Personality and the momentary challenges of everyday life: Decomposing the role of dispositional negativitiy

Supplementary Method and Results

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Description

This document contains supplemental information and graphics designed to enhance the transparent reporting of our results in an empirical study titled: "Personality and the momentary challenges of everyday life: Decomposing the role of dispositional negativity". In accordance with an open science framework we have made the "raw" `.Rmd` file that generated this document, the `R` scripts for analyses in the main manuscript, and the data available in the following GitHub repository: https://github.com/dr-consulting/shackman-umd-pax-ema-pub.

Table S1 - Study 2 Rotated Loadings from Split-Half Factor Analysis

	Positive	Negative	Angry	Tired
Enthus	0.82			
Joy	0.87			
Cheer	0.85			
Calm	0.67			
Content	0.78			
Relax	0.71			
Nerv		0.84		
Worry		0.81		
Afraid		0.74		
Annoy			0.83	
Angry			0.92	
Slug				0.84
Sad		0.47	0.3	
Tired				0.86
Hopeless		0.61		

Note. $N = 114, N_{obs} = 5577$

Figure S1 - Study 1 Dispositional Negativity Scores Distribution

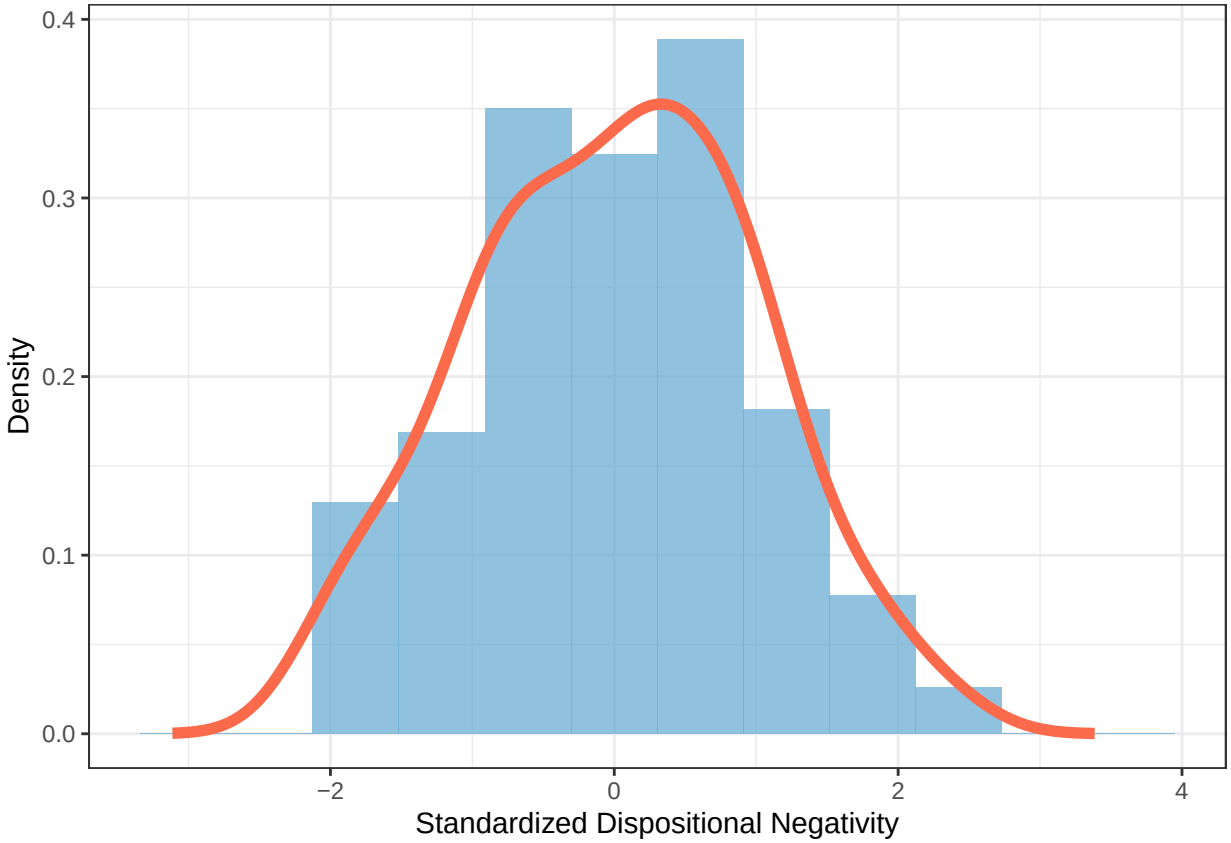


Figure S2 - Study 2 Dispositional Negativity Scores Distribution

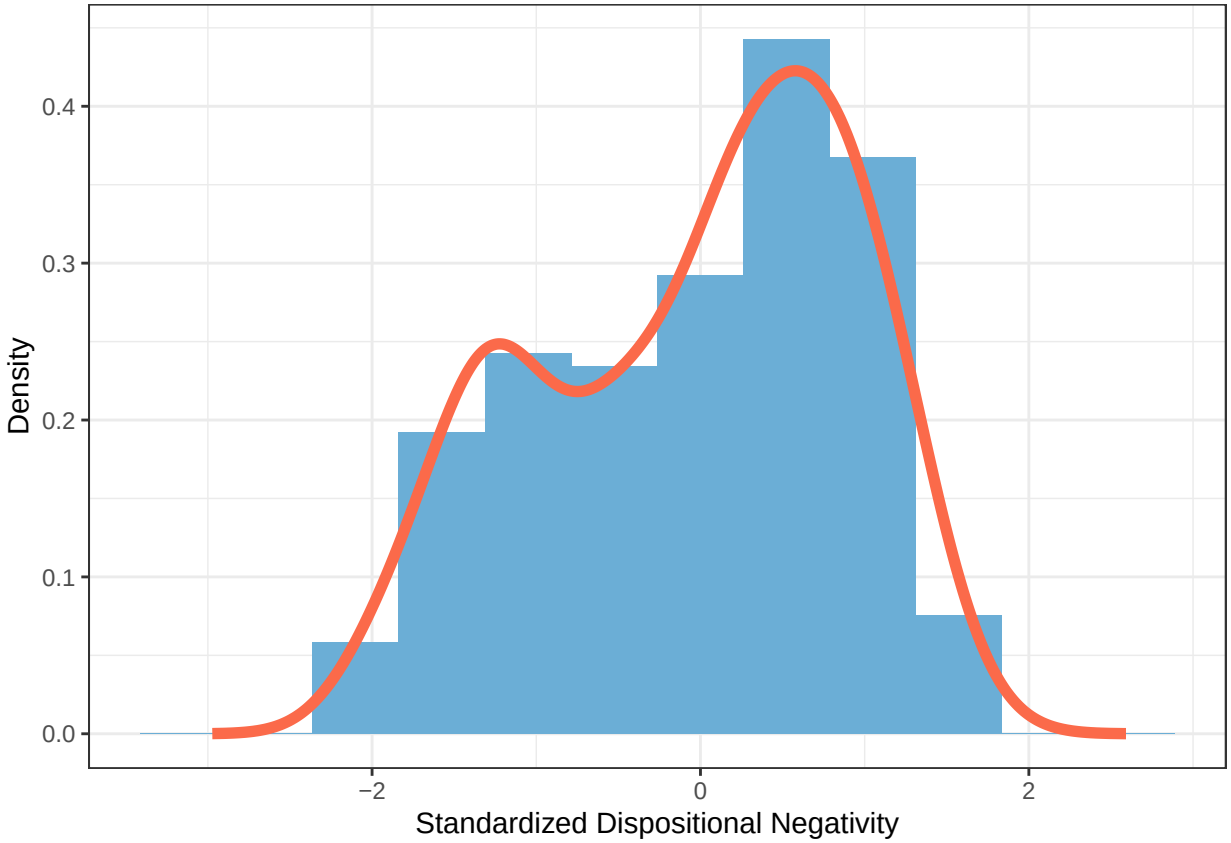
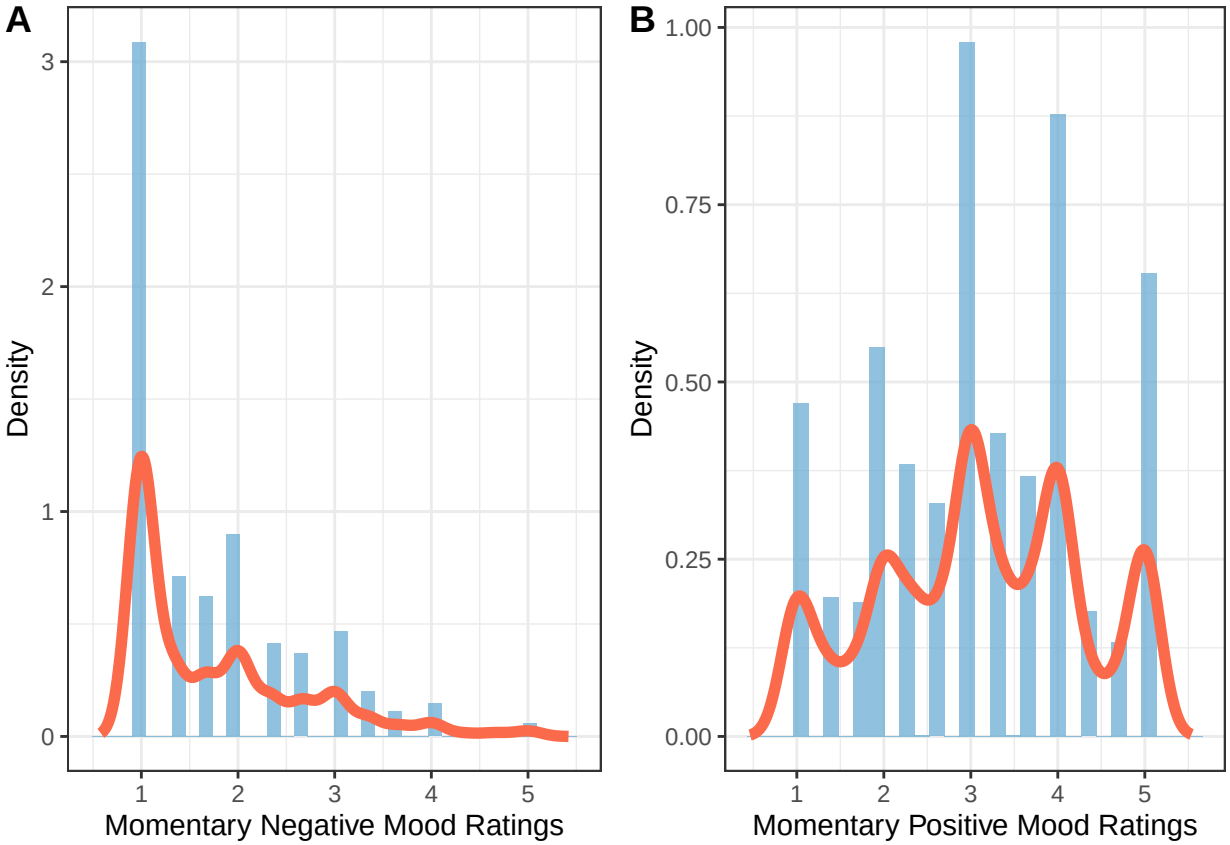
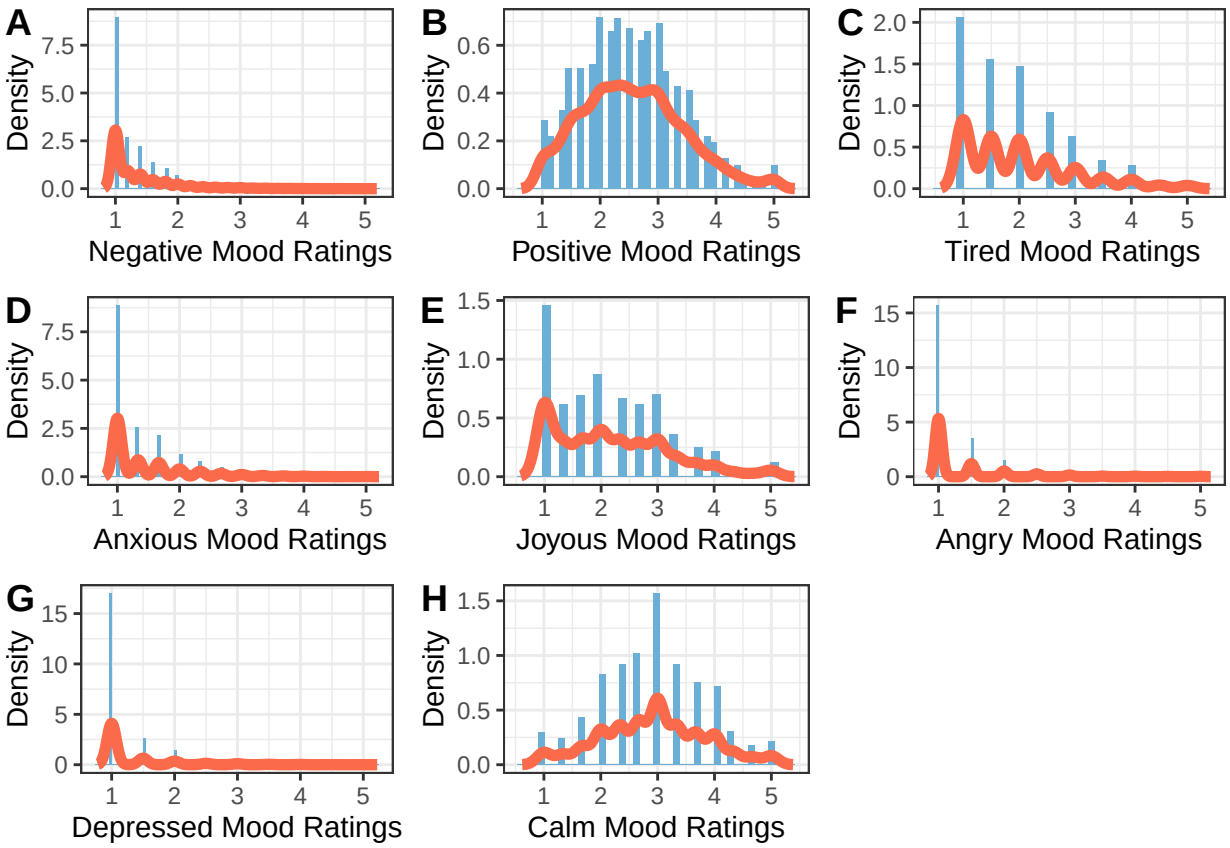


Figure S3 - Study 1 EMA Mood Scores Distributions



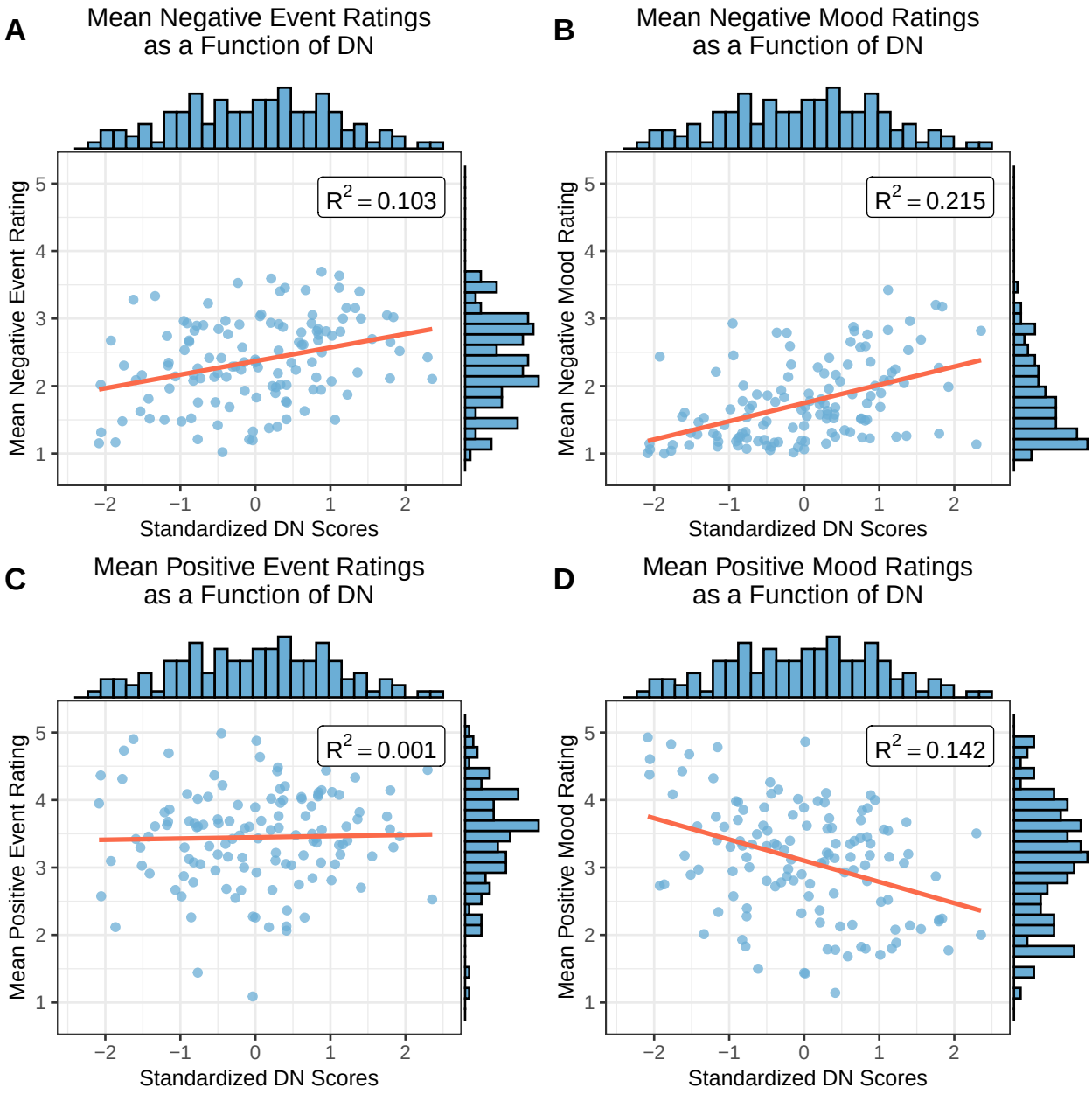
Panel A of **Supplemental Figure S3** diplays the histogram and density overlay of momentary negative mood ratings, which are clearly positively skewed. Panel B of **Supplemental Figure S3** displays the relatively more symmetrical distribution of positive mood ratings.

