MOONHACK 2019

SCRATCH PROJECT

Introduction

On 20 July 1969, Neil Armstrong took the first steps on the moon. As we celebrate the 50th anniversary of this incredible achievement, we have a chance to reflect on the difficulty and audacity of every part of the Moon missions. In this project, we're going to use Scratch to make a side-scrolling Moon Buggy game.

What you'll need:

Hardware

A computer capable of running Scratch 3

Software

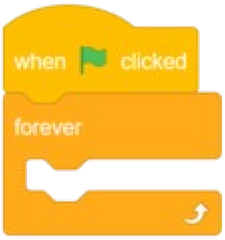
Scratch 3 (either online or offline)

Step 1: Set up the surface

✓ Activity Checklist

□ Open the starter project at https://scratch.mit.edu/projects/293834812/editor/.

□ First, we need to set up the Surface sprite so that it moves while the buggy stays still, simulating motion. Click on the Surface sprite and add the following code:

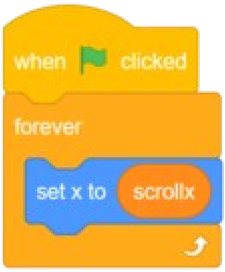


```
when 🏁 clicked
forever

```

This will continue running all of the code within the `forever` *loop*.

□ Next we will add code within our `forever` loop to move our surface:



```
when 🏁 clicked
forever
    set x to (scrollx)
```

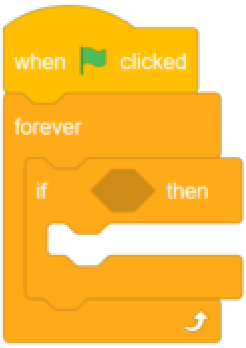
We will use the *variable* `scrollx` to keep track of how far our buggy has moved, and move our surface accordingly.

Step 2: Drive the buggy

If you run your program now, nothing much will happen. We are telling our surface to move with `scrollx` but we aren't changing `scrollx`.

✓ Activity Checklist

□ Click on the Buggy sprite and add the following code:

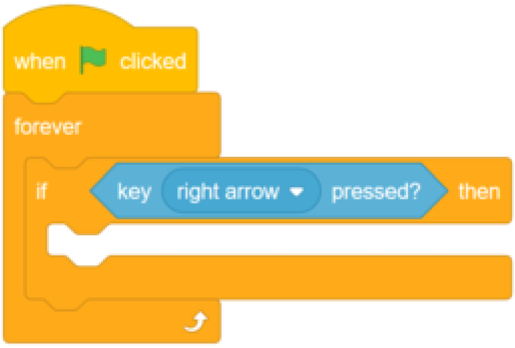


```
when 🏁 clicked
forever
    if < > then

```

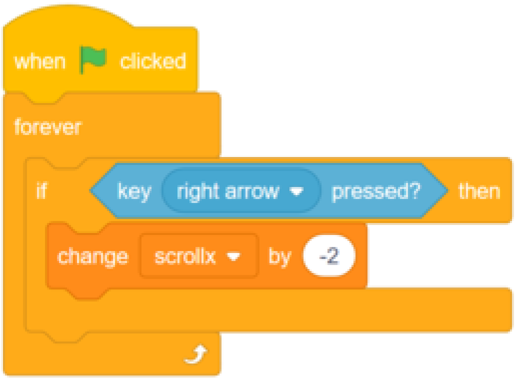
In addition to the loop, we have added an `if` statement. The code inside this block will only run if the condition after the if is met.

