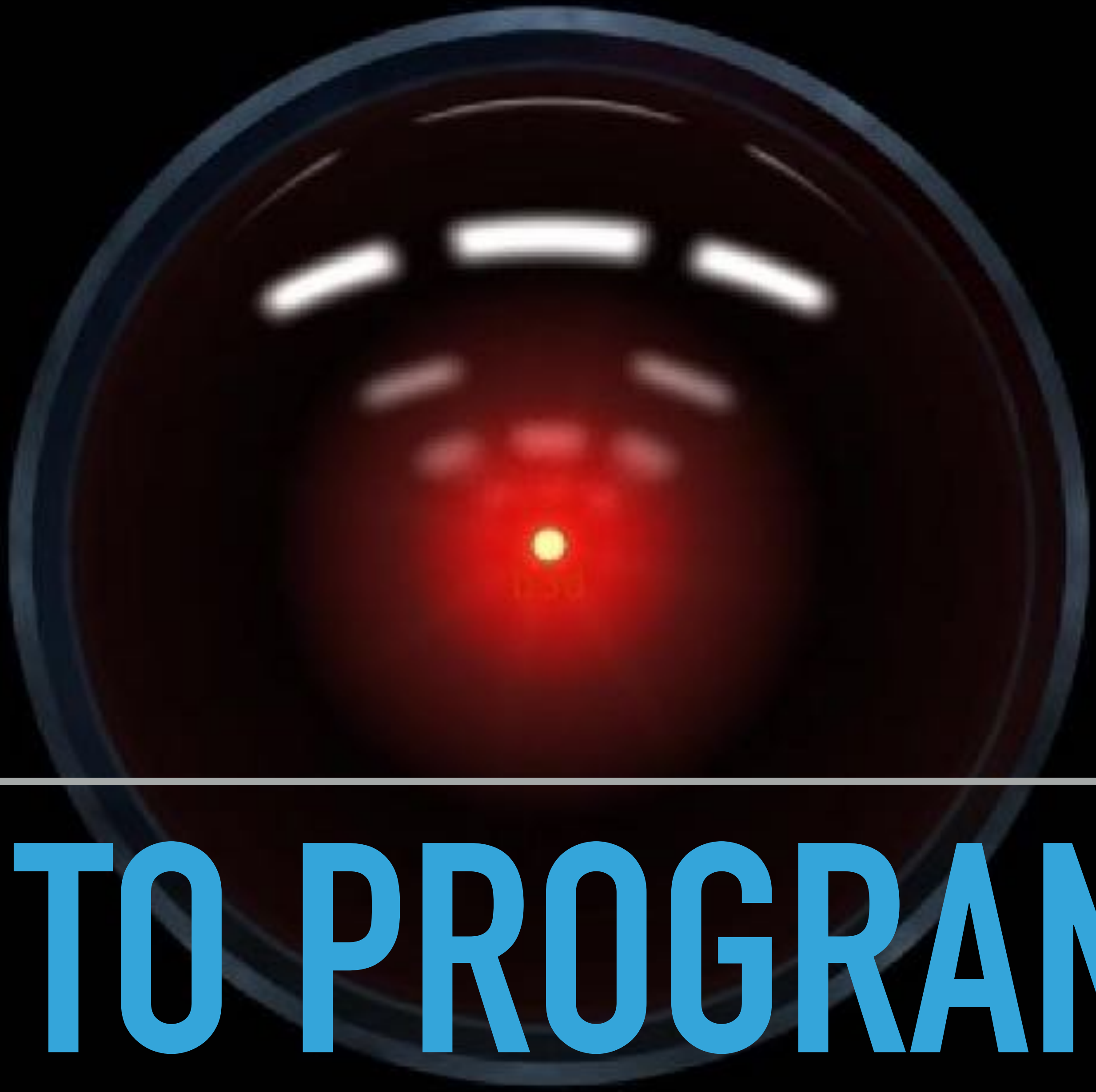
HTTP://WWW.SIMONWELLS.ORG
HTTP://ARG.NAPIER.AC.UK



DR SIMON WELLS

INTRO TO PROGRAMMING

WHY ARE WE HERE?

This is not meant to be an existential question

WHAT IS PROGRAMMING?

- Telling a computer what to do [solving problems]
  - Identifying parts of the solution [data]
  - Working out how to handle each part [algorithms]

- Writing (Sorry [not sorry] ;)

WHAT IS PROGRAMMING?

IF YOU CAN BAKE A CAKE/PREPARE A POT NOODLE/PUT UP A PICTURE/WIRE A PLUG/FIX A PUNCTURE/LIGHT A FIRE – THEN YOU CAN PROBABLY WRITE A PROGRAM…

HOW DO I BECOME A (GREAT) PROGRAMMER?

HOW DO I BECOME A PROGRAMMER?

MYTHS

- The programming genius
  - Just knows how to do it
  - Doesn’t exist, probably
  - Hollywood has a lot to answer for :(
- Can read/follow a book/article/tutorial & I’ll get it
  - Only part of the answer

- Hard work & Effort
  - (but this can also be a lot of fun)
- Deliberate Practice (over time):

  Thinking -> Doing -> Reflecting
- There is no magic.

HOW DO I BECOME A (GREAT) PROGRAMMER?

THE TRUTH?

PROGRAMMING IS A LIFESTYLE CHOICE

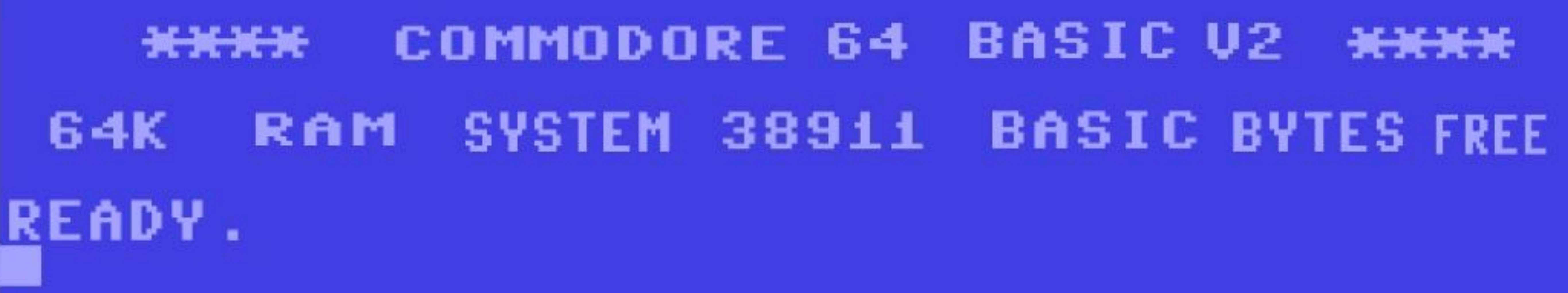
Write lots of programmes

BIO

- First Computer (age 7)
- Wrote some programmes (often from magazines & books)
- No real programming experience until university
- Nobody else in immediate family with a degree
- Nobody else with a higher degree at all (yet)
- Interested in ***everything…***

