Making it easier to be tidy

Session 8

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Statistical Horizons, September 2021

Load the packages, as always

```r
library(here)      # manage file paths
```

```
## here() starts at /Users/kjhealy/Documents/courses/data_wrangling
```

```r
library(socviz)    # data and some useful functions
```

```
##
## Attaching package: 'socviz'
```

```
## The following object is masked from 'package:kjhutils':
##
##     %nin%
```

```r
library(tidyverse) # your friend and mine
```

```
## ── Attaching packages ─────────────────────────────────────── tidyverse 1.3.1 ──
```

```
## ✓ ggplot2 3.3.5     ✓ purrr   0.3.4
## ✓ tibble  3.1.4     ✓ dplyr   1.0.7
## ✓ tidyr   1.1.3     ✓ stringr 1.4.0
## ✓ readr   2.0.1     ✓ forcats 0.5.1
```

```
## ── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
## x readr::edition_get()   masks testthat::edition_get()
## x dplyr::filter()        masks stats::filter()
## x purrr::is_null()       masks testthat::is_null()
## x dplyr::lag()           masks stats::lag()
## x readr::local_edition() masks testthat::local_edition()
## x dplyr::matches()       masks tidyr::matches(), testthat::matches()
```

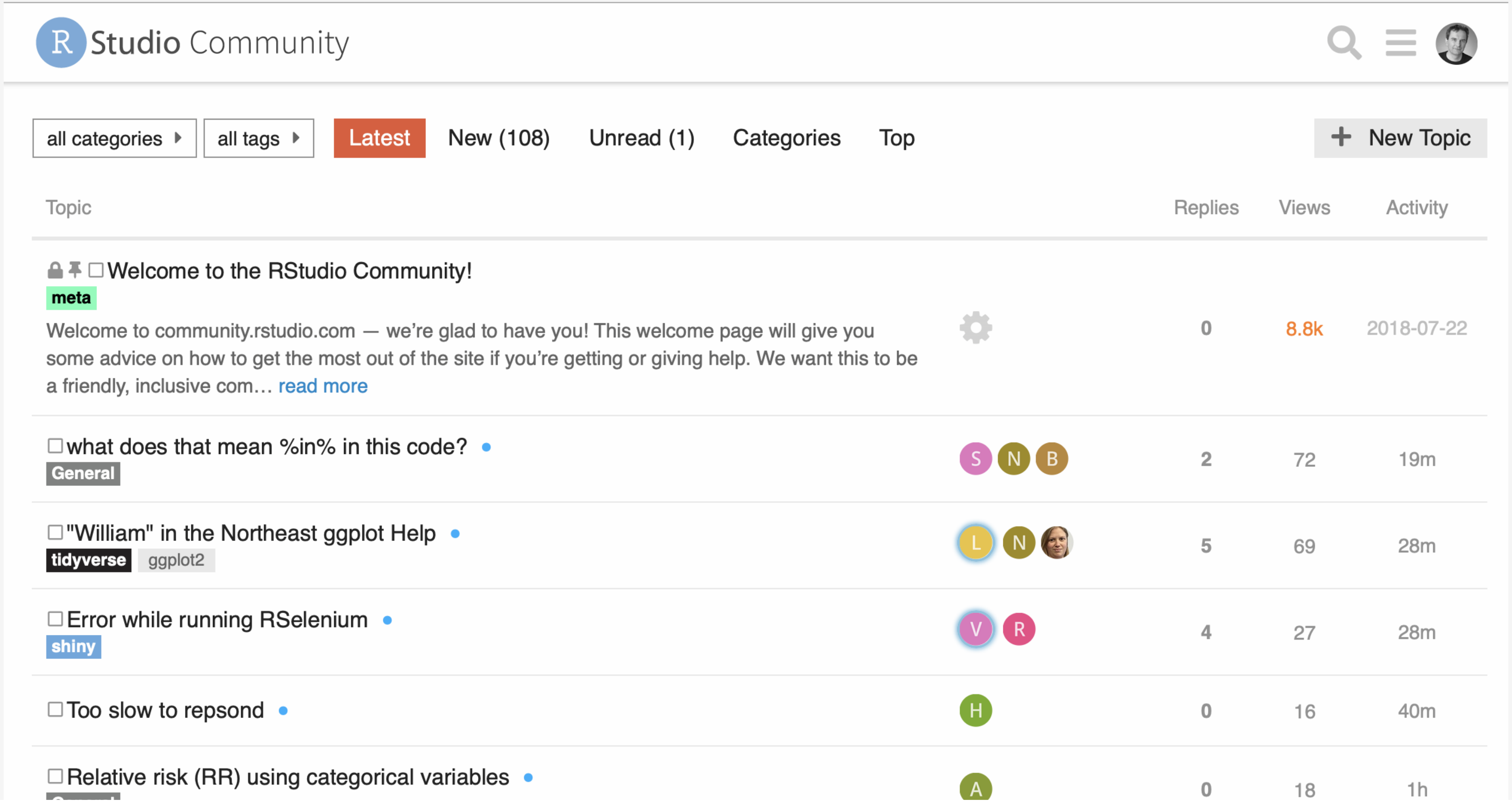
```r
library(haven)     # for Stata, SAS, and SPSS files

library(broom)     # tidy model summaries
```

