Dos and don't in Javascript

Javascript good parts and what to avoid

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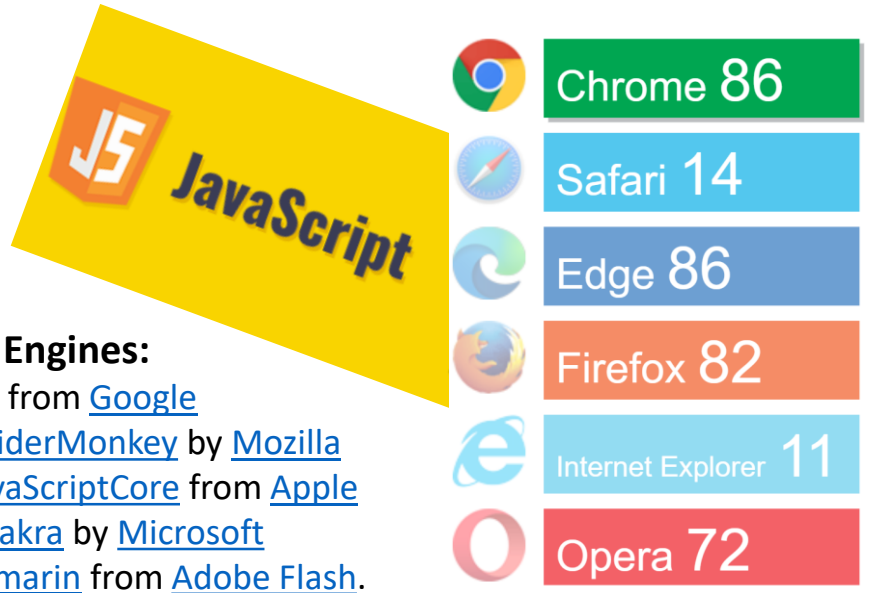
JS History, Ecosystem



JS Engines:
V8 from Google
SpiderMonkey by Mozilla
JavaScriptCore from Apple
Chakra by Microsoft
Tamarin from Adobe Flash.
Rhino & Nashorn by Oracle Java

2020	Chrome	Edge/IE	Firefox	Safari	Opera
October	80.4 %	5.2 %	7.1 %	3.7 %	2.1 %

Year	Chrome	IE	Firefox	Safari	Opera
2015	63.3 %	6.5 %	21.6 %	4.9 %	2.5 %
2009	6.5 %	39.4 %	47.9 %	3.3 %	2.1 %
2008		52.4 %	42.6 %	2.5 %	1.9 %
2007		58.5 %	35.9 %	1.5 %	1.9 %
				Netscape	
2006		62.4 %	27.8 %	0.4 %	1.4 %
2005		73.8 %	22.4 %	0.5 %	1.2 %
			Mozilla		
2004		80.4 %	12.6 %	2.2 %	1.6 %
2003		87.2 %	5.7 %	2.7 %	1.7 %
2002		84.5 %	3.5 %	7.3 %	

Languages for Web: HTML/CSS, **JavaScript**, Java applets, Flash/Flex

1993 Mosaic - first browser
1994 - Netscape Navigator
1995 – Mocha -> Live Script(JS) -> JavaScript (Brendan Eich, 10 days dev.)

1996 Browser war started: Microsoft JScript for IE browser
1997 – ECMAScript (spec.): JavaScript, JScript, ActionScript
2005 – AJAX born (E4X)
2008 – ES4 (Yahoo, Google, Microsoft, ..) -> ES6

2009 – CommonJS: Browserless JS, way to **Node.js.**
2015-2018 versions of JavaScript (ES6 - ECMAScript 2015)

Libs/Frameworks: jQuery, MooTools, D3.js, ExtJS, Angular, Vue, React, ..
UnitTesting: Unit.js, Jasmine, Jest, Mocha, Protractor, Cypress, ..

