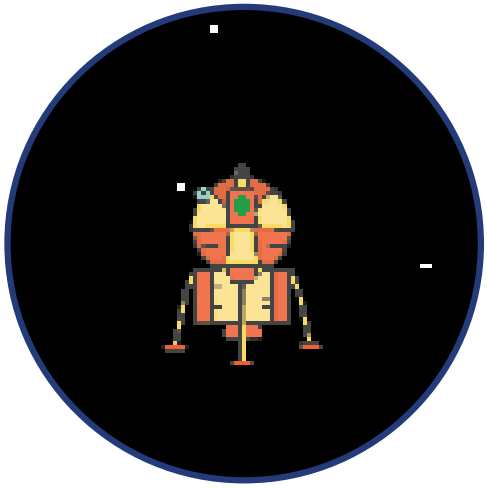
MOONHACK 2018

Lunar Module

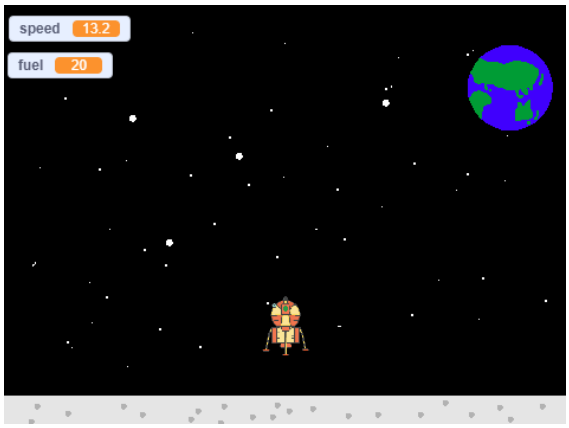


Simulate the first moon landing. Can you land safely on the moon?

INTRODUCTION

On 20 July 1969 the first humans to ever touch down on the Moon did so in the lunar module. Landing this machine was no easy task. The pilot, Neil Armstrong had to land the craft softly enough so that it would not crash on landing while also monitoring the amount of fuel he burned while slowing down the craft.

In this activity we are going to simulate this first moon landing.



What you will need

HARDWARE

A computer capable of running Scratch 3

SOFTWARE

Scratch 3:
either online
rpf.io/scratchon
or offline
rpf.io/scratchoff

What you will learn

- How to create user **input**
- How to set conditions
- How to use **variables** to control sprites

Project Links

Starter project

https://scratch.mit.edu/projects/1197991046/

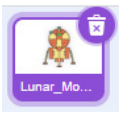
Completed project

https://scratch.mit.edu/projects/1197943602/

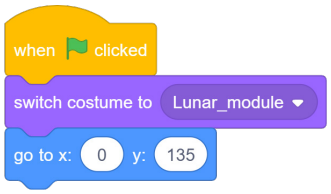
STEP 1 - PROGRAMMING THE LUNAR MODULE

Let's create the code that will place the Lunar Module in a place that will allow it to fall to the Moon. Open the starter project - https://scratch.mit.edu/projects/1197991046/

Select the lunar module sprite.

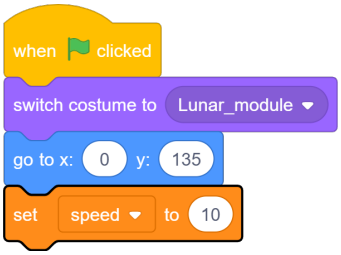


When this game starts by clicking the green flag the Lunar Module will appear exactly where you would like it to start and in the correct costume.



To keep track of our speed while we fall we will create a variable named speed. Click on the Make a Variable button. Name this new variable "speed"

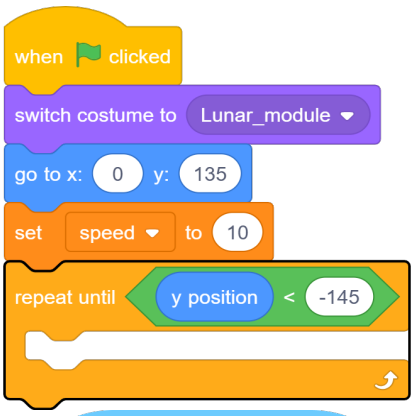
Add a new block to your code to set the speed to 10.



Test out your code by clicking the flag. Does the speed get set to -10 and Lunar Module move to the top of the screen?

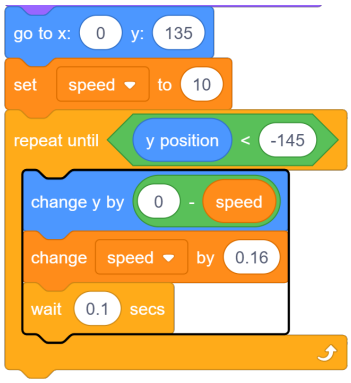
STEP 2 - SIMULATING MOON GRAVITY

We are going to add a repeat until loop to this project that will repeat a certain command until a certain condition is met. In this case it is the location of the lunar module.

