Javascript

L9019: Computação e Representação Gráfica | Martijn Kuipers

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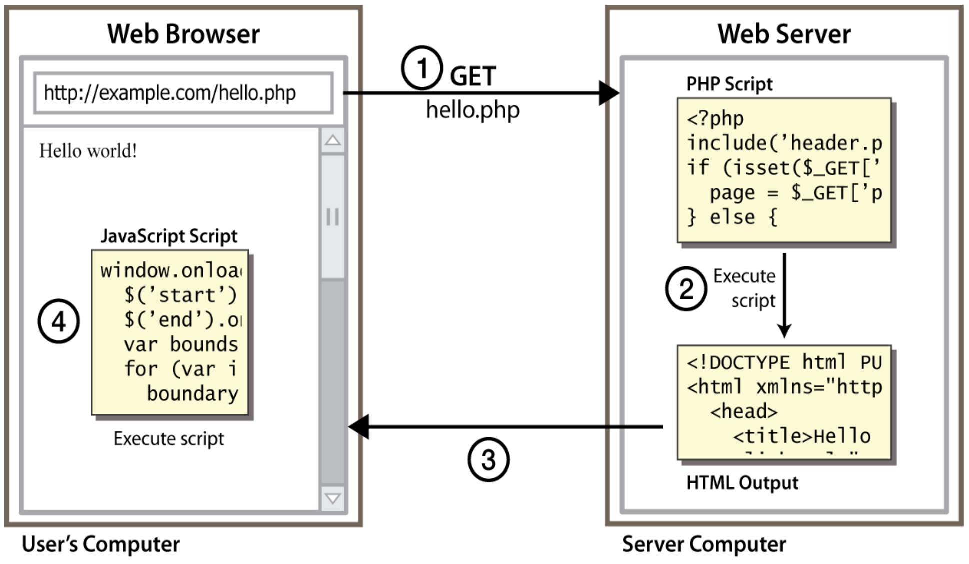
Client Side Scripting



Why use client-side programming?

PHP already allows us to create dynamic web pages. Why also use client-side scripting?

- client-side scripting (JavaScript) benefits:
  - **usability**: can modify a page without having to post back to the server (faster UI)
  - **efficiency**: can make small, quick changes to page without waiting for server
  - **event-driven**: can respond to user actions like clicks and key presses

Why use client-side programming?

- server-side programming (PHP) benefits:
  - **security**: has access to server's private data; client can't see source code
  - **compatibility**: not subject to browser compatibility issues
  - **power**: can write files, open connections to servers, connect to databases, ...

What is Javascript?

- a lightweight programming language ("scripting language")
  - used to make web pages interactive
  - insert dynamic text into HTML (ex: user name)
  - **react to events** (ex: page load user click)
  - get information about a user's computer (ex: browser type)
  - perform calculations on user's computer (ex: form validation)

What is Javascript?

- a web standard (but not supported identically by all browsers)
- NOT related to Java other than by name and some syntactic similarities

Javascript vs Java

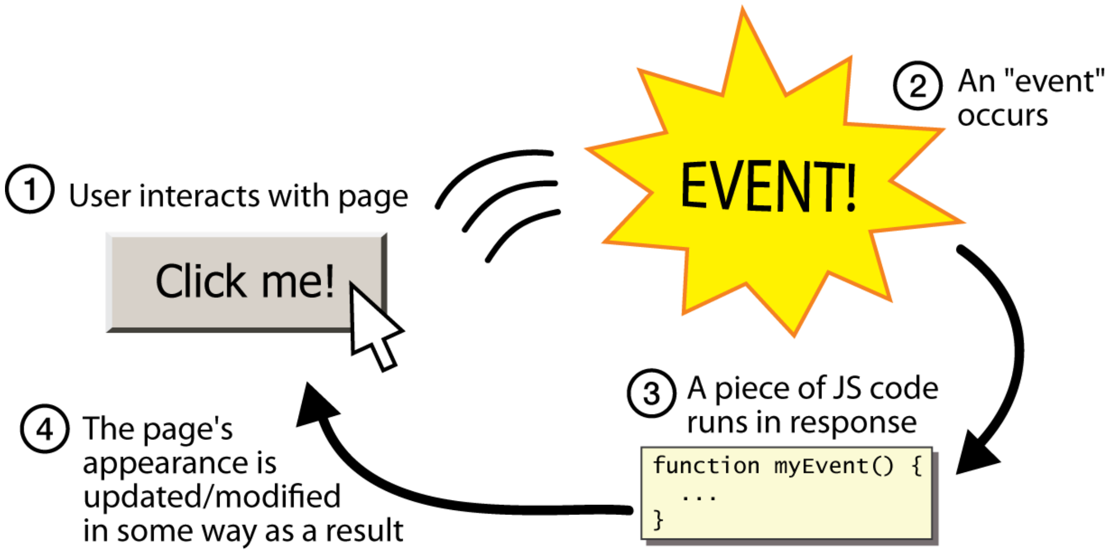
- interpreted, not compiled
- more relaxed syntax and rules
  - fewer and "looser" data types
  - variables don't need to be declared
  - errors often silent (few exceptions)
- key construct is the function rather than the class
  - "first-class" functions are used in many situations
- contained within a web page and integrates with its HTML/CSS content

