Run `git pull` in the main branch to follow along today.

JavaScript

DSC 106: Data Visualization

Sam Lau

UC San Diego

Announcements

Lab 4 due on Friday

Project 2 due on Tuesday

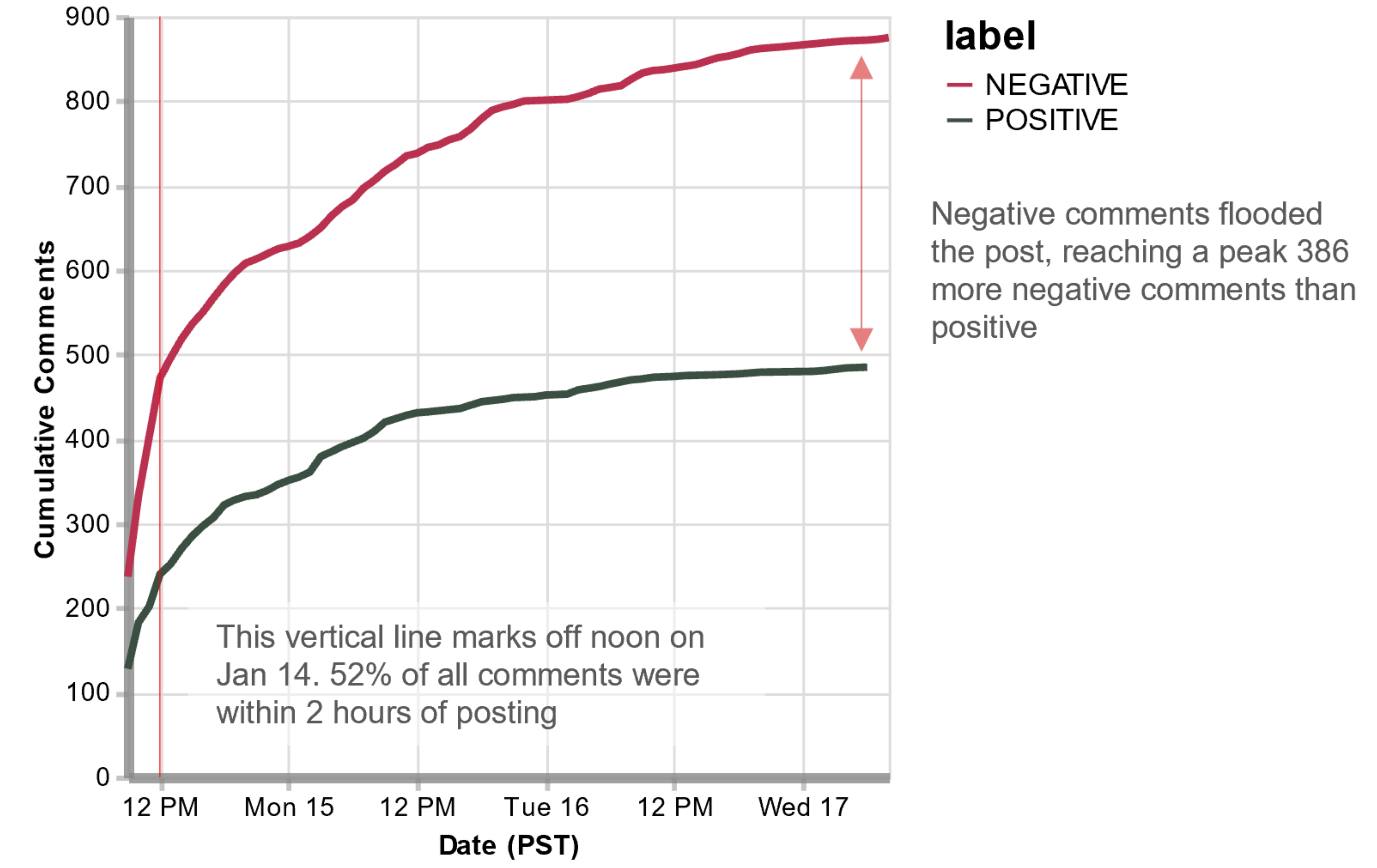
FAQs:

1. Do I have to use the same dataset for both earnest and deceptive vis for Project 2? **Yes.**
2. How similar do the earnest and deceptive vis need to be? **No requirement, but can help.**

Nifty Project 2 Submissions (from the past)

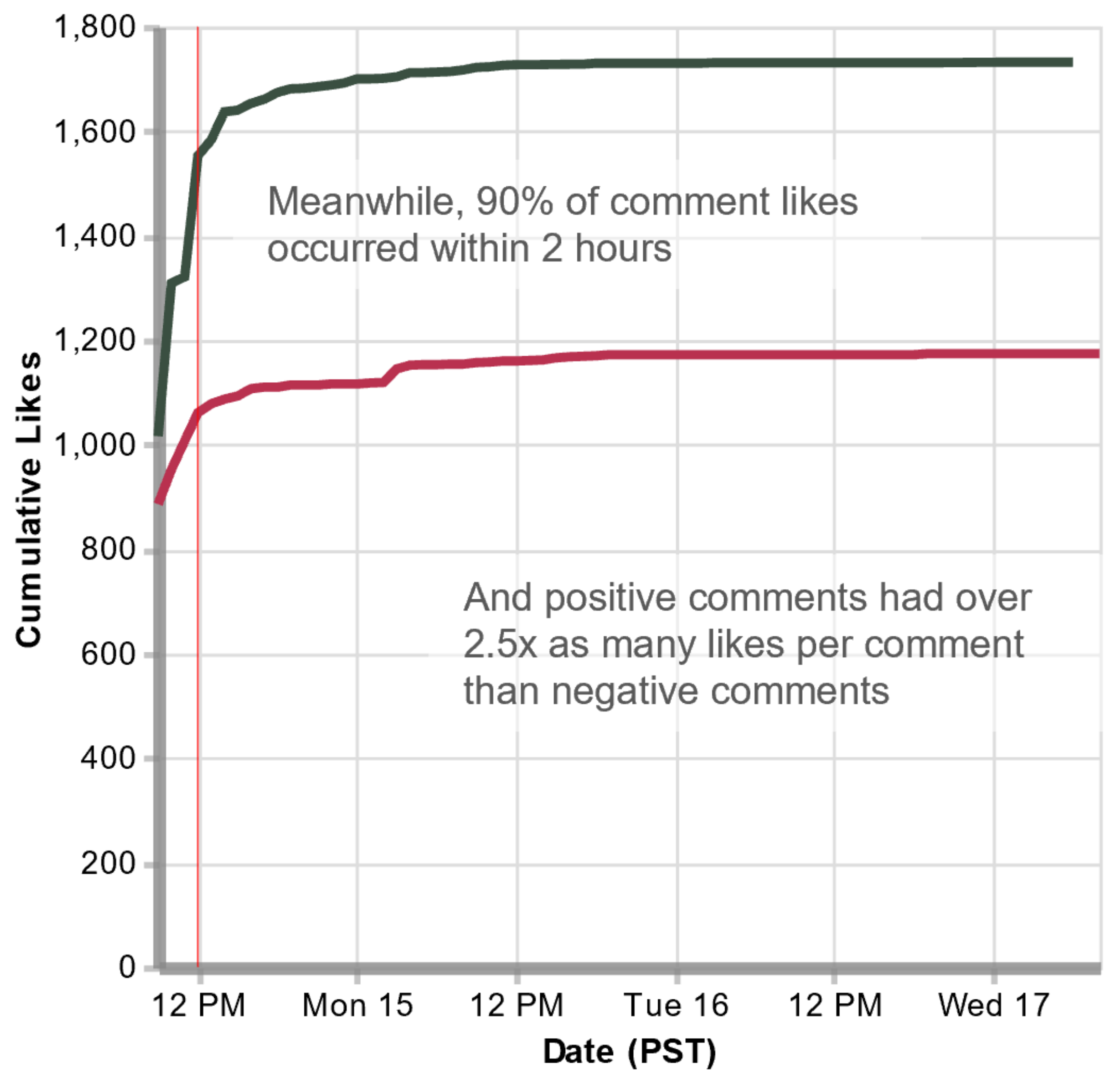
Digital Engagement in Politics: Diving into a Facebook Comment Section

Early January, President Biden announced he created 14 million new jobs while in office. 1,360 Facebook comments on the POTUS Facebook post were analyzed with Hugging Face sentiment analysis



Negative comments flooded the post, reaching a peak 386 more negative comments than positive

This vertical line marks off noon on Jan 14. 52% of all comments were within 2 hours of posting

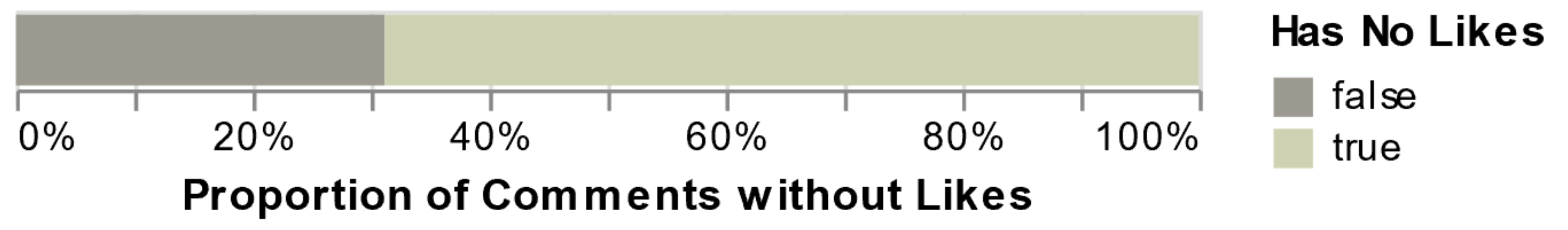


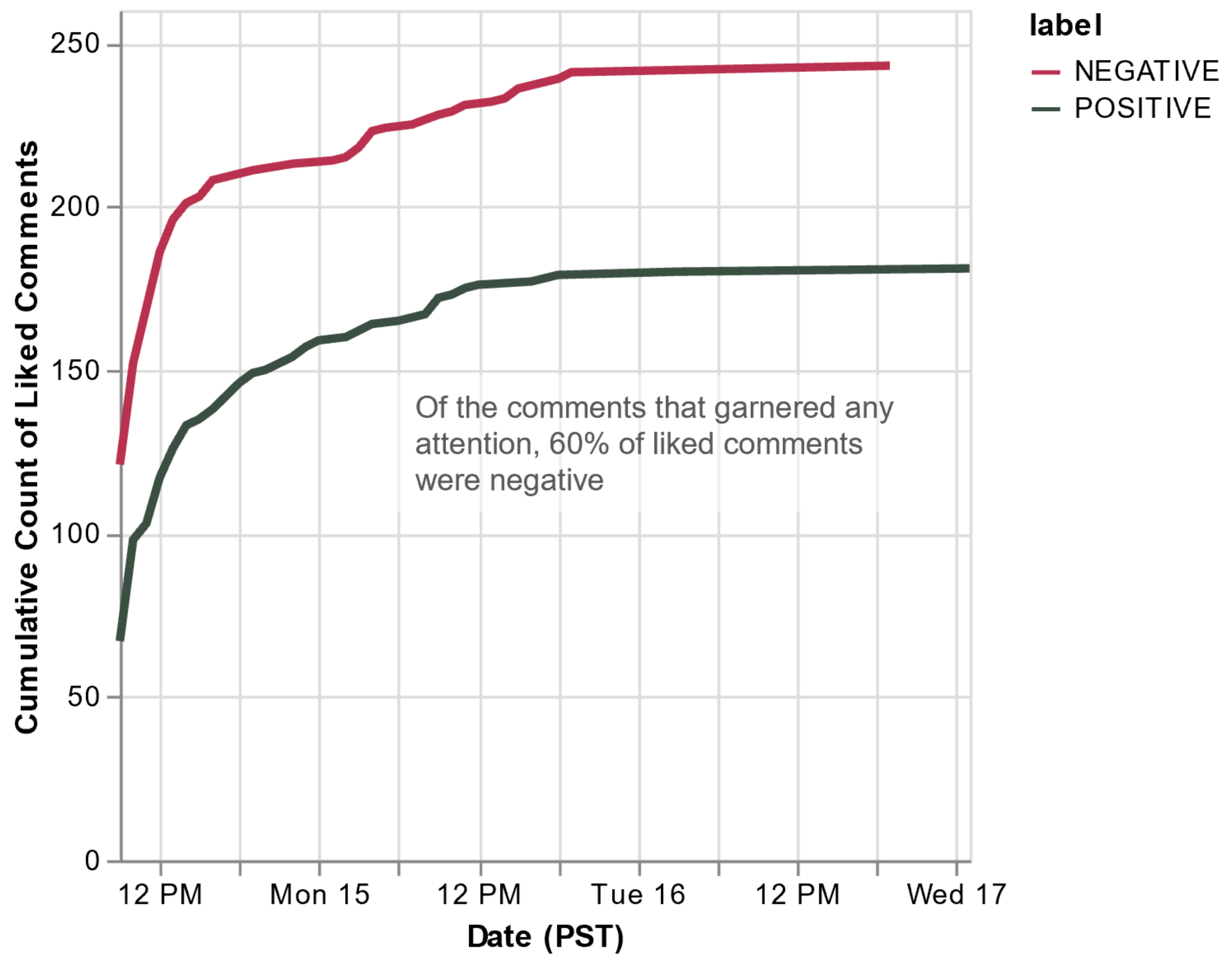
Meanwhile, 90% of comment likes occurred within 2 hours

And positive comments had over 2.5x as many likes per comment than negative comments

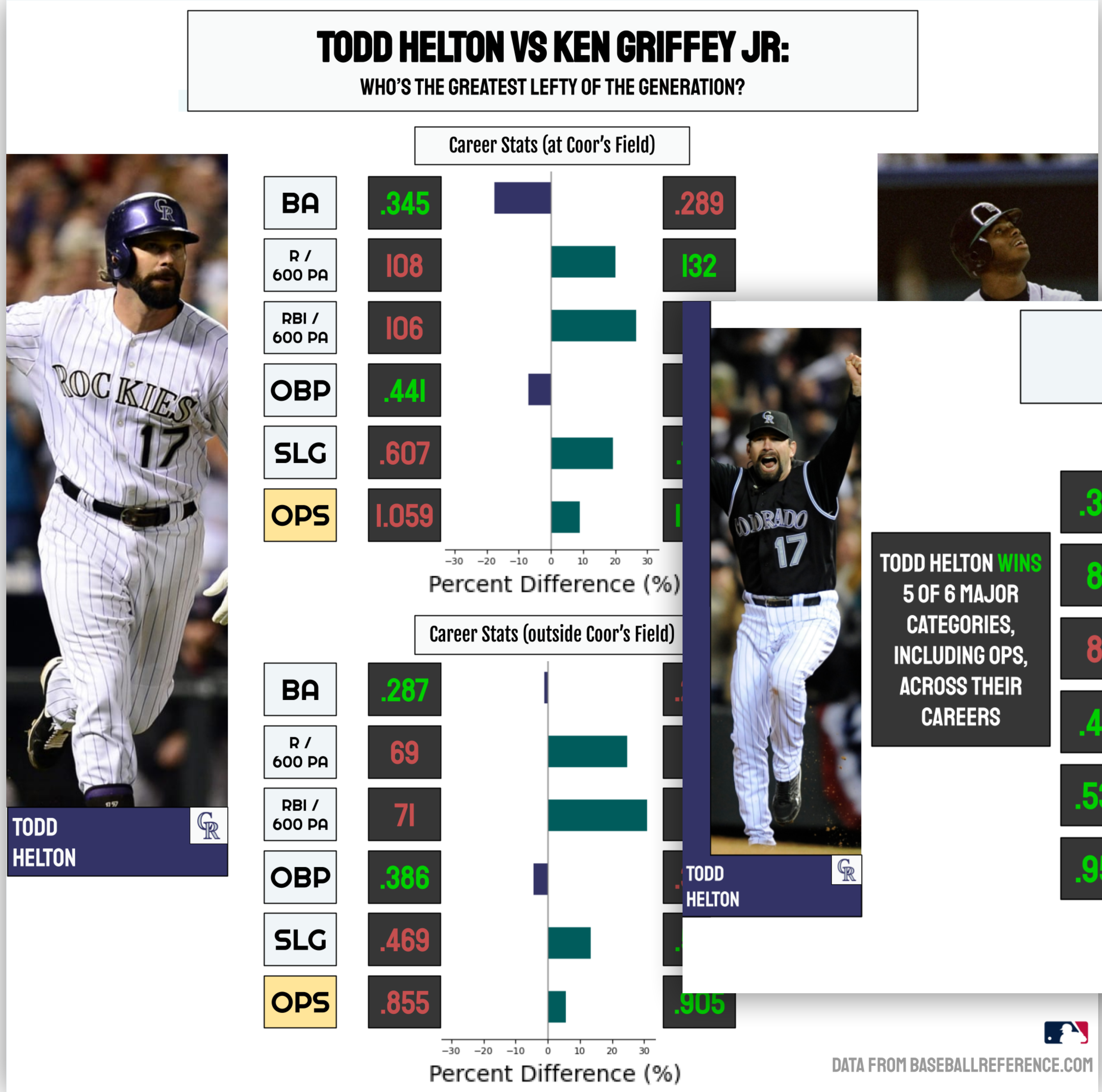
No One Likes Biden: Diving into a Facebook comment section

Early January, President Biden announced he created 14 million new jobs while in office. 1,360 Facebook comments on the POTUS Facebook post were analyzed with Hugging Face sentiment analysis. Most comments weren't liked. Let's look at what was.





Of the comments that garnered any attention, 60% of liked comments were negative



TODD HELTON VS KEN GRIFFEY JR:

WHO'S THE GREATEST LEFTY OF THE GENERATION?

