Plots

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Brief description of the script

This R markdown document plots the data of the resulting CSV file from the computing ISO 25178-2 parameters in ConfoMap. These data is part of the manuscript: *Dubreuil et al. A 'family of wear': Exploring use-wear patterns on ad hoc smoothing, burnishing/polishing tool*

This R project and respective scripts follow the procedures described by Marwick et al. 2017.

The authors would like to thank Ivan Calandra and Lisa Schunk for their help and contribution on several chunks of code included here in the script (pieces of code are also adapted from Calandra et al. 2019, Pedergnana et al. 2020a, 2020b).

To compile this markdown document do not delete or move files from their original folders.

For any questions, comments and inputs, please contact:

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Load packages

```
library(R.utils)
library(ggplot2)
library(tools)
library(tidyverse)
library(wesanderson)

dir_in <- "analysis/derived_data/"
dir_out <- "analysis/plots"
```

Get name, path and information of the file

```
data_file <- list.files(dir_in, pattern = "\\.Rbin$", full.names = TRUE)
md5_in <- md5sum(data_file)
```

Load data into R object

```
imp_data <- loadObject(data_file)
str(imp_data)
```

```
'data.frame':   30 obs. of  53 variables:
 $ Sample.ID               : chr  "Kremasti4" "Kremasti4" "Kremasti4" "Kremasti4" ...
 $ Microscope              : chr  "LSM" "LSM" "LSM" "LSM" ...
 $ Objective               : chr  "50x" "50x" "50x" "50x" ...
 $ PolishType              : chr  "natural" "natural" "natural" "natural" ...
 $ Surface                 : chr  "a" "b" "c" "d" ...
 $ Topo                    : chr  "Topo" "Topo" "Topo" "Topo" ...
 $ Acquisition.Date        : chr  "2021/04/15" "2021/04/15" "2021/04/15" "2021/04/15" ...
 $ Analysis.Date           : chr  "14:06:02" "14:08:39" "14:11:12" "14:13:40" ...
 $ Analysis.Time           : chr  "4/15/2021 10:24:41 AM" "4/15/2021 10:51:24 AM" "4/15/2021 11:45:47 Al
 $ Axis.length.X           : num  255 255 255 255 255 ...
 $ Axis.size.X             : num  3000 3000 3000 3000 3000 3000 3000 3000 3000 3000 ...
 $ Axis.spacing.X          : num  85.2 85.2 85.2 85.2 85.2 ...
 $ Axis.length.Y           : num  255 255 255 255 255 ...
 $ Axis.size.Y             : num  3000 3000 3000 3000 3000 3000 3000 3000 3000 3000 ...
 $ Axis.spacing.Y          : num  85.2 85.2 85.2 85.2 85.2 ...