Moving ahead

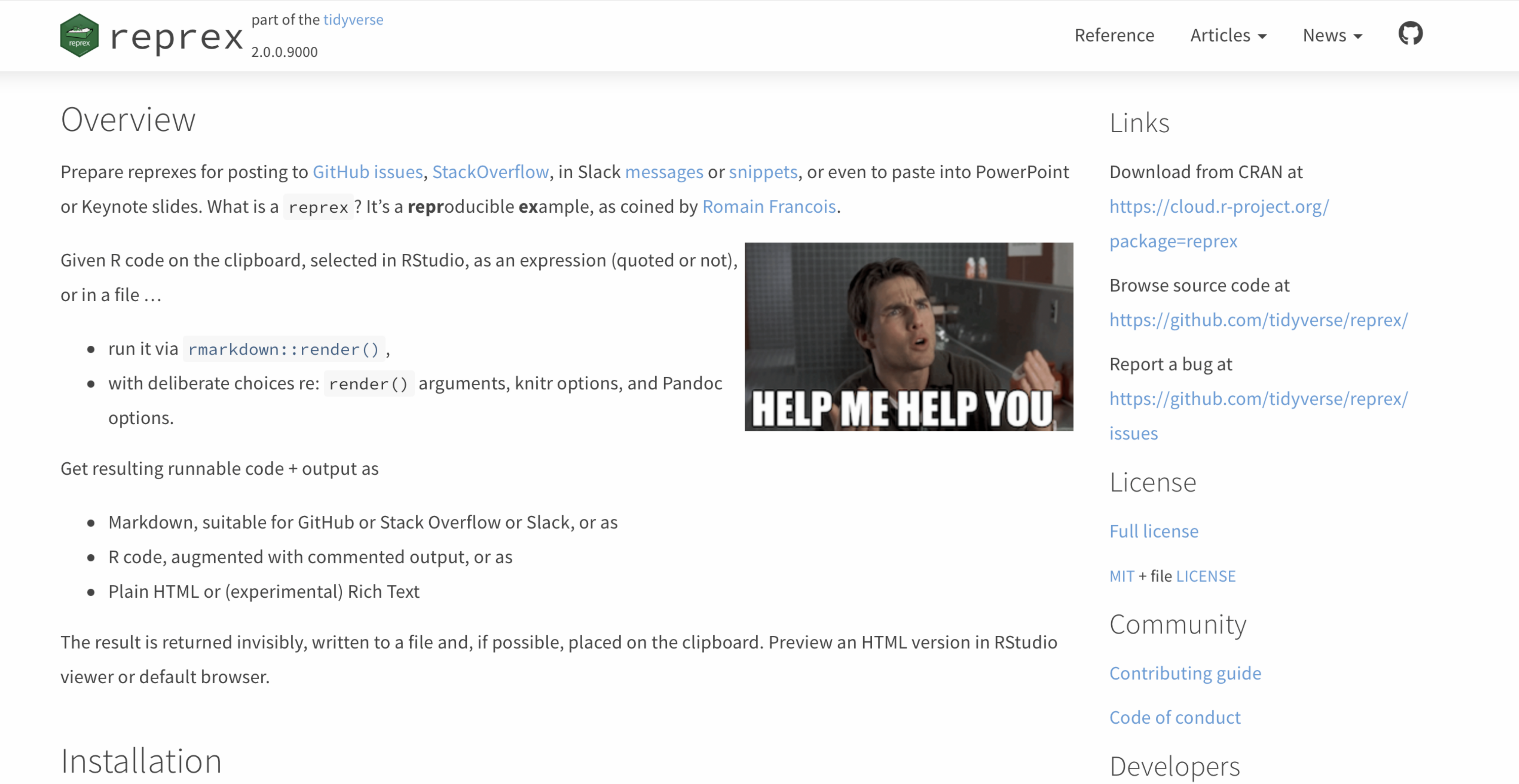
Some helpful things

The RStudio Community



Topic		Replies	Views	Activity
Welcome to the RStudio Community! meta Welcome to community.rstudio.com — we're glad to have you! This welcome page will give you some advice on how to get the most out of the site if you're getting or giving help. We want this to be a friendly, inclusive com… read more		0	8.8k	2018-07-22
□ what does that mean %in% in this code? ● General	S N B	2	72	19m
□ "William" in the Northeast ggplot Help ● tidyverse ggplot2	L N	5	69	28m
□ Error while running RSelenium ● shiny	V R	4	27	28m
□ Too slow to repsond ●	H	0	16	40m
□ Relative risk (RR) using categorical variables ●	A	0	18	1h

The reprex package



reprex part of the tidyverse 2.0.0.9000

Reference Articles News

Overview

Prepare reprexes for posting to GitHub issues, StackOverflow, in Slack messages or snippets, or even to paste into PowerPoint or Keynote slides. What is a `reprex`? It's a **repr**oducible **ex**ample, as coined by Romain Francois.

