AQP Examples

Hava Blair

2020-09-06

Contents

1 Prerequisites **5**

2 Waseca Soil Pits **7**

2.1 About 7

2.2 Description data collected 8

2.3 Create SoilProfileCollection (SPC) objects 9

2.4 Visually compare field descriptions with OSDs 10

3 Mower County Pedons **11**

3.1 Overview 11

3.2 Load data 11

3.3 Munsell colors conversion 12

3.4 Promote dataframe to SPC object 12

3.5 Plot the SPC object 14

3.6 Add dashed lines 14

4 References **17**

Chapter 1

Prerequisites

This is a *sample* book written in **Markdown**. You can use anything that Pandoc's Markdown supports, e.g., a math equation $a^2 + b^2 = c^2$.

The **aqp** package can be installed from CRAN:

```
#install.packages("aqp")
# or the development version
# devtools::install_github("ncss-tech/aqp")
```

Remember each Rmd file contains one and only one chapter, and a chapter is defined by the first-level heading `#`.

To compile this example to PDF, you need XeLaTeX. You are recommended to install TinyTeX (which includes XeLaTeX): https://yihui.name/tinytex/.

Chapter 2

Waseca Soil Pits

date: 2020-07-11

```
knitr::opts_chunk$set(echo = TRUE)
library(dplyr)
library(readxl)
library(aqp)
library(munsell)
library(soilDB)
```

2.1 About

Soil pits in Vivian Township, Waseca County, MN. Just north of Faribault county line. Visited July 8, 2020 for filming of UMN Extension educational video on soil structure.

Pea field with 2 pits dug by cooperator. First pit in the headlands where pea health was very poor. Second pit directly north ~30m from headland pit.

Field pit slightly upland from headland pit. Cattails visible in field corner not far from headlands pit - clearly a wet area. Field tiled for drainage, tile ~3 feet deep in this area.

2.1.1 Headlands Pit

Canisteo? Official Series Description here

Located at 43.8483, -93.6614

2.1.2 Field Pit

Nicollet? Official Series Description here

Located at 43.8487, -93.6614

2.2 Description data collected

```
##     PedonID           id hzname top bottom  hue value chroma Texture HzID    Efferve
## 1  Headland Pit-Canisteo     Ap   0     20    N   2.0      0     SiC    1
## 2  Headland Pit-Canisteo      A  20     30    N   2.0      0     SiC    2
## 3  Headland Pit-Canisteo     BA  30     40 2.5Y   3.0      1      CL    3
## 4  Headland Pit-Canisteo    Bkg  40     70 2.5Y   6.0      2      CL    4
## 5  Headland Pit-Canisteo      C  70    100 2.5Y   6.0      2      CL    5
## 6     Field Pit-Nicollet     Ap   0     30 10YR   2.0      1      CL    6
## 7     Field Pit-Nicollet      A  30     50 2.5Y   2.5      1      CL    7
## 8     Field Pit-Nicollet     Bw  50     70 2.5Y   3.0      2      CL    8
## 9     Field Pit-Nicollet    Bg?  70     90 2.5Y   4.0      2      CL    9
## 10    Field Pit-Nicollet      C  90    110 2.5Y   4.0      3       L   10 ST - masse
```

```
##     PedonID           id hzname
## 1  Headland Pit-Canisteo     Ap
## 2  Headland Pit-Canisteo      A
## 3  Headland Pit-Canisteo     BA
## 4  Headland Pit-Canisteo    Bkg
## 5  Headland Pit-Canisteo      C
## 6     Field Pit-Nicollet     Ap
## 7     Field Pit-Nicollet      A
## 8     Field Pit-Nicollet     Bw
## 9     Field Pit-Nicollet    Bg?
## 10    Field Pit-Nicollet      C
##                                                                                 Redox
## 1                                                                                <NA>
## 2                                                                                <NA>
## 3                                                                                <NA>
## 4                                                                                <NA>
## 5                                          Common, fine & medium Fe conc 7.5YR 5/8
## 6                                                                                <NA>
## 7                                                                                <NA>
## 8                                                                                <NA>
## 9                                                       Few fine Fe conc 7.5YR 5/8
## 10 Common fine Fe conc 7.5YR 5/8; some pockets of Fe-stained coarse sand & gravel
```

```
##     PedonID           id hzname
```

```
## 1  Headland Pit-Canisteo     Ap
## 2  Headland Pit-Canisteo      A
## 3  Headland Pit-Canisteo     BA
## 4  Headland Pit-Canisteo    Bkg
## 5  Headland Pit-Canisteo      C
## 6     Field Pit-Nicollet     Ap
## 7     Field Pit-Nicollet      A
## 8     Field Pit-Nicollet     Bw
## 9     Field Pit-Nicollet    Bg?
## 10    Field Pit-Nicollet      C
##
## 1
## 2
## 3
## 4
## 5
## 6
## 7
## 8
## 9
## 10 A few limestone coarse fragments 4-6cm in diameter; some carbonate masses that effervesce s
```

