JavaScript Crash Course

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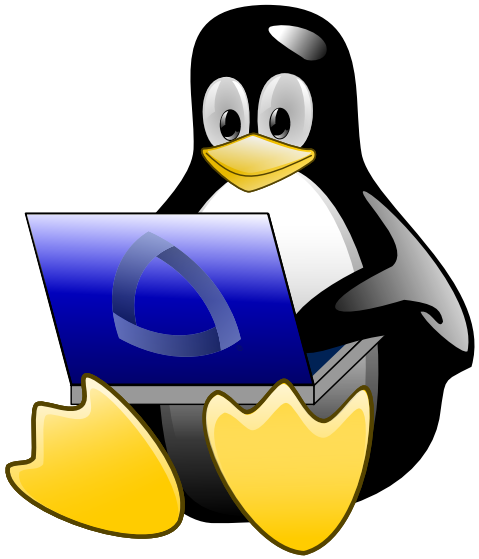

Colorado School of Mines
Linux Users Group

JavaScript is ***NOT*** Java [1]

- JavaScript was written was created in 10 days in May 1995 by Brendan Eich.
- JavaScript was originally called Mocha and was renamed to LiveScript before being renamed again to JavaScript.
- Why **Java**Script? Because Java happened to be popular then (that was before people realized how much Java sucks in a browser) and JavaScript looks syntactically similar at a glance.
- JavaScript is standardized[2] by Ecma International and there have been a number of ECMAScript versions. The latest is ECMAScript 6, but it is not fully supported by any browsers, including Firefox which only has partial support.

[1] Lots of this slide's information is from: `https://www.w3.org/community/webed/wiki/A_Short_History_of_JavaScript`

[2] JavaScript standards aren't actually that standard.

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Objects & Primitives

- Everything is either a primitive or an object.
- Objects are ALWAYS passed by reference
- Primitives are ALWAYS passed by value
- Objects in JavaScript are mutable keyed collections/dictionaries.
- JavaScript is *pseudoclassical*.
- JavaScript uses *prototypes* for inheritance.
- There is no such thing as a *class* in JavaScript.[1]

[1] ECMAScript 6 added support for classes, but JavaScript classes are just wrappers around the underlying prototype-based structure.

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Primitives: Types[1]

JavaScript has six primitive types:

- Boolean
- Null
- Undefined (yes, this is a type)
- Number (can be a number between $-(2^{53}-1)$ and $2^{53}-1$, `NaN`, `-Infinity`, or `Infinity`).
- String (single or double quotes declares a string literal[2])
- Symbol (new in ECMAScript 6)

[1] Info on this slide from: `https://developer.mozilla.org/en-US/docs/Web/JavaScript/Data_structures`

[2] Single quotes are recommended by Douglas Crockford because HTML normally uses double quotes and to avoid conflicts when manipulating DOM objects, single quotes should be used.

Objects: Inheritance and the Prototype Chain

- Every JavaScript object is linked to a *prototype*. If a member is not found in an object (i.e. if `obj.foobar == undefined`) then the prototype is searched. It defines a sort of "default" set of values for the object.
- "Empty" objects start with `Object.prototype` defined as their prototype.
- You can set the prototype of an object to another object (or to `undefined`) by calling `myObj.prototype = otherObj;`
- Since the prototype of an object is just another object, it too can have a prototype. Hence the prototype *chain*. When you access a property of an object, the whole prototype chain is searched for it.
- The prototype relationship is a dynamic relationship. If a property is added to the prototype, it is automatically visible to all objects based on that prototype.

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Objects: Syntax

```
var myObj = { // this is an object literal
    a: 3,
    'b': 'JavaScript',
    'is-awesome?': true,
    doSomething: function () {
        console.log(this.a); // 3
        console.log(a); // error
    }, // trailing commas are allowed
};
myObj.doSomething();
console.log(myObj.b, myObj['is-awesome?']);
```

Output:

```
3
error: a is undefined
JavaScript true
```

Objects: Arrays

JavaScript arrays are basically vectors (and are also objects, remember?).

```
1  var arr = [1, 'a', {}, [], true];
2  arr[0] = 'not a number';
3  arr.push('this is basically a vector');
4  console.log(arr);
```

Output:

```
1  [ 'not a number', 'a', {}, [], true, 'this is basically a vector' ]
```

Note that the elements of an array do not have to be the same type.

Variables

JavaScript is an **untyped** language. I don't know what that means and I don't think that Brendan did either when he wrote the language.

Variables are declared using the `var` keyword[1].

Examples:

- `var name;` - creates variable `name` of type `undefined`.
- `var name = 'Sumner';` - string literal
- `var age = 18;` - declaring a number literal
- `var hasFriends = false;` - declaring a boolean
- `var significantOther = null;`

[1] Sometimes you don't need to use `var` as I have described above.

Functions

- Functions are just objects with two special properties: a context (scope) and the function code.
- Functions can be defined anywhere where an object can be defined and can be stored in variables.
- Functions can access all arguments passed to a function via the `arguments` variable.
- Functions can access the callee of a function (`callee.func()`) via the `this` variable.
- Functions can also have named parameters.
- Functions always return a value. If no return is explicitly specified, the function will return `undefined`.

