

1. The variables and an overview of the sprites.

The image shows a Scratch IDE window titled "Space Invaders" by michaeladamkatz (unshared). The stage displays a cityscape backdrop with a "direction" variable set to 5. The Sprites area shows "Invader", "Candles1", "Candle", "Ball1", and "Ball2" sprites. The Scripts area contains a list of variables: "ball 1 falling", "ball 2 falling", "change direction", "direction", "pos x", and "pos y". The "direction" variable is checked. Below the list are blocks for "set ball 2 falling to 0", "change ball 2 falling by 1", "show variable ball 2 falling", and "hide variable ball 2 falling".

Space Invaders
v435.1 by michaeladamkatz (unshared)

direction 5

Scripts Backdrops Sounds

Motion Events
Looks Control
Sound Sensing
Pen Operators
Data More Blocks

Make a Variable

- ball 1 falling
- ball 2 falling
- change direction
- direction
- pos x
- pos y

set ball 2 falling to 0

change ball 2 falling by 1

show variable ball 2 falling

hide variable ball 2 falling

Make a List

Sprites New sprite: [Icons]

Stage 2 backdrops

Invader Candles1 Candle Ball1 Ball2

x: 240 y: -180

2. The Stage script.

The image shows a Scratch script for a stage, designed to set up and control an Invaders game. The script is as follows:

```
when green flag clicked
  set direction to 5
  set pos y to 130
  repeat 5
    set pos x to -220
    repeat 11
      create clone of Invader
      change pos x by 35
    change pos y by -35
  forever
    set change direction to 0
    broadcast step and wait
    if change direction = 1 then
      set direction to direction * -1
      broadcast descend and wait
    wait 0.25 secs
```

Two yellow callout boxes provide additional context:

- The first callout, pointing to the nested repeat loops, states: "nested loop to set up the rows of invaders".
- The second callout, pointing to the forever loop, states: "send 'step' messages over and over to march the invaders back and forth across the screen".

3. Invader script.

The image displays a Scratch script for an invader character, organized into several key sections:

- When clicked:** The script sets the size to 100% and hides the character.
- When I start as a clone:** This section sets the size to 80%, moves the character to its parent's position (pos x, pos y), and shows it. It then enters a **forever** loop:
 - Touching Candle?:** If true, it broadcasts 'unshoot' and deletes the clone. A callout box asks 'did I get shot?'.
 - Touching Candles1?:** If true, it says 'Got you!' for 2 seconds and stops all scripts. A callout box asks 'did I kill the player?'.
- When I receive step:** This script checks if the size is 100%. If so, it stops the script. It then changes the x position by the current direction. Two conditional blocks handle edge collisions:
 - If direction < 0 and x position < -230, it sets the change direction to 1.
 - If direction > 0 and x position > 230, it sets the change direction to -1.Finally, it changes to the next costume. A callout box explains: 'take a step, and possibly alert the Stage script that I've hit an edge (if I'm not the original sprite)'.
- When I receive descend:** This script checks if the size is 100%. If so, it stops the script and changes the y position by -10. A callout box explains: 'drop down a row (if I'm not the original sprite)'.

In the top right corner, a small Scratch cat icon is shown with coordinates: x: 165, y: -45.

4. Candles1 (aka shooter) script.

```
when green flag clicked
  set size to 40 %
  go to x: -129 y: -163
  forever loop
    CheckKeys

define CheckKeys
  if key right arrow pressed? then
    change x by 5
  if key left arrow pressed? then
    change x by -5

when space key pressed
  broadcast shoot
```

The image shows three Scratch scripts for the 'Candles1' object. The first script, triggered by a green flag click, sets the size to 40%, moves the object to x: -129 and y: -163, and enters a forever loop that repeatedly calls a 'CheckKeys' function. The 'CheckKeys' function is a defined block that checks if the right arrow key is pressed (moving x by 5) or the left arrow key is pressed (moving x by -5). The third script, triggered by the space key being pressed, broadcasts a 'shoot' message.

