Webscraping in R - Final

a short primer

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February 27, 2018

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  as well as the underlying construction of the web page (site)
  often times *(but not always)* determines the level of effort required to do the job...
- HMTL/CSS complexity? HTML tables rendered via javascript? deciphering XML hierarchy?
  Password protected site?....
  - all can determine which packages/functions to utilize in your effort and the overall approach to take

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  - after that, we'll go through dealing with XML-based webdata (using the *XML2R* package)
  - and finish up with using *rdom* or *RSelenium* to parse data from sites that use javascript to dynamically create website content (rvest can't help here...)

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  - And, a link to an interactive doc on the selectr::css_to_xpath function...(likely to come in handy at some point)

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- Additionally, here's a link to a *css-for-dummies* interactive game for getting over the hump
  - going though this will greatly ease anxiety when navigating webpages with complex HTML/CSS structures...
  - And, a link to an interactive doc on the selectr::css_to_xpath function...(likely to come in handy at some point)

    Just a ***little*** bit of knowledge on deciphering CSS (and later, xpath hierarchies for XML-based data) will go a **looooong** ways!

ok - enough now - let's parse some (html) webdata

Example 1:

- from a webpage listing all R User Groups (*website #1*), grab the groups located in the U.S., and filter on the (fairly large) subset that use meetup.com (*website #2*) as their organizational hub.....so we can gather the following attributes:

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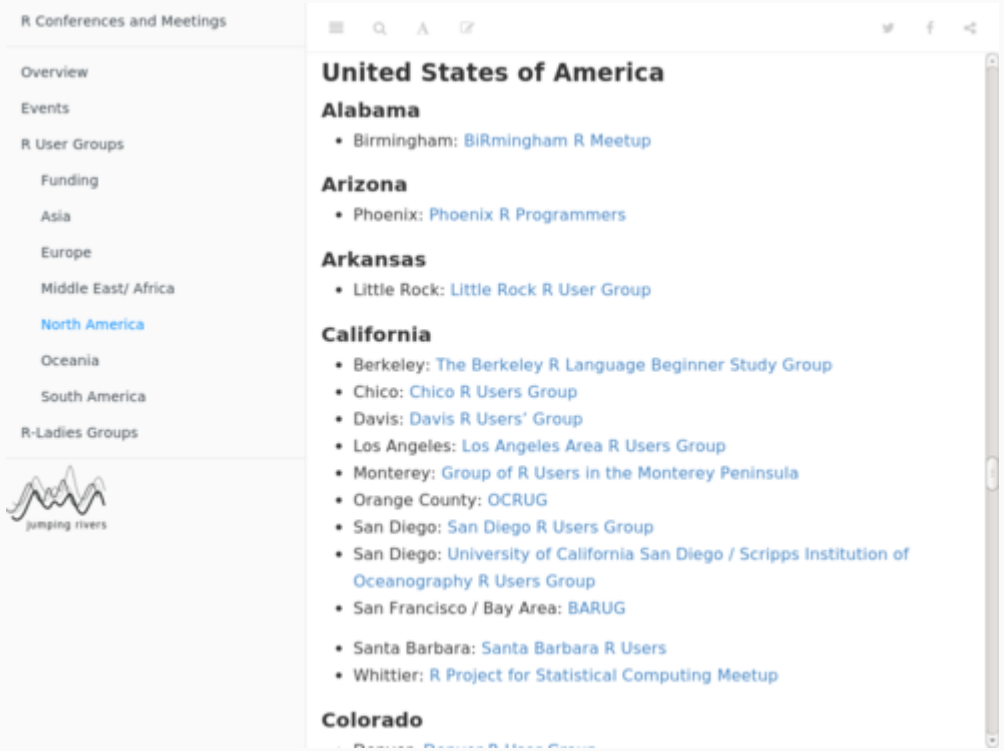
    - location
    - inception date
    - nbr of members
    - nbr of meetings since inception

    NOTE: the 2nd website will be parsed as many times as there are user groups that use meetup.com...not just once!

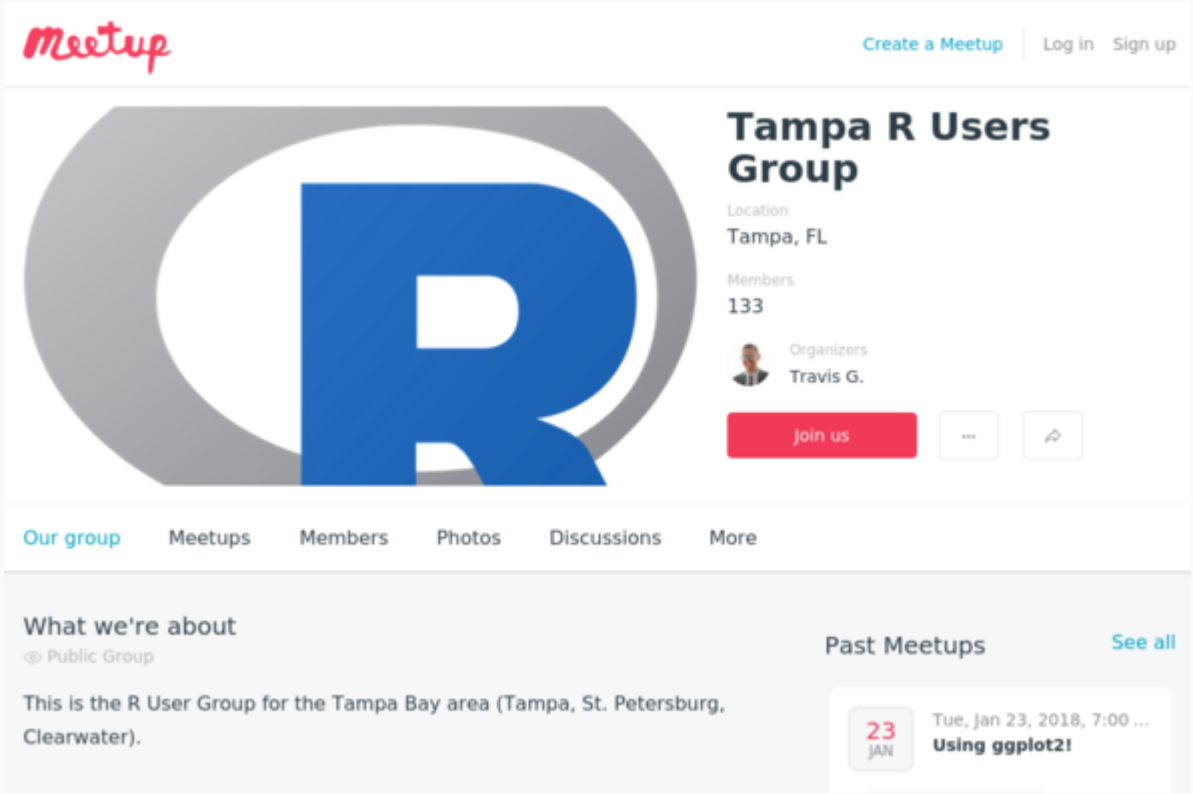
Example 1 - Website 1: R User Groups (in U.S.) parsed one time

https://jumpingrivers.github.io/meetingsR/r-user-groups.html#united-states-of-america



Example 1 - Website 2: meetup.com (parsed multiple times)

