



Fundamentals of Package Development

Andy Teucher
posit::conf(2023)
Hyatt Regency Hotel, Chicago

Housekeeping

- WiFi:
 - Network: Posit Conf 2023
 - Password: conf2023
- There are **gender-neutral bathrooms** located among the Grand Suite Bathrooms.
- There are two **meditation/prayer rooms**: Grand Suite 2A and Grand Suite 2B.
Open Sunday - Tuesday 7:30 a.m. - 7:00 p.m., Wednesday 8:00 a.m. - 6:00 p.m.
- The **lactation room** is located in Grand Suite 1.
Open Sunday - Tuesday 7:30 a.m. - 7:00 p.m., Wednesday 8:00 a.m. - 6:00 p.m.
- Participants who do not wish to be photographed have **red lanyards**; please note everyone's lanyard colours before taking a photo and respect their choices.

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- conf@posit.com
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Welcome!

This is a one-day course for people looking to learn how to build R packages in an efficient way, make them easy to maintain, and easy for users to use.

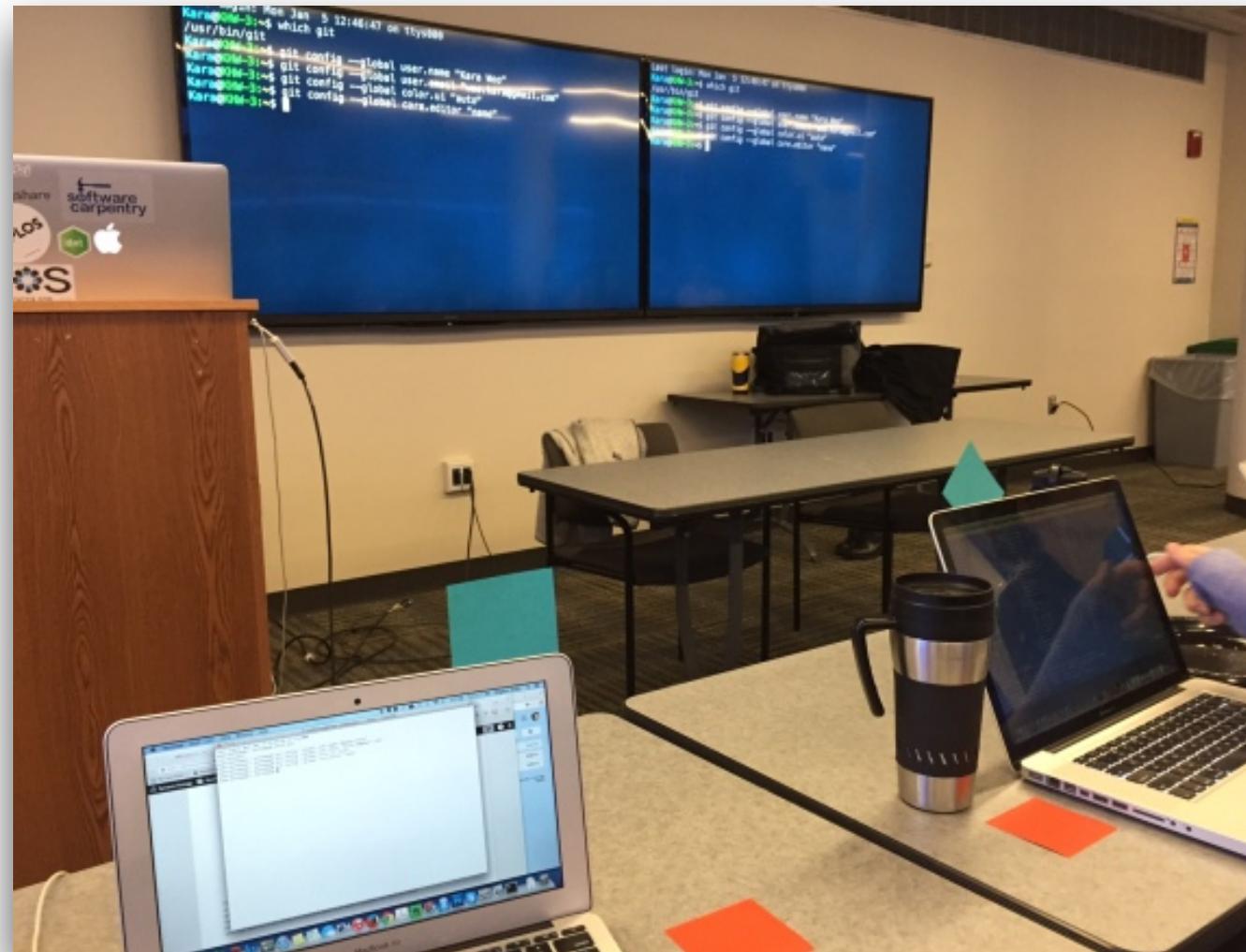
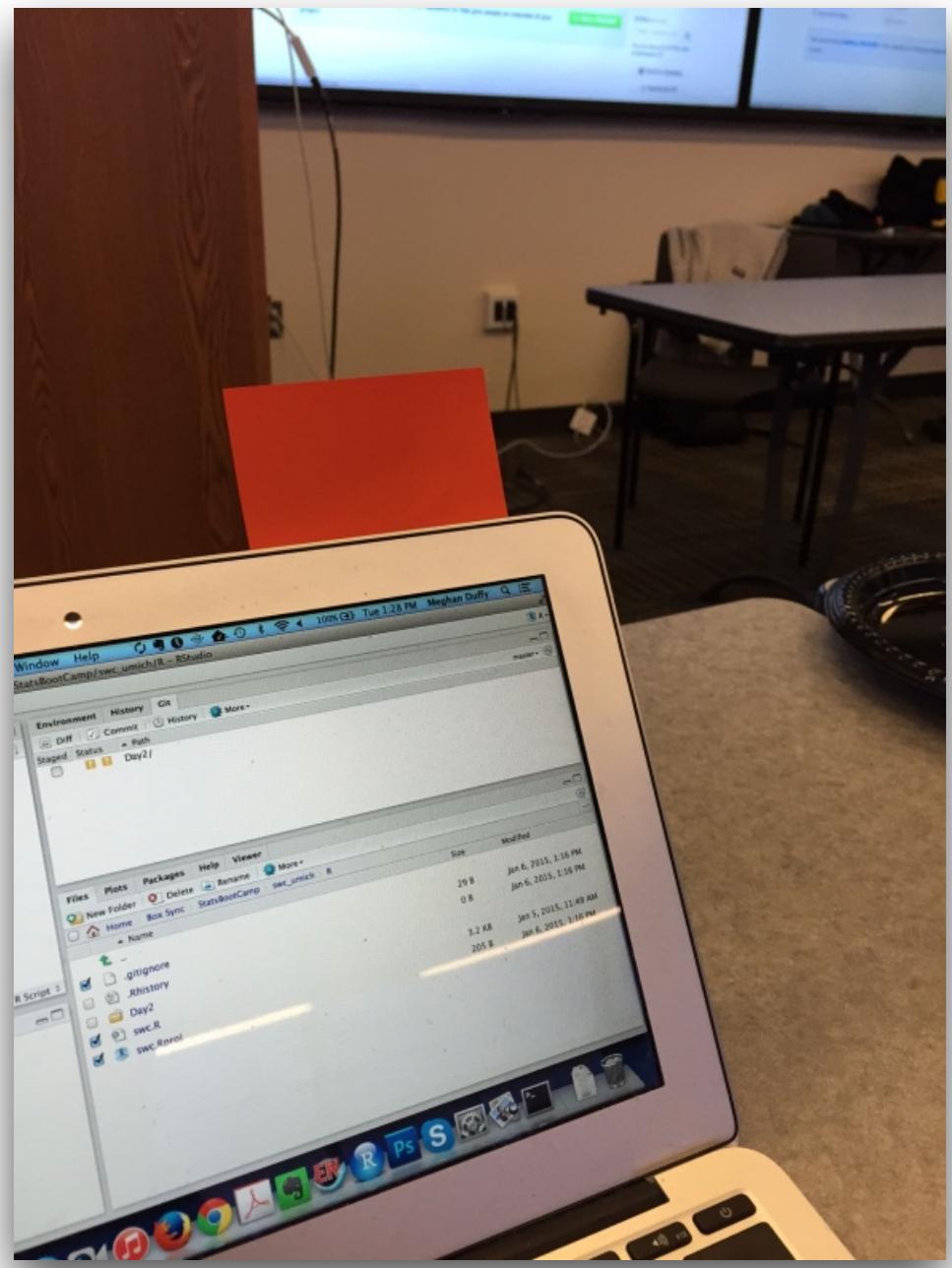
- Workshop website: pos.it/pkg-dev-conf23
- Introductions
 - Instructor
 - TAs:
 - Michele Peruzzi
 - Thomas Pedersen
 - Yourselves

Welcome!

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- Workshop website: pos.it/pkg-dev-conf23
- Introductions
 - Instructor
 - TAs:
 - Nic Crane
 - Simon Couch
 - Yourselves

Sticky Notes



PURPLE

I'm stuck, please
send help

GREEN

I'm good, let's
move on

Discord

1. Go to your event portal: <http://pos.it/conf-event-portal>
2. Click on the image that says, “Click here to join Discord, the virtual networking platform!”.
3. Accept the invitation, and review and agree to the code of conduct.
4. Click "Browse Channels" in the top-left corner and find **#fundamentals-of-package-development**
5. Click the checkbox to join the channel
6. Click on the channel in the left sidebar.
7. Introduce yourself!



Schedule and Learning Objectives

- What is a package and why should you make one? START: 9:00
- Package Structure and State - where do they come from, where do they live?

- Package Creation and Metadata BREAK: 10:30 - 11:00
- Documentation

- Testing LUNCH: 12:30 - 1:30
- Package Dependencies

- Continuous Integration BREAK: 3:00 - 3:30
- Package Website & Vignettes
- Package Distribution (CRAN)

END: 5:00

R Packages (2e)

Hadley Wickham

Jenny Bryan

<https://r-pkgs.org>

O'REILLY®

Second
Edition

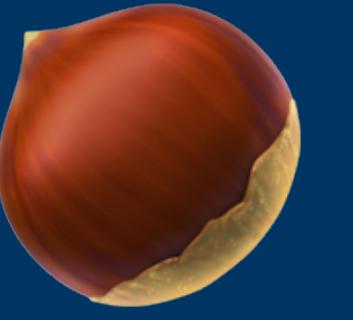
R Packages

Organize, Test, Document, and Share Your Code



Hadley Wickham
& Jennifer Bryan

Packages in a nutshell



Why make a package?



Why make a package?



Why make a package?



- Easier to reuse functions you write
- A consistent framework which encourages you to better organize, document, and test your code
- This framework means you can use many standardized tools
- Easiest way to distribute code (and data)
 - To your team
 - To the world

Script vs Package

<https://r-pkgs.org/package-within.html>

Script

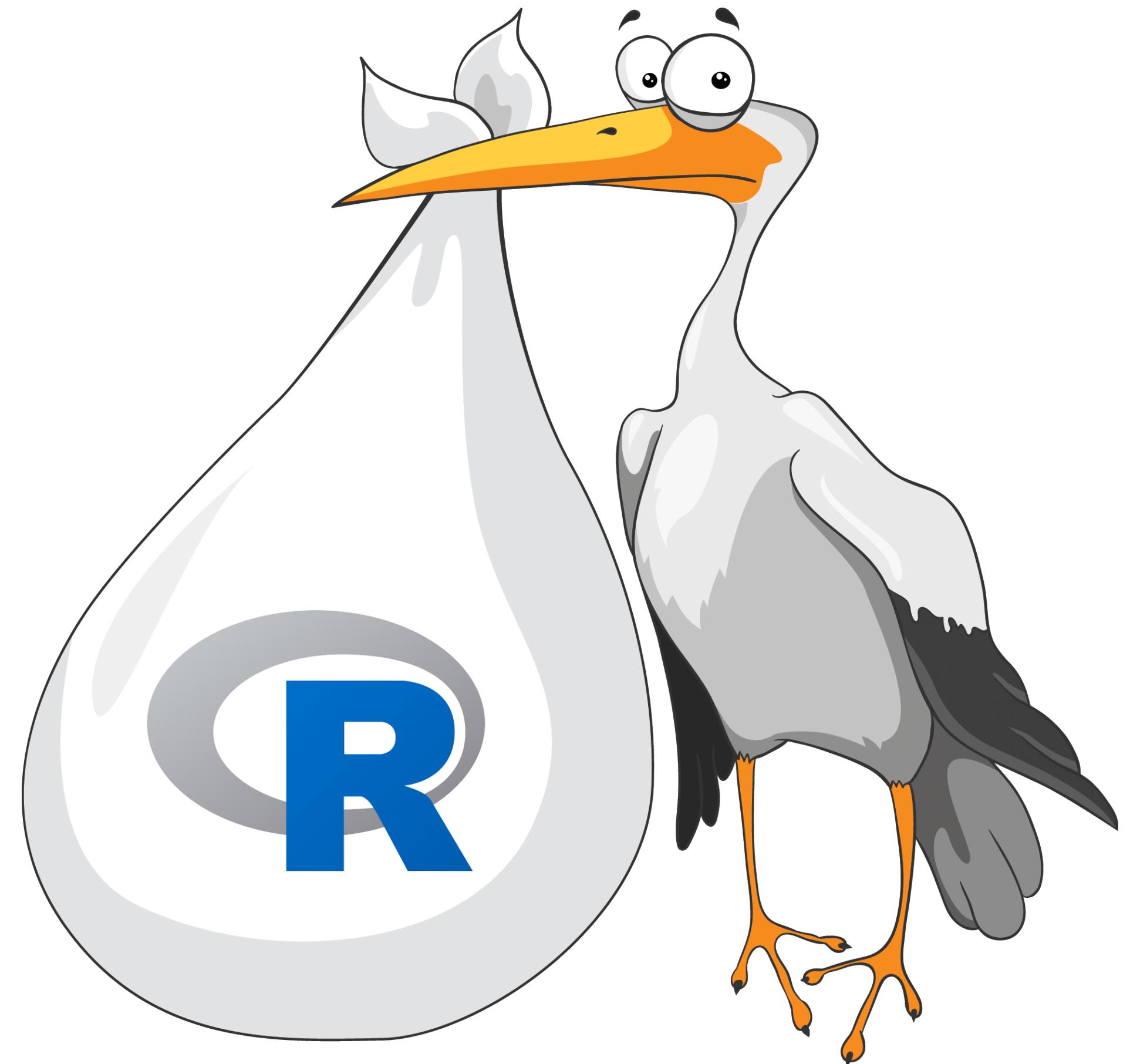
- Performs data analysis
- Collection of one or more `.R` files
- `library()` calls
- Documentation in `#` comments
- Run with `source()` or `select+run`

Package

- Reusable functions to use in analyses
- Defined by particular file organization
- Required packages in `DESCRIPTION`
- Documentation in `Roxygen` comments and “man” files
- Functions available when package attached

Where do packages come from?

- Discuss with your neighbour and put up a green sticky when you have:
 - Your favourite package
 - **2 places** from which you install packages
 - **2 functions** you can use to install packages
- Write them in the Discord channel



R Libraries - where do packages live?

- A **library** is a directory containing installed **packages**
- You have at least one library on your computer
- Common (and recommended) to have two libraries:
 1. A **system** library with **base** (14) and **recommended** (15) packages; installed with R.
 2. A **user** library with user-installed packages
- We use **library(pkg)** function to **attach** a package
- 7 base packages are always attached (**base**, **methods**, **utils**, **stats**, **grDevices**, **datasets**, **graphics**)

Your turn

Type `.libPaths()` to see your libraries

- How many libraries do you have?
- What are they? (Put them in the Discord)

Package Structure and State

Five forms

Source

- Directory of files with specific structure
 - What you interact with as you build a package
-

Bundle

- Package compressed into a single file (tar.gz) via `devtools::build()` -> `R CMD build`
 - Vignettes are built and files listed in `.Rbuildignore` are left behind
-

Binary

- Platform-specific compressed file (.tgz, .zip)
 - Made with `devtools::build(binary = TRUE)` -> `R CMD INSTALL --build`
-

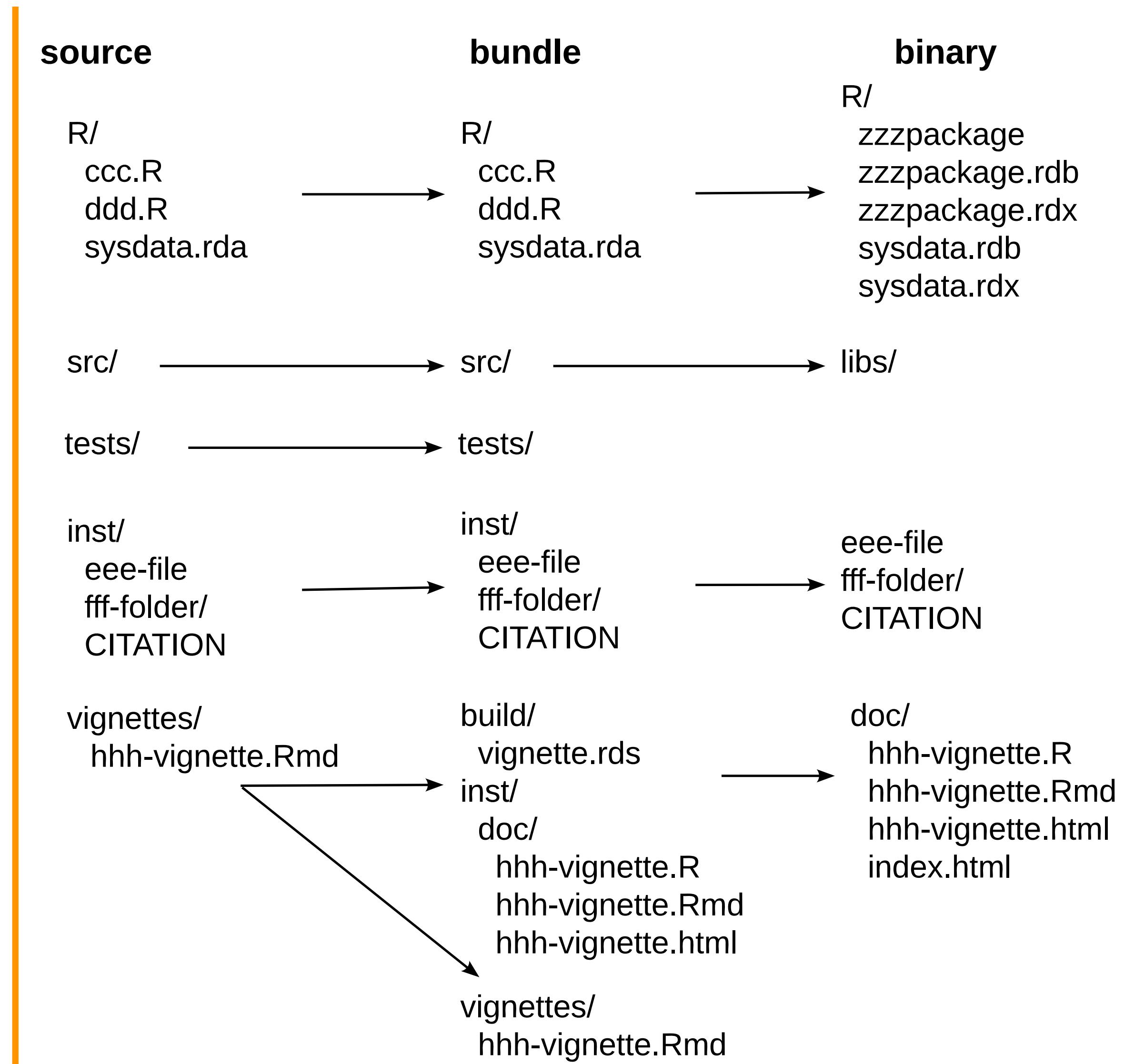
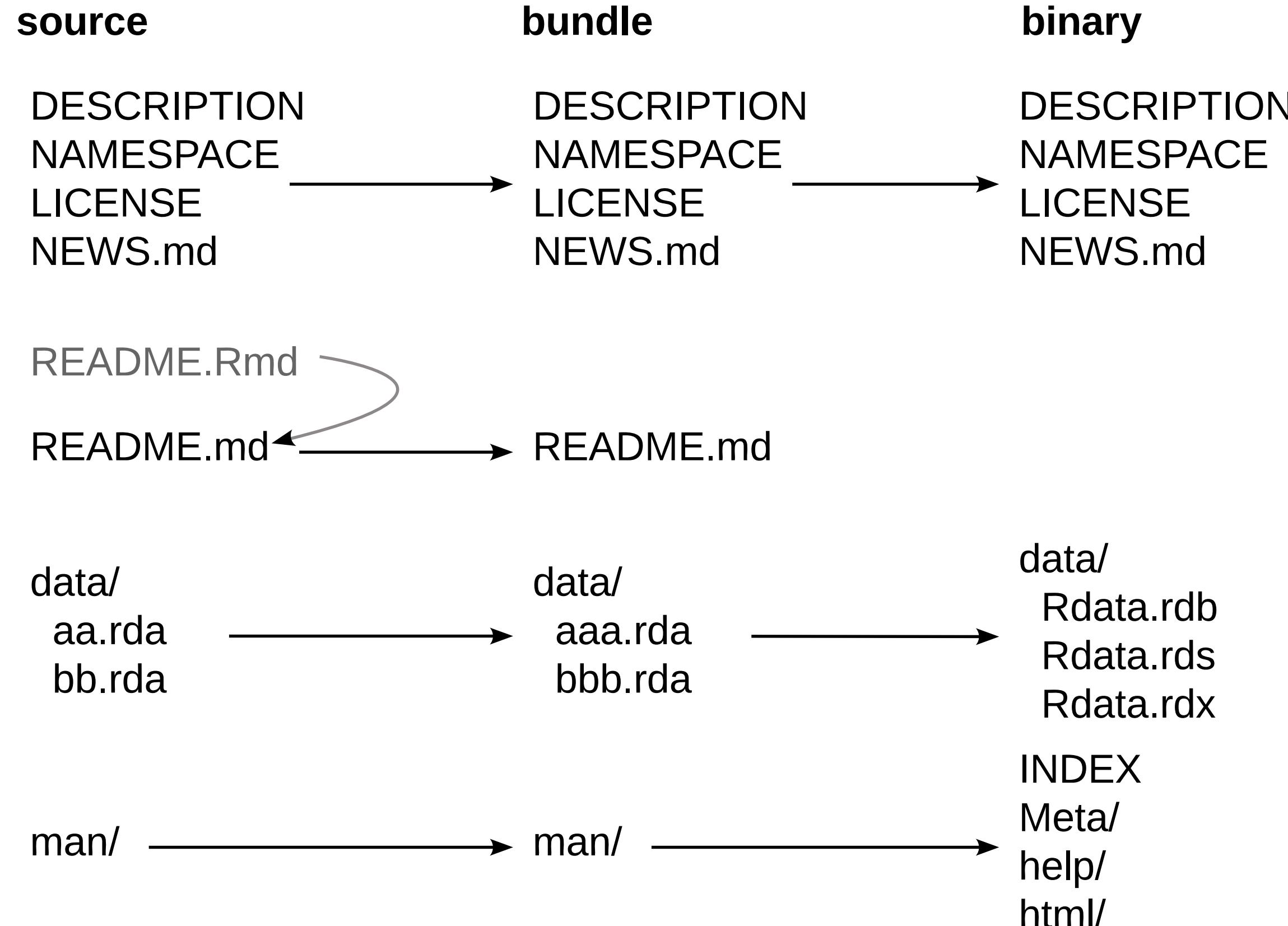
Installed

