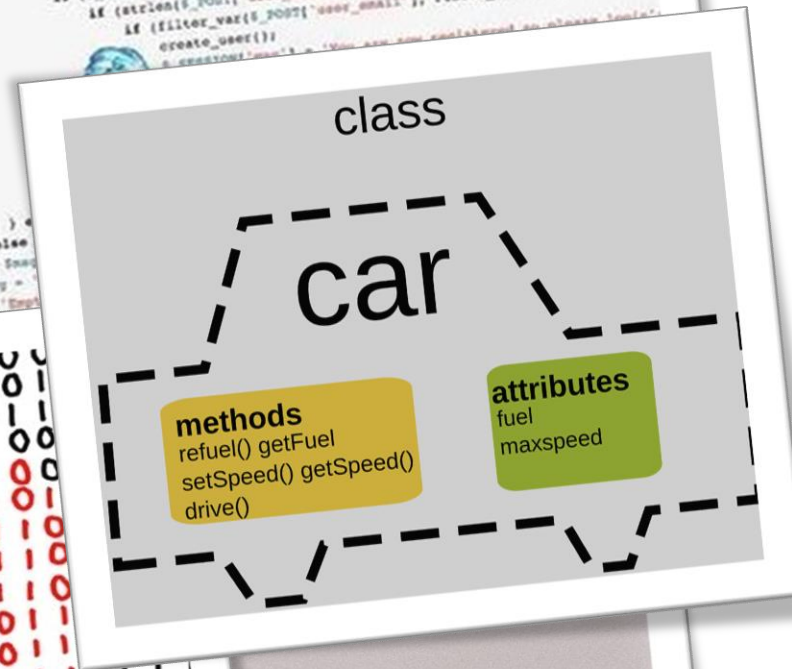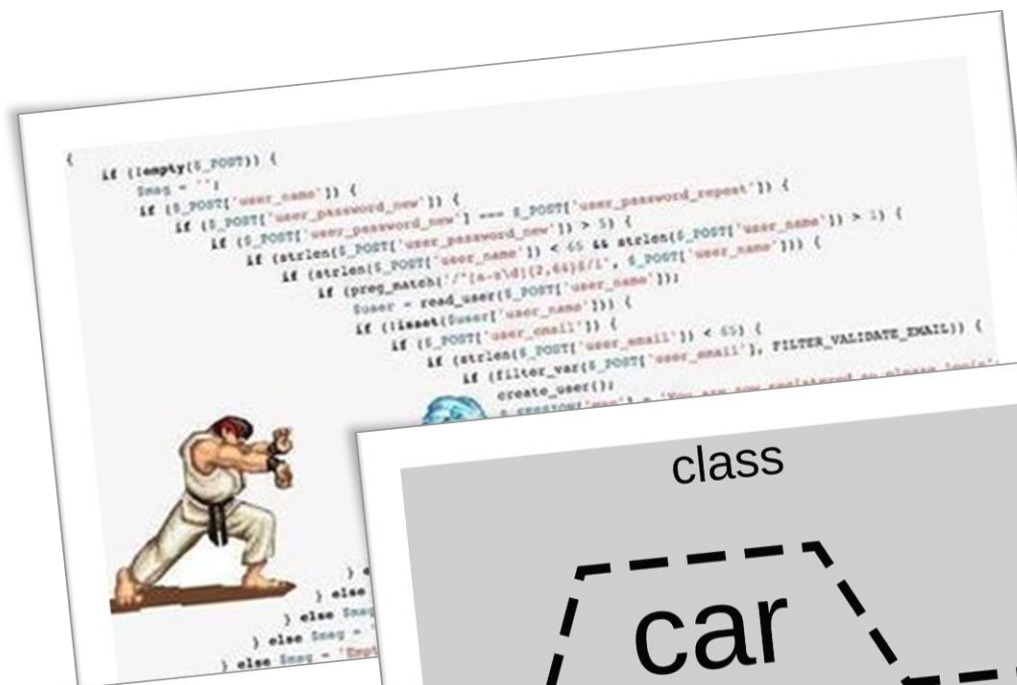# Programming Fundamentals (in JavaScript)

