

How to build Cheese Chase

Some of the world's earliest and most popular computer games were maze games. In a maze game, quick thinking is essential as you race around tight corners, avoiding monsters and collecting goodies.

AIM OF THE GAME

Mimi the mouse is hungry and stuck in a maze. Help her to find the cheese, but avoid the evil beetles. And watch out for ghosts – the maze is haunted!



◁ Mimi

You play the game as the mouse. Use the arrow keys on your keyboard to make her run either up, down, left, or right.



◁ Beetles

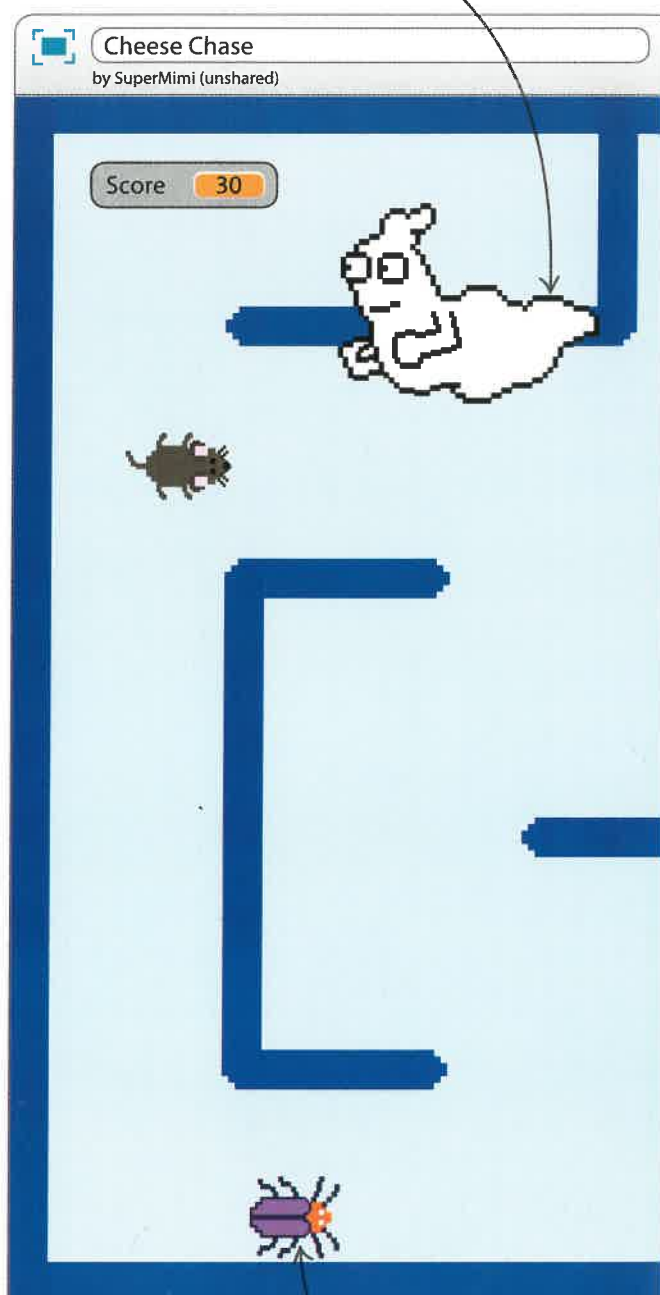
Beetles scuttle along the edges and make random turns when they hit a wall.



◁ Ghosts

Ghosts can float through walls. They can appear anywhere without warning and then disappear.

Only the ghosts can move through walls.



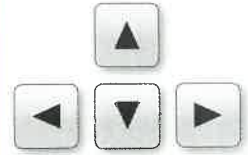
The beetles are small enough to let the mouse squeeze past.

Click the green flag to start a new game.

Click the stop sign to end a game.

GAME CONTROLS

Players use the arrow keys on a keyboard as game controls.



High Score 90

The game remembers the highest score. Can you beat it?

Collect blocks of cheese to score points.

You can create a maze with any pattern of walls.

◁ Chase the cheese

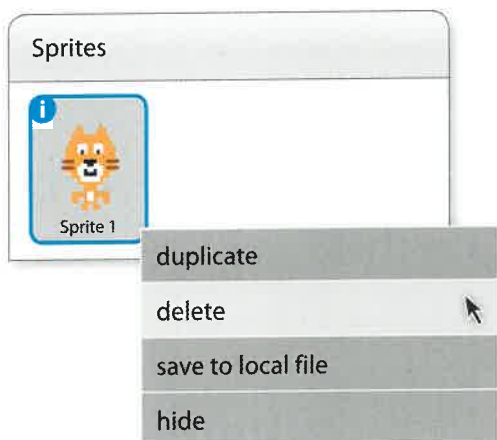
There are countless ways to change Cheese Chase and create your very own version of the game. For instance, you can adjust the speed, increase the number of beetles, and change the shape of the maze.

Keyboard control

Many games let the player use the keyboard to control the action. In Cheese Chase, the player uses the arrow keys on their keyboard to move Mimi the mouse around the stage. Start by creating a keyboard control script for Mimi.



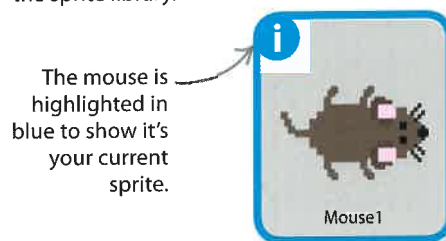
- 1** Start Scratch and choose "New Project". Delete the cat by right-clicking and selecting "delete". If you use a Mac computer, instead of right-clicking you can hold down the control key and click.



- 2** Click the "New sprite" symbol and look through the sprite library for Mouse1. Click "OK". The mouse should now be on the stage and in the sprites list.

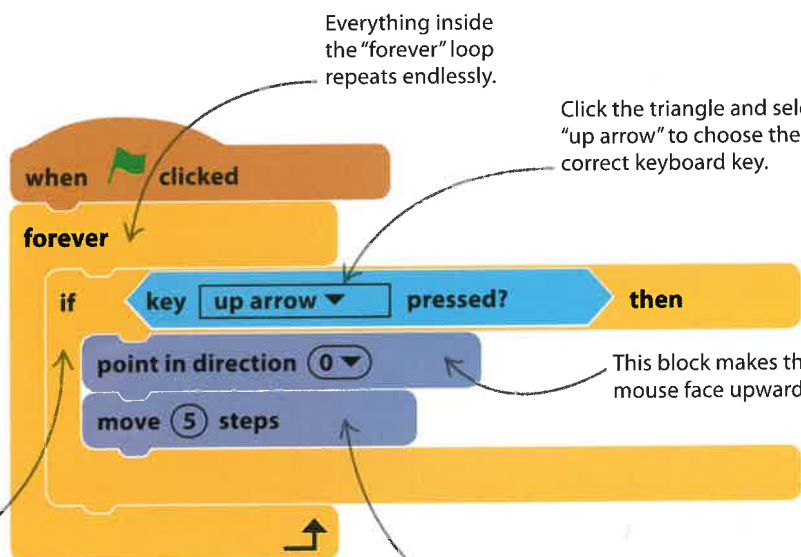


Click here to open the sprite library.



The mouse is highlighted in blue to show it's your current sprite.

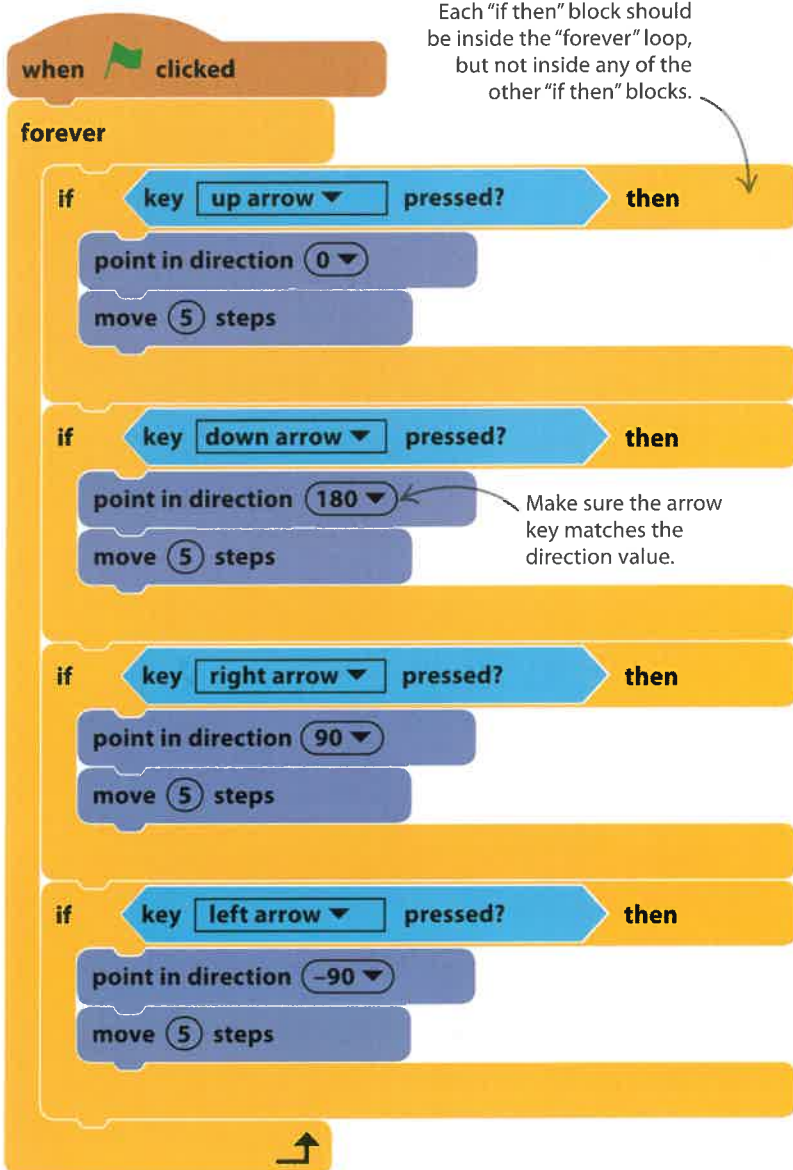
- 3** Add this script to the mouse to move the sprite up the stage using the up arrow key. To find the different coloured blocks, remember to click the different options in the Scripts tab. Read through the script carefully and think about what it does. Run the script by clicking the green flag. You should be able to move the Mouse sprite up the stage using the up arrow key.



