

CLEAR-3 ICA analysis pipeline

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This is a streamlined version of the analysis done in the manuscript, assembled from a variety of original analysis files. These files still reside in this repository for archival purposes (which means, unfortunately, that we have a certain degree of code duplication).

The pipeline is divided into three parts: Preprocessing, independent component analysis (ICA), and linear mixed-effects modelling. The meat of the preprocessing code has been delegated to R source files, which can be found in the `src` folder. The ICA and modelling code, on the other hand, is more verbose to allow easier exposition of, e.g., model structure.

```
knitr::opts_chunk$set(message = FALSE, cache = TRUE)
local <- TRUE

wd <- ""

if (!local) {
  # Cluster environment
  wd <- "~/Documents/Autocorrelation"
  # Base directory for the data set we will create
  dat_dir <- "/project_cephfs/3022017.02/projects/lorkno/data"
} else {
  wd <- "/Volumes/home/preclineu/lorkno/Documents/Autocorrelation"
  # Base directory for the data set we will create
  dat_dir <- "~/HPC_project/data"
}

# For some reason this sets the pwd only for the current scope, which means it
# does not affect anything outside an if block if you set it there.
# So that's why it's here instead of above.
setwd(wd)

src_dir <- "src"
source(file.path(src_dir, "load_dependencies.R"))

##
## Attaching package: 'gsignal'
```

```

## The following objects are masked from 'package:stats':
##
##   filter, gaussian, poly
## Loading required package: ggplot2
## Registered S3 method overwritten by 'GGally':
##   method from
##   +.gg      ggplot2
##
## Attaching package: 'psych'
## The following objects are masked from 'package:ggplot2':
##
##   %+%, alpha
## The following object is masked from 'package:gsignal':
##
##   kaiser
##
## Attaching package: 'scales'
## The following objects are masked from 'package:psych':
##
##   alpha, rescale
## Loading required package: timechange
##
## Attaching package: 'lubridate'
## The following object is masked from 'package:reshape':
##
##   stamp
## The following object is masked from 'package:gsignal':
##
##   dst
## The following objects are masked from 'package:base':
##
##   date, intersect, setdiff, union
## -- Attaching packages ----- tidyverse 1.3.2 --
## v tibble  3.1.8      v dplyr   1.0.10
## v tidyr   1.2.1      v stringr 1.4.1
## v readr   2.1.3      v forcats 0.5.2
## v purrr   0.3.5
## -- Conflicts ----- tidyverse_conflicts() --
## x psych::%+%( )          masks ggplot2::%+%( )
## x scales::alpha( )       masks psych::alpha( ), ggplot2::alpha( )
## x lubridate::as.difftime( ) masks base::as.difftime( )
## x readr::col_factor( )   masks scales::col_factor( )
## x lubridate::date( )     masks base::date( )
## x purrr::discard( )      masks scales::discard( )
## x lubridate::dst( )      masks gsignal::dst( )
## x tidyr::expand( )       masks reshape::expand( )
## x dplyr::filter( )       masks gsignal::filter( ), stats::filter( )

```

```

## x lubridate::intersect()   masks base::intersect()
## x dplyr::lag()             masks stats::lag()
## x dplyr::rename()          masks reshape::rename()
## x lubridate::setdiff()     masks base::setdiff()
## x lubridate::stamp()       masks reshape::stamp()
## x lubridate::union()       masks base::union()
## NOTE: Either Arial Narrow or Roboto Condensed fonts are required to use these themes.
##
##     Please use hrbrthemes::import_roboto_condensed() to install Roboto Condensed and
##
##     if Arial Narrow is not on your system, please see https://bit.ly/arialnarrow
##
## Welcome! Want to learn more? See two factoextra-related books at https://goo.gl/ve3WBa
##
## Attaching package: 'nlme'
##
##
## The following object is masked from 'package:dplyr':
##
##     collapse
##
## Loading required package: Matrix
##
## Attaching package: 'Matrix'
##
##
## The following objects are masked from 'package:tidyr':
##
##     expand, pack, unpack
##
## The following object is masked from 'package:reshape':
##
##     expand
##
## Attaching package: 'lme4'
##
##
## The following object is masked from 'package:nlme':
##
##     lmList
##
## Attaching package: 'mice'
##
##
## The following object is masked from 'package:gsignal':
##

```

```
##      filter
##
##
## The following object is masked from 'package:stats':
##
##      filter
##
##
## The following objects are masked from 'package:base':
##
##      cbind, rbind
##
##
## * miceadds 3.15-21 (2022-09-22 09:41:02)
##
##
## Attaching package: 'miceadds'
##
##
## The following objects are masked from 'package:GGally':
##
##      mean0, min0
man_img_dir <- "~/Documents/Writing/Papers/Paper 1/images"
```

Preprocessing

These functions repair potential file errors, move files into a BIDS-like structure, and then perform filtering and aggregation where necessary.

```
source(file.path(src_dir, "preproc_all.R"))

dir.create(dat_dir, showWarnings = FALSE, recursive = TRUE)

skip_src_transfer <- TRUE

rearrange_raw_files(skip_src_transfer)

preproc_biaffect()
```

Binds self-report and BiAffect data on the daily level. Also includes a bit of self-report cleaning.

```
source(file.path(src_dir, "join_selfreport_biaffect.R"))

dat_reg <- join_selfreport_biaffect(
  selfreport_path = file.path(dat_dir, "clear3daily_20221205.sav"),
  inclusion_path = "regression_inclusion_20230314.xlsx"
)
```

Trim preprocessed data to only include baseline data.

```
source(file.path(src_dir, "trim_baseline.R"))

trim_baseline(
  dat_reg,
  date_path = file.path(dat_dir, "CLEAR3_Biaffect_Leow", "Metadata",
```

```

        "clear3_start_tx_dates.xlsx"),
  save_path = file.path(dat_dir, "dat_reg_trimmed.rds")
)

```

One can now run `shiny/missingness/app.R` to browse the preprocessed data and select some minimum quality bounds for inclusion in the independent component and modelling analyses.

ICA

Run the ICA on the semi-contiguous (`dat_reg_semi_contiguous.rds`) and fragmented (`dat_reg_fragmented.rds`) data files created with the Shiny app.

```
source(file.path(src_dir, "ica.R"))
```