Stefano Balietti

Center for European Social Science Research at Mannheim University (MZES)
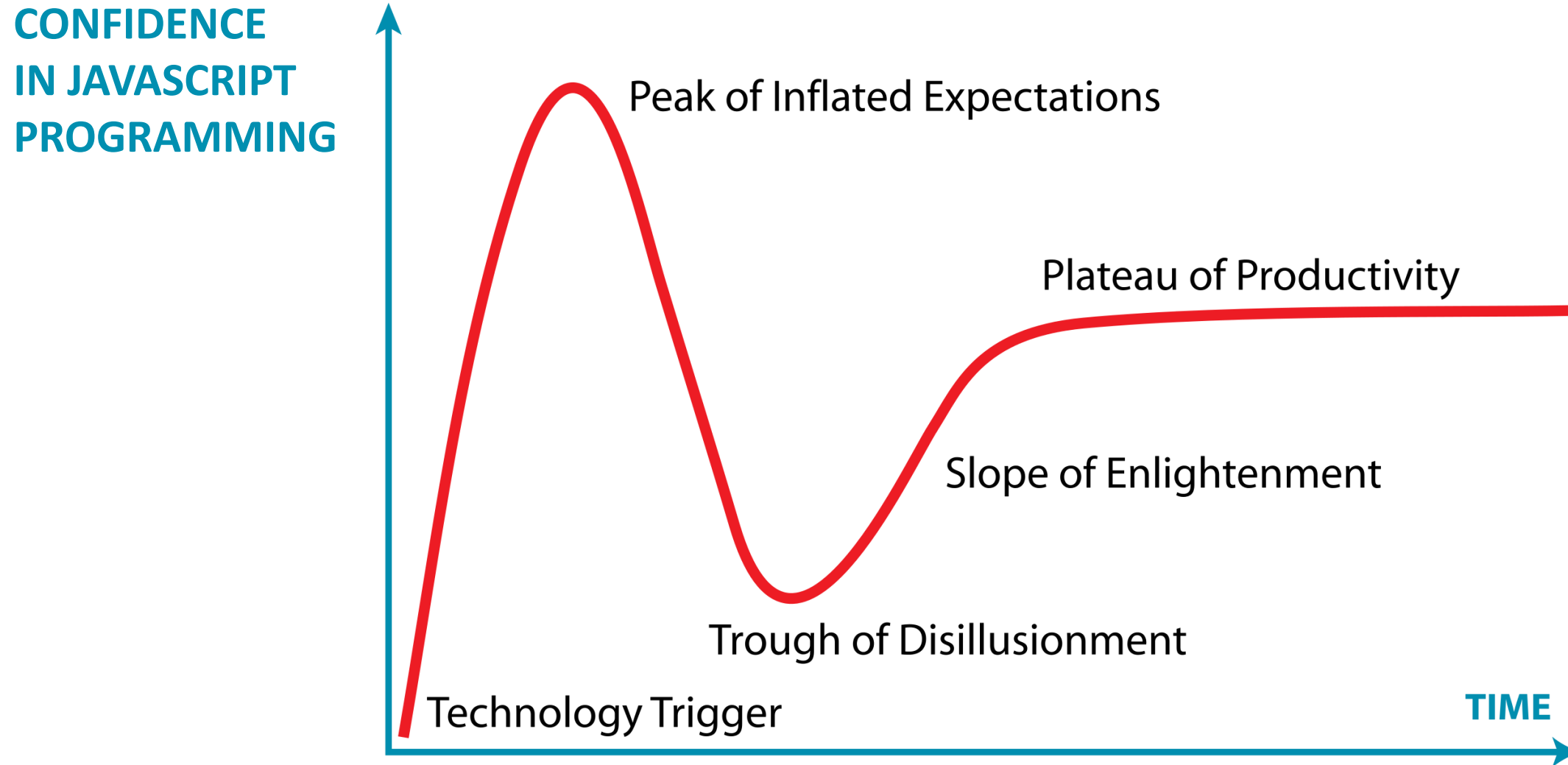Alfred-Weber Institute of Economics at Heidelberg University

@balietti | stefanobalietti.com | @nodegameorg | nodegame.org

Goals of the Seminar:
Fundamentals of Programming

1. **General programming notions:** variables, data structures, operators, conditional logic, and recursion.

