Fundamentals of Package Development

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

- WiFi:
  - Network: Posit Conf 2023
  - Password: conf2023
- Bathrooms through the kitchen
- 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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- any posit::conf staff member
- conf@posit.com
- 844-448-1212

Welcome!

- Introductions
  - Instructor:
    - Andy Teucher
    - GitHub: ateucher
    - Mastodon: @andyteucher@fosstodon.org
  - TAs:
    - Nic Crane
    - Simon Couch
  - Yourselves

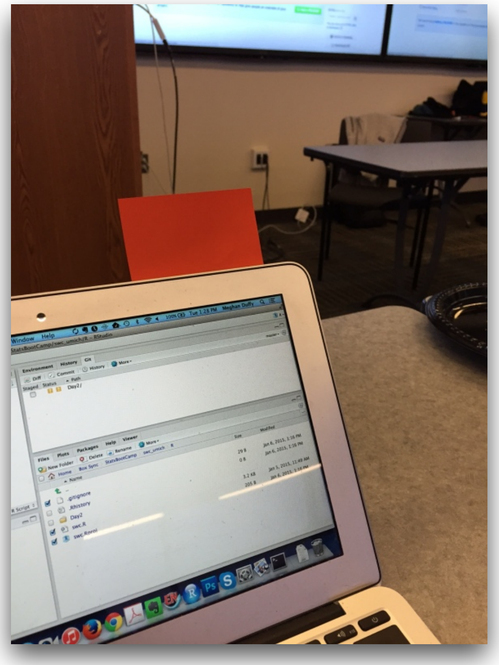
Sticky Notes

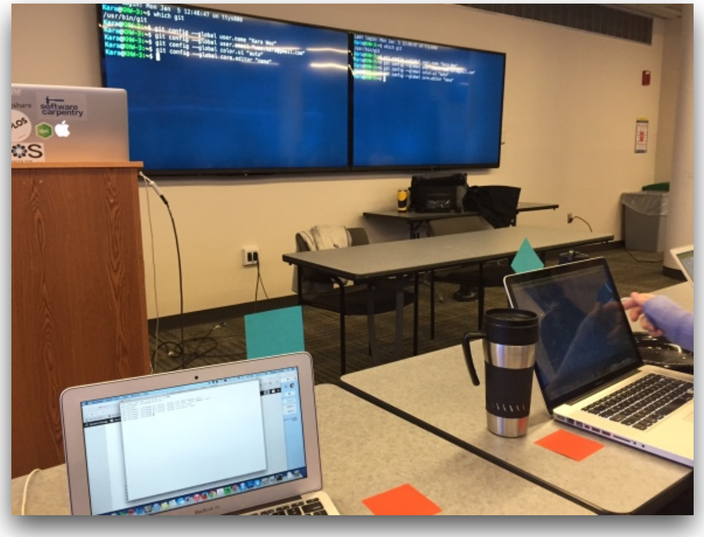
PURPLE

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!

Resources

- Workshop website: pos.it/pkg-dev-conf23
- Cheatsheet in your handout

Schedule and Learning Objectives

START: 9:00

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

BREAK: 10:30 - 11:00

- Package Creation and Metadata
- Documentation

LUNCH: 12:30 - 1:30

- Testing
- Package Dependencies

BREAK: 3:00 - 3:30

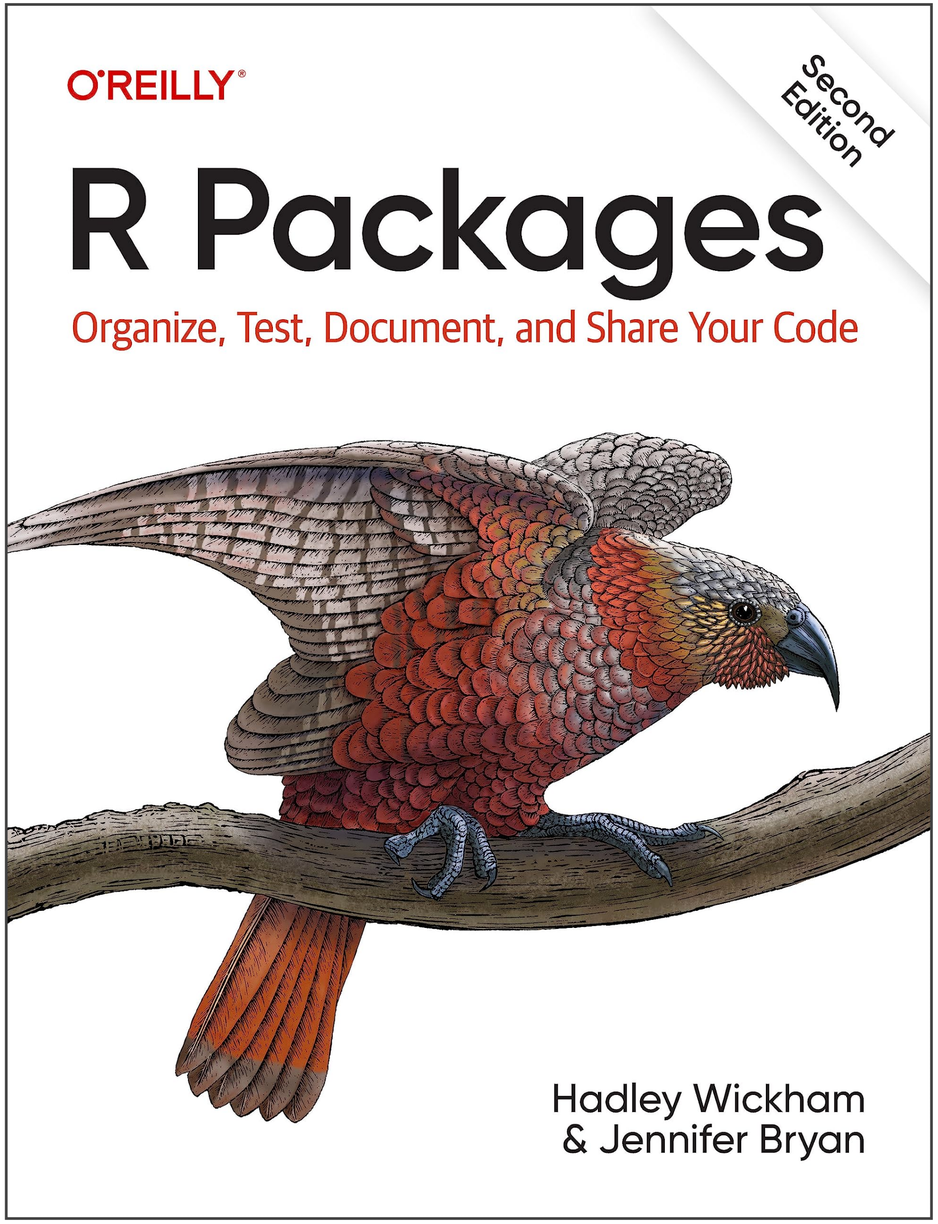
- Continuous Integration
- Package Website & Vignettes
- Package Distribution (CRAN)

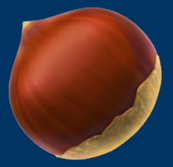
END: 5:00

R Packages (2e)

Hadley Wickham
Jenny Bryan

https://r-pkgs.org



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

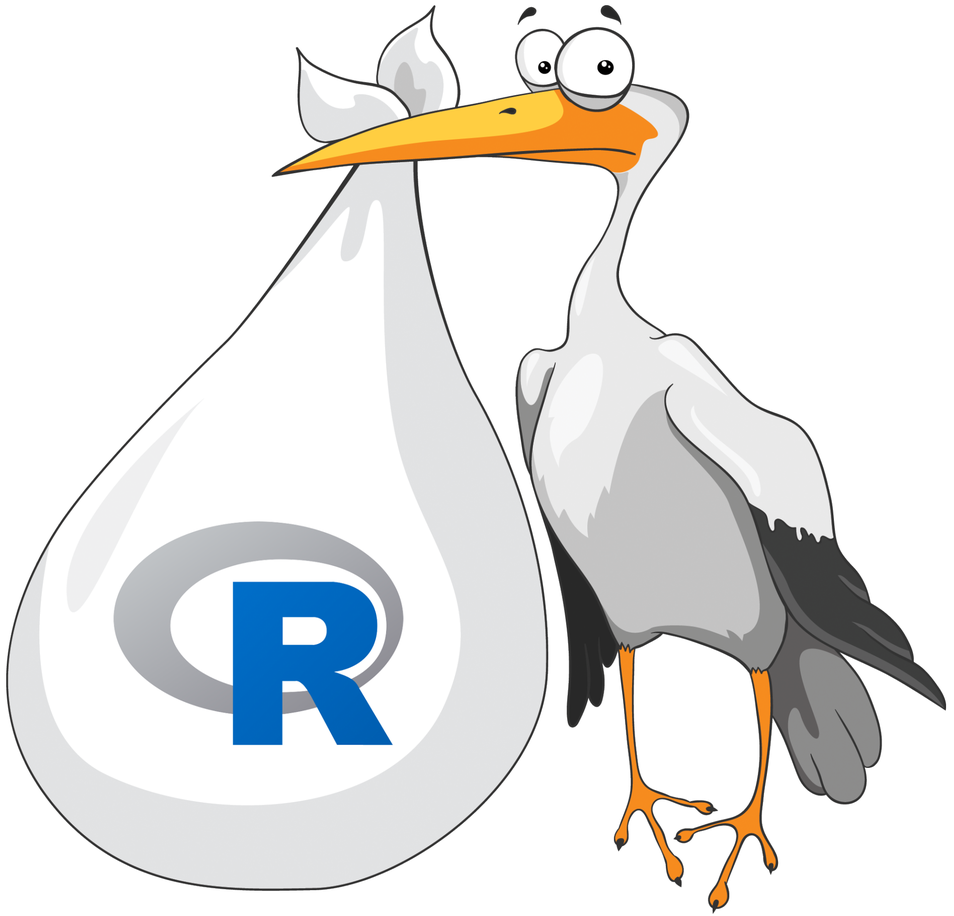
- Performs data analysis
- Collection of one or more `.R` files
- `library()` calls
- Documentation in `# comments`
- Run with `source()` or select+run

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

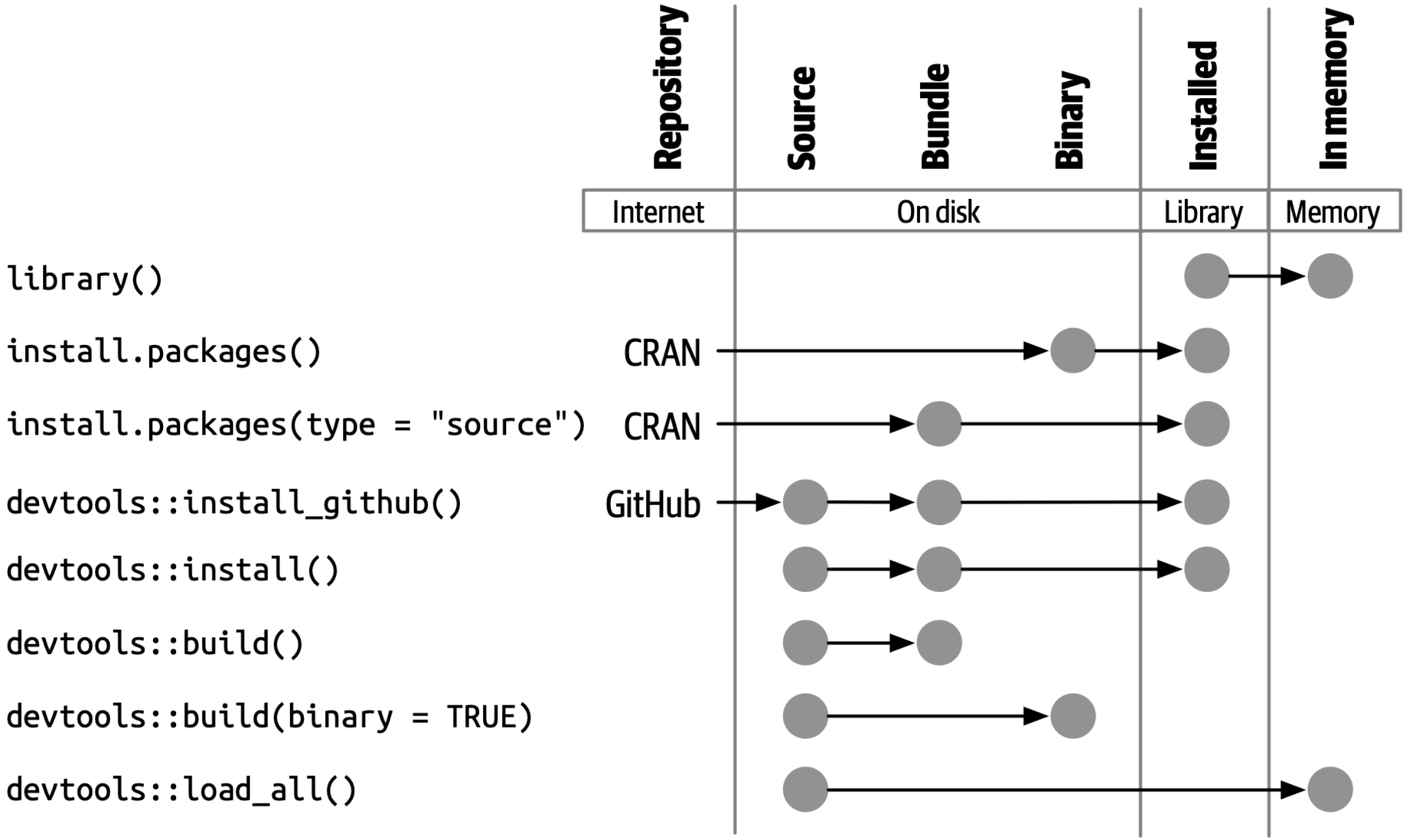
- How many libraries do you have?
- What are they? (Put them in the Discord)

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



Wickham, Hadley, and Jennifer Bryan. 2023. R Packages. 2nd ed.

