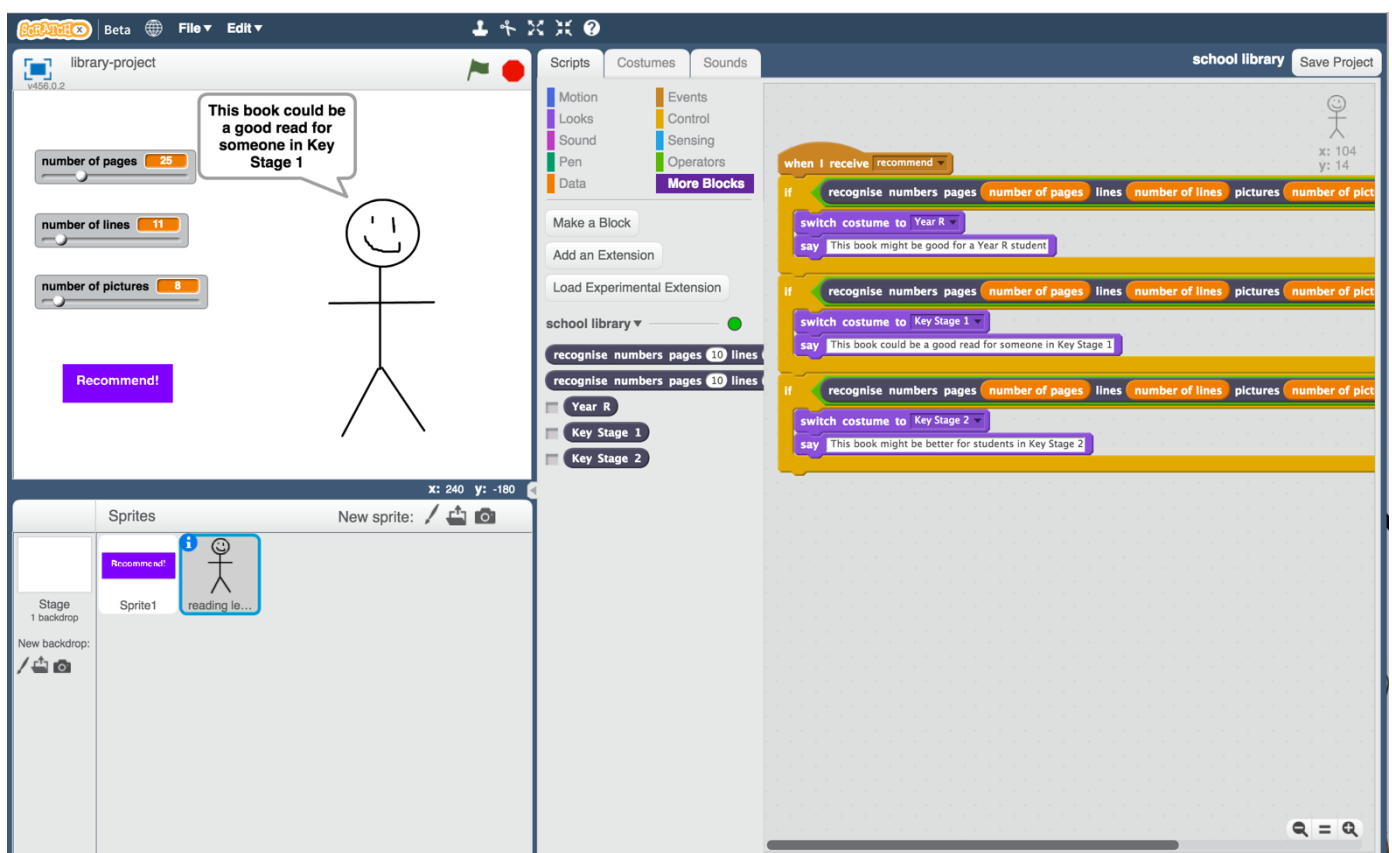


School Library

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.



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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".

