Writing Fearless Javascript

for portlets, widgets, and portals...

Fluid

Fearless Javascript

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http://fluidproject.org

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Douglas Crockford, senior JavaScript Architect at Yahoo!, Best known as one of the developers of JSON

John Resig, JavaScript Evangelist for the Mozilla Corporation, creator of jQuery, author of Pro Javascript Techniques

jQuery

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The jQuery Javascript Library. We love jQuery and JS toolkits in general. Please don't be turned off by our focus on jQuery. There are a lot of great JS Toolkits and libraries out there and the techniques we discuss today are applicable across toolkits.

In-class examples...

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```
svn co https://source.fluidproject.org/
 svn/sandbox/javascript-workshop/trunk
```

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Firebug

- Debugger
- Profiling tool
- DOM inspector
- Interactive console
- Every JS programmer's best friend!

Download it at: http://www.getfirebug.com/

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The jQuery Javascript Library. We love jQuery and JS toolkits in general. Please don’t be turned off by our focus on jQuery. There are a lot of great JS Toolkits and libraries out there and the techniques we discuss today are applicable across toolkits.

Setting Up FireBug

1. In Firefox 2, go to
   http://www.getfirebug.com/
2. Click the big Install Firebug 1.0 button
3. Restart Firefox after installing
4. Enable Firebug by clicking the green checkmark
5. Select the Console tab
6. Choose Options > Larger Command Line

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The jQuery Javascript Library. We love jQuery and JS toolkits in general. Please don't be turned off by our focus on jQuery. There are a lot of great JS Toolkits and libraries out there and the techniques we discuss today are applicable across toolkits.

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Ridiculous question?
After all this is a Web 2.0 world, everywhere we turn, it's AJAX this, DHTML that, social networks, but it is a reasonable question

Why Javascript?

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Ridiculous question?
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Why Javascript?

Why DHTML?

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Why Javascript?

Why DHTML?

Why AJAX?

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Why Javascript?

Why DHTML?

Why AJAX?

Why bother?

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Ridiculous question?
After all this is a Web 2.0 world, everywhere we turn, it's AJAX this, DHTML that, social networks, but it is a reasonable question

Web 2.0

aka. Web 3.0 alpha

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Definitions

DHTML = **D**ynamic **HTML**

AJAX = **A**synchronous **J**avascript **a**nd **X**ML

RIA = **R**ich **I**nternet **A**pplications

DHTML = Dynamic HTML = client-side interactivity
AJAX = Asynchronous Javascript and XML = small, responsive, transactions between client and server
the XML part of AJAX is used very rarely these days, being replaced by other data formats, such as JSON
RIA = Rich Internet Applications = rich interactions

Examples

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Flash?
Silverlight?

- Great technologies
  - powerful
  - fast
  - cross-platform (well, at least Flash has so far proven to be so)
  - Great for animation and media, I mean really great!
  - for some functionality Flash is better, at least for now, such as animation.

I've seen some awesome things done with DHTML based animations, especially using some of the new technologies that are being adopted such as Canvas and SVG, but for now Flash is much easier to author and has better results. But we're not talking about animation or video here, we're talking web apps, data, information, funcitonality and DHTML and AJAX can do anything that Flash and Flex, and Silverlight can do.

- Political
  - Open vs. Closed
- Practical
  - Also Open vs. Closed

Jump out to Fluid Layout Customizer in uPortal

DHTML/AJAX

- open-standards
- transparent
- works within a web page, not against it
- accessible

not just to screen readers and adaptive devices but to other components and other technologies, HTML and DOM are the currency of the web, components built using DOM can talk to each other in DOM, the HTML document object model becomes the API that allows us to build along side and on top of each other.

Javascript

- breezy little scripting language?
- industrial-strength programming language?
- both?

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Old-school JS

- Namespace pollution
- Obtrusive scripting: placing code and event handlers into markup
- Attempts to map a class-based system onto a class-less language
- Poor encapsulation: data and functions scattered about

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```
var currentTab = "";
var currentHighlight = "";

function showTab(tabKey) {
  // show tab stuff
}

function hideTab(tabKey) {
  // hide tab stuff
}

function init(tabSet) {
  // init block
}
```

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Javascript 101

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JavaScript is Different

- Everything is an object
- Extremely loose type system
- No classes
- Functions are first class
- Lots of annoying quirks

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Fun History

- Written at Netscape by Brendan Eich
- Original goal: kinda like LISP, but without all the brackets
- Rushed to market, bugs and all
- Microsoft reverse-engineered it
- ECMA was a browser war battleground

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Part 1: The Basics

- Variables
- Numbers
- Strings
- null
- undefined
- Objects and Arrays

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Defining Variables

- Define variables with var
- No need to declare types

```
var mango = "yum";
mango = 12345;
mango = false;
```