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 (even though it’s possible and often helpful)

libminer

Sneak peak of our end goal on GitHub

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

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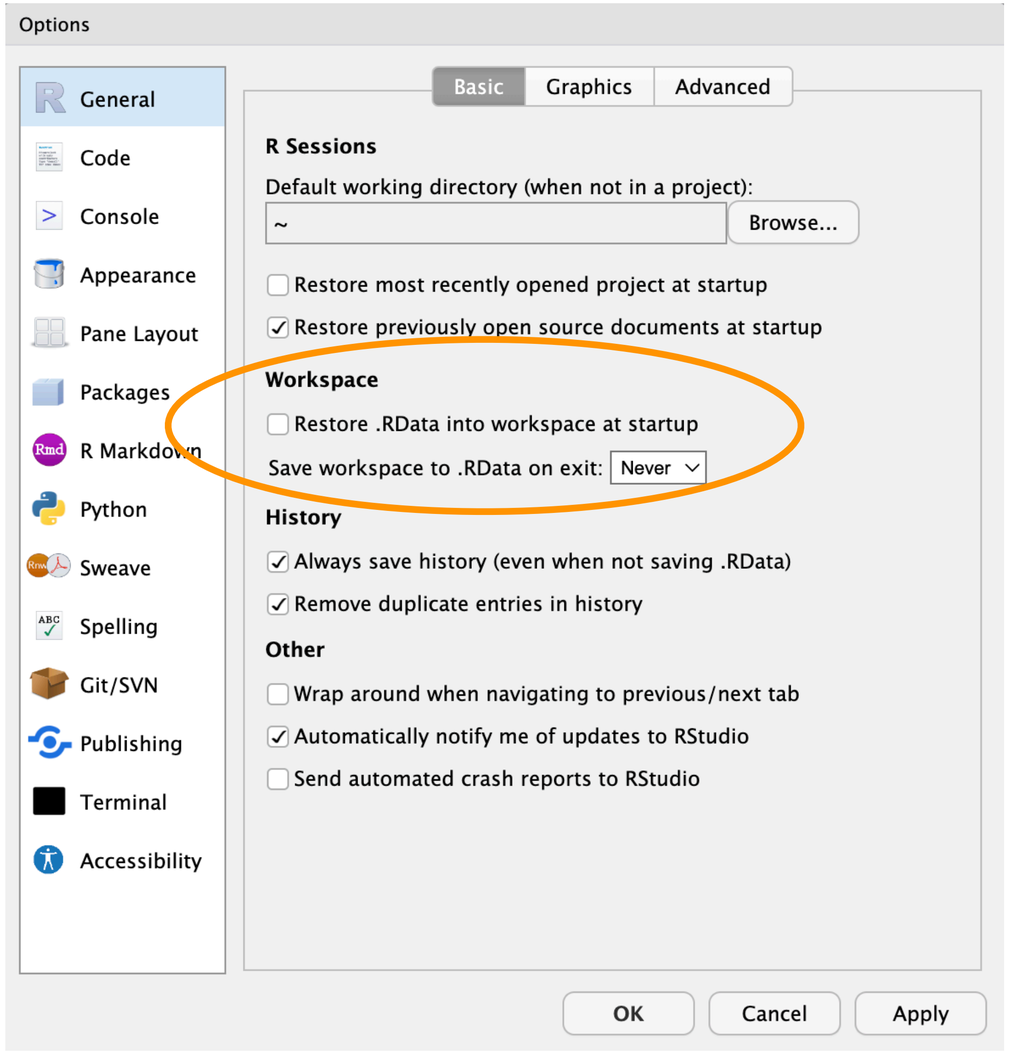
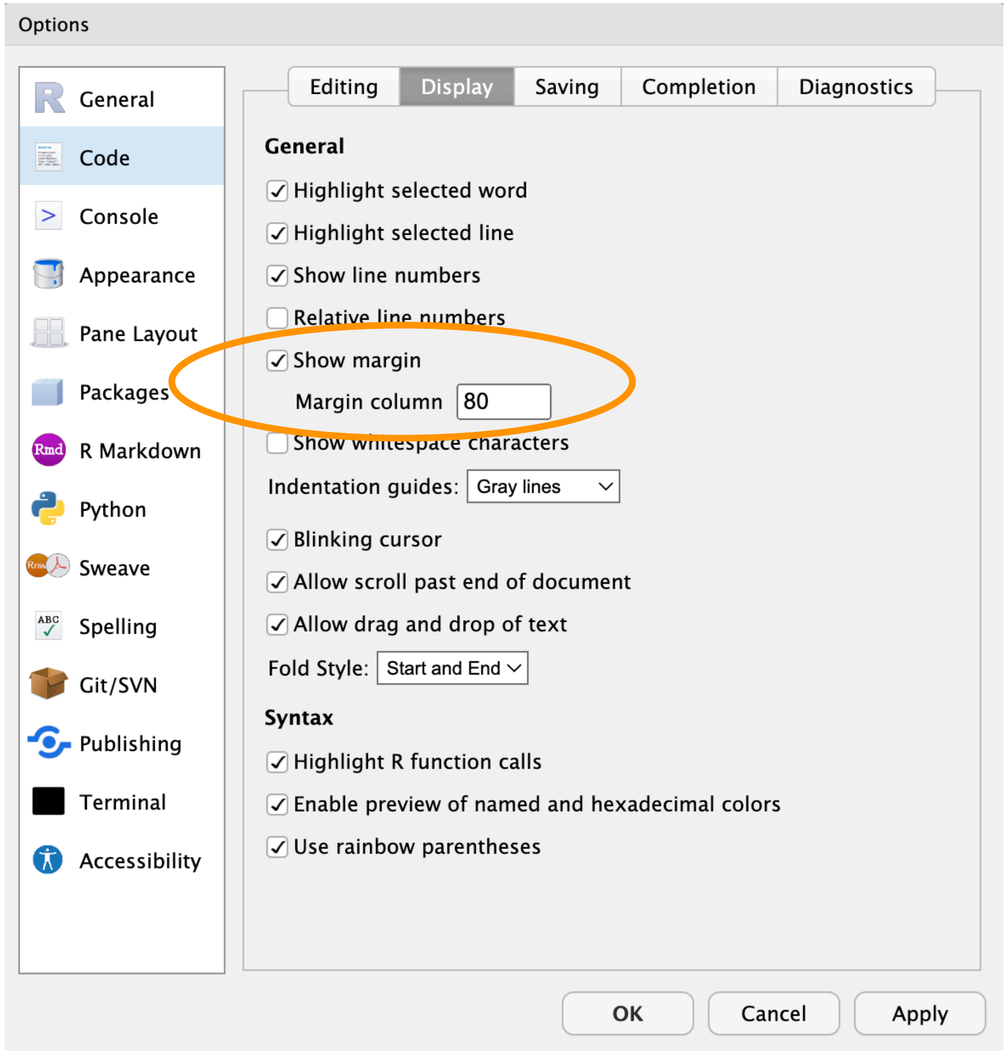
Get Ready

Get Ready

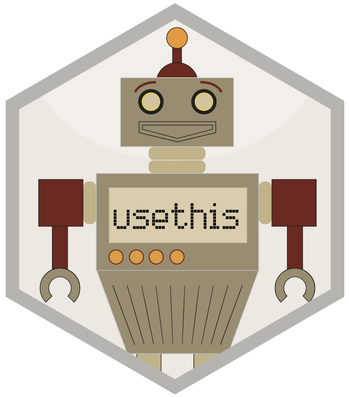
Configure RStudio

Tools > Global Options





Tools 🧰



- R >= 4.3.0
- RStudio (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() 📦

```
create_package("~/Desktop/mypackage")
#> ✔ Creating '/Users/jane/Desktop/mypackage/'
#> ✔ Setting active project to '/Users/jane/Desktop/mypackage'
#> ✔ Creating 'R/'
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#> ✔ Adding '.Rproj.user' to '.gitignore'
#> ✔ Adding '^\\.Rproj\\.user$' to '.Rbuildignore'
#> ✔ 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()

- `use_git_config(`
  `user.name = "Jane Doe",`
  `user.email = "jane@example.org"`
  `)`
- `use_git()`

- Turns package directory into a git repository
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#> * 'NAMESPACE'
#> Is it
#>
#> 1: Ab
#> 2: No
#> 3: Ye
```

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+0 (macOS)

`devtools::use_devtools()`

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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

- 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 defin

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()`

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

Test your function in the new package

But how?

- ~~`source("R/my-fun.R")`~~
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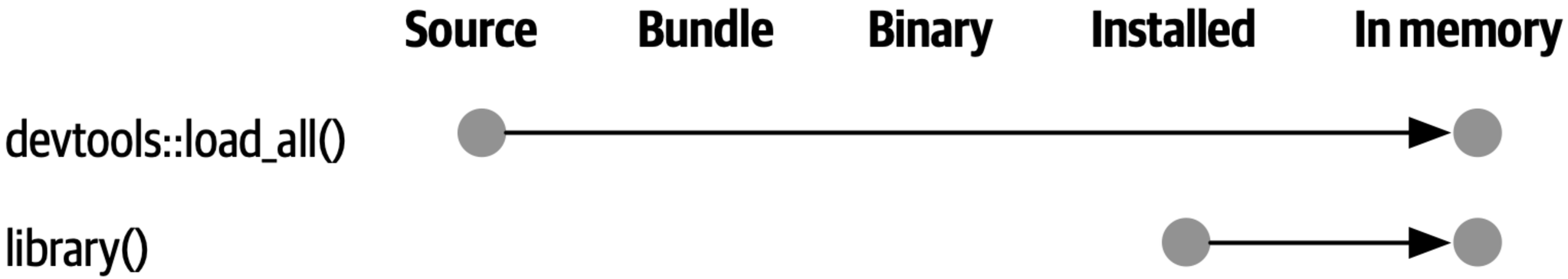
⌨ Ctrl+Shift+L (Windows & Linux)
⌨ Cmd+Shift+L (macOS)

`load_all()`

~= install.packages() + library()

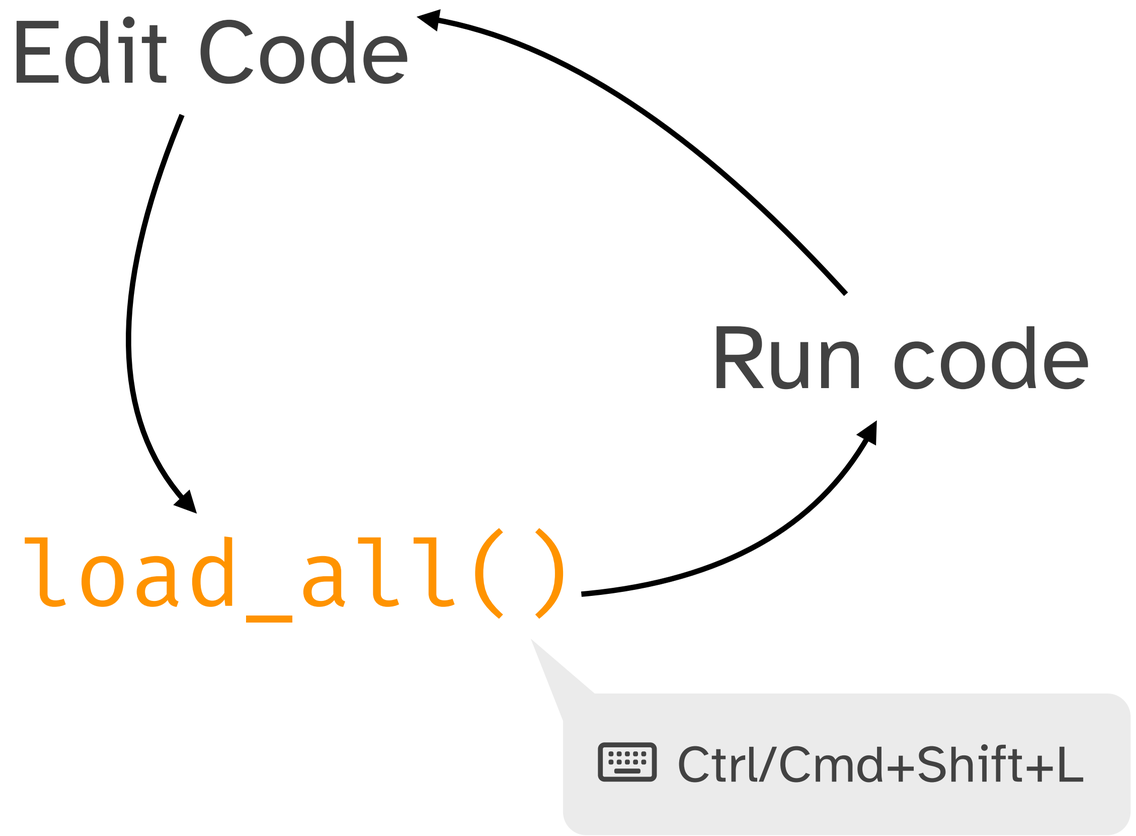


- Simulates building, installing, and attaching your package
- Makes all of the functions from your package immediately available to use
- Allows fast iteration of editing and test-driving your functions
- Good reflection of how users will interact with your package*

Wickham, Hadley, and Jennifer Bryan. 2023. R Packages. 2nd ed.

