Grow with Code	Grades 3 & 4

Coding Guide

You can view an example of this code here: https://scratch.mit.edu/projects/483698226

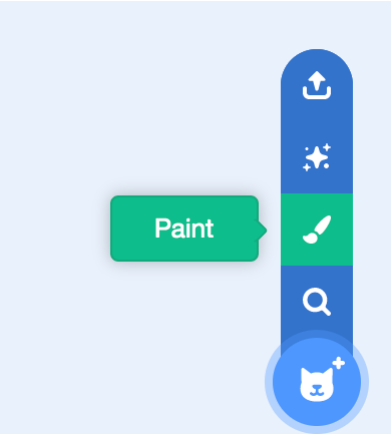
The goal of this program is to create a plant sprite that will "grow" (increase in size) when it touches factors (sunlight, water) that support plant growth. This code will allow students to practice using loops and nested events.

Create Sprites

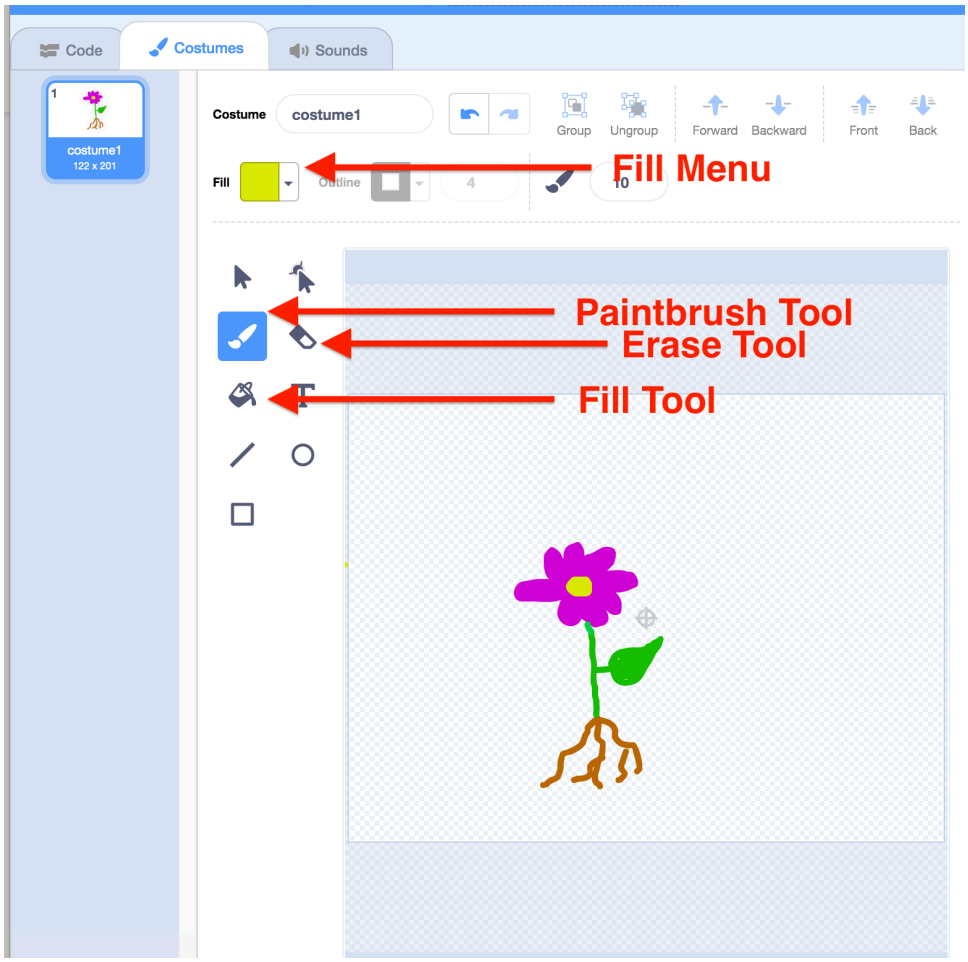
Sprites are the visual objects in our program. For this lesson, we will be creating three sprites: one to represent the sun, one to represent water, and one to represent a plant.