IN SOME WAYS MY EXPERIENCE WAS EASIER

- Immediacy
- Lower expectations
- Work with less



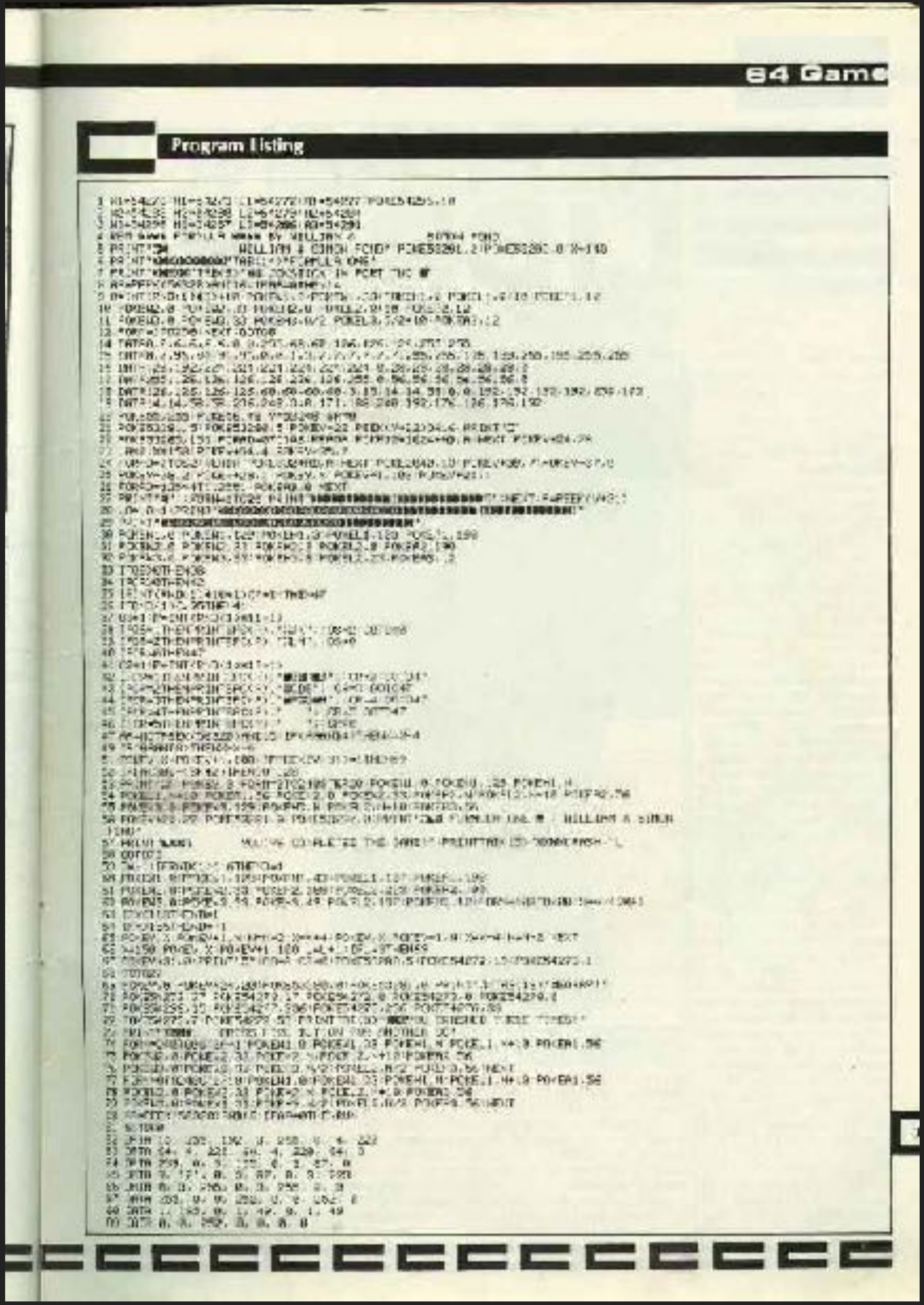
```
    **** COMMODORE 64 BASIC V2 ****

 64K RAM SYSTEM  38911 BASIC BYTES FREE

READY.
█
```

DOING ANYTHING WITH THIS MACHINE
INVOLVED PROGRAMMING:
WE COULD GET STRAIGHT TO THE
PROGRAMMING :D

Central Cavern
IR
igh Score 005784
Score 00010

WORK WITH LESS

- A lot fewer programmers around
- Home computers were untrusted, unreliable, and just not a mainstream consideration (for kids, for games, for the future)
- No smart phones
- No Internet/Web (we did have bulletin boards & modems though & Magazines)



64 Game

Program Listing

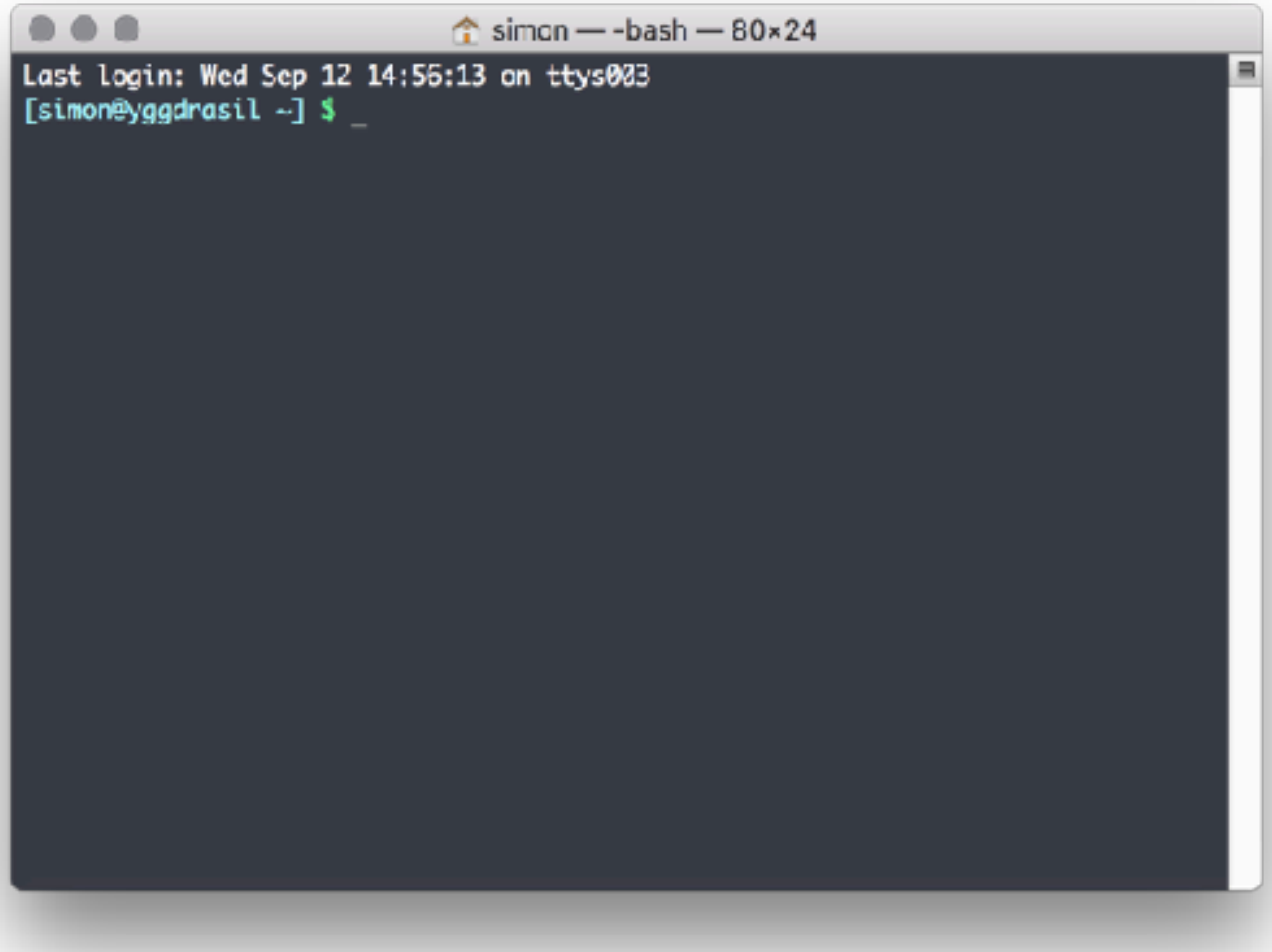
```
[illegible]
```

MODERN PROGRAMMING

- Getting into programming nowadays is easy:
  - Books, Web pages, Tutorials
  - Compilers, interpreters, IDEs
  - Nearly always have at least one computer on our person
- However:
  - Most computer experience is now point & click (or swipe)
  - We see lots of really cool stuff but don’t know how to get there from here
  - **Bootstrapping is hard**:
    - there’s lots of other stuff to do before you can start hacking away
- Also:
  - **What should I programme?**

- Modern computers aren’t really set up to make programming accessible out-of-the-box
- Some hoop jumping: need to install programming language tools (compiler, interpreter, IDE, editor)
  - NB. Some computers already have these installed by default (Mac OS & Linux), e.g. python, ruby
- Not as straightforward as powering up the machine & getting dumped straight into a programming interface

