CS 696 Functional Programming and Design
Fall Semester, 2015
Doc 19 Reagent Examples, Background
Nov 12, 2015

Blog & Video

Curious about ClojureScript, but not sure how to use it

http://timothypratley.blogspot.com/2015/11/curious-about-clojurescript-but-not.html

You task for Tuesday:
- Implement Tick-tack-toe from the video

ClojureScript

No
- Refs
- Agents

def - creates Javascript variable

Google Closure library - optimize

Numbers
- integer & floating point only
- Equality from Javascript
  - (= 0.0 0) => true

:private - not enforced

:const - can not redefine

fn
- no runtime check for arity

Most but not all collection fns are implemented

Almost all Seq library functions are available in ClojureScript

Foo/bar always means that Foo is a namespace

To access JS object properties use a leading hyphen

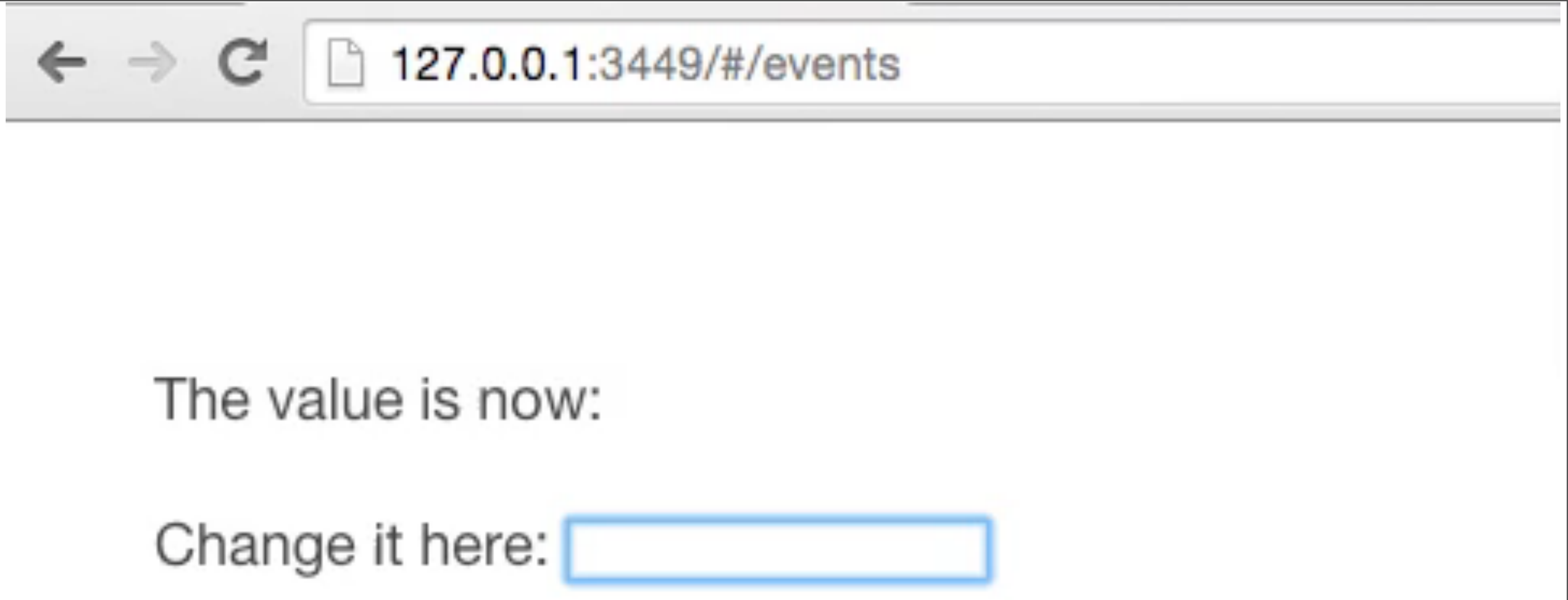
.-target .-value

Some Examples

Set Up

In core

```
(ns firstreagent.core
   (:require [reagent.core :as reagent :refer [atom]]
             [reagent.session :as session]
             [secretary.core :as secretary :include-macros true]
             [goog.events :as events]
             [goog.history.EventType :as EventType]
             [firstreagent.events :as e])
   (:import goog.History))


  (secretary/defroute "/events" []
                   (session/put! :current-page #'e/main))
```