□ Add the `key _ pressed` block as your if condition. Change the key from `space` to `right arrow` by clicking the dropdown arrow next to `space`:



```
when ⚑ clicked
forever
  if <key (right arrow ▾) pressed?> then
  
  end
end
```

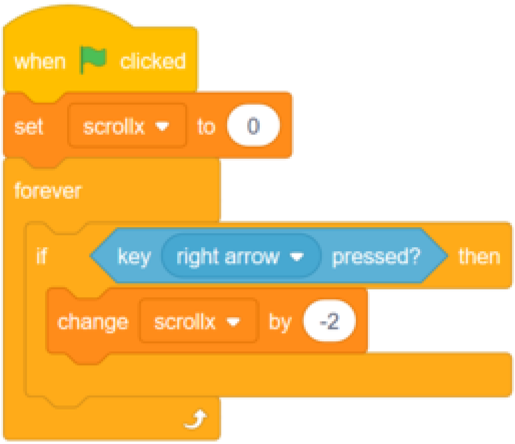
□ Add code to change `scrollx` by `-2` to make the Surface sprite move whenever the `right arrow` is down:



```
when ⚑ clicked
forever
  if <key (right arrow ▾) pressed?> then
    change [scrollx ▾] by (-2)
  end
end
```

Run your program. The Surface should move to the left, which makes the Buggy look like it's moving to the right. What happens when you get to the end of the surface? If you try and start again, the Suface stays in the same place. A game isn't much good if you can only play it once!

□ We'll add code to reset the Surface back to the centre when we press the `green flag`:



```
when ⚑ clicked
set [scrollx ▾] to (0)
forever
  if <key (right arrow ▾) pressed?> then
    change [scrollx ▾] by (-2)
  end
end
```

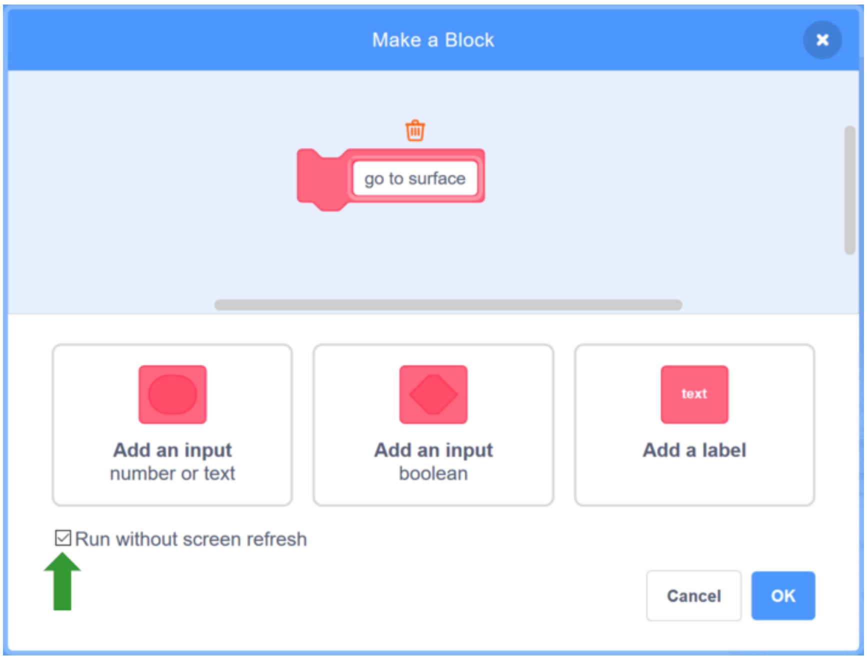
Challenge: Reversing Buggy

Currently, the buggy only goes forward, can you make it go backwards, too?

Step 3: Make the buggy go to the surface

Activity Checklist

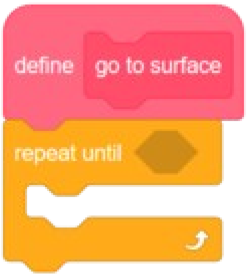
□ We're going to create our own block that will make the buggy always go to the top of the Surface sprite. Go to `My Blocks` and click `Make a Block`. Name your block `go to surface` and click the `Run without screen refresh` checkbox.



