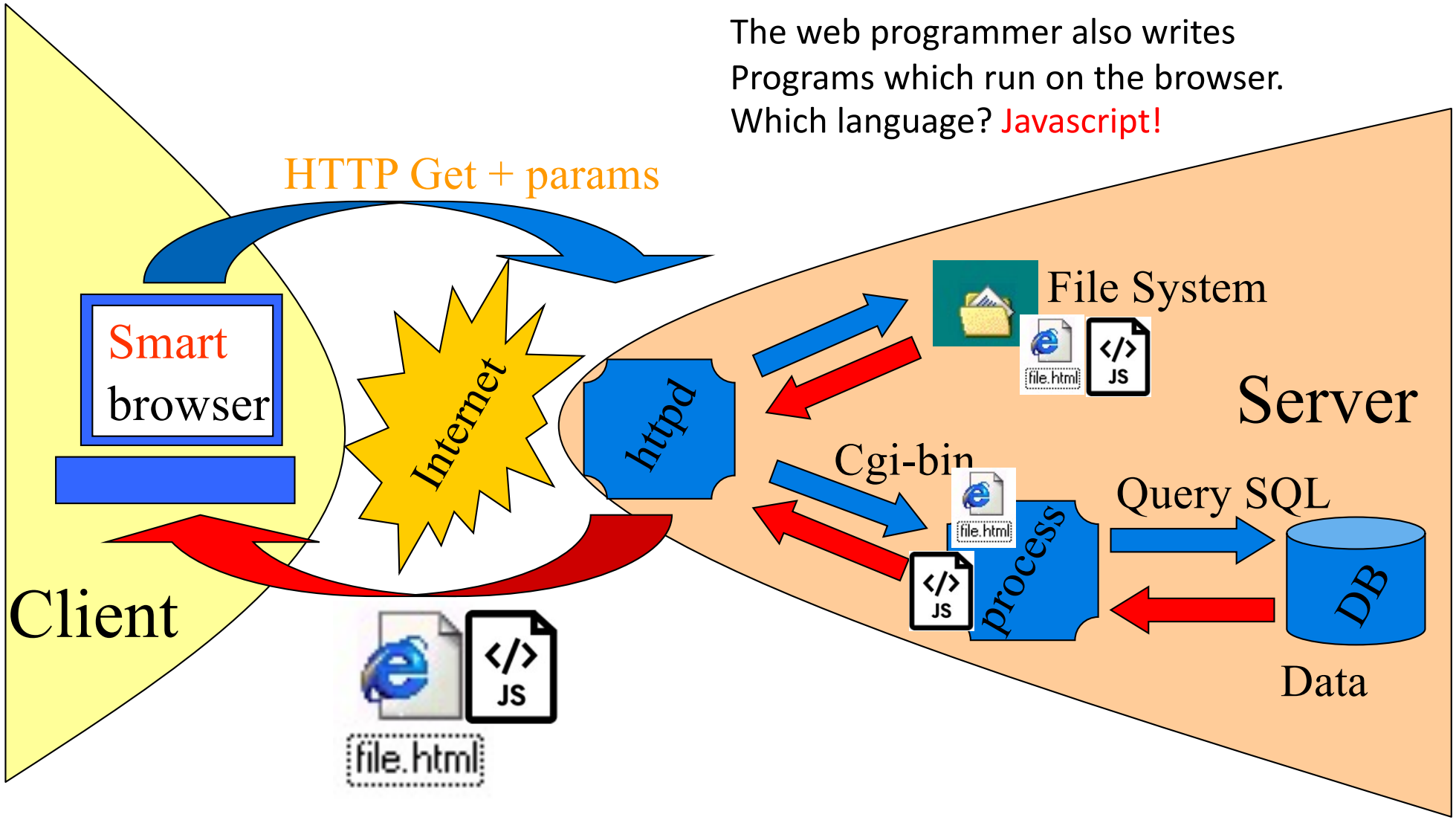
Javascript and the DOM

The web architecture with smart browser



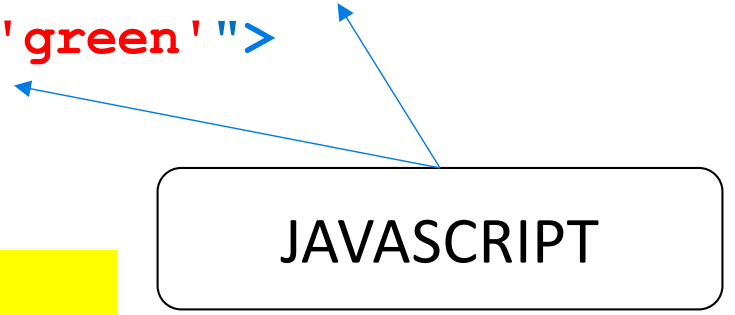
Evolution 3: execute code also on client! (How ?)

Javascript and the DOM

1- Adding dynamic behaviour to HTML

Example 1: onmouseover, onmouseout

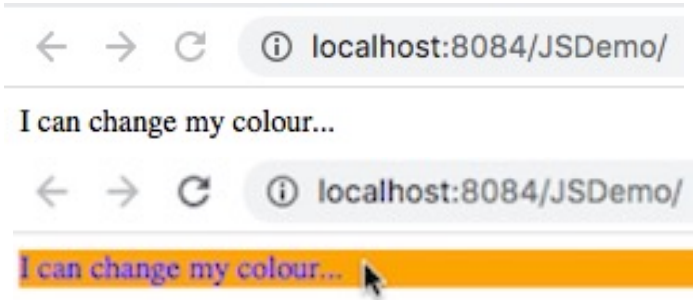
```
<!DOCTYPE html>
<html>
    <head>
        <title>Dynamic behaviour</title>
        <meta charset="UTF-8">
        <meta name="viewport" content="width=device-width,
  initial-scale=1.0">
    </head>
    <body>
        <div onmouseover="this.style.color = 'red'"
  onmouseout="this.style.color = 'green'">
