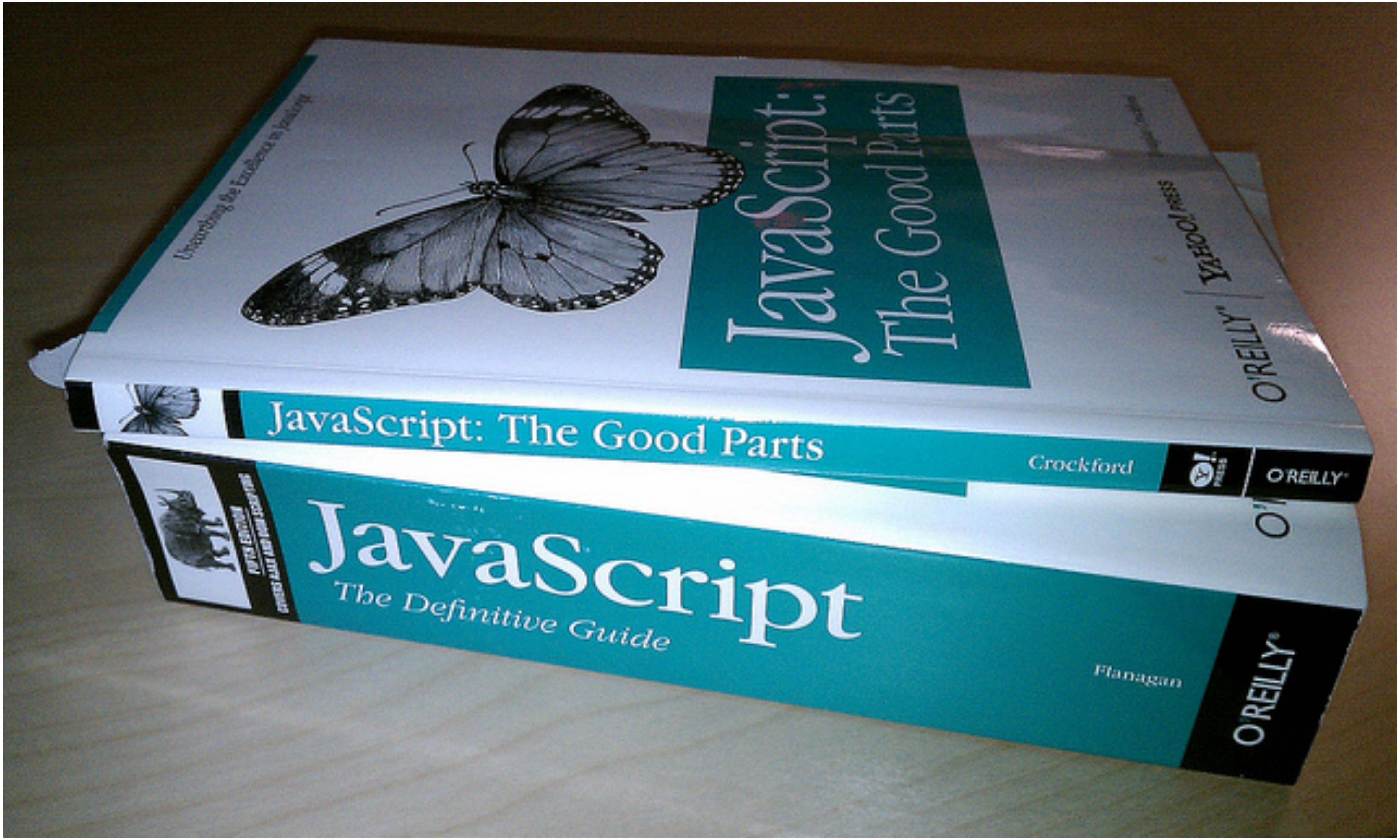
JavaScript Concepts


Unearthing the Excellence in JavaScript
JavaScript: The Good Parts
O'REILLY
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JavaScript: The Good Parts
Crockford
O'REILLY
FIFTH EDITION
JavaScript
The Definitive Guide
Flanagan
O'REILLY

JavaScript is pretty hard to escape if you want to do anything for the web

C of the Internet

“Take JavaScript for instance. It's widely criticized in the POPL community for getting many things wrong. But it must have gotten a ton of things right too, otherwise it wouldn’t be so popular. ”

– *Nikhil Swamy, MS Research*

Javascript is:

- Dynamically Typed
- Object-Oriented-ish
- Functional-ish

node
JS
®

Basically everything in JavaScript is an Object

Why do people dislike JavaScript?