127.0.0.1:3449/#/events

The value is now:

Change it here:

```
(ns firstreagent.events
  (:require  [reagent.core :as r] ))

(defn atom-input [value]
  [:input {:type "text"
           :value @value
           :on-change (fn [event] (reset! value (-> event .-target .-value)))}])

(defn main []
  (let [val (r/atom "foo")]
    (fn []
      [:div
       [:p "The value is now: " @val]
       [:p "Change it here: " [atom-input val]]])))
```

```
[:input {:type "text"
         :value @value
         :on-change (fn [event] (reset! value (-> event .-target .-value)))}]
```

```
<input on-change= "firstreagent.repl$eval13805$fn__13806@3c5b5bae"
    type="text"
    value="cat" />
```

All Three Run

```
[:input {:type "text"
         :value @value
         :on-change (fn [event] (reset! value (-> event .-target .-value)))}]
```

```
[:input {:type "text"
         :value @value
         :on-change (fn [] (reset! value “Cat”))}]
```

```
[:input {:type "text"
         :value @value
         :on-change (fn [event foo] (reset! value foo))}]
```

The Correct handler is Called

```
(def value (r/atom "foo"))

(defn handler
  ([] (reset! value "None"))
  ([event] (reset! value "One"))
  ([event foo] (reset! value "Two"))
  )

(defn atom-input [value]
  [:input {:type "text"
           :value @value
           :on-change handler}])

(defn main []
   (fn []
      [:div
       [:p "The value is now: " @value]
       [:p "Change it here: " [atom-input value]]]))
```

Some DOM Events

Mouse Events

onclick
oncontextmenu
ondblclick
onmousedown
onmouseenter
onmouseleave
onmousemove
onmouseover
onmouseout
onmouseup

Keyboard Events

onkeydown
onkeypress
onkeyup

Form Events

onblur
onchange
onfocus
onfocusin
onfocusout
oninput
oninvalid
onreset
onsearch
onselect
onsubmit

Lot more at

http://www.w3schools.com/jsref/dom_obj_event.asp

DOM -> Reagent event names

onchange -> on-change

onmousemove -> on-mouse-move

DOM Event Objects

Properties

bubbles
cancelable
currentTarget
defaultPrevented
eventPhase
isTrusted
target
timeStamp
type
view

Bubbling

```
<div class="d1">
    <div class="d2">
        <div class="d3">
        </div>
    </div>
</div>
```

If an event occurs in d3

It is sent to the element d3

Then to element d2

Then to elment d1

To stop bubbling

```
event.stopPropagation()   ;;   All modern browsers except IE

event.cancelBubble = true       ;;  IE
```

MouseEvent & KeyEvent Objects

MouseEvent Properties

altKey
button
buttons
clientX
clientY
ctrlKey
detail
metaKey
relatedTarget
screenX
screenY
shiftKey
which