Draw Plant Sprite

Encourage students to draw their own plant sprite to contain the major parts of plants (e.g., roots, stem, flower, leaf) using the **Paint** option in the sprite menu:



Selecting the **Paint** option will open the **Costumes** tab in Scratch where you can design your plant sprite on a canvas.

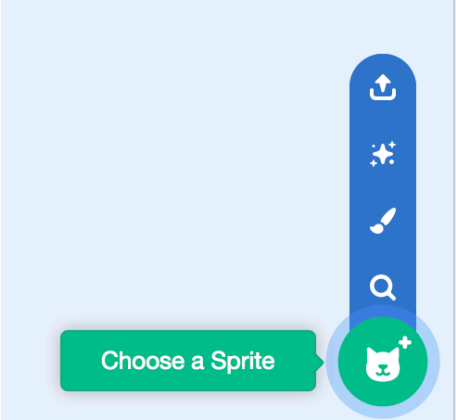


The **paintbrush tool** (represented by a paintbrush) will allow students to draw shapes using freeform lines by left-clicking and dragging (holding down the mouse button) on the canvas.

The **erase tool** (next to the paintbrush, shaped like an eraser), will allow students to remove parts of their drawing by left-clicking and dragging (holding down the mouse button) on the canvas

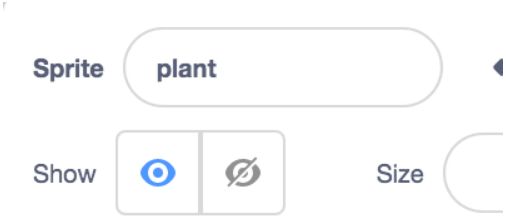
The **Fill tool** (represented by a paintbucket) will fill in enclosed areas with colour by clicking on the spaces to be filled. To select the Fill colour, use the dropdown menu labelled **Fill** near the top-left of the costumes panel.

Note: if detailed drawings are not an accessible option for your students (e.g., if your students have limited motor abilities), they can select a premade sprite in the Sprites Library by selecting **Choose a Sprite in the Sprite menu.



There is no flower or plant sprite in the library, but there are options for tree sprites.

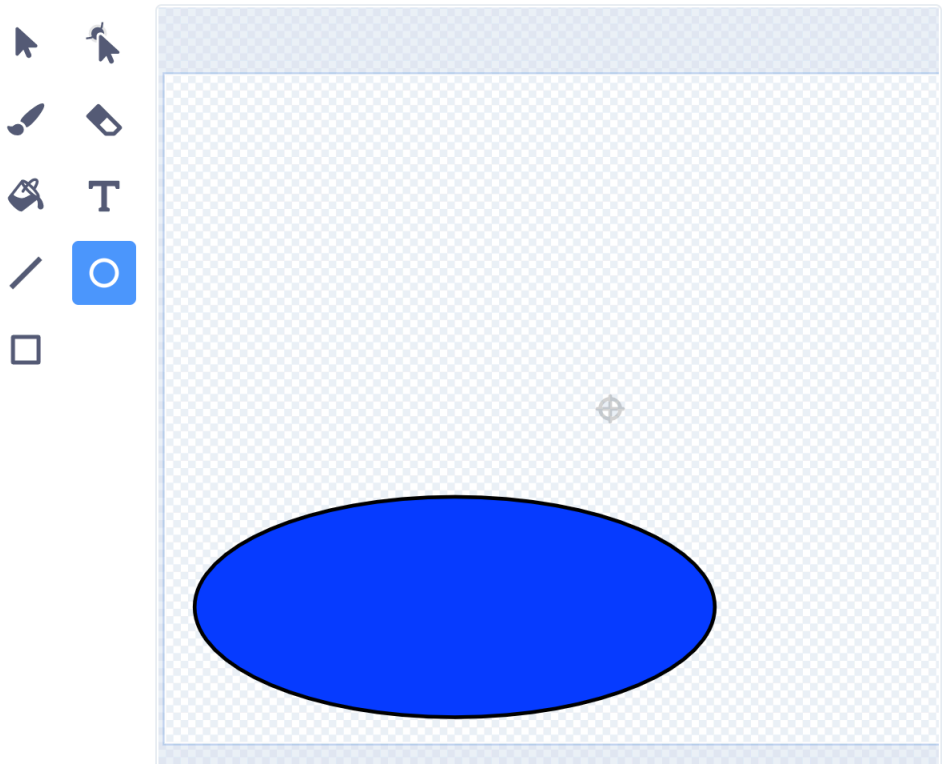
In the sprite panel, rename the sprite to “Plant” by typing the name into the Sprite field:



Draw Water Sprite

Select the **Paint** option in the Sprite menu. Use the drawing tools to draw a sprite to represent water.

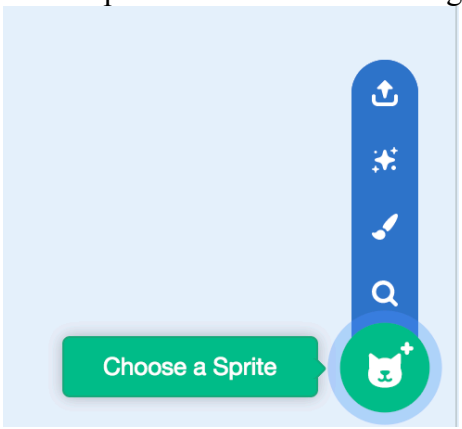
In the example below, the **Circle tool** was used to draw a blue oval to represent a pond or lake. This was drawn by left-clicking and dragging (holding down the mouse button) on the canvas



Edit the water sprite's position on the stage by dragging it into position using the mouse.

Create a Sun Sprite

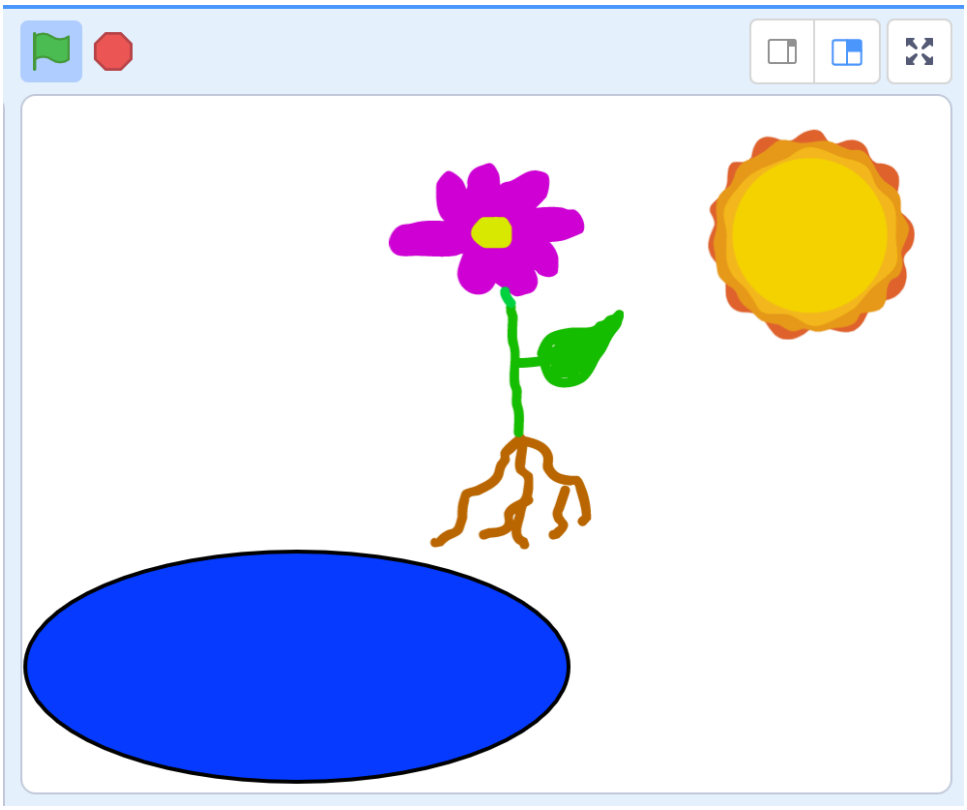
Select the **Choose a Sprite** option in the sprite menu at the bottom right of the screen:



Find the sun sprite (either by typing "sun" into the search bar at the top of the screen, or by scrolling through the sprite library's images) and click on its image to select it.