2.3 Create SoilProfileCollection (SPC) objects

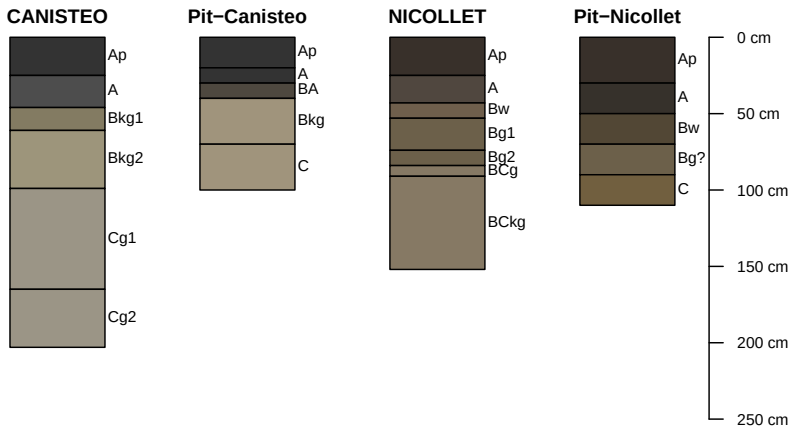
```
# promote data_min_st dataframe to SoilProfileCollection
depths(data_pits) <- id ~ top + bottom

#check that we have successfully converted class to SPC
class(data_pits)
```

```
## [1] "SoilProfileCollection"
## attr(,"package")
## [1] "aqp"
```

```
# OSD data for the two series I think we have at the Waseca pits
osd_pedons <- fetchOSD(c('canisteo', 'nicollet'))
```

2.4 Visually compare field descriptions with OSDs

```
# join the OSD pedons with the pit pedons
both <- aqp::union(list(osd_pedons, data_pits))

# set margins
par(mar = c(5,3,2,2), xpd=NA)

# plot soil profile collection
plotSPC(both, width = 0.25, name = 'hzname', plot.order= c(1,3,2,4), cex.names = 0.7)
```



Chapter 3

Mower County Pedons

date: 2020-09-06

3.1 Overview

Visualizing some soil profile descriptions from SL in Mower County.

