64-31.1 Projet de technologie web

Javascript Extended

Boris.Fritscher@he-arc.ch

JavaScript 101 (Part 2)

- Scopes
- Objects
- Prototypal inheritance
- More on functions
- Constructors
- Classes
- Arrays the functional way

Scopes before ECMAScript 2015

There are 2 scopes for variables:

- the (evil) global scope
- the function scope

```
var aVariableInGlobalScope;

function myFunction() {
  var aVariableInFunctionScope;
  anotherVariableInGlobalScope;
}

function myFunction2() {
  //no block scope!
  for(i = 0; i < 10; i++){
    //i is in global scope!
  }
  for(var j = 0; j < 10; j++){
    //j is in function scope!
  }
}
```

A variable declared within a function is **not accessible** outside this function.

Unless using **strict mode**, it is not mandatory to declare variables (beware of typos...)

Two scripts loaded from the same HTML page share the same global scope (beware of **conflicts**...)

There is **no block scope**.

Exploring scopes

```javascript
var aGlobalVar = 'hello';
var anotherGlobalVar = 'world';
function myFunction() {
    aGlobalVar = 'yo';
    var anotherGlobalVar = 'yeep';
    var localVar = 'local';
    iAmNotALocalVariable = 'iAmGlobal';
}
console.log('1. aGlobalVar: ' + aGlobalVar);
console.log('2. anotherGlobalVar: ' + anotherGlobalVar);

myFunction();
console.log('3. aGlobalVar: ' + aGlobalVar);
console.log('4. anotherGlobalVar: ' + anotherGlobalVar);
console.log('5. iAmNotALocalVariable: ' + iAmNotALocalVariable);
console.log('6. localVar: ' + localVar);
```

Creating objects

JavaScript has **no support for classes** (< ECMAScript 2015)

There are 3 ways to create objects:

```
//create an object with a literal
const person = {
  firstName: 'John',
  lastName: 'Smith'
};

// create an object with a prototype
let child = Object.create(person);

// create an object with a constructor
child = new Person('John', 'Smith');
```

class is a reserved word in JavaScript, but it is not used in the current version of the language (reserved for the future ECMAScript 2015).

A **constructor** is function like any other (capitalized is a coding convention).

It is the use of the **new** keyword that triggers the object creation process.

Every object inherits from a prototype object

```javascript
var person = {
    firstName: 'John',
    lastName: 'Smith'
};
// person's prototype is Object.prototype
console.log(Object.getPrototypeOf(person) === Object.prototype);

const father = {};
const child = Object.create(father);
// child's prototype is father
console.log(Object.getPrototypeOf(child) === father);

function Person(fn, ln) {
    this.firstName = fn;
    this.lastName = ln;
}
const john = new Person('John', 'Doe');
// john's prototype is Person.prototype
console.log(Object.getPrototypeOf(john) === Person.prototype);
```

Every object inherits from a prototype object

Every object inherits from a prototype object. **It inherits and can override its properties**, including its methods.

Objects created with object literals inherit from **Object.prototype**.

When you access the property of an object, JavaScript **looks up the prototype chain** until it finds an ancestor that has a value for this property.

Class-like data structure

badGreet is a property that will be replicated for every object created with the Person constructor:

- poor memory management
- not possible to alter behavior of all instances at once

```
function Person(fn, ln) {
    var privateVar;
    this.firstName = fn;
    this.lastName = ln;
    this.badGreet = function () {
      console.log('Hi ' + this.firstName);
    };
}

Person.prototype.greet = function () {
    console.log('Hey ' + this.firstName);
};
```

greet is a property that will be shared by all instances (because it will be looked up along the object inheritance chain).

privateVar is not accessible outside of the constructor.

fistName is publicly accessible (no encapsulation).

