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Communicating micro:bits

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Intro to micro:bit

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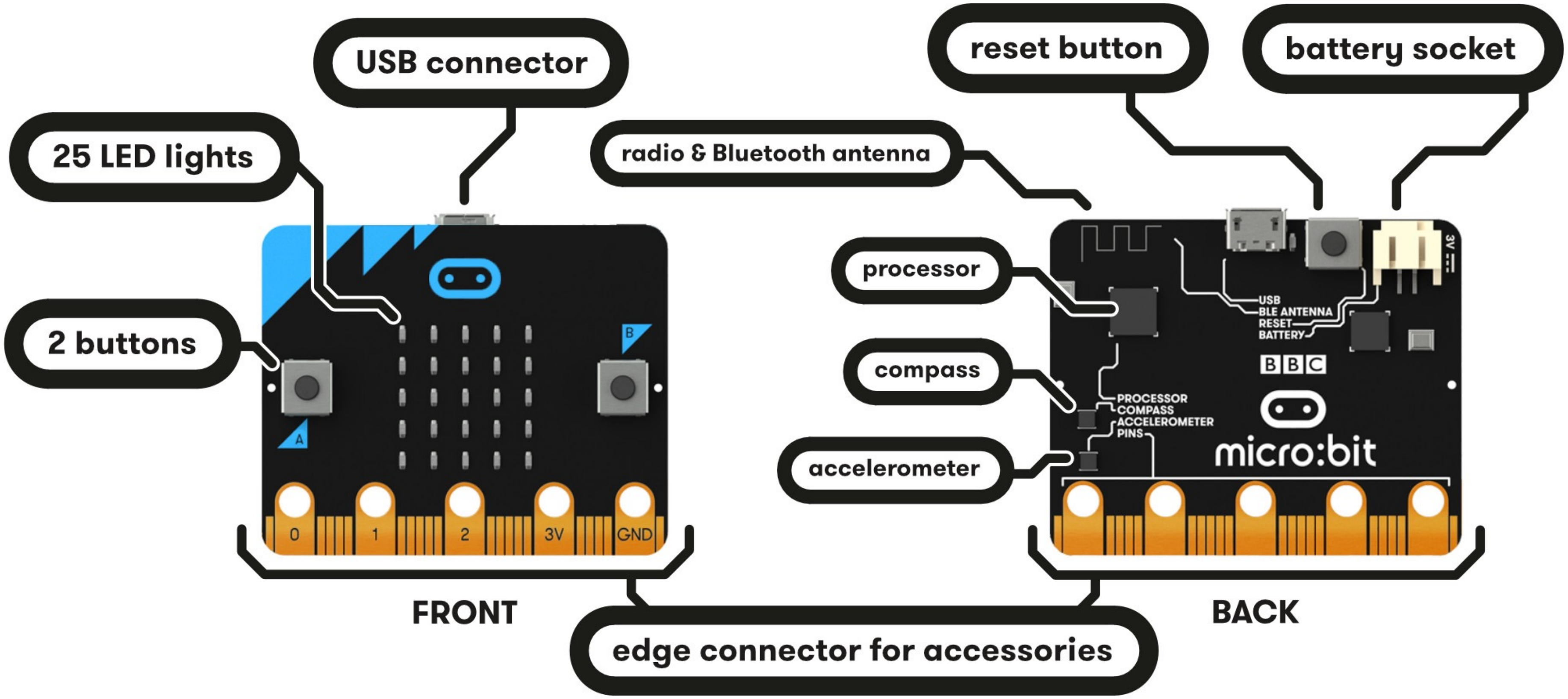
What is a micro:bit?



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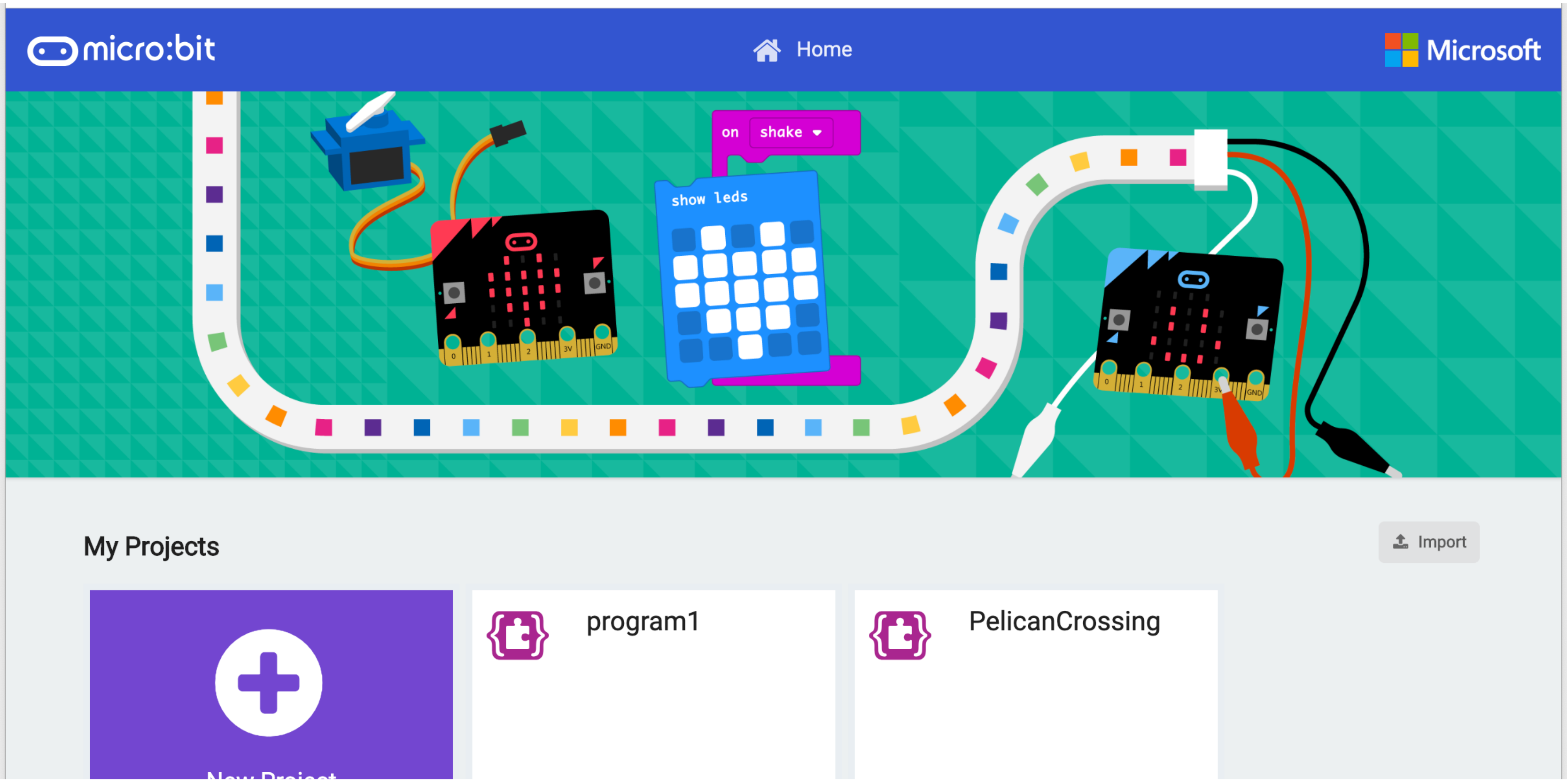
Starting with MakeCode