This SPC plotting ideas post was helpful but I had to dig in the documentation to find it - not linked on the main aqp webpage? http://ncss-tech.github.io/AQP/aqp/SPC-plotting-ideas.html

```
knitr::opts_chunk$set(echo = TRUE)
knitr::opts_chunk$set(tidy = TRUE)
knitr::opts_chunk$set(tidy.opts = list(width.cutoff=60))

library(tidyverse)
library(aqp)
library(readxl)
library(munsell)
```

3.2 Load data

```
pedons <- read_excel("./data/mower_pedons.xlsx") %>% as.data.frame()

sites <- read_excel("./data/mower_site.xlsx")
```

3.3 Munsell colors conversion

```
# convert munsell colors to R compatible colors and add
# horizon ID
with_colors <- pedons %>% mutate(soil_color = munsell2rgb(hue,
    value, chroma), hzID = c(1:nrow(pedons)))

with_colors
```

```
##        id top bottom name  hue value chroma soil_color hzID
## 1  1CVA-8   0      2   A1 2.5Y   2.5      1  #36312BFF    1
## 2  1CVA-8   2      3   A2 2.5Y   2.5      1  #36312BFF    2
## 3  1CVA-8   3      7   A3 2.5Y   2.5      1  #36312BFF    3
## 4  1CVA-8   7      8   A4 2.5Y   3.0      2  #524735FF    4
## 5  1CVA-8   8     12   B1 2.5Y   4.0      2  #6C604AFF    5
## 6  1CVA-8  12     13  2B2 2.5Y   4.0      2  #6C604AFF    6
## 7  1CVA-8  13     20  2B3 2.5Y   4.0      2  #6C604AFF    7
## 8  1CVA-8  20     37  2B4 10YR   5.0      2  #897866FF    8
## 9  1CVA-8  37     45  2BC 10YR   5.0      1  #83796FFF    9
## 10 1BMA-4   0      6   A1 10YR   2.0      1  #38302AFF   10
## 11 1BMA-4   6     11   A2 10YR   2.0      1  #38302AFF   11
## 12 1BMA-4  11     18   A3 10YR   2.0      2  #3D2F21FF   12
## 13 1BMA-4  18     21   A4 10YR   3.0      2  #554636FF   13
## 14 1BMA-4  21     25   B1 10YR   4.0      3  #755D41FF   14
## 15 1BMA-4  25     32  2B2 10YR   5.0      2  #897866FF   15
## 16 1BMA-4  32     51  2B3 10YR   5.0      2  #897866FF   16
## 17 1BMA-4  51     60  2BC 10YR   5.0      2  #897866FF   17
## 18 1SHA-1   0      1   A1 10YR   2.0      2  #3D2F21FF   18
## 19 1SHA-1   1      4   A2 10YR   2.0      2  #3D2F21FF   19
## 20 1SHA-1   4      8   A3 10YR   2.0      2  #3D2F21FF   20
## 21 1SHA-1   8     10   B1 10YR   4.0      3  #755D41FF   21
## 22 1SHA-1  10     15  2B2 10YR   4.0      3  #755D41FF   22
## 23 1SHA-1  15     24  2B3 10YR   4.0      2  #6F5F4CFF   23
## 24 1SHA-1  24     40  2B4 10YR   5.0      2  #897866FF   24
## 25 1SHA-1  40     45  2BC 10YR   5.0      2  #897866FF   25
```