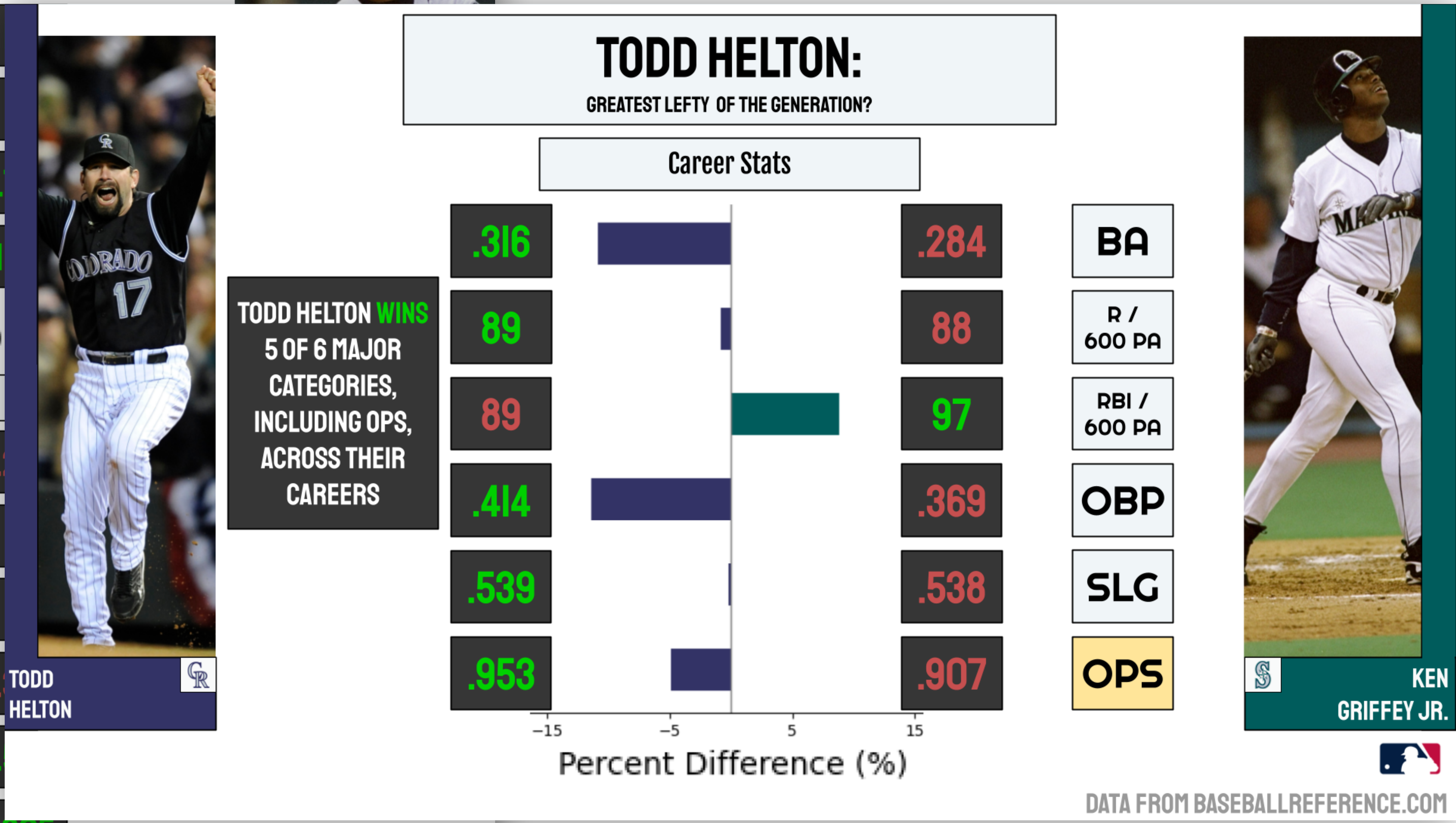
Career Stats (at Coor's Field)

BA	.345	.289
R / 600 PA	108	132
RBI / 600 PA	106	
OBP	.441	
SLG	.607	
OPS	1.059	

Career Stats (outside Coor's Field)

BA	.287	
R / 600 PA	69	
RBI / 600 PA	71	
OBP	.386	
SLG	.469	
OPS	.855	.905

DATA FROM BASEBALLREFERENCE.COM



TODD HELTON:

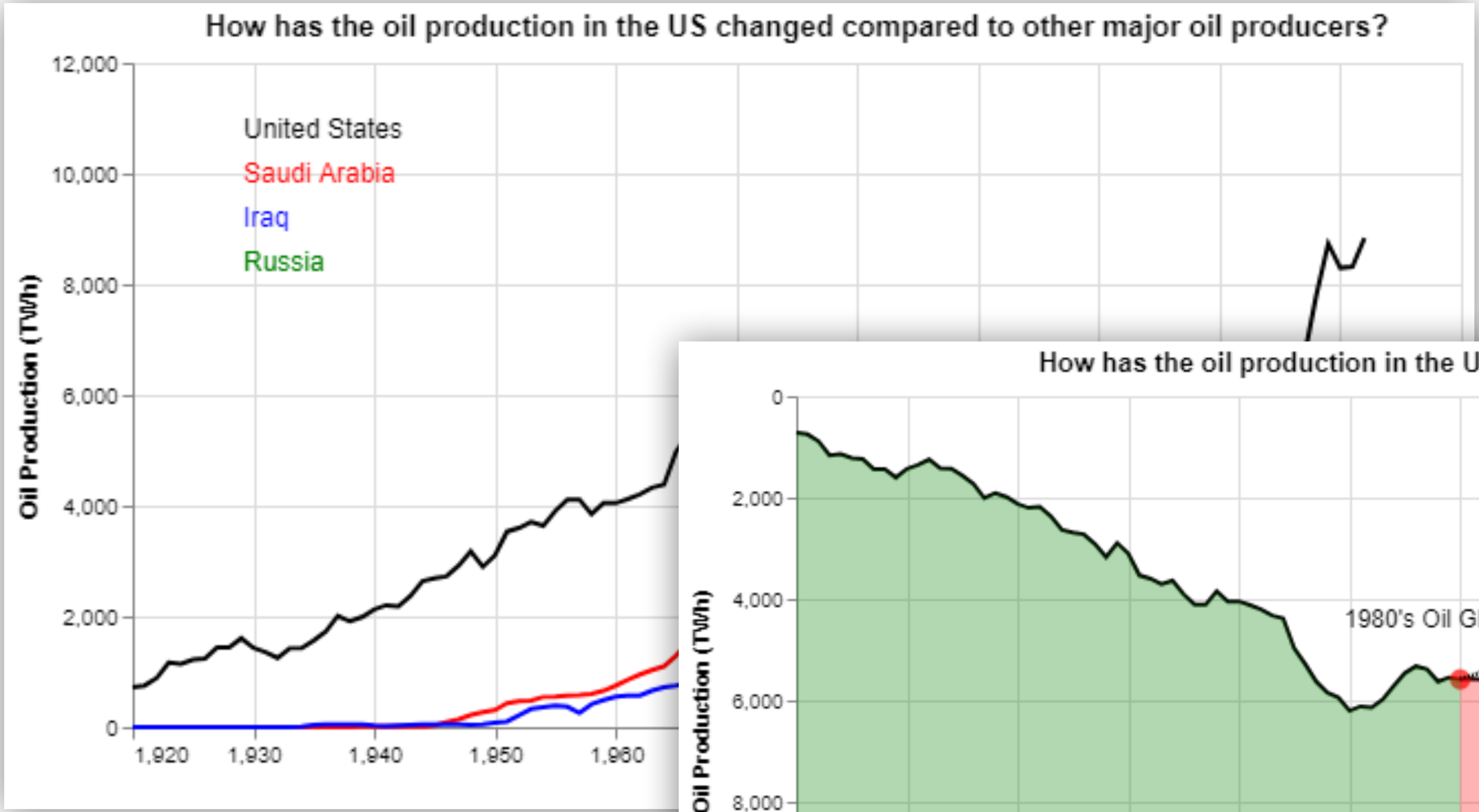
GREATEST LEFTY OF THE GENERATION?

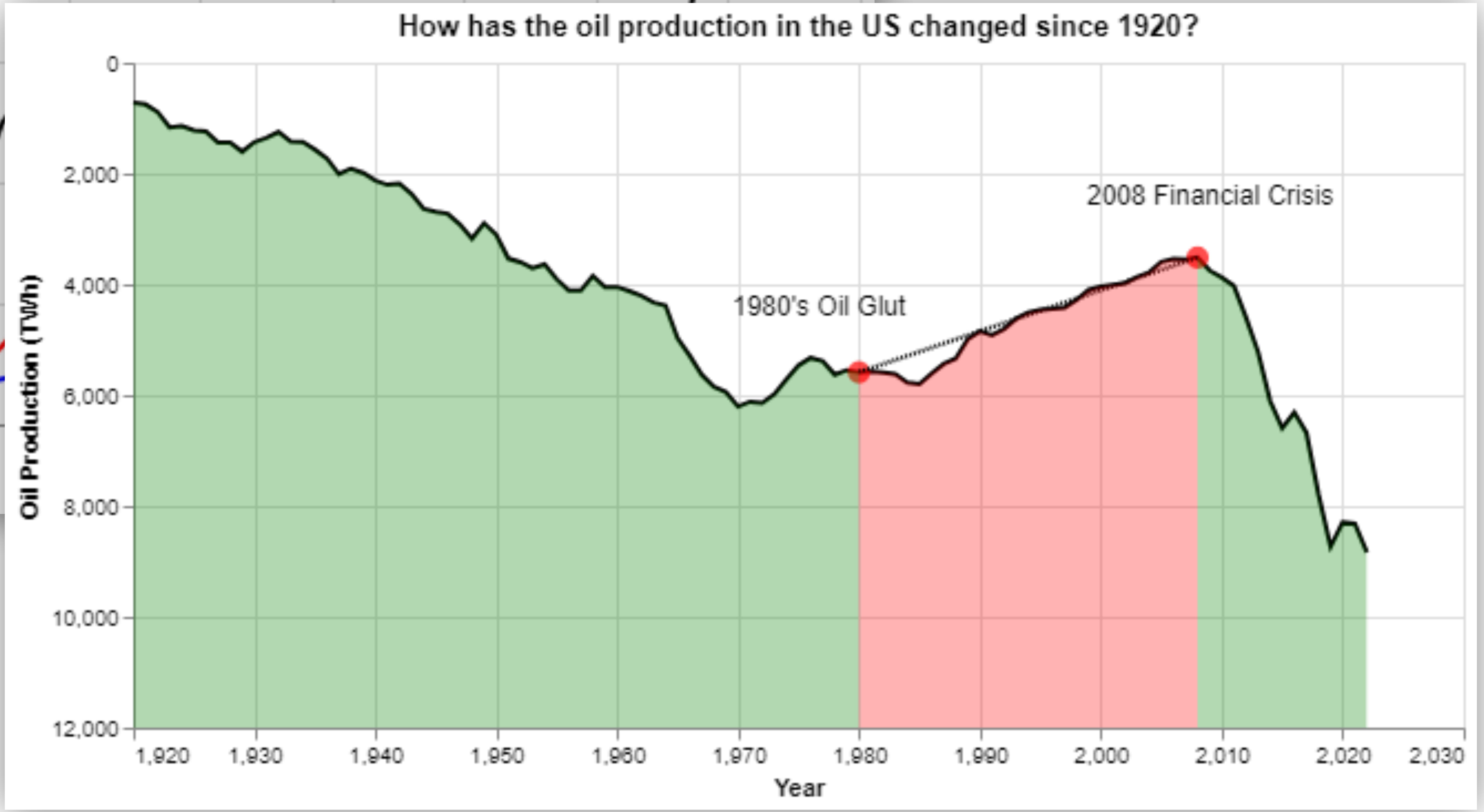
Career Stats

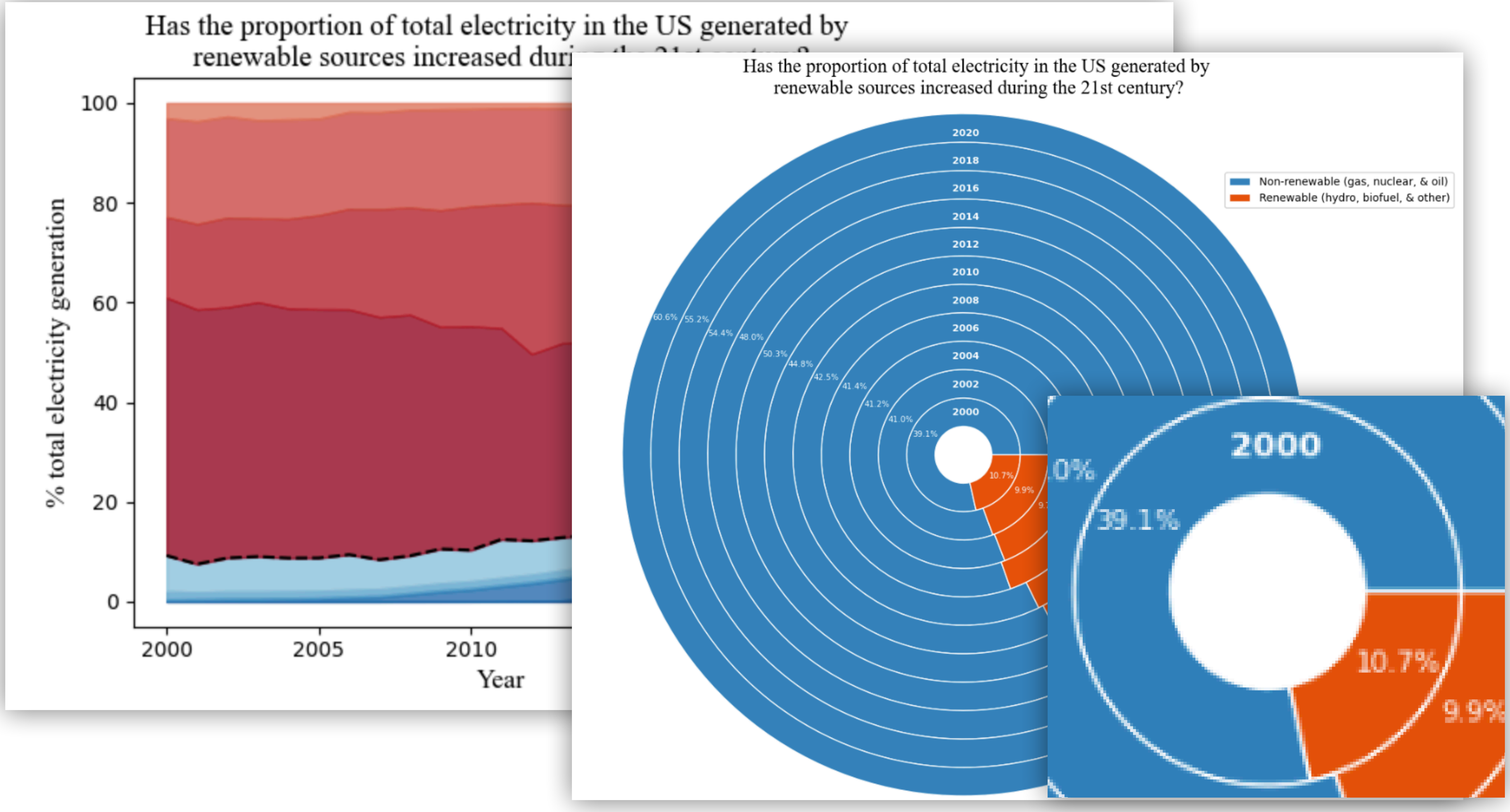
TODD HELTON WINS 5 OF 6 MAJOR CATEGORIES, INCLUDING OPS, ACROSS THEIR CAREERS

.316	.284	BA
89	88	R / 600 PA
89	97	RBI / 600 PA
.414	.369	OBP
.539	.538	SLG
.953	.907	OPS

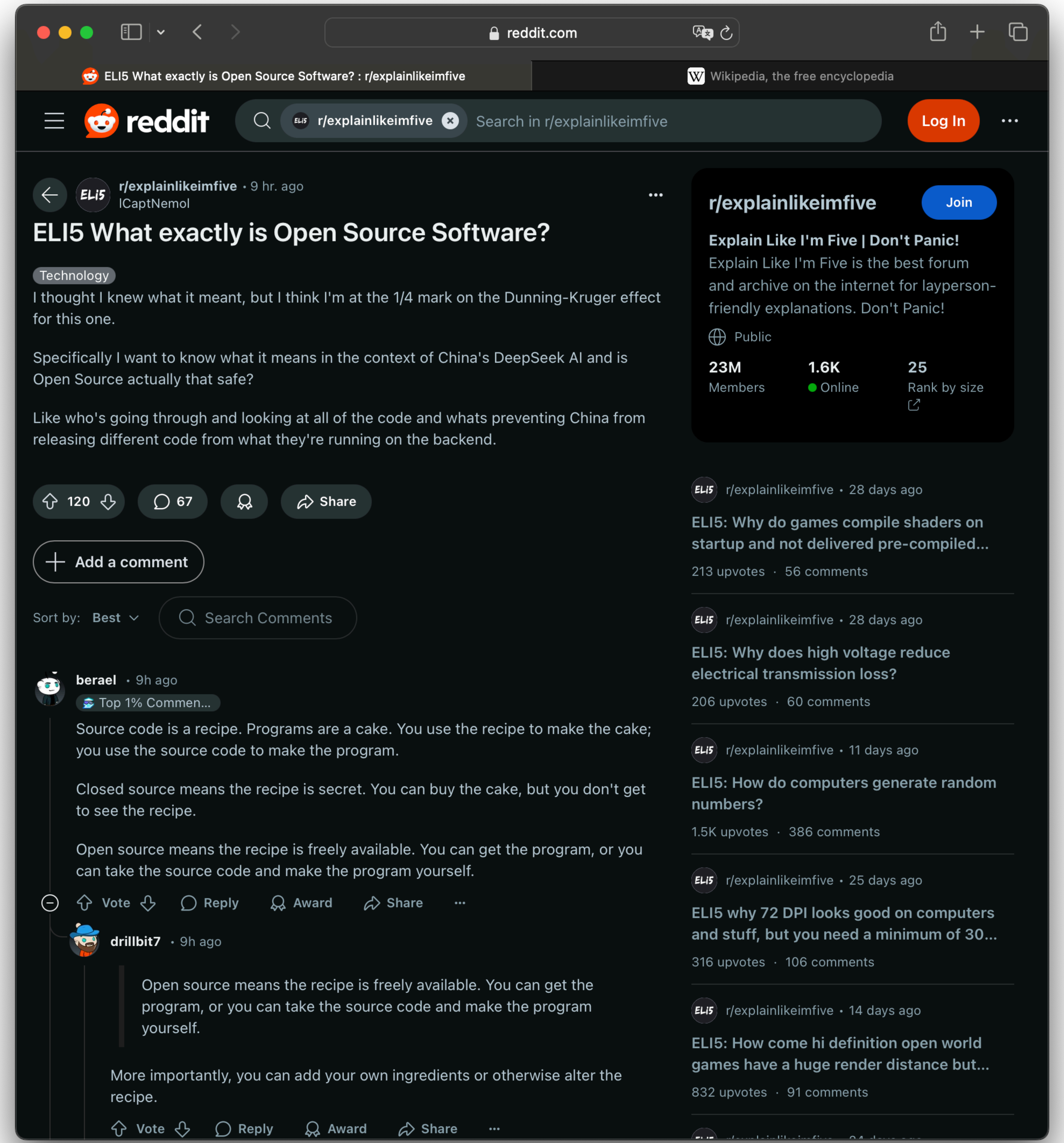
DATA FROM BASEBALLREFERENCE.COM


How has the oil production in the US changed compared to other major oil producers?
United States
Saudi Arabia
Iraq
Russia
Oil Production (TWh)
0
2,000
4,000
6,000
8,000
10,000
12,000
1,920
1,930
1,940
1,950
1,960


