Web Application Programming
Unity and Diversity

CS472

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Web Application Programming: Unity and Diversity

Course Overview

	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Theme I: HTML and CSS – Life Is Structured in Layers						
Week 1	HTML	CSS for Styling	CSS for Page Layout	HTML5 Forms	Intro to JavaScript	Execution Context Closure
Theme II: Client Side Programming – Faster Reaction Time						
Week 2	Execution Context Closure	Call Context this keyword	Inheritance	Classes	Review	Midterm Exam
Theme III: Server Side Programming with Node.js - Every Action has a Reaction						
Week 3	Node.js Intro	Modules	Express	REST & DOM Events	Promise, Async&await, Fetch, SPA	Review
Theme IV: Integrating all parts together - The Whole is Greater than the Sum of the Parts						
Week 4	Project	Project	Project Presentation	Final Exam		

CS472
Web Application Programming
Unity and Diversity

A dominant feature of the World Wide Web that has made it the most successful computing platform on the planet is that there is a single unifying protocol that underlies and connects all applications running on the WWW throughout the entire world. The Hypertext Transfer Protocol (HTTP) is used by all servers and browsers on the WWW. HTTP is a simple set of rules that allows every one of the billions of hosts running on the WWW to have access to every other host. It is this simple underlying unification mechanism that has made web applications the predominant form of delivery for modern software applications.

Web applications are an example of a system of almost infinite diversity and complexity that has arisen based on an underlying unifying mechanism. This is a concrete computing example of a similar law of nature from the science of physics and Maharishi's Science of Consciousness. In physics all the diversity of the physical world arises from the underlying *unified field* of physics. In the 1970's and 1980's physicists traced all forces in the universe back to four fundamental forces or fields of nature (gravity, electromagnetic, weak and strong nuclear forces). Now these four fields are integrated into a single field known as the unified field. According to Maharishi's science of consciousness this unified field is the same as the field of pure consciousness or pure awareness that we experience in our daily practice of the Transcendental Meditation Program.

When our thoughts and actions are connected to this level of pure consciousness, they are naturally in accord with the laws of nature guiding the entire universe. They will tend to be successful like the WWW's success in becoming the predominant computing platform in the world.

Course Goals

This course provides a systematic introduction to programming interactive and dynamic web applications for individuals with little or no prior web application programming experience. At the completion of the course, you will be proficient in designing and writing the following:
- HTML to specify webpage content.
- CSS to specify website styling and layout.
- Javascript as a functional language for making web pages responsive.
- Node.js and Express.js for creating dynamism in websites.

Client-Side Course Objectives
- Design and write web pages including proper separation of content in HTML, styling in CSS, and processing in JavaScript.
- Write CSS selection rules with understanding of CSS cascade, inheritance, and specifity rules
- Node.js for creating dynamism in websites
- Create sophisticated responsive layouts using box-model, flexbox, and grid.

- write JavaScript using functional programming techniques, closures, the module pattern, and inheritance via prototypes and function constructors.
- Understand JavaScript scope, execution context, scope chain, and event loop.

Server-Side Course Objectives

- Design and develop web applications with a deep understanding of concurrency.
- Use the industry standard MVC architecture.
- Clearly understand the different purposes of browser versus server-side code.

How You Will Accomplish the Objectives
Preview the slides and reading, attend lectures, complete readings and answer quiz questions.

How You Will Demonstrate You Have Accomplished the Objectives
Complete homework labs and write small applications on exams.

Course Texts

A Software Engineer Learns HTML5 JavaScript & jQuery: A Guide to standars-Based Web Applications by D. Cameron, Cisdal Publishing, 2014.

Web Programming Step by Step, Second Edition
by Marty Stepp, Jessica Miller, Victoria Kirst

JavaScript: The Definitive Guide: Master the World's Most-Used Programming Language

Node.js in Action

Class Attendance

Attendance at all classes is required, because all elements of class — lectures, questions and answers, discussions, laboratory work — contribute to the learning process. Absences are usually excused only if you are sick in bed or have a family emergency.

If you must miss a class, please let your instructor know ahead of time. Call, send an email, or send a note with a friend. There is no such thing as a "personal day." If you have personal business to take care of, please schedule it for after class or during the days between blocks. At the same time, it may occasionally be necessary for you to miss a class (or part of a class) for some reason other than illness or family emergency. Please speak with the instructor beforehand, who will be open to considering your needs.