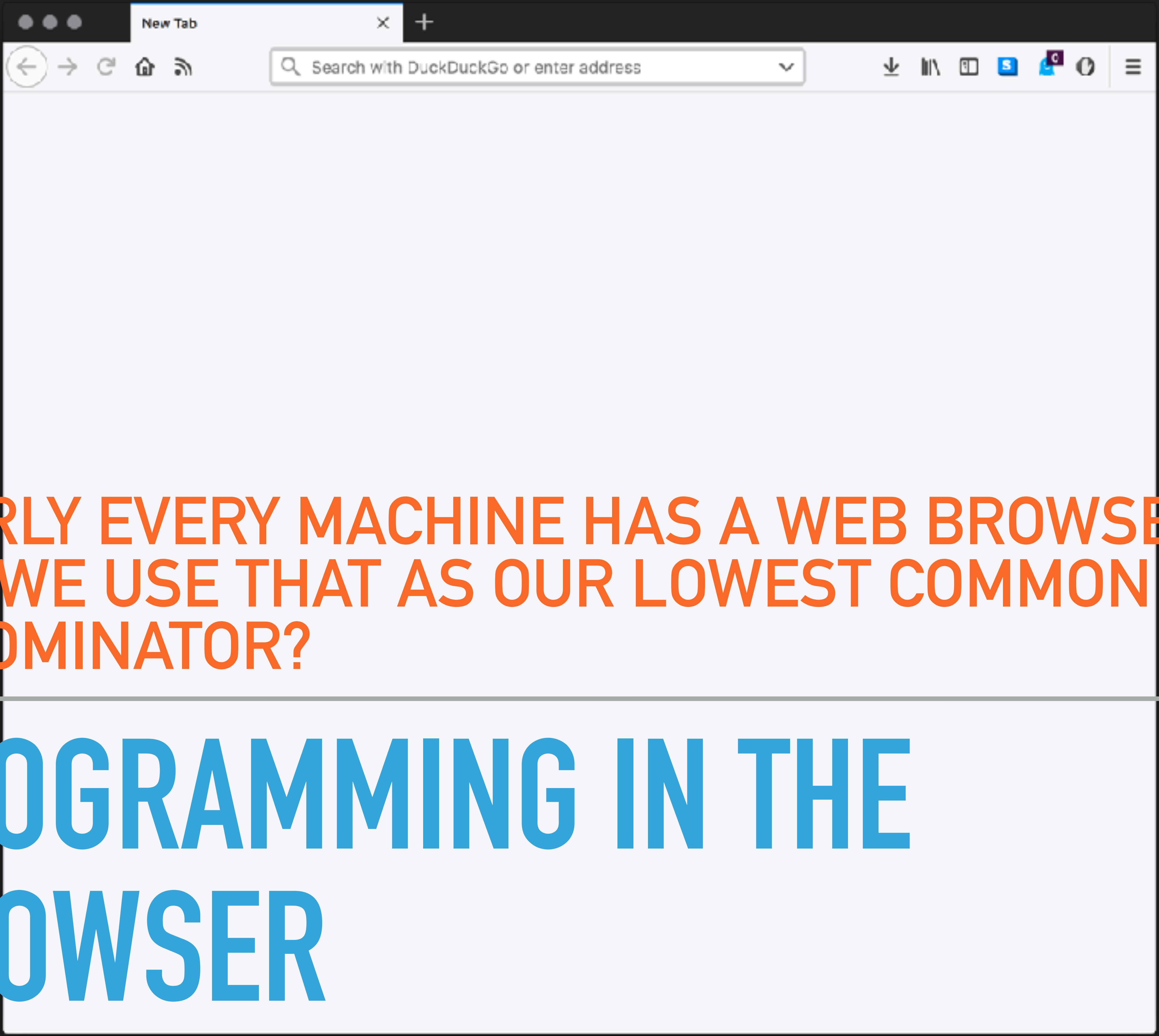
BOOTSTRAPPING IS HARD



```
Last login: Wed Sep 12 14:56:13 on ttys003
[simon@yggdrasil ~] $ _
```

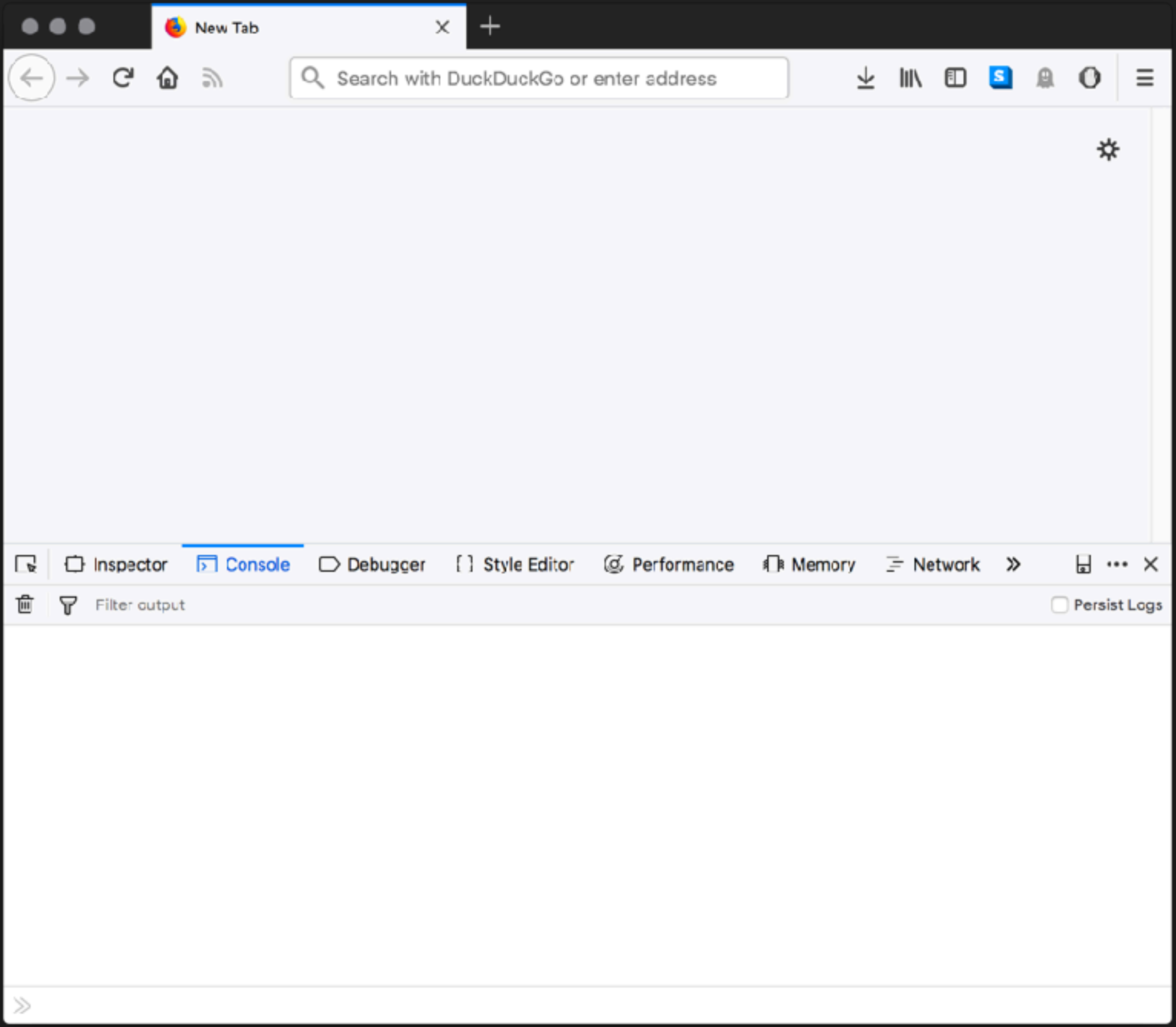
- Programming is a literate practise
  - If you only mouse around the GUI then life as a programmer is slightly more difficult
- CLI gives you the best, most fine-grained control of your computer
- Neal Stephenson “In the beginning was the command line”

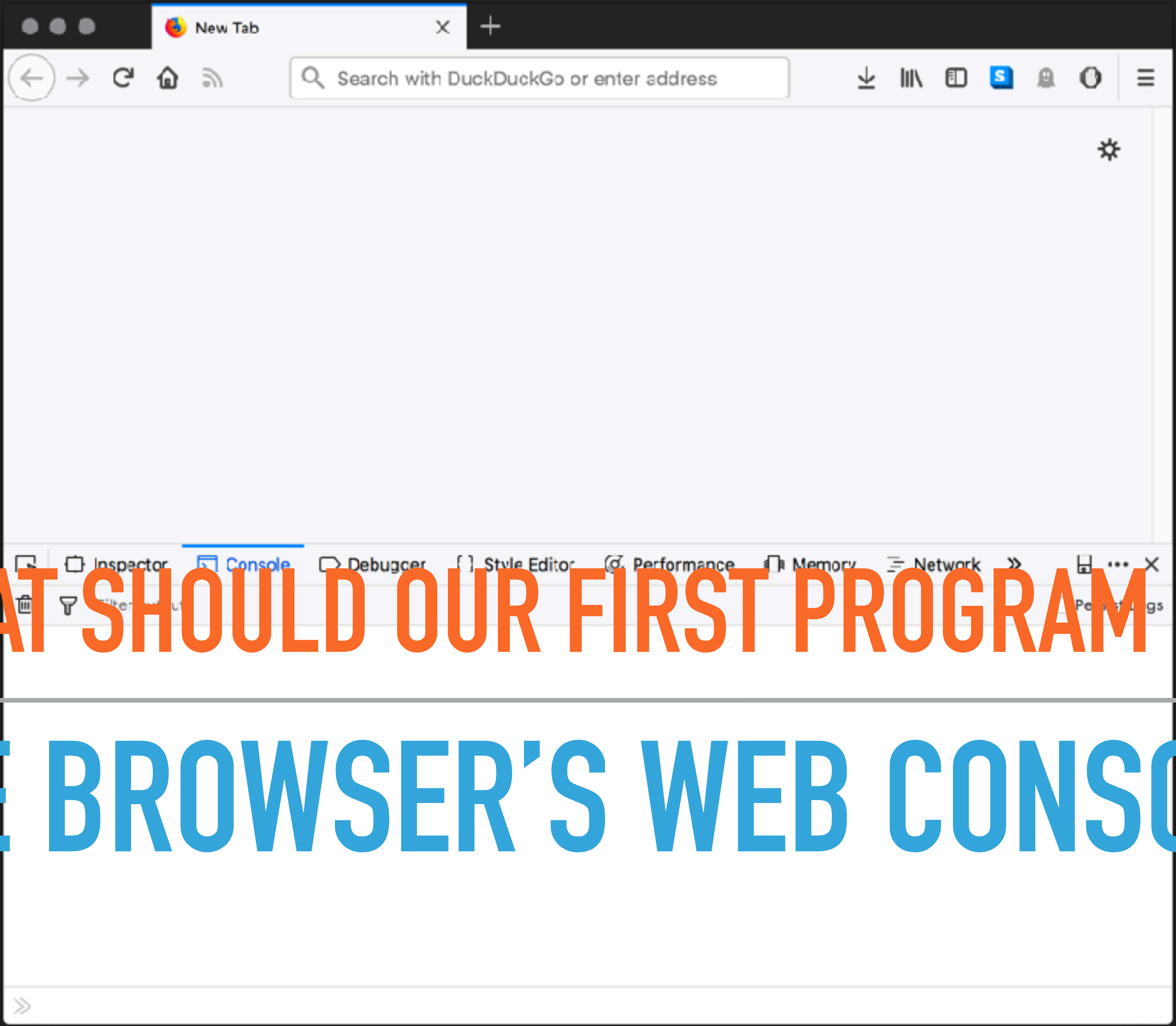
TIP: LEARN TO LOVE THE COMMAND LINE :)



