4 Control the computer: The drawing bug

By the end of this unit you will:

➔ know what Scratch is
➔ know how to use Scratch to control the computer
➔ understand the different commands that make up a Scratch program
➔ understand how to use loops to make your programs more powerful
➔ know how to get input from the user.

In this unit you will make a little bug that draws on the screen using Scratch.

A computer program is a set of instructions.

Computer programs control the way that a computer works. Different programs make the computer do different things.

In this unit you will use Scratch to create simple computer programs. Your programs will control a small image called a sprite. Your program will make the sprite move about on the screen.
Talk about...
Discuss the computer games you have played. What objects can you control when you play these games?

Activity Design a sprite

1. Look at the Scratch sprites on these pages. You will pick one of these later. You can also use images that you have made yourself!

2. On paper, draw a design for a sprite. You can make it as colourful as you like.

Computer games are programs that let you control objects on the screen. The objects can be anything: people or pieces in a game, or something else.

Fascinating fact
The first computers were huge! One computer could fill a large room, with hardly any space for people to fit in too!
4.1 Choose a sprite

You will learn:

- what Scratch is
- what a sprite is
- how to choose a sprite.

**Scratch** is a programming language. When you start up **Scratch** you will see a screen like this.

The computer program you make will control a sprite image. When you start up **Scratch** the sprite is a cat.

In the pictures in this unit you will see a sprite called ‘Ladybug 1’. But you can pick any sprite you like.
How to choose a new sprite

When you click on the ‘New sprite’ icon you will see the Sprite Library.

1. You can scroll through the library by dragging the grey side bar.

2. Click on the sprite you choose. Click on ‘OK’.

Activity Choosing a sprite

1. Choose a sprite. You can pick any image you like.
2. Save your work with a suitable file name.

The program that you will make in this unit is called ‘star bug’. There is a ready-made example of this program for you to look at.

If you have time…

The program that you will make in this unit is called ‘star bug’. Investigate the ‘star bug’ program.

1. Get into pairs.
2. Look at the ‘star bug’ script together. See what happens when you run the program.
3. Click on the green flag to run the program.
4. Click on the red dot to stop the program.
4.2 Control the sprite

You will learn:

- how to make a script from blocks
- how to pick the blocks you need
- how to fit the blocks together.

How to delete a sprite

Open the file you saved last time.

You can delete the cat sprite. You do not need it for the script to work.

1. **Right-click** on the cat sprite with the right button of the mouse.

2. Pick ‘delete’ from the menu.

What is a Scratch script made of?

On pages 54–55 you picked a new sprite. Now you will make a script to control the sprite.

A Scratch script is made of **blocks**. They are stored in groups.

A Scratch script always starts with an event. So you will start with the ‘event’ blocks.

This star bug script will run when you click the green flag. So that is the first block to choose.

1. **Click here to see** the ‘event’ blocks. Blocks in this section are brown.

2. The event is ‘click on the green flag’.
How to add a block to the script

To add a block to the script you must drag it into the script area. The blocks will join together. You can add blocks to make the sprite move forward and turn.

Motion blocks are blue. Some make the sprite walk forward. Some make the sprite turn.

Activity Make a script by joining blocks together

1. Add lots of blocks, like in the picture.
2. Run the script by clicking on the green flag. Click lots of times.
3. Save your work.

If you have time...

Experiment by adding other motion blocks to the script. See the effect of these changes.
4.3 Make a loop, draw a line

You will learn:

- what a loop is and why they make scripts more powerful
- how to add a loop to your script
- how to make the sprite draw on the screen.

On pages 56–57 you made a long script with lots of blocks in it. The same blocks were repeated over and over again.

Now you will replace that long list of blocks with a single ‘loop’. A loop is a control that makes the script repeat.

1. The loop blocks are in the ‘Control’ section.
2. This loop will repeat ten times.
3. This loop will repeat forever.

How to add a loop to a script you made

Step 1
First you will delete the repeated blocks.
Pull the first blue block away from the event block. All the other blocks will come with it.

Now drag the joined-together blocks off the script area, back to where they came from.

Step 2
Find the ‘forever’ loop in the yellow control blocks area. Join it to the event block.
How to make the sprite draw a line with a pen

The sprite can draw a line. The green ‘pen’ blocks control this. Add these blocks to the script.

- **Step 3**
  Open the blue ‘motion’ blocks. You need one ‘move’ block and one ‘turn’ block.

  ![Diagram of blocks](image)

  Put the blocks inside the forever loop.

  The forever loop will make the blocks repeat forever.

Activity Create a loop in your script

1. Using the instructions on these pages, add a loop to your script.
2. Add blocks so that the sprite draws with a pen.
3. Run the script. See what shape the sprite draws.
4. To stop the script, click the red dot. Save your work.

When you run a computer program it produces a result. In this example the result was a drawing of a star. The result of a computer program is called the **output** of the program.

Talk about...

