# Webscraping with RSelenium

Automate your browser actions

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## Introduction

Do you really need scraping?

Before scraping: is there an API?

- if yes, is there a package?
    - if yes, use the package
    - if no, build the API queries yourself with `{httr}`
- if no, scrape (politely)

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These 2 steps don't necessarily require the same tools, and *shouldn't be made at the same time*.

## Introduction

Here, we will focus on the first step: **how to obtain the HTML code you need on dynamic pages?**

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## Static vs dynamic

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- all the information is loaded with the page;
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Examples: Wikipedia, IMDB.

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**Dynamic webpage**: the website uses JavaScript to fetch data from their server and *dynamically* update the page.

Example: see later.

Why is it harder to do webscraping with dynamic pages?

Webscraping a static website can be quite simple:

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- download the HTML for each of them;
- read and clean the HTML

and that's it.

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This is easy because you can differentiate two pages with different content just by looking at their URL.

Example:

But in dynamic pages, there's no obvious way to see that the inputs are different:

So it seems that the only way to get the data is to go manually through all pages to get the HTML.

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*350h and 3 RAs later...*

## (R)Selenium

## Idea

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*"I wish I could click on this button to open a modal"*

```
remote_driver$
  findElement(using = "css", value = ".my-button")$
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```

## Idea

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*“I wish I could click on this button to open a modal”*

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remote_driver$
  findElement(using = "css", value = ".my-button")$
  clickElement()
```

*“I wish I could fill these inputs to automatically connect”*

```
remote_driver$
  findElement(using = "id", value = "password")$
  sendKeysToElement(list("my_super_secret_password"))
```

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| | |
|---|---|
| ▶ open a browser | ▶ `open()` / `navigate()` |
| ▶ click on something | ▶ `clickElement()` |
| ▶ enter values | ▶ `sendKeysToElement()` |
| ▶ go to previous/next page | ▶ `goBack()` / `goForward()` |
| ▶ refresh the page | ▶ `refresh()` |
| ▶ get all the HTML that is currently displayed | ▶ `getPageSource()` |

## Get started

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In the beginning there was ~~light~~ `rsDriver()`:

```
# if not already installed
# install.packages("RSelenium")
library(RSelenium)

driver <- rsDriver(browser = "firefox") # can also be chron
remote_driver <- driver[["client"]]
```

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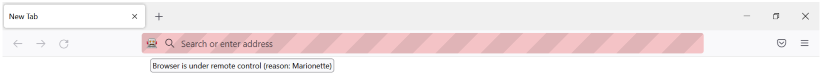
This will print a bunch of messages and open a “marionette browser”.



## Get started

From now on, everything we do is calling `<function>()` starting with `remote_driver$`[1].

[1] Or whatever you called it in the previous step.

## Exercise 1

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- open the browser;
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- in the left sidebar, click on the link “Contributors”;
- and voilà!

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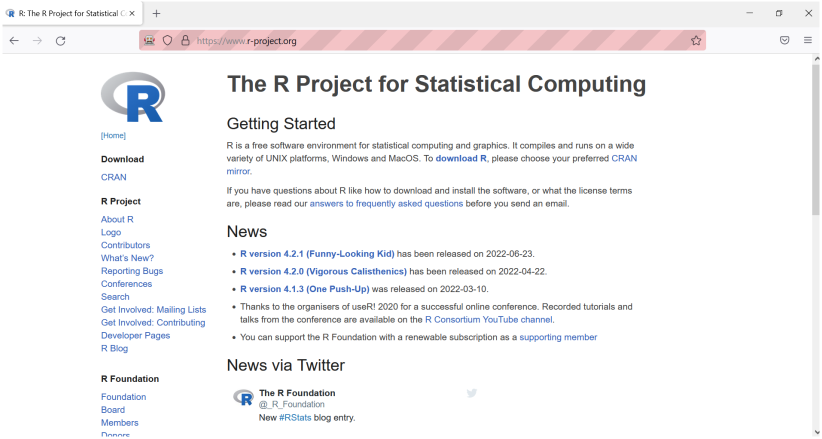
- in the left sidebar, click on the link “Contributors”;
- and voilà!

How can we do these steps programmatically?

## Open the browser and navigate

```r
remote_driver$navigate("https://r-project.org")
```



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## Getting Started

R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To **download R**, please choose your preferred CRAN mirror.

If you have questions about R like how to download and install the software, or what the license terms are, please read our answers to frequently asked questions before you send an email.

