Introduction to R

2.2 Loading and Storing Data

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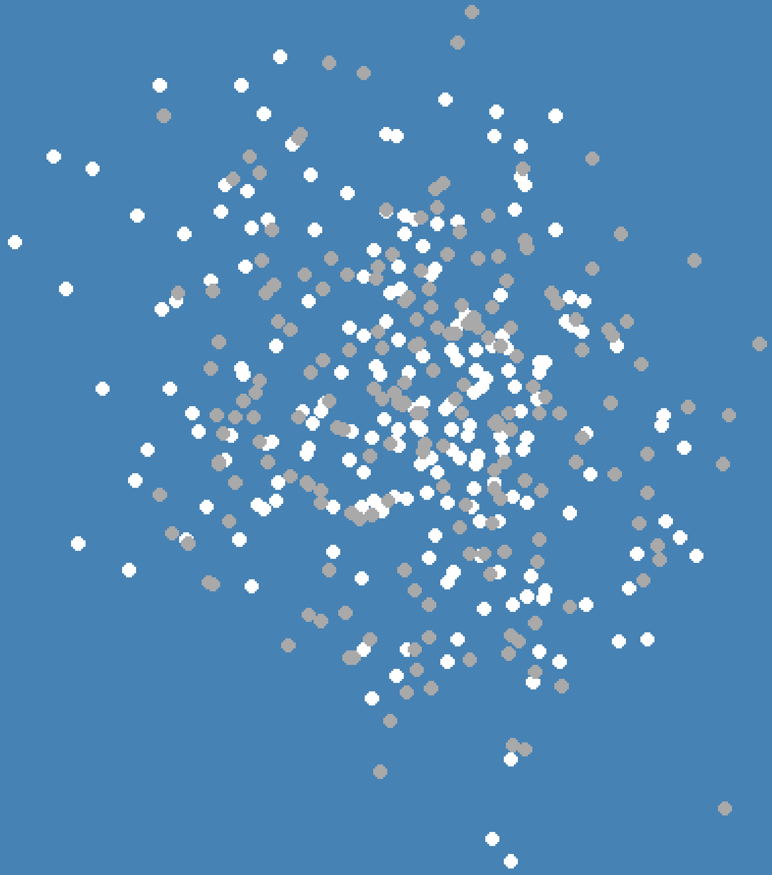


Overview

Good news: R is data-agnostic, you can import data of a large range of shapes & types in R.

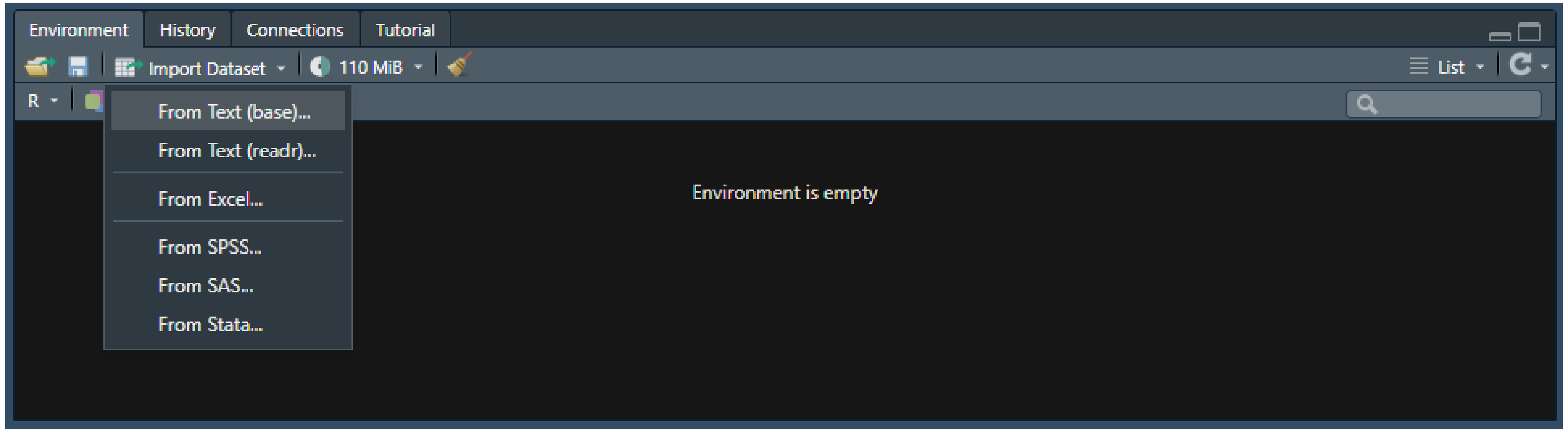
What we will cover

- Different ways how we can potentially move data into R
- How to import the most common data formats into R