ADD A VALUE

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

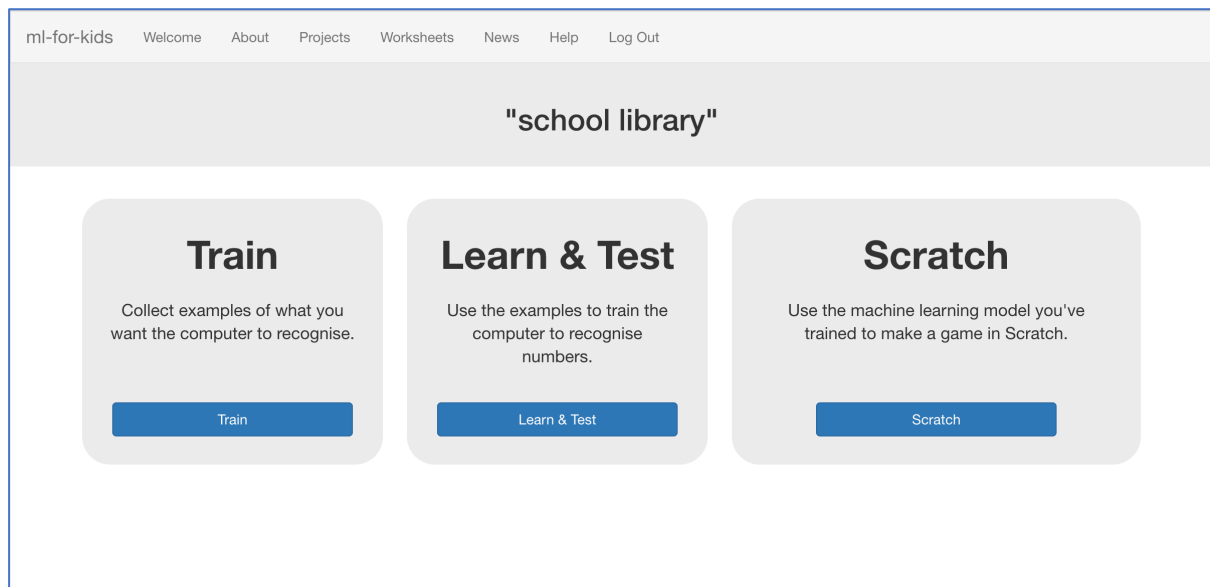
The screenshot shows a web interface for creating a new machine learning project. At the top, there is a navigation bar with links: ml-for-kids, Welcome, About, Projects, Worksheets, News, Help, and Log Out. Below this is a header section titled 'Start a new machine learning project'. The main form area contains a 'Project Name' field with the text 'school library' and a small icon on the right. Below the name field is a 'Recognizing' dropdown menu currently set to 'numbers'. Underneath the dropdown are three input fields, each with a 'Value' and a 'Type of value' dropdown. The first field has 'pages' as the value and 'number' as the type. The second field has 'lines' as the value and 'number' as the type. The third field has 'pictures' as the value and 'number' as the type. Each of these three fields has a red 'X' icon in a circle to its right. Below the first field is a blue button labeled 'ADD ANOTHER VALUE'. At the bottom right of the form are two buttons: 'CREATE' and 'CANCEL'.

12. Click “Create”

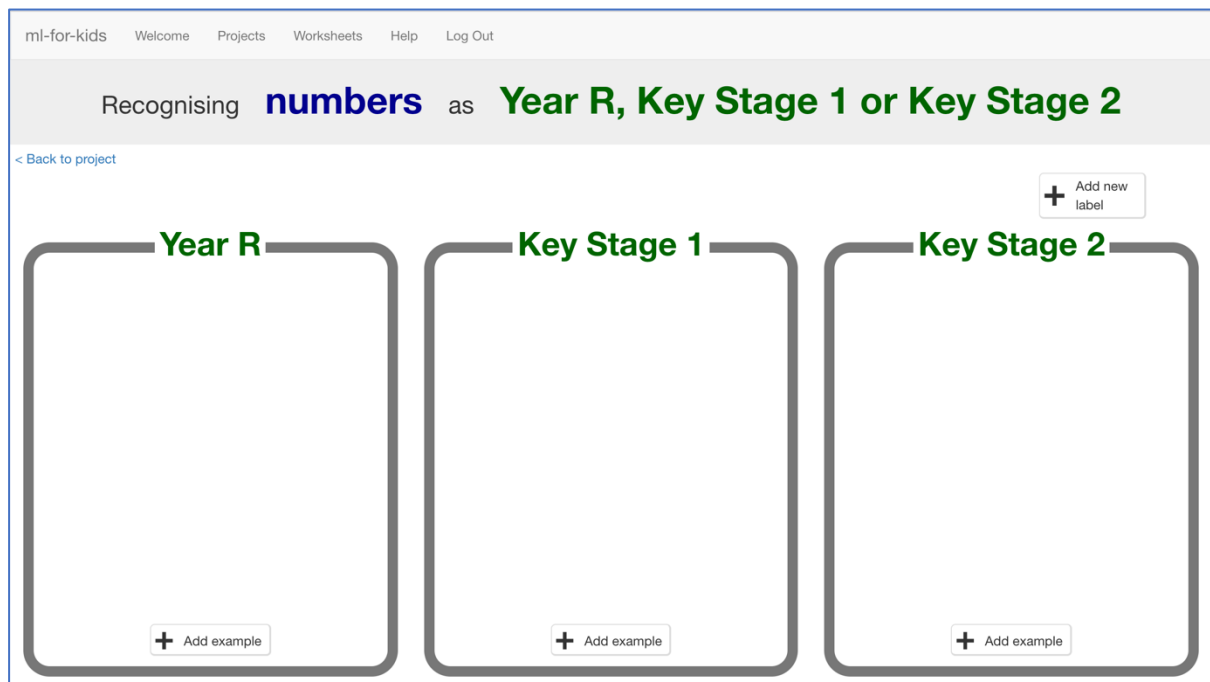
“school library” should now be in your projects list. Click on it.

The screenshot shows a web interface titled 'Your machine learning projects'. At the top, there is a navigation bar with links: ml-for-kids, Welcome, Projects, Worksheets, Help, and Log Out. Below this is a header section titled 'Your machine learning projects'. In the top right corner, there is a button with a plus sign and the text 'Add a new project'. The main area displays a list of two projects. The first project is 'school library', which is 'Recognising numbers'. The second project is 'make me happy', which is 'Recognising text as kind or mean'. Each project entry has a trash can icon to its right.

