Questionnaire on Well-Being (QWB)

CFA

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Reproducing CFA

```
library(readxl)
library(tidyverse)
```

```
-- Attaching core tidyverse packages ------------------------ tidyverse 2.0.0 --
v dplyr     1.1.4     v readr     2.1.5
v forcats   1.0.0     v stringr   1.5.1
v ggplot2   3.5.1     v tibble    3.2.1
v lubridate 1.9.3     v tidyr     1.3.1
v purrr     1.0.2
-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
i Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to be
```

```
library(lavaan)
```

```
This is lavaan 0.6-18
lavaan is FREE software! Please report any bugs.
```

```
library(patchwork)
```

Questionnaire on Well-Being (QWB), 18 items, each item is scored on a scale of 0 to 4 (Hlynsson et al. 2024). Data from the same paper. We'll use the data from the second study that was used in the CFA in the paper.

Code and data were retrieved from the paper's OSF page. Really great to see these materials made available, it is such an important step towards improving the standards of science!

```
# Read in study two data -----------------------------------------------------
dd <- read_excel("data/study_two.xlsx")

onefactor <- 'f1 =~ swb1 + swb2 + swb3 + swb4 + swb5 + swb6 + swb7 + swb8 +
                    swb9 + swb10 + swb11 + swb12 + swb13 + swb14 + swb15 +
                    swb16 + swb17 + swb18'

# Fit the model to the data
cfamodel <- sem(model = onefactor, data = dd, estimator = "WLSMV")
```

```
Warning: lavaan->lav_options_est_dwls():
   estimator "DWLS" is not recommended for continuous data. Did you forget to
   set the ordered= argument?
```

This warning message is important! For WLSMV to work properly, one also needs to specify `ordered = TRUE`.