Fragmented ICA

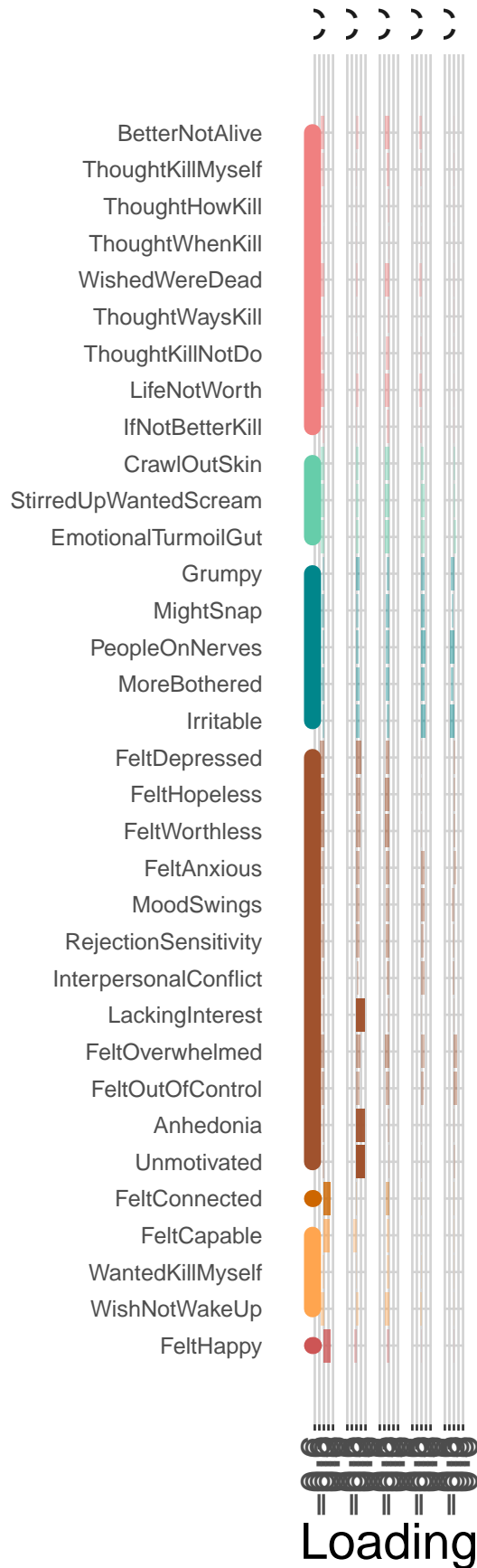
```

ica_frag <- run_icas(file.path(dat_dir, "dat_reg_fragmented.rds"),
  ns_comp = c(5, 10, 20),
  out_path = file.path(dat_dir, "dat_reg_frag_icas.rda"))

fancy_mix_fig(ica_frag[[1]],
  lims = c(-0.6, 0.6),
  ann_x = -0.75,
  save_path = file.path(man_img_dir, "mixing_matrix_5_frag.pdf"))

```

Variable

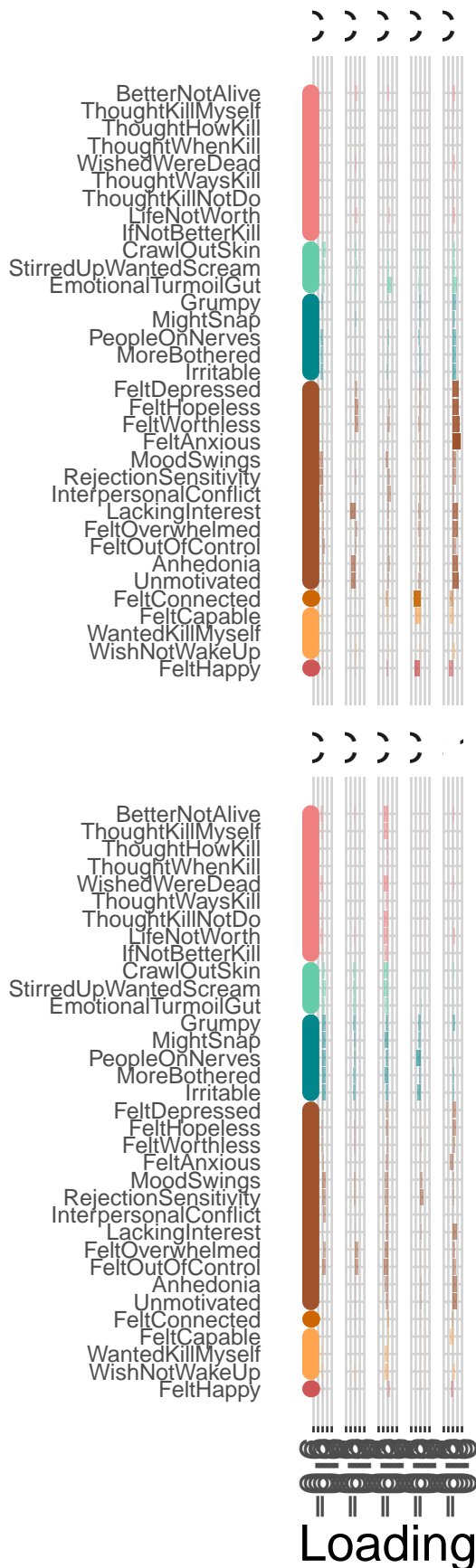


Questionnaire



```
## pdf
## 2
fancy_mix_fig(ica_frag[[2]],
              n_row = 2,
              lims = c(-0.6, 0.6),
              ann_x = -0.78,
              save_path = file.path(man_img_dir, "mixing_matrix_10_frag.pdf"),
              width = 15, height = 15)
```

Variable

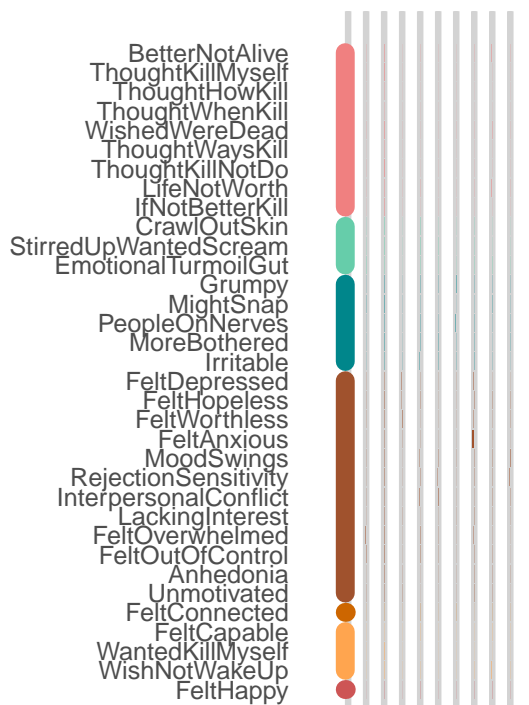



```
## pdf
## 2
fancy_mix_fig(ica_frag[[3]],
              n_row = 2,
              lims = c(-0.6, 0.6),
              ann_x = -0.9,
              save_path = file.path(man_img_dir, "mixing_matrix_20_frag.pdf"),
              width = 15, height = 15)
```