Linking to a JavaScript file: `script`

- script tag should be placed in HTML page's head
- script code is stored in a separate .js file
- JS code can be placed directly in the HTML file's body or head (like CSS)
  - but this is bad style (should separate content, presentation, and behavior

```
<script src="filename" type="text/javascript"></script>
                                                    HTML
```

Event-driven programming

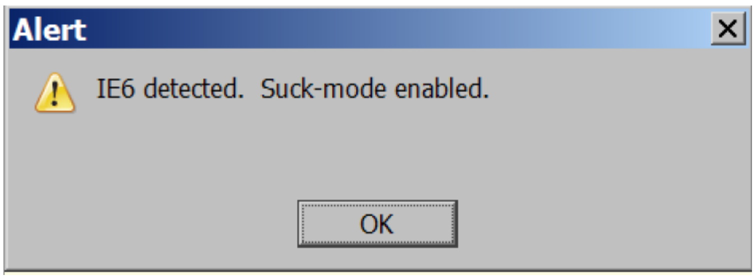

1 User interacts with page
Click me!
EVENT!
2 An "event" occurs
3 A piece of JS code runs in response
4 The page's appearance is updated/modified in some way as a result

```
function myEvent() {
  ...
}
```

A JavaScript statement: `alert`

- a JS command that pops up a dialog box with a message

```
alert("IE6 detected. Suck-mode enabled.");
                                               JS
```



IE6 detected. Suck-mode enabled.

Event-driven programming

- you are used to programs start with a main method (or implicit main like in PHP)
- JavaScript programs instead wait for user actions called *events* and respond to them
- event-driven programming: writing programs driven by user events

Buttons

- button's text appears inside tag; can also contain images
- To make a responsive button or other UI control:
  1. choose the control (e.g. button) and event (e.g. mouse 1. click) of interest
  2. write a JavaScript function to run when the event occurs
  3. attach the function to the event on the control

```html
<button>Click me!</button>                                  HTML
```

JavaScript functions

```
function name() {
statement ;
statement ;
...
statement ;
}                                                          JS
```

```
function myFunction() {
      alert("Hello!");
      alert("How are you?");
}                                                          JS
```

- the above could be the contents of example.js linked to our HTML page
- statements placed into functions can be evaluated in response to user events

Event handlers

- JavaScript functions can be set as event handlers
  - when you interact with the element, the function will execute
- onclick is just one of many event HTML attributes we'll use

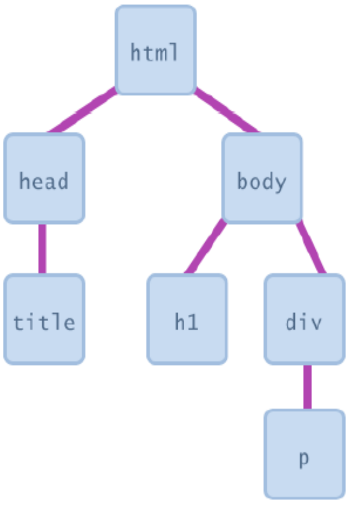
```
<element attributes onclick="function();">...
                                                         HTML
```

- but popping up an alert window is disruptive and annoying
  - A better user experience would be to have the message appear on the page...