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



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

The screenshot shows a web interface for 'Recognising numbers as Year R, Key Stage 1 or Key Stage 2'. A modal dialog box titled 'Add new example' is open, prompting the user to 'Enter an example of 'Year R''. The dialog has three input fields: 'pages' with the value '16', 'lines' with the value '4', and 'pictures' with the value '12'. At the bottom of the dialog are 'ADD' and 'CANCEL' buttons. The background shows three buckets: 'Year R', 'Key Stage 1', and 'Key Stage 2', each with an 'Add example' button.

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

The screenshot shows the main interface with three buckets: 'Year R', 'Key Stage 1', and 'Key Stage 2'. Each bucket contains several example cards with the following data:

Category	Example 1	Example 2	Example 3
Year R	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	pages 10 lines 2 pictures 8
Key Stage 1	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	pages 20 lines 6 pictures 18
Key Stage 2	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	pages 150 lines 21 pictures 8

- 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.

ml-for-kids Welcome Projects Worksheets Help Log Out

Machine learning models

[< Back to project](#)

What have you done?

You've collected examples of numbers for a computer to use to recognise when numbers is Year R, Key Stage 1 or Key Stage 2.

You've collected:

- 6 examples of Key Stage 1,
- 6 examples of Key Stage 2,
- 6 examples of Year R

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've collected so far.

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

Info from training server:

Train new machine learning model

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!

You've trained a machine learning model to recognise when numbers is Year R, Key Stage 1 or Key Stage 2.

You created the model on Saturday, July 1, 2017 12:37 PM.

You've collected:

- 6 examples of Key Stage 1,
- 6 examples of Key Stage 2,
- 6 examples of Year R

Try testing the machine learning model below. Enter an example of numbers below, that you didn't include in the examples you used to train it. It will tell you what it recognises it as, and how confident it is in that.

If the computer seems to have learned to recognise things correctly, then you can go to [Scratch](#) and use what the computer has learned to make a game!

If the computer is getting too many things wrong, you might want to go back to the [Train](#) page and collect some more examples. Once you've done that, click on the button below to train a new machine learning model and see what different the extra examples will make!

Try putting in some numbers to see how it is recognised based on your training.

pages	<input type="text" value="10"/>
lines	<input type="text" value="2"/>
pictures	<input type="text" value="8"/>

Test

Recognised 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.

< Back to project

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:

```
if recognise numbers pages 1 lines 2 pictures 3 (label) = Year R then
  say I think that was Year R
```

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.

- 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.