Try it out, and commit your changes 

Workflow



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

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- Reduce future pain by catching problems early*

Your Turn

https://ma

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.

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'
```

use_mit_license()

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✔ Writing 'LICENSE'
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```

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
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Encoding: UTF-8
Roxygen: list(markdown = TRUE)
RoxygenNote: 7.2.3
```

The DESCRIPTION file

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- Make yourself the author
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Encoding: UTF-8
Roxygen: list(markdown = T
RoxygenNote: 7.2.3
```

Your Turn

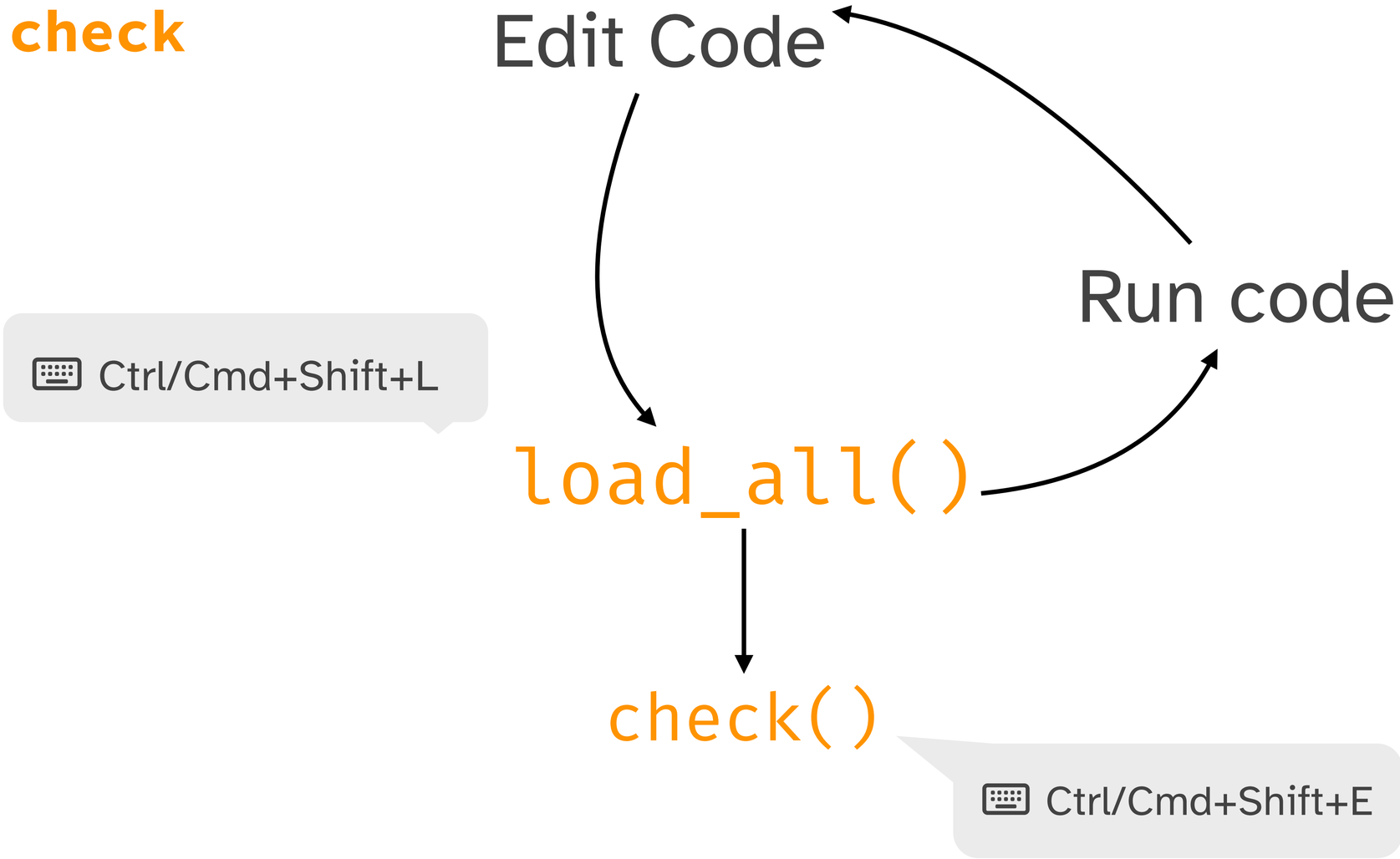
The DESCRIPTION file

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



check() again

```
check()


#> ══ Documenting ═══════════════════════════════════════════════════════
…
#> ══ Building ══════════════════════════════════════════════════════════
…
#> ══ Checking ══════════════════════════════════════════════════════════
…
#> ── R CMD check results ──────────────────────────────────────────────
#> Duration: 3.1s
#>
#> 0 errors ✔ | 0 warnings ✔ | 0 notes ✔
```

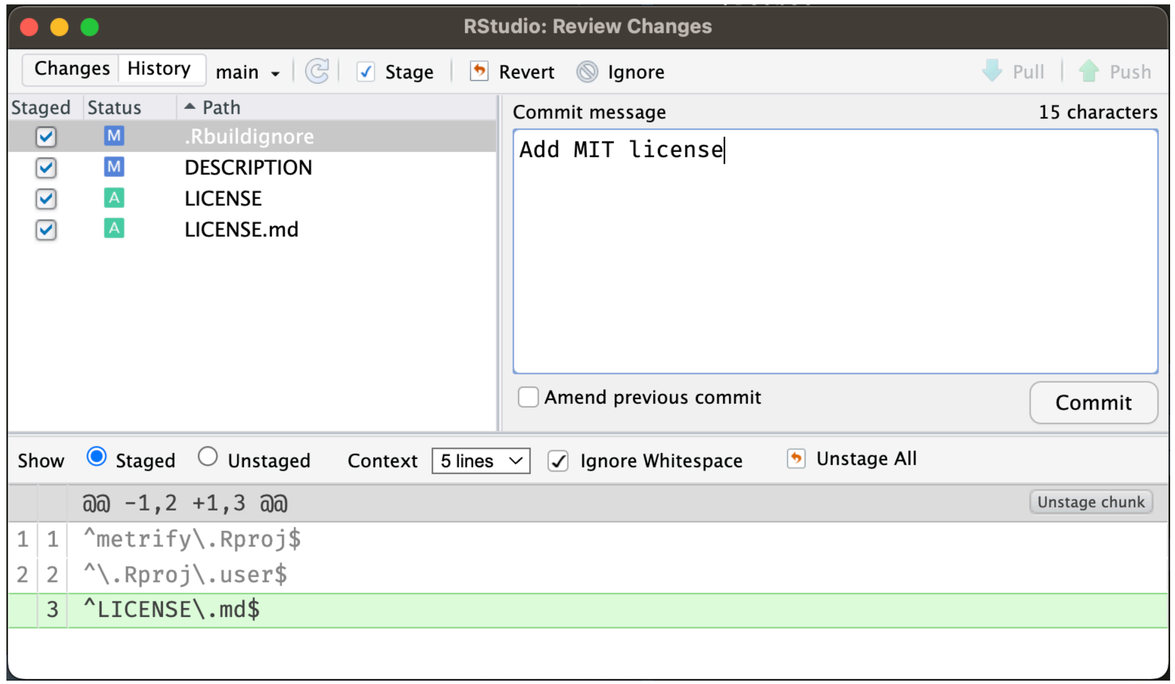

TED
LASSO


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()`

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 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:

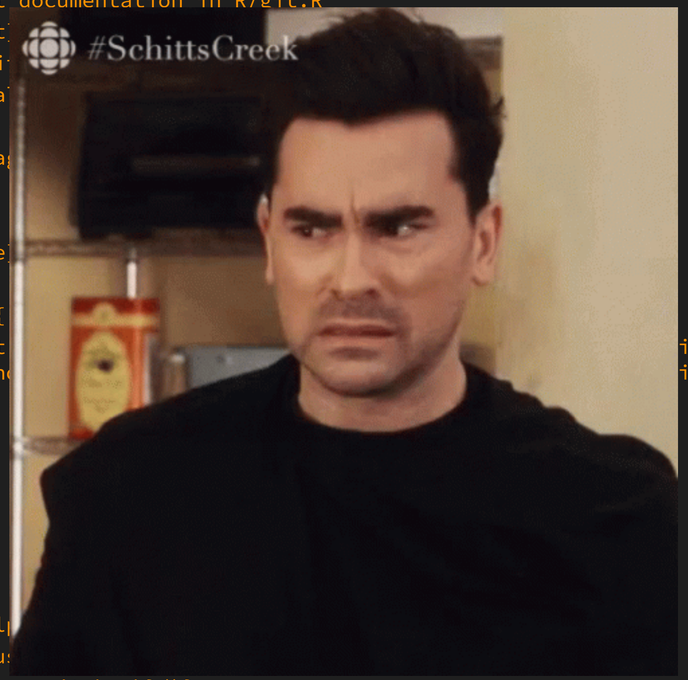
     ## Not run:

     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_gi
\title{Initia
\usage{
use_git(messa
}
\arguments{
\item{message
}
\description{
\code{use_git                                              iles to
\code{.gitign                                              it.
}
\examples{
\dontrun{
use_git()
}
}
\seealso{
Other git hel
\code{\link{u
\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)
```

roxygen2

- RStudio: *Code* > *Insert Roxygen Skeleton*

⌨ Cmd/Ctrl+Alt+Shift+R

- 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!

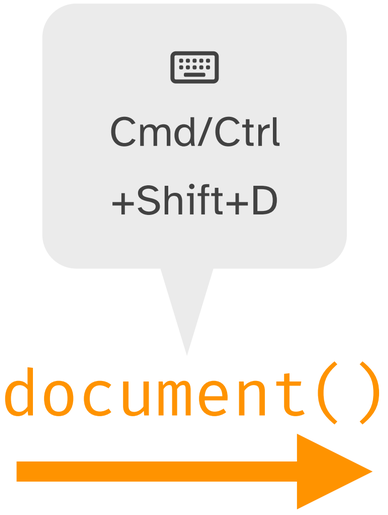
```
#' Title

#' 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