The blocks inside the "if then" block only run when the answer to the question is yes.

This block makes the mouse move.

- 4 To make the other arrow keys work, add three more "if then" blocks like the first one, but choose a different arrow key and direction for each one. To move right, select the right arrow key and set the direction to 90. For down, set it to 180. For left, set it to -90. Read through the finished script to make sure you understand it.



- 5 Now click the green flag to run the script. You should be able to move the mouse in all directions around the stage using the arrow keys. If it's not working, go back and check all the steps.

GAME DESIGN

Controllers

In Cheese Chase, we use the arrow keys to control the game, and in Star Hunter we used the mouse. Other computer games use very different types of controller.

Console controller

Console controllers usually have two small joysticks controlled with your thumbs, along with a range of other buttons. They are ideal for complex games that need a lot of different controls.



Dance mats

You control the game by stepping on giant keys. Dance mats are good for games involving physical activity, but they don't give fine control.



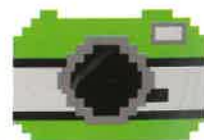
Motion sensor

These controllers detect movement, which makes them ideal for sports games where you swing your arms to use a racquet or bat, for example.



Camera

Special cameras in some game consoles allow the player to use body movements to control the game.

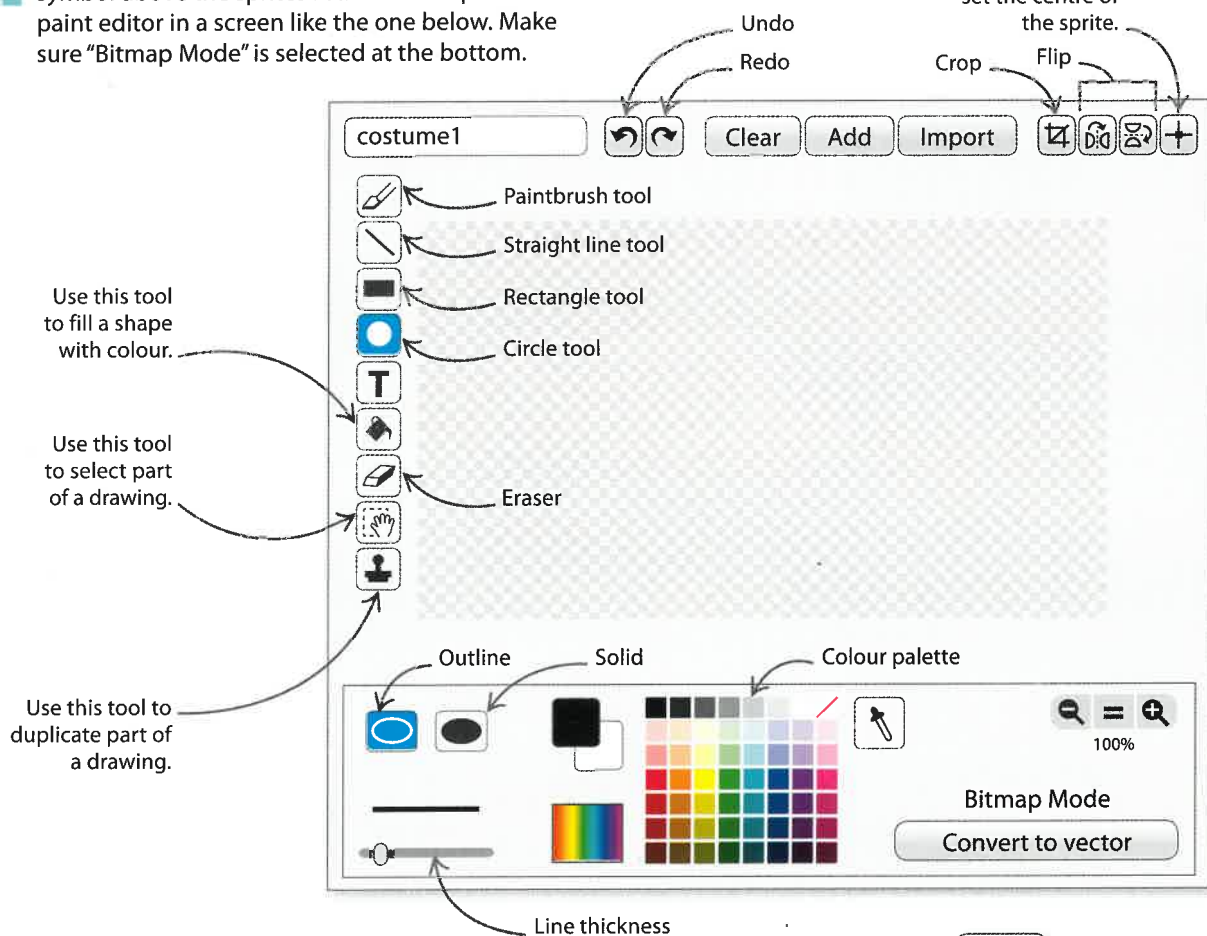


Using the paint editor

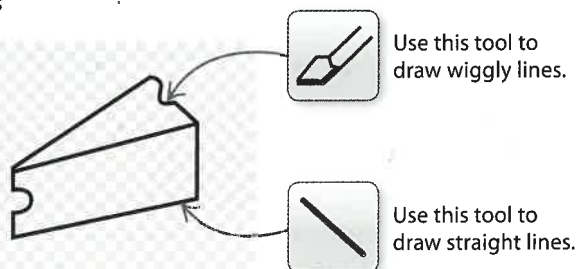
Cheese Chase now has its mouse heroine and she's hungry, but there's no cheese yet for her to chase. The sprite library in Scratch doesn't include a picture of cheese, so you'll need to make one yourself. You can do this with Scratch's paint editor.



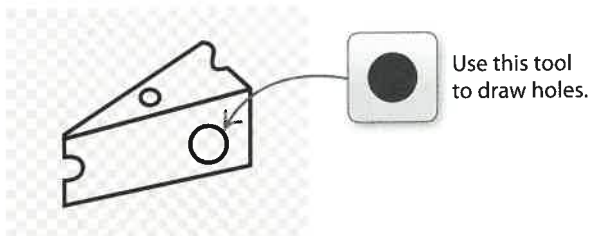
- 6** Create a blank sprite by clicking the small paintbrush symbol above the sprites list. This will open Scratch's paint editor in a screen like the one below. Make sure "Bitmap Mode" is selected at the bottom.



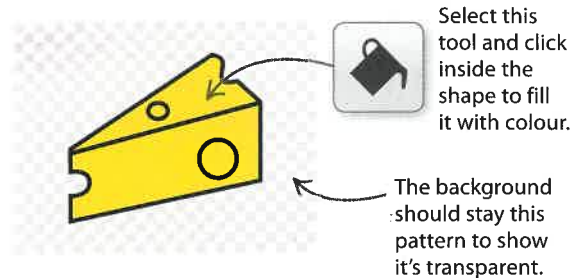
- 7** Now draw the cheese. Use the paintbrush tool and choose black from the colour palette at the bottom of the screen. Draw the outline of the cheese. If you want perfectly straight lines, use the line tool. Your cheese drawing might be too big at first, but you can make it smaller later.



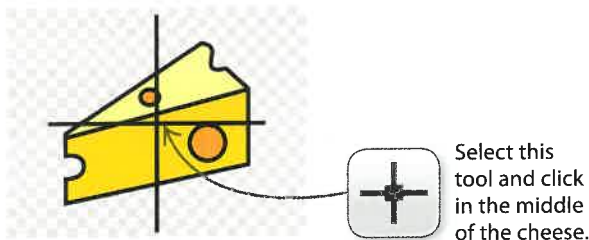
8 If you like, use the circle tool to draw holes in the cheese. Make the circle an outline rather than a solid circle by choosing the outline option at the bottom.



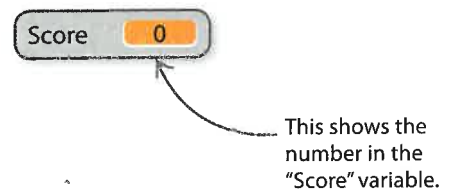
9 To add colour, choose yellow and use the fill tool to fill in the cheese. If your colour spills out and fills the whole background, click on the "undo" button. Make sure your lines don't have any gaps, then try again.