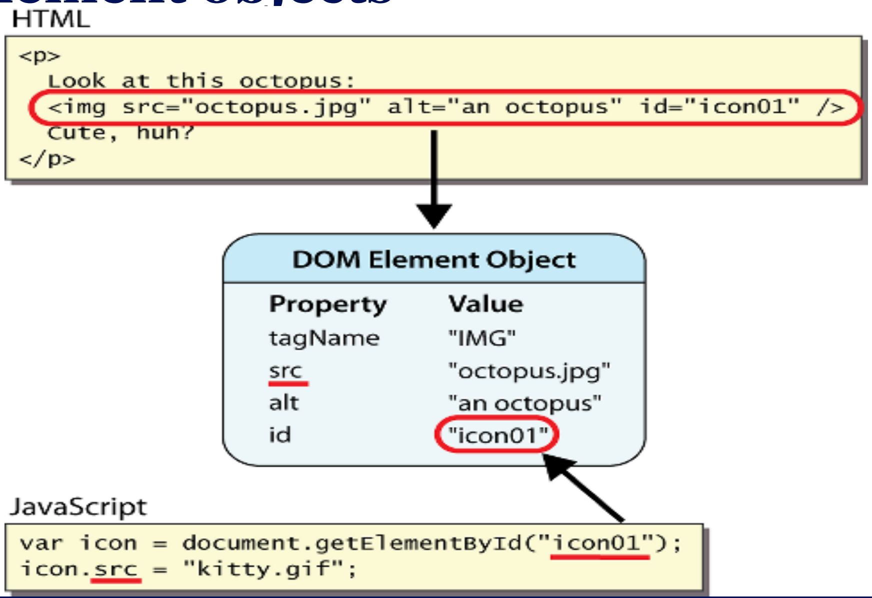
```
<button onclick="myFunction();">Click me!</button>
                                                         HTML
```

Document Object Model (DOM)

- most JS code manipulates elements on an HTML page
- we can examine elements' state
  - e.g. see whether a box is checked
- we can change state
  - e.g. insert some new text into a div
- we can change styles
  - e.g. make a paragraph red



DOM element objects



HTML

```
<p>
  Look at this octopus:
  <img src="octopus.jpg" alt="an octopus" id="icon01" />
  Cute, huh?
</p>
```

DOM Element Object

Property	Value
tagName	"IMG"
src	"octopus.jpg"
alt	"an octopus"
id	"icon01"

JavaScript

```
var icon = document.getElementById("icon01");
icon.src = "kitty.gif";
```

Accessing elements: `document.getElementById`

```
var name = document.getElementById("id");
                                                            JS
```

```
<button onclick="changeText();">Click me!</button>
<span id="output">replace me</span>
<input id="textbox" type="text" />                         HTML
```

```
function changeText() {
       var span = document.getElementById("output");
       var textBox = document.getElementById("textbox");

        textbox.style.color = "red";

}                                                           JS
```

Accessing elements: `document.getElementById`

- document.getElementById returns the DOM object for an element with a given id
- can change the text inside most elements by setting the innerHTML property
- can change the text in form controls by setting the value property

Changing element style: `element.style`

Attribute	Property or style object
color	color
padding	padding
background-color	backgroundColor
border-top-width	borderTopWidth
Font size	fontSize
Font famiy	fontFamily

Prettify

```
function changeText() {
       //grab or initialize text here

       // font styles added by JS:
       text.style.fontSize = "13pt";
       text.style.fontFamily = "Comic Sans MS";
       text.style.color = "red"; // or pink?
}                                                JS
```