- Binary package decompressed into a user's library
 - `install.packages()`
-

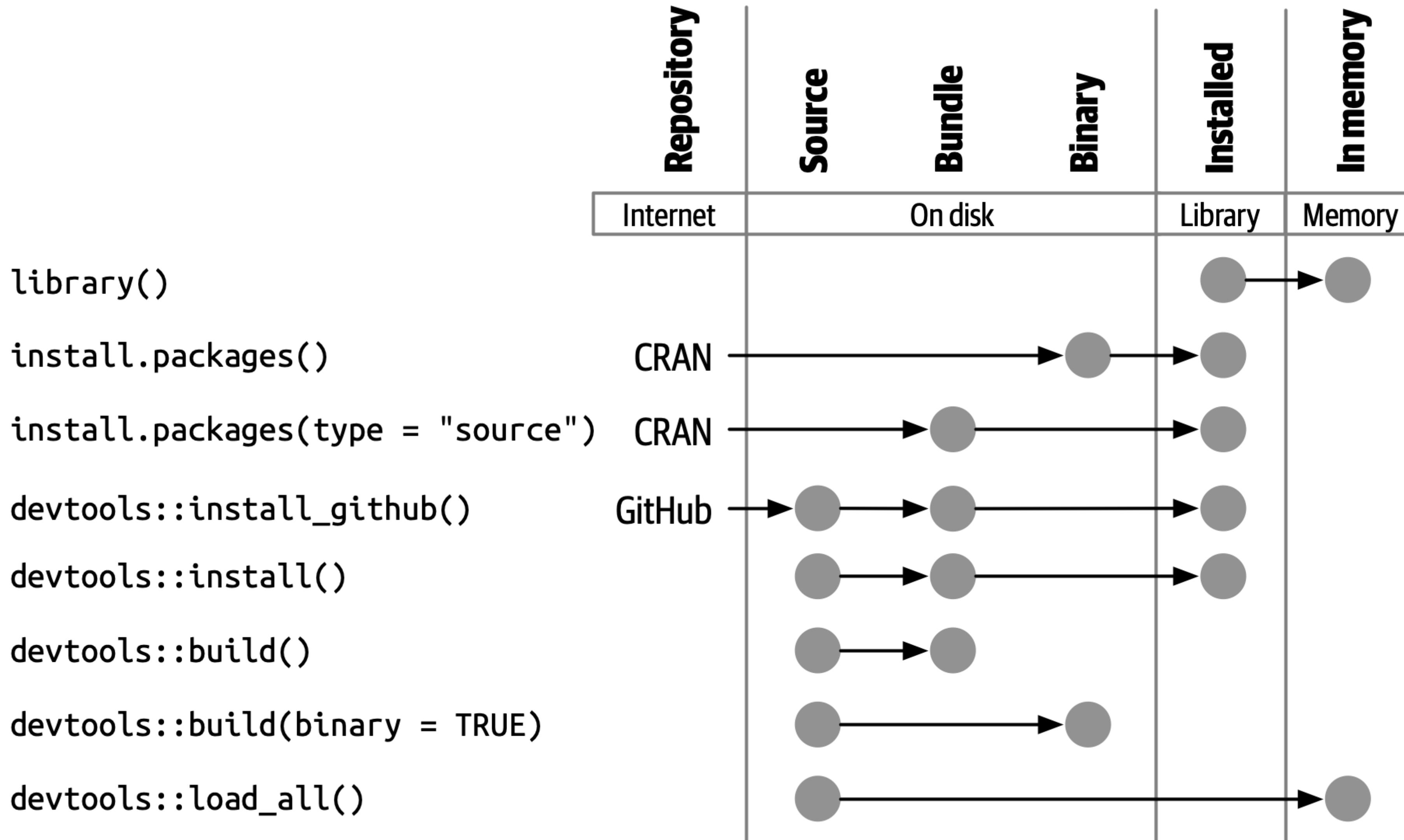
In Memory

- Loaded and ready for use in an R session
- `library()`

Package Structure and State



Package Structure and State



Let's make a package together

We will:

- Create a simple package
- Use git to track our changes
- Push the code to a repository on GitHub
- Create tests for our functions
- Create documentation for our functions
- Create a package website
(if we have time)
- Focus on workflows

We won't:

- Talk (much) about function writing and design
- Talk about how to include data in your package

libminer

Sneak peak of our end goal on GitHub

- <https://github.com/ateucher/libminer.master>
- A package to explore our local R package libraries



libminer

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Get Ready

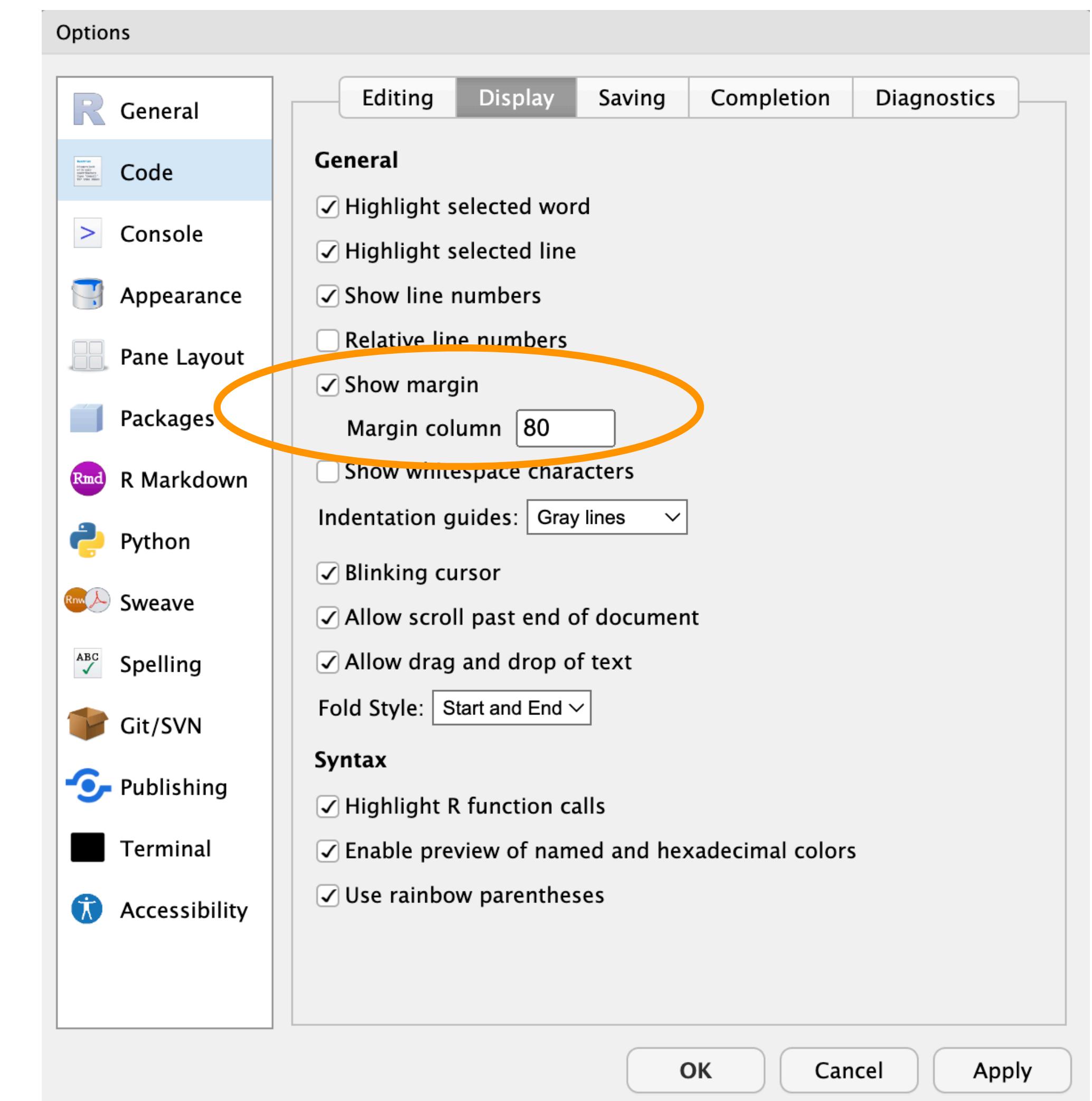
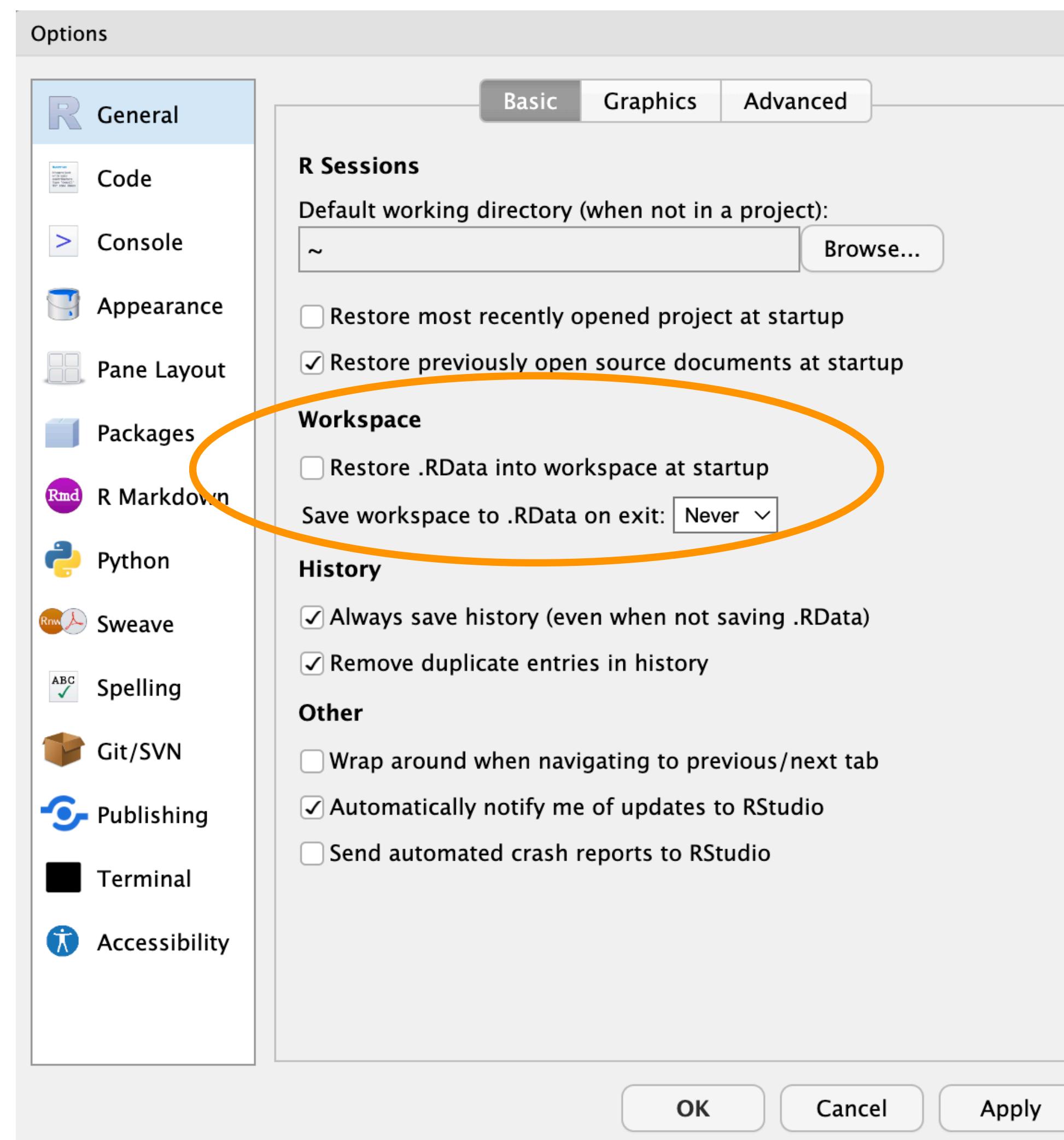


Get Ready



Configure RStudio

Tools > Global Options

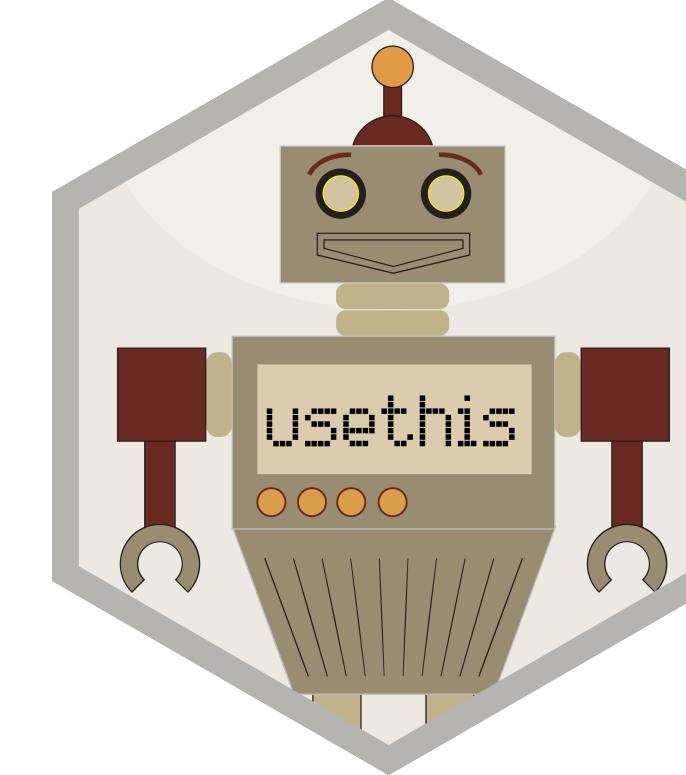


Tools



- R >= 4.3.0
- R Studio® (<https://posit.co/download/rstudio-desktop/>)
- Packages:

```
install.packages(  
  c("devtools", "roxygen2", "testthat", "knitr", "pkgdown")  
)
```



Create a package



Create a package



Load devtools



```
library(devtools)
#> Loading required package: usethis
```

```
packageVersion("devtools")
#> [1] '2.4.5'
```

- Update if necessary!
- Provides a suite of functions to aid package development
- Loads **usethis**, the source of most functions we will be using

create_package()



```
create_package("~/Desktop/mypackage")
```

```
└── .Rbuildignore  
└── .Rproj.user  
└── .gitignore  
└── DESCRIPTION  
└── NAMESPACE  
└── R  
└── mypackage.Rproj
```

- Creates directory
 - Final part of path will be the package name
- Sets up basic package skeleton
- Opens a new RStudio project
- Activates "build" pane in RStudio

create_package()



```
create_package("~/Desktop/mypackage")
#> ✓ Creating '/Users/jane/Desktop/mypackage/'
#> ✓ Setting active project to '/Users/jane/Desktop/mypackage'
#> ✓ Creating 'R/'
#> ✓ Writing 'DESCRIPTION'
#> Package: mypackage
#> Title: What the Package Does (One Line, Title Case)
#> Version: 0.0.0.9000
#> Authors@R (parsed):
#>     * First Last <first.last@example.com> [aut, cre] (YOUR-ORCID-ID)
#> Description: What the package does (one paragraph).
#> License: `use_mit_license()`, `use_gpl3_license()` or friends to pick a
license
#> Encoding: UTF-8
#> Roxygen: list(markdown = TRUE)
#> RoxygenNote: 7.2.3
#> ✓ Writing 'NAMESPACE'
#> ✓ Writing 'mypackage.Rproj'
#> ✓ Adding '^mypackage\\\\.Rproj$' to '.Rbuildignore'
#> ✓ Adding '.Rproj.user' to '.gitignore'
#> ✓ Adding '^\\\\.Rproj\\\\.user$' to '.Rbuildignore'
#> ✓ Setting active project to '<no active project>'
```

create_package()



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#> ✓ Setting active project to '<no active project>'
```

➡ Your Turn

use_git()

- `use_git_config(
 user.name = "Jane Doe",
 user.email = "jane@example.org"
)`
- `use_git()`
- Turns package directory into a git repository
- Commits your files (with a prompt)
- Restarts RStudio (with a prompt)
 - Activates "git" pane in RStudio

```
use_git()  
  