makecode.microbit.org



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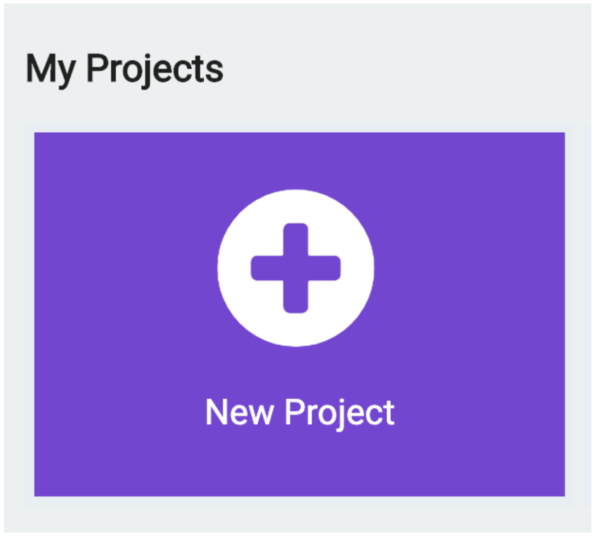
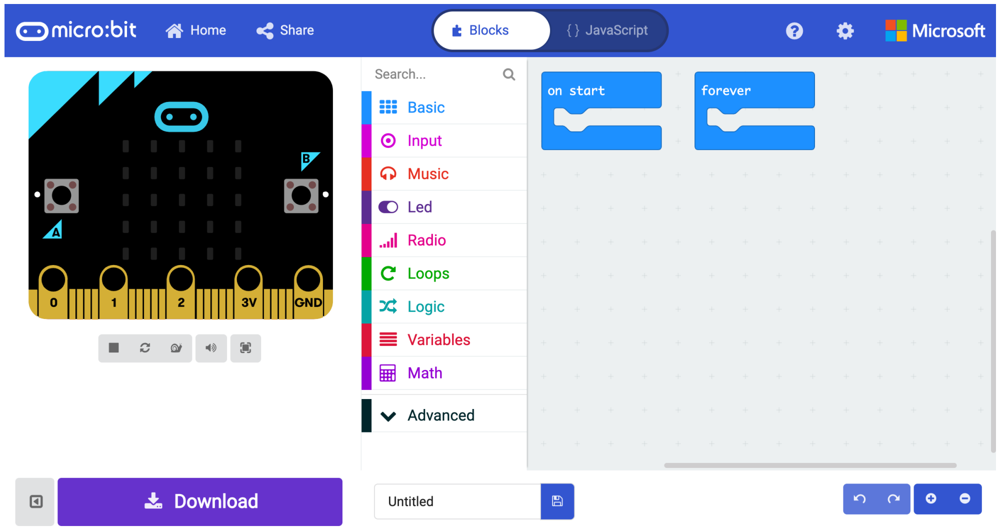
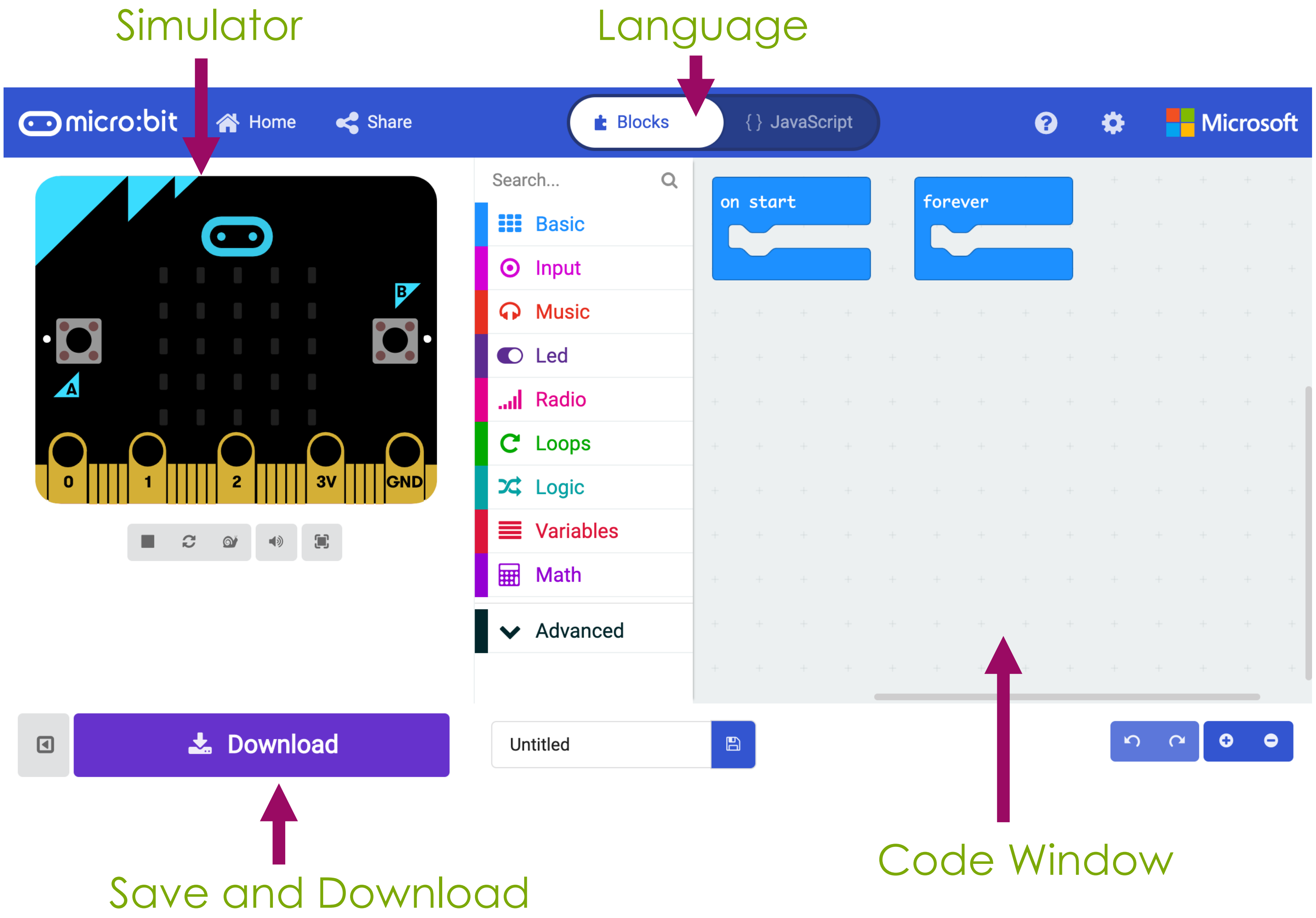
Starting with MakeCode

Click New Project

It should look like this!






Simulator
Language
micro:bit
Home
Share
Blocks
{ } JavaScript
Microsoft
Search...
Basic
Input
Music
Led
Radio
Loops
Logic
Variables
Math
Advanced
on start
forever
Download
Untitled
Save and Download
Code Window

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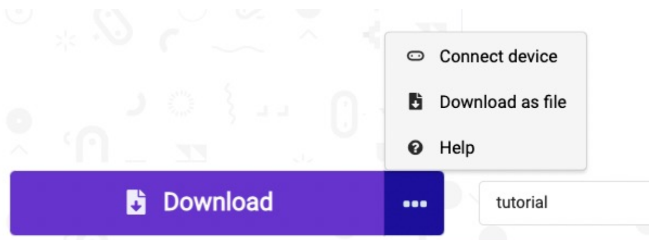
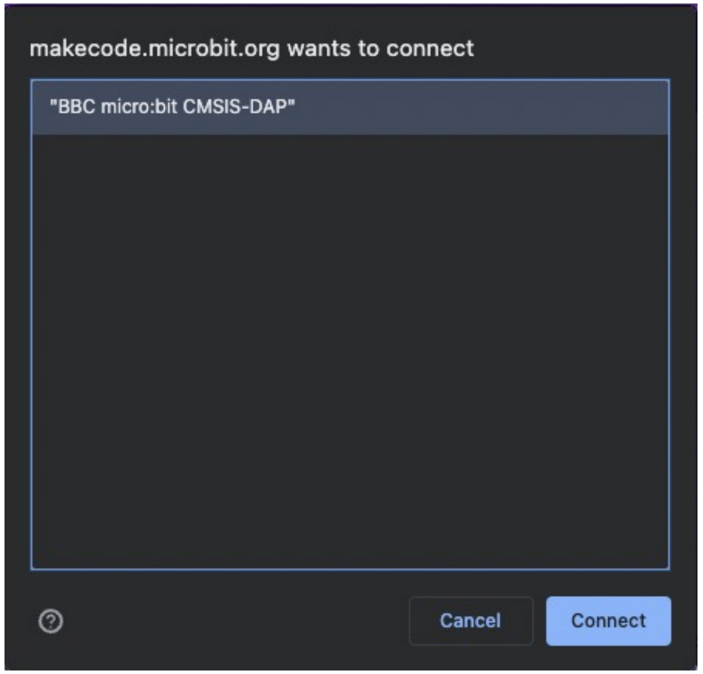
Connecting the micro:bit