2. **Object oriented programming:** classes, objects, interfaces and inheritance, encapsulation, and abstraction.

3. **Writing high-quality code**: well-establish design patterns, unit-testing, linting, documentation, version control system Git and GitHub, and continuous integration.

Learning Curve

CONFIDENCE IN JAVASCRIPT PROGRAMMING

Peak of Inflated Expectations

Plateau of Productivity

Slope of Enlightenment

Trough of Disillusionment

Technology Trigger

TIME

Adapted from: https://en.wikipedia.org/wiki/Hype_cycle

What is JavaScript?

What is JavaScript?

Let's Start with What is NOT

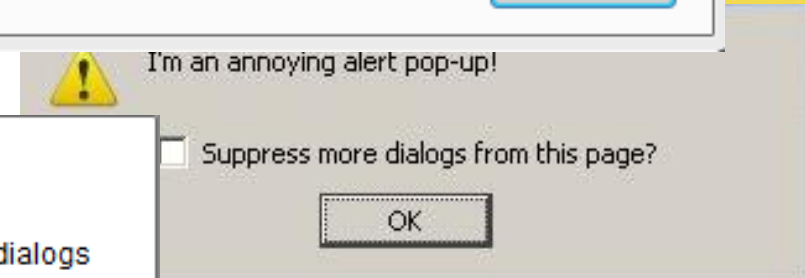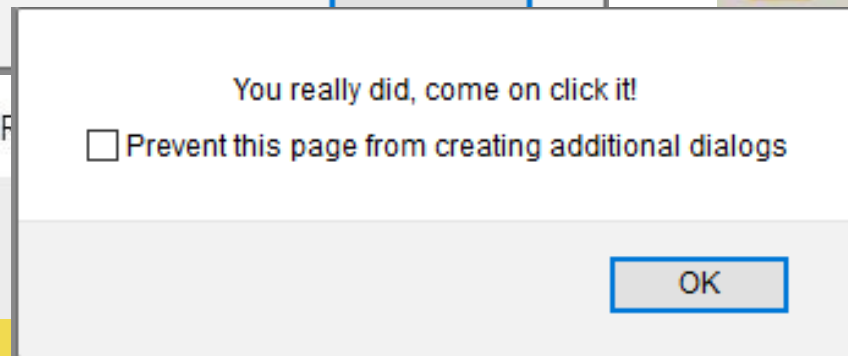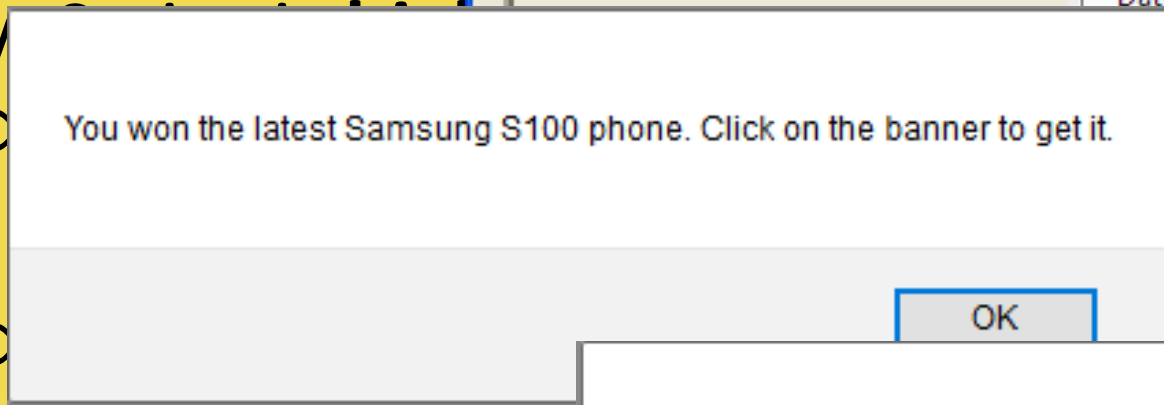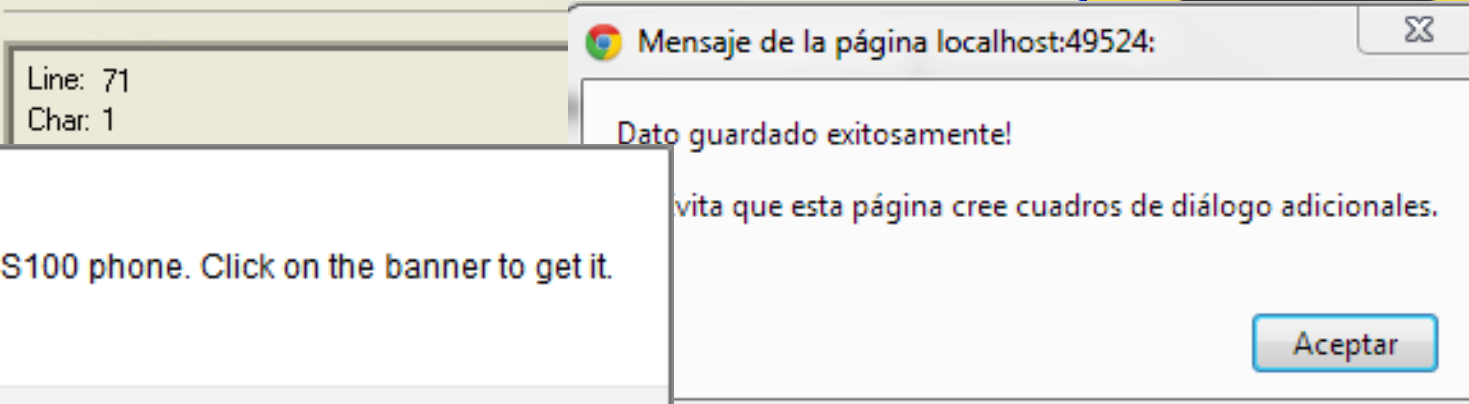- **JavaScript is NOT Java**, similar names, but for the rest rather different