3.4 Promote dataframe to SPC object

SPC = soil profile collection (S4 object)

```
# promote dataframe to SPC object
depths(with_colors) <- id ~ top + bottom
```

```
## using `hzID` as a unique horizon ID
```

```
# should be 'SoilProfileCollection'
class(with_colors)
```

```
## [1] "SoilProfileCollection"
## attr(,"package")
## [1] "aqp"
```

```
# inspect output
str(with_colors)
```

```
## Formal class 'SoilProfileCollection' [package "aqp"] with 11 slots
##   ..@ idcol       : chr "id"
##   ..@ hzidcol     : chr "hzID"
##   ..@ hzdesgncol  : chr(0)
##   ..@ hztexclcol  : chr(0)
##   ..@ depthcols   : chr [1:2] "top" "bottom"
##   ..@ metadata    :'data.frame': 1 obs. of  1 variable:
##   .. ..$ depth_units: chr "cm"
##   ..@ horizons    :'data.frame': 25 obs. of  9 variables:
##   .. ..$ id        : chr [1:25] "1BMA-4" "1BMA-4" "1BMA-4" "1BMA-4" ...
##   .. ..$ top       : num [1:25] 0 6 11 18 21 25 32 51 0 2 ...
##   .. ..$ bottom    : num [1:25] 6 11 18 21 25 32 51 60 2 3 ...
##   .. ..$ name      : chr [1:25] "A1" "A2" "A3" "A4" ...
##   .. ..$ hue       : chr [1:25] "10YR" "10YR" "10YR" "10YR" ...
##   .. ..$ value     : num [1:25] 2 2 2 3 4 5 5 5 2.5 2.5 ...
##   .. ..$ chroma    : num [1:25] 1 1 2 2 3 2 2 2 1 1 ...
##   .. ..$ soil_color: chr [1:25] "#38302AFF" "#38302AFF" "#3D2F21FF" "#554636FF" ...
##   .. ..$ hzID      : int [1:25] 1 2 3 4 5 6 7 8 9 10 ...
##   ..@ site        :'data.frame': 3 obs. of  1 variable:
##   .. ..$ id: chr [1:3] "1BMA-4" "1CVA-8" "1SHA-1"
##   ..@ sp          :Formal class 'SpatialPoints' [package "sp"] with 3 slots
##   .. .. ..@ coords     : num [1, 1] 0
##   .. .. ..@ bbox       : logi [1, 1] NA
##   .. .. ..@ proj4string:Formal class 'CRS' [package "sp"] with 1 slot
##   .. .. .. .. ..@ projargs: chr NA
##   ..@ diagnostic  :'data.frame': 0 obs. of  0 variables
##   ..@ restrictions:'data.frame': 0 obs. of  0 variables
```

```
# change the depth units (metadata/leabel) to inches -
# default is cm
depth_units(with_colors) <- "inches"
```

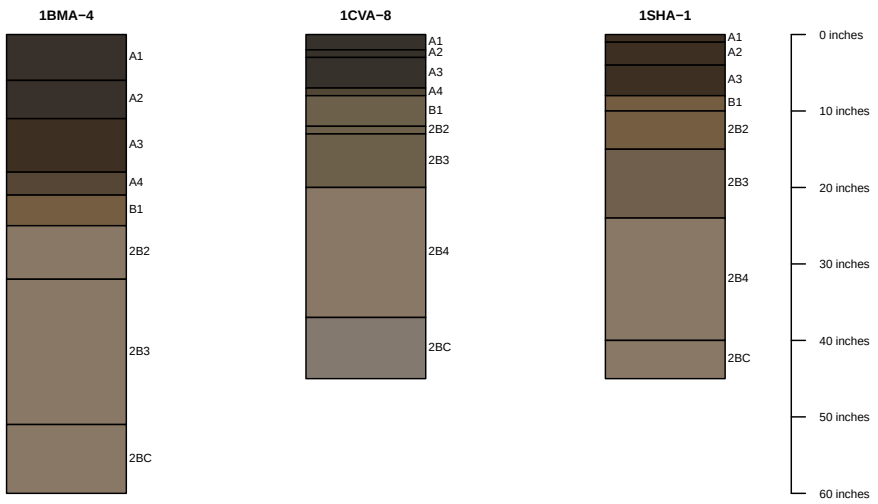
```
# check that unit conversion worked
metadata(with_colors)
```

```
##   depth_units
## 1      inches
```

3.5 Plot the SPC object

Most basic version here.