1. Plug the micro:bit into your computer

2. In the bottom left of your screen, click the 3 dots next to 'Download', then click 'Connect Device'



3. Follow the on-screen instructions until you see this popup


makecode.microbit.org wants to connect

"BBC micro:bit CMSIS-DAP"

4. Click the name of your device (it should be the only option)

5. Click connect

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Activity: Smile!

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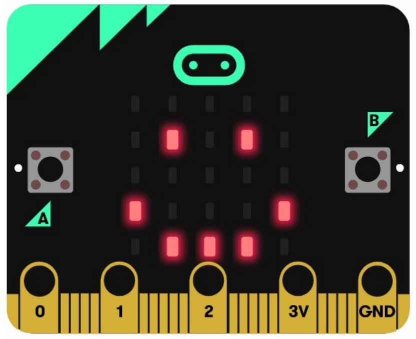
Smile!

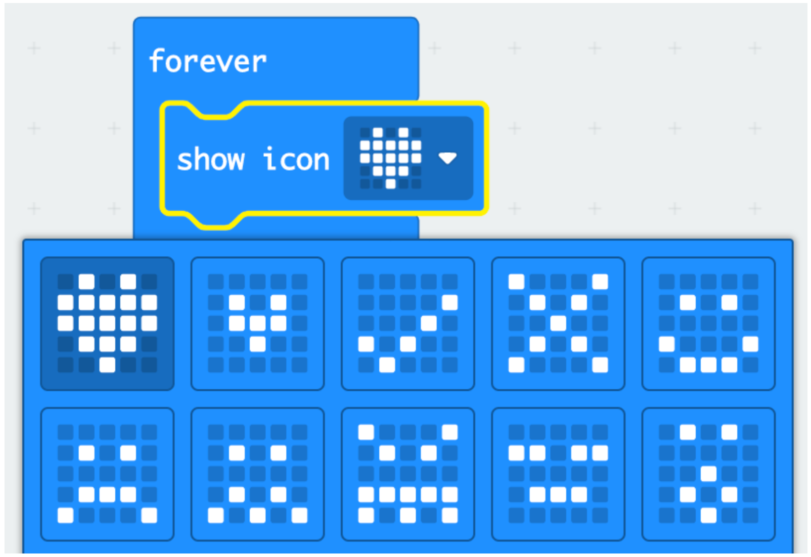
Let's start by displaying a happy face:

1. Click on basic
2. Click on the show icon command
3. Drag and drop it into the forever block
4. Use the dropdown menu to change the icon to a happy face
5. Click on download

What happens to the micro:bit?

Try choosing a different icon!





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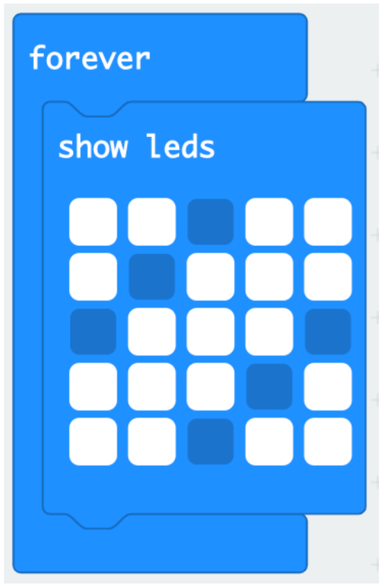
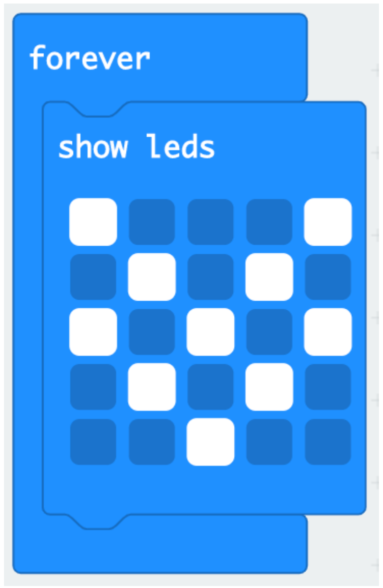
Custom Icons

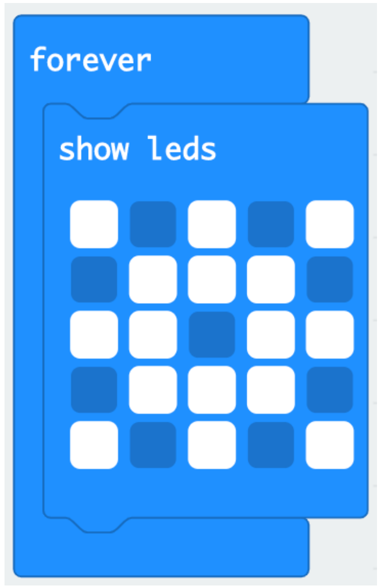
The show leds command lets us choose exactly which LED lights we want to light up.

This can be used to create your own icons.

See which shapes you can make. Remember to click download!







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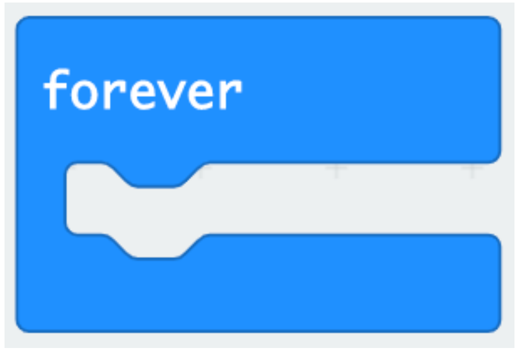
Activity: Changing Faces

Loops

- Loops allow us to repeat commands.
- They can be repeated forever, for a certain number of times, or for a given condition.
- These commands are found in the Loops section

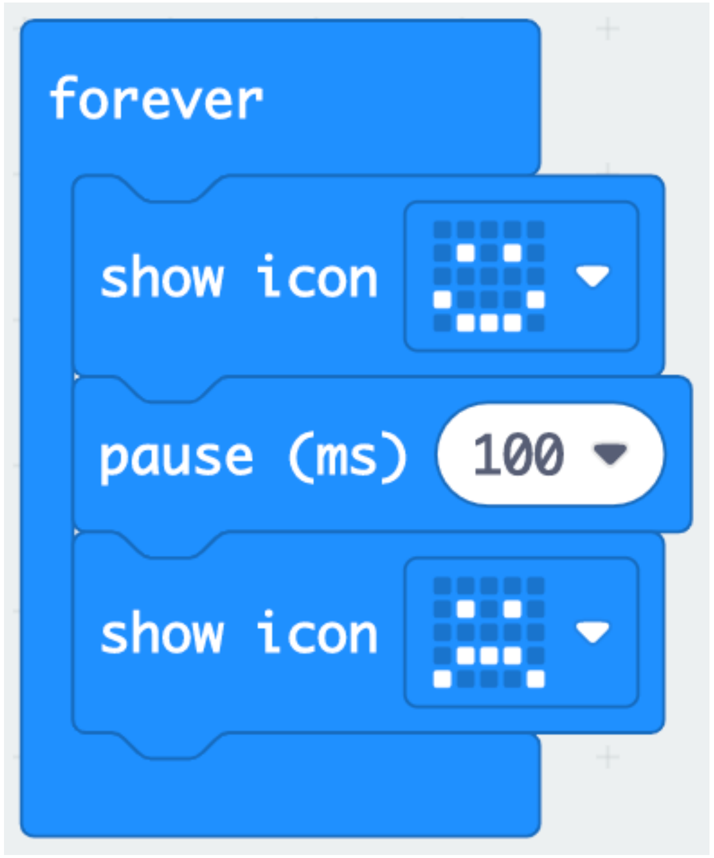
Default Loop

- We have a default loop command when we start the micro:bit project – the forever loop.
- The forever loop runs a set of commands until the micro:bit is unplugged or reset.
- You can only have one forever loop in the micro:bit code.



