Comp 324/424 - Client-side Web Design

Fall Semester 2018 - Week 9

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DEV Week Assessment

Course total = 25%

- continue development of a web application
  - *built from scratch*
  - *HTML5, CSS, JS...*
  - *continue design and development of initial project outline and design*
  - *working app (as close as possible...)*
  - ***NO** content management systems (CMSs) such as Drupal, Joomla, WordPress...*
  - ***NO** PHP, Python, Ruby, C# & .Net, Go, XML...*
  - ***NO** CSS frameworks, such as Bootstrap, Foundation, Materialize...*
  - *must implement data from either*
    - self hosted (MongoDB, Redis...)
    - APIs
    - cloud services (Firebase...)
    - **NO** SQL...
- outline research conducted
- describe data chosen for application
- show any prototypes, patterns, and designs

DEV Week Demo

DEV week assessment will include the following:

- brief presentation or demonstration of current project work
  - *~ 5 to 10 minutes per group*
  - *analysis of work conducted so far*
  - *e.g. during semester & DEV week*
  - *presentation and demonstration*
  - *outline current state of web app*
  - *explain what works & does not work*
  - *show implemented designs since project outline & mockup*
  - *show latest designs and updates*

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));
```

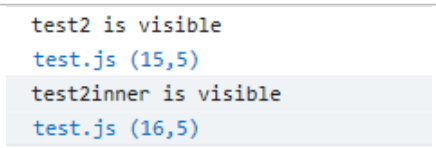
- using one function to create multiple other functions, `add1`, `add5`, `add10`, and so on.

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" : "test2inner is not v
  }
  // inner function now added to global scope - now able to access elsewhere & call later
  laterVal = innerFn;
}
// invokes outerFn, innerFn is created, and its reference assigned to laterVal
outerFn();
// THEN - 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

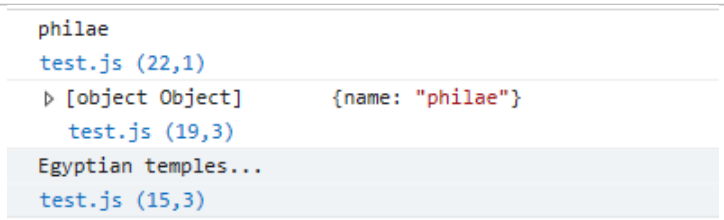
```
var sites = {};
sites.name = "philae";

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

ES6 JS - Arrow functions

basic

```
/**
  js-plain - definitions and arguments
    - basic example for arrow function
**/

// define array for planets
planets = ['mars', 'jupiter', 'venus'];
// use for each loop with array, and create arrow function for output to console
planets.forEach(planet => console.log(planet));
```

- Demo

ES6 JS - Arrow functions

function context

```
/**
  js-plain - definitions and arguments
    - example of arrow function with function context
**/

// button constructor
function Button() {
  this.clicked = false;
  // arrow function in function context
  this.click = () => {
    this.clicked = true;
    var message = `button clicked - ${this.clicked}`;
    console.log(message);
    document.getElementById("output").append(message);
  };
}

// create button object
var button = new Button();
var element = document.getElementById("test");
element.addEventListener("click", button.click);
```

- Demo

ES6 JS - Arrow functions

example

- Random Greeting Generator - A bit better - v0.2

JS - Closures - *private* object property

A brief demo of getters and setters with private object property.

- FN: constructor function
  - *'private variable' - not directly accessible*
  - *define properties on object*
  - *add getter and setter methods*
- Use:
  - *instantiate object using constructor*
  - *log output of check against getter method for value of 'private' variable*
  - *use 'setter' method to update value of 'private' variable*
  - *log output for check of value update of 'private' variable*

JS - closures - *private* object property - example

```
// define constructor
function Archive() {
    // private variable - accessible through function closures
    let _catalogue = 'glass bead';
    // define catalogue property access
    Object.defineProperty(this, 'catalogue', {
        get: () => {
            console.log(`catalogue requested...`);
            return _catalogue;
        },
        set: value => {
            console.log(`catalogue updated`);
            _catalogue = value;
        }
    });
}

// instantiate object from Archive constructor
const archiveCheck = new Archive();

// check access to constructor variable - returns 'undefined' without getter method
console.log(`direct access against private variable = ${archiveCheck._catalogue}`);
// check access using getter method - returns variable value
console.log(`getter access against private variable = ${archiveCheck.catalogue}`);

// update catalogue value - uses 'setter' method
archiveCheck.catalogue = 'history';

// check update catalogue variable
console.log(`updated catalogue = ${archiveCheck.catalogue}`);
```