NEARLY EVERY MACHINE HAS A WEB BROWSER - CAN WE USE THAT AS OUR LOWEST COMMON DENOMINATOR?

PROGRAMMING IN THE BROWSER


New Tab
Search with DuckDuckGo or enter address
Inspector
Console
Debugger
Style Editor
Performance
Memory
Network
Filter output
Persist Logs

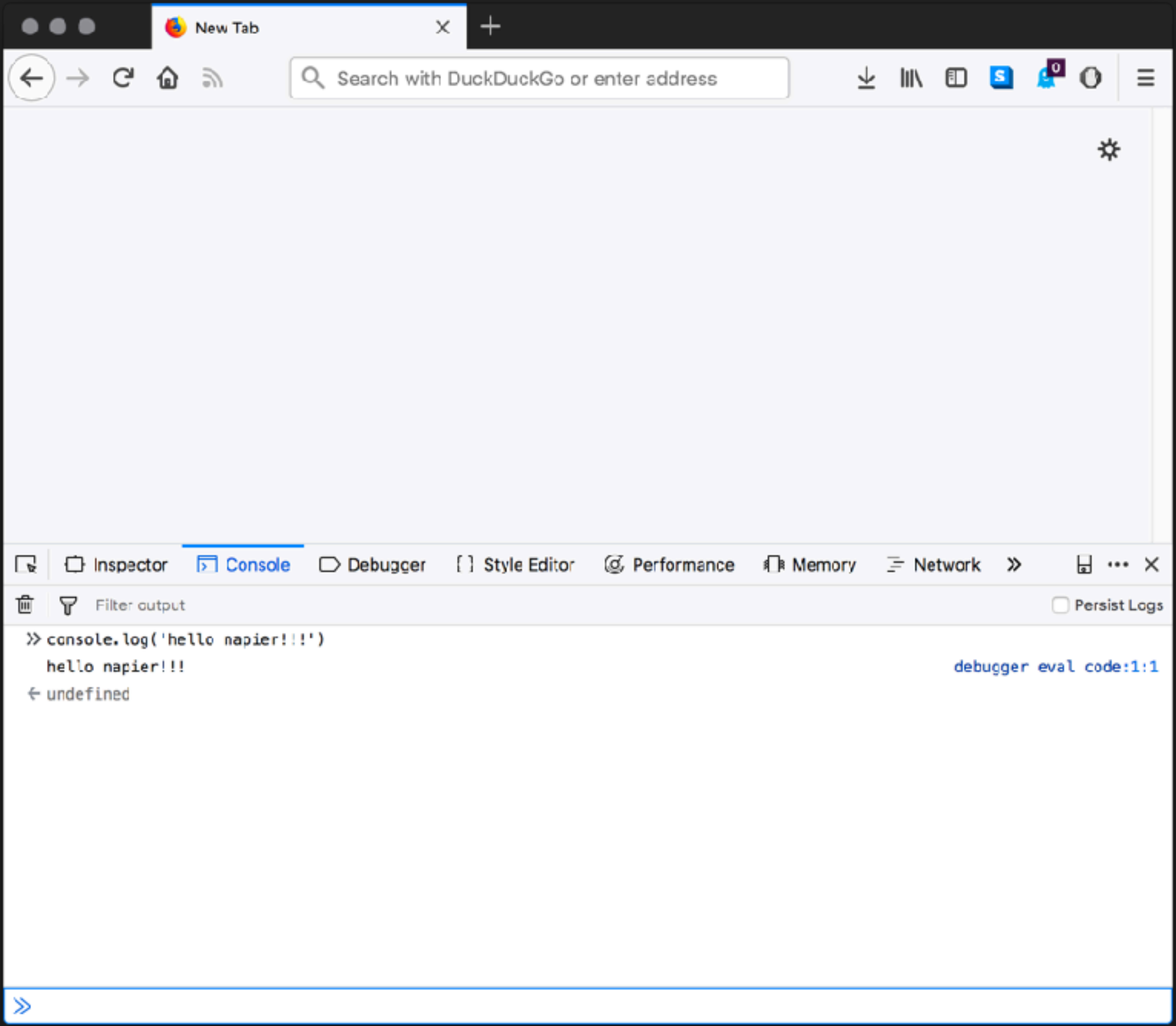


WHAT SHOULD OUR FIRST PROGRAM BE?

THE BROWSER’S WEB CONSOLE

#1

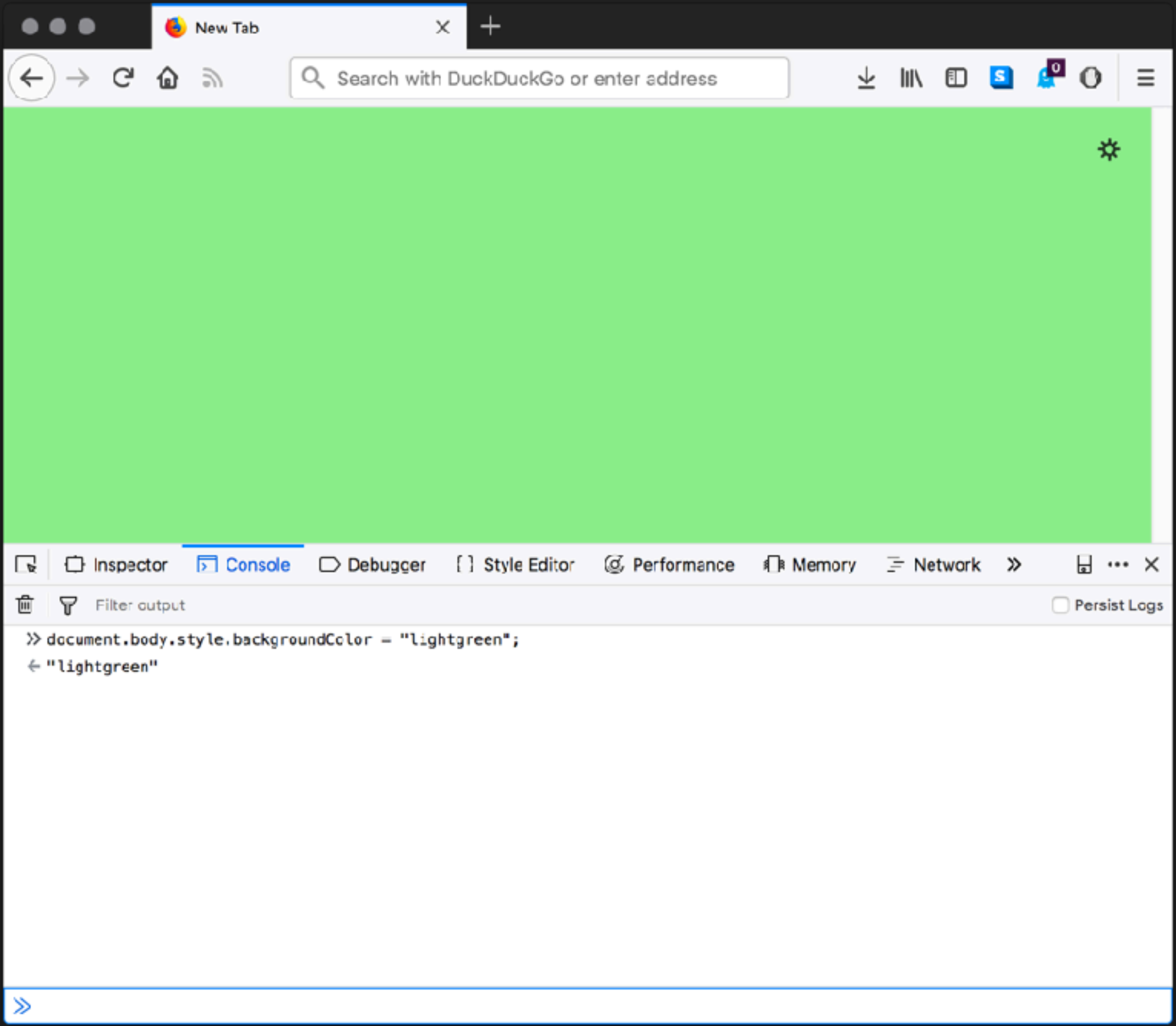
HELLO NAPIER



```
» console.log('hello napier!!!')
  hello napier!!!                                                    debugger eval code:1:1
← undefined
```