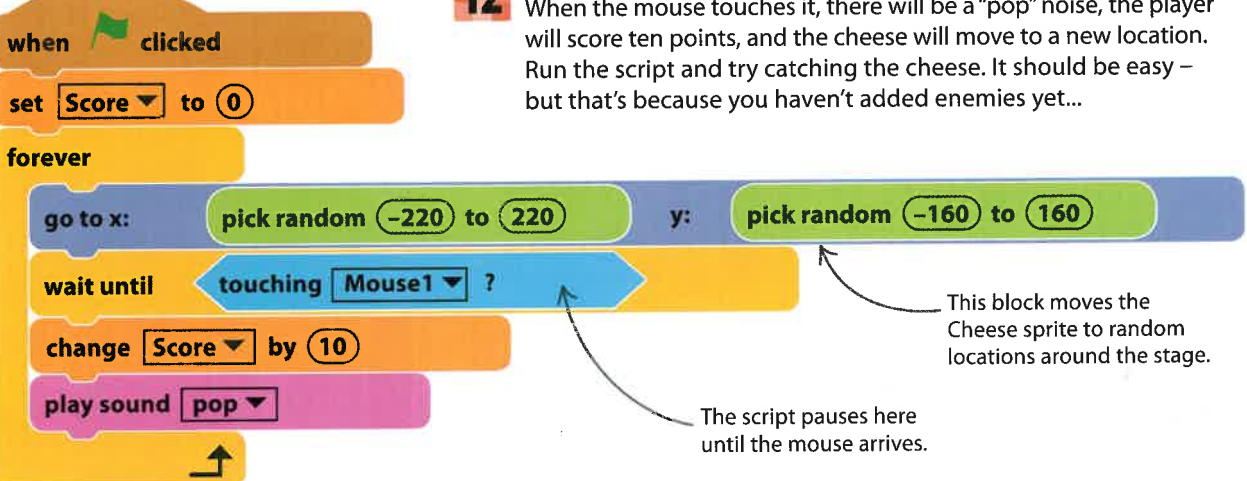
10 Now set the centre of your cheese. Click the "Set costume centre" tool in the top right and then click the middle of the cheese. The cheese is now ready to be added to the game.



11 To keep score, we need to create a variable called "Score". Choose Data in the blocks palette and click on "Make a Variable". Type the word "Score" in the pop-up box. The score counter will now appear on the stage.

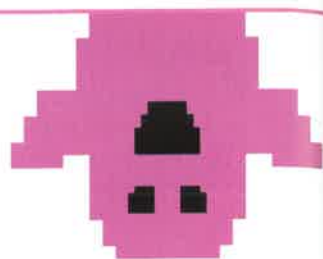


12 Now add a script to make the cheese appear in a random location. When the mouse touches it, there will be a "pop" noise, the player will score ten points, and the cheese will move to a new location. Run the script and try catching the cheese. It should be easy – but that's because you haven't added enemies yet...

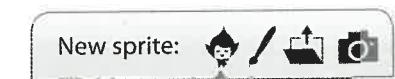


Getting spooky

Adding our first enemy to the project will make Cheese Chase into a proper game. A ghost is a good first enemy for this game because it can float through walls, so you won't need to change the ghost's script when we add the maze.



- 13** Click the "New sprite" symbol and select a ghost sprite from the sprite library. Click "OK" to add it to the project.

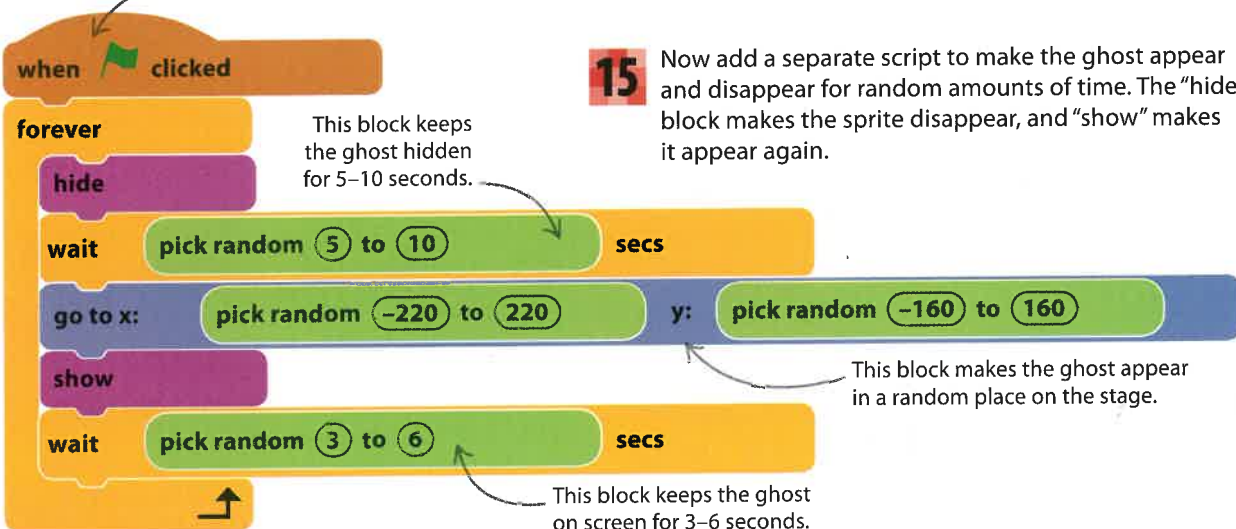


Click here to open the library.

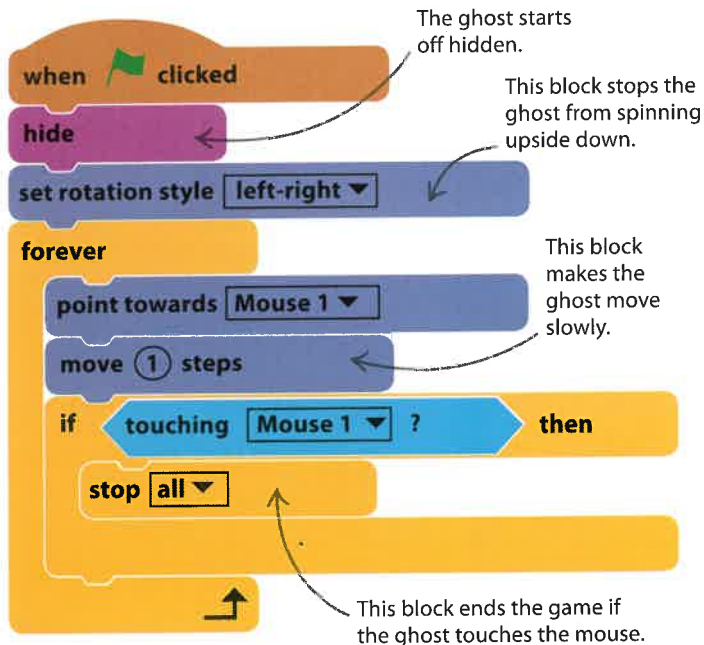


The ghost is now your selected sprite.

Starts a new script. Ghost1 will now have two scripts.

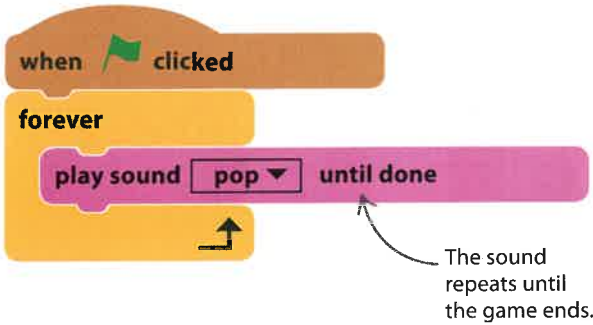


- 14** Add the following script to the ghost to make it chase the mouse. If it touches the mouse, the game will end. You might recognize most of this code from Star Hunter.

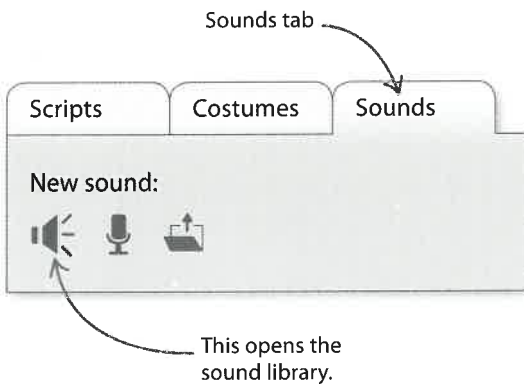


- 15** Now add a separate script to make the ghost appear and disappear for random amounts of time. The "hide" block makes the sprite disappear, and "show" makes it appear again.

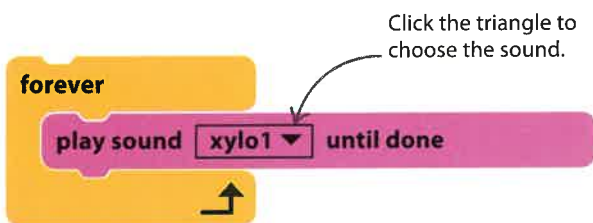
- 16** Next add music to the game. We usually add music to the stage rather than a sprite. Click the stage area on the left of the sprites list to highlight it in blue. Click the Scripts tab and add the following script to play a sound over and over. Click Sound in the blocks palette to find the “play sound until done” block.



- 17** Now click the Sounds tab above the blocks palette. Click the speaker symbol to open the sound library. Select the category “Music Loops” on the left, then choose the music “xylo1” and click “OK”. Repeat the process to load “dance celebrate” into the game too.



- 18** Return to the Scripts tab and change the selected sound from “pop” to “xylo1”. Run the game and think about how it feels to play. Next try the sound “dance celebrate”. Which one is better?



GAME DESIGN

Music in games

Watch a scary film with the sound off and it's not so scary anymore. Games are the same – the music sets the mood. A fast-paced game will use music with a driving beat to make you hurry. A spooky game should have haunting music to make you feel uneasy – jolly, bouncy music would break the spell. A puzzle game might have echoing, eerie music to create a sense of mystery. Some games use music as a key part of the game play, such as those where the player has to dance or push buttons in time to the beat.



