

Lecture 6: JavaScript Programming Environment

Except where otherwise noted, the contents of this document are Copyright 2012 Marty Stepp, Jessica Miller, Victoria Kirst and Roy McElmurry IV. All rights reserved. Any redistribution, reproduction, transmission, or storage of part or all of the contents in any form is prohibited without the author's expressed written permission. Slides have been modified for Maharishi University of Management Computer Science course CS472 in accordance with instructors agreement with authors.

Maharishi University of Management -Fairfield, Iowa © 2019



All rights reserved. No part of this slide presentation may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying or recording, or by any information storage and retrieval system, without permission in writing from Maharishi University of Management.

Main Point Preview

- ▶ JavaScript has a set of global DOM objects accessible to every web page. Every JavaScript object runs inside the global window object. The window object has many global functions such as alert and timer methods.
- ▶ *At the level of the unified field, an impulse anywhere is an impulse everywhere.*

Outline

- ▶ Global DOM Objects -- the global context all js programs run in
- ▶ Unobtrusive Javascript -- separation of content (HTML) and behavior (Javascript)
- ▶ DOM Element Objects -- the main operatives of js programs
- ▶ How HTML pages load JavaScript and when event handlers can be assigned
- ▶ JS Timers -- needed for today's lab, and common tool for js

The six global DOM objects

- ▶ Every JavaScript program can refer to the following global objects:

Name	Description
document	Current HTML page and its content
history	List of pages the user has visited
location	URL of the current HTML page
navigator	Info about the web browser you are using
screen	Info about the screen area occupied by the browser
window	The browser window



The window object

- ▶ *the entire browser window; the top-level object in DOM hierarchy*
- ▶ technically, all global code and variables become part of the window object
- ▶ properties:
 - ▶ [document](#), [history](#), [location](#), [name](#)
- ▶ methods:
 - ▶ [alert](#), [confirm](#), [prompt](#) (popup boxes)
 - ▶ [setInterval](#), [setTimeout](#), [clearInterval](#), [clearTimeout](#) (timers)
 - ▶ [open](#), [close](#) (popping up new browser windows)
 - ▶ [blur](#), [focus](#), [moveBy](#), [moveTo](#), [print](#), [resizeBy](#), [resizeTo](#), [scrollBy](#), [scrollTo](#)

Popup windows with window.open

```
window.open("http://foo.com/bar.html", "My  
Foo Window",  
"width=900,height=600,scrollbars=1");
```

- ▶ [window.open](#) pops up a new browser window
- ▶ This method is the cause of all the terrible popups on the web!
- ▶ some popup blocker software will prevent this method from running



The document object

- ▶ JavaScript representation of *the current web page and the elements inside it*
- ▶ properties:
 - ▶ [anchors](#), `body`, [cookie](#), [domain](#), [forms](#), [images](#), [links](#), [referrer](#), [title](#), [URL](#)
- ▶ methods:
 - ▶ [getElementById](#)
 - ▶ [getElementsByName](#)
 - ▶ [getElementsByTagName](#)
 - ▶ [close](#), [open](#), [write](#), [writeln](#)
- ▶ [complete list](#)

The location object

- ▶ *the URL of the current web page*
- ▶ properties:
 - ▶ host, hostname, href, pathname, port, protocol, search
- ▶ methods:
 - ▶ assign, reload, replace
- ▶ complete list

The navigator object

- ▶ *information about the web browser application*
- ▶ **properties:**
 - ▶ appName, appVersion, language, cookieEnabled, platform, userAgent
 - ▶ complete list
- ▶ Some web programmers examine the navigator object to see what browser is being used, and write browser-specific scripts and hacks:
 - ▶ `if (navigator.appName === "Microsoft Internet Explorer") { ...`
 - ▶ (this is poor style; you should not need to do this)

The screen object

- ▶ *information about the client's display screen*
- ▶ **properties:**
 - ▶ availHeight, availWidth, colorDepth, height, pixelDepth, width
 - ▶ complete list

The history object

- ▶ *the list of sites the browser has visited in this window*
- ▶ properties:
 - ▶ length
- ▶ methods:
 - ▶ Moving backward and forward through the user's history is done using the back, forward, go methods.
 - ▶ `window.history.back();`
 - ▶ HTML5 history API allows JavaScript to manipulate for SPA
- ▶ complete list
- ▶ sometimes the browser won't let scripts view history properties, for security

Main Point

Javascript has a set of global DOM objects accessible to every web page. Every Javascript object runs inside the global window object. The window object has many global functions such as alert and timer methods.