## News

- **R version 4.2.1 (Funny-Looking Kid)** has been released on 2022-06-23.
- **R version 4.2.0 (Vigorous Calisthenics)** has been released on 2022-04-22.
- **R version 4.1.3 (One Push-Up)** was released on 2022-03-10.
- Thanks to the organisers of useR! 2020 for a successful online conference. Recorded tutorials and talks from the conference are available on the R Consortium YouTube channel.
- You can support the R Foundation with a renewable subscription as a supporting member

## News via Twitter

**The R Foundation**
@_R_Foundation
New #RStats blog entry.

## Click on “Contributors”

This requires two things:

1. find the element
2. click on it

**How to find an element?**

- Humans -> eyes
- Computers -> HTML/CSS

To find the element, we need to open the console to see the structure of the page.

Several ways to do it:

- right-click -> “Inspect”
- `Ctrl` + `Shift` + `C`

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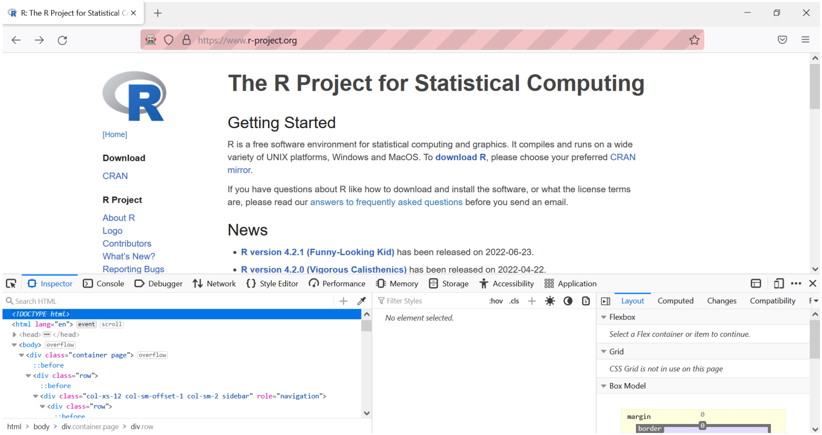

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```
<!DOCTYPE html>
<html lang="en"> event scroll
  <head> ··· </head>
  <body> overflow
    <div class="container page"> overflow
      ::before
      <div class="row">
        ::before
        <div class="col-xs-12 col-sm-offset-1 col-sm-2 sidebar" role="navigation">
          <div class="row">
            ::before
```

No element selected.

Flexbox

Select a Flex container or item to continue.

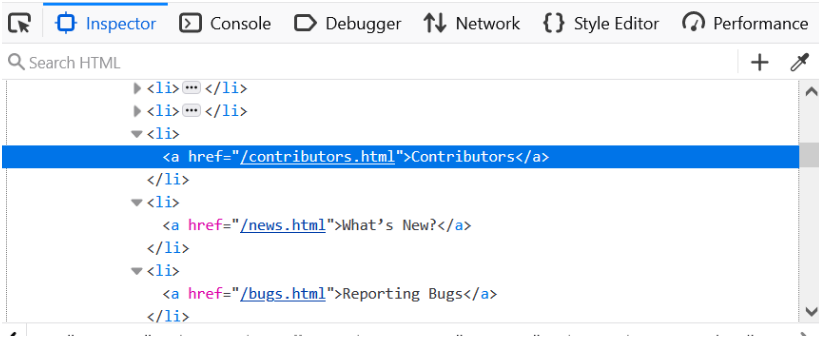
Grid

CSS Grid is not in use on this page

Box Model

margin 0
border 0

Then, hover the element we're interested in: the link "Contributors".



```
<li>⋯</li>
<li>⋯</li>
<li>
  <a href="/contributors.html">Contributors</a>
</li>
<li>
  <a href="/news.html">What's New?</a>
</li>
<li>
  <a href="/bugs.html">Reporting Bugs</a>
</li>
```

How can we find this with `RSelenium`?

```
?RSelenium::remoteDriver
```

-> `findElement`

- class name
- id
- name
- tag name
- css selector
- link text
- partial link text
- xpath

All of these work:

```
remote_driver$
  findElement("link text", "Contributors")$
  clickElement()

remote_driver$
  findElement("partial link text", "Contributors")$
  clickElement()

remote_driver$
  findElement("xpath", "/html/body/div/div[1]/div[1]/div/di
  clickElement()