 $ Axis.length.Z           : num  40.7 49.9 92.6 31.8 29.3 ...
 $ Axis.size.Z             : num  65532 65532 65531 65532 65531 ...
 $ Axis.spacing.Z          : num  0.621 0.761 1.413 0.485 0.447 ...
 $ NM.points.ratio.Z       : num  0 0 0 0 0 0 0 0 0 0 ...
 $ Sq                      : num  1.58 4.09 1.47 2.24 1.77 ...
 $ Ssk                     : num  -0.61 -0.391 -0.274 -0.049 -0.929 ...
 $ Sku                     : num  4.88 2.53 6.23 3.44 5.87 ...
 $ Sp                      : num  5.47 10.44 5.15 9.02 7.91 ...
 $ Sv                      : num  6.86 12.48 8.2 7.06 8.52 ...
 $ Sz                      : num  12.3 22.9 13.4 16.1 16.4 ...
 $ Sa                      : num  1.13 3.4 1.08 1.77 1.25 ...
 $ Smr                     : num  0.484 0.239 0.604 0.207 0.126 ...
 $ Smc                     : num  1.69 4.56 1.72 2.87 1.66 ...
 $ Sxp                     : num  3.99 9.02 2.67 4.65 4.7 ...
 $ Sal                     : num  19.5 32.4 23.5 30.6 20.7 ...
 $ Str                     : num  0.48 NA NA 0.614 0.813 ...
 $ Std                     : num  42.2 93.2 33 25.3 62 ...
 $ Sdq                     : num  0.383 0.658 0.521 0.403 0.403 ...
 $ Sdr                     : num  6 15.94 8.53 6.73 6.56 ...
 $ Vm                      : num  0.0895 0.1529 0.1057 0.0994 0.0945 ...
 $ Vv                      : num  1.78 4.72 1.82 2.97 1.75 ...
 $ Vmp                     : num  0.0895 0.1529 0.1057 0.0994 0.0945 ...
 $ Vmc                     : num  1.13 4.14 1.09 1.84 1.28 ...
 $ Vvc                     : num  1.5 4.24 1.65 2.68 1.41 ...
 $ Vvv                     : num  0.287 0.478 0.17 0.292 0.343 ...
 $ Maximum.depth.of.furrows: num  7.22 10.88 9.43 6.76 8.68 ...
 $ Mean.depth.of.furrows   : num  1.57 3.13 1.47 1.9 1.54 ...
 $ Mean.density.of.furrows : num  3750 3056 4011 3480 3423 ...
 $ First.direction         : num  89.9772 90.014 45.0229 0.0123 44.9941 ...
 $ Second.direction        : num  45 135 180 26.5 63.5 ...
 $ Third.direction         : num  180 45 33.7 90 90 ...
```

```
 $ Texture.isotropy        : num  74 82.7 77.8 90.3 92.3 ...
 $ epLsar                  : num  NA NA NA NA NA NA NA NA NA NA ...
 $ NewEplsar               : num  NA NA NA NA NA NA NA NA NA NA ...
 $ Asfc                    : num  9.93 25.92 17.49 11.21 10.47 ...
 $ Smfc                    : num  6281985 10723090 4628049 7318909 11574299 ...
 $ HAsfc9                  : num  0.539 0.39 1.927 0.603 0.546 ...
 $ HAsfc81                 : num  0.87 0.638 2.369 0.728 0.848 ...
```