- JAVA is a **compiled** language and while JavaScript is **interpreted**

- JAVA is generally more complex

- JAVA is fading (?)

THE #1 PROGRAMMER EXCUSE FOR LEGITIMATELY SLACKING OFF: "MY CODE'S COMPILING."

HEY! GET BACK TO WORK!

COMPILING!

OH. CARRY ON.

https://www.xkcd.com/378/

What is JavaScript?

- It is at the **core o**... with HTML and C...

- It is what makes ...

- Jav...Script which... and...

- It h... and...

- It is **dynamically t**...

- It has **first-class fu**...

What is JavaScript?

- It is at the **core of Web technologies**, with HTML and CSS

- It is what makes the pages interactive

- JavaScript is **high-level**, **scripted,** and **multi-paradigm**.

- It has **prototypical object-orientation** and **curly-bracket** syntax

- It is **dynamically typed**

- It has **first-class functions**

JS

JavaScript

- JavaScript was developed in May 1995 by *Brendan Eich* for Netscape Communications Corp

- Was created in **10 days** in order to accommodate the Navigator 2.0 Beta release

- Initially called **Mocha**, later renamed **LiveScript** in September, and later **JavaScript** in the same month

JavaScript

- Microsoft introduced **JScript** as reverse-engineered implementation of Netscape's JavaScript in 1996 in Internet Explorer 3

- In 1996 Netscape submitted JavaScript to European Computer Manufacturers Association (ECMA) to create and industry standard

- In 1997 **ECMAScript** was released

- Between 1997 and 2009 5 standard have been released

- *July 2015 ECMASCRIPT V6 released.*

JavaScript Is Constantly Updated

- [ES2016 a.k.a. ES7](#)
- [ES2017 a.k.a. ES8](#)
- [ES2018 a.k.a. ES9](#)
- [ES2019 a.k.a. ES10](#)
- [ES2020 a.k.a. ES11](#)

Node.JS

- **Node.JS** was created by *Ryan Dahl* and other developers working at Joyent in 2009

- Combination of Google's V8 JavaScript engine, an event loop, and a low-level I/O API

- **npm**, the node package manager, in 2011

- Versions: 0.10, 0.12, 4.0 … 12.0!