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Defining Variables

- If you omit var, it will be defined as a global variable. Bug!
- Accident prone; JavaScript won't warn you!

```
rottenTomato = "gross!"; // This is global
```

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Numbers and Strings

- Numbers
  - lots of precision
  - no distinction between floats and ints
  - NaN !== NaN
- Strings
  - Nearly Unicode
  - Immutable
  - No character type

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Null vs. Undefined

- null is the "nothing" value
- undefined is extremely nothing
  - Default parameter for defined variables
  - Also the value of undefined or missing members of objects

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Null vs. Undefined

think of undefined as "I've never heard of this thing"

and null as "nothing here"

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Null vs. Undefined

```
var foo;
foo === undefined

console.debug(someRandomVariable); // undefined
```

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Truthy and Falsey

- JavaScript does a lot of automatic type coercion
- This is scary, but helpful
- Shades of true and false
- Helpful when evaluating arguments

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Falsey Values

- `false`
- `null`
- `undefined`
- `""`
- `0 (zero)`
- `NaN`

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Truthy Values

Everything else is truthy...

- `true`
- Objects
- Non-zero numbers
- Non-empty Strings

Careful...

`-1`,`"false"`,`"0"` are all true

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Type Coercion

JavaScript does automatic type coercion in several scenarios

- This can be very dangerous!
- The + operator, for example:

```
1 + 2 === 3
"$" + 1 + 2 === "$12" not $3
+"12" === 12  // Implicit coercion
```

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Equal vs. Equivalent

Comparisons are coercive:

```
1 == "1" // true

0 == false // true
```

Non-coercive comparison:

```
0 === false // false

1 !== "1" // true
```

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Using Truthy and Falsey

- Checking for valid arguments before operating on them
- Substituting defaults
- Be careful with arguments that genuinely might be falsey, such as numbers

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Truthy/Falsey Example

```
function pie (apples, cinnamon) {
   // Only cut the apples if they aren't null or undefined.
   if (apples) {
      alert("Apples!");
      //apples.cut();
   }

   var nutmeg = "nutmeg";

   // If cinnamon is falsey (null or undefined),
   // assign spice to nutmeg instead
   var spice = cinnamon || nutmeg;

   if (apples && spice) {
      return "Tasty";
   } else {
      return "Crusty pie";
   }
}

pie(null, null); // "Crusty pie"
```

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Creating Objects

```
// Using the new keyword
var foo = new String("foo");
var answer = new Number(42);
var fiveThings = new Array(5);

// Using object literal notation
var myObject = {};

// Literals are more succinct
var foo = "foo";
var answer = 42;
var fiveThings = [1, 2, 3, 4, 5];
var basketOfFruit = {
   mangosteens: 5,
   kiwis: false,
   figs: "plenty"
};
```

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Objects Are Loose Containers

- At their core, objects are just maps
- `new Object()` or `{}` returns an empty container of key/value pairs
- Keys can be any string, values can be anything
- Two different ways to access members:

```
basketOfFruit.kiwis; // dot notation
basketOfFruit["figs"]; // subscript notation
```

- You can add new members to any object at any time

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Objects Are Modifiable

```
var basketOfFruit = {};

// New property
basketOfFruit.apples = "macintosh";

// New method
basketOfFruit.eat = function () {
    return “tasty”;
}
```

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No Classes

- JavaScript doesn't have any concept of classes
- Methods are just properties in a container:
  - pass them around
  - modify them
  - delete them

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No Classes

Duck typing:

If it walks like a duck and quacks like a duck, it's a duck.

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Part 2: Functions & Scope

- Functions are first class
- Ways to call a function
- Determining types
- Prototypal Inheritance
- Understanding this
- Closures

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First Class Functions

- Functions are data
- You can assign them
- You can pass them as arguments
- You can return them as results
- Functions can contain member variables

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Defining and Using Functions

```
var juicePuree = function (aFruit) {
    return puree(aFruit);
};
function squeezeJuice(aFruit) {
    return squeeze(aFruit);
}
function popsicle(juiceMakerFn, fruit) {
    var juice = juiceMakerFn(fruit);
    freeze(juice);
}
```

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What Does This Mean?

- No more anonymous inner classes!
- You can pass bits of logic around and have them be invoked later
- Callbacks are easy to write and ubiquitous

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Ways to Call a Function

```
// Plain old function call
popsicle(arguments);

// Calling a method on an object
var meal = {appetizer: "kiwi", dessert: function popsicle() { ..}};
meal.dessert(arguments);
meal["dessert"](arguments);

// Tricky context substition
var dessert = meal.dessert;
dessert.apply(thisObject, [arg1, arg2]);
dessert.call(thisObject, arg1, arg2);

// As a constructor...
```

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Constructor Functions

- No classes in JavaScript, so how do we define new objects?
- Instantiate a function using the new keyword
- Any function can be used as a constructor
- Conventional to use `CamelCaseLikeThis`.