https://www.meetup.com/Tampa-R-Users-Group/

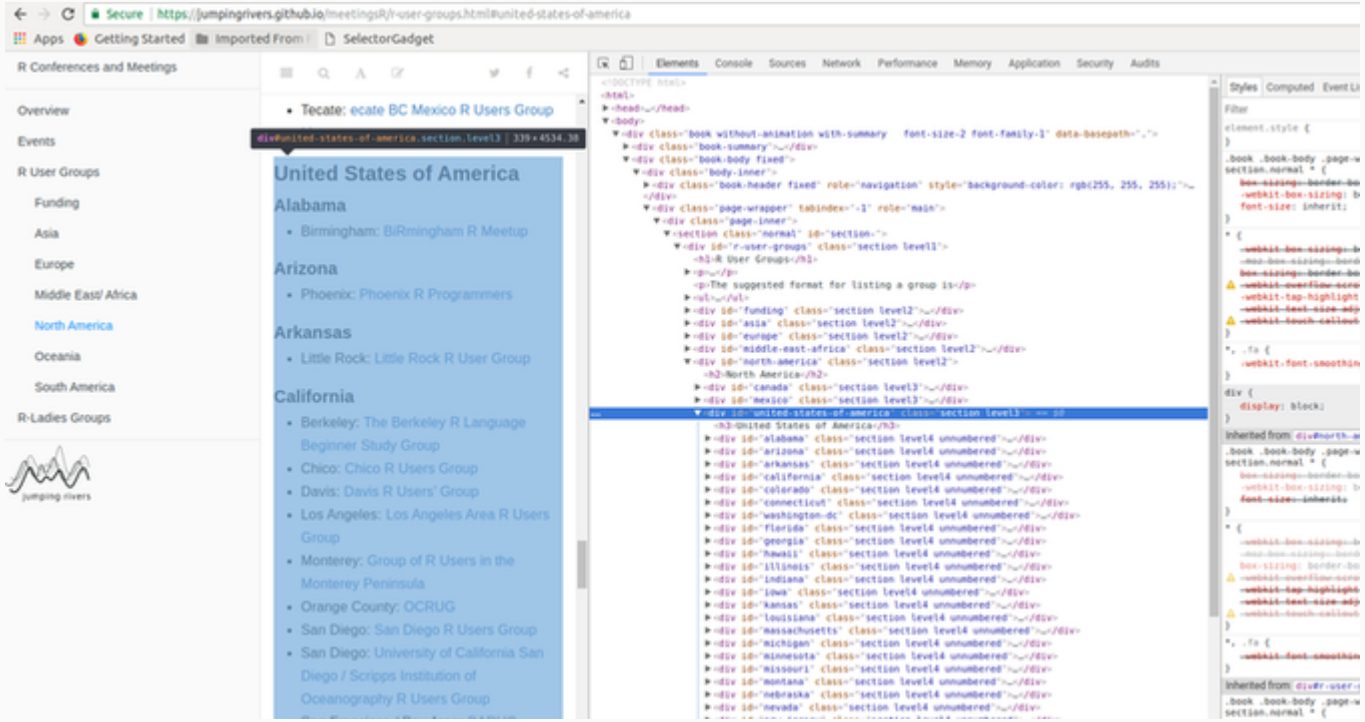


right-click-inspect-element (website #1)

In chrome, *right-click-inspect-element*, and mouse-over the list of R user groups highlighted (in blue!).

The CSS to pass to rvest::html_nodes() is in the **black retangular box**

div#united-states-of-america.section.level3



scrape URLs via css (& xpath)

Now that we have the css, we can use it in the **rvest::html_nodes()** method... as well as pass it to the **selectr::css_to_xpath** method (as a way to show the results will be the same when using **css** or **xpath** parms in the call to **rvest::html_nodes()**

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Now that we have the css, we can use it in the **rvest::html_nodes()** method... as well as pass it to the **selectr::css_to_xpath** method (as a way to show the results will be the same when using **css** or **xpath** parms in the call to **rvest::html_nodes()**

Remember, for website #1, we will scrape just URLs within the U.S.

```
library(rvest)
library(selectr)
url1 <- "https://jumpingrivers.github.io/meetingsR/r-user-groups.html#united-states-of-america"

us_rugs <- read_html(url1)                                  # read url1 to create object for US R User Grps

css1a <- "div#united-states-of-america.section.level3"      # from "right-click-inspect"" method

xp1a  <- css_to_xpath(selector=css1a)                       # get xpath equivalent for css (to show all.equal==TRUE)

rugs_urls1a <- html_nodes(us_rugs,css=css1a) %>%
               html_nodes(.,"a") %>%
                html_attr(.,"href")

rugs_urlsxp1a <- html_nodes(us_rugs,xpath=xp1a) %>% # use xpath this time ... "a" -->  denotes nodes w/a URL (with "href" attribute)
                 html_nodes(.,"a") %>%
                 html_attr(.,"href")

all.equal(rugs_urls1a,rugs_urlsxp1a)
```

```
## [1] TRUE
```

filter & clean URLs before passing to website #2

Not **all** of the 83 URLs use meetup.com (but most do), and we'll clean them up **before the next step**:

```
mu_urls ← rugs_urls1a[grep("meetup.com",rugs_urls1a)] %>%
          gsub("\\d+{4}|events/|members|files/","",.)
length(mu_urls)
```

```
## [1] 64
```

```
mu_urls[1:5]     # 64 out of 83 R User Groups in U.S. use meetup.com
```

```
## [1] "https://www.meetup.com/Bi-R-mingham-R-Meetup/"
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## [3] "https://www.meetup.com/r-enthusiasts/"
## [4] "https://www.meetup.com/Chico-R-Users-Group/"
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- OK...for the R-User Groups using meetup.com, *we've got their urls*
- and since **meetup.com** is a "well-formatted" website (i.e. consistent in HTML/CSS structure)....
- it should be quick work to get the CSS (xpath) info we need to parse it

right-click-inspect-element (website #2)

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browseURL(paste0(mu_urls[1],'/members/'))
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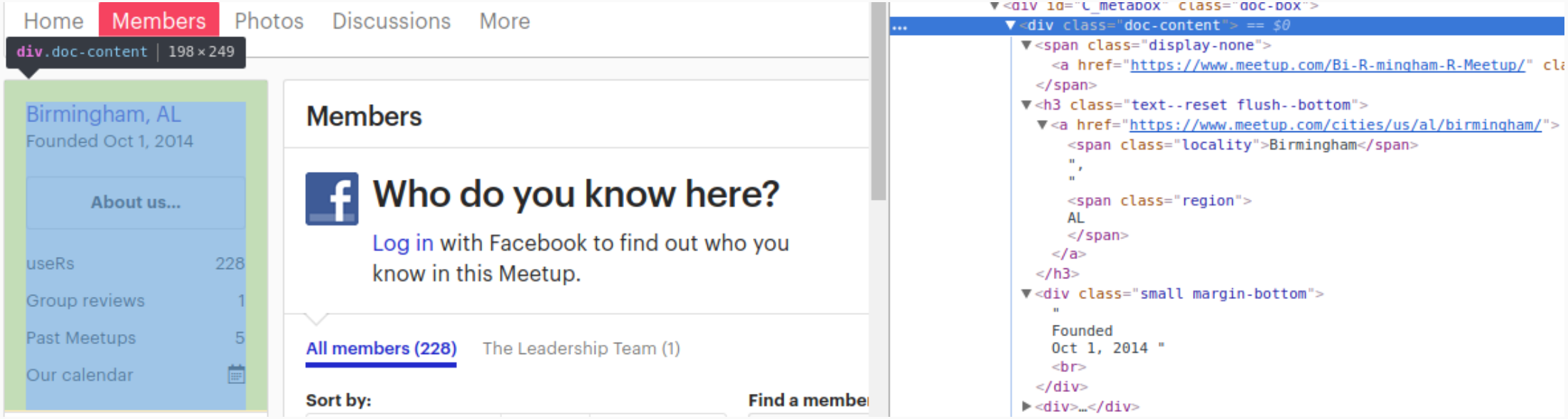
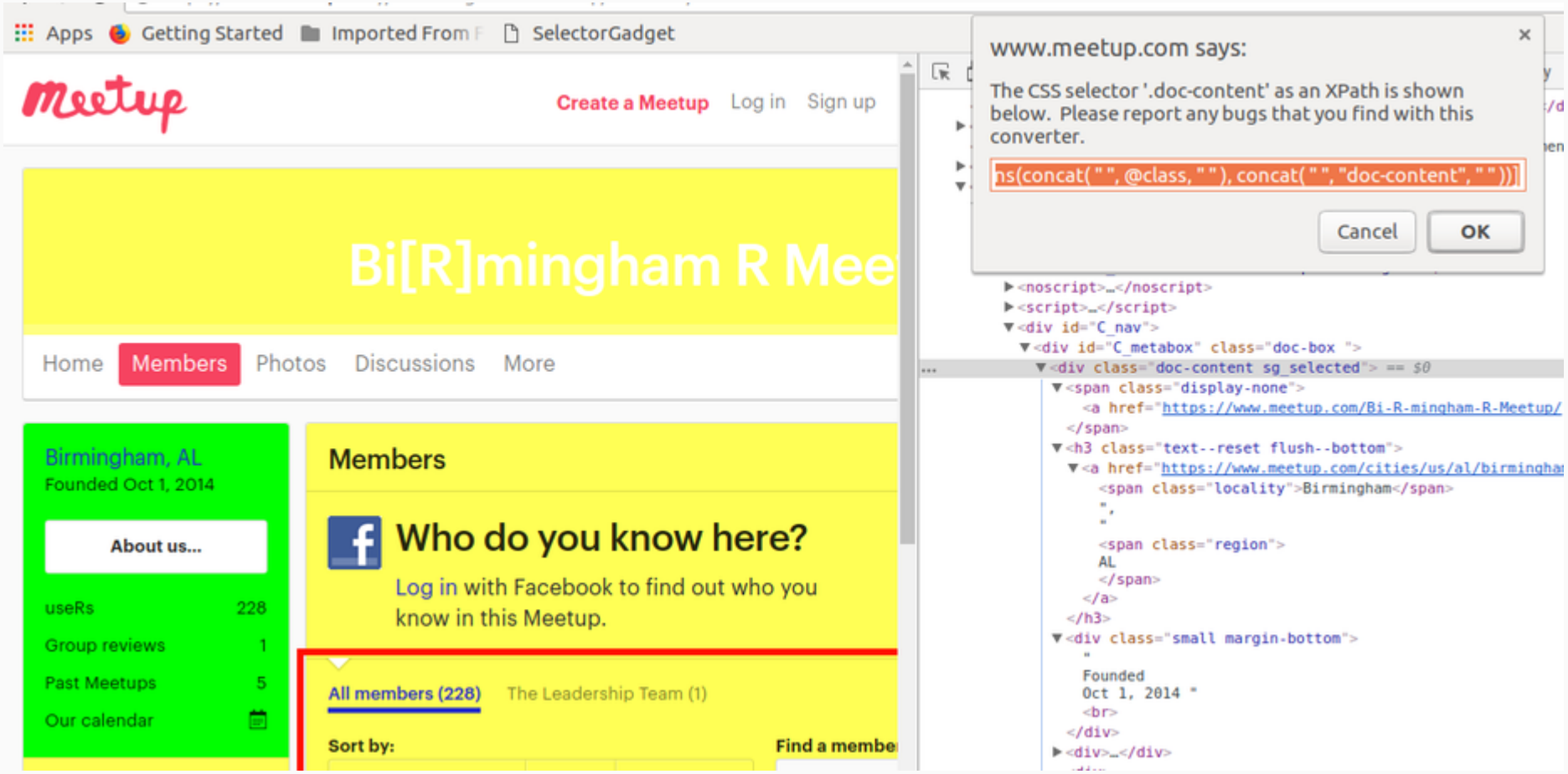
then, use selectorgadget and/or *right-click-inspect-method* to grab xpath to blue (or green) shaded box



selectorgadget method (website #2)

The gadget info box has the xpath to use (click xpath when green area is correctly set)



scrape meetup.com/meetings for all R User Groups

