

SUNSHINE BUILDER ACTIVITY

LOOPS

Expected Completion Time: 00:30

LEARNING OBJECTIVES

- Understanding the terms Program and Computer Programming
- Understanding of Loops and the Pen Tool

RESOURCES

- [Scratch Website](#)

VOCABULARY

- **Program**
 - An algorithm that can be coded into something that can be run by a machine.
- **Computer Programming**
 - Making sets of instructions to enable a computer to do a certain task
- **Loop**
 - The action of doing something over and over again

UNPLUGGED

INTRODUCTION: COMPUTER PROGRAMS ARE EVERYWHERE

1. Review the definitions of Program and Computer Programming as defined in the Vocab section above
2. Explain that computer programs are everywhere:
 - How does the soda machine decide what soda you have chosen?
 - How does the digital pad on your oven know what number to display?
 - How does the snack machine know how much money to give you?
 - How does leaving a voicemail on your phone work?
 - How does downloading videos and audio files and apps work?
 - Do you use a microwave ovens? How does it know how long to cook your food?
 - Does your air conditioner at your house allow you to control the temperature? How does it keep the temperature constant?
 - Do you have internet at your school? Or at your house? How does signal get to your house? How is it fixed remotely when the internet goes out?
 - Do you use the GPS system on your phone or in a car? How do you think it finds your current location? How do you think it determines how long it will take you to arrive at your destination?

Lesson Tip

Explain that there are computer programs that someone has written that tell these machines what to do.

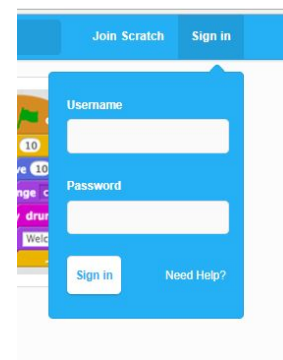
Flash Chat

What other things can you think of that would take instruction from a computer program?

CODING

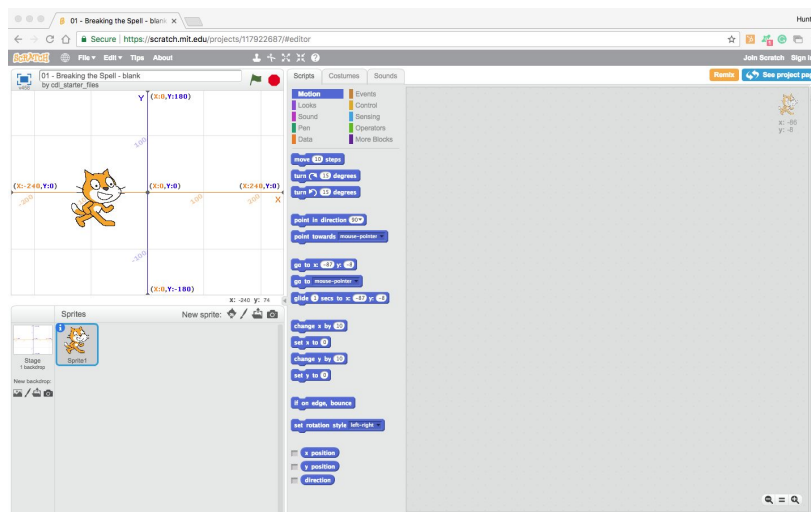
PREPARATION: GETTING STARTED IN SCRATCH

1. Open up a browser, such a Google Chrome, and navigate to the [Scratch Website](https://scratch.mit.edu).
 - a. If students are ok with discarding their projects, they may just click “Create” in the top left corner
 - b. If students would like to save their projects, they will need to log in to their Scratch Accounts

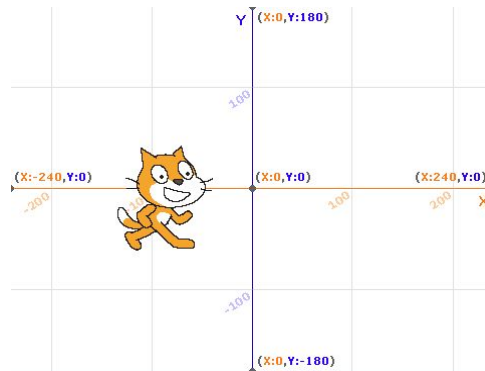


PREPARATION: UNDERSTANDING SCRATCH ENVIRONMENT

1. Have the students explore the different parts of the Scratch programming environment



- a. **Stage:** Upper left section of the screen. This is where the output from the coding sequences will be displayed. The puzzle or game interactions will occur in this section.