Changing Faces

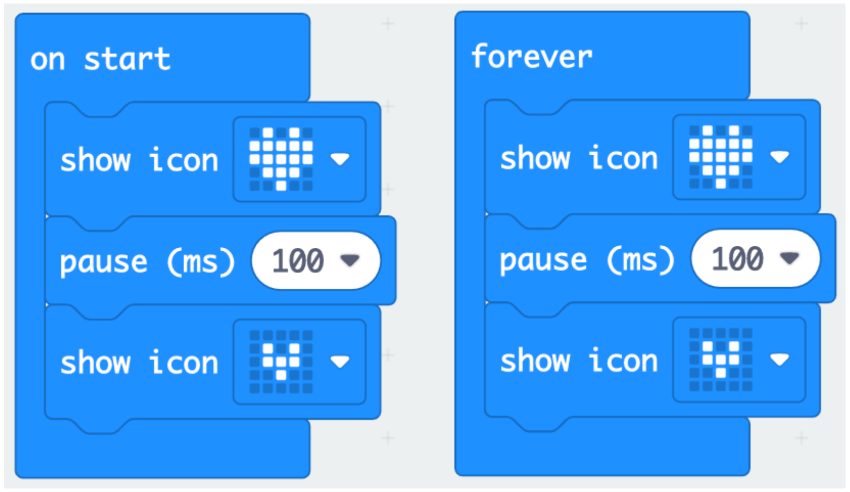
- We have created an application which shows the happy face icon on the micro:bit.
- Now we can extend our application to show an animation.
- Add a pause (ms) 100 command and add a sad face icon after the pause.
- What happens when you download the program onto the micro:bit?



```
forever
    show icon
    pause (ms) 100
    show icon
```

On Start vs Forever

- on start will run the code as soon as the micro:bit starts and ends once the code ends.
- forever will run the code well…forever.
- Try these two examples. What happens differently when you put the code in the on start loop instead of the forever block?



```
on start
    show icon
    pause (ms) 100
    show icon
```

```
forever
    show icon
    pause (ms) 100
    show icon
```

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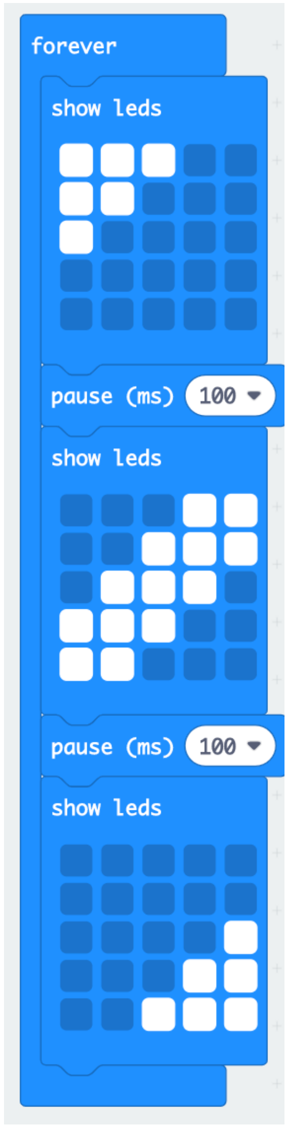
Make Your Own Animation



```
forever
    show leds
    pause (ms) 100
    show leds
    pause (ms) 100
    show leds
```

- So far, we have used the default icons to create our animations
- Try using the show leds command you saw earlier to create your own animation.

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Activity: Events

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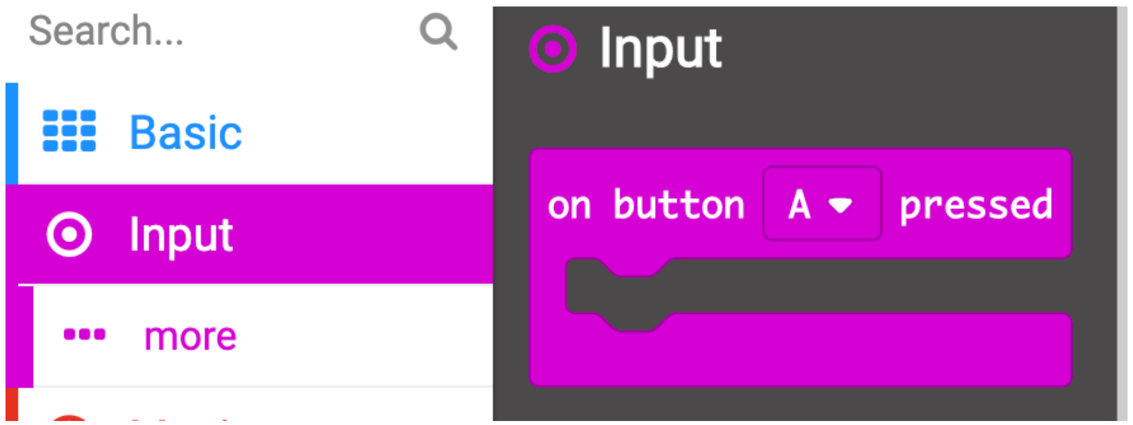
Events

- Each micro:bit has two buttons, A and B.
- These buttons help us choose which action to take without reprogramming the micro:bit each time.
- For example, we can show a happy face when we press button A and a sad face when we press button B.
- The commands we need are found in the input section.



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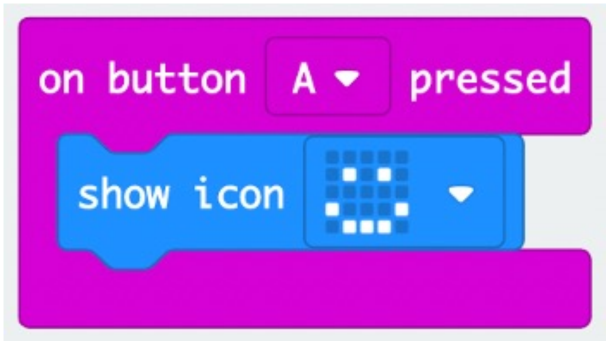
Events

Let's try using an event for button A:

1. Click on input
2. Drag and drop the on button A pressed block into your code
3. Now click on basic and drag and drop the show icon into the event block
4. Choose your favourite icon and download the code.

What happens?



