



School Library

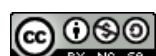
In this project you will make a school librarian character that can make reading book recommendations.

If you describe a book to it, it will try to predict who that book might be suitable for.

You will teach the computer to recognise fiction books of different reading levels by giving it examples of each.

The image shows a Scratch project titled "library-project". The stage features a stick figure with a speech bubble that says "This book could be a good read for someone in Key Stage 1". There are three sliders on the stage: "number of pages" (set to 25), "number of lines" (set to 11), and "number of pictures" (set to 8). A "Recommend!" button is located at the bottom left. In the script editor, the "school library" costume is selected. The script contains three nested if statements based on the number of pages, lines, and pictures. Each if statement checks for specific values (10 or 20) and changes the costume to represent a different reading level (Year R, Key Stage 1, or Key Stage 2) while saying a corresponding message.

```
when I receive [recommend v]
if (recognise numbers pages [number of pages v] lines [number of lines v] pictures [number of pict v])
  switch costume to [Year R v]
  say [This book might be good for a Year R student v]
else if (recognise numbers pages [number of pages v] lines [number of lines v] pictures [number of pict v])
  switch costume to [Key Stage 1 v]
  say [This book could be a good read for someone in Key Stage 1 v]
else if (recognise numbers pages [number of pages v] lines [number of lines v] pictures [number of pict v])
  switch costume to [Key Stage 2 v]
  say [This book might be better for students in Key Stage 2 v]
```



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1. You need a collection of fiction books for this project.
Go to the school library!
2. Find examples of fiction books of different reading levels, and collect the following information about them:
 - * Number of pages in the book
 - * Number of lines in each page (*choose a typical full page of text*)
 - * Number of pictures in the book (*if the book is too long, or there are too many pictures to count, it's okay to make an estimate*)
 - * The reading level (e.g. Year R / Key Stage 1 / Key Stage 2.
Your school may have different ways to group fiction books, such as by reading level or using coloured bands. Try to limit yourself to just a few different reading levels though)

3. Do this for at least five books at each reading level.
*More books would be better if you can find them and have the time!
It's easiest to collect this on pen and paper. Try drawing out a table to make it easier.*

number of pages	number of lines	number of pictures	reading level
16	4	12	Year R
16	6	12	Year R
24	5	20	Year R

4. Go to <https://machinelearningforkids.co.uk/> in a web browser
5. Click on “Get started”
6. 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.*

- 7.** Click on “**Projects**” on the top menu bar

- 8.** Click the “**+ Add a new project**” button.

- 9.** Name your project “school library” and set it to learn how to recognise “**numbers**”

ml-for-kids Welcome About Projects Worksheets News Help Log Out

Start a new machine learning project

Project Name *

school library

Recognizing *

numbers

ADD A VALUE

Start to describe the values that you'll include with each example to train the computer with by clicking the 'Add a value' button.

CREATE **CANCEL**

- 10.** Click “**Add a value**” three times.
Set the type of all these values to “number”.

ml-for-kids Welcome About Projects Worksheets News Help Log Out

Start a new machine learning project

Project Name *

school library

Recognizing *

numbers

Value 1 *	Type of value *	number	✖
Value 2 *	Type of value *	number	✖
Value 3 *	Type of value *	number	✖

If this field can be described as numbers, choose "number".
If it can be described as choosing from a few options, choose "multiple-choice".

11. Name the three fields “pages”, “lines” and “pictures”

We will use these for:

pages – the number of pages in a book

lines – the number of lines on a page

pictures – the number of pictures in the book

The screenshot shows a web-based form for creating a machine learning project. At the top, there's a navigation bar with links: ml-for-kids, Welcome, About, Projects, Worksheets, News, Help, and Log Out. Below the navigation is a title "Start a new machine learning project". The main area contains a "Project Name *" field with the value "school library". Under the heading "Recognizing *", there is a dropdown menu set to "numbers". Three input fields are present, each with a red "X" icon to its right: "Value 1 *" with "pages" and "number", "Value 2 *" with "lines" and "number", and "Value 3 *" with "pictures" and "number". Below these fields is a blue "ADD ANOTHER VALUE" button. At the bottom right are two buttons: a blue "CREATE" button and a white "CANCEL" button.

12. Click “Create”

“school library” should now be in your projects list. Click on it.

The screenshot shows a list of machine learning projects. At the top, there's a navigation bar with links: ml-for-kids, Welcome, Projects, Worksheets, Help, and Log Out. Below the navigation is a title "Your machine learning projects". A button labeled "+ Add a new project" is visible. Two projects are listed in a grid-like structure: "school library" (recognizing numbers) and "make me happy" (recognizing text as kind or mean). Each project entry has a delete icon (trash can) to its right.