More Javascript Syntax

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Variables

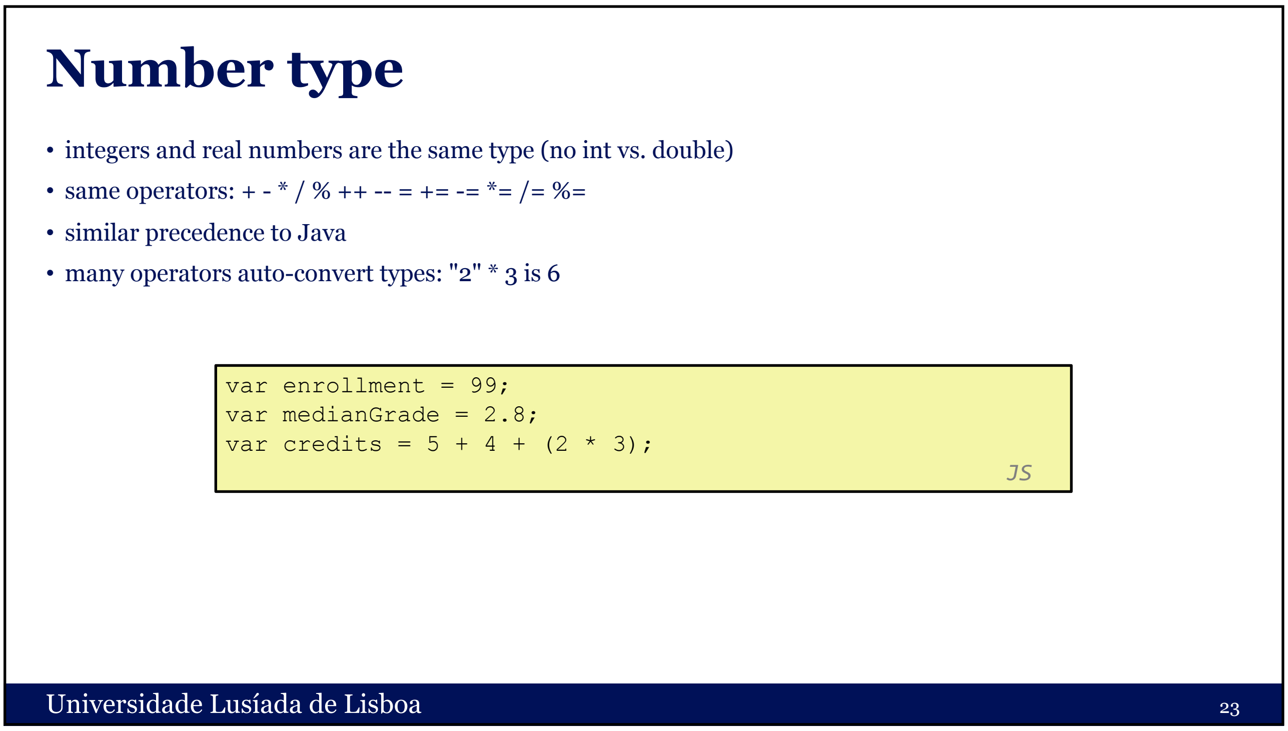
- variables are declared with the var keyword (case sensitive)

```
var name = expression;                              JS
```

- types are not specified, but JS does have types ("loosely typed")
  - `Number, Boolean, String, Array, Object, Function, Null, Undefined`

```
var clientName = "Connie Client";
var age = 32;
var weight = 127.4;                                 JS
```

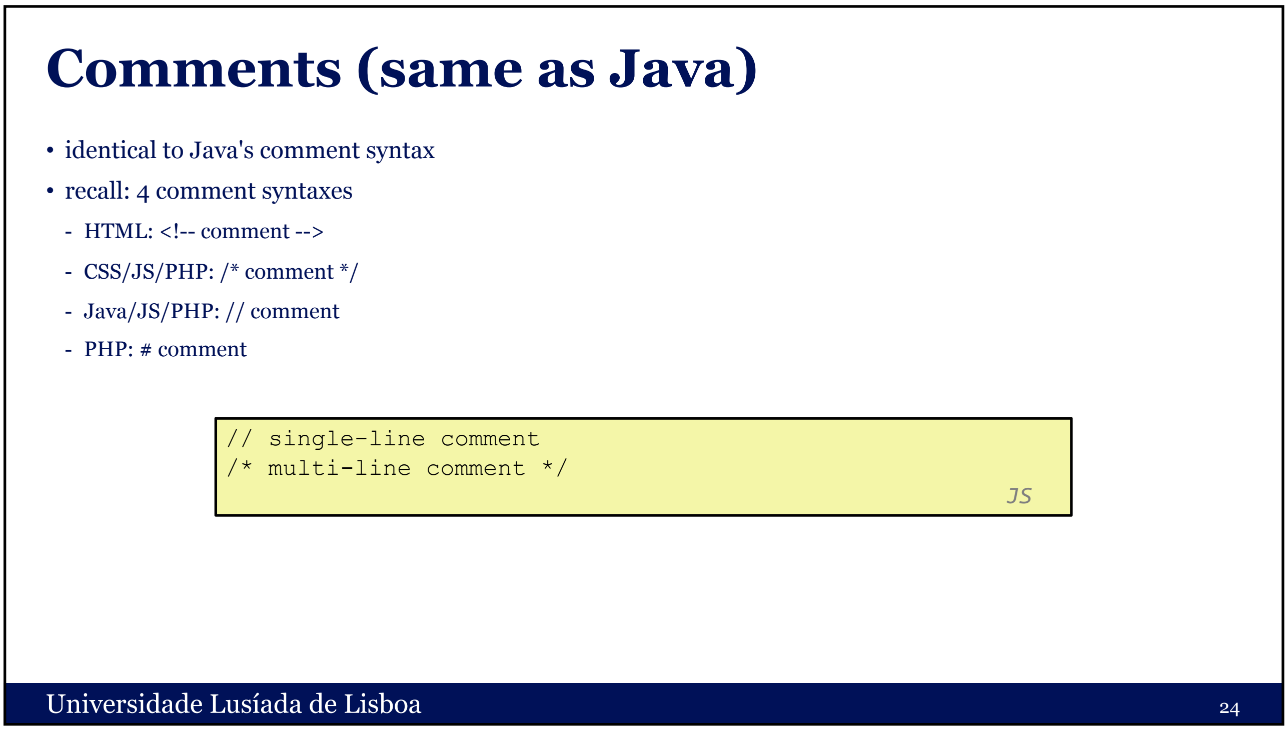
  - can find out a variable's type by calling `typeof`



