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### 3 Algorithms to code

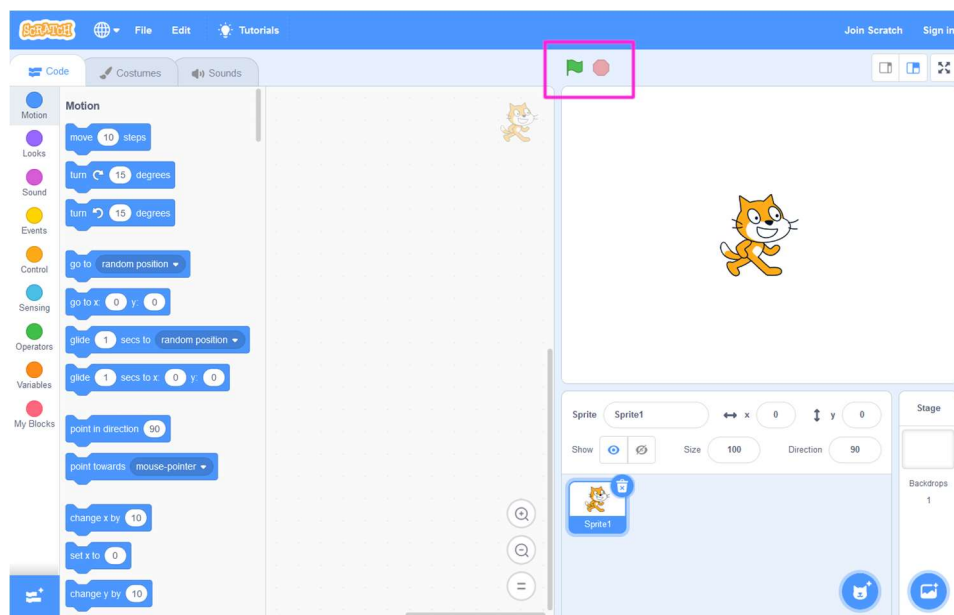
#### 3.1 Programming in Scratch

Scratch is a programming language where code is presented as blocks that the programmer can drag and drop to create their program and connect to characters in a scene. It serves as a useful tool to transition from algorithm to code without moving all the way to text-based languages.

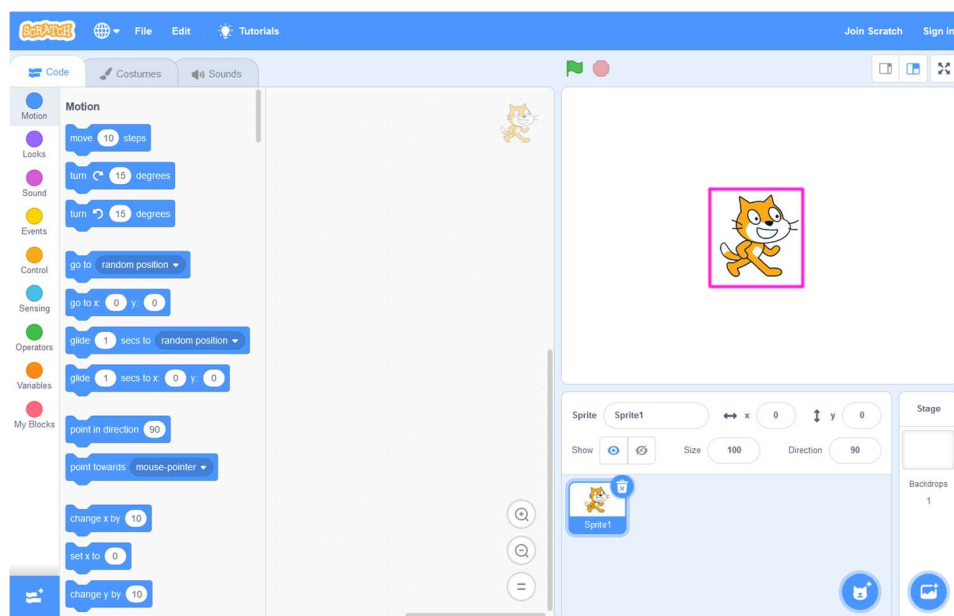
##### 3.1.1 Introducing the Scratch interface