#> ✓ Setting active project to  
#>   '/Users/Jane/rrr/mypackage'  
#> ✓ Adding '.Rhistory', '.Rdata',  
#>   '.httr-oauth', '.DS_Store',  
#>   '.quarto' to '.gitignore'  
#> There are 5 uncommitted files:  
#> * '.gitignore'  
#> * '.Rbuildignore'  
#> * 'DESCRIPTION'  
#> * 'metrify.Rproj'  
#> * 'NAMESPACE'  
#> Is it ok to commit them?  
#>  
#> 1: Absolutely not  
#> 2: Not now  
#> 3: Yeah
```

use_git()

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```
use_git()
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#> * '.gitignore'  
#> * '.Rbuildignore'  
#> * 'DESCRIPTION'  
#> * 'metrify.Rproj'  
#> * 'NAMESPACE'  
#> Is it ok to commit?  
#> 1: Abort  
#> 2: No  
#> 3: Yes
```

→ Your Turn

devtools::use_devtools()

Automatically load devtools when R starts

- Opens .Rprofile file
- Copies code to your clipboard
- Paste into .Rprofile
- Restart R

```
if (interactive()) {  
  # Load package dev packages:  
  suppressMessages(require("devtools"))  
}
```

⌨️ Ctrl+Shift+F10 (Windows & Linux)
⌨️ Cmd+Shift+Ø (macOS)

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➡️ Your Turn

use_r()

Write your first function

- R code goes in **R/**
- Name the file after the function it defines

```
use_r("my-fun")
```

```
#> ✓ Setting active project to '/Users/jane/rrr/mypackage'  
#> • Edit 'R/my-fun.R'
```

- Put the definition of your function (and only the definition!) in this file

use_r()

Write your first function

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```

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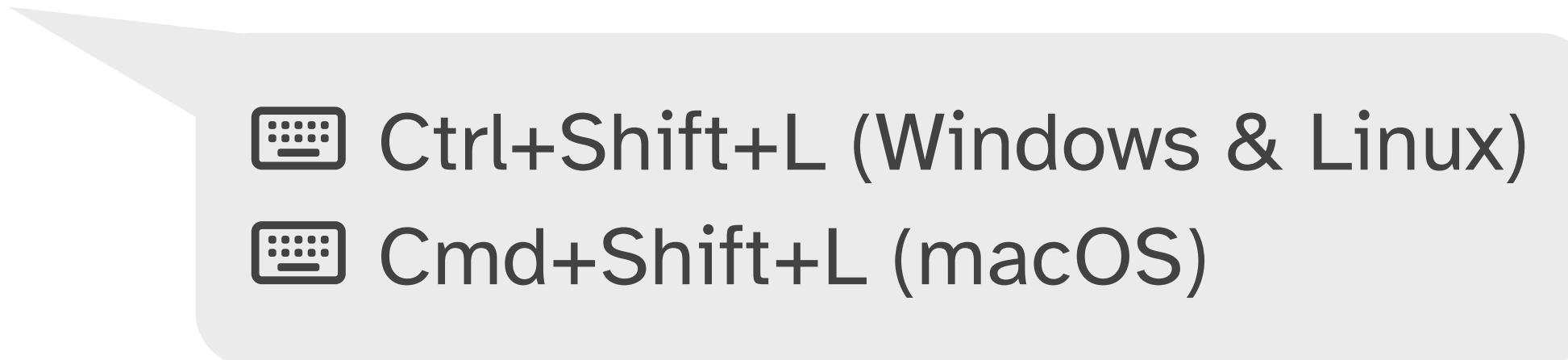
- Put the definition of your function (and only the defin

→ Your Turn

Test your function in the new package

But how?

- `source("R/my-fun.R")`
- Send function to console using RStudio (Ctrl/CMD+Return)

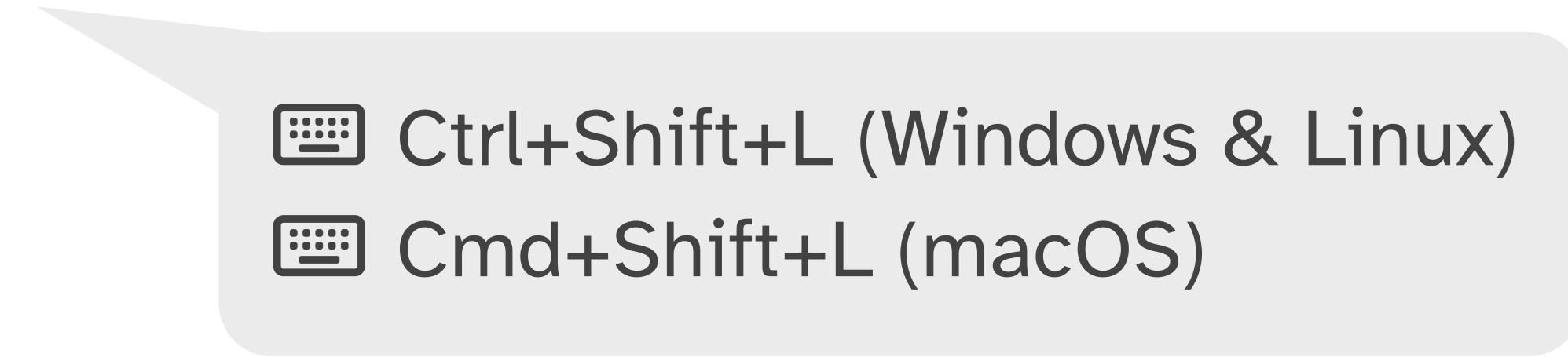


- `Ctrl+Shift+L` (Windows & Linux)
- `Cmd+Shift+L` (macOS)

Test your function in the new package

But how?

- ~~source("R/my-fun.R")~~
- ~~Send function to console using RStudio (Ctrl/CMD+Return)~~
- ~~devtools::load_all()~~

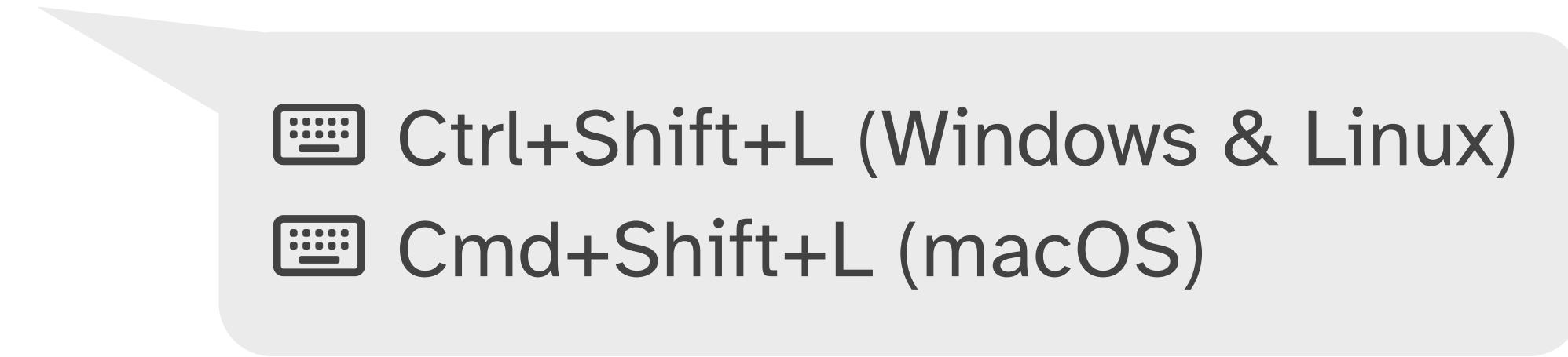


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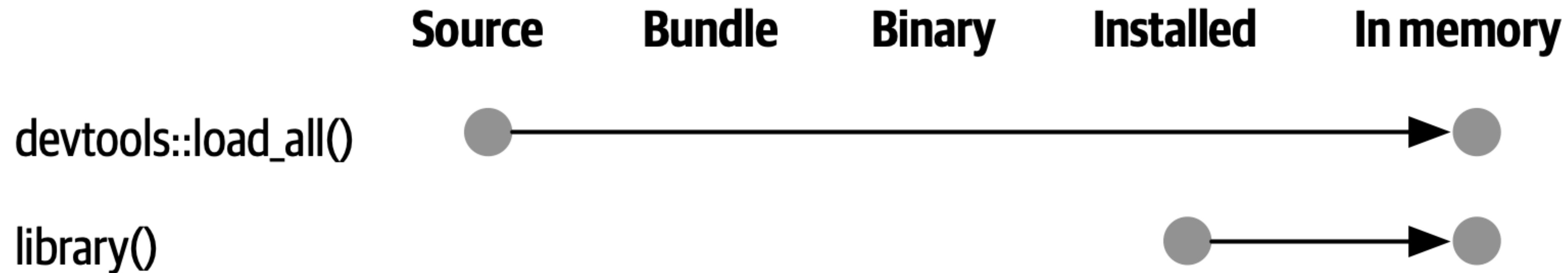
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- ~~Send function to console using RStudio (Ctrl/CMD+Return)~~
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`load_all()`

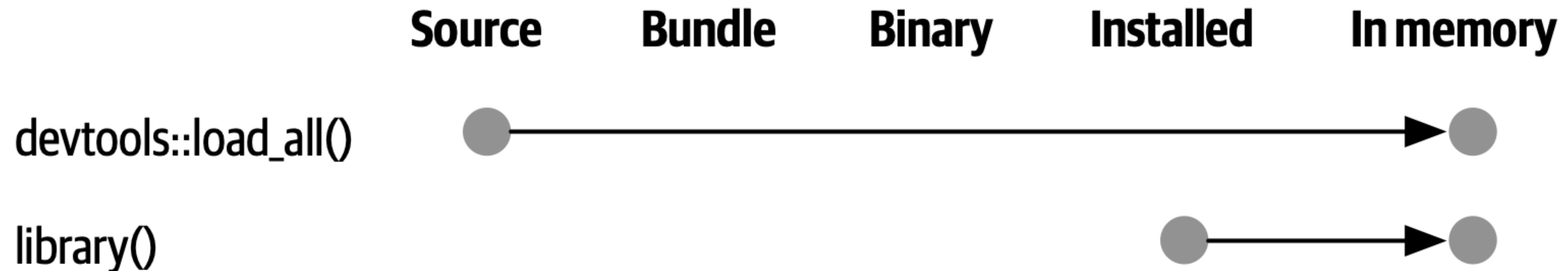
`== install.packages() + library()`



- Simulates building, installing, and attaching your package
- Makes all of the functions from your package immediately available to use
- Allows fast iteration of editing and test-driving your functions
- Good reflection of how users will interact with your package*

load_all()

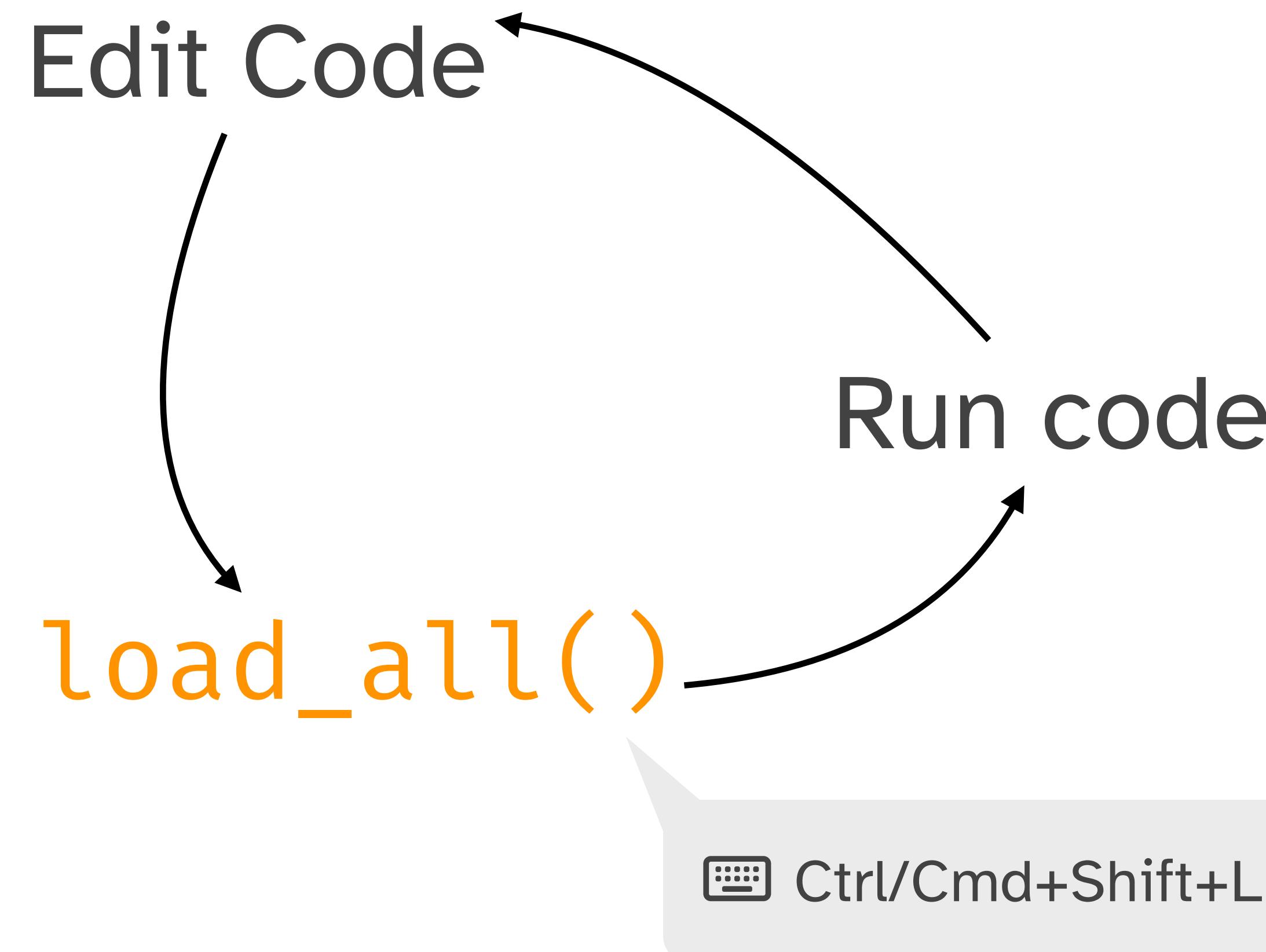
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→ Your Turn

Workflow



Try it out, and commit your
changes



R CMD check

3 types of messages

- **ERRORs:** Severe problems - always fix.
- **WARNINGs:** Problems that you should fix, and must fix if you're planning to submit to CRAN.
- **NOTEs:** Mild problems or, in a few cases, just an observation.
 - When submitting to CRAN, try to eliminate all NOTEs.

check()

Run R CMD check from within R

```
check()
```

```
#> — R CMD check results ——————  
#> Duration: 3.1s  
#>  
#> ✓ checking DESCRIPTION meta-information ... WARNING  
#> Invalid license file pointers: LICENSE  
#>  
#> 0 errors ✓ | 1 warning ✘ | 0 notes ✓
```

- **check()** early and often
- Reduce future pain by catching problems early*

*If it hurts, do it more often, by Martin Fowler:

<https://martinfowler.com/bliki/FrequencyReducesDifficulty.html>

check()

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```

- **check()** early and often
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→ Your Turn

Licenses

`use_*_license()`

- Permissive:
 - **MIT**: simple and permissive.
 - **Apache 2.0**: MIT + provides patent protection.
- Copyleft:
 - Requires sharing of improvements.
 - **GPL (v2 or v3)**
 - **AGPL, LGPL** (v2.1 or v3)
- Creative commons licenses:
 - Appropriate for data packages.
 - **CC0**: dedicated to public domain.
 - **CC-BY**: Free to share and adapt, must give appropriate credit.

use_mit_license()

- ✓ Adding 'MIT + file LICENSE' to License
- ✓ Writing 'LICENSE'
- ✓ Writing 'LICENSE.md'
- ✓ Adding '^LICENSE\\\\.md\$' to '.Rbuildignore'

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→ Your Turn

The DESCRIPTION file

Package metadata

- Make yourself the author

- Name & Email

- Role

- ORCID (optional)

- Write descriptive

- Title:

- Description:



⌨️ Ctrl+.

start typing DESCRIPTION

```
Package: mypackage
Title: What the Package Does (One Line, Title Case)
Version: 0.0.0.9000
Authors@R: person(
  "First", "Last", ,
  "first.last@example.com",
  role = c("aut", "cre"),
  comment = c(ORCID = "YOUR-ORCID-ID")
)
Description: What the package does (one paragraph).
License: `use_mit_license()`, `use_gpl3_license()` or
         friends to pick a license
Encoding: UTF-8
Roxygen: list(markdown = TRUE)
RoxygenNote: 7.2.3
```

The DESCRIPTION file

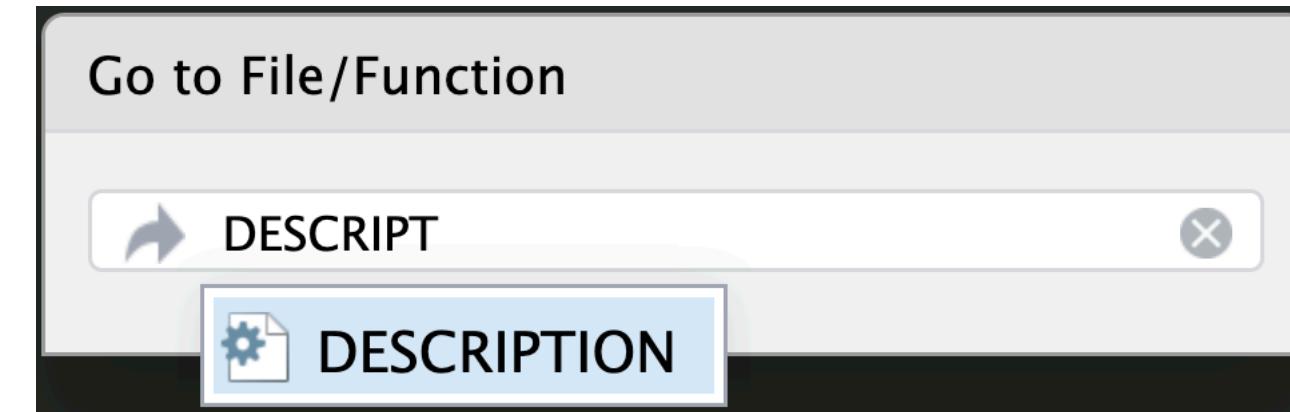
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➡ Your Turn

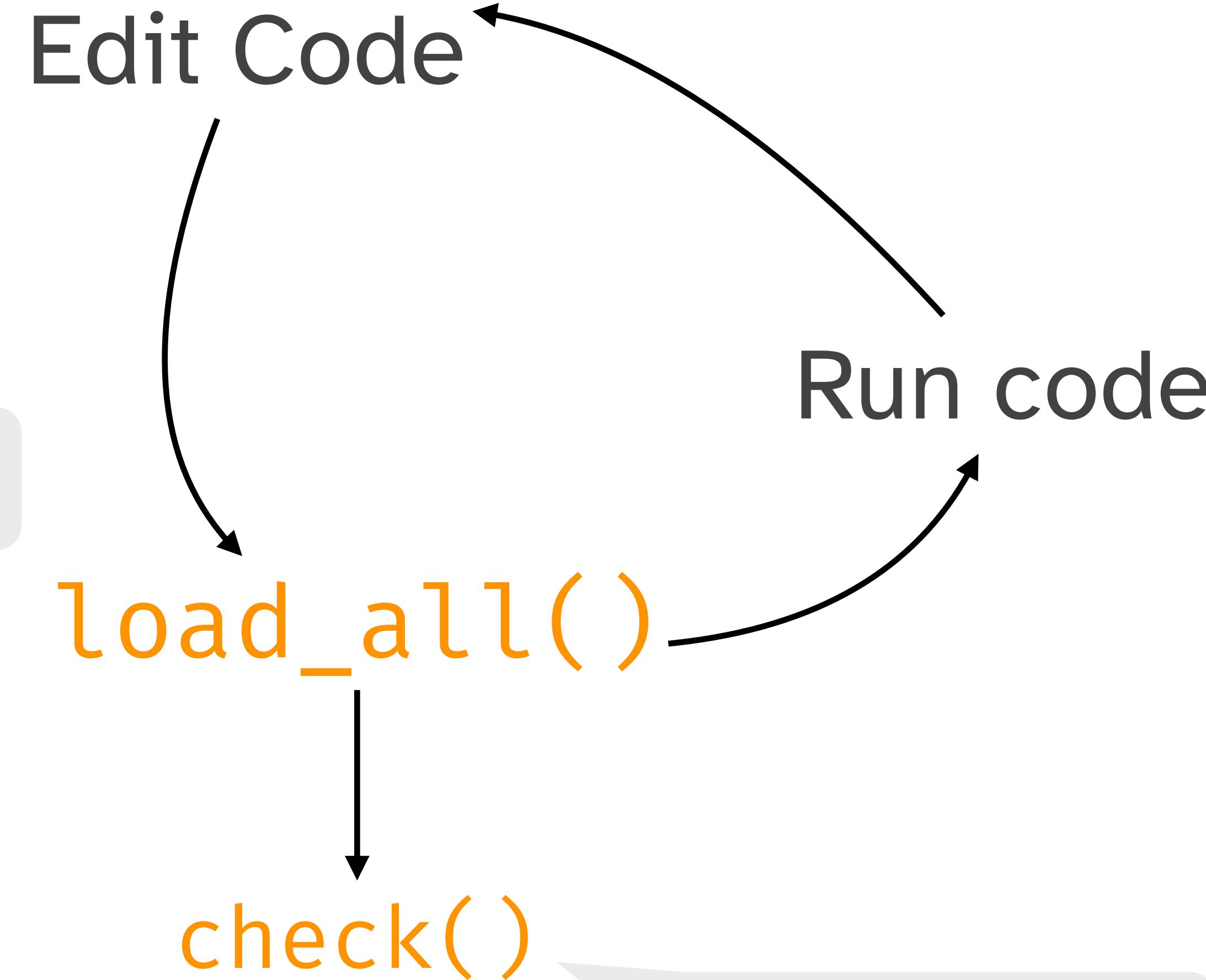
The DESCRIPTION file

Package metadata

- Take a look at the DESCRIPTION for ggplot2.
 - CRAN Package page
 - DESCRIPTION on GitHub
 - Note other Author roles:
 - ‘cph’ (copyright holder, often your employer)
 - ‘fnd’ (funder)