Importing Data

Built-in Functionality for Manually Loading Data

The RStudio Graphical User Interface comes with built-in functionalities to manually define how you want to import data.



- define data type
- define object name in R
- define rows to skip, column names etc.

Importing native .RData or .rds files

Sometimes, you will import data that has been generated from within R by another user.

.Rdata files

```
load("your_data.RData")
```

- restores the workspace that has been saved to your_data.RData
- includes all "original" object names
- can load many objects (e.g. data frames) at once

.rds files

```
your_dataNEW <- readRDS("your_data.rds")
```

- you can assign the content of your_data.rds to a new object name
- typically used to load in one individual data frame

Absolute vs. Relative File Paths

When importing data that is located offline on your CPU, we will need to specify a file path.

You can either import a dataset specifying an absolute file path:

- Let's say your data is called your_data.RData
- Data is located on your Desktop
- Specify the absolute file path:

```r
load("C:/User/user/Desktop/your_data.RData")
```

Or you import a dataset using a path relative to your working directory:

```r
setwd("C:/User/user/Desktop")
load("your_data.RData")
```

- path relates to the working directory that you have defined before
- R loads the file your_data.RData that is located in this directory

Note: You can't directly copy-paste file paths from your operating system (e.g. Windows) to R.

- R uses / in file paths
- Windows uses \
- Typing \\ also works in R

Importing External File Formats: tidyverse

Very often, we will import data from an external file that is not a native R object.

- .txt-file?
- comma- or tab-delimited?
- Stata- or SPSS-file?

The tidyverse holds a range of packages available that allow you to import almost any kind of external data file into R.

- readr::read_csv() for comma delimited files
- readr::read_csv2() for semicolon delimited files
- readr::read_tsv() for tab delimited files

- readxl::read_excel() for .xls and xlsx files

- haven::read_dta() for Stata files (.dta)
- haven::read_sav() for SPSS files (.sav)

Importing External File Formats: tidyverse

```r
library(haven)
ess10 <- haven::read_dta("./dat/ESS10.dta")
print(ess10[1:15, 1:10])
```

```
## # A tibble: 15 × 10
##    name        essro…¹ edition prodd…²  idno cntry dweight pweight nwspol netus…³
##    <chr>         <dbl> <chr>   <chr>   <dbl> <chr>   <dbl>   <dbl> <dbl+> <dbl+l>
##  1 ESS10e01_2       10 1.2     28.06.… 10002 BG      1.03    0.218  80     1 [Nev…
##  2 ESS10e01_2       10 1.2     28.06.… 10006 BG      0.879   0.218  63     5 [Eve…
##  3 ESS10e01_2       10 1.2     28.06.… 10009 BG      1.01    0.218 390     5 [Eve…
##  4 ESS10e01_2       10 1.2     28.06.… 10024 BG      0.955   0.218  60     5 [Eve…
##  5 ESS10e01_2       10 1.2     28.06.… 10027 BG      0.841   0.218 120     5 [Eve…
##  6 ESS10e01_2       10 1.2     28.06.… 10048 BG      0.946   0.218  60     5 [Eve…
##  7 ESS10e01_2       10 1.2     28.06.… 10053 BG      1.01    0.218  30     5 [Eve…
##  8 ESS10e01_2       10 1.2     28.06.… 10055 BG      1.03    0.218  70     5 [Eve…
##  9 ESS10e01_2       10 1.2     28.06.… 10059 BG      0.991   0.218  60     1 [Nev…
## 10 ESS10e01_2       10 1.2     28.06.… 10061 BG      1.05    0.218  60     1 [Nev…
## 11 ESS10e01_2       10 1.2     28.06.… 10064 BG      1.00    0.218 300     5 [Eve…
## 12 ESS10e01_2       10 1.2     28.06.… 10068 BG      1.03    0.218   0     1 [Nev…
## 13 ESS10e01_2       10 1.2     28.06.… 10071 BG      0.931   0.218  30     5 [Eve…
## 14 ESS10e01_2       10 1.2     28.06.… 10077 BG      0.991   0.218  30     1 [Nev…
## 15 ESS10e01_2       10 1.2     28.06.… 10078 BG      0.990   0.218  60     1 [Nev…
## # … with abbreviated variable names ¹essround, ²proddate, ³netusoft
```

