Data Imports

STAT 220

Bastola

January 26 2022

Working Directories

The working directory is where R looks for files and saves files by default.

```
# see working directory
getwd()
# change your working directory
setwd()
```

To set working directory to your STAT 220 course folder

```
setwd("path/to/stat220-folder/")  # set
getwd()     # check
```

Useful Terminal Commands:

```
$ cd
$ ls
$ pwd
```

Web Imports

To your working environment:

```
url <- "https://raw.githubusercontent.com/deepbas/statdatasets/main/murders.csv"
dat <- read_csv(url)
```

To download file to working folder:

```
download.file(url, "murders.csv")
```

Download, store, and then remove:

```
tempfile()
[1] "/tmp/RtmpWp1r8k/file3e2512d1df58"
tmp_filename <- tempfile()
download.file(url, tmp_filename)
mydat <- read_csv(tmp_filename)
file.remove(tmp_filename)
[1] TRUE
```

readr

- `readr` is a part of tidyverse library
- Includes functions for reading data stored in text file spreadsheets into R.
- Functions in the package include `read_csv()`, `read_tsv()`, `read_delim()` and more.
- These differ by the delimiter they use to split columns.

readr functions

function	reads
read_csv()	Comma separated values
read_csv2()	Semi-colon separated values
read_delim()	General delimited files
read_fwf()	Fixed width files
read_log()	Apache log files
read_table()	Space separated
read_tsv()	Tab delimited values

Basic syntax

All `readr` functions share a common syntax

```
df <- read_csv(file = "path/to/file.csv", ...)
```

Base R Imports

- R-base import functions
  - `read.csv()`
  - `read.table()`
  - `read.delim()`
- Generate data frames rather than tibbles
- Character variables are converted to factors
  - Can be avoided by setting the argument `stringsAsFactors=FALSE`

Advantages of `readr`

- `readr` functions are:
  - ~ 10 times faster
  - Return tibbles
  - Have more intuitive defaults.
  - No row names, no strings as factors.

Data frames and tibbles Conversion

- `as_tibble()` - convert a data frame to a tibble
- `as.data.frame()` - convert a tibble to a data frame

Your turn 1

Please git clone the repository on Data Imports to your local folder.

Task: Use `read_csv()` to import the `desserts` data set from https://raw.githubusercontent.com/deepbas/statdatasets/main/desserts.csv

Store the data in the `desserts` object

Overview of data

- Contains results from series 1-8 of *The Great British Bake Off*
- Case defined by series, episode and baker
- Data set created by Alison Hill

03:00

Did it work as expected?

```
Rows: 549
Columns: 16
$ series                <dbl> 1, 1, 1, 1, 1, 1, 1, 1
$ episode               <dbl> 1, 1, 1, 1, 1, 1, 1, 1
$ baker                 <chr> "Annetha", "David", "E
$ technical             <chr> "2nd", "3rd", "1st", "
$ result                <chr> "IN", "IN", "IN", "IN"
$ uk_airdate            <chr> "17 August 2010", "17
$ us_season             <dbl> NA, NA, NA, NA, NA, NA
$ us_airdate            <date> NA, NA, NA, NA, NA, N
$ showstopper_chocolate <chr> "chocolate", "chocolat
$ showstopper_dessert   <chr> "other", "other", "oth
$ showstopper_fruit     <chr> "no fruit", "no fruit"
$ showstopper_nut       <chr> "no nut", "no nut", "n
$ signature_chocolate   <chr> "no chocolate", "choco
$ signature_dessert     <chr> "cake", "cake", "cake"
$ signature_fruit       <chr> "no fruit", "fruit", "
$ signature_nut         <chr> "no nut", "no nut", "n
```

Something to note ..

- `technical` is character, not numeric
- `uk_airdate` is character, not date

The `col_types` argument

By default, looks at first 1000 rows to guess variable data types (`guess_max`)

```
desserts <- read_csv(
  "https://raw.githubusercontent.com/deepbas/statdatasets/main/desserts.csv",
  col_types = list(
    technical = col_number(),
    uk_airdate = col_date()
  )
)
```

Looking for `problems`

List of potential problems parsing the file

```
problems(desserts)
# A tibble: 556 × 5
     row   col expected         actual          file
   <int> <int> <chr>            <chr>           <chr>
 1     2     6 date in ISO8601  17 August 2010 ""
 2     3     6 date in ISO8601  17 August 2010 ""
 3     4     6 date in ISO8601  17 August 2010 ""
 4     5     4 a number         N/A             ""
 5     5     6 date in ISO8601  17 August 2010 ""
 6     6     6 date in ISO8601  17 August 2010 ""
 7     7     4 a number         N/A             ""
 8     7     6 date in ISO8601  17 August 2010 ""
 9     8     6 date in ISO8601  17 August 2010 ""
10     9     4 a number         N/A             ""
# … with 546 more rows
```

Date formatting

```
# A tibble: 556 × 5
    row   col expected         actual          file
  <int> <int> <chr>            <chr>           <chr>
1     2     6 date in ISO8601 17 August 2010 ""
2     3     6 date in ISO8601 17 August 2010 ""
3     4     6 date in ISO8601 17 August 2010 ""
4     5     4 a number        N/A             ""
5     5     6 date in ISO8601 17 August 2010 ""
# … with 551 more rows
```