Figure S4 - Study 2 EMA Mood Scores Distributions (*a priori* composites)



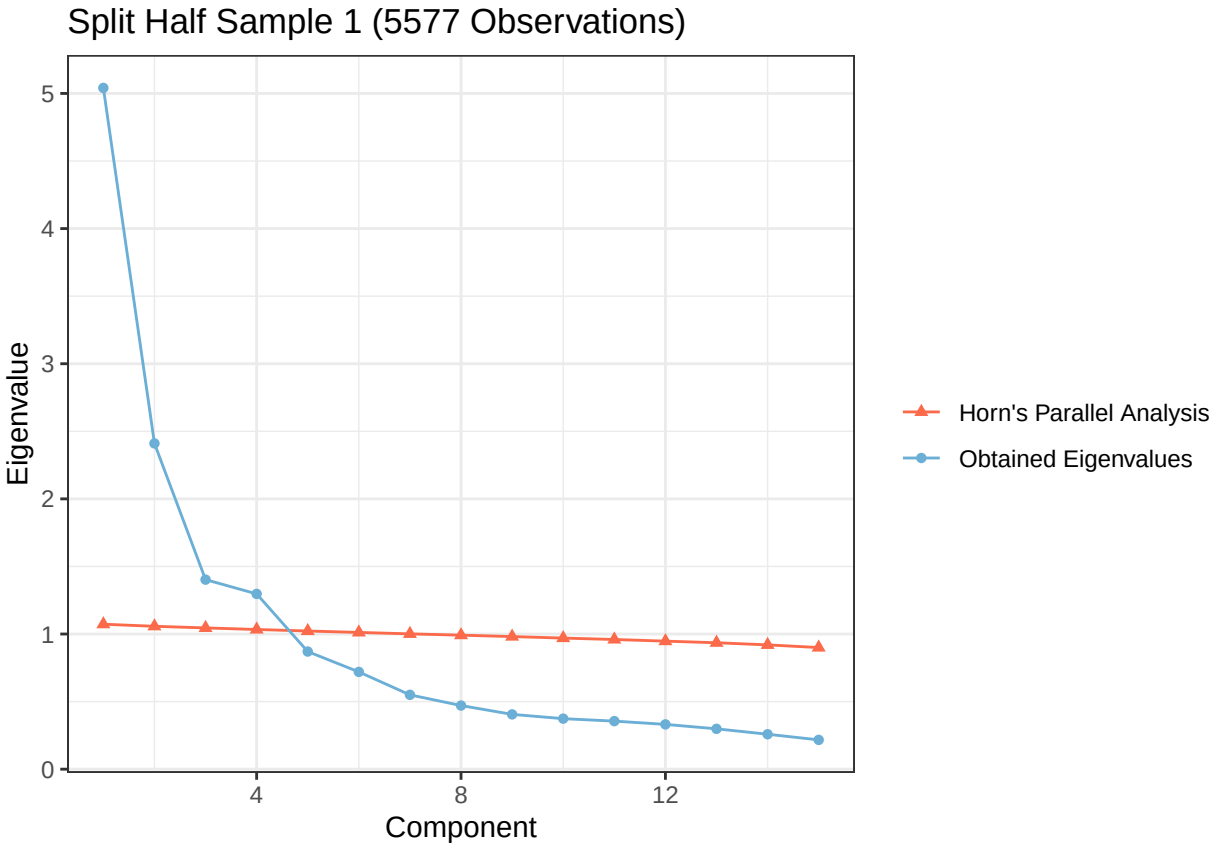
The first column of the plot (i.e., Panels A, D, and G) contains the negative mood composite derived from the split half factor analysis results, and two *a priori* facets designed to tap anxious and depressed momentary mood. The second column (i.e., Panels B, E, and H) displays similar composites and facets in our momentary measures of positive affect. The third and final column (i.e., Panels C and F) display the distributions of momentary tired and angry mood ratings.

Figure S5 - Study 1 Bivariate Associations: DN and EMA Aggregates



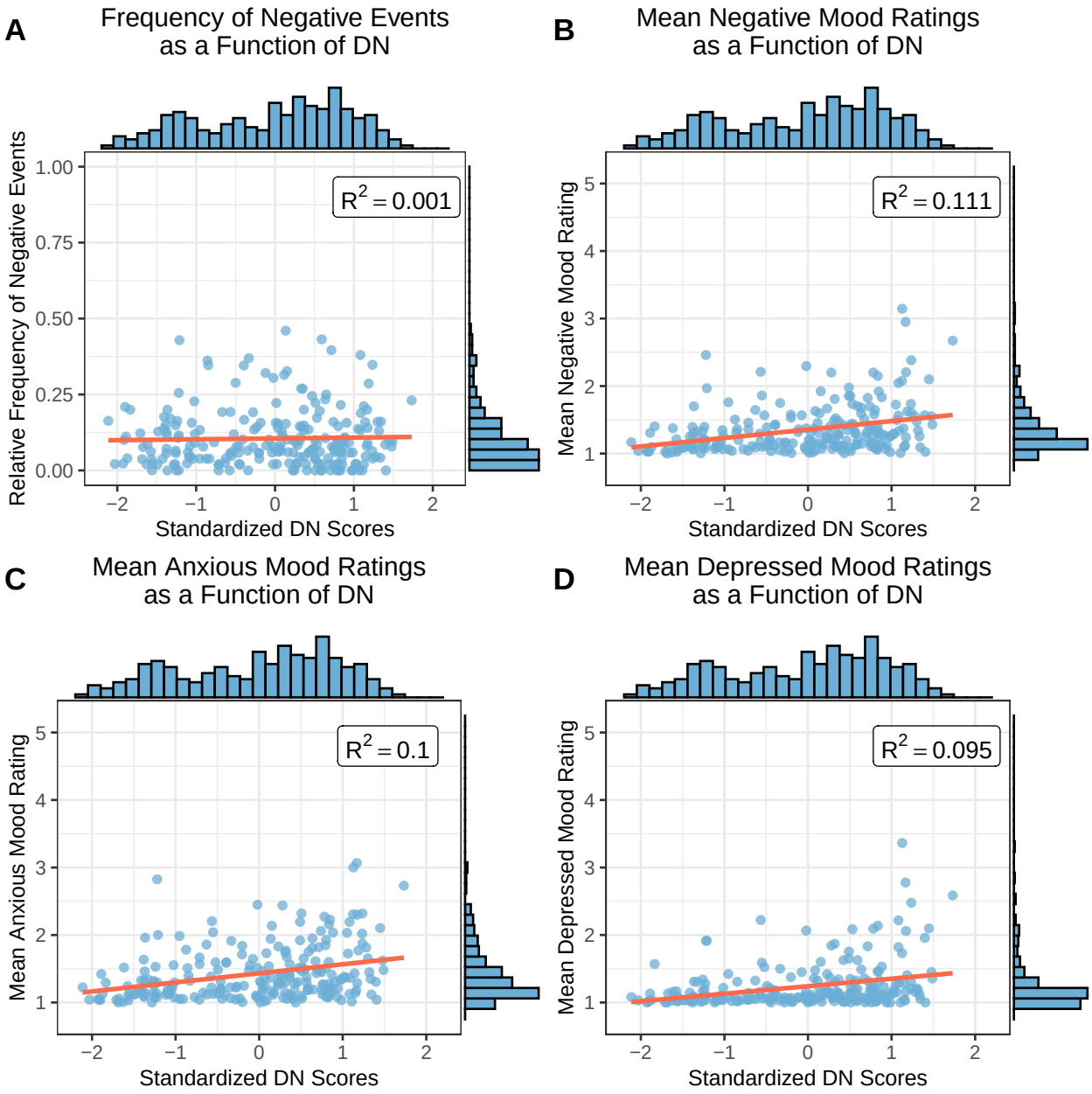
Note. DN = Dispositional Negativity. The top histogram is effectiely repeated across each plot. The top row displays the association between dispositional negativity scores and participants' mean negative event ratings in plot **A** and the association between dispositional negativity and participants' mean negative momentary mood ratings in panel **B**. The same associations are presented in panels **C** and **D** but for the corresponding positively valenced measures.

