Measuring in Pixels with Scratch

In the Primary division, a big mathematical idea is understanding how to measure correctly, using both non-standard and standardized measurements. Many students struggle with measuring because they fail to understand the iteration process in measuring: that a unit of measurement is repeated over and over again. The purpose of this module is to give students an opportunity to measure an object and explore the concept of distance and perimeter through coding.

This program was a collaboration between Lisa Anne Floyd (a teacher in TVDSB) and myself. My students and I created an initial idea which Lisa then improved on. The code you see below is the remix of the original code.

Curriculum Expectations:

Overall: estimate, measure, and record length, perimeter using non-standard units and standard units

Specific:

- estimate and measure length, height, and distance, using standard units (i.e., centimetre, metre) and non-standard units;
- record and represent measurements of length, height, and distance in a variety of ways e.g., written, pictorial, concrete (Sample problem: Investigate how the steepness of a ramp affects the distance an object travels. Use cash-register tape for recording distances.);
- select and justify the choice of a standard unit (i.e., centimetre or metre) or a nonstandard unit to measure length (e.g., “I needed a fast way to check that the two teams would race the same distance, so I used paces.”);
- estimate, measure, and record the distance around objects, using nonstandard units (Sample problem: Measure around several different doll beds using string, to see which bed is the longest around.)

Scratch:

You and your students can investigate these curriculum expectations using an online coding program called, Scratch. Go to https://scratch.mit.edu. You can sign up for a free account. This will allow you to save your work. If you do not sign up then you will not be able to share and save your materials.

created by Jonathan So (PDSB) and help from Lisa Anne Floyd (TVDSB)
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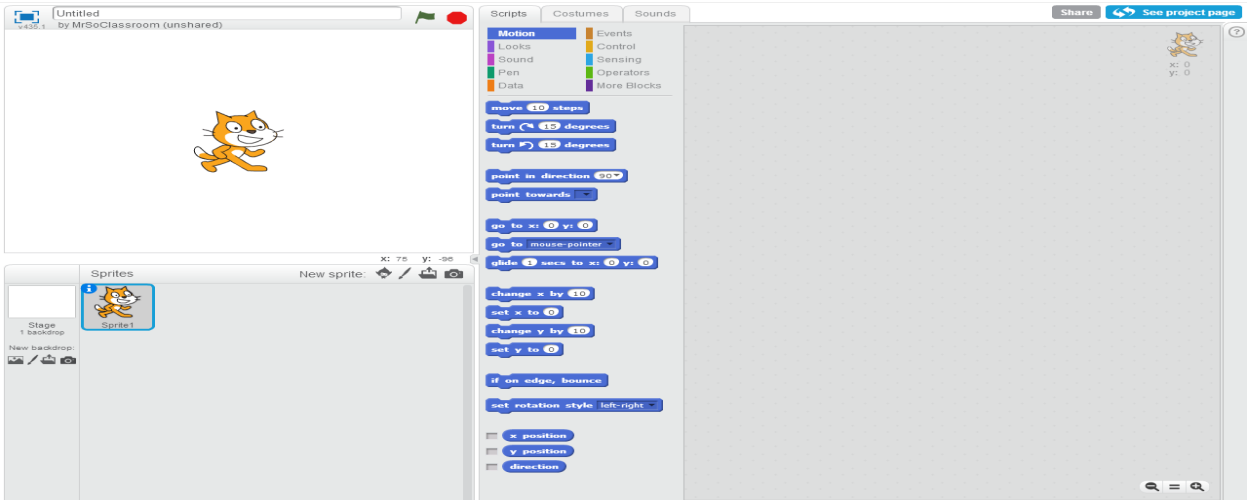
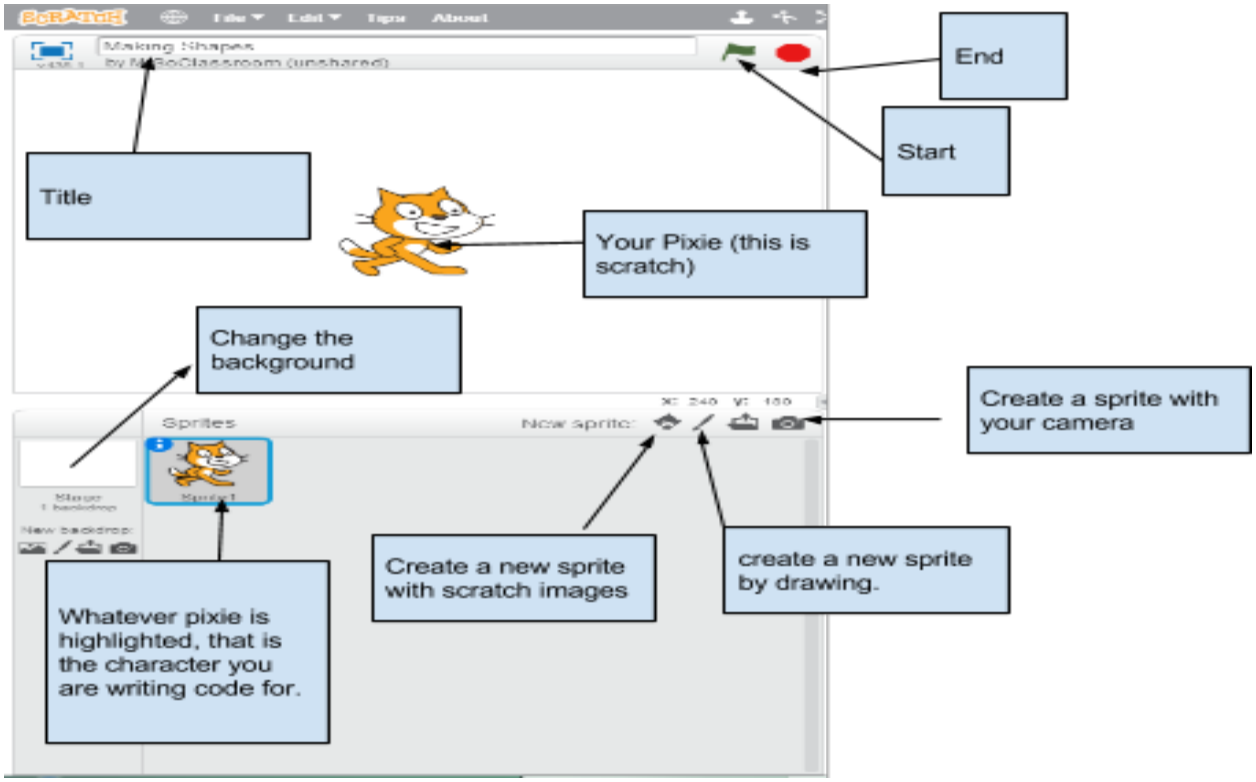
When you start Scratch this is the first page that you will see:



There are many features on this page.The following pictures provide an overview of the the program.