Prepare variables

Define numeric variables

```
num.var <- 20:length(imp_data)
```

The following variables will be used:

```
[20] Sq
[21] Ssk
[22] Sku
[23] Sp
[24] Sv
[25] Sz
[26] Sa
[27] Smr
[28] Smc
[29] Sxp
[30] Sal
[31] Str
[32] Std
[33] Sdq
[34] Sdr
[35] Vm
[36] Vv
[37] Vmp
[38] Vmc
[39] Vvc
[40] Vvv
[41] Maximum.depth.of.furrows
[42] Mean.depth.of.furrows
[43] Mean.density.of.furrows
[44] First.direction
[45] Second.direction
[46] Third.direction
[47] Texture.isotropy
[48] epLsar
[49] NewEplsar
[50] Asfc
[51] Smfc
```

```
[52] HAsfc9
[53] HAsfc81
```

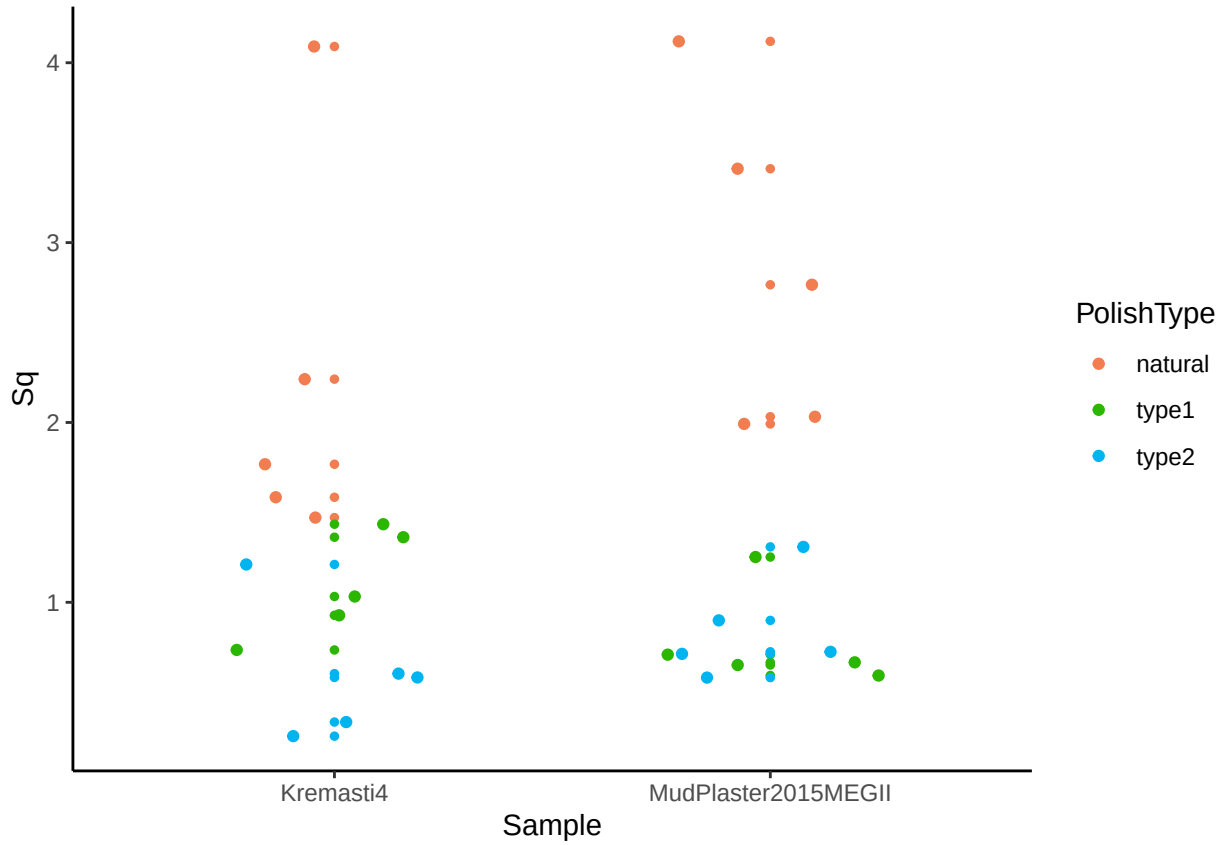
Plot each of the selected numeric variables

Plot just original samples/surfaces organized by parameter

```
for (i in num.var) {
    p <- ggplot(data = imp_data, aes_string(x = "Sample.ID", y = names(imp_data)[i],
                                            colour = "PolishType")) +
         geom_point(size = 1) +
         geom_jitter(width = 0.25) +
         theme_classic() +
         labs(colour = "PolishType") +
         labs(x = "Sample", y = gsub("\\.", " ", names(imp_data)[i])) +
         scale_colour_hue(h = c(25,225), limits = levels(imp_data[["Surface"]]))
  print(p)

  # saves the plots
  file_out <- paste0(file_path_sans_ext(info_in[["file"]]), "_plot_",
                     names(imp_data)[i], ".pdf")
    ggsave(filename = file_out, plot = p, path = dir_out, device = "pdf", width = 26,
           height = 21, units = "cm" )
}
```