Given R code on the clipboard, selected in RStudio, as an expression (quoted or not), or in a file …

- run it via `rmarkdown::render()`,
- with deliberate choices re: `render()` arguments, knitr options, and Pandoc options.

Get resulting runnable code + output as

- Markdown, suitable for GitHub or Stack Overflow or Slack, or as
- R code, augmented with commented output, or as
- Plain HTML or (experimental) Rich Text

The result is returned invisibly, written to a file and, if possible, placed on the clipboard. Preview an HTML version in RStudio viewer or default browser.

Installation

Links

Download from CRAN at https://cloud.r-project.org/package=reprex

Browse source code at https://github.com/tidyverse/reprex/

Report a bug at https://github.com/tidyverse/reprex/issues

License

Full license

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Community

Contributing guide

Code of conduct

Developers

Best demonstrated live

When asking for help, make a **reproducible example**

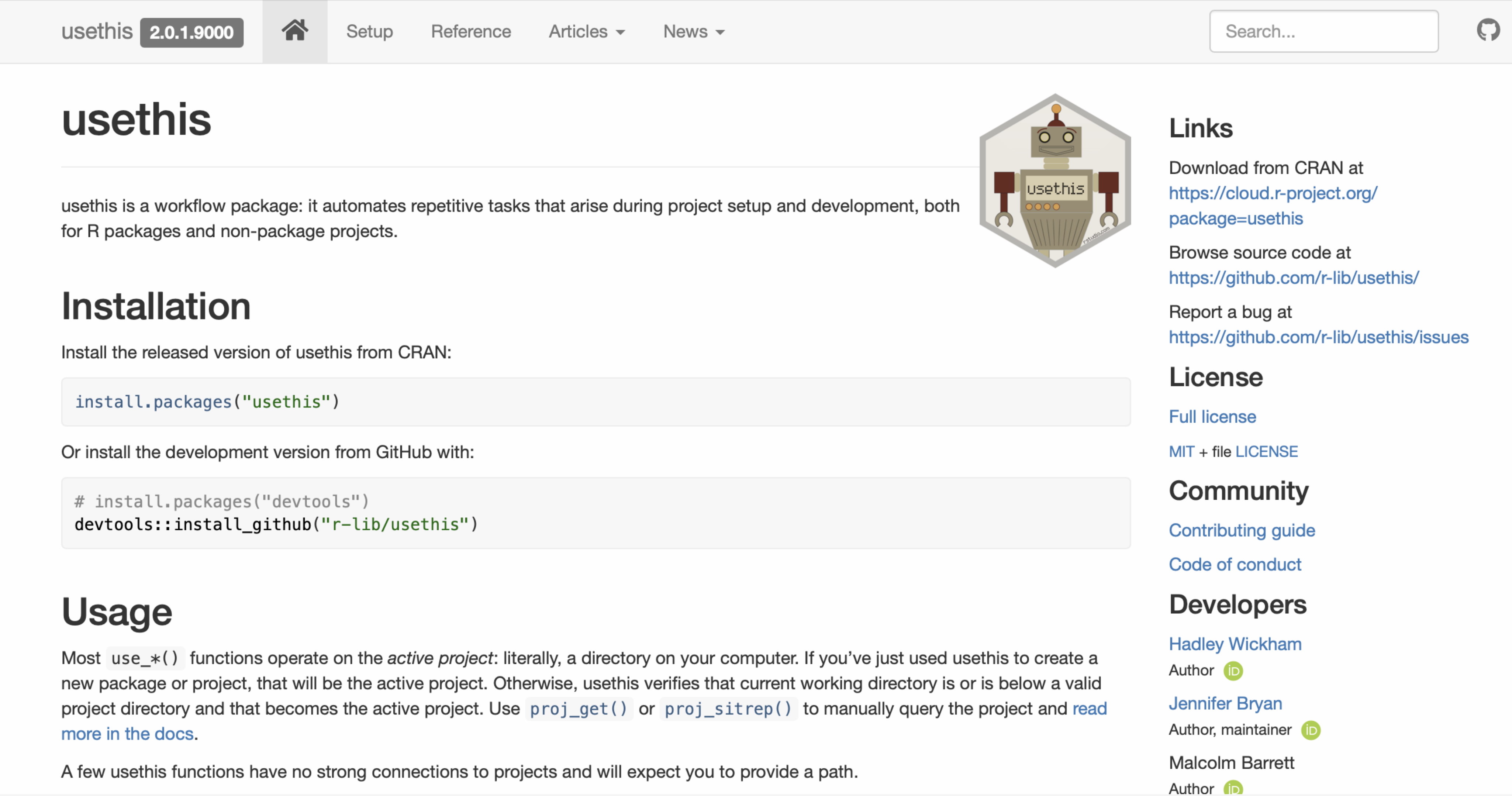
```r
library(reprex)
```

```r
library(tidyverse)

starwars %>%
  count(homeworld, species) %>%
  mutate(pct = n / sum(n) * 100) %>%
  arrange(desc(pct))
```

```
## # A tibble: 58 × 4
##    homeworld species       n   pct
##    <chr>     <chr>     <int> <dbl>
##  1 Tatooine  Human         8  9.20
##  2 Naboo     Human         5  5.75
##  3 <NA>      Human         5  5.75
##  4 Alderaan  Human         3  3.45
##  5 Naboo     Gungan        3  3.45
##  6 <NA>      Droid         3  3.45
##  7 Corellia  Human         2  2.30
##  8 Coruscant Human         2  2.30
##  9 Kamino    Kaminoan      2  2.30
## 10 Kashyyyk  Wookiee       2  2.30
## # … with 48 more rows
```

