

# Introduction to JavaScript

**Digital Technologies**

Creating Digital Solutions strand

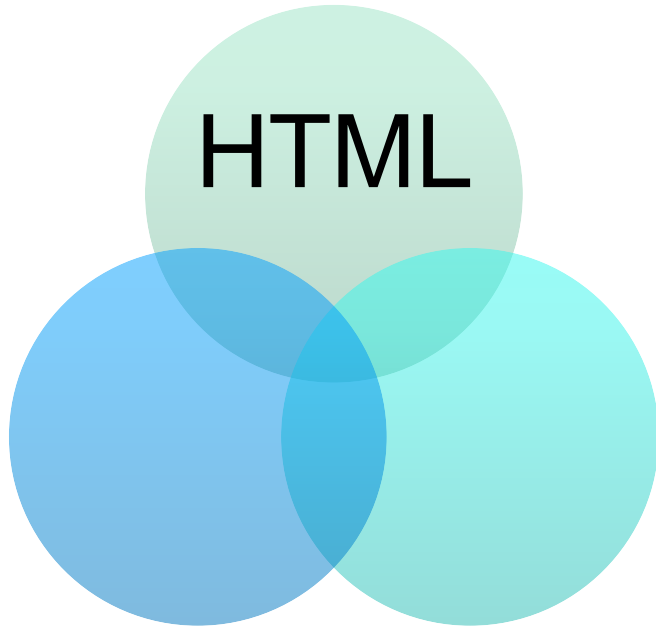
# What is JavaScript?

- scripting language designed to add interactivity to web pages
- included in Netscape Navigator browser (1995)
- (it is NOT Java!)

# Why JavaScript?

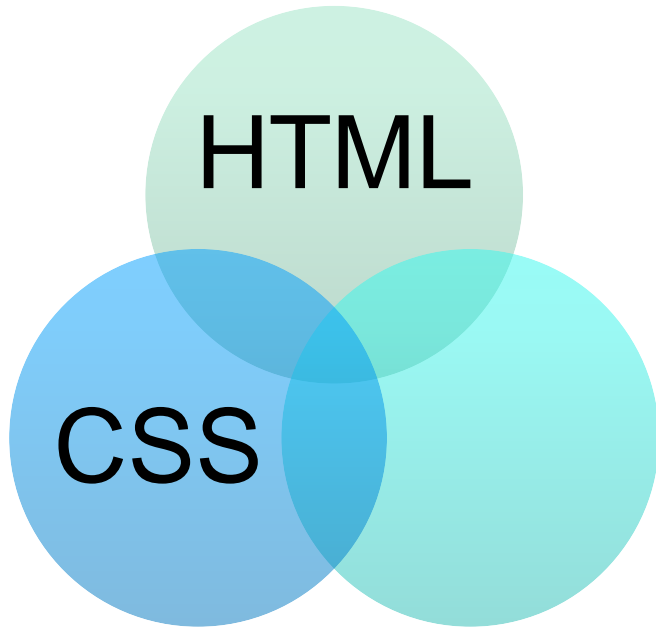
- it is one of the major technologies that powers the web
- easy to learn
- extensive documentation and support resources available

# Why JavaScript?



HTML = content

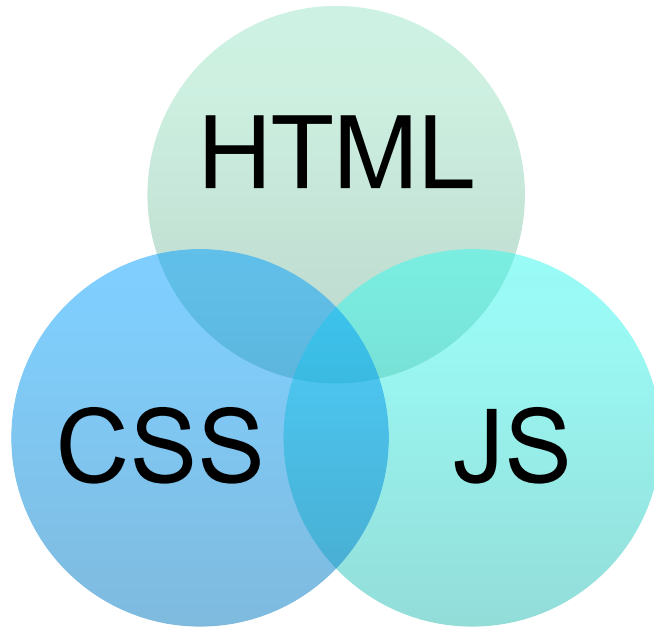
# Why JavaScript?