Workflow

Code + check



Ctrl/Cmd+Shift+E

check() again

```
check()
```

```
#> == Documenting ==
...
#> == Building ==
...
#> == Checking ==
...
#> — R CMD check results —
#> Duration: 3.1s
#>
#> 0 errors ✅ | 0 warnings ✅ | 0 notes ✅
```





**TED
LASSO**



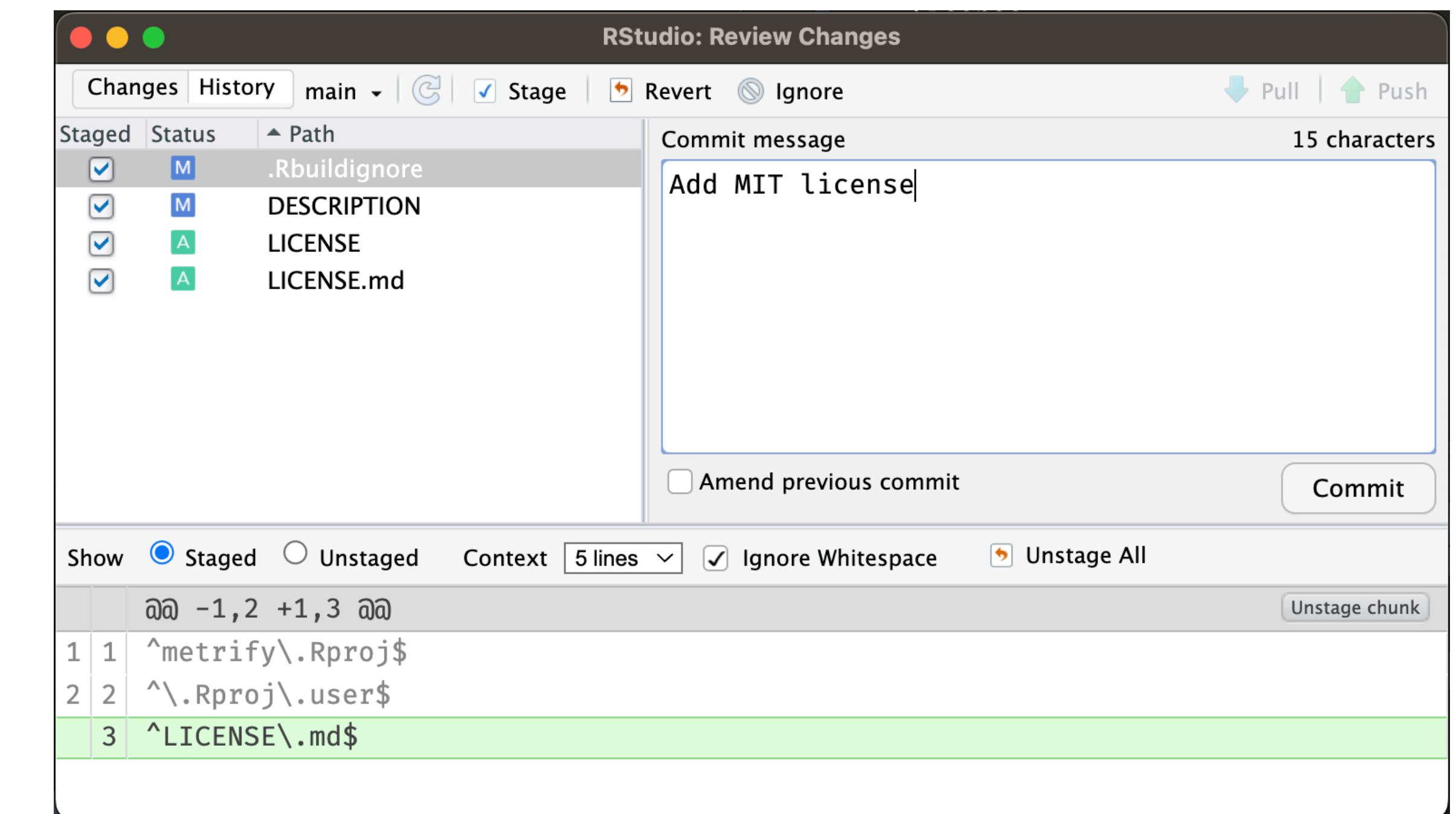
**TED
LASSO**

Commit changes to git



```
$ git add DESCRIPTION \
LICENSE \
LICENSE.md \
.Rbuildignore
```

```
$ git commit -m "Add MIT license"
```



use_github()

Put your package code on GitHub

- Prerequisites:
 - GitHub account
 - `create_github_token()` - follow instructions
 - `gitcreds::gitcreds_set()` - paste PAT
 - `git_sitrep()` - verify

`use_github()` - push content to new repository on GitHub

use_github()

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- Prerequisites:
 - GitHub account
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`use_github()` - push content to new repo

 Your Turn

Avoid some pain of package setup: `edit_r_profile()`

And set default `DESCRIPTION` values

```
# Set usethis options:  
options(  
  usethis.description = list(  
    "Authors@R" = utils::person(  
      "Jane", "Doe",  
      email = "jane@example.com",  
      role = c("aut", "cre"),  
      comment = c(ORCID = "0000-1111-2222-3333"))  
  ))
```

*<https://usethis.r-lib.org/articles/usethis-setup.html>

While you're in there...

Set some other helpful defaults

```
options(  
  warnPartialMatchArgs = TRUE,  
  warnPartialMatchDollar = TRUE,  
  warnPartialMatchAttr = TRUE  
)
```

Documentation



Documentation



Documentation

Documentation

Function documentation

```
> ?use_git  
use_git          package:usethis          R Documentation  
  
Initialise a git repository  
  
Description:  
  
'use_git()' initialises a Git repository and adds important files  
to '.gitignore'. If user consents, it also makes an initial  
commit.  
  
Usage:  
  
  use_git(message = "Initial commit")  
  
Arguments:  
  
  message: Message to use for first commit.  
  
See Also:  
  
  Other git helpers: 'use_git_config()', 'use_git_hook()',  
  'use_git_ignore()'  
  
Examples:  
  
  ## Not run:  
  
  use_git()  
  ## End(Not run)
```

Documentation

man/* .Rd

```
% Generated by roxygen2: do not edit by hand
% Please edit documentation in R/git.R
\name{use_git}
\alias{use_git}
\title{Initialise a git repository}
\usage{
use_git(message = "Initial commit")
}
\arguments{
\item{message}{Message to use for first commit.}
}
\description{
\code{use_git()} initialises a Git repository and adds important files to
\code{.gitignore}. If user consents, it also makes an initial commit.
}
\examples{
\dontrun{
use_git()
}
}
\seealso{
Other git helpers:
\code{\link{use_git_config}()},
\code{\link{use_git_hook}()},
\code{\link{use_git_ignore}()}
}
\concept{git helpers}
```

Function documentation



```
> ?use_git
use_git                  package:usethis
R Documentation
Initialise a git repository

Description:
  'use_git()' initialises a Git repository and adds important files
  to '.gitignore'. If user consents, it also makes an initial
  commit.

Usage:
  use_git(message = "Initial commit")

Arguments:
  message: Message to use for first commit.

See Also:
  Other git helpers: 'use_git_config()', 'use_git_hook()',
  'use_git_ignore()'

Examples:
  ## Not run:
  use_git()
  ## End(Not run)
```

Documentation

man/* .Rd

```
% Generated by roxygen2: do not edit by hand
% Please edit documentation in R/git.R
\name{use_git}
\alias{use_git}
\title{Initialise a git repository}
\usage{
use_git(message = "Initial commit")
}
\arguments{
\item{message}{Character string specifying message to use for first commit.}
}
\description{
}
\code{use_git()}
\code{.gitignore}
}
\examples{
}
\dontrun{
use_git()
}
\seealso{
}
Other git helpers
\code{\link{use_git_config()}}
\code{\link{use_git_hook()}}
\code{\link{use_git_ignore()}}
}
\concept{git helpers}
```

The image shows a scene from the TV show Schitt's Creek. David Rose, played by Eugene Levy, is looking directly at the camera with a confused expression. He has dark hair and is wearing a black t-shirt. In the background, there's a window showing a room with some furniture and a red bookshelf. The overall tone is humorous, suggesting that the documentation process can be confusing.

Function documentation

```
> ?use_git
use_git          package:usethis
Initialise a git repository
Description:
  'use_git()' initialises a Git repository and adds important files
  to '.gitignore'. If user consents, it also makes an initial
  commit.
Usage:
  use_git(message = "Initial commit")
Arguments:
  message: Message to use for first commit.
See Also:
  Other git helpers: 'use_git_config()', 'use_git_hook()',
  'use_git_ignore()'
Examples:
  ## Not run:
  use_git()
  ## End(Not run)
```

The image shows a comparison between two types of documentation. On the left, a screenshot of a terminal or code editor displays the raw R documentation for the 'use_git' function, showing its source code and metadata. On the right, a screenshot of an R help page for the same function is shown, providing a structured overview of the function's purpose, usage, arguments, and examples. An orange arrow points from the raw code towards the help page, indicating the transformation or output of the documentation process.

roxygen2



- RStudio: *Code > Insert Roxygen Skeleton*
- Special comments (#') above function definition in `R/*.R`
 - Title
 - Description
 - Parameters (`@param`)
 - Return value (`@return`)
 - Export tag (`@export`)
 - Example usage (`@examples`)
 - ...
- Markdown-like syntax
- Keep documentation with code!

Cmd/Ctrl+Alt+Shift+R

```
#' Title  
#' A longer description of what the function  
#' is used for  
#'  
#' @param x  
#' @param y  
#'  
#' @return  
#' @export  
#'  
#' @examples  
add <- function(x, y) {  
  x+y  
}
```

document()

R/use-git.R

```
#' Initialise a git repository
#'
#' `use_git()` initialises a Git
#' repository and adds important
#' files to `.gitignore`. If user
#' consents, it also makes an
#' initial commit.
#'
#' @param message Message to use
#'   for first commit.
#' @export
#' @examples
#' \dontrun{
#'   use_git()
#' }
use_git <- function(message = "Initial
commit") {
  . . .
}
```

Cmd/Ctrl
+Shift+D

document()
→

man/*.Rd

```
% Generated by roxygen2: do not edit by hand
% Please edit documentation in R/git.R
\name{use_git}
\alias{use_git}
\title{Initialise a git repository}
\usage{
use_git(message = "Initial commit")
}
\arguments{
\item{message}{Message to use for first commit.}
}
\description{
\code{use_git()} initialises a Git repository and adds
important files to \code{.gitignore}. If user consents,
it also makes an initial commit.
}
\examples{
\dontrun{
use_git()
}
}
```

Create roxygen comments

- Go to function definition  Ctrl+.
(Start typing function name...)
- Cursor in function definition
- Insert roxygen skeleton  Cmd/Ctrl+Alt+Shift+R
- Complete the roxygen fields
- `document()`  Cmd/Ctrl+Shift+D
- `?myfunction`
- 

Create roxygen comments

- Go to function definition
- Cursor in function definition
- Insert roxygen skeleton
- Complete the roxygen fields
- `document()`
- `?myfunction`
- 🎉

⌨️ Ctrl+.

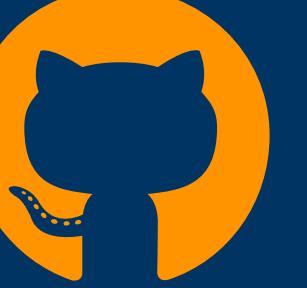
(Start typing function name...)

⌨️ Cmd/Ctrl+Alt+Shift+R

⌨️ Cmd/Ctrl+Shift+D



Your Turn

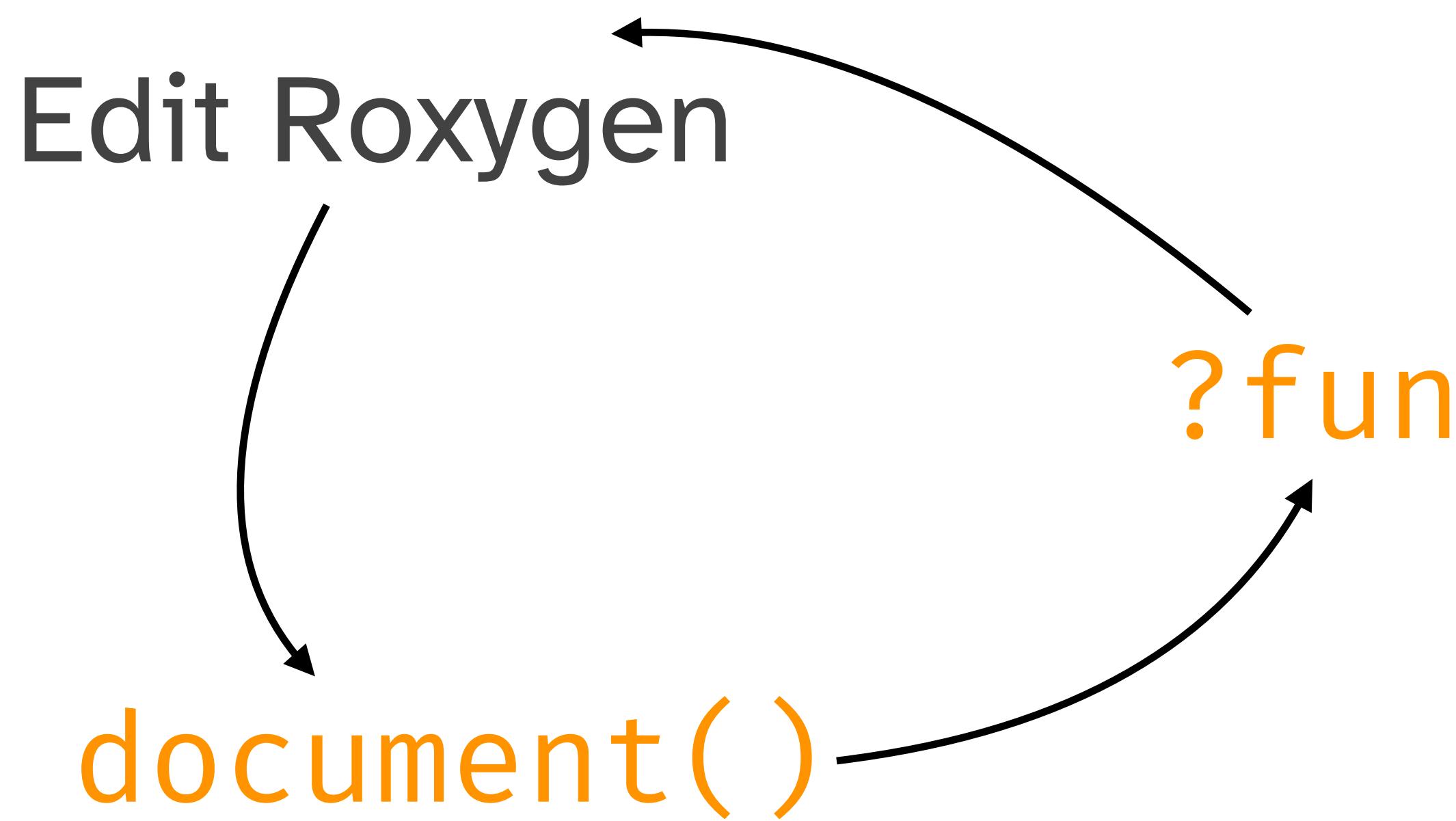
check() 
Commit your changes 
Push to Github 

NAMESPACE

An introduction

- Lists R objects that are:
 - **Exported** from your package to be used by package users
 - `export()`, `S3method()`, ...
 - **Imported** from another package to be used internally by your package
 - `import()`, `importFrom()`, ...
- `document()` updates the NAMESPACE file with directives from Roxygen comments in your R code.