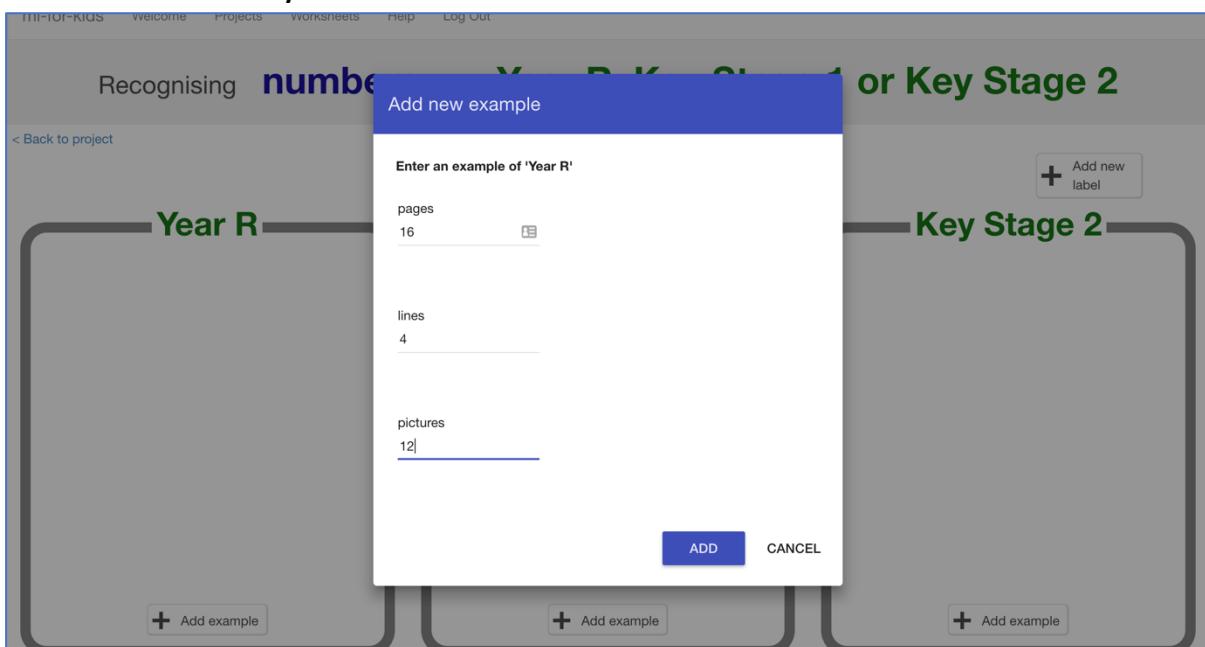
13. We'll start by collecting examples of books to train the computer with. Click the **Train** button.

The screenshot shows the 'ml-for-kids' website interface. At the top, there is a navigation bar with links: 'ml-for-kids', 'Welcome', 'About', 'Projects', 'Worksheets', 'News', 'Help', and 'Log Out'. Below the navigation bar, the text '"school library"' is displayed. There are three main sections: 'Train', 'Learn & Test', and 'Scratch'. The 'Train' section contains the text: 'Collect examples of what you want the computer to recognise.' and a blue 'Train' button. The 'Learn & Test' section contains the text: 'Use the examples to train the computer to recognise numbers.' and a blue 'Learn & Test' button. The 'Scratch' section contains the text: 'Use the machine learning model you've trained to make a game in Scratch.' and a blue 'Scratch' button.

14. Click on “+ Add new label” and call it “Year R”.
Do that again, and create a second bucket called “Key Stage 1”.
Do that again, and create a third bucket called “Key Stage 2”.
If you used different names for reading levels, use those instead.

The screenshot shows the 'ml-for-kids' website interface for adding new labels. At the top, there is a navigation bar with links: 'ml-for-kids', 'Welcome', 'Projects', 'Worksheets', 'Help', and 'Log Out'. Below the navigation bar, the text 'Recognising numbers as Year R, Key Stage 1 or Key Stage 2' is displayed. There are three boxes labeled 'Year R', 'Key Stage 1', and 'Key Stage 2'. Each box has a 'Add example' button at the bottom left. In the top right corner, there is a button labeled '+ Add new label'.

- 15.** Click the “Add example” button in the “Year R” bucket, and type in the values from your first Year R book. Click “Add”



- 16.** Do this for the values of all the books you collected.

The screenshot shows the same project interface. Now, the "Year R" bucket on the left contains six examples: pages 16, lines 4, pictures 12; pages 12, lines 3, pictures 10; pages 12, lines 1, pictures 10; pages 10, lines 2, pictures 11; pages 15, lines 3, pictures 12; and pages 10, lines 2, pictures 8. The "Key Stage 1" bucket in the middle contains six examples: pages 20, lines 5, pictures 13; pages 23, lines 4, pictures 20; pages 24, lines 5, pictures 20; pages 24, lines 6, pictures 18; pages 16, lines 8, pictures 9; and pages 20, lines 6, pictures 18. The "Key Stage 2" bucket on the right contains six examples: pages 73, lines 15, pictures 26; pages 294, lines 25, pictures 0; pages 87, lines 20, pictures 22; pages 128, lines 24, pictures 8; pages 112, lines 20, pictures 0; and pages 150, lines 21, pictures 8. Each bucket has an "Add example" button at the bottom.

- 17.** Click the “< Back to project” link once you’ve finished to go back to the Project menu, then click on the “Learn & Test” button.

18. Click the “Train new machine learning model” button at the bottom of the page.

The screenshot shows the 'Machine learning models' page. At the top, there is a navigation bar with links: ml-for-kids, Welcome, Projects, Worksheets, Help, and Log Out. Below the navigation bar, the title 'Machine learning models' is centered. Underneath the title, there is a link '< Back to project'. The page is divided into two main sections: 'What have you done?' on the left and 'What's next?' on the right. The 'What have you done?' section contains text about collecting examples of numbers and a list of items collected: 6 examples of Key Stage 1, 6 examples of Key Stage 2, and 6 examples of Year R. The 'What's next?' section contains text about starting the computer's training and a button labeled 'Train new machine learning model'. Below these sections, there is a box labeled 'Info from training server:' which is currently empty. A small button labeled 'Train new machine learning model' is located at the bottom of this box.

19. Use the Test form to try out the model you've trained.

Test it with a book that you haven't shown the computer before. In other words, not one that you've used in your examples in Training.

If you're not happy with how the computer predicts the reading level, go back to step 15, and add some more examples.