Let's see if we can reproduce the fit metrics reported in the paper (p.15), using the output from the misspecified function call above.

```
cfamodel %>% summary(standardized=T, ci=F, fit.measures= TRUE, )
```

```
lavaan 0.6-18 ended normally after 33 iterations
```

```
  Estimator                                         DWLS
  Optimization method                             NLMINB
  Number of model parameters                          36

                                                    Used       Total
  Number of observations                            1561        1795

Model Test User Model:
                                                Standard      Scaled
  Test Statistic                                 603.028    1576.509
  Degrees of freedom                                 135         135
  P-value (Chi-square)                             0.000       0.000
  Scaling correction factor                                    0.391
  Shift parameter                                             33.384
    simple second-order correction

Model Test Baseline Model:

  Test statistic                               40316.305    8701.238
  Degrees of freedom                                 153         153
  P-value                                          0.000       0.000
  Scaling correction factor                                    4.698

User Model versus Baseline Model:

  Comparative Fit Index (CFI)                      0.988       0.831
  Tucker-Lewis Index (TLI)                         0.987       0.809

  Robust Comparative Fit Index (CFI)                           0.986
  Robust Tucker-Lewis Index (TLI)                              0.984

Root Mean Square Error of Approximation:

  RMSEA                                            0.047       0.083
  90 Percent confidence interval - lower           0.043       0.079
  90 Percent confidence interval - upper           0.051       0.086
  P-value H_0: RMSEA <= 0.050                      0.887       0.000
  P-value H_0: RMSEA >= 0.080                      0.000       0.892

  Robust RMSEA                                                 0.052
  90 Percent confidence interval - lower                       0.049
  90 Percent confidence interval - upper                       0.054
  P-value H_0: Robust RMSEA <= 0.050                           0.106
  P-value H_0: Robust RMSEA >= 0.080                           0.000

Standardized Root Mean Square Residual:

  SRMR                                             0.053       0.053
```

```
Parameter Estimates:

  Standard errors                             Robust.sem
  Information                                   Expected
  Information saturated (h1) model          Unstructured

Latent Variables:
                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
  f1 =~
    swb1              1.000                               0.639    0.695
    swb2              0.861    0.035   24.575    0.000    0.550    0.544
    swb3              0.550    0.036   15.121    0.000    0.352    0.413
    swb4              0.876    0.034   25.809    0.000    0.560    0.647
    swb5              0.929    0.039   23.849    0.000    0.594    0.635
    swb6              0.967    0.040   24.054    0.000    0.618    0.656
    swb7              1.064    0.036   29.625    0.000    0.680    0.765
    swb8              1.142    0.034   33.522    0.000    0.730    0.808
    swb9              1.124    0.036   30.957    0.000    0.718    0.780
    swb10             1.182    0.040   29.564    0.000    0.755    0.751
    swb11             1.202    0.045   26.933    0.000    0.768    0.730
    swb12             0.872    0.037   23.385    0.000    0.557    0.654
    swb13             0.707    0.039   17.969    0.000    0.452    0.493
    swb14             0.980    0.035   27.907    0.000    0.626    0.666
    swb15             1.202    0.043   28.182    0.000    0.768    0.743
    swb16             1.104    0.036   30.255    0.000    0.706    0.715
    swb17             1.097    0.040   27.296    0.000    0.701    0.728
    swb18             0.981    0.045   21.770    0.000    0.627    0.587

Variances:
                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
   .swb1              0.436    0.018   24.187    0.000    0.436    0.517
   .swb2              0.721    0.025   28.874    0.000    0.721    0.704
   .swb3              0.601    0.024   24.670    0.000    0.601    0.829
   .swb4              0.435    0.017   25.780    0.000    0.435    0.581
   .swb5              0.523    0.019   27.276    0.000    0.523    0.597
   .swb6              0.506    0.019   26.097    0.000    0.506    0.570
   .swb7              0.327    0.014   22.718    0.000    0.327    0.414
   .swb8              0.283    0.012   23.155    0.000    0.283    0.347
   .swb9              0.332    0.013   25.432    0.000    0.332    0.392
   .swb10             0.441    0.018   24.399    0.000    0.441    0.436
   .swb11             0.518    0.022   23.263    0.000    0.518    0.468
   .swb12             0.415    0.017   24.855    0.000    0.415    0.572
   .swb13             0.634    0.022   28.570    0.000    0.634    0.757
   .swb14             0.493    0.019   26.580    0.000    0.493    0.557
   .swb15             0.480    0.020   24.323    0.000    0.480    0.449
   .swb16             0.476    0.019   25.534    0.000    0.476    0.489
   .swb17             0.436    0.019   22.826    0.000    0.436    0.470
   .swb18             0.749    0.028   26.616    0.000    0.749    0.656
    f1                0.408    0.026   15.931    0.000    1.000    1.000
```

The "standard" column in the output looks like what has been reported in the paper (see quote below) regarding 2, RMSEA, and CFI. Good to see that it is reproducible.

> A single-factor solution for the Confirmatory factor analysis for the Questionnaire on Well-Being. QWB resulted in a good fit for the data: 2(135) = 603.03, p < 0.001, CFI = 0.988, SRMR = 0.053, RMSEA = 0.047 [90% CI: 0.043, 0.051]. Thus, our single- factor model for the QWB exhibits all of our predetermined criteria for a good model fit.