You never know where I'll appear next!



Maze making

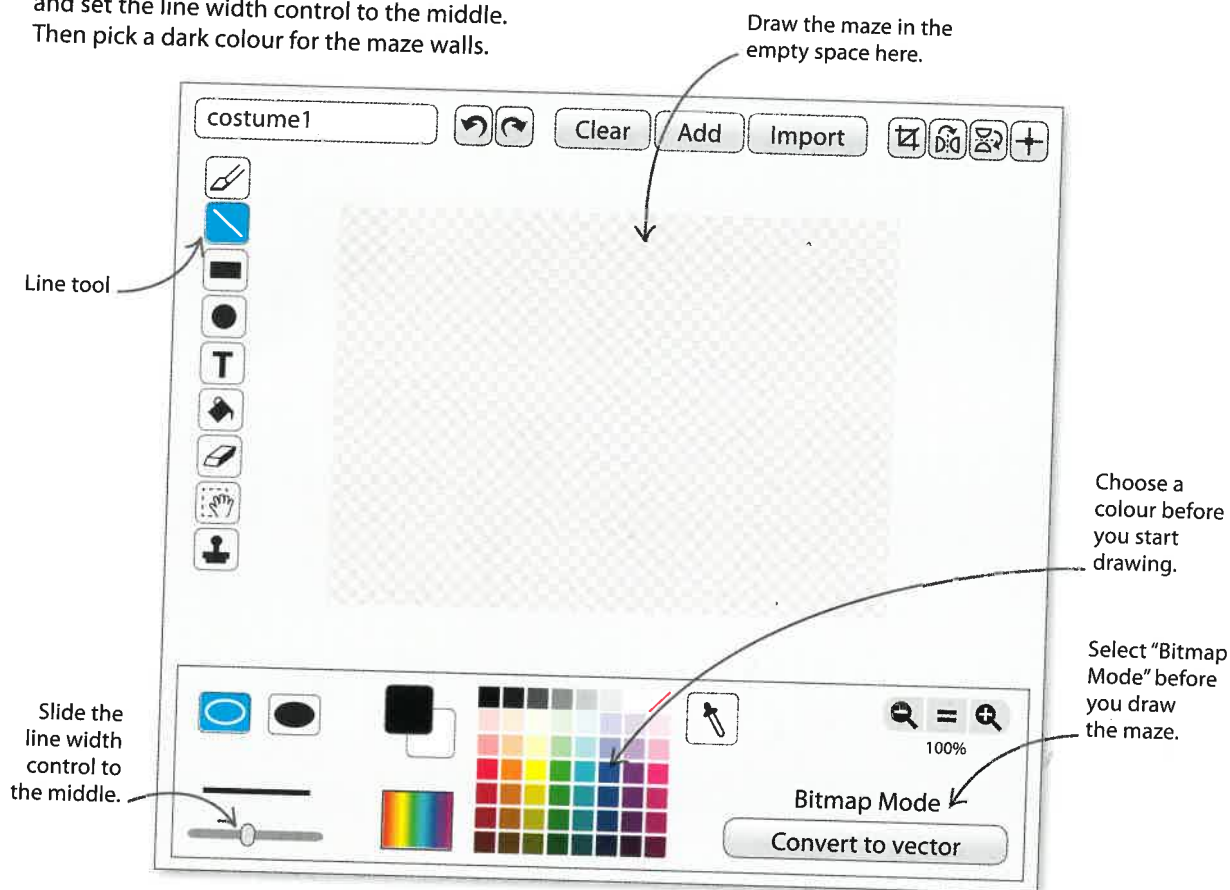
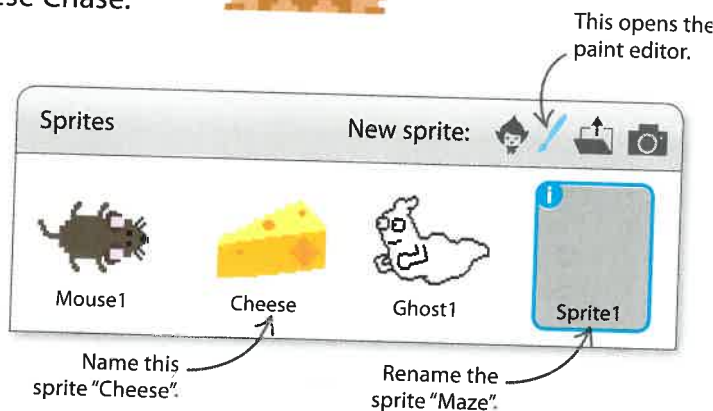
Mimi the mouse can run anywhere she likes on the stage. Put a stop to that by adding a maze. The maze will make it difficult for her to move from one place to another, adding an extra challenge to Cheese Chase.



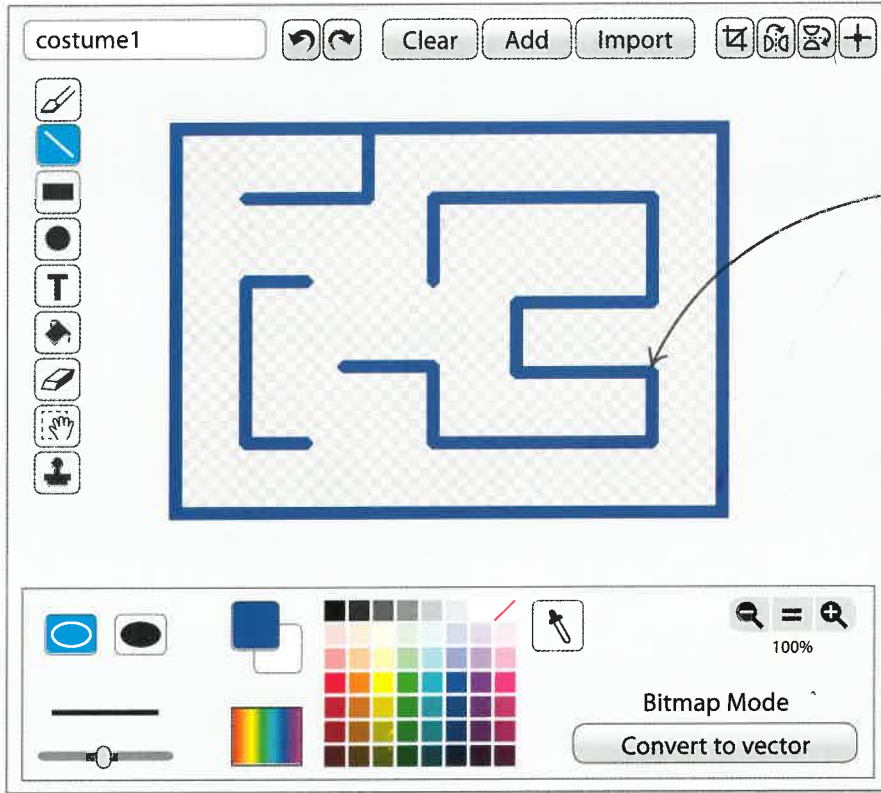
ENTER MAZE HERE

19 The maze will be a sprite, not a backdrop, because that makes it easier to detect when another sprite touches it. Draw it in Scratch's paint editor. Click on the paintbrush symbol in the sprites list, then click on the blue "i" and rename the sprite "Maze".

20 Now you can start using the paint editor. Make sure "Bitmap Mode" is selected in the bottom right. If not, click the "Convert to bitmap" button to change the mode. Choose the line tool and set the line width control to the middle. Then pick a dark colour for the maze walls.



- 21** Now draw the maze. Start by drawing the outside of the maze at the outer edge of the chequered drawing area. Hold down the shift key on your keyboard to make sure lines are perfectly vertical or horizontal. Then add the inside walls.



Make sure the lines of the maze are perfectly straight.



- 22** Finally, we need to add a script to make sure the maze is always in the centre of the stage so it's fully visible. With the Maze sprite selected, click on the Scripts tab and add the following script.

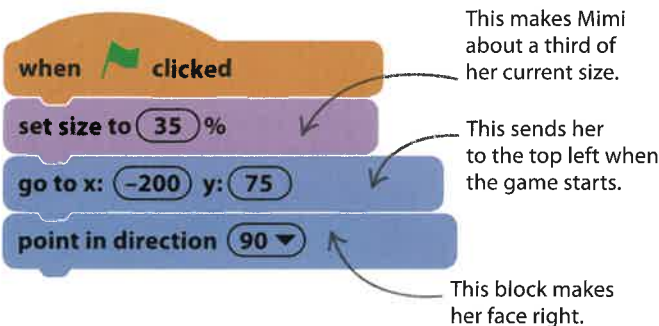


At the centre of the stage, x is 0 and y is 0.

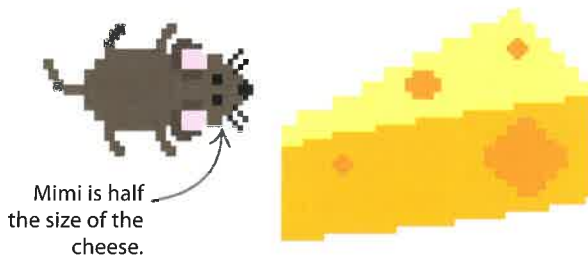
- 23** Run the project. You'll find that Mimi can run through walls, but don't worry as we'll fix that later.