Make sure you repeat step 18 to train with the new examples though!

The screenshot shows the 'Test' form. It has two main sections. The left section contains text about training the model and a list of items collected: 6 examples of Key Stage 1, 6 examples of Key Stage 2, and 6 examples of Year R. The right section contains text about testing the model and a list of items entered: pages (10), lines (2), and pictures (8). Below these sections, there is a text input field with placeholder text 'Try putting in some numbers to see how it is recognised based on your training.' and a 'Test' button. The test results show that the input was recognized as 'Year R' with 100% confidence.

What have we done so far?

You've started to train a computer to predict the reading level for a fiction book. You've done this by training it recognise sets of numbers as being "Year R", "Key Stage 1", or "Key Stage 2".

These examples are being used to train a machine learning "model".

This is called "supervised learning" because of the way you are supervising the computer's training.

The computer will learn from patterns in the examples you've given it. These will be used to be able to make predictions for numbers about new books.

20. Click the "**< Back to project**" link, then click the "**Scratch**" button.

This page has instructions on how to use the new blocks in Scratch from your project. Keep the page open if you need to check on how to use them.

Tips

More examples!

The more examples you give it, the better the computer should get at recognising the reading level for books.

Try and be even

Try and come up with roughly the same number of examples for each reading level.

If you have a lot of examples for one reading level, and not the others, the computer might learn that reading level is more common and more likely, so you'll affect the predictions that it makes.

Mix things up with your examples

Try to come up with lots of different types of examples.

For example, don't choose lots of examples of very similar books in a set or series.

21. Click the “Open in Scratch” button at the bottom to launch the Scratch editor.

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

recognise numbers pages 1 lines 2 pictures 3 (label)

Put numbers in the input for this, and it will return the label that your machine learning model recognises it as.

recognise numbers pages 1 lines 2 pictures 3 (confidence)

This will return how confident your machine learning model is that it recognises the type of numbers. (As a number from 0 - 100).

Year R **Key Stage 1** **Key Stage 2**

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

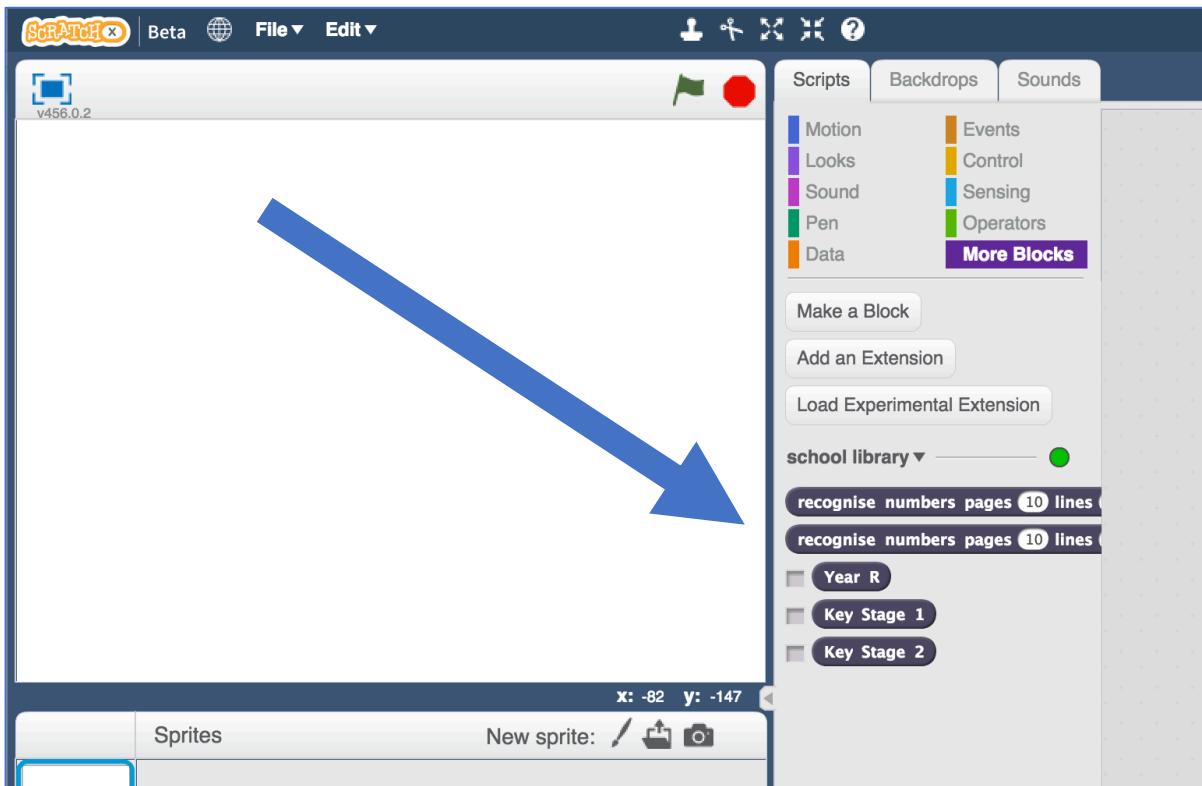
This means you can do something like this:

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

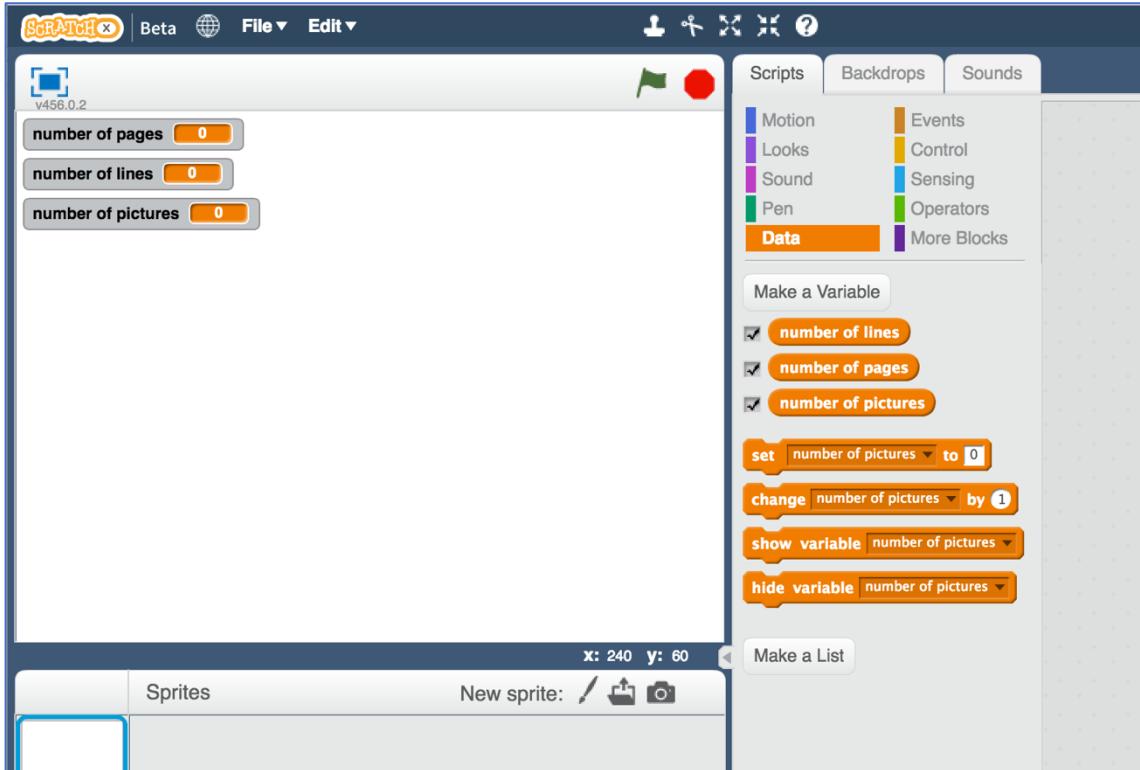
- ● means your model is trained and ready to go
- ○ means your model hasn't finished training yet
- ● means something went wrong. Go back to the [Learn & Test](#) page to see what went wrong with training.

[Open in Scratch](#)

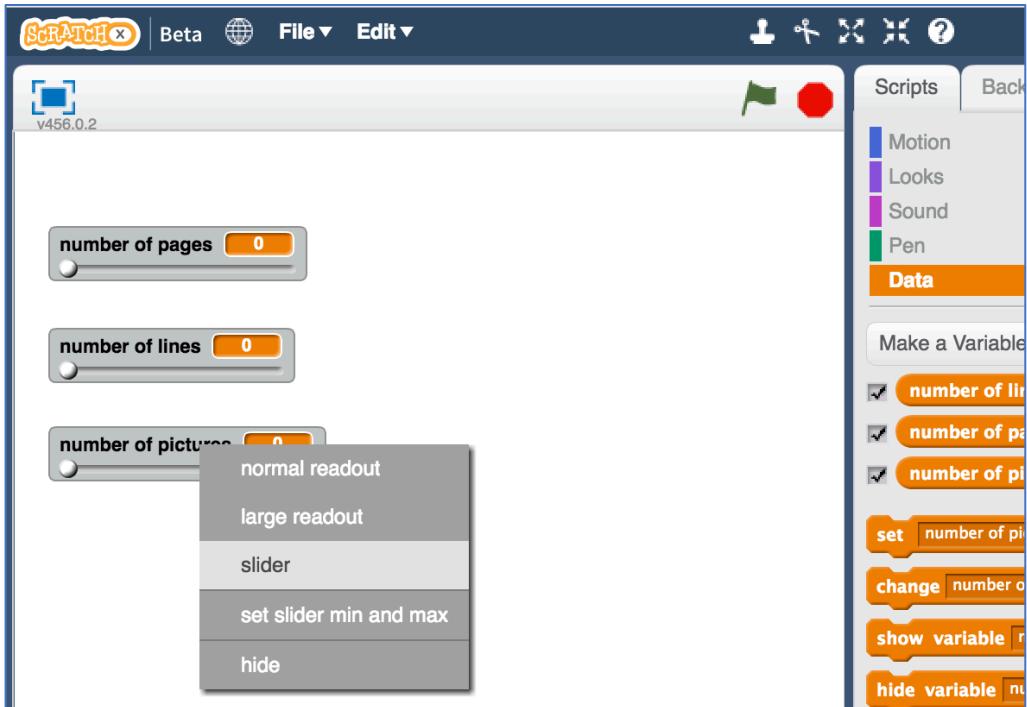
22. You should see new blocks in the “More blocks” section from your “school library” project.



- 23.** Create three new variables, for all sprites. Call these “number of lines”, “number of pages”, and “number of pictures”.
Leave them ticked, so they stay visible on the stage.



- 24.** Set all of the variables so that they are displayed on the stage as “sliders”. Spread them out a bit so you have space.
Right click on the variables on the stage, and choose “slider”.