```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") {
  . . .
}
```



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

⌨ 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`
- 🎉

Your Turn

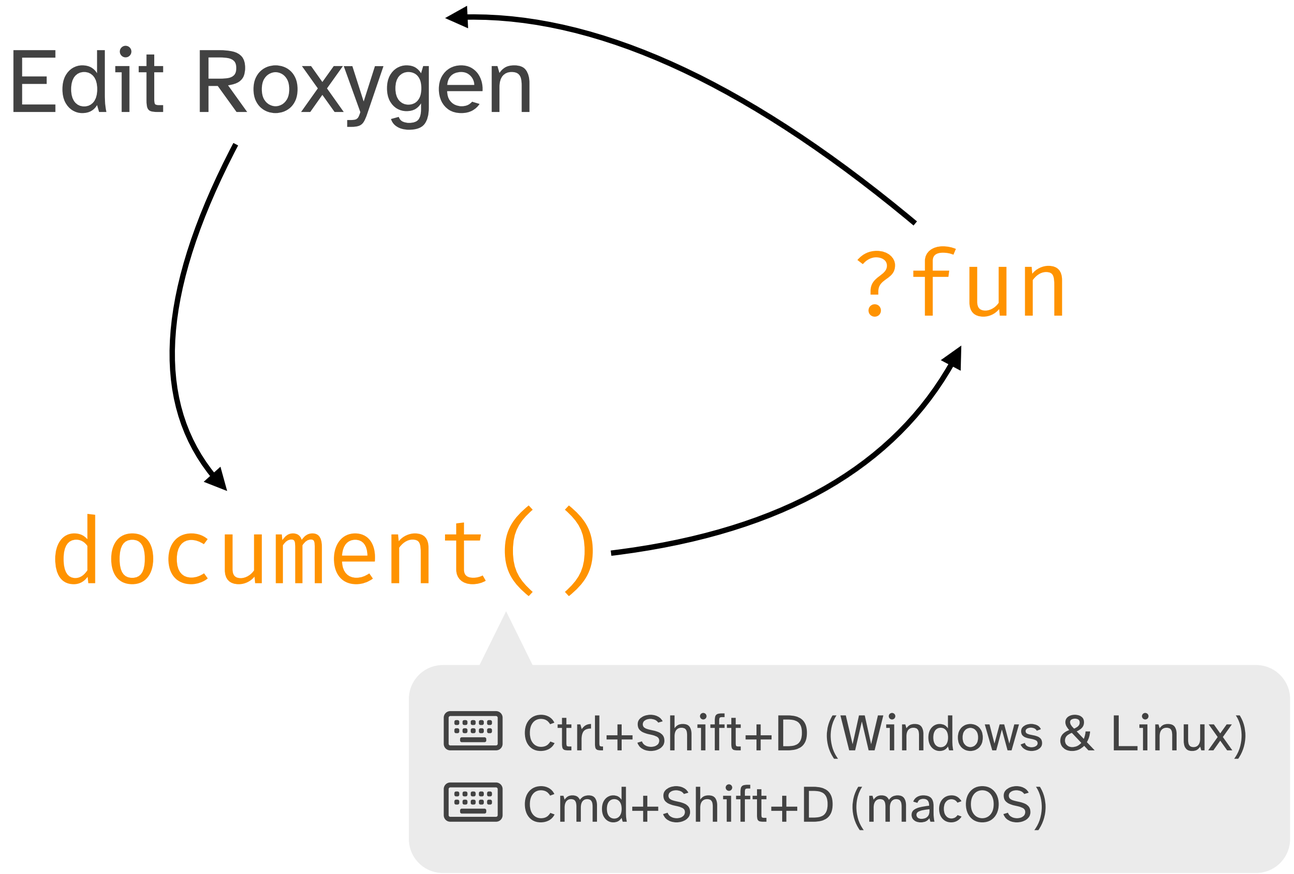
check()
Commit your changes
Push to Github

NAMESPACE

An introduction

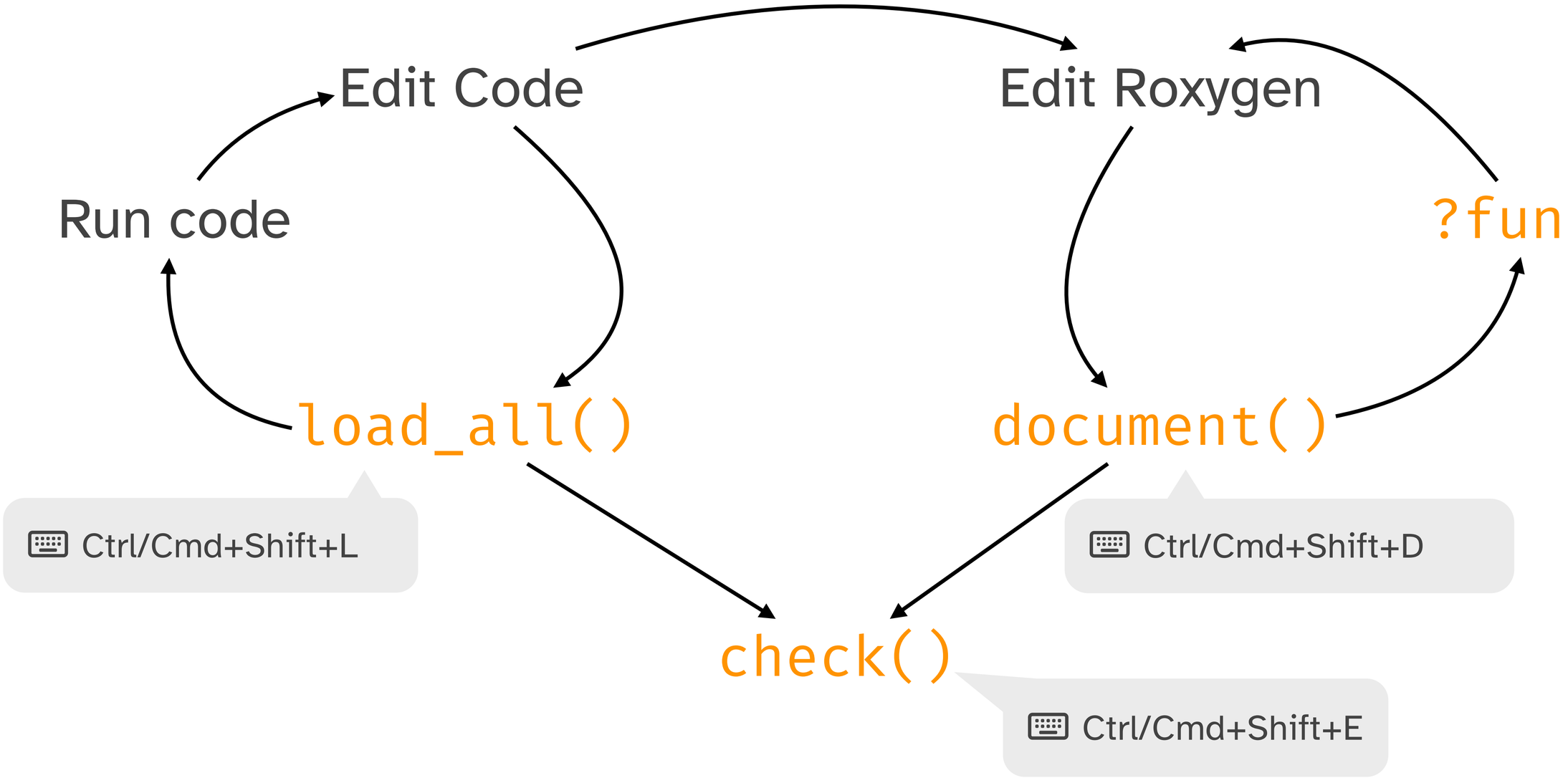
- Lists R objects that are:
  - **Exported** from your package to be used by package users
    - `export()`, `S3method()`, …
  - **Imported** from another package to be used internally by your package
    - `import()`, `importFrom()`, …
- `document()` updates the `NAMESPACE` file with directives from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

Documentation workflow



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

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+0 (macOS)

- Attach 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+0 (macOS)

- Attach package with `library()` like any other packa

Your Turn

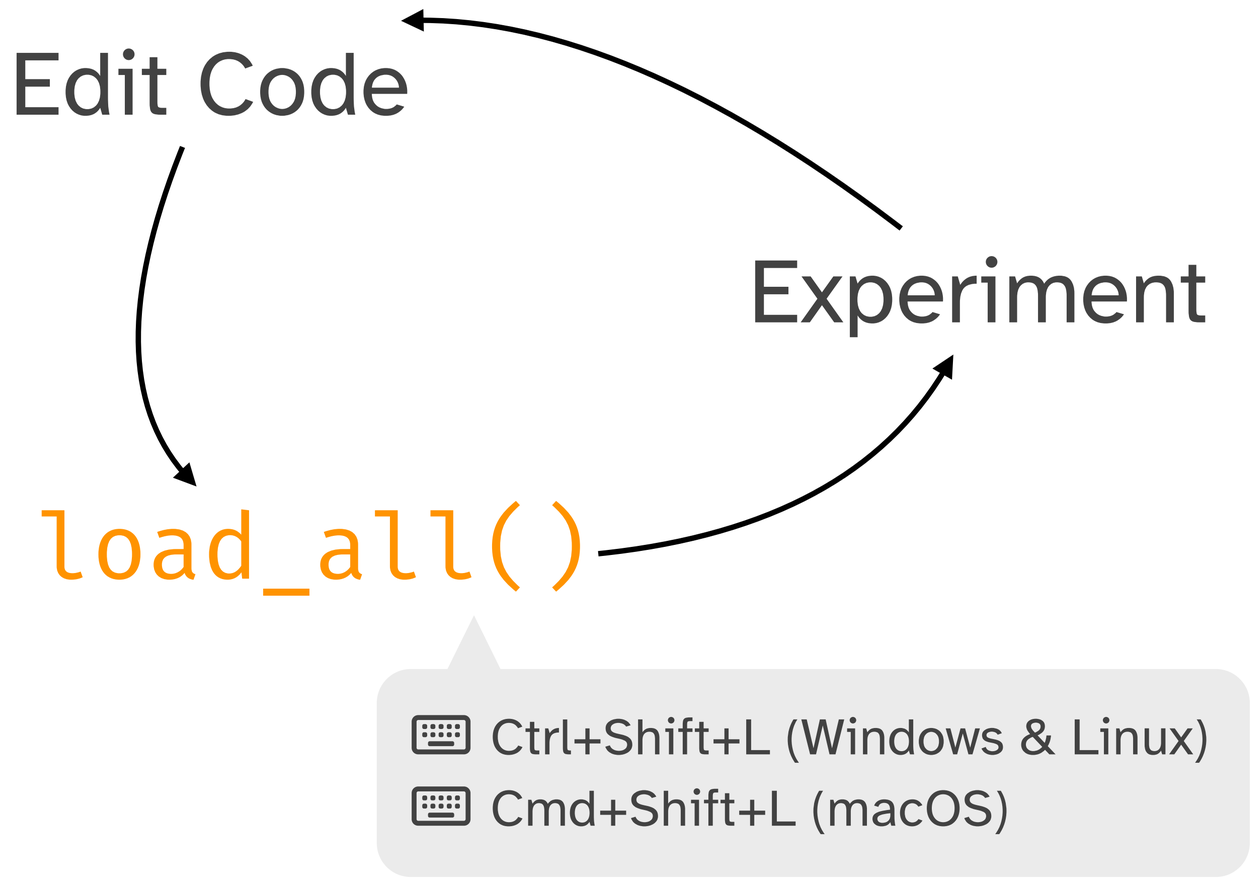
Commit your changes 
Push to Github 

Testing

Testing

Testing

Current workflow



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.
```

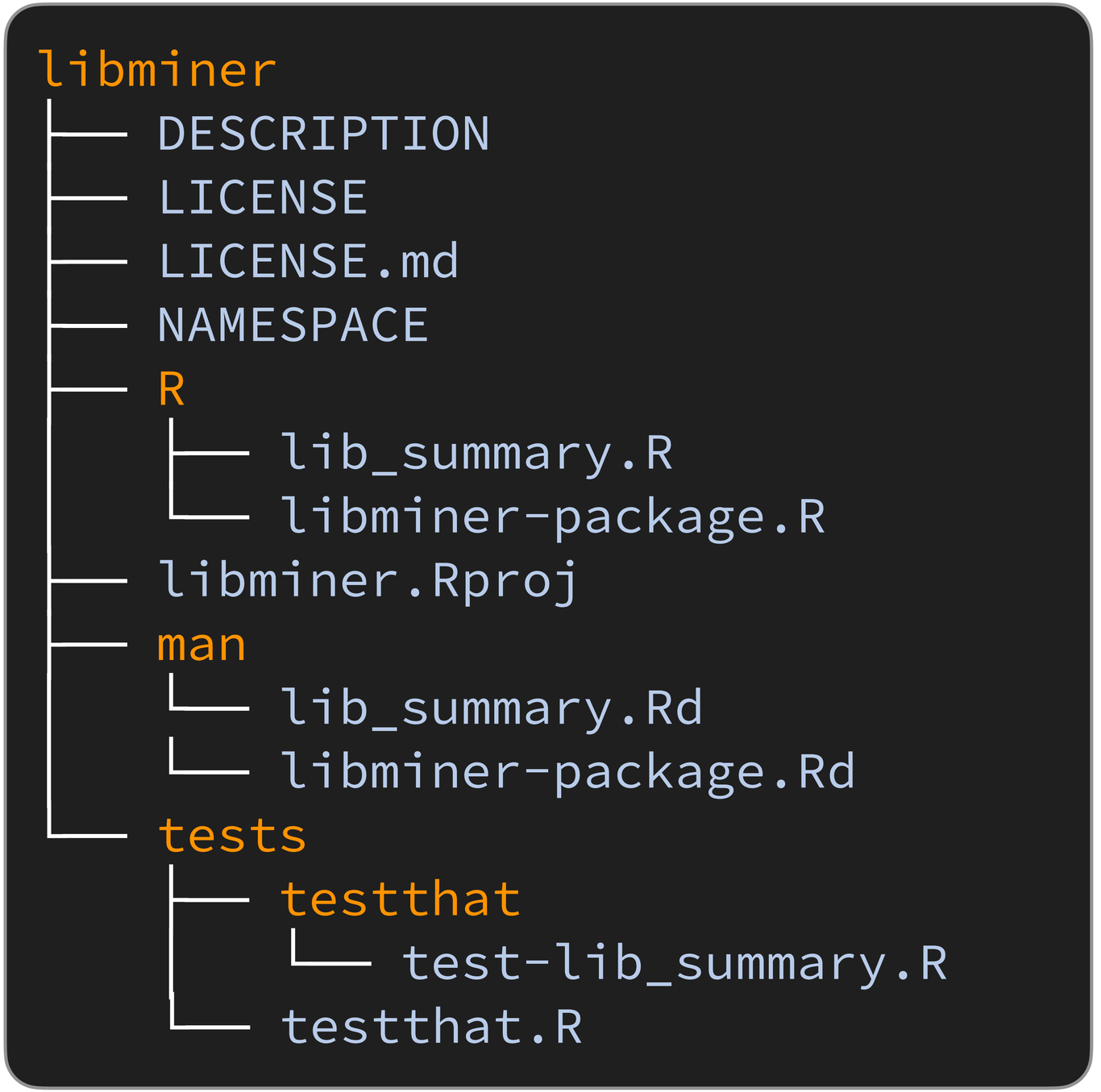
*Sorry, you still have to write the tests