#2

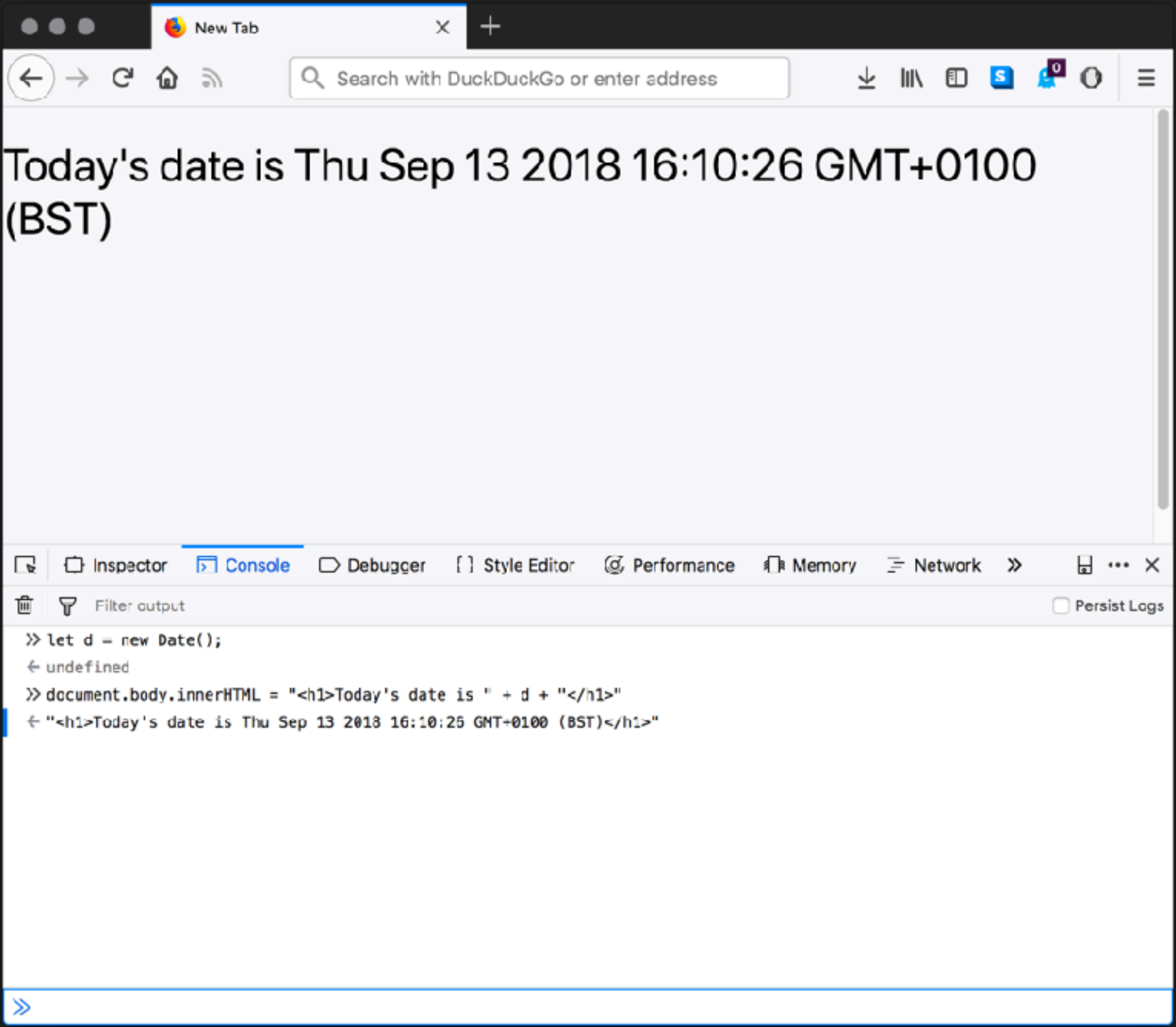
INTERACT WITH THE WEB PAGE/SCREEN



```
>> document.body.style.backgroundColor = "lightgreen";
← "lightgreen"
```

#3

USE STANDARD JAVASCRIPT FUNCTIONS

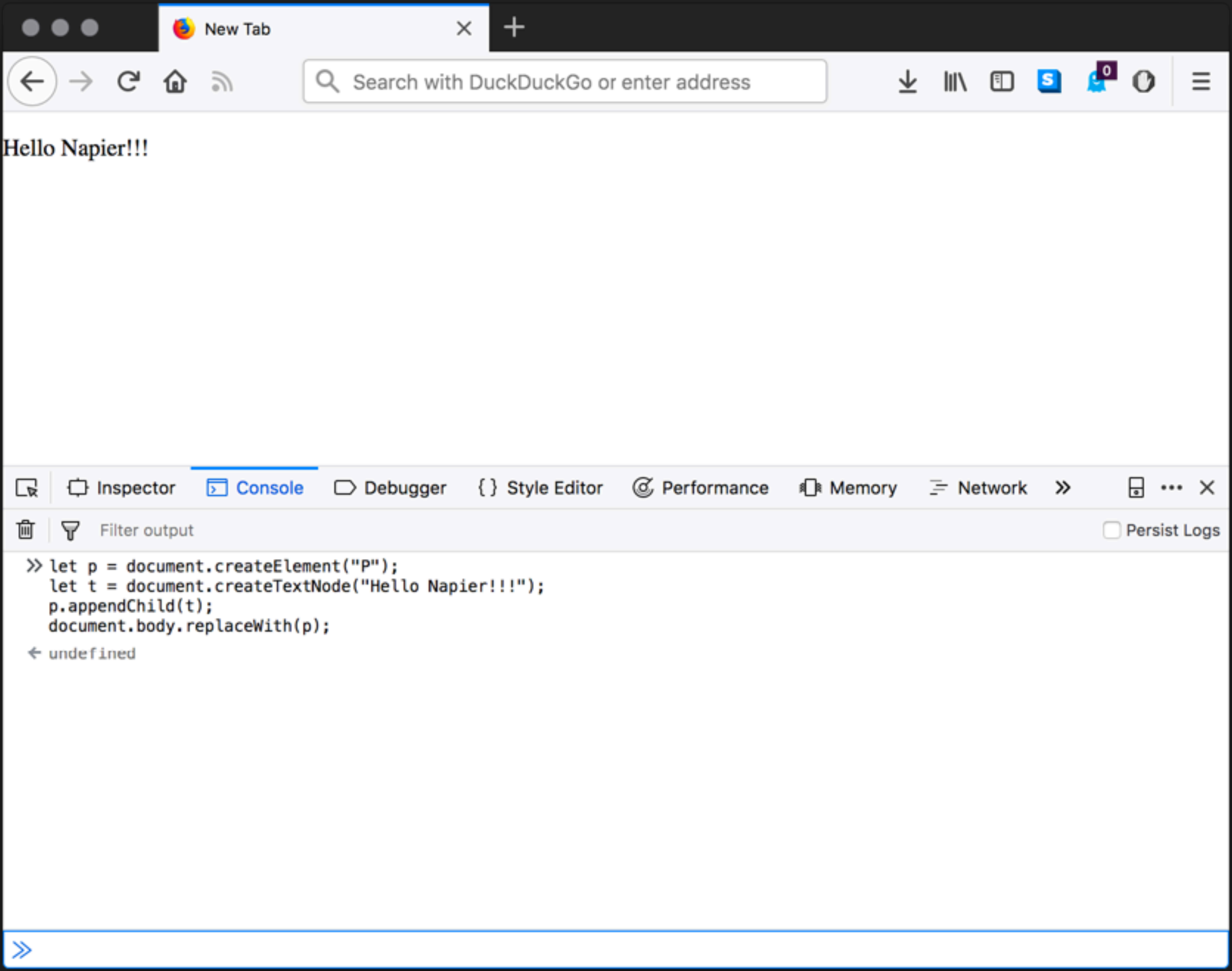


Today's date is Thu Sep 13 2018 16:10:26 GMT+0100 (BST)

```
>> let d = new Date();
← undefined
>> document.body.innerHTML = "<h1>Today's date is " + d + "</h1>"
← "<h1>Today's date is Thu Sep 13 2018 16:10:25 GMT+0100 (BST)</h1>"
```