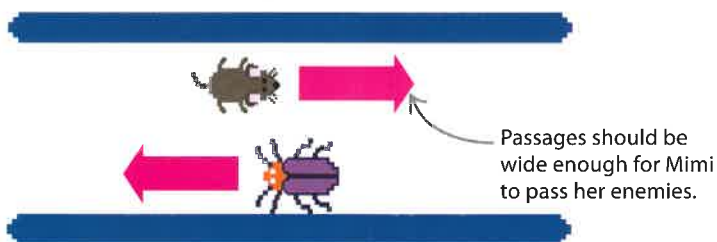
- 24** Mimi, the ghost, and the cheese are all too big for the maze, so we need to shrink them. Add the following blocks at the beginning of Mimi's script, before the "forever" block, and fill in the numbers below.



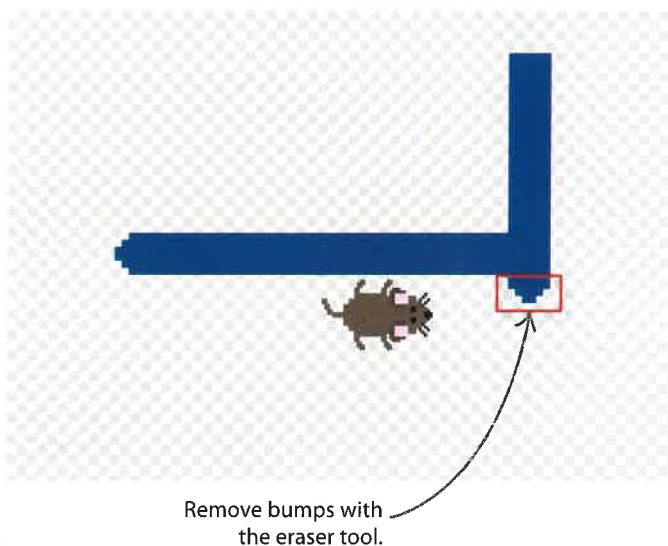
- 25** Now add a purple "set size to" block to the ghost's main script. Set the size to 35 per cent. Add a "set size to" block to the Cheese sprite too, and adjust the percentage until the cheese is about twice the size of Mimi.



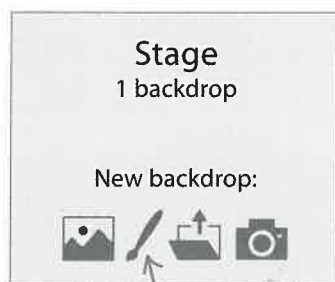
- 26** You might need to fine-tune your Maze costume to make sure Mimi can fit through all the passages, with enough room to pass her enemies (which we're going to add later). To alter the maze, select the Maze sprite and click the Costumes tab. Use the eraser tool to remove walls or the selection tool to move them.




- 27** If you use the eraser, be careful not to leave any flecks of paint behind as Mimi will stop if she hits them. Check the corners of the maze for bumps that Mimi might get stuck on and remove them.

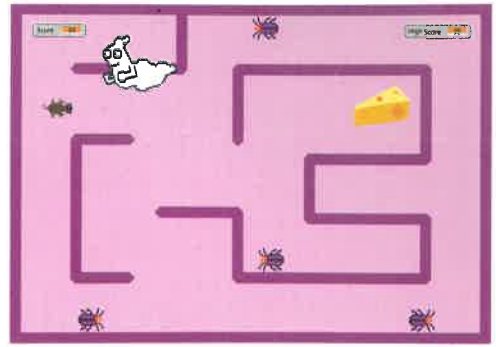
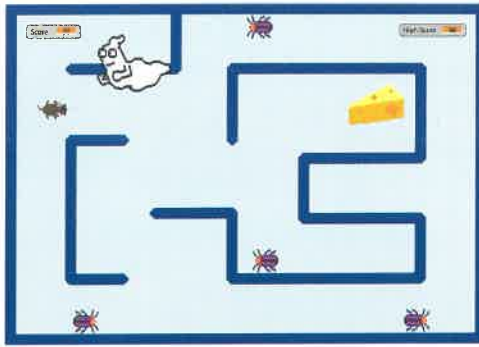


- 28** Add a background colour to the game by painting a backdrop, not the Maze sprite. At the bottom left of the screen, click the paintbrush symbol in the stage info area. This opens the paint editor. Make sure "Bitmap Mode" is selected at the bottom.

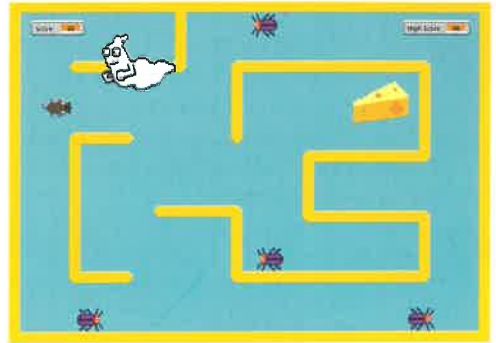
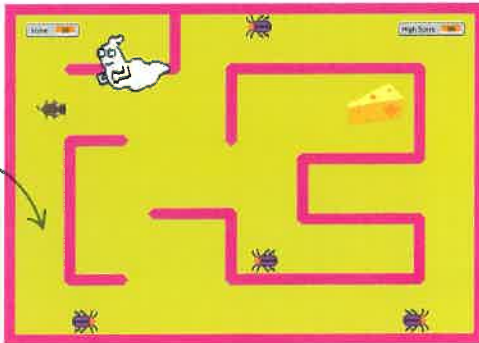


Click here to paint the backdrop.

29 Choose a colour, select the fill tool , and then click on the backdrop to fill it with colour.



Try different colours to see which one looks best in the maze.

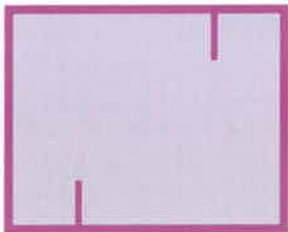


GAME DESIGN

Space in games

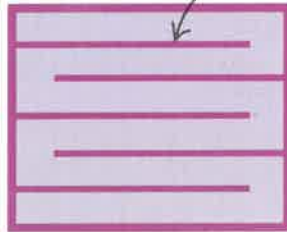
How the obstacles in a game are laid out has a big effect on how you play. A maze is the perfect obstacle to demonstrate this.

Walls restrict movement.



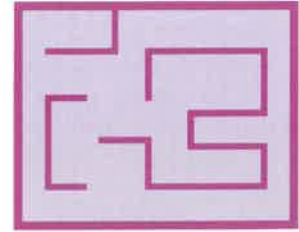
△ Open space

The player can move in any direction most of the time. A game like this needs fast-moving enemies or lots of enemies to make it challenging.



△ Closed-in space

The player is forced to move in a very limited way. Just one enemy patrolling the corridors of this maze would make life hard. The player has to think ahead to avoid getting trapped.



△ Balanced space

This is what the maze in Cheese Chase is designed to be. It limits the player's movement enough to make the game interesting, but allows some freedom.

Mouse trap

Mimi can currently run straight through the walls of the maze like a ghost, but we want her to stay trapped inside the passages. Time to change her script.

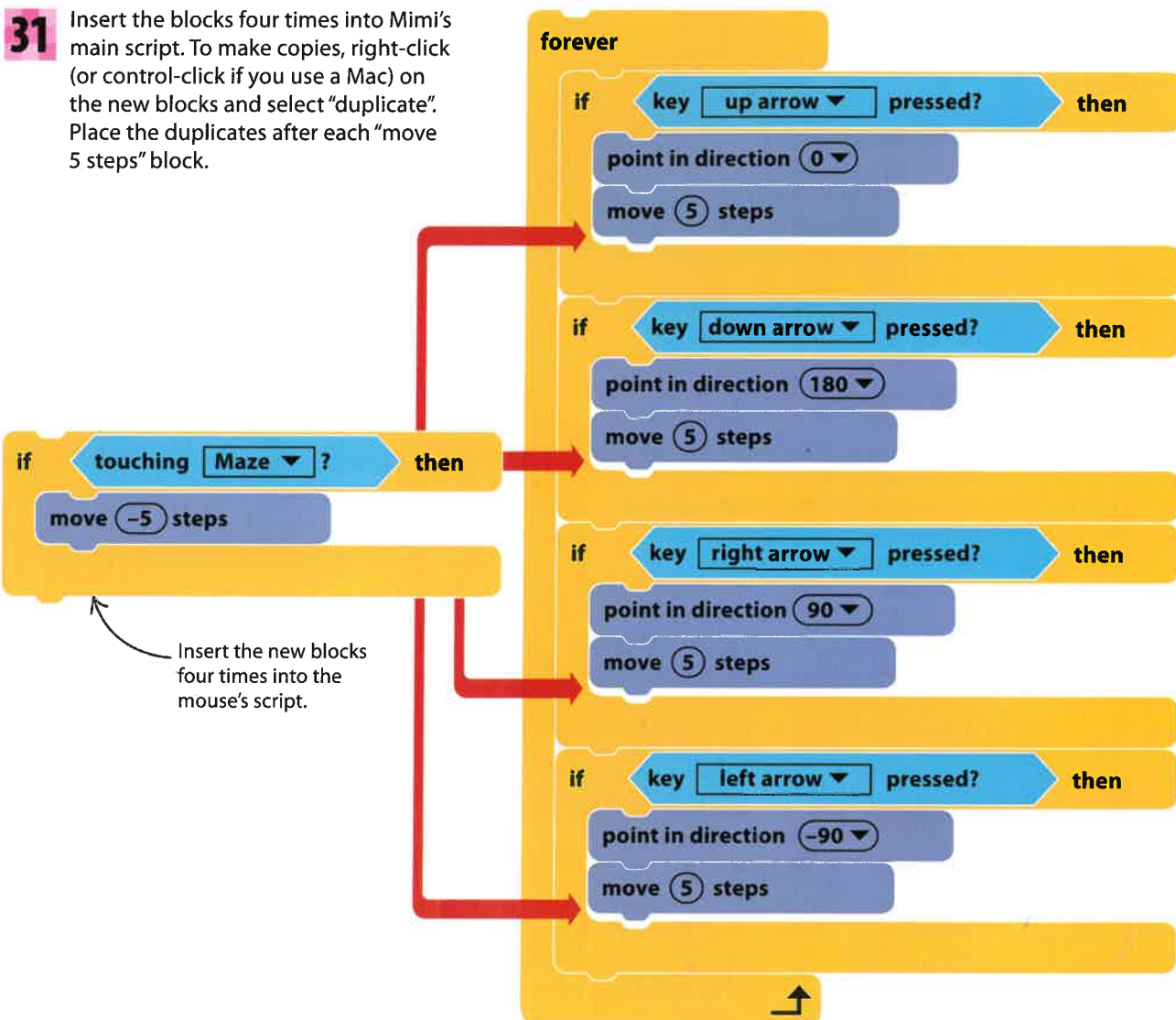


- 30** Select Mimi and drag the following blocks to an empty part of the scripts area. This set of blocks will make Mimi reverse if she runs into a wall.