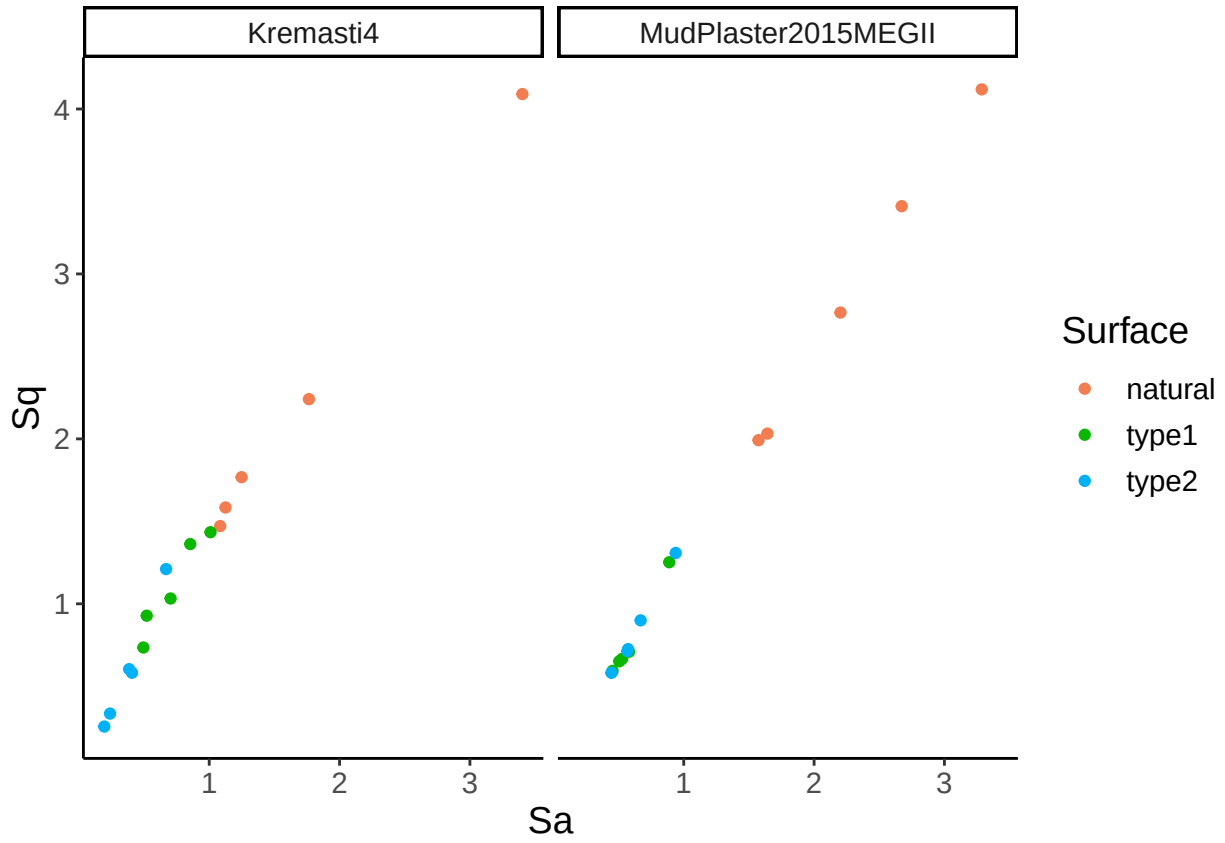
```
Error in is.factor(x): object 'info_in' not found
```



Scatterplots of selected variables combined with Sample.ID and Polish type

Sa vs. Sq

```
#plot
Sa_Sq <- ggplot(data = imp_data) +
         geom_point(mapping = aes(x = Sa, y = Sq, colour = PolishType)) +
         theme_classic() +
         theme(text = element_text(size = 14)) +
         labs(colour = "Surface") +
         facet_wrap(~ Sample.ID) +
         scale_colour_hue(h = c(25, 230))
print(Sa_Sq)
```




```
# saving the plot
file_out <- paste0(file_path_sans_ext(info_in[["file"]]), "_scatterplot_Sa-Sq", ".pdf")
```