Let's run the CFA function call with `ordered = TRUE` added to make the WLSMV estimator, which was correctly described in the paper, work as intended.

```
cfamodel2 <- sem(model = onefactor, data = dd, estimator = "WLSMV", ordered = TRUE)
cfamodel2 %>% summary(standardized=T, ci=F, fit.measures= TRUE, )
```

```
lavaan 0.6-18 ended normally after 34 iterations

  Estimator                                         DWLS
  Optimization method                             NLMINB
  Number of model parameters                          90

                                                    Used       Total
  Number of observations                            1561        1795

Model Test User Model:
                                                Standard      Scaled
  Test Statistic                                1832.971    2940.978
  Degrees of freedom                                 135         135
  P-value (Chi-square)                             0.000       0.000
  Scaling correction factor                                    0.630
  Shift parameter                                             32.413
    simple second-order correction

Model Test Baseline Model:

  Test statistic                              131413.959   40457.340
  Degrees of freedom                                 153         153
  P-value                                          0.000       0.000
  Scaling correction factor                                    3.257

User Model versus Baseline Model:

  Comparative Fit Index (CFI)                      0.987       0.930
  Tucker-Lewis Index (TLI)                         0.985       0.921

  Robust Comparative Fit Index (CFI)                           0.831
  Robust Tucker-Lewis Index (TLI)                              0.808
```

```
Root Mean Square Error of Approximation:

  RMSEA                                          0.090       0.115
  90 Percent confidence interval - lower         0.086       0.112
  90 Percent confidence interval - upper         0.093       0.119
  P-value H_0: RMSEA <= 0.050                    0.000       0.000
  P-value H_0: RMSEA >= 0.080                    1.000       1.000

  Robust RMSEA                                               0.126
  90 Percent confidence interval - lower                     0.122
  90 Percent confidence interval - upper                     0.130
  P-value H_0: Robust RMSEA <= 0.050                         0.000
  P-value H_0: Robust RMSEA >= 0.080                         1.000

Standardized Root Mean Square Residual:

  SRMR                                           0.060       0.060

Parameter Estimates:

  Parameterization                               Delta
  Standard errors                           Robust.sem
  Information                                 Expected
  Information saturated (h1) model        Unstructured

Latent Variables:
                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
  f1 =~
    swb1              1.000                                0.740    0.740
    swb2              0.788    0.022   35.977    0.000    0.583    0.583
    swb3              0.614    0.029   21.080    0.000    0.454    0.454
    swb4              0.946    0.021   44.763    0.000    0.700    0.700
    swb5              0.944    0.022   43.672    0.000    0.699    0.699
    swb6              0.940    0.023   41.605    0.000    0.695    0.695
    swb7              1.123    0.020   56.041    0.000    0.831    0.831
    swb8              1.187    0.019   62.155    0.000    0.878    0.878
    swb9              1.112    0.019   59.591    0.000    0.823    0.823
    swb10             1.061    0.020   54.326    0.000    0.785    0.785
    swb11             1.076    0.021   50.727    0.000    0.796    0.796
    swb12             0.954    0.022   42.924    0.000    0.706    0.706
    swb13             0.713    0.026   27.920    0.000    0.527    0.527
    swb14             0.946    0.020   46.765    0.000    0.700    0.700
    swb15             1.064    0.020   52.990    0.000    0.787    0.787
    swb16             1.009    0.019   54.088    0.000    0.747    0.747
    swb17             1.066    0.020   52.085    0.000    0.789    0.789
    swb18             0.840    0.024   35.203    0.000    0.622    0.622

Thresholds:
                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
    swb1|t1          -2.252    0.088  -25.646    0.000   -2.252   -2.252
```