This block makes Mimi move five steps backwards.

- 31** Insert the blocks four times into Mimi's main script. To make copies, right-click (or control-click if you use a Mac) on the new blocks and select "duplicate". Place the duplicates after each "move 5 steps" block.



▷ How does it work?

You might wonder why Mimi has to move five steps backwards. The reason is that she normally moves forward five steps at a time. The backward move reverses the forward one, making her stand still. This happens so quickly that you don't see her reverse.

Mimi moves five steps forwards.

Ouch!

Touching the wall triggers the reverse move.

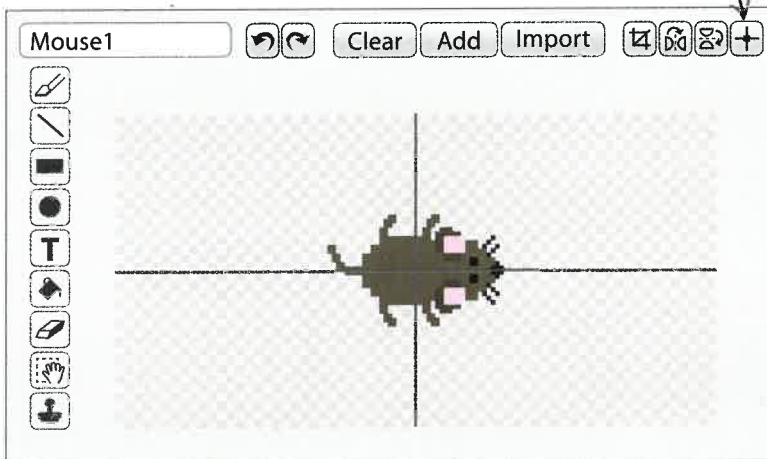
Mimi moves five steps backwards.

32 If Mimi's tail or paws touch a wall when she turns around, she can get stuck. We can fix this bug by making some changes to Mimi's costume in the paint editor.

If Mimi's tail overlaps the wall, she might stop moving.

34 There's another problem that we can fix. Every sprite has a centre point, but if this isn't in the exact centre, the mouse will wobble when its direction changes and might overlap a wall and get stuck. Choose the "Set costume centre" tool and then click in the exact middle of Mimi to correct her centre point.

Set costume centre



33 Select Mouse1 in the sprites list and click the Costumes tab above the blocks palette. Choose "Convert to bitmap" at the bottom, and then use the eraser tool to trim Mimi's tail.



EXPERT TIPS

Bounding boxes

One of the big challenges that game programmers face is detecting when sprites with complicated shapes collide. Even in simple 2D games, collision detection can cause problems, such as sprites getting stuck or solid objects merging. A common solution is to use "bounding boxes" – invisible rectangles or circles that surround the sprite. When these simple shapes intersect, a collision is detected. In 3D games, spheres or 3D boxes can do the same job.



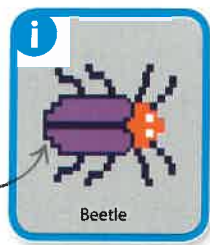
Beetle mania

Now for Mimi's main enemies: a small army of evil beetles that scurry about inside the maze. If she bumps into one, the game ends.

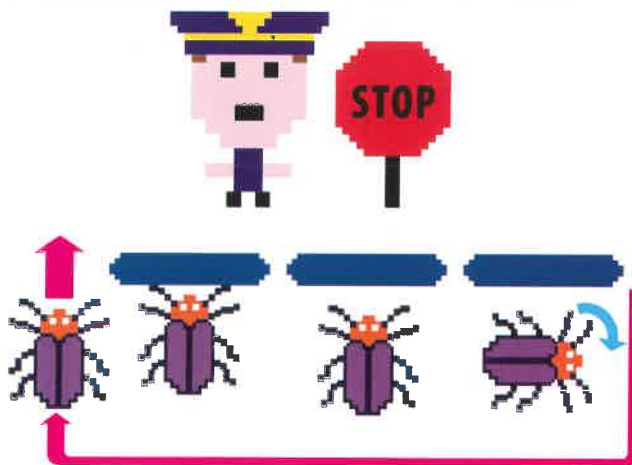
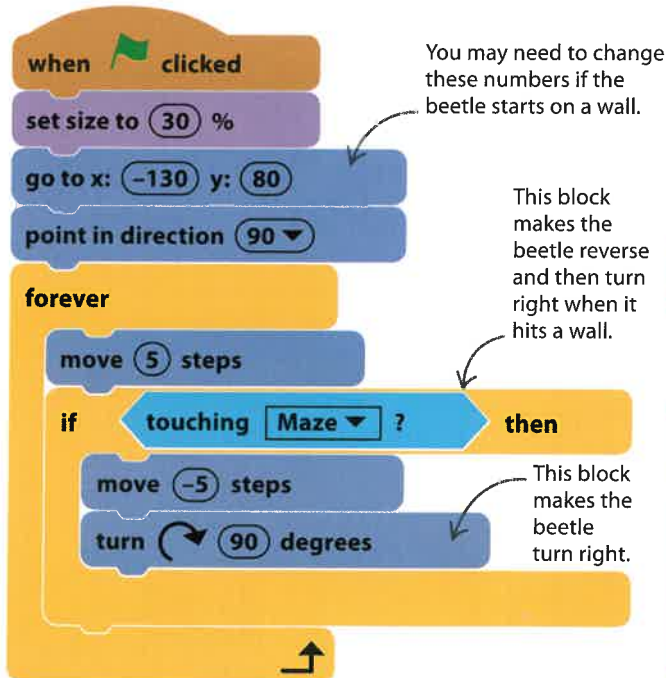
35 To make the beetles move automatically, you need to create a sequence of steps for them to follow. Programmers call this an algorithm. Our algorithm will tell each beetle to move forward until it hits a wall. Then it will stop, turn, and move forward again.

36 Click the "New sprite" symbol and choose the Beetle sprite from the library.

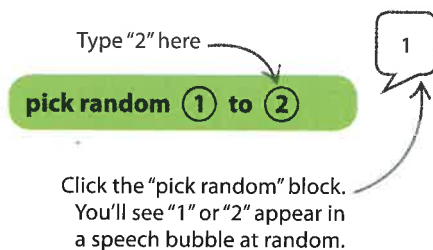
The beetle is now your selected sprite.



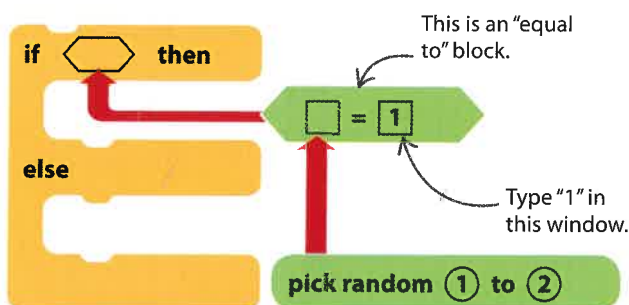
37 Add the following script to set the beetle's size, location, and direction. It uses a "forever" loop to move the beetle, and an "if then" block to make it stop and turn right whenever it hits a wall.



38 Run the script. You might notice a glitch: the beetle always turns right and ends up going round in loops. We need to change the script so that the beetle turns left or right at random. To make a random choice, use a "pick random" block. Drag it to an empty part of the scripts area and set the second number to 2.



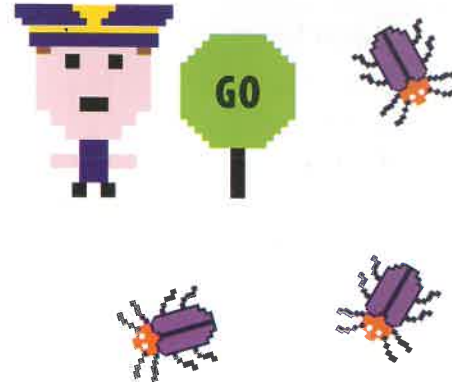
39 Now drag the "pick random" block into the first window of an "equal to" block. Then drag the "equal to" block into an "if then else" block.



40 Add two "turn 90 degrees" blocks to make the beetle turn left or right. Read through the script carefully and see if you can figure out how it works.

```

if [pick random 1 to 2] = 1 then
  turn 90 degrees
else
  turn 90 degrees
  
```



41 Remove the "turn 90 degrees" block from the beetle's original script and put the "if then else" block in its place, as below. Run the project and watch what happens. Check there's enough room for Mimi to squeeze past the beetle. If not, adjust the maze in the paint editor.

```

when green flag clicked
  set size to 30 %
  go to x: -130 y: 80
  point in direction 90
  forever loop
    move 5 steps
    if touching Maze ? then
      move -5 steps
      if [pick random 1 to 2] = 1 then
        turn 90 degrees
      else
        turn 90 degrees
  
```

The blocks inside the "if then" block run only when the beetle touches the maze.