At the level of the unified field, an impulse anywhere is an impulse everywhere.

Main Point Preview

- ▶ Unobtrusive JavaScript promotes separation of web page content into 3 different concerns: content (HTML), presentation (CSS), and behavior(JS) (ala MVC, knower, known, process of knowing)
- ▶ *JavaScript code runs when the page loads it. Event handlers cannot be assigned until the target elements are loaded. Event handlers often use anonymous functions. Creative intelligence proceeds in an orderly sequential manner.*

Unobtrusive JavaScript

- ▶ JavaScript event code seen yesterday was *obtrusive*, in the HTML; this is bad style
- ▶ now we'll see how to write unobtrusive JavaScript code
 - ▶ HTML with minimal JavaScript inside
 - ▶ uses the DOM to attach and execute all JavaScript functions
- ▶ allows separation of web site into 3 major categories:
 - ▶ **content** (HTML) - what is it?
 - ▶ **presentation** (CSS) - how does it look?
 - ▶ **behavior** (JavaScript) - how does it respond to user interaction?

Obtrusive event handlers(bad)

```
<button onclick="okayClick();" >OK</button>
```

```
function okayClick() {  
    alert("booyah");  
}
```

- ▶ this is bad style (HTML is cluttered with JS code)
- ▶ goal: remove all JavaScript code from the HTML body

Unobtrusive JavaScript

```
// where element is a DOM element object  
element.onevent = function;
```

```
<button id="ok">OK</button>  
var okButton = document.getElementById("ok");  
okButton.onclick = okayClick;
```

- ▶ it is legal to attach event handlers to elements' DOM objects in your JavaScript code
 - ▶ notice that you do **not** put parentheses after the function's name
- ▶ this is better style than attaching them in the HTML
- ▶ Where should we put the above code?

Linking to a JavaScript file: script

- ▶ JS code can be placed directly in the HTML file's body or head (like CSS)
 - ▶ but this is bad style (should separate content, presentation, and behavior)
- ▶ script tag should be placed in HTML page's head
- ▶ script code should be stored in a separate .js file (like CSS)

```
<script src="filename" type="text/javascript"></script>
```

```
<script src="example.js" type="text/javascript"></script>
```

When does my code run?

```
<html>
  <head>
    <script src="myfile.js" type="text/javascript"></script>
  </head>
  <body> ... </body> </html>
```

```
// global code
var x = 3;
function f(n) { return n + 1; }
function g(n) { return n - 1; }
x = f(x);
```

- ▶ your file's JS code runs the moment the browser loads the script tag
 - ▶ any variables are declared immediately
 - ▶ any functions are declared but not called, unless your global code explicitly calls them
- ▶ at this point in time, the browser has not yet read your page's body
 - ▶ none of the DOM objects for tags on the page have been created yet

▶ See example: [lecture06_examples/runjs.html](#)

A failed attempt at being unobtrusive

```
<html>
  <head>
    <script src="myfile.js" type="text/javascript"></script>
  </head>
  <body> ... </body> </html>
<div><button id="ok">OK</button></div>

// global code
document.getElementById("ok").onclick = okayClick; //
  error: null
```

- ▶ problem: **myfile.js** code runs the moment the script is loaded
- ▶ script in head is processed before page's body has loaded
 - ▶ no elements are available yet or can be accessed yet via the DOM
- ▶ we need a way to attach the handler after the page has loaded...
- ▶ See [lecture06_examples/failedattempt.html](#)