Variable



Questionnaire



Loading

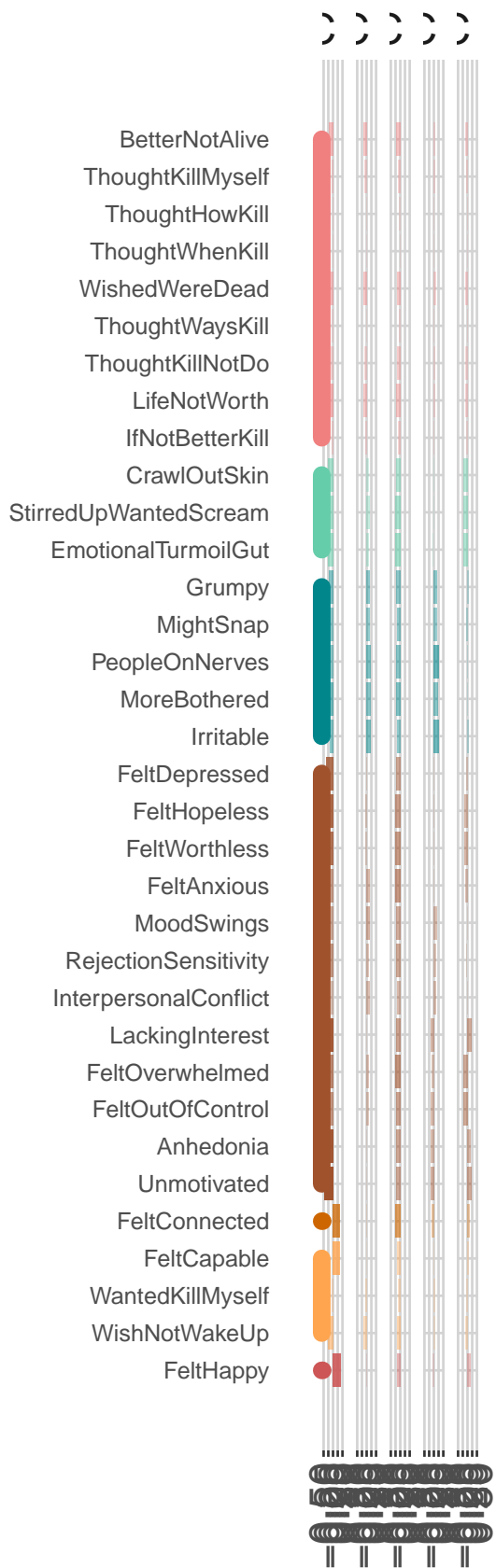
```
## pdf
## 2
```

Semi-contiguous ICA

```
icas <- run_icas(dat_path = file.path(dat_dir, "dat_reg_semi_contiguous.rds"),
               ns_comp = c(5, 10, 20),
               out_path = file.path(dat_dir, "dat_reg_contig_icas.rda"))

fancy_mix_fig(icas$`5`,
              save_path = file.path(man_img_dir, "mixing_matrix_5.pdf"))
```

Variable



Loading

Questionnaire

ASIQ
BAM
BITE
DRSP
INQ
Misc
PANAS

```
## pdf
## 2
fancy_mix_fig(icas$`10`, n_row = 2,
              save_path = file.path(man_img_dir, "mixing_matrix_10.pdf"),
              width = 15, height = 15)
```

Variable



Questionnaire

- ASI
- BAM
- BITe
- DRSP
- INQ
- Misc
- PANAS

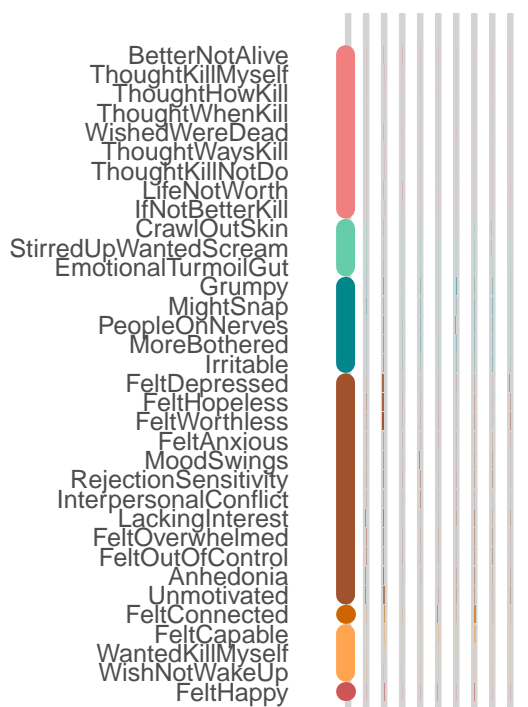
Loading

```
## pdf
## 2
fancy_mix_fig(icas$`20`, n_row = 2, lims = c(-0.6, 0.6),
              save_path = file.path(man_img_dir, "mixing_matrix_20.pdf"),
              width = 15, height = 15)
```

Variable



Questionnaire



Loading

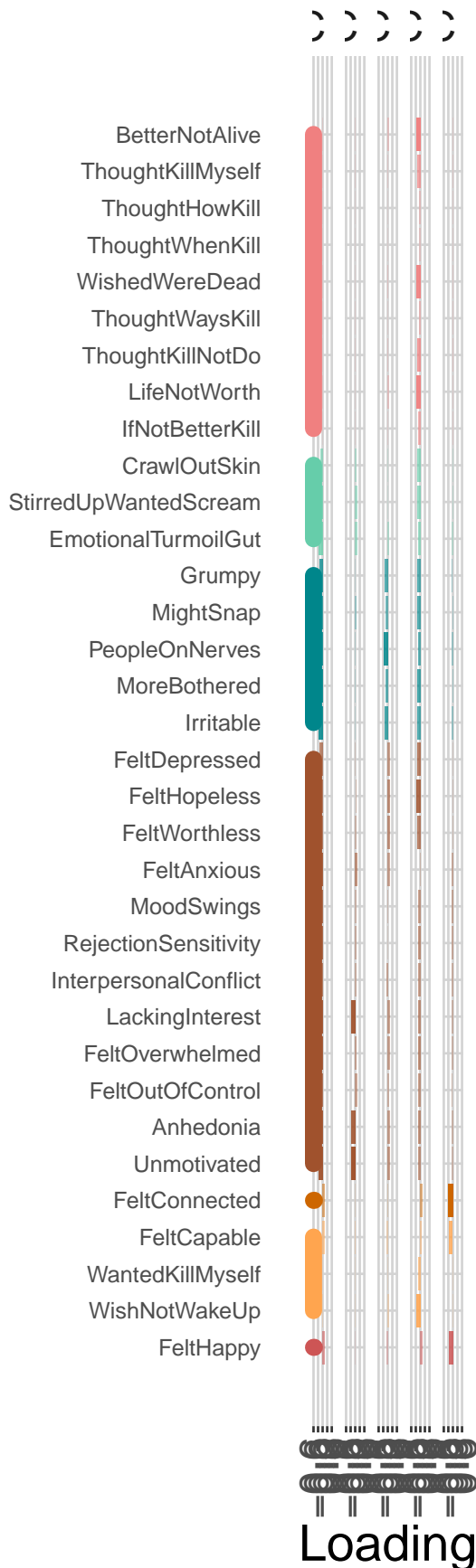

```
## pdf
## 2
```

Within-subject mean-centring

```
ica_norm <- run_icas(dat_path = file.path(dat_dir, "dat_reg_fragmented.rds"),
                    ns_comp = c(5), sub_norm = TRUE)[[1]]

fancy_mix_fig(ica_norm,
              lims = c(-0.6, 0.6),
              save_path = file.path(man_img_dir, "mixing_matrix_5_norm.pdf"))
```

Variable



Questionnaire



```
## pdf
## 2
```

Models

This section presents the code and output for running the models. Since validating the model assumptions is a rather space-consuming activity (i.e., lots of plots), it has been delegated to a different file. Take a look at `multilevel_modelling.Rmd` for more information.

```
source(file.path(src_dir, "lmer.R"))
```

Fragmented

```
ls <- prep_reg_dat(
  dat_path = file.path(dat_dir, "dat_reg_fragmented.rds"),
  ica_path = file.path(dat_dir, "dat_reg_frag_icas.rda")
)

## Number of BiAffect cases: 1807
## Number of subjects: 50
## Number of self-report cases: 5712
## Number of subjects: 104
## Complete-case entries in combined data: 1807
## Number of subjects: 50
## Entries in data after filtering out weeks with one observation: 1753
## Number of subjects: 48

dat_reg_frag <- ls$dat_reg
dat_bi <- ls$dat_bi
dat_sr <- ls$dat_sr
icas <- ls$icas
subs <- ls$subs
dates <- ls$dates
dats_c_frag <- ls$dats_c
```