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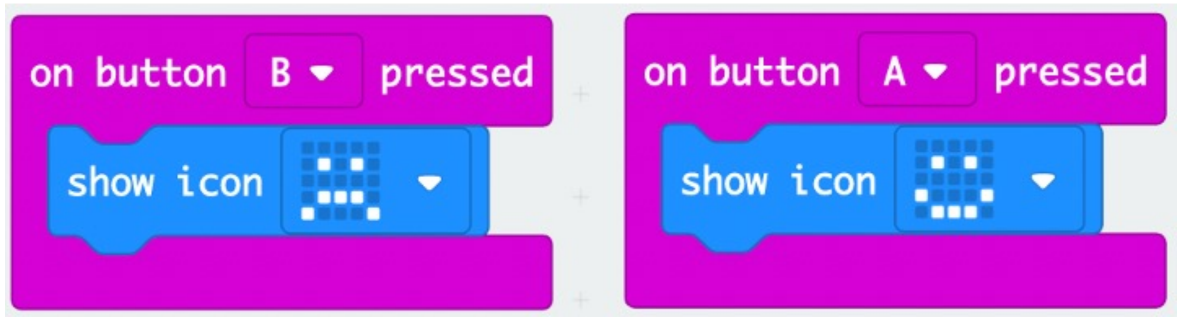
Multiple Events

- We can use multiple input commands – one for each button.
- Try adding an input for button B, the same way you did for button A.
- Try running the code.



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Activity: Radio Communication

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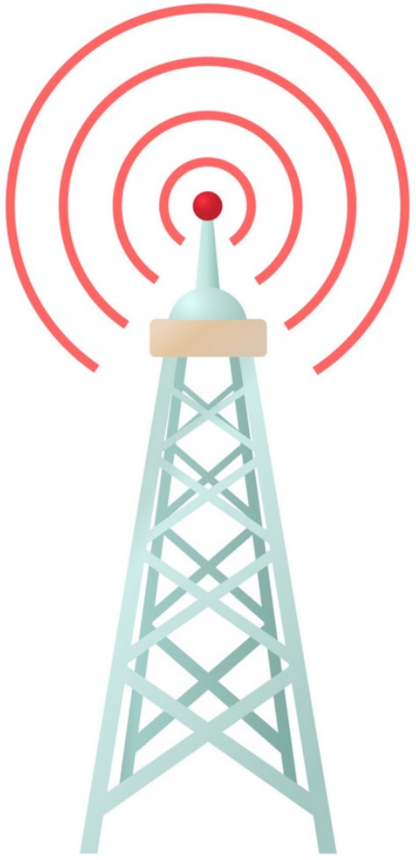
Radio Communication

- Radio is a way of communicating through radio waves.
- This means we can send information from one place to another over very long distances.
- Can you think of something that might use radio?



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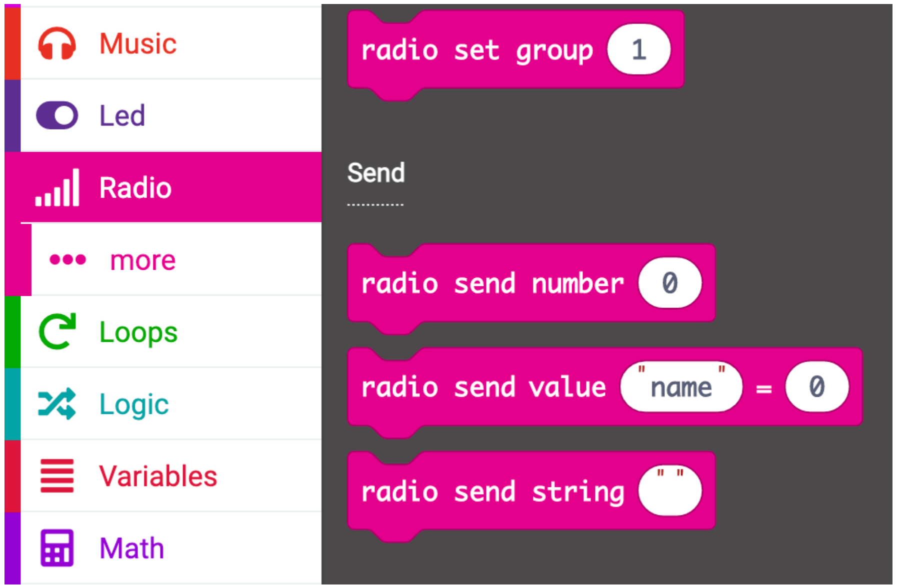
Radio Communication

- Micro:bits have a Bluetooth feature that allows them to communicate with each other.
- We can use this to send messages between micro:bits.
- The blocks we need for this are found in the Radio section.



```
radio set group 1
radio send number 0
radio send value "name" = 0
radio send string " "
```

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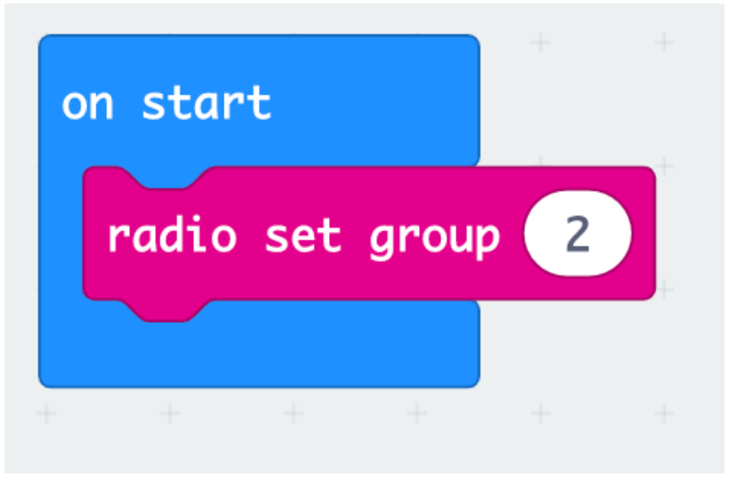
Radio Groups

- Before we can send messages to each other we have to set the radio group.
- Radio groups are like channels – any micro:bit using the same group will receive the message.
- Try setting both micro:bits to the same radio group - this can be any number, just make sure they are the same!



```
on start
    radio set group 2
```

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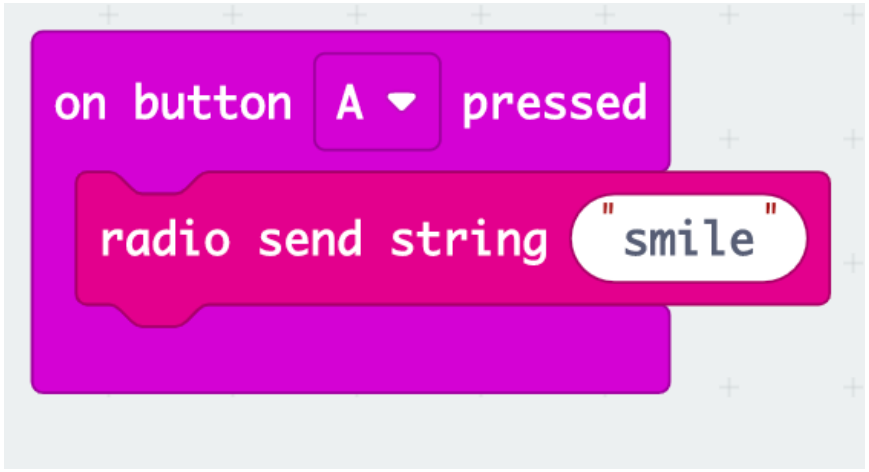
Sending...

- With the micro:bits in the same radio group, we can start sending messages between them.
- There are two ways to send information:

1. radio send number to send a number
2. radio send string to send a message

- Let’s try sending a text message.