#4

CONSTRUCT A WEB PAGE

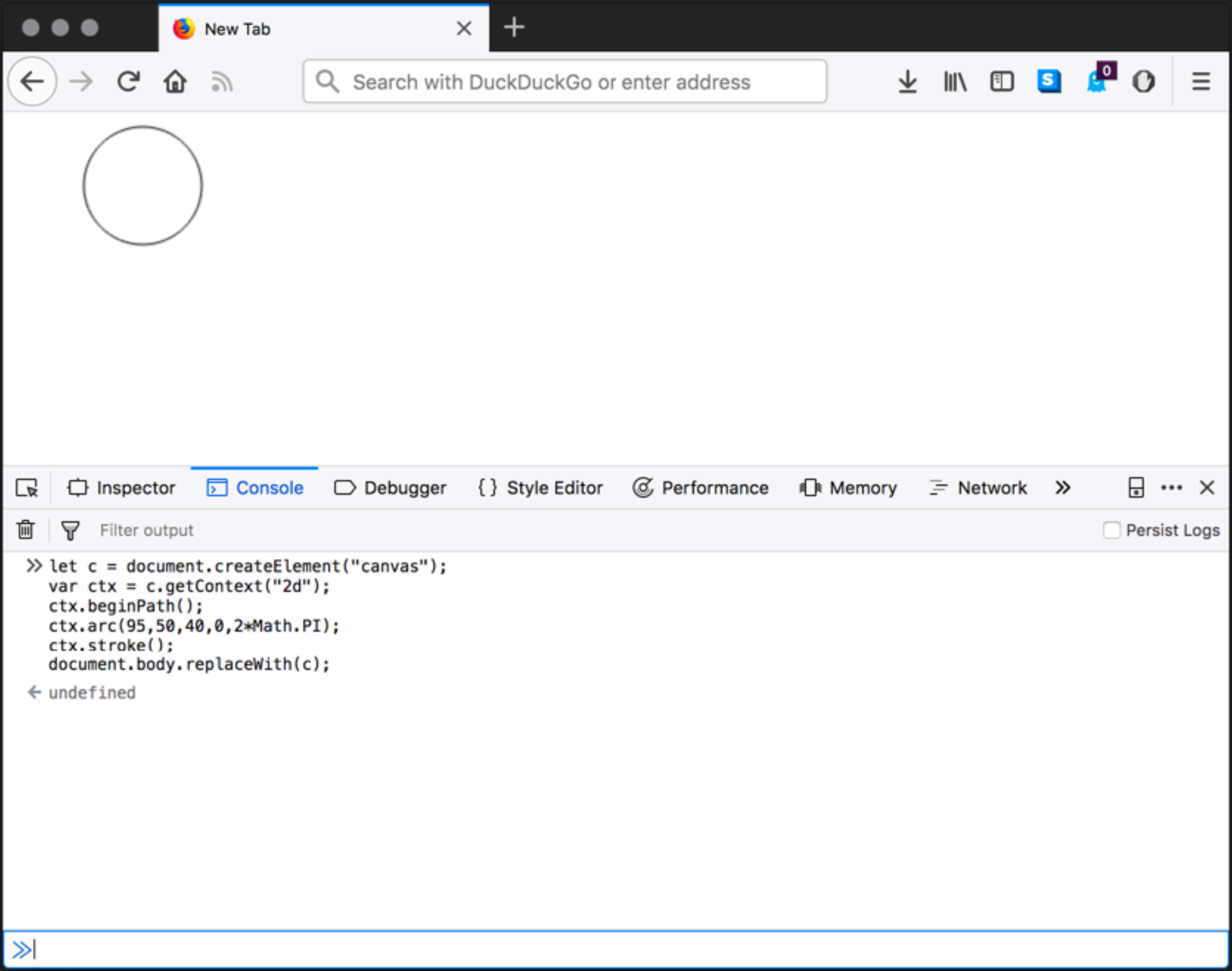


Hello Napier!!!

```
>> let p = document.createElement("P");
   let t = document.createTextNode("Hello Napier!!!");
   p.appendChild(t);
   document.body.replaceWith(p);
← undefined
```

#5

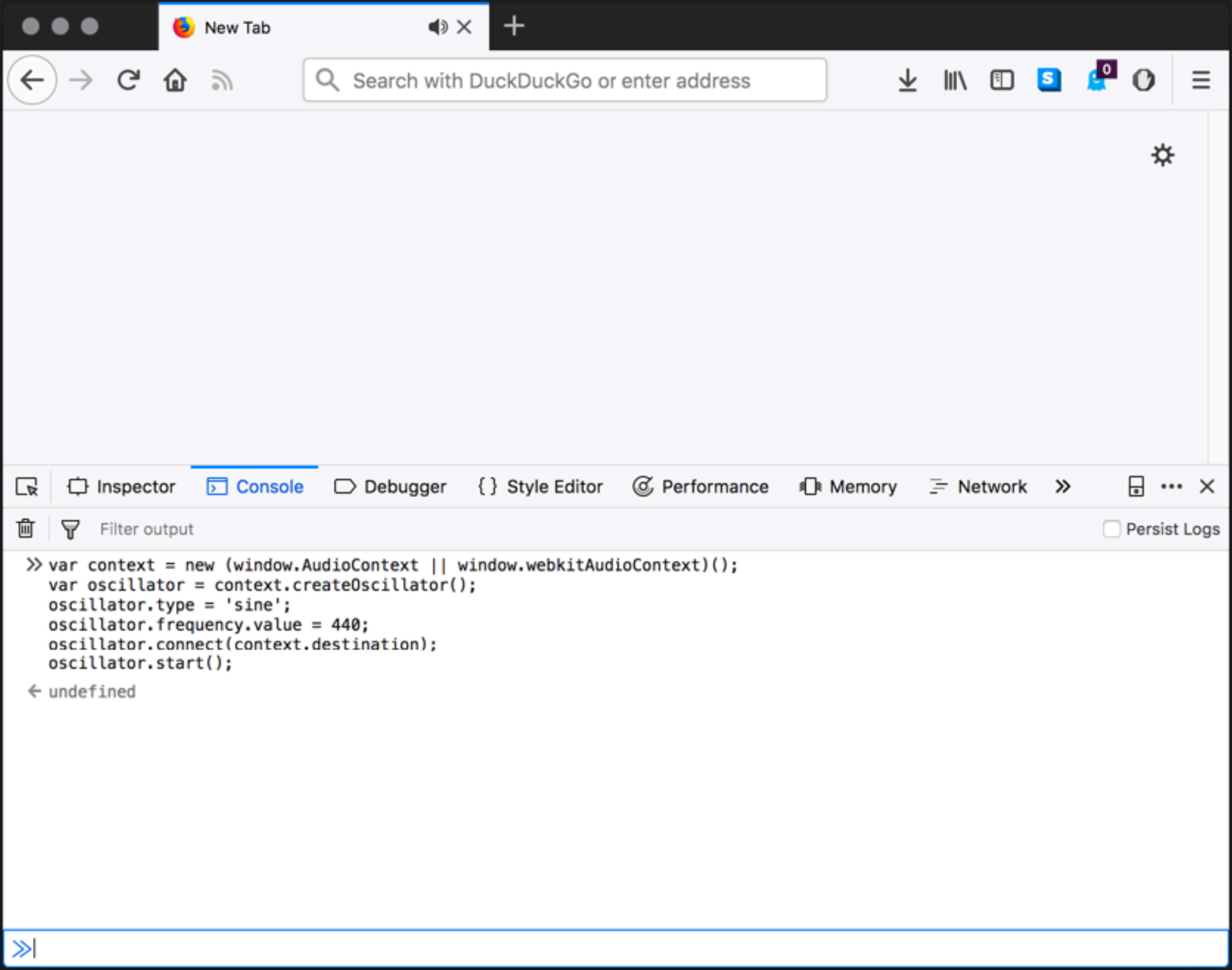
GRAPHICS



```
>> let c = document.createElement("canvas");
   var ctx = c.getContext("2d");
   ctx.beginPath();
   ctx.arc(95,50,40,0,2*Math.PI);
   ctx.stroke();
   document.body.replaceWith(c);
 ← undefined
```