Scratch Beta File Edit

v456.0.2

Scripts Backdrops Sounds

Motion Looks Sound Pen Data Events Control Sensing Operators **More Blocks**

Make a Block Add an Extension Load Experimental Extension

school library ●

recognise numbers pages 10 lines

recognise numbers pages 10 lines

☐ Year R

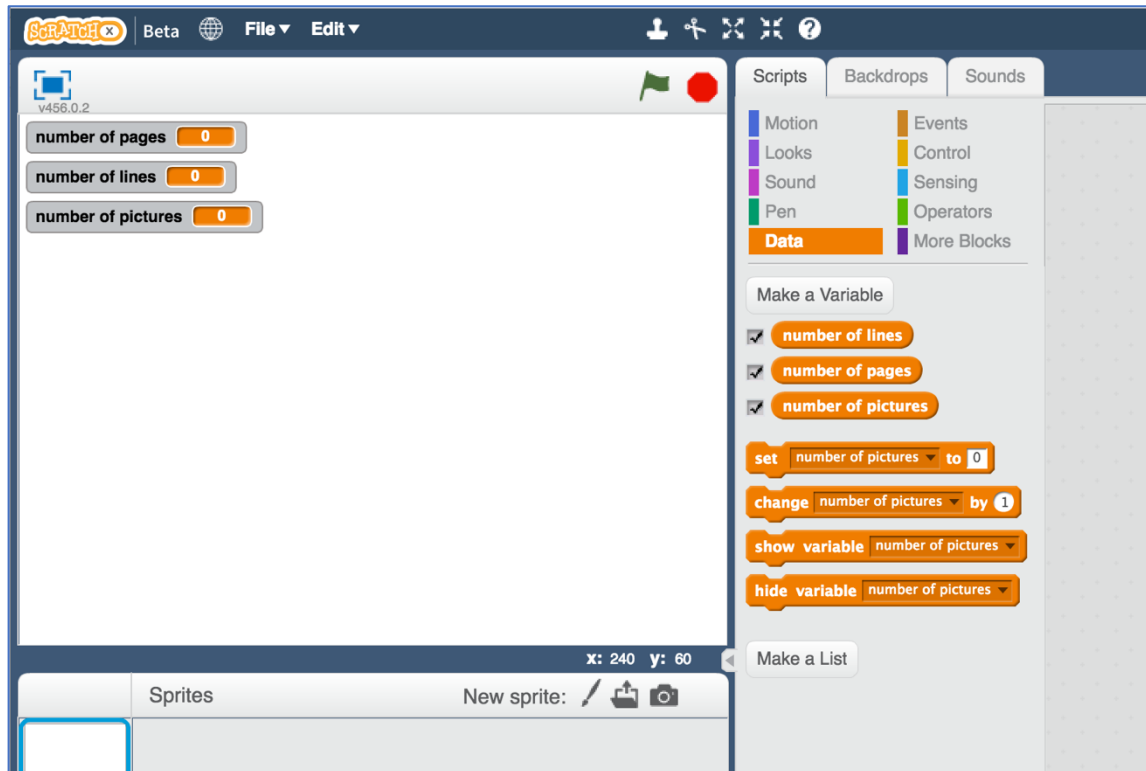
☐ Key Stage 1

☐ Key Stage 2

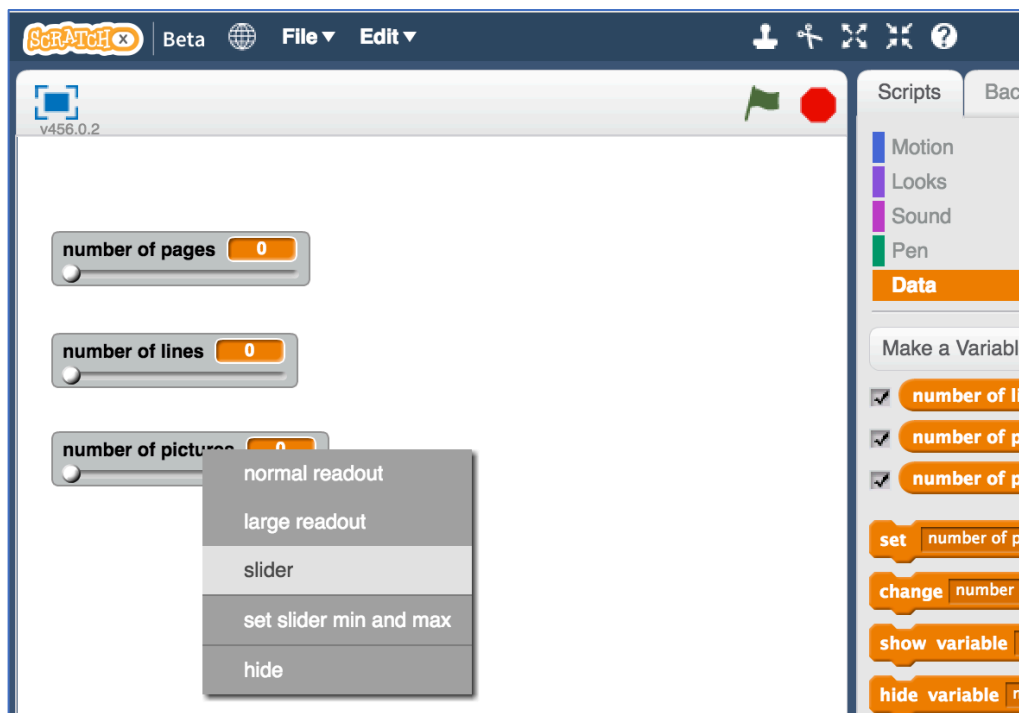
Sprites New sprite: [icon] [icon] [icon]

X: -82 Y: -147

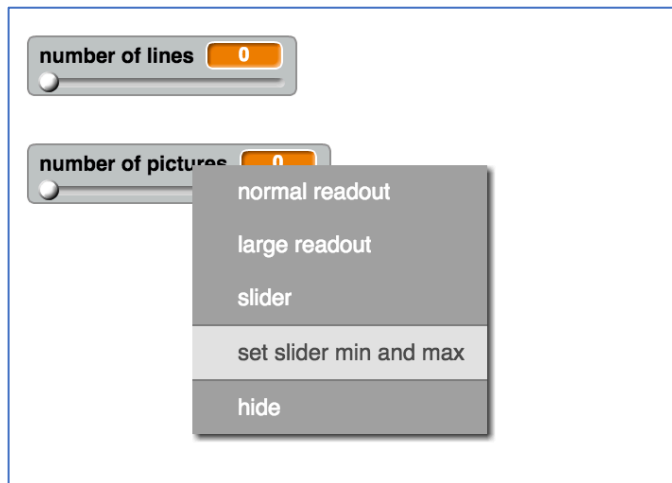
- 23.** Create three new variables, for all sprites. Call these “number of lines”, “number of pages”, and “number of pictures”.
Leave them ticked, so they stay visible on the stage.