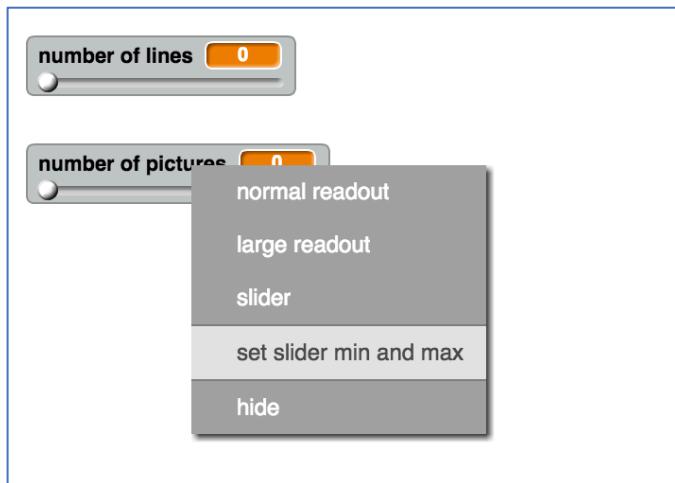


25. Update the minimum and maximum for each of the sliders so that the range is more sensible.

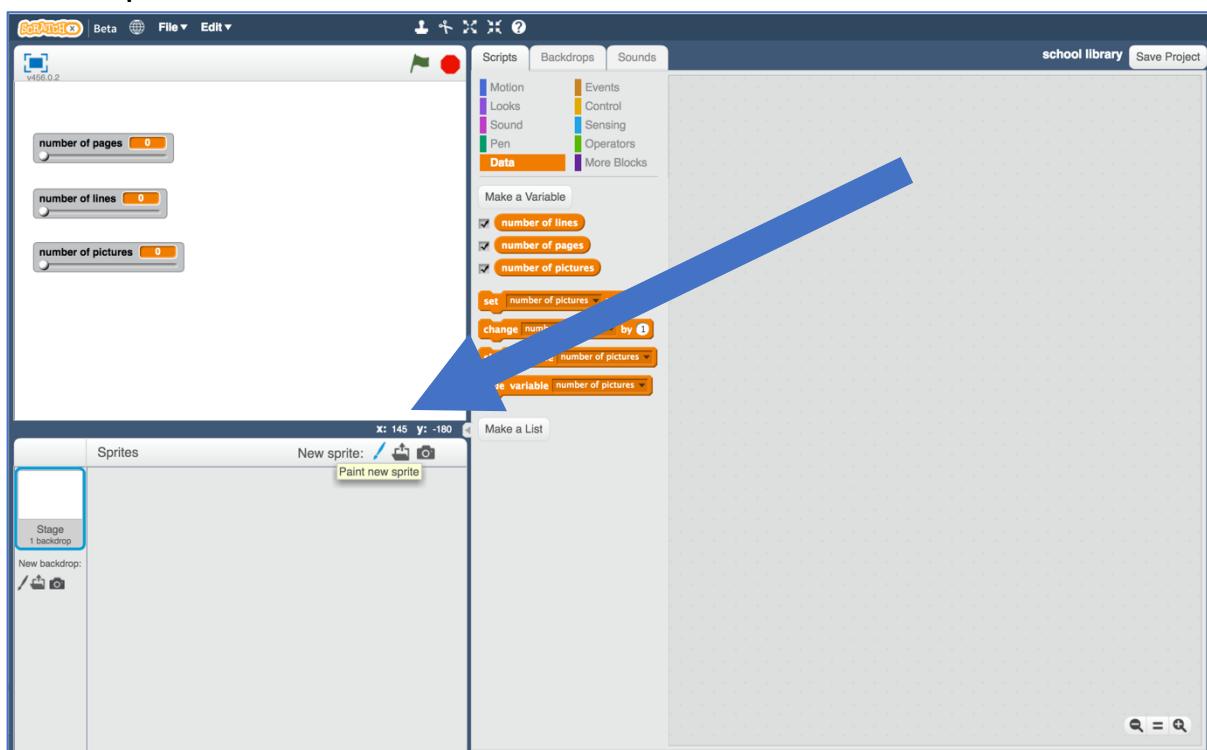
*For example, you could use minimum of 0 and maximum of 300 for pages.
You could use 0 – 40 for number of lines.*

You could use 0 – 50 for pictures.

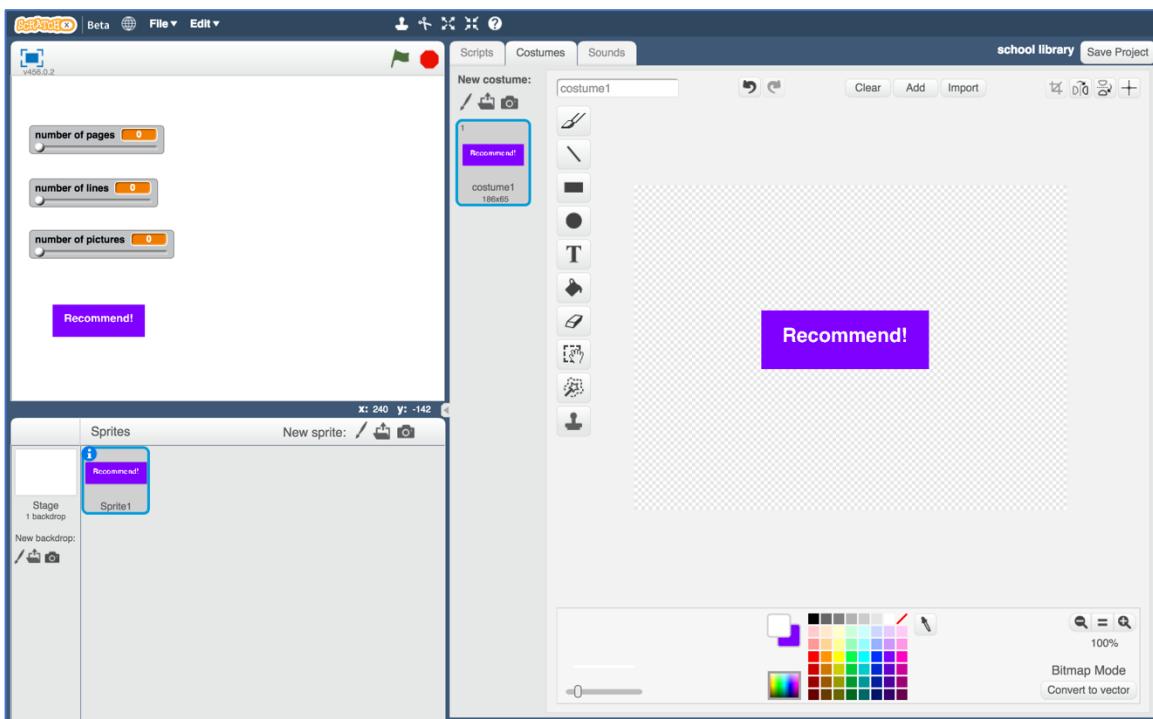
But choose what you think makes sense based on your books.