Figure S6 - Study 2 PCA Scree Plot



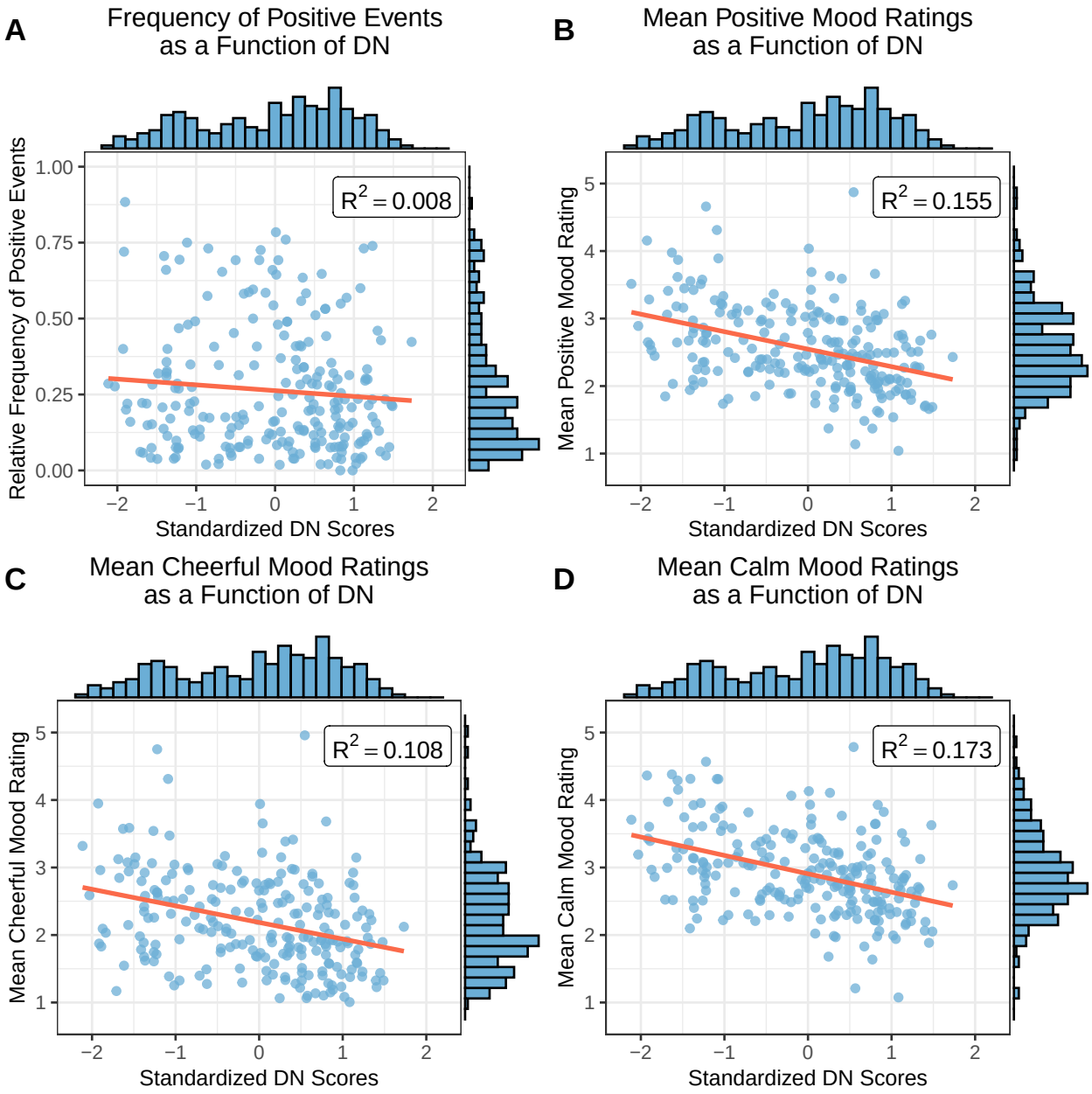
Results from the split-half parallel analysis support retention of four factors using the 95th percentile values from randomly generated uncorrelated data with equivalent dimensionality.

Figure S7 - Study 2 Bivariate Associations: DN and "Negative" EMA Aggregates



Note. DN = Dispositional Negativity. The top histogram is effectiely repeated across each plot. The top row displays the association between dispositional negativity scores and participants' relative frequency of reporting a negative event in plot **A** and the association between dispositional negativity and participants' mean negative momentary mood ratings in panel **B** (a combination of *anxious* and *depressed* items). The same associations are presented in panels **C** and **D** but for the separate *anxious* and *depressed* mood averages.

Figure S8 - Study 2 Bivariate Associations: DN and "Positive" EMA Aggregates



Note. DN = Dispositional Negativity. The top histogram is effectiely repeated across each plot. The top row displays the association between dispositional negativity scores and participants' relative frequency of reporting a negative event in plot **A** and the association between dispositional negativity and participants' mean negative momentary mood ratings in panel **B** (a combination of *anxious* and *depressed* items). The same associations are presented in panels **C** and **D** but for the separate *anxious* and *depressed* mood averages.

Supplemental Analysis - Initial and Final Confirmatory Factor Analysis Models

We analyzed a subset of momentary mood items taken from the second half of study 2 participants. We performed an exploratory factor analysis on the first half of the randomly split data set. Given the nested structure of the data we employed a multilevel confirmatory factor analysis approach in *lavaan* (CITE). Latent factors were allowed to correlate (i.e., an orthogonal structure was not assumed).

The initial model include no item-level covariances either at the within-subject or the between-subject levels of the model. The final model included within-subject covariances for items loading on the separate positive and negative mood facets. There were also two error covariances added at the between-subjects level of the model. Standardized model summaries are available on the next two pages. The `Std.all` contains the standardized values for each parameter. Readers are most likely interested in the `Latent Variables:` tables in the output at each level of the model.