How has the oil production in the US changed since 1920?
1980's Oil Glut
2008 Financial Crisis
Oil Production (TWh)
0
2,000
4,000
6,000
8,000
10,000
12,000
1,920
1,930
1,940
1,950
1,960
1,970
1,980
1,990
2,000
2,010
2,020
2,030
Year


Has the proportion of total electricity in the US generated by renewable sources increased duri
% total electricity generation
100
80
60
40
20
0
2000
2005
2010
Year
Has the proportion of total electricity in the US generated by renewable sources increased during the 21st century?
2020
2018
2016
2014
2012
2010
2008
2006
2004
2002
2000
Non-renewable (gas, nuclear, & oil)
Renewable (hydro, biofuel, & other)
60.6%
55.2%
54.4%
48.0%
50.3%
44.8%
42.5%
41.4%
41.2%
41.0%
39.1%
10.7%
9.9%
2000
39.1%
10.7%
9.9%

JavaScript


reddit.com
ELI5 What exactly is Open Source Software? : r/explainlikeimfive
Wikipedia, the free encyclopedia
reddit
r/explainlikeimfive
Search in r/explainlikeimfive
Log In
Join
120
67
Share
Add a comment
Sort by: Best
Search Comments
Vote
Reply
Award
Share

r/explainlikeimfive · 9 hr. ago
lCaptNemol

ELI5 What exactly is Open Source Software?

Technology

I thought I knew what it meant, but I think I'm at the 1/4 mark on the Dunning-Kruger effect for this one.

Specifically I want to know what it means in the context of China's DeepSeek AI and is Open Source actually that safe?

Like who's going through and looking at all of the code and whats preventing China from releasing different code from what they're running on the backend.

berael · 9h ago
Top 1% Commen...

Source code is a recipe. Programs are a cake. You use the recipe to make the cake; you use the source code to make the program.

Closed source means the recipe is secret. You can buy the cake, but you don't get to see the recipe.

Open source means the recipe is freely available. You can get the program, or you can take the source code and make the program yourself.

drillbit7 · 9h ago

> Open source means the recipe is freely available. You can get the program, or you can take the source code and make the program yourself.

More importantly, you can add your own ingredients or otherwise alter the recipe.

r/explainlikeimfive

Explain Like I'm Five | Don't Panic!
Explain Like I'm Five is the best forum and archive on the internet for layperson-friendly explanations. Don't Panic!

Public

23M	1.6K	25
Members	● Online	Rank by size

r/explainlikeimfive · 28 days ago
ELI5: Why do games compile shaders on startup and not delivered pre-compiled...
213 upvotes · 56 comments

r/explainlikeimfive · 28 days ago
ELI5: Why does high voltage reduce electrical transmission loss?
206 upvotes · 60 comments

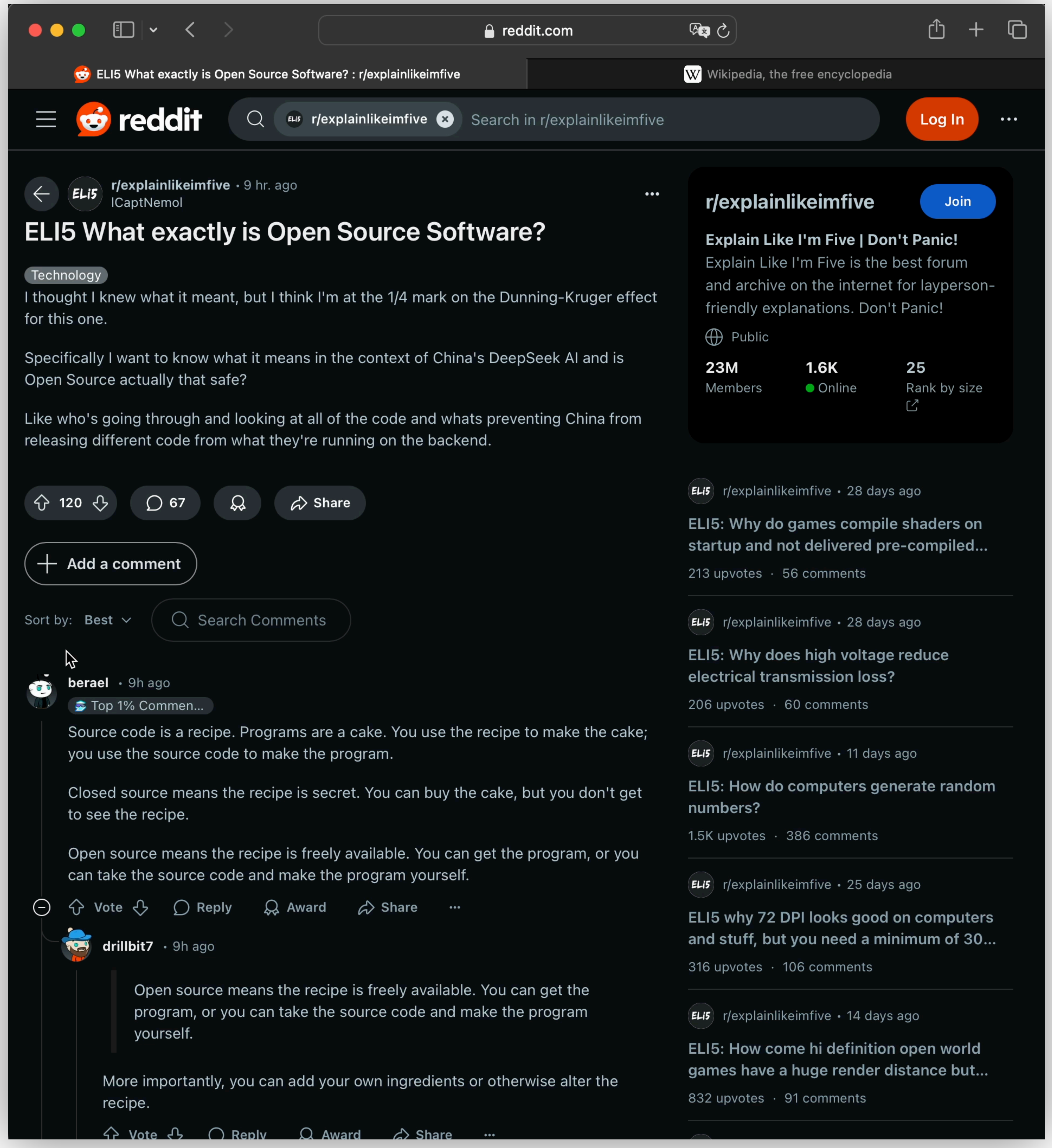
r/explainlikeimfive · 11 days ago
ELI5: How do computers generate random numbers?
1.5K upvotes · 386 comments

r/explainlikeimfive · 25 days ago
ELI5 why 72 DPI looks good on computers and stuff, but you need a minimum of 30...
316 upvotes · 106 comments

r/explainlikeimfive · 14 days ago
ELI5: How come hi definition open world games have a huge render distance but...
832 upvotes · 91 comments

HTML defines content (text, images, links)

CSS defines style (layout, colors, font)


reddit.com

ELI5 What exactly is Open Source Software? : r/explainlikeimfive

Wikipedia, the free encyclopedia

reddit

r/explainlikeimfive Search in r/explainlikeimfive

Log In

r/explainlikeimfive • 9 hr. ago
ICaptNemol

ELI5 What exactly is Open Source Software?

Technology

I thought I knew what it meant, but I think I'm at the 1/4 mark on the Dunning-Kruger effect for this one.

Specifically I want to know what it means in the context of China's DeepSeek AI and is Open Source actually that safe?

Like who's going through and looking at all of the code and whats preventing China from releasing different code from what they're running on the backend.

120 67 Share

Add a comment

Sort by: Best Search Comments

berael • 9h ago
Top 1% Commen...

Source code is a recipe. Programs are a cake. You use the recipe to make the cake; you use the source code to make the program.

Closed source means the recipe is secret. You can buy the cake, but you don't get to see the recipe.

Open source means the recipe is freely available. You can get the program, or you can take the source code and make the program yourself.

Vote Reply Award Share ...

drillbit7 • 9h ago

> Open source means the recipe is freely available. You can get the program, or you can take the source code and make the program yourself.

More importantly, you can add your own ingredients or otherwise alter the recipe.

Vote Reply Award Share ...

r/explainlikeimfive Join

Explain Like I'm Five | Don't Panic!

Explain Like I'm Five is the best forum and archive on the internet for layperson-friendly explanations. Don't Panic!

Public

23M	1.6K	25
Members	Online	Rank by size

r/explainlikeimfive • 28 days ago
ELI5: Why do games compile shaders on startup and not delivered pre-compiled...
213 upvotes · 56 comments

r/explainlikeimfive • 28 days ago
ELI5: Why does high voltage reduce electrical transmission loss?
206 upvotes · 60 comments

r/explainlikeimfive • 11 days ago
ELI5: How do computers generate random numbers?
1.5K upvotes · 386 comments

r/explainlikeimfive • 25 days ago
ELI5 why 72 DPI looks good on computers and stuff, but you need a minimum of 30...
316 upvotes · 106 comments

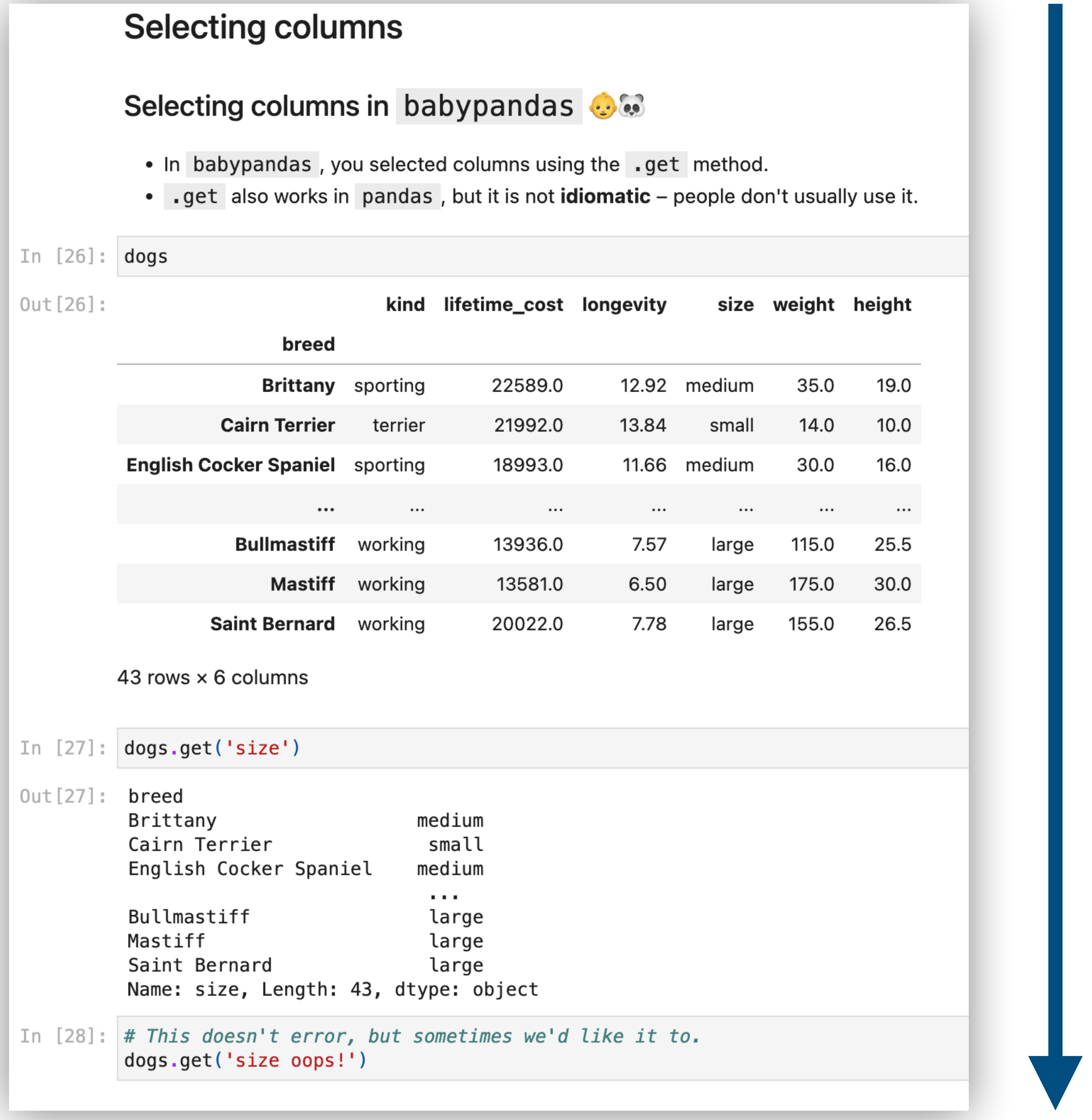
r/explainlikeimfive • 14 days ago
ELI5: How come hi definition open world games have a huge render distance but...
832 upvotes · 91 comments

HTML defines content
(text, images, links)

CSS defines style
(layout, colors, font)

One simple mental model:
JS manipulates HTML and CSS

pandas code executes from top to bottom



Selecting columns

Selecting columns in `babypandas` 👶🐼

- In `babypandas`, you selected columns using the `.get` method.
- `.get` also works in `pandas`, but it is not **idiomatic** – people don't usually use it.

```
In [26]: dogs
```

Out[26]:

breed	kind	lifetime_cost	longevity	size	weight	height
Brittany	sporting	22589.0	12.92	medium	35.0	19.0
Cairn Terrier	terrier	21992.0	13.84	small	14.0	10.0
English Cocker Spaniel	sporting	18993.0	11.66	medium	30.0	16.0
...	...	...	...	...	...	...
Bullmastiff	working	13936.0	7.57	large	115.0	25.5
Mastiff	working	13581.0	6.50	large	175.0	30.0
Saint Bernard	working	20022.0	7.78	large	155.0	26.5

43 rows × 6 columns

```
In [27]: dogs.get('size')
```

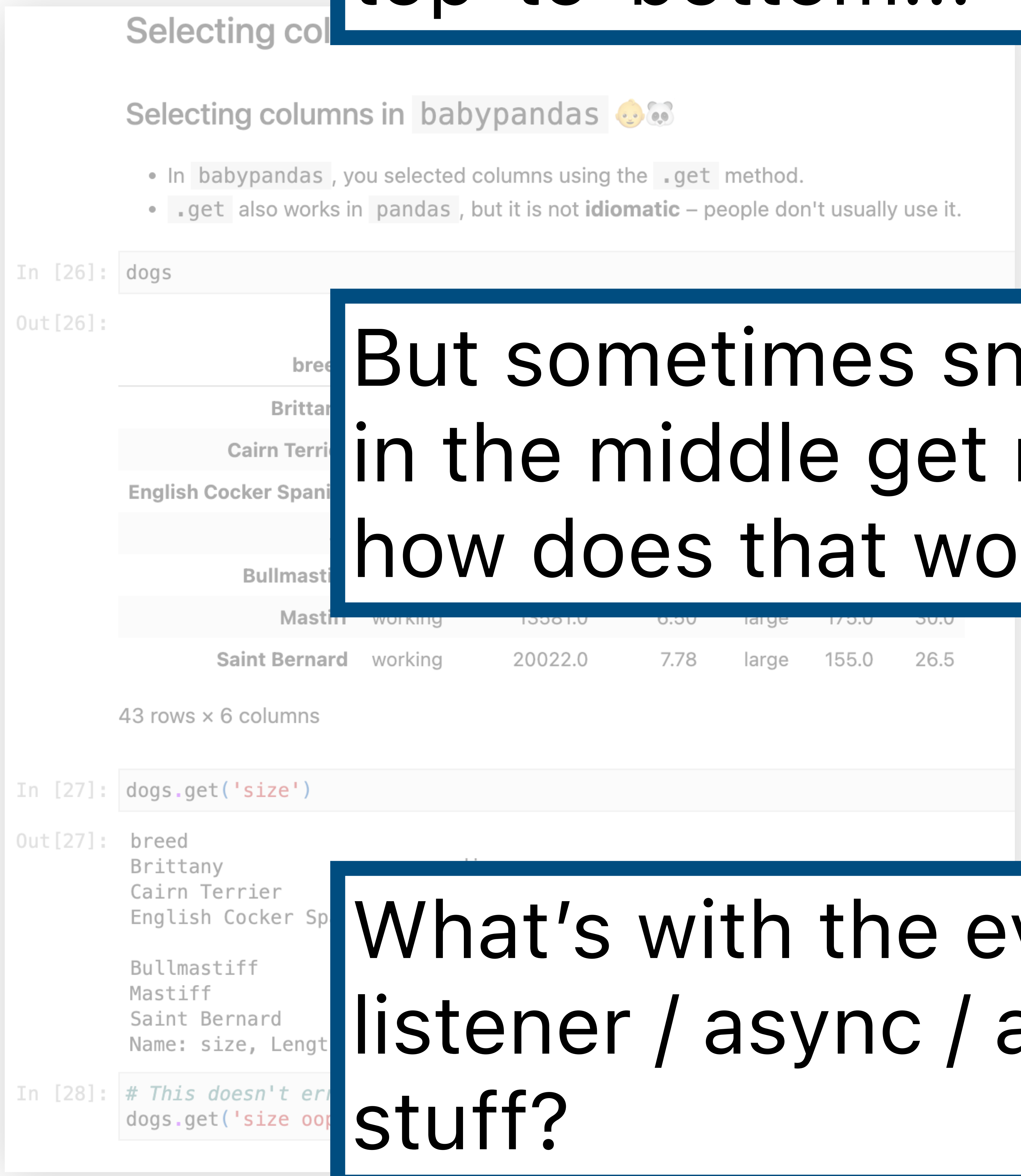
```
Out[27]: breed
Brittany                   medium
Cairn Terrier               small
English Cocker Spaniel     medium
                             ...
Bullmastiff                 large
Mastiff                     large
Saint Bernard               large
Name: size, Length: 43, dtype: object
```

```
In [28]: # This doesn't error, but sometimes we'd like it to.
dogs.get('size oops!')
```

JS code runs once from top-to-bottom...

