

Making tidy easier

Data Wrangling, Session 8

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Code Horizons

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Making it easier to be tidy

Load the packages, as always

```
library(here)      # manage file paths  
library(socviz)    # data and some useful functions  
library(tidyverse) # your friend and mine  
library(haven)     # for Stata, SAS, and SPSS files  
  
library(broom)     # tidy model summaries
```

Moving ahead

Some helpful things

The RStudio Community

R Studio Community   

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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	   2	72	19m
 "William" in the Northeast ggplot Help • tidyverse ggplot2	   5	69	28m
 Error while running RSelenium • shiny	  4	27	28m
 Too slow to respond •	 0	16	40m
 Relative risk (RR) using categorical variables • General	 0	18	1h
 Categorical to numeric • General rstudio	    9	27	1h

The reprex package



reprex

part of the tidyverse
2.0.0.9000

Reference

Articles ▾

News ▾



Overview

Prepare reproxes 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 **reproducible example**, 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](https://cloud.r-project.org/package=reprex)

Browse source code at

[https://github.com/tidyverse/reprex/
issues](https://github.com/tidyverse/reprex/)

License

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Developers

Best demonstrated live

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

```
library(reprex)  
  
library(tidyverse)  
  
starwars %>  
  count(homeworld, species) %>  
  mutate(pct = n / sum(n) * 100) %>  
  arrange(desc(pct))  
  
# A tibble: 57 × 4  
  homeworld species     n   pct  
  <chr>      <chr> <int> <dbl>  
1 Tatooine    Human     8   9.20  
2 <NA>        Human     6   6.90  
3 Naboo       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  
# i 47 more rows
```

The usethis package

usethis **2.0.1.9000**  Setup Reference Articles ▾ News ▾ 

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](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>

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Developers

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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.

```
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
# i 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(
  include = c(age, grade, response),
  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()
```

Tables, tables, tables

Characteristic	N	Drug A N = 98 ¹	Drug B, N = 102 ¹	p-value ²
Age	189	46 (37, 60)	48 (39, 56)	0.7
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

¹ Median (Q1, Q3); 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
    label = list(race = "Race", degree = "Degree", marital = "Marital Status"),
    missing = "no" # don't list missing data separately
  ) >
  bold_labels()
```

Tables, tables, tables

Characteristic	White N = 2,096 ¹	Black N = 487 ¹	Other N = 276 ¹
Degree			
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 Status			
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		
<i>N Non-missing</i>	91	98
<i>Mean (SD)</i>	47 (15)	47 (14)
<i>Median (Q1, Q3)</i>	46 (37, 60)	48 (39, 56)
<i>Min, Max</i>	6, 78	9, 83
Marker Level (ng/mL)		
<i>N Non-missing</i>	92	98
<i>Mean (SD)</i>	1.02 (0.89)	0.82 (0.83)
<i>Median (Q1, Q3)</i>	0.84 (0.23, 1.60)	0.52 (0.18, 1.21)
<i>Min, Max</i>	0.00, 3.87	0.01, 3.64

The power of lists

Similar to earlier, but simpler:

```
library(gapminder)

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

out_le ← gapminder ▷
  filter(continent %min% "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>   <lm>  <tibble> <chr>    <dbl>     <dbl>     <dbl>     <dbl>
1 Asia      <tibble> <lm>  <tibble> (Int...  9.58     2.71      3.54 4.46e- 4
2 Asia      <tibble> <lm>  <tibble> log(...  6.25     0.331     18.9 3.73e- 57
3 Europe    <tibble> <lm>  <tibble> (Int... 13.0      1.92      6.76 5.52e- 11
4 Europe    <tibble> <lm>  <tibble> log(...  6.31     0.205     30.8 8.06e-103
5 Africa    <tibble> <lm>  <tibble> (Int...  7.60      2.63      2.89 4.03e- 3
6 Africa    <tibble> <lm>  <tibble> log(...  5.69     0.361     15.8 1.86e- 47
7 Americas  <tibble> <lm>  <tibble> (Int... -19.1     4.82     -3.95 9.65e- 5
8 Americas  <tibble> <lm>  <tibble> log(...  9.72     0.558     17.4 2.51e- 47
# i 2 more variables: conf.low <dbl>, conf.high <dbl>
```

The power of lists

```
## 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>      <dbl>   <dbl>  <list>
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
```

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/>

Test the output of your functions

```
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
# i 203 more rows
```

Test the output of your functions

```
get_stmf ← function(url = "https://www.mortality.org/File/GetDocument/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, ...))
}
```

Test the output of your functions

```
stmf_raw ← read_csv(here("data", "stmf.csv"), skip = 2) ▷
janitor::clean_names() ▷
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 = str_replace(age_group, "_", "-"),
       age_group = str_replace(age_group, "p", "+")) ▷
rename(death_count = d, death_rate = r) ▷
mutate(approx_date = paste0(year, "-", "W",
                           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"))
```

Test the output of your functions