KeyEvent Properties

altKey
ctrlKey
charCode
key
keyCode
metaKey
shiftKey
which

More Dom Events

http://www.w3schools.com/jsref/dom_obj_event.asp

List, tutorial

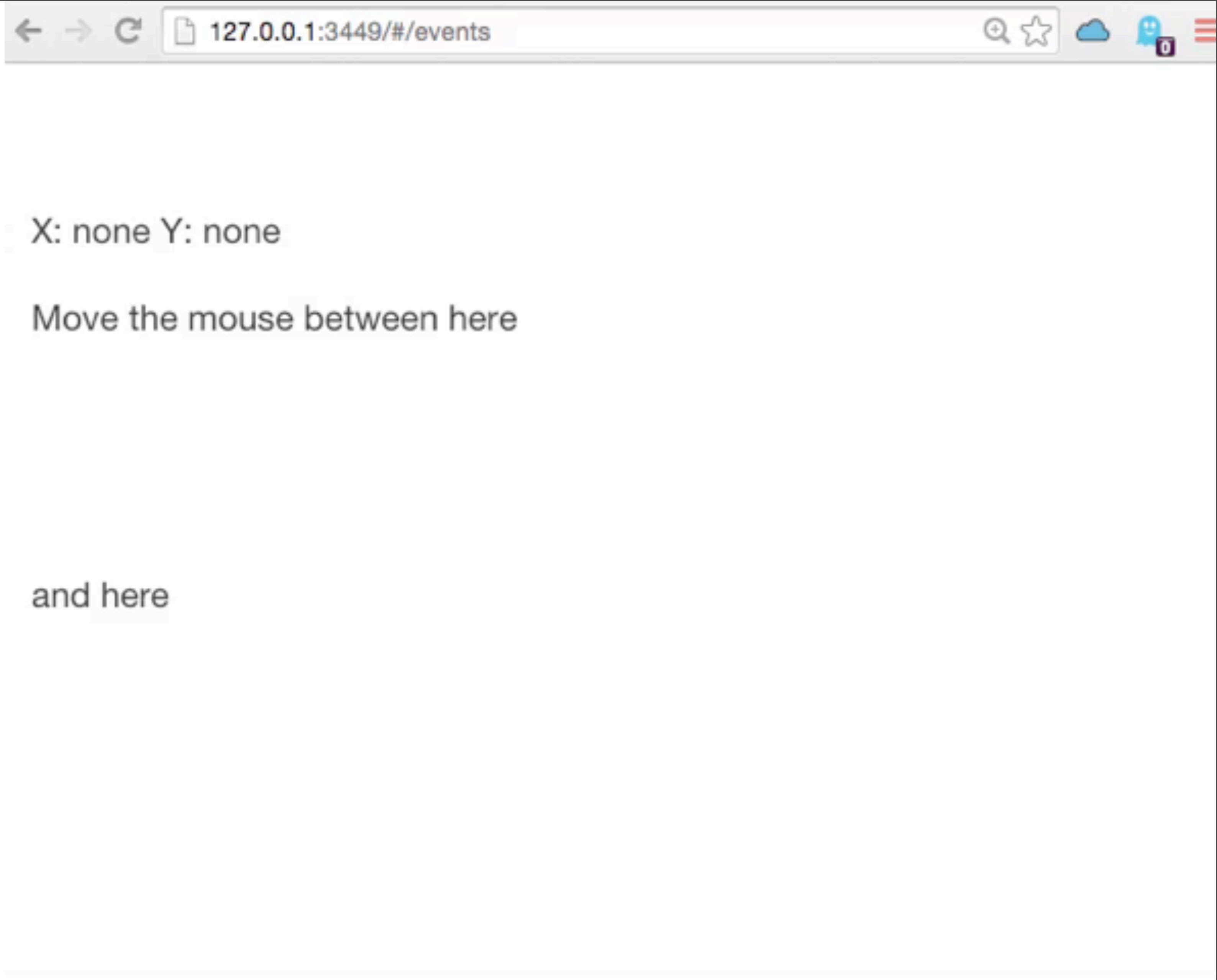
http://quirksmode.org/dom/events/index.html

Browser compatibility

Second Example

In core

```
(ns firstreagent.core
   (:require [reagent.core :as reagent :refer [atom]]
            [reagent.session :as session]
            [secretary.core :as secretary :include-macros true]
            [goog.events :as events]
            [goog.history.EventType :as EventType]
            [firstreagent.events :as e])
   (:import goog.History))


  (secretary/defroute "/events" []
                  (session/put! :current-page #'e/main))
```