The window.onload event

```
// this will run once the page has finished loading
function functionName() {
    element.event = functionName;
    element.event = functionName;
    ...
}
window.onload = functionName; // global code
```

- ▶ we want to attach our event handlers right after the page is done loading
 - ▶ there is a global event called window.onload event that occurs at that moment
- ▶ in window.onload handler we attach all the other handlers to run when events occur

See example: [lecture06_examples/unobtrusivehandler1.html](#)

Common unobtrusive JS errors

- ▶ many students mistakenly write `()` when attaching the handler

```
window.onload = pageLoad();
```

```
window.onload = pageLoad;
```

```
okButton.onclick = okayClick();
```

```
okButton.onclick = okayClick;
```

- ▶ **IMPORTANT FUNDAMENTAL CONCEPT !!!**
 - ▶ **Function reference versus evaluation**

- ▶ event names are all lowercase, not capitalized like most variables

```
window.onLoad = pageLoad;
```

```
window.onload = pageLoad;
```

Anonymous functions

```
function (parameters) {  
    statements;  
}
```

- ▶ JavaScript allows you to declare **anonymous functions**
- ▶ quickly creates a function without giving it a name
- ▶ can be stored as a variable, attached as an event handler, etc.
- ▶ Important in JavaScript because of event handling nature and minimizing namespace clutter

Anonymous function example

```
window.onload = function() {  
    var okButton = document.getElementById("ok");  
    okButton.onclick = okayClick;  
};  
function okayClick() {  
    alert("booyah");  
}
```

or the following is also legal (though harder to read):

```
window.onload = function() {  
    var okButton = document.getElementById("ok");  
    okButton.onclick = function() {  
        alert("booyah");  
    };  
};
```

See example: lecture06_examples/anonymous.html

Main Point

- ▶ Unobtrusive JavaScript promotes separation of web page content into 3 different concerns: content (HTML), presentation (CSS), and behavior(JS) (ala MVC, knower, known, process of knowing)
- ▶ JavaScript code runs when the page loads it. Event handlers cannot be assigned until the target elements are loaded. Event handlers often use anonymous functions. Creative intelligence proceeds in an orderly sequential manner.

Main Point Preview

- ▶ The DOM is an API so the JavaScript programmer can conveniently access and manipulate the HTML elements in code.
- ▶ *The TM and TM-Sidhi programs are techniques that allow anyone to conveniently contact and act at the level of the Unified Field.*

Recall: DOM element objects

- ▶ every element on the page has a corresponding DOM object
- ▶ access/modify the attributes of the DOM object with *objectName.attributeName*

HTML

```
<p>  
  Look at this octopus:  
    
  Cute, huh?  
</p>
```

DOM Element Object

Property	Value
tagName	"IMG"
<u>src</u>	"octopus.jpg"
alt	"an octopus"
id	"icon01"

JavaScript

```
var icon = document.getElementById("icon01");  
icon.src = "kitty.gif";
```

DOM object properties

```
<div id="main" class="foo bar">
  <p>Hello, <em>very</em> happy to see you!</p>
  
</div>
```

```
var mainDiv = document.getElementById("main");
var icon = document.getElementById("icon");
```

See example: [lecture06_examples/objectproperties.html](#)

Property	Description	Example
tagName	element's HTML tag	mainDiv.tagName is "DIV"
className	CSS classes of element	mainDiv.className is "foo bar"
innerHTML	Content in element	mainDiv.innerHTML is "\n <p>Hello...
src	URL target of an image	icon.src is "greatwall.jpg"

DOM properties for form controls

```
<input id="sid" type="text" size="7" maxlength="7"
/>
```

```
<input id="frosh" type="checkbox" checked="checked"
/> Froshman?
```

```
var sid = document.getElementById("sid");
```

```
var frosh = document.getElementById("frosh");
```

Property	Description	Example
value	the text/value chosen by the user	sid.value could be "1234567"
checked	whether a box is checked	frosh.checked is true
disabled	whether a control is disabled (boolean)	frosh.disabled is false
readOnly	whether a text box is read-only	sid.readOnly is false