ISO8601 format: `2021-10-04`

What we have: `17 August 2010`

Adding `format` instructions

```
desserts <- read_csv(
  "https://raw.githubusercontent.com/deepbas/statdatasets/main/desserts.csv",
    col_types = list(
    technical = col_number(),
    uk_airdate = col_date(format = "%d %B %Y")
  )
)
```

- Year: `"%Y"` (4 digits). `"%y"` (2 digits)
- Month: `"%m"` (2 digits), `"%b"` (abbreviated name in current locale), `"%B"` (full name in current locale).
- Day: `"%d"` (2 digits), `"%e"` (optional leading space)

Looking for more problems

List of potential problems parsing the file

```
problems(desserts)
# A tibble: 7 × 5
    row   col expected actual file
  <int> <int> <chr>    <chr>  <chr>
1     5     4 a number N/A    ""
2     7     4 a number N/A    ""
3     9     4 a number N/A    ""
4    11     4 a number N/A    ""
5    35     4 a number N/A    ""
6    36     4 a number N/A    ""
7    37     4 a number N/A    ""
```

Addressing missing values

By default `na = c("", "NA")` are the recognized missing values

```
desserts <- read_csv(
  "https://raw.githubusercontent.com/deepbas/statdatasets/main/desserts.csv",
  col_types = list(
    technical = col_number(),
    uk_airdate = col_date(format = "%d %B %Y")
  ),
  na = c("", "NA", "N/A")
)
```

No more problems

```
problems(desserts)
# A tibble: 0 × 5
# … with 5 variables: row <int>, col <int>, expected <chr>, actual <chr>,
#   file <chr>
```

The Dataset

```
# A tibble: 549 × 16
   series episode baker     technical result uk_airdate us_season us_airdate
    <dbl>   <dbl> <chr>         <dbl> <chr>  <date>          <dbl> <date>
 1      1       1 Annetha           2 IN     2010-08-17         NA NA
 2      1       1 David             3 IN     2010-08-17         NA NA
 3      1       1 Edd               1 IN     2010-08-17         NA NA
 4      1       1 Jasminder        NA IN     2010-08-17         NA NA
 5      1       1 Jonathan          9 IN     2010-08-17         NA NA
 6      1       1 Louise           NA IN     2010-08-17         NA NA
 7      1       1 Miranda           8 IN     2010-08-17         NA NA
 8      1       1 Ruth             NA IN     2010-08-17         NA NA
 9      1       1 Lea              10 OUT    2010-08-17         NA NA
10      1       1 Mark             NA OUT    2010-08-17         NA NA
# … with 539 more rows, and 8 more variables: showstopper_chocolate <chr>,
#   showstopper_dessert <chr>, showstopper_fruit <chr>, showstopper_nut <chr>,
#   signature_chocolate <chr>, signature_dessert <chr>, signature_fruit <chr>,
#   signature_nut <chr>
```

Column casting functions

Type	`dplyr::glimpse()`	`readr::col_*()`
logical	`<lgl>`	`col_logical`
numeric	`<int>` or `<dbl>`	`col_number`
character	`<chr>`	`col_character`
factor	`<fct>`	`col_factor`
date	`<date>`	`col_date`

?read_csv

```
read_csv(file,
         col_names = TRUE,
         col_types = NULL,
         locale = default_locale(),
         na = c("", "NA"),
         quoted_na = TRUE,
         quote = "\"",
         comment = "",
         trim_ws = TRUE,
         skip = 0,
         n_max = Inf,
         guess_max = min(1000, n_max),
         progress = show_progress())
```

Your turn 2

Use the appropriate `read_<type>()` function to import the following data sets:

- `simple-1.dat`
- `mild-1.csv`
- `tricky-1.csv`

If you hit any errors/problems, be sure to explore them and identify the issue, even if you can't "fix" it.

Remember, it might help to look at the data first!