swb1|t2	-1.076	0.039	-27.312	0.000	-1.076	-1.076
swb1|t3	-0.102	0.032	-3.213	0.001	-0.102	-0.102
swb1|t4	1.117	0.040	27.866	0.000	1.117	1.117
swb2|t1	-1.949	0.067	-29.073	0.000	-1.949	-1.949
swb2|t2	-0.847	0.036	-23.368	0.000	-0.847	-0.847
swb2|t3	-0.020	0.032	-0.633	0.527	-0.020	-0.020
swb2|t4	1.082	0.039	27.392	0.000	1.082	1.082
swb3|t1	-2.613	0.129	-20.271	0.000	-2.613	-2.613
swb3|t2	-1.627	0.053	-30.772	0.000	-1.627	-1.627
swb3|t3	-0.886	0.037	-24.149	0.000	-0.886	-0.886
swb3|t4	0.316	0.032	9.776	0.000	0.316	0.316
swb4|t1	-2.341	0.096	-24.399	0.000	-2.341	-2.341
swb4|t2	-1.189	0.041	-28.723	0.000	-1.189	-1.189
swb4|t3	-0.075	0.032	-2.353	0.019	-0.075	-0.075
swb4|t4	1.212	0.042	28.968	0.000	1.212	1.212
swb5|t1	-2.044	0.073	-28.162	0.000	-2.044	-2.044
swb5|t2	-0.908	0.037	-24.557	0.000	-0.908	-0.908
swb5|t3	0.191	0.032	5.993	0.000	0.191	0.191
swb5|t4	1.257	0.043	29.397	0.000	1.257	1.257
swb6|t1	-2.232	0.086	-25.911	0.000	-2.232	-2.232
swb6|t2	-1.151	0.041	-28.285	0.000	-1.151	-1.151
swb6|t3	-0.133	0.032	-4.174	0.000	-0.133	-0.133
swb6|t4	0.948	0.037	25.272	0.000	0.948	0.948
swb7|t1	-2.317	0.094	-24.744	0.000	-2.317	-2.317
swb7|t2	-1.312	0.044	-29.847	0.000	-1.312	-1.312
swb7|t3	-0.208	0.032	-6.498	0.000	-0.208	-0.208
swb7|t4	0.978	0.038	25.798	0.000	0.978	0.978
swb8|t1	-2.294	0.092	-25.065	0.000	-2.294	-2.294
swb8|t2	-1.105	0.040	-27.710	0.000	-1.105	-1.105
swb8|t3	-0.038	0.032	-1.189	0.234	-0.038	-0.038
swb8|t4	1.145	0.041	28.210	0.000	1.145	1.145
swb9|t1	-1.852	0.062	-29.836	0.000	-1.852	-1.852
swb9|t2	-0.602	0.034	-17.755	0.000	-0.602	-0.602
swb9|t3	0.534	0.033	15.978	0.000	0.534	0.534
swb9|t4	1.542	0.050	30.794	0.000	1.542	1.542
swb10|t1	-1.664	0.054	-30.703	0.000	-1.664	-1.664
swb10|t2	-0.645	0.034	-18.832	0.000	-0.645	-0.645
swb10|t3	0.311	0.032	9.625	0.000	0.311	0.311
swb10|t4	1.375	0.045	30.257	0.000	1.375	1.375
swb11|t1	-2.018	0.071	-28.422	0.000	-2.018	-2.018
swb11|t2	-1.099	0.040	-27.631	0.000	-1.099	-1.099
swb11|t3	-0.279	0.032	-8.668	0.000	-0.279	-0.279
swb11|t4	0.598	0.034	17.657	0.000	0.598	0.598
swb12|t1	-2.423	0.104	-23.194	0.000	-2.423	-2.423
swb12|t2	-1.367	0.045	-30.210	0.000	-1.367	-1.367
swb12|t3	-0.092	0.032	-2.909	0.004	-0.092	-0.092
swb12|t4	1.082	0.039	27.392	0.000	1.082	1.082
swb13|t1	-2.070	0.074	-27.876	0.000	-2.070	-2.070
swb13|t2	-1.236	0.042	-29.203	0.000	-1.236	-1.236
swb13|t3	-0.183	0.032	-5.741	0.000	-0.183	-0.183

```
    swb13|t4          1.029    0.039   26.611    0.000    1.029    1.029
    swb14|t1         -1.994    0.070  -28.659    0.000   -1.994   -1.994
    swb14|t2         -0.915    0.037  -24.692    0.000   -0.915   -0.915
    swb14|t3          0.105    0.032    3.314    0.001    0.105    0.105
    swb14|t4          1.275    0.043   29.553    0.000    1.275    1.275
    swb15|t1         -1.718    0.056  -30.542    0.000   -1.718   -1.718
    swb15|t2         -0.842    0.036  -23.275    0.000   -0.842   -0.842
    swb15|t3          0.112    0.032    3.516    0.000    0.112    0.112
    swb15|t4          1.099    0.040   27.631    0.000    1.099    1.099
    swb16|t1         -1.834    0.061  -29.952    0.000   -1.834   -1.834
    swb16|t2         -0.901    0.037  -24.422    0.000   -0.901   -0.901
    swb16|t3          0.075    0.032    2.353    0.019    0.075    0.075
    swb16|t4          1.179    0.041   28.616    0.000    1.179    1.179
    swb17|t1         -2.098    0.076  -27.561    0.000   -2.098   -2.098
    swb17|t2         -1.260    0.043  -29.429    0.000   -1.260   -1.260
    swb17|t3         -0.323    0.032   -9.977    0.000   -0.323   -0.323
    swb17|t4          0.756    0.035   21.440    0.000    0.756    0.756
    swb18|t1         -1.658    0.054  -30.718    0.000   -1.658   -1.658
    swb18|t2         -0.828    0.036  -22.996    0.000   -0.828   -0.828
    swb18|t3          0.010    0.032    0.329    0.742    0.010    0.010
    swb18|t4          1.034    0.039   26.695    0.000    1.034    1.034

Variances:
                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
   .swb1              0.453                               0.453    0.453
   .swb2              0.660                               0.660    0.660
   .swb3              0.794                               0.794    0.794
   .swb4              0.510                               0.510    0.510
   .swb5              0.512                               0.512    0.512
   .swb6              0.517                               0.517    0.517
   .swb7              0.310                               0.310    0.310
   .swb8              0.229                               0.229    0.229
   .swb9              0.323                               0.323    0.323
   .swb10             0.384                               0.384    0.384
   .swb11             0.366                               0.366    0.366
   .swb12             0.502                               0.502    0.502
   .swb13             0.722                               0.722    0.722
   .swb14             0.511                               0.511    0.511
   .swb15             0.380                               0.380    0.380
   .swb16             0.442                               0.442    0.442
   .swb17             0.378                               0.378    0.378
   .swb18             0.614                               0.614    0.614
    f1                0.547    0.018   29.873    0.000    1.000    1.000
```