The usethis package



usethis

usethis is a workflow package: it automates repetitive tasks that arise during project setup and development, both for R packages and non-package projects.

Installation

Install the released version of usethis from CRAN:

```
install.packages("usethis")
```

Or install the development version from GitHub with:

```
# install.packages("devtools")
devtools::install_github("r-lib/usethis")
```

Usage

Most `use_*()` functions operate on the *active project*: literally, a directory on your computer. If you've just used usethis to create a new package or project, that will be the active project. Otherwise, usethis verifies that current working directory is or is below a valid project directory and that becomes the active project. Use `proj_get()` or `proj_sitrep()` to manually query the project and read more in the docs.

A few usethis functions have no strong connections to projects and will expect you to provide a path.

Links

Download from CRAN at https://cloud.r-project.org/package=usethis

Browse source code at https://github.com/r-lib/usethis/

Report a bug at https://github.com/r-lib/usethis/issues

License

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Community

Contributing guide

Code of conduct

Developers

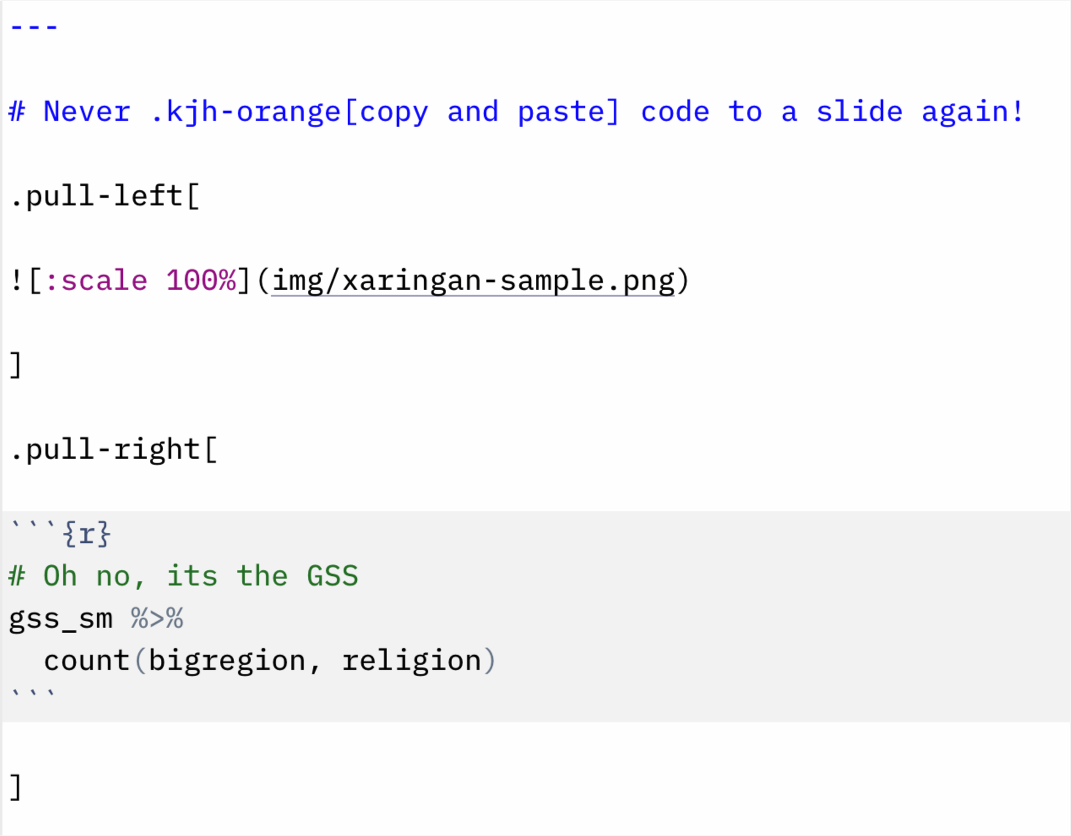
Hadley Wickham
Author

Jennifer Bryan
Author, maintainer

Malcolm Barrett
Author

The packages that made these slides

Never paste tables into a slide again!



~~~
---

# Never .kjh-orange[copy and paste] code to a slide again!

.pull-left[

![:scale 100%](img/xaringan-sample.png)

]

.pull-right[

```{r}
# Oh no, its the GSS
gss_sm %>%
  count(bigregion, religion)
```

]
~~~

religion	Northeast	Midwest	South	West
Protestant	158	325	650	238
Catholic	162	172	160	155
Jewish	27	3	11	10
None	112	157	170	180
Other	28	33	50	48
NA	1	5	11	1

Tables, tables, tables

The **gtsummary** package is very powerful. There are a number of other very good tidy table-making options too.

```r
library(gtsummary)

trial
```

```