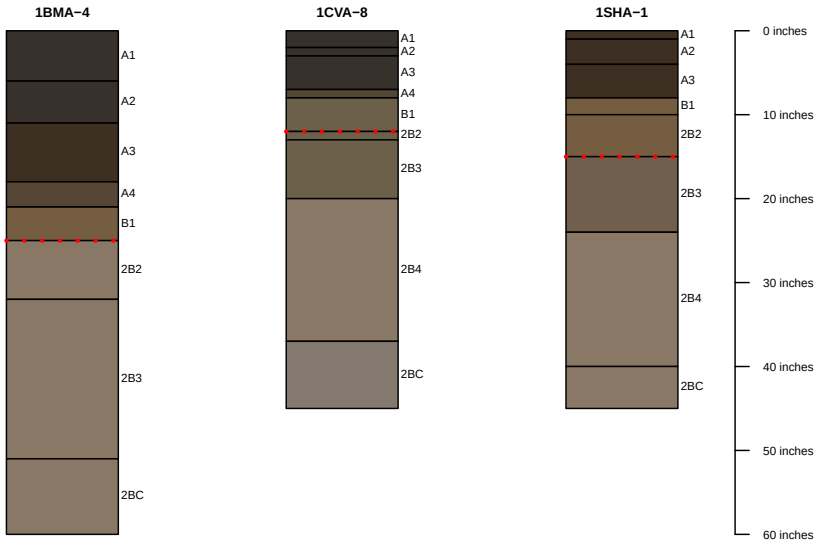
```
# margin specification (bottom, left, top, right) default is
# typically c(5,4,4,2)
par(mar = c(1, 1, 1, 1))

plot(with_colors, name = "name", width = 0.2)
```



3.6 Add dashed lines

Want to represent the lag line (transition to older till parent material) with a dotted line across each soil profile.

```r
# grab lag line depth from sites df

lag <- sites %>%
  select(id, lag_in)

# need the ids in alpha order to align with pedons plotted alphabetically below (otherwise the la

lag_sorted <- lag[order(lag$id),]

# keep in mind that each pedon is centered over its integer index on the x-axis of the plot (firs
x.pos <- 1:length(with_colors)

# segments function needs vectors of coordinates:
#specifies start/end the line segments
# see https://bookdown.org/ndphillips/YaRrr/low-level-plotting-functions.html
from.x <- c(x.pos - 0.2)
to.x <- c(x.pos + 0.2)
from.y <- lag_sorted$lag_in
to.y <- lag_sorted$lag_in

par(mar = c(0,2,0,2))

plot(with_colors, name = "name",
     width = 0.2)

segments(x0 = from.x,
         x1 = to.x,
         y0 = from.y,
         y1 = to.y,
         col = "red",
         lwd = 3, # width of line
         lty = 3)  # line type
```


1BMA−4
A1
A2
A3
A4
B1
2B2
2B3
2BC
1CVA−8
A1
A2
A3
A4
B1
2B2
2B3
2B4
2BC
1SHA−1
A1
A2
A3
B1
2B2
2B3
2B4
2BC
0 inches
10 inches
20 inches
30 inches
40 inches
50 inches
60 inches

Chapter 4

References

Low level plotting functions, including segments() and text(), which might be useful for adding additional labels (such as "lag line") in the future: https://bookdown.org/ndphillips/YaRrr/low-level-plotting-functions.html

