Comp 324/424 - Client-side Web Design

Spring Semester 2017 - Week 5

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Contents

DEV week overview...

- begin development of a web application
- built from scratch
- builds upon examples, technology outlined during first part of semester
  - *HTML5, CSS, JS, jQuery, JSON...*
  - ***NO** PHP, Python, Ruby, Go, XML, Bootstrap...*
- final app must implement data from either
  - *self hosted (MongoDB, Redis...)*
  - *APIs*
  - *cloud data services (Firebase...)*
  - ***NO** SQL...*
- **or** use *dummy datasets* for DEV Week demo...
- outline research conducted
- describe data chosen for application
- show any mockups, prototypes, patterns, and designs

DEV week presentation and demo...

brief presentation or demonstration of current project work

- ~ 5 to 10 minutes per group
- analysis of work conducted so far
  - *eg: during semester & DEV week*
- presentation, demonstration, or video overview...
  - *outline current state of web app*
  - *show prototypes and designs*
  - *explain what works & does not work*
  - *anything else considered relevant to your research or development...*

JS Core - more variables - part I

- a few rules and best practices for naming valid **identifiers**
- using typical ASCII alphanumeric characters
  - *an identifier must begin with* `a-z, A-Z, $, _`
  - *may contain any of those characters, plus* `0-9`
- property names follow this same basic pattern
- careful not to use certain keywords, or reserved words
- reserved words can include such examples as,
  - `break, byte, delete, do, else, if, for, this, while` *and so on*
  - *further details are available at the W3 Schools site*
- in JS, we can use different declaration keywords relative to intended scope
  - `var` *for local,* `global` *for global...*
- such declarations will influence scope of usage for a given variable
- concept of **hoisting**
  - *defines the declaration of a variable as belonging to the entire scope*
  - *by association accessible throughout that scope as well*
  - *also works with JS functions - hoisted to the top of the scope*

JS Core - more variables - part 2

- concept of nesting, and scope specific variables
- ES6 enables us to restrict variables to a block of code
- use keyword **let** to declare a block-level variable

```
if (a > 5) {
let b = a + 4;

console.log(b);

}
```

- **let** restricts variable's scope to `if` statement
- variable `b` is not available to the whole function

JS Core - more variables - part 3

- add **strict mode** to our code
- without we get a variable that will be hoisted to the top either
  - *set as a globally available variable, although it could be deleted*
  - *or it will set a value for a variable with the matching name*
- bubbled up through the available layers of scope
- becomes similar in essence to a declared global variable
- can create some strange behaviour in our applications
  - *tricky and difficult to debug*
- remember to declare your variables correctly and at the top

JS Core - more variables - example

```
var a;

function myScope() {
    "use strict";
    a = 49;
}

myScope()
a = 59;
console.log(a);
```

JS Core - functions and values

- variables acting as groups of code and blocks
- act as one of the primary mechanisms for scope within our JS applications
- also use functions as values
- effectively using them to set values for other variables

```
var a;

function scope() {
  "use strict";
    a = 49;
  return a;
}

b = scope() * 2;
console.log(b);
```

- useful and interesting aspect of the JS language
  - *allows us to build values from multiple layers and sources*

JS Core - more conditionals - part I

- briefly considered conditional statements using the `if` statement,

```
if (a > b) {
console.log("a is the best...");
} else {
console.log("b is the best...");
}
```

- Switch statements effectively follow the same pattern as `if` statements
  - *designed to allow us to check for multiple values in a more succinct manner*
  - *enable us to check and evaluate a given expression*
  - *then attempt to match a required value against an available `case`*
- addition of `break` is important, ensures only matched case is executed
  - *then the application breaks from the switch statement*
- if no `break` execution after that case will continue
  - *commonly known as **fall through***
  - *may be an intentional feature of your code design*
  - *allows a match against multiple possible cases*

JS Core - switch conditional - example

```
var a = 4;

switch (a) {
case 3:
  //par 3
  console.log("par 3");
  break;
case 4:
  //par 4
  console.log("par 4");
  break;
case 5:
  //par 5
  console.log("par 5");
  break;
case 59:
  //dream score
  console.log("record");
  break;
default:
  console.log("more practice");
}
```

JS Core - more conditionals - part 2

- a more concise way to write our conditional statements
- known as the **ternary** or **conditional** operator
- consider this operator a more concise form of standard `if...else` statement

```
var a = 59;
var b = (a > 59) ? "high" : "low";
```

- equivalent to the following standard `if...else` statement

```
var a = 59;

if (a > 59) {
  var b = "high";
} else {
  var b = "low";
}
```