## # A tibble: 200 × 8
##    trt      age marker stage grade response death ttdeath
##    <chr>  <dbl>  <dbl> <fct> <fct>    <int> <int>   <dbl>
##  1 Drug A    23  0.16  T1    II           0     0    24
##  2 Drug B     9  1.11  T2    I            1     0    24
##  3 Drug A    31  0.277 T1    II           0     0    24
##  4 Drug A    NA  2.07  T3    III          1     1    17.6
##  5 Drug A    51  2.77  T4    III          1     1    16.4
##  6 Drug B    39  0.613 T4    I            0     1    15.6
##  7 Drug A    37  0.354 T1    II           0     0    24
##  8 Drug A    32  1.74  T1    I            0     1    18.4
##  9 Drug A    31  0.144 T1    II           0     0    24
## 10 Drug B    34  0.205 T3    I            0     1    10.5
## # … with 190 more rows
```

Tables, tables, tables

The **gtsummary** package is very powerful. There are a number of other very good tidy table-making options too.

```
trial %>%
  tbl_summary(
    by = trt, # split table by group
    missing = "no" # don't list missing data separately
  ) %>%
  add_n() %>% # add column with total number of non-missing observations
  add_p() %>% # test for a difference between groups
  modify_header(label = "**Variable**") %>% # update the column header
  bold_labels()
```

Tables, tables, tables

Variable	**N**	**Drug A**, N = 98[1]	**Drug B**, N = 102[1]	**p-value**[2]
Age	189	46 (37, 59)	48 (39, 56)	0.7
Marker Level (ng/mL)	190	0.84 (0.24, 1.57)	0.52 (0.19, 1.20)	0.085
T Stage	200			0.9
T1		28 (29%)	25 (25%)	
T2		25 (26%)	29 (28%)	
T3		22 (22%)	21 (21%)	
T4		23 (23%)	27 (26%)	
Grade	200			0.9
I		35 (36%)	33 (32%)	
II		32 (33%)	36 (35%)	
III		31 (32%)	33 (32%)	
Tumor Response	193	28 (29%)	33 (34%)	0.5
Patient Died	200	52 (53%)	60 (59%)	0.4
Months to Death/Censor	200	23.5 (17.4, 24.0)	21.2 (14.6, 24.0)	0.14

[1] Median (IQR); n (%)

[2] Wilcoxon rank sum test; Pearson's Chi-squared test

Tables, tables, tables

`gtsummary()` straight out of the box:

```
gss_sm %>%
  select(race, degree, marital) %>%
  drop_na() %>%
  tbl_summary(
    by = race, # split table by group
    missing = "no" # don't list missing data separately
  ) %>%
  add_n() %>% # add column with total number of non-missing observations
#  modify_header(label = "**Variable**") %>% # update the column header
  bold_labels()
```

