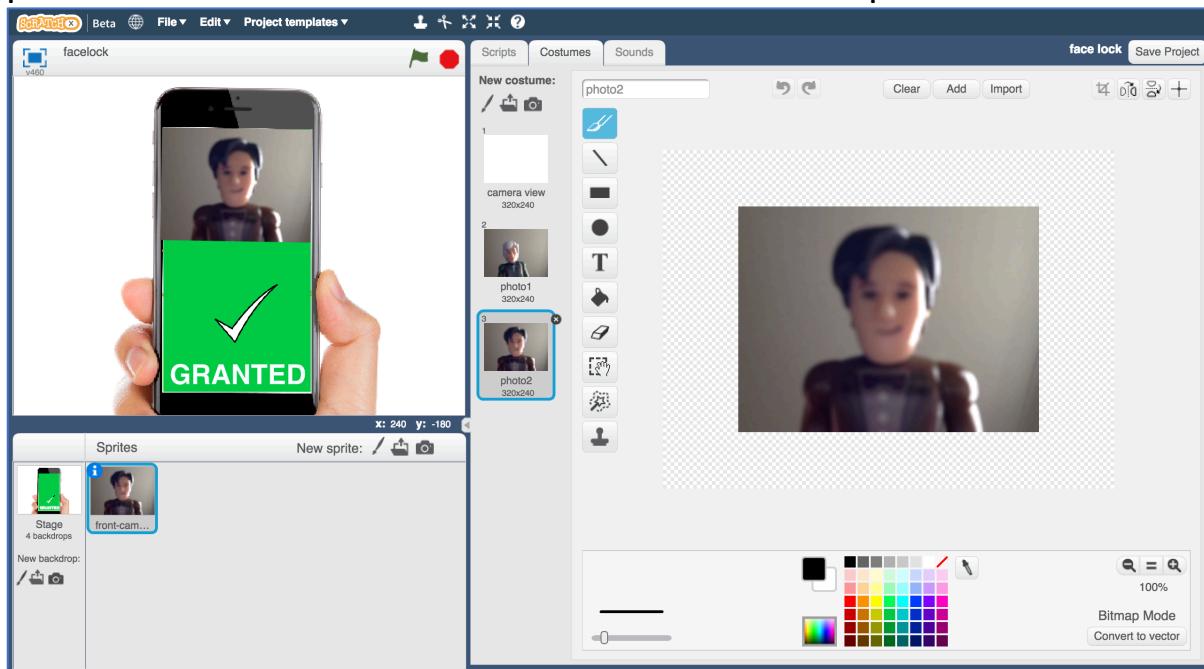
then click on the “New costume from camera” button



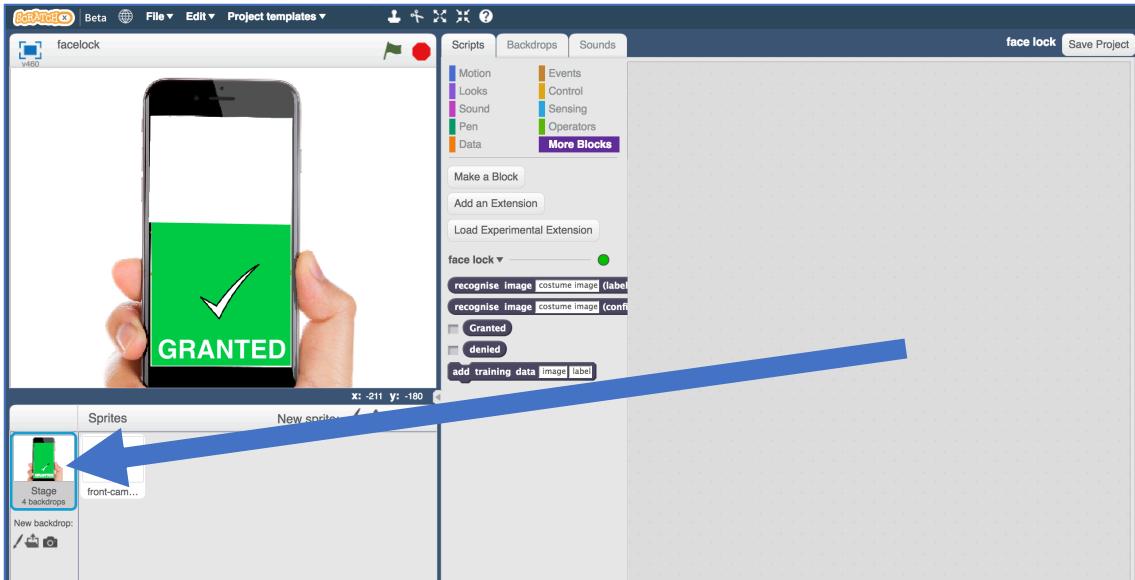
24. Use the webcam to take a photo of a face that should not be allowed to use the phone