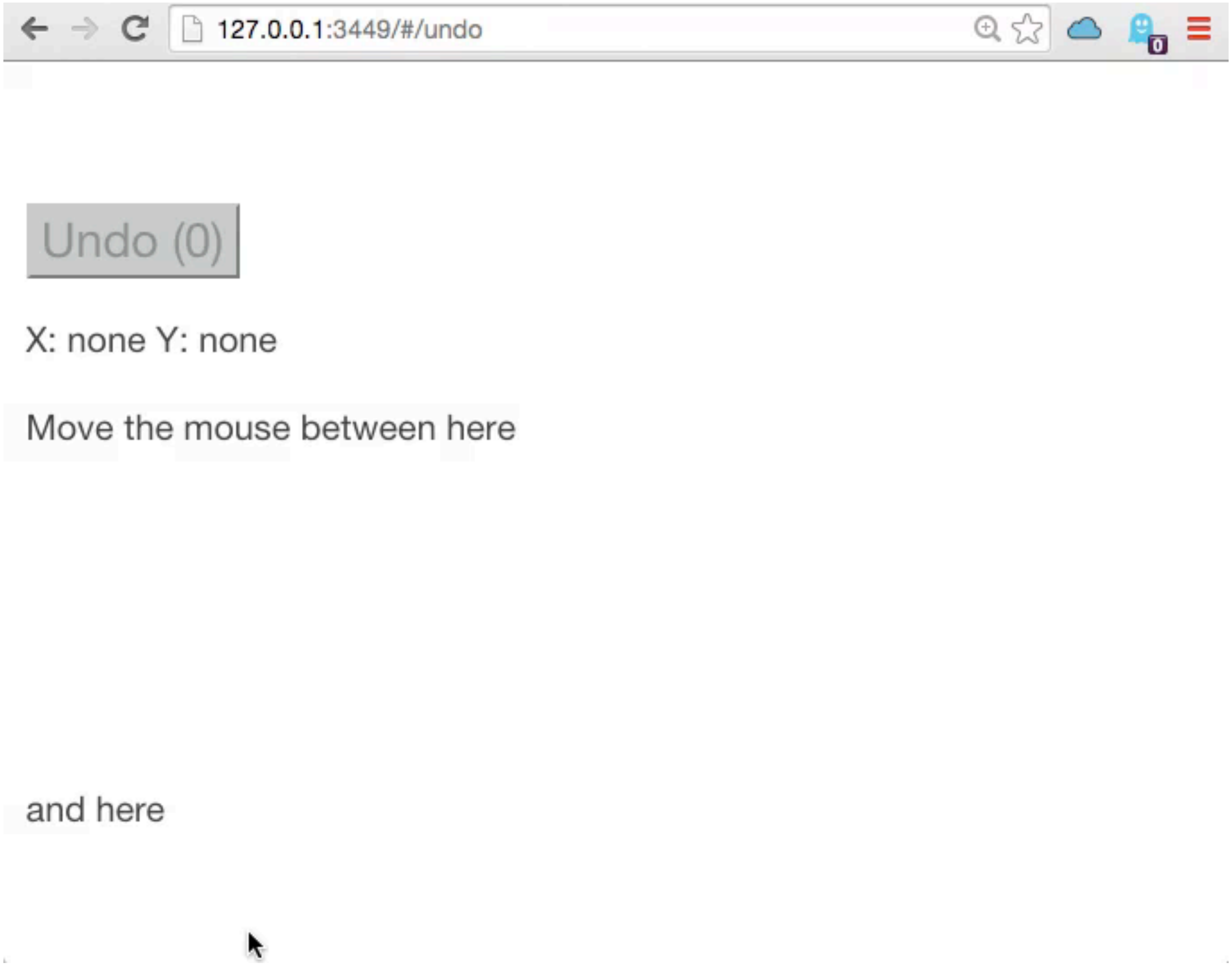
X: none Y: none

Move the mouse between here

and here

```
(ns firstreagent.events
  (:require [reagent.core :as r]))

(defn main []
  (let [value (r/atom {:x "none" :y "none"})]
    (fn []
      [:div {:on-mouse-move #(reset! value {:x (.-clientX %) :y (.-clientY %)})}
       [:p "X:  " (:x @value) " Y: " (:y @value)]
       [:p "Move the mouse between here"]
      (repeat 3 [:br])
       [:p "and here"]])))
```