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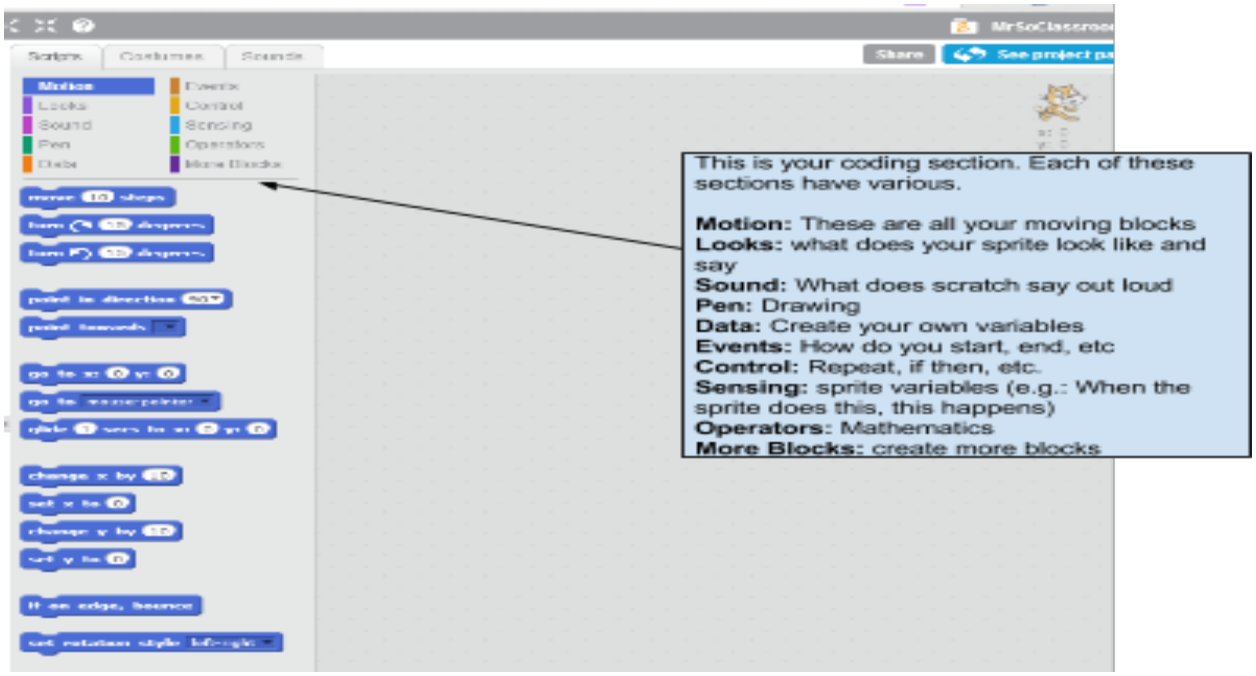
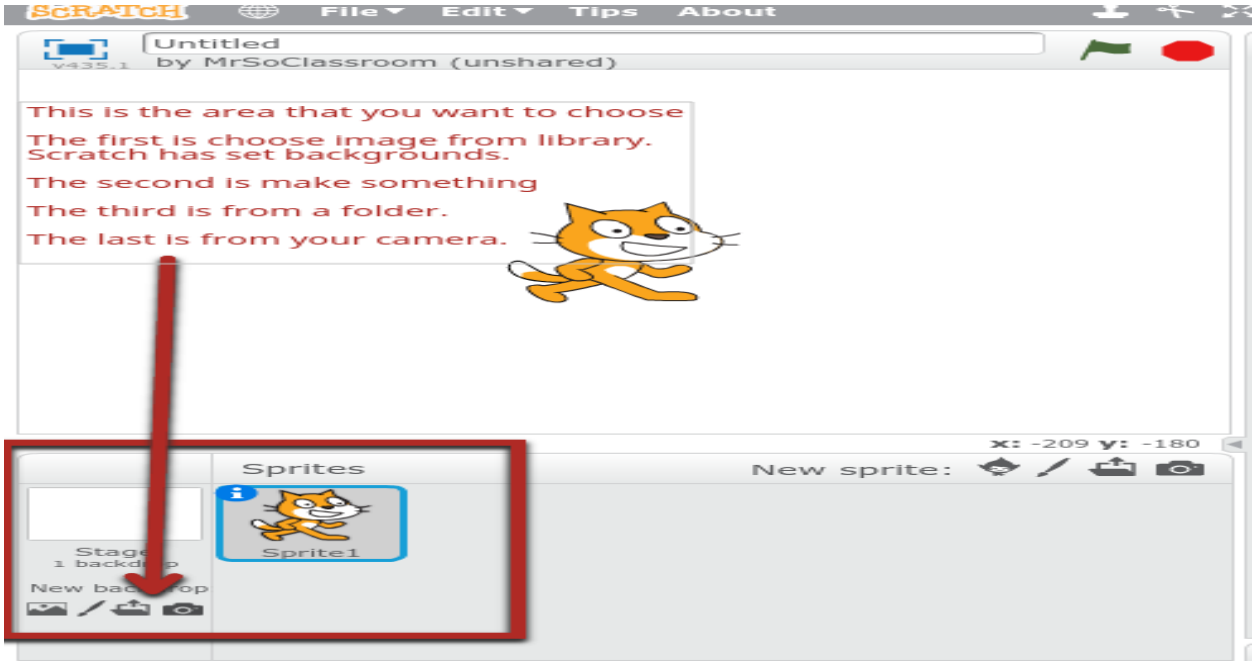


Let's get started. The first step is to input a picture into the background. The first time I did this I had the students add a new sprite but I advise against this as it created some confusion around which sprite they were coding and the line often went behind the sprite instead of on top. To insert a background you need to click one of the options in the background section of Scratch. This is located at the bottom left corner of the screen.



