

Comp 424 - Client-side Web Design

Fall Semester 2016 - Week 6

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 - *series / test app*
 - *a few extras...*

DEV week overview...

- begin development of a web application
- built from scratch
- builds upon examples, technology outlined during weeks 1 to 6
 - *HTML5, CSS, JS, jQuery, JSON...*
 - **NO** *PHP, Ruby, Go etc...*
- 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 - 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 I

- 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 - I

```
//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

```
test is visible...  
test.js (13,2)
```

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" : "test2inner is not visible");
    }

    //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();

//innerFn is invoked using laterVal - can't access innerFn directly...
laterVal();
```

Image - JS Core - closures - inner scope

```
test2 is visible  
test.js (15,5)  
test2inner is visible  
test.js (16,5)
```

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

```
philae
test.js (22,1)
  > [object Object]      {name: "philae"}
    test.js (19,3)
Egyptian temples...
test.js (15,3)
```

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 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 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 I

- 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-2.1.4.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="https://code.jquery.com/jquery-2.1.4.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

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 I - travel notes - series I

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>
```

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 I

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 I

HTML5, CSS, & JS - example - part I I

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 = $("

");

        //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 I

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 = $("

");

    //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 I

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](#) -

HTML5, CSS, & JS - example - part 14

interaction - add a note - abstract code

- need to create a new function to abstract
 - *creation and output of a new note*
 - *manage the input field for our note app*
- moving logic from button click function to separate, abstracted function
- then call this function as needed
 - *for a button click or keyboard press*
 - *then create and render the new note*

```
//manage input field and new note output
function createNote() {
    //object for wrapper html for note
    var $note = $("

");
    //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("");
    }
}


```

HTML5, CSS, & JS - example - part 15

interaction - add a note - travel.js

```
//overall app logic and loader...

function travelNotes() {

  "use strict";


  //manage input field and new note output

  function createNote() {

    //object for wrapper html for note

    var $note = $("

");

    //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("");

    }

  }


  //handle user event for `add` button click

  $(".note-input button").on("click", function(e) {

    createNote();

  });


  //handle user event for keyboard press

  $(".note-input input").on("keypress", function(e){

    if (e.keyCode === 13) {

      createNote();

    }

  });

};

$(document).ready(travelNotes);


```

■ DEMO 6 - travel notes - series I

HTML5, CSS, & JS - example - part 16

interaction - add a note - animate

- jQuery well-known for its simple ability to animate elements
- many built-in effects available in jQuery
 - *build our own as well*
- to `fadeIn` an element, effectively it needs to be hidden first
- we hide our newly created note
- then we can set it to `fadeIn` when ready
- many additional parameters for jQuery's `fadeIn` function
 - *customise a callback*
 - *change the speed of the animation*
 - *and so on...*
- jQuery API - `fadeIn`

HTML5, CSS, & JS - example - part 17

interaction - add a note - animate js

```
//manage input field and new note output
function createNote() {
    //object for wrapper html for note
    var $note = $("

");

    //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());

        //hide new note to setup fadeIn...
        $note.hide();

        //append note text to note-output
        $(".note-output").append($note);

        //fadeIn hidden new note
        $note.fadeIn("slow");

        $note_text.val("");
    }
}


```

■ DEMO 7 - travel notes - series I

HTML5, CSS, & JS - example - part 18

style and render notes

- we have some new notes in our app
- add some styling to help improve the look and feel of a note
- can set background colours, borders font styles...
- set differentiating colours for each alternate note
- allows us to try some pseudoclasses in the CSS
 - *specified paragraphs in the `note-output` section*

```
.note-output p:nth-child(even) {  
  background-color: #ccc;  
}  
.note-output p:nth-child(odd) {  
  background-color: #eee;  
}
```

- DEMO 8 - travel notes - series I

HTML5, CSS, & JS - final thoughts

- a basic app that records simple notes
- many additional options we can add
- some basic functionality is needed to make it useful
 - *autosave - otherwise we lose our data each time we refresh the browser*
 - *edit a note*
 - *delete a note*
 - *add author information*
- additional functionality might include
 - *save persistent data to DB, name/value pairs...*
 - *organise and view collections of notes*
 - *add images and other media*
 - *local and APIs*
 - *add contextual information*
 - *again, local and APIs*
 - *structure notes, media, into collection*
 - *define related information*
 - *search, sort...*
 - *export options and sharing...*
- security, testing, design patterns

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 I

- 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
- DEMO 6 - travel notes - demo 6
- DEMO 7 - travel notes - demo 7
- DEMO 8 - travel notes - demo 8

References - JS & Libraries

- [jQuery](#)
- [jQuery API](#)
- [jQuery :parent selector](#)
- [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](#)