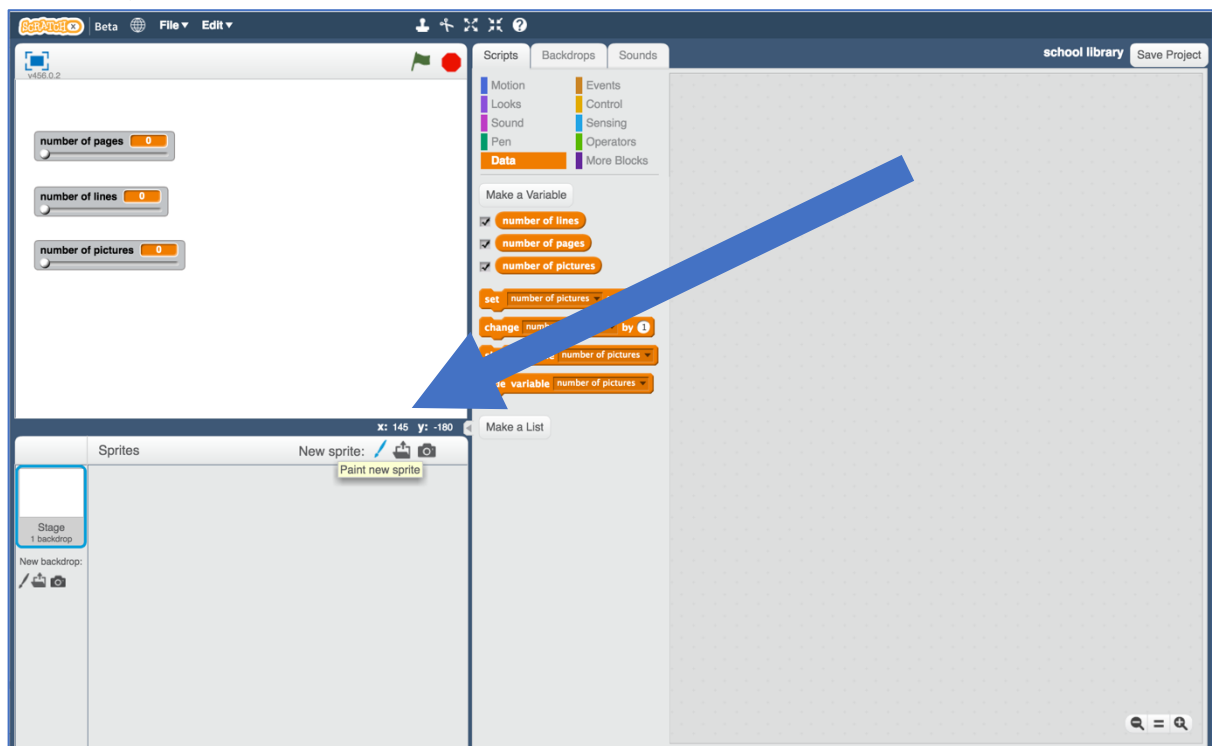
- 24.** Set all of the variables so that they are displayed on the stage as “sliders”. Spread them out a bit so you have space.
Right click on the variables on the stage, and choose “slider”.



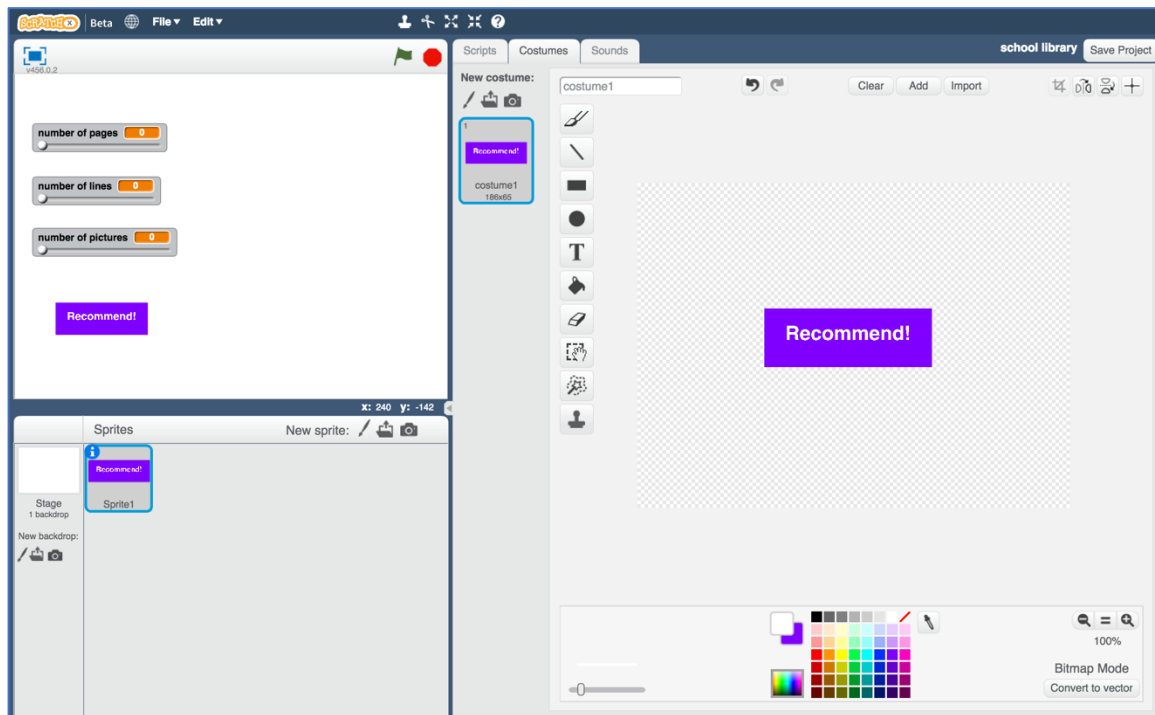
- 25.** Update the minimum and maximum for each of the sliders so that the range is more sensible.
*For example, you could use minimum of 0 and maximum of 300 for pages.
You could use 0 – 40 for number of lines.
You could use 0 – 50 for pictures.
But choose what you think makes sense based on your books.*