Documentation workflow



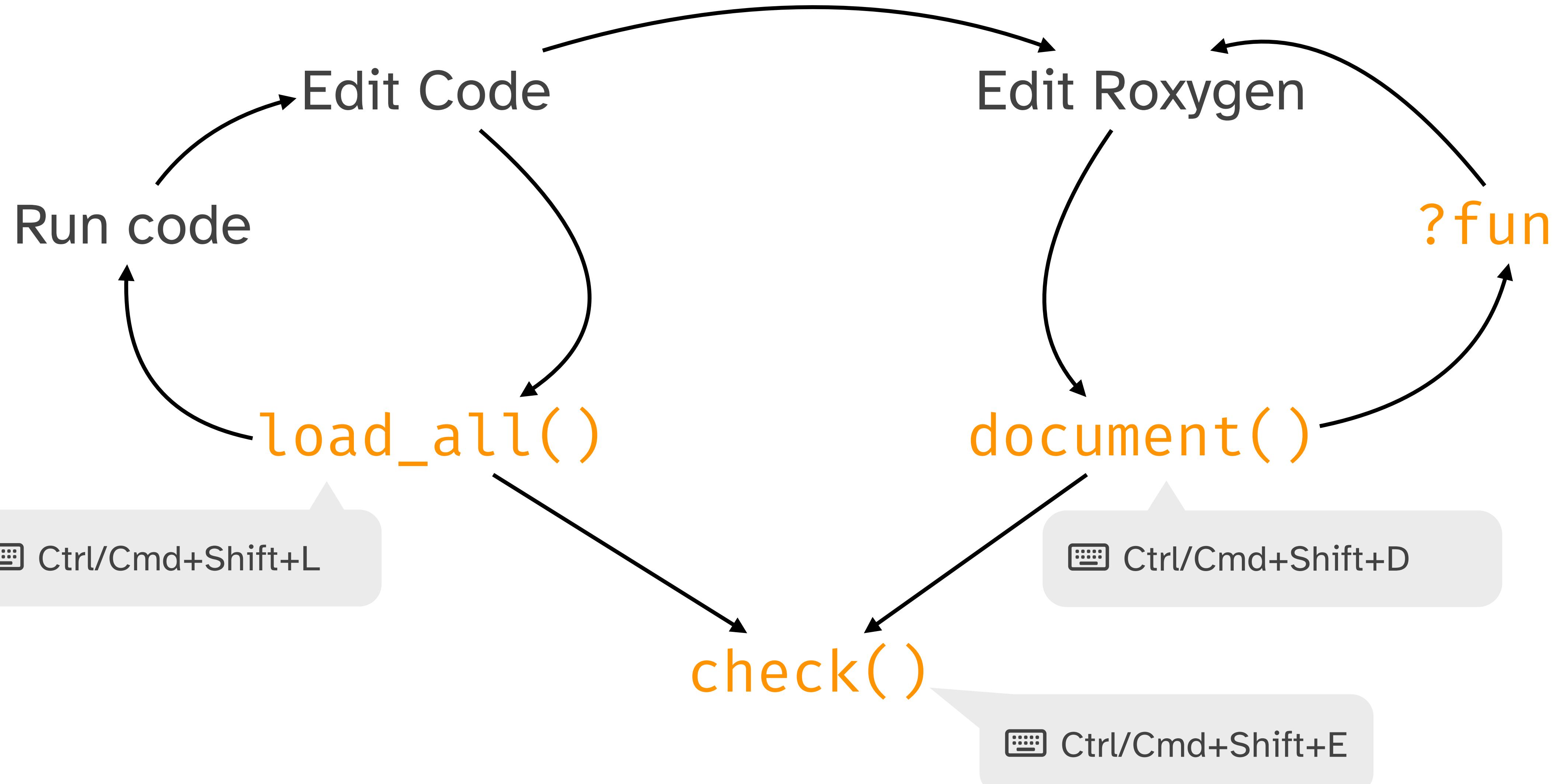
Ctrl+Shift+D (Windows & Linux)



Cmd+Shift+D (macOS)

Workflow

Code + documentation + check



Package-level documentation

use_package_doc()

```
use_package_doc()  
  
#> ✓ Writing 'R/mypackage-package.R'  
#> • Modify 'R/mypackage-package.R'  
  
document()
```

- Package-level help available via `?mypackage`
- Creates relevant `.Rd` file from `DESCRIPTION`
- A good place for roxygen dependency directives

Package-level documentation

use_package_doc()

```
use_package_doc()  
  
#> ✓ Writing 'R/mypackage-package.R'  
#> • Modify 'R/mypackage-package.R'  
  
document()
```

- Package-level help available via `?mypackage`
- Creates relevant `.Rd` file from `DESCRIPTION`
- A good place for roxygen dependency directives

 Your Turn

check() again

```
check()
```

```
#> == Documenting ==
...
#> == Building ==
...
#> == Checking ==
...
#> — R CMD check results —
#> Duration: 3.1s
#>
#> 0 errors ✅ | 0 warnings ✅ | 0 notes ✅
```

install()

Install package to your library

- R CMD INSTALL

⌨️ Ctrl+Shift+B (Windows & Linux)
⌨️ Cmd+Shift+B (macOS)

- Restart R

⌨️ Ctrl+Shift+F10 (Windows & Linux)
⌨️ Cmd+Shift+Ø (macOS)

- Load package with `library()` like any other package

install()

Install package to your library

- R CMD INSTALL

⌨️ Ctrl+Shift+B (Windows & Linux)
⌨️ Cmd+Shift+B (macOS)

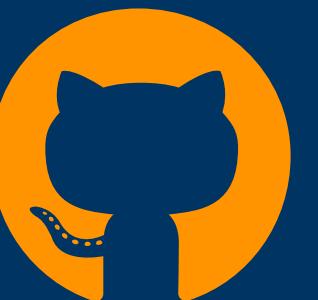
- Restart R

⌨️ Ctrl+Shift+F10 (Windows & Linux)
⌨️ Cmd+Shift+Ø (macOS)

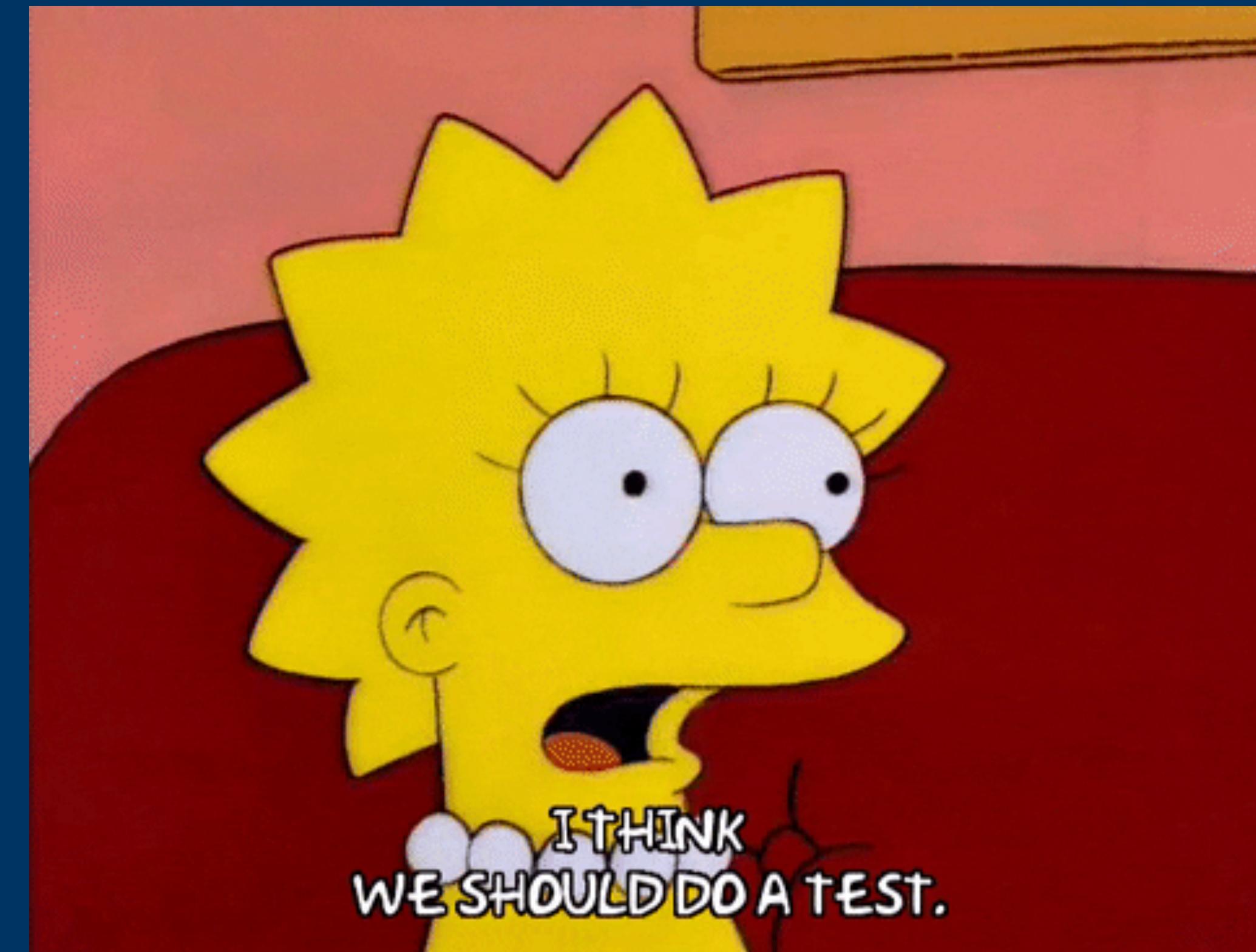
- Load package with `library()` like any other package

➡ Your Turn

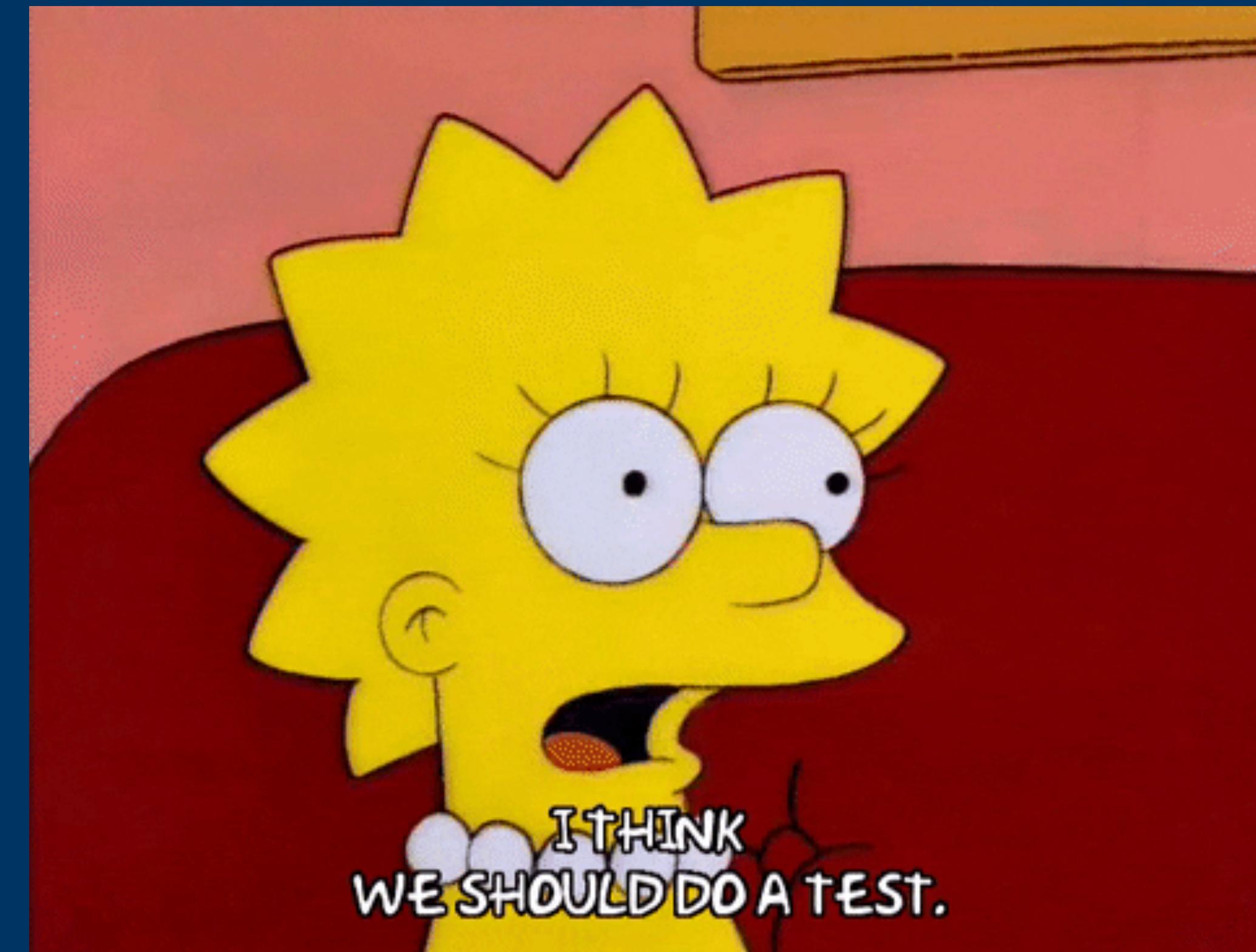
Commit your changes
Push to Github



Testing

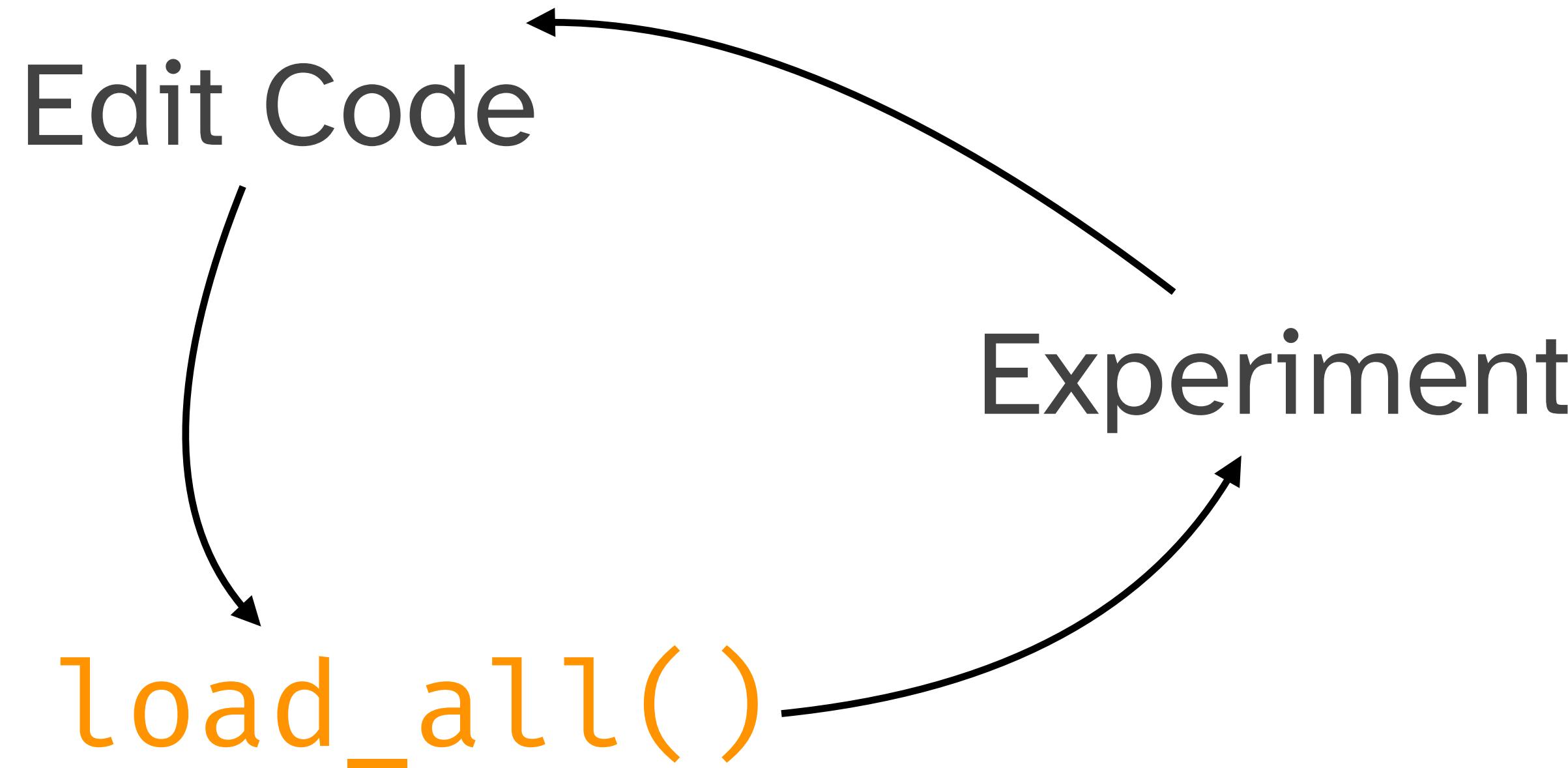


Testing



Testing

Current workflow



Ctrl+Shift+L (Windows & Linux)



Cmd+Shift+L (macOS)

Automated Testing

Benefits

- Fewer bugs
- Better code structure
- Call to action when fixing bugs
- Robust (future-proof) code



use_testthat()

Set up formal testing of your package*

```
use_testthat()
```

```
#> ✓ Adding 'testthat' to Suggests field in DESCRIPTION
#> ✓ Adding '3' to Config/testthat.edition
#> ✓ Creating 'tests/testthat/'
#> ✓ Writing 'tests/testthat.R'
#> • Call `use_test()` to initialize a basic test file and
open it for editing.
```

*Sorry, you still have to write the tests

use_test()

```
use_test('my-fun.R')*
```

```
#> ✓ Writing 'tests/testthat/test-my-fun.R'  
#> • Edit 'tests/testthat/test-my-fun.R'
```

*Omit file name when '**R/my-fun.R**' is active file

File structure

```
libminer
├── DESCRIPTION
├── LICENSE
├── LICENSE.md
├── NAMESPACE
├── R
│   └── lib_summary.R
│   └── libminer-package.R
└── libminer.Rproj
man
└── lib_summary.Rd
└── libminer-package.Rd
tests
└── testthat
    └── test-lib_summary.R
    └── testthat.R
```

Test structure

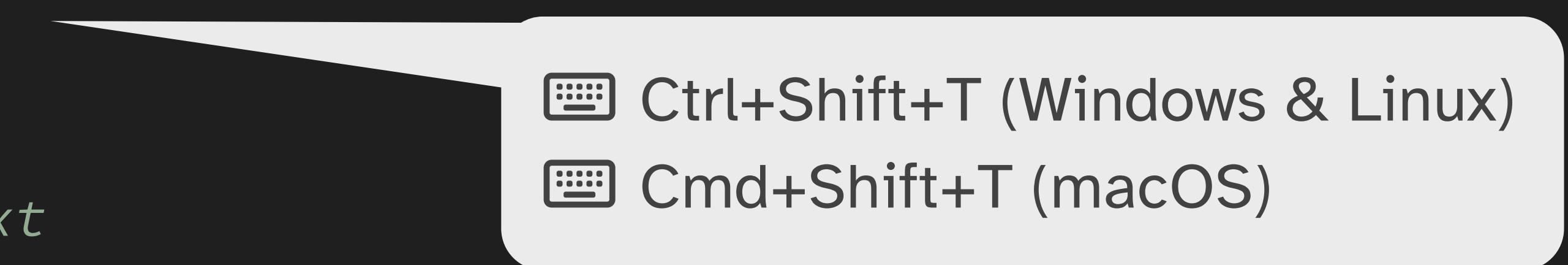
```
testthat("description of what you're testing", {  
  expect_equal([function output], [expected output])  
})
```

- **File:** one or more related tests
- **Test:** `test_that("...")`
 - Tests a unit of functionality (hence unit tests)
 - Contains one or more expectations
- **Expectation:** `expect_``that`(...)
 - Tests a specific computation and compares it to an expected value

test()

- Runs all tests in your test suite

```
test()  
#> i Testing  
#> ✓ | F W S  OK | Context  
#>  
#> :: |          0 |  
#> ✓ |          1 |  
#>  
#> == Results =====  
#> [ FAIL 0 | WARN 0 | SKIP 0 | PASS 1 ]
```



Ctrl+Shift+T (Windows & Linux)
Cmd+Shift+T (macOS)

test()

- Runs all tests in your test suite

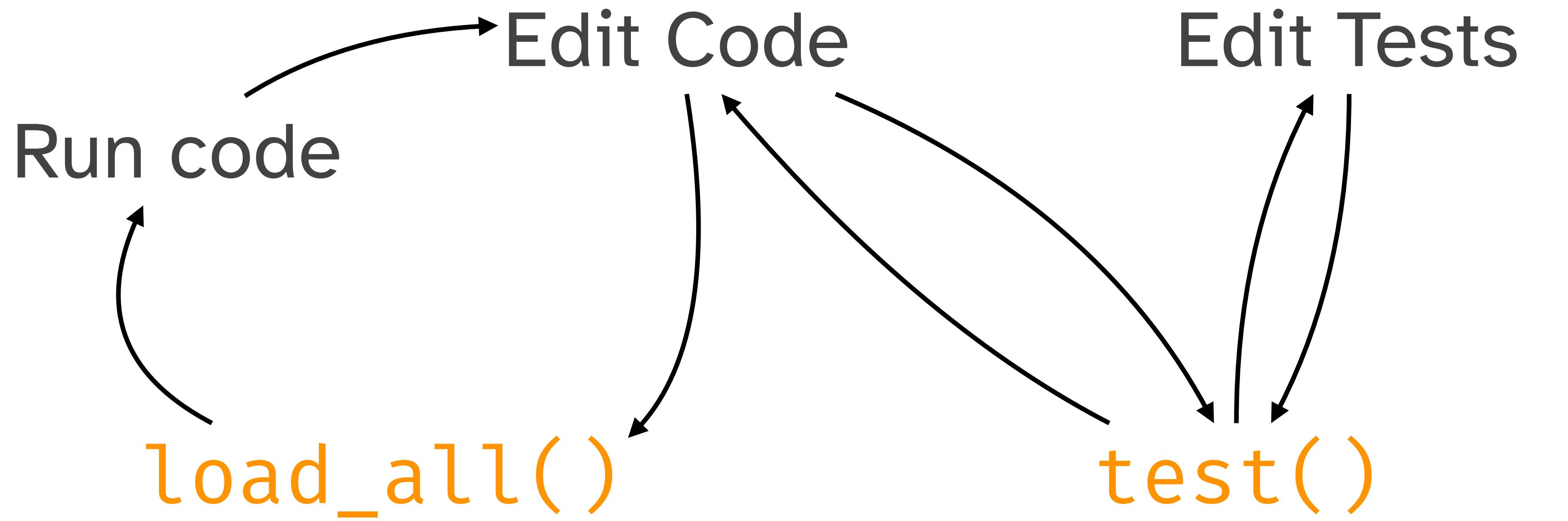
```
test()  
#> i Testing  
#> ✓ | F W S  OK | Context  
#>  
#> :: | 0 |  
#> ✓ | 1 |  
#>  
#> == Results ==  
#> [ FAIL 0 | WARN 0 | SKIP 0 | PASS 1 ]
```