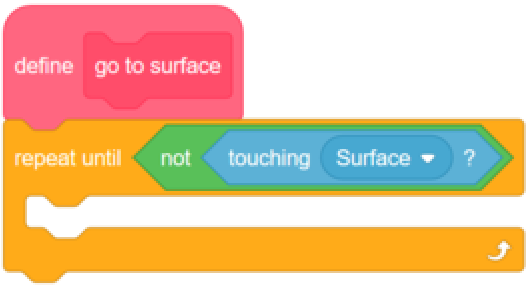
☑ Run without screen refresh

Normally, when we have a loop, it will run once through the loop on every frame of the game. Checking the `Run without screen refresh` box will run through the entire block without needing to wait for the next frame.

□ When you press `OK` a `define go to surface` block will appear on your screen. Add a `repeat until` block beneath this:

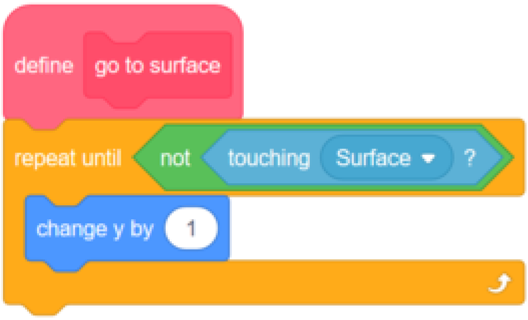


□ We want to repeat the code inside this block until we're not touching the Surface sprite anymore:



```
define go to surface
repeat until <not <touching Surface ?>>
end
```

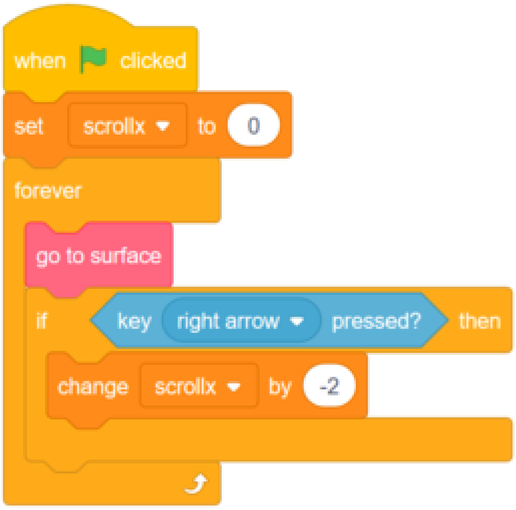
□ Every time we go around the loop, we want to go up by one pixel:



```
define go to surface
repeat until <not <touching Surface ?>>
    change y by 1
end
```

This will 'push' the buggy upwards whenever it's touching the Surface sprite, until it's no longer touching that sprite.

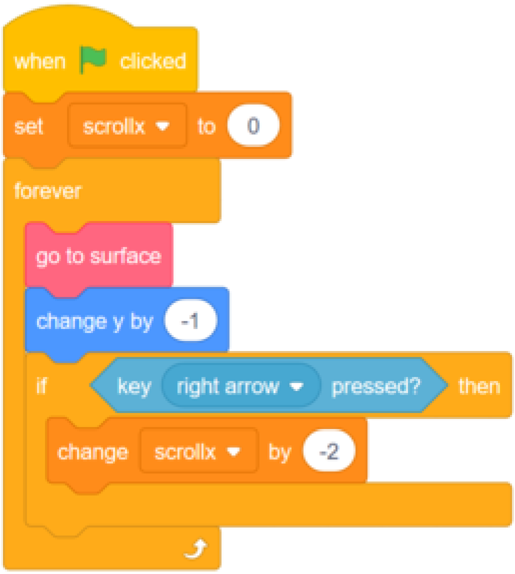
□ We've finished writing our `go to surface` block, but we're not using it yet. We need to put it into our main loop:



```
when flag clicked
set scrollx to 0
forever
    go to surface
    if <key right arrow pressed?> then
        change scrollx by -2
    end
end
```

Run your program now. Your Buggy will go up on the uphill parts, but it won't go down on the downhill parts.