Undo


127.0.0.1:3449/#/undo

X: none Y: none

Move the mouse between here

and here

Undo

```
(def location (r/atom {:x "none" :y "none"}))

(def undo-list (r/atom nil))

(defn undo []
  (let [undos @undo-list]
    (when-let [old (first undos)]
      (reset! location old)
      (reset! undo-list (rest undos)))))


(defn undo-button []
  (let [n (count @undo-list)]
    [:input {:type "button" :on-click undo
             :disabled (zero? n)
             :value (str "Undo (" n ")")}]))
```

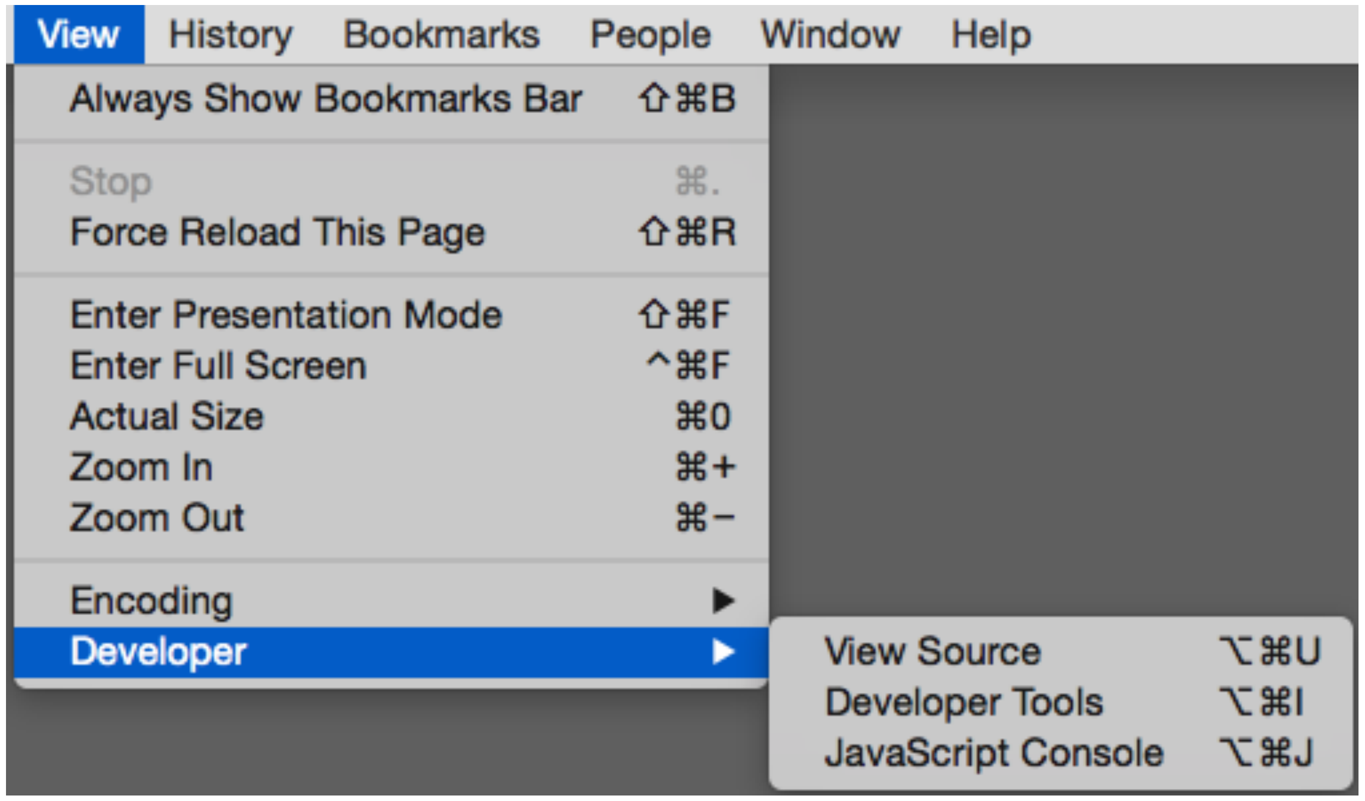
```
(defn track-mouse
  []
  [:div {:on-mouse-move #(reset! location {:x (.-clientX %) :y (.-clientY %)})}
   [:p "X:  " (:x @location) " Y: " (:y @location)]
   [:p "Move the mouse between here"]
   (repeat 5 [:br])
   [:p "and here"]])

(defn main []
  (add-watch location ::undo-watcher
             (fn [_ _ old-state _]
               (swap! undo-list conj old-state)))
  [:div
   [undo-button]
   [track-mouse]]
 )
```