- Implicit Conversions, it’s hard to make JS **crash**
  - Easily leads to strange behavior, unpredictible
  - So you have to test your code a lot
- Weird behavior of builtins, == vs ===, etc…
- Javascript uses **prototypical inheritance**
  - If you think about it like C++/Java, you will be terribly wrong

Numbers, Strings, Booleans, `null`, and `undefined`

Everything else is an object!

The hardest thing to get your head around in JS is that objects don’t belong to a **class** per-se. Classes still exist, but they’re more like **recipes** for objects

These are all **objects** in JS

```
{a: 23}
```

```
{foo: 12, bar: (x) => x}
```

```
{a: “hello”}
```

Observations: JS “objects” are mostly dictionaries

```
{
  speed: 12,
  distance: 13
}
```

```
x.speed
```

```
x[“speed”]
```

Write functions using the **function** keyword

```
function dist(x0, x1) {
   return Math.sqrt(
       (x1[0]-x0[0])**2
     + (x1[1]-x0[1])**2);
 }
```

```
> dist
[Function: dist]
```

Like Racket, JavaScript has a fairly functional flavor to it…

```
var x = function(x) { return x**2; }
```

```
function twice(f) { return function(x) { return f(f(x)); }; }
```

```
> [1,2,3].map(function (x) { return x.toString(); })
[ '1', '2', '3' ]
```

Another way to write functions in JS

```
> [1,2,3,4].reduce ((acc,next) => acc + " " + next.toString());
'1 2 3 4'
```

JavaScript has **closures**

```
function countUpFrom(x) {
    var counter = x;
    return function() {
       var cur = counter;
       counter = cur+1;
       return cur;
} };
```

```
> var startingAtFive = countUpFrom(5);
undefined
> startingAtFive()
5
> startingAtFive()
6
> startingAtFive()
7
```

Currying…

```
var myFirstCurry = function(word) {
     return function(user) {
            return [word , ", " , user].join("");
     };
};

var HelloUser = myFirstCurry("Hello");
HelloUser("Aadhya"); // Output: "Hello, Aadhya”
```

Q: What does this look like in Racket?

Classes

```
function Apple (typeofapple) {
    this.typeofapple = typeofapple;
    this.color = "red";
    this.getInfo = function() {
        return this.color + ' ' + this.typeofapple + ' apple';
    };
}
```

Critical question: what gets passed in for **this**?

```
function Apple (type) {
    this.type = type;
    this.color = "red";
    this.getInfo = function() {
        return this.color + ' ' + this.type + ' apple';
    };
}
```

Observation: if I don’t explicitly specify, it goes to the **default** object

new Apple(3)

- Creates an **empty object**, let’s call it x
- Binds this to x
- Runs the Apple function using x as this

```
function Apple (type) {
    this.type = type;
    this.color = "red";
    this.getInfo = function() {
        return this.color + ' ' + this.type + ' apple';
    };
}
```

new Apple(3)

This: {}

```
function Apple (type) {
    this.type = type;
    this.color = "red";
    this.getInfo = function() {
        return this.color + ' ' + this.type + ' apple';
    };
}
```

```
Apple { type: 3, color: 'red', getInfo: [Function] }
```

One really crummy thing about JS: it **silently fails**

```
> new Apple
Apple { type: undefined, color: 'red', getInfo: [Function] }
```

E.g., `Apple` needed an argument, but we didn't pass it one. So JS just fills in `undefined`