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Constructor Functions

```
function Apple(type, colour) {
  this.type = type;
  this.colour = colour;
};

var macintosh = new Apple("macintosh", "red");
```

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.constructor

- All objects have a `.constructor` property
- It points to the function that created the instance

```
var macintosh = new Apple("macintosh", "red");
macintosh.constructor === Apple

var plainOldObject = {foo: "foo"};
plainOldObject.contructor === Object
```

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Determining Types

- JavaScript has a typeof keyword for determining type

```
var plum = "yum";
if (typeof plum === "string") {
    alert("Plum is  a String!");
}
```

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Typeof is Innacurate

```
// Inaccurate results for some built-in types
typeof(new Object()) // 'object'
typeof(new Array()) // 'object'
typeof(new Function()) // 'function'
typeof(new String()) // 'string'
typeof(new Number()) // 'number'
typeof(Boolean()) // 'boolean'
typeof(null) // 'object'
typeof(undefined) // 'undefined'
```

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Typeof is broken

```
// typeof is useless for custom types
function Apple(type, colour) {};
typeof(new Apple()) // 'object'
```

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Better Ways to Check Types

```
function DragonFruit() {};

// Check the .constructor property
var myFruit = new DragonFruit();
myFruit.constructor === DragonFruit;

// Use instanceof
(myFruit instanceof DragonFruit)
```

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Prototypal Inheritance

- Did I mention that JavaScript doesn't have classes?
- Inheritance is based on prototypes:

> "Give me an object that is like that one over there."

- Constructor functions have a .prototype property
- It points to an object that provides base functionality

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Setting Prototypes

```
var Animal = function() {
      this.sound = "growl";
      this.species = "mammal";
};

var Cat = function(colour) {
      this.colour = colour;
      this.sound = "meow";
};
Cat.prototype = new Animal();

var felix = new Cat(black);
felix.sound === "meow"; // Resolved directly at Cat.
felix.species === "mammal"; // Resolved at Cat.prototype.species

// Felix now has a species property, and the value defined by Animal will be ignored.
felix.species = "insect";
```

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Dynamically Modifying Types

```
Cat.prototype.claws = function () {
    return "Ouch!";
}

var garfield = new Cat();
garfield.claws(); // "Ouch!"

// Felix is automatically updated with the claws function.
felix.claws(); // Also "Ouch!"
```

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Don't Extend Built-in Types

- Dynamic objects are awesome. But dangerous.
- Looseness allows us to change contracts for everyone
- Different scripts share the same browser window
- They all share the basic types
- Modifying built-in functionality will break things

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Breaking Built-in Types

```
Object.prototype.keys = function () {
    var keys = [];
    for (prop in this) {
       keys.push(prop);
    }
    return keys;
}

var myKeys = {foo: "foo", bar: "bar"}.keys();
console.debug(myKeys); // [foo, bar, keys];
```

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this

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Context and `this`

- JavaScript this pointer seems wild and unpredictable
- It points to different objects depending on the context
- Subtle, confusing, and powerful

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Global `this`

- In the global space, this points to the Global object
- In a browser, `this === window`

```
this.pie = "apple";
pie === "apple";
window.pie === "apple";
```

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Function Scope `this`

```
function bake(aPie) {
  this.pie = aPie;
};
bake("cherry");
pie === "cherry"
window.pie === "cherry"
```

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Object Instances

- The new keyword instantiates a new object
- *this* pointer is automatically assigned to the new instance

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Object this

```
function Pie(fruit, flour) {
    this.fruit = fruit;
    this.bottomCrust = flour;
    this.topping = "chocolate";
};

Pie.prototype.showMeThis = function () {
    return this;
}

var applePie = new Pie("apple", "wholeWheat");
applePie.showMeThis() === applePie;
```

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Constructors are Just Functions

```
Pie("cherry", "flax");
window.fruit === "cherry";
window.bottomCrust === "flax";
window.topping === "chocolate";
```

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Borrowing Functions and *this*

```
var applePie = new Pie("apple", "wholeWheat");
var showPie = applePie.showMeThis;
      // Note the lack of brackets.

// We've detached the method from its context
// so 'this' reverts back to the Global object
showPie() === window;
```

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Substituting Contexts

```
var cake = new Cake("peach", "chocolate");
var showPie = applePie.showMeThis;

var cakePie = showPie.call(cake, null);
cakePie === cake;
```

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No Block Scope

```
// Blocks don't have scope in JavaScript
var fruits = ["apples", "oranges", "lemons"];
for (var i = 0; i < fruits.length; i++) {
  var currentFruit = fruits[i];
}
// The incrementor and currentFruit variables
are still in scope!
i === 3;
currentFruit === "lemons";
```

