Web Dev Basics 2

CS571: Building User Interfaces

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Before Lecture

- Clone today's code to your machine.
- Download and install Postman!

Web Dev Basics 1

- The Web is made up of HTML, CSS, and JS!
  - **HTML:** structure
  - **CSS:** styling
  - **JS:** behavior
- CSS and JS can be applied to HTML inline, internal, or externally.

Web Dev Basics 1

Use `document` to reference the DOM.

```
let title = document.getElementById("articleTitle");
let loginBtn = document.getElementsByName("login")[0];
let callouts = document.getElementsByClassName("callout"); // *
```

*class refers to a **CSS** class

We can add *event listeners* or read/modify *properties*.

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Using these DOM elements, we can change the title of the article, add an action for when the button is clicked, and make all of the callouts red.

```
title.innerText = 'My Website!';
loginBtn.addEventListener("click", () => {
  alert("You are advancing to the next part of the site...");
});

for (let callout of callouts) {
  callout.style.color = "red";
}
```

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Finish ICE-1

Use *today*'s starter code.

Learning Objectives

1. Manipulate the DOM via JavaScript.
2. Define a callback function.
3. Understand how asynchronous code executes.
4. Fetch, parse, and use JSON data from an API to populate webpage.

What is JSON?

Definition: JavaScript Object Notation (JSON) is a structured way to represent text-based data based on JS object syntax.

Refresher: JS Objects

Definition: Objects are unordered collection of related data of primitive or reference types defined using key-value pairs.

```
const instructor = {
  firstName: "Cole",
  lastName: "Nelson",
  roles: ["student", "faculty"]
}
```

JSON Equivalent

```json
{
  "firstName": "Cole",
  "lastName": "Nelson",
  "roles": ["student", "faculty"]
}
```

What's the difference? A JS Object is executable code; JSON is a language-agnostic representation of an object. There are also slight differences in syntax.

You can write comments in JS Objects...

```
const drinks = [
  {
    name: "Mimosa",
    ingredients: [
      {name: "Orange Juice", hasAlcohol: false},
      {name: "Champagne", hasAlcohol: true}
    ]
  },
  {
    name: "Vesper Martini", // shaken, not stirred
    ingredients: [
      {name: "Gin", hasAlcohol: true},
      {name: "Vodka", hasAlcohol: true},
      {name: "Dry Vermouth", hasAlcohol: true},
    ]
  }
]
```

… but not in JSON!

```
[
  {
    "name": "Mimosa",
    "ingredients": [
      { "name": "Orange Juice", "hasAlcohol": false },
      { "name": "Champagne", "hasAlcohol": true }
    ]
  },
  {
    "name": "Vesper Martini",
    "ingredients": [
      { "name": "Gin", "hasAlcohol": true },
      { "name": "Vodka", "hasAlcohol": true },
      { "name": "Dry Vermouth", "hasAlcohol": true }
    ]
  }
]
```

Conversion

Because JS Objects and JSON are so similar, it is easy to convert between them.

- `JSON.parse` JSON String → JS Object
- `JSON.stringify` JS Object → JSON string

Conversion Examples

Using `JSON.parse` and `JSON.stringify`.

```
const myObj = JSON.parse('{"name": "Cole", "age": 26}');
const myStr = JSON.stringify(myObj);

console.log(typeof myObj); // object
console.log(typeof myStr); // string
```

❗❗ **Question:** Can I do `myObj.age = 27`? Yes!

Re-Visiting `const`

`const` means you cannot re-assign the variable. You can, however, re-assign one of its properties.

```
const cat = {name: "Pepper", age: 12}

cat.name = "Salt" // ok!
cat.age = 4; // ok

cat = {name: "Salt", age: 4} // not ok!
```

Yikes... this can be helpful, but also dangerous!

Deep Copying

We can make a deep copy using `JSON.parse` and `JSON.stringify` together*

```
let x = 1; // primitive! (stack)
const myObj = { "name": "Cole", "age": 26 }; // complex! (heap)
const myDeepCopy = JSON.parse(JSON.stringify(myObj));
myObj.name = 'Brad';
```

Interactive Example

*small caveat: does not copy functions of an object

Reference Copying

This is not a true copy! We call it a "reference" copy.

```
const myObj = { "name": "Cole", "age": 26 };
const myCopy = myObj;
myObj.name = 'Brad';
```

Why does this happen? *Objects* are stored on the heap; the variable's value is just a memory address!

Interactive Example

Why do I need to know this?

Web programming is **all about data**. Can I take this data an API and display it to a user?

- *Always* know the data that you are working with.
- *Be aware* of how assignments affect this data.

Let's start getting some data via an **API**!