Five components

```
dat_c1_frag <- dats_c_frag[[1]]

m5.frag.X1.nlme <- lme(X1 ~ medianIKD +
  percent95IKD +
  madIKD +
  autocorrectRate +
  backspaceRate +
  totalKeyPresses +
  active +
  upright,
  random = ~ 1 | subject / week,
  data = dat_c1_frag)

m5.frag.all.nlme <- dat_c1_frag %>%
  summarize(across(starts_with("X", ignore.case = FALSE),
    ~ list(update(m5.frag.X1.nlme,
      reformulate(".", cur_column())))))
```

```
estimates_to_csv(file.path(dat_dir, "m5_nlme_p_frag.csv"),
                  m5.frag.all.nlme,
                  include_corrected = TRUE)
```

```
##           X1.beta X1.p' X1.p X2.beta X2.p' X2.p X3.beta
## Median IKD      0.038 0.32   1  0.096 0.016 0.64 0.015
## 95th percentile IKD -0.0083 0.79   1 -0.033 0.31   1 -0.019
## MAD IKD        -0.0073 0.82   1 -0.018 0.59   1 0.051
## Autocorrect rate   0.018 0.51   1 -0.0048 0.87   1 -0.031
## Backspace rate    -0.016 0.51   1  0.029 0.26   1 0.012
## Total number of key presses -0.0043 0.86   1  0.016 0.53   1 -0.027
## Movement rate     0.078 0.0023 0.093 -0.11 7.1e-05 0.0028 -0.0080
## Upright rate      0.034 0.17   1  0.014 0.61   1 0.027
##           X3.p' X3.p X4.beta X4.p' X4.p X5.beta X5.p' X5.p
## Median IKD      0.67   1 -0.097 0.027   1  0.025 0.55   1
## 95th percentile IKD 0.53   1  0.053 0.15   1 -0.020 0.58   1
## MAD IKD        0.098   1  0.059 0.11   1 -0.0014 0.97   1
## Autocorrect rate  0.24   1  0.016 0.62   1 -0.020 0.51   1
## Backspace rate   0.60   1 -0.013 0.64   1  0.0073 0.79   1
## Total number of key presses 0.24   1  0.064 0.023 0.93 -0.054 0.045   1
## Movement rate    0.74   1  0.055 0.062   1 -0.029 0.30   1
## Upright rate     0.26   1  0.018 0.53   1 -0.027 0.33   1
```

Ten components

```
dat_c2_frag <- dats_c_frag[[2]]

m10.frag.X1.nlme <- lme(X1 ~ medianIKD +
                        percent95IKD +
                        madIKD +
                        autocorrectRate +
                        backspaceRate +
                        totalKeyPresses +
                        active +
                        upright,
                        random = ~ 1 | subject / week,
                        data = dat_c2_frag)

m10.frag.all.nlme <- dat_c2_frag %>%
  summarize(across(starts_with("X", ignore.case = FALSE),
                    ~ list(update(m10.frag.X1.nlme,
                                   reformulate(".", cur_column())))))

estimates_to_csv(file.path(dat_dir, "m10_nlme_p_frag.csv"),
                  m10.frag.all.nlme,
                  include_corrected = TRUE,
                  transpose = TRUE)
```

```
##           Upright rate Movement rate Total number of key presses Backspace rate
## X1.beta      -0.00020      -0.051              -0.051              0.019
## X1.p'        0.99        0.088              0.073              0.51
## X1.p         1          1          1          1          1
## X2.beta      -0.059      0.037              -0.0026             -0.033
```

| | | | | |
|-------------|------------------|---------|---------------------|------------|
| ## X2.p' | 0.041 | 0.20 | 0.92 | 0.24 |
| ## X2.p | 1 | 1 | 1 | 1 |
| ## X3.beta | 0.0021 | -0.050 | -0.056 | 0.034 |
| ## X3.p' | 0.95 | 0.12 | 0.063 | 0.25 |
| ## X3.p | 1 | 1 | 1 | 1 |
| ## X4.beta | -0.0063 | -0.030 | -0.0060 | 0.0075 |
| ## X4.p' | 0.79 | 0.20 | 0.79 | 0.74 |
| ## X4.p | 1 | 1 | 1 | 1 |
| ## X5.beta | 0.013 | -0.072 | 0.022 | 0.029 |
| ## X5.p' | 0.61 | 0.0070 | 0.39 | 0.25 |
| ## X5.p | 1 | 0.56 | 1 | 1 |
| ## X6.beta | 0.0043 | 0.042 | 0.063 | -0.021 |
| ## X6.p' | 0.88 | 0.15 | 0.023 | 0.46 |
| ## X6.p | 1 | 1 | 1 | 1 |
| ## X7.beta | -0.082 | 0.042 | -0.014 | -0.00020 |
| ## X7.p' | 0.0045 | 0.15 | 0.61 | 0.99 |
| ## X7.p | 0.36 | 1 | 1 | 1 |
| ## X8.beta | 0.037 | 0.039 | -0.042 | -0.0083 |
| ## X8.p' | 0.20 | 0.17 | 0.13 | 0.76 |
| ## X8.p | 1 | 1 | 1 | 1 |
| ## X9.beta | -0.0056 | -0.026 | 0.0069 | -0.013 |
| ## X9.p' | 0.85 | 0.40 | 0.82 | 0.66 |
| ## X9.p | 1 | 1 | 1 | 1 |
| ## X10.beta | -0.060 | -0.083 | -0.0048 | -0.011 |
| ## X10.p' | 0.032 | 0.0037 | 0.86 | 0.68 |
| ## X10.p | 1 | 0.29 | 1 | 1 |
| ## | Autocorrect rate | MAD IKD | 95th percentile IKD | Median IKD |
| ## X1.beta | 0.0061 | 0.0033 | -0.040 | 0.0091 |
| ## X1.p' | 0.85 | 0.93 | 0.29 | 0.84 |
| ## X1.p | 1 | 1 | 1 | 1 |
| ## X2.beta | -0.013 | 0.0097 | 0.048 | -0.11 |
| ## X2.p' | 0.67 | 0.79 | 0.19 | 0.014 |
| ## X2.p | 1 | 1 | 1 | 1 |
| ## X3.beta | 0.0093 | 0.10 | 0.0034 | -0.12 |
| ## X3.p' | 0.78 | 0.0094 | 0.93 | 0.015 |
| ## X3.p | 1 | 0.75 | 1 | 1 |
| ## X4.beta | -0.033 | 0.019 | -0.011 | 0.0050 |
| ## X4.p' | 0.19 | 0.51 | 0.72 | 0.89 |
| ## X4.p | 1 | 1 | 1 | 1 |
| ## X5.beta | -0.019 | -0.054 | -0.013 | 0.071 |
| ## X5.p' | 0.51 | 0.11 | 0.69 | 0.072 |
| ## X5.p | 1 | 1 | 1 | 1 |
| ## X6.beta | 0.012 | 0.074 | 0.050 | -0.091 |
| ## X6.p' | 0.70 | 0.040 | 0.17 | 0.035 |
| ## X6.p | 1 | 1 | 1 | 1 |
| ## X7.beta | -0.025 | -0.045 | 0.041 | 0.064 |
| ## X7.p' | 0.43 | 0.22 | 0.26 | 0.14 |
| ## X7.p | 1 | 1 | 1 | 1 |
| ## X8.beta | -0.028 | 0.051 | -0.0038 | -0.037 |
| ## X8.p' | 0.36 | 0.16 | 0.92 | 0.39 |
| ## X8.p | 1 | 1 | 1 | 1 |
| ## X9.beta | -0.019 | -0.022 | -0.026 | 0.064 |
| ## X9.p' | 0.56 | 0.57 | 0.50 | 0.17 |
| ## X9.p | 1 | 1 | 1 | 1 |

| | | | | |
|-------------|--------|-------|--------|-------|
| ## X10.beta | -0.029 | 0.018 | 0.0015 | 0.022 |
| ## X10.p' | 0.35 | 0.62 | 0.97 | 0.60 |
| ## X10.p | 1 | 1 | 1 | 1 |