```
#xpath for to obtain group's attributes
```

```
#from the meetup.com/members page
```

```
mu_htm ← read_html(paste0(mu_urls[1],'/members/'))
```

```
mu_infoxp ← '//*[@id="C_metabox"]/div[1]'
```

```
mu_info ← html_nodes(mu_htm,xpath=mu_infoxp)
```

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```
## founded on date has this CSS

dob_css ← 'div.small.margin-bottom'

mu_dob ← gsub("Founded\n","",html_text(html_nodes(mu_info,css=dob_css),trim=T))
```

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```
# CSS for citi and state
```

```
mu_city ← html_text(html_nodes(mu_info,css=".locality"))
```

```
mu_st ← gsub("\\n","",html_text(html_nodes(mu_info,css=".region")))
```

```
# CSS for (text of) "data" elements
```

```
mu_datacss ← 'ul.paddedList.small.margin-bottom'
```

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putting it together: run code for scraping & parsing the metrics....

```
all_grpinfo ← matrix(nrow=length(mu_urls), ncol=6)
colnames(all_grpinfo) ← c('mu_city', 'mu_st', 'mu_dob', 'mu_nbrmems', 'mu_pstmtgs', 'mu_urls')

mu_infoxp ← '//*[@id="C_metabox"]/div[1]'  # xpath for selecting group attributes from the meetup.com/members page for a given R user group URL
dob_css ← 'div.small.margin-bottom'        # CSS locator for founded date for group
mu_datacss ← 'ul.paddedList.small.margin-bottom' # CSS for (text of) data elements

n ← 5 # scraping 1st 5 urls - see later footnote on wrapping up scrape websites that may limit HTML requests
for (i in 1:n) {
mu_htm ← read_html(paste0(mu_urls[i],'/members/'))
mu_info ← html_nodes(mu_htm,xpath=mu_infoxp)
mu_city ← html_text(html_nodes(mu_info,css=".locality"))
mu_st ← html_text(html_nodes(mu_info,css=".region")) %>%
         gsub("\\n","",.)

mu_dob ← html_text(html_nodes(mu_info,css=dob_css),trim=T) %>%
          gsub("Founded\n","",.)

mu_data ← html_nodes(mu_info,css=mu_datacss) %>%
           html_nodes(.,css="a") %>%
           html_text(.)
mu_nbrmems ← strsplit(mu_data[1],"\n")[[1]][2]
mu_pstmtgs ← strsplit(mu_data[grep("Past Meet", mu_data)],"\n")[[1]][3]

all_grpinfo[i,] ← cbind(mu_city, mu_st, mu_dob, mu_nbrmems, mu_pstmtgs, mu_urls[i])
}
```

sample output

OK - what does it look like?.....

```
options(width = 150)
all_grpinfo[1:n,]
```

```
##      mu_city        mu_st mu_dob         mu_nbrmems mu_pstmtgs mu_urls
## [1,] "Birmingham"   "AL"  "Oct 1, 2014"  "228"      "5"        "https://www.meetup.com/Bi-R-mingham-R-Meetup/"
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[1] https://stackoverflow.com/questions/39056103/iterating-rvest-scrape-function-gives-error-in-open-connectionx-rb-time/39057166/

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- or, one could parse meetings for the topic/subject matter, and *number of attendees*...etc etc etc

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- or, one could parse meetings for the topic/subject matter, and *number of attendees*...etc etc etc
  - as a *pedagogical device*, one could create an animated *shiny app* showing growth of R over time and geography (*West Coast to East Coast?*)
  - and on and on and on.....(what about expanding to non-U.S. groups?)

Summary take-away....

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And now, let's move on to scraping some XML-formatted data

Scraping and Parsing XML

- *First*, let's mention one prolific contributor in the effort to demystify the scraping/manipulation of XML

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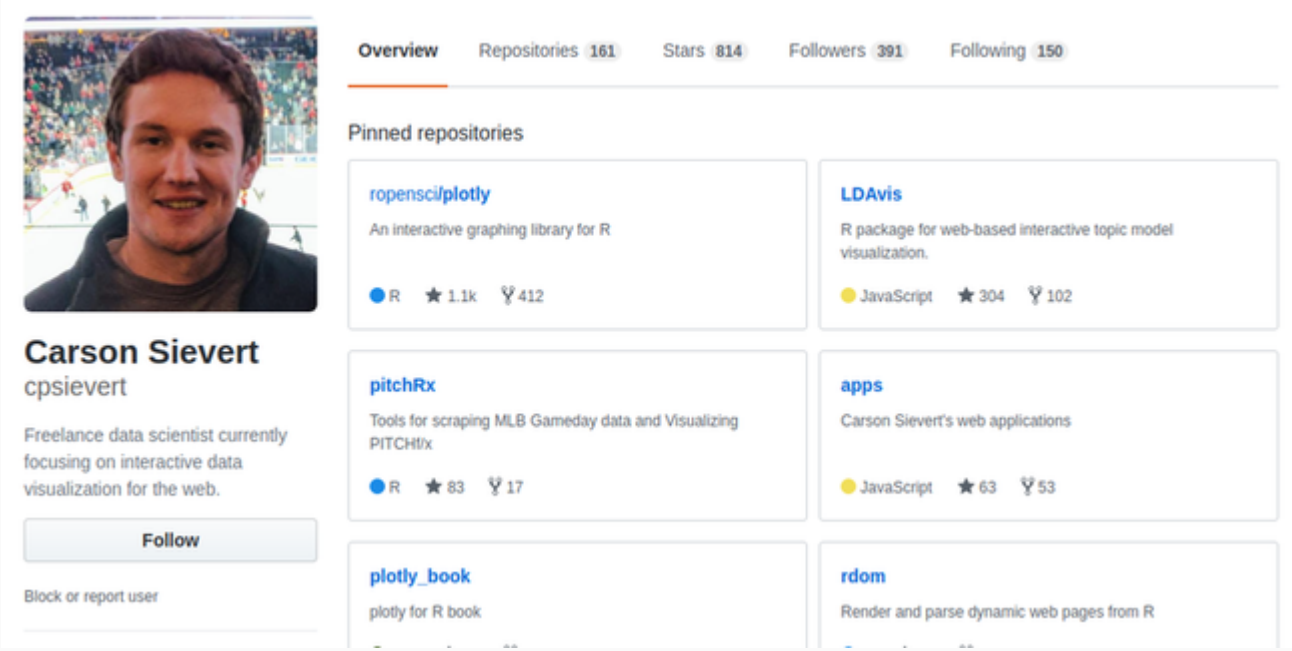
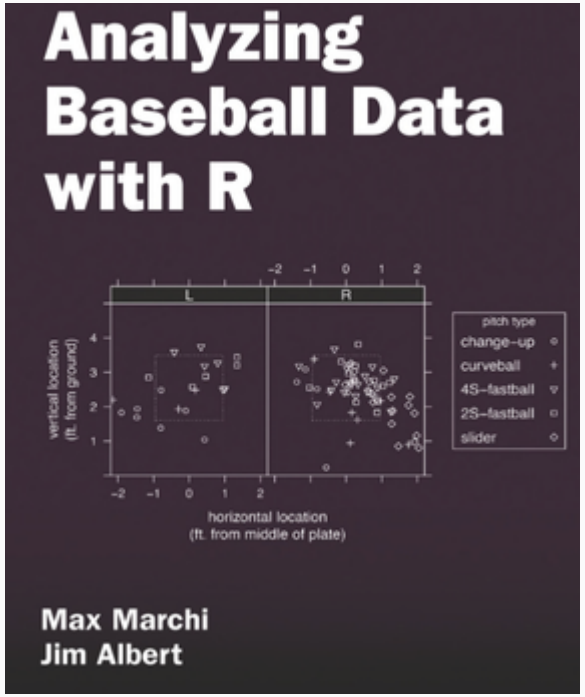
- Carson Seivert wrote the *pitchRx* package (for scraping MLB's "gameday" XML data)



