2017 Scratch After-School Class: Week 12

Automatic graffiti

For our final session we'll use Scratch's *pen* blocks to make an automatic graffiti machine. We'll assume we have permission from the wall's owner to decorate it however we want.

We'll use two new parts of Scratch: ***lists*** and the ***pen blocks***.

How to use the project

When we've written it, you'll use this project like this:

- Press 'r' to start **r**ecording your graffiti.
- Draw with the mouse — hold down the button to draw.
- Press 's' to **s**top recording.
- Press 'p' to **p**lay the recorded graffiti.

Choose a backdrop

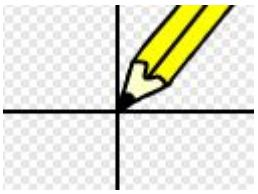
Select the stage, then choose the 'Backdrops' tab. (This is where the 'Costumes' tab is for a normal sprite.) Add a suitable backdrop. You can use the '`brick wall2`' backdrop from the library, or find something on the web.

Choose a drawing implement

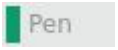
Add a new sprite to do the drawing. I used the '`pencil`' from the library but you can find something on the web instead if you prefer — maybe a spray can?

Set costume centre

Use the 'set costume centre' tool to pick a part of the drawing implement where it makes sense for the drawing to happen. For the pencil, I chose the point.

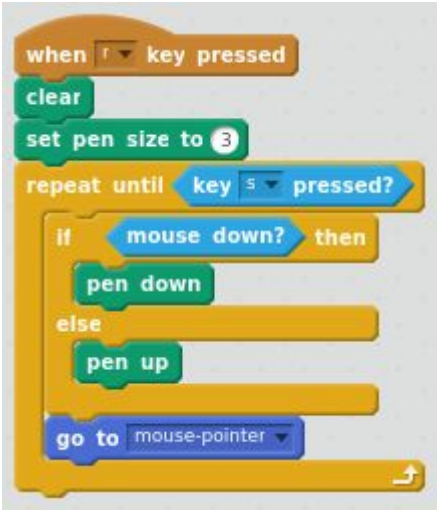


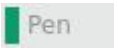
The 'pen' blocks in Scratch

The blocks in the 

section let you pretend a sprite is carrying a pen with it, which can either be 'down' on the paper or 'up' in the air. When the pen is 'down', the sprite draws a line on the stage as it moves around.

Draw with the pencil



Using the blocks in the 

section, ***add this script to the pencil***:

To start with, we clear all old pen drawings, and choose a medium-thickness pen.

Now look at the body of the '`repeat until`' loop. The idea here is that we check whether the mouse button is down, to decide whether the user wants to draw a line or just move the pencil. Once we've done that, we move to wherever the mouse pointer is. If the pen is down, this will draw a short piece of straight line. If the pen is up, the pencil will just move.

We want to keep doing all that until the user says to stop, by pressing 's'.

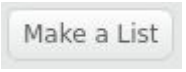
Test it!

Check you can press 'r' to start a drawing and 's' to stop it.

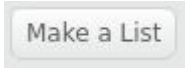
Remembering what the user has done

We want Scratch to remember what the user did, so we can replay it afterwards. So far in Scratch we've used a *variable* to remember something. But we want to remember a whole collection of things — a drawing is made up of lots of different 'moves' the user did.

Remember lots of things in a *list*

In the 'data' section, there is a 

button. A 'list' in Scratch lets you remember lots of things at the same time. We want to remember all the moves the user made while making their drawing.

Use the 

button to make a 'moves' list. Leave it ticked for now so it's shown on the screen. Untick it later, once things are working.

The three things we need to remember about a 'move' in the drawing are:

- Whether the pen should be down or up.
- What 'x' coordinate the pencil moved to.
- What 'y' coordinate the pencil moved to.

So for each move, we need to add these three things to the 'moves' list.

***Change the pencil's script* as shown here**:

You'll add the five blocks which work with the 'moves' list:

- Delete all items from the list at the start.
- Add either 'down' or 'up' to the list.
- Add the 'x' and 'y' coordinates to the list.

Test it!

If you go to full screen, and press the 'r' key to start recording, the 'moves' list will very quickly have hundreds or even a couple of thousand items on it. Press 's' quite soon! If you then scroll up and down, you should see groups of three items, for the moves you made while doing your test drawing. Each group is (up/down, x, y).

In the example here, you can see a section where I was holding down the mouse button and moving rightwards (because 'x' is getting bigger) and downwards (because 'y' is getting smaller).