But sometimes snippets in the middle get re-run, how does that work?

What's with the event listener / async / await stuff?

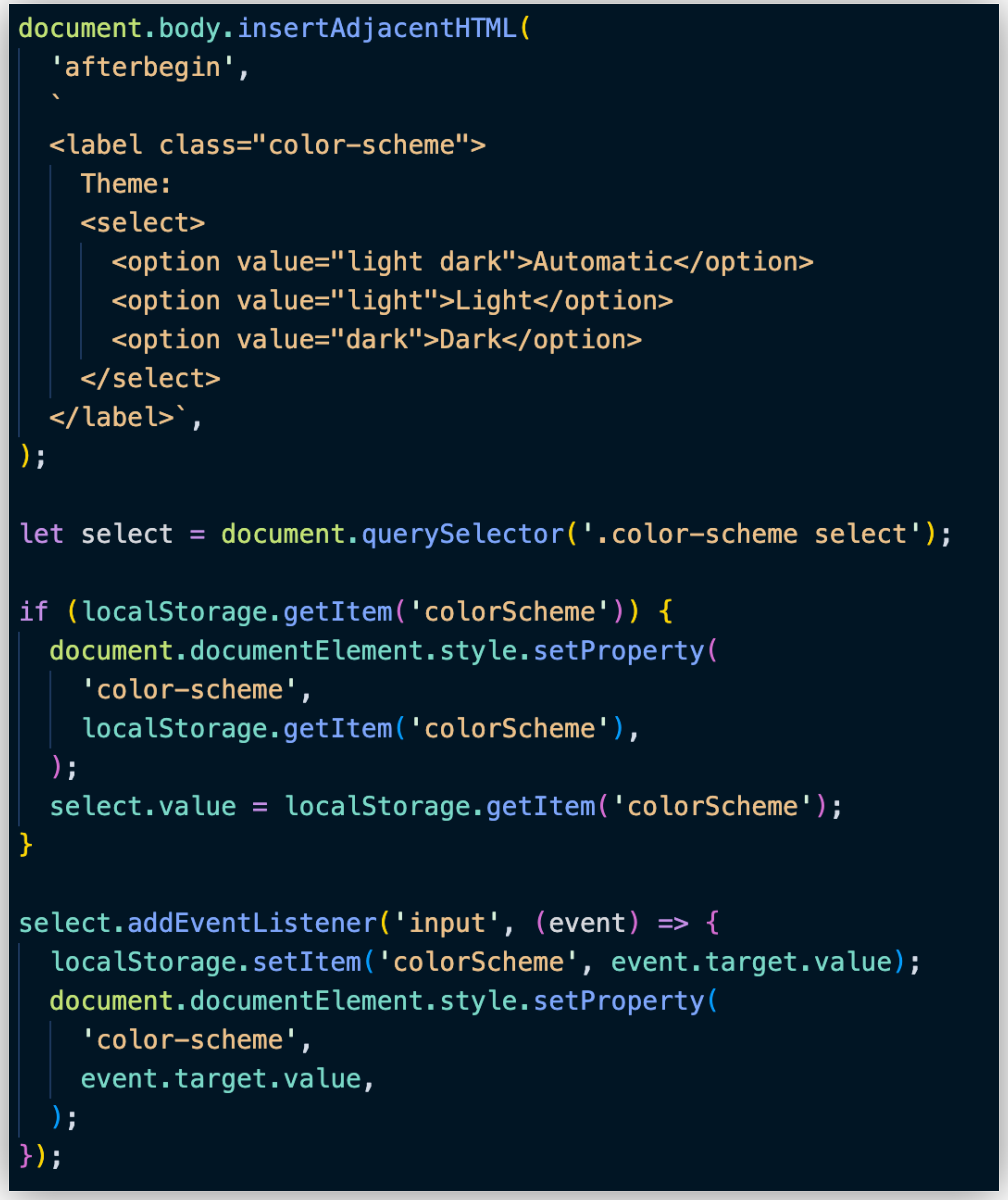


Selecting col

Selecting columns in `babypandas` 👶🐼

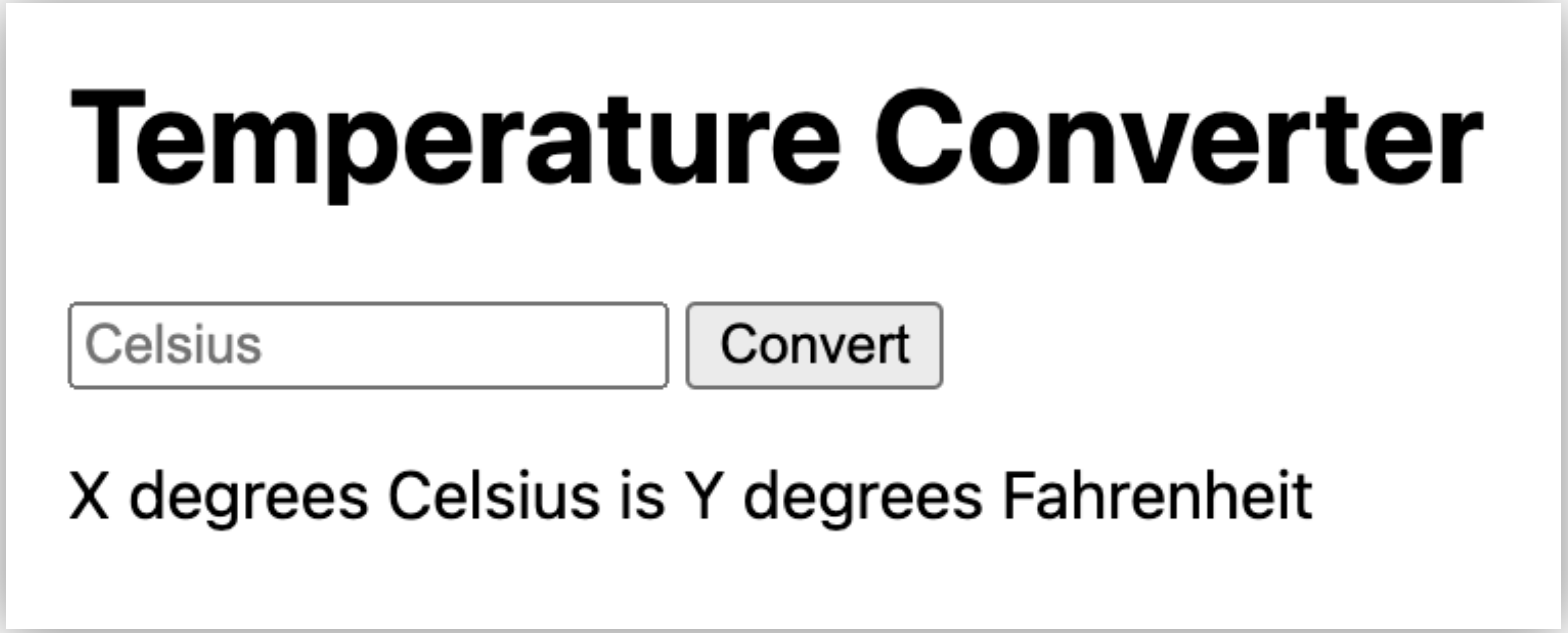
- In `babypandas`, you selected columns using the `.get` method.
- `.get` also works in `pandas`, but it is not **idiomatic** – people don't usually use it.

```
In [26]: dogs

Out[26]:
                    bree
                 Brittar
             Cairn Terri
     English Cocker Spani

               Bullmasti
                  Mastiff
            Saint Bernard  working  20022.0  7.78  large  155.0  26.5

43 rows × 6 columns

In [27]: dogs.get('size')

Out[27]: breed
         Brittany
         Cairn Terrier
         English Cocker Sp

         Bullmastiff
         Mastiff
         Saint Bernard
         Name: size, Lengt

In [28]: # This doesn't er
         dogs.get('size oo
```



```
document.body.insertAdjacentHTML(
  'afterbegin',
  `
  <label class="color-scheme">
    Theme:
    <select>
      <option value="light dark">Automatic</option>
      <option value="light">Light</option>
      <option value="dark">Dark</option>
    </select>
  </label>`,
);

let select = document.querySelector('.color-scheme select');

if (localStorage.getItem('colorScheme')) {
  document.documentElement.style.setProperty(
    'color-scheme',
    localStorage.getItem('colorScheme'),
  );
  select.value = localStorage.getItem('colorScheme');
}

select.addEventListener('input', (event) => {
  localStorage.setItem('colorScheme', event.target.value);
  document.documentElement.style.setProperty(
    'color-scheme',
    event.target.value,
  );
});
```

Example:
Temperature Converter


Temperature Converter

X degrees Celsius is Y degrees Fahrenheit

Pseudocode:

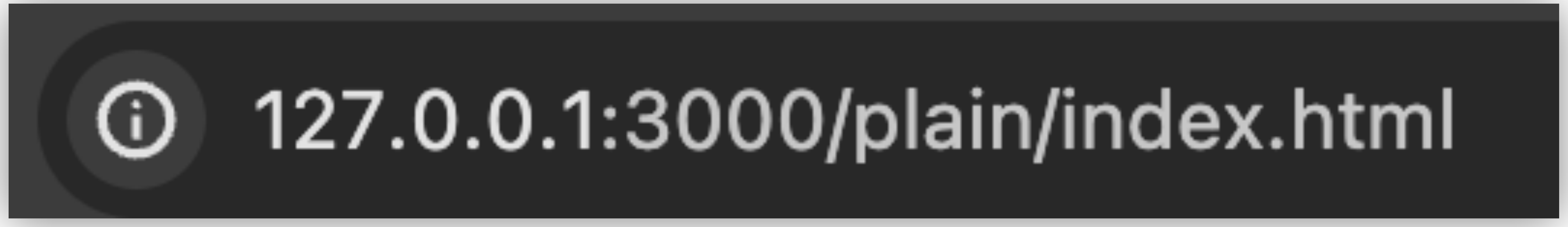
1. When we click "Convert", read value in Celsius box.
2. Convert value to F
3. Update text below box

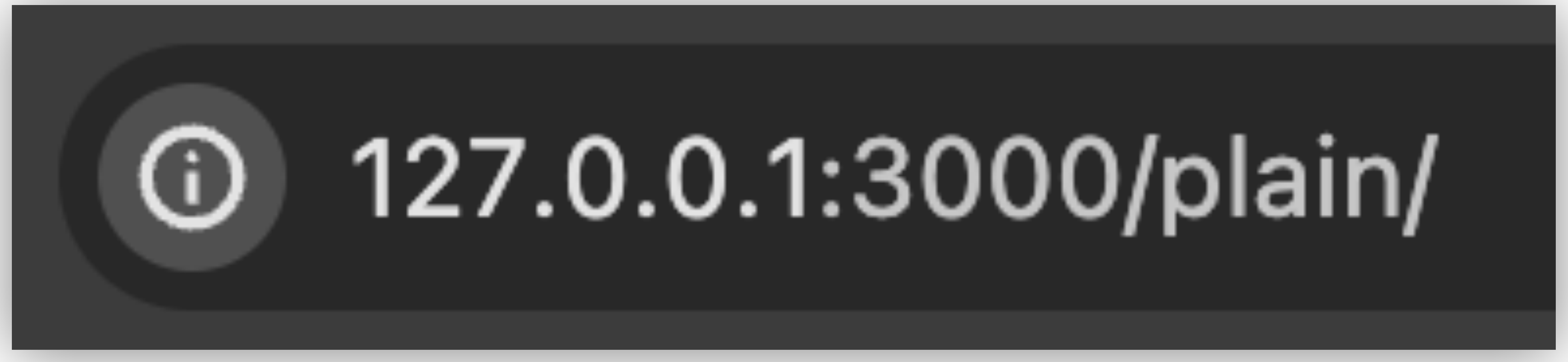
JS approach:

1. Attach event listener to Convert button. Event handler reads value from Celsius box.
2. Convert value to F
3. Replace text of the <div> element below.

(demo)

Typing a URL into address bar only asks for one HTML file (index.html in this case):


127.0.0.1:3000/plain/index.html

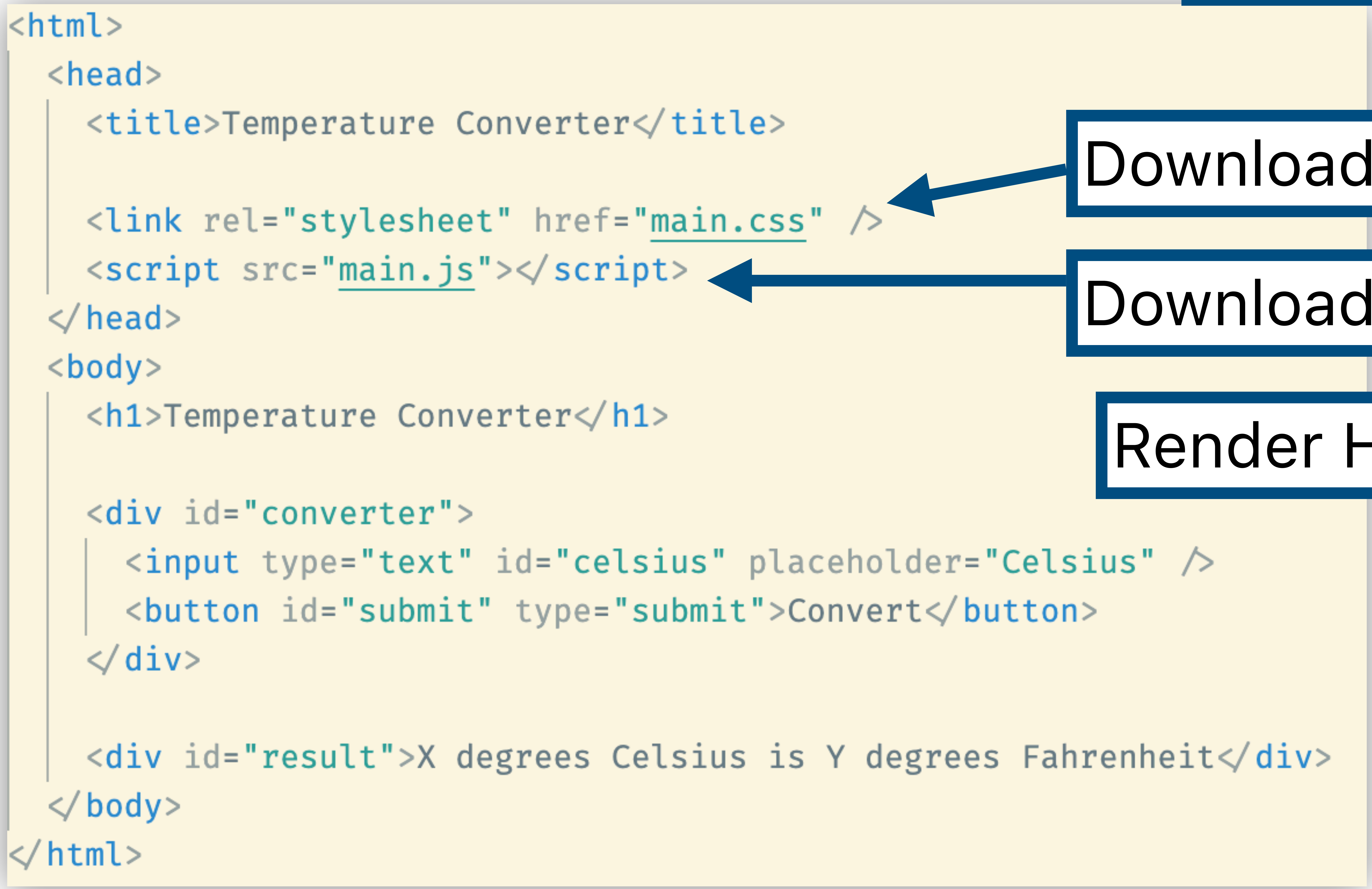

127.0.0.1:3000/plain/

index.html is appended if it isn't in URL, so this is the same.