Scraping and Parsing XML

- as referenced in the book *Analyzing Baseball Data in R*



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- If there's one way to learn how to deal with XML, it's in putting together your own database of EVERY pitch thrown in EVERY MLB game over the past x years!
- Since Carson has provided detailed examples of using XML2R[2] in the context of *baseball*, let's do something related to a *different* sport....

[2] https://xml2r.cpsievert.me/

Scraping and Parsing XML

In the spirit of ***March Madness***, let's grab some NCAA Basketball **"market"** data (i.e., Vegas Oddslines) from *wagertalk.com*

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College Basketball
Tuesday, February 20th, 2018

Time	Gm#	(-) Team	Score	Opener	Public%	Bookmaker	Pincle	Grande	Bovada	Greek	5Dimes	BOnline
02/20 7:00p	501 502	Boston College NC State		159u-116 8	52% 52%	157 5-105	157 5-106	5-105	157 5	157 5-105	157 5	157½u-115 4½-115
02/20 7:00p	503 504	West Virginia Baylor		143u-115 1	51% 51%	1-115 140½	1-106 140½	1	1-115 141u-115	142 pk	1 140½	1-111 140½u-115

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7:00p	502	NC State		8	52%	5-105	5-106	5-105	5	5-105	5	4½-115
02/20	503	West Virginia		143u-115	51%	1-115	1-106	1	1-115	142	1	1-111
7:00p	504	Baylor		1	51%	140½	140½		141u-115	pk	140½	140½u-115

The above shows the odds/lines for NCAA BB as of around noon EST on Feb. 20th 2018....

Scraping and Parsing XML

Fortunately, that data is available in XML format here:

http://www.wagertalk.com/spt-opt/schedule.php?host=WAGERTALK&sport=ncaabb&period=0

```
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  - <LEAGUE number="4" name="College Basketball">
    - <GAME date="20180220" time="1600" seconds="1519113600">
      - <TEAM number="501" name="Boston College">
          <OPENER value="159u-116"/>
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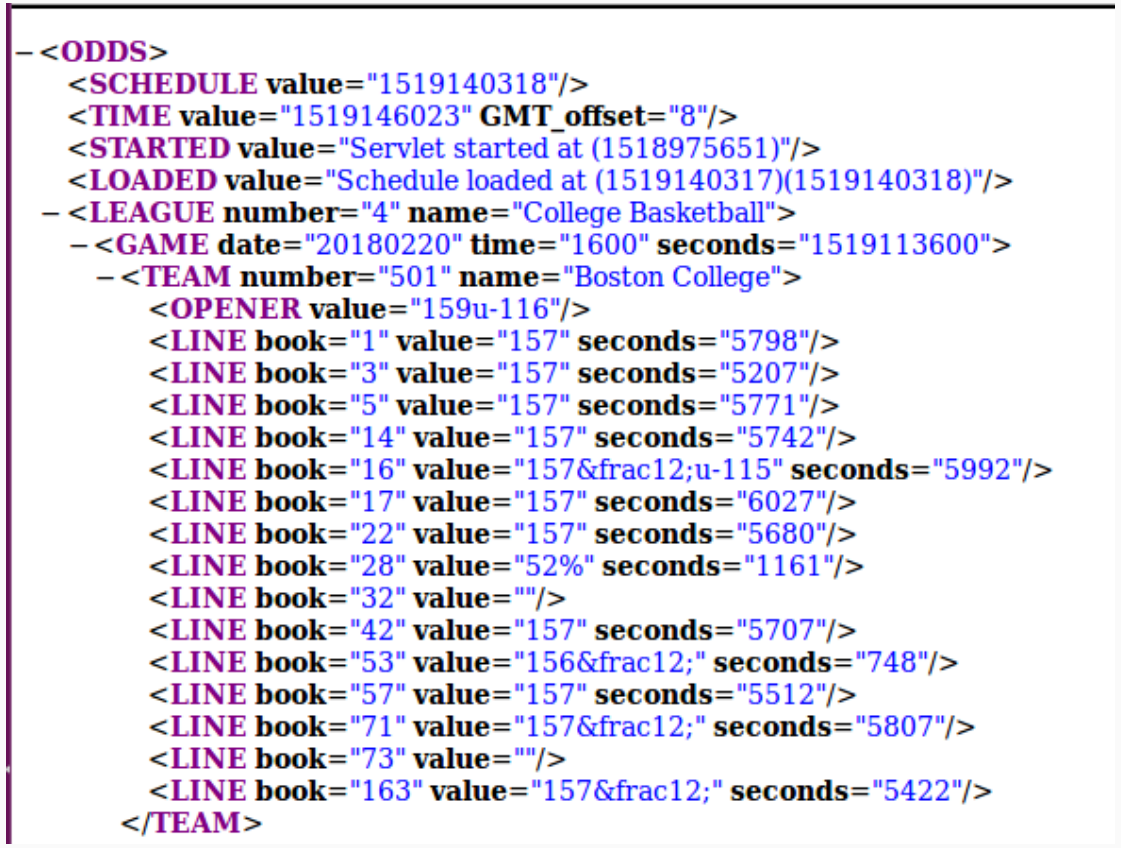
.....now left's examine the XML hierarchy....

.....before running some simple code....

Examining the XML structure

XML Hierarchy

1. open the file and example the structure
   - expand and collapse the XML hierarchy to geta feel for how the parent/child relationships are formatted
2. think of the XML in terms of *facts* and *dimensions*[3], and in terms of 'global' information.
   - in this case, the (my phrase) 'global' tags are SCHEDULE, TIME, STARTED, LOADED, LEAGUE
3. each GAME node has associated date/datetime elements, but also has 2 TEAM child nodes....
4. finally, TEAM node has set of LINE tags
   - LINE tags relate to the line's "provider" (bookmaker)
   - one set of LINEs relate to "point spread", and the other relates to game totals (OVER/UNDER)



[3] https://en.wikipedia.org/wiki/Dimensional_modeling

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- for this exercise, we'll use just 3 functions:
  - XML2R::XML2Obs
  - XML2R::add_key
  - XML2R::collapse_obs

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xmlobs1 ← XML2Obs(xml1, quiet=TRUE)
table(names(xmlobs1))
```

```
##
##                     ODDS//LEAGUE              ODDS//LEAGUE//GAME        ODDS//LEAGUE//GAME//TEAM   ODDS//LEAGUE//GAME//TEAM//LINE
##                                1                              88                             176                               656
## ODDS//LEAGUE//GAME//TEAM//OPENER                ODDS//LOADED                ODDS//SCHEDULE                 ODDS//STARTED
##                               176                           1                               1                                 1
##                       ODDS//TIME
##                                1
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After having perused the XML file by collapsing/expanding nodes, the output *makes sense*....

- each GAME has **2** TEAMS

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##                              176                               1                               1                               1
##                       ODDS//TIME
##                                1
```

After having perused the XML file by collapsing/expanding nodes, the output *makes sense*....