03:00

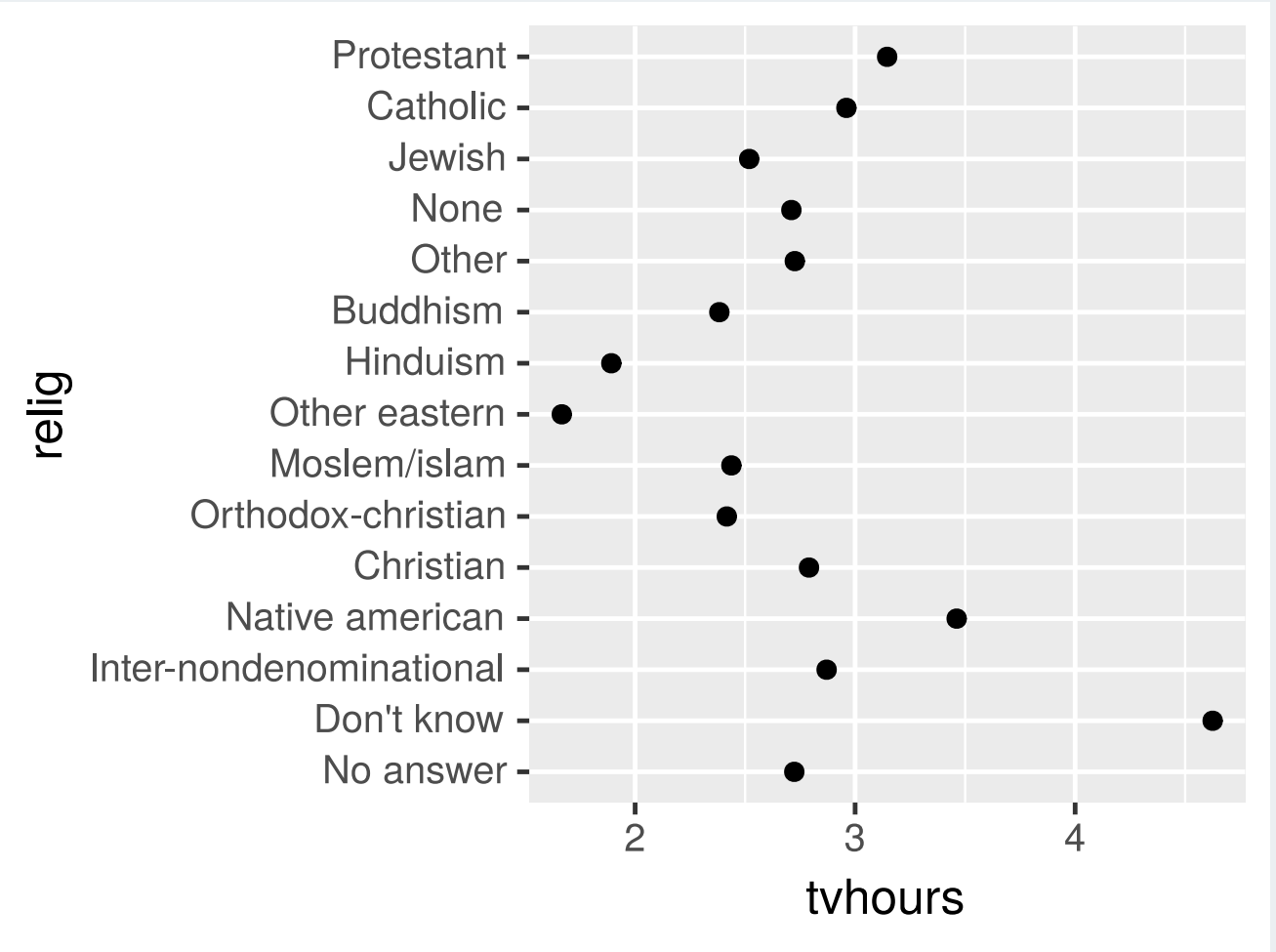
More with forcats: gss_cat

A sample of data from the General Social Survey, a long-running US survey conducted by NORC at the University of Chicago.

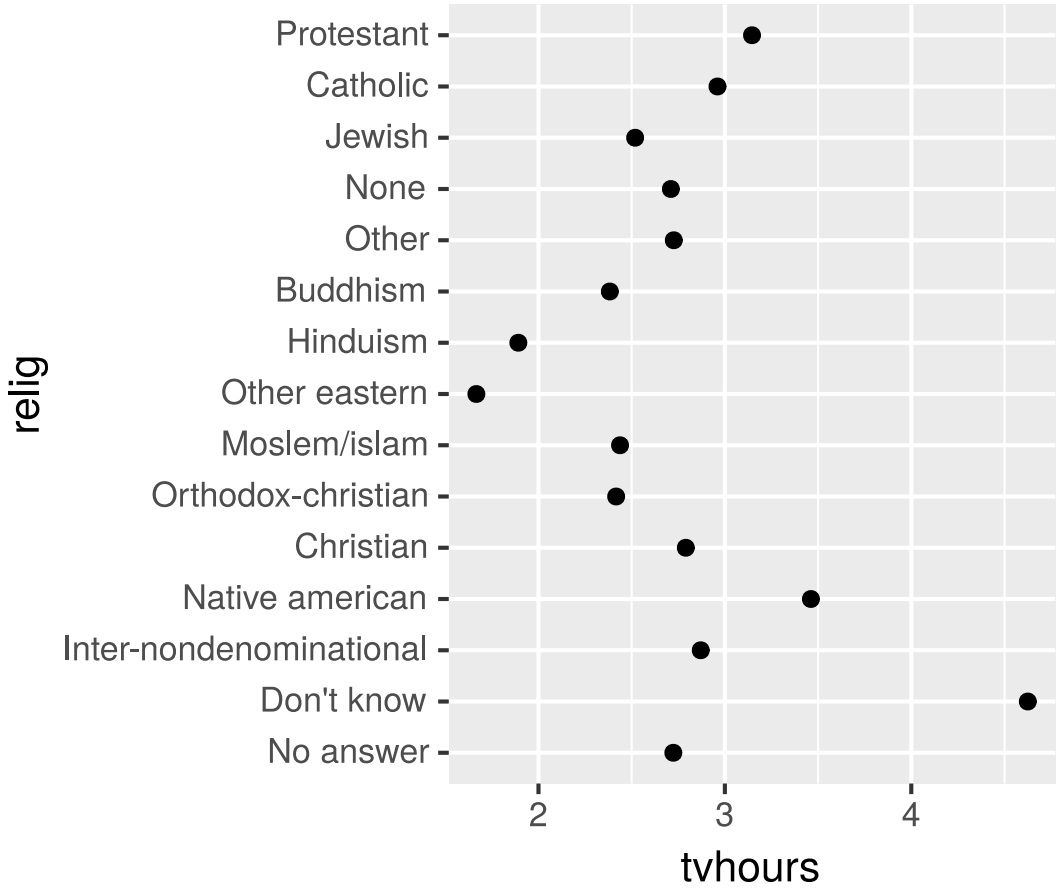
```
# A tibble: 21,483 × 9
    year marital         age race  rincome        partyid  relig  denom  tvhours
   <int> <fct>         <int> <fct> <fct>          <fct>    <fct>  <fct>    <int>
 1  2000 Never married    26 White $8000 to 9999  Ind,nea… Prote… South…       12
 2  2000 Divorced         48 White $8000 to 9999  Not str… Prote… Bapti…       NA
 3  2000 Widowed          67 White Not applicable Indepen… Prote… No de…        2
 4  2000 Never married    39 White Not applicable Ind,nea… Ortho… Not a…        4
 5  2000 Divorced         25 White Not applicable Not str… None   Not a…        1
 6  2000 Married          25 White $20000 - 24999 Strong … Prote… South…       NA
 7  2000 Never married    36 White $25000 or more Not str… Chris… Not a…        3
 8  2000 Divorced         44 White $7000 to 7999  Ind,nea… Prote… Luthe…       NA
 9  2000 Married          44 White $25000 or more Not str… Prote… Other         0
10  2000 Married          47 White $25000 or more Strong … Prote… South…        3
# … with 21,473 more rows
```