Number type

- integers and real numbers are the same type (no int vs. double)
- same operators: + - * / % ++ -- = += -= *= /= %=
- similar precedence to Java
- many operators auto-convert types: "2" * 3 is 6

```
var enrollment = 99;
var medianGrade = 2.8;
var credits = 5 + 4 + (2 * 3);
                                              JS
```



Comments (same as Java)

- identical to Java's comment syntax
- recall: 4 comment syntaxes
  - HTML: <!-- comment -->
  - CSS/JS/PHP: /* comment */
  - Java/JS/PHP: // comment
  - PHP: # comment

```
// single-line comment
/* multi-line comment */
                                              JS
```

Math object

```
var rand1to10 = Math.floor(Math.random() * 10 + 1);
var three = Math.floor(Math.PI);
                                                  JS
```

- methods: `abs, ceil, cos, floor, log, max, min, pow, random, round, sin, sqrt, tan`
- properties: `E, PI`

Special values: null and undefined

```
var ned = null;
var benson = 9;
// at this point in the code,
// ned is null
// benson's 9
// caroline is undefined
                                                  JS
```

- `undefined` : has not been declared, does not exist
- `null` : exists, but was specifically assigned an empty or null value
- Why does JavaScript have both of these?

Logical operators

- > < >= <= && || ! == != === !==

- most logical operators automatically convert types:
  - 5 < "7" is true
  - 42 == 42.0 is true
  - "5.0" == 5 is true

- === and !== are strict equality tests; checks both type and value
  - "5.0" === 5 is false

if/else statement (same as Java)

```
if (condition) {
       statements;
} else if (condition) {
       statements;
} else {
       statements;
}
                                                          JS
```

- identical structure to Java's if/else statement
- JavaScript allows almost anything as a condition

Boolean type

```
var iLike190M = true;
var ieIsGood = "IE6" > 0; // false
if ("web devevelopment is great") { /* true */ }
if (0) { /* false */ }
                                                      JS
```

- any value can be used as a Boolean
  - "falsey" values: 0, 0.0, NaN, "", null, and undefined
  - "truthy" values: anything else
- converting a value into a Boolean explicitly:
  - `var boolValue = Boolean(otherValue);`
  - `var boolValue = !!(otherValue);`

for loop (same as Java)

```
var sum = 0;
for (var i = 0; i < 100; i++) {
       sum = sum + i;
}                                                      JS
```

```
var s1 = "hello";
var s2 = "";
for (var i = 0; i < s.length; i++) {
       s2 += s1.charAt(i) + s1.charAt(i);
}
// s2 stores "hheelllloo"                              JS
```

while loops (same as Java)

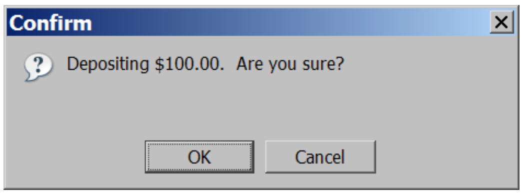
```
while (condition) {
        statements;
}                                                    JS
```

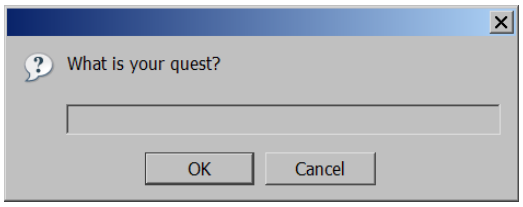
```
do {
    statements;
} while (condition);
                                                     JS
```

- break and continue keywords also behave as in Java

Popup boxes

```
alert("message"); // message
confirm("message"); // returns true or false
prompt("message"); // returns user input string
                                                     JS
```