Before looking closer at the results and making comparisons to the published/reported metrics, we need to address the issue of reporting the correct model fit metrics. For WLSMV, the .scaled metrics should be used.

Also, the Hu & Bentler (1999) cutoff values references in the paper are not appropriate for ordinal data analyzed with the WLSMV estimator (McNeish 2023; Savalei 2018). The R-package `dynamic` can produce appropriate cutoff values for model fit indices. We'll get into that after reviewing the scaled fit metrics.

Scaled fit metrics

Another important issue is reporting the correct model fit metrics. For WLSMV, the .scaled metrics should be used.

```
fit_metrics_scaled <- c("chisq.scaled", "df", "pvalue.scaled",
                        "cfi.scaled", "tli.scaled", "rmsea.scaled",
                        "rmsea.ci.lower.scaled","rmsea.ci.upper.scaled",
                        "srmr")

fitmeasures(cfamodel2, fit_metrics_scaled) %>%
  rbind() %>%
  as.data.frame() %>%
  mutate(across(where(is.numeric),~ round(.x, 3))) %>%
  rename(Chi2.scaled = chisq.scaled,
         p.scaled = pvalue.scaled,
         CFI.scaled = cfi.scaled,
         TLI.scaled = tli.scaled,
         RMSEA.scaled = rmsea.scaled,
         CI_low.scaled = rmsea.ci.lower.scaled,
         CI_high.scaled = rmsea.ci.upper.scaled,
         SRMR = srmr) %>%
  knitr::kable()
```

	Chi2.scaled	df	p.scaled	CFI.scaled	TLI.scaled	RMSEA.scaled	CI_low.scaled	CI_high.scaled	SRMR
.	2940.978	135	0	0.93	0.921	0.115	0.112	0.119	0.06

Again, these were the metrics reported in the paper:

> A single-factor solution for the Confirmatory factor analysis for the Questionnaire on Well-Being. QWB resulted in a good fit for the data: 2(135) = 603.03, p < 0.001, CFI = 0.988, SRMR = 0.053, RMSEA = 0.047 [90% CI: 0.043, 0.051]. Thus, our single- factor model for the QWB exhibits all of our predetermined criteria for a good model fit.

The differences from the model fit metrics output in the table above and found in the paper are partially due to the missing `ordered = TRUE` option, but also from reporting the wrong metrics for the WLSMV estimator.