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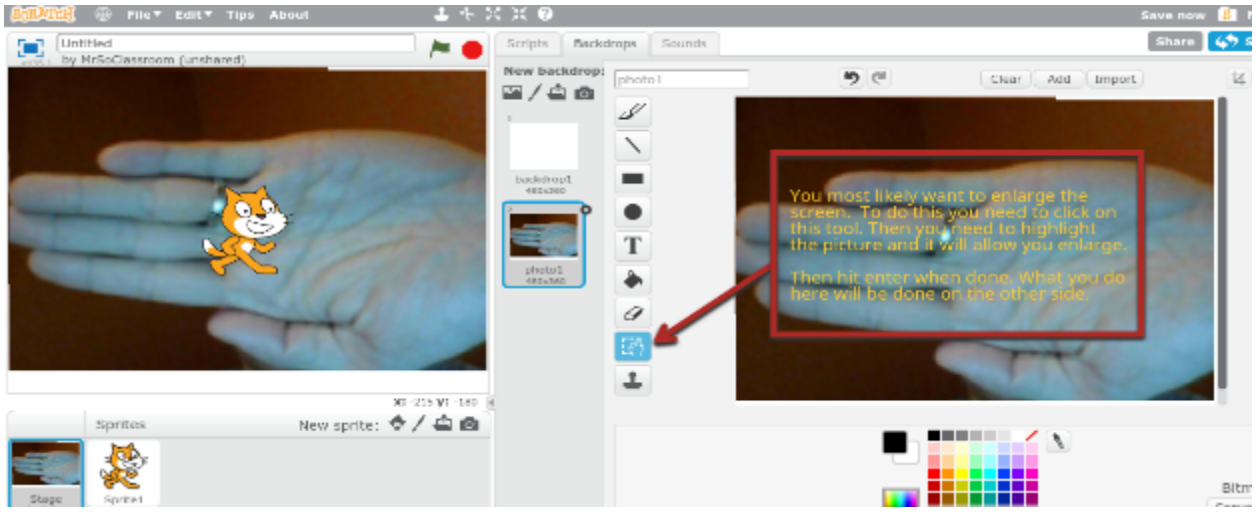
I think you can take this part out now because you already thanked her at the beginning**.** I want to first start begin by saying that I had a lot of help from Lisa Anne Floyd in the creation of this code. My students first did something completely different and she was able to make it more elegant. For this task I wanted the students to measure the perimeter of their hand. They used the camera icon and took a picture of their hand. Feel free to use whatever object you would like.

Most likely you will want to enlarge the screen. To do this you need to click on the select tool (it is the one that looks like a box with dotted lines. Then you need to highlight the picture and it will allow you to enlarge the object. Click enter when done. What you do in the editing screen on the right will automatically appear on the left when you hit enter.



Once you have the picture in place it is time to code. You will need to click on the scripts section in the middle of your page and it will bring you back to the coding section (see the next picture).

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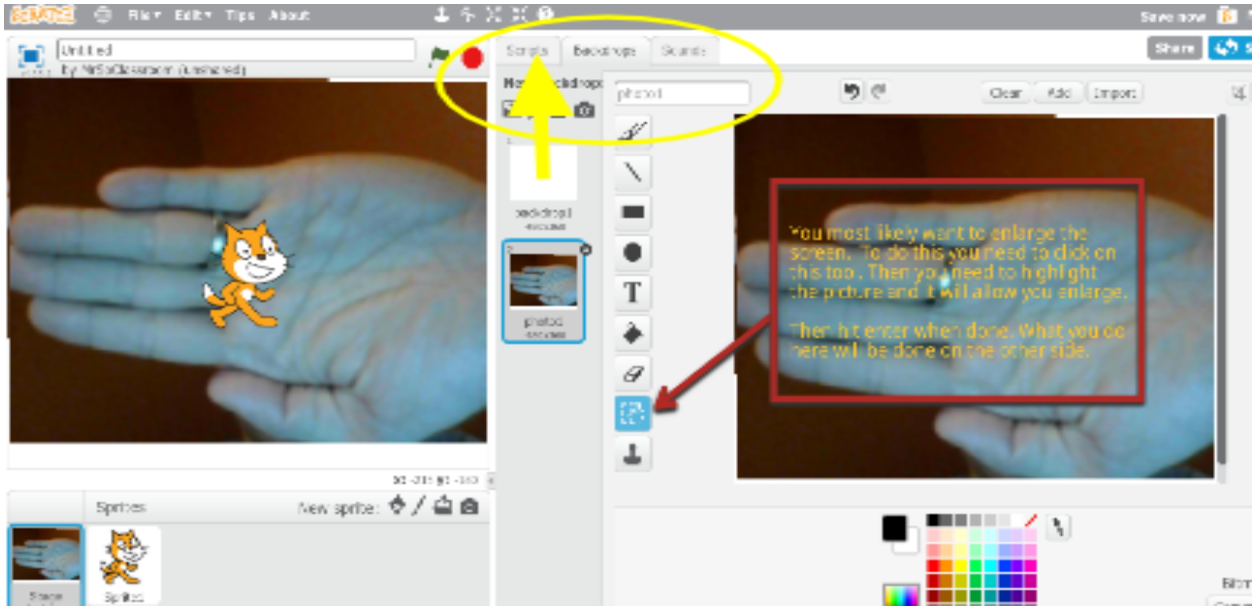
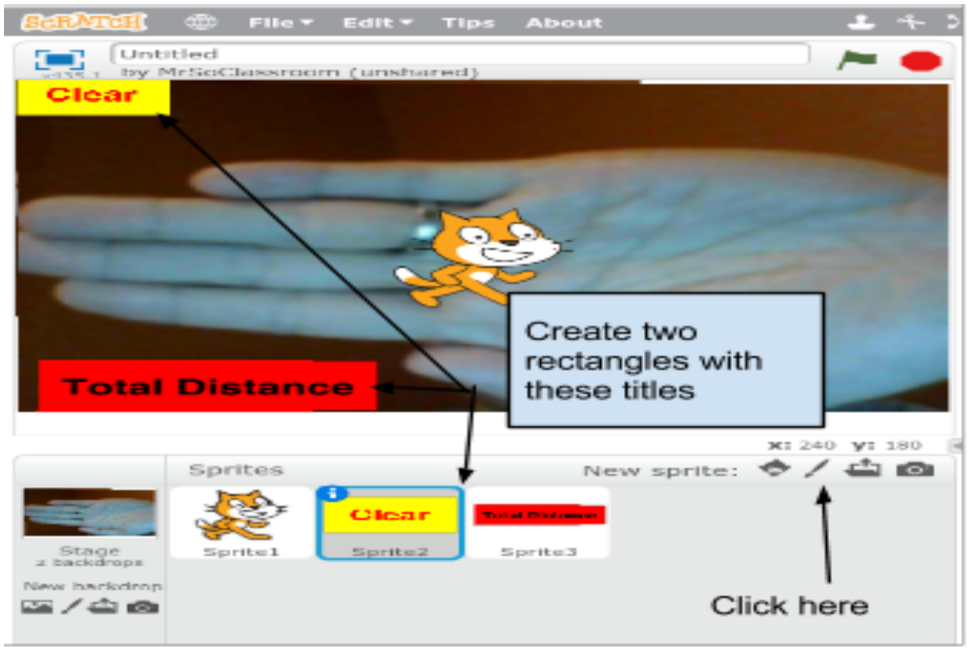


Now we need to create two sprites. A sprite is a small character or object that we can code; Scratch the cat is an example of a sprite. Their role is to clear data and to tell us the total distance. First we need to create them; in a minute we will tell them what to do. To create a sprite go to the new sprite section and click on the paint brush. This lets us create a sprite from our drawings. To be honest you could put any sprite in there; all that matters is that the sprites do what we want them to do. I create from drawing so the students don't get confused. Creating sprites is just like using paint in Office (very similar controls).