#6

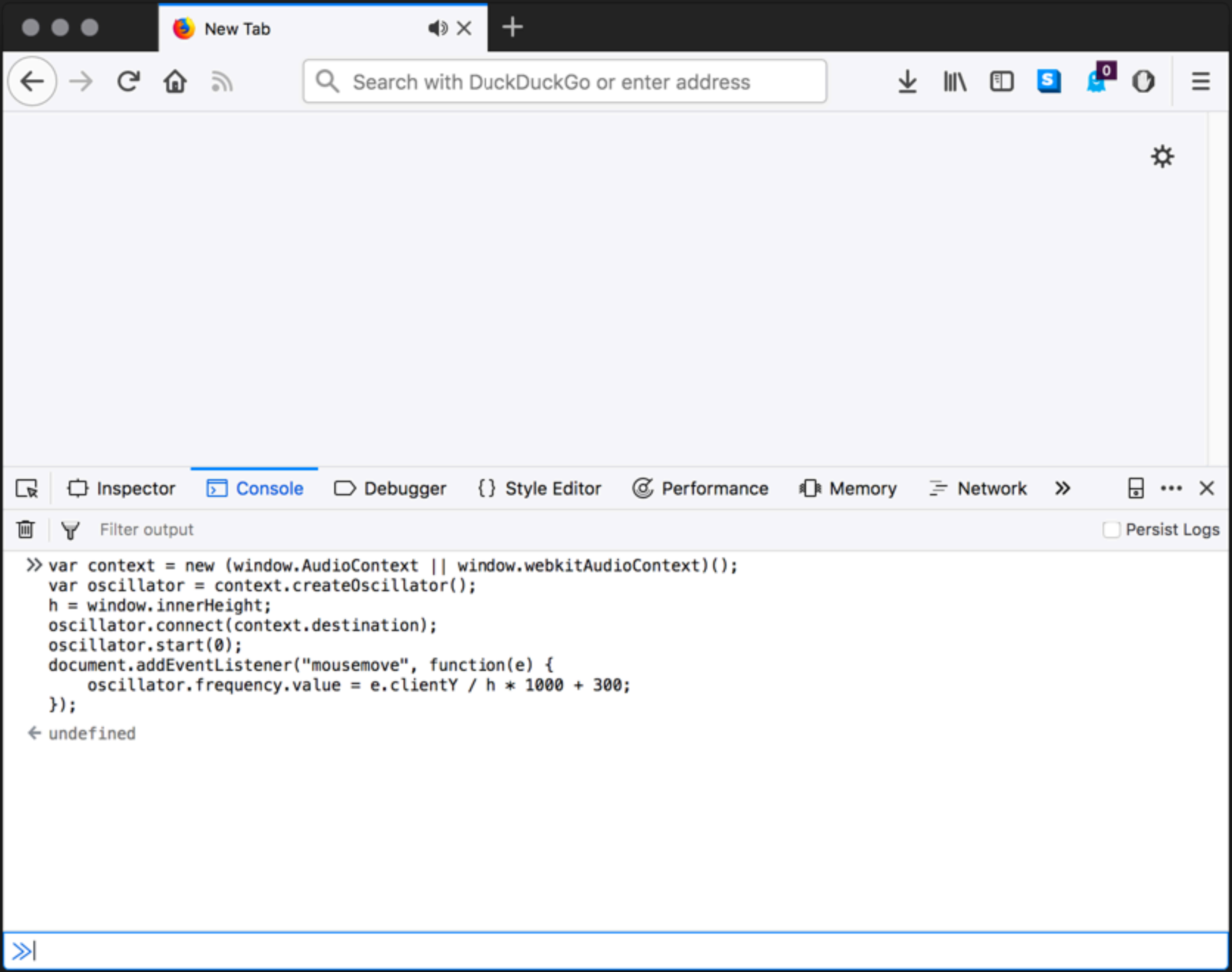
SOUND - BEEPS



```
>> var context = new (window.AudioContext || window.webkitAudioContext)();
   var oscillator = context.createOscillator();
   oscillator.type = 'sine';
   oscillator.frequency.value = 440;
   oscillator.connect(context.destination);
   oscillator.start();
←  undefined
```

#7

SOUND - MUSIC (AFTER A FASHION)



```
>> var context = new (window.AudioContext || window.webkitAudioContext)();
   var oscillator = context.createOscillator();
   h = window.innerHeight;
   oscillator.connect(context.destination);
   oscillator.start(0);
   document.addEventListener("mousemove", function(e) {
       oscillator.frequency.value = e.clientY / h * 1000 + 300;
   });
← undefined
```

- Nearly every computer has a browser so we can programme “old school” style almost anywhere at any time
- More likely to run against our own limitations right now than those of the the browser/JS
- Can build simple hackery into our daily programming habits

WHERE ARE WE?

WHAT SHOULD I PROGRAMME?

- Good Question!
- I’ve shown some simple things to get started
- What are you interested in?
- Key is to start small (remember the limitations & lower expectations I mentioned earlier)
- We want to make small increments without biting off more than we can chew.

WHAT SHOULD I PROGRAMME?

- Codes & Ciphers
    - This is actually an assignment in my second year web tech class (so I won’t spoil it here)
- Chaos, Fractals, Artificial Life, & Cellular Automata
- Procedural Generation

WHERE DID SIMON START?