HTML = content

CSS = presentation

# Why JavaScript?



HTML = content

CSS = presentation

JS = interactivity

# Curriculum

Where can I use JavaScript in teaching Digital Technologies?

# Scope & Sequence F-10

Victorian Curriculum Foundation-10	Digital Technologies: Foundation – Level 10				Victorian Curriculum AND ASSESSMENT AUTHORITY
Foundation – Level 2	Levels 3 and 4	Levels 5 and 6	Levels 7 and 8	Levels 9 and 10	
<b>Digital Systems</b>					
Identify and explain digital systems (hardware and software components) for a purpose	Explore a range of digital systems with peripheral devices for different purposes, and transmit different types of data	Examine the main components of common digital systems, and how both digital systems may connect together to form networks to transmit data	Investigate how data are transmitted and secured in wired, wireless and mobile networks	Investigate the role of hardware and software in managing, controlling and securing the movement of and access to data in networked digital systems	
<b>Data and Information</b>					
Recognise and explain patterns in data and represent data as pictures, symbols and diagrams	Recognise different types of data and explain how the same data can be represented in different ways	Examine how whole numbers are used as the basis for representing all types of data in digital systems	Investigate how digital systems represent text, image and sound data in binary	Analyse simple compression of data and how content data are separated from presentation	
Collect, explore and sort data, and use digital systems to present the data creatively	Collect, access and present different types of data using simple software to create information and solve problems	Analyse, store and validate different types of data and use a range of software to interpret and evaluate data to create information	Acquire data from a range of sources and evaluate their authenticity, accuracy and timeliness	Design techniques for acquiring, storing and validating quantitative and qualitative data from a range of sources, considering privacy and security requirements	
Independently and with others create and organise ideas and information using information systems, and share these with known people in safe online environments	Individually and with others, plan, create and communicate ideas and information safely, seeking agreed ethical and social protocols	Plan, create and communicate ideas, information and online-collaborative projects, seeking agreed ethical, social and technical protocols	Analyse and visualise data using a range of software to create information, and use structured data to create objects or events	Analyse and evaluate data to create information and address complex problems, and model processes, entities and their relationships using structured data	
			Manage, create and communicate interactive ideas, information and projects collaboratively online, taking safety and social contexts into account	Manage and collaboratively create interactive solutions for sharing ideas and information online, taking into account social contexts and legal responsibilities	
<b>Creating Digital Solutions</b>					
Follow, describe and represent a sequence of steps and decisions (algorithms) needed to solve simple problems	Define simple problems, and describe and follow a sequence of steps and decisions involving branching and user input (algorithms) needed to solve them	Define problems in terms of data and functional requirements, drawing on previously solved problems to identify similarities	Define and decompose real-world problems being into account functional requirements and sustainability (economic, environmental, social, technical and usability constraints)	Define and decompose real-world problems precisely, taking into account functional and non-functional requirements and including informing stakeholders to identify needs	
		Design a user interface for a digital system, generating and considering alternative design ideas	Design the user experience of a digital system, generating, evaluating and communicating alternative designs	Design the user experience of a digital system, evaluating alternative designs against criteria including functionality, accessibility, usability and aesthetics	
		Design, modify and follow simple algorithms represented diagrammatically and in English, including sequential steps, branching, and iteration	Design algorithms represented diagrammatically and in English, including sequential steps, branching, iteration and to identify errors	Design algorithms represented diagrammatically and in English, including sequential steps, branching, iteration and test cases	
	Develop simple solutions as visual programs	Develop digital solutions as simple visual programs	Develop and modify programs with user interfaces involving branching, iteration and functions using a general-purpose programming language	Develop modular programs, applying selected algorithms and data structures including using an object-oriented programming language	
Explain how people safely use common information systems to meet information, communication and recreation needs	Explain how system-developed solutions and existing information systems meet common personal, school or community needs	Explain how student-developed solutions and existing information systems meet current and future community and sustainability needs	Evaluate how well student-developed solutions and existing information systems meet needs, are innovative and take account of future risks and sustainability	Evaluate critically how well student-developed solutions and existing information systems meet needs, are innovative and take account of future risks and sustainability and provide opportunities for revision	
<b>Achievement Standard</b>					
By the end of Level 2, students identify how common digital systems and their peripheral devices are used to meet specific purposes. Students use digital systems to represent single patterns in data in different ways and collect familiar data and display them to convey meaning. Students design solutions to simple problems using a sequence of steps and decisions. They create and organise ideas and information using information systems and share these in safe online environments.	By the end of Level 4, students describe how a range of digital systems and their peripheral devices can be used for different purposes. Students explain how the same data can be represented in different ways. They collect and manipulate different data when creating information and digital solutions. They plan and safely use information systems when creating and communicating ideas and information, applying agreed protocols. Students define simple problems, and design and develop digital solutions using algorithms that make decision-making and user input. They explain how their developed solutions and existing information systems meet their purposes.	By the end of Level 6, students explain the functions of digital system components and how digital systems are connected to form networks that transmit data. Students explain how digital systems use whole numbers as a basis for representing a variety of data types. They manage the creation and communication of ideas, information and digital projects collaboratively using validated data and agreed protocols. Students define problems in terms of data and functional requirements and design solutions by developing algorithms to address the problems. They incorporate decision-making, repetition and user interface design into their designs and develop their digital solutions, including a visual program. Students explain how information systems and their developed solutions meet current and future needs taking sustainability into account.	By the end of Level 8, students distinguish between different types of networks and their suitability in meeting different purposes. Students explain how text, image and sound data can be represented and secured in digital systems and presented using digital systems. They analyse and evaluate data from a range of sources to make solutions and create information. They manage the collaborative creation of interactive ideas, information and projects and use appropriate codes of conduct when communicating online. Students define and decompose problems in terms of functional requirements and constraints. They design user experiences and algorithms incorporating branching and iteration, and develop, test, and modify digital solutions. Students evaluate information systems, and their solutions in terms of meeting needs, innovation and sustainability.	By the end of Level 10, students explain the control and management of networked digital systems, and the data security implications of the interaction between hardware, software and users. Students explain simple data compression, and why content data are separated from presentation. They take account of privacy and security requirements when collecting and validating data and use digital systems to analyse, visualise and model actual aspects of data. Students share and collaborate online, establishing protocols for the legal and safe use, transmission and maintenance of data and projects. Students define and decompose complex problems in terms of functional and non-functional requirements. They design and evaluate user experiences, and algorithms, and develop and test modular programs, including an object-oriented program. Students evaluate their solutions and information systems in terms of risk, sustainability and potential for revision.	