Classes since ECMAScript 2015

```
class SkinnedMesh extends THREE.Mesh {
  constructor(geometry, materials) {
    super(geometry, materials);

    this.idMatrix = SkinnedMesh.defaultMatrix();
    this.bones = [];
    this.boneMatrices = [];
    //...
  }
  update(camera) {
    //...
    super.update();
  }
  static defaultMatrix() {
    return new THREE.Matrix4();
  }
}
```

Arrays the functional way

```javascript
const fruits = ['abricot', 'ananas', 'strawberry', 'orange'];

// creates a new array with the results of calling a provided function
// on every element in the calling array.
const transformedFruits = fruits.map(fruit => {
    return fruit.toUpperCase();
});

// executes a provided function once for each array element.
transformedFruits.forEach(fruit => {
    console.log(fruit);
});

// creates a new array with all elements that pass the test implemented
// by the provided function.
const aFruits = fruits.filter(fruit => {
    return fruit.charAt(0) === 'a';
});
```

Arrays the functional way

```javascript
const fruits = ['abricot', 'ananas', 'strawberry', 'orange'];

// executes a reducer function (that you provide)
// on each element of the array,
// resulting in a single output value.

const count = fruits.reduce((val, fruit) => {
    console.log('reducer invoked with ' + val);
    return val + 1;
}, 0);
console.log('There are ' + count + ' fruits in the array');
```

There are more functional methods: sort, some, every, flat, flatMap

https://developer.mozilla.org/en-US/docs/Web/JavaScript/Reference/Global_Objects/Array

DOM Document

```
// access body Element
const element = document.body;

// find element(s)
const element = document.getElementById("some_id");

// returns an Element
const parentElement = document.querySelector("ul");

// returns an iterable of Elements
const elements = document.querySelectorAll("li");
const element = elements[0];

// create a new element
const element = document.createElement("div");

// add to DOM
parentElement.append(element);
```

https://github.com/oneuijs/You-Dont-Need-jQuery

DOM Element

```
// edit classes
element.classList.add("big");
element.classList.remove("big");
element.classList.toggle("big");

// edit content
const value = element.innerText;
element.innerText = "some text";
element.innerHTML = "text with <b>HTML</b>";

// edit attributes
const value = element.getAttribute("src");
element.setAttribute("src", "https://...");

// events: click, dblclick, change, keydown, mouseenter, mouseleave
element.addEventListener('click', () => {
  // handler function
  // do something
});
```

```html
<!DOCTYPE html>
<html>
<body onload="onload()">
  <ul class="list">
    <li>a</li>
    <li>b</li>
  </ul>
</body>
</html>
```

```css
.big{
  font-size: 200%;
}
```

```javascript
function onload() {
  const div = document.createElement('div');
  div.innerText = 'Hello';
  document.body.append(div);

  for (const li of document.querySelectorAll('.list li')) {
    li.addEventListener('click', () => {
      li.classList.toggle('big');
    })
  }
}
```

JavaScript 101 (Part 3)

- Functions are objects
- Closures
- Module patterns
- this

Functions are objects

```javascript
function aFunc(){ return true; } // no semicolon

// anonymous function
const f = function(i){ return i; }; // semicolon since assignment

const g = function g(i){
  if(i > 100){
    return i;
  }
  return g(i+1); // recursive call
};
const h = function(aFunctionObj){
  // 3 ways to call a function
  console.log(aFunctionObj(0));
  console.log(aFunctionObj.apply(this, [0]));
  console.log(aFunctionObj.call(this, 0));
};

h(f);
h(g);
```

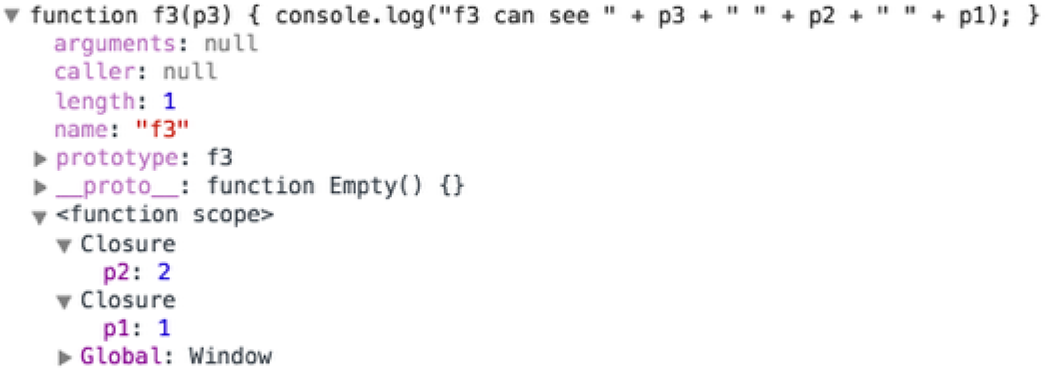
Functions can be nested

An **object** is created for every function.