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Functions Have Scope

```
function cherryPicker(cherryTree) {
    function picker(branch) {
        var cherries = branch.pickCherries();
        cherries.wash();
        return cherries;
    }

    var basketOfCherries = [];
    for (branch in cherryTree) {
        var someCherries = picker(branch);
        basketOfCherries.push(someCherries);
    }

    return basketOfCherries;
}

var cherries = cherryPicker(hugeTree);
picker === undefined;
```

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Closures

- You can define a function inside another function
- Inner functions have access to the outer function's variables
- A closure is formed by returning the inner function from the outer function
- The inner function will still have access to all the variables from the outer function

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A Simple Closure

```
function addNumbers (a, b) {

    function addEmUp (c) {
       return a + b + c;
    }

    return addEmUp;
}
var add = addNumbers(1, 2); // add is a Function
add(3); // Result is 6.
```

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Closures Simplify Event Handlers

```
function showMessage(messageToDisplay) {
     var todaysPie = "Banana creme pie";

     return function(event) {
        alert(messageToDisplay + " " + todaysPie);
        showPictureOfPie(event.target, todaysPie);
     }
}
```

```
var clickHandler = showMessage("Welcome to my pie shop. Today's pie is:")
$(element).click(clickHandler);

$(element).click() // Shows an alert that reads "Welcome to my pie shop. Today's pie is: Banana creme pie"
```

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How Is This Possible?

- Each invocation of a function runs in its own execution context
- The execution context holds helpful information:
  - arguments to the function call
  - a scope chain, which stores variable declarations
  - the `this` pointer
- Identifiers are resolved against the context's scope chain
- This means that inner scopes can access variables in the outer scope

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Global

Variables[]

- messageClickHandler

showMessage()

Variables[]

- messageToDisplay
- todaysPie

function()

Variables[]

- event

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Javascript Toolkits

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what's the problem?

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Javascript is tricky?

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No

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Javascript is easy

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What is hard?

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Example: Events

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Example: Events

```
Microsoft Internet Explorer
   = element.attachEvent('onclick',doSomething);

W3C Way (everyone else)
   = element.addEventListener('click',doSomething,false);
```

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Example: Events

```
if (myBtn.addEventListener) {
    myBtn.addEventListener('click',doSomething(),false);
} else {
    myBtn.attachEvent('onclick',doSomething());
}
```

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Example: Events

```
function addEvent(element, type, handler) {
    if (element.addEventListener) {
       element.addEventListener(type, handler, false);
    } else {
       element.attachEvent('on'+type, handler);
    }
}
```

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Example: Events

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Example: Events

```
        }
}
// a counter used to create unique IDs
addEvent.guid = 1;

function removeEvent(element, type, handler) {
        if (element.removeEventListener) {
                element.removeEventListener(type, handler, false);
        } else {
                // delete the event handler from the hash table
                if (element.events && element.events[type]) {
                        delete element.events[type][handler.$$guid];
                }
        }
}

function handleEvent(event) {
        var returnValue = true;
        // grab the event object (IE uses a global event object)
        event = event || fixEvent(((this.ownerDocument || this.document || this).parentWindow || window).event);
        // get a reference to the hash table of event handlers
        var handlers = this.events[event.type];
        // execute each event handler
        for (var i in handlers) {
                this.$$handleEvent = handlers[i];
                if (this.$$handleEvent(event) === false) {
                        returnValue = false;
                }
        }
        return returnValue;
}

function fixEvent(event) {
        // add W3C standard event methods
        event.preventDefault = fixEvent.preventDefault;
        event.stopPropagation = fixEvent.stopPropagation;
        return event;
}

fixEvent.preventDefault = function() {
        this.returnValue = false;
};

fixEvent.stopPropagation = function() {
        this.cancelBubble = true;
};
```

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browser differences...

too many to list...