SPC plotting ideas: http://ncss-tech.github.io/AQP/aqp/SPC-plotting-ideas.html

```
devtools::session_info()
```

```
## - Session info ---------------------------------------------------------------------------------
##  setting  value
##  version  R version 3.6.3 (2020-02-29)
##  os       Windows >= 8 x64
##  system   x86_64, mingw32
##  ui       RStudio
##  language (EN)
##  collate  English_United States.1252
##  ctype    English_United States.1252
##  tz       America/Chicago
##  date     2020-09-06
##
## - Packages -------------------------------------------------------------------------------------
##  package      * version  date       lib source
##  aqp          * 1.19     2020-01-24 [1] CRAN (R 3.6.3)
##  assertthat     0.2.1    2019-03-21 [1] CRAN (R 3.6.3)
##  backports      1.1.8    2020-06-17 [1] CRAN (R 3.6.3)
##  blob           1.2.1    2020-01-20 [1] CRAN (R 3.6.3)
##  bookdown       0.20     2020-06-23 [1] CRAN (R 3.6.3)
##  broom          0.7.0    2020-07-09 [1] CRAN (R 3.6.3)
##  callr          3.4.3    2020-03-28 [1] CRAN (R 3.6.3)
```

```
##  cellranger     1.1.0    2016-07-27 [1] CRAN (R 3.6.3)
##  cli            2.0.2    2020-02-28 [1] CRAN (R 3.6.3)
##  cluster        2.1.0    2019-06-19 [2] CRAN (R 3.6.3)
##  codetools      0.2-16   2018-12-24 [2] CRAN (R 3.6.3)
##  colorspace     1.4-1    2019-03-18 [1] CRAN (R 3.6.1)
##  crayon         1.3.4    2017-09-16 [1] CRAN (R 3.6.3)
##  curl           4.3      2019-12-02 [1] CRAN (R 3.6.3)
##  DBI            1.1.0    2019-12-15 [1] CRAN (R 3.6.3)
##  dbplyr         1.4.4    2020-05-27 [1] CRAN (R 3.6.3)
##  desc           1.2.0    2018-05-01 [1] CRAN (R 3.6.3)
##  devtools       2.3.0    2020-04-10 [1] CRAN (R 3.6.3)
##  digest         0.6.25   2020-02-23 [1] CRAN (R 3.6.3)
##  dplyr        * 1.0.0    2020-05-29 [1] CRAN (R 3.6.3)
##  ellipsis       0.3.1    2020-05-15 [1] CRAN (R 3.6.3)
##  evaluate       0.14     2019-05-28 [1] CRAN (R 3.6.3)
##  fansi          0.4.1    2020-01-08 [1] CRAN (R 3.6.3)
##  forcats      * 0.5.0    2020-03-01 [1] CRAN (R 3.6.3)
##  formatR        1.7      2019-06-11 [1] CRAN (R 3.6.3)
##  fs             1.4.2    2020-06-30 [1] CRAN (R 3.6.3)
##  generics       0.0.2    2018-11-29 [1] CRAN (R 3.6.3)
##  ggplot2      * 3.3.2    2020-06-19 [1] CRAN (R 3.6.3)
##  glue           1.4.1    2020-05-13 [1] CRAN (R 3.6.3)
##  gtable         0.3.0    2019-03-25 [1] CRAN (R 3.6.3)
##  haven          2.3.1    2020-06-01 [1] CRAN (R 3.6.3)
##  hms            0.5.3    2020-01-08 [1] CRAN (R 3.6.3)
##  htmltools      0.5.0    2020-06-16 [1] CRAN (R 3.6.3)
##  httr           1.4.1    2019-08-05 [1] CRAN (R 3.6.3)
##  jsonlite       1.7.0    2020-06-25 [1] CRAN (R 3.6.3)
##  knitr          1.29     2020-06-23 [1] CRAN (R 3.6.3)
##  lattice        0.20-41  2020-04-02 [1] CRAN (R 3.6.3)
##  lifecycle      0.2.0    2020-03-06 [1] CRAN (R 3.6.3)
##  