Advantages of Node.JS

- **Easy to Learn.** If you know JavaScript...otherwise easy to get started, but careful of pitfalls!

- **Full Stack JS**. Single programming language for client side (e.g., browser) and backend (i.e., server)

- **Freedom to Develop Apps.** Web apps and mobile apps, browser extensions, games, decentralized apps...

- **Higher performance.** Process several request *simultaneously* thanks to the *asynchronous non-blocking paradigm;* highly scalable *horizontally* and *vertically*

- **Many Frameworks and Testing tools.** Bootstrap, jQuery, React, Mocha, Ganache, nodeGame...

- **Huge and Active Community.**

https://www.quora.com/What-are-the-advantages-of-node-js-1

JavaScript is #1 Language on Github

https://octoverse.github.com/
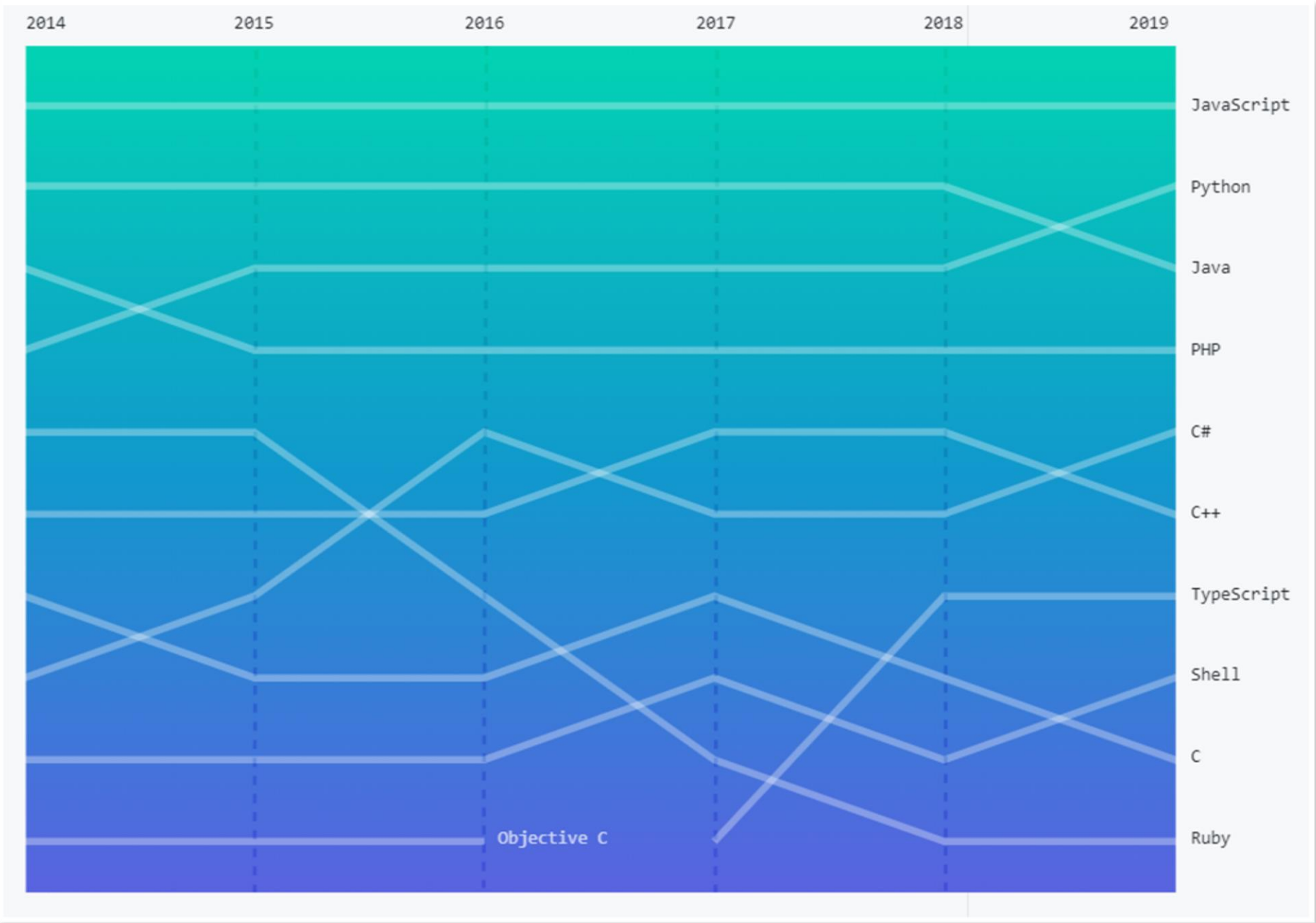
GitHub.com