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Functions: Callback

Since JavaScript functions are objects, they can be passed just like other objects.

```
1  function doStuff(callback) {
2      // do a bunch of processing
3      var x = 3;
4      console.log('in doStuff');
5      callback(x);
6  }
7
8  doStuff(function(x) {
9      console.log(x * 3);
10 });
```

Output:

```
1  in doStuff
2  9
```

Functions: New

JavaScript functions can be invoked with the `new` keyword, mimicking traditional class-based languages:

```
1  function Thing(val) {
2      this.v = val;
3  }
4
5  var t = new Thing(12);
6  console.log(t.v); // prints 12
```

But don't be fooled. Really that is just equivalent to:

```
1  ...
2
3  var t = {};
4  t.prototype = Thing.prototype;
5  t.Thing(12); // the important bit!
6  console.log(t.v); // prints 12
```

Scope

There are two scopes in JavaScript: global and function.[1]

Variables declared outside of a function are automatically in the global scope.

Variables declared within a function *without* the `var` keyword are also in the global scope.

```
1  var a = 2;
2  (function() {
3      b = 3
4      var c = 5;
5  })(); // this creates and invokes the function immediately
6
7  console.log(a); // logs 2
8  console.log(b); // logs 3
9  console.log(c); // error since c is undefined in global scope
```

Global Abatement

Because your code could coexist with other people's code, on the same HTML page, it is recommended that you reduce your *global footprint* by only creating a few global objects and then putting all assets into that object.

```
1  myGlobal = (function() {
2      var myInternalData = 10;
3      return {
4          data: 5,
5          subObject: {
6              cool: 'things',
7          },
8          fn: function() { return myInternalData; },
9      };
10 })();
```

Since you can add properties to objects at will, you can still split your code into multiple files.

Private Variables

You can simulate private variables the same way:

```
1  var Dog = function(name) {
2      var gender = 'male';
3      this.name = name;
4      this.isBoy = function () {
5          return gender == 'male';
6      };
7  };
8
9  var myDog = new Dog('Sebastian');
10 console.log(myDog.gender);  // logs undefined
11 console.log(myDog.name);    // logs 'Sebastian'
12 console.log(myDog.isBoy()); // logs true
```

Syntax: Control Statements

```
1  // if statement syntax is identical to C++
2  if (condition) {
3  } else if (condition) {
4  } else {
5  }
6
7  // ternary syntax is just like C++
8  var a = condition ? val_if_true : val_if_false;
9
10 for (initializer; condition; incrementor) {
11     // for loop syntax is identical
12 }
13
14 for (var prop in obj) {
15     obj[prop].doThing(); // prop is the key
16                          // could be a number or a string
17 }
```

Pitfalls: Variable Hoisting

Variables are *hoisted* to the top of the function they are declared in. Thus, the following is entirely valid.

```
1  function scopeEx() {
2      b = 5;
3      console.log(b); // logs 5
4      var b = 3
5      console.log(b); // logs 3
6  }
```

This is confusing. Just declare your variables before you use them.

[1] In ES6, variables declared with `let` are actually block scope.

Pitfalls: Truthy, Falsy and == vs ===

JavaScript has the notion of being *truthy* and *falsy*.

The following values are always falsy: `false`, `0`, `""`, `null`, `undefined`, `NaN`.

Do not expect all falsy values to be equal to each other (`false == null` is false).

JavaScript has two equality operators:

- == compares without checking variable type. This will cast then compare.
- === compares and checks variable type.

DOM Manipulation

The *Document Object Model* is an API used by JavaScript to interact with the elements of an HTML document.[1]
jQuery is great for simple DOM manipulation.

```
1  <div id="cool">Cool</div>
2  <div class="myCls">jQuery Demo</div>
```

```
1  var coolDiv = document.getElementById('cool'); // pure JS
2  coolDiv.style.background = 'blue';
3
4  var coolDiv = $('#cool');                      // jQuery
5  coolDiv.css('background-color', 'blue');
```

jQuery does a ton of other useful things as well, but that's what the docs are for.

[1] https://en.wikipedia.org/wiki/Document_Object_Model

Canvas Manipulation

While many JS games (like 2048) use lots of HTML and CSS to drawn the game, with some JS and DOM/JQuery-stuff for the logic. However, you can also draw the game directly using a Canvas. All you need then is a few lines of HTML and the rest can happen in your script. You can even create 3D stuff with WebGL or a 3rd party library like Three.js.

```
1  var c = document.getElementById("myCanvas");
2  var ctx = c.getContext("2d");
3  ctx.moveTo(0,0);
4  ctx.lineTo(200,100);
5  ctx.stroke();
```

Libraries

- DOM Manipulation (HTML and CSS stuff)
  - ✓JQuery (Yep)
- HTML5 Canvas (Direct drawing from JS)
  - ✓EaselJS (Nice interation callbacks)
  - bHive (Never used it, but other people like it)
  - ✓Paper.js (Good vector and shape drawing)
  - WebGL (3D Graphics if you can OpenGL the things)
    - ✓Three.js (3D Graphics if you can't Opengl the things)
    - BabylonJS (Looks pretty I guess)
- WebSockets (TCP, multiplayer, experimental, good luck)
  - Sockets.io (talk to your Node.JS server?)
- Audio Stuff
  - SoundJS (Again, never used)
  - Google (you are smart, figure it out)

Additional Resources

A lot of this presentation was based off of *JavaScript: The Good Parts* by Douglas Crockford. This is an essential read for anyone interested in learning JavaScript for anything more than writing a few simple scripts.

MDN is the best resource for JavaScript documentation (`https://developer.mozilla.org/en-US/`).

JSHint (`http://jshint.com/about/`) is a tool which checks JavaScript syntax and helps prevent bugs in your code. JSHint has plugins for most IDEs and text editors. Here's a SO article on the Vim plugin: `http://stackoverflow.com/questions/473478/vim-jslint/5893447`