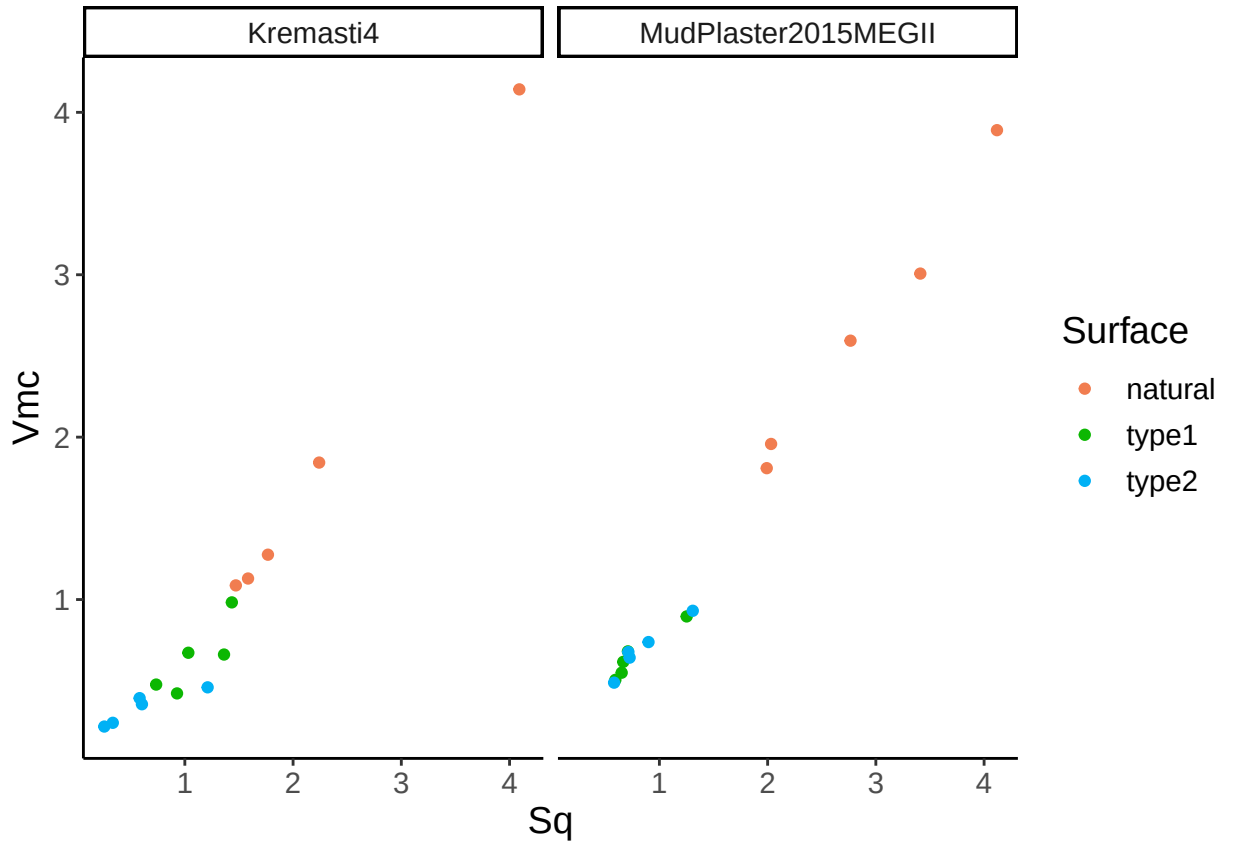
```
Error in is.factor(x): object 'info_in' not found
```

```
ggsave(filename = file_out, plot = Sa_Sq, path = dir_out, device = "pdf")
```

```
Error in force(filename): object 'file_out' not found
```