JS Alternatives: in writing code / transpilers: DART, **Typescript**, AtScript, Elm, ClojureScript, Kaffeine, CoffeeScript, BottomLine, Opal, Roy, ...
Alongside client and server software, it is now even possible to write native mobile apps using JavaScript. Also one language for FE&BE&DB

What brings Typescript (compile time check, ….)

- Typed Superset of JS, transpiled to JS (no type information). ES5 | ES6 ,
- Static type, Composing types, Generic, REST args,
- OOP features: Interfaces, Classes, Enums, ..
- More …

Do's and Don'ts: https://www.typescriptlang.org/docs/handbook/declaration-files/do-s-and-don-ts.html

Don't ever use the types Number, String, Boolean, Symbol, or Object

```
/* WRONG */
function reverse(s: String): String;
```

```
/* OK */
function reverse(s: string): string;
```

Return Types of Callbacks: Don't use the return type any for callbacks whose value will be ignored:

```
/* WRONG */
function fn(x: () => any) { x(); }
```

```
/* OK */ (even VOID is problematic: not type, discards value, .. )
function fn(x: () => void) { x(); }
```

It still does not solve the problems caused by JS, …

JavaScript is a sloppy language, and does a lot error-forgiveness. JSLint/ESLint/TSLint or TS or libraries like (lodash, decimal.js, ..) helps you to program better JS code and to avoid most of the slop.

Best Practices

- Avoid Global Variables: Global variables and functions can be overwritten by other scripts
- Beware of Automatic Type Conversions: “3”+”2”=32, “3”-”1”=2 Confusing Addition & Concatenation
- Use Parameter Defaults: otherwise undefined if not provided
- Avoid using eval() : run text as code, security issue, like bat or shell files
- Misunderstanding Floats: var y = 0.2; var z = x + y // result in z will not be 0.3;
- Avoid creating objects via **new** on Number, String, Boolean, Objects, Array, ..
- Accessing Arrays with Named Indexes:
- properties will produce undefined or incorrect results:
- Undefined is Not Null
- Be ready to expect weird results
- Reduce Activity in Loops
- Reduce DOM Size
- Avoid Using with
- Reduce DOM Access: Accessing the HTML DOM is slow
- ES5/6, TS, JSLint/EsLint, new libraries like lodash ,..

```
console.log("3" + "2");//32
console.log("3" - "2");//1
```

```
var x ="Hello";
var y = new String( value: "Hello");
(x === y)// false,  x is a string and y is an object.

//Even worse
var x = new String( value: "Hello");
var y = new String( value: "Hello");
(x == y)// is false because you cannot compare objects.
```

```
var person = [];
person["firstName"] = "John";
person["lastName"] = "Doe";
person["age"] = 46;
var x = person.length;      // person.length will return 0
var y = person[0];          // person[0] will return undefined
```

```
//Browser compatibility issues
var str = "HELLO WORLD";
str[0]; //IE 7 or earlier, …
str[0] = "A";// Gives no error, but does not work
/str[0]; // returns H
```

The Problematic/Sloppy part of JavaScript - reason to avoid

- It’s weakly typed, which makes the code comparatively obscure;
- Code is open, can be used for malicious purposes and compromise the client-side security;
- Code has to be tested on different browsers, won’t execute/interpret in the same way on every browser;
- Drawbacks including IEEE 754 Double Precision, the fact that a number of functions and properties tend to be executed differently across browsers, aggressive coercion, and problematic global variables (to name just a few).

JavaScript Data, Object types:

Primitive Data Types: string, number, boolean, symbols(es6), null, undefined. Primitive values are **immutable**
Types of Objects: [type object] Object, Date, Array, String, Number, Symbol, Boolean, function[function]. Mutatble key-col.
Types contain no values: null, undefined [typeof null is **object**], [typeof undefined is **undefined**]

HOISTING

JavaScript Declarations are Hoisted. Variables can be used before declared. It is JS's default behavior of moving all **declarations** regardless of where a function is placed, to the top of the scope. JavaScript only hoists declarations, not **initializations**.

```
x = 5;// Assign 5 to x
///some logic
var x;
```

```
<script>
var x = 5;  // Initialize x
elem = document.getElementById("demo");     // Find an element
elem.innerHTML = "x is " + x + " and y is " + y;  // Display x and y
var y = 7;  // Initialize y
</script>
```