Abuse of innerHTML

```
// bad style!
```

```
var paragraph = document.getElementById("welcome");  
paragraph.innerHTML = "<p>text and <a  
    href='page.html'>link</a>";
```

- ▶ innerHTML can inject arbitrary HTML content into the page
- ▶ however, this is prone to bugs and errors and is considered poor style
 - ▶ not part of DOM standard
 - ▶ issues involving DOM rebuilding tree and maintaining node and event handler references
- ▶ Best practice: inject plain text only
 - ▶ Do not use innerHTML to inject HTML tags;

DOM elements style property

```
<button id="clickme">Color Me</button>

window.onload = function() {
    document.getElementById("clickme").onclick =
        changeColor;
};

function changeColor() {
    var clickMe = document.getElementById("clickme");
    clickMe.style.color = "red";
}
```

Property	Description
style	lets you set any CSS style property for an element

- ▶ contains same properties as in CSS, but with camelCasedNames
 - ▶ examples: backgroundColor, borderLeftWidth, fontFamily

Common DOM styling errors

- ▶ many students forget to write `.style` when setting styles

```
var clickMe = document.getElementById("clickme");  
clickMe.color = "red";  
clickMe.style.color = "red";
```

- ▶ style properties are capitalized like `This`, not like `this`

```
clickMe.style.font-size = "14pt";  
clickMe.style.fontSize = "14pt";
```

- ▶ style properties *must* be set as strings, often with units at the end

```
clickMe.style.width = 200;  
clickMe.style.width = "200px";  
clickMe.style.padding = "0.5em";
```

- ▶ write exactly the value you would have written in the CSS, but in quotes

Unobtrusive styling

```
function okayClick() {  
  this.style.color = "red";  
  this.className = "highlighted";  
}  
  
.highlighted { color: red; }
```

- ▶ well-written JavaScript code should contain as little CSS as possible
- ▶ use JS to set CSS classes/IDs on elements
- ▶ define the styles of those classes/IDs in your CSS file

Getting/Setting CSS classes

```
function highlightField() {  
    // turn text yellow and make it bigger  
    if (!document.getElementById("text").className) {  
        document.getElementById("text").className = "highlight";  
    } else if  
        (document.getElementById("text").className.indexOf("invalid") < 0) {  
        document.getElementById("text").className += "highlight";  
    }  
}
```

- ▶ JS DOM's className property corresponds to HTML class attribute
- ▶ somewhat clunky when dealing with multiple space-separated classes as one big string
 - ▶ which is what getElementById(..).className returns

Problems with reading/changing styles

```
<button id="clickme">Click Me</button>

window.onload = function() {
    document.getElementById("clickme").onclick = biggerFont;
};

function biggerFont() {
    var size =
        parseInt(document.getElementById("clickme").style.fontSize);
    size += 4;
    document.getElementById("clickMe").style.fontSize = size
        + "pt";
}
```

- ▶ style property lets you set any CSS style for an element
- ▶ problem(?): you cannot (sometimes? in-the-past?) read existing styles with it
- ▶ See example: lecture06_examples/style.html

Common bug: incorrect usage of existing styles

```
document.getElementById("main").style.top
```

```
document.getElementById("main").style.top + 100 +  
"px"; // bad
```

- ▶ the above example computes e.g. "200px" + 100 + "px" ,
which would evaluate to "200px100px"

- ▶ a corrected version:

```
document.getElementById("main").style.top =  
    parseInt(document.getElementById("main").style.top  
    ) + 100 + "px"; // correct
```

Main Point

- ▶ The DOM is an API so the JavaScript programmer can conveniently access and manipulate the HTML elements in code.
- ▶ *The TM and TM-Sidhi programs are techniques that allow anyone to conveniently contact and act at the level of the Unified Field.*