Initial CFA - No Item-Level Covariances

```
## lavaan 0.6-6 ended normally after 131 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         87
##
##   Number of observations                          5647
##   Number of clusters [ID]                          114
##
## Model Test User Model:
##                                               Standard      Robust
##   Test Statistic                              4224.059    3041.653
##   Degrees of freedom                           168         168
##   P-value (Chi-square)                          0.000       0.000
##   Scaling correction factor                                 1.389
##         Yuan-Bentler correction (Mplus variant)
##
## Model Test Baseline Model:
##
##   Test statistic                             26715.975   15878.493
##   Degrees of freedom                           210         210
##   P-value                                       0.000       0.000
##   Scaling correction factor                                 1.683
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                   0.847       0.817
##   Tucker-Lewis Index (TLI)                      0.809       0.771
##
##   Robust Comparative Fit Index (CFI)                        0.849
##   Robust Tucker-Lewis Index (TLI)                           0.811
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)              -81618.647  -81618.647
##   Scaling correction factor                                  5.454
##       for the MLR correction
##   Loglikelihood unrestricted model (H1)      -79506.617  -79506.617
##   Scaling correction factor                                  2.776
##       for the MLR correction
##
##   Akaike (AIC)                               163411.293  163411.293
##   Bayesian (BIC)                             163988.876  163988.876
##   Sample-size adjusted Bayesian (BIC)        163712.416  163712.416
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.065       0.055
##   90 Percent confidence interval - lower         0.064       0.054
##   90 Percent confidence interval - upper         0.067       0.056
##   P-value RMSEA <= 0.05                          0.000       0.000
##
```

```
##   Robust RMSEA                                                  0.065
##   90 Percent confidence interval - lower                        0.063
##   90 Percent confidence interval - upper                        0.067
##
## Standardized Root Mean Square Residual (corr metric):
##
##   SRMR (within covariance matrix)                 0.072       0.072
##   SRMR (between covariance matrix)                0.096       0.096
##
## Parameter Estimates:
##
##   Standard errors                               Sandwich
##   Information bread                             Observed
##   Observed information based on                  Hessian
##
##
## Level 1 [within]:
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   W_PA =~
##     Joy              1.000                               0.651    0.774
##     Cheer            1.089    0.022   50.383    0.000    0.709    0.807
##     Enthus           0.944    0.023   40.623    0.000    0.614    0.721
##     Content          0.890    0.036   24.957    0.000    0.580    0.680
##     Relax            0.635    0.046   13.712    0.000    0.413    0.481
##     Calm             0.539    0.042   12.890    0.000    0.351    0.422
##   W_NA =~
##     Nerv             1.000                               0.438    0.657
##     Worry            1.111    0.055   20.067    0.000    0.486    0.711
##     Afraid           0.601    0.050   11.956    0.000    0.263    0.599
##     Hopeless         0.435    0.089    4.895    0.000    0.191    0.438
##     Sad              0.487    0.089    5.493    0.000    0.213    0.403
##   W_ANG =~
##     Angry            1.000                               0.325    0.685
##     Annoy            1.709    0.173    9.860    0.000    0.555    0.759
##   W_TRD =~
##     Tired            1.000                               0.751    0.771
##     Slug             0.802    0.046   17.521    0.000    0.602    0.730
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   W_PA ~~
##     W_NA            -0.132    0.014   -9.351    0.000   -0.464   -0.464
##     W_ANG           -0.095    0.013   -7.273    0.000   -0.449   -0.449
##     W_TRD           -0.211    0.019  -11.032    0.000   -0.431   -0.431
##   W_NA ~~
##     W_ANG            0.068    0.014    4.889    0.000    0.480    0.480
##     W_TRD            0.049    0.010    4.807    0.000    0.150    0.150
##   W_ANG ~~
##     W_TRD            0.037    0.008    4.517    0.000    0.150    0.150
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
```

```
##    .Joy               0.000                               0.000    0.000
##    .Cheer             0.000                               0.000    0.000
##    .Enthus            0.000                               0.000    0.000
##    .Content           0.000                               0.000    0.000
##    .Relax             0.000                               0.000    0.000
##    .Calm              0.000                               0.000    0.000
##    .Nerv              0.000                               0.000    0.000
##    .Worry             0.000                               0.000    0.000
##    .Afraid            0.000                               0.000    0.000
##    .Hopeless          0.000                               0.000    0.000
##    .Sad               0.000                               0.000    0.000
##    .Angry             0.000                               0.000    0.000
##    .Annoy             0.000                               0.000    0.000
##    .Tired             0.000                               0.000    0.000
##    .Slug              0.000                               0.000    0.000
##     W_PA              0.000                               0.000    0.000
##     W_NA              0.000                               0.000    0.000
##     W_ANG             0.000                               0.000    0.000
##     W_TRD             0.000                               0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy              0.283    0.019   14.588    0.000    0.283    0.400
##    .Cheer            0.270    0.021   13.070    0.000    0.270    0.349
##    .Enthus           0.349    0.023   15.179    0.000    0.349    0.480
##    .Content          0.390    0.021   18.139    0.000    0.390    0.537
##    .Relax            0.568    0.031   18.155    0.000    0.568    0.769
##    .Calm             0.569    0.030   18.957    0.000    0.569    0.822
##    .Nerv             0.253    0.024   10.454    0.000    0.253    0.569
##    .Worry            0.231    0.027    8.620    0.000    0.231    0.494
##    .Afraid           0.124    0.014    8.713    0.000    0.124    0.642
##    .Hopeless         0.153    0.020    7.721    0.000    0.153    0.808
##    .Sad              0.234    0.023   10.167    0.000    0.234    0.837
##    .Angry            0.119    0.014    8.435    0.000    0.119    0.531
##    .Annoy            0.227    0.028    8.064    0.000    0.227    0.424
##    .Tired            0.385    0.035   11.029    0.000    0.385    0.405
##    .Slug             0.318    0.027   11.606    0.000    0.318    0.467
##     W_PA             0.424    0.035   12.113    0.000    1.000    1.000
##     W_NA             0.192    0.025    7.674    0.000    1.000    1.000
##     W_ANG            0.105    0.022    4.885    0.000    1.000    1.000
##     W_TRD            0.564    0.045   12.640    0.000    1.000    1.000
##
##
## Level 2 [ID]:
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   B_PA =~
##     Joy              1.000                               0.655    0.956
##     Cheer            0.963    0.035   27.773    0.000    0.631    0.975
##     Enthus           0.930    0.038   24.345    0.000    0.609    0.931
##     Content          0.825    0.070   11.774    0.000    0.540    0.799
##     Relax            0.686    0.070    9.776    0.000    0.449    0.730
##     Calm             0.690    0.069    9.980    0.000    0.452    0.732
```

```
##   B_NA =~
##     Nerv              1.000                               0.363    0.830
##     Worry             1.084    0.047   22.830    0.000    0.393    0.847
##     Afraid            0.762    0.142    5.367    0.000    0.276    0.942
##     Hopeless          0.790    0.218    3.626    0.000    0.286    0.854
##     Sad               0.914    0.236    3.877    0.000    0.331    0.861
##   B_ANG =~
##     Angry             1.000                               0.209    0.989
##     Annoy             1.279    0.179    7.138    0.000    0.267    0.859
##   B_TRD =~
##     Tired             1.000                               0.444    0.762
##     Slug              1.125    0.196    5.746    0.000    0.499    0.985
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   B_PA ~~
##     B_NA            -0.017    0.021   -0.823    0.410   -0.071   -0.071
##     B_ANG            0.004    0.012    0.294    0.769    0.026    0.026
##     B_TRD           -0.011    0.031   -0.362    0.718   -0.039   -0.039
##   B_NA ~~
##     B_ANG            0.068    0.021    3.318    0.001    0.897    0.897
##     B_TRD            0.087    0.027    3.283    0.001    0.543    0.543
##   B_ANG ~~
##     B_TRD            0.052    0.020    2.578    0.010    0.561    0.561
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy               1.222    0.065   18.731    0.000    1.222    1.784
##    .Cheer             1.301    0.062   21.003    0.000    1.301    2.010
##    .Enthus            1.076    0.062   17.238    0.000    1.076    1.645
##    .Content           1.894    0.064   29.425    0.000    1.894    2.802
##    .Relax             1.869    0.059   31.841    0.000    1.869    3.038
##    .Calm              1.970    0.059   33.482    0.000    1.970    3.193
##    .Nerv              0.488    0.042   11.552    0.000    0.488    1.116
##    .Worry             0.554    0.045   12.385    0.000    0.554    1.193
##    .Afraid            0.186    0.028    6.600    0.000    0.186    0.632
##    .Hopeless          0.187    0.032    5.879    0.000    0.187    0.558
##    .Sad               0.277    0.037    7.555    0.000    0.277    0.720
##    .Angry             0.159    0.021    7.669    0.000    0.159    0.752
##    .Annoy             0.419    0.031   13.619    0.000    0.419    1.345
##    .Tired             1.187    0.056   21.126    0.000    1.187    2.037
##    .Slug              0.702    0.049   14.399    0.000    0.702    1.386
##     B_PA              0.000                               0.000    0.000
##     B_NA              0.000                               0.000    0.000
##     B_ANG             0.000                               0.000    0.000
##     B_TRD             0.000                               0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy               0.040    0.008    4.807    0.000    0.040    0.086
##    .Cheer             0.021    0.007    2.880    0.004    0.021    0.050
##    .Enthus            0.057    0.013    4.503    0.000    0.057    0.134
##    .Content           0.165    0.030    5.508    0.000    0.165    0.361
##    .Relax             0.177    0.028    6.285    0.000    0.177    0.467
```

```
##    .Calm             0.176    0.029    6.119    0.000    0.176    0.464
##    .Nerv             0.060    0.024    2.500    0.012    0.060    0.312
##    .Worry            0.061    0.023    2.601    0.009    0.061    0.282
##    .Afraid           0.010    0.003    2.803    0.005    0.010    0.113
##    .Hopeless         0.030    0.013    2.267    0.023    0.030    0.271
##    .Sad              0.038    0.018    2.084    0.037    0.038    0.259
##    .Angry            0.001    0.003    0.376    0.707    0.001    0.022
##    .Annoy            0.025    0.007    3.854    0.000    0.025    0.262
##    .Tired            0.142    0.033    4.372    0.000    0.142    0.419
##    .Slug             0.007    0.039    0.188    0.851    0.007    0.029
##     B_PA             0.429    0.056    7.683    0.000    1.000    1.000
##     B_NA             0.131    0.031    4.238    0.000    1.000    1.000
##     B_ANG            0.044    0.019    2.353    0.019    1.000    1.000
##     B_TRD            0.197    0.054    3.640    0.000    1.000    1.000
```