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



Test structure

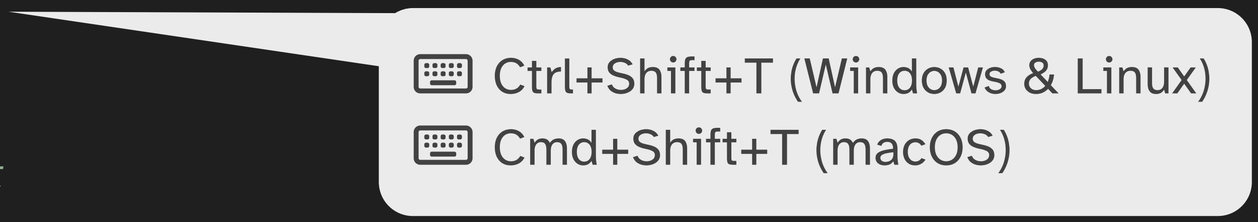
```
testthat("description of what you're testing", {
  expect_equal([function output], [expected output])
})
```

- **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 ]
```



test()

- Runs all tests in your test suite

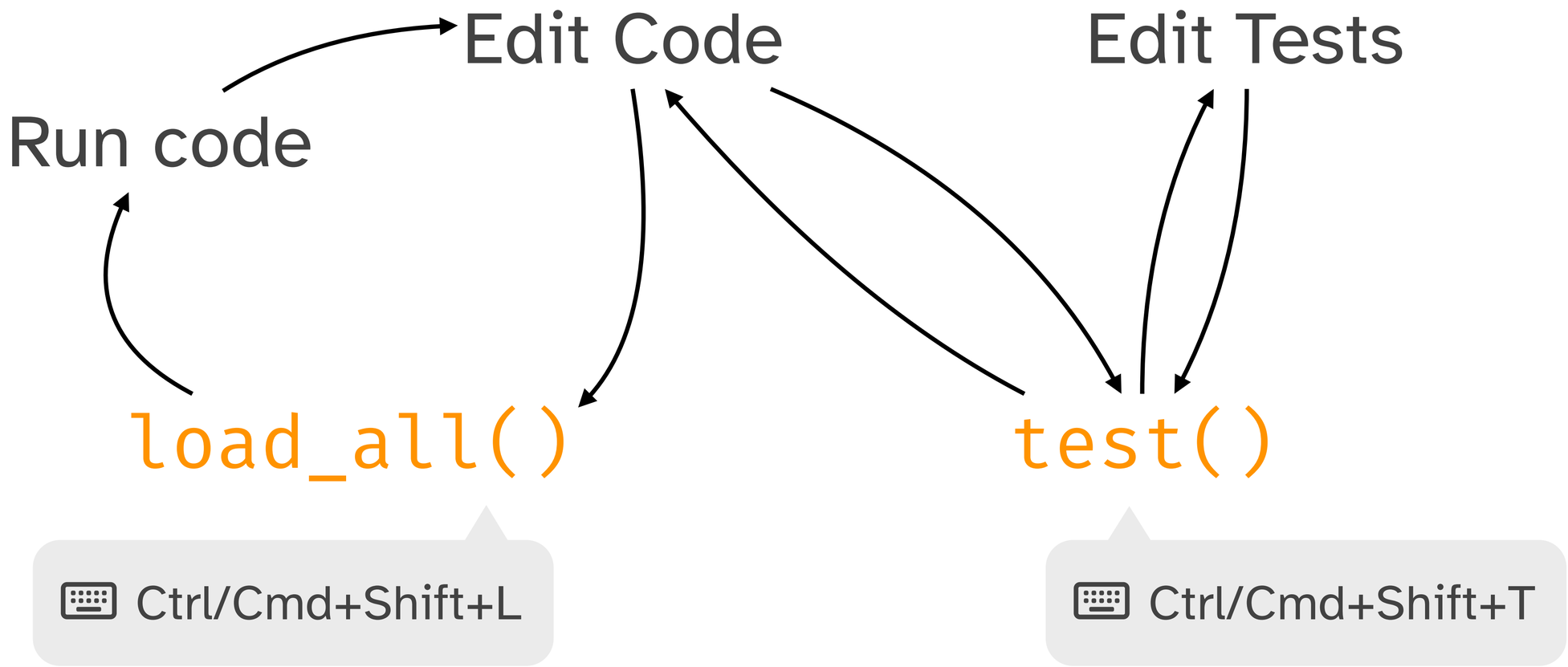
```
test()

#> 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

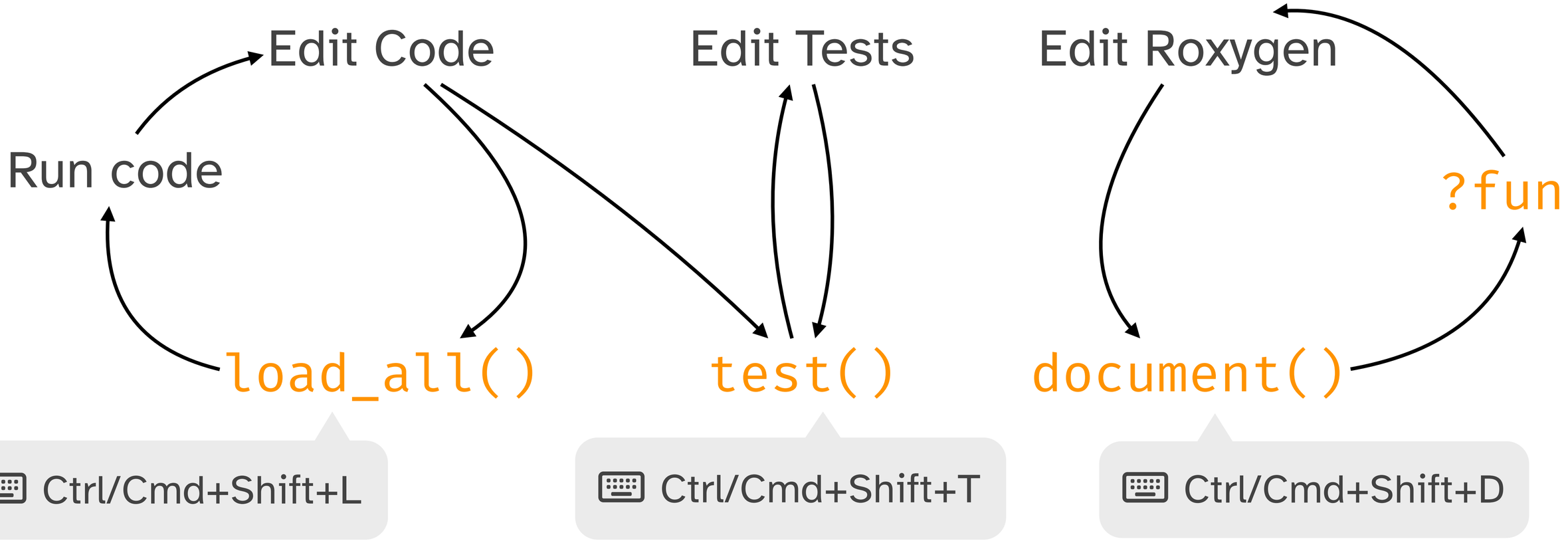
Updated workflow

Code + testing



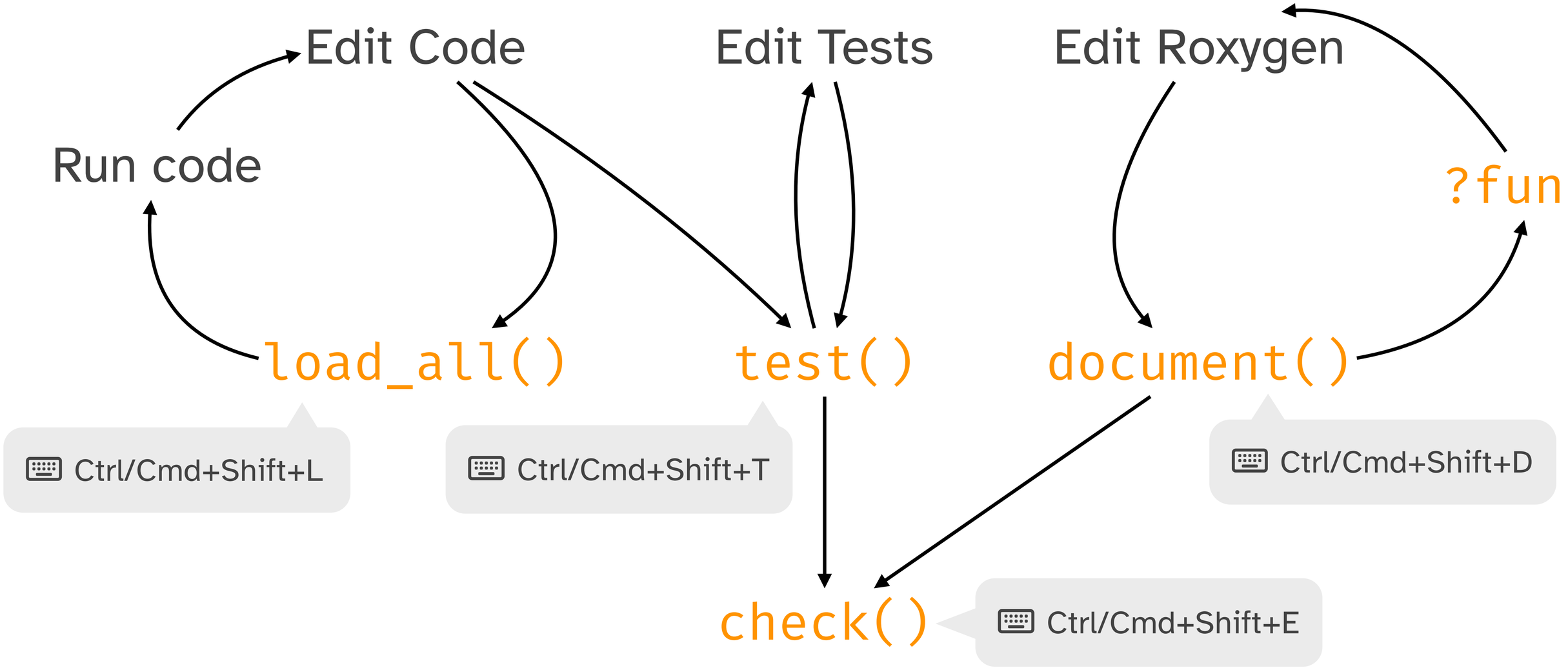
Workflow

Code + testing + documentation



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

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

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

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
- **`import`** == Available to be used internally by your package
- Don't edit manually - use roxygen tags:

```
#' @importFrom pkg fun
#' @import pkg
```

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)
```

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)
```