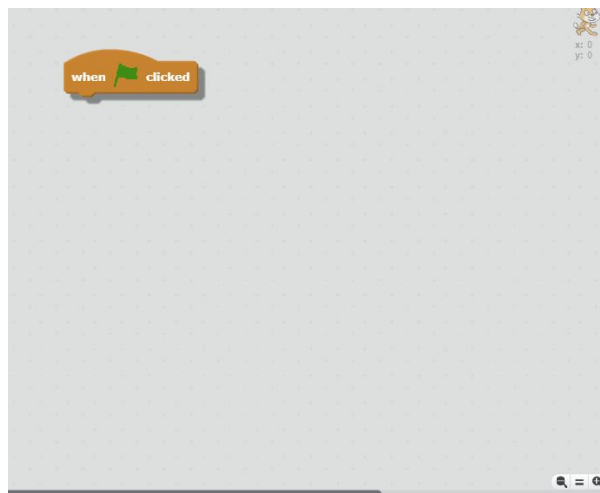
- b. **Green Flag/Stop Sign Button:** Take note of the Green Flag and Stop Sign buttons in the upper right section of the stage. As students build projects, they will learn to start a program by clicking the Green Flag. They will learn to stop a program by clicking the Stop Sign Button.



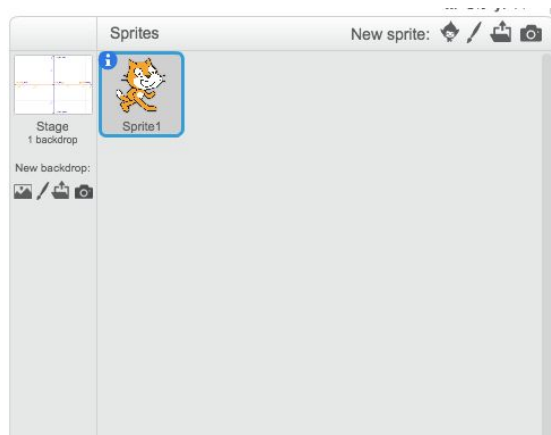
- c. **Palette:** The Middle Column on the screen. Contains tabs for different programming elements (i.e., scripts, costumes, sounds). All code blocks are color coded to match the tab in which it can be found.



- d. **Scripts:** When using the Scripts palette, students will drag and drop coding blocks into the Scripts area.
- e. **Costumes:** When using the Costumed Palette, students will be able to change components of the sprites.
- f. **Sounds:** When using the Sounds Palette, students will be able to record or utilize sound files
- g. **Scripts Area:** Right hand side of screen. This is the area where a student will build a program by dragging blocks from the palette.



- h. **Sprite List:** The bottom left section of the screen is the sprite list. Sprites currently contained in that area are available for use in the project. The New Sprite toolbar allows students to add or create new sprites to use. Each time you select a sprite, the scripts area will change to show the scripts tied to that sprite.



PREPARATION: SUNSHINE BUILDER ACTIVITY

REFERENCES:

New Blocks: All code blocks are color coded to match the tab on the palette in which it can be found

Pen Blocks

- **clear:** Removes all pen marks put on the screen
- **pen down:** Puts the sprite's pen down
- **set pen color to ____ :** Sets the pen color to the specified color shown on the picture
- **set pen size to ____ :** Sets the pen size to the amount
- **change pen color by ____:** allow the color of the pen to change by a given amount

Motion Blocks

- **go to x: ____ y: ____ :** Moves the sprite to the specified x and y position
- **move ____ steps:** Moves the sprite forward the specific amount of steps in the direction it is facing.
- **turn ____ degrees:** Turns the sprite (clockwise) the specified amount
- **point in direction ____ :** Points the sprite in the direction

Control Blocks

- **repeat ____:** A loop that repeats the specified amount of times
- **wait ____ secs:** Pause the script for the amount of time specified

Event Blocks

- **When green flag clicked:** Executes all code blocks with this command at the top when the green flag button is clicked on the stage.

PROCEDURE 1: INTRODUCTION OF LOOPS

1. Explain to the students that the lesson will introduce a coding element called Loops.
 - Explain that Loops are the action of doing something over and over again
 - Discuss everyday examples of loops. Ask Students “Can you think of something that you do over and over again?”
 - Go to school everyday
 - Eat three times a day
 - Walking is a repetition of steps
 - Ask students if they can think of any other loops
 - Lead this to the next activity
 - You could say: we’re going to practice some loops right now!

