

Making tidy easier

Data Wrangling, Session 8

Kieran Healy

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



all categories ▾

all tags ▾

Latest

New (108)

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Categories

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+ New Topic

Topic

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☐ 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 repsond •



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 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 **re**producible **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](#)

MIT + file [LICENSE](#)

Community

[Contributing guide](#)

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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 ▾

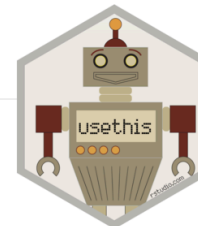
News ▾

Search...



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>

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Developers

[Hadley Wickham](#)

Author

[Jennifer Bryan](#)

Author, maintainer

[Malcolm Barrett](#)

Author

Quarto

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 %in% "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      <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>      <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> <chr>
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> <chr>
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>	<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"))

## ✓ | 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](#)

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())
```

cname	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Australia	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Austria	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y
Belgium	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y
Bulgaria	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y
Canada	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Croatia	-	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y
Czech Republic	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Y	Y
Denmark	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
England and Wales	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Estonia	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y
Finland	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
France	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y
Germany	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y
Greece	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Hungary	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y
Iceland	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y
Israel	-	-	-	-	-	-	-	-	-	-	Y	Y	Y	Y	Y	Y	Y