Timer events

method	description
<code><u>setTimeout</u>(<i>function</i>, <i>delayMS</i>);</code>	arranges to call given function after given delay in ms
<code><u>setInterval</u>(<i>function</i>, <i>delayMS</i>);</code>	arranges to call function repeatedly every <i>delayMS</i> ms
<code><u>clearTimeout</u>(<i>timerID</i>);</code> <code><u>clearInterval</u>(<i>timerID</i>);</code>	stops the given timer so it will not call its function

- ▶ both `setTimeout` and `setInterval` return an ID representing the timer
 - ▶ this ID can be passed to `clearTimeout/Interval` later to stop the timer

setTimeout Example

```
<button onclick="delayMsg();" >Click me!</button>
```

```
<span id="output"></span>
```

```
function delayMsg() {  
    setTimeout(booyah, 5000);  
    document.getElementById("output").innerHTML =  
        "Wait for it...";  
}  
  
function booyah() {  
    // called when the timer goes off  
    document.getElementById("output").innerHTML =  
        "BOOYAH!";  
}
```


setInterval example

```
<button id="clickbtn">Click me!</button>
```

```
<span id="output"></span>
```

```
let timer = null; // stores ID of interval timer
```

```
window.onload = function () {  
  document.getElementById("clickbtn").onclick = function () {  
    if (timer == null) {  
      timer = setInterval(function () {  
        // called each time the timer goes off  
        document.getElementById("output").innerHTML += " Rudy!";  
      }, 1000);  
    } else {  
      clearInterval(timer);  
      timer = null;  
    }  
  }  
};
```

Passing parameters to timers

```
function delayedMultiply() {  
    // 6 and 7 are passed to multiply when  
    timer goes off  
    setTimeout(multiply, 2000, 6, 7);  
}  
function multiply(a, b) {  
    alert(a * b);  
}
```

- ▶ any parameters after the delay are eventually passed to the timer function
- ▶ why not just write this? **setTimeout(multiply(6, 7), 2000);**

Common timer errors

- ▶ many students mistakenly write `()` when passing the function

~~`setTimeout(booyah(), 2000);`~~

`setTimeout(booyah, 2000);`

~~`setTimeout(multiply(num1 * num2), 2000);`~~

`setTimeout(multiply, 2000, num1, num2);`

- ▶ what does it actually do if you have the `()` ?
 - ▶ it calls the function immediately, rather than waiting the 2000ms!

functions as first-class citizens

- ▶ Functions can be variables

```
var myfunc = function(a, x) {  
  return a * b;  
};  
var x = myfunc(2, 3); // 6
```

- ▶ Functions can be parameters

```
function apply(a, b, f) {  
  return f(a, b);  
}  
var x = apply(2, 3, myfunc); // 6
```

- ▶ Functions can be return values

```
function getAlert(str) {  
  return function() { alert(str); }  
}  
var myAlertFunc = getAlert("What's up!");
```

JavaScript “strict” mode

```
"use strict"; your code...
```

```
(function() {  
  "use strict";  
  your code...  
})();
```

- ▶ writing "use strict"; at the very top of your JS file turns on strict syntax checking:
 - ▶ shows an error if you try to assign to an undeclared variable
 - ▶ stops you from overwriting key JS system libraries
 - ▶ forbids some unsafe or error-prone language features
- ▶ "use strict" also works inside of individual functions
- ▶ You should *always* turn on strict mode for your code in this class!

CONNECTING THE PARTS OF KNOWLEDGE WITH THE WHOLENESS OF KNOWLEDGE

Actions in Accord with the Laws of Nature

1. JavaScript is attached to HTML pages and is executed on the browser.
 2. JavaScript reacts to browser events and manipulates the web page using the HTML DOM API
-
3. **Transcendental consciousness** is the source of thought and the home of all the laws of nature.
 4. **Impulses within the transcendental field** spontaneously are in accord with all the laws of nature.
 5. **Wholeness moving within itself:** In unity consciousness, one enjoys all perceptions and knowledge in terms of the source of all the laws of nature, pure bliss consciousness. This is parallel to the good feeling and confidence that we experience when we have a deep appreciation and understanding of the environment in which JavaScript runs.
- 