PROCEDURE 2: INTRODUCTION OF PROJECT

1. Now Explain to the students that we're going to have Scratchy draw a sun.

Flash Chat

Be sure to click on the Scratchy Sprite. The student will know the Scratchy sprite is selected because it will have a Blue Box around the sprite.

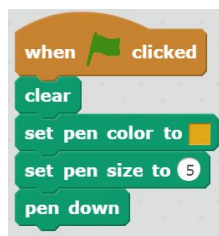
PROCEDURE 3: SETTING UP THE PEN

1. Start by selecting the **Events** header in the Scripts tab of the palette
 - a. Explain to students that in computers, an **Event** is used to send a message.
 - b. In this step, we will use the **Event** called **When green flag clicked** to send a message to run this block of code.
2. Select the block called **When green flag clicked** and drag it onto the Scripts area. Explain to the students that we will use the **When green flag clicked** event block to start our program.
 - a. Ask the students if they remember the **Green Flag/Stop Sign button** at the top of the stage? Have them recall that to start the program, we click on the green flag in the upper right corner of the stage.



3. In this project, we're going to be using the pen tool. Anytime we use the pen tool, there's 4 blocks we typically need:
 - a. **clear**
 - b. **pen down**
 - c. **set pen color to**
 - d. **set pen size to**
4. Explain what each block does (see New Blocks above) as you drag them to the Script Area.
 - a. The **clear** block gets rid of any previous pen marks, like starting with a fresh piece of paper.

- b. You must set a **pen size** and **pen color** so that the pen has the ability to draw.
 - c. The **pen down** block lets the sprite draw, just like putting pen down on paper in real life.
5. Click on the **Pen** header in the Scripts tab of the palette
 - a. Explain that the blocks of code located under the green-colored “**Pen**” tab are used to make sprites draw paths onto the stage. These blocks allow you to change the pen size, color, shape, visibility, etc.
 - b. Drag the **clear** block into the scripts area of Scratchy
 - i. Connect this code to the **When green flag clicked** block you just dragged over
 1. As the **clear** block is brought closer under the **When green flag clicked** block, a white shadow will appear
 2. When the white shadow appears, the **clear** block is ready to connect
 - c. Next Drag the **set pen color to** block into the scripts area of Scratchy
 - i. Connect this code to the **clear** block you just dragged over
 - ii. As the **set pen color to** block is brought closer under the **clear** block, a white shadow will appear
 - iii. When the white shadow appears, the **set pen color to** block is ready to connect
 - d. Next Drag the **set pen size to** block into the scripts area of Scratchy
 - i. Connect this code to the **set pen color to** block you just dragged over
 - ii. As the **set pen size to** block is brought closer under the **set pen color to** block, a white shadow will appear
 - iii. When the white shadow appears, the **set pen size to** block is ready to connect
 - e. Next Drag the **pen down** block into the scripts area of Scratchy
 - i. Connect this code to the **set pen size to** block you just dragged over
 1. As the **pen down** block is brought closer under the **set pen size to** block, a white shadow will appear
 2. When the white shadow appears, the **pen down** block is ready to connect
6. This is what the first block of code should look like! With this, we’ve told Scratchy how to use his pen.



7. Now, the students can choose the color they want to use.
 - a. To set the **pen color**, first click on the colored square. You should notice that your cursor changes to a gloved hand.
 - b. While your cursor looks like a gloved hand, hover your cursor over any part of the screen you'd like the color to be!
 - c. For example, if I want my pen color to be orange, you could hover your mouse over Scratchy. Once you've found the color you like, click to set that color.
8. Before moving to the next step, you could ask your class:
 - a. What does the clear block do?
 - b. Why do we need the pen down block?

PROCEDURE 4: DRAWING THE SUN

Now, we want to make Scratchy draw a sun! But instead of using tons of go-to blocks, specifying each x and y coordinate (that would be way too tedious), we can change Scratchy's direction and make him move back and forth while drawing.

1. We'll do that by starting a new script. Start by dragging another **When green flag clicked** block to an empty section in the Scripts area.

- a. Ask the students if they remember where they find the **When green flag clicked**

Flash Chat

Ask students if they remember why we use the **When green flag clicked** block?

clicked block? Once they can respond that it is found in the **Events** header in the Scripts tab of the palette, remind them that in computer science, we use events to send a message. In this case, the message is to run this block of code **When green flag clicked**.