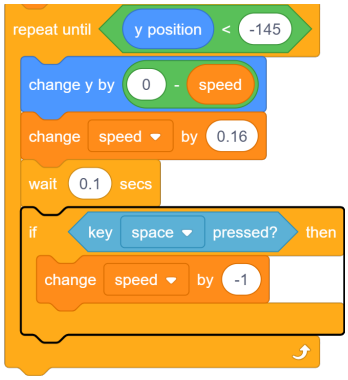


STEP 2 - SIMULATING MOON GRAVITY

Next we are going to add 3 blocks of code that will simulate the speed at which the Lunar Module fell to the Moon upon landing. Did you know that the gravitational force on the Moon is 0.16 as strong as it is here on Earth?



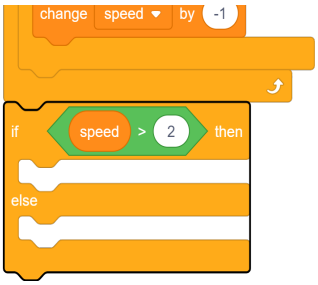
Lastly, we are going to add thrusters to your Lunar Module. This will allow you to change the speed at which the vehicle is falling by changing its speed to the opposite direction.



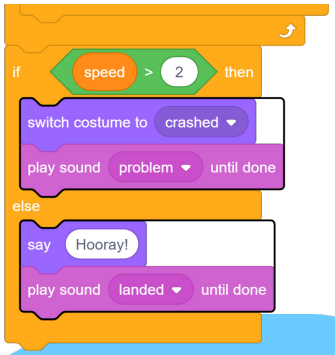
Test your program. You probably have a Lunar Module that can fly to the top of the screen or land on the Moon with ease. Next we are going to make this game more realistic by adding some more concepts to your Scratch program.

STEP 3 - CRASH OR SUCCESS?

We are going to create a conditional statement that states if the vehicle is traveling at a speed higher than -2m/s at the time of landing then we will report a crash.



Depending on whether or not the landing is successful, we will create a different sound and image for the lunar module.

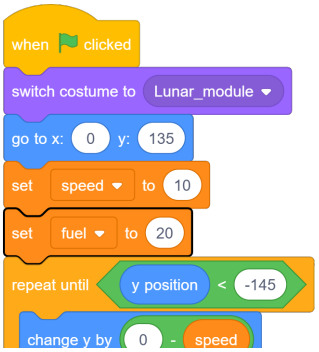


Test your code. Will the Lunar Module land successfully on the moon if travelling at the appropriate speed?

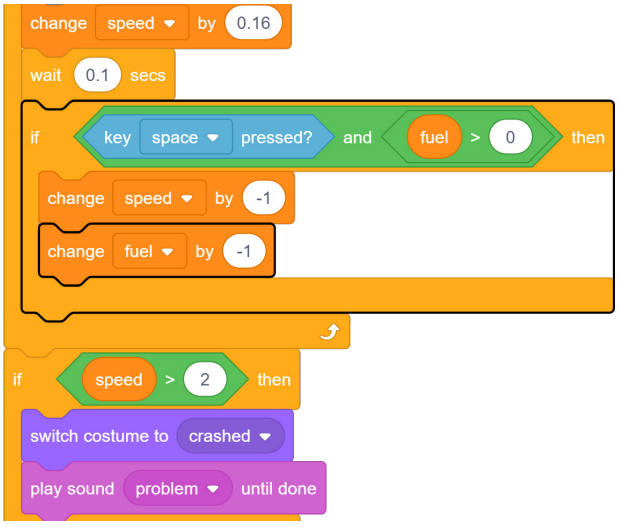
STEP 4 - FUEL

We would all love to have unlimited fuel in our vehicles. But Neil Armstrong had a limited amount he could use. We are going to make this simulator more realistic by adding a finite amount of fuel we can burn.

Firstly, we are going to create a variable called fuel. Now that we have created a fuel variable let's set the fuel variable to 20 to limit our thrusters when landing.



Next, we will need to update our conditional statement to check if we have any fuel left before changing our speed and decreasing our fuel level. If it meets the condition that the space key is pressed and fuel is greater than 0, then change speed and fuel.



Congratulations! You have completed the Moonhack Scratch project of 2018! Celebrate by inviting your friends and family to have a go at your new Lunar Module simulator.

Challenges:

Adding thrusters

Adding thrusters – You update your code to change its costume to thrusters every time you burn fuel? Don't forget to add the thruster sound too!

Hint: you will need to replace your if block with an if/else block

Earth Speed

Would it be possible to land the Lunar Module on Earth with the same amount of fuel? Test this theory by changing the speed at which the vehicle falls to 1 g and see if you can land safely?

Mars Lander

The NASA needs you! Research the gravitational force on Mars and change the speed of your Lunar module to reflect this. Let NASA know exactly how much fuel they will need to carry in a similar module when landing humans on the Red Planet.

You have completed the Moonhack Scratch project from 2018. High five your teachers, friends, and family!

Rereleased in 2025 for Moonhack's 10th birthday.