Twenty components

```
dat_c3_frag <- dats_c_frag[[3]]

m20_frag.X1.nlme <- lme(X1 ~ medianIKD +
  percent95IKD +
  madIKD +
  autocorrectRate +
  backspaceRate +
  totalKeyPresses +
  active +
  upright,
  random = ~ 1 | subject / week,
  data = dat_c3_frag)

m20_frag.all.nlme <- dat_c3_frag %>%
  summarize(across(starts_with("X", ignore.case = FALSE),
    ~ list(update(m20_frag.X1.nlme,
      reformulate(".", cur_column())))))

estimates_to_csv(file.path(dat_dir, "m20_nlme_p_frag.csv"),
  m20_frag.all.nlme,
  include_corrected = TRUE,
  transpose = TRUE)
```

| ## | Upright rate | Movement rate | Total number of key presses | Backspace rate |
|------------|--------------|---------------|-----------------------------|----------------|
| ## X1.beta | -0.072 | 0.014 | -0.030 | 0.034 |
| ## X1.p' | 0.017 | 0.66 | 0.30 | 0.25 |
| ## X1.p | 1 | 1 | 1 | 1 |
| ## X2.beta | -0.021 | 0.042 | 0.070 | -0.040 |
| ## X2.p' | 0.49 | 0.17 | 0.016 | 0.17 |
| ## X2.p | 1 | 1 | 1 | 1 |
| ## X3.beta | 0.0014 | 0.058 | 0.018 | 0.044 |
| ## X3.p' | 0.96 | 0.061 | 0.54 | 0.13 |
| ## X3.p | 1 | 1 | 1 | 1 |
| ## X4.beta | 0.077 | -0.041 | -0.0027 | 0.053 |
| ## X4.p' | 0.0077 | 0.16 | 0.92 | 0.060 |
| ## X4.p | 1 | 1 | 1 | 1 |
| ## X5.beta | -0.045 | 0.031 | 0.019 | -0.011 |
| ## X5.p' | 0.13 | 0.30 | 0.51 | 0.69 |
| ## X5.p | 1 | 1 | 1 | 1 |
| ## X6.beta | 0.037 | 0.014 | 0.057 | -0.041 |
| ## X6.p' | 0.24 | 0.66 | 0.061 | 0.17 |
| ## X6.p | 1 | 1 | 1 | 1 |
| ## X7.beta | 0.024 | -0.14 | 0.0060 | 0.022 |
| ## X7.p' | 0.38 | 9.7e-07 | 0.82 | 0.40 |
| ## X7.p | 1 | 0.00015 | 1 | 1 |
| ## X8.beta | -0.045 | 0.0044 | -0.0081 | -0.019 |
| ## X8.p' | 0.11 | 0.88 | 0.77 | 0.50 |
| ## X8.p | 1 | 1 | 1 | 1 |

| | | | | |
|-------------|------------------|---------|---------------------|------------|
| ## X9.beta | -0.069 | -0.034 | -0.058 | 0.0096 |
| ## X9.p' | 0.029 | 0.28 | 0.054 | 0.75 |
| ## X9.p | 1 | 1 | 1 | 1 |
| ## X10.beta | -0.044 | 0.025 | 0.0025 | -0.0038 |
| ## X10.p' | 0.083 | 0.33 | 0.92 | 0.88 |
| ## X10.p | 1 | 1 | 1 | 1 |
| ## X11.beta | -0.017 | -0.0010 | -0.030 | 0.027 |
| ## X11.p' | 0.58 | 0.97 | 0.32 | 0.36 |
| ## X11.p | 1 | 1 | 1 | 1 |
| ## X12.beta | 0.023 | 0.0027 | 0.017 | -0.0065 |
| ## X12.p' | 0.46 | 0.93 | 0.56 | 0.83 |
| ## X12.p | 1 | 1 | 1 | 1 |
| ## X13.beta | -0.042 | -0.042 | 0.050 | -0.0089 |
| ## X13.p' | 0.13 | 0.14 | 0.068 | 0.74 |
| ## X13.p | 1 | 1 | 1 | 1 |
| ## X14.beta | 0.088 | 0.0092 | -0.0037 | 0.014 |
| ## X14.p' | 0.0047 | 0.77 | 0.90 | 0.64 |
| ## X14.p | 0.76 | 1 | 1 | 1 |
| ## X15.beta | 0.021 | -0.049 | -0.036 | 0.029 |
| ## X15.p' | 0.48 | 0.11 | 0.22 | 0.32 |
| ## X15.p | 1 | 1 | 1 | 1 |
| ## X16.beta | -0.018 | -0.032 | -0.015 | -0.027 |
| ## X16.p' | 0.58 | 0.34 | 0.64 | 0.39 |
| ## X16.p | 1 | 1 | 1 | 1 |
| ## X17.beta | -0.031 | -0.028 | 0.020 | 0.023 |
| ## X17.p' | 0.33 | 0.38 | 0.51 | 0.44 |
| ## X17.p | 1 | 1 | 1 | 1 |
| ## X18.beta | -0.015 | -0.040 | -0.018 | -0.030 |
| ## X18.p' | 0.62 | 0.18 | 0.52 | 0.29 |
| ## X18.p | 1 | 1 | 1 | 1 |
| ## X19.beta | 0.0057 | 0.027 | -0.0097 | -0.0015 |
| ## X19.p' | 0.85 | 0.37 | 0.74 | 0.96 |
| ## X19.p | 1 | 1 | 1 | 1 |
| ## X20.beta | 0.042 | -0.042 | 0.048 | -0.040 |
| ## X20.p' | 0.20 | 0.21 | 0.12 | 0.20 |
| ## X20.p | 1 | 1 | 1 | 1 |
| ## | Autocorrect rate | MAD IKD | 95th percentile IKD | Median IKD |
| ## X1.beta | -0.066 | -0.050 | 0.035 | 0.062 |
| ## X1.p' | 0.044 | 0.19 | 0.35 | 0.17 |
| ## X1.p | 1 | 1 | 1 | 1 |
| ## X2.beta | 0.025 | 0.052 | 0.084 | -0.077 |
| ## X2.p' | 0.45 | 0.17 | 0.026 | 0.088 |
| ## X2.p | 1 | 1 | 1 | 1 |
| ## X3.beta | -0.049 | 0.025 | -0.044 | -0.034 |
| ## X3.p' | 0.13 | 0.52 | 0.25 | 0.46 |
| ## X3.p | 1 | 1 | 1 | 1 |
| ## X4.beta | -0.0033 | 0.0021 | -0.050 | 0.066 |
| ## X4.p' | 0.92 | 0.95 | 0.18 | 0.13 |
| ## X4.p | 1 | 1 | 1 | 1 |
| ## X5.beta | -0.021 | -0.049 | 0.061 | 0.030 |
| ## X5.p' | 0.51 | 0.20 | 0.11 | 0.50 |
| ## X5.p | 1 | 1 | 1 | 1 |
| ## X6.beta | -0.011 | 0.020 | 0.047 | -0.082 |
| ## X6.p' | 0.75 | 0.62 | 0.23 | 0.081 |