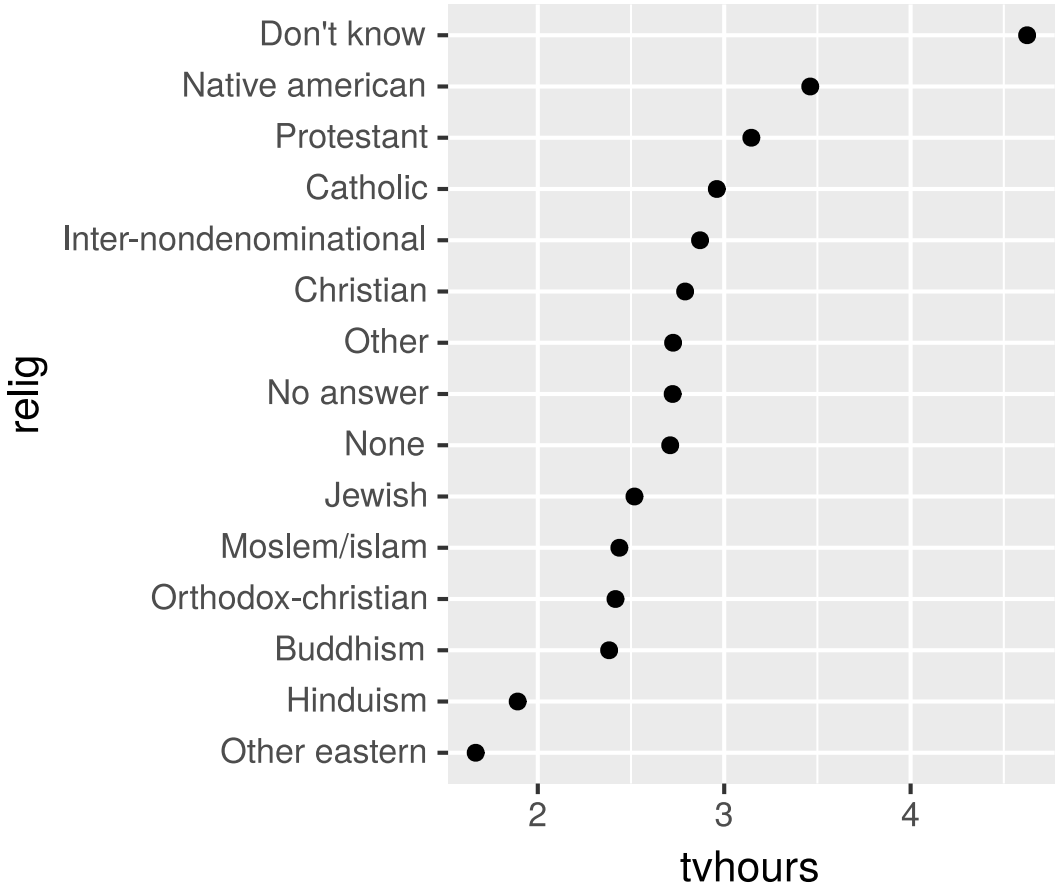
Which religions watch the least TV?

```
gss_cat %>%
  drop_na(tvhours) %>%
  group_by(relig) %>%
  summarize(tvhours = mean(tvhours
  ggplot(aes(tvhours, relig)) +
    geom_point()
```