What is an API?

Definition: An application programming interface (API) is a set of definitions and protocols for communication through the serialization and de-serialization of objects.

JSON is a language-agnostic medium that we can serialize to and de-serialize from!

How do we make an API request?

- Your browser!
- cURL
- Postman
- JavaScript

Try making an API request to...

- https://v2.jokeapi.dev/joke/Any?safe-mode
- https://cs571.org/api/s24/ice/chili

In-Class Activity

Fetch from the Jokes and CS571 APIs using...

- Your browser!
- Postman

Request for JSON

- Requests can be `synchronous` or `asynchronous`.
- `asynchronous` requests are recommended as they are *non-blocking*. Typically, they use a *callback* when the data is received and lets the browser continue its work while the request is made.

More on synchronous/asynchronous requests

Making Asynchronous HTTP Requests

Two key methods: `XMLHttpRequest` (old) and `fetch` (new). `fetch` is a promise-based method.

- `Promise` objects represent the eventual completion/failure of an *asynchronous* operation and its resulting value.
- `async` / `await` — keywords to indicate that a function is *asynchronous* -- will learn later!

`fetch()`

```
fetch(url)
  .then((response) => response.json()) // ignore the headers, get the data
  .then((data) => {                    // implictly parses JSON to JS Object
    console.log("Data received!");
    console.log(data);
  })
  .catch(error => console.error(error)) // Print errors (if any)
```

Fetching Jokes

`fetch()`

Fetch happens *asynchronously*.

```
fetch(url)
  .then((response) => response.json())
  .then((data) => {
    console.log("I won't be printed 'til later!")
    console.log("Data takes time to fetch!")
  })
  .catch(error => console.error(error))

console.log("I will print first!")
```

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`fetch()` from a CS571 API

```
fetch(url, {
  method: "GET",
  headers: {
    "X-CS571-ID": "bid_xxxxxxxxxxx" // generally bad practice
  }
})
.then(response => response.json())
.then(data => {
  // Do something with the data
})
.catch(error => console.error(error)) // Print errors
```

There is a database that maps your BID to a WISC ID!

Callback Functions

`then` and `catch` take a *callback function* as an argument.

Definition: A *callback function* (sometimes called a *function reference*) is passed into another function as an argument, which is then invoked inside the outer function to complete a routine or action.

More on callback functions

Callback Functions

Reminder: All of these define a function.

```
function fToC (temp) {
  return (temp - 32) * 5/9;
}
```

A *function definition*

```
const fToC = (temp) => {
  return (temp - 32) * 5/9;
}
```

An *arrow function*

```
const fToC = (temp) => (temp - 32) * 5/9
```

With an *implicit return*

Your Turn!

Let's fetch some recipes.

https://cs571.org/api/s24/ice/chili
https://cs571.org/api/s24/ice/pasta
https://cs571.org/api/s24/ice/pizza

Remember: You'll need a Badger ID to access these!

Badger IDs

Logging in to the CS571 APIs creates a cookie* in your browser. This cookie contains your Badger ID.

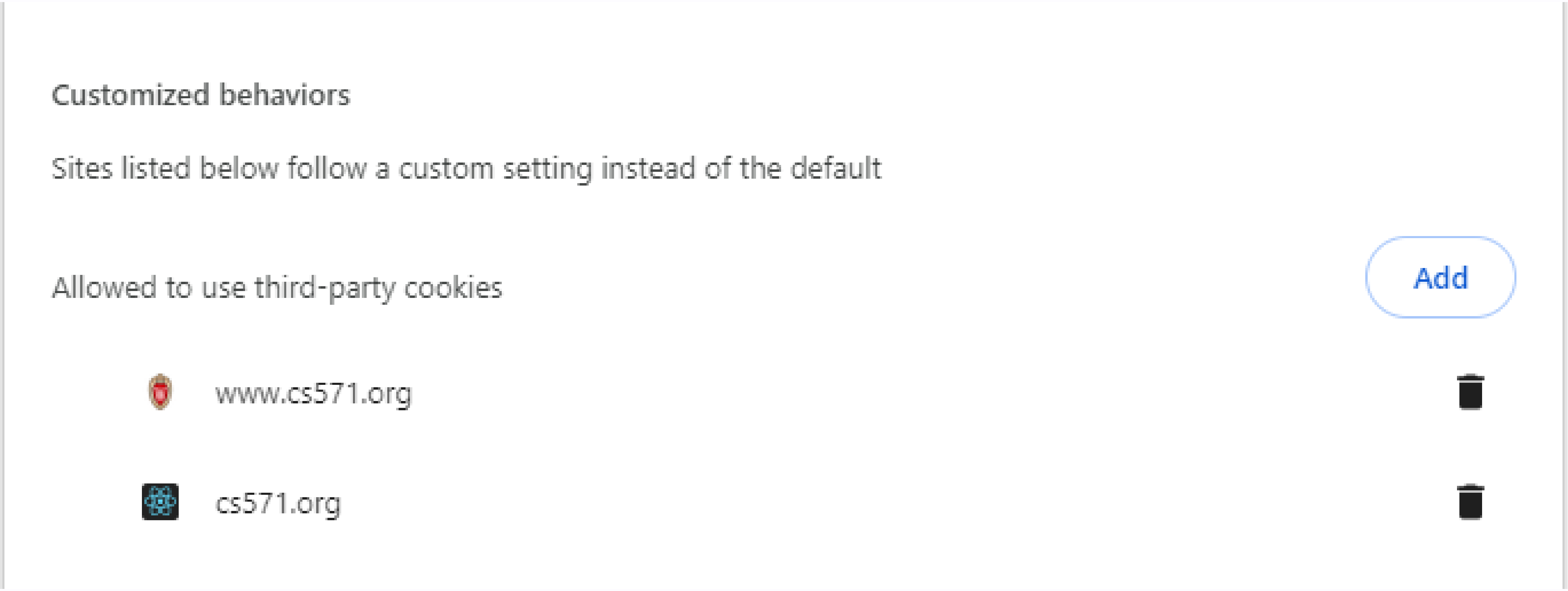
Unfortunately, this is considered a third-party cookie!