Arrays

```
var name = []; // empty array
var name = [value, value, ..., value]; // pre-filled
name[index] = value; // store element
                                                    JS
```

```
var ducks = ["Huey", "Dewey", "Louie"];
var stooges = []; // stooges.length is 0
stooges[0] = "Larry"; // stooges.length is 1
stooges[1] = "Moe"; // stooges.length is 2
stooges[4] = "Curly"; // stooges.length is 5
stooges[4] = "Shemp"; // stooges.length is 5
                                                    JS
```

Array methods

```
var a = ["Stef", "Jason"]; // Stef, Jason
a.push("Brian"); // Stef, Jason, Brian
a.unshift("Kelly"); // Kelly, Stef, Jason, Brian
a.pop(); // Kelly, Stef, Jason
a.shift(); // Stef, Jason
a.sort(); // Jason, Stef
                                                    JS
```

- array serves as many data structures: list, queue, stack, ...
- methods: `concat, join, pop, push, reverse, shift, slice, sort, splice, toString, unshift`
  - push and pop add / remove from back
  - unshift and shift add / remove from front
  - shift and pop return the element that is removed

`String` type

- methods: `charAt, charCodeAt, fromCharCode, indexOf, lastIndexOf, replace, split, substring, toLowerCase, toUpperCase`
  - charAt returns a one-letter String (there is no char type)
- length property (not a method as in Java)
- Strings can be specified with "" or ''
- concatenation with + :
  - 1 + 1 is 2, but "1" + 1 is "11"

```
var s = "Connie Client";
var fName = s.substring(0, s.indexOf(" ")); // "Connie"
var len = s.length; // 13
var s2 = 'Melvin Merchant';
                                                     JS
```

More about `String`

- accessing the letters of a String:
  - escape sequences behave as in Java: \' \" \& \n \t \\
  - converting between numbers and Strings:

```
var count = 10;
var s1 = "" + count; // "10"
var s2 = count + " bananas, ah ah ah!"; // "10 bananas, ah
ah ah!"
var n1 = parseInt("42 is the answer"); // 42
var n2 = parseFloat("booyah"); // NaN                  JS
```

```
var firstLetter = s[0]; // fails in IE
var firstLetter = s.charAt(0); // does work in IE
var lastLetter = s.charAt(s.length - 1);               JS
```

Splitting strings: split and join

```
var s = "the quick brown fox";
var a = s.split(" "); // ["the", "quick", "brown", "fox"]
a.reverse(); // ["fox", "brown", "quick", "the"]
s = a.join("!"); // "fox!brown!quick!the"
                                                    JS
```

- split breaks apart a string into an array using a delimiter
  - can also be used with regular expressions (seen later)
- join merges an array into a single string, placing a delimiter between them

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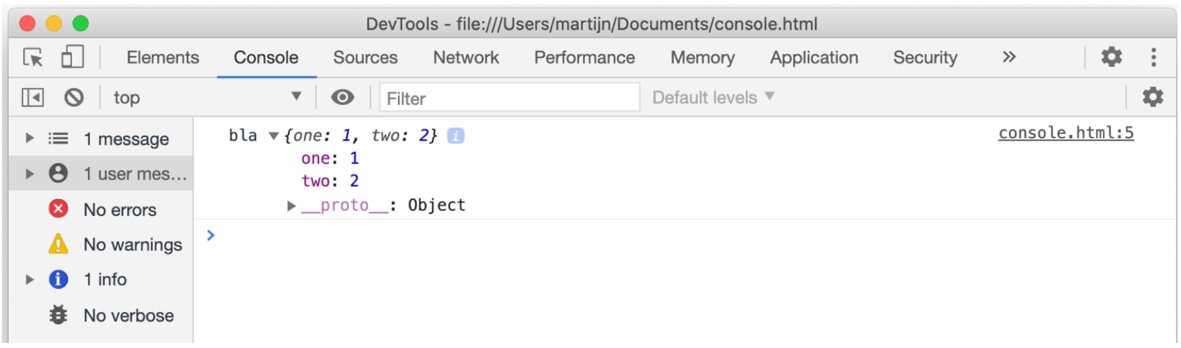
console.log(..)

You can use ***console.log("bla!", var1);*** to print the text and variable in the developers console.



```
bla ▼{one: 1, two: 2}                                   console.html:5
       one: 1
       two: 2
     ▶__proto__: Object
```

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