JS Core - closures - part 1

- important and useful aspect of JavaScript
- dealing with variables and scope
  - *continued, broader access to ongoing variables via a function's scope*
- closures as a useful construct to allow us to access a function's scope
  - *even after it has finished executing*
- can give us something similar to a private variable
  - *then access through another variable using relative scopes of outer and inner*
- inherent benefit is that we are able to repeatedly access internal variables
  - *normally cease to exist once a function had executed*

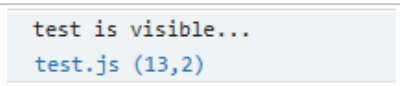
JS Core - closures - example - 1

```
//value in global scope
var outerVal = "test1";

//declare function in global scope
function outerFn() {
  //check & output result...
  console.log(outerVal === "test1" ? "test is visible..." : "test not visible..
}

//execute function
outerFn();
```

Image - JS Core - closures - global scope



JS Core - Closures - global scope

JS Core - closures - example - 2

```
"use strict";

function addTitle(a) {
  var title = "hello ";
  function updateTitle() {
    var newTitle = title+a;
    return newTitle;
  }
    return updateTitle;
}

var buildTitle = addTitle("world");
console.log(buildTitle());
```

JS Core - closures - part 2

Why use closures?

- use closures a lot in JavaScript
  - *real driving force behind Node.js, jQuery, animations...*
- closures help reduce amount, complexity of code necessary for advanced features
- closures help us add otherwise impossible features, e.g.
  - *any task using callbacks - event handlers...*
  - *private object variables...*
- closure allows us to work with a function that has been defined within another scope
  - *still has access to all variables within the defined outer scope*
  - *helps create basic encapsulated data*
  - *store data in a separate scope - then share it where needed*

JS Core - closures - part 3

```
function count(a) {
return function(b) {
      return a + b;
  }
}

var add1 = count(1);
var add5 = count(5);
var add10 = count(10);

console.log(add1(8));
console.log(add5(8));
console.log(add10(8));
```

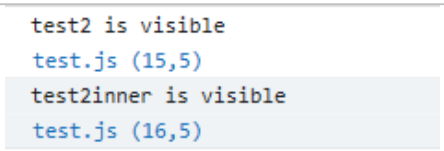
- using one function to create multiple other functions, `add1`, `add5`, `add10`, and so on.

JS Core - closures - example - 3

```
//variables in global scope
var outerVal = "test2";
var laterVal;

function outerFn() {
  //inner scope variable declared with value - scope limited to function
  var innerVal = "test2inner";
  //inner function - can access scope from parent function & variable innerVal
  function innerFn() {
    console.log(outerVal === "test2" ? "test2 is visible" : "test2 not visible"
    console.log(innerVal === "test2inner" ? "test2inner is visible" : "test2inn
  }
  //inner function now added to global scope - now able to access elsewhere & c
  laterVal = innerFn;
}
//invokes outerFn, innerFn is created, and its reference assigned to laterVal
outerFn();
//innerFn is invoked using laterVal - can't access innerFn directly...
laterVal();
```

Image - JS Core - closures - inner scope



JS Core - Closures - inner scope

JS Core - closures - part 4

- how is the `innerVal` variable available when we execute the inner function?
  - *this is why **closures** are such an important and useful concept in JavaScript*
  - *use of closures creates a sense of persistence in the scope*
- closures help create
  - *scope persistence*
  - *delayed access to functions and variables*
- closure creates a safe wrapper around
  - *the function*
  - *variables that are in scope as a function is defined*
- closure ensures function has everything necessary for correct execution
- closure wrapper persists whilst function exists

n.b. *closure usage is not memory free - there is an impact on app memory and usage...*

JS core - `this`

- `this` keyword - correct and appropriate usage
  - *commonly misunderstood feature of JS*
- value of `this` is not inherently linked with the function itself
- value of `this` determined in response to how the function is called
- value itself can be dynamic, simply based upon how the function is called
- if a function contains `this`, its reference will usually point to an **object**

JS core - `this` - part I

global, window object

- when we call a function, we can bind the `this` value to the `window` object
- resultant object refers to the root, in essence the `global` scope

```
function test1() {
  console.log(this);
}

test1();
```

- **NB:** the above will return a value of `undefined` in strict mode.
- also check for the value of `this` relative to the global object,

```
var a = 49;

function test1() {
    console.log(this.a);
}

test1();
```