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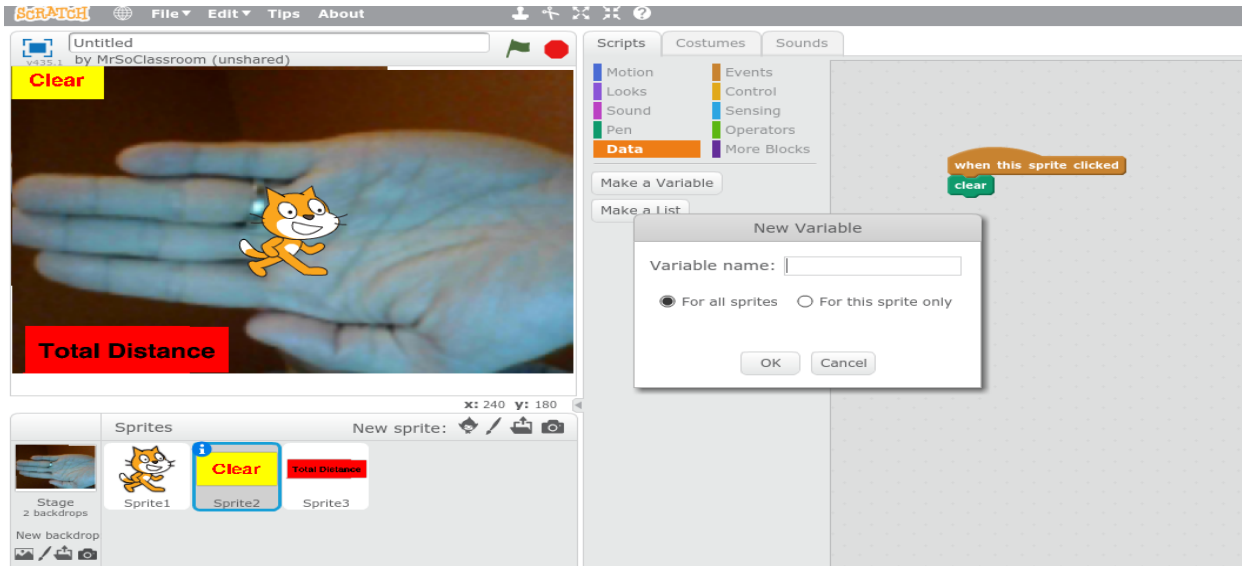
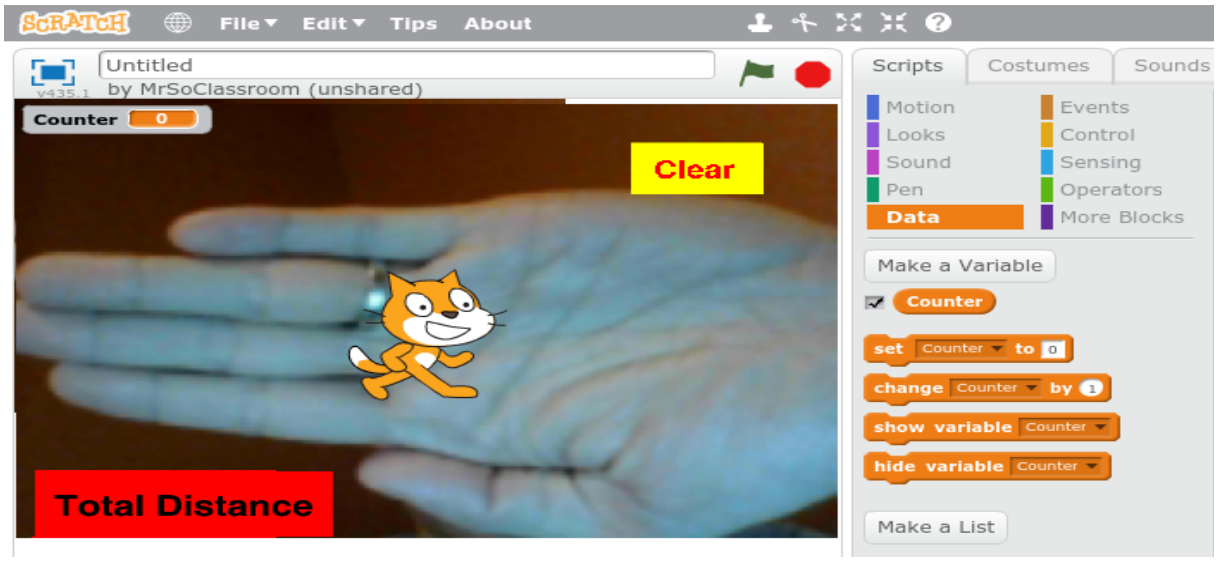
You are now ready to code. To begin the process we have to create a new variable. Go to the data section of Scratch. Click on: create new variable.



Call this variable, ”Counter.” This will create a bunch of new variable blocks that we will be using. You will also notice a new section being added to your top left hand section of the screen. You may also need to move your sprite over if it is being blocked by the counter that just appeared. You can do that in the costume section. Highlight your sprite and move it over.



We can start by coding the two new sprites we created. The clear sprite will do exactly what it says, “Clear.” First, go to the events section and click the block titled: “when this sprite clicked”. Then go to the pen section and drag over the block: “Clear”. The final step is to go