# Creating Digital Solutions

## Levels 7 and 8

- Develop and modify programs with **user interfaces** involving **branching**, **iteration** and **functions** using a **general-purpose programming language** (VCDTCD043)

## Levels 9 and 10



- Develop **modular** programs, applying selected algorithms and **data structures** including using an **object-oriented programming language** (VCDTCD0053)

# User interface

- Web page is interface
- Event model
- Objects in page can have actions attached
- Page listens for events

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Level D (Towards Foundation)	Foundation to Level 2	Levels 3 and 4
<p><b>Level D Description</b></p> <p>In Level D, students are building their independence and participating cooperatively in group learning activities. They combine and sequence key words and images to communicate personal interest...</p> <p><a href="#">Show more</a></p>	<p><b>Foundation to Level 2 Description</b></p> <p>In Foundation to Level 2, students are introduced to common digital systems and patterns that exist within data they collect. Students organise, manipulate and present this data, including numerical...</p> <p><a href="#">Show more</a></p>	<p><b>Levels 3 and 4 Description</b></p> <p>In Levels 3 and 4, students explore digital systems in terms of their components and peripheral devices such as digital microscopes, cameras and interactive whiteboards. They collect, manipulate...</p> <p><a href="#">Show more</a></p>
<p><b>Level D Content Descriptions</b></p> <hr/> <p><b>Digital Systems</b></p> <p>Carry out some key functions on digital systems (hardware and software components) to meet a purpose (VCDTDS010)</p> <hr/> <p><b>Data and Information</b></p>	<p><b>Foundation to Level 2 Content Descriptions</b></p> <hr/> <p><b>Digital Systems</b></p> <p>Identify and explore digital systems (hardware and software components) for a purpose (VCDTDS013)</p> <hr/> <p><b>Data and Information</b></p>	<p><b>Levels 3 and 4 Content Descriptions</b></p> <hr/> <p><b>Digital Systems</b></p> <p>Explore a range of digital systems with peripheral devices for different purposes, and transmit different types of data (VCDTDS019)</p> <hr/> <p><b>Data and Information</b></p>