Final CFA - Includes Item Error Covariances

```
## lavaan 0.6-6 ended normally after 157 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         99
##
##   Number of observations                          5647
##   Number of clusters [ID]                          114
##
## Model Test User Model:
##                                              Standard      Robust
##   Test Statistic                             1339.321    1014.170
##   Degrees of freedom                              156         156
##   P-value (Chi-square)                          0.000       0.000
##   Scaling correction factor                                 1.321
##         Yuan-Bentler correction (Mplus variant)
##
## Model Test Baseline Model:
##
##   Test statistic                            26715.975   15878.493
##   Degrees of freedom                              210         210
##   P-value                                       0.000       0.000
##   Scaling correction factor                                 1.683
##
## User Model versus Baseline Model:
##
##   Comparative Fit Index (CFI)                   0.955       0.945
##   Tucker-Lewis Index (TLI)                      0.940       0.926
##
##   Robust Comparative Fit Index (CFI)                        0.957
##   Robust Tucker-Lewis Index (TLI)                           0.942
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)             -80176.278  -80176.278
##   Scaling correction factor                                 5.068
##       for the MLR correction
##   Loglikelihood unrestricted model (H1)     -79506.617  -79506.617
##   Scaling correction factor                                 2.776
##       for the MLR correction
##
##   Akaike (AIC)                              160550.556  160550.556
##   Bayesian (BIC)                            161207.805  161207.805
##   Sample-size adjusted Bayesian (BIC)       160893.213  160893.213
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.037       0.031
##   90 Percent confidence interval - lower         0.035       0.030
##   90 Percent confidence interval - upper         0.038       0.033
##   P-value RMSEA <= 0.05                          1.000       1.000
##
```

```
##   Robust RMSEA                                               0.036
##   90 Percent confidence interval - lower                     0.034
##   90 Percent confidence interval - upper                     0.038
##
## Standardized Root Mean Square Residual (corr metric):
##
##   SRMR (within covariance matrix)                0.047       0.047
##   SRMR (between covariance matrix)               0.086       0.086
##
## Parameter Estimates:
##
##   Standard errors                             Sandwich
##   Information bread                           Observed
##   Observed information based on                Hessian
##
##
## Level 1 [within]:
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   W_PA =~
##     Joy              1.000                               0.561    0.668
##     Cheer            1.079    0.029   36.642    0.000    0.606    0.689
##     Enthus           0.908    0.029   31.572    0.000    0.510    0.598
##     Content          1.127    0.059   18.984    0.000    0.633    0.742
##     Relax            0.750    0.067   11.183    0.000    0.421    0.490
##     Calm             0.615    0.058   10.610    0.000    0.345    0.415
##   W_NA =~
##     Nerv             1.000                               0.262    0.393
##     Worry            1.330    0.101   13.151    0.000    0.349    0.510
##     Afraid           0.757    0.079    9.535    0.000    0.198    0.452
##     Hopeless         0.843    0.153    5.515    0.000    0.221    0.508
##     Sad              1.055    0.162    6.496    0.000    0.277    0.524
##   W_ANG =~
##     Angry            1.000                               0.340    0.718
##     Annoy            1.554    0.140   11.068    0.000    0.529    0.724
##   W_TRD =~
##     Tired            1.000                               0.751    0.771
##     Slug             0.801    0.048   16.544    0.000    0.602    0.730
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##  .Relax ~~
##    .Calm              0.225    0.020   11.038    0.000    0.225    0.396
##  .Hopeless ~~
##    .Sad               0.025    0.008    2.998    0.003    0.025    0.149
##  .Nerv ~~
##    .Worry             0.152    0.016    9.557    0.000    0.152    0.423
##    .Afraid            0.074    0.011    6.723    0.000    0.074    0.309
##  .Worry ~~
##    .Afraid            0.053    0.010    5.120    0.000    0.053    0.229
##  .Content ~~
##    .Relax             0.061    0.018    3.473    0.001    0.061    0.143
##    .Calm              0.072    0.014    4.992    0.000    0.072    0.166
```

```
##  .Joy ~~
##    .Enthus            0.135    0.019    7.309    0.000    0.135    0.317
##    .Cheer             0.145    0.019    7.503    0.000    0.145    0.363
##  .Cheer ~~
##    .Enthus            0.163    0.019    8.614    0.000    0.163    0.376
##   W_PA ~~
##     W_NA             -0.095    0.014   -6.901    0.000   -0.647   -0.647
##     W_ANG            -0.097    0.012   -7.822    0.000   -0.509   -0.509
##     W_TRD            -0.182    0.022   -8.461    0.000   -0.431   -0.431
##   W_NA ~~
##     W_ANG             0.058    0.012    5.002    0.000    0.655    0.655
##     W_TRD             0.046    0.008    5.960    0.000    0.233    0.233
##   W_ANG ~~
##     W_TRD             0.036    0.008    4.296    0.000    0.141    0.141
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy               0.000                              0.000    0.000
##    .Cheer             0.000                              0.000    0.000
##    .Enthus            0.000                              0.000    0.000
##    .Content           0.000                              0.000    0.000
##    .Relax             0.000                              0.000    0.000
##    .Calm              0.000                              0.000    0.000
##    .Nerv              0.000                              0.000    0.000
##    .Worry             0.000                              0.000    0.000
##    .Afraid            0.000                              0.000    0.000
##    .Hopeless          0.000                              0.000    0.000
##    .Sad               0.000                              0.000    0.000
##    .Angry             0.000                              0.000    0.000
##    .Annoy             0.000                              0.000    0.000
##    .Tired             0.000                              0.000    0.000
##    .Slug              0.000                              0.000    0.000
##     W_PA              0.000                              0.000    0.000
##     W_NA              0.000                              0.000    0.000
##     W_ANG             0.000                              0.000    0.000
##     W_TRD             0.000                              0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy               0.392    0.026   15.032    0.000    0.392    0.554
##    .Cheer             0.405    0.026   15.561    0.000    0.405    0.525
##    .Enthus            0.466    0.029   15.893    0.000    0.466    0.642
##    .Content           0.326    0.023   14.027    0.000    0.326    0.449
##    .Relax             0.562    0.032   17.531    0.000    0.562    0.760
##    .Calm              0.573    0.030   18.853    0.000    0.573    0.828
##    .Nerv              0.375    0.028   13.214    0.000    0.375    0.845
##    .Worry             0.346    0.024   14.141    0.000    0.346    0.740
##    .Afraid            0.154    0.019    7.988    0.000    0.154    0.796
##    .Hopeless          0.141    0.019    7.450    0.000    0.141    0.742
##    .Sad               0.203    0.021    9.582    0.000    0.203    0.726
##    .Angry             0.109    0.014    7.576    0.000    0.109    0.485
##    .Annoy             0.254    0.027    9.253    0.000    0.254    0.476
##    .Tired             0.384    0.036   10.635    0.000    0.384    0.405
##    .Slug              0.319    0.029   10.853    0.000    0.319    0.468
```

```
##     W_PA              0.315    0.035    9.077    0.000    1.000    1.000
##     W_NA              0.069    0.015    4.653    0.000    1.000    1.000
##     W_ANG             0.116    0.022    5.348    0.000    1.000    1.000
##     W_TRD             0.565    0.048   11.778    0.000    1.000    1.000
##
##
## Level 2 [ID]:
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   B_PA =~
##     Joy              1.000                               0.657    0.958
##     Cheer            0.965    0.036   26.576    0.000    0.634    0.978
##     Enthus           0.930    0.039   23.721    0.000    0.611    0.933
##     Content          0.809    0.068   11.939    0.000    0.531    0.791
##     Relax            0.662    0.065   10.129    0.000    0.435    0.711
##     Calm             0.667    0.064   10.353    0.000    0.438    0.713
##   B_NA =~
##     Nerv             1.000                               0.333    0.760
##     Worry            1.092    0.053   20.427    0.000    0.363    0.780
##     Afraid           0.806    0.126    6.397    0.000    0.268    0.916
##     Hopeless         0.897    0.185    4.836    0.000    0.298    0.894
##     Sad              1.031    0.197    5.221    0.000    0.343    0.895
##   B_ANG =~
##     Angry            1.000                               0.210    0.997
##     Annoy            1.257    0.161    7.795    0.000    0.264    0.851
##   B_TRD =~
##     Tired            1.000                               0.443    0.762
##     Slug             1.126    0.207    5.438    0.000    0.499    0.986
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##  .Relax ~~
##    .Calm             0.172    0.026    6.504    0.000    0.172    0.929
##  .Nerv ~~
##    .Worry            0.067    0.019    3.606    0.000    0.067    0.810
##   B_PA ~~
##     B_NA            -0.015    0.019   -0.793    0.428   -0.070   -0.070
##     B_ANG            0.004    0.012    0.378    0.705    0.032    0.032
##     B_TRD           -0.012    0.032   -0.362    0.717   -0.040   -0.040
##   B_NA ~~
##     B_ANG            0.064    0.021    3.107    0.002    0.917    0.917
##     B_TRD            0.079    0.026    3.063    0.002    0.539    0.539
##   B_ANG ~~
##     B_TRD            0.051    0.020    2.530    0.011    0.551    0.551
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy              1.222    0.065   18.731    0.000    1.222    1.782
##    .Cheer            1.301    0.062   21.005    0.000    1.301    2.009
##    .Enthus           1.077    0.062   17.239    0.000    1.077    1.644
##    .Content          1.894    0.064   29.427    0.000    1.894    2.819
##    .Relax            1.870    0.059   31.863    0.000    1.870    3.058
##    .Calm             1.969    0.059   33.459    0.000    1.969    3.206
```

```
##    .Nerv              0.487    0.042   11.542    0.000    0.487    1.114
##    .Worry             0.554    0.045   12.381    0.000    0.554    1.190
##    .Afraid            0.185    0.028    6.598    0.000    0.185    0.634
##    .Hopeless          0.187    0.032    5.879    0.000    0.187    0.561
##    .Sad               0.277    0.037    7.553    0.000    0.277    0.723
##    .Angry             0.159    0.021    7.668    0.000    0.159    0.756
##    .Annoy             0.419    0.031   13.619    0.000    0.419    1.350
##    .Tired             1.186    0.056   21.127    0.000    1.186    2.039
##    .Slug              0.702    0.049   14.398    0.000    0.702    1.387
##     B_PA              0.000                              0.000    0.000
##     B_NA              0.000                              0.000    0.000
##     B_ANG             0.000                              0.000    0.000
##     B_TRD             0.000                              0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy               0.039    0.008    4.792    0.000    0.039    0.083
##    .Cheer             0.018    0.008    2.350    0.019    0.018    0.043
##    .Enthus            0.056    0.013    4.343    0.000    0.056    0.130
##    .Content           0.169    0.030    5.571    0.000    0.169    0.374
##    .Relax             0.185    0.027    6.812    0.000    0.185    0.494
##    .Calm              0.185    0.028    6.569    0.000    0.185    0.491
##    .Nerv              0.081    0.020    4.108    0.000    0.081    0.422
##    .Worry             0.085    0.020    4.231    0.000    0.085    0.391
##    .Afraid            0.014    0.006    2.204    0.028    0.014    0.160
##    .Hopeless          0.022    0.008    2.957    0.003    0.022    0.200
##    .Sad               0.029    0.014    2.052    0.040    0.029    0.200
##    .Angry             0.000    0.002    0.112    0.911    0.000    0.006
##    .Annoy             0.027    0.006    4.357    0.000    0.027    0.277
##    .Tired             0.142    0.034    4.153    0.000    0.142    0.420
##    .Slug              0.007    0.042    0.173    0.863    0.007    0.029
##     B_PA              0.431    0.056    7.699    0.000    1.000    1.000
##     B_NA              0.111    0.029    3.767    0.000    1.000    1.000
##     B_ANG             0.044    0.018    2.414    0.016    1.000    1.000
##     B_TRD             0.196    0.055    3.571    0.000    1.000    1.000
```