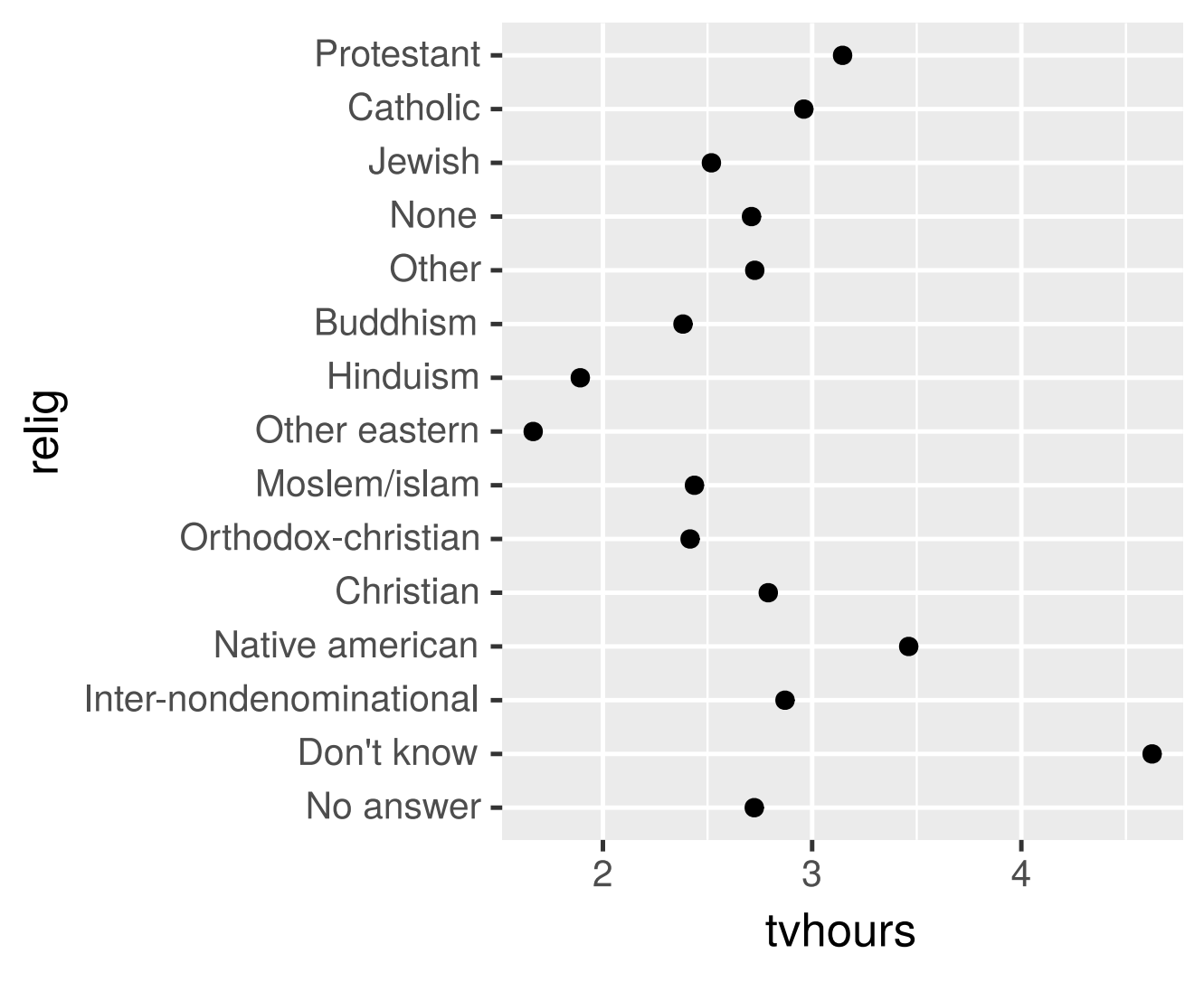


Which one do you prefer?





Why is the y-axis in this order?



`levels()`

Use `levels()` to access a factor's levels

```
gss_cat %>% pull(relig) %>% levels()
 [1] "No answer"                "Don't know"
 [3] "Inter-nondenominational" "Native american"
 [5] "Christian"                "Orthodox-christian"
 [7] "Moslem/islam"             "Other eastern"
 [9] "Hinduism"                 "Buddhism"
[11] "Other"                    "None"
[13] "Jewish"                   "Catholic"
[15] "Protestant"               "Not applicable"
```

Most useful factor skills

1. **Reorder** the levels
2. **Recode** the levels
3. **Collapse** levels
4. **Lump** levels

fct_reorder

- `.f` factor vector

```
separate(
  .f,
  .x,
  .fun = median,
  ...,
  .desc = FALSE
  )
```

fct_reorder

- `.f` factor vector
- `.x` variable to reorder by (in conjunction with `.fun`)

```
separate(
  .f,
  .x,
  .fun = median,
  ...,
  .desc = FALSE
  )
```