Importing External File Formats: Other packages

There is a range of other packages that you can use for data import as well as some base R functions.

base R

- read.table()
- read.csv()
- read.delim()
- read.delim2()

Packages

foreign package:

- foreign::read.dta()
- foreign::read.spss()

readstata13 package:

- readstata13::read.dta13()

Note: Type help(read.table) or ?read.table into your R console for more information.

Saving Your Data

Exporting Data: External File Formats

Most read_*-functions come with a sibling that allows you to store your R data frame as an external file format on your CPU. The haven package offers a lot of those, but these functionalities can also be found in base R using the read.* prefix ("." rather than "_").

tidyverse

- write_csv() writes comma delimited files
- write_csv2() writes semicolon delimited files
- write_tsv() writes tab delimited files
- write_dta() writes Stata files (.dta)
- write_sav() writes .sav files

base R

- write.csv() writes comma delimited files
- write.csv2() writes semicolon delimited files

foreign package

- write.dta() writes Stata files (.dta)
- write.foreign(df, package = c("SPSS", "Stata", "SAS")) is a generic function that exports simple data frames to other statistical packages of your choice

Example of Data Export and Import

Write data frame to hard disk

```r
library(readr)

# write to csv file
write_csv(ess10, "./dat/ess10.csv")
```

Import data, inspect

```r
# re-import data from csv file
ess10 <- read_csv("./dat/ess10.csv")

# inspect
print(ess10[1:10, 1:4])
```

```
## # A tibble: 10 × 4
##    name        essround edition proddate
##    <chr>          <dbl>   <dbl> <chr>
##  1 ESS10e01_2        10     1.2 28.06.2022
##  2 ESS10e01_2        10     1.2 28.06.2022
##  3 ESS10e01_2        10     1.2 28.06.2022
##  4 ESS10e01_2        10     1.2 28.06.2022
##  5 ESS10e01_2        10     1.2 28.06.2022
##  6 ESS10e01_2        10     1.2 28.06.2022
##  7 ESS10e01_2        10     1.2 28.06.2022
##  8 ESS10e01_2        10     1.2 28.06.2022
##  9 ESS10e01_2        10     1.2 28.06.2022
## 10 ESS10e01_2        10     1.2 28.06.2022
```

Exporting Data: R's Native Formats

If you wish to stick to R's native file formats, you essentially have two options:

.RData files

```
save(your_data, file = "your_data.RData")
load("your_data.RData")
```

- allows you to store your whole workspace (incl. several objects)

.rds files

```
saveRDS(your_data, file = "your_data.rds")
your_dataNEW <- readRDS("your_data.rds")
```

- only works for individual R objects

Variable and Value Labels

Labelled Data

Especially with pre-compiled data sources that you haven't collected yourself, datasets often come with variable labels. That is, columns are described by their column name and a variable label. Labels are metadata that provide a more detailed description of the column names or the numerical values of a particular variable.

How to read in your data in a way that labels are accessible?