⌨️ Ctrl+Shift+T (Windows & Linux)
⌨️ Cmd+Shift+T (macOS)

➡ Your Turn

Updated workflow

Code + testing



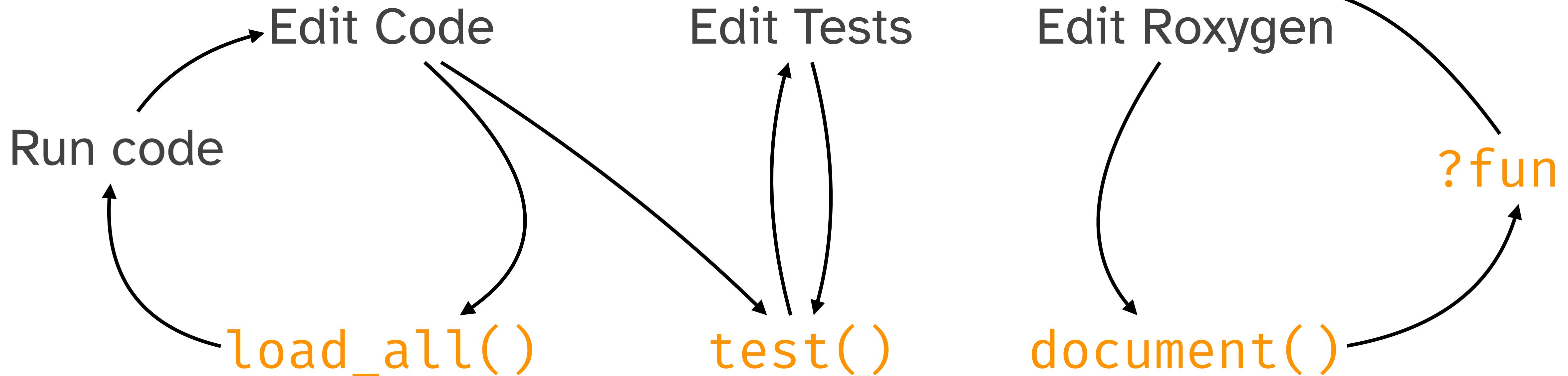
Ctrl/Cmd+Shift+L



Ctrl/Cmd+Shift+T

Workflow

Code + testing + documentation



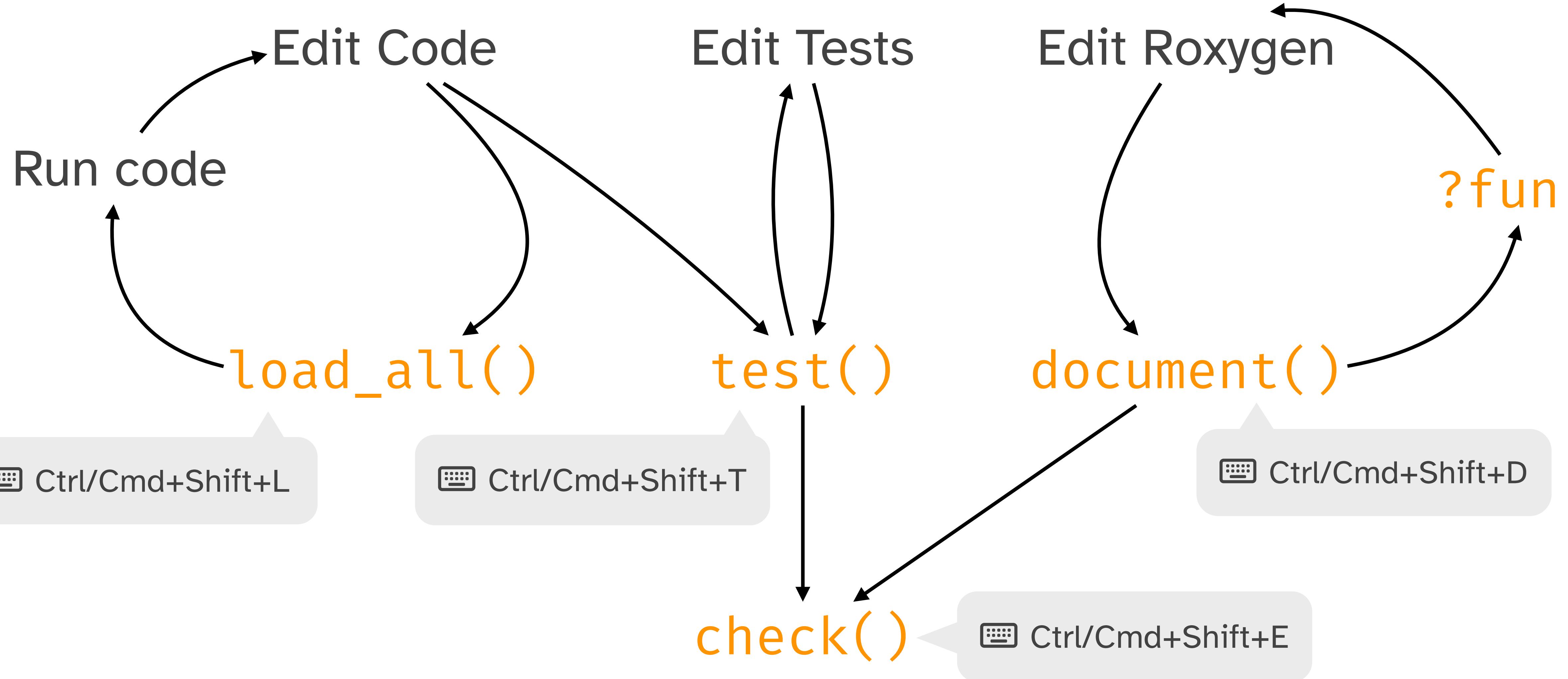
⌨️ `Ctrl/Cmd+Shift+L`

⌨️ `Ctrl/Cmd+Shift+T`

⌨️ `Ctrl/Cmd+Shift+D`

Workflow

Code + testing + documentation + check



check() 
Commit your changes 
Push to Github 

Dependencies



Dependencies



Use functions from another package inside your package

```
library("fs")  
  
# use functions from the fs package...
```

Use functions from another package inside your package

```
library("fs")  
# use fun...
```

...kage...

use_package()

Add a dependency

- Use functions from another package inside your package
- Dependencies must be declared
 - Even from included packages (`stats::sd()`, `tools::file_ext()` etc.)
- Never call `library(pkg)` in code below R/!

```
use_package("fs")
#> ✓ Adding 'fs' to Imports field in DESCRIPTION
#> • Refer to functions with `fs::fun()`
```

Listing dependencies in DESCRIPTION

Three options

- **Depends:**
 - Ensures the package is installed with your package
 - *Attaches the package when yours is attached*
 - Rarely needed or recommended
- **Imports:**
 - Ensures the package is installed with your package
 - Most common location for dependencies
- **Suggests:**
 - Does not ensure installation automatically
 - Packages required for development (running tests, building vignettes, etc).
 - Rarely used functionality (especially if the dependency is difficult to install)

devtools DESCRIPTION file:

[https://github.com/r-lib/devtools/blob/main/
DESCRIPTION](https://github.com/r-lib/devtools/blob/main/DESCRIPTION)

Listing dependencies in DESCRIPTION

Three options

- Depends:
 - Ensures the package is installed with your package
 - *Attaches the package when yours is attached*
 - Rarely needed or recommended
- Imports:
 - Ensures the package is installed with your package
 - Most common location for dependencies
- Suggests:
 - Does not ensure installation automatically
 - Packages required for development (running tests, building vignettes, etc).
 - Rarely used functionality (especially if the dependency is difficult to install)

devtools DESCRIPTION file:

[https://github.com/r-lib/devtools/blob/main/
DESCRIPTION](https://github.com/r-lib/devtools/blob/main/DESCRIPTION)

Imports: DESCRIPTION vs NAMESPACE

DESCRIPTION

- Lists packages that your package requires
- Ensures required packages are **installed** during package installation
- **Does not** import that package into your package's namespace
- Add via `use_package()` (or manually)

NAMESPACE

- **Imports** R objects from another package into your package's namespace
- Available to be used internally by your package
- Don't edit manually - use roxygen tags:

```
#' @importFrom pkg fun
#' @importpkg
```

3 ways to use functions from another package

1 - Call function with namespace qualifier

1. Add package to DESCRIPTION file in Imports
2. Call function like package::fun()

Most common and recommended pattern

DESCRIPTION

Imports:
purrr

R/my-fun.R

```
#' @export
myfun <- function(x) {
  purrr::map(x, mean)
}
```

NAMESPACE

export(myfun)

document()



3 ways to use functions from another package

2 - Import just the functions you want to use via `@importFrom` tag:

1. Add package to `DESCRIPTION` file in `Imports`
2. Use `@importFrom` roxygen tags
3. Call function like `fun()`

DESCRIPTION

Imports:
purrr

R/my-fun.R

```
#' @importFrom purrr map
#' @export
myfun <- function(x) {
  map(x, mean)
}
```

NAMESPACE

```
importFrom(purrr, map)
export(myfun)
```

document()



3 ways to use functions from another package

3 - Import the entire package via `@import roxygen` tag:

1. Add package to `DESCRIPTION` file in `Imports`
2. Use `@import roxygen` tag
3. Call functions like `fun()`

DESCRIPTION

Imports:
purrr

R/my-fun.R

```
#' @import purrr
#' @export
myfun <- function(x) {
  y <- map(x, mean)
  reduce(y, `+`)
}
```

NAMESPACE

import(purrr)
export(myfun)

document()

3 ways to use functions from another package

1. `package::fun()`

2. Import just the functions you want to use via `@importFrom` roxygen tag:

```
#' @importFrom pkg fun1 fun2
```

Adds to `NAMESPACE`:

```
importFrom(pkg, fun1)
importFrom(pkg, fun2)
```

*Shortcut: `usethis::use_import_from("pkg", "function")`

3. Import the entire package with `@import`:

```
#' @import pkg
```

Adds to `NAMESPACE`:

```
import(pkg)
```



Use your new dependency

Write a function using a function from the dependent package

- `use_package("fs")`
- Write/edit function using dependency: `pkg::fn()`
- Edit roxygen comments
- `document()`
 - Writes `man/*.Rd` files & regenerates `NAMESPACE`
- Update tests

Use your new dependency

Write a function using a function from the dependent package

- `use_package("fs")`
- Write/edit function using dependency: `pkg::fn()`
- Edit roxygen comments
- `document()`
 - Writes `man/*.Rd` files & regenerates `NAMESPACE`
- Update tests

 Your Turn

Let's add one more

```
use_import_from("pkg", "function")
```

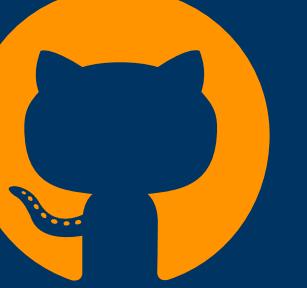
- See:
 - DESCRIPTION
 - R/mypackage-package.R (remember use_package_doc()?)
 - NAMESPACE
- Write/edit function using dependency: fn()
- *test()

Let's add one more

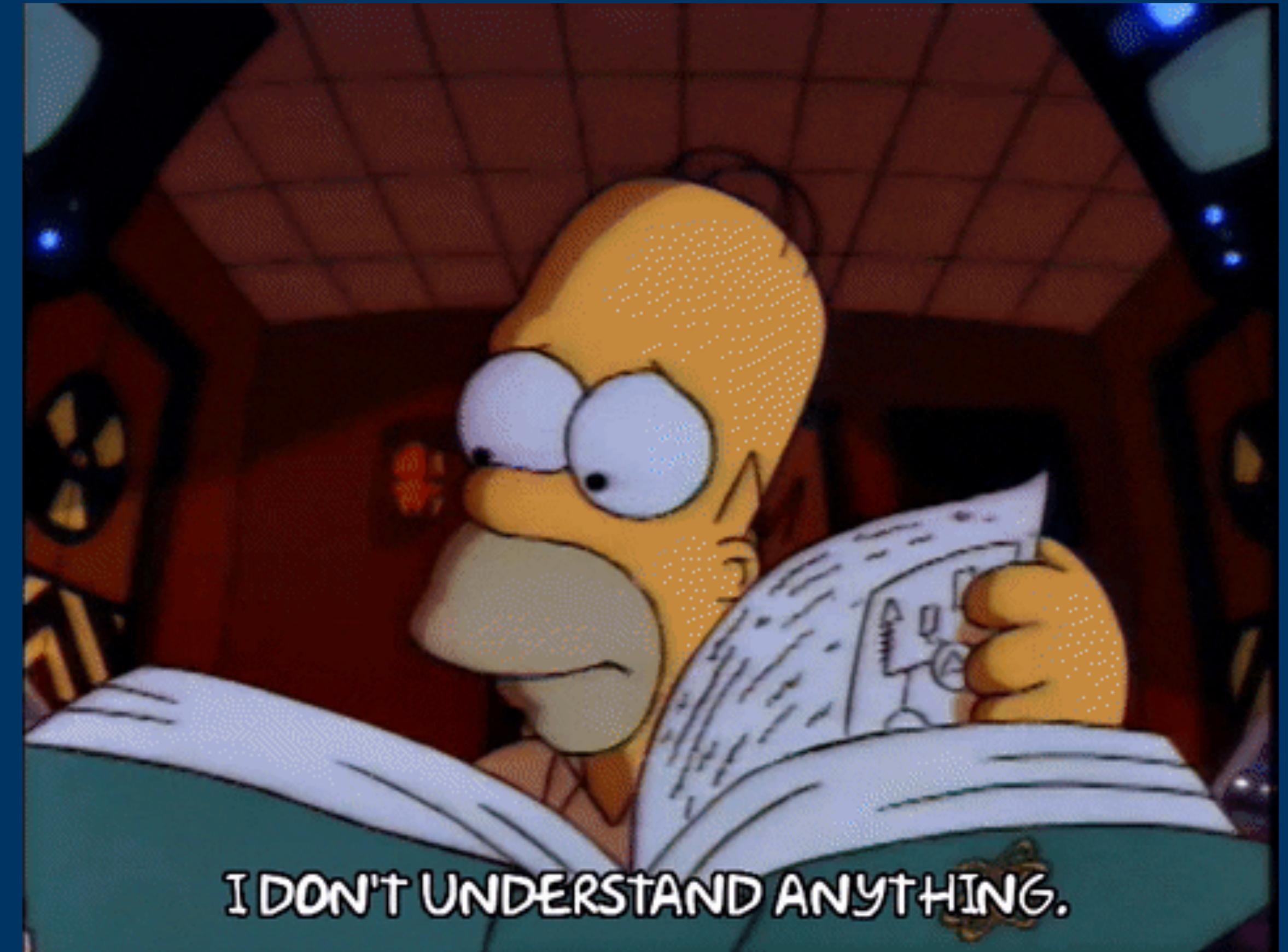
```
use_import_from("pkg", "function")
```

- See:
 - DESCRIPTION
 - R/mypackage-package.R (remember use_package_doc()?)
 - NAMESPACE
- Write/edit function using dependency: fn()
- *test()

→ Your Turn

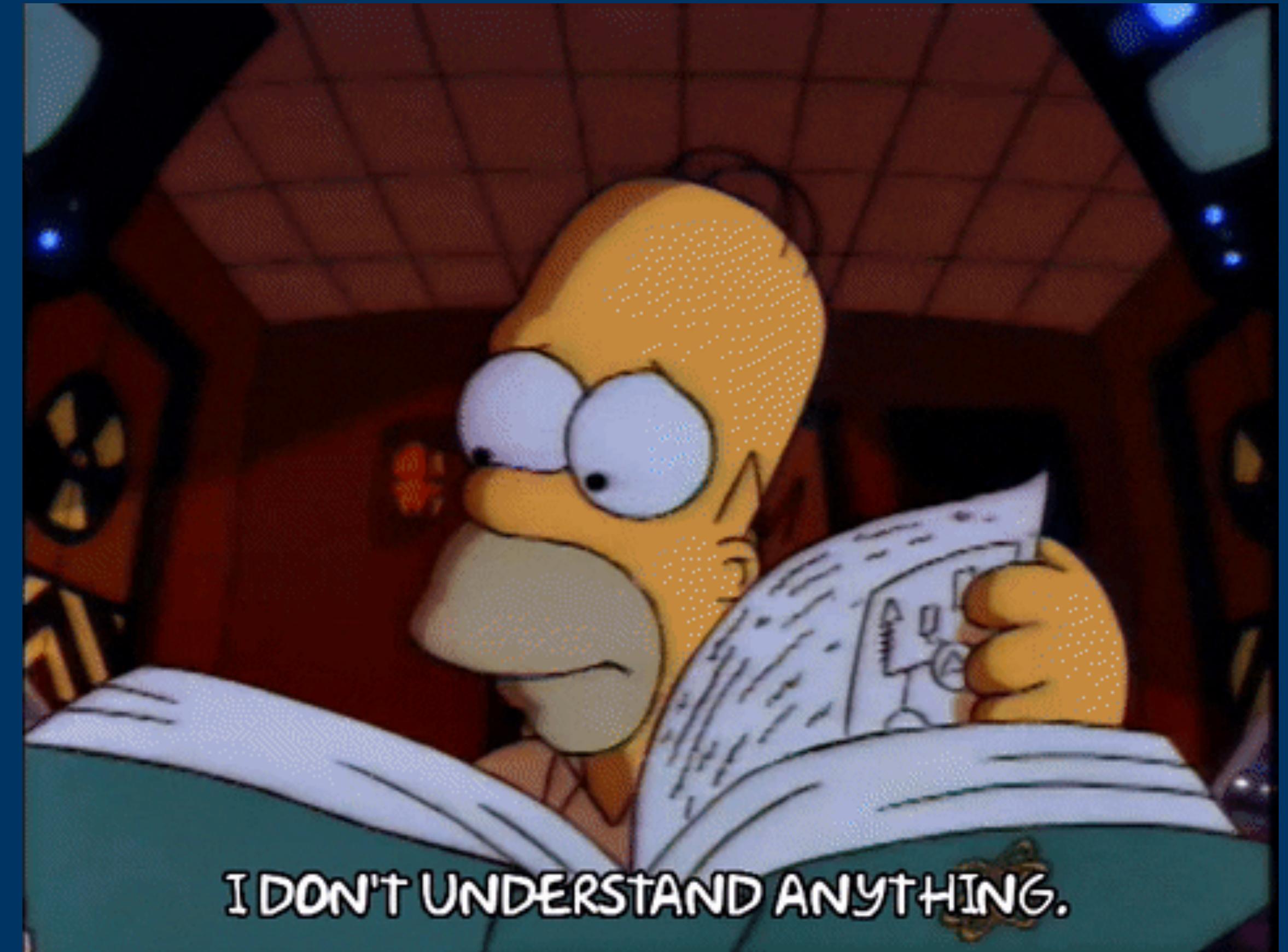
check() 
Commit your changes 
Push to Github 

README



I DON'T UNDERSTAND ANYTHING.