Tables, tables, tables

Variable	**N**	**White**, N = 2,096[1]	**Black**, N = 487[1]	**Other**, N = 276[1]
degree	2,859			
Lt High School		197 (9.4%)	60 (12%)	71 (26%)
High School		1,057 (50%)	292 (60%)	112 (41%)
Junior College		166 (7.9%)	33 (6.8%)	17 (6.2%)
Bachelor		426 (20%)	71 (15%)	39 (14%)
Graduate		250 (12%)	31 (6.4%)	37 (13%)
marital	2,859			
Married		979 (47%)	121 (25%)	110 (40%)
Widowed		196 (9.4%)	35 (7.2%)	18 (6.5%)
Divorced		363 (17%)	93 (19%)	39 (14%)
Separated		55 (2.6%)	27 (5.5%)	20 (7.2%)
Never Married		503 (24%)	211 (43%)	89 (32%)

[1] n (%)

Tables, tables, tables

With a bit more work ...

```
trial %>%
  select(trt, age, marker) %>%
  tbl_summary(
    by = trt,
    type = all_continuous() ~ "continuous2",
    statistic = all_continuous() ~ c("{N_nonmiss}",
                                     "{mean} ({sd})",
                                     "{median} ({p25}, {p75})",
                                     "{min}, {max}"),

    missing = "no"
  ) %>%
  italicize_levels()
```

Tables, tables, tables

Characteristic	**Drug A**, N = 98	**Drug B**, N = 102
Age		
N	91	98
Mean (SD)	47 (15)	47 (14)
Median (IQR)	46 (37, 59)	48 (39, 56)
Range	6, 78	9, 83
Marker Level (ng/mL)		
N	92	98
Mean (SD)	1.02 (0.89)	0.82 (0.83)
Median (IQR)	0.84 (0.24, 1.57)	0.52 (0.19, 1.20)
Range	0.00, 3.87	0.00, 3.64

The power of lists

Similar to earlier, but simpler:

```r
library(gapminder)

## Fit as a function, for clarity
fit_ols <- function(df) {
    lm(lifeExp ~ log(gdpPercap), data = df)
}


out_le <- gapminder %>%
  filter(continent %nin% "Oceania") %>%
  group_by(continent) %>%
  nest() %>%
  mutate(model = map(data, fit_ols),
         mod_sum = map(model, glance),
         mod_terms = map(model, tidy, conf.int = TRUE),
         ) %>%
  unnest(cols = c(mod_terms))
```

The power of lists

```
out_le
```

```
## # A tibble: 8 × 11
## # Groups:   continent [4]
##   continent data    model mod_sum  term   estimate std.error statistic   p.value
##   <fct>     <list>  <lis> <list>   <chr>     <dbl>     <dbl>     <dbl>     <dbl>
## 1 Asia      <tibbl… <lm>  <tibble… (Inte…     9.58     2.71       3.54 4.46e-  4
## 2 Asia      <tibbl… <lm>  <tibble… log(g…     6.25     0.331     18.9  3.73e- 57
## 3 Europe    <tibbl… <lm>  <tibble… (Inte…    13.0      1.92       6.76 5.52e- 11
## 4 Europe    <tibbl… <lm>  <tibble… log(g…     6.31     0.205     30.8  8.06e-103
## 5 Africa    <tibbl… <lm>  <tibble… (Inte…     7.60     2.63       2.89 4.03e-  3
## 6 Africa    <tibbl… <lm>  <tibble… log(g…     5.69     0.361     15.8  1.86e- 47
## 7 Americas  <tibbl… <lm>  <tibble… (Inte…   -19.1      4.82      -3.95 9.65e-  5
## 8 Americas  <tibbl… <lm>  <tibble… log(g…     9.72     0.558     17.4  2.51e- 47
## # … with 2 more variables: conf.low <dbl>, conf.high <dbl>
```

The power of lists

```r
## Nice formatting of the numbers
## There are many convenience packages
## like this; it's not too hard to write your own, either
# remotes::install_github("tjmahr/printy")

text_ready <- out_le %>%
  mutate(
    across(c(estimate, conf.low, conf.high),
           printy::fmt_fix_digits, 2),
    se = printy::fmt_fix_digits(std.error, 3),
    ci = glue::glue("[{conf.low}, {conf.high}]")
  ) %>%
  select(continent, term, estimate, se, ci)
```

The `printy` package is by T.J. Mahr

The power of lists

```
text_ready
```

```
## # A tibble: 8 × 5
## # Groups:   continent [4]
##   continent term           estimate se    ci
##   <fct>     <chr>          <chr>    <chr> <glue>
## 1 Asia      (Intercept)    9.58     2.706 [4.26, 14.90]
## 2 Asia      log(gdpPercap) 6.25     0.331 [5.60, 6.90]
## 3 Europe    (Intercept)    12.97    1.917 [9.19, 16.74]
## 4 Europe    log(gdpPercap) 6.31     0.205 [5.91, 6.71]
## 5 Africa    (Intercept)    7.60     2.632 [2.43, 12.77]
## 6 Africa    log(gdpPercap) 5.69     0.361 [4.98, 6.40]
## 7 Americas  (Intercept)    -19.07   4.824 [-28.56, -9.58]
## 8 Americas  log(gdpPercap) 9.72     0.558 [8.62, 10.82]
```