Each function has access to variables defined in the **parent** functions (an in the **global scope**).

```
function f1(p1){
  console.log('f1 can see ' + p1);
  function f2(p2){
    console.log('f2 can see ' + p2 + ' ' + p1);
    function f3(p3){
      console.log('f3 can see ' + p3 + ' ' + p2 + ' ' + p1);
    }
    f3(3);
  }
  f2(2);
}
f1(1);
```

Closures



```
▼ function f3(p3) { console.log("f3 can see " + p3 + " " + p2 + " " + p1); }
    arguments: null
    caller: null
    length: 1
    name: "f3"
  ▶ prototype: f3
  ▶ __proto__: function Empty() {}
  ▼ <function scope>
    ▼ Closure
        p2: 2
    ▼ Closure
        p1: 1
    ▶ Global: Window
```

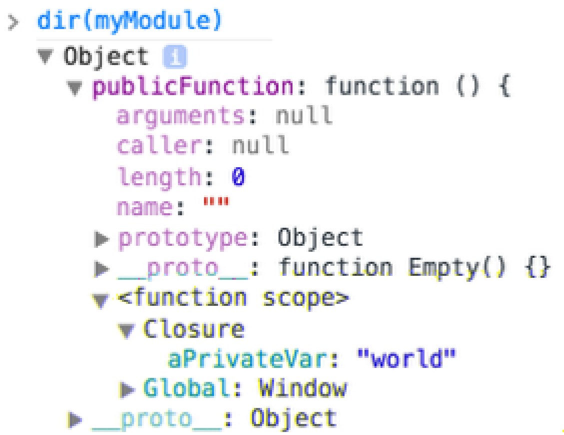
A closure is formed
when a nested function
accesses a **free variable**

- In a function, a **free variable** is a variable that is neither a local variable, nor a parameter of the function.
- A **closure** is the combination of a code block (the function code) and saved parent scopes.

```
function f1(p1){
  console.log('f1 can see ' + p1);
  function f2(p2){
    console.log('f2 can see ' + p2 + ' ' + p1);
    function f3(p3){
      console.log('f3 can see ' + p3 + ' ' + p2 + ' ' + p1);
    }
    f3(3);
  }
  f2(2);
```

Module patterns in ES5

Patterns are applied to create modules



```
> dir(myModule)
  ▼ Object
    ▼ publicFunction: function () {
        arguments: null
        caller: null
        length: 0
        name: ""
      ▶ prototype: Object
      ▶ __proto__: function Empty() {}
      ▼ <function scope>
        ▼ Closure
            aPrivateVar: "world"
        ▶ Global: Window
    ▶ __proto__: Object
```

```
var myModule = (function(){

    var aPrivateVar = 'World';
    var privateFunction1 = function(){
        console.log('Hello ' + aPrivateVar);
    };
    var privateFunction2 = function(){};

    // Make some elements public
    return {
      publicFunction: privateFunction1
    };
})(); // The function is immediately invoked

myModule.publicFunction();
```

Whe accesses aPrivateVar, a **closure** is formed.

privateFunction1 is **available even after** the immediately invoked function has returned.

privateFunction1 and privateFunction2 share the same parent scope.