Comparing Model Fit:

For the sake of completeness, a test of model improvement from model 1 to model 11 is presented below. The reason for 11 models is that we used modifications indices as a partial guide in determining the appropriateness of adding certain error covariances.

```
## Scaled Chi-Squared Difference Test (method = "satorra.bentler.2001")
##
## lavaan NOTE:
##     The "Chisq" column contains standard test statistics, not the
##     robust test that should be reported per model. A robust difference
##     test is a function of two standard (not robust) statistics.
##
##            Df    AIC    BIC  Chisq Chisq diff Df diff Pr(>Chisq)
## fit.CFA11 156 160551 161208 1339.3
## fit.CFA   168 163411 163989 4224.1     1268.3      12  < 2.2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Note that this is not an exhaustive test of the factor structure of these momentary mood items. There are certainly other reasonable model structures that were not tested here, especially considering the various ways one could specify the between-subjects and within-subjects models. Caveats aside, we see these analyses as a relatively robust effort to develop an appropriate measurement model for the set of mood items we collected during our EMA surveys.

Reliability Measures

```
## lavaan 0.6-6 ended normally after 157 iterations
##
##   Estimator                                         ML
##   Optimization method                           NLMINB
##   Number of free parameters                         99
##
##   Number of observations                          5647
##   Number of clusters [ID]                          114
##
## Model Test User Model:
##                                                   Standard      Robust
##   Test Statistic                                 1339.321    1014.170
##   Degrees of freedom                                156         156
##   P-value (Chi-square)                            0.000       0.000
##   Scaling correction factor                                   1.321
##         Yuan-Bentler correction (Mplus variant)
##
## Model Test Baseline Model:
##
##   Test statistic                             26715.975   15878.493
##   Degrees of freedom                               210         210
##   P-value                                        0.000       0.000
##   Scaling correction factor                                  1.683
##
## User Model versus Baseline Model:
##
```

```
##   Comparative Fit Index (CFI)                    0.955       0.945
##   Tucker-Lewis Index (TLI)                       0.940       0.926
##
##   Robust Comparative Fit Index (CFI)                         0.957
##   Robust Tucker-Lewis Index (TLI)                            0.942
##
## Loglikelihood and Information Criteria:
##
##   Loglikelihood user model (H0)             -80176.278  -80176.278
##   Scaling correction factor                                  5.068
##       for the MLR correction
##   Loglikelihood unrestricted model (H1)     -79506.617  -79506.617
##   Scaling correction factor                                  2.776
##       for the MLR correction
##
##   Akaike (AIC)                              160550.556  160550.556
##   Bayesian (BIC)                            161207.805  161207.805
##   Sample-size adjusted Bayesian (BIC)       160893.213  160893.213
##
## Root Mean Square Error of Approximation:
##
##   RMSEA                                          0.037       0.031
##   90 Percent confidence interval - lower         0.035       0.030
##   90 Percent confidence interval - upper         0.038       0.033
##   P-value RMSEA <= 0.05                          1.000       1.000
##
##   Robust RMSEA                                               0.036
##   90 Percent confidence interval - lower                     0.034
##   90 Percent confidence interval - upper                     0.038
##
## Standardized Root Mean Square Residual (corr metric):
##
##   SRMR (within covariance matrix)                0.047       0.047
##   SRMR (between covariance matrix)               0.086       0.086
##
## Parameter Estimates:
##
##   Standard errors                             Sandwich
##   Information bread                           Observed
##   Observed information based on                Hessian
##
##
## Level 1 [within]:
##
## Latent Variables:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   W_PA =~
##     Joy               1.000                               0.561    0.668
##     Cheer             1.079    0.029   36.642    0.000    0.606    0.689
##     Enthus            0.908    0.029   31.572    0.000    0.510    0.598
##     Content           1.127    0.059   18.984    0.000    0.633    0.742
##     Relax             0.750    0.067   11.183    0.000    0.421    0.490
##     Calm              0.615    0.058   10.610    0.000    0.345    0.415
##   W_NA =~
```

```
##     Nerv              1.000                               0.262    0.393
##     Worry             1.330    0.101   13.151    0.000    0.349    0.510
##     Afraid            0.757    0.079    9.535    0.000    0.198    0.452
##     Hopeless          0.843    0.153    5.515    0.000    0.221    0.508
##     Sad               1.055    0.162    6.496    0.000    0.277    0.524
##   W_ANG =~
##     Angry             1.000                               0.340    0.718
##     Annoy             1.554    0.140   11.068    0.000    0.529    0.724
##   W_TRD =~
##     Tired             1.000                               0.751    0.771
##     Slug              0.801    0.048   16.544    0.000    0.602    0.730
##
## Covariances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##  .Relax ~~
##    .Calm              0.225    0.020   11.038    0.000    0.225    0.396
##  .Hopeless ~~
##    .Sad               0.025    0.008    2.998    0.003    0.025    0.149
##  .Nerv ~~
##    .Worry             0.152    0.016    9.557    0.000    0.152    0.423
##    .Afraid            0.074    0.011    6.723    0.000    0.074    0.309
##  .Worry ~~
##    .Afraid            0.053    0.010    5.120    0.000    0.053    0.229
##  .Content ~~
##    .Relax             0.061    0.018    3.473    0.001    0.061    0.143
##    .Calm              0.072    0.014    4.992    0.000    0.072    0.166
##  .Joy ~~
##    .Enthus            0.135    0.019    7.309    0.000    0.135    0.317
##    .Cheer             0.145    0.019    7.503    0.000    0.145    0.363
##  .Cheer ~~
##    .Enthus            0.163    0.019    8.614    0.000    0.163    0.376
##   W_PA ~~
##     W_NA             -0.095    0.014   -6.901    0.000   -0.647   -0.647
##     W_ANG            -0.097    0.012   -7.822    0.000   -0.509   -0.509
##     W_TRD            -0.182    0.022   -8.461    0.000   -0.431   -0.431
##   W_NA ~~
##     W_ANG              0.058    0.012    5.002    0.000    0.655    0.655
##     W_TRD              0.046    0.008    5.960    0.000    0.233    0.233
##   W_ANG ~~
##     W_TRD              0.036    0.008    4.296    0.000    0.141    0.141
##
## Intercepts:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy               0.000                               0.000    0.000
##    .Cheer             0.000                               0.000    0.000
##    .Enthus            0.000                               0.000    0.000
##    .Content           0.000                               0.000    0.000
##    .Relax             0.000                               0.000    0.000
##    .Calm              0.000                               0.000    0.000
##    .Nerv              0.000                               0.000    0.000
##    .Worry             0.000                               0.000    0.000
##    .Afraid            0.000                               0.000    0.000
##    .Hopeless          0.000                               0.000    0.000
##    .Sad               0.000                               0.000    0.000
```