- JSFiddle - this - window
- JSFiddle - this - global

JS core - `this` - part 2

object literals

- within an object literal, the value of `this`, thankfully, will always refer to its own object

```
var object1 = {
    method: test1
};

function test1() {
    console.log(this);
}

object1.method();
```

- return value for `this` will be the object itself
- we get the returned object with a property and value for the defined function
- other object properties and values will be returned and available as well
- JSFiddle - this - literal
- JSFiddle - this - literal 2

JS core - `this` - part 3

object literals

```
var sites = {};
sites.name = "philae";

sites.titleOutput = function() {
  console.log("Egyptian temples...");
};

sites.objectOutput = function() {
  console.log(this);
};

console.log(sites.name);
sites.objectOutput();
sites.titleOutput();
```

Image - Object literals console output

JS - `this` - object literals output

JS core - `this` - part 4

events

- for events, value of `this` points to the owner of the bound event

```
<div id="test">click to test...</div>
```

```
var testDiv = document.getElementById('test');

function output() {
  console.log(this);
};

testDiv.addEventListener('click', output, false);
```

- element is clicked, value of `this` becomes the clicked element
- also change the context of `this` using built-in JS functions
  - *such as `.apply()`, `.bind()`, and `.call()`*
- JSFiddle - this - events

JS extras - best practices - part 1

a few best practices...

variables

- limit use of global variables in JavaScript
  - *easy to override*
  - *can lead to unexpected errors and issues*
  - *should be replaced with appropriate local variables, closures*
- local variables should always be declared with keyword `var`
  - *avoids automatic global variable issue*

declarations

- add all required declarations at the top of the appropriate script or file
  - *provides cleaner, more legible code*
  - *helps to avoid unnecessary global variables*
  - *avoid unwanted re-declarations*

types and objects

- avoid declaring numbers, strings, or booleans as objects
- treat more correctly as primitive values
  - *helps increase the performance of our code*
  - *decrease the possibility for issues and bugs*

JS extras - best practices - part 2

type conversions and coercion

- weakly typed nature of JS
  - *important to avoid accidentally converting one type to another*
  - *converting a number to a string or mixing types to create a NaN (Not a Number)*
- often get a returned value set to NaN instead of generating an error
  - *try to subtract one string from another may result in* `NaN`

comparison

- better to try and work with === instead of ==
  - *== tries to coerce a matching type before comparison*
  - *=== forces comparison of values and type*

defaults

- when parameters are required by a function
  - *function call with a missing argument can lead to it being set as* ***undefined***
  - *good coding practice to assign default values to arguments*
  - *helps prevent issues and bugs*

switches

- consider a `default` for the switch conditional statement
- ensure you always set a `default` to end a switch statement

JS extras - performance - part I

loops

- try to limit the number of calculations, executions, statements performed per loop iteration
- check loop statements for assignments and statements
  - *those checked or executed once*
  - *rather than each time a loop iterates*
- `for` loop is a standard example of this type of quick optimisation

```
// bad
for (i = 0; i < arr.length; i++) {
...
}
// good
l = arr.length;
for (i = 0; i < l; i++) {
...
}
```

- source - W3

JS extras - performance - part 2

DOM access

- repetitive DOM access can be slow, and resource intensive
- try to limit the number of times code needs to access the DOM
- simply access once and then use as a local variable

```
var testDiv = document.getElementById('test');
testDiv.innerHTML = "test...";
```

JavaScript loading

- not always necessary to place JS files in the <head> element
  - *check context, in particular for recent mobile and desktop frameworks*
  - *Cordova, Electron...*
- adding JS scripts to end of the page's body
  - *allows browser to load the page first*
- HTTP specification defines browsers should not download more than two components in parallel

JS extras - JSON - part 1

- JSON is a lightweight format and wrapper for storing and transporting data
- inherently language agnostic, easy to read and understand
- growing rapidly in popularity
  - *many online APIs have updated XML to JSON for data exchange*
- syntax of JSON is itself derived from JS object notation
  - *text-only format*
- allows us to easily write, describe, and manipulate JSON in practically any programming language
- **JSON syntax** follows a few basic rules,
  - *data is recorded as name/value pairs*
  - *data is separated by commas*
  - *objects are defined by a start and end curly brace*
  - *{ }*
  - *arrays are defined by a start and end square bracket*
  - *[ ]*

JS extras - JSON - part 2

- underlying construct for JSON is a pairing of name and value

```
"city":"Marseille"
```

JSON Objects

- contained within curly braces
- objects can contain multiple name/value pairs

```
{
  "country":"France",
  "city":"Marseille"
}
```