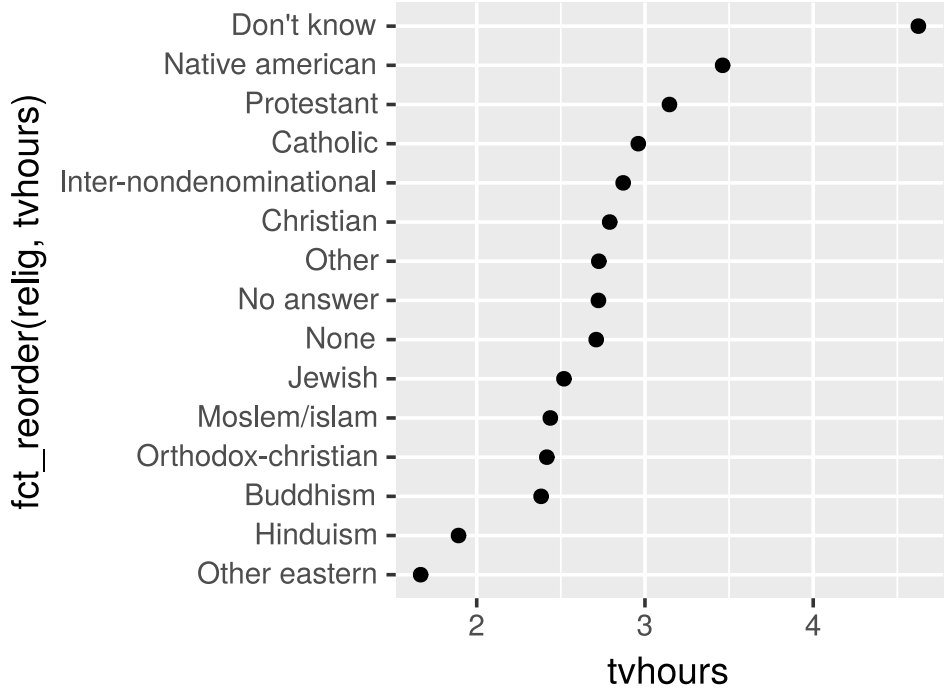
fct_reorder

- `.f` factor vector
- `.x` variable to reorder by (in conjunction with `.fun`)
- `.fun` function to reorder by

```
separate(
  .f,
  .x,
  .fun = median,
  ...,
  .desc = FALSE
  )
```

Reorder relig by tvhours

```
gss_cat %>%
  drop_na(tvhours) %>%
  group_by(relig) %>%
  summarize(tvhours = mean(tvhours)) %>%
  ggplot(aes(
    x = tvhours,
    y = fct_reorder(relig, tvhours)
  )) +
    geom_point()
```



Your turn 4

Use `rincome_summary` to construct a dotplot of `rincome` against `age`.

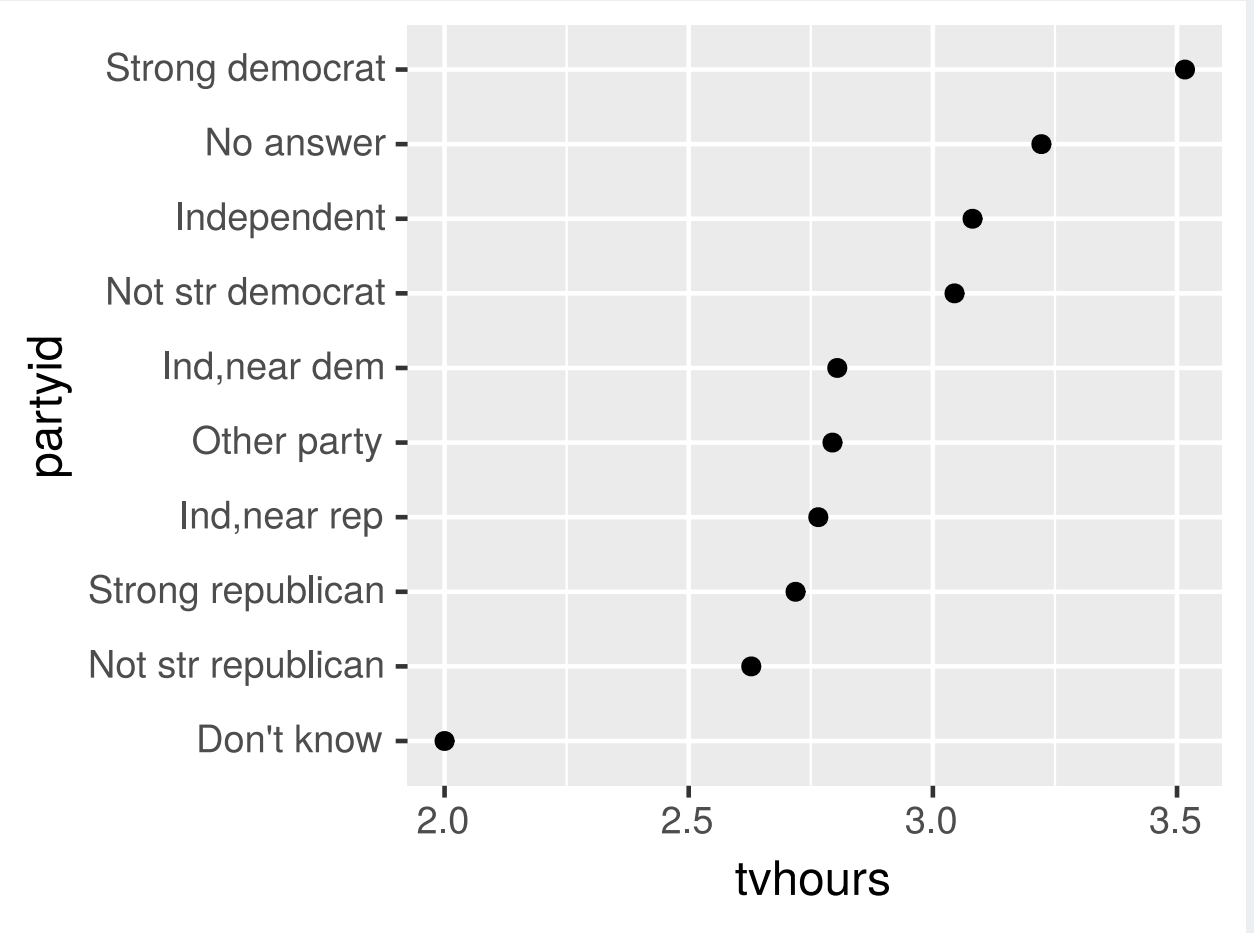
Reorder `rincome` by `age`

```
rincome_summary <- gss_cat %>%
  group_by(rincome) %>%
  summarize(
    age = mean(age, na.rm = TRUE),
    tvhours = mean(tvhours, na.rm = TRUE),
    n = n()
  )
```