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

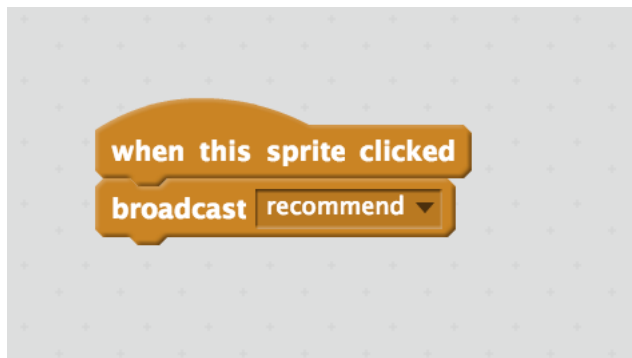


- 27.** Draw a button and give it a label like “Recommend”.
Move it to under your three sliders, and adjust the size so that it fits.



- 28.** Click on the Scripts tab.

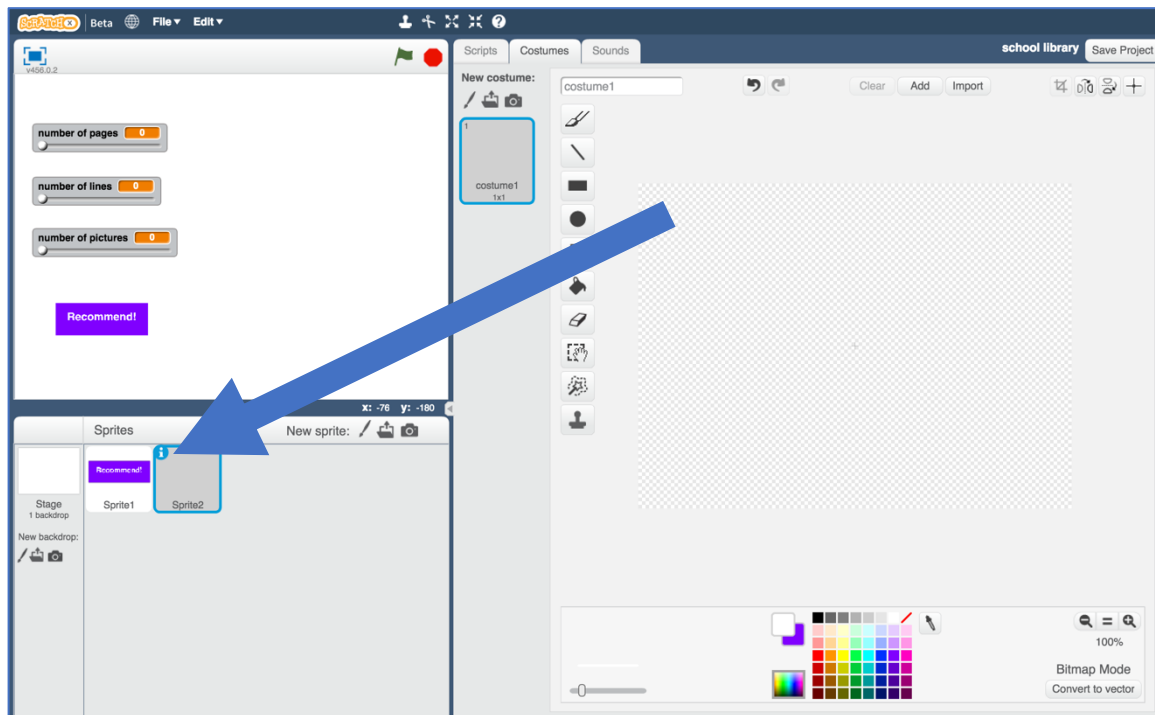
- 29.** Create a script for this button sprite, so that clicking the button broadcasts a new “recommend” message.