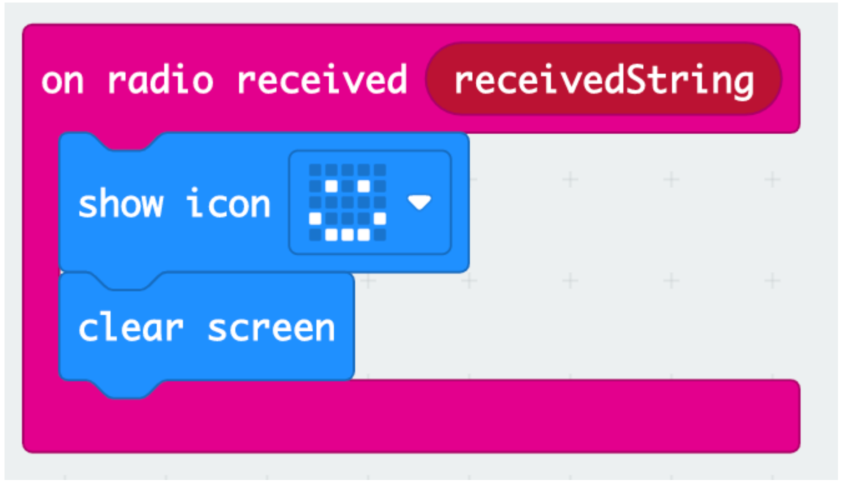
```
on button A ▾ pressed
    radio send string "smile"
```

… and Receiving

Now that one micro:bit has sent a message, we need to tell the other micro:bit what to do with the message it received.

Drag the on radio received received string block into your code and choose an icon to display.

Try the code and see what happens.



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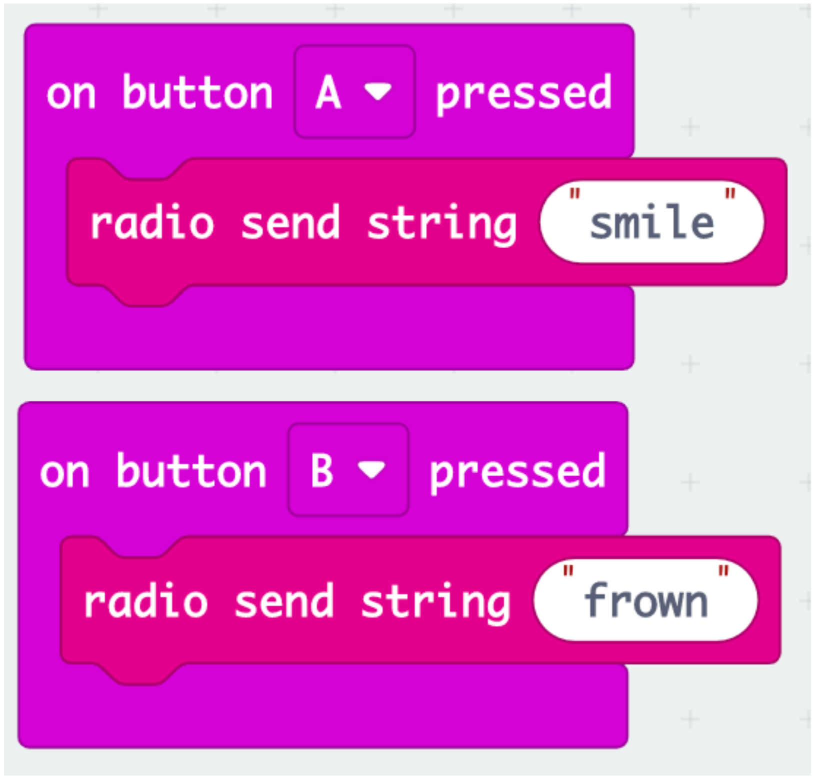
Sending Different Messages

We can use the buttons on the micro:bit to choose different messages to send.

Now add a second event.

Try running the code to see what happens. Can you spot the problem? How do you think we can solve this?



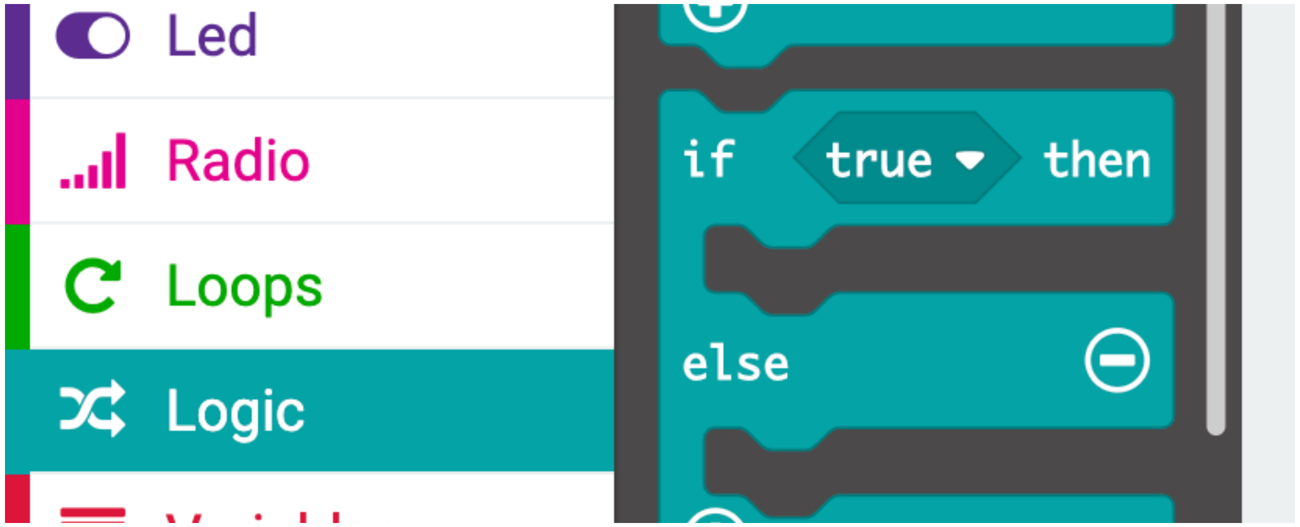
```
on button A ▾ pressed
    radio send string "smile"

on button B ▾ pressed
    radio send string "frown"
```

Conditionals

Conditions

- Conditions help us perform different actions based on different conditions.
- These conditions should always result in Yes/No or True/False.
- For example:
  - **If** my homework is done, **then** I can go outside to play.
  - **If** I have eaten my dinner, **then** I can have dessert.
- Can you think of some more examples?

Logic



- In micro:bit these conditional statements are found under Logic section.

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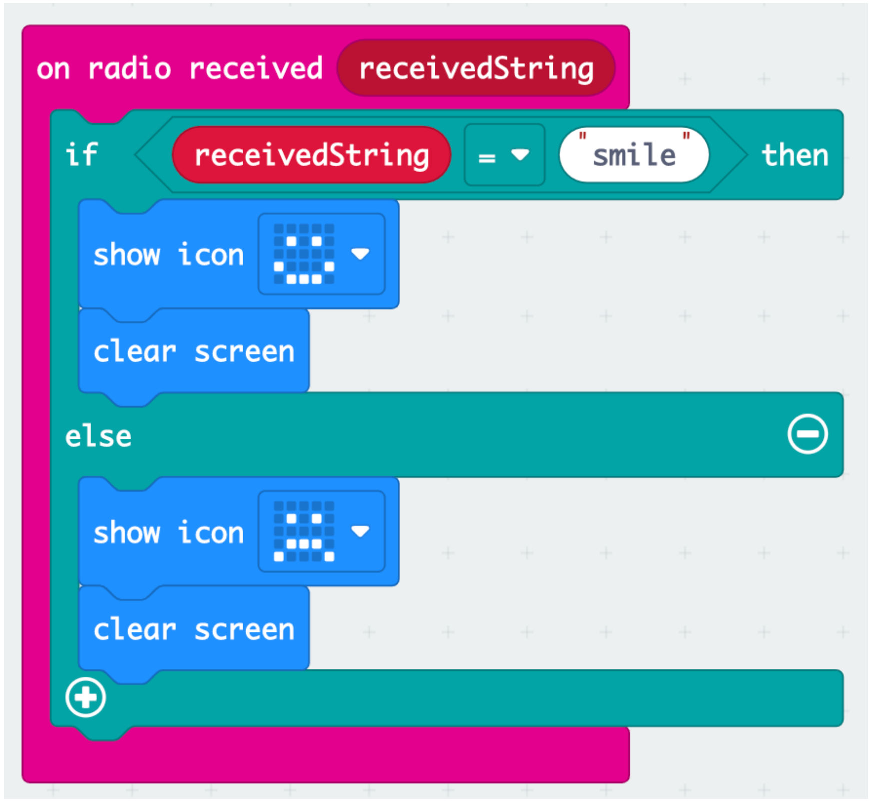
Receiving Different Messages