5. Candle (aka missile) script.

```
when green flag clicked
  set size to 20 %
  hide

when I receive shoot
  go to Candles1
  show

when I receive unshoot
  hide

when green flag clicked
  forever loop
    change y by 5
    if y position > 180 then
      hide
```

The image shows three Scratch scripts for the 'Candle' object. The first script, triggered by a green flag click, sets the size to 20% and hides the object. The second script, triggered by receiving a 'shoot' message, moves the object to 'Candles1' and shows it. The third script, triggered by a green flag click, enters a forever loop that moves the object up by 5 units (change y by 5) and checks if its y position is greater than 180. If so, it hides the object. A small candle icon in the top right corner has coordinates x: -95 and y: 199.

6. The Ball1 (aka invader bomb 1).

The image shows a Scratch script for a character named 'The Ball1'. The script is annotated with yellow callout boxes explaining its logic. In the top right corner, there is a small orange circle representing the character, with coordinates 'x: -214' and 'y: 12'.

Script:

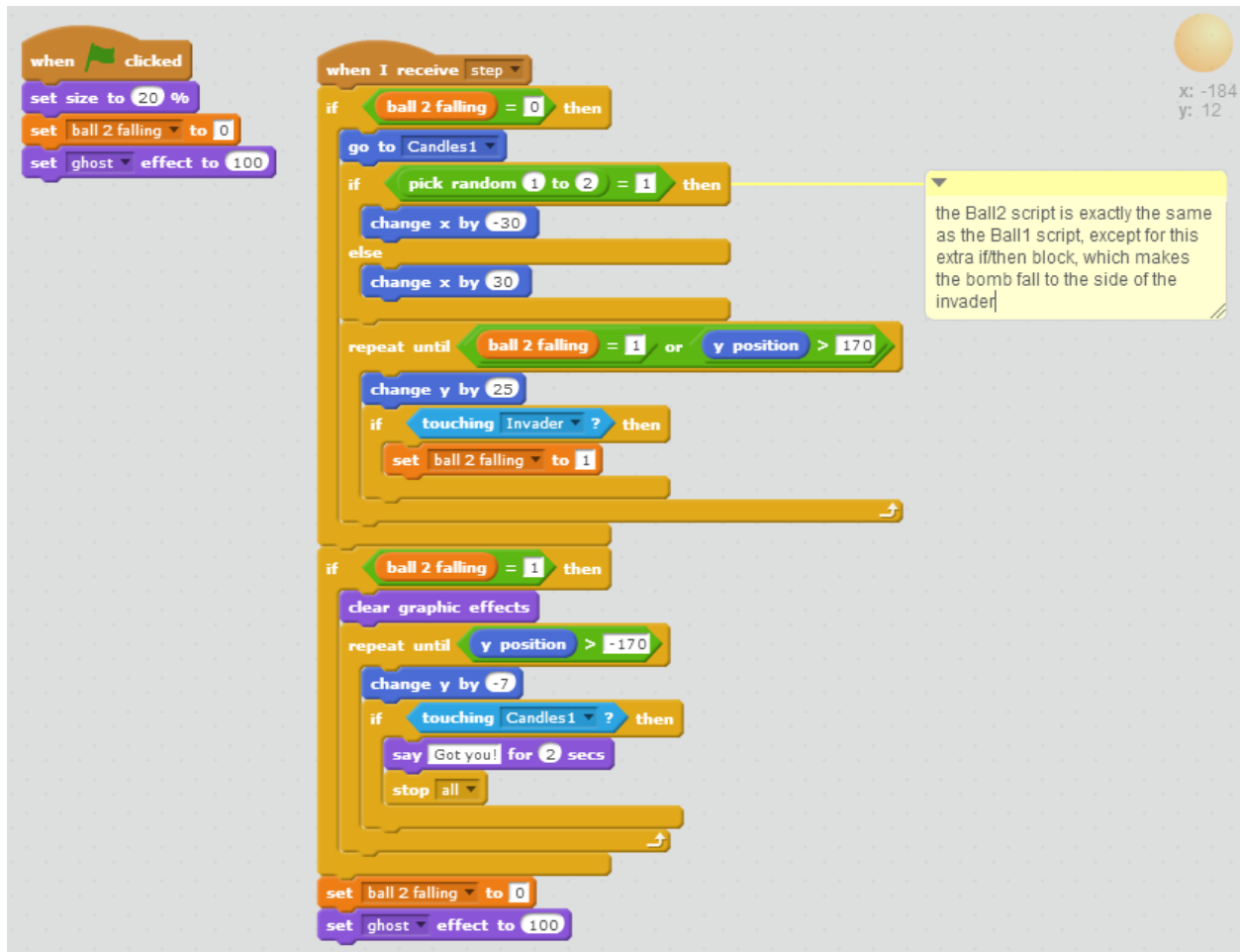
- when clicked
 - set size to 20 %
 - set ball 1 falling to 0
 - set ghost effect to 100
- when I receive step
 - if ball 1 falling = 0 then
 - go to Candles1
 - repeat until ball 1 falling = 1 or y position > 170
 - change y by 25
 - if touching Invader ? then
 - set ball 1 falling to 1
 - if ball 1 falling = 1 then
 - clear graphic effects
 - repeat until y position < -170
 - change y by -7
 - if touching Candles1 ? then
 - say Got you! for 2 secs
 - stop all
 - set ball 1 falling to 0
 - set ghost effect to 100