26. Create a new sprite by clicking on the paint brush button next to the “New sprite” label.



27. Draw a button and give it a label like “Recommend”.
Move it to under your three sliders, and adjust the size so that it fits.



28. Click on the Scripts tab.

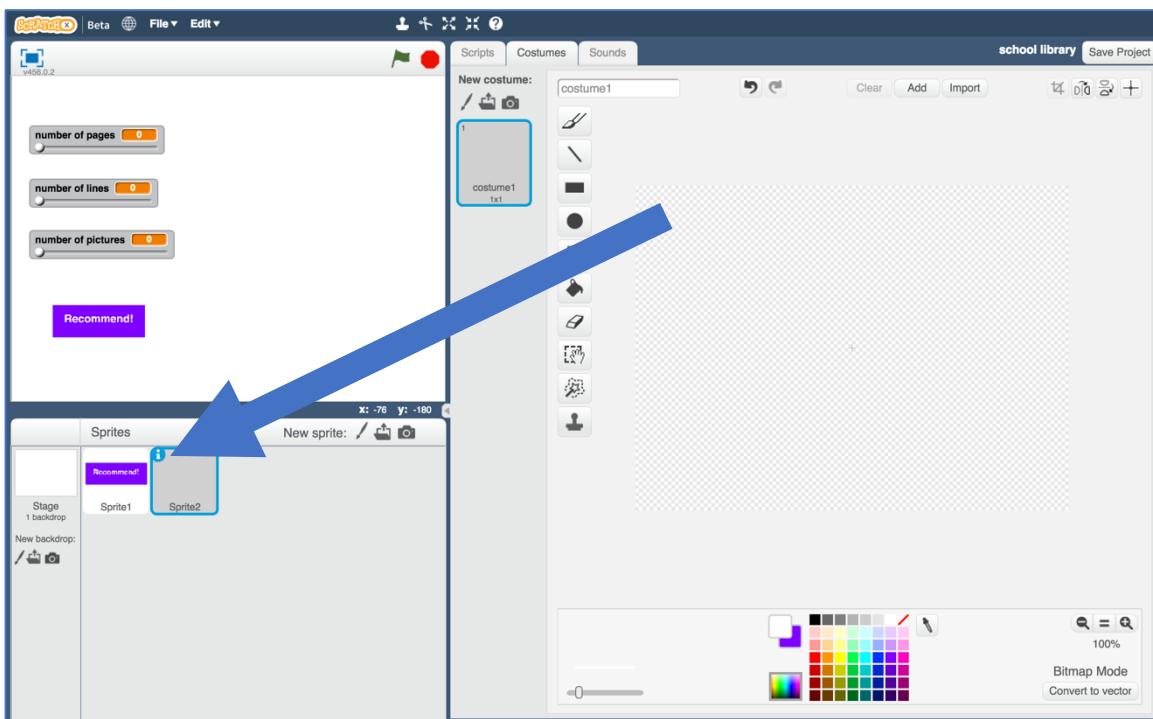
29. Create a script for this button sprite, so that clicking the button broadcasts a new “recommend” message.