CELLULAR AUTOMATA

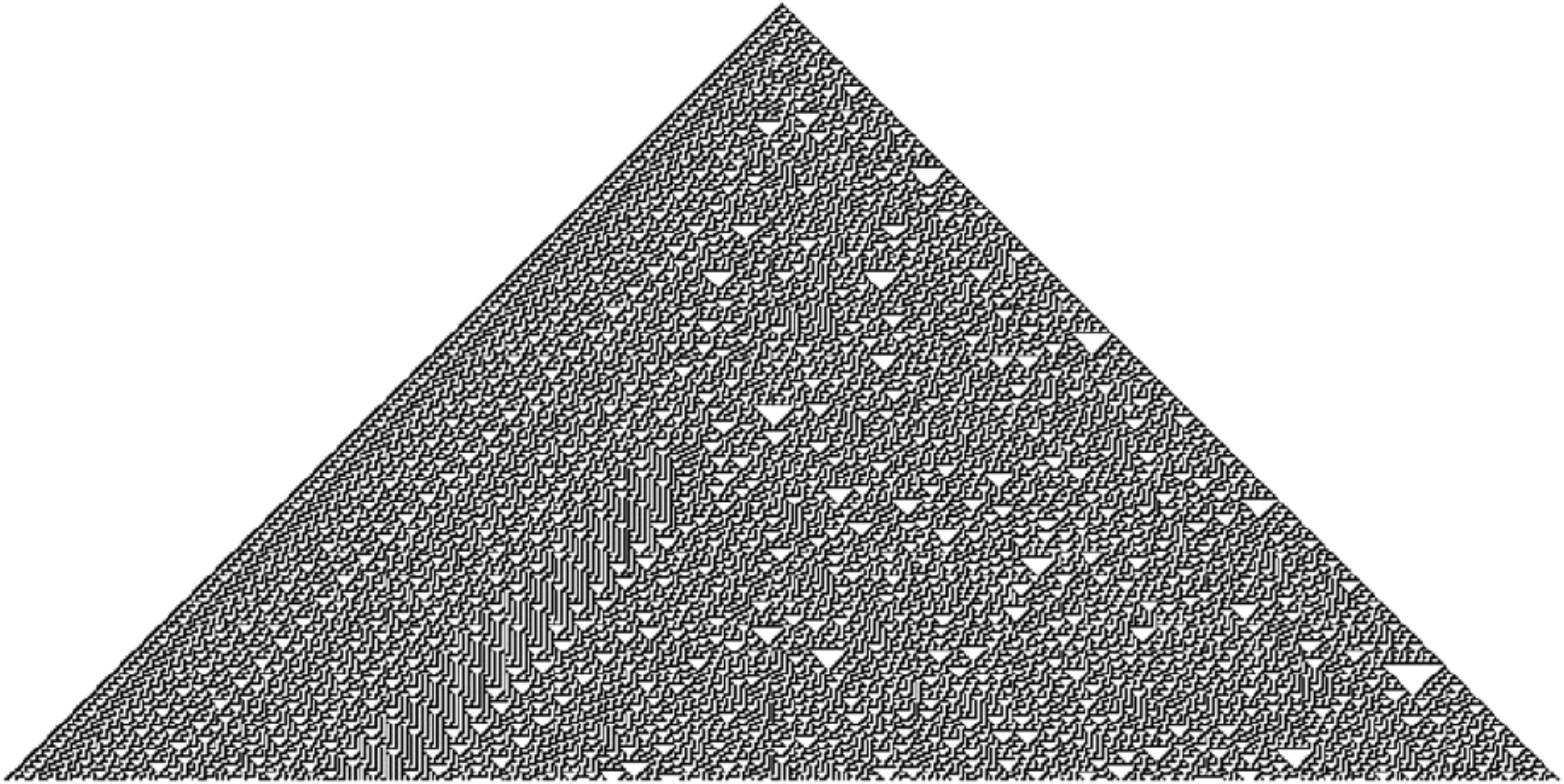
- A grid of cells that can be on or off

Take a starting generation

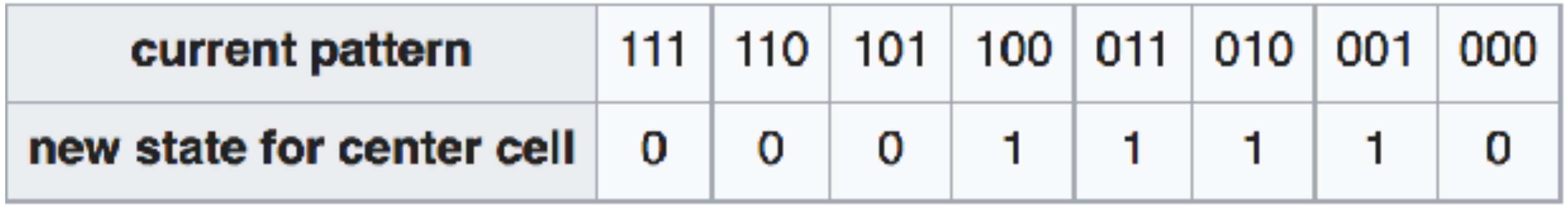
Some cells on & the rest off

Calculate the next *generation* according to some simple rules & repeat

- Can lead to very complex, sometime chaotic, behaviours
- The CompSci bit: Some CA have been proven to be able to calculate anything that a regular computer can calculate



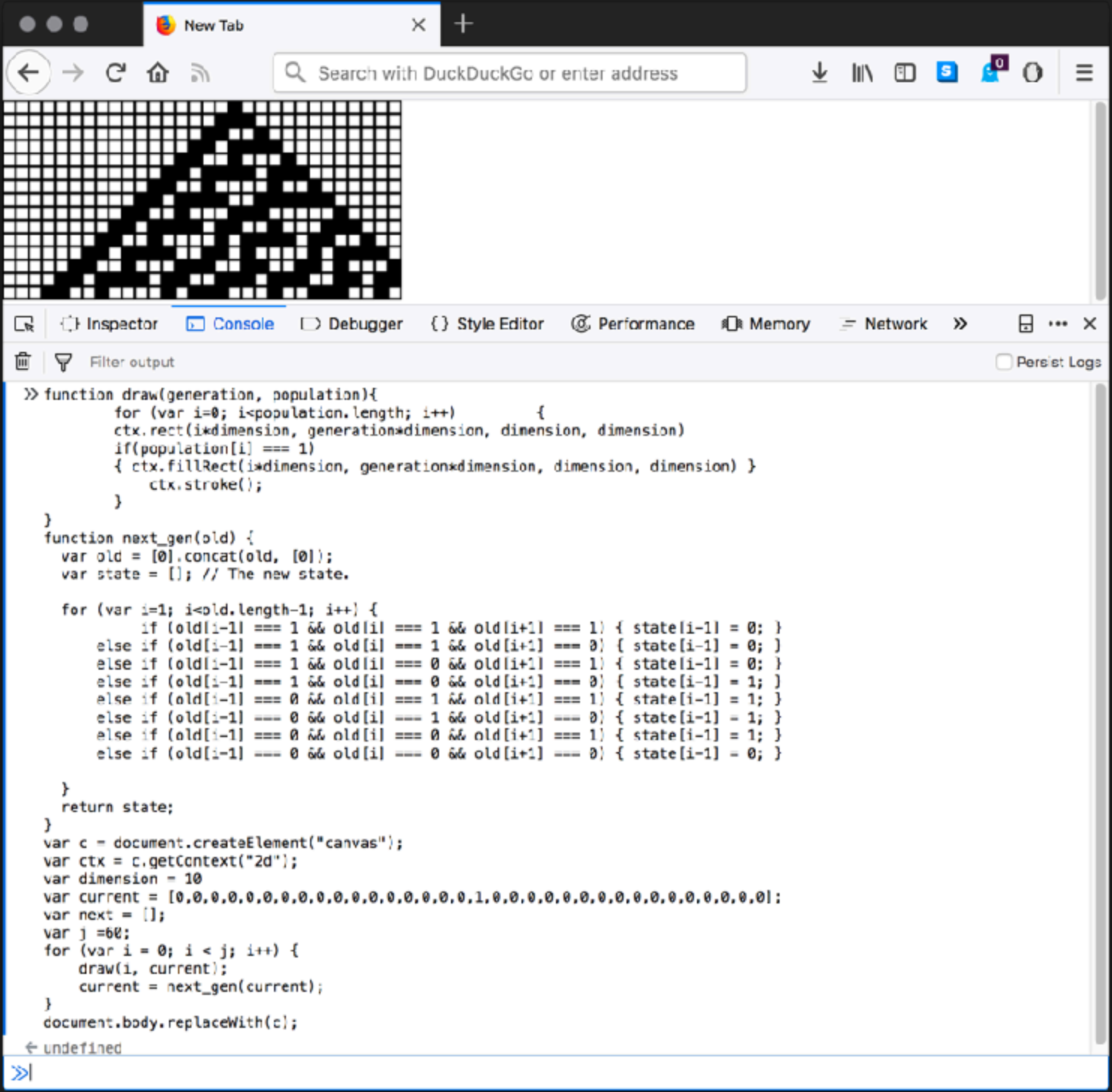
RULE 30



current pattern	111	110	101	100	011	010	001	000
new state for center cell	0	0	0	1	1	1	1	0

#8

1D CELLULAR AUTOMATA



```
>> function draw(generation, population){
           for (var i=0; i<population.length; i++)          {
           ctx.rect(i*dimension, generation*dimension, dimension, dimension)
           if(population[i] === 1)
           { ctx.fillRect(i*dimension, generation*dimension, dimension, dimension) }
               ctx.stroke();
           }
   }
   function next_gen(old) {
     var old = [0].concat(old, [0]);
     var state = []; // The new state.

     for (var i=1; i<old.length-1; i++) {
              if (old[i-1] === 1 && old[i] === 1 && old[i+1] === 1) { state[i-1] = 0; }
         else if (old[i-1] === 1 && old[i] === 1 && old[i+1] === 0) { state[i-1] = 0; }
         else if (old[i-1] === 1 && old[i] === 0 && old[i+1] === 1) { state[i-1] = 0; }
         else if (old[i-1] === 1 && old[i] === 0 && old[i+1] === 0) { state[i-1] = 1; }
         else if (old[i-1] === 0 && old[i] === 1 && old[i+1] === 1) { state[i-1] = 1; }
         else if (old[i-1] === 0 && old[i] === 1 && old[i+1] === 0) { state[i-1] = 1; }
         else if (old[i-1] === 0 && old[i] === 0 && old[i+1] === 1) { state[i-1] = 1; }
         else if (old[i-1] === 0 && old[i] === 0 && old[i+1] === 0) { state[i-1] = 0; }

     }
     return state;
   }
   var c = document.createElement("canvas");
   var ctx = c.getContext("2d");
   var dimension = 10
   var current = [0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0];
   var next = [];
   var j =60;
   for (var i = 0; i < j; i++) {
       draw(i, current);
       current = next_gen(current);
   }
   document.body.replaceWith(c);
 ← undefined
>>
```

- There are some places that collect programming problems & issue challenges:
  - Project Euler
  - Stack Exchange Code Golf
  - Code kata
- Reddit Daily Programmer
- Programming Praxis
- Rosetta Code
- International Collegiate Programming Contest Problems Index
- Algorithmist

I DON'T LIKE ANY OF THAT CRAP, WHAT SHOULD I DO?

IN SUMMARY

- Think small (until it's time to think big)
- Follow your interests
- If you don't have any interests then:
    - look around you | read more | steal from others
- Become a daily programmer
- Write LOTS of code
- Have fun

PROGRAMMING SURGERIES

- School of Computing (Merchiston Campus)
- Schedule (Weeks 02-15)
  - Monday, Lab MER_C06, 2pm-4pm
  - Wednesday, Lab MER_C06, 11am-1pm
  - Friday, Lab MER_C06, 12pm-2pm

HACKATHON

- For non-freshers, a hackathon runs during fresher’s week
- Come along to D2 between 2 & 3PM this afternoon to see what they’ve been doing (& get an idea of what you might want to be involved in next year)

WE ARE ALL SMART HERE. DISTINGUISH YOURSELF BY BEING KIND.