| | | | | |
|-------------|----------|---------|---------|---------|
| ## X6.p | 1 | 1 | 1 | 1 |
| ## X7.beta | -0.030 | 0.054 | -0.023 | -0.024 |
| ## X7.p' | 0.31 | 0.11 | 0.50 | 0.56 |
| ## X7.p | 1 | 1 | 1 | 1 |
| ## X8.beta | 0.017 | -0.054 | -0.023 | 0.14 |
| ## X8.p' | 0.58 | 0.13 | 0.51 | 0.00099 |
| ## X8.p | 1 | 1 | 1 | 0.16 |
| ## X9.beta | 0.029 | 0.061 | -0.041 | -0.048 |
| ## X9.p' | 0.37 | 0.13 | 0.31 | 0.32 |
| ## X9.p | 1 | 1 | 1 | 1 |
| ## X10.beta | -0.032 | -0.021 | 0.0081 | 0.044 |
| ## X10.p' | 0.24 | 0.51 | 0.80 | 0.25 |
| ## X10.p | 1 | 1 | 1 | 1 |
| ## X11.beta | 0.023 | 0.043 | 0.00091 | -0.082 |
| ## X11.p' | 0.49 | 0.29 | 0.98 | 0.084 |
| ## X11.p | 1 | 1 | 1 | 1 |
| ## X12.beta | 0.022 | 0.0073 | 0.041 | -0.0027 |
| ## X12.p' | 0.51 | 0.85 | 0.31 | 0.95 |
| ## X12.p | 1 | 1 | 1 | 1 |
| ## X13.beta | 0.032 | -0.095 | 0.020 | 0.091 |
| ## X13.p' | 0.30 | 0.0079 | 0.57 | 0.033 |
| ## X13.p | 1 | 1 | 1 | 1 |
| ## X14.beta | 0.0077 | -0.023 | -0.031 | 0.032 |
| ## X14.p' | 0.82 | 0.56 | 0.43 | 0.49 |
| ## X14.p | 1 | 1 | 1 | 1 |
| ## X15.beta | -0.040 | -0.0081 | 0.0032 | -0.047 |
| ## X15.p' | 0.22 | 0.83 | 0.93 | 0.30 |
| ## X15.p | 1 | 1 | 1 | 1 |
| ## X16.beta | 0.051 | 0.11 | -0.024 | -0.10 |
| ## X16.p' | 0.14 | 0.0082 | 0.57 | 0.035 |
| ## X16.p | 1 | 1 | 1 | 1 |
| ## X17.beta | -0.063 | -0.054 | -0.094 | 0.11 |
| ## X17.p' | 0.059 | 0.19 | 0.021 | 0.027 |
| ## X17.p | 1 | 1 | 1 | 1 |
| ## X18.beta | 0.0011 | 0.082 | 0.0060 | -0.086 |
| ## X18.p' | 0.97 | 0.026 | 0.87 | 0.051 |
| ## X18.p | 1 | 1 | 1 | 1 |
| ## X19.beta | 0.0067 | 0.0078 | -0.023 | 0.025 |
| ## X19.p' | 0.84 | 0.84 | 0.54 | 0.58 |
| ## X19.p | 1 | 1 | 1 | 1 |
| ## X20.beta | -0.00069 | 0.0062 | -0.022 | -0.0040 |
| ## X20.p' | 0.98 | 0.88 | 0.59 | 0.94 |
| ## X20.p | 1 | 1 | 1 | 1 |

Semi-contiguous

```
ls <- prep_reg_dat(
  dat_path = file.path(dat_dir, "dat_reg_semi_contiguous.rds"),
  ica_path = file.path(dat_dir, "dat_reg_contig_icas.rda")
)
```

```
## Number of BiAffect cases: 2336
## Number of subjects: 50
## Number of self-report cases: 4215
```



```
## Number of subjects: 98
## Complete-case entries in combined data: 1454
## Number of subjects: 45
## Entries in data after filtering out weeks with one observation: 1423
## Number of subjects: 43

dat_reg_contig <- ls$dat_reg
dat_bi <- ls$dat_bi
dat_sr <- ls$dat_sr
icas <- ls$icas
subs <- ls$subs
dates <- ls$dates
dats_c <- ls$dats_c
```

Five components

```
dat_c1 <- dats_c[[1]]

m5.X1.nlme <- lme(X1 ~ medianIKD +
  percent95IKD +
  madIKD +
  autocorrectRate +
  backspaceRate +
  totalKeyPresses +
  active +
  upright,
  random = ~ 1 | subject / week,
  data = dat_c1)

m5.all.nlme <- dat_c1 %>%
  summarize(across(starts_with("X", ignore.case = FALSE),
    ~ list(update(m5.X1.nlme, reformulate(".", cur_column())))))

estimates_to_csv(file.path(dat_dir, "m5_nlme_p.csv"),
  m5.all.nlme,
  include_corrected = TRUE)
```

| | | | | | | | | |
|--------------------------------|---------|---------|---------|---------|-------|---------|---------|------|
| ## | X1.beta | X1.p' | X1.p | X2.beta | X2.p' | X2.p | X3.beta | |
| ## Median IKD | -0.044 | 0.26 | 1 | -0.093 | 0.044 | 1 | -0.030 | |
| ## 95th percentile IKD | -0.0082 | 0.80 | 1 | 0.031 | 0.43 | 1 | -0.032 | |
| ## MAD IKD | 0.026 | 0.43 | 1 | 0.058 | 0.14 | 1 | 0.036 | |
| ## Autocorrect rate | 0.0011 | 0.97 | 1 | -0.0067 | 0.85 | 1 | -0.042 | |
| ## Backspace rate | -0.028 | 0.28 | 1 | -0.012 | 0.69 | 1 | -0.017 | |
| ## Total number of key presses | -0.014 | 0.60 | 1 | 0.045 | 0.14 | 1 | -0.042 | |
| ## Movement rate | 0.12 | 5.2e-06 | 0.00021 | 0.039 | 0.21 | 1 | -0.023 | |
| ## Upright rate | 0.045 | 0.088 | 1 | 0.026 | 0.41 | 1 | -0.0065 | |
| ## | X3.p' | X3.p | X4.beta | X4.p' | X4.p | X5.beta | X5.p' | X5.p |
| ## Median IKD | 0.43 | 1 | -0.091 | 0.045 | 1 | 0.086 | 0.065 | 1 |
| ## 95th percentile IKD | 0.31 | 1 | 0.026 | 0.49 | 1 | -0.039 | 0.33 | 1 |
| ## MAD IKD | 0.26 | 1 | 0.046 | 0.23 | 1 | -0.014 | 0.72 | 1 |
| ## Autocorrect rate | 0.13 | 1 | 0.011 | 0.75 | 1 | 0.0020 | 0.95 | 1 |
| ## Backspace rate | 0.48 | 1 | -0.022 | 0.45 | 1 | 0.052 | 0.088 | 1 |
| ## Total number of key presses | 0.089 | 1 | 0.049 | 0.097 | 1 | 0.0079 | 0.80 | 1 |
| ## Movement rate | 0.37 | 1 | 0.044 | 0.15 | 1 | 0.0017 | 0.96 | 1 |

```
## Upright rate          0.80    1 -0.0088  0.77    1    0.030  0.34    1
```