2. Next, we need Scratchy to start in the center of the stage, so we add the **go to x: ____ y: ____** block to center him.
 - a. Click on the **Motion** header in the Scripts tab
 - i. Drag the **go to x: ____ y: ____** block to the scripts area of Scratchy

- ii. Place this block under the **When green flag clicked** block
 1. As the **go to x: ____ y: ____** block is brought closer under the **When green flag clicked** block, a white shadow will appear
 2. When the white shadow appears, the **go to x: ____ y: ____** block is ready to connect
- iii. Click inside the circle next to the x and enter a zero
- iv. Click inside the circle next to the y and enter a zero
3. Next, we are going to build some code that does the same thing over and over again. We call that activity a Loop.

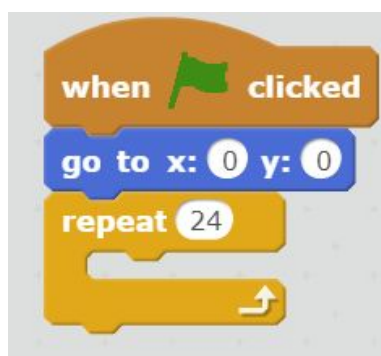
- a. Review the vocabulary term Loop as defined in the Vocab section above:
 - i. Ask students if anyone can think of the definition of a Loop discussed earlier in this project. Encourage them to recall that it is a term for doing something over and over again.
- b. We will now add a loop called a **repeat** loop
 - i. Explain that a repeat loop will have a number in it.
 - ii. Explain that sometimes we have a limit on the number of times that we repeat

activities. In this case, the number we use in the

repeat

determines the number of times we repeat the activity.

- c. Locate the **repeat ____:** block in the **Control** header in the Scripts tab
 - i. Drag the **repeat ____:** block to the scripts area of Scratchy
 - ii. Place this block under the **go to x: ____ y: ____** block
 1. As the **repeat ____:** block is brought closer under the **go to x: ____ y: ____** block, a white shadow will appear
 2. When the white shadow appears, the **repeat ____** block is ready to connect
 - iii. Enter the number 24 in the white circle (We will explain later why we use the number 24)
- d. The completed code sequence will look like this:



Flash Chat

Why might we have a number as part of a repeat loop? Do we always repeat activities forever?

4. Now we'll use the **move** ____ **steps** block and the **turn** ____ **degrees** block to make Scratchy move. We have to use both positive and negative steps so that he can return to the center after drawing each ray. We will use the **wait** ____ **secs** block to create a short pause between each motion.
 - a. The **move** ____ **steps** block is located on the **Motion** header of the Scripts tab.
 - i. Click on the **Motion** header in the Scripts tab
 1. Drag the **move** ____ **steps** block to the scripts area of Scratchy
 2. Place this block inside the **repeat** ____ block
 - a. As the **move** ____ **steps** block is brought inside the **repeat** ____ block, a white shadow will appear
 - b. When the white shadow appears, the **move** ____ **steps** block is ready to connect
 3. Click inside the circle inside the **move** ____ **steps** and enter the number 100
 - b. The **wait** ____ **secs** block is located on the **Control** header of the Scripts tab.
 - i. Click on the **Control** header in the Scripts tab
 1. Drag the **wait** ____ **secs** block to the scripts area of Scratchy
 2. Place this block inside the **repeat** ____ block and under the **move** ____ **steps**
 - a. As the **wait** ____ **secs** block is brought under the **move** ____ **steps** block, a white shadow will appear
 - b. When the white shadow appears, the **wait** ____ **secs** block is ready to connect
 3. Click inside the circle inside the **wait** ____ **secs** block and enter the number 0.1
 - c. Add another **move** ____ **steps** block (as before)
 - i. Place this block inside the **repeat** ____ block under the **wait** ____ **secs** block
 1. As the **move** ____ **steps** block is brought under the **wait** ____ **secs** block, a white shadow will appear
 2. When the white shadow appears, the **move** ____ **steps** block is ready to connect
 - ii. Click on the white circle inside the **move** ____ **steps** block and enter the number -100
 - d. The **turn** ____ **degrees** block is located on the **Motion** header of the Scripts tab
 - i. Click on the **Motion** header in the Scripts tab
 1. Drag the **turn** ____ **degrees** block to the scripts area of Scratchy