I can **explicitly** specify `this` by using the `call` builtin function

```
> var x = {};
> Apple.call(x)
undefined
> x
{ type: undefined, color: 'red', getInfo: [Function] }
```

Note: not idiomatic JS

JS has a **strange** take on inheritance…

Object literal

```
var Car = {
  name: “plain old car”
}
```

Object literal

```
var car = {
wheels:
  function() { return "I have "
               + this.numWheels(); }
}
```

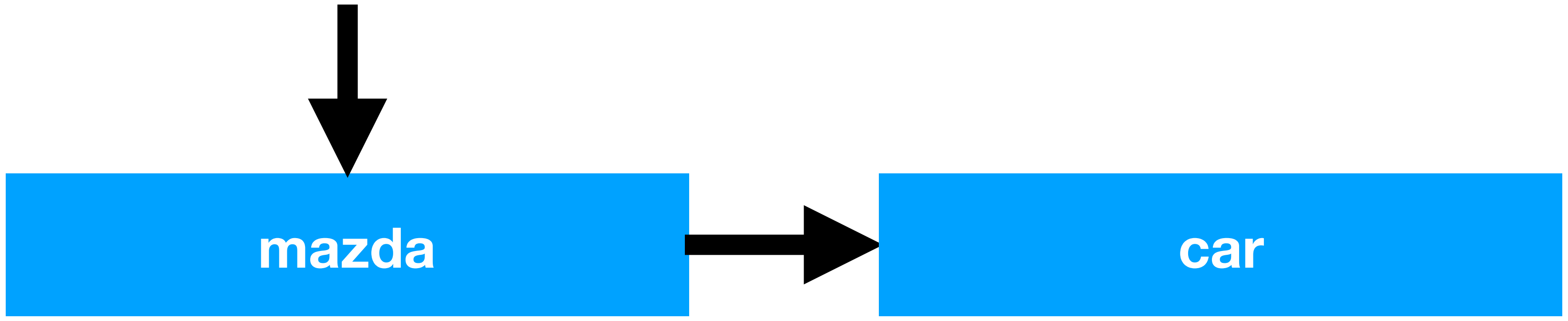
Note: runtime error if I call wheels

```
var car = {
wheels:
  function() { return "I have "
               + this.numWheels(); }
}
```

```
var mazda = {
  numWheels: function() { return 4; }
 };
```

```
> mazda.__proto__ = car;
{ wheels: [Function: wheels] }
> mazda
{ numWheels: [Function: numWheels] }
> mazda.__proto__
{ wheels: [Function: wheels] }
> mazda.wheels()
'I have 4'
```

When I want to look up **wheels**

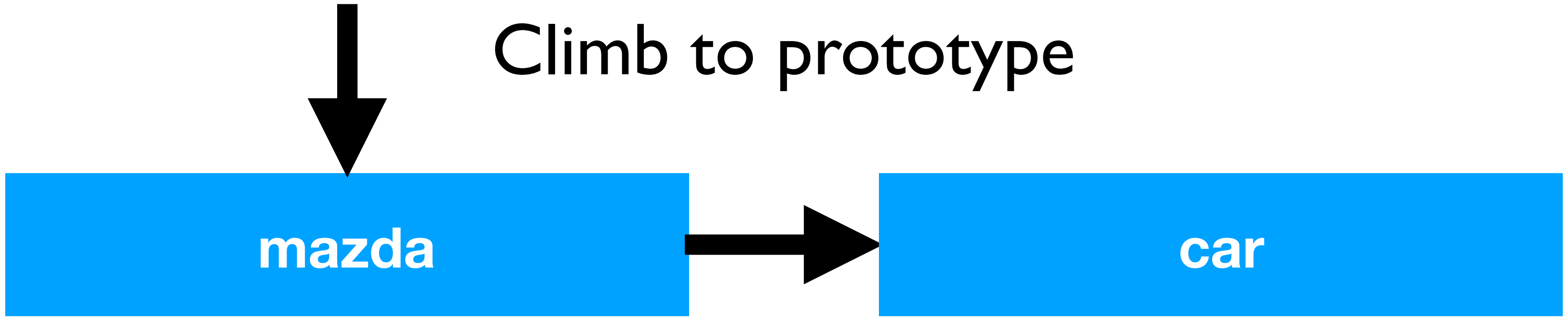


mazda

car

Not here!!!