40 m+

developers on GitHub, including 10M new users in 2019.*

44 m+

repositories created in the last year—and 44% more developers created their first repository in 2019 than in 2018.*

87 m+

pull requests merged in the last year—and 28% more developers opened their first pull request in 2019 than in 2018.*

20 m+

issues closed in the last year. That's a lot of decisions made, bugs fixed, and boxes checked.*

https://octoverse.github.com/

Open the JavaScript console of your browser:

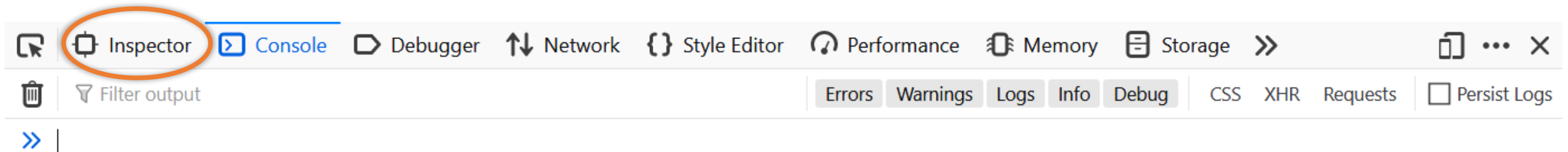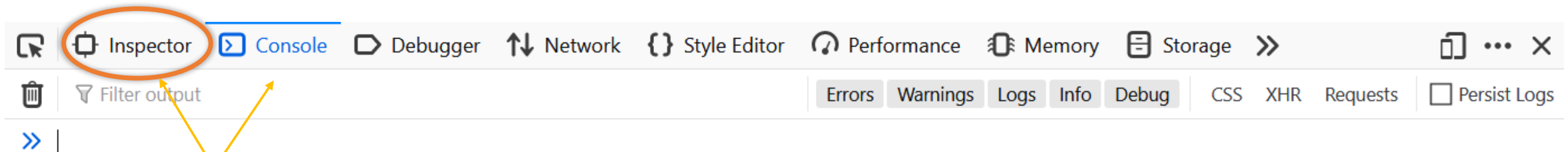(ctrl+shift+I or Right Click/Inspect Element)
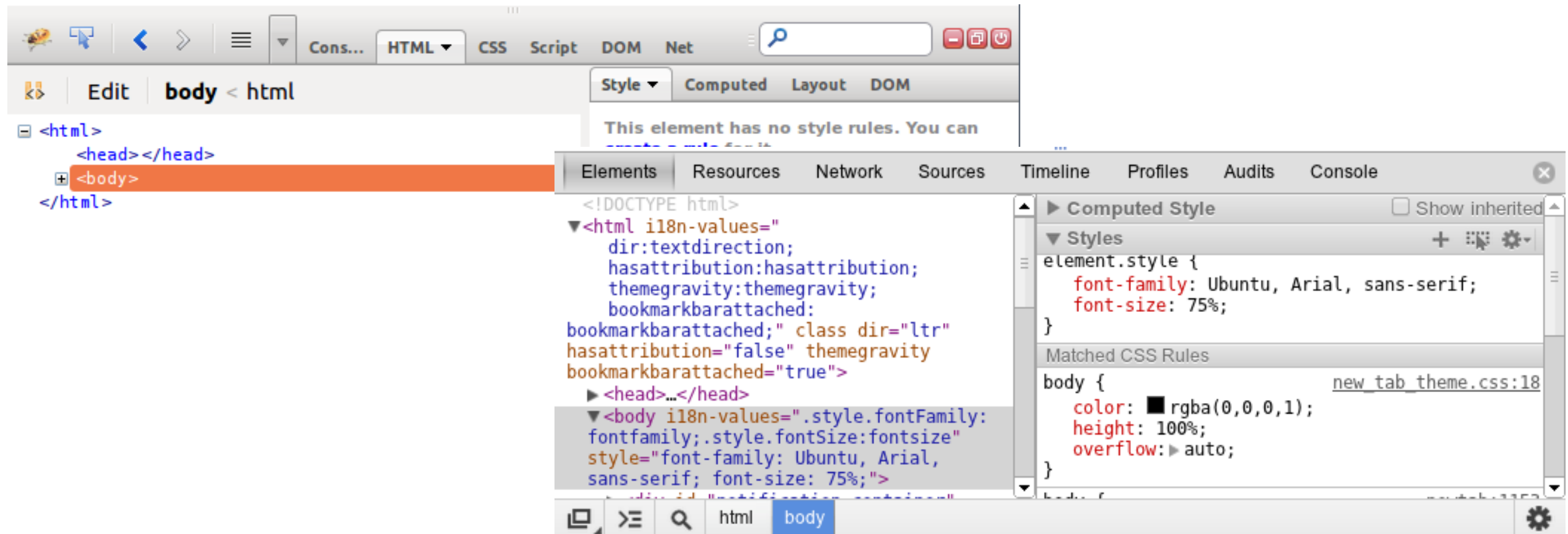
Hands On