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

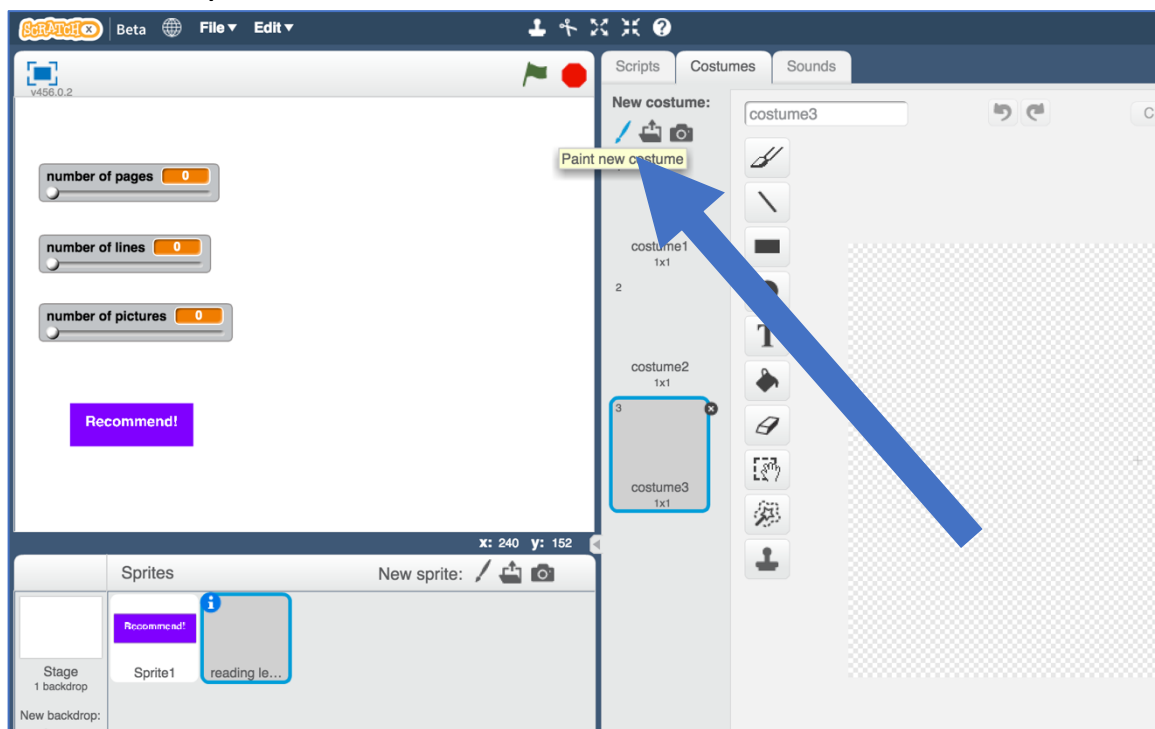
31. Name the sprite “reading level”