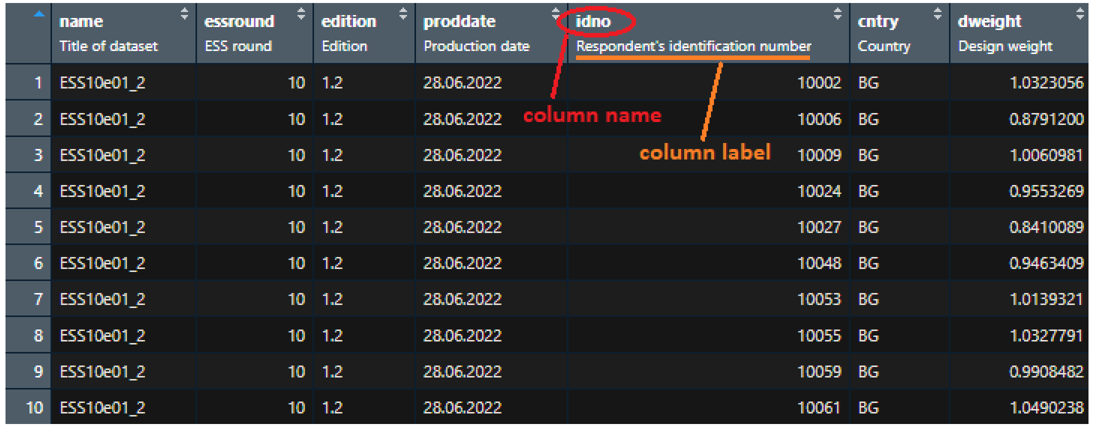
Not all functions for importing data recover variable and value labels that are stored in the metadata.

- The haven package recovers these.
- With the sjlabelled package, you can easily assess them.

```r
library(haven)
ess10 <- haven::read_dta("./dat/ESS10.dta")
```

Column labels

```r
View(ess10)
```



	name Title of dataset	essround ESS round	edition Edition	proddate Production date	idno Respondent's identification number	cntry Country	dweight Design weight
1	ESS10e01_2	10	1.2	28.06.2022	10002	BG	1.0323056
2	ESS10e01_2	10	1.2	28.06.2022	10006	BG	0.8791200
3	ESS10e01_2	10	1.2	28.06.2022	10009	BG	1.0060981
4	ESS10e01_2	10	1.2	28.06.2022	10024	BG	0.9553269
5	ESS10e01_2	10	1.2	28.06.2022	10027	BG	0.8410089
6	ESS10e01_2	10	1.2	28.06.2022	10048	BG	0.9463409
7	ESS10e01_2	10	1.2	28.06.2022	10053	BG	1.0139321
8	ESS10e01_2	10	1.2	28.06.2022	10055	BG	1.0327791
9	ESS10e01_2	10	1.2	28.06.2022	10059	BG	0.9908482
10	ESS10e01_2	10	1.2	28.06.2022	10061	BG	1.0490238

```r
library(sjlabelled)
sjlabelled::get_label(ess10$idno)
```

```
## [1] "Respondent's identification number"
```

Value labels

Start with tabulating the variable happy in an uninformative way:

```
table(ess10$happy)
```

```
##
##    0    1    2    3    4    5    6    7    8    9   10
##  164  122  254  521  627 2158 1808 3262 4483 2585 2030
```

Value labels

Now, get the column label of the variable to understand what is measured.

```
sjlabelled::get_label(ess10$happy)
```

```
## [1] "How happy are you"
```

Finally, get the value labels to understand how it is measured.

```
sjlabelled::get_labels(ess10$happy)
```

```
##  [1] "Extremely unhappy" "1"                 "2"
##  [4] "3"                 "4"                 "5"
##  [7] "6"                 "7"                 "8"
## [10] "9"                 "Extremely happy"   "Refusal"
## [13] "Don't know"        "No answer"
```

Attention: Haven package

One thing to note about the haven package is that although it recovers value labels and variable labels, it stores all variables of a data frame as a special data type: haven_labelled.

```
class(ess10$cntry)
```

```
## [1] "haven_labelled" "vctrs_vctr"     "character"
```

This data type is not always compatible with other procedures in R, but we will see some workarounds!

References

Parts of this course are inspired by the following resources:

- Wickham, Hadley and Garrett Grolemund, 2017. *R for Data Science - Import, Tidy, Transform, Visualize, and Model Data*. O'Reilly.
- Bahnsen, Oke and Guido Ropers, 2022. *Introduction to R for Quantitative Social Science*. Course held as part of the GESIS Workshop Series.
- Breuer, Johannes and Stefan Jünger, 2021. *Introduction to R for Data Analysis*. Course held as part of the GESIS Summer School in Survey Methodology.
- Teaching material developed by Verena Kunz, David Weyrauch, Oliver Rittmann and Viktoriia Semenova.