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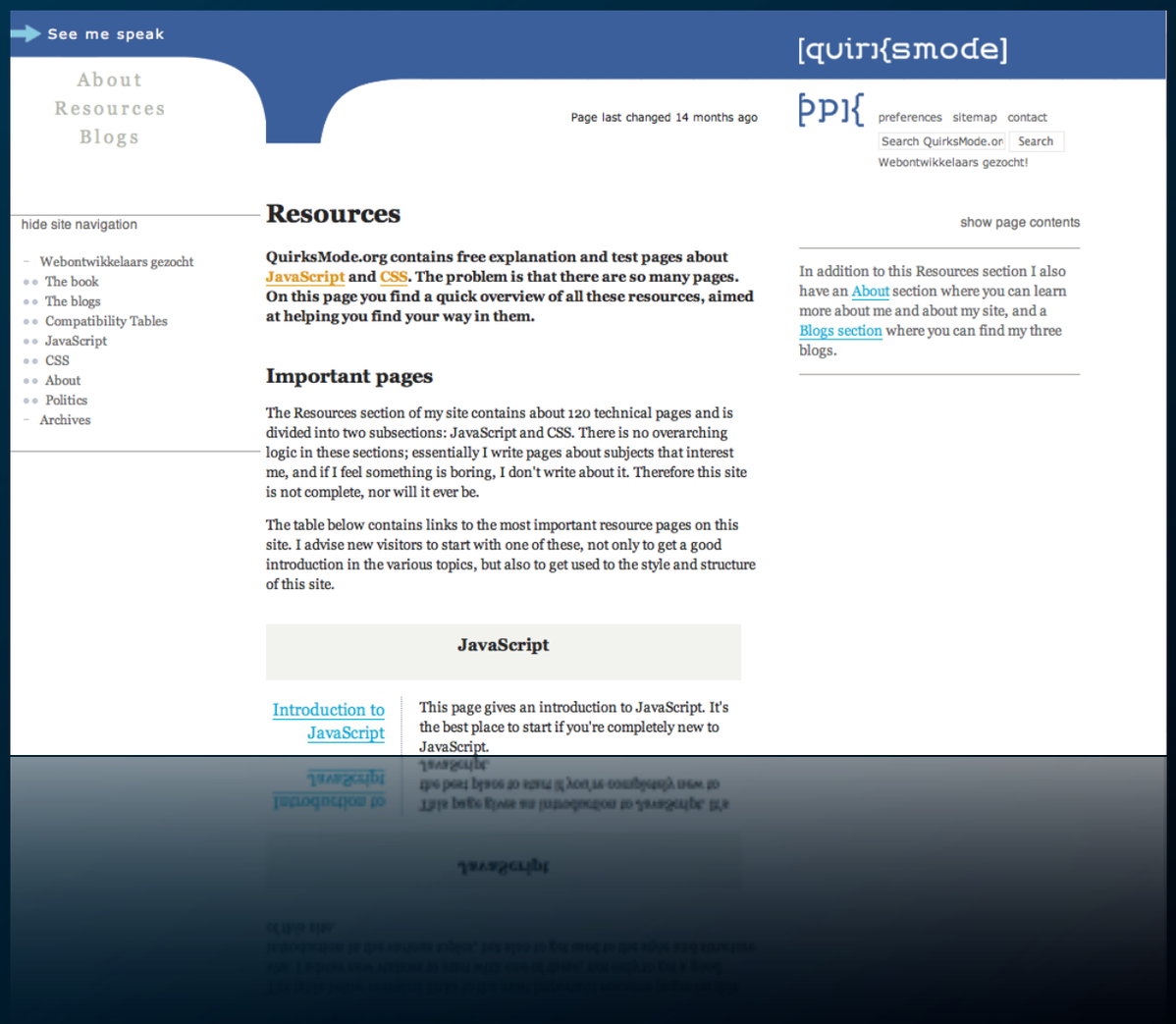
QuirksMode

www.quirksmode.org



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Example: DOM Selection

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Example: DOM Selection

visual representation of the
DOM for http://uPortal.org

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Example: DOM Selection

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Example: DOM Selection

find something and do something with it

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Example: DOM Selection

```
var elm = document.getElementById('myButton');

var elms = document.getElementsByTagName('tr');
```

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Example: DOM Selection

```
var myItems =
  document.getElementById("myList")
    .getElementsByTagName("li");
```

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Example: DOM Selection

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Example: DOM Selection

```
by id
by class
by parent
by child
by sibling
by attribute
by function
```

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Example: DOM Selection

by a combination of any and all of these

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What is hard?

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What is hard?

- browser inconsistencies and bugs

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What is hard?

- browser inconsistencies and bugs
    - Browser Abstraction

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What is hard?

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What is hard?

- complex data and user interfaces in web applications

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What is hard?

- complex data and user interfaces in web applications
    - DOM traversal, selection, and manipulation

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What is hard?

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What is hard?

- subtle and varied high-quality user interactions

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What is hard?

- subtle and varied high-quality user interactions
    - event binding must be easy and dynamic

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What is hard?

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What is hard?

- the call and response of asynchronous client-server interaction

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What is hard?

- the call and response of asynchronous client-server interaction
    - quick, responsive, bullet-proof AJAX functionality

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foundational toolkits

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enabling and enhancing

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leveraging someone else's pain

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thousands of toolkits?

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thousands of toolkits?

- single problem solutions

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thousands of toolkits?

- single problem solutions
- widgets

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The Fluid Criteria

- Cross-browser support
- Easy debugging
- Event abstraction
- A solid DOM manipulation library
- A strong community and clear roadmap for improvements
- Accessibility

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Leading Toolkits

- Prototype / script.aculo.us
- Dōjō / dijit
- YUI YAHOO!
- GWT Google™
- MooTools
- MochiKit
- jQuery

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do more or less the same things, but they do them in very different ways
what I mean from by a philosophy is that the toolkits reflect the linguistic-bias of the people who wrote them
prototype feels like Ruby
Dojo attempts to bring to Javascript the classical inheritance of Java
in GWT you actually write Java which then is compiled into Javascript ... did half the room just wake up?