Ten components

```
dat_c2 <- dat_c[[2]]

m10.X1.nlme <- lme(X1 ~ medianIKD +
                  percent95IKD +
                  madIKD +
                  autocorrectRate +
                  backspaceRate +
                  totalKeyPresses +
                  active +
                  upright,
                  random = ~ 1 | subject / week,
                  data = dat_c2)

m10.all.nlme <- dat_c2 %>%
  summarize(across(starts_with("X", ignore.case = FALSE),
    ~ list(update(m10.X1.nlme, reformulate(".", cur_column())))))

estimates_to_csv(file.path(dat_dir, "m10_nlme_p.csv"),
  m10.all.nlme,
  include_corrected = TRUE)
```

```
##          X1.beta X1.p' X1.p X2.beta X2.p' X2.p X3.beta X3.p'
## Median IKD      0.064 0.21    1   0.072 0.13    1  -0.097 0.055
## 95th percentile IKD -0.023 0.60    1  -0.046 0.25    1   0.028 0.51
## MAD IKD         -0.028 0.53    1  -0.051 0.20    1   0.075 0.084
## Autocorrect rate  -0.013 0.72    1   0.026 0.47    1   0.010 0.78
## Backspace rate    0.0021 0.95    1   0.011 0.73    1   0.018 0.58
## Total number of key presses -0.0021 0.95    1  -0.051 0.10    1  -0.054 0.10
## Movement rate     -0.032 0.34    1  -0.036 0.26    1  -0.063 0.065
## Upright rate      0.0085 0.80    1   0.011 0.73    1  -0.016 0.63
##          X3.p X4.beta X4.p' X4.p X5.beta X5.p' X5.p X6.beta
## Median IKD      1   0.022 0.58    1   0.069 0.13    1   0.051
## 95th percentile IKD 1  -0.029 0.38    1   0.012 0.75    1   0.013
## MAD IKD         1   0.0061 0.86    1  -0.026 0.50    1  -0.048
## Autocorrect rate 1  -0.029 0.32    1   0.038 0.26    1   0.0079
## Backspace rate    1  -0.011 0.66    1   0.0082 0.78    1   0.031
## Total number of key presses 1 -0.012 0.65    1   0.070 0.021    1   0.011
## Movement rate     1  -0.050 0.058    1  -0.025 0.42    1  -0.053
## Upright rate      1  -0.027 0.30    1  -0.040 0.20    1  -0.012
##          X6.p' X6.p X7.beta X7.p' X7.p X8.beta X8.p' X8.p
## Median IKD      0.23    1  -0.069 0.15    1   0.13 0.0055 0.44
## 95th percentile IKD 0.72    1  -0.057 0.17    1  -0.045 0.26    1
## MAD IKD         0.18    1   0.046 0.27    1  -0.027 0.50    1
## Autocorrect rate 0.80    1   0.036 0.33    1   0.017 0.64    1
## Backspace rate   0.26    1  -0.016 0.62    1   0.064 0.041    1
## Total number of key presses 0.69    1   0.010 0.75    1   0.021 0.50    1
## Movement rate    0.064    1  -0.053 0.10    1  -0.020 0.53    1
## Upright rate     0.68    1   0.082 0.013    1   0.025 0.43    1
##          X9.beta X9.p' X9.p X10.beta X10.p' X10.p
## Median IKD      0.063   0.16    1  -0.0010 0.98    1
```

| | | | | | | |
|--------------------------------|--------|--------|------|---------|------|---|
| ## 95th percentile IKD | -0.020 | 0.61 | 1 | -0.0075 | 0.85 | 1 |
| ## MAD IKD | -0.054 | 0.16 | 1 | 0.014 | 0.73 | 1 |
| ## Autocorrect rate | -0.011 | 0.74 | 1 | 0.041 | 0.24 | 1 |
| ## Backspace rate | 0.0050 | 0.87 | 1 | 0.014 | 0.66 | 1 |
| ## Total number of key presses | -0.036 | 0.23 | 1 | -0.0072 | 0.82 | 1 |
| ## Movement rate | -0.085 | 0.0056 | 0.45 | 0.039 | 0.22 | 1 |
| ## Upright rate | -0.016 | 0.61 | 1 | 0.046 | 0.15 | 1 |

Twenty components

```
dat_c3 <- dats_c[[3]]

m20.X1.nlme <- lme(X1 ~ medianIKD +
  percent95IKD +
  madIKD +
  autocorrectRate +
  backspaceRate +
  totalKeyPresses +
  active +
  upright,
  random = ~ 1 | subject / week,
  data = dat_c3)

m20.all.nlme <- dat_c3 %>%
  summarize(across(starts_with("X", ignore.case = FALSE),
    ~ list(update(m20.X1.nlme, reformulate(".", cur_column())))))

estimates_to_csv(file.path(dat_dir, "m20_nlme_p.csv"),
  m20.all.nlme,
  include_corrected = TRUE)
```

| ## | X1.beta | X1.p' | X1.p | X2.beta | X2.p' | X2.p | X3.beta | |
|--------------------------------|---------|-------|---------|---------|--------|---------|---------|-------|
| ## Median IKD | 0.051 | 0.34 | 1 | 0.011 | 0.82 | 1 | 0.034 | |
| ## 95th percentile IKD | -0.017 | 0.72 | 1 | 0.013 | 0.76 | 1 | -0.037 | |
| ## MAD IKD | -0.068 | 0.15 | 1 | -0.035 | 0.40 | 1 | 0.0082 | |
| ## Autocorrect rate | -0.037 | 0.34 | 1 | -0.051 | 0.16 | 1 | -0.073 | |
| ## Backspace rate | 0.020 | 0.57 | 1 | 0.082 | 0.0096 | 1 | 0.049 | |
| ## Total number of key presses | -0.035 | 0.31 | 1 | -0.012 | 0.71 | 1 | 0.022 | |
| ## Movement rate | 0.0045 | 0.90 | 1 | 0.011 | 0.75 | 1 | 0.012 | |
| ## Upright rate | -0.018 | 0.62 | 1 | -0.0078 | 0.81 | 1 | 0.031 | |
| ## | X3.p' | X3.p | X4.beta | X4.p' | X4.p | X5.beta | X5.p' | X5.p |
| ## Median IKD | 0.49 | 1 | -0.028 | 0.57 | 1 | 0.14 | 0.0067 | 1 |
| ## 95th percentile IKD | 0.38 | 1 | -0.0064 | 0.88 | 1 | -0.018 | 0.70 | 1 |
| ## MAD IKD | 0.85 | 1 | -0.017 | 0.69 | 1 | -0.088 | 0.051 | 1 |
| ## Autocorrect rate | 0.047 | 1 | -0.029 | 0.43 | 1 | -0.030 | 0.43 | 1 |
| ## Backspace rate | 0.13 | 1 | 0.030 | 0.36 | 1 | 0.027 | 0.43 | 1 |
| ## Total number of key presses | 0.51 | 1 | 0.0085 | 0.80 | 1 | -0.047 | 0.17 | 1 |
| ## Movement rate | 0.73 | 1 | -0.0071 | 0.84 | 1 | 0.015 | 0.67 | 1 |
| ## Upright rate | 0.36 | 1 | 0.00087 | 0.98 | 1 | 0.013 | 0.72 | 1 |
| ## | X6.beta | X6.p' | X6.p | X7.beta | X7.p' | X7.p | X8.beta | X8.p' |
| ## Median IKD | 0.074 | 0.13 | 1 | -0.020 | 0.67 | 1 | 0.097 | 0.034 |
| ## 95th percentile IKD | -0.062 | 0.14 | 1 | -0.040 | 0.31 | 1 | 0.031 | 0.43 |
| ## MAD IKD | -0.023 | 0.59 | 1 | 0.0029 | 0.94 | 1 | -0.059 | 0.14 |
| ## Autocorrect rate | -0.0034 | 0.92 | 1 | 0.013 | 0.71 | 1 | 0.029 | 0.39 |