As Scratch is likely an unfamiliar environment to you, there are four important sections of the interface to understand:

1. A GREEN FLAG THAT IS USED TO RUN THE CODE AND A RED STOP SIGN TO STOP CODE RUNNING.

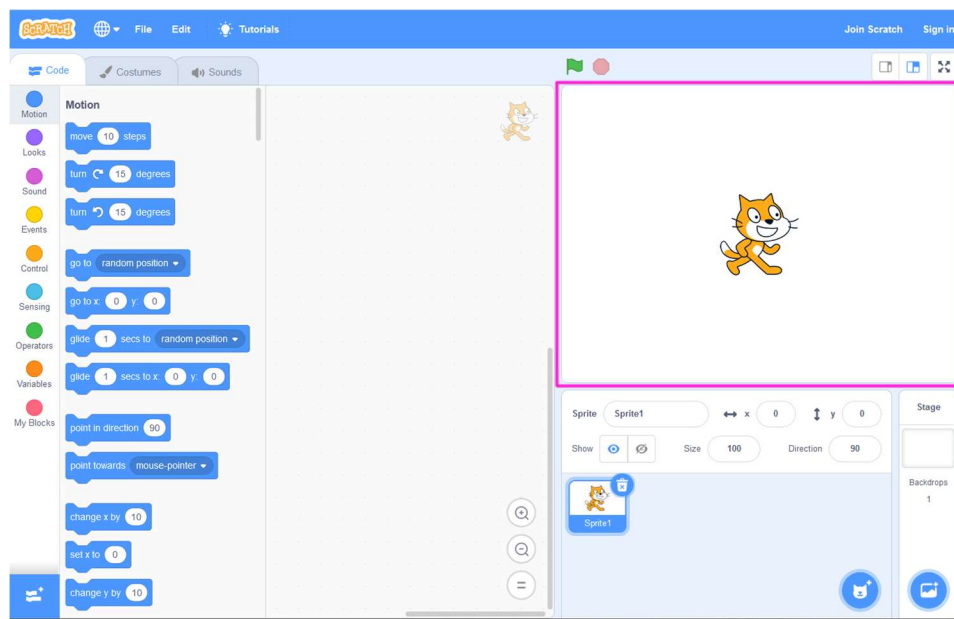


2. CHARACTERS, KNOWN AS SPRITES, THAT CAN BE PROGRAMMED

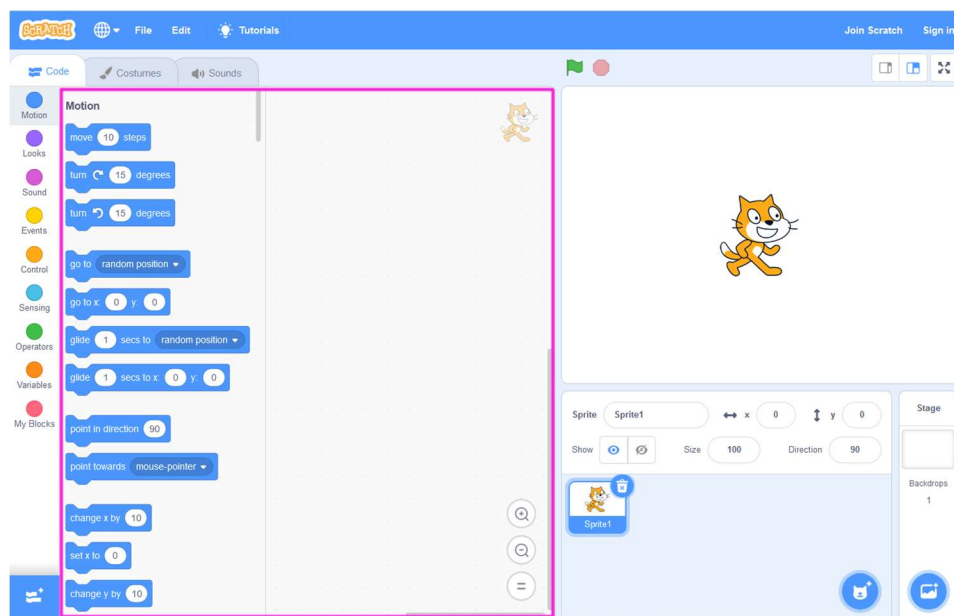


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### 3. THE STAGE, OFTEN WITH A BACKGROUND, THAT THESE SPRITES MOVE AROUND



### 4. CODING BLOCKS THAT CAN BE DRAGGED INTO THE CODING AREA TO CREATE SIMPLE PROGRAMS



#### Exercise

Open scratch by heading to <https://scratch.mit.edu/> in a web browser. Click the “Start Creating” button. **You may see a green tutorial window; you can close this.** Confirm you can identify the four areas explained above within your Scratch window. Mark them off as you find them.