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

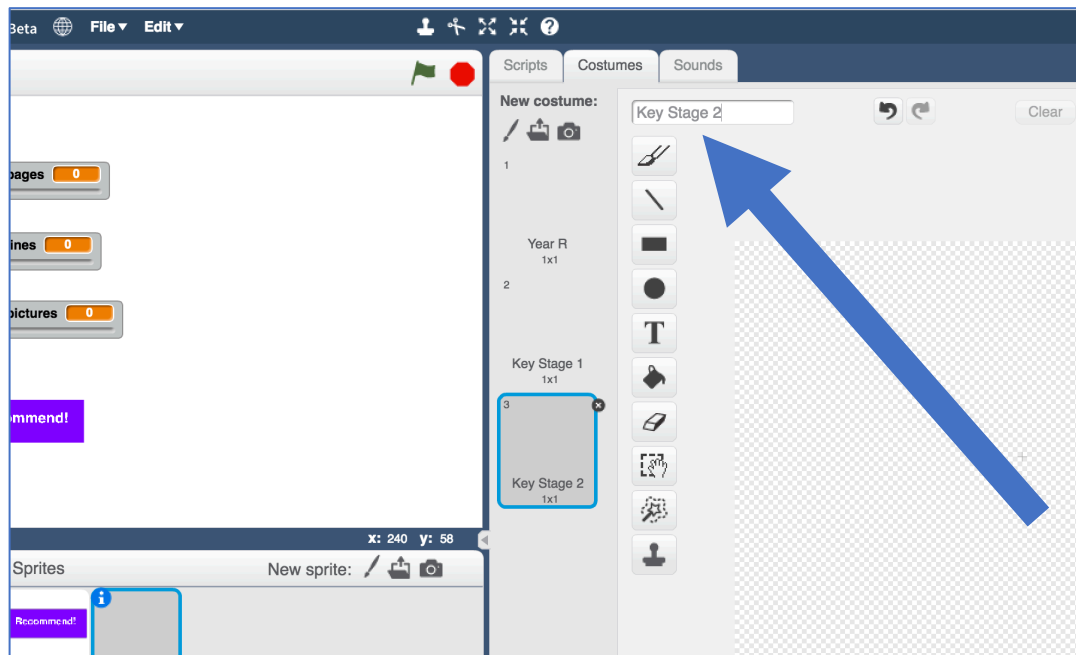


32. Create three costumes for the reading level sprite.

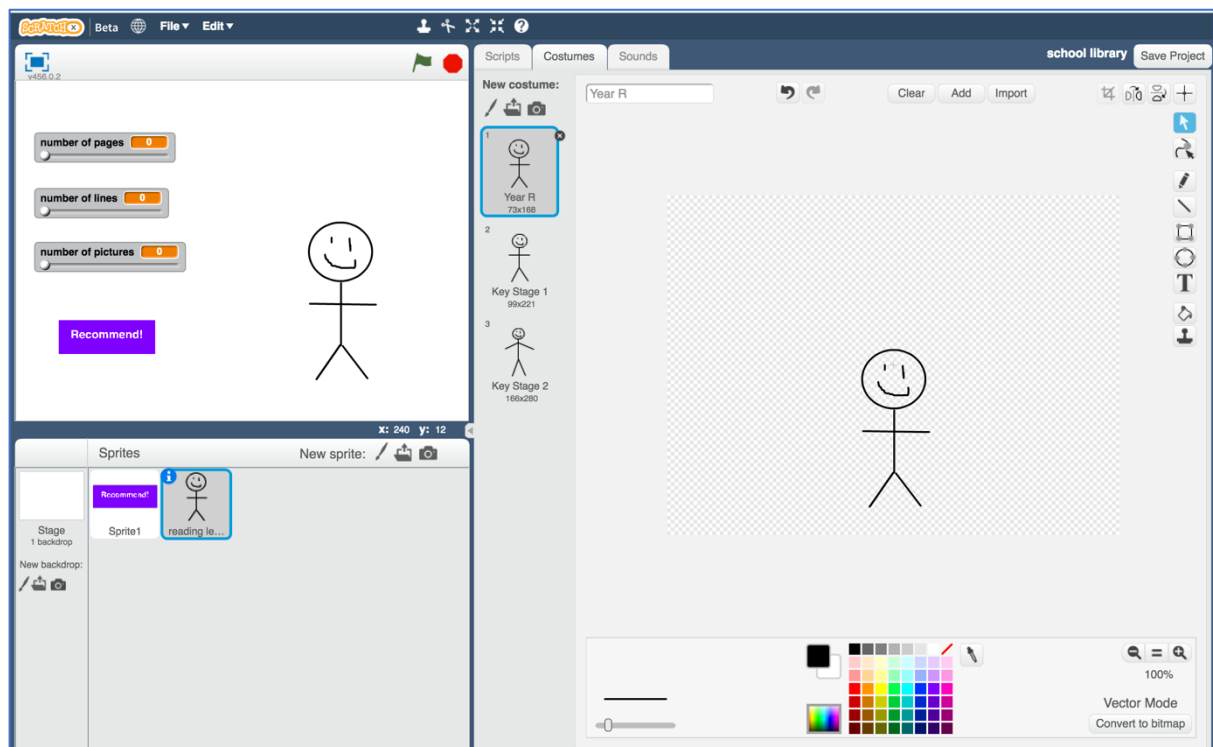
Click on the paint brush button next to the “New costume” label to do this.



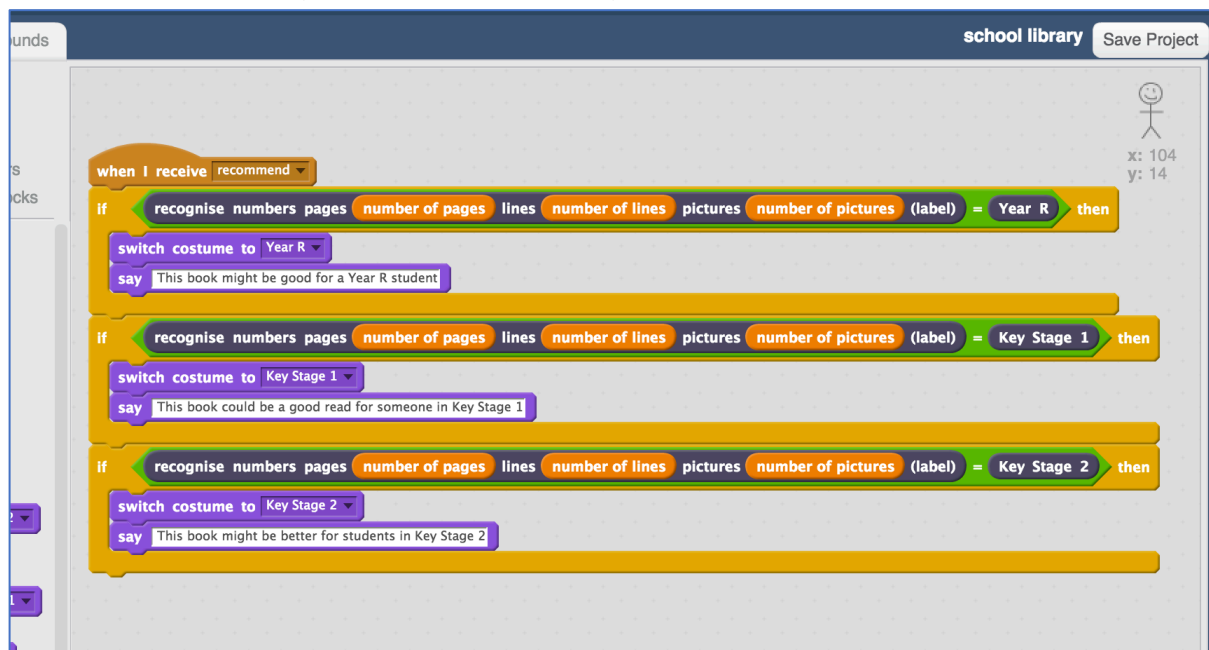
- 33.** Name the costumes “Year R”, “Key Stage 1”, and “Key Stage 2”
Type the names into the white box shown below



- 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?