30. Click on the “Paint new sprite” paintbrush icon again, to create another sprite.

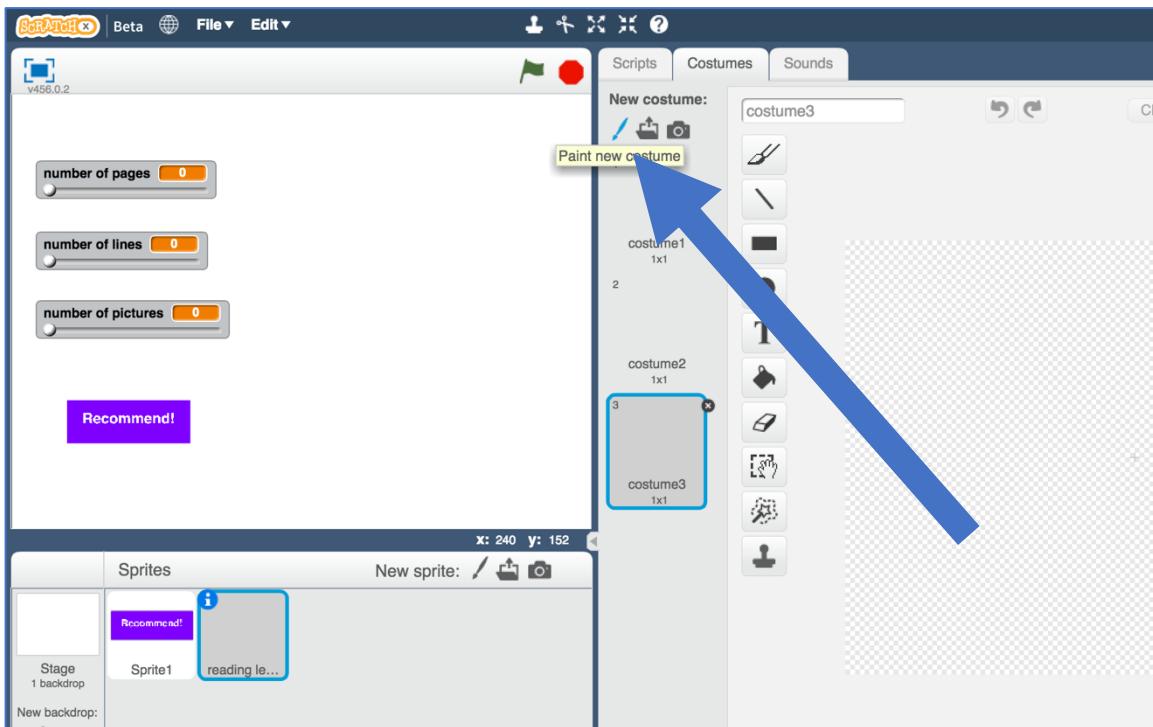
31. Name the sprite “reading level”

Click on the blue *i* icon shown below to name the sprite

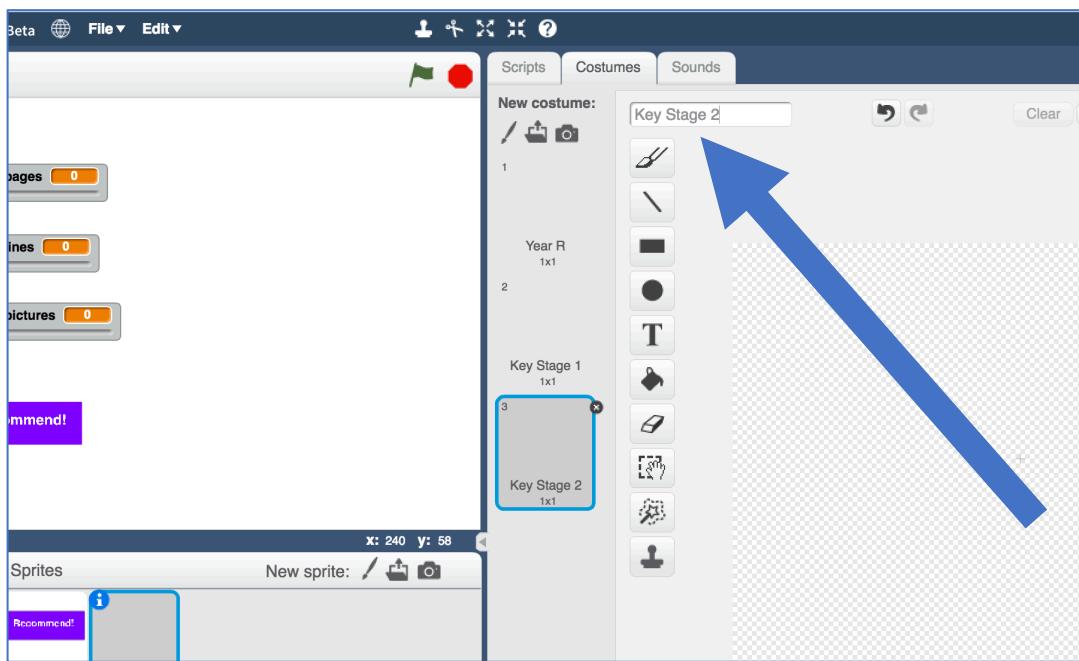


32. Create three costumes for the reading level sprite.

Click on the paint brush button next to the “New costume” label to do this.



- 33.** Name the costumes “Year R”, “Key Stage 1”, and “Key Stage 2”
Type the names into the white box shown below