README



I DON'T UNDERSTAND ANYTHING.

use_readme_rmd()

Generates README.md, your package's home page on GitHub

- The purpose of the package
- Installation instructions
- Example usage
- Contributing guide

```
use_readme_rmd()
```

```
#> ✓ Writing 'README.Rmd'  
#> ✓ Adding '^README\\\\.Rmd$' to '.Rbuildignore'  
#> • Update 'README.Rmd' to include installation instructions.  
#> ✓ Writing '.git/hooks/pre-commit'
```

build_readme()

README.Rmd -> README.md

- Installs package to a temporary directory before rendering
- README.md renders on the front page of your GitHub repo

build_readme()

README.Rmd -> README.md

- Installs package to a temporary directory before rendering
- README.md renders on the front page of your GitHub repo

 Your Turn

Final check() and install()

You did it!

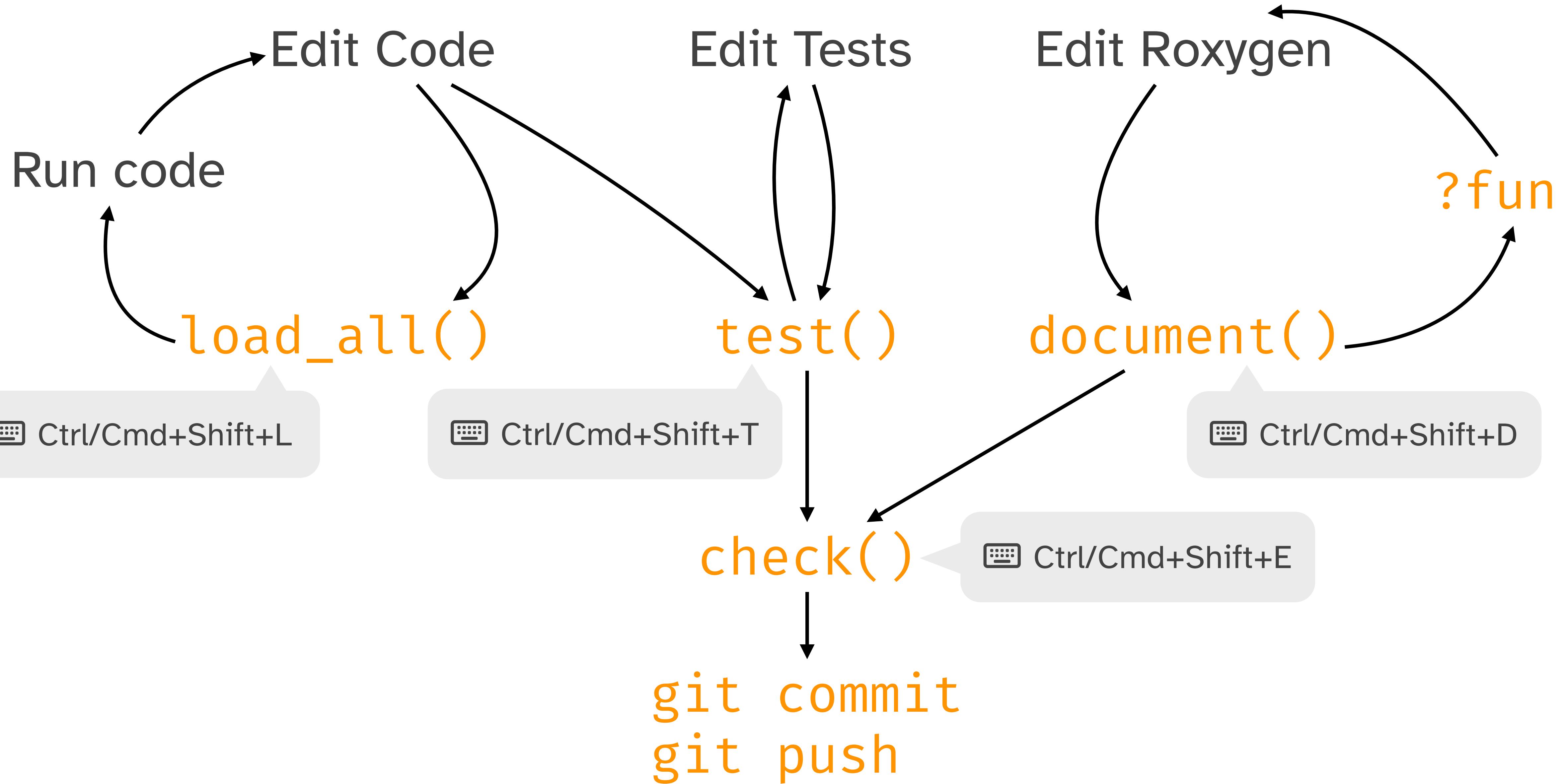
```
check()
```

```
#> — R CMD check results —————  
#> Duration: 3.1s  
#>  
#> 0 errors ✓ | 0 warnings ✓ | 0 notes
```

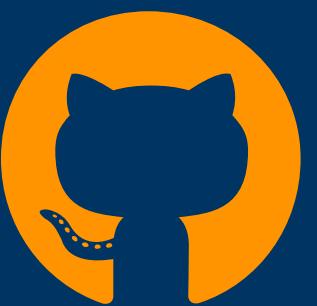
```
install()
```

```
#> — R CMD build —————  
#> checking for file '/Users/jane/rrr/mypackage/DESCRIPTION' ... ✓  
#> preparing 'mypackage':  
#> checking DESCRIPTION meta-information ... ✓  
#> checking for LF line-endings in source and make files and shell  
scripts  
#> checking for empty or unneeded directories  
#> building 'mypackage_0.0.0.9000.tar.gz'  
#> Running /usr/local/bin/R CMD INSTALL \  
#>   /tmp/RtmpK6WnOX/mypackage_0.0.0.9000.tar.gz --install-tests  
#> * installing to library '/Users/jane/Library/R/arm64/4.3/library'  
#> * installing *source* package 'mypackage' ...  
#> ** using staged installation  
#> ** help  
#> *** installing help indices  
#> ** building package indices  
#> ** testing if installed package can be loaded from temporary  
location  
#> ** testing if installed package can be loaded from final location  
#> ** testing if installed package keeps a record of temporary  
installation path  
#> * DONE (mypackage)
```

Review: Workflow



Commit your changes
Push to Github



Review: functions

Run once

- `create_package()`
- `use_git()`
- `use_github()`
- `use_mit_license()`
- `use_testthat()`
- `use_readme_rmd()`

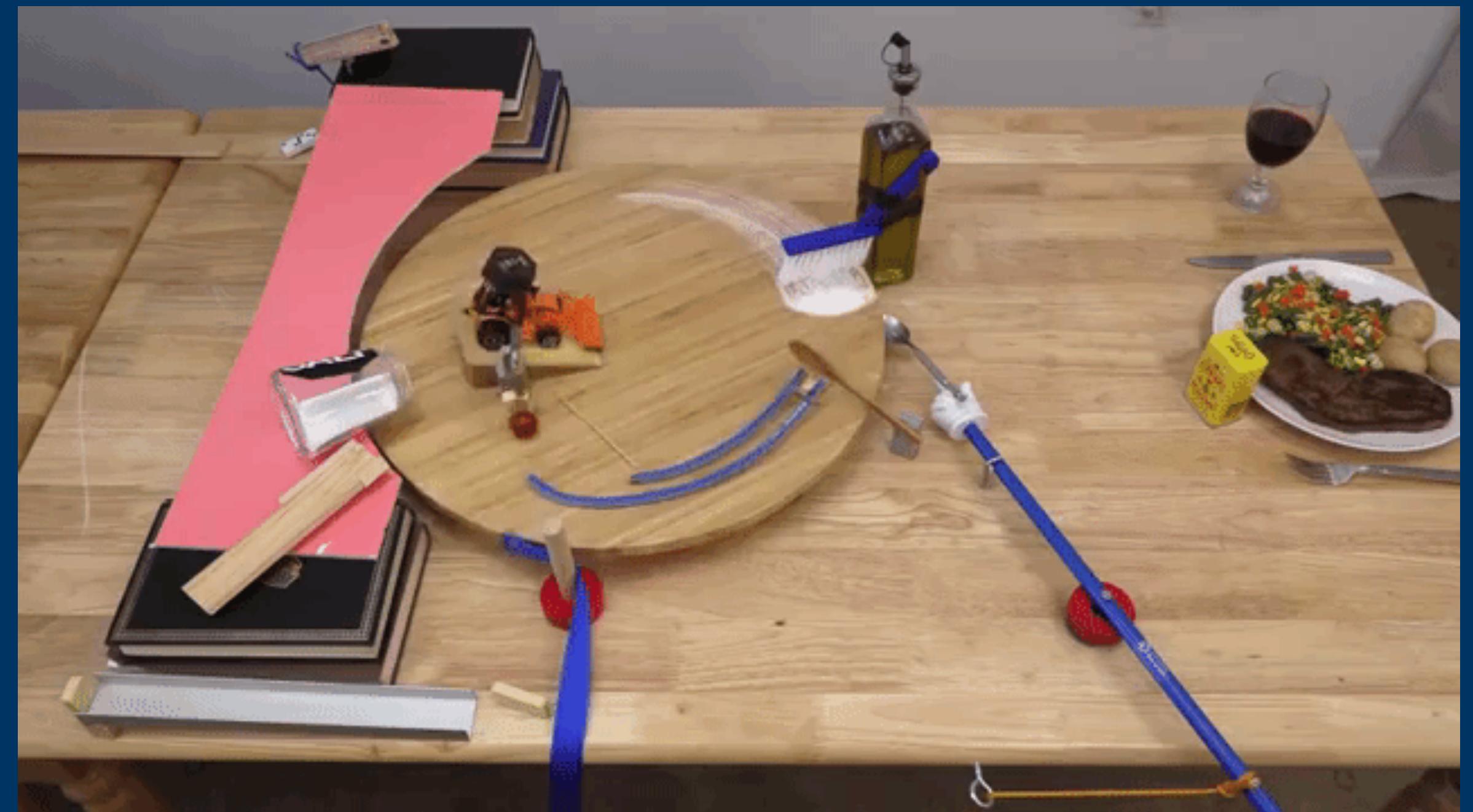
Run periodically

- `use_r()`
- `use_test()`
- `use_package()`
- `rename_files()`

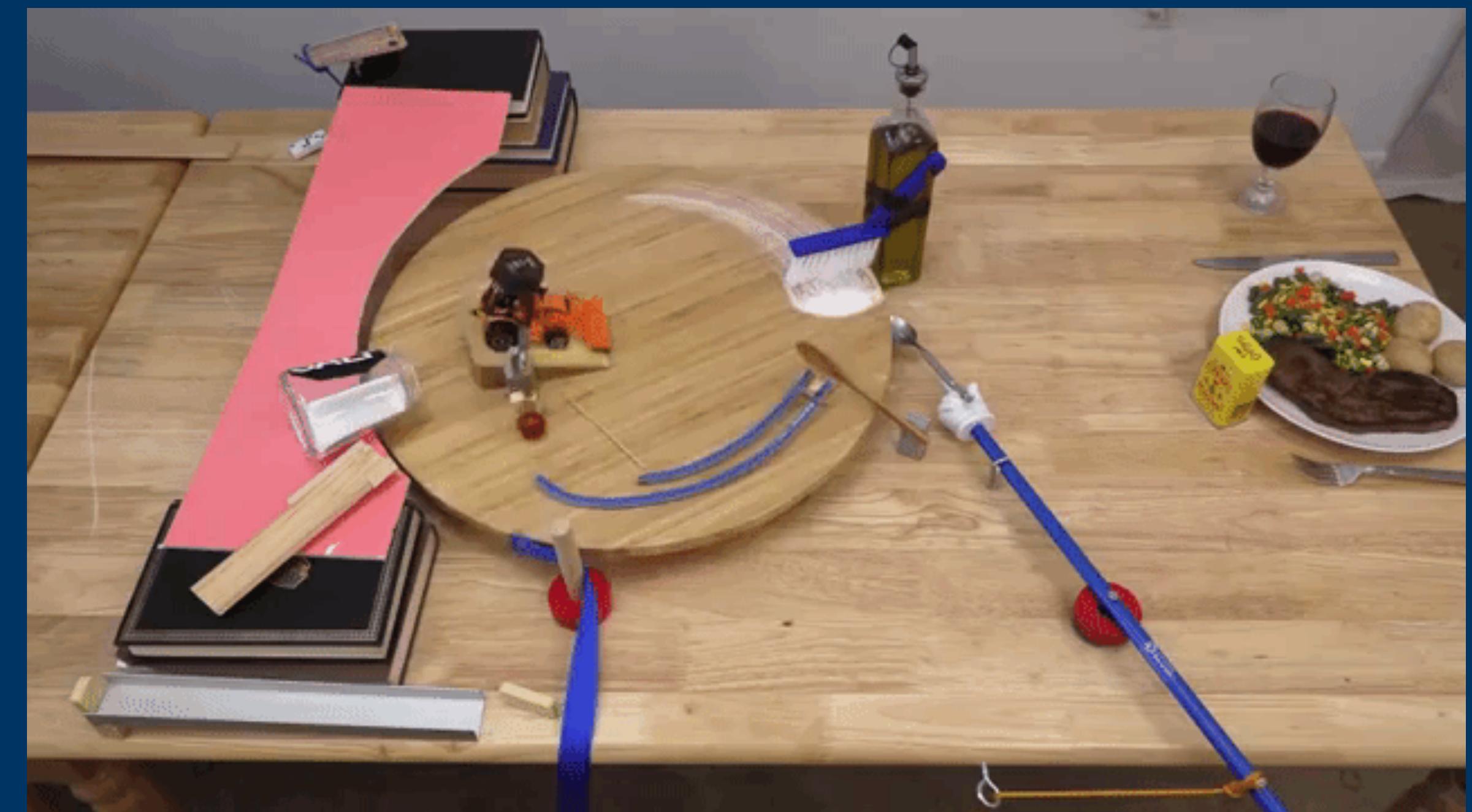
Run frequently

- `load_all()`
⌨️ Ctrl/Cmd+Shift+L
- `document()`
⌨️ Ctrl/Cmd+Shift+D
- `test()`
⌨️ Ctrl/Cmd+Shift+T
- `check()`
⌨️ Ctrl/Cmd+Shift+E

Continuous Integration



Continuous Integration



use_github_action()

github.com/r-lib/actions

- "check-standard": Runs R CMD check when you push
- "test-coverage": Compute test coverage and report at codecov.io
 - (Requires an account and API key)
- "pr-comments": Enables automatic documentation and styling of code via special PR comments
- And more...*

*<https://github.com/r-lib/actions/tree/v2-branch/examples>

use_github_action()

github.com/r-lib/actions

- "check-standard": Runs R CMD check when you push
- "test-coverage": Compute test coverage and report at codecov.io
 - (Requires an account and API key)
- "pr-comments": Enables automatic documentation and styling of code via special PR comments
- And more...*

→ Your Turn

*<https://github.com/r-lib/actions>

Website



Website



use_pkdown_github_pages()

pkdown.r-lib.org/

- Automatically creates a website using pkdown:
 - Function documentation
 - Dataset documentation
 - Vignettes (and articles)
 - README and NEWS
- Sets up a GitHub Action to deploy on GitHub Pages



use_pkgdown_github_pages()

pkgdown.r-lib.org/

- Automatically creates a website using pkgdown:
 - Function documentation
 - Dataset documentation
 - Vignettes (and articles)
 - README and NEWS
- Sets up a GitHub Action to deploy on GitHub Pages



→ Your Turn

Vignettes

Long-form documentation

- “Article” format
- Demonstrate a common use case or problem your package is designed to solve.
- `use_vignette("short-name", "Longer Title")`

Review: functions

Run once

- `create_package()`
- `use_git()`
- `use_github()`
- `use_mit_license()`
- `use_testthat()`
- `use_readme_rmd()`
- `use_pkdown_github_pages()`

Run periodically

- `use_r()`
- `use_test()`
- `use_package()`
- `rename_files()`
- `use_github_action()`
- `use_vignette()`

Run frequently

- `load_all()`
Keyboard icon: Ctrl/Cmd+Shift+L
- `document()`
Keyboard icon: Ctrl/Cmd+Shift+D
- `test()`
Keyboard icon: Ctrl/Cmd+Shift+T
- `check()`
Keyboard icon: Ctrl/Cmd+Shift+E