In the sprite panel, rename the sprite "Water" by typing the new name into the Sprite field.

Drag the sun sprite into position in the "sky" on the stage by dragging it using the mouse.



Program the Plant

We are going to build three programs inside the Plant Sprite:

1. One program to reset plant size and have the Plant Sprite follow cursor movements
2. One program to have the Plant Sprite "grow" (get larger) when it touches the Sun Sprite
3. One program to have the Plant Sprite "grow" (get larger) when it touches the Water Sprite

All three of these programs will use loops to repeat actions.

1. Cursor-Following Program

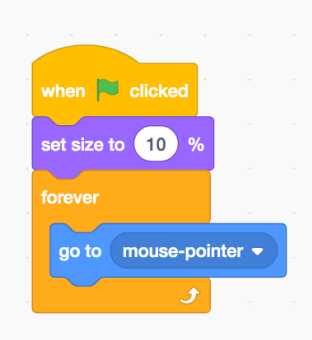
In the yellow **Events** menu, choose the **when green flag clicked** block and drag it onto the canvas. This block will start our program when we click the green flag button.

In the purple **Looks** menu, choose the **set size the 100%** block and connect it directly below the **when green flag clicked** block. Change the value on this block to 10%. This will make sure that our plant sprite is tiny when we start the program.

In the light orange **Control** menu, choose the **forever** block and place it directly below the **set size to 10%** block. The **forever** block is a **loop** —every block that is placed inside this block will be repeated until we tell the program to stop.

In the blue **Motion** menu, choose the **go to [random position]** block and place it *inside* the **forever** loop block. Using the dropdown menu on this block, select **mouse-pointer.** This will tell the program to have the plant sprite always be in the same position as the cursor (when the cursor is in a position over the stage panel).

The completed program should look like this:



2. Grow When Touching Sun

In the yellow **Events** menu, choose the **when green flag clicked** block and drag it onto the canvas. This block will start our program when we click the green flag button (at the same time as our other programs).

In the light orange **Control** menu, choose the **forever** block and place it directly below the **when green flag clicked** block. The rest of this program will be built inside the **forever** loop.

In the light orange **Control** menu, choose the **if [space] then** block and place it inside the **forever** loop.

This is a conditional statement block that will wait for a condition (placed in the shaded hexagon on the block) to be met before continuing the program. The continued program are the blocks that we place inside the mouth-like space on the **if/then** block.

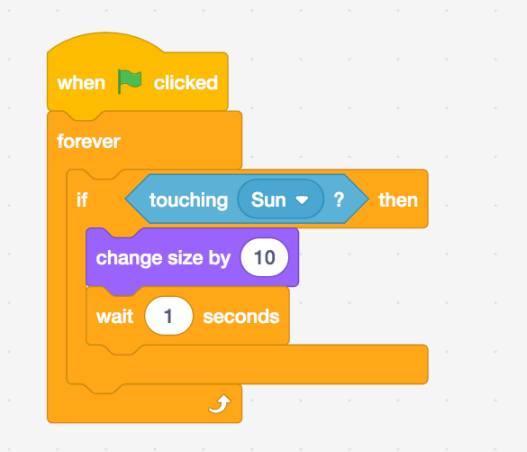
To set our condition: we want this program to continue when the plant sprite is touching the sun sprite.

- In the light blue **Sensing** menu, choose the **touching mouse-pointer?** block and drag it on top of the shaded hexagon of the **if/then** block. The hexagon will stretch to fit the **touching mouse-pointer?** block. Using the dropdown menu on this block, choose the option **Sun**.

To continue our program:

- In the purple **Looks** menu, choose the **change size by 10** block and place it inside the **if [touching Sun?] then** block.
- In the light orange **Control** menu, choose the **wait 1 second** block and place it inside the **if [touching Sun?] then** block, below the **change size by 10** block.