When I want to look up **wheels**



Climb to prototype

mazda

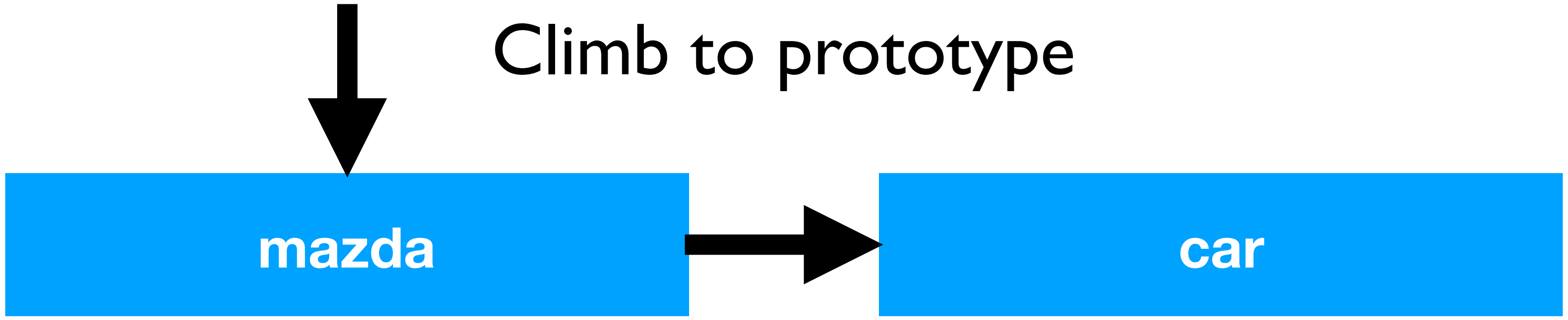
car

Not here!!!

Found **wheels** here

```
function() { return "I have "
                + this.numWheels(); }
```

When I want to look up **wheels**



Climb to prototype

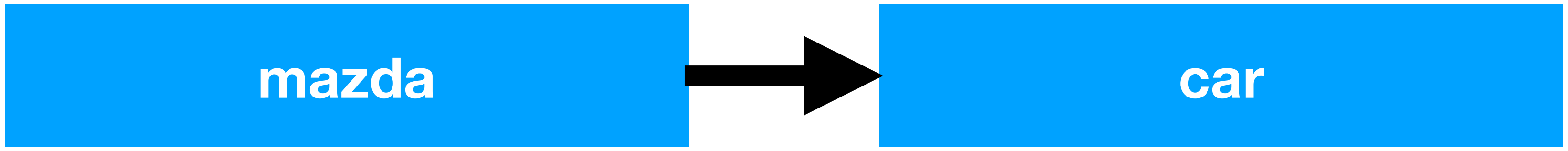
Not here!!!

Found **wheels** here

```
function() { return "I have "
                  + this.numWheels(); }
```

Now, **this** is `mazda`

Need to lookup `numWheels`



Finds it here!

Lookups are **dynamic**

```
car.wheels = function() { return “I have some number”; }
```

`mazda.wheels()` now gives `“I have some number”`

Using `__proto__` directly is terrible form

Instead, use `Object.create(car)`

`Object.create(car)`

- Creates a new object
- Sets its prototype to be `car`
- Now all lookups go through `car`
  - Unless you set otherwise, of course