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)
```

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

Let's add one more

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

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

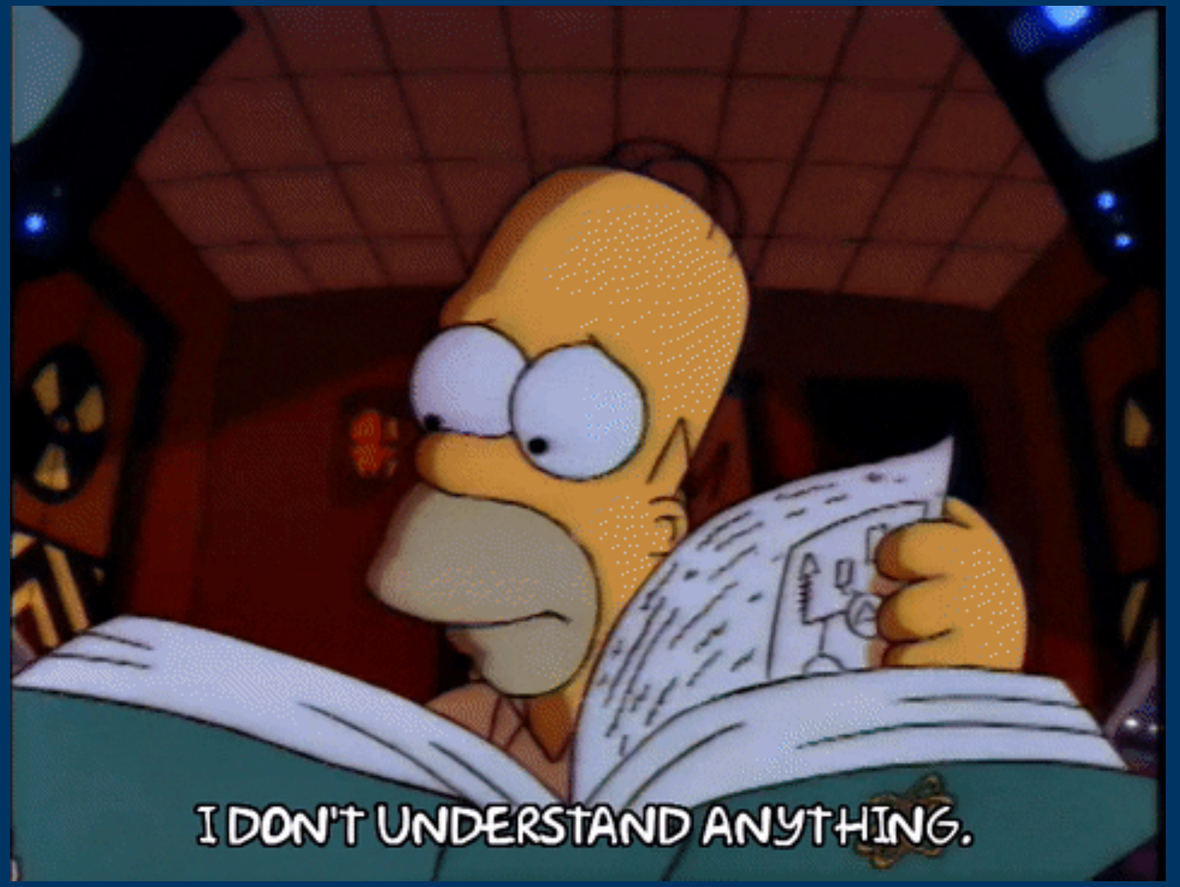
Let's add one more

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

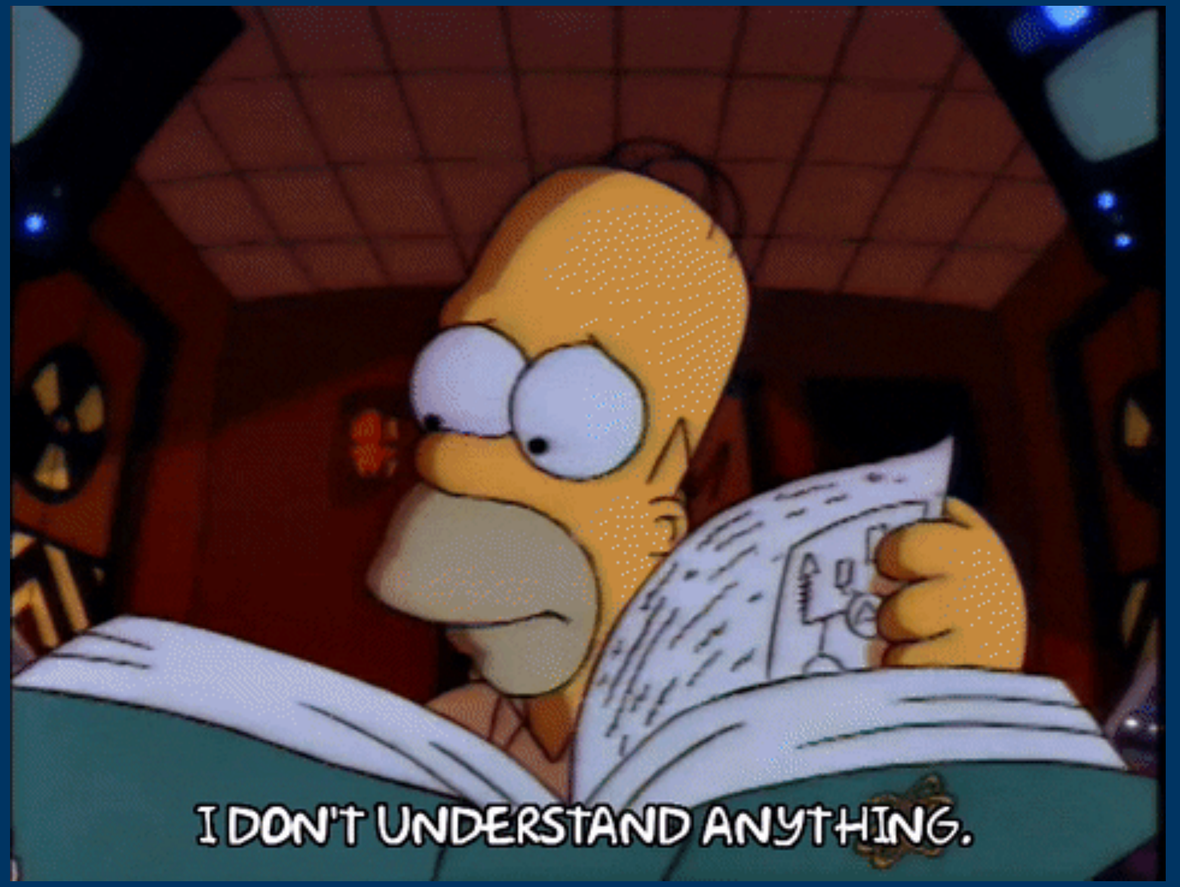
- See:
  - `DESCRIPTION`
  - `R/mypackage-packge.R` (remember `use_package_doc()`?)
  - `NAMESPACE`
- Write/edit function using dependency: `fn()`
- `*test()`

check()
Commit your changes
Push to Github

README



README



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

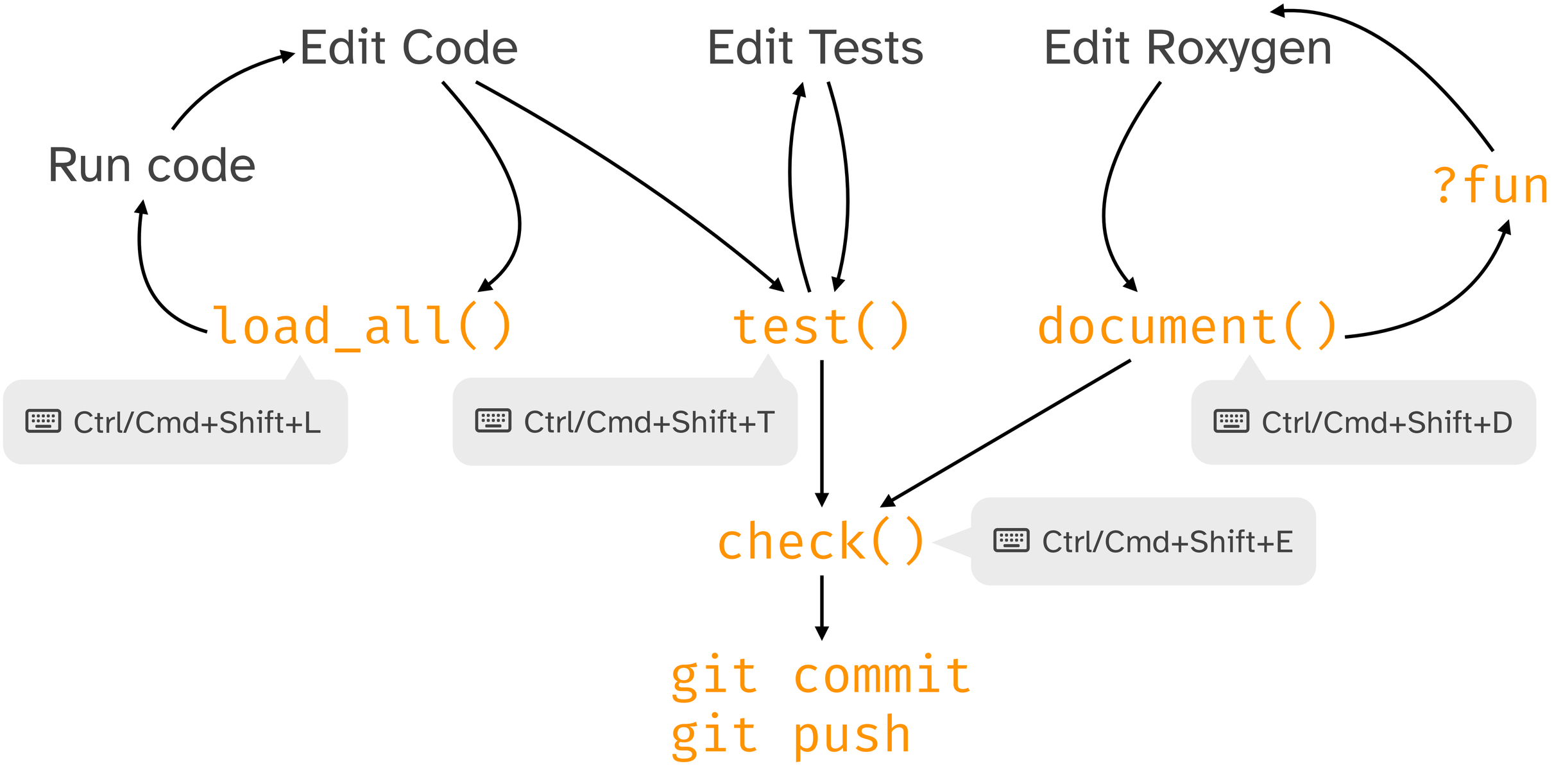
Final `check()` and `install()`

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

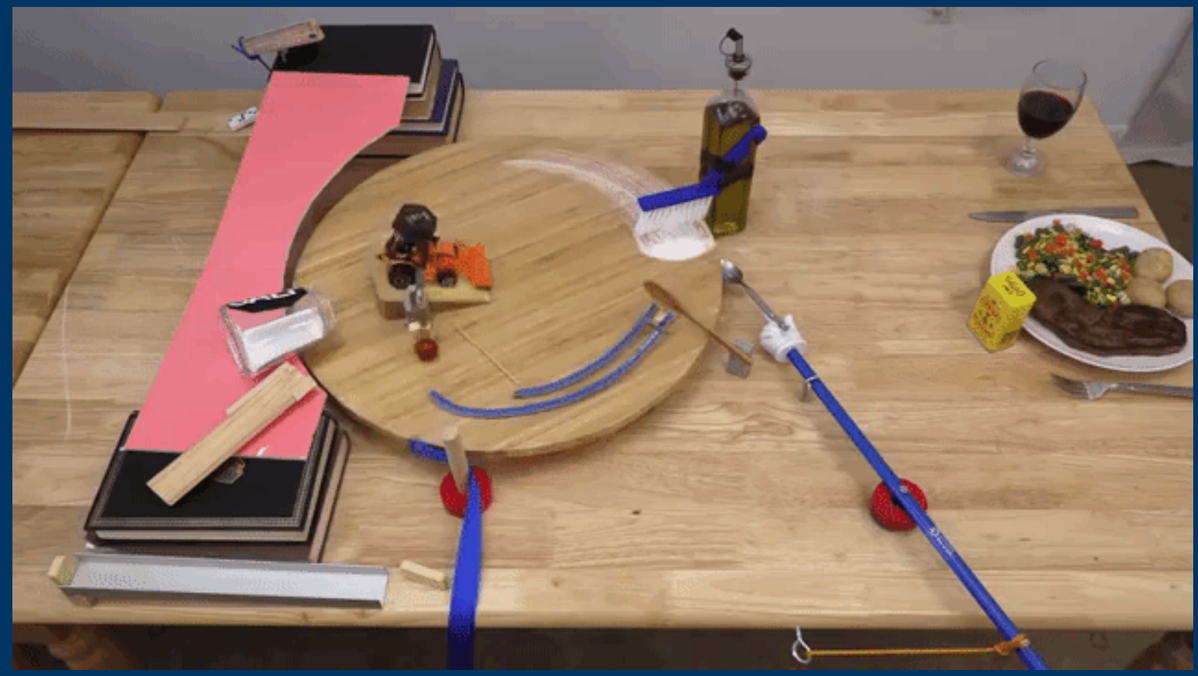
- `test()`

⌨ Ctrl/Cmd+Shift+T

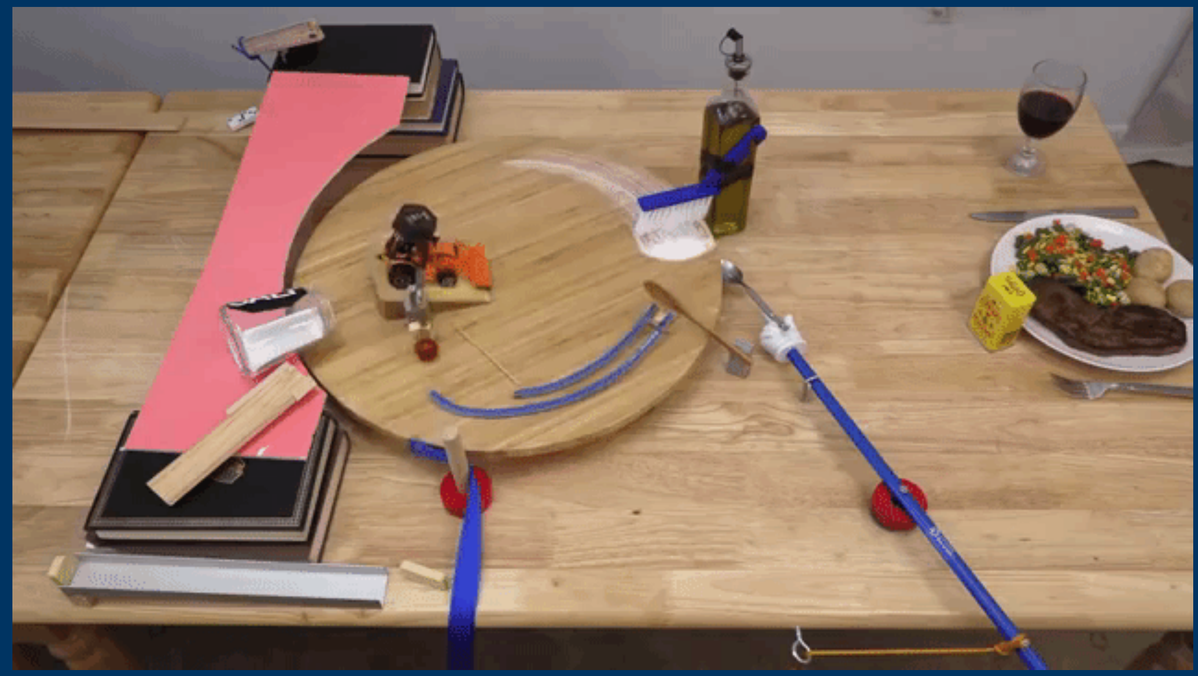
- `check()`

⌨ 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:
  - On different platforms (macOS, Windows, Linux)
  - On current R, R-devel, and R-oldrel
- `"test-coverage":` Compute test coverage and report at `codecov.io`
- `"pr-commands":` 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:
  - On different platforms (macOS, Windows, Linux)
  - On current R, R-devel, and R-oldrel
- `"test-coverage"`: Compute test coverage and report at `codecov.io`
- `"pr-commands"`: Enables automatic documentatio
  special PR comments
- And more...*

*https://github.com/r-lib/

Your Turn

Website

Website

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

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

Review: functions

Run once

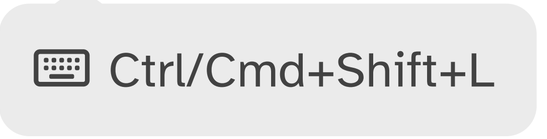
- `create_package()`
- `use_git()`
- `use_github()`
- `use_mit_license()`
- `use_testthat()`
- `use_readme_rmd()`
- `use_pkgdown_github_pages()`

Run periodically

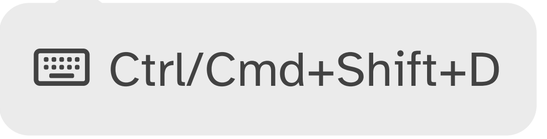
- `use_r()`
- `use_test()`
- `use_package()`
- `rename_files()`
- `use_github_action()`
- `use_vignette()`

Run frequently

- `load_all()`

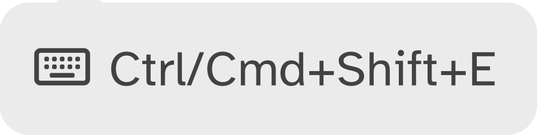


- `document()`



- `test()`

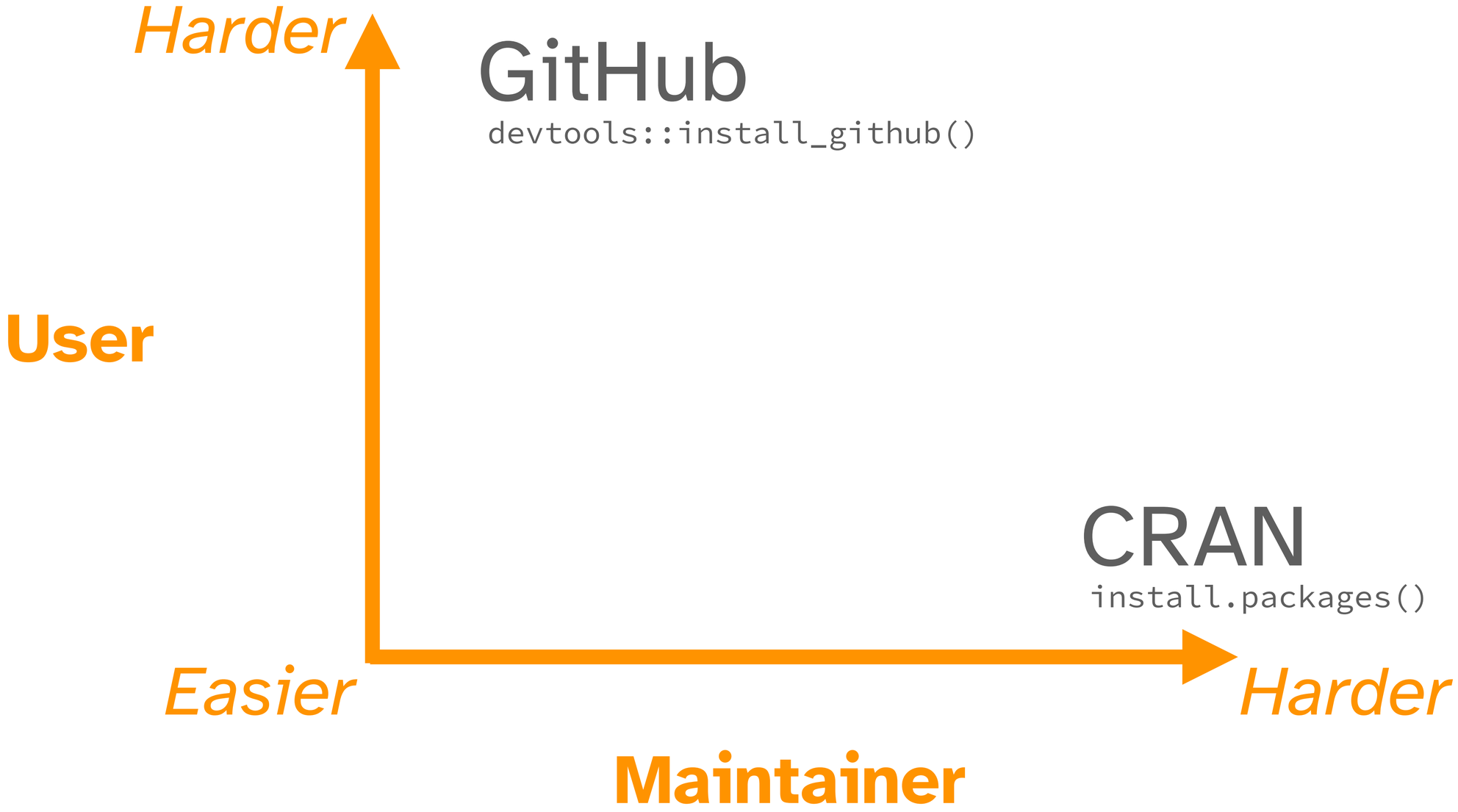
- `check()`



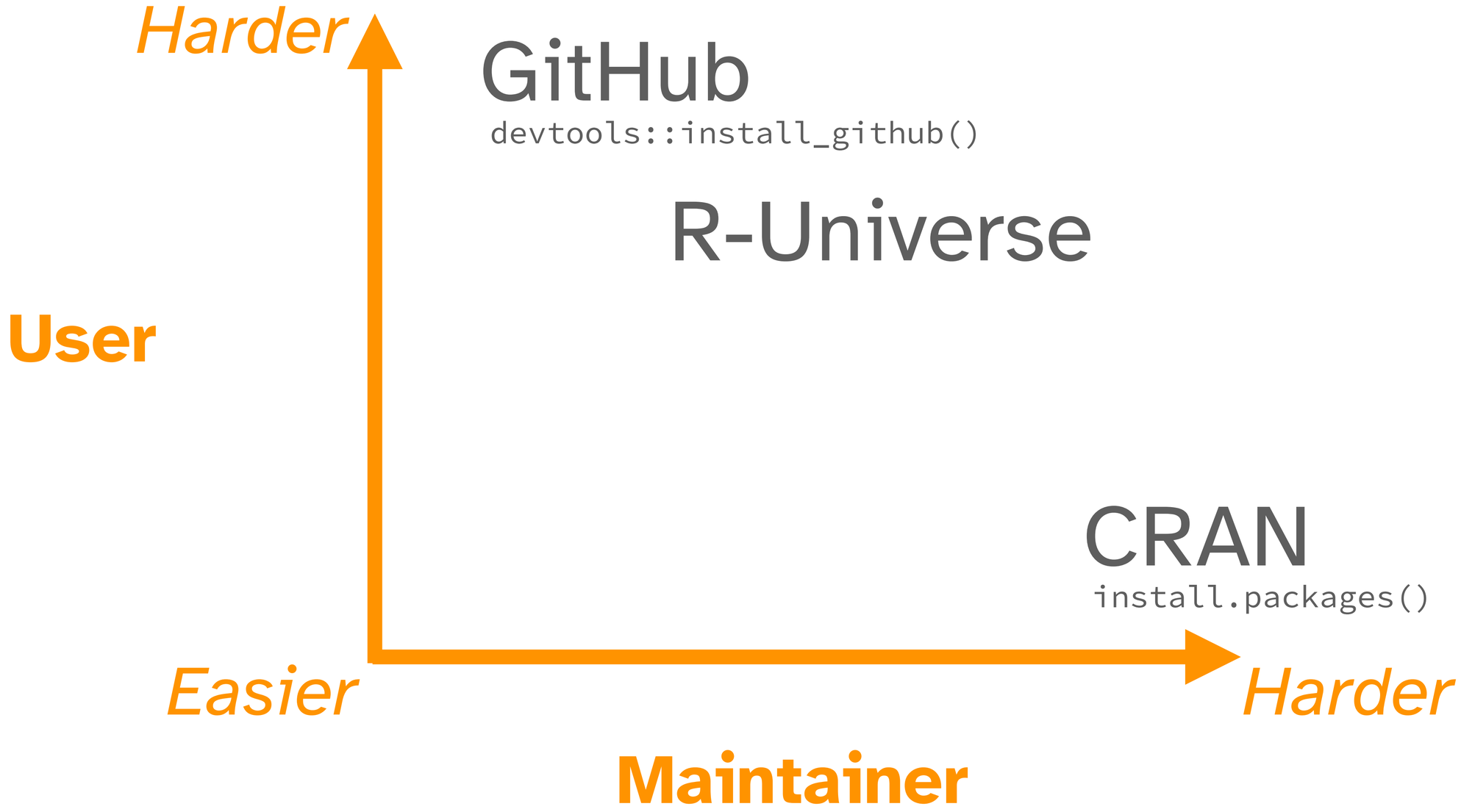
Sharing your Package

Sharing your Package

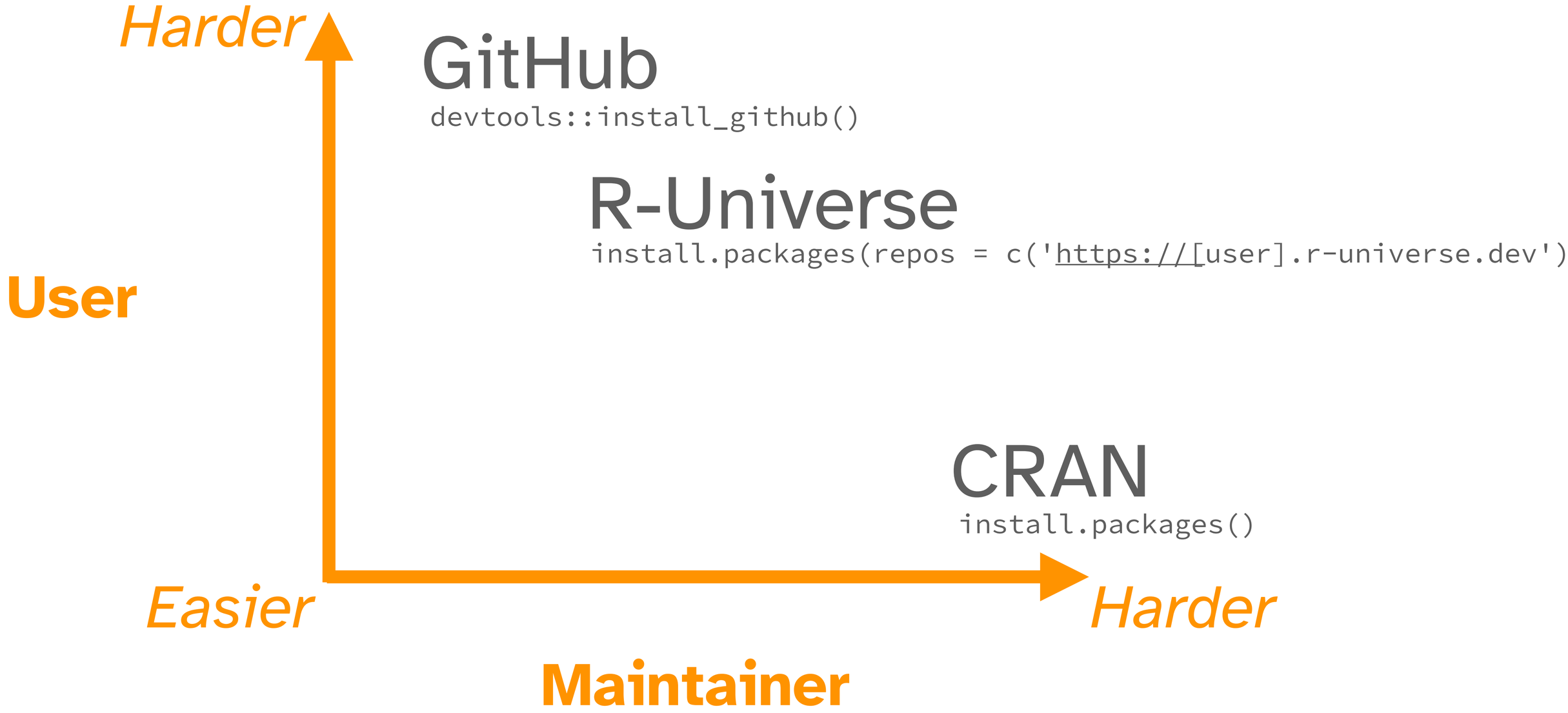
Package Distribution



Package Distribution



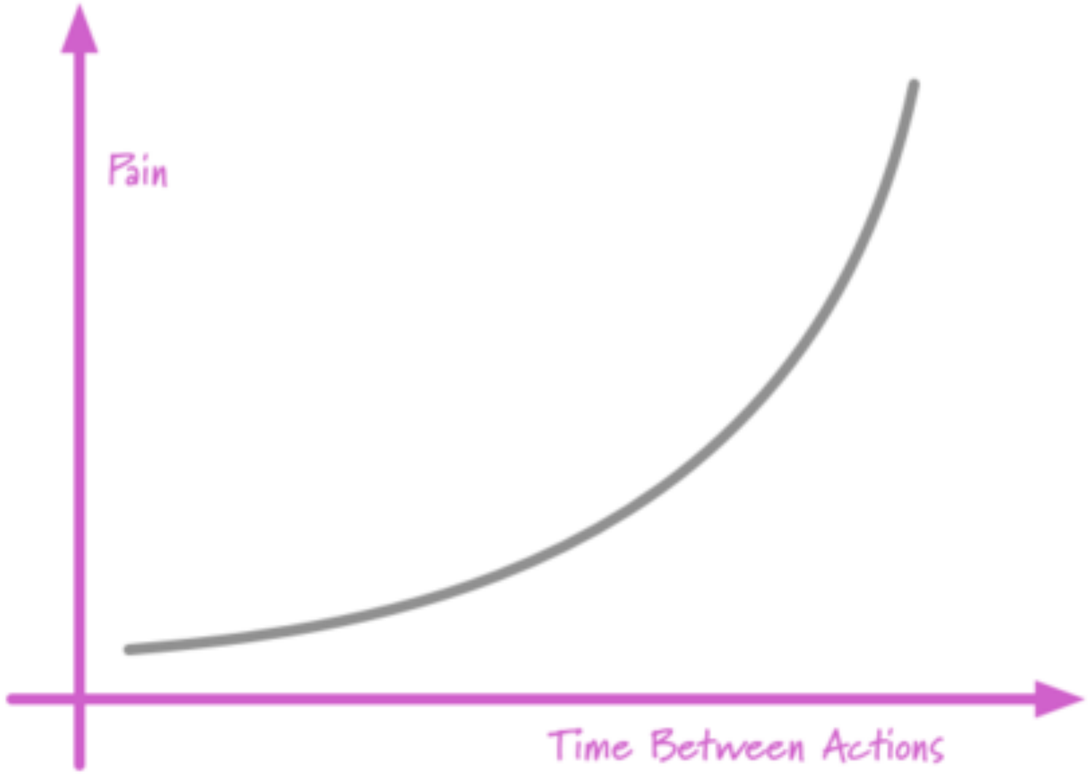
Package Distribution