The power of lists

Now ...

```
stats <- text_ready %>%
  mutate(term = janitor::make_clean_names(term)) %>%
  printy::super_split(continent, term) # Thanks again, TJ Mahr
```

The power of lists

Why are we doing this?

```
stats
```

```
## $Africa
## $Africa$intercept
## # A tibble: 1 × 5
## # Groups:   continent [1]
##   continent term      estimate se    ci
##   <fct>     <chr>     <chr>    <chr> <glue>
## 1 Africa    intercept 7.60     2.632 [2.43, 12.77]
##
## $Africa$log_gdp_percap
## # A tibble: 1 × 5
## # Groups:   continent [1]
##   continent term           estimate se    ci
##   <fct>     <chr>          <chr>    <chr> <glue>
## 1 Africa    log_gdp_percap 5.69     0.361 [4.98, 6.40]
##
##
## $Americas
## $Americas$intercept
## # A tibble: 1 × 5
## # Groups:   continent [1]
```

The power of lists

```
The Intercept term for Africa was 'r stats$Africa$intercept$estimate' 'r stats$Africa$intercept$ci'.

For Europe it was 'r stats$Europe$intercept$estimate' 'r stats$Europe$intercept$ci'
```

The Intercept term for Africa was 7.60 [2.43, 12.77].

For Europe it was 12.97 [9.19, 16.74].

For more, see this post by TJ Mahr:

https://www.tjmahr.com/lists-knitr-secret-weapon/

You should **test** the output of your functions

```r
countries <- read_csv(here("data", "countries.csv"))

countries
```

```
## # A tibble: 213 × 4
##    cname       iso3  iso2  continent
##    <chr>       <chr> <chr> <chr>
##  1 Afghanistan AFG   AF    Asia
##  2 Algeria     DZA   DZ    Africa
##  3 Armenia     ARM   AM    Asia
##  4 Australia   AUS   AU    Oceania
##  5 Austria     AUT   AT    Europe
##  6 Azerbaijan  AZE   AZ    Asia
##  7 Bahrain     BHR   BH    Asia
##  8 Belarus     BLR   BY    Europe
##  9 Belgium     BEL   BE    Europe
## 10 Brazil      BRA   BR    South America
## # … with 203 more rows
```

You should test the output of your functions

```r
get_stmf <- function(url = "https://www.mortality.org/Public/STMF/Outputs",
                     fname = "stmf",
                     date = lubridate::today(),
                     ext = "csv",
                     dest = "data-raw/data",
                     save_file = c("n", "y"),
                     ...) {
  save_file <- match.arg(save_file)
  target <-  fs::path(url, fname, ext = ext)
  message("target: ", target)

  destination <- fs::path(here::here("data-raw/data"),
                          paste0(fname, "_", date), ext = ext)

  tf <- tempfile(fileext = ext)
  curl::curl_download(target, tf)

  switch(save_file,
         y = fs::file_copy(tf, destination),
         n = NULL)

  janitor::clean_names(read_csv(tf, ...))
}
```

You should **test** the output of your functions

```
stmf_raw <- get_stmf(skip = 2) %>%
  rename(deaths_total = d_total, rate_total = r_total) %>%
  select(country_code:sex, deaths_total, rate_total, split:forecast, everything()) %>%
  pivot_longer(
    cols = d0_14:r85p,
    names_to = c("measure", "age_group"),
    names_pattern = "(r|d)(.*)"
  ) %>%
  pivot_wider(names_from = measure,
              values_from = value) %>%
  mutate(age_group = stringr::str_replace(age_group, "_", "-"),
         age_group = stringr::str_replace(age_group, "p", "+")) %>%
  rename(death_count = d, death_rate = r) %>%
  mutate(approx_date = paste0(year, "-", "W",
                              stringr::str_pad(week, width = 2, pad = "0"), "-", "7"),
         approx_date = ISOweek::ISOweek2date(approx_date)) %>%
  select(country_code:sex, split:forecast, approx_date,
         age_group:death_rate, deaths_total, rate_total) %>%
  mutate(country_code = replace(country_code, country_code == "AUS2", "AUS"),
         country_code = replace(country_code, country_code == "NZL_NP", "NZL"))
```