Download, then render index.html

Download, then render index.html

HTML is also "executed" top-to-bottom:



```html
<html>
  <head>
    <title>Temperature Converter</title>

    <link rel="stylesheet" href="main.css" />
    <script src="main.js"></script>
  </head>
  <body>
    <h1>Temperature Converter</h1>

    <div id="converter">
      <input type="text" id="celsius" placeholder="Celsius" />
      <button id="submit" type="submit">Convert</button>
    </div>

    <div id="result">X degrees Celsius is Y degrees Fahrenheit</div>
  </body>
</html>
```

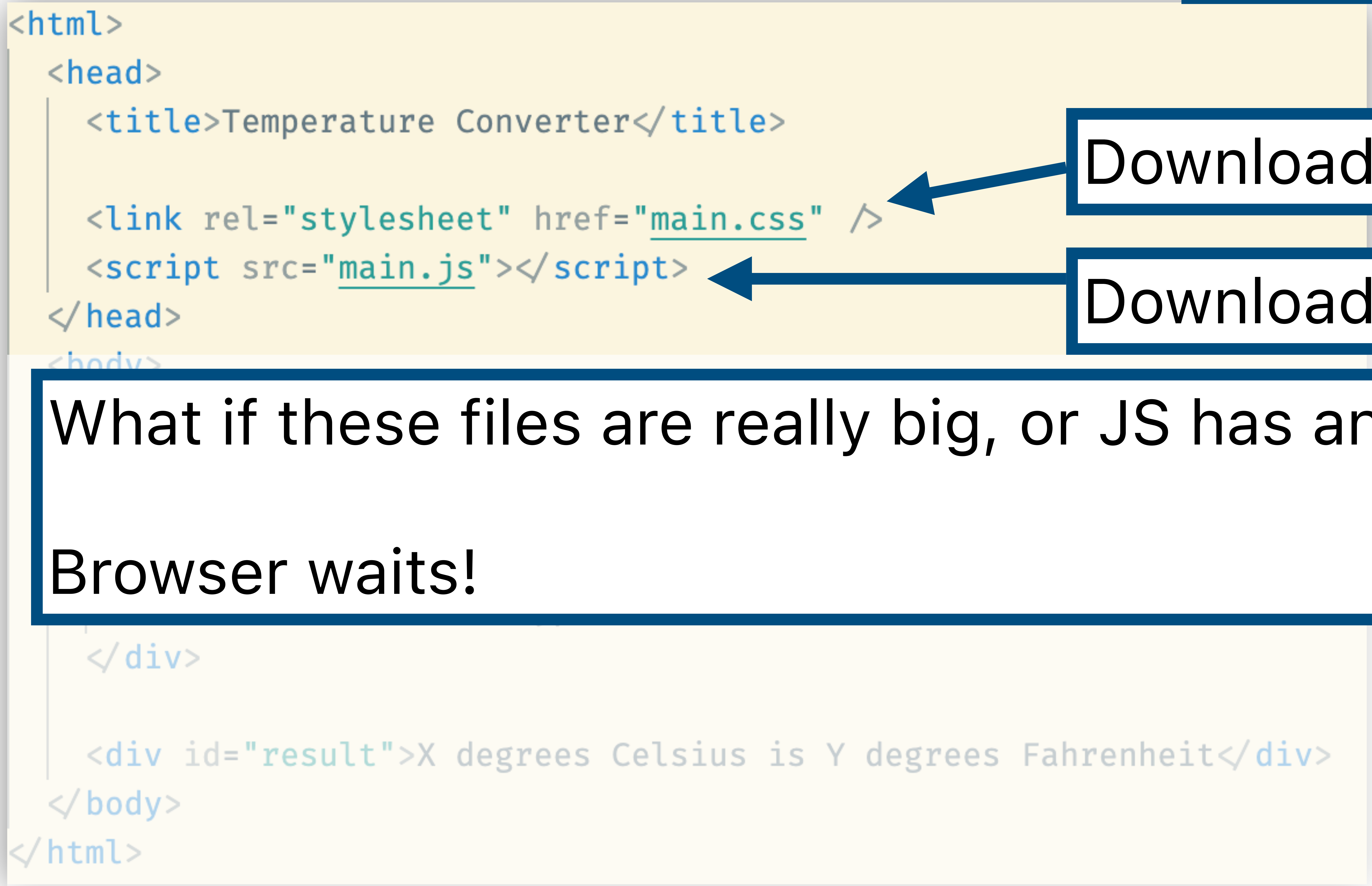
Download and run the main.css file

Download and run the main.js file

Render HTML to screen

Download, then render index.html

HTML is also "executed" top-to-bottom:



```
<html>
  <head>
    <title>Temperature Converter</title>

    <link rel="stylesheet" href="main.css" />
    <script src="main.js"></script>
  </head>
  <body>
    </div>

    <div id="result">X degrees Celsius is Y degrees Fahrenheit</div>
  </body>
</html>
```

Download and run the main.css file

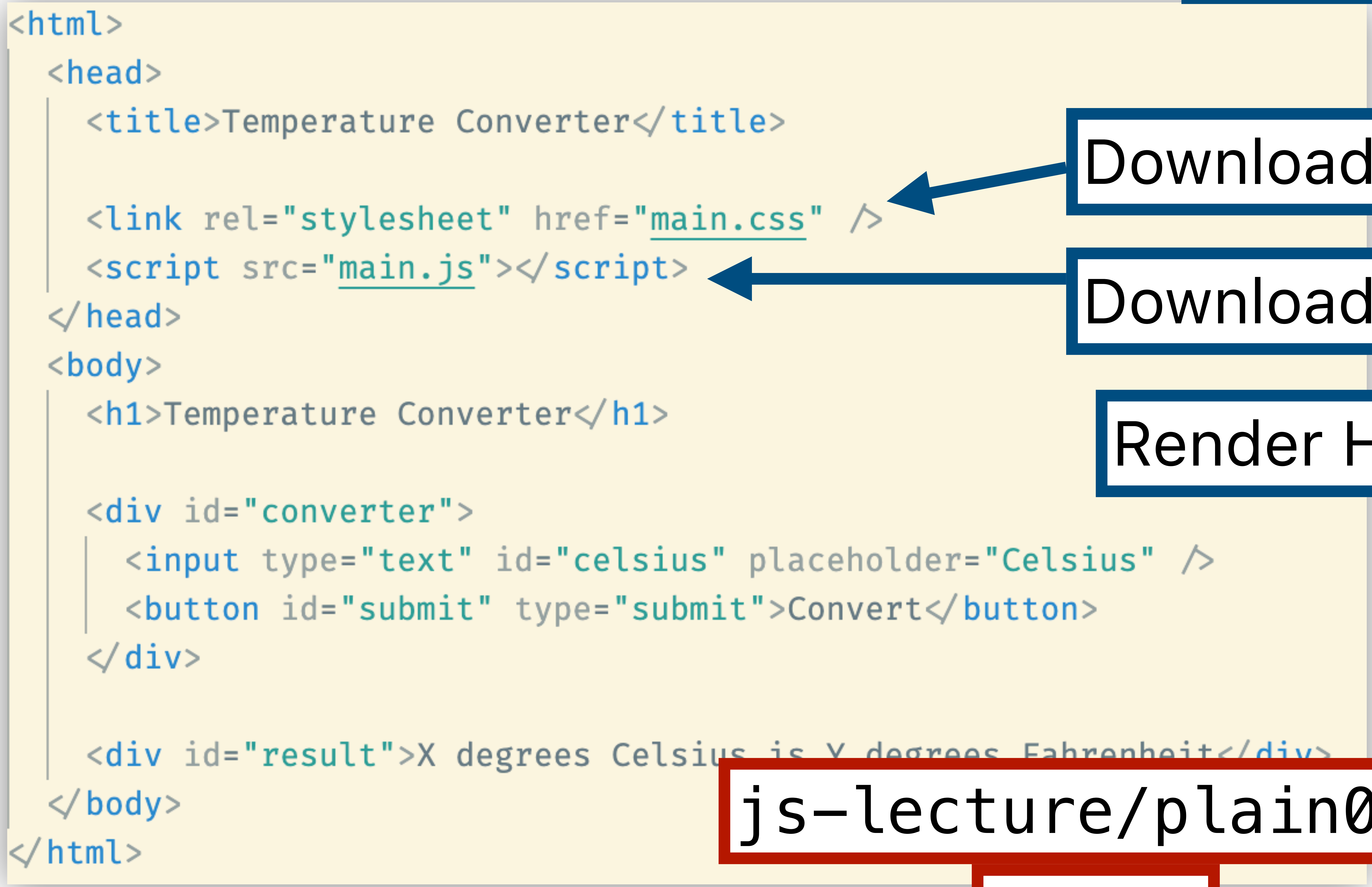
Download and run the main.js file

What if these files are really big, or JS has an infinite loop??

Browser waits!

Download, then render index.html

HTML is also "executed" top-to-bottom:



```html
<html>
  <head>
    <title>Temperature Converter</title>

    <link rel="stylesheet" href="main.css" />
    <script src="main.js"></script>
  </head>
  <body>
    <h1>Temperature Converter</h1>

    <div id="converter">
      <input type="text" id="celsius" placeholder="Celsius" />
      <button id="submit" type="submit">Convert</button>
    </div>

    <div id="result">X degrees Celsius is Y degrees Fahrenheit</div>
  </body>
</html>
```

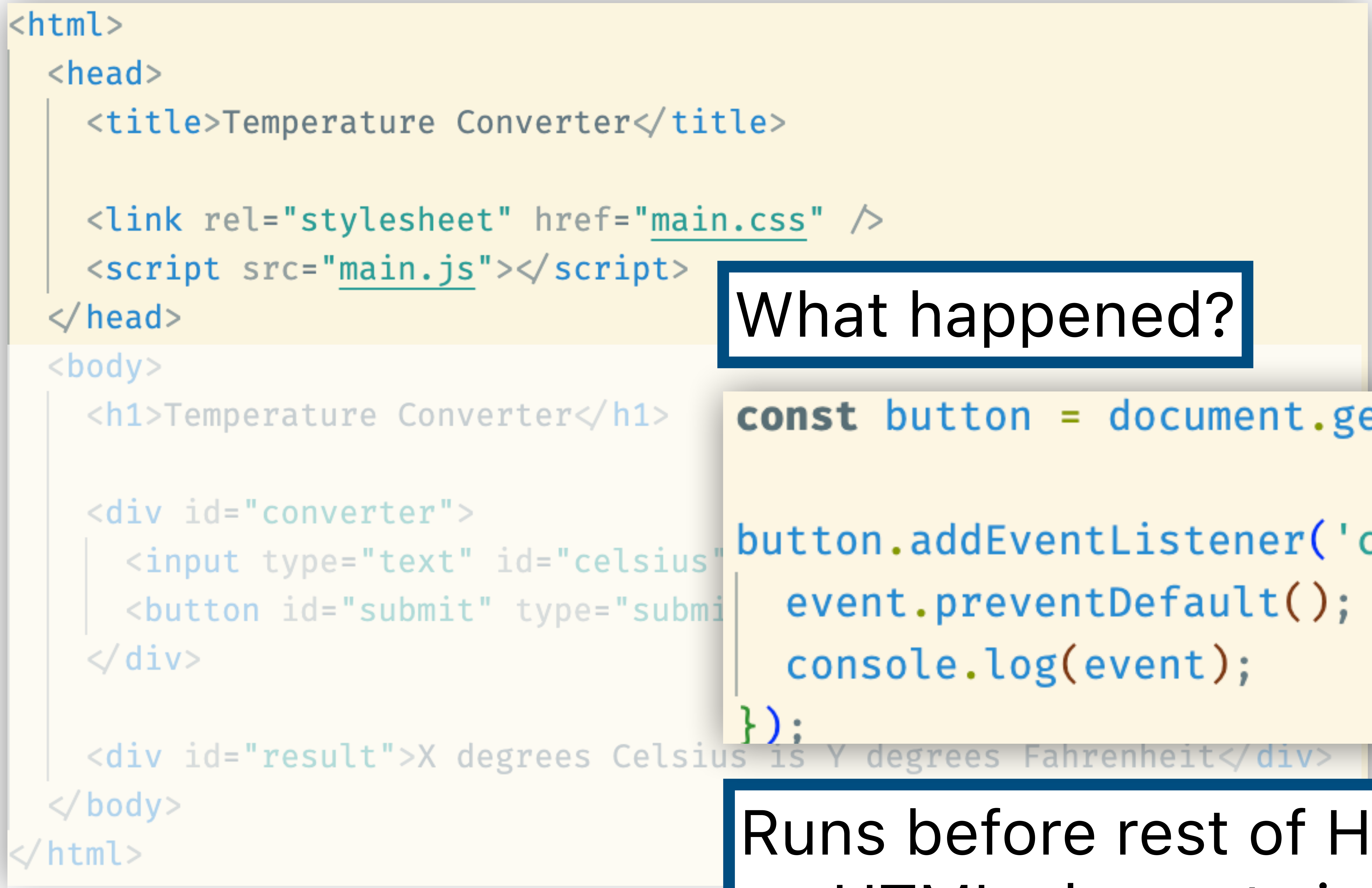
Download and run the main.css file

Download and run the main.js file

Render HTML to screen

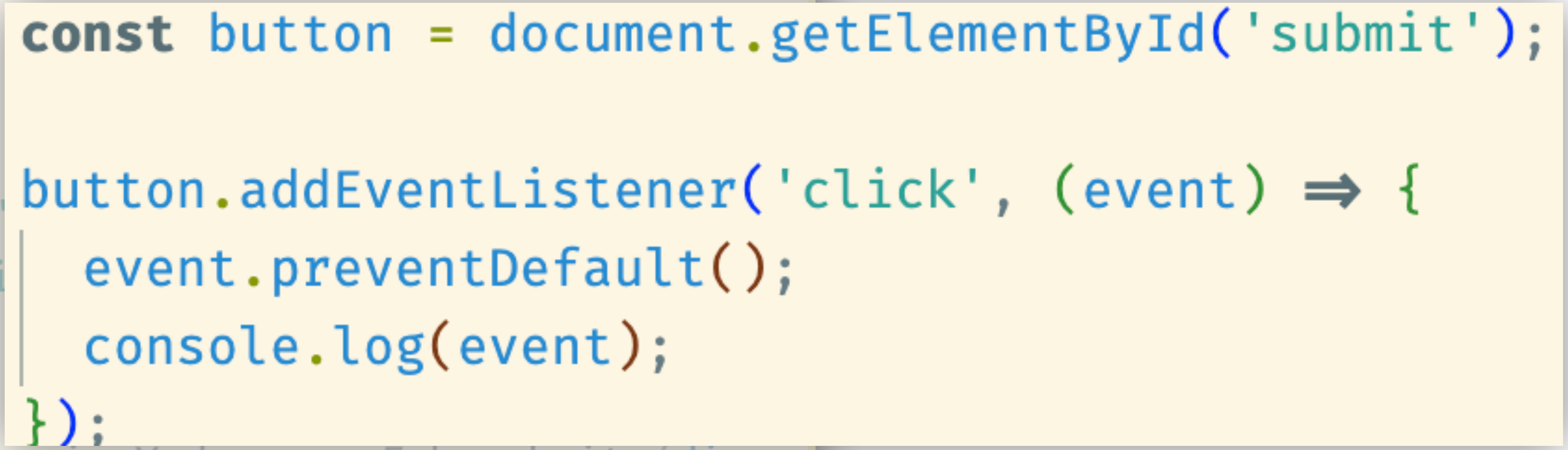
js-lecture/plain01/

(demo)



```
<html>
  <head>
    <title>Temperature Converter</title>

    <link rel="stylesheet" href="main.css" />
    <script src="main.js"></script>
  </head>
  <body>
    <h1>Temperature Converter</h1>

    <div id="converter">
      <input type="text" id="celsius"
      <button id="submit" type="submi
    </div>

    <div id="result">X degrees Celsius is Y degrees Fahrenheit</div>
  </body>
</html>
```

What happened?



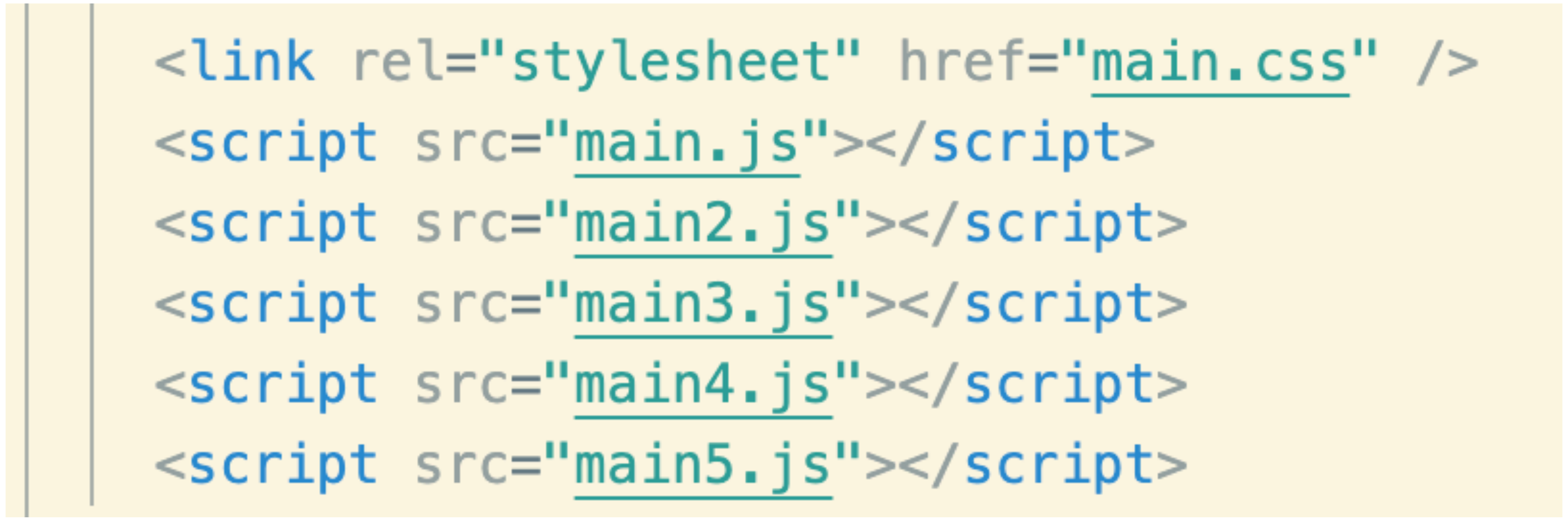
```
const button = document.getElementById('submit');

button.addEventListener('click', (event) => {
  event.preventDefault();
  console.log(event);
});
```

Runs before rest of HTML loads. There are no HTML elements in document!