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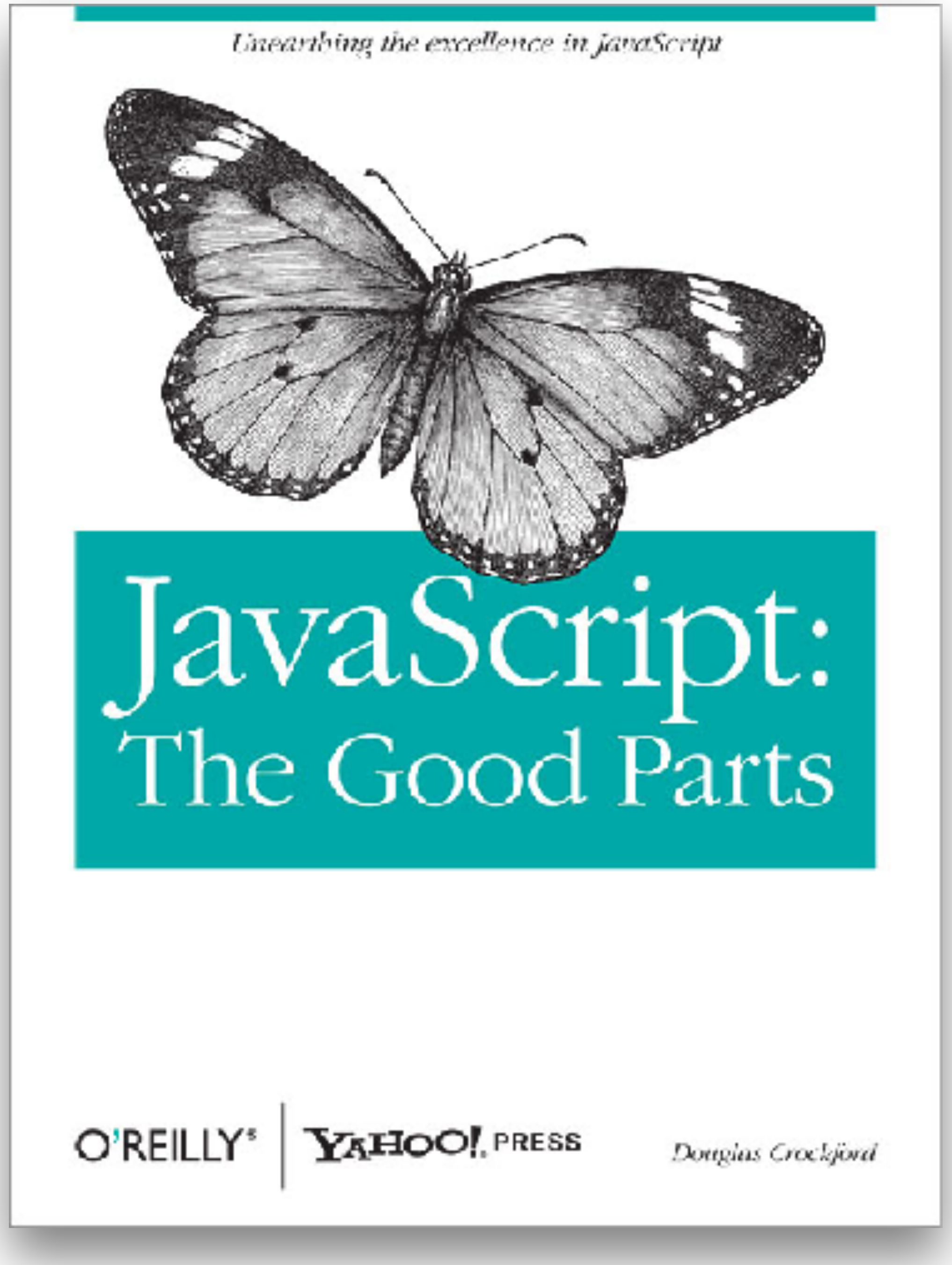
This effectively enables using car as a **class**