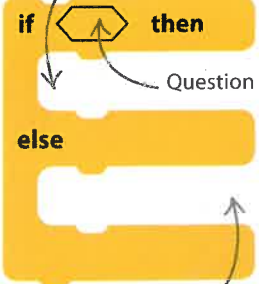


EXPERT TIPS

if then else

The "if then else" block is just like an "if then" but with an extra trick. A normal "if then" asks a question and runs the blocks inside only if the answer is yes. The "if then else" block can hold two groups of blocks: one to run if the answer is yes, and another if the answer is no. The words "if", "then", and "else" are used in nearly all computer languages to make decisions between two options.

The blocks inside the first gap run if the answer is yes.

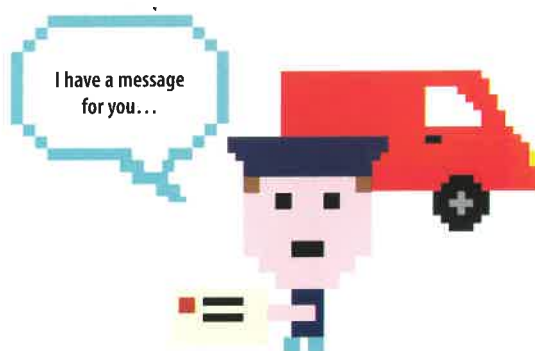
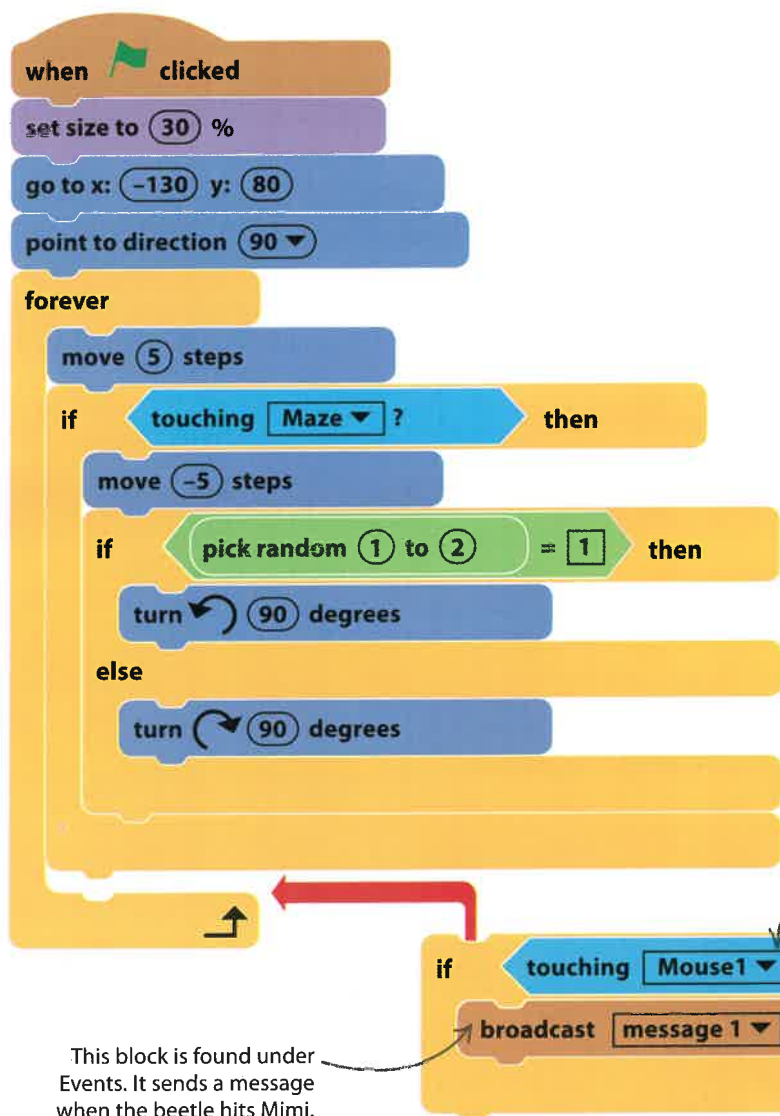


The blocks inside the second gap run if the answer is no.

Sending messages

The next step is to make the beetle end the game if Mimi bumps into it. Instead of using another “touching” block in Mimi’s script, you can use a message. Scratch lets you send messages between sprites to trigger scripts. The beetle will send a message to Mimi that stops her script.

- 42** Add the “if then” blocks shown below to the beetle’s script. The new blocks check whether the beetle is touching Mimi and, if it is, send a message. Select “Mouse1” in the “touching” block.

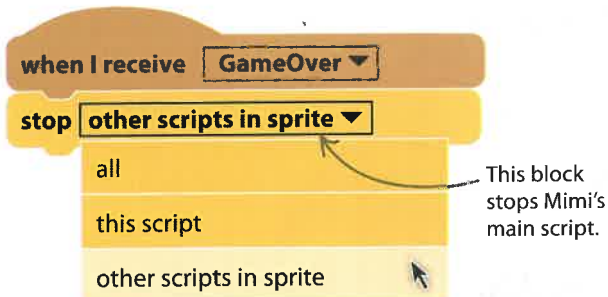


- 43** Now give the message a name. Open the menu in the “broadcast” block, choose “new message”, and type “GameOver” in the pop-up box.

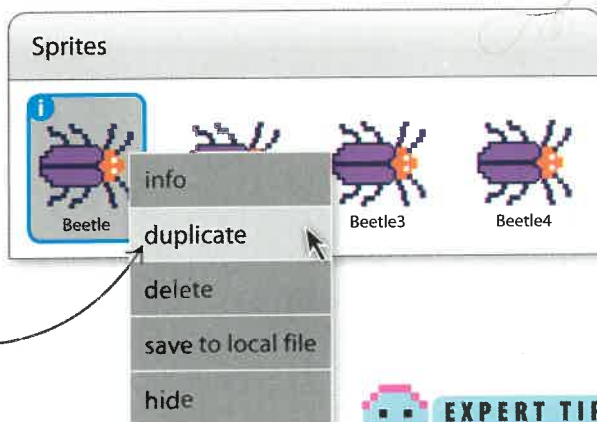


Select "Mouse1".

44 Now add an extra script to Mimi to receive the message. Drag the following blocks to an empty part of her scripts area. Try the game out. Mimi should stop moving when she touches the beetle, but the beetle will continue to move. Later we'll use a message to show a "GAME OVER!" sign as well.

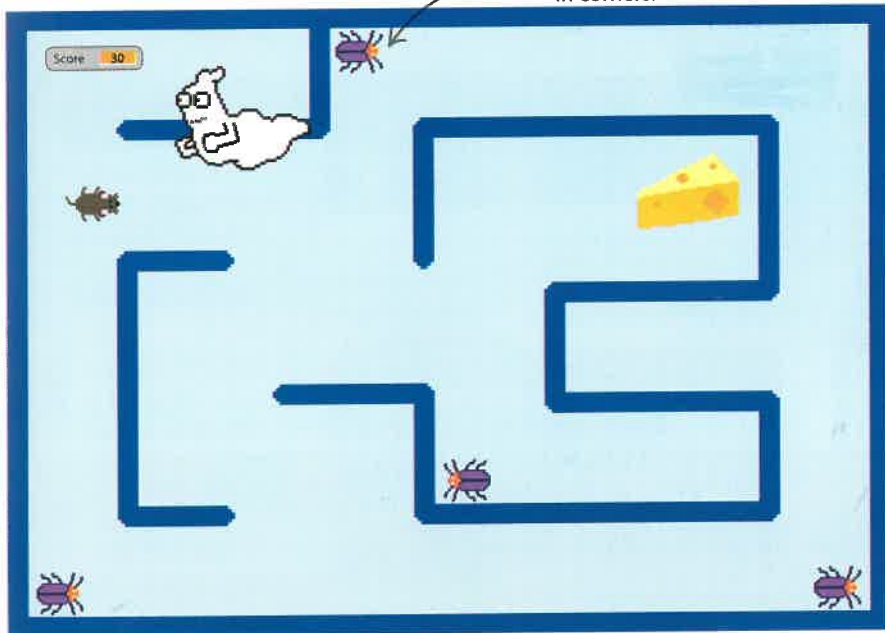


45 The game needs more beetles. Copy the Beetle sprite by right-clicking on it (use control-click if you work on a Mac) and then choose "duplicate". Make three new beetles. These will all have the same script. See what happens when you run the project.



46 You'll need to change the numbers in the "go to" blocks for each new beetle so they don't all start in the same place. Starting in different corners works quite well. Experiment!

Beetles start in corners.



EXPERT TIPS

Messages

Messages provide a neat way of making sprites react to each other. We could have made the mouse check if it's touching a beetle, but that would mean adding "if then" and "touching" blocks to Mimi's script for all four beetles. By using messages, we can add more enemies without changing Mimi's code.

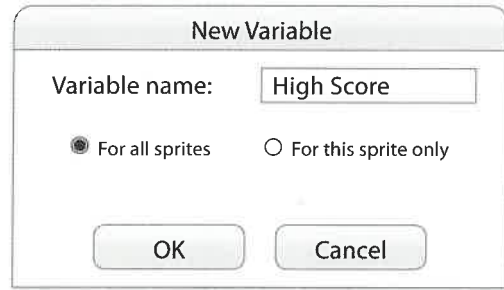


High score

You can make a game more fun by adding a high score for players to beat. We create this in the same way as the score tracker: by making a variable and displaying it on the stage.