What computer outputs can you think of?
4.4 Change script values

You will learn:

- why script blocks contain values
- how to change the values in the script blocks
- what happens when you change script values.

On pages 58–59 you used a loop to control the sprite. The sprite will keep moving until you stop the program. You also added a pen to the script. The sprite will draw a line when it moves.

Changing number values

Look at the script you made. The blue motion blocks include number values. Now you will change the number values. This will change what the sprite does. The path it draws will change.

The first value shows how many steps the sprite walks. In Scratch each step is very small.

The second value sets the amount the sprite turns. It is given as a number of degrees.

The bigger the number of degrees, the more the sprite will turn. 90 degrees is a right angle.

How to change number values

1. Click in the box where the number is shown.
2. Type the new number.
**Activity** \ Changing the path of the sprite using number values

1. This value sets the number of steps. Change it to 100.

2. This value sets the number of degrees. Change it to 150.

The path of the sprite should change. The new path will look like a star.

**Activity** \ Changing the colour of the pen

Now change the colour of the pen.

1. Select the ‘pen’ blocks.
2. Find the block which says ‘set pen colour to 0’.
3. Drag this block into the script.
4. Make sure the script blocks show the right number values. Run the script. Save your work.

This value sets the colour of the pen. It can be any value from 0 to 300.

**If you have time...**

Change the number values in the script blocks. Explore the effect of entering different number values. You can make the sprite draw many different shapes in different colours.
4.5 A fixed loop

You will learn:

- what a fixed loop is
- how to use a fixed loop in programming
- how to make a rainbow image.

The commands inside the loop repeat forever.

Another kind of loop is a fixed loop. A fixed loop will repeat a fixed number of times. Then it will stop.

A fixed loop is also called a counter-controlled loop. That is because the computer counts how many times it repeats.

How to make a fixed loop

Look at the script you made. Pull the blocks apart from each other. Drag the ‘forever loop’ piece back to the blocks area.

Look in the ‘Control’ section. Find the block that says ‘repeat 10’. Drag this block to the script area. Make the script using this block.

It will look like the picture here.

1. This block will repeat the loop ten times.
2. Change the values as shown here.
How to make a rainbow star

Look in the ‘Pen’ section. Find the block that says ‘change pen colour by 10’. Drag it into the loop. Now every time the loop repeats the pen colour will change.

1 The new block goes here.

2 Change the number of repeats to 100.

3 Change the number of steps to 150.

4 Change the number of degrees to 190.

When you run the script the sprite will draw this image.

Activity Practise the scripts

1 Make the two scripts shown on this page.

2 Run the scripts to see what they do.

If you have time...

Make more changes to the scripts. Experiment with the two different types of loop.

Talk about...

In Scratch the different types of block are different colours.

1 What colours are used?

2 How does the use of colour help you to learn?
4.6 User input

You will learn:

- what user input is
- why user input is useful
- how to add user input to a script.

The **user** is the person who controls the program. The user makes the program stop and start.

**User input** means the values that the user types while the program is running. In this lesson you will write a script which asks the user for input.

### How to add input as a user

**Step 1**

Look in the ‘Motion’ section of the block area. Find the block that looks like this picture.

1. These numbers may be different.

Drag the block into your script at the very top. This sets the position of the sprite at the start of the program.

2. Change the values to 0 as shown here. The sprite will start in the very middle of the screen.
Step 2

Look in the ‘Sensing’ section of the block area. Find the block that looks like this picture. This block will ask the user a question. Change the question from ‘What’s your name?’ to ‘How many degrees?’

When you run the program the sprite will ask you the question.

Step 3

Look at the place where you found the question block. You will find an answer block. This block will store the answer that the user typed in. Drag the block into your script in the position shown here. It fits into another block.

Activity  Entering different numbers

1. Run the script you have built.
2. Try entering different numbers and see how the image changes.

If you have time…

See if you can change the script so that instead of asking the number of degrees it asks the number of steps.
What you have learned about controlling the computer

You have learned how to control a sprite; how to make a script out of blocks; how to use a loop to repeat commands; how to change values; and how to include user input.

The activities on this page will let you see how much you have learned.

1. What is a Scratch script?

2. What are Scratch blocks used for?

3. A Scratch program included the command ‘pen down’. What does that command do?

4. What happens to Scratch commands that are in a loop?

5. What is the difference between a ‘forever’ loop and a fixed loop?

6. What is user input?
Activity  Label the picture

Your teacher will give you a copy of this picture.

Write on the picture to show:

- Where the script is.
- Where the sprite is.
- Where you click to make the program start.
- Where you click to make the program stop.

Activity  Make a forever loop for a Scratch sprite

1. Pick a Scratch sprite.
2. Create a script for the sprite which will make it go forward 150 steps and turn 145 degrees.
3. Put these commands inside a ‘forever’ loop.

If you have time…

Extend the script you created in the last activity so that your sprite draws a rainbow star.

Here is one that shows a cat sprite drawing a rainbow star.