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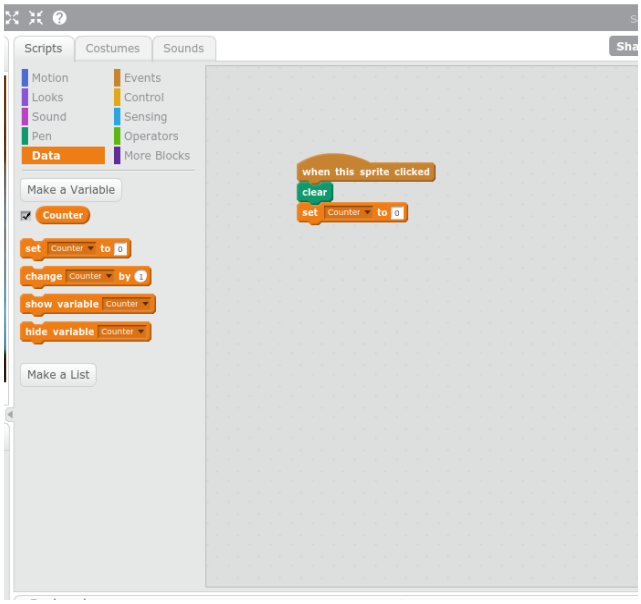
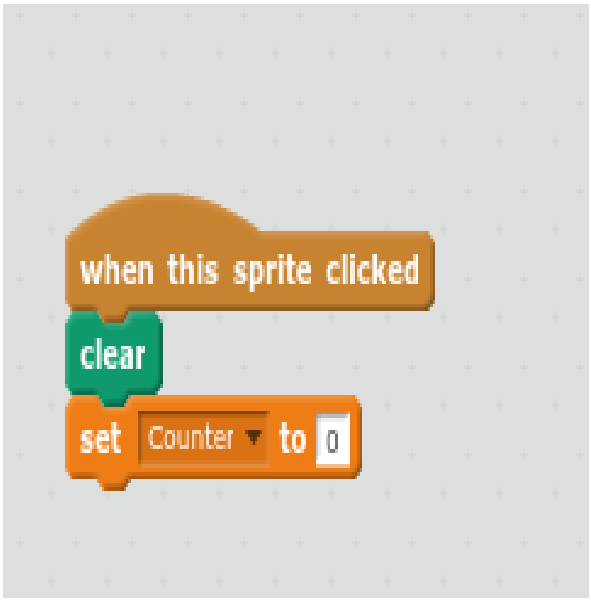
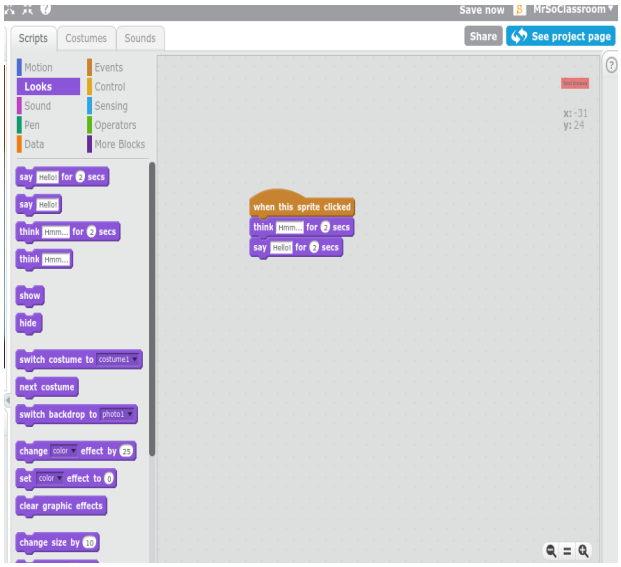
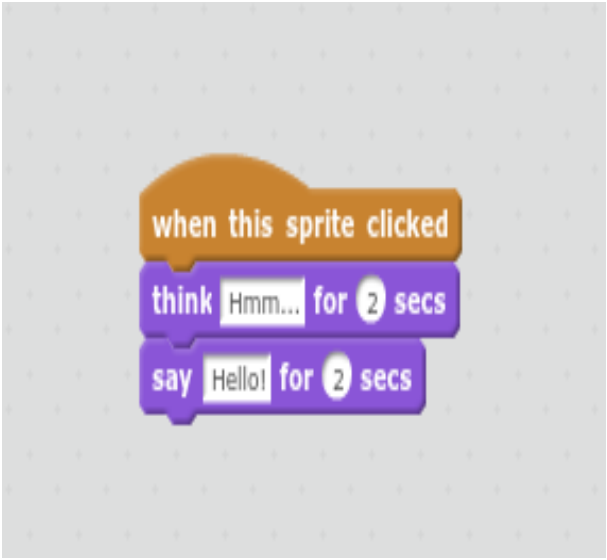
back to the data section and drag over the section that says: set counter to 0. We have now told the computer that when “clear” is clicked the following steps will happen: clear all lines and set the counter back to 0.





That is all you need for that sprite. We can now move on to the total distance. Click on that sprite in the sprite section. If you don’t do that you will continue to code in whatever sprite is highlighted. We will once again need to go to the event section and drag the block: “when sprite is clicked”. We will then go to the “looks section” and drag two different blocks. The first block is: “think…(hmm….)”. The next one is: “say…….”. Your code should look like this:





Now we need to go to the operation section and add the “join block” into the (Hello!).

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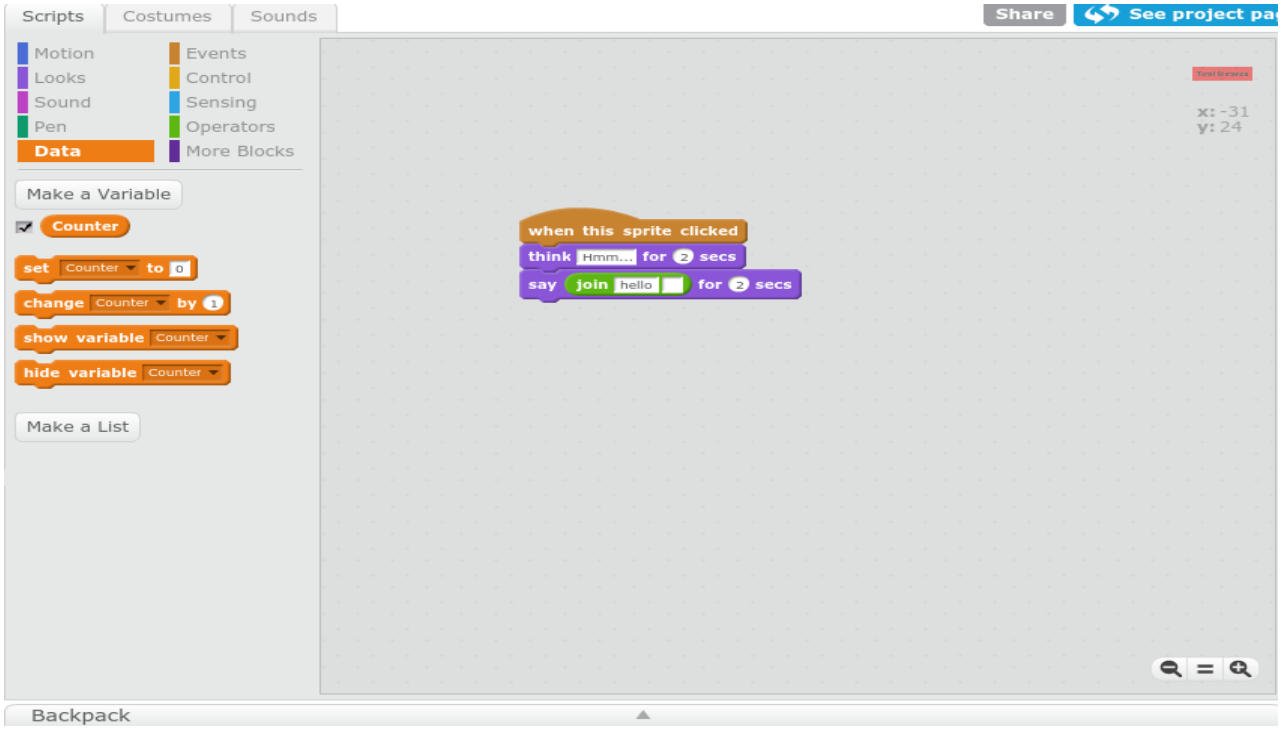
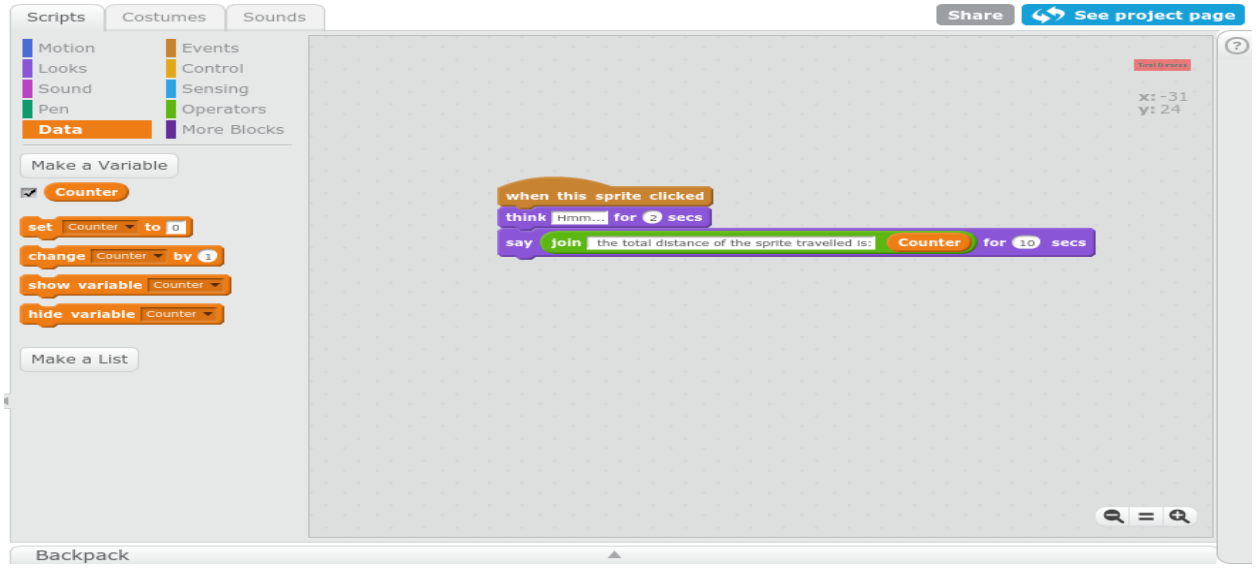