```
##    .Angry             0.000                                0.000    0.000
##    .Annoy             0.000                                0.000    0.000
##    .Tired             0.000                                0.000    0.000
##    .Slug              0.000                                0.000    0.000
##     W_PA              0.000                                0.000    0.000
##     W_NA              0.000                                0.000    0.000
##     W_ANG             0.000                                0.000    0.000
##     W_TRD             0.000                                0.000    0.000
##
## Variances:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy              0.392    0.026   15.032    0.000    0.392    0.554
##    .Cheer            0.405    0.026   15.561    0.000    0.405    0.525
##    .Enthus           0.466    0.029   15.893    0.000    0.466    0.642
##    .Content          0.326    0.023   14.027    0.000    0.326    0.449
##    .Relax            0.562    0.032   17.531    0.000    0.562    0.760
##    .Calm             0.573    0.030   18.853    0.000    0.573    0.828
##    .Nerv             0.375    0.028   13.214    0.000    0.375    0.845
##    .Worry            0.346    0.024   14.141    0.000    0.346    0.740
##    .Afraid           0.154    0.019    7.988    0.000    0.154    0.796
##    .Hopeless         0.141    0.019    7.450    0.000    0.141    0.742
##    .Sad              0.203    0.021    9.582    0.000    0.203    0.726
##    .Angry            0.109    0.014    7.576    0.000    0.109    0.485
##    .Annoy            0.254    0.027    9.253    0.000    0.254    0.476
##    .Tired            0.384    0.036   10.635    0.000    0.384    0.405
##    .Slug             0.319    0.029   10.853    0.000    0.319    0.468
##     W_PA             0.315    0.035    9.077    0.000    1.000    1.000
##     W_NA             0.069    0.015    4.653    0.000    1.000    1.000
##     W_ANG            0.116    0.022    5.348    0.000    1.000    1.000
##     W_TRD            0.565    0.048   11.778    0.000    1.000    1.000
##
##
## Level 2 [ID]:
##
## Latent Variables:
##                   Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##   B_PA =~
##     Joy              1.000                                0.657    0.958
##     Cheer            0.965    0.036   26.576    0.000    0.634    0.978
##     Enthus           0.930    0.039   23.721    0.000    0.611    0.933
##     Content          0.809    0.068   11.939    0.000    0.531    0.791
##     Relax            0.662    0.065   10.129    0.000    0.435    0.711
##     Calm             0.667    0.064   10.353    0.000    0.438    0.713
##   B_NA =~
##     Nerv             1.000                                0.333    0.760
##     Worry            1.092    0.053   20.427    0.000    0.363    0.780
##     Afraid           0.806    0.126    6.397    0.000    0.268    0.916
##     Hopeless         0.897    0.185    4.836    0.000    0.298    0.894
##     Sad              1.031    0.197    5.221    0.000    0.343    0.895
##   B_ANG =~
##     Angry            1.000                                0.210    0.997
##     Annoy            1.257    0.161    7.795    0.000    0.264    0.851
##   B_TRD =~
##     Tired            1.000                                0.443    0.762
```

```
##     Slug              1.126    0.207    5.438    0.000    0.499    0.986
##
## Covariances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##  .Relax ~~
##    .Calm              0.172    0.026    6.504    0.000    0.172    0.929
##  .Nerv ~~
##    .Worry             0.067    0.019    3.606    0.000    0.067    0.810
##   B_PA ~~
##     B_NA             -0.015    0.019   -0.793    0.428   -0.070   -0.070
##     B_ANG             0.004    0.012    0.378    0.705    0.032    0.032
##     B_TRD            -0.012    0.032   -0.362    0.717   -0.040   -0.040
##   B_NA ~~
##     B_ANG             0.064    0.021    3.107    0.002    0.917    0.917
##     B_TRD             0.079    0.026    3.063    0.002    0.539    0.539
##   B_ANG ~~
##     B_TRD             0.051    0.020    2.530    0.011    0.551    0.551
##
## Intercepts:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy               1.222    0.065   18.731    0.000    1.222    1.782
##    .Cheer             1.301    0.062   21.005    0.000    1.301    2.009
##    .Enthus            1.077    0.062   17.239    0.000    1.077    1.644
##    .Content           1.894    0.064   29.427    0.000    1.894    2.819
##    .Relax             1.870    0.059   31.863    0.000    1.870    3.058
##    .Calm              1.969    0.059   33.459    0.000    1.969    3.206
##    .Nerv              0.487    0.042   11.542    0.000    0.487    1.114
##    .Worry             0.554    0.045   12.381    0.000    0.554    1.190
##    .Afraid            0.185    0.028    6.598    0.000    0.185    0.634
##    .Hopeless          0.187    0.032    5.879    0.000    0.187    0.561
##    .Sad               0.277    0.037    7.553    0.000    0.277    0.723
##    .Angry             0.159    0.021    7.668    0.000    0.159    0.756
##    .Annoy             0.419    0.031   13.619    0.000    0.419    1.350
##    .Tired             1.186    0.056   21.127    0.000    1.186    2.039
##    .Slug              0.702    0.049   14.398    0.000    0.702    1.387
##     B_PA              0.000                              0.000    0.000
##     B_NA              0.000                              0.000    0.000
##     B_ANG             0.000                              0.000    0.000
##     B_TRD             0.000                              0.000    0.000
##
## Variances:
##                    Estimate  Std.Err  z-value  P(>|z|)   Std.lv  Std.all
##    .Joy               0.039    0.008    4.792    0.000    0.039    0.083
##    .Cheer             0.018    0.008    2.350    0.019    0.018    0.043
##    .Enthus            0.056    0.013    4.343    0.000    0.056    0.130
##    .Content           0.169    0.030    5.571    0.000    0.169    0.374
##    .Relax             0.185    0.027    6.812    0.000    0.185    0.494
##    .Calm              0.185    0.028    6.569    0.000    0.185    0.491
##    .Nerv              0.081    0.020    4.108    0.000    0.081    0.422
##    .Worry             0.085    0.020    4.231    0.000    0.085    0.391
##    .Afraid            0.014    0.006    2.204    0.028    0.014    0.160
##    .Hopeless          0.022    0.008    2.957    0.003    0.022    0.200
##    .Sad               0.029    0.014    2.052    0.040    0.029    0.200
##    .Angry             0.000    0.002    0.112    0.911    0.000    0.006
```

```
##    .Annoy             0.027    0.006    4.357    0.000    0.027    0.277
##    .Tired             0.142    0.034    4.153    0.000    0.142    0.420
##    .Slug              0.007    0.042    0.173    0.863    0.007    0.029
##     B_PA              0.431    0.056    7.699    0.000    1.000    1.000
##     B_NA              0.111    0.029    3.767    0.000    1.000    1.000
##     B_ANG             0.044    0.018    2.414    0.016    1.000    1.000
##     B_TRD             0.196    0.055    3.571    0.000    1.000    1.000
```

```
## $within
##             W_PA      W_NA     W_ANG     W_TRD
## alpha  0.8166953 0.6878633 0.6435746 0.7139527
## omega  0.6862027 0.4832306 0.6753958 0.7227583
## omega2 0.6862027 0.4832306 0.6753958 0.7227583
## omega3 0.6927551 0.4885608 0.6754631 0.7228190
## avevar 0.3756051 0.2257814 0.5213774 0.5688410
##
## $ID
##             B_PA      B_NA     B_ANG     B_TRD
## alpha  0.9517211 0.9288524 0.8816782 0.8535716
## omega  0.9164923 0.8759641 0.8930191 0.8559516
## omega2 0.9164923 0.8759641 0.8930191 0.8559516
## omega3 0.8907600 0.8722423 0.8881351 0.8517976
## avevar 0.7414822 0.6929359 0.8087144 0.7488380
```

References

Rosseel, Y. (2012). `lavaan`: An R package for structural equation modeling. *Journal of Statistical Software, 48*, 1-36. doi: 10.18637/jss.v048.i02