

## **Comp 324/424 - Client-side Web Design**

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Spring Semester 2018 - Week 6

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## JS Core - closures - part 2

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### 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

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```
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

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

- JS Fiddle - Closures - Example 3

## Image - JS Core - closures - inner scope

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

JS Core - Closures - inner scope

## JS Core - closures - part 4

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- 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

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- `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

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## *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

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### ***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

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### *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

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```
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

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### 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 - Closures - private object property

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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

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```
// 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 Fiddle - private object property

# JS extras - best practices - part I

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## ***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

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### **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

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## 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

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### 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

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- 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

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- 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

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### 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

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## 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

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## *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

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## *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

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## 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

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### 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

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### ***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

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### *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

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### *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

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### *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

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### **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 II

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## 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

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### 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

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### *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

## Demos

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- 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 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

## References

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