- each GAME has **2** TEAMS
- the 'global' information is associated with a **single** count of a node ('time', 'loaded', etc)
- now, we'll make sure the PARENT node data is passed to the CHILD nodes (before creating data.frame type output)

mapping parent-to-child (via XML2R::add_key)

Remember - the LINE nodes are the "facts", and we need to be able to map those facts to their parent attributes...

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```

```
xmlobs1 ← add_key(xmlobs1, parent="ODDS//LEAGUE//GAME", recycle="date", key.name="gamedate")
```

```
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```

- under GAME//TEAM, we want the (team) "name" and the (game-wager) "number" passed down

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```

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```
# new col of "gamewgrnbr"
xmlobs1 ← add_key(xmlobs1, parent="ODDS//LEAGUE//GAME//TEAM", recycle="number", key.name="gamewgrnbr")
# new col of "teamname"
xmlobs1 ← add_key(xmlobs1 , parent="ODDS//LEAGUE//GAME//TEAM", recycle="name", key.name="teamname")
```

collapsing observations (via XML2R::collapse_obs)

Now, we can simply use XML2R::collapse_obs to get a matrix

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```
#collapse observations from the ....//LINE nodes

#and remove the "url" colname (don't need it)

oddsline ← collapse_obs(xmlobs1[grep("^ODDS//LEAGUE//GAME//TEAM//LINE$",names(xmlobs1))])

oddsline ← oddsline[,-grep("url",colnames(oddsline))]
```

run code and show output

We'll just run the previously shown code and show some output to verify all 3 XML2R functions we've used did their job...

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```
xmlobs1 <- add_key(xmlobs1, parent="ODDS//LEAGUE//GAME", recycle="date", key.name="gamedate") # adding key - new col of "gamedate"
xmlobs1 <- add_key(xmlobs1, parent="ODDS//LEAGUE//GAME", recycle="time", key.name="gametime") # adding key - new col of "gametime"
xmlobs1 <- add_key(xmlobs1, parent="ODDS//LEAGUE//GAME//TEAM", recycle="number", key.name="gamewgrnbr") # new col of "gamewgrnbr"
xmlobs1 <- add_key(xmlobs1 , parent="ODDS//LEAGUE//GAME//TEAM", recycle="name", key.name="teamname")
oddsline <- collapse_obs(xmlobs1[grep("^ODDS//LEAGUE//GAME//TEAM//LINE$",names(xmlobs1))])  # this returns a matrix
oddsline <- oddsline[,-grep("url",colnames(oddsline))]            # get rid of the long "url" colname
head(oddsline)
```

```
##      book value           seconds gamedate   gametime gamewgrnbr teamname
## [1,] "1"  "1&frac12;"     "41302" "20180226" "1600"   "721"      "Marquette"
## [2,] "3"  "1&frac12;"     "36722" "20180226" "1600"   "721"      "Marquette"
## [3,] "5"  "1&frac12;"     "35957" "20180226" "1600"   "721"      "Marquette"
## [4,] "14" "1&frac12;"     "41362" "20180226" "1600"   "721"      "Marquette"
## [5,] "16" "1&frac12;-106" "6009"  "20180226" "1600"   "721"      "Marquette"
## [6,] "17" "1&frac12;-108" "2671"  "20180226" "1600"   "721"      "Marquette"
```

Post-processing: task list

Here's a list of things to do to get the data into a "usable" data frame....

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We won't go through them with code, but a screenshot of the *final persistance* to a mysql table will be shown

- parse the lines for half-points (gsub the "ampersand frac12")
- perform necessary character-to-numeric conversions
- ...and then for dates/datetimes, convert to appropriate POSIX.. classes
- get the "datetime-line-refresh" from the global //TIME attribute and...
- use that with the "seconds" value to calculate the datetime for a given "LINE"
- calculate an "hours-to-gametime" column (optional - but easier to digest!)
- load to a database table (mysql is my preference) for tracking line movements over time

Final resting place (for the parsed & processed XML)

sportlinetype_x	book	gamedttm	game_id	game_name	gamewgri	game	teamname_x	teamname_y	away_	home_	away_ps_	home_ps_	favetes	favet	ps_dttmlinevalue	pshrs2gt
ncaabb_ps	1	2017-11-28 18:30:00	511_512	Baylor_@_Xavier	511	512	Baylor	Xavier	4.5	-4.5	-110	-110	1	0	2017-11-27 17:59:22	24.5
ncaabb_ps	1	2017-11-28 19:00:00	513_514	Appalachian State_@_VA Co...	513	514	Appalachian State	VA Commo...	11	-11	-110	-110	1	0	2017-11-27 17:42:54	25.3
ncaabb_ps	1	2017-11-28 19:00:00	515_516	Brown_@_Rhode Island	515	516	Brown	Rhode Island	20	-20	-110	-110	1	0	2017-11-27 17:43:04	25.3
ncaabb_ps	1	2017-11-28 19:00:00	517_518	Florida State_@_Rutgers	517	518	Florida State	Rutgers	-4.5	4.5	-111	-109	0	1	2017-11-27 17:43:41	25.3

Notice the "pshr2gt" column...(point-spread-hours-to-gametime)

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Notice the "pshr2gt" column...(point-spread-hours-to-gametime)

- that's from adding "seconds" to the global "TIME" attribute and subtracting game-datetime

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ncaabb_ps	1	2017-11-28 19:00:00	513_514	Appalachian State_@_VA Co...	513	514	Appalachian State	VA Commo...	11	-11	-110	-110	1	0	2017-11-27 17:42:54	25.3
ncaabb_ps	1	2017-11-28 19:00:00	515_516	Brown_@_Rhode Island	515	516	Brown	Rhode Island	20	-20	-110	-110	1	0	2017-11-27 17:43:04	25.3
ncaabb_ps	1	2017-11-28 19:00:00	517_518	Florida State_@_Rutgers	517	518	Florida State	Rutgers	-4.5	4.5	-111	-109	0	1	2017-11-27 17:43:41	25.3

Notice the "pshr2gt" column...(point-spread-hours-to-gametime)

- that's from adding "seconds" to the global "TIME" attribute and subtracting game-datetime

Moving on - knowing when it's time to use RSelenium

Final resting place (for the parsed & processed XML)

sportlinetype_x	book	gamedttm	game_id	game_name	gamewgri	game	teamname_x	teamname_y	away_	home_	away_ps_	home_ps_	favetes	favet	ps_dttmlinevalue	pshrs2gt
ncaabb_ps	1	2017-11-28 18:30:00	511_512	Baylor_@_Xavier	511	512	Baylor	Xavier	4.5	-4.5	-110	-110	1	0	2017-11-27 17:59:22	24.5
ncaabb_ps	1	2017-11-28 19:00:00	513_514	Appalachian State_@_VA Co...	513	514	Appalachian State	VA Commo...	11	-11	-110	-110	1	0	2017-11-27 17:42:54	25.3
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  Moving on - knowing when it's time to use RSelenium

- (or its easy-to-use wrapper form via the rdom package)

Intro to RSelenium

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  - provides shortcuts for scraping via the built-in functions/methods

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- send mouse events, clicks, submit forms, take screenshots
- and makes it easier to extract text and attributes within a webpage much more easily than previously shown

Getting started with RSelenium

- **Suggest** to watch these videos hosted by the RSelenium package author (John Harrison)

Getting started with RSelenium

- **Suggest** to watch these videos hosted by the RSelenium package author (John Harrison) John Harrison video 1 - soup2nuts
  John Harrison video 2 - javascript example

- print out the RSelenium doc and follow along some examples.....