print

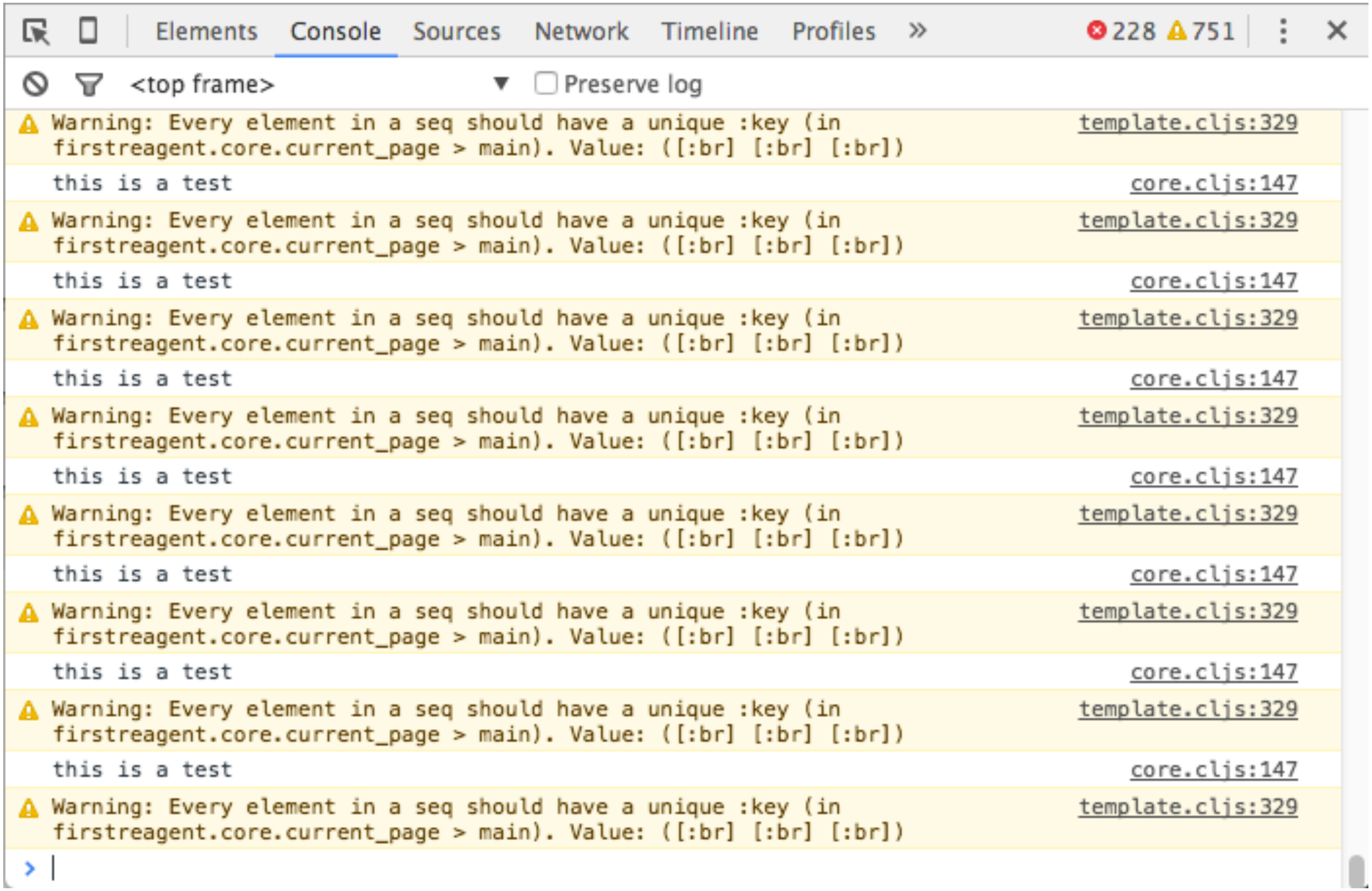
In clojurescript print output will appear in the browser’s JavaScript console

```
(defn main []
  (let [value (r/atom {:x "none" :y "none"})]
    (fn []
      [:div {:on-mouse-move #(reset! value {:x (.-clientX %) :y (.-clientY %)})}
       [:p "X:  " (:x @value) " Y: " (:y @value)]
       [:p "Move the mouse between here"]
       (repeat 3 [:br])
       (print "this is a test")
       [:p "and here"]])))
```