Sq vs. Vmc

```
Sq_Vmc <- ggplot(data = imp_data) +
          geom_point(mapping = aes(x = Sq, y = Vmc, colour = PolishType)) +
          theme_classic() +
          theme(text = element_text(size = 14)) +
          labs(colour = "Surface") +
          facet_wrap(~ Sample.ID) +
          scale_colour_hue(h = c(25, 230))
print(Sq_Vmc)
```




```
file_out <- paste0(file_path_sans_ext(info_in[["file"]]), "_scatterplot_Sq-Vmc", ".pdf")
```

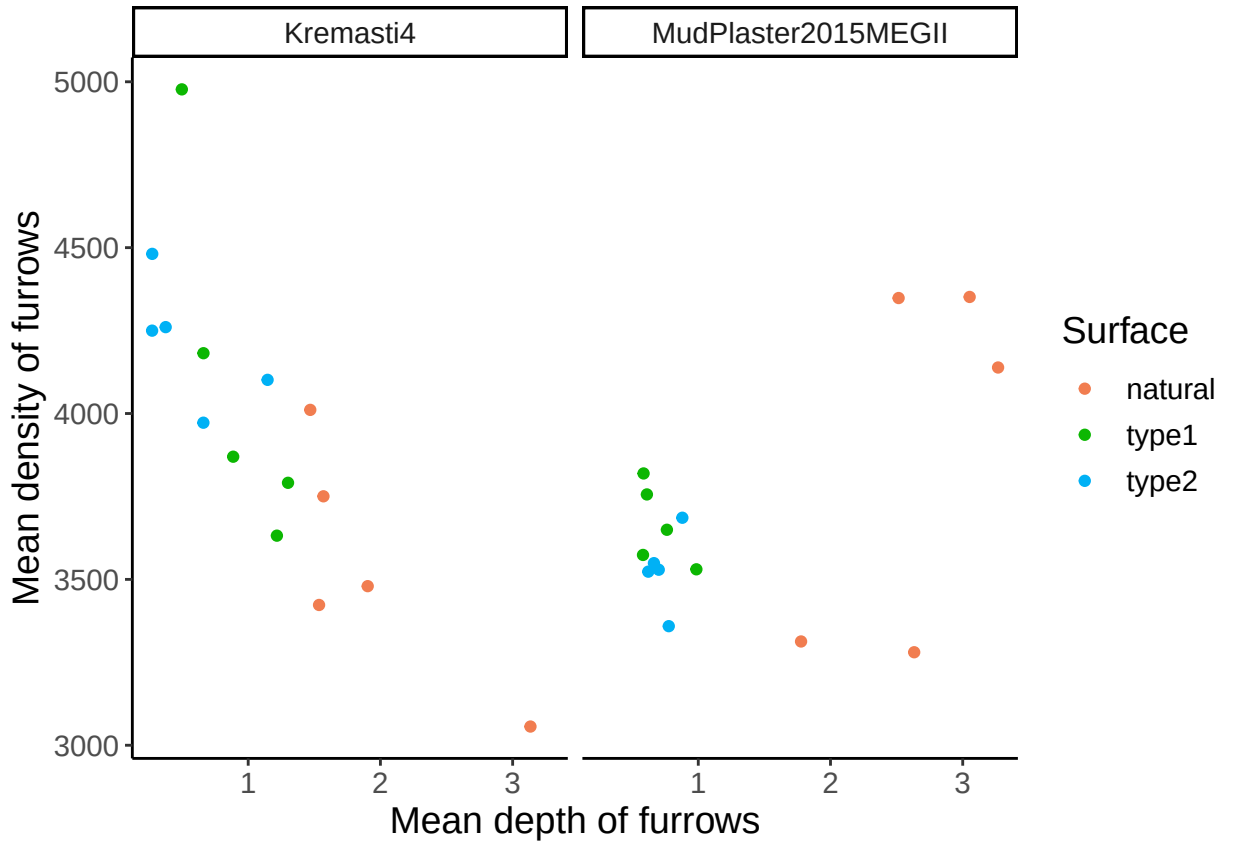
```
Error in is.factor(x): object 'info_in' not found
```

```
ggsave(filename = file_out, plot = Sq_Vmc, path = dir_out, device = "pdf")
```

```
Error in force(filename): object 'file_out' not found
```