  https://cran.r-project.org/web/packages/RSelenium/RSelenium.pdf

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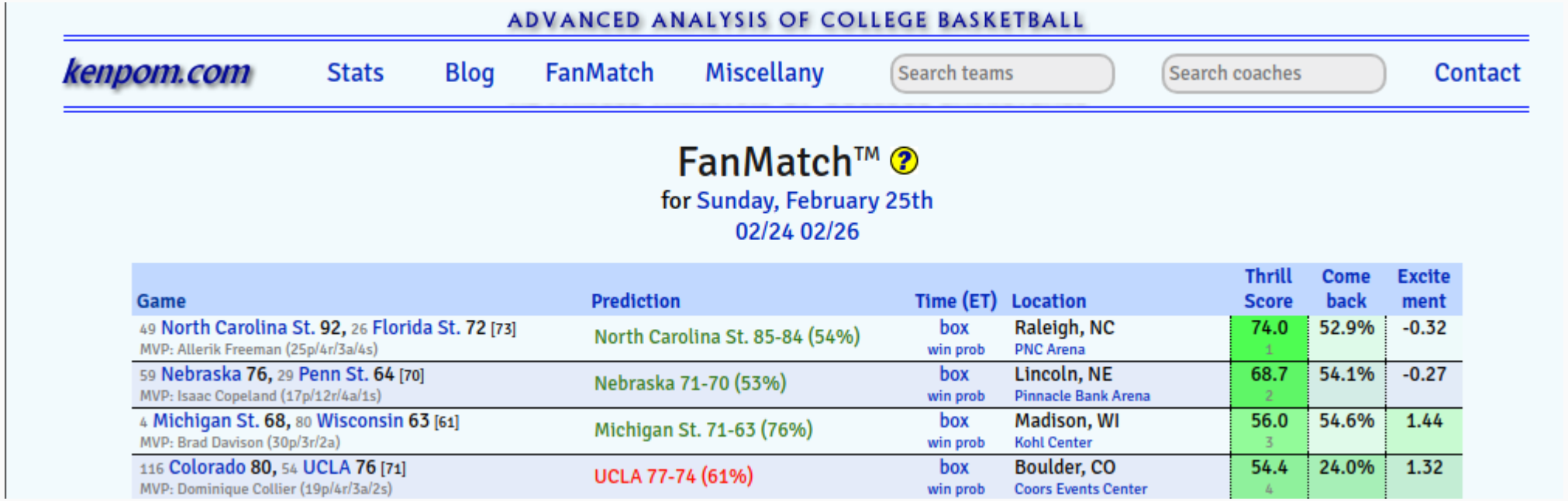
  - it's accessable via executing javascript (another thing that makes RSelenium so powerful)

Using RSelenium: Ex. #1

Data to get from kenpom.com....



ADVANCED ANALYSIS OF COLLEGE BASKETBALL

kenpom.com Stats Blog FanMatch Miscellany Search teams Search coaches Contact

FanMatch™

for Sunday, February 25th

02/24 02/26

Game	Prediction	Time (ET)	Location	Thrill Score	Come back	Excite ment
49 North Carolina St. 92, 26 Florida St. 72 [73] MVP: Allerik Freeman (25p/4r/3a/4s)	North Carolina St. 85-84 (54%)	box win prob	Raleigh, NC PNC Arena	74.0 1	52.9%	-0.32
59 Nebraska 76, 29 Penn St. 64 [70] MVP: Isaac Copeland (17p/12r/4a/1s)	Nebraska 71-70 (53%)	box win prob	Lincoln, NE Pinnacle Bank Arena	68.7 2	54.1%	-0.27
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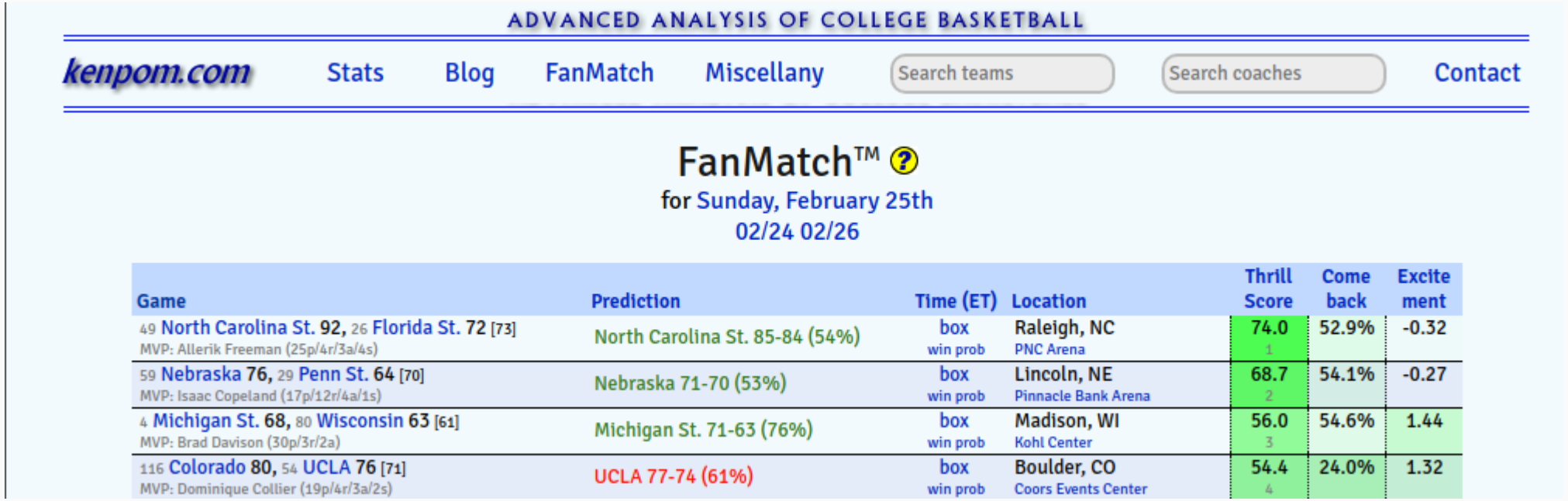

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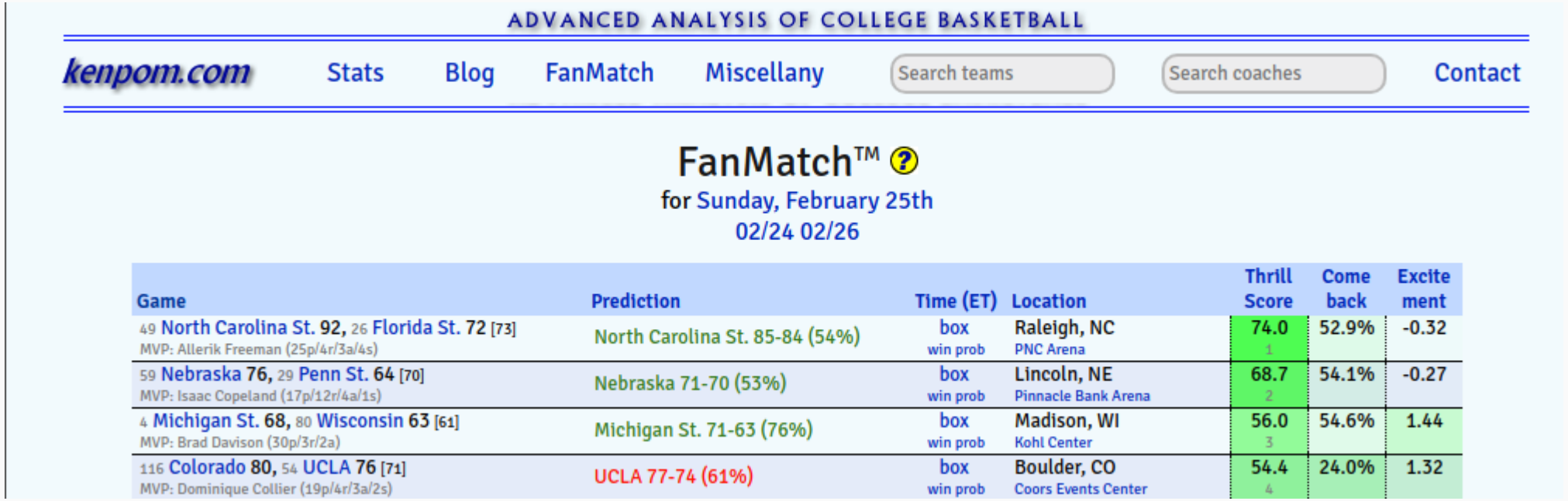