  I can change my colour!</div>
    </body>
</html>
```

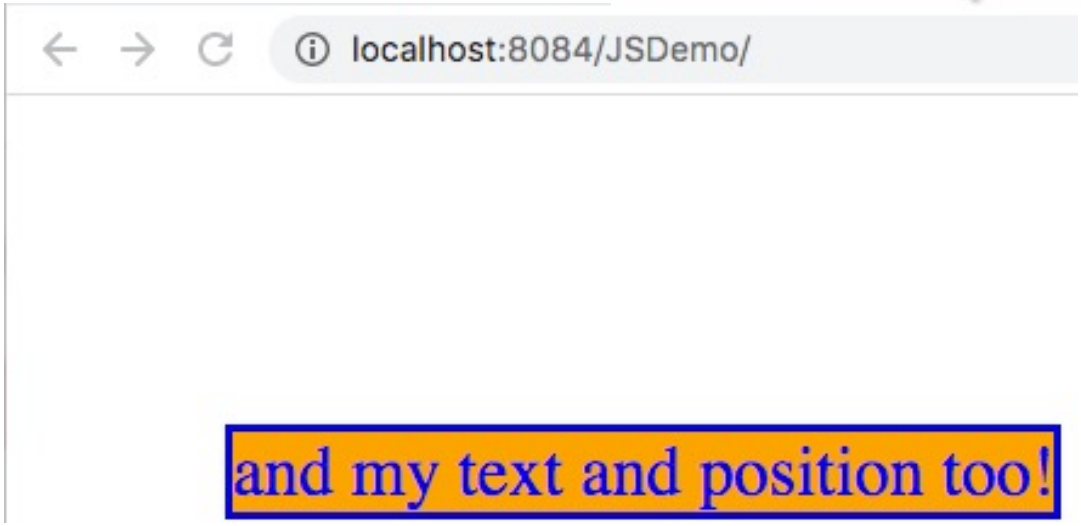


The dynamic behaviour is
on the client side!
(The file can be loaded locally)

Example 2: onmouseover, onmouseout

```
<body>
  <div
    onmouseover="this.style.background='orange';
      this.style.color = 'blue';"
    onmouseout="
      this.innerText='and my text and position too!';
      this.style.position='absolute';
      this.style.left='100px';
      this.style.top='150px';
      this.style.borderStyle='ridge';
      this.style.borderColor='blue';
      this.style.fontSize='24pt';">
   I can change my colour...
  </div>
</body >
```