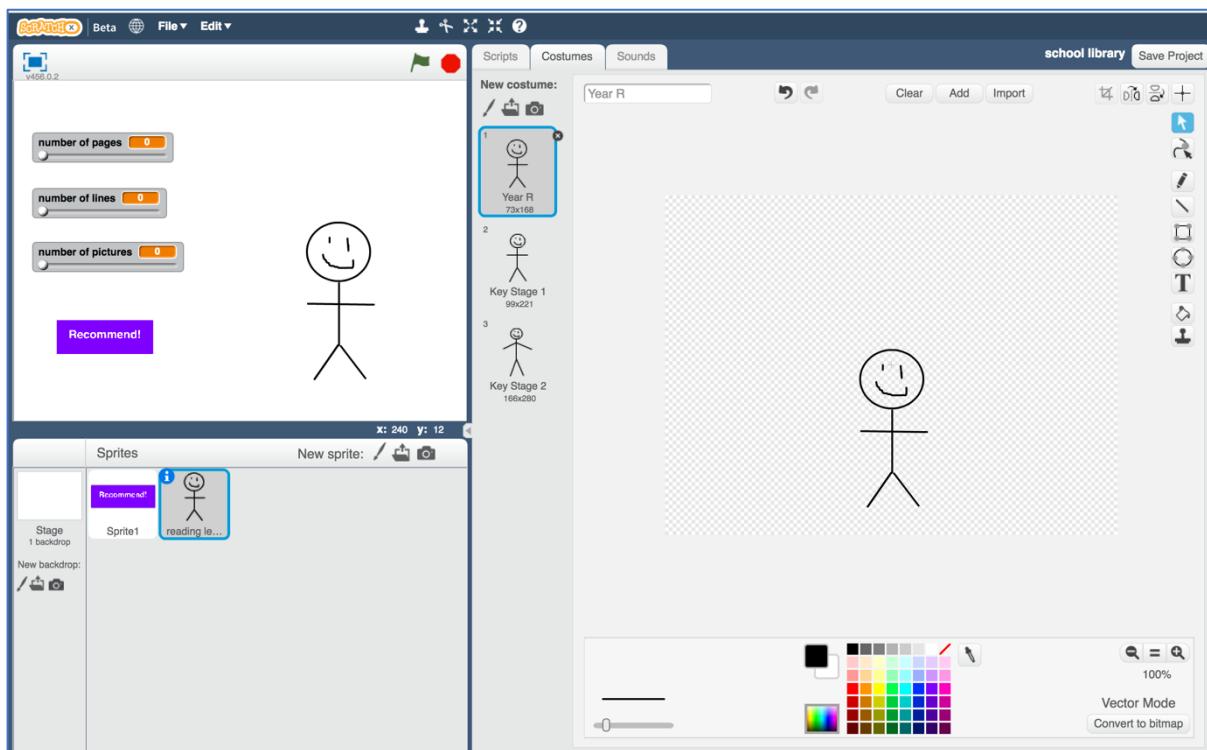
- 34.** Draw a child in each costume.

Draw a small child in the Year R costume

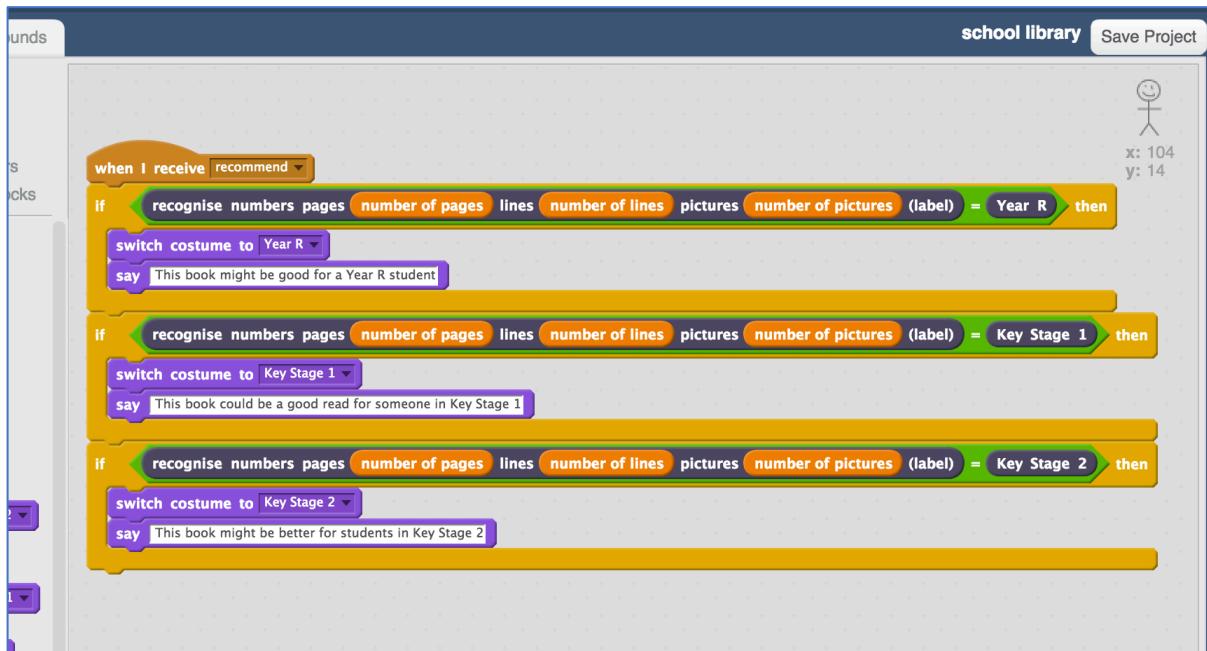
Draw a medium child in the Key Stage 1 costume

Draw a larger child in the Key Stage 2 costume

If you’re not good at drawing, a stick figure is fine!



35. Click on the Scripts tab and enter the following script.
Think about how you could use “Duplicate” to make this easier.



36. Test your project!

Set the sliders to values from a new book – a book that you didn’t use to train your machine learning model.

Click the recommend button to see a recommendation for who the book is suitable for.



37. Save your project

Click File -> Save Project

What have we done so far?

You've created a Scratch game with a school librarian that uses machine learning.

Your character is using “predictive modelling” – making a prediction of who a book might be suitable for, based on the machine learning model that you've made.

You trained that machine learning model by collecting examples of books, and telling the computer what reading level each of them would be. The more examples you give it, the better it should get at recommending correctly.

Ideas and Extensions

Now that you've finished, why not give one of these ideas a try?

Or come up with one of your own?

Choose different numbers

Instead of number of pages, number of lines, and number of pictures, what other numbers could you use?

What other numbers or measurements could you make that you think could be used to make predictions or recommendations?

The height of the book? The thickness? The size of the letters?

Try creating a new numbers project and this time use your own ideas. Compare it with your first project – is it better or worse at making recommendations?