In Chrome


View
History
Bookmarks
People
Window
Help
Always Show Bookmarks Bar ⇧⌘B
Stop ⌘.
Force Reload This Page ⇧⌘R
Enter Presentation Mode ⇧⌘F
Enter Full Screen ^⌘F
Actual Size ⌘0
Zoom In ⌘+
Zoom Out ⌘−
Encoding ▶
Developer ▶
View Source ⌥⌘U
Developer Tools ⌥⌘I
JavaScript Console ⌥⌘J

The Console



```
Warning: Every element in a seq should have a unique :key (in          template.cljs:329
firstreagent.core.current_page > main). Value: ([:br] [:br] [:br])
this is a test                                                             core.cljs:147
Warning: Every element in a seq should have a unique :key (in          template.cljs:329
firstreagent.core.current_page > main). Value: ([:br] [:br] [:br])
this is a test                                                             core.cljs:147
Warning: Every element in a seq should have a unique :key (in          template.cljs:329
firstreagent.core.current_page > main). Value: ([:br] [:br] [:br])
this is a test                                                             core.cljs:147
Warning: Every element in a seq should have a unique :key (in          template.cljs:329
firstreagent.core.current_page > main). Value: ([:br] [:br] [:br])
this is a test                                                             core.cljs:147
Warning: Every element in a seq should have a unique :key (in          template.cljs:329
firstreagent.core.current_page > main). Value: ([:br] [:br] [:br])
this is a test                                                             core.cljs:147
Warning: Every element in a seq should have a unique :key (in          template.cljs:329
firstreagent.core.current_page > main). Value: ([:br] [:br] [:br])
this is a test                                                             core.cljs:147
Warning: Every element in a seq should have a unique :key (in          template.cljs:329
firstreagent.core.current_page > main). Value: ([:br] [:br] [:br])
this is a test                                                             core.cljs:147
Warning: Every element in a seq should have a unique :key (in          template.cljs:329
firstreagent.core.current_page > main). Value: ([:br] [:br] [:br])
>
```

Some Details

Core of a Component

Render function

- Input some data
- Returns Hiccup vector that will be converted to HTML

Source https://github.com/Day8/re-frame/wiki/Creating-Reagent-Components

Three Ways to Create a Component

Render function

    Form-1 component

Function that returns a render function

    Form-2 component

Map of functions, one of which is the render function

    Form-3 component

Render function - Form-1 Reagent Component

```
(defn greet
  [name]                    ;; data coming in is a string
  [:div "Hello " name])
```

~~(defn wrong-component~~
~~[name]~~
~~[[:div "Hello"] [:div name]])~~

```
(defn right-component
  [name]
  [:div
    [:div "Hello"]
    [:div name]])
```

Form-2 Reagent Component

Function that returns a render function

```
(defn timer-component []
  (let [seconds-elapsed (reagent/atom 0)]     ;; setup, and local state
    (fn []        ;; inner, render function is returned
      (js/setTimeout #(swap! seconds-elapsed inc) 1000)
      [:div "Seconds Elapsed: " @seconds-elapsed])))
```

timer-component is called once per component instance

The render function it returns will potentially be called many, many times

Rookie mistake

```
(defn outer
  [a b c]           ;; <--- parameters
  ;;  ....
  (fn [a b c]        ;; <--- forgetting to repeat them, is a rookie mistake
    [:div
      (str a b c)]))
```