- You are on localhost, but sending a cs571.org cookie

Therefore, you may need to add some exceptions to your browser settings!

*we'll learn more about cookies later this semester!

Allow on Google Chrome...



Customized behaviors

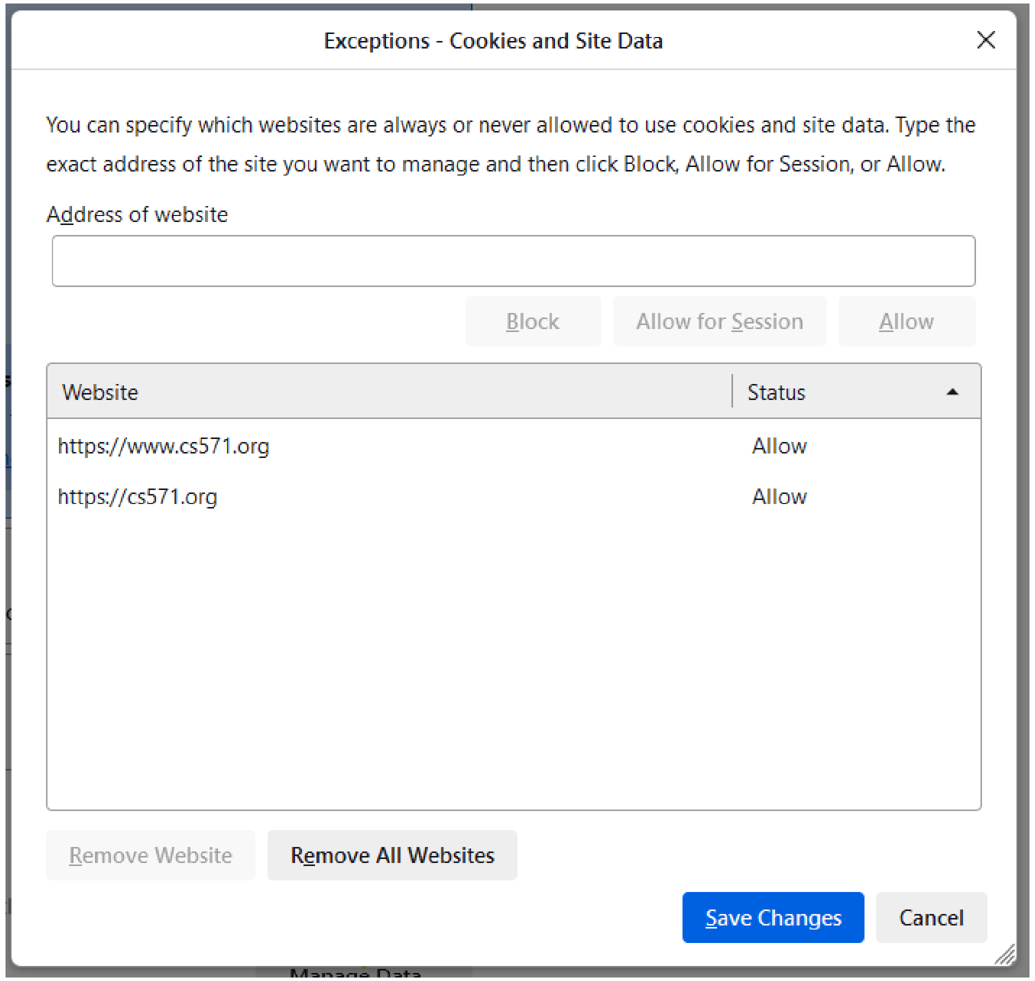
Sites listed below follow a custom setting instead of the default

Allowed to use third-party cookies

www.cs571.org

cs571.org

Allow on Mozilla Firefox...