The completed program should look like this:



3. Grow When Touching Water

In the yellow **Events** menu, choose the **when green flag clicked** block and drag it onto the canvas. This block will start our program when we click the green flag button (at the same time as our other programs).

In the light orange **Control** menu, choose the **forever** block and place it directly below the **when green flag clicked** block. The rest of this program will be built inside the **forever** loop.

In the light orange **Control** menu, choose the **if [space] then** block and place it inside the **forever** loop.

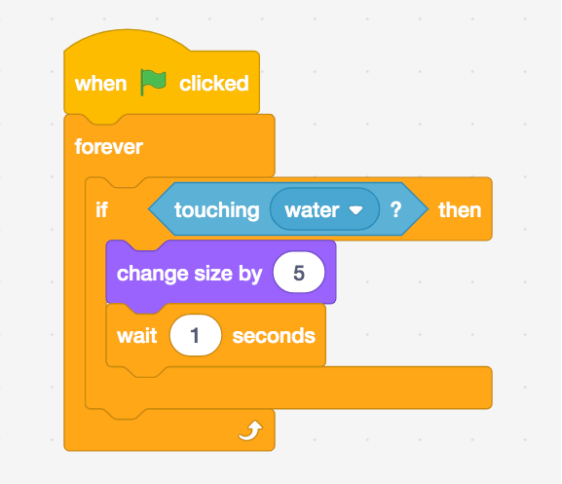
To set our condition: we want this program to continue when the plant sprite is touching the sun sprite.

- In the light blue **Sensing** menu, choose the **touching mouse-pointer?** block and drag it on top of the shaded hexagon of the **if/then** block. The hexagon will stretch to fit the **touching mouse-pointer?** block. Using the dropdown menu on this block, choose the option **Water**.

To continue our program:

- In the purple **Looks** menu, choose the **change size by 10** block and place it inside the **if [touching Water?] then** block.
- In the light orange **Control** menu, choose the **wait 1 second** block and place it inside the **if [touching Water?] then** block, below the **change size by 10** block.
- Change the value of the **change size by 10** block to 5.

The completed program should look like this:



Encourage students to test the program by pressing the green flag button above the Scratch stage and by moving their cursor around the stage so that the plant sprite is sometimes touching the sun sprite or the water sprite. What happens?

Have students change the value in the **change size by** blocks in their programs and test their program again. How does the program change when the values are higher or lower?

Opportunities for extension:

Grade 4 students might want to add a consumer sprite to this activity to create a short food chain

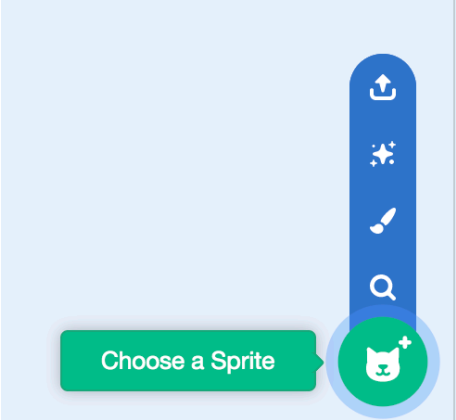
To achieve this, we will want to:

1. Add a new sprite to represent a consumer (an herbivore) to "eat" the plant sprite
2. Add a program that makes the plant sprite smaller when it is touching the consumer sprite

1. Add consumer sprite.

Students can draw a consumer by selecting **Paint** from the sprite menu. The consumer that they choose to draw should be an herbivore (or omnivore), like a rabbit, cow, or caterpillar.

Optional: instead of drawing the consumer, student may select a relevant sprite from the Sprite Library by selecting **Choose a sprite** from the sprite menu.



In the sprite panel, rename the sprite "Consumer" by typing the new name into the Sprite field.

Drag the consumer sprite into position on the stage by dragging it using the mouse.

2. Build the Program

** Make sure that you have selected the plant sprite. You should be building all programs for this lesson on the same sprite.