Replay the graffiti

We'll use the list to replay the graffiti. We'll look at this in pieces. You can make the blocks as the worksheet explains them, then put them together into the script at the end of the section.

Remember which move we're replaying

We'll use a variable to keep track of where we are in the list:

Make a variable 'which-move'.

This will tell us which item (first? fourth? hundredth?) in the 'moves' list is the start of the group of three items describing the move we're about to replay.

Variables for 'x' and 'y' coordinates

To make our program easier to read, we'll also use variables to store the 'x' and 'y' numbers of the move we're replaying:

Make two variables: 'move-x' and 'move-y'.

Getting the information from the list

We now need to pick out the down/up, 'x', and 'y' values for the move we're working on. Look at this small piece of the example list above:

- Item no.1282 is 'down';
- Item no.1283 is '−21';
- Item no.1284 is '10'.

And suppose 'which move' is 1282. Then we can get the bits we need by:

- Down/up is 

;
- The 'x' coordinate is 

;
- The 'y' coordinate is 

.

We'll use the 'down/up' value to decide whether to put the pen up or down.

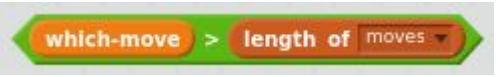
We'll use the 'x' and 'y' coordinates to know where to move to.

How to work on the next move?

Each move takes three list items, so to go on to the next move, we'll need to do:

How to know when we're finished?

If 'which-move' is bigger than the number of items in the list, we're done. The 'question' block we need is:



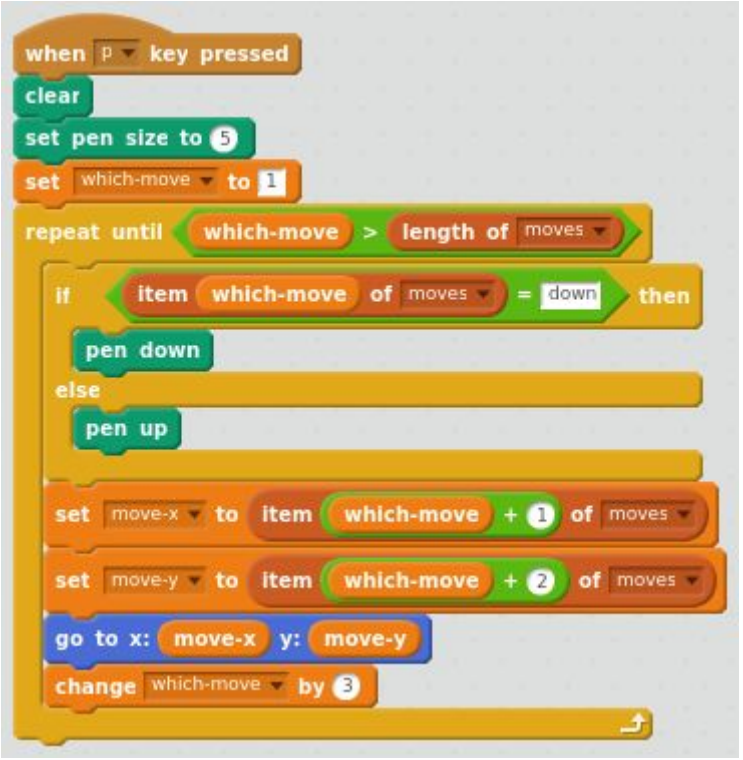
Put all this together

***Add this script* to the pencil**:

We first clear away all old drawings, then choose a slightly wider pen.

We make sure we start at the first recorded move.

Then, until we've replayed all moves, we pick out the pieces of information we need. We put the pen down or up, then move to the recorded location.



Test it!

You should be able to hit 'p' to play your recorded drawing.

Challenges

If you have time, either now or at home afterwards, you could try:

- Hide the pencil after the replay is finished. (You'll need to show it at the start, and also work out what to do when the user is recording their drawing.)
- After replaying the graffiti, make it pause, then wipe the wall clean, then replay it again in a different colour. Make it do this round and round forever.
- Extend the previous challenge to move the graffiti along and/or up or down a random amount each time it's replayed.
- Make the colour change continuously as the graffiti is replayed.
- Replay the graffiti more slowly (easy) or more quickly (hard).

Key points

Use a *list* to remember a whole collection of things.

Use the *pen blocks* to draw on the stage.

About this document

Scratch is developed by the Lifelong Kindergarten Group at the MIT Media Lab. See http://scratch.mit.edu.