Annotations:

- hide to prepare for "search" mode (points to 'set ghost effect to 100')
- if I'm not already falling, do my "search" mode by (invisibly) going to the shooter and then moving up until I touch the first invader; if I touch one, start falling (points to the first 'if' block)
- if I'm falling, clear the ghost effect to make myself visible, and then drop straight down until I hit the shooter or the bottom of the screen (points to the second 'if' block)
- if I got to the bottom of the screen without hitting the shooter, clear the falling flag and make myself invisible again (points to the final 'set' blocks)

Coordinates: x: -214, y: 12

7. The Ball2 (aka bomb 2) script. Use “duplicate” sprite and just make one small change to the script.



The image shows a Scratch script for a ball object. The script is organized into three main sections:

- Initialization (when clicked):** The ball's size is set to 20%, the 'ball 2 falling' variable is set to 0, and the 'ghost effect' is set to 100.
- Initial Movement (when I receive step):** If 'ball 2 falling' is 0, the ball goes to 'Candles1'. A 'pick random 1 to 2 = 1' block is added, which then changes the x-position by -30. Otherwise, it changes the x-position by 30. A 'repeat until' loop moves the ball down by 25 units until 'ball 2 falling' is 1 or the y-position is greater than 170. If it touches 'Invader', 'ball 2 falling' is set to 1.
- Collision and Reset:** If 'ball 2 falling' is 1, the ball's graphic effects are cleared. A 'repeat until' loop moves the ball up by 7 units until its y-position is greater than -170. If it touches 'Candles1', it says 'Got you!' for 2 seconds and stops all scripts. Finally, 'ball 2 falling' is set back to 0 and 'ghost effect' is set to 100.

A callout box points to the 'pick random 1 to 2 = 1' block with the text: "the Ball2 script is exactly the same as the Ball1 script, except for this extra if/then block, which makes the bomb fall to the side of the invader".

```
when clicked
  set size to 20 %
  set ball 2 falling to 0
  set ghost effect to 100

when I receive step
  if ball 2 falling = 0 then
    go to Candles1
    if pick random 1 to 2 = 1 then
      change x by -30
    else
      change x by 30
  repeat until ball 2 falling = 1 or y position > 170
    change y by 25
    if touching Invader ? then
      set ball 2 falling to 1

  if ball 2 falling = 1 then
    clear graphic effects
    repeat until y position > -170
      change y by 7
      if touching Candles1 ? then
        say Got you! for 2 secs
        stop all
    set ball 2 falling to 0
    set ghost effect to 100
```