Next, go to the data section and insert the counter block into the second blank space. In the first type the following text, “The total distance of the sprite travelled is”: Now when the sprite is clicked it will calculate and then tell us how many steps in pixels Scratch has travelled.



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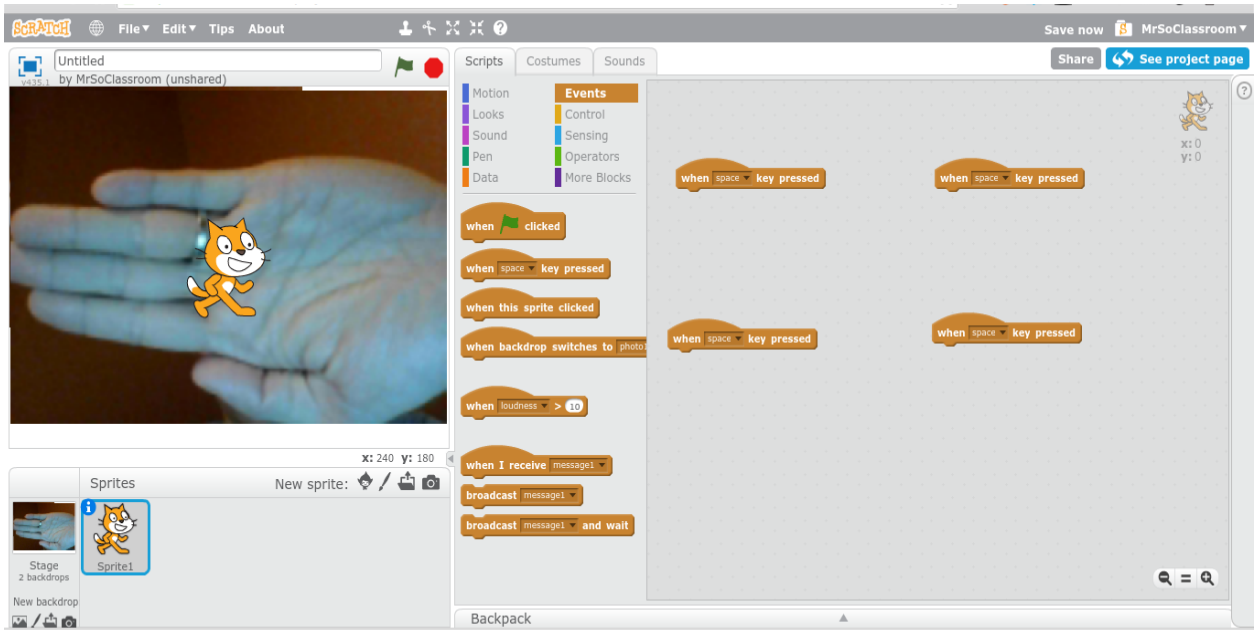
Now that we have our little sprites complete we can move on to the major coding section, Scratch. Click on the Scratch sprite. Please note: We will be doing four different codes but all in the same coding space. These can all be done at the same time. The first step is to tell Scratch when to start. For this to happen we need to go to the events section and click on: “when (space) key is pressed”. Drag four of these into the coding area.



Next we need to change each of the (space) section to our four arrow keys (up, down, right, left).

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Basically what we have done is told Scratch that when these particular keys are pressed you will be doing something different. Now we need to put the pen down so that scratch draws a line wherever he walks. To do this go to the pen section and insert four pen down blocks and connect them to the four sections.