The first lesson of each course is the most important. Students are expected to be present from the first lesson onward. Any student not present on the first morning (except for such compelling reasons as illness or family emergency) may be asked to withdraw from the course. Unexcused absences may result in the student receiving a grade of NC (No Credit) for the whole course.

Evaluation Criteria

Midterm Exam	40%
Final Exam	40%
Labs	10%
Project	10%

We will use the following grading scale:

Range	Letter Grade
93-100	A
90 - 92	A-
87 - 89	B+
83 - 86	B
80 - 82	B-
77 - 79	C+
73 - 76	C
70 - 72	C-
0 - 69	NC

Introduction to Web Programming:
Layers of Abstraction

The basic technologies that make up the Internet are the World Wide Web and the Hyper Text Markup Language (HTML). Many technologies are built on top of other technologies. *Life is found in layers and the TM Technique gives us access to the full range of our awareness and thoughts.*

MAIN POINTS

1. The internet is a global computer network that uses the IP protocol to uniquely identify computers on the network. Through the TCP protocol each IP address can work with multiple services at the same time. One of these services is the HTTP protocol which is used by the World Wide Web to transport HTML pages. There are many layers of the Internet. *Familiarity with the deep layers is necessary for optimal understanding and use of the surface layers. TM settles our mind so that it is more connected to the deep layers that are the basis of the more expressed layers.*

2. The Hyper Text Markup Language uses tags to demarcate different sections of a text. An HTML page always starts with a <html> tag, inside of which it has a <head> tag to describe the page, and a <body> tag of the contents that will actually be displayed. These are the tags you will use for every HTML page. This is a foundational concept. W*ell begun is half done. Start with a good foundation and build upon that.*

3. More common tags include inline elements, lists, tables. The most important concept is to use tags based on their semantics (meaning), not based on their visual effect (which can easily be changed). By using tags for their meaning, clients (including non visual) will better understand the meaning of your page and use it more effectively. *Clear and settled awareness allows us to better grasp the meaning of information and take the right actions for success.*

CONNECTING THE PARTS OF KNOWLEDGE
WITH THE WHOLENESS OF KNOWLEDGE
Intro to Web Programming: Layers of Abstraction

1. HTML is the basis of Web Programming, every web page is composed of HTML.
2. To be an effective web programmer you also must understand the deeper underlying realities of HTTP, TCP, and DNS.

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3. **Transcendental consciousness** is when our mind is in contact with the deepest underlying reality, the unified field.
4. **Impulses within the Transcendental field**: the infinite dynamism of the unified field constantly expresses itself as all of the layers of the universe
5. **Wholeness moving within itself:** In Unity Consciousness, one experiences that all these layers are ultimately composed of pure consciousness, our own pure awareness.

CSS for Styling:
Evolution through Specialization

The basics of CSS give different visual styles to HTML elements, changing their preset default appearance. CSS was a natural evolution to HTML that enhances the flexibility and sophistication of HTML for the specialized function of visual styling. *Nature evolves by creating encapsulated subsystems to handle specialized functionalities.*
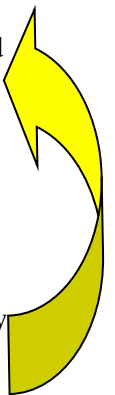
MAIN POINTS

1. The CSS Properties for color, font, text, background, and lists are the basic properties used on almost every page. *There are a lot of details here, but few concepts. If you know the general concepts the details will follow with practice. Highest first—capture the fort to control the territory.*

2. The Cascading in CSS indicates that there are multiple levels of style sheets. More specific styles overwrite more general styles. We can be more specific by using Class selectors (groups of elements) and even more so with id selectors (individual elements) and context selectors.
Life is found in layers.

3. The <div> tag provides a generic block level element that can be used for any division or section of your page. The <span> tag provides a generic inline element for specifying any range of text inside a box. By using these tags, combined with CSS selectors we can write powerful and reusable CSS rules to style and layout pages. *This is an example of efficiency through abstraction. We can have rules that apply to many different elements by abstracting over tags and classes. Do less and accomplish more by acting from abstract levels of awareness.*

CONNECTING THE PARTS OF KNOWLEDGE
WITH THE WHOLENESS OF KNOWLEDGE
CSS: Evolution through Specialization

1. How a page is displayed is affected by both the HTML and the CSS.
2. Although every HTML tag has a default way of displaying, it can easily be changed with CSS and should never be the basis for using it. Instead use HTML tags based on meaning.