//eg. const and let

```
carName = "Volvo";
document.getElementById("demo").innerHTML = carName;
let carName; //ReferenceError: Cannot access 'carName' before initialization
```

The function Statement, function Expression - fun-statements (not fun-expression) are subject to hoisting.

function foo( ) {}

var foo = function foo( ) {};

Objects JS objects inherit members from the prototype chain so they are *never truly empty*. To test for membership without prototype chain involvement, use the hasOwnProperty method or limit your results

new - creates a new object that inherits from the operand's prototype member, and then calls the operand, binding the new object to this. **Avoid creating Strings, Numbers, Booleans, Objects, & Arrays as Objects!** Unexpected **results** and **slow down execution speed. Two objects can't be even compared**. There is no compile-time or runtime warning.

```
var a = new String('b');        //String object
var b = new Number(10);        //Number object
var c = new Boolean(true);    //Boolean object
var d = new Object();        //Object object
var e = new Array();        //Array object
```

Use: var a = "b"; var b = 10; var c = true; var d= {}; var e =[] instead

```
let check  = new Boolean (false);
if(check) {
    console.log("WOW FOUND, even FALSE");//FOUND, even FALSE
}

let check2  = false;
if(check2) {
    console.log("WOW FOUND, even FALSE");//skipped
}
```

this - keyword refers to the object it belongs to. It has different values depending on where it is used:

- In a method, `this` refers to the **owner object**.
- Alone, `this` refers to the **global object,** [object Window].
- Also, in "use strict" `this` refers to the **global object** [object Window].
- In a function, `this` refers to the **global object**. [object Window].
- In a function, in strict mode, `this` is `undefined`.
- In an event, `this` refers to the **element** that received the event.
- Methods like `call()`, and `apply()` can refer `this` to **any object**.
- In short, with arrow functions there are no binding of `this`.

Phony Arrays - slower than real arrays

JavaScript does not have real arrays. No need to give them a dimension, and they never generate outof-bounds errors. But their performance can be considerably worse than real arrays.

The **typeof operator does not distinguish between arrays and objects**.

var fruits = ["Banana", "Orange", "Apple", "Mango"];

typeof fruits; //object, how can I recognize ARRAY

1) isArray function or

2)
```
if (my_value && typeof my_value === 'object'
            && typeof my_value.length === 'number'
            && !(my_value.propertyIsEnumerable('length'))) {
    //my_value is definitely an array!
    }
```

Another example

```
var elms = new Array(40,100);//Creates an array with two elements (40 and 100)
var elms = new Array(40);// Creates an array with 40 undefined elements!!!!!
```

```
var person = [];
person[0] = "John";
person[1] = "Doe";
person[2] = 46;
var x = person.length;       // person.length will return 3
var y = person[0];           // person[0] will return "John"
```

re-define arrays with named-indexes

```
var person = [];
person["firstName"] = "John";
person["lastName"] = "Doe";
person["age"] = 46;
var x = person.length;       // person.length will return 0
var y = person[0];           // person[0] will return undefined
```

hasOwnProperty When using a *for in* loop, usually a good idea to use **hasOwnProperty(variable)** to **make sure the property belongs to the object you want** and is not instead an inherited property from the prototype chain:

```
for (myvariable in object) {
 if
(object.hasOwnProperty(myvariable)) {
    ... //statements to be executed
    }
}
```

hasOwnProperty - can be replaced with other function

```
var name;
another_stooge.hasOwnProperty = null;       // trouble
for (name in another_stooge) {
    if (another_stooge.hasOwnProperty(name)) { // boom
        document.writeln(name + ': ' + another_stooge[name]);
    }
}
```

Semicolon insertion When inserting semicolons in places where they are not welcome, returns **undefined ;)**

```
return
{
status: true
}; //returns undefined
```

```
return {
status: true
}; //returns { status: true }
```

null and undefined

Undefined refers to something which has not yet been assigned a value (yet). Null refers to something which definitively has no value. In that case, just return a null. Also different browsers seem to be returning these differently.