Modules since ECMAScript 2015

import/export functions and variables between files.

```
// lib/math.js
export function sum(x, y) {
  return x + y;
}
export const pi = 3.141593;
```

```
// app.js
import * as math from "lib/math";
console.log("2π = " + math.sum(math.pi, math.pi));
```

import/export syntax

```
import defaultMember from "module-name";
import * as name from "module-name";
import { member } from "module-name";
import { member as alias } from "module-name";
import { member1 , member2 } from "module-name";
import { member1 , member2 as alias2 , [...] } from "module-name";
import defaultMember, { member [ , [...] ] } from "module-name";
import defaultMember, * as name from "module-name";
import "module-name";
```

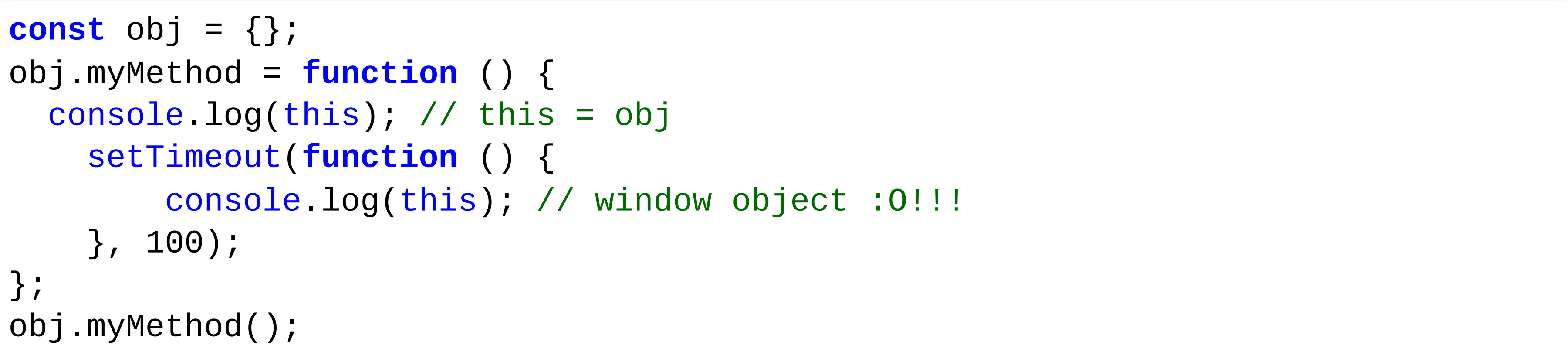
```
export { name1, name2, …, nameN };
export { variable1 as name1, variable2 as name2, …, nameN };
export let name1, name2, …, nameN; // also var
export let name1 = …, name2 = …, …, nameN; // also var, const

export default expression;
export default function (…) { … } // also class, function*
export default function name1(…) { … } // also class, function*
export { name1 as default, … };

export * from …;
export { name1, name2, …, nameN } from …;
export { import1 as name1, import2 as name2, …, nameN } from …;
```

this

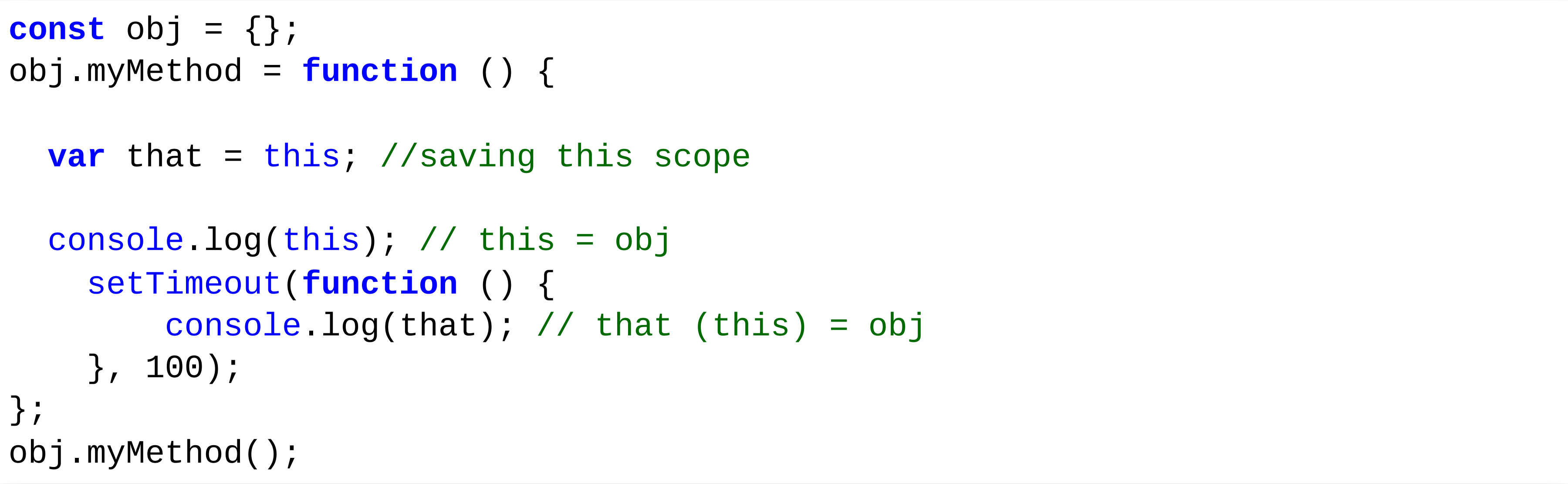
- How the function is called: determines the `this` value
- It is dynamic, which means the value could change
- You can change the `this` context through `.call()`, `.apply()` and `.bind()`

```
// let's assume .elem is <div class="elem"></div>
const element = document.querySelector('.elem');

// our function
const someFunc = function () {
  console.log(this);
};

// when clicked, `this` will become the element
element.addEventListener('click', someFunc); // <div>

// if we just invoke the function, `this` becomes the window object
someFunc(); // [object Window]
```