Why use jQuery?

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- The Fluid project had done extensive work in Dojo before settling on jQuery.
- We had high hopes for Dojo because it was the first library to really embrace accessibility... and we're all about accessibility on Fluid
- But we ran into issues with Dojo and their widget library Dijit which made it difficult to move forward...
    - So after a frantic week of rewriting one of our components in a handful toolkits we settled on...

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    - So after a frantic week of rewriting one of our components in a handful toolkits we settled on...

jQuery

jQuery was built with the skills of Web developers in mind. It doesn't try to be another language, it attempts to support and advance the inherent strengths of Javascript, prototypical inheritance, functions as first-class objects, and it's strengths are in how easy it is to find and work with the DOM - the HTML, the stuff of web sites and web applications

jQuery

Write Less, Do More

jQuery was built with the skills of Web developers in mind. It doesn't try to be another language, it attempts to support and advance the inherent strengths of Javascript, prototypical inheritance, functions as first-class objects, and it's strengths are in how easy it is to find and work with the DOM - the HTML, the stuff of web sites and web applications

jQuery

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jQuery

- DOM selection and manipulation
  - using CSS selectors
- Event management
- Effects and Animation

Fluid

jQuery

- DOM selection and manipulation
  - using CSS selectors
- Event management
- Effects and Animation
- AJAX

Fluid

jQuery

- DOM selection and manipulation
  - using CSS selectors
- Event management
- Effects and Animation
- AJAX
- jQuery UI

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finding something without jQuery

```
var myItems =
  document.getElementById("myList")
    .getElementsByTagName("li");
```

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finding something with jQuery

```
var myItems = jQuery('#myList li');
```

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finding something with jQuery

```
jQuery('#myList li.highlighted');

jQuery('table.foo tbody tr:even');

jQuery('div > p');
```

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jump out to 1st example

doing something

```
function stripeListElements(listID) {
    // get the items from the list
    var myItems =
    document.getElementById(listID).getElementsByTagName("li");
    // skip line 0 as it's the header row
    for(count = 0; count < myItems.length; count++) {
        if ((count % 2) === 0) {
            myItems[count].className = "odd";
        }
    }
}
```

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doing something with jQuery

```
function stripeListElements(listId) {
    jQuery('#' + listId + " li:even").addClass("odd");
}
```

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zero-based foo

doing something with jQuery

```
function stripeListElements(listId) {
    jQuery('#' + listId + " li:even").addClass("odd");
}
```

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zero-based foo

Learning jQuery

Fluid

online documentation

jQuery.com

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The basics

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Finding stuff in the DOM

```
jQuery('selector')
```

selectors can be

- tags: `jQuery('tr')`
- ids: `jQuery('#myId")`
- classes: `jQuery(".myClass")`
- and various combinations there of

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Doing something with it

```
$('.some-hidden-thing').show();

$('.some-hidden-thing').fadeIn('slow');

$('<li>A new list item</li>').appendTo('#myList');

$('#myList li:last').replaceWith('<li>A new list item</li>');

$('div.container').clone().appendTo(‘body’);
```

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Attaching Events

```
$('.button').click(function(){
     doSomething();
});

$('.button').hover(function(){
     jQuery(this).addClass('hilite');
}, function(){
     jQuery(this).removeClass('hilite');
});

$('.button').focus(function(){
     jQuery(this).addClass('hilite');
});

$('.button').blur(function(){
     jQuery(this).addClass('hilite');
});
```

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Attaching Events : chaining

```
$('.button').addClass('buttonClass);

$('.button').click(doSomething()});
```

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Attaching Events : chaining

```
$('.button').addClass('buttonClass).click( doSomething());
```

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One Special Event

```
$(document).ready();
```

```
$(document).ready(
    jQuery('#aList li:even").addClass("odd");
);
```

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jQuery

- Google (in Google Code)
- Bank of America
- Source Forge
- Sakai
- Drupal
- BBC
- Dell
- Slashdot
- Engadget

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How to Build a Portal-Friendly UI

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Portals Are Hard

- Multiple instances: namespacing is essential
- Lots of different JavaScript code running
- High chance of collisions
- Can't expect control of the document

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Writing Portal-Friendly JavaScript

- Put code in a unique namespace
- Use closures for privacy
- Be unobtrusive
- Support multiple instantiation
- Constrain selectors to a specific fragment

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Start With a Unique Namespace

```
// Add on to the fluid object if it exists
// otherwise initialize it as an empty object.

var fluid = fluid || {}
```

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Use Closures for Privacy

```
(function() {
    function myPrivateFunction () {
    }

    fluid.Tabs = function () {
        // Constructor function.
    };
}) ();
```

