

WEB230: JavaScript 1

Module 7: The Secret Life of Objects

Encapsulation

- Object Oriented programming was developed in the 1970's and '80's
- the idea is to divide programs into smaller pieces
- each piece is responsible for managing its own state

Methods

- properties that hold functions

```
let rabbit = {};  
rabbit.speak = function(line) {  
  console.log("The rabbit says " + line + "");  
};  
  
rabbit.speak("I'm alive.");
```

this

- usually a method needs to do something with the object
- inside a function that is called as a method of an object, this refers to the object

```
function speak(line) {  
  console.log(`The ${this.type} rabbit says '${line}'`);  
}  
let whiteRabbit = {type: "white", speak: speak};  
  
whiteRabbit.speak("Oh, how late it's getting!");
```

Arrow Functions

- arrow functions don't have their own this
- instead they use this from the surrounding scope

```
const speak = line => {  
  console.log(`The ${this.type} rabbit says '${line}'`);  
}  
let whiteRabbit = {type: "white", speak: speak};  
  
whiteRabbit.speak("Oh, how late it's getting!");
```

- doesn't work - this.type == undefined

Classes

- a class defines the shape of a type of object
 - what methods and properties it has
- objects based on a class are called an "instance" of the class

Prototypes

- Even an empty object has properties:

```
let empty = {};
console.log(empty.toString);
console.log(empty.toString());
```

- It has a method called toString
- Objects have prototypes
- `Object.getPrototypeOf()` will return the prototype of an object
- `Object.prototype` is the base prototype of most objects
- Other prototypes can be layered on top

```
console.log(Object.getPrototypeOf([]) == Array.prototype);
console.log(Object.getPrototypeOf(Array.prototype)
  == Object.prototype);
```

Prototype

- defines properties that are shared
- properties that are different for each must be stored directly on the object

```
let empty = {};
console.log(empty.toString);
// → function toString(){...}
console.log(empty.toString());
// → [object Object]
```

- JavaScript prototypes can be considered informal classes

Constructors

- constructor functions create objects that derive from some shared prototype
- calling a function with the `new` keyword in front of it causes it to be treated as a constructor
- the constructor will have its `this` variable bound to a new object
- the new object will be returned

```
function Rabbit(type) {
  this.type = type;
}

let killerRabbit = new Rabbit("killer");
let blackRabbit = new Rabbit("black");
console.log(blackRabbit.type);
```

- the constructor has a property named `prototype`
 - holds a empty object that derives from `Object.prototype`
 - every instance created with this constructor will have this object as its prototype

```
Rabbit.prototype.speak = function(line) {
  console.log("The " + this.type + " rabbit says " +
    line + "");
};
blackRabbit.speak("Doom...");
```

Class Notation

- a JavaScript `class` is a constructor function
- newer, less awkward notation
- not supported in Internet Explorer
- the `class` keyword starts the declaration
- `constructor()` is the constructor function
- methods can be declared *after* the constructor
 - don't use the `function` keyword
 - these methods are put in the prototype
 - can't declare properties inside a `class`

```
class Rabbit {
  constructor(type) {
    this.type = type;
  }
  speak(line) {
    console.log(`The ${this.type} rabbit says '${line}'`);
  }
}

let killerRabbit = new Rabbit("killer");
let blackRabbit = new Rabbit("black");
```

Overriding Derived Properties

- If the object does not have a property it will look to the prototype

```
Rabbit.prototype.teeth = "small";
console.log(killerRabbit.teeth);
killerRabbit.teeth = "long, sharp, and bloody";
console.log(killerRabbit.teeth);
console.log(blackRabbit.teeth);
console.log(Rabbit.prototype.teeth);
```

Prototype Interference

- A prototype can be used at any time to add new properties and methods to all objects based on it

```
Rabbit.prototype.dance = function() {
  console.log("The " + this.type + " rabbit dances a jig.");
};

killerRabbit.dance();
```

in Operator

- in operator tells us if an object has a property
- `.hasOwnProperty()` tells us if it has the property, not the prototype

```
let lunch = {
  pizza: 200,
  donut: 350
}
Object.prototype.nonsense = "hi";

console.log(`pizza: ${'pizza' in lunch}`);
console.log(`nonsense: ${'nonsense' in lunch}`);
```

`.hasOwnProperty()` Method

- We can check if a property belongs to the object but not on its prototype
- `.hasOwnProperty()` returns true if the property is on the object

```
let lunch = {
  pizza: 200,
  donut: 350
}
Object.prototype.nonsense = "hi";

console.log(`pizza: ${lunch.hasOwnProperty('pizza')}`);
console.log(`nonsense: ${lunch.hasOwnProperty('nonsense')}`);
```

for...in Loop

- `for...in` will loop through properties of an object

```
let lunch = {  
  pizza: 200,  
  donut: 350  
}  
Object.prototype.nonsense = "hi";  
  
for( let food in lunch ) {  
  console.log(food);  
}
```

Polymorphism

- polymorphism is when a method or an operator does different things on different data types
- JavaScript methods can be polymorphic
- Eg. all values have a method `.toString()`
 - `toString()` is used to convert values to strings
- We can write our own `.toString()`, to work with our object

```
let lunch = {};  
  
console.log('I brought ' + lunch);  
  
lunch.toString = function() {  
  return 'My lunch.';  
};  
  
console.log('I brought ' + lunch);
```

Getters and Setters

- Sometimes we need to control setting or getting values of a property
- This created the style of writing getter and setter methods

```
class Temperature {  
  constructor(celsius) {  
    this.celsius = celsius;  
  }  
  getFahrenheit() {  
    return this.celsius * 1.8 + 32;  
  }  
  setFahrenheit(value) {  
    this.celsius = (value - 32) / 1.8;  
  }  
}
```

```
let temp = new Temperature(22);  
console.log(temp.fahrenheit);
```

JavaScript has Getters and Setters

- JavaScript has built-in getters and setters
- Act like properties but call methods

```
class Temperature {  
  constructor(celsius) {  
    this.celsius = celsius;  
  }  
  get fahrenheit() {  
    return this.celsius * 1.8 + 32;  
  }  
  set fahrenheit(value) {  
    this.celsius = (value - 32) / 1.8;  
  }  
}
```

```
let temp = new Temperature(22);  
console.log(temp.fahrenheit);
```