25. Click the “New costume from camera” button again, and take a photo of a face that should be allowed to use the phone



26. Click on the Stage

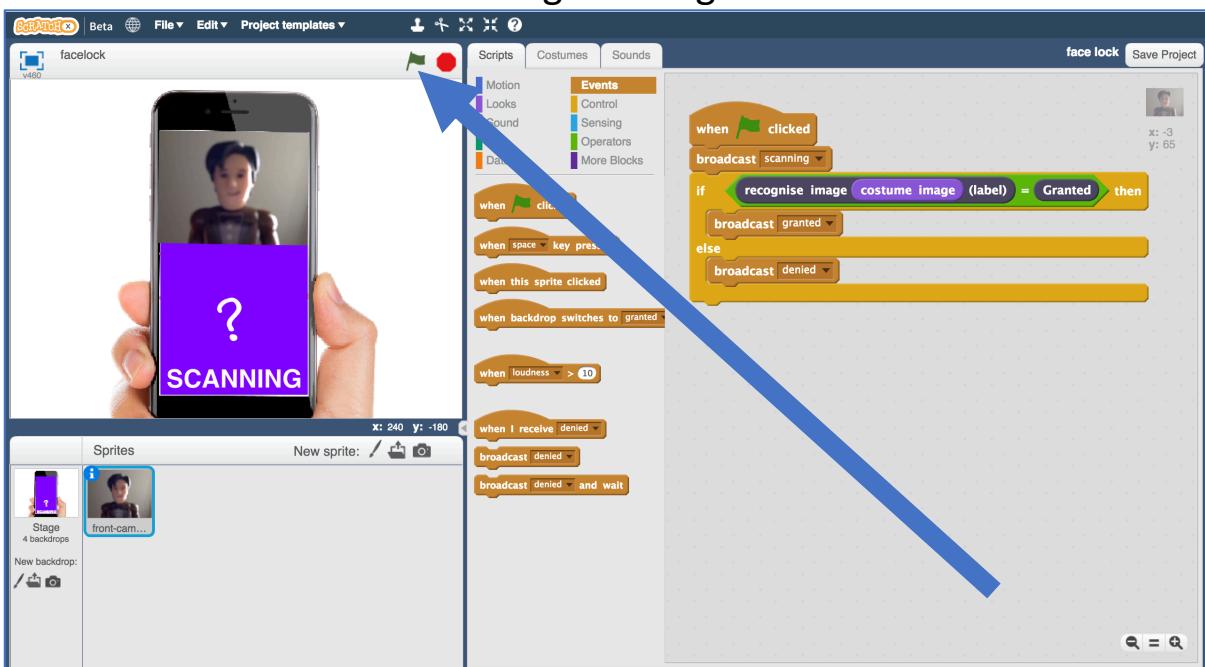


27. Create the following scripts

These will make the phone screen update based on whether it is locked.

```
when I receive scanning
  switch backdrop to scanning
when I receive granted
  switch backdrop to granted
when I receive denied
  switch backdrop to denied
```

28. It's time to test! Click the green flag



Ideas and Extensions

What if the computer isn't sure?

The confidence block returns a percentage (a number from 0 to 100) with how confident it is that it has recognised the face.



```
costume image (confidence)
```

How could you update your script to use this?

Should the phone still unlock if the computer is only 10% sure that it has correctly recognised the owner's face?

Add more people for the computer to accept

Can you get the phone to recognise two different people's faces that it should let through?

Try confusing the computer

If you train the computer to recognise you while you're in one place only, can it still recognise you if you are somewhere else? What if you change your clothes?

Is the computer recognising your face, or something else?

Experiment to find out how the computer learns and how it behaves.

What have you done?

You've trained a facial recognition system. You've done this by collecting examples of pictures of faces, and used this to train a machine learning model that is able to recognise faces.

You've used this model to create an app, using the model as an authentication method (a way of proving that someone is who they say they are).

It's a very simple system so far.

Can you think of ways that you could fool it?

Did you know?

The first known attempt at facial recognition was in 1965 by Woodrow Wilson Bledsoe. He manually inputted measurements of a person's face and stored them, along with measurements of other people's faces.

When presented with a new photograph, the system could be used to work out which person most closely resembled the picture.

He found a number of issues with getting his system to cope with differences in "head rotation, tilt, light intensity, the angle of the light, aging, facial expression" and a number of other factors. These were impossible to avoid at the time.

Recently, Apple introduced facial recognition into their phones, by using software known as Face ID. Instead of relying on pictures, this makes a detailed map of over 30,000 specific points on your face. This helps it to handle small changes in the look of your face, such as wearing makeup or a different hairstyle. Other companies, such as Samsung, have also introduced similar technology to their phones.