null and undefined differences

```
typeof undefined //undefined
typeof null      // object
null == undefined // true
null === undefined // false
```

void - In JavaScript, void is an operator (but in many languages, **void is a return type**) that takes an operand and returns undefined. This is not useful, and it is very confusing. Avoid void.

```
console.log(void 0); //undefined
console.log(undefined); //undefined
```

```
// a naughty global variable from another script
var undefined = "oops";
```

ES5 improved this by making undefined immutable

void - introduced to handle the shadowing of undefined in **pre-ES5,** where undefined on the global scope can be **overridden** or **shadowed**. Is an operator not return type.

```
1) let i = void 2; // i === undefined
```

```
2) <a href="javascript:void(0)">Click Here</a>
```

```
3) void function what() {
    console.log('What')
   }();
   //using void for IIFE will always evaluate to undefined.
   what();
```

```
4) let tt = (function() {})() === void 0; //undefined
   console.log(tt); //true
```

VOID method returns UNDEFINED. //In Java VOID method does not return anything, …

Global Variables should be avoided

- Visible in every scope, can significantly complicate the behavior of the program, harder to run subprograms
- Can be re-declared, re-assigned, …

Three ways to define global variables

- **var foo = value;** (any place outside the function)
- **window.foo = value;** (add directly to global object)
- **foo = value;** (implied global or implicit global via variable hoisting) more open to buggy programs

JS has function SCOPE: Each function creates new scope. Variables declared in function, become **LOCAL** to the function.
Undefined Variables and Functions. If a variable is not explicitly declared, then JS assumes that the variable was global

E.g.1

```
function foo() {
    var variable1, variable2;
    variable1 = 5; varaible2 = 6;
    return variable1 + varaible2;
}
```

E.g.2

```
var carName = "Ford";
console.log(carName);
var carName; //still has value  Ford
console.log(carName);
var carName = 76; //type changed
console.log(carName);
```

Alternative:

- To minimize use of global-var: var myApp = {}; which holds all fileds for your app. e.g. Angular style…
- Use let|const (scoped var) .
- Use jslint/eslint: helps to catch variable-hoisting bugs, to find if you use variable out of scope
- Or closure for data hiding

Typeof, instanceof - returns a string that identifies the type

```
console.log( typeof 0 ); // "number"
console.log( typeof new Number() ); // "object"
console.log( typeof Infinity ); //"number"
console.log( typeof NaN ); // "number"
console.log( typeof 'Hi' ); // "string"
console.log( typeof new String("Hi") ); // "Object"
console.log( typeof true ); // "boolean"
console.log( typeof new Boolean(true) ); //"object"
console.log( typeof null ); // "object“,  not null
console.log( typeof undefined ); //"undefined"
//console.log( typeof new Symbol() ); // "symbol" - only in ES6
console.log( typeof [] ); //"object“ - arrays are objects.
console.log( typeof [1,2,3]); // "object", not "array"
console.log( typeof new Array(1,2,3)); // "object"
console.log( typeof new Date() ); //"object"
console.log( typeof /^$/ ); // "object“
console.log( typeof new RegExp('^$')); //"object"
console.log( typeof {a: "abc"} ); //"object"
console.log( typeof typeof {} ); //"string"
console.log(typeof function () {}); //function
```

All objects are *truthy* and null is *falsy*

Arrays are objects in JavaScript so typeof array will return 'object'

You cannot use typeof to determine if a JS object is an array (or a date).

```
var myArr = [1,2,3,4];
console.log(myArr.constructor.toString().indexOf("Array") > -1);
console.log(myArr.constructor === Array );//2-way
isArray //3 way, …
```

Falsy Values - These values are all **falsy**, but they are not interchangeable.

All other values are ***truthy*** including all objects & the string 'false'.