JS extras - JSON - part 3

JSON Arrays

- contained within square brackets
  - *arrays can also contain objects*

```
{
    "cities": [
        {
            "name": "Marseille",
            "region": "Provence-Alpes-Côte d'Azur"
        },
        {
            "name": "Paris",
            "region": "Île-de-France"
        }
    ]
}
```

- use this with JavaScript, and parse the JSON object.
  - *JSFiddle - Parse JSON*

HTML5, CSS, & JS - example - part I

Structure

- combine HTML5, CSS, and JavaScript, to create an example application
- outline of our project's basic directory structure

```
.
|- assets
|   |- images //logos, site/app banners - useful images for site's design
|   |- scripts //js files
|   |- styles  //css files
|- docs
|   |- json //any .json files
|   |- txt //any .txt files
|   |- xml //any .xml files
|- media
|   |- audio //local audio files for embedding & streaming
|   |- images //site images, photos
|   |- video //local video files for embedding & streaming
|- index.html
```

- each of the above directories can, of course, contain many additional sub-directories
  - *|– `images` may contain sub-directories for albums, galleries...*
  - *|– `xml` may contain sub-directories for further categorisation..*
  - *and so on...*

HTML5, CSS, & JS - example - part 2

index.html

```
<!DOCTYPE html>
<html>
  <head>
    <meta charset="UTF-8">
    <title>travel notes - v0.1</title>
    <meta name="description" content="information on travel destinations">
    <meta name="author" content="ancientlives">
    <!-- css styles... -->
    <link rel="stylesheet" type="text/css" href="assets/styles/style.css">
  </head>
  <body>
    ...
    <!-- js scripts... -->
    <script type="text/javascript"      src="https://code.jQuery.com/jQuery-2.1
    <script type="text/javascript" src="assets/scripts/travel.js"></script>
  </body>
</html>
```

- JS files at foot of body
  - *hierarchical rendering of page by browser - top to bottom*
  - *JS will now be one of the last things to load*
  - *JS files often large, slow to load*
  - *helps page load faster...*

HTML5, CSS, & JS - example - part 3

index.html - body

```
<body>
  <!-- document header -->
  <header>
    <h3>travel notes</h3>
    <p>record notes from various cities and placed visited...</p>
  </header>
  <!-- document main -->
  <main>
    <!-- note input -->
    <section class="note-input">
    </section>
    <!-- note output -->
    <section class="note-output">
    </section>
  </main>
  <!-- document footer -->
  <footer>
    <p>app's copyright information, additional links...</p>
  </footer>
  <!-- js scripts... -->
  <script type="text/javascript" src="https://code.jQuery.com/jQuery-2.1.4.min.
  <script type="text/javascript" src="assets/scripts/travel.js"></script>
</body>
```

HTML5, CSS, & JS - example - part 4

style.css

```
body {
  width: 850px;
  margin: auto;
  background: #fff;
  font-size: 16px;
  font-family: "Times New Roman", Georgia, Serif;
}
h3 {
  font-size: 1.75em;
}
header {
  border-bottom: 1px solid #dedede;
}
header p {
  font-size: 1.25em;
  font-style: italic;
}
footer p {
  font-size: 0.8em;
}
```

HTML5, CSS, & JS - example - part 5

travel.js

```
//overall app logic and loader...
function travelNotes() {
    "use strict";

    $(".note-output").html("<p>first travel note for Marseille...</p>");

};

$(document).ready(travelNotes);
```

- a simple JS function to hold the basic logic for our app
- call this function any reasonable, logical name
- in initial function, we set the `strict` pragma
- add an example call to the jQuery function, `html()`
  - *sets some initial note content*
- function `travelNotes()` loaded using the jQuery function `ready()`
  - *many different ways to achieve this basic loading of app logic*
- DEMO 1 - travel notes - series 1

HTML5, CSS, & JS - example - part 6

add a note

- app's structure includes three clear semantic divisions of content
  - *`<header>`, `<main>`, and `<footer>`*
- `<main>` content category - create and add our notes for our application
- allow a user to create a new note
  - *enter some brief text, and then set it as a note*
- output will simply resemble a heading or brief description for our note
- add HTML element `<input>` to allow a user to enter note text
  - *new attributes in HTML5 such as autocomplete, autofocus, required, width...*
  - *set accompanying*

```
<h5>add note</h5>
<input>
```

```
<input type="text" value="add a note...">
```