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**Level D (Towards Foundation)**

**Level D Description**

In Level D, students are building their independence and participating cooperatively in group learning activities. They combine and sequence key words and images to communicate personal interest...

Show more

**Level D Content Descriptions**

**Digital Systems**

Carry out some key functions on digital systems (hardware and software components) to meet a purpose (VCDTDS010)

**Data and Information**

**Foundation to Level 2**

**Foundation to Level 2 Description**

In Foundation to Level 2, students are introduced to common digital systems and patterns that exist within data they collect. Students organise, manipulate and present this data, including numerical...

Show more

**Foundation to Level 2 Content Descriptions**

**Digital Systems**

Identify and explore digital systems (hardware and software components) for a purpose (VCDTDS013)

**Data and Information**

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```

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97   allSelected: 'Showing all'
98 });
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100 $('#select-ccps').multiSelect({
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102   noneSelected: 'Cross-curriculum priorities',
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### Level D (Towards Foundation)

**Level D Description**

In Level D, students are building their independence and participating cooperatively in group learning activities. They combine and sequence key words and images to communicate personal interest...

Show more

**Level D Content Descriptions**

**Digital Systems**

Carry out some key functions on digital systems (hardware and software components) to meet a purpose (VCDTDS010)

**Data and Information**

### Foundation to Level 2

**Foundation to Level 2 Description**

In Foundation to Level 2, students are introduced to common digital systems and patterns that exist within data they collect. Students organise, manipulate and present this data, including numerical...

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**Foundation to Level 2 Content Descriptions**

**Digital Systems**

Identify and explore digital systems (hardware and software components) for a purpose (VCDTDS013)

**Data and Information**

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$('#select-ccps').multiSelect({
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JavaScript files

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**Level D Content Descriptions**

**Digital Systems**

Carry out some key functions on digital systems (hardware and software components) to meet a purpose (VCDTDS010)

**Data and Information**

### Foundation to Level 2

**Foundation to Level 2 Description**  
In Foundation to Level 2, students are introduced to common digital systems and patterns that exist within data they collect. Students organise, manipulate and present this data, including numerical...

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**Foundation to Level 2 Content Descriptions**

**Digital Systems**

Identify and explore digital systems (hardware and software components) for a purpose (VCDTDS013)

**Data and Information**

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**Level D Content Descriptions** **Foundation to Level 2 Content Descriptions**

**Digital Systems** **Digital Systems**

**Data and Information** **Data and Information**

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**Level D Content Descriptions** **Foundation to Level 2 Content Descriptions**

**Digital Systems** **Digital Systems**

Carry out some key functions on digital systems (hardware and software components) to meet a purpose (VCDTDS010)

Identify and explore digital systems (hardware and software components) for a purpose (VCDTDS013)

**Data and Information** **Data and Information**

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Level D Content Descriptions Foundation to Level 2 Content Descriptions

Digital Systems Digital Systems

Carry out some key functions on digital systems (hardware and software components) to meet a purpose (VCDTDS010)

Identify and explore digital systems (hardware and software components) for a purpose (VCDTDS013)

Data and Information Data and Information

Collect, sort, and recognise, with assistance, different types of patterns in data, and use digital systems to represent data as pictures, symbols and diagrams (VCDTDI011)

Recognise and explore patterns in data and represent data as pictures, symbols and diagrams (VCDTDI014)

Collect, explore and sort data, and use digital systems to present the data creatively (VCDTDI015)

Independently and with others create and organise

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Elements Network Resources Timelines Debugger Storage Canvas