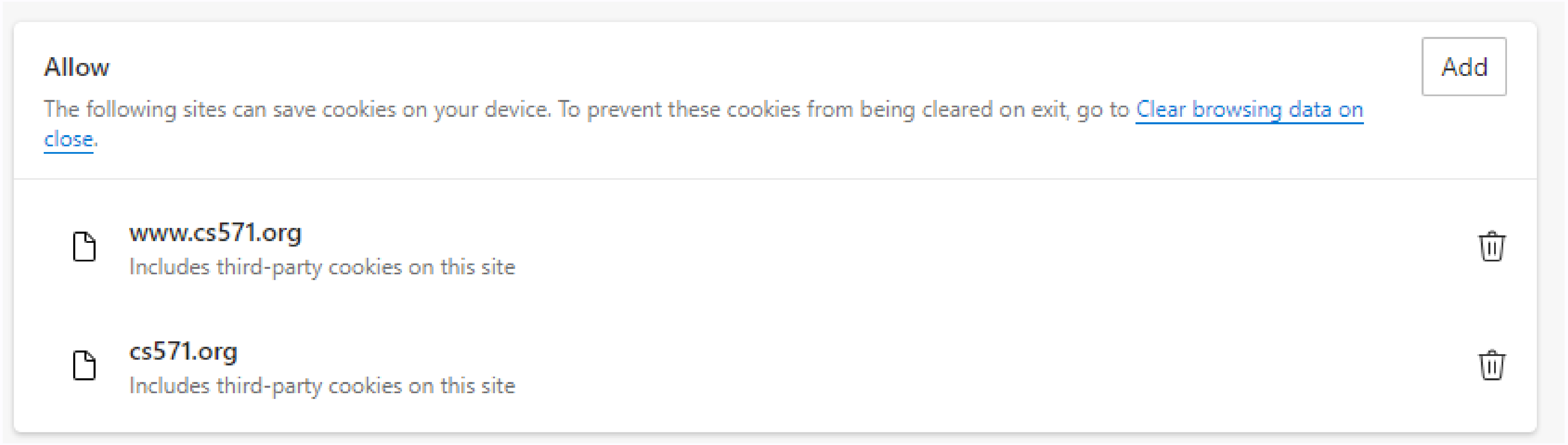

Exceptions - Cookies and Site Data

You can specify which websites are always or never allowed to use cookies and site data. Type the exact address of the site you want to manage and then click Block, Allow for Session, or Allow.

Address of website

Website	Status
https://www.cs571.org	Allow
https://cs571.org	Allow

Allow on Microsoft Edge...



Allow

Add

The following sites can save cookies on your device. To prevent these cookies from being cleared on exit, go to Clear browsing data on close.

www.cs571.org
Includes third-party cookies on this site

cs571.org
Includes third-party cookies on this site

Badger IDs

After adding `cs571.org` and `www.cs571.org` as an exception, you will likely need to wait a minute and restart your browser!

You may just hardcode your Badger ID as well; but **don't make it public!**

`fetch()` from a CS571 API

```
fetch(url, {
  method: "GET",
  headers: {
    "X-CS571-ID": CS571.getBadgerId() // Works when logged in!
  }
})
.then(response => response.json())
.then(data => {
  // Do something with the data
})
.catch(error => console.error(error)) // Print errors
```

Works when logged into CS571 on the current browser!

DOM Manipulation

Earlier, we learned how to get elements from the DOM and change their text.

```
let title = document.getElementById("articleTitle");
title.innerText = "My New Title!"
```

What if we want to *add* elements?

```
title.innerHTML = "<strong>My New Title!</strong>"
```

DOM Manipulation

We typically prefer to *not* use `innerHTML` when adding things to the DOM. Why?* Instead, we would...

```
const title = document.getElementById("articleTitle")
const newNode = document.createElement('strong')
newNode.innerText = 'My New Title!'
const newNode = title.appendChild(newNode);
```

* We could still safely clear the existing text with `title.innerHTML = ''`

Your Turn!

Let's display recipes to the page *dynamically*.

Questions?