Value	Type
0	Number
NaN (not a number)	Number
'' (empty string)	String
false	Boolean
null	Object
undefined	Undefined

```
if (my_value && typeof my_value === 'object') {
    //then my value is definitely an object or an array
    //and truthy (first statement)
}
```

All objects are *truthy* and null is *falsy*

```
let check  = new Boolean (false);
if(check) {
    console.log("WOW FOUND, even FALSE");//FOUND, even FALSE
}

let check2  = false;
if(check2) {
    console.log("WOW FOUND, even FALSE");//skipped
}
```

Instanceof checks if an object is an instance of a class or constructor

```
//array is complex type, even though [] has typeof Object
console.log([] instanceof Array); // true
console.log(typeof []); //object

//instance of only works for complex data type
const a = "I'm a string primitive";
const b = new String("I'm a String Object");
console.log(a instanceof String); //returns false
console.log(b instanceof String); //returns true
```

E.g. shows clarity on the differences between **typeof** and **instanceof**

```
const isString = (str) => {
  return typeof str === 'string' || str instanceof String
}
```

1. **== (equal values)** 2. **=== (both type and value, but still not complete)** 3. **Object.is()**

Comparing two JavaScript objects will **always** return `false`.

//result is same with number/Number, boolean/Boolean, array/Array

var x = “JavaScript";
var y = new String("JavaScript");
x == y //true, equal values
x === y //false, have different types (**string** and **object**)

Even worse: Objects cannot be compared:

```
var x = new String("JavaScript");
var y = new String("JavaScript");
// (x == y) is false because x and y are different objects
// (x === y) is false because x and y are different objects
// just if two obj same, NaN can be used during comparison
Object.is(x, x)); //true
Object.is(x, y)); //false
```

== operator always converts (to matching types) before comparison.
=== operator forces comparison of values and type:

5==‘5’ //true
5===“5” //false

0 == ""; // true
1 == "1"; // true
1 == true; // true
0 === ""; // false
1 === "1"; // false
1 === true; // false

Manual comparison needed to compare Objects:
Read properties and compare them manually. Eg. object1.name === object2.name
You also can use Object.keys() [shallow(for primitives) or deep versions] just to fasten the process.
Other ways: ES6 way Object.entries(k1).toString() === Object.entries(k2).toString(); No for nested obj+keys order
2) JSON.stringify (key order matters) 3) **LODASH**

In JAVA .. Just equals() checks value equality, == if both references to same OBJ in memory

parseInt – no warning or informative message when converting also issue is with dates/times/
Eg1: parseInt("**32**") and parseInt("**32 meters**") produce the same result 32,
Eg2: parseInt("08") and parseInt("09") based on Base 8, but es5 (integer) **;)** Provide Radix.

Floating point (64bit), no warning|info message, behaves differently in different browser converts a string into an integer.
0.1 + 0.2 is not equal to 0.3 //0.30000000000000004 ==> var z = (x * 10 + y * 10) / 10; //0.3
Numbers in JS no types of numbers, like integers, short.. numbers without a period or exp. are accurate up to 15 digits
var x = 999999999999999; // x will be 999999999999999
var y = 9999999999999999; // y will be 10000000000000000

```
console.log(0.1 + 0.2); //0.30000000000000004
console.log(0.1 + 0.2 === 0.3); //false // ???
x = 1.0000000000000001
console.log(x === 1); //true // ???
```

Bitwise – JavaScript has the same set of bitwise operators (&, |, ^, ~, >>, ..) as Java: In Java they work with integers. JS has no integers. Bit operator work on 32bit, result converted back to JS, …
In JavaScript, they are very far from the hardware and very slow. JavaScript is rarely used for doing bit manipulation. As a result, in JavaScript programs, it is more likely that & is a mistyped && operator.

NaN – NaN (Not-a-Number) is not equal to any value (including itself, **NaN !=== NaN**) and is essentially an **illegal number value**, but *typeOf(NaN)===number //true*. Use isNaN(number) to check for NaNs

```
var isNumber = function isNumber(value) {
    return typeof value === 'number' && isFinite(value); //not NaN & Infinity
```

THANK YOU

References

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