| | | | | | | | | |
|--------------------------------|----------|---------|-------|----------|----------|---------|---------|-------|
| ## Backspace rate | 0.036 | 0.26 | 1 | -0.014 | 0.64 | 1 | -0.0089 | 0.76 |
| ## Total number of key presses | -0.031 | 0.33 | 1 | -0.044 | 0.16 | 1 | 0.075 | 0.012 |
| ## Movement rate | -0.0049 | 0.88 | 1 | -0.035 | 0.27 | 1 | -0.045 | 0.15 |
| ## Upright rate | -0.0027 | 0.93 | 1 | 0.024 | 0.45 | 1 | -0.035 | 0.25 |
| ## | X8.p | X9.beta | X9.p' | X9.p | X10.beta | X10.p' | X10.p | |
| ## Median IKD | 1 | -0.10 | 0.039 | 1 | 0.0092 | 0.85 | 1 | |
| ## 95th percentile IKD | 1 | 0.029 | 0.47 | 1 | -0.0032 | 0.94 | 1 | |
| ## MAD IKD | 1 | 0.046 | 0.27 | 1 | 0.018 | 0.67 | 1 | |
| ## Autocorrect rate | 1 | -0.019 | 0.59 | 1 | 0.0021 | 0.95 | 1 | |
| ## Backspace rate | 1 | -0.048 | 0.13 | 1 | -0.023 | 0.48 | 1 | |
| ## Total number of key presses | 1 | -0.017 | 0.60 | 1 | 0.030 | 0.35 | 1 | |
| ## Movement rate | 1 | -0.065 | 0.048 | 1 | 0.12 | 0.00032 | 0.052 | |
| ## Upright rate | 1 | -0.0078 | 0.81 | 1 | -0.052 | 0.11 | 1 | |
| ## | X11.beta | X11.p' | X11.p | X12.beta | X12.p' | X12.p | | |
| ## Median IKD | -0.011 | 0.83 | 1 | -0.090 | 0.083 | 1 | | |
| ## 95th percentile IKD | -0.055 | 0.23 | 1 | 0.039 | 0.38 | 1 | | |
| ## MAD IKD | 0.017 | 0.71 | 1 | -0.014 | 0.75 | 1 | | |
| ## Autocorrect rate | 0.0055 | 0.88 | 1 | -0.070 | 0.070 | 1 | | |
| ## Backspace rate | -0.011 | 0.75 | 1 | -0.035 | 0.30 | 1 | | |
| ## Total number of key presses | -0.028 | 0.41 | 1 | -0.011 | 0.74 | 1 | | |
| ## Movement rate | -0.047 | 0.18 | 1 | 0.018 | 0.60 | 1 | | |
| ## Upright rate | -0.069 | 0.049 | 1 | -0.0082 | 0.82 | 1 | | |
| ## | X13.beta | X13.p' | X13.p | X14.beta | X14.p' | X14.p | | |
| ## Median IKD | 0.025 | 0.56 | 1 | -0.087 | 0.095 | 1 | | |
| ## 95th percentile IKD | -0.036 | 0.31 | 1 | 0.071 | 0.11 | 1 | | |
| ## MAD IKD | -0.0019 | 0.96 | 1 | 0.040 | 0.37 | 1 | | |
| ## Autocorrect rate | -0.020 | 0.52 | 1 | -0.042 | 0.27 | 1 | | |
| ## Backspace rate | 0.020 | 0.46 | 1 | -0.019 | 0.58 | 1 | | |
| ## Total number of key presses | 0.014 | 0.61 | 1 | 0.084 | 0.014 | 1 | | |
| ## Movement rate | 0.090 | 0.0017 | 0.27 | -0.0043 | 0.90 | 1 | | |
| ## Upright rate | 0.029 | 0.32 | 1 | 0.037 | 0.30 | 1 | | |
| ## | X15.beta | X15.p' | X15.p | X16.beta | X16.p' | X16.p | | |
| ## Median IKD | -0.014 | 0.80 | 1 | -0.021 | 0.66 | 1 | | |
| ## 95th percentile IKD | -0.023 | 0.62 | 1 | -0.091 | 0.024 | 1 | | |
| ## MAD IKD | 0.042 | 0.38 | 1 | 0.057 | 0.16 | 1 | | |
| ## Autocorrect rate | 0.0090 | 0.82 | 1 | 0.032 | 0.36 | 1 | | |
| ## Backspace rate | 0.040 | 0.25 | 1 | 0.015 | 0.62 | 1 | | |
| ## Total number of key presses | -0.048 | 0.18 | 1 | -0.029 | 0.35 | 1 | | |
| ## Movement rate | 0.029 | 0.43 | 1 | -0.013 | 0.69 | 1 | | |
| ## Upright rate | -0.043 | 0.24 | 1 | 0.029 | 0.37 | 1 | | |
| ## | X17.beta | X17.p' | X17.p | X18.beta | X18.p' | X18.p | | |
| ## Median IKD | 0.21 | 6.7e-05 | 0.011 | -0.018 | 0.66 | 1 | | |
| ## 95th percentile IKD | -0.13 | 0.0031 | 0.50 | 0.011 | 0.75 | 1 | | |
| ## MAD IKD | -0.099 | 0.029 | 1 | -0.0069 | 0.84 | 1 | | |
| ## Autocorrect rate | -0.083 | 0.031 | 1 | 0.045 | 0.14 | 1 | | |
| ## Backspace rate | 0.046 | 0.17 | 1 | 0.020 | 0.45 | 1 | | |
| ## Total number of key presses | 0.030 | 0.39 | 1 | -0.012 | 0.66 | 1 | | |
| ## Movement rate | -0.051 | 0.15 | 1 | 0.018 | 0.51 | 1 | | |
| ## Upright rate | -0.022 | 0.53 | 1 | 0.054 | 0.051 | 1 | | |
| ## | X19.beta | X19.p' | X19.p | X20.beta | X20.p' | X20.p | | |
| ## Median IKD | 0.051 | 0.28 | 1 | 0.036 | 0.48 | 1 | | |
| ## 95th percentile IKD | 0.035 | 0.38 | 1 | -0.026 | 0.55 | 1 | | |
| ## MAD IKD | -0.018 | 0.65 | 1 | -0.027 | 0.53 | 1 | | |
| ## Autocorrect rate | -0.029 | 0.41 | 1 | 0.029 | 0.44 | 1 | | |

| | | | | | | |
|--------------------------------|--------|--------|------|-------|-------|---|
| ## Backspace rate | 0.0023 | 0.94 | 1 | 0.017 | 0.60 | 1 |
| ## Total number of key presses | -0.029 | 0.35 | 1 | 0.019 | 0.58 | 1 |
| ## Movement rate | 0.034 | 0.29 | 1 | 0.034 | 0.32 | 1 |
| ## Upright rate | -0.088 | 0.0061 | 0.98 | 0.074 | 0.034 | 1 |