`js-lecture/plain02/`

(demo)

JS Modules

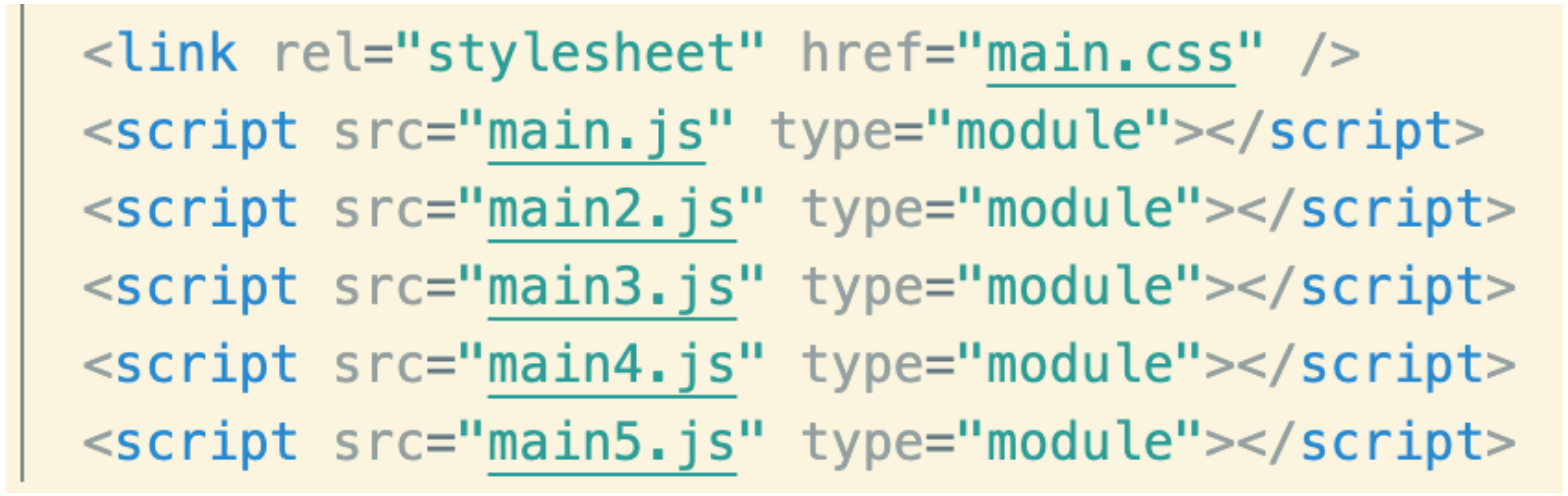


```
<link rel="stylesheet" href="main.css" />
<script src="main.js"></script>
<script src="main2.js"></script>
<script src="main3.js"></script>
<script src="main4.js"></script>
<script src="main5.js"></script>
```

Loading multiple JS files was a pain back in the day!

No import/export syntax = all global variables

JS Modules



```html
<link rel="stylesheet" href="main.css" />
<script src="main.js" type="module"></script>
<script src="main2.js" type="module"></script>
<script src="main3.js" type="module"></script>
<script src="main4.js" type="module"></script>
<script src="main5.js" type="module"></script>
```

Now, files run AFTER HTML loads

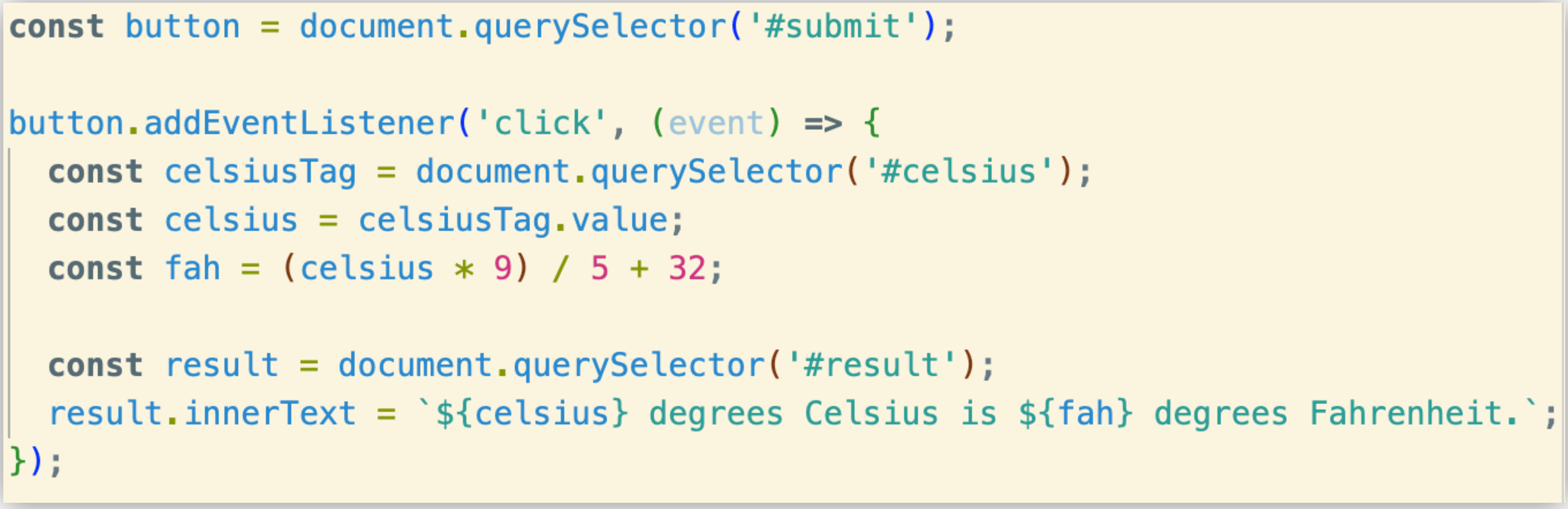
Import/export syntax = no global variables

Don’t need to worry about order

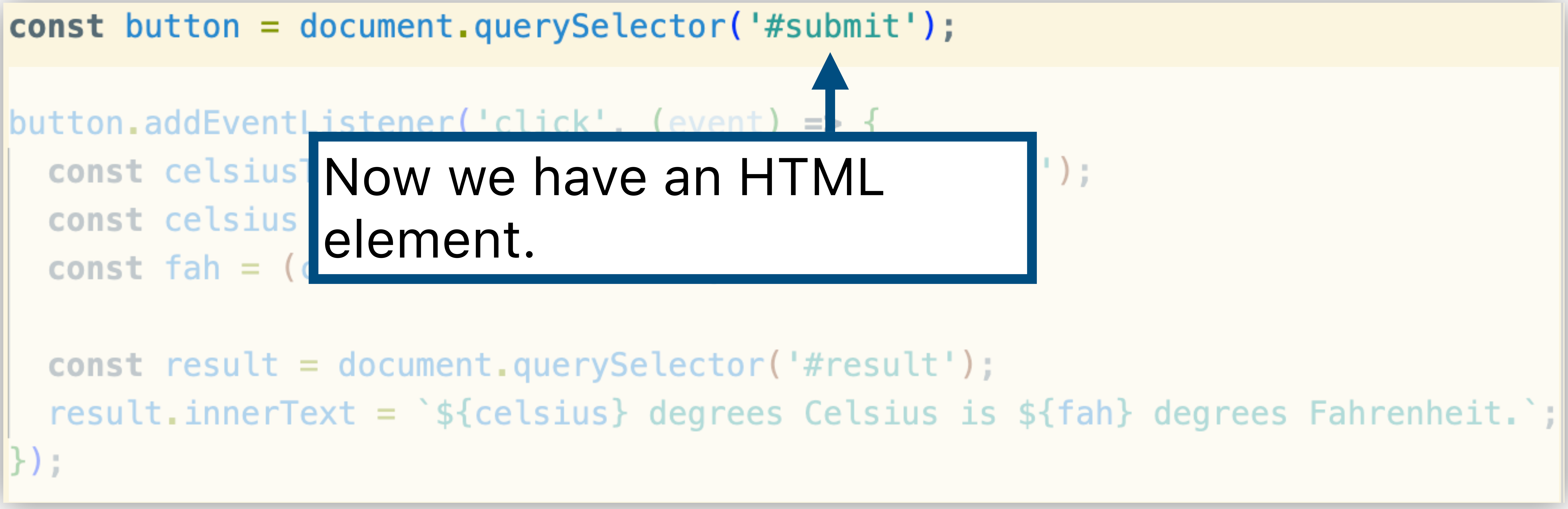
`js-lecture/plain02/`

(demo)

Let's walk through the code line by line

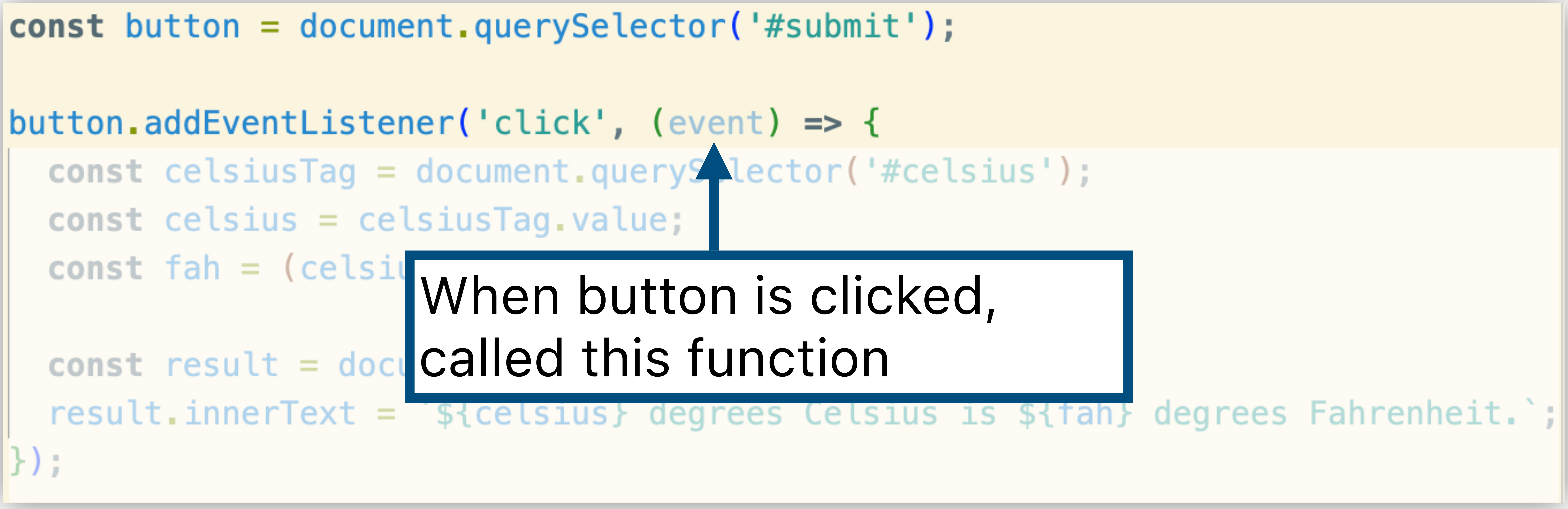


```
const button = document.querySelector('#submit');

button.addEventListener('click', (event) => {
  const celsiusTag = document.querySelector('#celsius');
  const celsius = celsiusTag.value;
  const fah = (celsius * 9) / 5 + 32;

  const result = document.querySelector('#result');
  result.innerText = `${celsius} degrees Celsius is ${fah} degrees Fahrenheit.`;
});
```



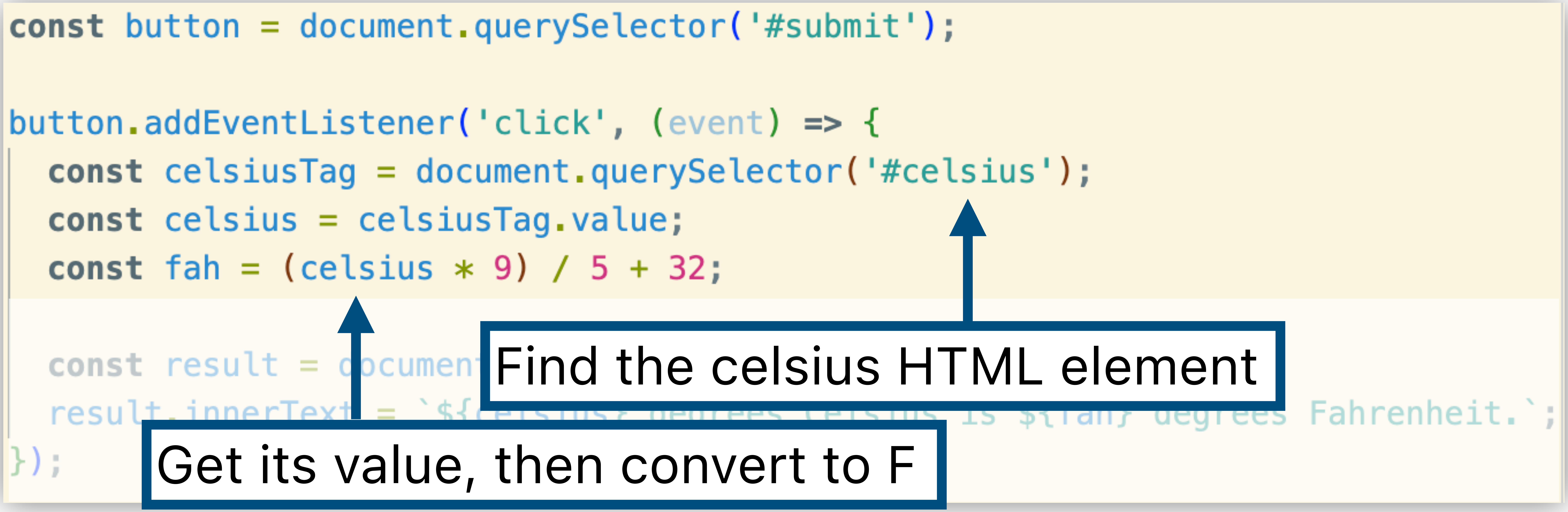
```
const button = document.querySelector('#submit');

button.addEventListener('click', (event) => {
  const celsiusT                                  ');
  const celsius
  const fah = (c

  const result = document.querySelector('#result');
  result.innerText = `${celsius} degrees Celsius is ${fah} degrees Fahrenheit.`;
});
```

Now we have an HTML element.



```
const button = document.querySelector('#submit');

button.addEventListener('click', (event) => {
  const celsiusTag = document.queryS lector('#celsius');
  const celsius = celsiusTag.value;
  const fah = (celsiu

  const result = docu
  result.innerText = `${celsius} degrees Celsius is ${fah} degrees Fahrenheit.`;
});
```

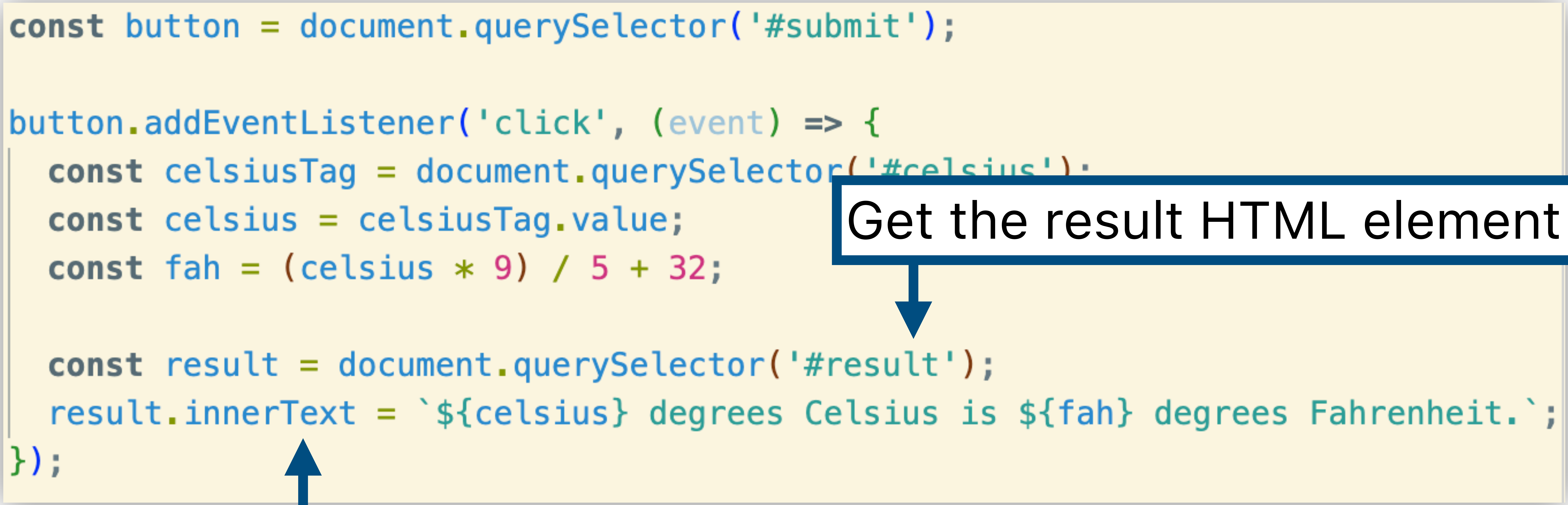
When button is clicked,
called this function



```
const button = document.querySelector('#submit');

button.addEventListener('click', (event) => {
  const celsiusTag = document.querySelector('#celsius');
  const celsius = celsiusTag.value;
  const fah = (celsius * 9) / 5 + 32;

  const result = documen
  result.innerText = `${celsius} degrees Celsius is ${fah} degrees Fahrenheit.`;
});
```