The correct model fit metrics indicate problems, no matter which cutoffs one would use, especially regarding RMSEA. Let us review the modification indices.

Modification indices

We'll filter the list and only present those with mi/ 2 > 30.

```r
modificationIndices(cfamodel2,
                    standardized = T) %>%
  as.data.frame(row.names = NULL) %>%
  filter(mi > 30) %>%
  arrange(desc(mi)) %>%
  mutate(across(where(is.numeric),~ round(.x, 3))) %>%
  knitr::kable()
```

lhs	op	rhs	mi	epc	sepc.lv	sepc.all	sepc.nox
swb4	~~	swb5	213.550	-0.242	-0.242	-0.474	-0.474
swb5	~~	swb12	155.477	-0.211	-0.211	-0.416	-0.416
swb7	~~	swb8	132.329	-0.143	-0.143	-0.536	-0.536
swb11	~~	swb17	102.493	-0.144	-0.144	-0.388	-0.388
swb1	~~	swb2	78.974	-0.172	-0.172	-0.315	-0.315
swb1	~~	swb16	68.421	-0.138	-0.138	-0.309	-0.309
swb2	~~	swb16	68.162	-0.161	-0.161	-0.298	-0.298
swb5	~~	swb6	63.609	-0.146	-0.146	-0.284	-0.284
swb15	~~	swb17	62.165	-0.117	-0.117	-0.308	-0.308
swb12	~~	swb13	58.963	-0.162	-0.162	-0.269	-0.269
swb13	~~	swb14	48.027	-0.148	-0.148	-0.244	-0.244
swb9	~~	swb18	42.649	-0.120	-0.120	-0.269	-0.269
swb4	~~	swb12	39.141	-0.118	-0.118	-0.233	-0.233
swb2	~~	swb17	34.139	0.137	0.137	0.275	0.275
swb8	~~	swb12	33.173	0.123	0.123	0.363	0.363
swb2	~~	swb3	31.034	-0.132	-0.132	-0.182	-0.182

Many very large mi/ 2 values due to residual correlations.

Dynamic cutoff values

As mentioned earlier, the often used Hu & Bentler (1999) cutoff values are based on simulations of continuous data and ML estimation. In order to establish useful cutoff values for the WLSMV estimator with ordinal data, we need to run simulations relevant to the current set of items and response data (McNeish 2023). This has been implemented in the development version of `dynamic`.

```r
library(dynamic) # devtools::install_github("melissagwolf/dynamic") for development versio
```

```
Beta version. Please report bugs: https://github.com/melissagwolf/dynamic/issues.
```

```r
dyncut <- catOne(cfamodel2, reps = 500)
```

```r
dyncut
```

```
Your DFI cutoffs:
            SRMR  RMSEA CFI
Level-0     0.015 0.011 0.999
Specificity 95%   95%   95%

Level-1     0.026 0.04  0.991
```

```
Sensitivity 95%   95%   95%

Level-2     0.031 0.056 0.983
Sensitivity 95%   95%   95%

Level-3     0.034 0.066 0.977
Sensitivity 95%   95%   95%

Empirical fit indices:
 Chi-Square  df p-value   SRMR   RMSEA    CFI
   2940.978 135       0   0.06   0.115   0.93

 Notes:
  -'Sensitivity' is % of hypothetically misspecified models correctly identified by cutoff
  -Cutoffs with 95% sensitivity are reported when possible
  -If sensitivity is <50%, cutoffs will be supressed
```

Explanations on Levels 0-3 from the `dynamic` package vignette:

> When there are 6 or more items, cfaOne will consider three levels of misspecification. As in catHB, the Level-0 row corresponds to the anticipated fit index values if the fitted model were the exact underlying population model. The Level-1 row corresponds to the anticipated fit index values if the fitted model omitted 0.30 residual correlations between approximately 1/3 of item pairs. The Level-2 row corresponds to the anticipated fit index values if the fitted model omitted 0.30 residual correlations between approximately 1/3 of item pairs. The Level-3 row corresponds to the anticipated fit index values if the fitted model omitted 0.30 residual correlations between all item pairs.