☐ GREEN FLAG AND STOP SIGN

☐ CHARACTERS

☐ THE STAGE

☐ CODING BLOCKS

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### 3.1.2 Programming with Scratch

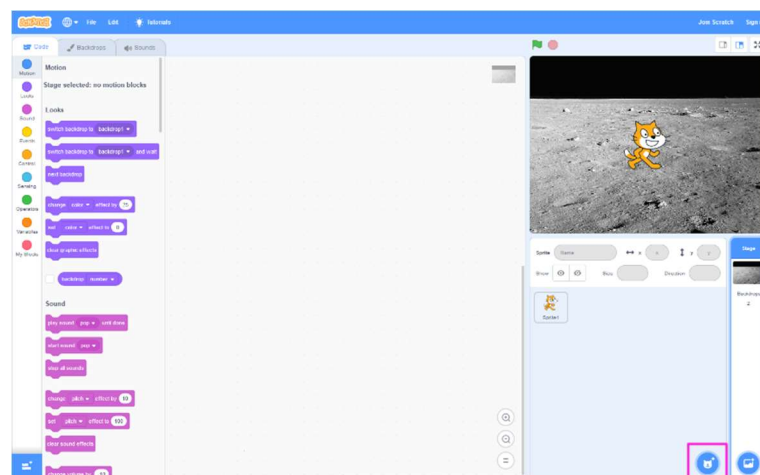
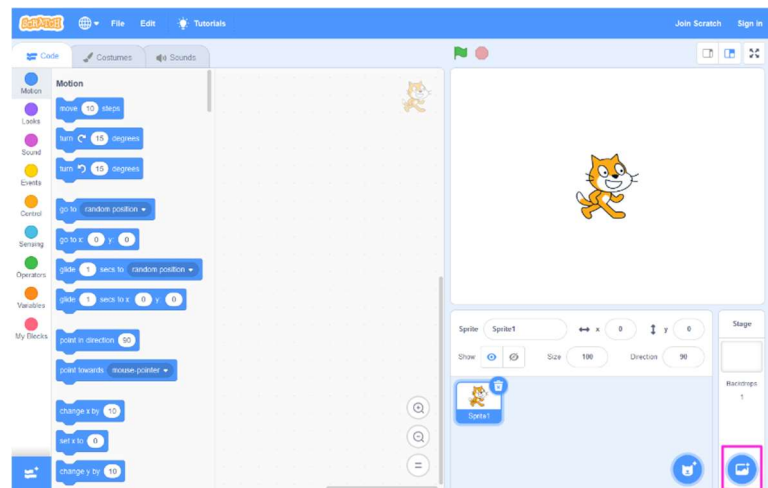
Programming with Scratch involves selecting sprites (characters) to bring into your scene, adding a background for some scene context and adding code blocks to bring your scene to life.

#### Exercise

*In this exercise we will launch a rocket into space to introduce you to programming in Scratch.*

*Open scratch by heading to <https://scratch.mit.edu/> in a web browser. Click the “Start Creating” button. **You may see a green tutorial window; you can close this.***

*Start by choosing the backdrop you want from the button in the bottom right corner. We will be launching a rocket; choose something you think is appropriate for that scene.*