2. Place this block inside the **repeat** ____ block and under the 2nd **move** ____ **steps** block
 - a. As the **turn** ____ **degrees** block is brought inside the **move** ____ **steps** block, a white shadow will appear
 - b. When the white shadow appears, the **turn** ____ **degrees** block is ready to connect
3. Click inside the circle inside the **turn** ____ **degrees** block and enter the number 15
5. This is what the completed block of code will look like



6. With older students, ask students if they have any ideas why we made the loop repeat 24 times
 - a. Give them a hint, it has to do with the degrees of a circle and how much we are turning Scratchy.
 - b. Because we are turning him 15 degrees every time, and we want him to make rays all the way around the center, we will need to repeat the process 24 times. $24 * 15 = 360$, which is the degrees of a circle!

Lesson Tip

If students are younger, explain that it is like slicing up a circle-shaped pizza into 24 triangle slices

PROCEDURE 5: RUNNING THE PROGRAM

1. Ask the students if they remember the Event block we used in each procedure so that we will be able to run our code? Encourage them to think about the **When green flag**

clicked block

2. Have them locate the **Green Flag/Stop Sign** button on the top of the stage
3. Explain that if they click on the **Green Flag** button at the top of the stage, they will run the code.
4. Have the students click the **Green Flag** button at the top of the stage
 - a. Did they notice Scratchy drew a sun!
5. If the program does not draw a sun, encourage them to problem solve, or debug the program
 - a. Have them explain what is not working
 - b. Encourage the to talk with their neighbor to see if they can figure it out together
 - c. Review the procedure to build the code to see if the mistake can be identified
 - d. Return to step 4, and repeat until Scratchy draws a sun
6. If the program is working correctly, the image on the stage will look like this:



PROCEDURE 6: FINAL TOUCHES

1. We can add a “point in direction” block so Scratchy is facing the right direction
2. The **point in direction** ____ block is located on the **Motion** header of the Scripts tab.
 - a. Click on the **Motion** header in the Scripts tab
 - i. Drag the **point in direction** ____ block to the scripts area of Scratchy
 - ii. Place this block under the **repeat** ____ block
 - iii. As the **point in direction** ____ block is brought under the **repeat** ____ block, a white shadow will appear
 1. When the white shadow appears, the **point in direction** ____ block is ready to connect

- iv. Click inside the circle inside the **point in direction** ____ block and select the number 90
3. The completed block of code will look like this:



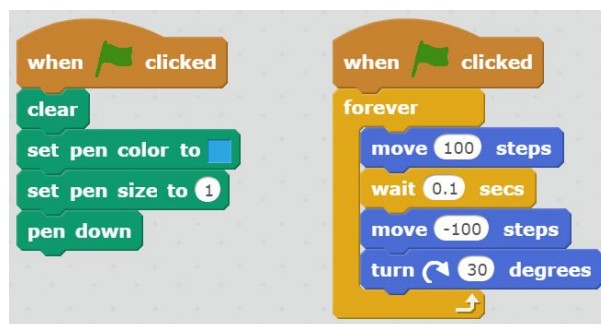
4. Have the students click the Green Flag button at the top of the stage.
 - a. Did they notice Scratchy drew a sun!
5. If the program does not draw a sun, encourage them to problem solve, or debug the program.
 - a. Have them explain what is not working
 - b. Encourage the to talk with their neighbor to see if they can figure it out together
 - c. Review the procedure to build the code to see if the mistake can be identified
 - d. Return to step 4, and repeat until Scratchy draws a sun
6. If the program is working correctly, the image on the stage will look like this:



INDEPENDENT CODING

This section allows students to demonstrate what they've learned and confirms that they understand the concepts covered in the lesson.

- Now that students have learned these blocks, have them open a new file.
- Ask students to move Scratchy in a way that makes another sun or even a different shape (like a snowflake!). This time, Scratchy could draw a sun with a different number of rays by changing the number in the **turn ____ degrees** block
- Make sure students try on their own before they ask for help or look at the demo. One example of many solutions:



CHALLENGE ACTIVITY

This section allows students to take it a step further by learning additional commands.

RAINBOW SUNSHINE

- Introduce the **change pen color by** block (see *New Blocks* above)
- Let students try to make their pen draw a rainbow of colors
- If students need more guidance, tell them they will need:
 - when Green Flag is Clicked
 - **forever** Loop
 - **change pen color by** Block
 - **wait** Block



Now you're all finished! Remember, students can create a Scratch account to save their work. They can login at home and show their parents what they made!

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