JavaScript is event-based

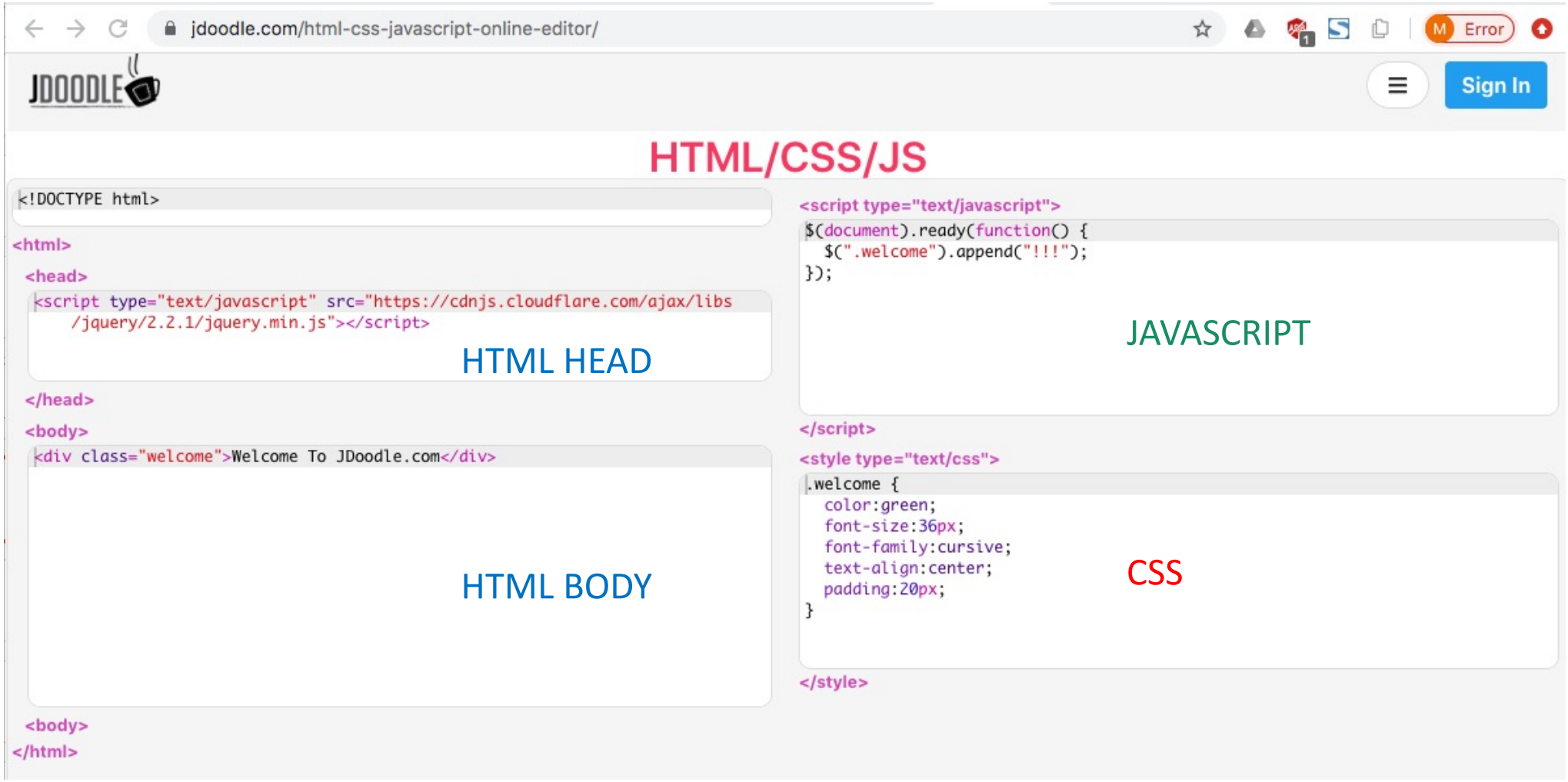
UiEvents:

These event objects iherits the properties of the UiEvent:

- The FocusEvent
- The InputEvent
- The KeyboardEvent
- The MouseEvent
- The TouchEvent
- The WheelEvent

See https://www.w3schools.com/jsref/obj_uievent.asp

Test and Gym



https://www.jdoodle.com/html-css-javascript-online-editor/

Javascript and the DOM

2- Introduction to the language

JavaScript History

- JavaScript was born as Mocha, then "**LiveScript**" at the beginning of the 94's.
- Name changed into JavaScript (name owned by Netscape)
- Microsoft responds with **Vbscript**
- Microsoft introduces **JScript** (dialect of Javascript)
- A standard is defined: ECMAScript (ECMA-262, ISO-16262)
- Jscript survives (as ECMAScript incarnation till 2009, then as Chakra till 2015)
- Another incarnation of ECMAScript is **ActionScript** (Adobe, for Flash)

JavaScript: History

Name	Edition	Date published			
Mocha		May-95			
LiveScript		Sep-95			
JavaScript		Dec-95			
			Jscript	Aug-96	Microsoft
ECMAScript	1	Jun-97			
ECMAScript	2	Jun-98	ActionScript	1998	Macromedia/Adobe
ECMAScript	3	Dec-99			
ECMAScript	4	Abandoned			
ECMAScript	5	Dec-09			
ECMAScript	5,1	Jun-11			
ECMAScript 2015 (ES2015)	6	Jun-15			
ECMAScript 2016 (ES2016)	7	Jun-16			
ECMAScript 2017 (ES2017)	8	Jun-17			
ECMAScript 2018 (ES2018)	9	Jun-18			
ECMAScript 2019 (ES2019)	10	Jun-19			

ECMAScript Engine

An ECMAScript engine is a program that executes source code written in a version of the ECMAScript language standard

Examples:

- **V8 (Chrome, NodeJS, Opera)**
- **SpiderMonkey (Mozilla)**
- **Chakra (Microsoft)**
- **JavaScriptCore(Apple)**
- **Nashorn (Oracle – JDK)**

See https://en.wikipedia.org/wiki/List_of_ECMAScript_engines

JavaScript Myths

- JavaScript is NOT simple
  - **Simple tasks are indeed simple**
- JavaScript is NOT Java

	Java	JavaScript
Browser Control	NO	YES
Networking	YES	Partial
Graphics	YES	Partial

JavaScript is…

- Scripted (not compiled)
- Powerful
- Cross-Platform
- Client and Server
- Object-based
  (and partially oriented)
- Event-driven

JavaScript allows…

- Dynamic Web Sites
- Dynamic HTML (DHTML)
- Interactive Pages/Forms
- Server-Side Functionality
- Application Development

JavaScript and HTML

- Between `<script>` and `</script>` tags
- In a `<script src="url"></script>` tag
- Between `<server>` and `</server>` tags
- In an event handler:

```
<input type="button" value="Click me"
                onClick="js code">
<div onmouseover="this.style.color =
  'red'" onmouseout="this.style.color =
  'green'”>
```

Base

- Syntax is C-like (C++-like, Java-like)

  case-sensitive,

  statements end with (optional) semicolon ;

  //comment /*comment*/

  operators (=,*,+,++,+=,!=,==,&&,…)

Statements

- `if (expression) {statements} else {statements}`
- `switch (expression) {`
  `case value: statements; break;`
  `…`
  `default: statements; break;`
  `}`
- `while (expression) {statements}`
- `do (expression) while {statements}`
- `for (initialize ; test ; increment) {statements}`
  `for (a in s) {statements}`

Data types

- Primitive data types
  number, string, boolean, undefined

- Complex data types
  object, function (more later!)

- Loosely, dynamic typed variables (Basic-like)

```
t0==typeof(x);
var x=3;
var t1=typeof(x);
x="pippo";
var t2=typeof(x);
```

t0: undefined

t1: number

t2: string

Data types: Objects and DOM

Javascript also has Objects, somehow similar to Java Objects (even though their implementation is quite different, and their definition not as clean and straightforward as in Java).