- Demo - private object property

JS extras - best practices - part I

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 1

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 - initial usage

fun exercise

Choose one of the following app examples,

- **sports** website for latest scores and updates
  - *e.g. scores for current matches, statistics, team data, player info &c.*
- **shopping** website
  - *product listings and adverts, cart, reviews, user account page &c.*
- **restaurant** website
  - *introductory info, menus, sample food images, user reviews &c.*

Then, consider the following

- where do you need JavaScript in the app?
  - *why?*

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 1

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="assets/scripts/jquery.min.js"></script>
    <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="assets/scripts/jquery.min.js"></script>
  <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 5.1

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*

HTML5, CSS, & JS - example - part 5.2

travel.js - plain JS

```
function travelNotes() {
  "use strict";

  // get a reference to `.note_output` in the DOM
  // n.b. these can be combined as well...
  let noteOutput = document.querySelector('.note-output');
  noteOutput.innerHTML = '<p>first travel note for Marseille...</p>';

}

// load app
travelNotes();
```

- 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 9.1

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 9.2

interaction - add a note - plain JS

```
let addNoteBtn = document.getElementById('add-note');
addNoteBtn.addEventListener('click', () => {
  console.log('add button clicked...');
});
```

HTML5, CSS, & JS - example - part 10.1

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`

HTML5, CSS, & JS - example - part 10.2

interaction - add a note - output - plain JS

```
function travelNotes() {
  "use strict";

  // get a reference to `.note_output` in the DOM
  let noteOutput = document.querySelector('.note-output');
  // add note button
  let addNoteBtn = document.getElementById('add-note');

  // add event listener to add note button
  addNoteBtn.addEventListener('click', () => {
    // create p node
    let p = document.createElement('p');
    // create text node
    let noteText = document.createTextNode('sample note text...');
    // append text to paragraph
    p.appendChild(noteText);
    // append new paragraph and text to existing note output
    noteOutput.appendChild(p);
  });

}
```

- DEMO 3 - travel notes - series 1

HTML5, CSS, & JS - example - part 11.1

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);
```

HTML5, CSS, & JS - example - part 11.2

interaction - add a note - output - plain JS

```
function travelNotes() {
  "use strict";

  // get a reference to `.note_output` in the DOM
  let noteOutput = document.querySelector('.note-output');
  // add note button
  let addNoteBtn = document.getElementById('add-note');
  // input field for add note
  let inputNote = document.getElementById('input-note');

  addNoteBtn.addEventListener('click', () => {
    // create p node
    let p = document.createElement('p');
    // get value from input field for note
    let inputVal = inputNote.value;
    // create text node
    let noteText = document.createTextNode(inputVal);
    // append text to paragraph
    p.appendChild(noteText);
    // append new paragraph and text to existing note output
    noteOutput.appendChild(p);
  });

}
```

- DEMO 4 - travel notes - series 1

HTML5, CSS, & JS - example - part 12.1

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);
```

HTML5, CSS, & JS - example - part 12.2

interaction - add a note - clear input - plain JS

```
function travelNotes() {
  "use strict";

  // get a reference to `.note_output` in the DOM
  let noteOutput = document.querySelector('.note-output');
  // add note button
  let addNoteBtn = document.getElementById('add-note');
  // input field for add note
  let inputNote = document.getElementById('input-note');

  // add event listener to add note button
  addNoteBtn.addEventListener('click', () => {
    // create p node
    let p = document.createElement('p');
    // get value from input field for note
    let inputVal = inputNote.value;

    // check input value
    if (inputVal !== '') {
      // create text node
      let noteText = document.createTextNode(inputVal);
      // append text to paragraph
      p.appendChild(noteText);
      // append new paragraph and text to existing note output
      noteOutput.appendChild(p);
      // clear input text field
      inputNote.value = '';
    }
  });

}
```

- DEMO 5 - travel notes - series 1

HTML5, CSS, & JS - example - part 13.1

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

HTML5, CSS, & JS - example - part 13.2

interaction - add a note - keyboard listener - plain JS

```
// add event listener for keypress in note input field
inputNote.addEventListener('keypress', (e) => {
  // check key pressed by code - 13 - return
  if (e.keyCode === 13) {
    console.log('return key pressed...');
  }
});
```

- example recording keypresses
  - *Demo Editor*

Demos

- JSFiddle tests - JS
  - *JSFiddle - this - events*
  - *JSFiddle - this - global*
  - *JSFiddle - this - literal*
  - *JSFiddle - this - literal 2*
  - *JSFiddle - this - window*
  - *JSFiddle - Parse JSON*
- 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*

Resources

- jQuery
  - *jQuery*
  - *jQuery API*
  - *jQuery :parent selector*
- Lint options
  - *JSLint - JavaScript Validator*
  - *JSONLint - JSON Validator*
- MDN
  - *MDN - JS*
  - *MDN - JS Objects*
- W3 - JS Performance