The Inspector is where you can visualize the live DOM (Document Object Model) and make changes, including CSS (Cascading Style Sheets) changes.

Hands On

The Inspector is where you can visualize the live DOM (Document Object Model) and make changes, including CSS (Cascading Style Sheets) changes.

Inspector | Console | Debugger | Network | Style Editor | Performance | Memory | Storage

Filter output | Errors | Warnings | Logs | Info | Debug | CSS | XHR | Requests | Persist Logs

The actual names might be slightly different depending on the browser version and language. For instance, "Inspector" is sometimes called "Elements."

Hands On

? Try to open different web sites, how does the content of the console changes?

Hands On

bahn.de: lots of messy output, including your first and last name

Hands On

facebook.com: a warning to not fall victim of social engineering phishing attacks

```
.d8888b.  888                                888
d88P  Y88b 888                                888
Y88b.      888                                888
 "Y888b.    888888  .d88b.  88888b.     888      This is a browser feature intended for
    "Y88b. 888    d88""88b 888 "88b    888      developers. If someone told you to copy
      "888 888    888  888 888  888   Y8P      and paste something here to enable a
Y88b  d88P Y88b.  Y88..88P 888 d88P            Facebook feature or "hack" someone's
 "Y8888P"   "Y888  "Y88P"  88888P"    888      account, it is a scam and will give them
                            888                access to your Facebook account.
                            888
                            888
```

See *https://www.facebook.com/selfxss* for more information.