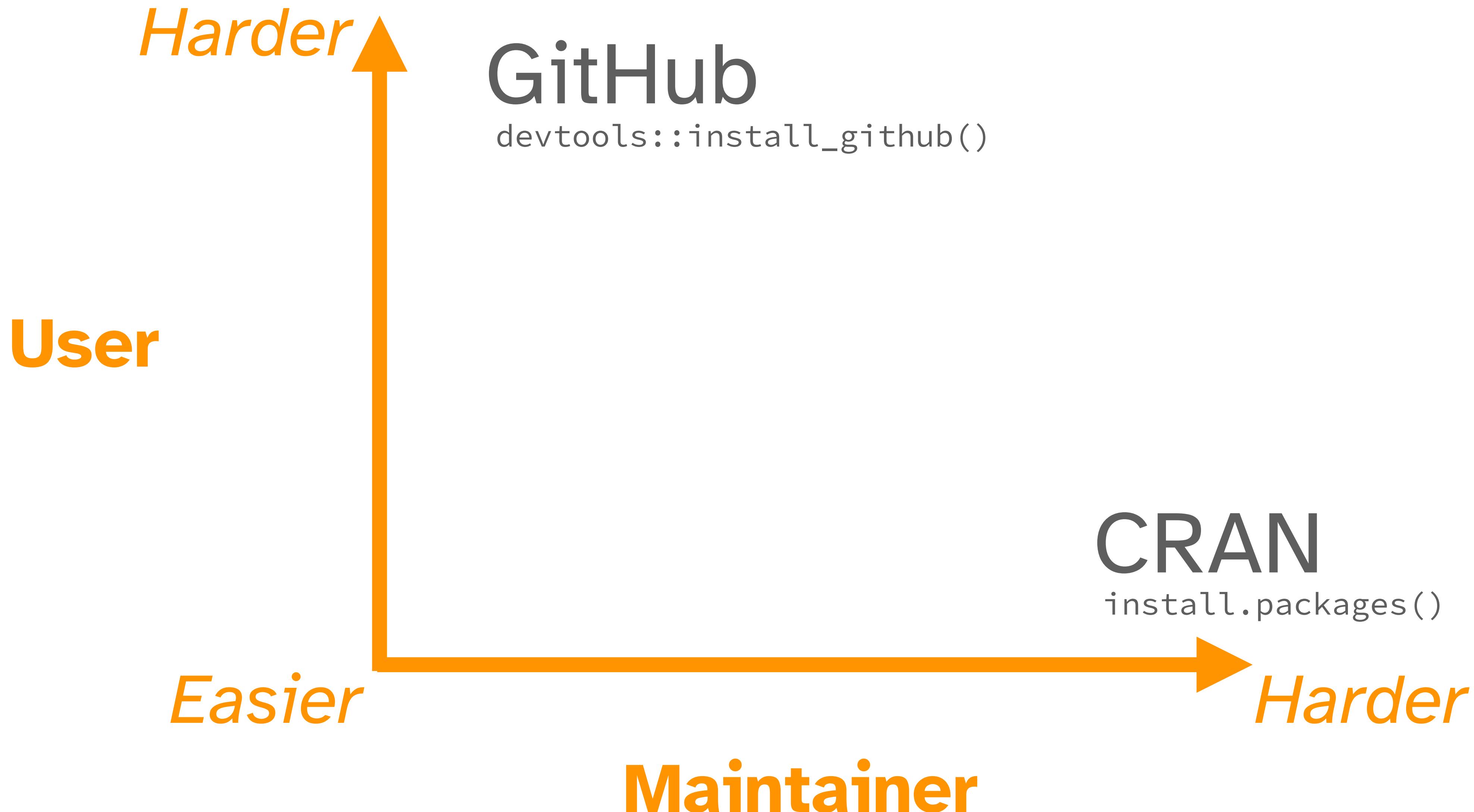
Sharing your Package



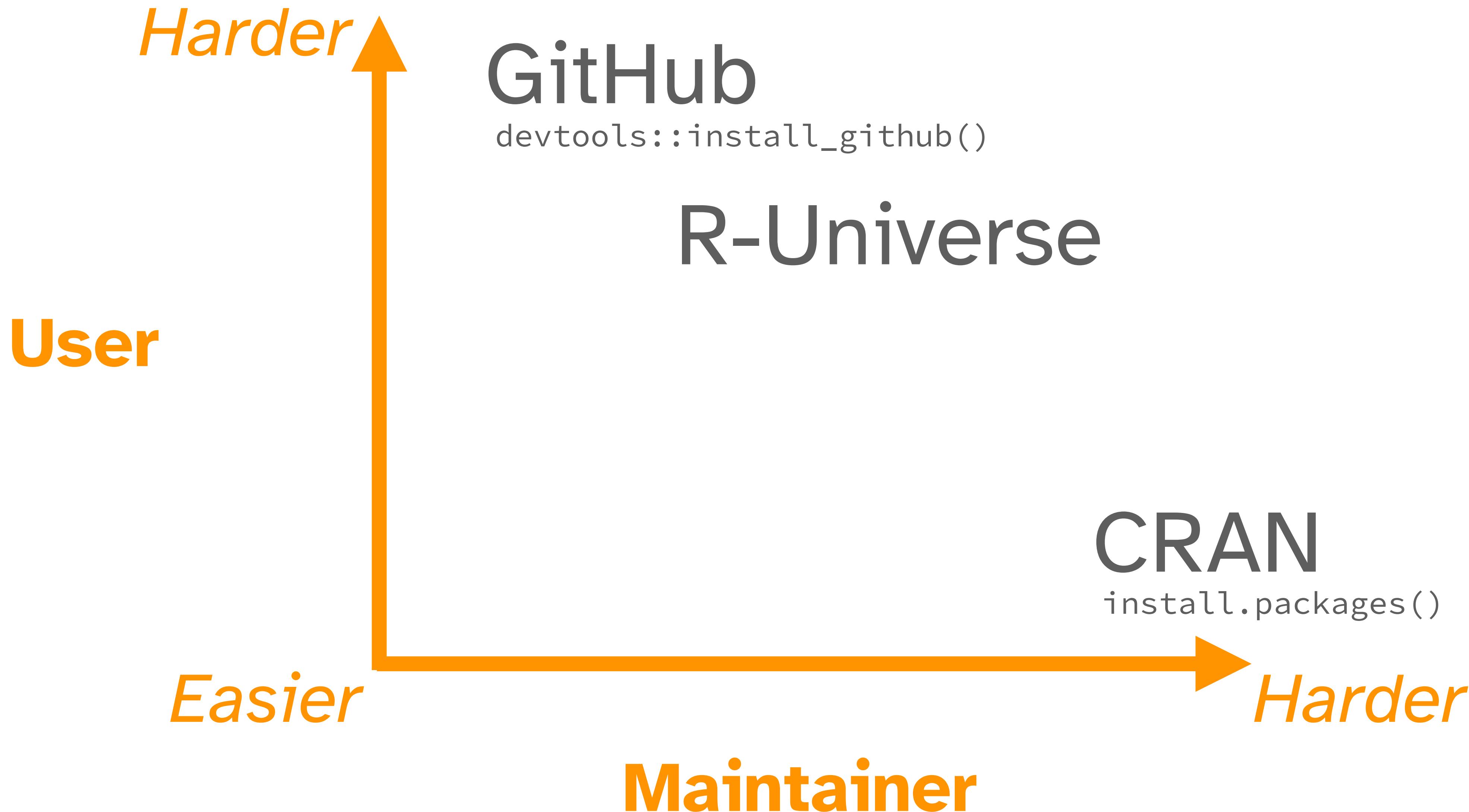
Sharing your Package



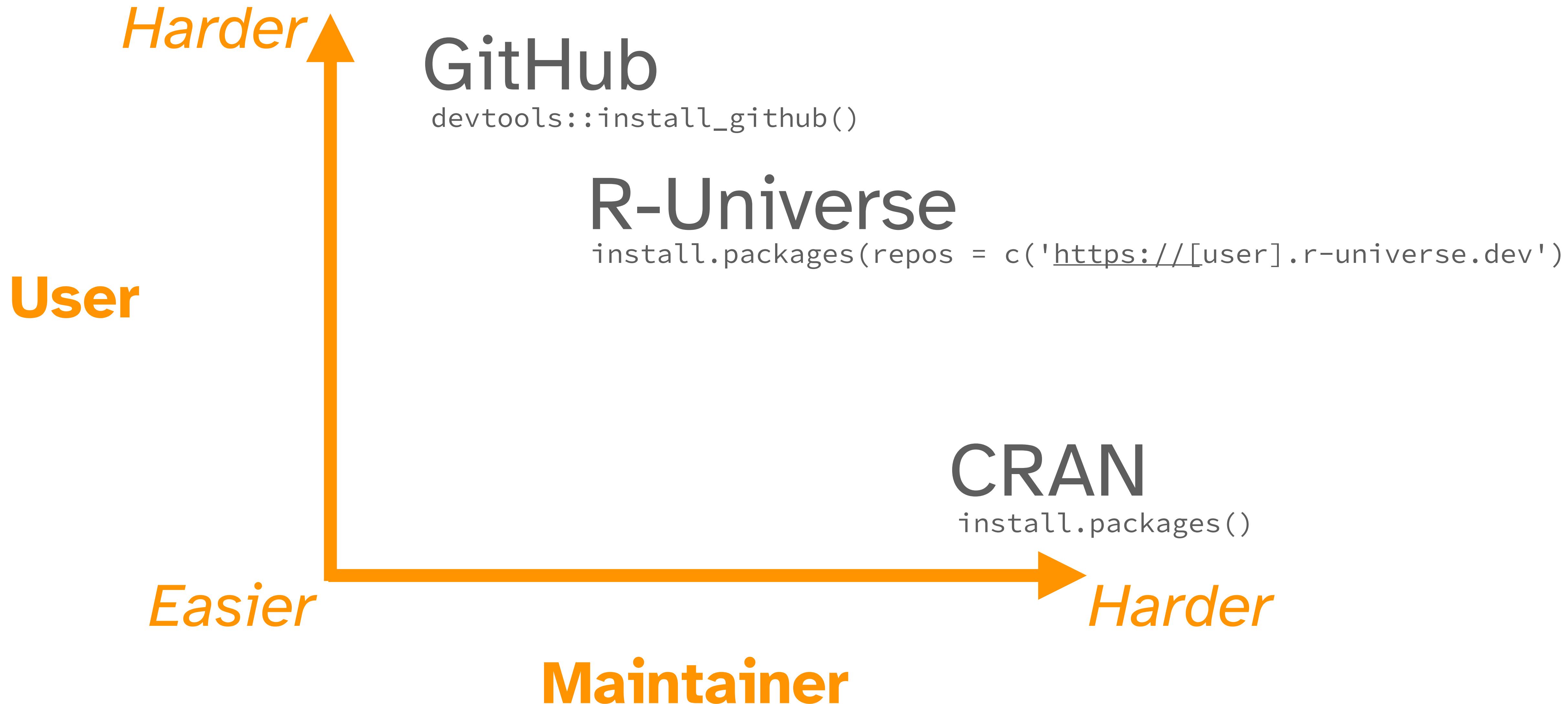
Package Distribution



Package Distribution



Package Distribution



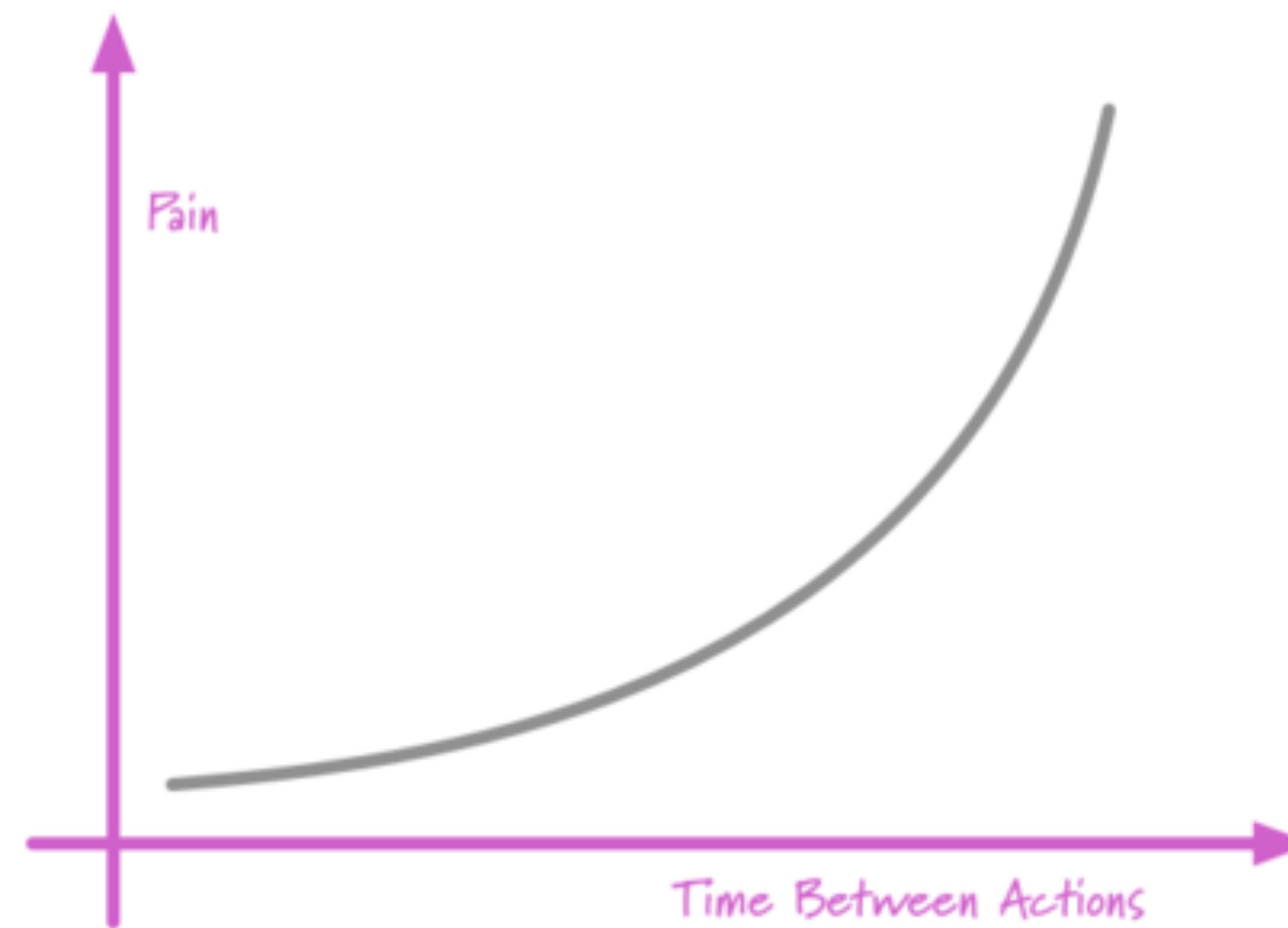
Releasing your package to CRAN



Releasing your package to CRAN



“If it hurts, do it more often”



Releasing to CRAN

TLDR:

- `use_release_issue()`
 - Opens a GitHub issue with a checklist
- `release()`
 - Runs through an additional list of checks
 - Builds package bundle and submits to CRAN

Release libminer 0.1.0 #1

[Open](#)

[25 tasks](#)

ateucher opened this issue 4 minutes ago · 0 comments



ateucher commented 4 minutes ago

Owner ...

First release:

- `usethis::use_news_md()`
- `usethis::use_cran_comments()`
- Update (aspirational) install instructions in README
- Proofread `Title:` and `Description:`
- Check that all exported functions have `@return` and `@examples`
- Check that `Authors@R:` includes a copyright holder (role 'cph')
- Check [licensing of included files](#)
- Review <https://github.com/DavisVaughan/extrachecks>

Prepare for release:

- `git pull`
- `urlchecker::url_check()`
- `devtools::build_readme()`
- `devtools::check(remote = TRUE, manual = TRUE)`
- `devtools::check_win-devel()`
- `git push`
- Draft blog post

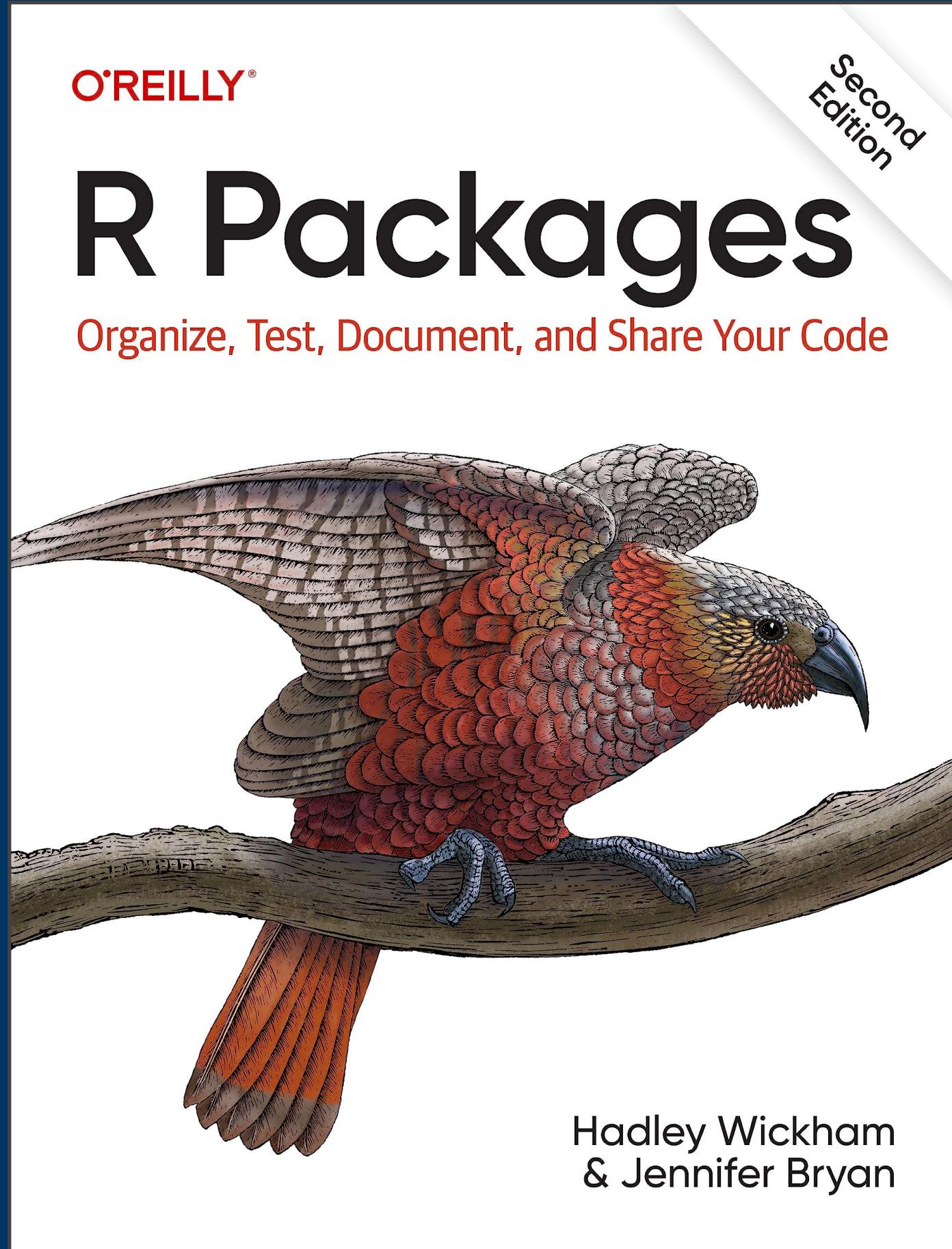
Submit to CRAN:

- `usethis::use_version('minor')`
- `devtools::submit_cran()`
- Approve email

Wait for CRAN...

- Accepted 🎉
- Add preemptive link to blog post in pkgdown news menu
- `usethis::use_github_release()`
- `usethis::use_dev_version(push = TRUE)`
- `usethis::use_news_md()`
- Finish blog post
- Tweet

Resources



r-pkgs.org

Happy Git and GitHub for the userR

Search

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Half the battle

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8 Install a Git client

Connect Git, GitHub, RStudio

Can you hear me now?

9 Personal access token for HTTPS

10 Set up keys for SSH

11 Connect to GitHub

12 Connect RStudio to Git and GitHub

13 Detect Git from RStudio

14 RStudio, Git, GitHub Hell

Still from Heaven King video

Happy Git provides opinionated instructions on how to:

- Install Git and get it working smoothly with GitHub, in the shell and in the RStudio IDE.
- Develop a few key workflows that cover your most common tasks.
- Integrate Git and GitHub into your daily work with R and R Markdown.

happygitwithr.com

Package Development :: CHEAT SHEET

Package Structure

A package is a convention for organizing files into directories. This cheat sheet shows how to work with the 7 most common parts of an R package:

- DESCRIPTION
- NAMESPACE
- R/
- tests/
- man/
- vignettes/
- data/

Set up metadata and organize package functions

Write R code for your package

Verify your code is correct

Document your code and write tutorials and how-tos

Include datasets in your package

Workflow

```
graph TD
    A[Edit code] --> B[load_all()]
    A[Edit tests] --> C[test()]
    A[Edit roxygen] --> D[document()]
    B --> E[Run code]
    C --> E
    D --> E
    E --> F[check()]
    F --> G[git commit]
    G --> H[git push]
```

DESCRIPTION

The DESCRIPTION file describes your work, sets up how your package will work with other packages, and applies a license.

- Pick a license with `use_mit_license()`, `use_gpl3_license()`.
- Add packages that you need with `use_package()`.

NAMESPACE

The NAMESPACE file helps make your package self-contained: it won't interfere with other packages, and other packages won't interfere with it.

- Import packages that your package requires to work. R will load them when it installs your package.
`use_package(x, type = "imports")`
- Suggest packages that developers of your package can install or not, as they like.
`use_package(x, type = "suggests")`

R/

All of the R code in your package goes in R/. A package with just an R/ directory is still a very useful package.

- Create a new package project with `create_package("path/to/name")`.
- Create R files with `use_r("file-name")`.

Having problems with git? Get a situation report with `git_stripped()`.

load_all() (Ctrl/Cmd + Shift + L) — Load code
document() (Ctrl/Cmd + Shift + D) — Rebuild docs and NAMESPACE
test() (Ctrl/Cmd + Shift + T) — Run tests
check() (Ctrl/Cmd + Shift + E) — Check complete package

load_all() (Ctrl/Cmd + Shift + L) — Load code
document() (Ctrl/Cmd + Shift + D) — Rebuild docs and NAMESPACE
test() (Ctrl/Cmd + Shift + T) — Run tests
check() (Ctrl/Cmd + Shift + E) — Check complete package

Creates a new package project with `create_package("path/to/name")`.
Creates R files with `use_r("file-name")`.

Follow the tidyverse style guide at [style.tidyverse.org](#).
Click on a function and press F2 to go to its definition.
Find a function or file with Ctrl + F.

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posit

posit.co/resources/cheatsheets/

Tidy design principles

Welcome

The goal of this book is to help you write better R code. It has four main components:

- Identifying design **challenges** that often lead to suboptimal outcomes.
- Introducing useful **patterns** that help solve common problems.
- Defining key **principles** that help you balance conflicting patterns.
- Discussing **case studies** that help you see how all the pieces fit together with real code.

While I've called these principles "tidy" and they're used extensively by the tidyverse team to promote consistency across our packages, they're not exclusive to the tidyverse. Think tidy in the sense of tidy data (broadly useful regardless of what tool you're using) not tidyverse (a collection of functions designed with a singular point of view in order to facilitate learning and use).

This book will be under heavy development for quite some time; currently we are loosely aiming for completion in 2025. You'll find many chapters contain disjointed text that mostly serve as placeholders for the authors, and I do not recommend attempting to systematically read the book at this time. If you'd like to follow along with my journey writing this book, and learn which chapters are ready to read, please sign up for my [tidy design substack mailing list](#).

1 Unifying principles →

design.tidyverse.org
tidydesign.substack.com

Survey

<http://pos.it/conf-workshop-survey>

- Your feedback is crucial!
- Data from the survey informs curriculum and format decisions for future conf workshops, and we really appreciate you taking the time to provide it.