Find the celsius HTML element

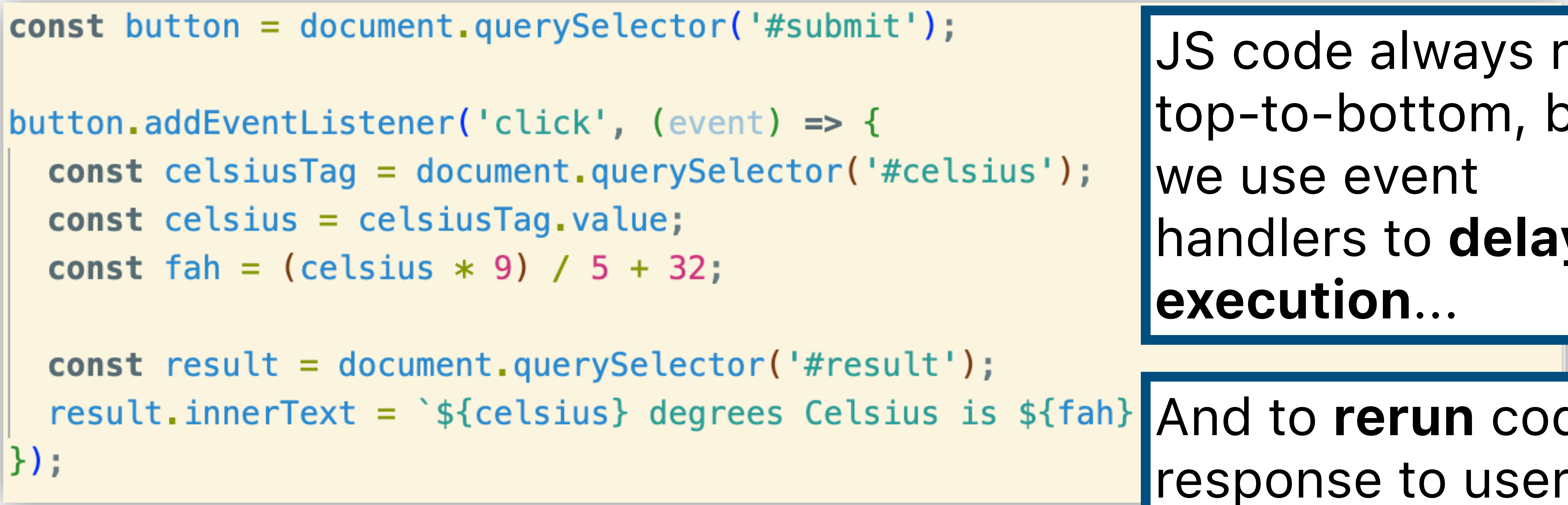
Get its value, then convert to F



```
const button = document.querySelector('#submit');

button.addEventListener('click', (event) => {
  const celsiusTag = document.querySelector('#celsius');
  const celsius = celsiusTag.value;
  const fah = (celsius * 9) / 5 + 32;

  const result = document.querySelector('#result');
  result.innerText = `${celsius} degrees Celsius is ${fah} degrees Fahrenheit.`;
});
```

Get the result HTML element

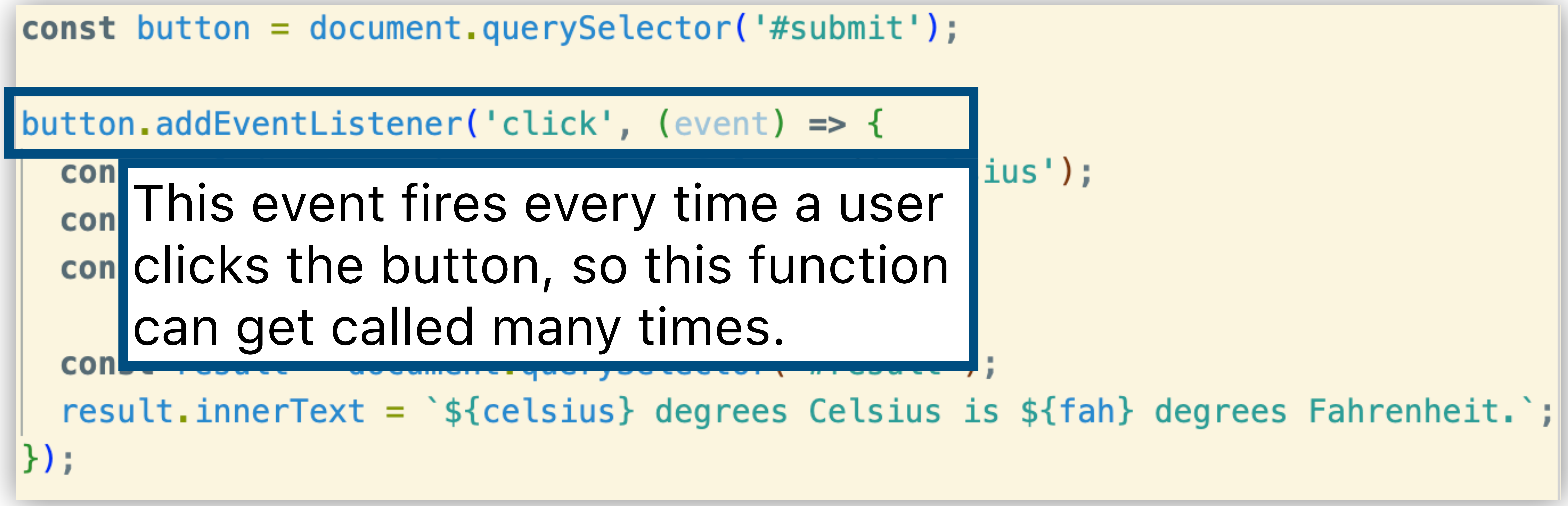
And set its text.



```
const button = document.querySelector('#submit');

button.addEventListener('click', (event) => {
  const celsiusTag = document.querySelector('#celsius');
  const celsius = celsiusTag.value;
  const fah = (celsius * 9) / 5 + 32;

  const result = document.querySelector('#result');
  result.innerText = `${celsius} degrees Celsius is ${fah}
});
```

JS code always runs top-to-bottom, but we use event handlers to **delay execution**...

And to **rerun** code in response to user input.



```
const button = document.querySelector('#submit');

button.addEventListener('click', (event) => {
  con                                              ius');
  con
  con

  con                                              ;
  result.innerText = `${celsius} degrees Celsius is ${fah} degrees Fahrenheit.`;
});
```

This event fires every time a user clicks the button, so this function can get called many times.

Enough JS to be dangerous

Querying HTML

`document.querySelector()`	Returns first element that match
`document.querySelectorAll()`	Returns list of elements that match

Mutating HTML

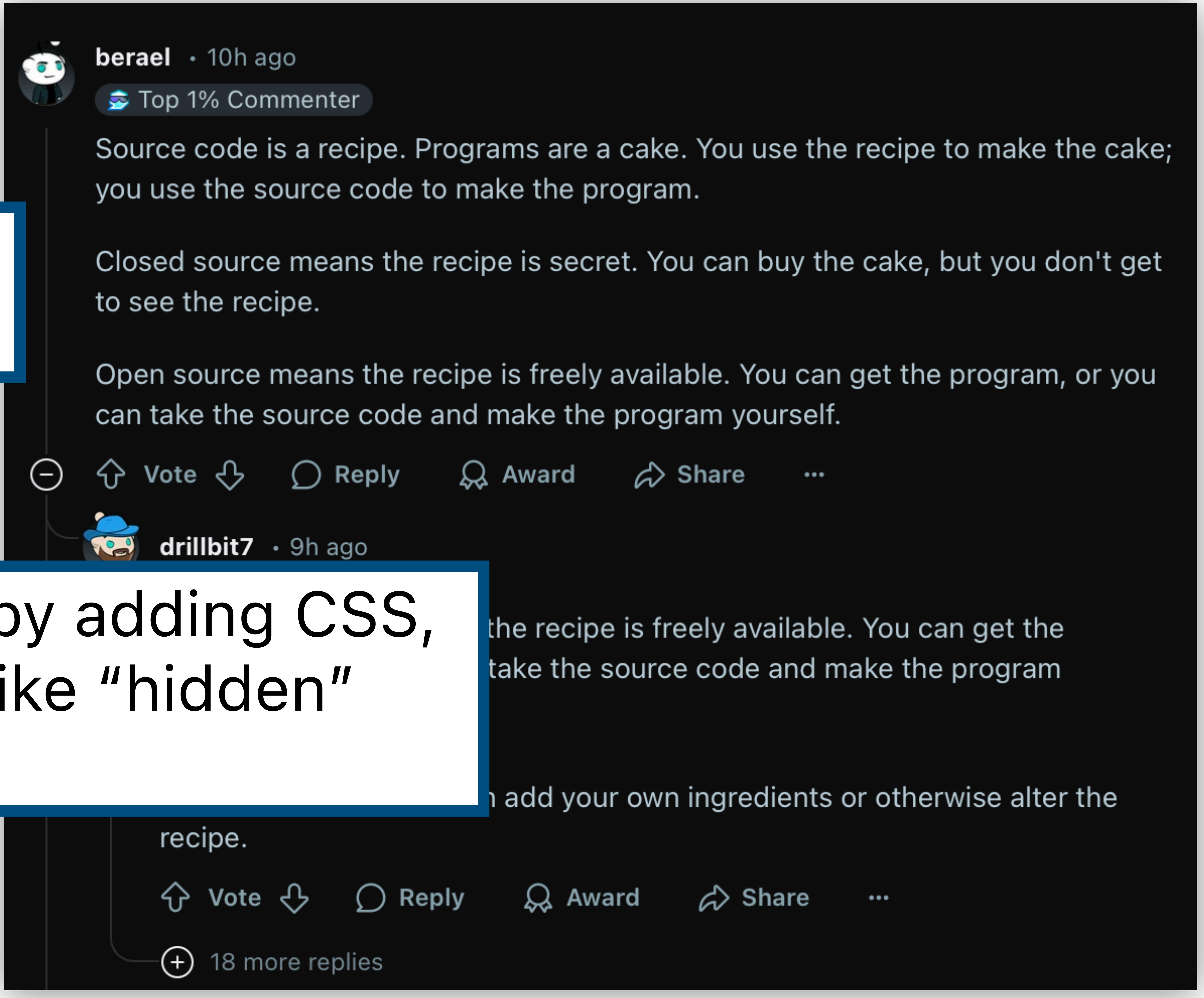
`el.innerText = ‘hello’`	Changes text of element
`el.innerHTML = ‘<p>hello</p>’`	Changes HTML of element

Enough JS to be dangerous

Event listeners

`el.addEventListener(‘click’, fn)`	Runs fn when element is clicked
`el.addEventListener(‘keydown’, fn)`	Runs fn when a keyboard key is pressed
`el.addEventListener(‘input’, fn)`	Runs fn when input changes

Example: Collapsing comments


beraael · 10h ago
Top 1% Commenter

Source code is a recipe. Programs are a cake. You use the recipe to make the cake; you use the source code to make the program.

Closed source means the recipe is secret. You can buy the cake, but you don't get to see the recipe.

Open source means the recipe is freely available. You can get the program, or you can take the source code and make the program yourself.

drillbit7 · 9h ago

the recipe is freely available. You can get the take the source code and make the program

add your own ingredients or otherwise alter the recipe.

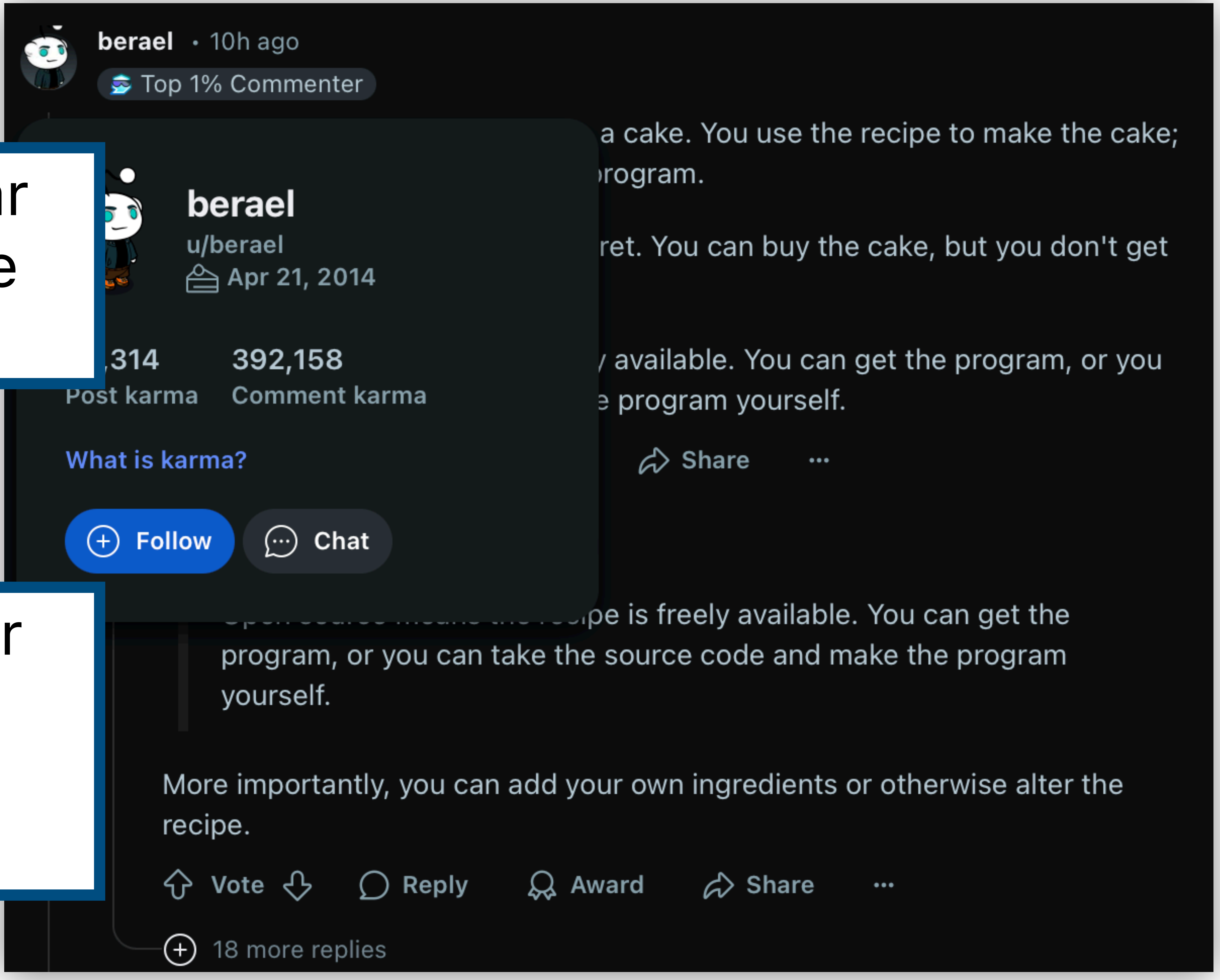
Add event listener to minus sign element for click events.

In event handler, hide HTML by adding CSS, or by adding an HTML class like “hidden” which CSS will hide.

Example: Avatar hover

Add event listener to avatar image element for a mouse hover event.

In event handler, fetch user data from the server, then display the information in HTML.



berael · 10h ago
Top 1% Commenter

berael
u/berael
Apr 21, 2014

,314 Post karma
392,158 Comment karma

What is karma?

Follow
Chat

a cake. You use the recipe to make the cake;
rogram.

ret. You can buy the cake, but you don't get

available. You can get the program, or you
e program yourself.

Share ···

pe is freely available. You can get the program, or you can take the source code and make the program yourself.

More importantly, you can add your own ingredients or otherwise alter the recipe.

Vote Reply Award Share ···

18 more replies

You Try: Your favorite website interaction

Go to your favorite website, pick an interactive element, describe event listener and event handler.

tryclassbuzz.com
Code: **interaction**

Async / await

js-lecture/weather01/

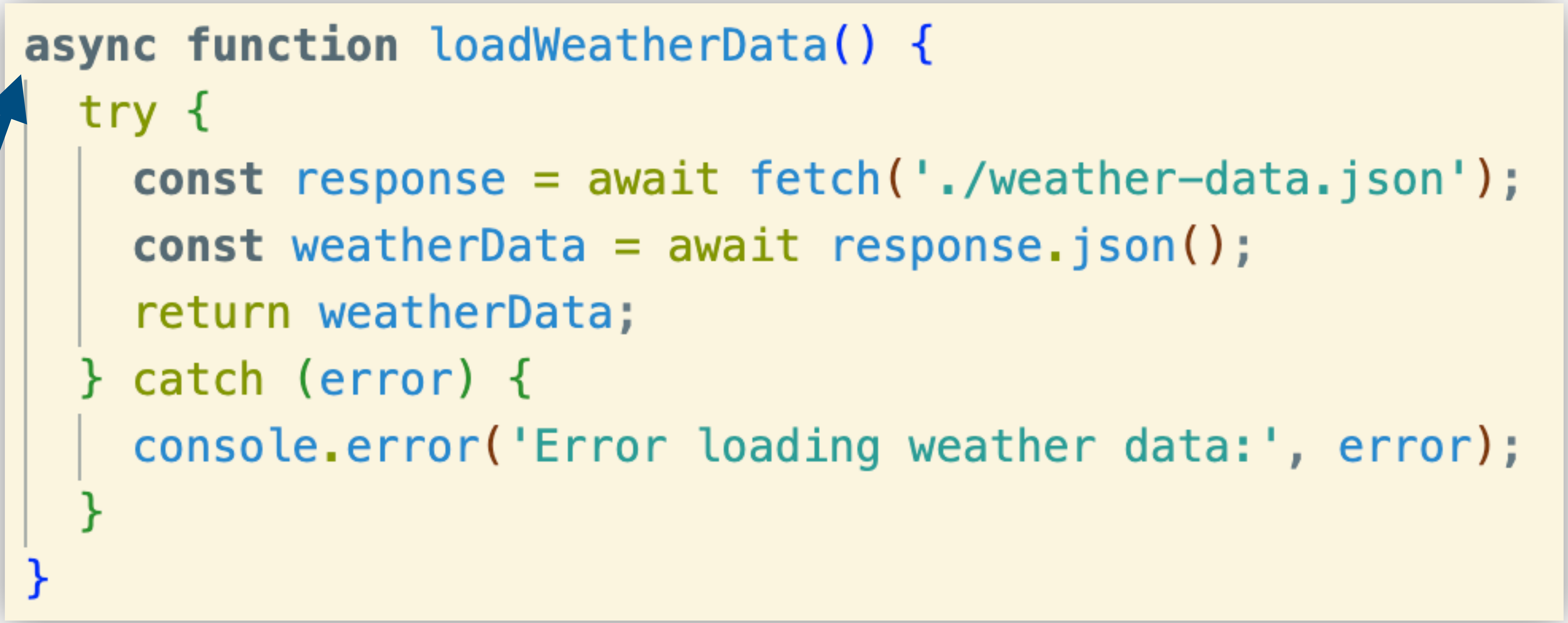
(demo)

```
<head>
  <title>Temperature Converter</title>

  <link rel="stylesheet" href="main.css" />
  <script src="main.js" type="module"></script>
```