- 47** Select Data in the blocks palette. Click “Make a Variable” and create a new variable called “High Score”. A new block will appear, and the high score counter will appear on the stage. Drag it wherever you like.



48 Now add an extra set of blocks to the Cheese sprite’s “forever” loop to test for a new high score each time the player gains points. Run the project and see if anyone can beat your high score.

The “if then” block tests whether the high score has been beaten. If so, the score becomes the new high score.

Find the “more than” block in Operators.

```

when clicked
  set size to 70 %
  set Score to 0
  forever
    go to x: pick random -220 to 220 y: pick random -160 to 160
    wait until touching Mouse1 ?
    change Score by 10
    play sound pop
    if Score > High Score then
      set High Score to Score
  
```

Game over!

At the moment, the only signal the game has ended is that the mouse stops moving. You can add a finishing touch to any game by displaying a large, bold "GAME OVER!" sign. To do this you need to create a sprite and use the "GameOver" message to make it appear.

Don't forget to check the sprite's centre with the set centre tool.

- 49** Click the paintbrush symbol in the sprites list to create a new sprite with the paint editor. Using "Bitmap Mode", draw a rectangle and fill it with a dark colour. Now switch to "Vector Mode". Choose a bright colour and use the text tool to type "GAME OVER!" in the rectangle. Change the font to "Scratch" and use the selection tool to make the text large.

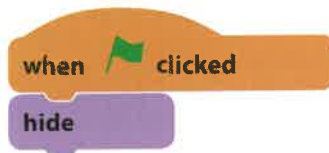


Use the selection tool to enlarge the text.

To change the font, highlight the text first.

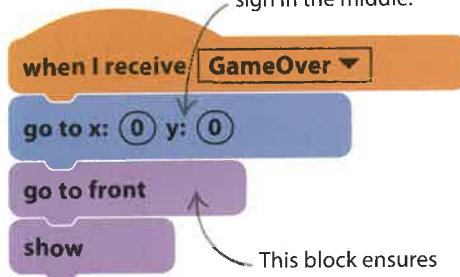
Change the font to Scratch.

- 50** You don't want the "GAME OVER!" sign to show until the game is really over, so let's hide it with a script. Switch to the Scripts tab and add these blocks.



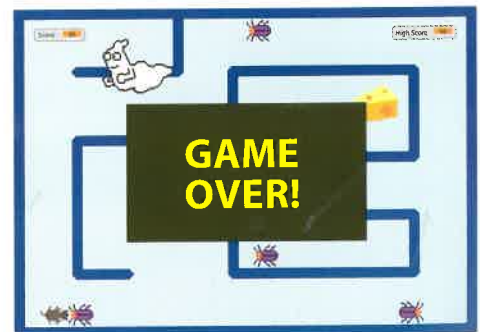
This places the "GAME OVER!" sign in the middle.

- 51** Now add a script to make the sprite appear when the game ends. You can use the same message that stops Mimi to trigger this script.



This block ensures other sprites are behind the sign.

- 52** Run the game. You should now see the "GAME OVER!" sign when you get caught by a beetle. To make the sign work with the ghost too, replace its "stop all" block with a "broadcast GameOver" block.



Hacks and tweaks

Take Cheese Chase to the next level by tweaking the rules of the game and the way the sprites behave. You can also experiment with big changes that turn Cheese Chase into a totally different kind of game.



◁ Play on

You need to play the game a lot to find out what works and what can be improved. Get other people to play. You can adjust many properties of the game until you get the right configuration: a game where the abilities of the player and enemies are well balanced.

▷ Tweak timings

You might find Cheese Chase harder than Star Hunter. To make it easier, you can make the beetles slower or make the ghost appear for a shorter time. You can also speed up Mimi. For variety, try making each beetle run at a different speed.



△ Add sounds

Jazz up the game with some sound effects using the “play sounds” block when the ghost appears, when the game ends, or when you get a high score. There are lots of sounds in Scratch’s sound library that you can experiment with.

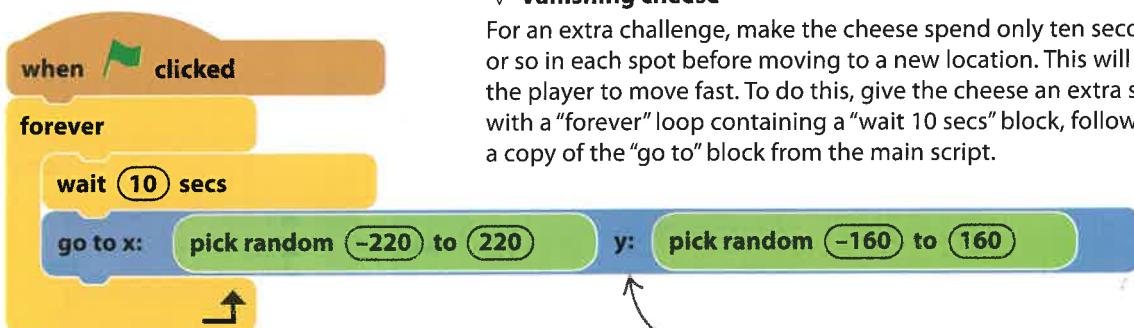
▷ Rocket power

Add a power boost that hides all the enemies for ten seconds when the mouse touches it. To do this, you would need to add a new sprite and a message to trigger a hide-wait-show script in each enemy.



▽ Vanishing cheese

For an extra challenge, make the cheese spend only ten seconds or so in each spot before moving to a new location. This will force the player to move fast. To do this, give the cheese an extra script with a “forever” loop containing a “wait 10 secs” block, followed by a copy of the “go to” block from the main script.



This block picks a random location for the cheese.

> Don't touch the walls

Make the game end if Mimi touches the walls of the maze. Add a script to the Maze sprite to send the message "GameOver" if she touches the maze. This makes the game much harder. To make it even harder, try switching the player's controls from the keyboard to the computer mouse. The game then becomes a test of a steady hand.

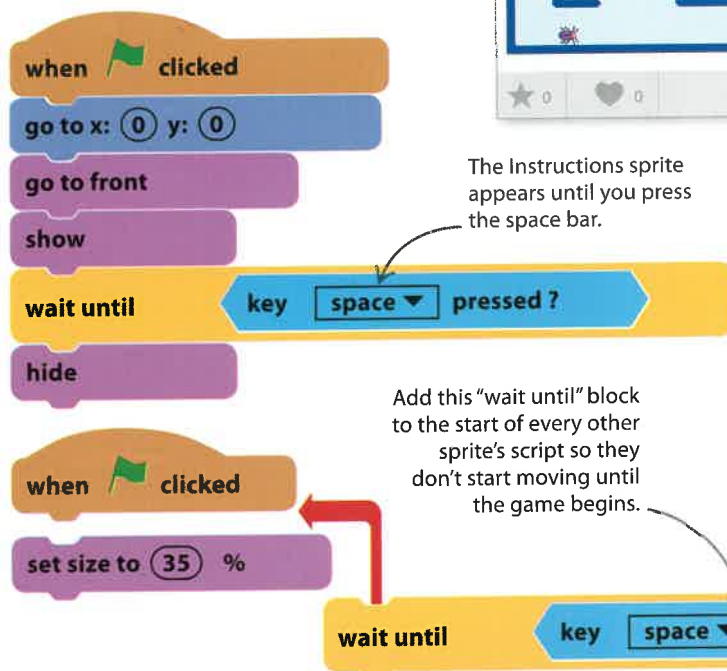


Adding instructions

Players like to see a game's instructions clearly before they start playing. Here are three ways of including instructions.

▽ Instructions sprite

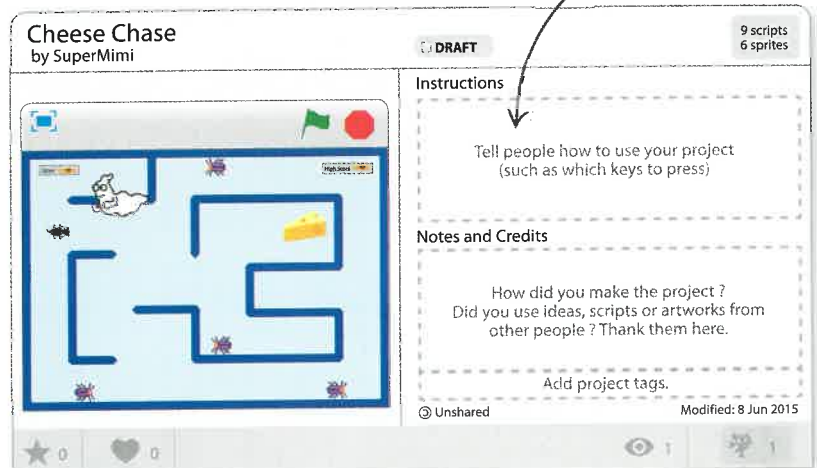
You can use the paint editor to create an instructions sprite in the same way that you created the game-over sprite. Give it the following script to show the sprite at the start of the game and to hide it once the player presses the space bar.



▽ Project page

The easiest way to include instructions is to simply type them in the instructions box on the project page. You need to log in to an online Scratch account to do this.

Type the instructions here.



▽ Speech bubbles

Make your game characters tell the player the instructions using speech bubbles. Add a "say" block to the start of Mimi's script to explain the game. Don't forget to add "wait" blocks to the enemies' scripts – otherwise there's a risk you'll lose before you start!