All Resources Documents

f-10 — victoriancurriculum.vcaa.vic.edu.au

- Images
- Scripts
  - common.js**
  - core.js
  - cstyle.js
  - cstyle.rules.js
  - jquery-ui.js
  - jquery.ba-bbq.js
  - jquery.blockUI.js
  - jquery.cookie.js
  - jquery.dialogOptions.js
  - jquery.hint.js
  - jquery.hoverIntent.js
  - jquery.multiSelect.js
  - jquery.scrollToView.js
  - json2.js
  - modernizr.js
  - pxem.jquery.js
  - respond.js
  - jquery-1.11.1.min.js — code.jquery.com
  - ga.js — www.google-analytics.com
- Stylesheets
- Extension Scripts

```
// Curriculum filter drop-downs
$('#select-year-levels').multiSelect({
  noneSelected: 'No levels selected',
  oneOrMoreSelected: 'Showing selected levels',
  allSelected: 'Showing all levels'
});

$('#select-domains').multiSelect({
  noneSelected: 'No selections',
  oneOrMoreSelected: 'Showing selections',
  allSelected: 'Showing all'
});

$('#select-ccps').multiSelect({
  selectAllText: 'Show all cross-curriculum priorities',
  noneSelected: 'Cross-curriculum priorities',
  oneOrMoreSelected: 'Cross-curriculum priorities',
  allSelected: 'Cross-curriculum priorities'
});

// Curriculum show/hide options
$('#show-leveldescs')
  .click(function () {
    cstyle.enable('f10-descs-hide', this.checked != true);
  })
  .attr('checked', !cstyle.isEnabled('f10-descs-hide'));

$('#show-contentdescs')
  .click(function () {
    cstyle.enable('f10-cds-hide', this.checked != true);
  })
  .attr('checked', !cstyle.isEnabled('f10-cds-hide'));

$('#show-achvmtstds')
  .click(function () {
    cstyle.enable('f10-achstds-hide', this.checked != true);
  })
  .attr('checked', !cstyle.isEnabled('f10-achstds-hide'));
});
```

# Branching

Branching describes ‘conditional statements’ where there is more than one possible outcome of an operation

# Branching

'if' statement is simplest case

```
if (age < 18)
```

```
    alert('You are not allowed to access this page!');
```

# Branching

'if/else' structure gives us alternate paths

```
if (temperature < 18)
    turnHeaterOn();
else
    turnHeaterOff();
```

# Branching

'if/else if' structure gives us multiple choices

```
if (light === 'green')  
    go();  
else if (light === 'yellow')  
    stop();  
else  
    wait();
```

# Branching

```
if (key === 'w')
  up();
else if (key === 's')
  down();
else if (key === 'a')
  left();
else if (key === 'd')
  right();
else ...
```

'if/else if' can get  
unwieldy with lots of  
options

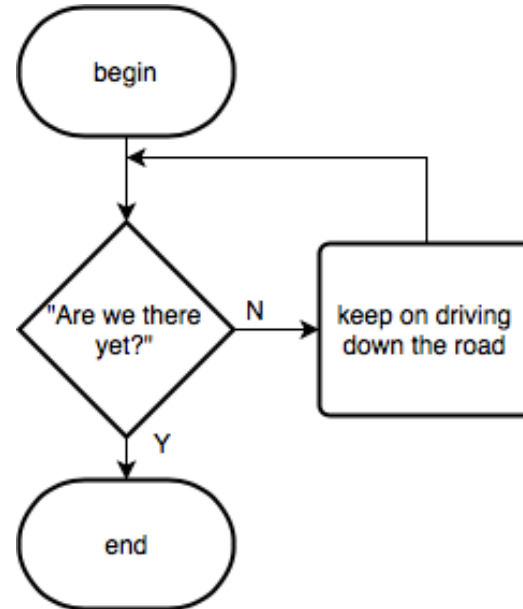
# Branching

```
switch (key) {  
    case('w'):  
        up();  
        break;  
    case ('s'):  
        down();  
        break;  
    case ('a'):  
        left();  
        break;  
    case ('d'):  
        right();  
        break;  
}
```

‘switch’ is much nicer

# Iteration

Iteration is another word for looping. Computers are good at doing repetitive tasks, and this control structure allows that.