Mean depth of furrows vs. mean density of furrows

```
furrows <- ggplot(data = imp_data) +
           geom_point(mapping = aes(x = Mean.depth.of.furrows, y = Mean.density.of.furrows, colour = Pol
           theme_classic() +
           theme(text = element_text(size = 14)) +
           labs(colour = "Surface", x = "Mean depth of furrows", y = "Mean density of furrows") +
           facet_wrap(~ Sample.ID) +
           scale_colour_hue(h = c(25, 230))
print(furrows)
```




```
file_out <- paste0(file_path_sans_ext(info_in[["file"]]), "_scatterplot_furrows", ".pdf")
```

```
Error in is.factor(x): object 'info_in' not found
```

```
ggsave(filename = file_out, plot = furrows, path = dir_out, device = "pdf")
```

```
Error in force(filename): object 'file_out' not found
```

---

sessionInfo() and RStudio version

```
sessionInfo()
```

```
R version 4.1.0 (2021-05-18)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 10 x64 (build 19044)

Matrix products: default

locale:
```

```
[1] LC_COLLATE=English_United States.1252
[2] LC_CTYPE=English_United States.1252
[3] LC_MONETARY=English_United States.1252
[4] LC_NUMERIC=C
[5] LC_TIME=English_United States.1252

attached base packages:
[1] tools     stats     graphics  grDevices utils     datasets  methods
[8] base

other attached packages:
 [1] wesanderson_0.3.6 forcats_0.5.2     stringr_1.5.0     dplyr_1.0.10
 [5] purrr_0.3.5       readr_2.1.3       tidyr_1.2.1       tibble_3.1.8
 [9] tidyverse_1.3.2   ggplot2_3.4.0     R.utils_2.12.2    R.oo_1.25.0
[13] R.methodsS3_1.8.2

loaded via a namespace (and not attached):
 [1] lubridate_1.9.0     assertthat_0.2.1    rprojroot_2.0.3
 [4] digest_0.6.31       utf8_1.2.2          R6_2.5.1
 [7] cellranger_1.1.0    backports_1.4.1     reprex_2.0.2
[10] evaluate_0.19       highr_0.9           httr_1.4.4
[13] pillar_1.8.1        rlang_1.0.6         googlesheets4_1.0.1
[16] readxl_1.4.1        rstudioapi_0.14     jquerylib_0.1.4
[19] rmarkdown_2.19      labeling_0.4.2      googledrive_2.0.0
[22] munsell_0.5.0       broom_1.0.2         compiler_4.1.0
[25] modelr_0.1.10       xfun_0.35           pkgconfig_2.0.3
[28] htmltools_0.5.4     tidyselect_1.2.0    fansi_1.0.3
[31] crayon_1.5.2        tzdb_0.3.0          dbplyr_2.2.1
[34] withr_2.5.0         grid_4.1.0          jsonlite_1.8.4
[37] gtable_0.3.1        lifecycle_1.0.3     DBI_1.1.3
[40] magrittr_2.0.3      scales_1.2.1        cli_3.4.1
[43] stringi_1.7.6       cachem_1.0.6        farver_2.1.1
[46] fs_1.5.2            xml2_1.3.3          bslib_0.4.2
[49] ellipsis_0.3.2      generics_0.1.3      vctrs_0.5.1
[52] glue_1.6.2          hms_1.1.2           fastmap_1.1.0
[55] yaml_2.3.6          timechange_0.1.1    colorspace_2.0-3
[58] gargle_1.2.1        rvest_1.0.3         knitr_1.41
[61] haven_2.5.1         sass_0.4.4
```