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3. **Transcendental consciousness** is the field that underlies all differences.
4. **Impulses within the Transcendental field**: pure consciousness is a field of infinite possibilities that gives rise to the great diversity of the relative world, the same underlying content can appear as many expressions.
5. **Wholeness moving within itself:** In Unity Consciousness, one experiences that this unbounded diversity is nothing but the self.

Page Layout:
Whole Is Greater than the Sum of the Parts

CSS provides different tools for creating a layout. There are a variety of ways to position an element; most of them are based on taking a block level element and placing it in relation to some other block. The question is always: "This position is relative to what?" This illustrates the general principle that individual parts must often be understood in terms of a larger context. *The whole is greater than the sum of its parts.*

MAIN POINTS

1. The Box Model is a description of how every element has a basic width and height, outside of which it has padding, a border, and margin. For inline elements only the left and right margin and padding affect surrounding elements. *This is another encapsulation mechanism that allows layout style to be separate from the page content. Life is found in layers.*

2. A block-level element always starts on a new line and takes up the full width available (stretches out to the left and right as far as it can). An inline element does not start on a new line and only takes up as much width as necessary. These are the fundamental display types for almost all HTML elements. Understanding these fundamental types is critical to creating effective layouts. *Familiarity with fundamental levels of awareness is critical to successful action.*

3. Static position flows box elements from top to bottom, and inline elements from left to right. Relative position keeps the space in the original flow but displays the element at an offset. Absolute position takes the element out of the flow and places it relative to the 'containing element'. Fixed position takes the element out of the flow and places it relative to the viewport. *Layouts require understanding how parts fit into a larger whole. The whole is greater than the sum of its parts.*

4. The CSS float property makes its element move to right or left side of the containing box. The clear property moves its element downwards if there is a floating element on the specified side. Float is a convenient way to have text wrap around an element or make something appear on the right or left side. *Do less and accomplish more.*

5. Responsive design is the strategy of making a site that responds to the browser and device width. Responsive design utilizes media queries to determine the available display area and new CSS techniques such as flexbox and grid to make designs more flexible. *The unified field is the source of all possibilities and when we think from this level our actions are spontaneously responsive to whatever situation we encounter.*

CONNECTING THE PARTS OF KNOWLEDGE
WITH THE WHOLENESS OF KNOWLEDGE
CSS Positioning: Whole Is Greater than the Sum of the Parts

1. You can use floats and positioning to change where elements are displayed.

2. Modern web apps use responsive design principles including media queries, viewport, Flexbox, grid, and frameworks such as Bootstrap

3. **Transcendental consciousness** is the experience of pure wholeness.
4. **Impulses within the Transcendental field**: At quiet levels of awareness thoughts are fully supported by the wholeness of pure consciousness.
5. **Wholeness moving within itself:** In Unity Consciousness, one appreciates all parts in terms of their ultimate reality in wholeness.

HTML Forms: Connecting with the Source

HTML forms generate and process user input. Users complete HTML forms using different data widgets , and the server will process the information submitted from the forms.   *Forms are a communication mechanism, connecting a model with a remote view of the model and in this case providing input to the model. Forms collect and send information to the server like our sensory systems collect and send perceptions to our awareness.*

MAIN POINTS

1. An HTML form allows the user to send data (input parameters) to the server. Forms are created with the <form> tag, and can be submitted with either an HTTP GET or POST method. *HTTP is a protocol for contacting the server and thereby gaining access to all the resources on the server. Similarly, the TM technique is a protocol for contacting the Self and thereby gaining access to all the resources of pure consciousness.*

2. HTML provides many different types of input widgets, including text fields, text areas, check boxes, radio buttons, and dropdown lists, this is also an area HTML 5 is expanding to make form filling more efficient and effortless. *Nature supports the growth of things that are efficient. Do less and accomplish more.*

CONNECTING THE PARTS OF KNOWLEDGE
WITH THE WHOLENESS OF KNOWLEDGE
Connecting with the Source

1. Forms let us submit data to the web server, which can then generate a custom reponse based on server side information.
2. GET requests are intended to only retrieve information and should be idempotent. POST requests are intended to submit data and not request a direct response.