lubridate      1.7.9    2020-06-08 [1] CRAN (R 3.6.3)
##  magrittr       1.5      2014-11-22 [1] CRAN (R 3.6.3)
##  MASS           7.3-51.6 2020-04-26 [1] CRAN (R 3.6.3)
##  memoise        1.1.0    2017-04-21 [1] CRAN (R 3.6.3)
##  modelr         0.1.8    2020-05-19 [1] CRAN (R 3.6.3)
##  munsell      * 0.5.0    2018-06-12 [1] CRAN (R 3.6.3)
##  pillar         1.4.6    2020-07-10 [1] CRAN (R 3.6.3)
##  pkgbuild       1.1.0    2020-07-13 [1] CRAN (R 3.6.3)
##  pkgconfig      2.0.3    2019-09-22 [1] CRAN (R 3.6.3)
##  pkgload        1.1.0    2020-05-29 [1] CRAN (R 3.6.3)
##  plotrix        3.7-8    2020-04-16 [1] CRAN (R 3.6.3)
##  plyr           1.8.6    2020-03-03 [1] CRAN (R 3.6.3)
##  prettyunits    1.1.1    2020-01-24 [1] CRAN (R 3.6.3)
##  processx       3.4.3    2020-07-05 [1] CRAN (R 3.6.3)
##  ps             1.3.3    2020-05-08 [1] CRAN (R 3.6.3)
```

```
##  purrr        * 0.3.4    2020-04-17 [1] CRAN (R 3.6.3)
##  R6             2.4.1    2019-11-12 [1] CRAN (R 3.6.3)
##  raster         3.3-7    2020-06-27 [1] CRAN (R 3.6.3)
##  RColorBrewer   1.1-2    2014-12-07 [1] CRAN (R 3.6.0)
##  Rcpp           1.0.5    2020-07-06 [1] CRAN (R 3.6.3)
##  readr        * 1.3.1    2018-12-21 [1] CRAN (R 3.6.3)
##  readxl       * 1.3.1    2019-03-13 [1] CRAN (R 3.6.3)
##  remotes        2.1.1    2020-02-15 [1] CRAN (R 3.6.3)
##  reprex         0.3.0    2019-05-16 [1] CRAN (R 3.6.3)
##  reshape        0.8.8    2018-10-23 [1] CRAN (R 3.6.3)
##  reshape2       1.4.4    2020-04-09 [1] CRAN (R 3.6.3)
##  rlang          0.4.7    2020-07-09 [1] CRAN (R 3.6.3)
##  rmarkdown      2.3      2020-06-18 [1] CRAN (R 3.6.3)
##  rprojroot      1.3-2    2018-01-03 [1] CRAN (R 3.6.3)
##  rstudioapi     0.11     2020-02-07 [1] CRAN (R 3.6.3)
##  rvest          0.3.5    2019-11-08 [1] CRAN (R 3.6.3)
##  scales         1.1.1    2020-05-11 [1] CRAN (R 3.6.3)
##  sessioninfo    1.1.1    2018-11-05 [1] CRAN (R 3.6.3)
##  soilDB       * 2.5      2020-01-28 [1] CRAN (R 3.6.3)
##  sp             1.4-2    2020-05-20 [1] CRAN (R 3.6.3)
##  stringi        1.4.6    2020-02-17 [1] CRAN (R 3.6.2)
##  stringr      * 1.4.0    2019-02-10 [1] CRAN (R 3.6.3)
##  testthat       2.3.2    2020-03-02 [1] CRAN (R 3.6.3)
##  tibble       * 3.0.3    2020-07-10 [1] CRAN (R 3.6.3)
##  tidyr        * 1.1.0    2020-05-20 [1] CRAN (R 3.6.3)
##  tidyselect     1.1.0    2020-05-11 [1] CRAN (R 3.6.3)
##  tidyverse    * 1.3.0    2019-11-21 [1] CRAN (R 3.6.3)
##  usethis        1.6.1    2020-04-29 [1] CRAN (R 3.6.3)
##  vctrs          0.3.2    2020-07-15 [1] CRAN (R 3.6.3)
##  withr          2.2.0    2020-04-20 [1] CRAN (R 3.6.3)
##  xfun           0.15     2020-06-21 [1] CRAN (R 3.6.3)
##  xml2           1.3.2    2020-04-23 [1] CRAN (R 3.6.3)
##  yaml           2.2.1    2020-02-01 [1] CRAN (R 3.6.2)
##
## [1] C:/Users/Hava/Documents/R/win-library/3.6
## [2] C:/Program Files/R/R-3.6.3/library
```