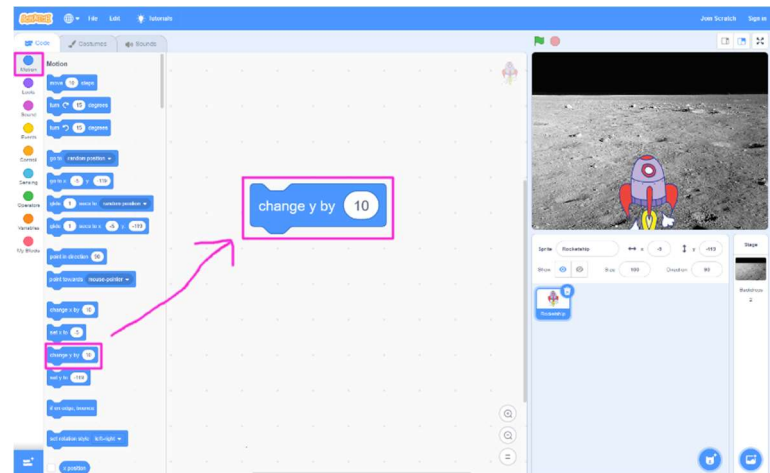
*Next, we will choose a sprite (character) for our scene. Another button near the bottom right lets us add characters to the scene. Choose the Rocketship sprite and click it to add it to the scene.*

***You may choose to remove the cat from the scene. If you select the cat in the small sprite window you will see a rubbish bin icon appear that will remove the sprite.***

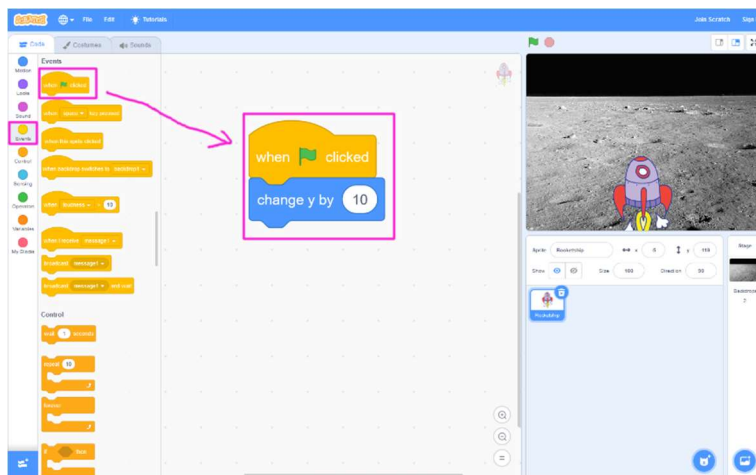
*Once a sprite is added to a scene you can move it around using the mouse. Move the rocket to somewhere near the bottom middle of the scene.*

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Now that we have the sprite we want, we can attach code blocks to it to make it move. From the left of the screen, **make sure that “Motion” is selected** and find the block labelled “Change y by 10”. Drag that block from the Motion window to the central coding area window for your rocket.



Clicking a block of code will run it, you should now notice that when you click “change y by 10” the rocket moves upwards. **If your rocket goes too far up the screen you can drag it back down directly in the scene window.**



Next, we want our block to run when the green flag is pressed. From the left of the screen, **make sure that “Events” is selected** and find the block labelled “when [flag] clicked”. Drag that block from the Events window to the central coding area window for your rocket and attach it to the top of the “Change y by 10” block you created already.

If all has gone well, you should now be able to use the green flag to move your rocket instead of clicking the block directly.

When your program runs, your rocket may not move very far up yet. Can you discover a way to make your rocket get all the way to the top of the screen with a single click of the green flag?

Can you discover a way to make your rocket fly to the top right of the screen instead of just the top?

Your rocket has five different costumes (states) to display. Can you discover how to change costumes. Could you make your rocket start off without a flame and then add one after taking off?

Pat yourself on the back, you have just completed your first program in Scratch.

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## 3.2 Designing a program

In the previous stage you created your first simple program in Scratch. In this stage you will use a program design, including an algorithm, and ultimately create a program in Scratch. Program designs need to include all of the key information to allow someone to turn the program design into code in the chosen programming environment.

### 3.2.1 Contents of a program design




A program design could include:

- The task (what you want to achieve)
- Algorithms
- Any additional assets required (artwork, sounds etc.)

### 3.2.2 Following a program design

#### Exercise

Look at the program design below. This program will get the Fish sprite to swim from one side of the screen to the other and back again. The specific artwork is shown including the 'underwater' background and the Fish sprite. The algorithm shows that when the green flag is pressed, the Fish will move 300 places the right, pause, then move 300 places to the left and stop.