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3. **Transcendental consciousness** is the experience of the source of thought.
4. **Impulses within the Transcendental field**: inputs and perceptions are appreciated in their full value at the quiet levels of the mind.
5. **Wholeness moving within itself:** In Unity Consciousness one appreciates the full value of all inputs and perceptions. Everything is appreciated as some expression of Totality.

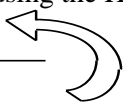# JavaScript for Modern Web Apps: Spontaneous Right Action

JavaScript is a powerful lightweight loosely typed interpreted functional OO language that makes web pages highly dynamic and responsive. It runs in all browsers and is an increasingly important programming language. **Science of Consciousness:** If our awareness is grounded in pure consciousness then our actions will be dynamic and responsive.

MAIN POINTS

1. JavaScript is a loosely typed language. It has types but does no compile time type checking. Programmers must be cautious of automatic type conversions, including conversions to Boolean types. It has a flexible and powerful array type as well as distinct types of null and undefined. **Science of Consciousness:** To be an effective JavaScript programmer one needs to understand the principles and details of the language. If our awareness is established in the source of all the laws of nature then our actions will spontaneously be in accord with the laws of nature for a particular environment.

2. JavaScript programs have no main. They respond to user actions called events. **Science of Consciousness:** JavaScript was designed as a language that could effectively respond to browser and DOM events. We respond most effectively to events in our environment if our awareness is settled and alert.

3. The purpose of most JavaScript code is to manipulate the HTML DOM, which is a set of JavaScript objects that represent each element on an HTML page. **Science of Consciousness:** The purpose of thought is to produce successful actions and achievements in the world, and more powerful thoughts will produce more successful actions.

CONNECTING THE PARTS OF KNOWLEDGE WITH
THE WHOLENESS OF KNOWLEDGE
JavaScript for Modern Web Apps: Spontaneous Right Action

1. JavaScript is embedded in an HTML page 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:** Actions arising from this level will spontaneously be in accord with all the laws of nature.

5. **Wholeness moving within itself:** In unity consciousness, all of one's perceptions and actions are grounded in the experience of pure consciousness.
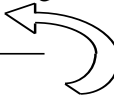
The JavaScript Programming Environment
Actions in Accord with the Laws of Nature

With web applications, JavaScript runs in the environment of a browser. Understanding this special programming environment is critical to success. **Science of Consciousness:** If our thoughts are connected to the home of all the laws of nature, then one will naturally behave according to the principles appropriate for any special environment.

MAIN POINTS

1. 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. **Science of Consciousness:** To be successful we must have both fine discrimination and broad awareness. The experience of pure consciousness provides global awareness, but also enhances our ability to have fine focus and make careful discriminations.

2."Unobtrusive" JavaScript promotes separation of web page content into 3 different concerns: content (HTML), presentation (CSS), and behavior(JS). **Science of Consciousness:** This is another example of knower (model), known (view), and process of knowing (controller) which is found throughout computer science and nature. When we experience transcendental consciousness, our Self is the knower, and it is also the known, and the experience is itself the process of the knower knowing herself.

3. 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 because the code is specific to that event and element. **Science of Consciousness:** Creative intelligence proceeds in an orderly sequential manner. When our thoughts and actions arise from the source of all the laws of nature then we spontaneously act in accord with the natural order of events in nature.

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

CONNECTING THE PARTS OF KNOWLEDGE WITH
THE WHOLENESS OF KNOWLEDGE

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.

Scope, Closures, and Encapsulation
Life Is Structured in Layers

All natural systems make use of layering of encapsulated subsystems to build up more complex super systems. JavaScript relies heavily on functions for most of its layering and encapsulation. **Science of Consciousness:** Life is structured in layers and when we practice the TM program we experience all the layers of thought from gross thinking to finest feeling.

MAIN POINTS

1. JavaScript has global scope and local scope within functions when variables are declared with var. **Science of Consciousness:** The experience of transcending opens our awareness to the expanded vision of unbounded awareness, at the same time that it promotes the ability to focus sharply within any local boundaries.