If main.js code is slow, then page will freeze (!) while waiting for JS to finish

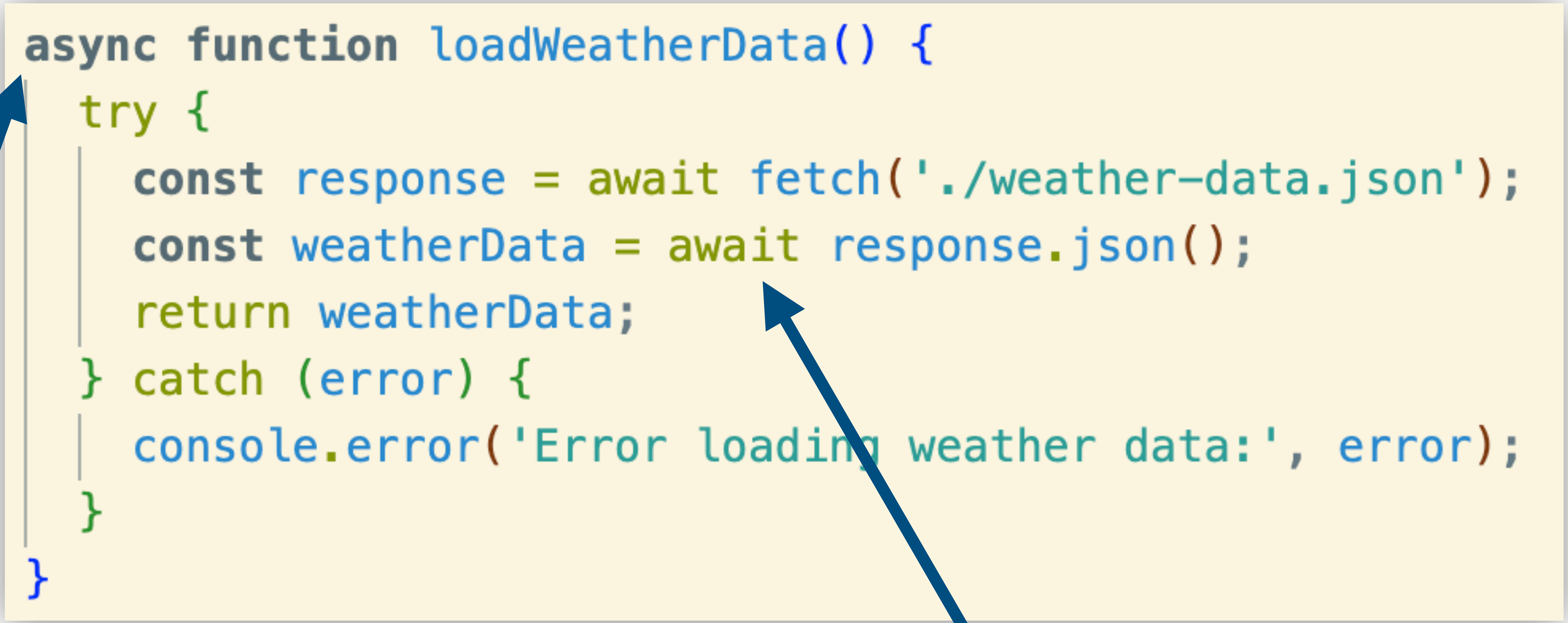
What if the dataset just takes a while to download?

Idea: Allow functions to run in the background (asynchronously) so that page doesn't freeze



```
async function loadWeatherData() {
  try {
    const response = await fetch('./weather-data.json');
    const weatherData = await response.json();
    return weatherData;
  } catch (error) {
    console.error('Error loading weather data:', error);
  }
}
```

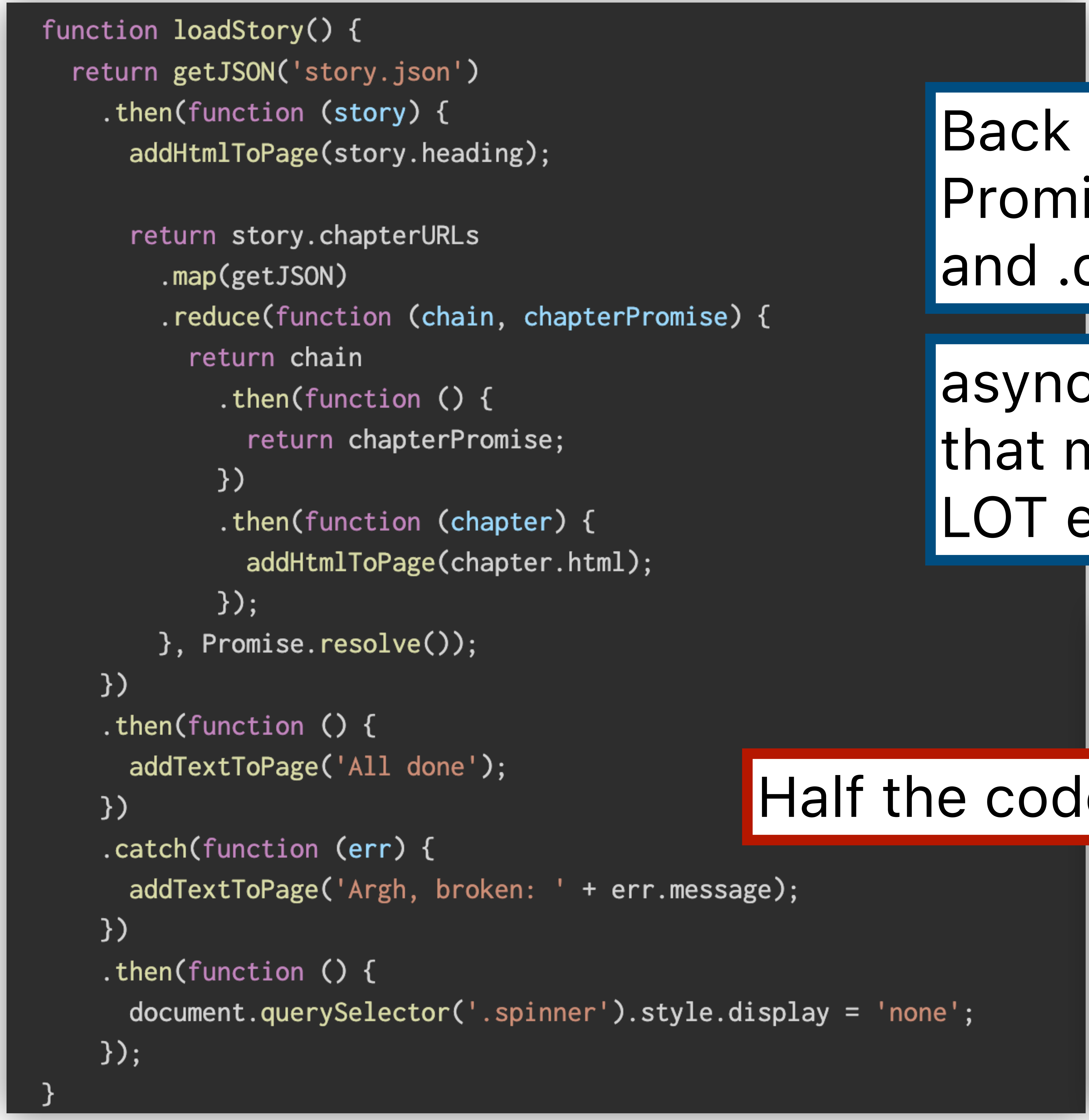
async = this function uses other async functions



```
async function loadWeatherData() {
  try {
    const response = await fetch('./weather-data.json');
    const weatherData = await response.json();
    return weatherData;
  } catch (error) {
    console.error('Error loading weather data:', error);
  }
}
```

async = this function uses other async functions

await = this function might take a while, so let the browser do other stuff while we wait



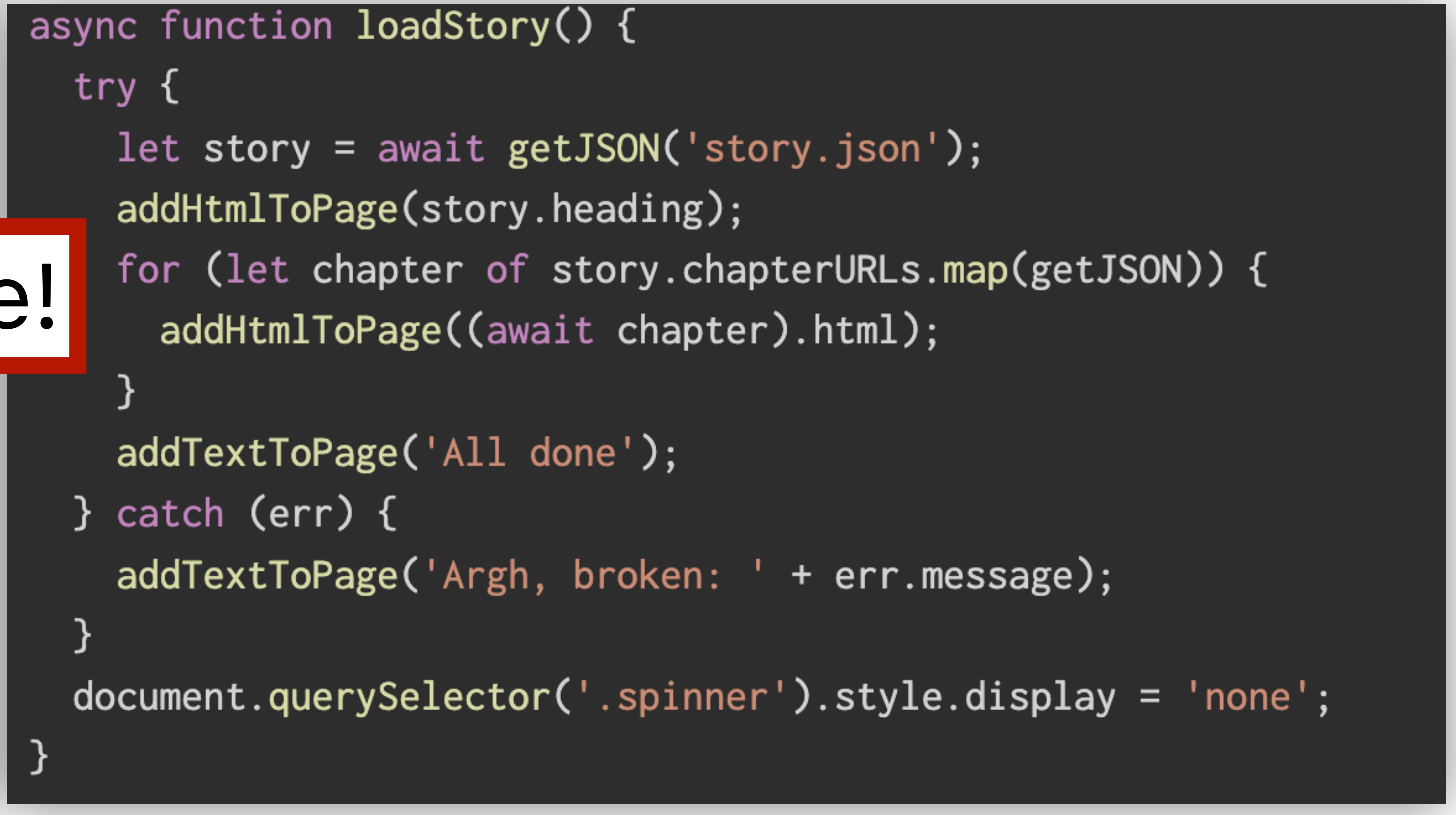
```
function loadStory() {
  return getJSON('story.json')
    .then(function (story) {
      addHtmlToPage(story.heading);

      return story.chapterURLs
        .map(getJSON)
        .reduce(function (chain, chapterPromise) {
          return chain
            .then(function () {
              return chapterPromise;
            })
            .then(function (chapter) {
              addHtmlToPage(chapter.html);
            });
        }, Promise.resolve());
    })
    .then(function () {
      addTextToPage('All done');
    })
    .catch(function (err) {
      addTextToPage('Argh, broken: ' + err.message);
    })
    .then(function () {
      document.querySelector('.spinner').style.display = 'none';
    });
}
```

Back in the day, we had to use JS Promises that had a .then() and .catch() syntax.

async/await is the modern version that makes writing this code a LOT easier

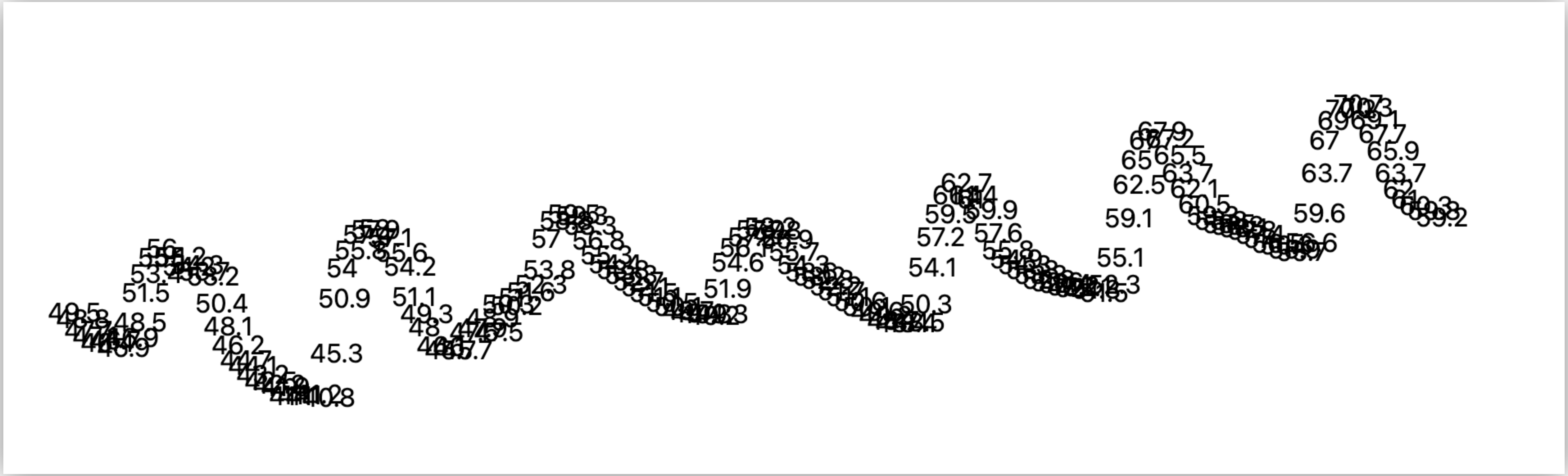
Half the code!

https://jakearchibald.com/2014/es7-async-functions/



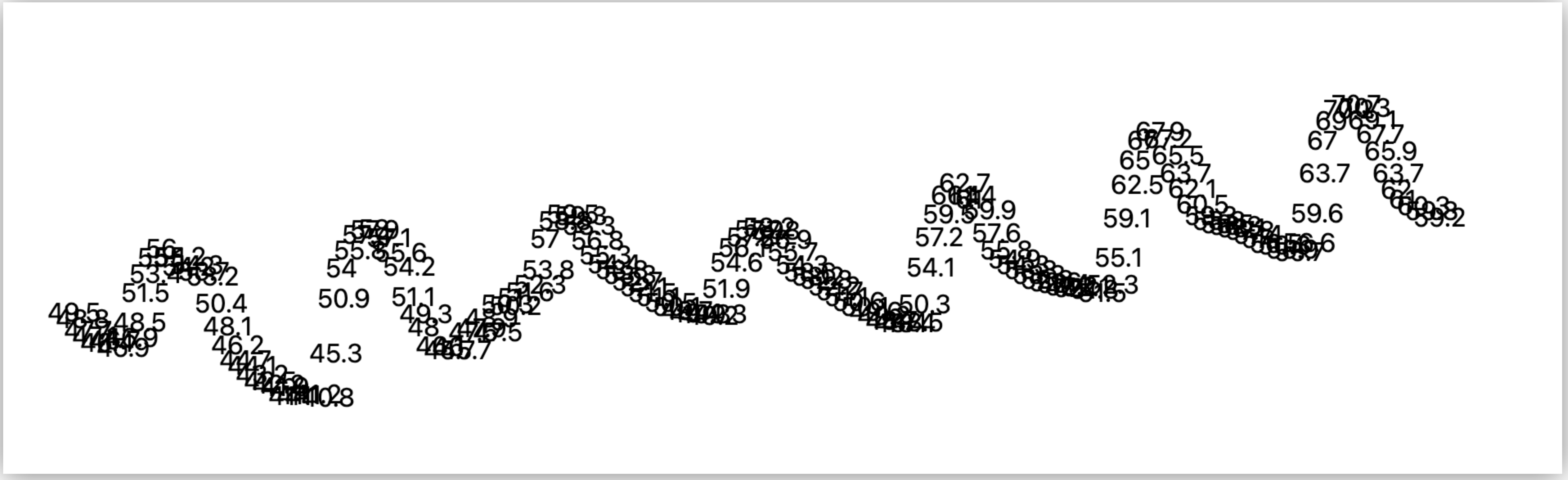
```
async function loadStory() {
  try {
    let story = await getJSON('story.json');
    addHtmlToPage(story.heading);
    for (let chapter of story.chapterURLs.map(getJSON)) {
      addHtmlToPage((await chapter).html);
    }
    addTextToPage('All done');
  } catch (err) {
    addTextToPage('Argh, broken: ' + err.message);
  }
  document.querySelector('.spinner').style.display = 'none';
}
```

Now, let's make our very first data visualization in JS:



`js-lecture/weather02/`
(demo)

`js-lecture/weather03/`
(demo)



How would you add an x-axis and y-axis? Gridlines?

tryclassbuzz.com
Code: **axes**