Releasing your package to CRAN

Releasing your package to CRAN

“If it hurts, do it more often”

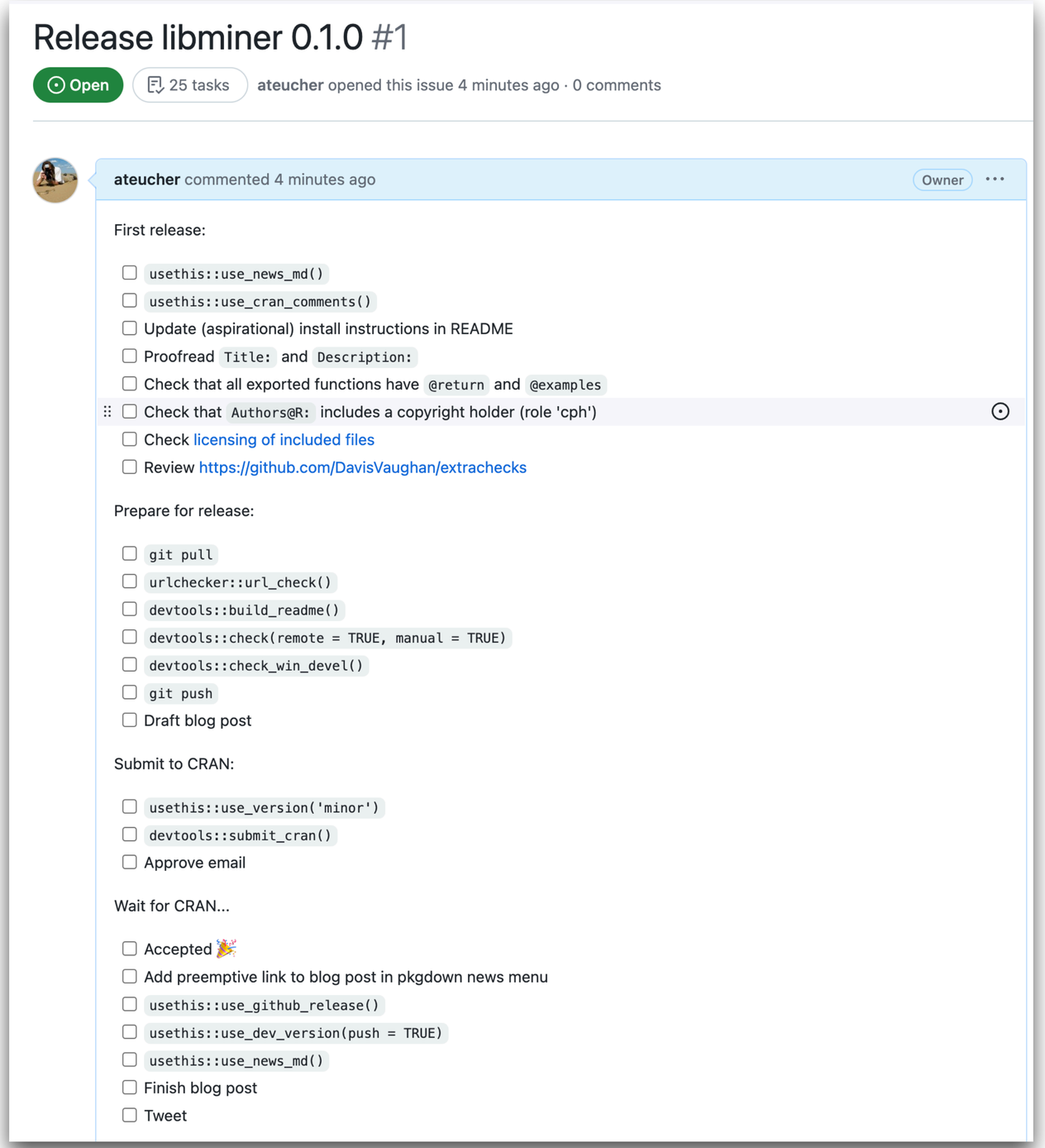


Martin Fowler: https://martinfowler.com/bliki/FrequencyReducesDifficulty.html

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:

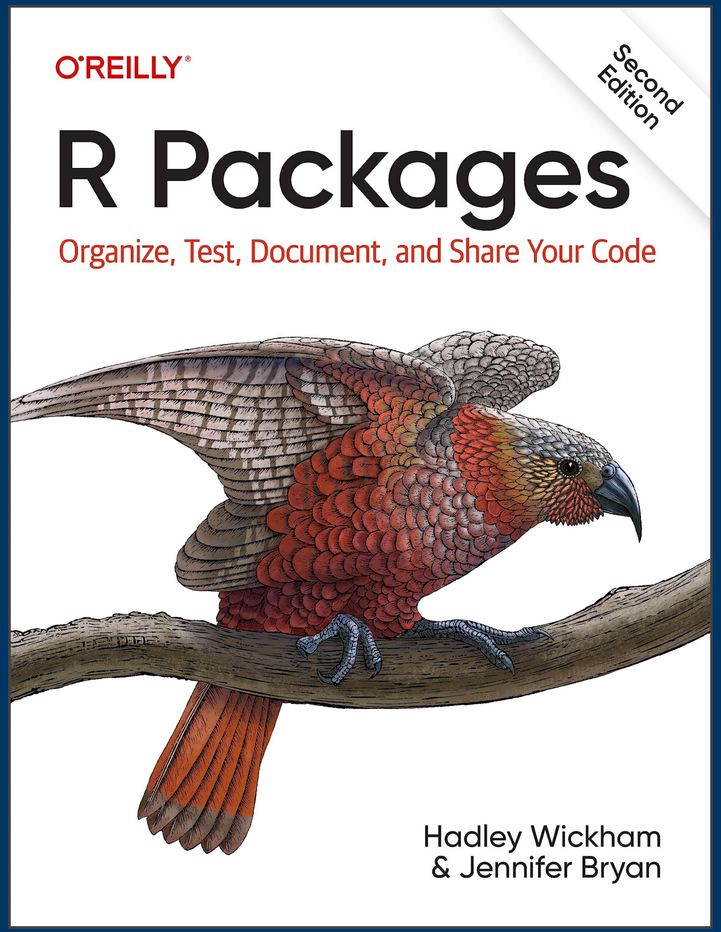
- [ ] `usethis::use_version('minor')`
- [ ] `devtools::submit_cran()`
- [ ] Approve email

Wait for CRAN...

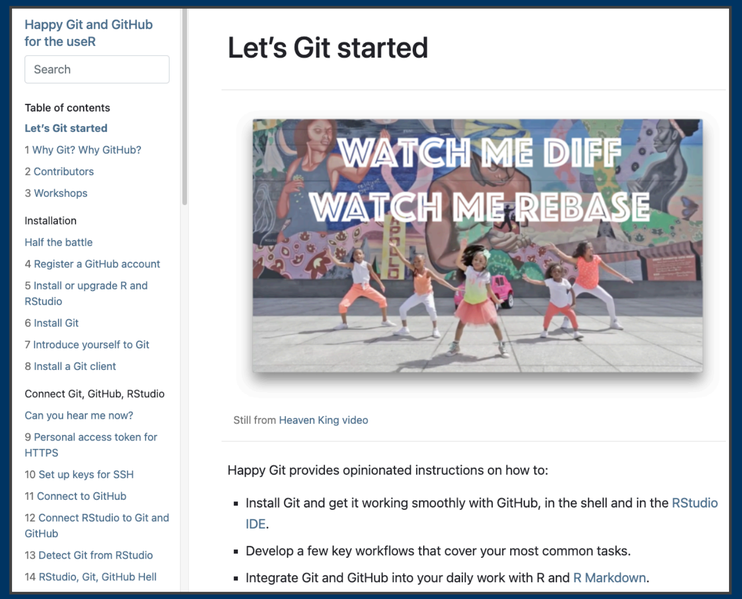
- [ ] Accepted 🎉
- [ ] Add preemptive link to blog post in pkgdown news menu
- [ ] `usethis::use_github_release()`
- [ ] `usethis::use_dev_version(push = TRUE)`
- [ ] `usethis::use_news_md()`
- [ ] Finish blog post
- [ ] Tweet

Resources

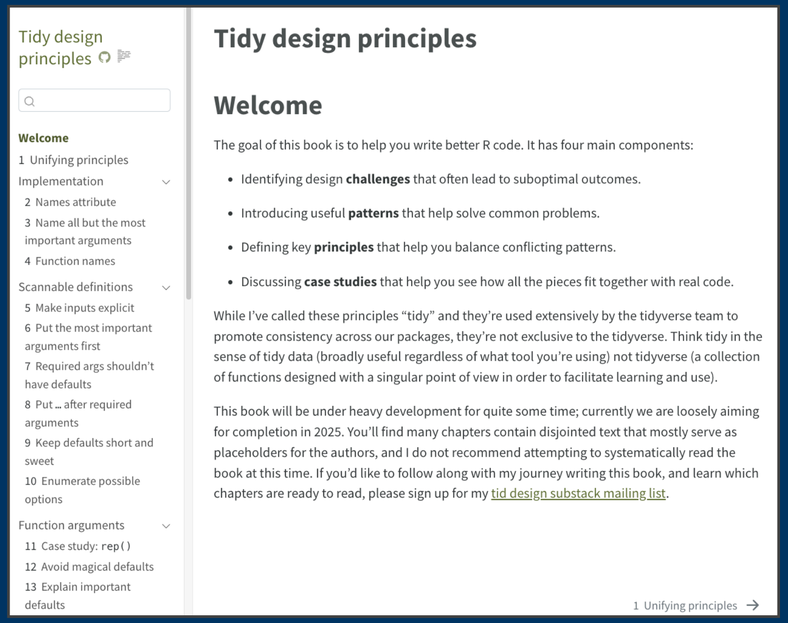
https://community.rstudio.com/c/package-development



r-pkgs.org

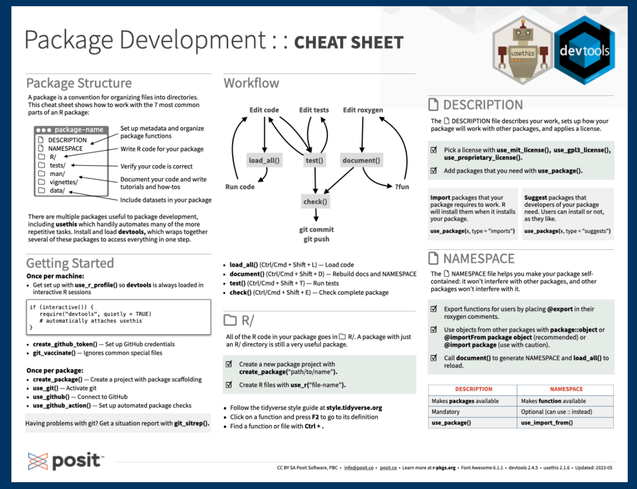


happygitwithr.com



design.tidyverse.org

tidydesign.substack.com



posit.co/resources/cheatsheets/

Thank You!

Course Materials

pos.it/pkg-dev-conf23

Survey

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

Your feedback is crucial! Please complete the post-workshop survey! 🙏

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