In the sense that a class is a blueprint for an object https://www.infoworld.com/article/3196070/node-js/10-javascript-concepts-nodejs-programmers-must-master.html

http://sporto.github.io/blog/2013/02/22/a-plain-english-guide-to-javascript-prototypes/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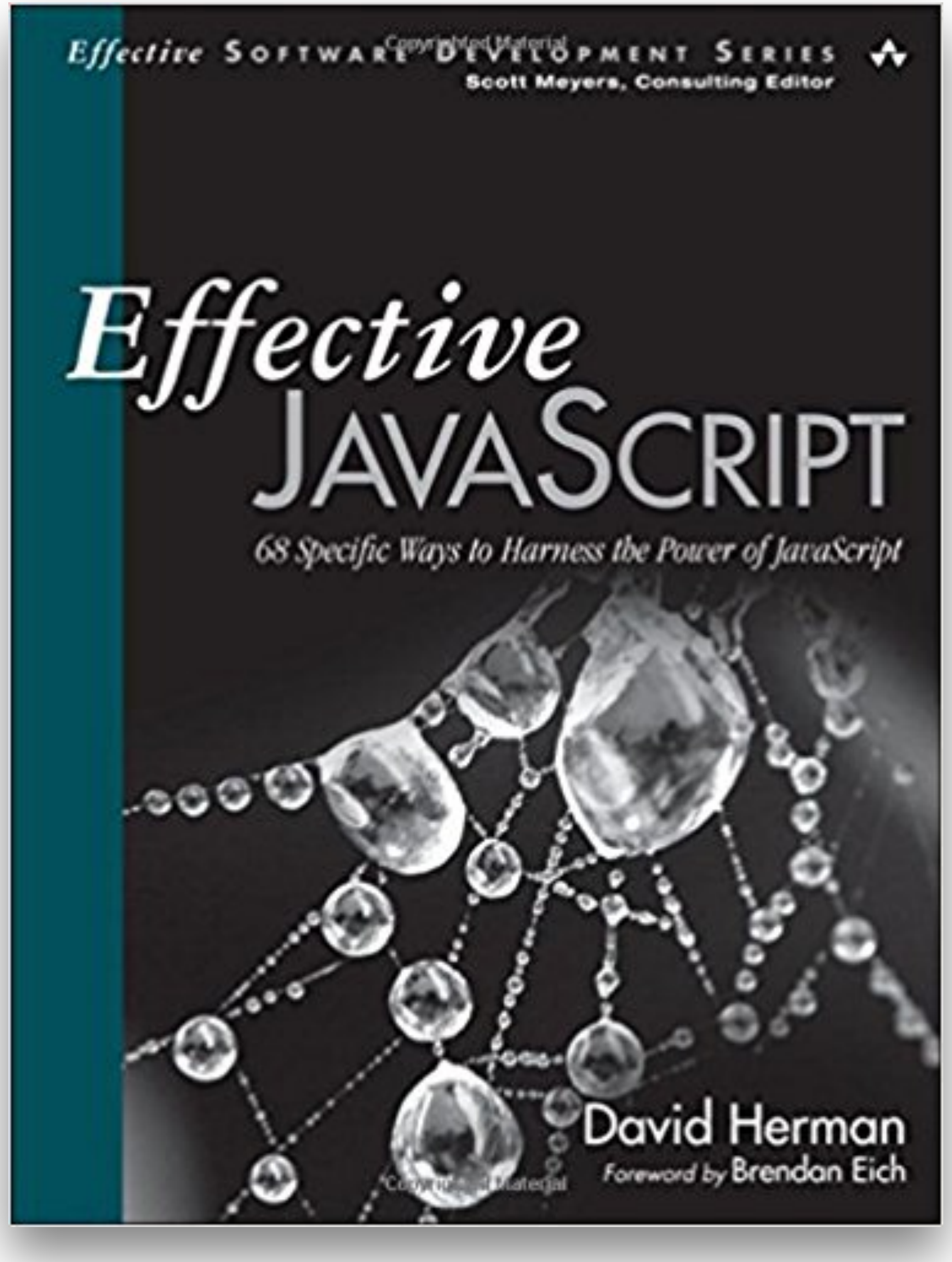
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David Herman
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