You should **test** the output of your functions

```r
stmf_raw
```

```
## # A tibble: 534,255 × 13
##    country_code  year  week sex   split split_sex forecast approx_date age_group
##    <chr>        <dbl> <dbl> <chr> <dbl>     <dbl>    <dbl> <date>      <chr>    
##  1 AUS           2015     1 m         1         0        0 2015-01-04  0-14     
##  2 AUS           2015     1 m         1         0        0 2015-01-04  15-64    
##  3 AUS           2015     1 m         1         0        0 2015-01-04  65-74    
##  4 AUS           2015     1 m         1         0        0 2015-01-04  75-84    
##  5 AUS           2015     1 m         1         0        0 2015-01-04  85+      
##  6 AUS           2015     1 f         1         0        0 2015-01-04  0-14     
##  7 AUS           2015     1 f         1         0        0 2015-01-04  15-64    
##  8 AUS           2015     1 f         1         0        0 2015-01-04  65-74    
##  9 AUS           2015     1 f         1         0        0 2015-01-04  75-84    
## 10 AUS           2015     1 f         1         0        0 2015-01-04  85+      
## # … with 534,245 more rows, and 4 more variables: death_count <dbl>,
## #   death_rate <dbl>, deaths_total <dbl>, rate_total <dbl>
```

You should test the output of your functions

```
md_ccodes <- tibble(country_code = unique(stmf_raw$country_code)) %>%
  left_join(countries, by = c("country_code" = "iso3")) %>%
  mutate(cname = replace(cname, country_code == "DEUTNP", "Germany"),
         iso2 = replace(iso2, country_code == "DEUTNP", "DE"),
         continent = replace(continent, country_code == "DEU", "Europe"),
         cname = replace(cname, country_code == "FRATNP", "France"),
         iso2 = replace(iso2, country_code == "FRATNP", "FR"),
         continent = replace(continent, country_code == "FRA", "Europe"),
         cname = replace(cname, country_code == "GBRTENW", "England and Wales"),
         cname = replace(cname, country_code == "GBR_SCO", "Scotland"),
         cname = replace(cname, country_code == "GBR_NIR", "Northern Ireland"),
         continent = replace(continent, country_code %in% c("GBRTENW", "GBR_SCO", "GBR_NIR"), "Europe")
         ) %>%
  left_join(countries)


stmf <- left_join(stmf_raw, md_ccodes) %>%
  select(country_code, cname:iso3, everything()) %>%
  mutate(iso3 = replace(iso3, iso2 == "DE", "DEU"),
         iso3 = replace(iso3, iso2 == "FR", "FRA"))
```

You should test the output of your functions

```r
stmf
```

```
## # A tibble: 534,255 × 17
##    country_code cname     iso2  continent iso3   year  week sex   split split_sex
##    <chr>        <chr>     <chr> <chr>     <chr> <dbl> <dbl> <chr> <dbl>     <dbl>
##  1 AUS          Australia AU    Oceania   AUS    2015     1 m         1         0
##  2 AUS          Australia AU    Oceania   AUS    2015     1 m         1         0
##  3 AUS          Australia AU    Oceania   AUS    2015     1 m         1         0
##  4 AUS          Australia AU    Oceania   AUS    2015     1 m         1         0
##  5 AUS          Australia AU    Oceania   AUS    2015     1 m         1         0
##  6 AUS          Australia AU    Oceania   AUS    2015     1 f         1         0
##  7 AUS          Australia AU    Oceania   AUS    2015     1 f         1         0
##  8 AUS          Australia AU    Oceania   AUS    2015     1 f         1         0
##  9 AUS          Australia AU    Oceania   AUS    2015     1 f         1         0
## 10 AUS          Australia AU    Oceania   AUS    2015     1 f         1         0
## # … with 534,245 more rows, and 7 more variables: forecast <dbl>,
## #   approx_date <date>, age_group <chr>, death_count <dbl>, death_rate <dbl>,
## #   deaths_total <dbl>, rate_total <dbl>
```

Use testthat to implement some checking

```r
## countries
test_that("countries conforms to spec", {
  countries_colnames <- c("cname", "iso3", "iso2", "continent")
  expect_equal(colnames(countries), countries_colnames)
})


## stmf
test_that("stmf conforms to spec", {
  stmf_colnames <- c("country_code", "cname", "iso2", "continent", "iso3", "year",
                     "week", "sex", "split", "split_sex", "forecast", "approx_date",
                     "age_group", "death_count", "death_rate", "deaths_total", "rate_total")
  expect_equal(colnames(stmf), stmf_colnames)
})
```

Use testthat to implement some checking

```
testthat::test_dir(here("tests", "testthat"))

## ✓ |  OK F W S | Context
##
- |   0       | stmf
- |   0       | Validating package data objects
✓ |   2       | Validating package data objects
##
## ══ Results ═════════════════════════════════════════════════════════════════════
## [ FAIL 0 | WARN 0 | SKIP 0 | PASS 2 ]
```

testthat in practice

Oriented towards package development

Consider packaging your datasets! Benefits to documentation/codebooks etc

One-table example: uscenpops

More extensive: covdata

How R packages work: Wickham & Bryan