- Now we can tell the micro:bit to display a different icon when receiving different messages.
- Drag the if-else statement into the on radio received block and change the input and output.
- Try running the code to see what happens!



```
on radio received receivedString
  if receivedString = "smile" then
    show icon
    clear screen
  else
    show icon
    clear screen
```

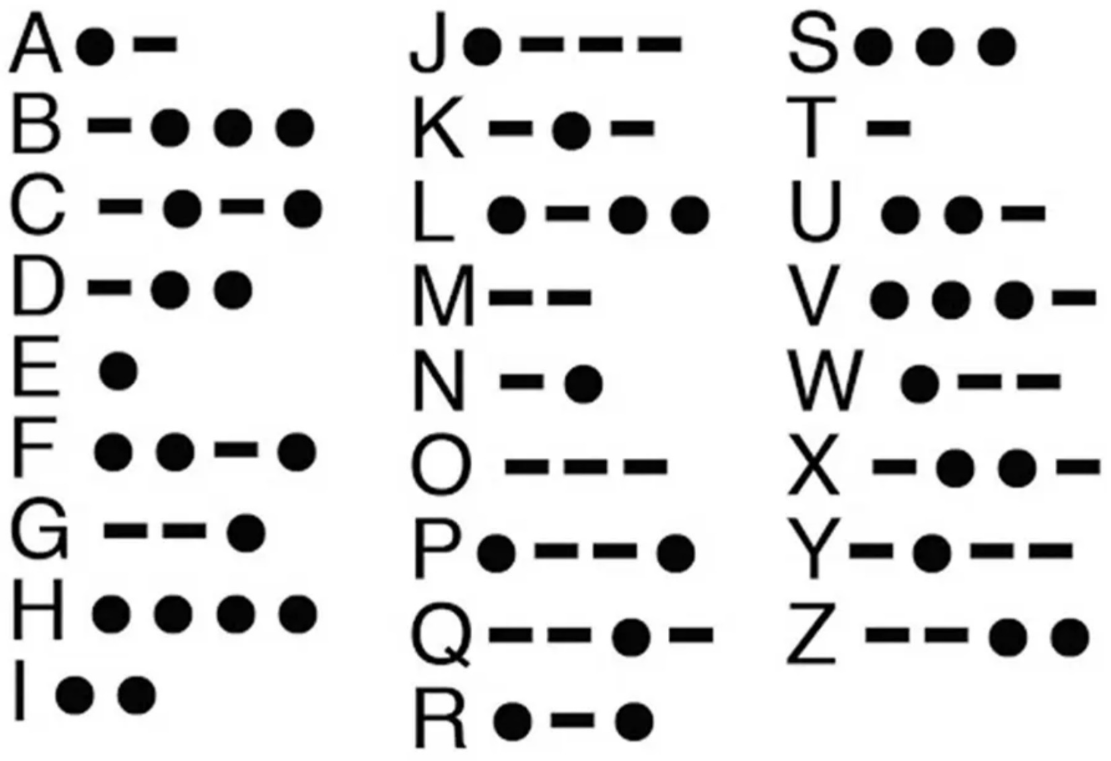
Morse Code

Samuel Morse

- Before the telephone was invented, we couldn't transmit complex messages over a distance.
- In the 1800s, the American Samuel Morse designed a system of communicating using only two symbols/sounds: **dots** and **dashes.**
- It involved sending either a quick electrical pulse (**dot**) or a longer electrical pulse (**dash**) down a wire.
- The receiver could then translate these **dots** and **dashes** into letters.

Dots and Dashes

- Morse code uses only two symbols to represent every letter and number.



A	•–	J	•–––	S	•••
B	–•••	K	–•–	T	–
C	–•–•	L	•–••	U	••–
D	–••	M	––	V	•••–
E	•	N	–•	W	•––
F	••–•	O	–––	X	–••–
G	––•	P	•––•	Y	–•––
H	••••	Q	––•–	Z	––••
I	••	R	•–•		

Morse Code Example

Let's try to translate this code:

.... . .-.. .-.. ---

Morse Code Example

Let’s try to translate this code:

•••• • •–•• •–•• –––

Morse Code Example

Let’s try to translate this code:

···· · ·–·· ·–·· –––

H

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Morse Code Example

Let’s try to translate this code:

.... . .-.. .-.. ---

H

Morse Code Example

Let’s try to translate this code:

.... . .-.. .-.. ---

H E

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Morse Code Example

Let’s try to translate this code:

•••• • •–•• •–•• –––

H E

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Morse Code Example

Let’s try to translate this code:

•••• • •–•• •–•• –––

H E L

Morse Code Example

Let’s try to translate this code:

•••• • •−•• •−•• −−−

H E L

Morse Code Example

Let’s try to translate this code:

•••• • •–•• •–•• –––

H E L L

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Morse Code Example

Let’s try to translate this code:

••••   •   •−••   •−••   −−−

H E L L

Morse Code Example

Let’s try to translate this code:

••••   •   •−••   •−••   −−−

H E L L O

Uses of Morse Code

- Even though we can now send complex messages to each other, Morse code can still sometimes be useful.

- Can you think of some situations where it might be good to use a language like morse code?

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Uses of Morse Code

- Emergency situations: Using sound, or light, or even physical materials. Especially if you don’t speak the same language as the person you are communicating with.

- Secret messages: Not many people can understand Morse code. You can use it to send secret messages to your friends.

- Communication for people who are unable to talk.

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Activity: Micro:bit Morse Code

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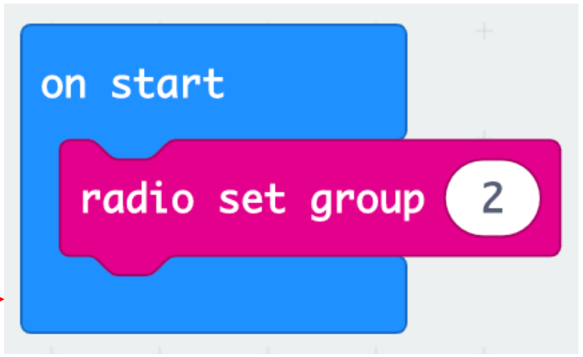
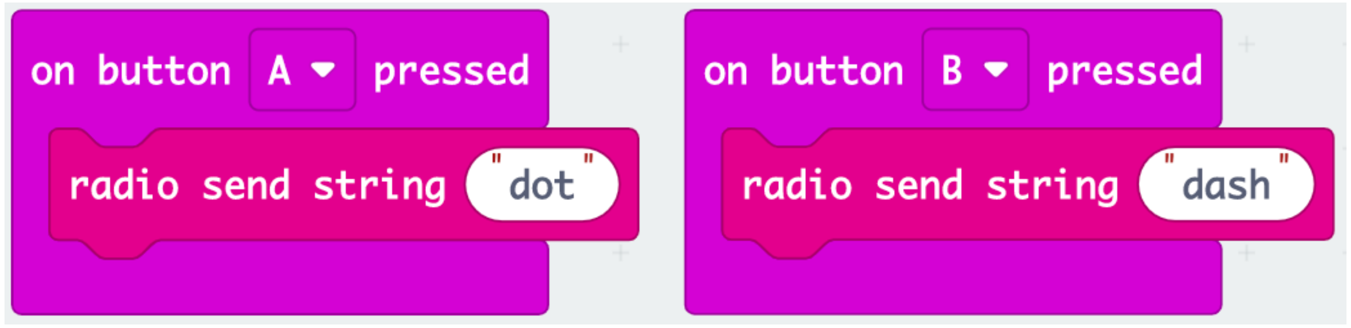
Micro:bit Morse Code

Using everything you have learnt today we are going to program the micro:bits to communicate using Morse code.