The next section may take some explaining to the students. If we left Scratch alone he would just stay idle in one place. We need him to face the direction in which we want him to move. For example, if we clicked left he would face left and go left. To do this we need to insert a set rotation block. Go to the Motion section and insert two set rotation blocks. This block goes

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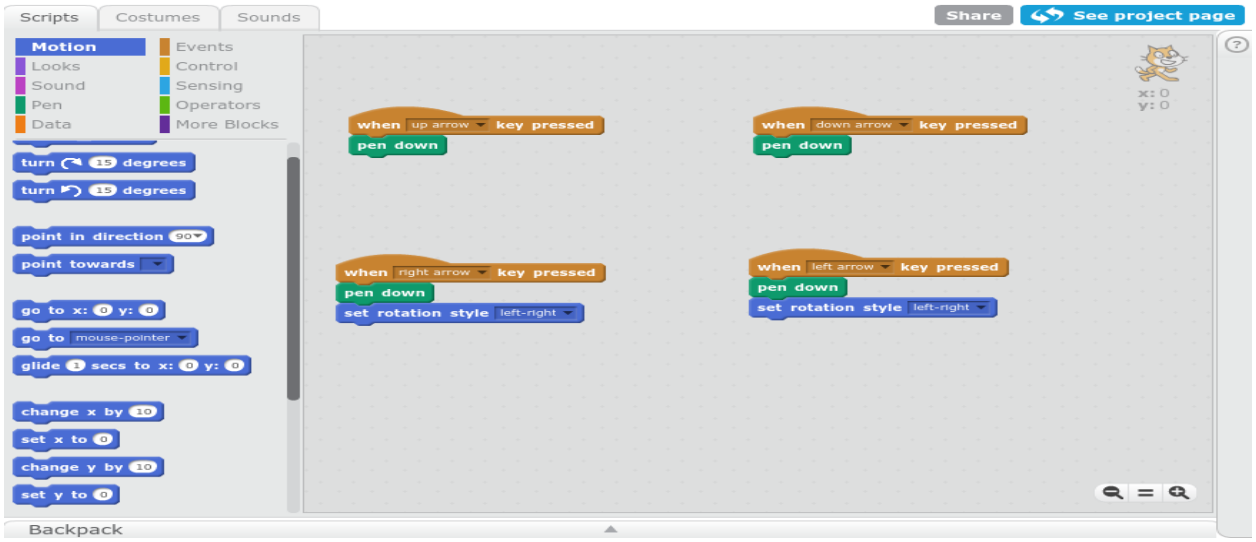
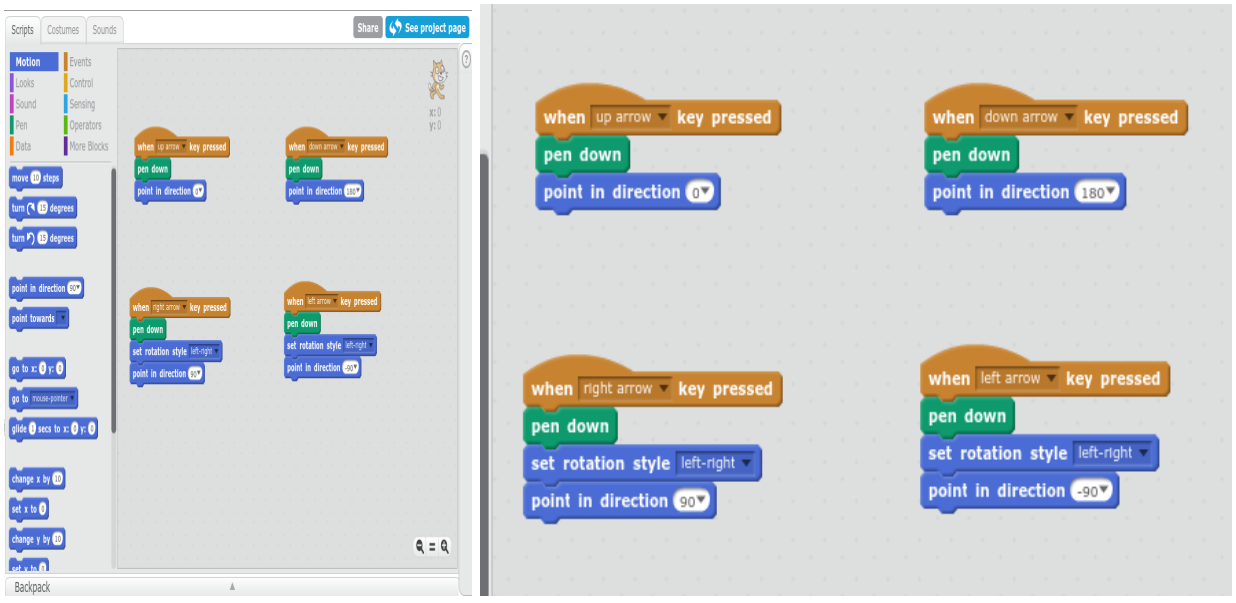
under the left event buttons. Change this to Left-Right. The other goes under the up button and change it to: “all around”.



We also need to tell Scratch to point in certain directions. For the up, down and right we need to insert: “point in the direction (90)”. For “up” set it to 0 degrees, for “right” set it to 90 degrees, for “down” set it to 180 degrees and for “left” -90 degrees. The nice thing is the block tells you the direction to set it.



Now we are set to tell Scratch to move. This can be found in the Motion section, which we are already in. Into the block that says “move ( ) steps” insert a numeral. I would set the steps to 10 as we don’t want it to be too huge of a jump.