Objects have variables and methods.

Similarly to Java Objects, they can be printed: in such case they use their customized toString() method, or give a generic indication such as **[object HTMLDivElement]**

Some Javascript Objects represent fragments of an HTML document. The collection of these Objects represent the whole page. Such representation is called Document Object Model.

Operators

- Mathematical operators: standard, plus ** for exponentiation (ES6)
- Assignment operators: standard, plus **= for exponentiation (ES6)
- String operators: + (concatenation), see later
- Comparison operators: standard, plus type and value

===	equal value and equal type
!==	not equal value or not equal type

- Logical and bitwise operators: standard
- Type operators

typeof	Returns the type of a variable
instanceof	Returns true if an object is an instance of an object type

see https://www.w3schools.com/js/js_operators.asp

More here:

https://www.w3schools.com/js/default.asp

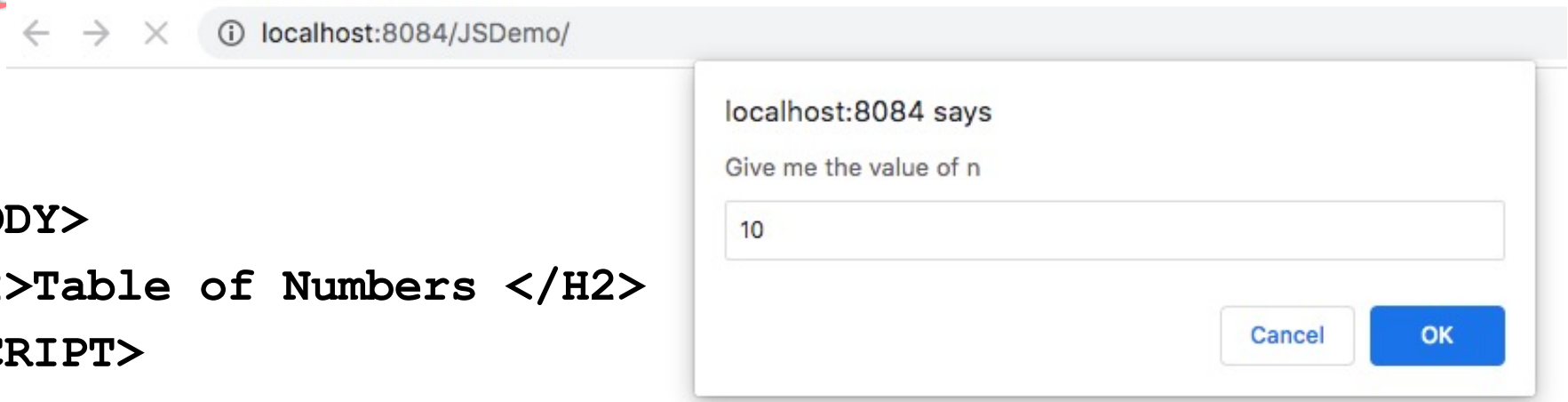
it is suggested to quickly
go through these items!