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Keep Common Aliases Private

Pass important dependencies in as an argument to the closure:

```
jQuery.noConflict();

(function ($) {
  // The $ variable is only visible inside our
  private space.
  $ === jQuery;
}) (jQuery);

$ === undefined;
```

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Support Multiple Instances on the Same Page

- Don't share global variables, encapsulate state
- Parameterize CSS class names so different instances can be styled differently
- Constrain your searches to a unique container

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Multiple Instance Support

```
function Tabs(parentContainerId, itemsSelector, cssClasses) {
     this.componentContainer = jQuery("#" + parentContainerId);
     this.items = jQuery(itemsSelector);
     this.currentlySelectedItem = items[0];
     this.classNames = cssClasses;
};

var portalTabs = new Tabs("portalTabs", "li", {selected:
"portalTabs-selected"});

var portletTabs = new Tabs("myPortlet-tabs", "li", {selected:
"myPortlet-selected"});
```

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Don't Wildly Scan by Class

```
jQuery(".highlighted", jQuery(this.componentContainer));
```

not

```
jQuery(".highlighted");
```

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Fluid Components

We use all these techniques and a few more:

- Unobtrusiveness
- DOM Agnosticism
- Highly configurable

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Fluid Design Goals

- Components should be customizable
- Skinnable with style sheets
- Customize the structure and appearance by modifying HTML
- Inject custom handlers and logic
- Accessible from the start

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Unobtrusiveness

Separation of code and content

```
jQuery("#myItem").click(
  function () { alert "foo";}
);
```

not

```
<div id="myItem" onclick="function()
{ alert('foo') };">
```

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Don't Make Assumptions About the DOM

- Don't make assumptions that will prevent customization...
- Flexible containment hierarchy
- Types of elements
- Class names

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Allow Users to Specify Their Own Selectors

- Components bind to a set of "interesting things"
- Use jQuery selectors to form these bindings, but make them configurable
- Otherwise, if the HTML changes, your hard-coded selectors will break
- Allow users to pass in their own alternate

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```
function Tabs(elementSelectors) {
  this.selectors = jQuery.extend({},
  elementSelectors, defaults.selectors);
}
```

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Good Defaults

```
defaults: {
    selectors: {
        tabContainer: "#tabList",
        tabs: "#tabList li",
        tabPanels: "#panels div",
    },
    styleNames: {
        selected: "key-highlight",
        focussed: "highlight",
        disabled: "dim"
    },
    activate: function () {
    alert("Doesn't do anything in this prototype. " +
              "Add your own activate function here!");
    },
    showDebugPane: false
}
```

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Provide Useful Extension

```
function Tabs() { ... };
Tabs.prototype.shouldSelect(element) { ... };
Tabs.prototype.willSelect(element) { ... };
Tabs.prototype.willDisplayPanel(forTab) { ... };
var myTabs = new Tabs();
myTabs.shouldSelect = function (tab) {
    return (!tab.is(".disabled"));
}
myTabs.willDisplayPanel = function (activeTab) {
    getContentFromServerForTab(activeTab);
}
```

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JavaScript Accessibility

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What is Accessibility?

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A New Definition

- Accessibility is the ability of the system to accommodate the needs of the user
- Disability is the mismatch between the user and the interface offered by the system
- We all experience disability

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Fluid's a11y Vision

- Embrace diversity: one size doesn't fit all
- Recognize different needs under different circumstances
- Build systems that can bend and adapt to meet those user needs

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Accessible is Better

- The **curb cut effect**: everyone benefits
- Interoperable
- Easier to reuse and repurpose
- Better future-proofing
- More robust
- Works on more devices

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Familiar Techniques

- Label images with alt text
- Label form fields with `<label>` tags
- Skip links and access keys
- Use semantic markup

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A New Can of Worms

- The shift from document to application
- The familiar techniques aren't enough
- Most DHTML is completely inaccessible
- New techniques are still being figured out

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Assistive Technologies

- Present and control the user interface in alternative ways
- Screen readers
- Screen magnifiers
- On-screen keyboards
- Use built-in operating system APIs to understand the user interface

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The Problem

- Custom widgets often look but don't act like their counterparts on the desktop
- HTML provides only simple semantics
- Not enough information for ATs
- Dynamic updates require new design strategies to be accessible

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The Solution

- Describe user interfaces with ARIA
- Add consistent keyboard controls
- Provide flexible styling and presentation

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Keyboard Accessibility

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Keyboard Navigation

- Everything that works with the mouse should work with the keyboard
- ... but not always in the same way
- Support familiar conventions

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Keyboard Conventions

- **Tab** key focuses the control or widget
- **Arrow keys** select an item
- **Enter** or **Spacebar** activate an item

- Tab is handled by the browser. For the rest, you need to write code.

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Tabbing and Tabindex

- Each focusable item can be reached in sequence by pressing the Tab key
- Shift-Tab moves backwards
- The `tabindex` attribute allows you to customize the tab order
- `tabindex="1"` removes element from the tab order: useful for custom handlers

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Tabindex examples