Saving this scope



```
const obj = {};
obj.myMethod = function () {
  console.log(this); // this = obj
    setTimeout(function () {
        console.log(this); // window object :O!!!
    }, 100);
};
obj.myMethod();
```



```
const obj = {};
obj.myMethod = function () {

  var that = this; //saving this scope

  console.log(this); // this = obj
    setTimeout(function () {
        console.log(that); // that (this) = obj
    }, 100);
};
obj.myMethod();
```

http://todd   tt   t

EC

Enhanced Object Literals

```javascript
const make = 'Kia', model = 'Sorento', value = 40000
const car = {
  // with property value shorthand
  // syntax, you can omit the property
  // value if key matches variable
  // name
  make,  // same as make: make
  model, // same as model: model
  value, // same as value: value

  // computed values now work with
  // object literals
  ['make' + make]: true,

  // Method definition shorthand syntax
  // omits `function` keyword & colon
  depreciate() {
    this.value -= 2500;
  }
};
```

http://www.benmvp.com/learning-es6-enhanced-object-literals/

Destructuring

```
// list matching
const [a, ,b] = [1,2,3];
a === 1;
b === 3;

// Fail-soft destructuring
const [a] = [];
a === undefined;

// Fail-soft destructuring with defaults
[a = 1] = [];
a === 1;

// object matching
const {name: n, likes: [,,c]} = {name: 'hello', likes: ['cat', 'dog', 'cow']};
n === 'hello';
c === 'cow';
```

Default + Rest + Spread

```
function f(x, y=12) {
  // y is 12 if not passed (or passed as undefined)
  return x + y;
}
f(3) == 15

function f(x, ...y) {
  // y is an Array
  return x * y.length;
}
f(3, "hello", true) == 6

function f(x, y, z) {
  return x + y + z;
}
// Pass each elem of array as argument
f(...[1,2,3]) == 6
```

ECMAScript 2015-2016

And a lot more:

- Iterators
- Generators
- Unicode
- Map, Set, WeakMap, WeakSet
- Proxies
- Symbols
- Async Await
- Tail Calls

https://github.com/DrkSephy/es6-cheatsheet
https://babeljs.io/learn-es2015/

References

- https://developer.mozilla.org/fr/docs/Web/JavaScript/Une_r%C
- https://developer.mozilla.org/fr/docs/Web/JavaScript/Guide
- https://developer.mozilla.org/en-US/Learn/Getting_started_wit
- http://sutterlity.gitbooks.io/apprendre-jquery/content/rappel_j
- http://eloquentjavascript.net/
- https://developer.chrome.com/devtools
- https://babeljs.io/learn-es2015/

Sources

- Cours TWEB@heig-vd, Olivier Liechti
  https://github.com/wasadigi/Teaching-HEIGVD-TWEB/