In the yellow **Events** menu, choose the **when green flag clicked** block and drag it onto the canvas. This block will start our program when we click the green flag button (at the same time as our other programs).

In the light orange **Control** menu, choose the **forever** block and place it directly below the **when green flag clicked** block. The rest of this program will be built inside the **forever** loop.

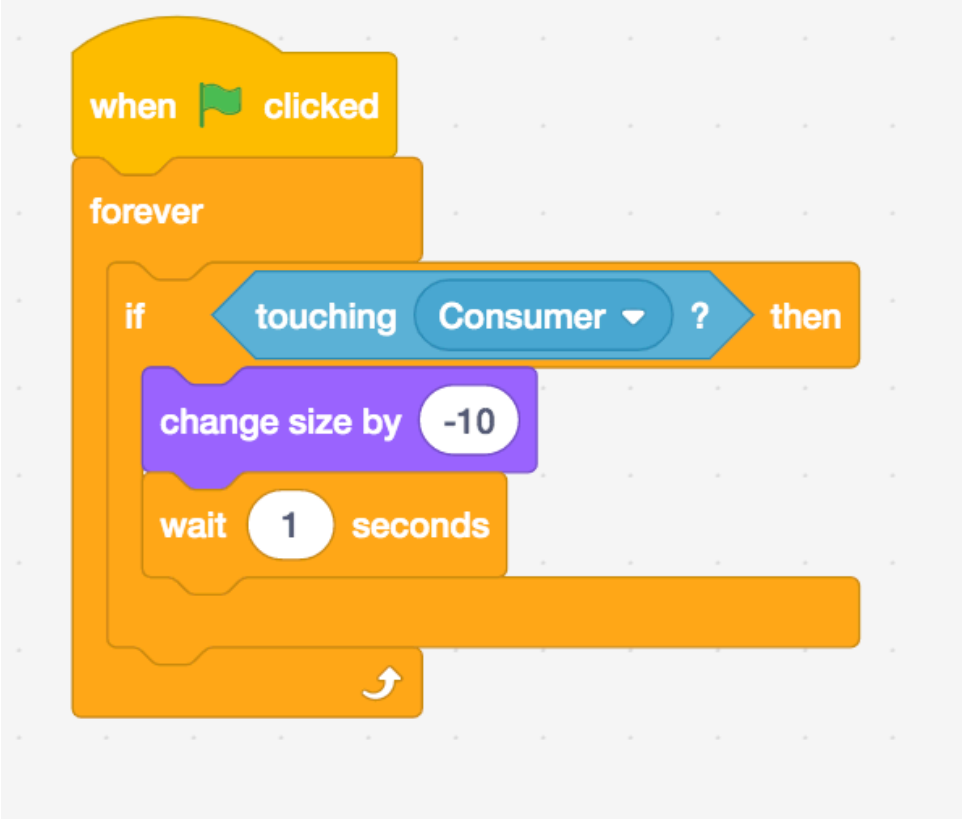
In the light orange **Control** menu, choose the **if [space] then** block and place it inside the **forever** loop.

To set our condition: we want this program to continue when the plant sprite is touching the sun sprite.
In the light blue **Sensing** menu, choose the **touching mouse-pointer?** block and drag it on top of the shaded hexagon of the **if/then** block. The hexagon will stretch to fit the **touching mouse-pointer?** block. Using the dropdown menu on this block, choose the option **Consumer**.

To continue our program:
In the purple **Looks** menu, choose the **change size by 10** block and place it inside the **if [touching Consumer?] then** block.

In the light orange **Control** menu, choose the **wait 1 second** block and place it inside the **if [touching Consumer?] then** block, below the **change size by 10** block.
Change the value of the **change size by 10** block to -10. By using a negative number (represented by a minus sign), the plant sprite will become smaller when it changes size.

The completed program should look like this:



Encourage students to test the program by pressing the green flag button above the Scratch stage and by moving their cursor around the stage so that the plant sprite is sometimes touching the sun sprite or the water sprite or the consumer sprite. What happens?

Have students change the value in the **change size by** blocks in their programs and test their program again. How does the program change when the values are higher or lower?