As we can see, the observed/empirical fit metrics from the data does not come close to even the Level-3 simulation based cutoff values.

Summary comments

The 18 items do not fit a unidimensional model, due to issues with residual correlations and potential multidimensionality.

Software used

```r
sessionInfo()
```

```
R version 4.4.1 (2024-06-14)
Platform: aarch64-apple-darwin20
Running under: macOS Sonoma 14.6.1

Matrix products: default
BLAS:   /Library/Frameworks/R.framework/Versions/4.4-arm64/Resources/lib/libRblas.0.dylib
LAPACK: /Library/Frameworks/R.framework/Versions/4.4-arm64/Resources/lib/libRlapack.dylib;
```

```
locale:
[1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8

time zone: Europe/Stockholm
tzcode source: internal

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

other attached packages:
 [1] dynamic_1.1.0   patchwork_1.2.0 lavaan_0.6-18   lubridate_1.9.3
 [5] forcats_1.0.0   stringr_1.5.1   dplyr_1.1.4     purrr_1.0.2
 [9] readr_2.1.5     tidyr_1.3.1     tibble_3.2.1    ggplot2_3.5.1
[13] tidyverse_2.0.0 readxl_1.4.3

loaded via a namespace (and not attached):
 [1] tidyselect_1.2.1     R.utils_2.12.3       fastmap_1.2.0
 [4] digest_0.6.37        timechange_0.3.0     lifecycle_1.0.4
 [7] Deriv_4.1.3          dcurver_0.9.2        cluster_2.1.6
[10] mirt_1.42            magrittr_2.0.3       compiler_4.4.1
[13] rlang_1.1.4          tools_4.4.1          utf8_1.2.4
[16] yaml_2.3.10          knitr_1.48           mnormt_2.1.1
[19] curl_5.2.2           Bayesrel_0.7.7       withr_3.0.1
[22] R.oo_1.26.0          grid_4.4.1           stats4_4.4.1
[25] fansi_1.0.6          colorspace_2.1-1     future_1.34.0
[28] progressr_0.14.0     GPArotation_2024.3-1 globals_0.16.3
[31] scales_1.3.0         MASS_7.3-61          GenOrd_1.4.0
[34] cli_3.6.3            mvtnorm_1.3-1        rmarkdown_2.27
[37] vegan_2.6-8          generics_0.1.3       rstudioapi_0.16.0
[40] future.apply_1.11.2  SimDesign_2.17.1     tzdb_0.4.0
[43] sessioninfo_1.2.2    pbapply_1.7-2        audio_0.1-11
[46] splines_4.4.1        parallel_4.4.1       cellranger_1.1.0
[49] beepr_2.0            vctrs_0.6.5          Matrix_1.7-0
[52] jsonlite_1.8.8       hms_1.1.3            listenv_0.9.1
[55] testthat_3.2.1.1     snow_0.4-4           parallelly_1.38.0
[58] glue_1.7.0           semTools_0.5-6       codetools_0.2-20
[61] stringi_1.8.4        gtable_0.3.5         quadprog_1.5-8
[64] munsell_0.5.1        pillar_1.9.0         brio_1.1.5
[67] htmltools_0.5.8.1    R6_2.5.1             Rdpack_2.6.1
[70] simstandard_0.6.3    evaluate_0.24.0      pbivnorm_0.6.0
[73] lattice_0.22-6       rbibutils_2.2.16     R.methodsS3_1.8.2
[76] RPushbullet_0.3.4    Rcpp_1.0.13          gridExtra_2.3
[79] nlme_3.1-165         permute_0.9-7        mgcv_1.9-1
[82] xfun_0.46            pkgconfig_2.0.3
```

References

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Hu, Li-tze, and Peter M. Bentler. 1999. "Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria Versus New Alternatives." *Structural Equation Modeling: A Multidisciplinary Journal* 6 (1): 1–55. https://doi.org/10.1080/10705519909540118.

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