HTML5, CSS, & JS - example - part 7

tidy up styling

- additional styles to create correct, logical separation of visual elements and content
- add a border to the top of our footer
  - *perhaps matching the header in style*
- update the box model for the `<main>` element
- add some styling for `<h5>` heading

```
h5 {
  font-size: 1.25em;
  margin: 10px 0 10px 0;
}
main {
  overflow: auto;
  padding: 15px 0 15px 0;
}
footer {
  margin-top: 5px;
  border-top: 1px solid #dedede;
}
```

HTML5, CSS, & JS - example - part 8

input update

```
<input><button>add</button>
```

```
.note-input input {
  width: 40%;
}
.note-input button {
  padding: 2px;
  margin-left: 5px;
  border-radius: 0;
  border: 1px solid #dedede;
  cursor: pointer;
}
```

- also update css for `input` and `button`
- remove button's rounded borders to match style of `input`
- match border for button to basic design aesthetics
- set cursor appropriate for a link style...
- DEMO 2 - travel notes - series 1

HTML5, CSS, & JS - example - part 9

interaction - add a note

- added and styled our input and button for adding a note
- use jQuery to handle click event on button
- update `travel.js` file for event handler

```
//handle user event for `add` button click
$(".note-input button").on("click", function(e) {
  console.log("add button clicked...");
});
```

HTML5, CSS, & JS - example - part 10

interaction - add a note - output

- update this jQuery code to better handle and output the text from the input field
- what is this handler actually doing?
  - *jQuery code has attached an event listener to an element in the DOM*
  - *referenced in the selector option at the start of the function*
  - *uses standard CSS selectors to find the required element*
- jQuery can select and target DOM elements using standard CSS selectors
  - *then manipulate them, as required, using JavaScript*

```
//handle user event for `add` button click
$(".note-input button").on("click", function(e) {
  $(".note-output").append("<p>sample note text...</p>");
});
```

- output some static text to `note-output`
- DEMO 3 - travel notes - series 1

HTML5, CSS, & JS - example - part 11

interaction - add a note - output

```
//overall app logic and loader...
function travelNotes() {
    "use strict";

  //handle user event for `add` button click
  $(".note-input button").on("click", function(e) {
    //object for wrapper html for note
    var $note = $("<p>");
    //get value from input field
    var note_text = $(".note-input input").val();
    //set content for note
    $note.html(note_text);
    //append note text to note-output
    $(".note-output").append($note);
  });

};

$(document).ready(travelNotes);
```

- DEMO 4 - travel notes - series 1

HTML5, CSS, & JS - example - part 12

interaction - add a note - clear input

```
//overall app logic and loader...
function travelNotes() {
    "use strict";

  //handle user event for `add` button click
  $(".note-input button").on("click", function(e) {
    //object for wrapper html for note
    var $note = $("<p>");
    //define input field
    var $note_text = $(".note-input input");
    //conditional check for input field
    if ($note_text.val() !== "") {
    //set content for note
    $note.html($note_text.val());
    //append note text to note-output
    $(".note-output").append($note);
    $note_text.val("");
  }
  });

};

$(document).ready(travelNotes);
```

- DEMO 5 - travel notes - series 1

HTML5, CSS, & JS - example - part 13

interaction - add a note - keyboard listener

- need to consider how to handle keyboard events
- listening and responding to a user hitting the return key in the input field
- similar pattern to user click on button

```
$(".note-input input").on("keypress", function (e) {
  if (e.keyCode === 13) {
    ...do something...
  }
});
```

- need to abstract handling both button click and keyboard press
- need to be selective with regard to keys pressed
- add a conditional check to our listener for a specific key
- use local variable from the event itself, eg: e, to get value of key pressed
- compare value of e against key value required
- example recording keypresses - Demo Editor

JSFiddle - tests

- JSFiddle - this - events
- JSFiddle - this - global
- JSFiddle - this - literal
- JSFiddle - this - literal 2
- JSFiddle - this - window
- JSFiddle - Parse JSON

Demos

Travel notes app - series 1

- DEMO 1 - travel notes - demo 1
- DEMO 2 - travel notes - demo 2
- DEMO 3 - travel notes - demo 3
- DEMO 4 - travel notes - demo 4
- DEMO 5 - travel notes - demo 5

References - JS & Libraries

- jQuery
- JSLint - JavaScript Validator
- JSONLint - JSON Validator
- MDN
  - *MDN - JS*
  - *MDN - JS Data Types and Data Structures*
  - *MDN - JS Grammar and Types*
  - *MDN - JS Objects*
- W3 - JS Object
- W3 - JS Performance