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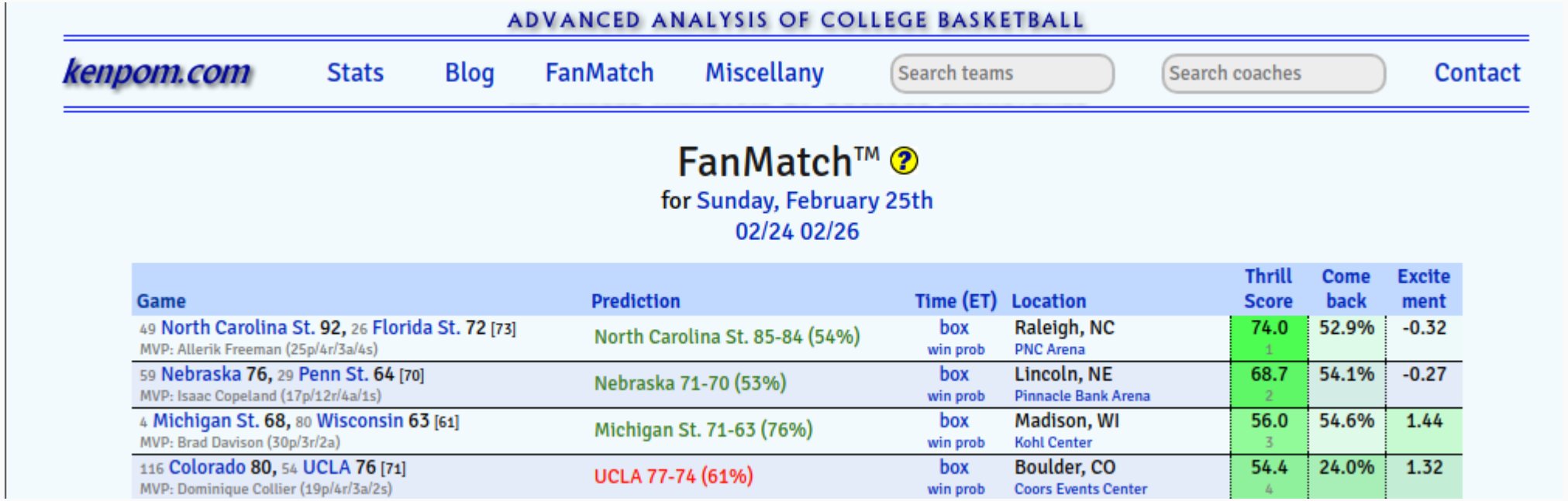

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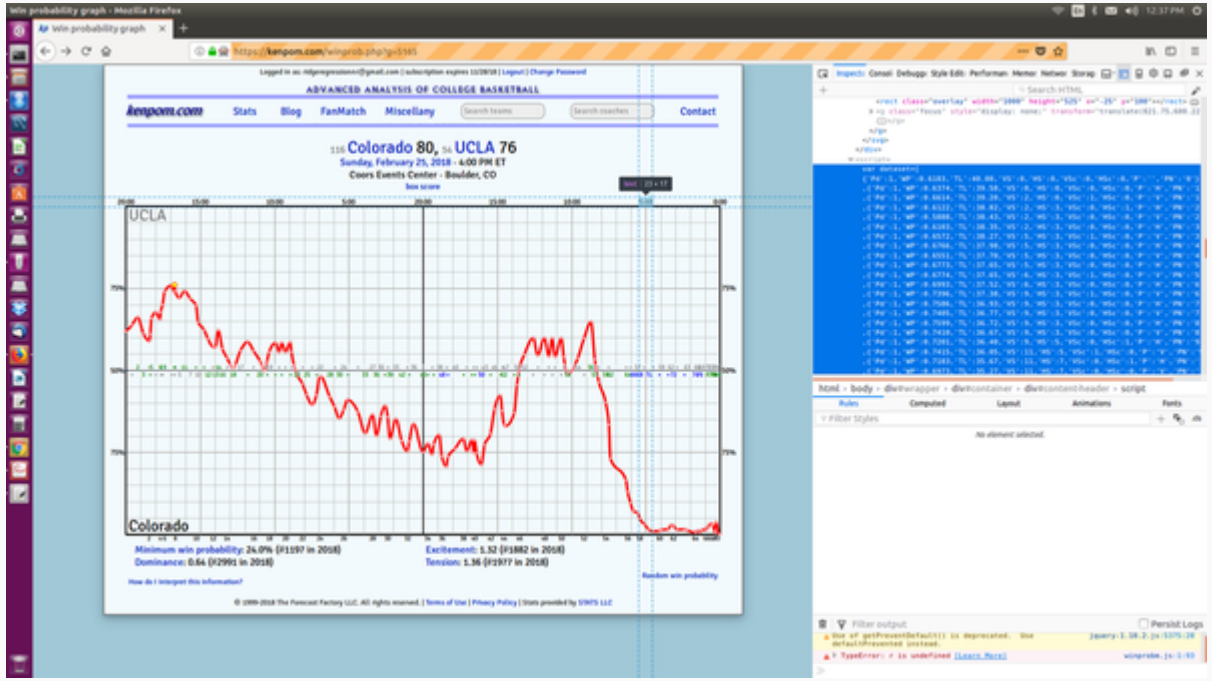
- We will get values from the Prediction column
- as well as the href's from the win prob link (under the "Time" column)
- and parse the Prediction column for Winner, score, prob-win, etc.

Using RSelenium: Ex. #1

The win prob graph and javascript-generated data looks like this:



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library(RSelenium)
rD ← rsDriver(port=4445L, browser="chrome")
remDr ← rD[["client"]]
```

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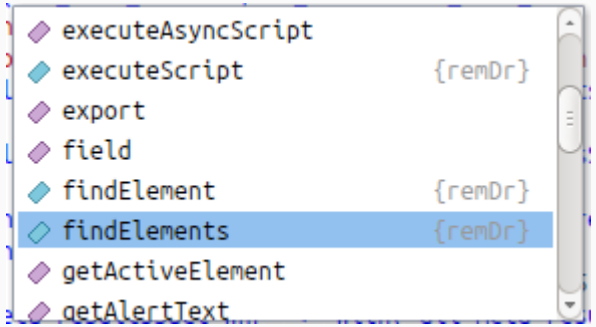
```
library(RSelenium)
rD ← rsDriver(port=4445L, browser="chrome")
remDr ← rD[["client"]]
```

- we instantiated the "client" as **remDr**...
- remDr$ - see doc for the class methods that make using RSelenium really SMOOTH!



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remDr$navigate("https://kenpom.com")
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```
# concact xpaths to search for wnrs and losers WITHIN the table
```

```
game_preds ← remDr$findElements(value = "//td[@class = 'wrong'] | //td[@class = 'correct']")
```

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# concact xpaths to search for wnrs and losers WITHIN the table

game_preds ← remDr$findElements(value = "//td[@class = 'wrong'] | //td[@class = 'correct']")

# Now, we can use RSelenium's class ('$') methods technique to get the text which we will (later) parse

game_predsTxt ← sapply(game_preds,function(x) x$getElementText())
```

Using RSelenium: Ex. #1

- to get the within-game probabilities, we need to get all hrefs that point to the graphs
- ...we will (later) iterate over those links

```
# find ALL elements, then sapply that result to get the element attribute="href" (a link!)
fmUrls  ← remDr$findElements(value = "//span/a")
fmHrefs ← sapply(fmUrls,function(x) x$getElementAttribute('href'))

#each game also has a link to the "MVP" for the game, so filter those out
# keeping only "winprob" links
fmWinProbs ← fmHrefs[grep("winprob",fmHrefs)]
```

Using RSelenium: Ex. #1

- iterate over the URLs that have the win-prob graphs...
- and extract the data via remDr$executeScript()