Javascript and the DOM

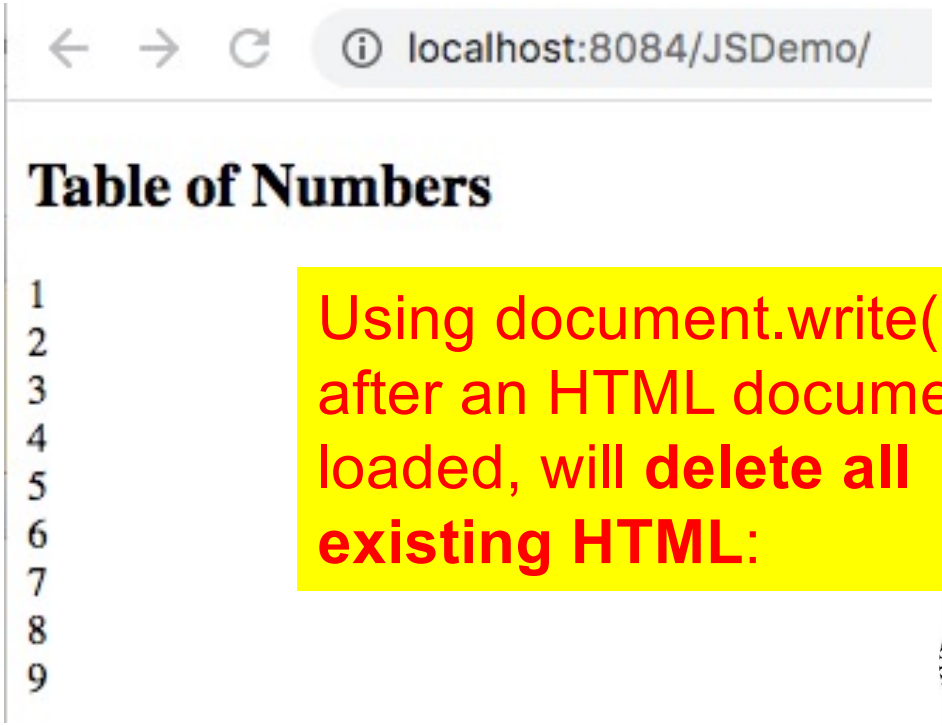
3- user input and output

Core

User I/O




```
<BODY>
<H2>Table of Numbers </H2>
<SCRIPT>
n=window.prompt("Give me the value of n",3);
for (i=1; i<n; i++) {
   document.write(i);
   document.write("<BR>");
}
</SCRIPT>
</BODY>
</HTML>
```



The dynamic behaviour is on the client side!
(The file can be loaded locally)

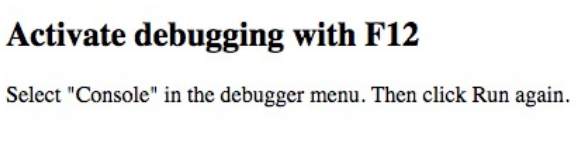
Using document.write() after an HTML document is loaded, will **delete all existing HTML**:

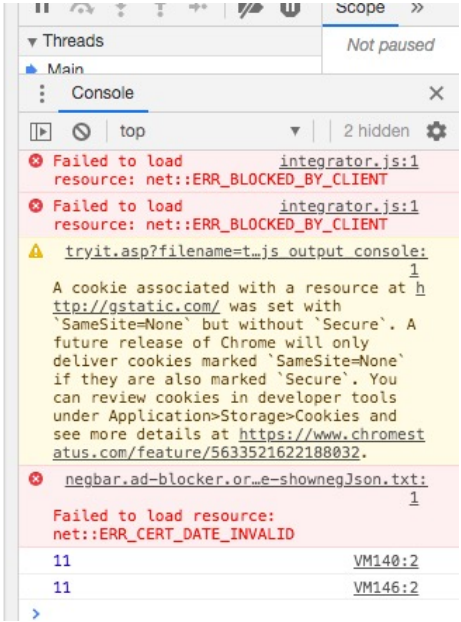
JS output

Writing into the HTML output using `document.write()`.

Writing into an alert box, using `window.alert()`.

Writing into the browser console, using `console.log()`.





JS output

Writing into an HTML element, using:

- innerHTML

```
<div onmouseover="this.innerHTML='How are you?';">
  Hello</div>
```

- innerText

```
<div onmouseover="this.innerText='How are you?';">
  Hello</div>
```

- textContent

```
<div onmouseover="this.textContent='How are you?';">
  Hello</div>
```

```
<div onmouseover="window.alert(this.property)";>
This element contains <code>code</code>, <span
   style="visibility:hidden">hidden information, </span>
   and <strong>strong language</strong>.</div>
```