Task	Background	Sprite	Algorithm
Get a fish to swim from one side of the screen to the other and back again			<ol style="list-style-type: none"><li>1.  Click the green flag</li><li>2. change x by 300</li><li>3. wait 2 seconds</li><li>4. change x by -300</li></ol>

Open scratch by heading to <https://scratch.mit.edu/> in a web browser. Click the "Start Creating" button. **You may see a green tutorial window; you can close this.** Implement this program in Scratch by adding the relevant background, sprite and creating the relevant code. Make sure that you run your code by clicking/tapping on the green flag, to check that it works.

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*Compare your solution to the image on the last page of this section. What parts of your solution were the same, which were different and why?*

### 3.2.3 Creating your own program design

#### Exercise

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*Create your own design for a simple animation in the format used above. Make sure that it shows your task, artwork, and algorithm.*

Task	Background	Sprite	Algorithm

*When you are finished, consider how others might interpret your design. Pay close attention to the **order**, **format**, or **clarity** of your instructions. Consider showing somebody else your design and write down any ideas you come up with to improve it.*

### 3.2.4 More Scratch activities

If you want to play with Scratch a bit more, there are some Code Club exercises available online at <https://projects.raspberrypi.org/en/codeclub/scratch-module-1>

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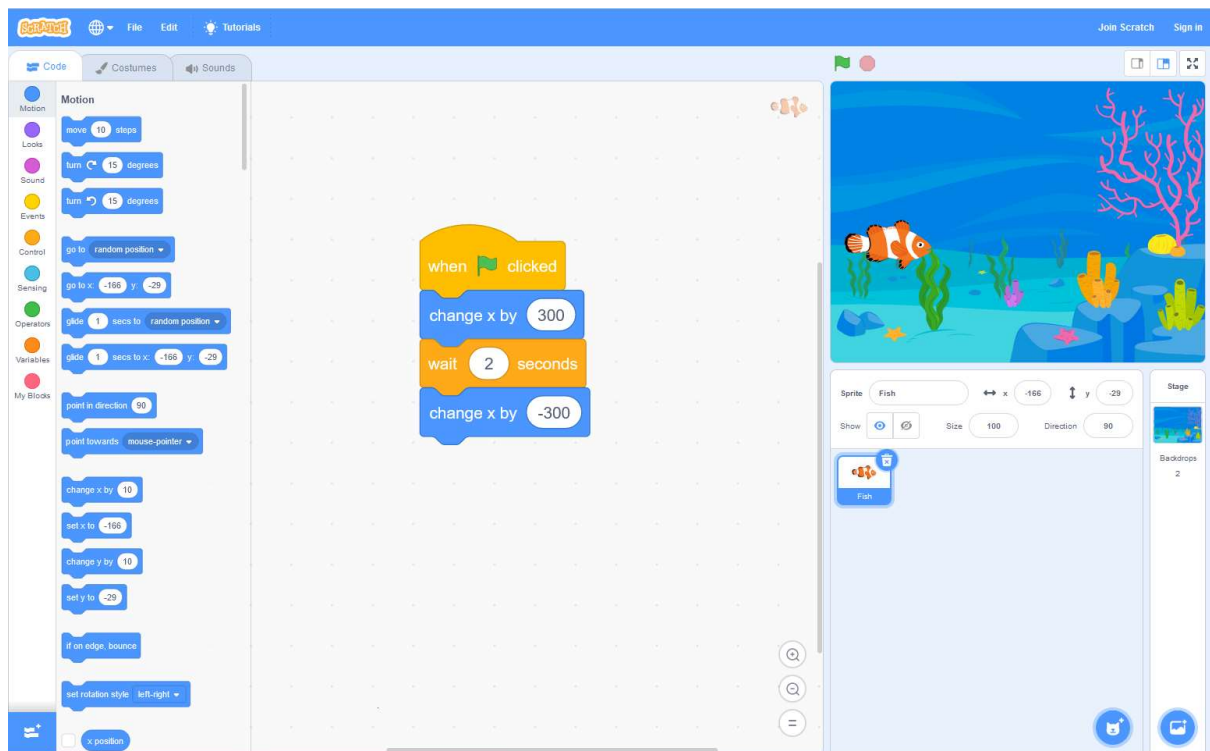


Figure 1. One possible solution to “3.2.2 Following a program design” exercise