```
for (i in 1:length(fmWinProbs)){
    remDr$navigate(fmWinProbs[[i]])
    winprob <- remDr$executeScript("return dataset;")
winprobDf <- do.call(rbind.data.frame,winprob)
    gamedata <- remDr$executeScript("return data;")
gamedataDf <- do.call(cbind.data.frame,gamedata[!names(gamedata) %in% 'input'])
    wpdf <- merge(winprobDf, gamedataDf[names(gamedataDf) %in% c('gid','ymd','gameTime','team1','team2')])
names(wpdf) <- gsub("WP","visitorWP",names(wpdf))
names(wpdf) <- gsub("team1","team_away",names(wpdf))
names(wpdf) <- gsub("team2","team_home",names(wpdf))
wpdf$homeWP <- with(wpdf,1-visitorWP)
if (i==1) {all_games <- wpdf
           all_meta <- gamedataDf }
    else {all_games <- rbind(all_games,wpdf)
          all_meta <- rbind(all_meta,gamedataDf)}
}
results <- cbind.data.frame(all_meta, pred_wnr, pred_pwin, pred_wnrscr, pred_loserscr,stringsAsFactors=FALSE)
results$pred_ttl <- with(results, pred_wnrscr+pred_loserscr)
results$act_ttl <- with(results, score1+score2)
results$pred_diff <- pred_wnrscr - pred_loserscr
results$act_diff  <- ifelse(results$pred_wnr==results$team2,results$score2-results$score1,results$score1-results$score2)
```

Using RSelenium: Ex. #1

- There are TWO data frames obtained from the javascript calls

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- the detailed one with the within-game probabilities (all_games data frame)

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P	Pd	VSc	TL	HSc	visitorWP	HS	VS	PN	gid	ymd	gameTime	team_away	team_home	homeWP
	1	0	40.00	0	0.0132	0	0	0	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9868
H	1	0	39.62	1	0.0120	2	0	1	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9880
V	1	0	39.02	0	0.0112	2	0	1	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9888
H	1	0	38.85	0	0.0123	2	0	2	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9877
V	1	0	38.52	0	0.0114	2	0	2	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9886
H	1	0	38.13	0	0.0128	2	0	3	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9872
V	1	0	37.83	0	0.0118	2	0	3	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9882
H	1	0	37.67	0	0.0131	2	0	4	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9869
V	1	1	37.38	0	0.0162	2	3	4	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9838
H	1	0	37.10	1	0.0135	5	3	5	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9865
V	1	0	36.82	0	0.0124	5	3	5	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9876
H	1	0	36.62	1	0.0101	8	3	6	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9899
V	1	0	36.30	0	0.0092	8	3	6	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9908
H	1	0	36.00	1	0.0083	10	3	7	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9917
V	1	1	35.72	0	0.0093	10	5	7	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9907
H	1	0	35.33	1	0.0084	12	5	8	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9916
V	1	0	35.12	0	0.0076	12	5	8	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9924
H	1	0	35.00	1	0.0068	14	5	9	5164	2018-02-25	3:00 PM	East Carolina	Houston	0.9932

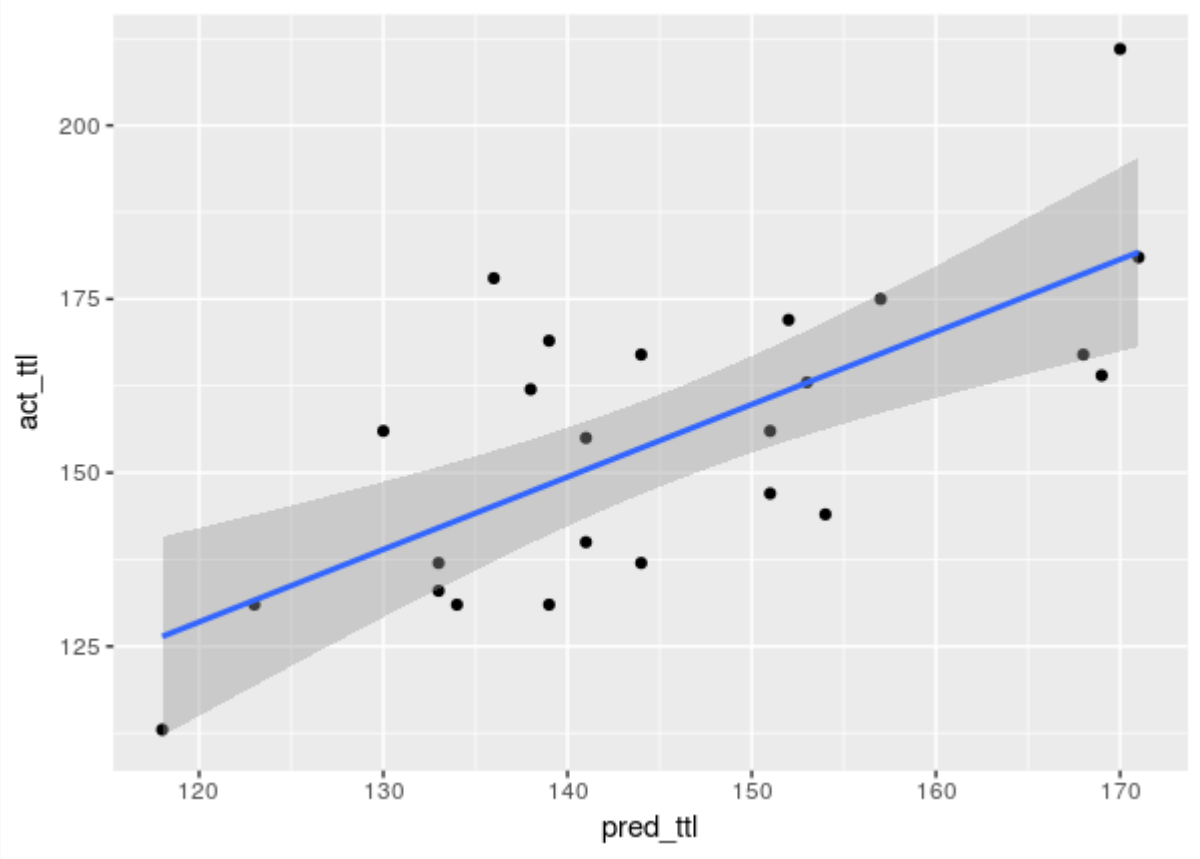
Using RSelenium: Ex. #1

- and the "meta" data one with the predictions & outcomes (results data frame)

excitement	rank1	rank2	rank_minWP	rank_excitement	srank_tension	dominance	favchg	score1	srank_excitement	dateOfGame	pred_wnr	pred_pwin	pred_wnrscr	pred_loserscr	pred_ttl	act_ttl	pred_diff
-0.32	26	49	99999	99999	4480	2.04	0	72	4453	Sunday, February 25, 2018	North Carolina St.	54	85	84	169	164	1
-0.27	29	59	99999	99999	4367	1.61	0	64	4391	Sunday, February 25, 2018	Nebraska	53	71	70	141	140	1
1.44	4	80	99999	99999	1094	0.72	0	68	1694	Sunday, February 25, 2018	Michigan St.	76	71	63	134	131	8
1.32	54	116	99999	99999	1977	0.64	0	76	1882	Sunday, February 25, 2018	UCLA	61	77	74	151	156	3
2.49	89	115	99999	99999	1308	0.47	0	90	366	Sunday, February 25, 2018	New Mexico	52	86	85	171	181	1
-0.37	85	101	99999	99999	4617	1.79	0	70	4541	Sunday, February 25, 2018	Iowa	58	77	74	151	147	3
2.58	98	93	99999	99999	256	0.22	0	79	299	Sunday, February 25, 2018	East Tennessee St.	64	72	69	141	155	3
-0.31	97	84	99999	99999	4442	1.86	0	56	4451	Sunday, February 25, 2018	Temple	65	64	59	123	131	5
1.11	106	146	99999	99999	1277	0.82	0	75	2228	Sunday, February 25, 2018	Rutgers	53	67	66	133	137	1
-0.09	139	130	99999	99999	4390	1.82	0	101	4091	Sunday, February 25, 2018	Rider	64	87	83	170	211	4
2.48	137	173	99999	99999	80	0.11	0	69	382	Sunday, February 25, 2018	Wofford	56	73	71	144	137	2
0.24	143	176	99999	99999	3198	1.5	0	83	3523	Sunday, February 25, 2018	Connecticut	57	70	68	138	162	2
2.26	154	196	99999	99999	1759	-0.9	0	88	610	Sunday, February 25, 2018	Illinois Chicago	50	70	69	139	169	1
-0.14	108	6	99999	99999	4018	1.96	0	60	4163	Sunday, February 25, 2018	Purdue	95	86	68	154	144	18
1.08	112	5	99999	99999	2038	0.52	0	74	2269	Sunday, February 25, 2018	Cincinnati	95	74	56	130	156	18
0.64	310	303	99999	99999	3643	1.2	0	75	2912	Sunday, February 25, 2018	Western Carolina	64	86	82	168	167	4
0.9	309	333	99999	99999	2825	0.89	0	65	2511	Sunday, February 25, 2018	VMI	52	67	66	133	133	1
-0.08	90	281	99999	99999	4126	2.7	0	75	4058	Sunday, February 25, 2018	Northern Kentucky	79	74	65	139	131	9

Using RSelenium: Ex. #1

- Now that there's some data, let's at least show it!



Using RSelenium: Conclusions

- RSelenium makes scraping much less cumbersome than via other methods....
- it's worth the associated learning curve

Don't need the "full" power of RSelenium?

- try using rdom
- it allows access to the DOM (for parsing dynamic content)

  https://github.com/cpsievert/rdom