This element contains code, and **strong language.**

- innerHTML

  Full HTML content

property

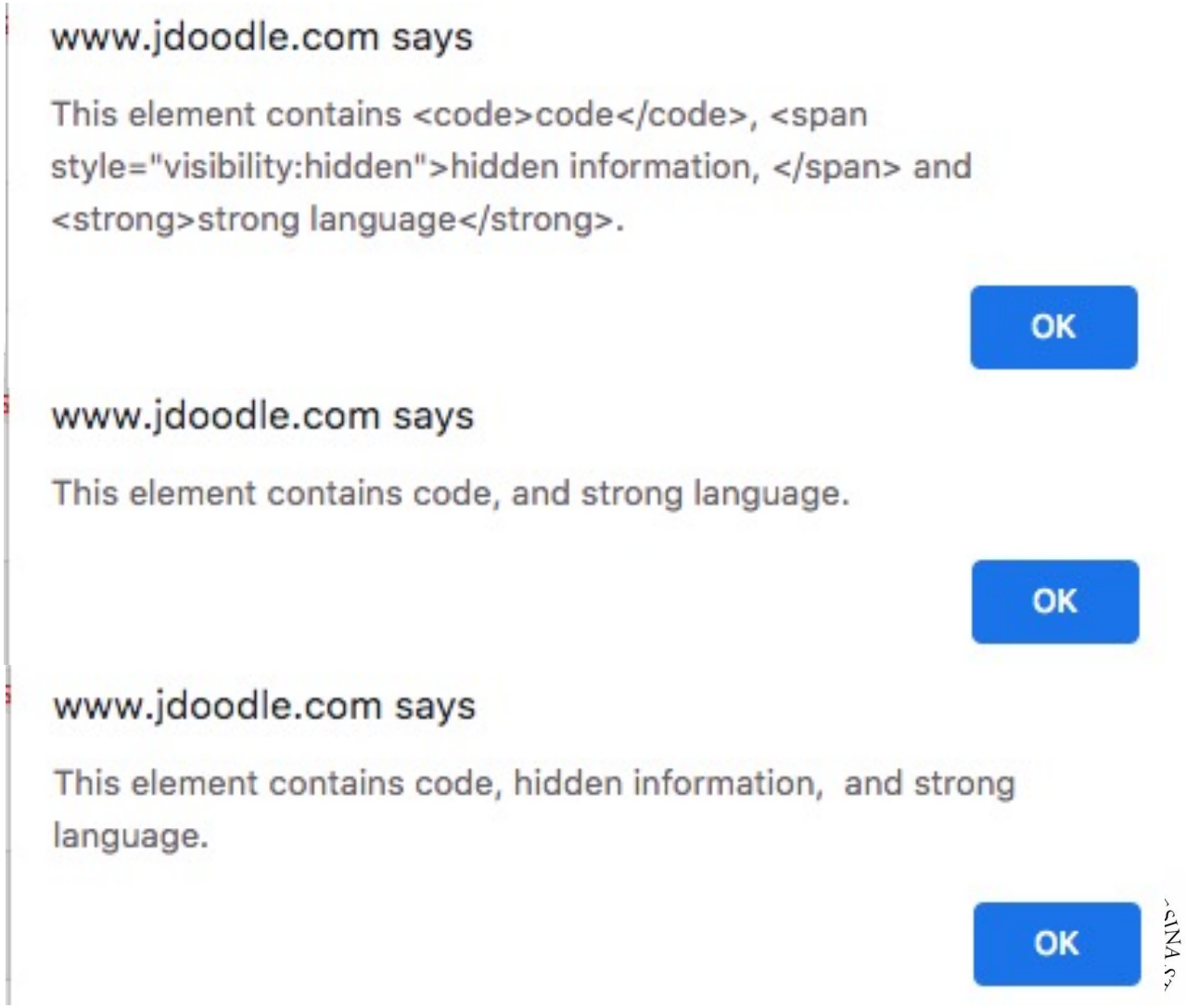
- innerText

  Text only, CSS aware

- textContent

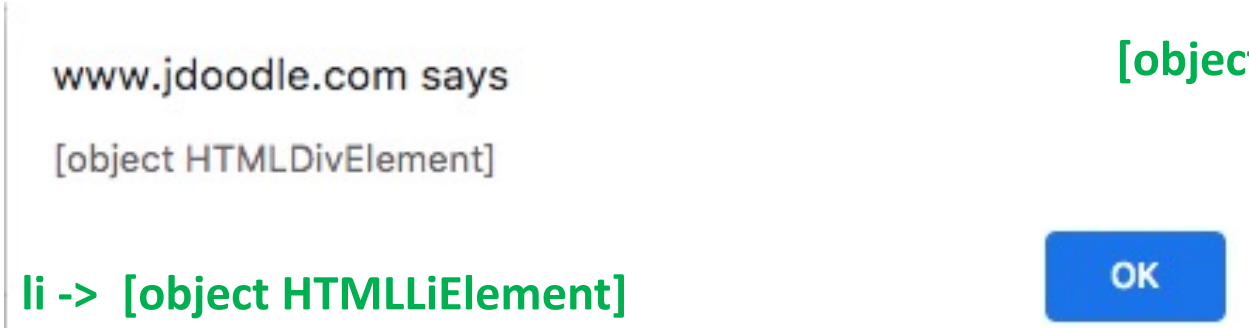
  Text only, CSS unaware

JS output



What is "this"?

```
<div onmouseover="window.alert(this)";"> Hello</div>
```



[object HTMLDivElement]

li -> [object HTMLLiElement]

h1,...h5 -> [object HTMLHeadingElement]

b, i -> [object HTMLElement]

```
<a onmouseover="window.alert(this)";"
  href="http://localhost"> a link</a>
```

a -> http://localhost

```
<b onmouseover="window.alert(this.nodeName)";"> Hello</b>
```

b -> b

a -> a

Javascript: the language

4- Taking a look at strings

Strings

JavaScript Strings are a strange, double-headed beast…

They are both

a primitive data type and

an object

View also:
https://www.w3schools.com/js/js_strings.asp

Strings as Objects

Usually, JavaScript strings are primitive values, created from literals:

```
var firstName_primitive = "John";
```

But strings can also be defined as objects with the keyword new:

```
var firstName_object = new String("John");
```

When using === , firstName_primitive and firstName_object are NOT EQUAL, because the === operator expects equality in both type and value. With == they are EQUAL.

String operators

a+b => football

a<b => true

String methods

There are a lot of java-like methods

Some examples:

charAt(0)

indexOf(substring), lastIndexOf(substring)

charCodeAt(n),fromCharCode(value,…)

concat(value,…),slice(start,end)

toLowerCase(), toUpperCase()

replace(regexp,string), search(regexp)

- List: https://www.w3schools.com/jsref/jsref_obj_string.asp
  (Ignore constructor and prototype for now)