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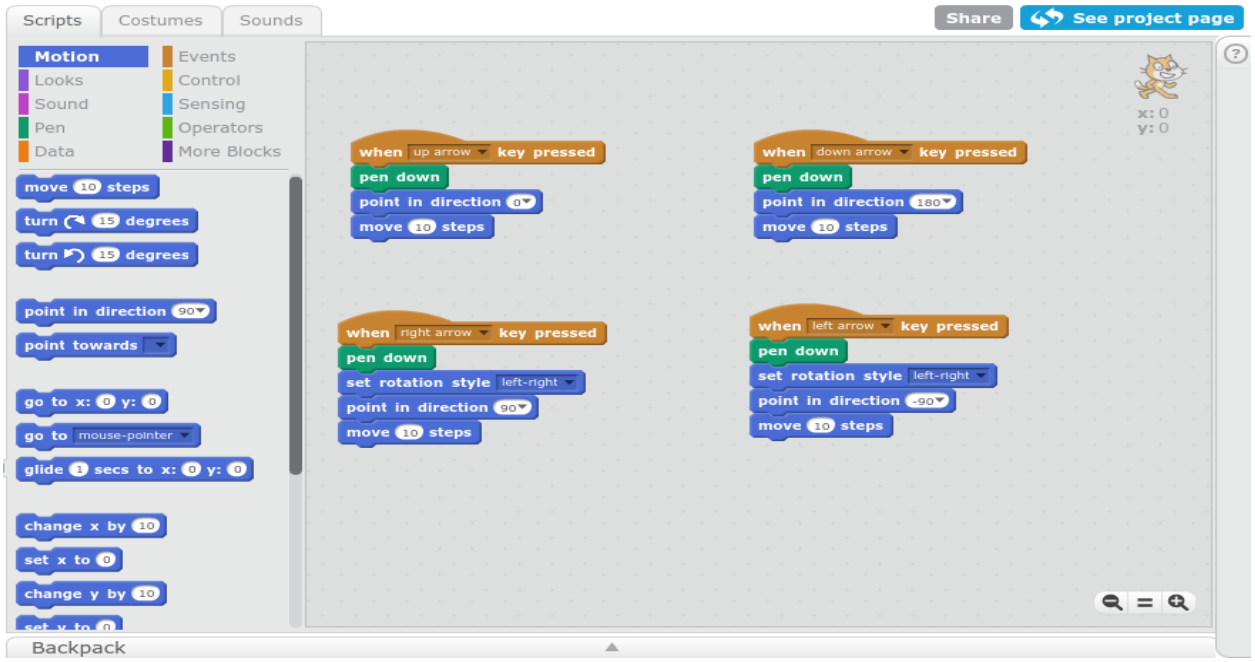
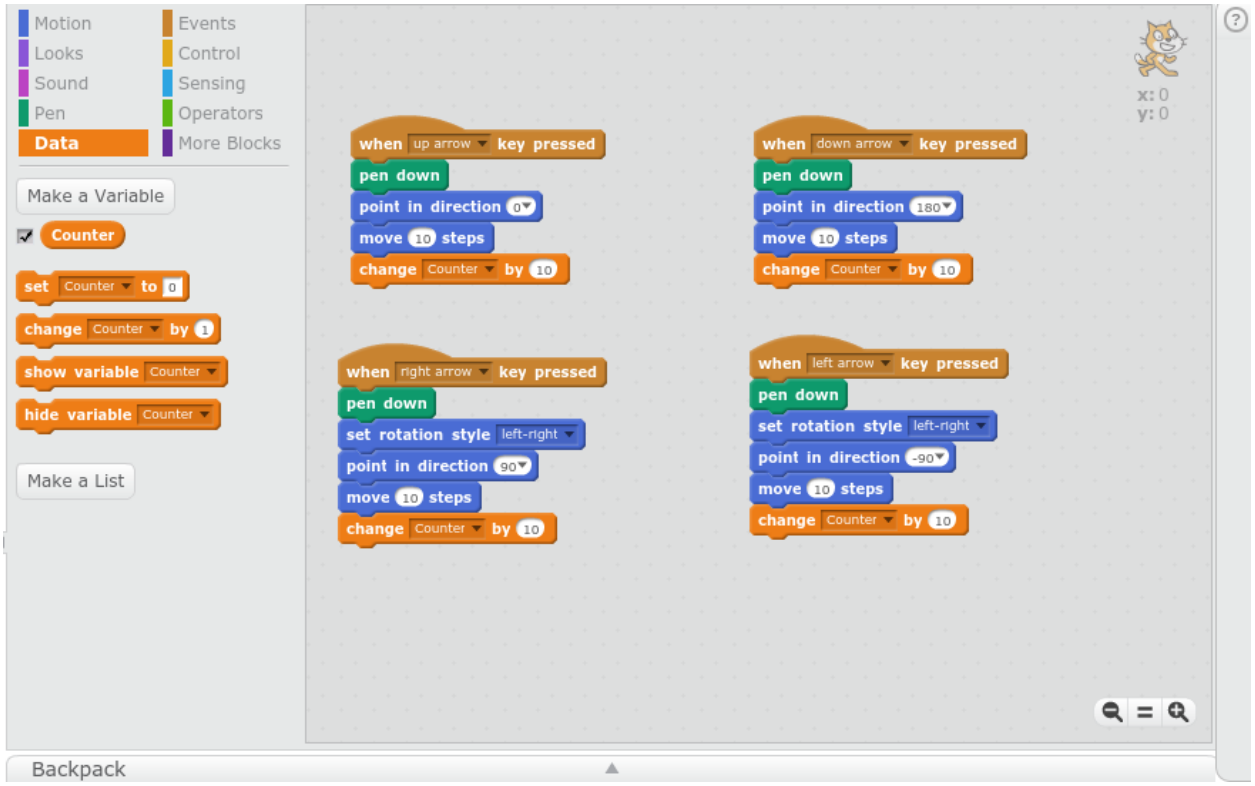


The final step is to add the counter count; go to the data section and insert: “change counter by (0)” and change the 0 to 10. Basically this matches the steps that Scratch is taking.



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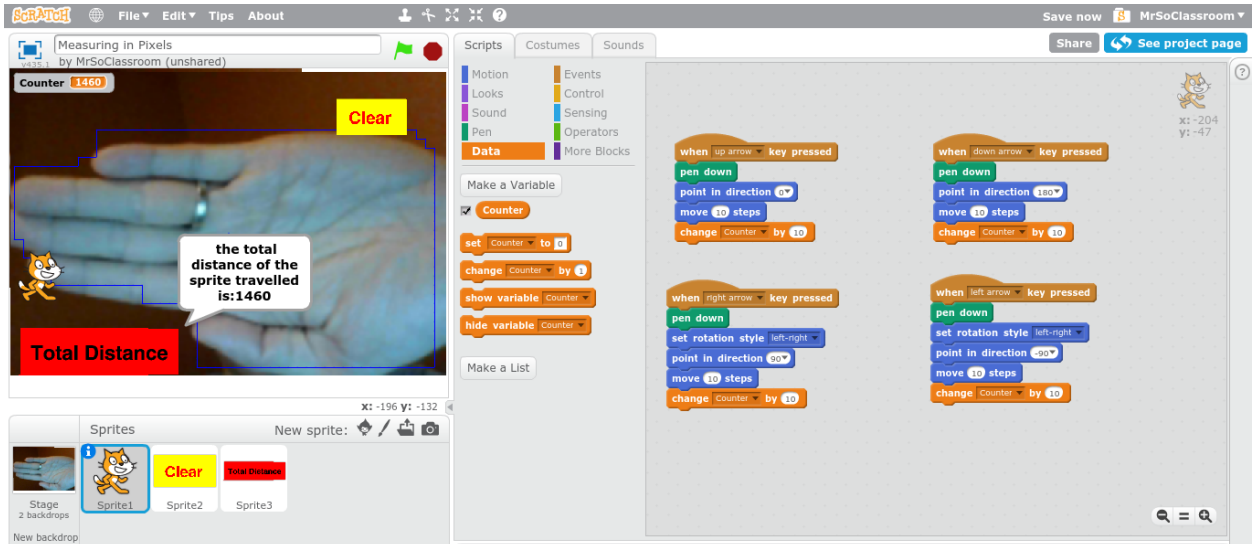
You are now ready to try it out. I would move Scratch to somewhere on the edge of your hand and then start moving. As you move, your counter should begin to count.



This program lends itself to other investigations: measure the distance/perimeter of your hand with fingers apart, measure the distance/perimeter of one finger, students compare and contrast their findings for both fingers and hands, graph the results. Students can do a lot of estimating before actually counting and do some proportionate reasoning as well.

To see the code in its entirety go to this link: https://scratch.mit.edu/projects/59043428/

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