□ To make your Buggy go down the hills, we will add a gravity effect to it. Add a `change y` block to make your buggy slowly fall down if it's in the air:



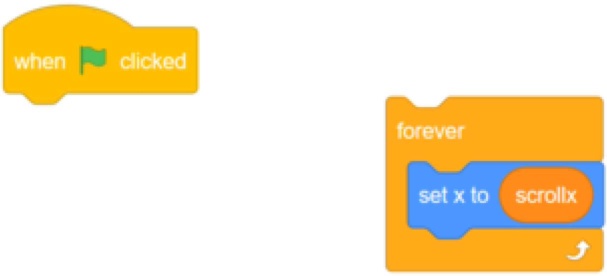
```
when 🏁 clicked
set scrollx ▾ to 0
forever
    go to surface
    change y by -1
    if key right arrow ▾ pressed? then
        change scrollx ▾ by -2
```

Step 4: More surface

At the moment, we don't travel very far on the moon before we fall of the edge! Let's make a lunar experience a bit more expansive.

Activity Checklist

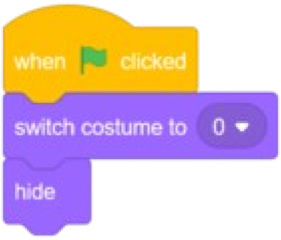
□ Click on the Surface sprite and separate the `when green flag clicked` block from the rest of the code:



```
when 🏁 clicked
```

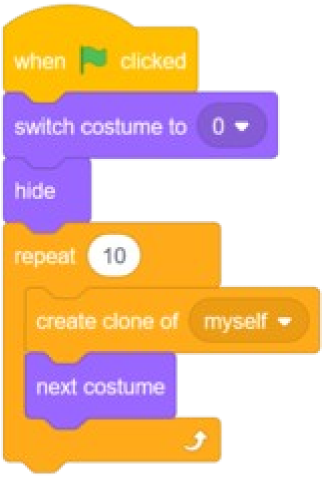
```
forever
    set x to scrollx
```

□ Under the `when green flag clicked` add code to set up the initial conditions:



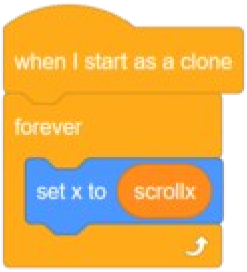
```
when 🏁 clicked
switch costume to 0 ▾
hide
```

□ Add a loop that will create a clone for each costume of the sprite:



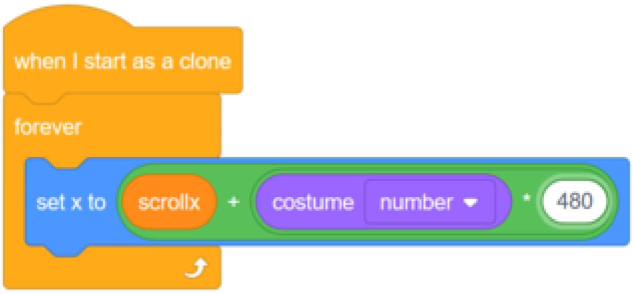
```
when 🏴 clicked
switch costume to 0 ▾
hide
repeat 10
    create clone of myself ▾
    next costume
```

□ On the code that you detached, add `when I start as clone` hat block:



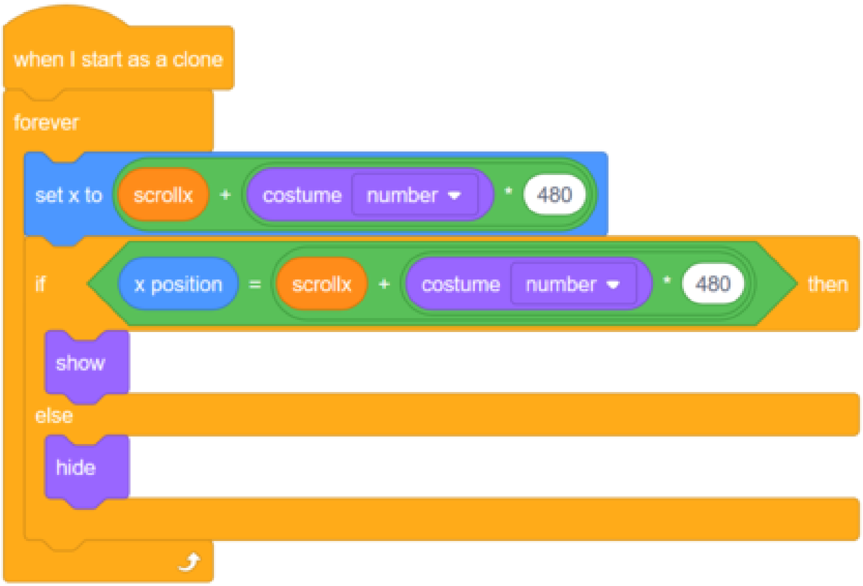
```
when I start as a clone
forever
    set x to scrollx
```

□ Because we have multiple costumes that make up the surface of our moon, we need to move them across the screen with our `scrollx`, but each costume needs offset by 480 pixels from the previous one (the width of the costume):



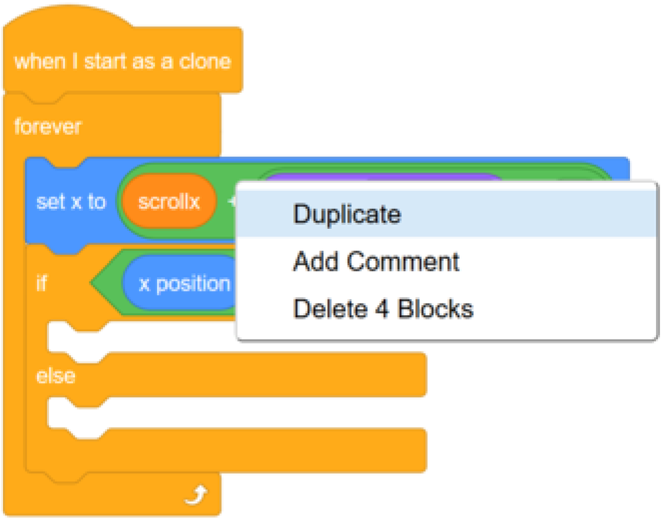
```
when I start as a clone
forever
    set x to scrollx + costume number ▾ * 480
```

□ If we run our program now, the surface sprites won't appear, because we've previously told Scratch to hide them. We don't just want to show all of the sprites, because Scratch doesn't let our sprites go all the way off the screen. Instead we can tell Scratch that if the actual x coordinate of the sprite is where we think it should be, then show it, otherwise, hide it:



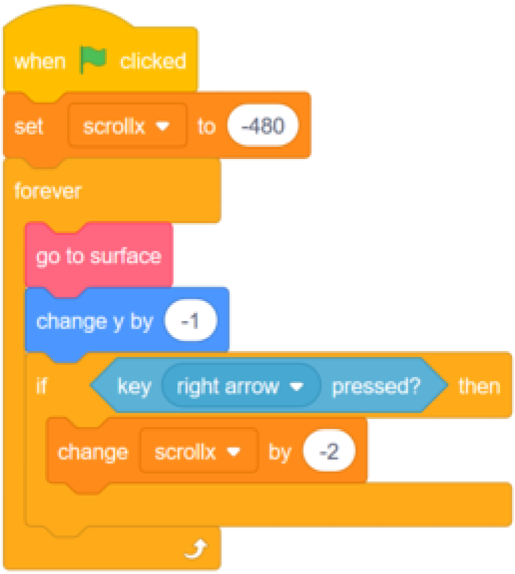
```
when I start as a clone
forever
    set x to (scrollx + (costume number * 480))
    if (x position = (scrollx + (costume number * 480))) then
        show
    else
        hide
```