Hands On

```
<!--
       0000000                           000      0000000
      111111111       11111111100        000      111111111
       00000        111111111111111111     00000     000000
        000       111111111111111111111111100000      000
        000       1111        11111111111111111100     000
        000       11      0       1111111100           000
        000        1      00           1               000
        000           00       00      1               000
        000          000     00000     1               000
       00000        0000   00000000     1             00000
     11111          000 00    000000    000              11111
      00000         0000      000000    00000          00000
       000        10000       000000    000            0000
       000        00000       000000    1               000
       000       000000       10000     1      0        000
       000       1000000 00            1      00        000
       000        1111111              1 0000           000
       000        1111111100          000000            000
      0000        11111111111111110000000              0000
     111111111       1111111111111100000            111111111
        0000000            00000000              0000000

     NYTimes.com: All the code that's fit to printf()
     We're hiring: https://nytimes.wd5.myworkdayjobs.com/Tech
    -->
```
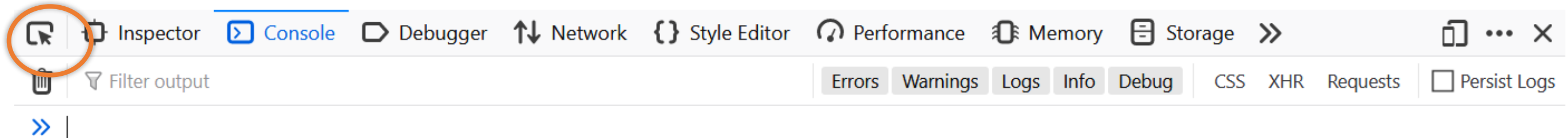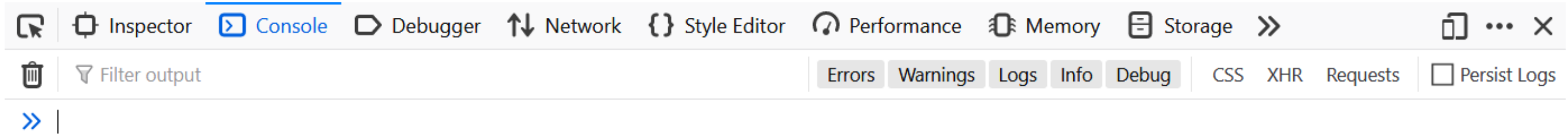
nytimes.com: a job offer!

Hands On

? Try to open different web sites, how does the content of the console changes?

⚒ Clear any pre-existing output: click on button or type `clear()`

| ⌖ | 🗗 Inspector | ▶ Console | ▷ Debugger | ⇅ Network | {} Style Editor | ♩ Performance | ⬚ Memory | 🗐 Storage | » | | 🗗 ••• ✕ |

🗑 ▽ Filter output   Errors   Warnings   Logs   Info   Debug   CSS   XHR   Requests   ☐ Persist Logs

» |

Hands On

Inspector | Console | Debugger | Network | Style Editor | Performance | Memory | Storage »

Filter output · Errors · Warnings · Logs · Info · Debug · CSS · XHR · Requests · Persist Logs
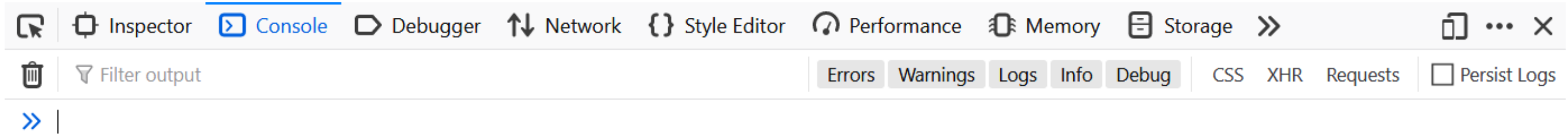
Type something in the console using the command:

```
console.log('This is my very own text');
```

Hands On

Now do it… feel the power of the alert!

```
alert('This is my revenge!');
alert('again and again...');
```

Theory with examples
Do-it yourself exercises

Exercises extend what is covered in the slides. Some of you will find some exercises easy and others more difficult. Don't worry if you don't finish them all:
Do them at your own pace!

How I Learnt JavaScript

Great tutorial from novice to JavaScript Ninja:
http://javascript.info/

10+years ago...

KUDOS: Some of the examples in this course are taken from here