remote_driver$
  findElement("css selector", "div.col-xs-6:nth-child(1) >
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  clickElement()
```
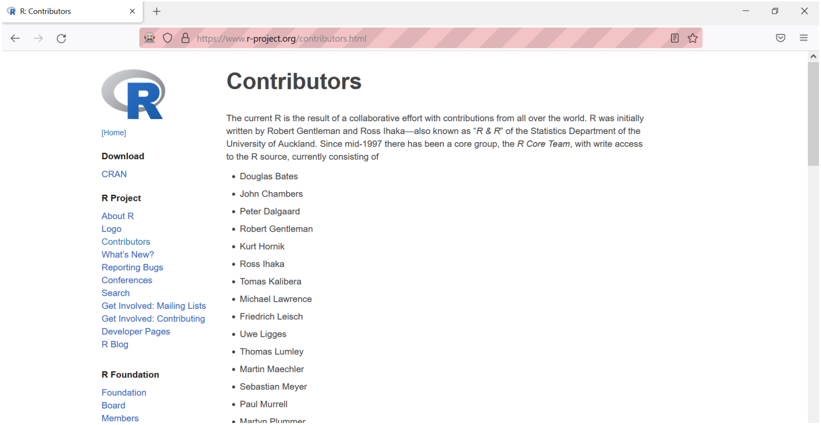

Tip

You can check that you found the right element by highlighting

## We are now on the right page!



# Contributors

The current R is the result of a collaborative effort with contributions from all over the world. R was initially written by Robert Gentleman and Ross Ihaka—also known as "*R & R*" of the Statistics Department of the University of Auckland. Since mid-1997 there has been a core group, the *R Core Team*, with write access to the R source, currently consisting of

- Douglas Bates
- John Chambers
- Peter Dalgaard
- Robert Gentleman
- Kurt Hornik
- Ross Ihaka
- Tomas Kalibera
- Michael Lawrence
- Friedrich Leisch
- Uwe Ligges
- Thomas Lumley
- Martin Maechler
- Sebastian Meyer
- Paul Murrell
- Martyn Plummer

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Last step: obtain the HTML of the page.

```
remote_driver$getPageSource()
```

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```r
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```

To read it with `rvest`:

```r
x <- remote_driver$getPageSource()[[1]]
rvest::read_html(x)
```

Do we read the HTML and extract the information in the same script?

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**No!**

Instead, we save the HTML in an external file, and we will be able to access it in another script (and offline) to manipulate it as we want.

```r
write(x, file = "contributors.html")
# Later and in another script
rvest::read_html("contributors.html")
```

Click here to see the results.

## Exercise 2: a harder & real-life example

The previous example was not a *dynamic* page: we could have used the link to the page and apply webscraping methods for static webpages.

```r
rvest::read_html("https://www.r-project.org/contributors.ht
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rvest::read_html("https://www.r-project.org/contributors.ht
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Let's now dive into a more complex example, where RSelenium is the only way to obtain the data.

## Before using RSelenium

*Using RSelenium is slower than using "classic" scraping methods*, so it's important to check all possibilities before using it.

Use Selenium if:

- the HTML you want is not directly accessible, i.e needs some interactions (clicking on a button, connect to a website...)
- the URL doesn't change with the inputs
- you can't access the data directly in the "network" tab of the console

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Interesting read: the Ethical Scraper

## Example: Sao Paulo immigration museum

ASK MARTIN FIRST

## Appendix

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For reference, here's the code to extract the list of contributors:

```
library(rvest)

html <- read_html("contributors.html")

bullet_points <- html %>%
  html_elements(css = "div.col-xs-12 > ul > li") %>%
  html_text()

blockquote <- html %>%
  html_elements(css = "div.col-xs-12.col-sm-7 > blockquote'
  html_text() %>%
  strsplit(., split = ", ")

blockquote <- blockquote[[1]] %>%
  gsub("\\r|\\n|\\.|and", "", .)

others <- html %>%
```

# Appendix

```
 [1] "Douglas Bates"          "John Chambers"          "Pe
 [4] "Robert Gentleman"       "Kurt Hornik"            "Ro
 [7] "Tomas Kalibera"         "Michael Lawrence"       "Fr
[10] "Uwe Ligges"             "Thomas Lumley"          "Ma
[13] "Sebastian Meyer"        "Paul Murrell"           "Ma
[16] "Brian Ripley"           "Deepayan Sarkar"        "Du
[19] "Luke Tierney"           "Simon Urbanek"          "Va
[22] "Suharto Anggono"        "Thomas Baier"           "Ga
[25] "Henrik Bengtsson"       "Roger Biv"              "Be
[28] "David Brahm"            "Göran Broström"         "Pa
[31] "Vince Carey"            "Saikat DebRoy"          "Ma
[34] "Brian D'Urso"           "Lyndon Drake"           "Di
[37] "Claus Ekstrom"          "Sebastian Fischmeister" "Jo
[40] "Paul Gilbert"           "Yu Gong"                "Ga
[43] "Frank E Harrell Jr"     "Peter M Haverty"        "To
[46] "Robert King"            "Kjetil Kjernsmo"        "Ro
[49] "Philippe Lambert"       "Jan de Leeuw"           "Ji
[52] "Patrick Lindsey"        "Catherine Loader"       "Go
```