01:30

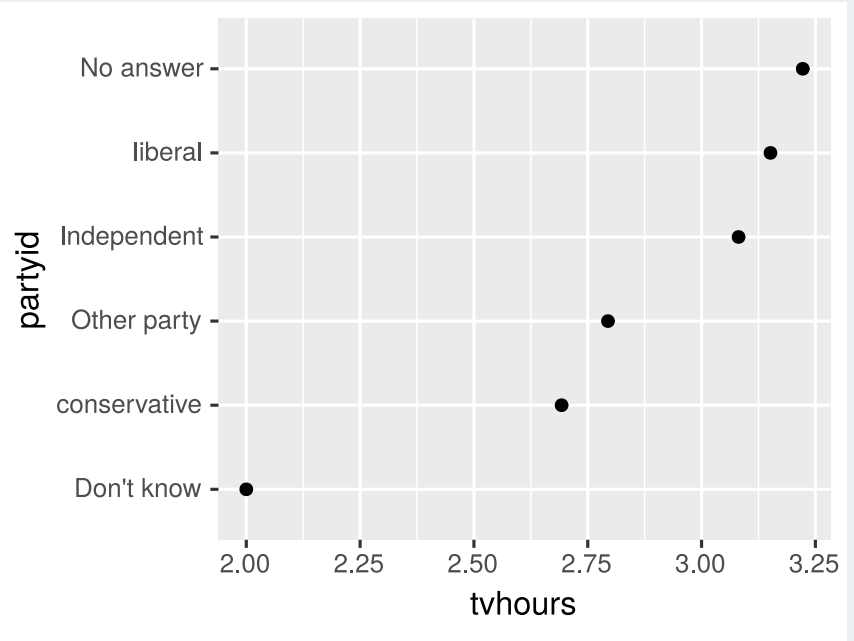
Which political leaning watches more TV?

How could we improve the `partyid` labels?



Collapsing partyid: fct_collapse()

```
gss_cat %>%
  drop_na(tvhours) %>%
  select(partyid, tvhours) %>%
  mutate(
    partyid =
      fct_collapse(
        partyid,
        conservative = c("Strong republican",
                         "Not str republican",
                         "Ind,near rep"),
        liberal = c("Strong democrat",
                    "Not str democrat",
                    "Ind,near dem"))
  ) %>%
  group_by(partyid) %>%
  summarize(tvhours = mean(tvhours)) %>%
  ggplot(aes(tvhours, fct_reorder(partyid, tvhours))) +
  geom_point() +
  labs(y = "partyid")
```