2. JavaScript has a 2-pass compiler that hoists all function declarations and any variables declared with var keyword. These declarations are visible anywhere in the current function scope regardless of where they are declared. Variables have value 'undefined' until the execution pass and an assignment is made. **Science of Consciousness:** The first pass sets up the proper conditions for the successful execution of the second pass. Similarly, when we set up the proper conditions for transcending then all we have to do is let go and nature will ensure that the experience is successful.

3. When we ask for any variable, JavaScript will look for that variable in the current scope. If it doesn't find it, it will consult its outer scope until we reach the global scope.
    Science of Consciousness: During the process of transcending we naturally proceed from local awareness to more subtle levels of awareness to unbounded awareness.

4. Closures are created whenever an inner function is defined and it closes over its free variables. Closures provide encapsulation of methods and data.   Encapsulation promotes self-sufficiency, stability, and re-usability. **Science of Consciousness:** Transcendental consciousness provides encapsulation of thoughts, perceptions, and actions by our Self, pure awareness. This experience promotes self-sufficiency, stability, and adaptability.

5. Functional programming methods map, filter, reduce make code more understandable and error free by automating details of general-purpose looping mechanisms, indicating their intent by their name, and not changing the state of the original array. **Science of Consciousness:** Growth of consciousness makes behavior simpler and more error free because intentions that arise from deep levels are spontaneously in accord with and supported by all the laws of nature.

CONNECTING THE PARTS OF KNOWLEDGE
WITH THE WHOLENESS OF KNOWLEDGE
Life Is Found in Layers

1. JavaScript is a functional OO language that has a shared global namespace for each page and local scope within functions.

2. Closures and objects are fundamental to JavaScript best coding practices, particularly for promoting encapsulation, layering, and abstractions in code.

3.Transcendental consciousness is the experience of the most fundamental layer of all existence, pure consciousness, the experience of one's own Self.

4. **Impulses within the transcendental field:** The many layers of abstraction required for sophisticated JavaScript implementations will be most successful if they arise from a solid basis of thought that is suppor by all the laws of nature.

5. **Wholeness moving within itself:**   In unity consciousness, one appreciates that all complex systems are ultimately compositions of pure consciousness, one's own Self.

Objects and Encapsulation
Life Is Structured in Layers

All natural systems make use of layering of encapsulated subsystems to build up more complex super systems. JavaScript relies heavily on functions for most of its layering and encapsulation. **Science of Consciousness:** Life is structured in layers and when we practice the TM program we experience all the layers of thought from gross thinking to finest feeling.
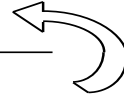
MAIN POINTS

1. Objects are a widely used encapsulation mechanism in JavaScript. They are easily created with object literals. They can dynamically add new properties; behave like associative arrays; must use 'this' to refer to properties; **Science of Consciousness:** Individual awareness encapsulates unbounded awareness. Our individual awareness becomes more efficient and effective if it is supported by unbounded awareness.

2. In JavaScript, like Java, the keyword 'this' refers to the containing object. However, in JavaScript the same 'this' can refer to many different types of objects depending on the context. **Science of Consciousness:** The keyword 'this' is an important form of self-referral and understanding this self-referral is critical to writing successful JavaScript. Experiencing and understanding self-referral consciousness is critical to living a successful life.

3. The revealing module pattern is widely used to provide a public API to an underlying implementation of private methods and properties. **Science of Consciousness:** The Transcendental Meditation program is sort of API to access the support of all the laws of nature through the experience of pure consciousness, the source of all the laws of nature.

4. JavaScript supports prototype inheritance so that objects can inherit common functionality from a single 'prototype' object. **Science of Consciousness:** Pure consciousness is a level of awareness that is a common experience shared by everyone.

CONNECTING THE PARTS OF KNOWLEDGE
WITH THE WHOLENESS OF KNOWLEDGE
Life Is Found in Layers

1. JavaScript is a functional OO language with objects but no classes.
2. Closures and objects are fundamental to JavaScript best coding practices, particularly for promoting encapsulation, layering, and abstractions in code.

3. **Transcendental consciousness** is the experience of the most fundamental layer of all existence, pure consciousness, the experience of one's own Self.

4. **Impulses within the transcendental field:** The many layers of abstraction required for sophisticated JavaScript implementations will be most successful if they arise from a solid basis of thought that is suppor by all the laws of nature.

5. **Wholeness moving within itself:** In unity consciousness, one appreciates that all complex systems are ultimately compositions of pure consciousness, one's own Self.