```
<!-- Tab container should be focusable -->
<ul id="animalTabs" tabindex="0">
  <!-- Individual Tabs shouldn't be focusable -->
  <!-- We'll focus them with JavaScript instead -->
  <li id="tab1" tabindex="-1">Cats</li>
  <li id="tab2" tabindex="-1">Dogs</li>
  <li id="tab3" tabindex="-1">Alligators</li>
</ul>
```

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Setting Tabindex with jQuery

```
// Put the tab list in the tab order.
jQuery("#animalTabs").tabindex(0);

// Remove the individual tabs from the tab order.
// We'll focus them programmatically with the arrows.
jQuery("#animalTabs li").tabindex(-1);
```

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Handling Focus Events

```
// Make the tabList focusable with Tab.
var tabList = jQuery("#animalTabs").tabbable();

// Make the tabs selectable with the arrow keys.
var tabs = jQuery("li", tabList);
tabs.selectable(tabList, {
  willSelect: function(aTab) {
    aTab.addClass("highlight");
  }
});
```

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Adding Activation Handlers

```
// Make each tab activatable with Enter & Spacebar
tabs.activatable(function(aTab) {
  alert("You just selected: " + aTab.text());
});
```

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Supporting Assistive Technology

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Opaque Markup

```
// These are tabs. How would you know?
<ul>
   <li>Cats</li>
   <li>Dogs</li>
   <li>Gators</li>
</ul>
<div>
   <div>Cats meow.</div>
   <div>Dogs bark.</div>
   <div>Gators bite.</div>
</div>
```

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ARIA

- Accessible Rich Internet Applications
- W3C specification in the works
- Fills the semantic gaps in HTML
- Roles, states, and properties
- Live regions

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Roles

- Describe widgets not present in HTML 4
- `slider, menubar, tab, dialog`
- Applied using the `role` attribute

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States and Properties

- Added to elements within the DOM
- Properties describe characteristics:
  - `draggable, hasPopup, required`
- States describe what's happening:
  - `busy, disabled, selected, hidden`
- Applied using custom `aria-` attributes

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Using ARIA

```
// Now *these* are Tabs!
<ul id="animalTabs" role="tablist" tabindex="0">
  <!-- Individual Tabs shouldn't be focusable -->
  <!-- We'll focus them with JavaScript instead -->
   <li id="cats" role="tab" tabindex="-1">Cats</li>
   <li id="dogs" role="tab" tabindex="-1">Dogs</li>
   <li id="gators" role="tab" tabindex="-1">Gators</li>
</ul>
<div id="panels">
   <div role="tabpanel" labelledby="cats">Cats meow.</div>
   <div role="tabpanel" labelledby="dogs">Dogs bark.</div>
   <div role="tabpanel" labelledby="gators">Gators bite.</div>
</div>
```

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Setting ARIA with jQuery

```
var tabContainer = jQuery(“#animalTabs”);
tabContainer.ariaRole(“tablist”);

var tabs = jQuery(“li”, tabContainer);
tabs.each(function(idx, item) {
   jQuery(item).ariaRole(“tab”);
});
tabs.eq(0).ariaState(“selected”, “true”);
```

```
var panels = jQuery(“#panels > div”);
panels.each(function(idx, item) {
   jQuery(item).ariaRole(“tabpanel”);
};
```

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Live Regions

- Stock tickers, Ajax validation, etc.
- Need to identify areas that are updated
- Associate controls with live content
- Types of changes (add/remove/modify)
- Is it appropriate to interrupt the user?

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Be Polite

- `aria-live="polite"`: only announce if nothing else is going on.
- `aria-live="assertive"`: Announce ASAP, but don't interrupt.
- `aria-live="rude"`: Updates are extremely important. Interrupt immediately.

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Things to Think About

- What kind of UI are you building?
- Does it resemble something familiar?
- What states or modes does it have?
- Can you reuse an existing widget?

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Accessibility Resources

- http://wiki.fluidproject.org/display/fluid/DHTML+Developer+Checklist
- http://wiki.fluidproject.org/display/fluid/UX+Accessibility+Walkthrough+Protocols
- http://developer.mozilla.org/en/docs/Accessible_DHTML
- http://developer.mozilla.org/en/docs/Key-navigable_custom_DHTML_widgets
- http://developer.mozilla.org/en/docs/AJAX:WAI_ARIA_Live_Regions

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Where to go next?

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Resources

- Fluid DHTML Developers Checklist
- Fluid Javascript Resources
  - Links to our favorite JS Resources

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Tools

- Firefox
- Firebug
- JSLint in Eclipse or Aptana
- IE Debugging
  - Script Debugger in the free version of Visual Studio for the Web

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Q & A

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