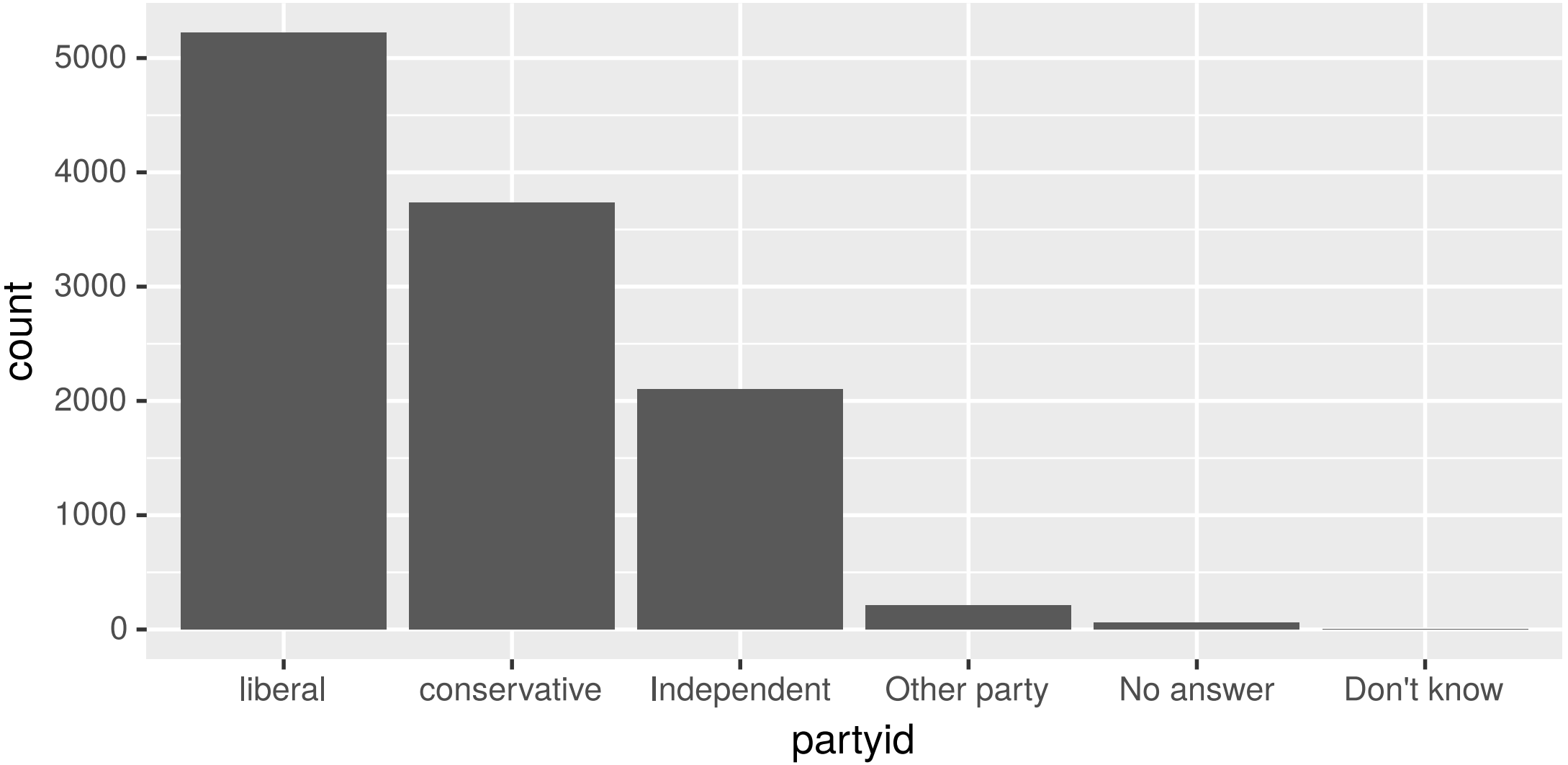


Your turn 5

Collapse the `marital` variable to have levels `Married`, `not_married`, and `No answer`

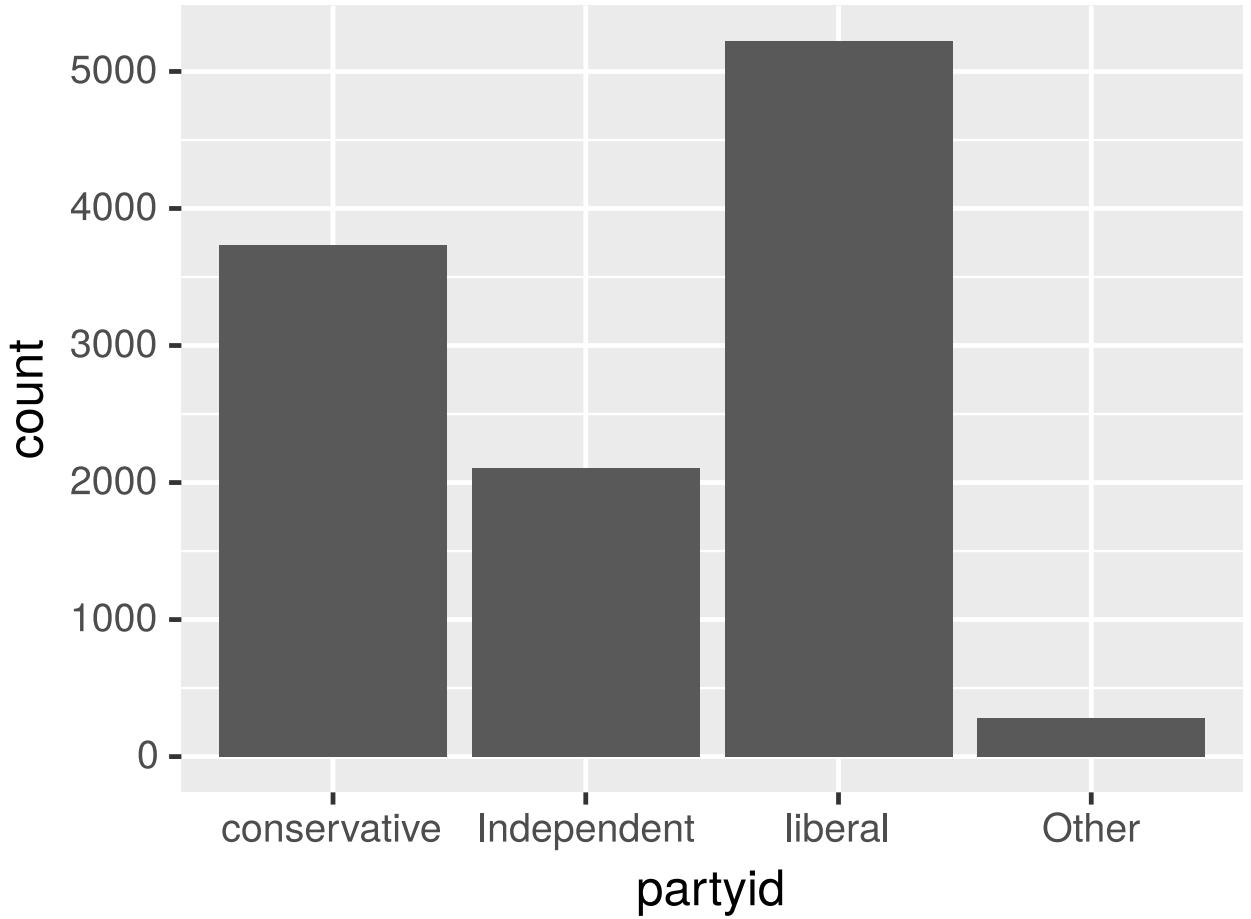
Include `"Never married"`, `"Divorced"`, and "`Widowed`" in `not_married`

02:00


5000
4000
3000
2000
1000
0
count
liberal
conservative
Independent
Other party
No answer
Don't know
partyid

Lumping partyid

```
gss_cat %>%
  mutate(partyid = fct_lump(partyic
  ggplot(aes(partyid)) +
  geom_bar() +
  labs(x = "partyid")
```



Acknowledgements

These slides were adapted from Adam Loy's instruction materials on data imports and manipulating factors and are licensed under the CC BY 4.0 Creative Commons.