# Iteration

There are two basic kinds of loop

- a 'while' loop will run until some condition is met

```
while (lives > 0){  
    nextLife();  
}
```

# Iteration

There are two basic kinds of loop

- a 'for' loop will run a given number of times

```
for (count = 0; count < 10; count++){  
    printUserRecord(count);  
}
```

# Functions

Most programming languages support the use of functions to organise and reuse code. A function is a block of code that performs a particular task.

# Functions

JavaScript, like most languages already has many built-in functions. This saves you writing the same code over and over again.

```
length("This is a string");
```

will return the value 16

# Functions

We can also write our own functions, to encapsulate a group of instructions that do one particular thing, and that we may call many times.

```
function showWarning(message) {  
    alert("We have a problem: " + message);  
}
```

# Modular programs

As programs become more complex, you can split code across multiple files. Each 'module' represents a different part of the overall program.



# Modular programs

Designing programs in modules has several advantages:

- aid to abstraction – low level code is hidden
- modules can be re-used

# Object-oriented (OOP)

**Object-oriented programming** treats a program as a collection of objects, each of which can contain their own data and functions.

JavaScript includes many built-in objects  
e.g. `Date()`, `Math()`



# Data structures

In JavaScript, objects act as data structures to store related data as a single variable type:

```
var fred = {firstName: "Fred", lastName:  
            "Smith", age: 35};
```

fred.lastName will return "Smith"


# Other uses

Whilst originally intended for web use, the popularity of JavaScript has seen it used as a general purpose language in other applications.

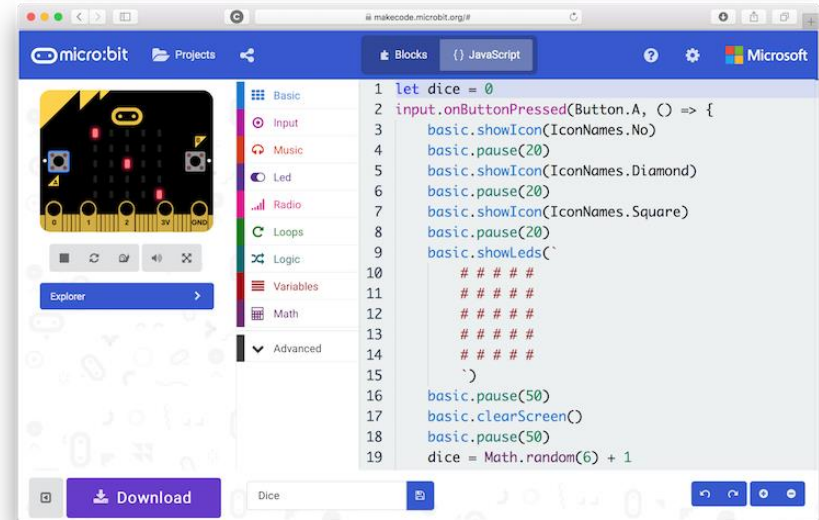
- server applications
- robotics
- user interfaces
- databases

# Other uses

```
iPad 12:49 pm
← Start
1 async function startProgram() {
2   speak('Hello Darrel');
3   setMainLed({
4     r: 0,
5     g: 23,
6     b: 255
7   });
8   setSpeed(50.0);
9   await delay(1.0);
10  setSpeed(0.0);
11 }
```



Sphero



```
micro:bit JavaScript
1 let dice = 0
2 input.onButtonPressed(Button.A, () => {
3   basic.showIcon(IconNames.No)
4   basic.pause(20)
5   basic.showIcon(IconNames.Diamond)
6   basic.pause(20)
7   basic.showIcon(IconNames.Square)
8   basic.pause(20)
9   basic.showLeds(`
10    #####
11    #####
12    #####
13    #####
14    #####
15    `)
16   basic.pause(50)
17   basic.clearScreen()
18   basic.pause(50)
19   dice = Math.random(6) + 1
```

BBC micro:bit

# Pros

- One of the most popular and widely-used languages
- Simple language to learn
- Tools are easy to find and free

# Cons

- Not as 'English-like' as some other languages, so need to learn syntax
- Need to understand how web pages work to be able to use it

# Resources

Well-supported with books, online tutorials, reference materials

# Online tutorials

- W3schools
- Grok Learning
- Hour of Code
- Codecademy
- Khan Academy