1. Start by setting both micro:bits to the same radio group.
2. Use events to send a different messages for each button



```
on start
    radio set group 2
```



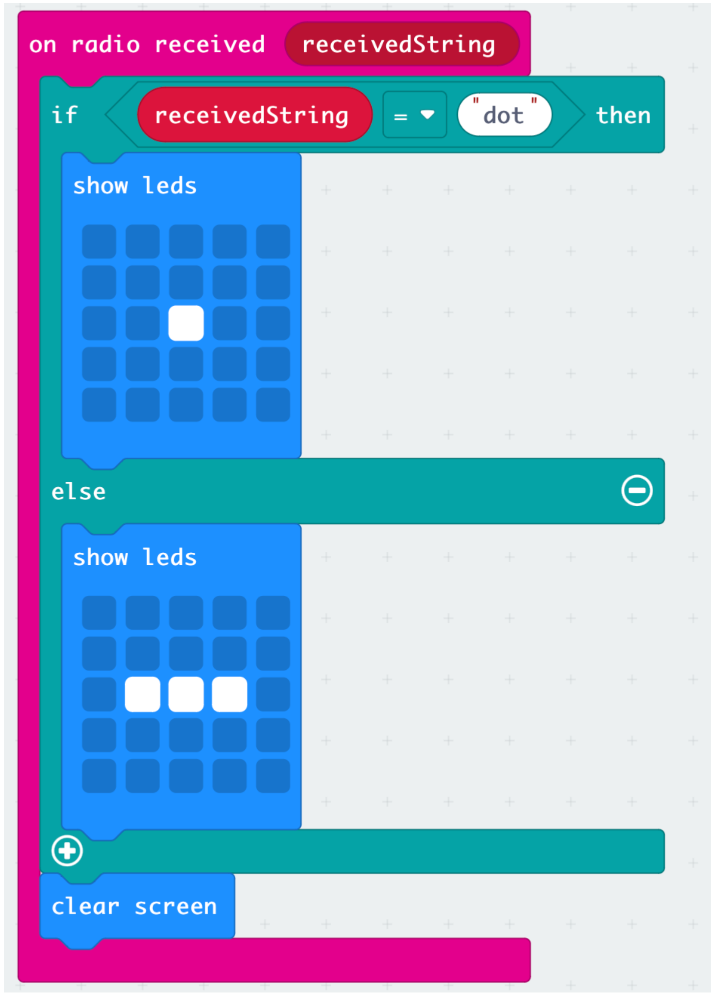
```
on button A pressed
    radio send string "dot"
```

```
on button B pressed
    radio send string "dash"
```

Micro:bit Morse Code

3. Use an if-else statement and the show leds block so that the receiving micro:bit will show the correct output.
4. Try sending some messages to each other. Use the Morse code key and see if you can work out what your friend is trying to say.

Remember to leave a time gap between letters so that your partner knows when to start a new letter.


```
on radio received receivedString
    if receivedString = "dot" then
        show leds
    else
        show leds
    clear screen
```

Extension Activity: Word Breaks

Word Breaks

- Can you think of some problems with using our Morse code radio? What if we want to send entire sentences?
- How does the receiver know when a new word is starting?
- If they don't know when to add a space, they could get a message like "iamlearningtocodewithmicrobit" which can be difficult to understand

- We can add a symbol to represent a word ending.
- We've already used buttons A and B – can you find another input block we can use to send the space symbol signal?

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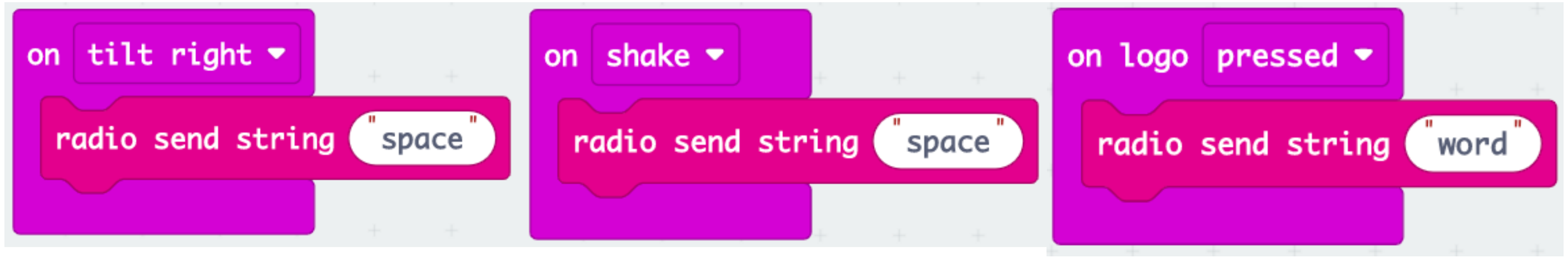
Word Breaks

Input block examples:

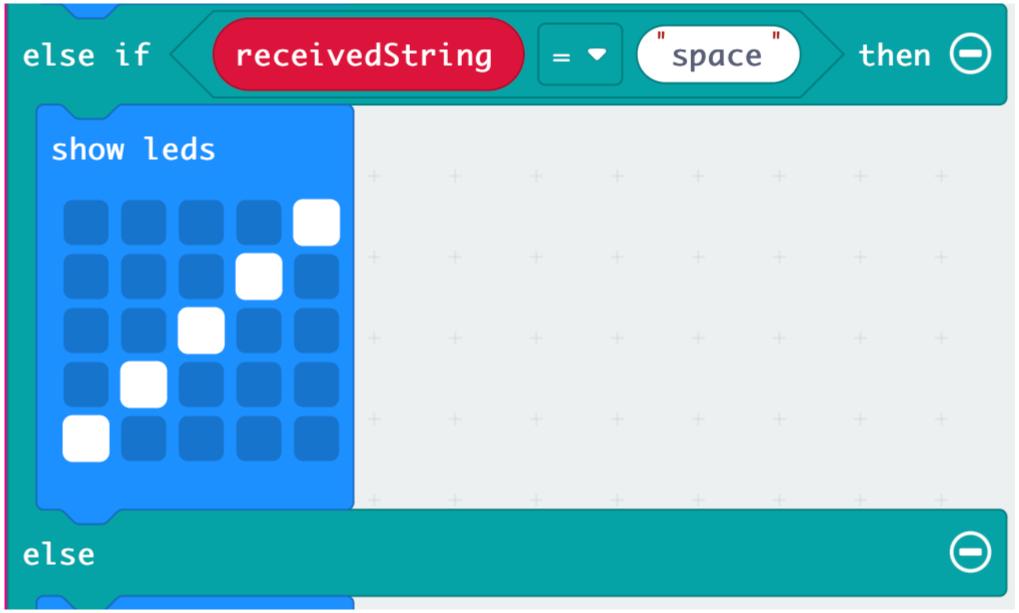


```
on tilt right ▾
  radio send string "space"

on shake ▾
  radio send string "space"

on logo pressed ▾
  radio send string "word"
```

There are many more options – try a few!

Word Breaks

- You will also have to add another condition in the if block.
- Choose an icon to display when a word ends



```
else if  receivedString  = ▾  " space "  then
  show leds
    . . . . #
    . . . # .
    . . # . .
    . # . . .
    # . . . .
else
```

Letter breaks

- Instead of leaving a time gap between letters, you can create yet another symbol to represent a letter ending.
- This will make it even easier for the receiver to understand the message, and quicker for the sender to send the message.