Explain why

React Component

React Component - Relevant Parts

Data
- props (properties)
  - Arguments/parameters
- state

Functions
- render (required)
- getInitialState
- getDefualtProps
  - We will not see these two
- create-class
  - Constructor

render function called when props or state change

React Component Lifecycle Methods

componentWillMount
    Called once

componentDidMount
    Called once

componentWillReceiveProps
    Called when receiving new props

shouldComponentUpdate
    Return false to cancel update

componentWillUpdate
    Called before update

componentDidUpdate
    Called after update

componentWillUnmount

Form-3 Reagent Component

Rarely needed

Map of functions
- render function
- Some React component lifecyle methods

```
(defn my-component
  [x y z]
  (let [some (local but shared state)      ;; <-- closed over by lifecycle fns
        can  (go here)]
     (reagent/create-class                ;; <-- expects a map of functions
       {:component-did-mount              ;; the name of a lifecycle function
        #(println "component-did-mount")   ;; your implementation

        :component-will-mount             ;; the name of a lifecycle function
        #(println "component-will-mount")  ;; your implementation

        ;; other lifecycle funcs can go in here

        :display-name  "my-component"  ;; for more helpful warnings & errors
```

When Do Components Update

Reagent Component are Reactive

Each Component has a render function

Render function turns input data into hiccup (HTML)

Render functions are rerun when their input data changes, producing new hiccup

New hiccup is "interpreted" by Reagent and ultimately results in new HTML

Source https://github.com/Day8/re-frame/wiki/When-do-components-update%3F view on 11/11/15

Two Types of Input

props

ratoms - Reagent atoms

Props

```
(defn greet
  [name]         ;; name is a string
  [:div "Hello " name])
```

Name is a prop (property)

greet will be called each time name changes

```
(defn greet
  [name]
  [:div "Hello " name])

(defn greet-family
  []
  [:div
    [greet "Dad"]
    [greet (str "Bro-" (rand-int 10))]])
```

Each time greet-family is rendered

Is subcomponents are checked

If there props have changed
    rerender them

[greet "Dad"] - rendered once

[greet (str "Bro-" (rand-int 10))]
    9 times out of ten rerendered when parent is rerendered

Ratoms

```
(def name  (reagent.ratom/atom "Bear"))

(defn ask-for-forgiveness
  []          ;; <--- no props
  [:div "Please " @name " with me"])
```

ask-for-forgiveness

    rerendered when @name changes

What happens when button is pressed?

parent-renderer is rerun

greet-number’s prop has changed
    so rerun

more-button is not rerun

```
(defn parent
  []
  (let [counter  (reagent.ratom/atom 1)]    ;; the render closes over this state
    (fn  parent-renderer
      []
      [:div
        [more-button counter]            ;; no @ on counter
        [greet-number @counter]])))
```

```
(defn greet-number
  "I say hello to an integer"
  [num]                          ;; an integer
  [:div (str "Hello #" num)])
```

What happens when button is pressed?

```
(defn more-button
  [counter]                          ;; a ratom
  [:div  {:class "button-class"
       :on-click  #(swap! counter inc)}   ;; increment the int value in counter
       "More"])
```

```
(defn parent
  []
  (let [counter  (reagent.ratom/atom 1)]    ;; the render closes over this state
    (fn  parent-renderer
      []
      [:div
        [more-button counter]           ;; no @ on counter
        [greet-number @counter]])))
```

When are things Equal?

```
(def x1  {:a 42  :b 45})
(def x2  {:a 42  :b 45})

(= x1 x2)                 ;; =>  true

(identical? x1 x2)        ;; => false
```

=

    are values same
    Java equals

identical?

    point to the same structure
    Java ==

=

    use to compare props

indentical?

    Used to compare value inside ratoms

Lifecycle Functions

prop changes trigger all lifecycle methods

ratoms changes do not trigger lifecycle methods