- Detailed examples: https://www.w3schools.com/js/js_string_methods.asp

Javascript: the language

5 - getting deeper: plus operator – part 1

operand1 + operand2 = result

+ Operator : rules

Phase 1: conversion

1) Any Object operand is converted to a primitive value (String, Number, Boolean);
2) If an operand is a String and the other is not, the non-String operand is converted to String
3) Any remaining Boolean operand is converted to Number (true->1, false->0)
4) Any remaining null operand is converted to Number (0)
5) Any remaining Undefined is converted to Number (NaN)

Phase 2: execution

6) If both operands are String, concatenation is performed.
7) If both operands are Number, sum is performed.

+ Operator : examples without instantiated Objects

x	y	Is there a String operand?	x+y
1	2	NO	3
"1"	2	YES -> Rule 2	12
1	null	NO -> Rule 4	1
"1"	null	YES -> Rule 2	1null
1	undefined	NO-> Rule 5	NaN
"1"	undefined	YES -> Rule 2	1undefined
1	true	NO ->Rule 3	2
"1"	true	YES -> Rule 2	1true
false	true	NO ->Rule 3	1
true	null	NO ->Rule 3, 4	1
true	undefined	NO->Rule 3, 5	NaN
null	null	NO ->Rule 4	0
null	undefined	NO->Rule 4, 5	NaN

Operations with integers

```
<script>
var x = "100";
var y = "10";
document.write(x * y);document.write("<br>");
document.write(x + y);document.write("<br>");
document.write(x * 1 + y);document.write("<br>");
document.write(x * 1 + y * 1);document.write("<br>");
</script>
```

OUTPUT:

1000
10010
10010
110

+ as unary operator

Unary + can be used to convert string to number

```
var y = "5";          // y is a string
var x = + y;          // x is a number (5)

var y = "Pippo";      // y is a string
var x = + y;          // x is a number (NaN)
```