```
stmf_raw
```

```
# A tibble: 576,840 × 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+
# i 576,830 more rows
# i 4 more variables: death_count <dbl>, death_rate <dbl>, deaths_total <dbl>,
#   rate_total <dbl>
```

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"))
```

Test the output of your functions

```
stmf
```

```
# A tibble: 576,840 × 17
  country_code cname   iso2 continent iso3   year week sex   split split_sex
  <chr>        <chr>  <chr>    <chr>  <dbl> <dbl> <chr> <dbl>    <dbl>
1 AUS         Austral... AU   Oceania  AUS   2015   1 m     1     0
2 AUS         Austral... AU   Oceania  AUS   2015   1 m     1     0
3 AUS         Austral... AU   Oceania  AUS   2015   1 m     1     0
4 AUS         Austral... AU   Oceania  AUS   2015   1 m     1     0
5 AUS         Austral... AU   Oceania  AUS   2015   1 m     1     0
6 AUS         Austral... AU   Oceania  AUS   2015   1 f     1     0
7 AUS         Austral... AU   Oceania  AUS   2015   1 f     1     0
8 AUS         Austral... AU   Oceania  AUS   2015   1 f     1     0
9 AUS         Austral... AU   Oceania  AUS   2015   1 f     1     0
10 AUS        Austral... AU   Oceania  AUS   2015   1 f     1     0
# i 576,830 more rows
# i 7 more variables: forecast <dbl>, approx_date <date>, age_group <chr>,
#   death_count <dbl>, death_rate <dbl>, deaths_total <dbl>, rate_total <dbl>
```

For example, manually

```
## stmf
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")

all.equal(colnames(stmf), stmf_colnames)

[1] TRUE
```

Imagine how you might build up a set of tests and checks

But you don't have to manage this manually

Use **testthat** to check things

```
## 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 check things

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

## V | OK F W S | Context
##
## - | 0      | stmf
## - | 0      | Validating package data objects
## V | 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`

Summarizing your wrangling with **skimr**

We might want to make a **codebook** of our data

```
library(skimr)
```

Summarize with `skimr`

We might want to make a `codebook` of our data

```
library(skimr)
organdata ← read_csv(here("data", "organdonation.csv"))
```

Summarize with `skimr`

```
organdata > skim(where(is.numeric)) > partition()
```

Variable type: numeric

skim_variable	n_missing	complete_rate	mean	sd	p0	p25	p50	p75	p100	hist
year	34	0.86	1996.50	3.46	1991.00	1993.75	1996.50	1999.25	2002.00	
donors	34	0.86	16.48	5.11	5.20	13.00	15.10	19.60	33.90	
pop	17	0.93	39921.29	62219.22	3514.00	6938.00	15531.00	57301.00	288369.00	
pop.dens	17	0.93	12.00	11.09	0.22	1.94	9.49	19.11	38.89	
gdp	17	0.93	22986.18	4665.92	12917.00	19546.00	22756.00	26180.00	36554.00	
gdp.lag	0	1.00	22574.92	4790.71	11434.00	19034.25	22158.00	25886.50	36554.00	
health	0	1.00	2073.75	733.59	791.00	1581.00	1956.00	2407.50	5665.00	
health.lag	0	1.00	1972.99	699.24	727.00	1542.00	1850.50	2290.25	5267.00	
pubhealth	21	0.91	6.19	0.92	4.30	5.50	6.00	6.90	8.80	
roads	17	0.93	113.04	36.33	58.21	83.46	111.22	139.57	232.48	
cerebvas	17	0.93	610.80	144.45	300.00	500.00	604.00	698.00	957.00	
assault	17	0.93	16.53	17.33	4.00	9.00	11.00	16.00	103.00	
external	17	0.93	450.06	118.19	258.00	367.00	421.00	534.00	853.00	
txp.pop	17	0.93	0.72	0.20	0.22	0.63	0.71	0.83	1.12	

Summarize with `skimr`

```
organdata %> skim(!where(is.numeric)) %> partition()
```

Variable type: character

skim_variable	n_missing	complete_rate	min	max	empty	n_unique	whitespace
country	0	1.00	5	14	0	17	0
world	14	0.94	6	11	0	3	0
opt	28	0.88	2	3	0	2	0
consent.law	0	1.00	8	8	0	2	0
consent.practice	0	1.00	8	8	0	2	0
consistent	0	1.00	2	3	0	2	0
ccode	0	1.00	2	4	0	17	0

Custom Summaries

```
stmf_country_years ← function(df = stmf) {  
  df %>  
    dplyr::select(cname, year) %>  
    dplyr::group_by(cname, year) %>  
    dplyr::tally() %>  
    dplyr::mutate(n = as.character(n),  
                 n = dplyr::recode(n, "0" = "-", .default = "Y")) %>  
    dplyr::group_by(year, cname) %>  
    dplyr::arrange(year) %>  
    tidyr::pivot_wider(names_from = year, values_from = n) %>  
    dplyr::mutate(dplyr::across(where(is.character), dplyr::recode, .missing = "-")) %>  
    dplyr::arrange(cname)  
}
```

Custom Summaries

```
knitr::kable(stmf_country_years())
```