Tip: If you don't want to rewrite the code for the position of the surface, you can duplicate it by right clicking on the + block and pressing duplicate:



```
when I start as a clone
forever
    set x to (scrollx + ...)
    if (x position ...
    else
```

□ If you run your program now, your first surface sprite will start off the screen to the right, you can fix this by clicking on the Buggy sprite and changing the initial value of `scrollx` to `-480`:



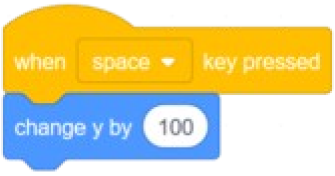
```
when green flag clicked
set scrollx to -480
forever
    go to surface
    change y by -1
    if key right arrow pressed? then
        change scrollx by -2
```

Step 5: Jumping buggy

We want to make our buggy jump to avoid obstacles!

✓ Activity Checklist

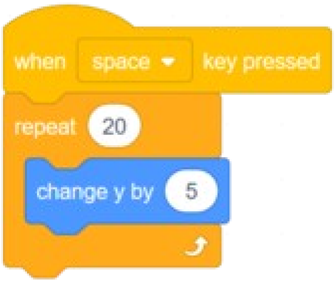
□ Add the following code to make your buggy jump up by 100 pixels when the space bar is pressed:



```
when [space ▾] key pressed
change y by (100)
```

Run your program now. We're making our buggy jump, but it isn't very smooth.

□ Change your code to the following to make the jump a bit smoother:



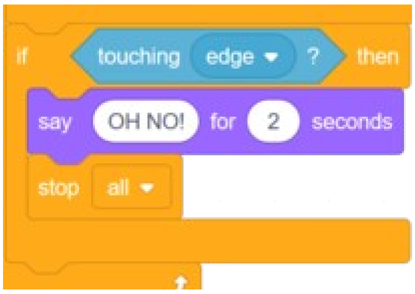
```
when [space ▾] key pressed
repeat (20)
    change y by (5)
```

Step 6: Jumping the chasms and getting to the finish

As you drive along, you'll see there are some chasms. We don't want to fall down a bottomless pit, so let's add code to make us jump them to get to the finish.

✓ Activity Checklist

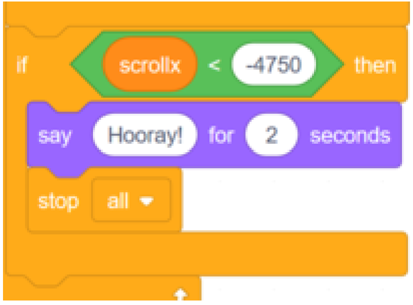
□ Firstly, we need to tell the game that we've lost if we fall into the chasm. In this case, we can use the `touching edge` block to check if we're touching the edge, and if we are, it's game over. At the end of your Buggy's forever loop, add the following code:



```
if <touching [edge ▾] ?> then
    say [OH NO!] for (2) seconds
    stop [all ▾]
```

Run your program now. If you fall into a chasm, it should end your game.

□ We can now lose the game, but we also want to win when we reach the goal. Add the following code to the end of your Buggy's forever loop to finish the game when we reach the goal:



```
if scrollx < -4750 then
    say Hooray! for 2 seconds
    stop all
```

Notice that because we're using a negative number for `scrollx`, we need to use the `<` block.

Challenge: Fix the buggy buggy

When your game restarts after losing the game, your buggy sprite is still touching the edge, causing you to lose straight away! Can you position the buggy when the game restarts so it’s not touching the edge?

Challenge: Add a timer

It's fun to be able to compare your best time with your friends. Can you add a timer to measure how long it takes you to win the game?

Advanced challenge: Improved jumping

Right now, when you jump, there's nothing to stop you jumping again or changing direction mid-way through your jump. On the moon, you can't do this! Can you update your program so that your buggy will only jump once, and can't jump again or change direction until it has landed?
Hint: Setting a variable inside the repeat until loop of your go-to-surface block will help you keep track of whether or not you are touching the ground.