

Report 8

07/01/2019

1 Summary

Including background and interactions in the model leads to non-significant estimates. This summary is based on models with just the relevant count predictor (all gestures, holdout and gives, utterances, etc) and months, with an interaction between count and months. A by-dyad random intercept has been included in all models.

The estimate of understood and understood/said words is higher at 18 months than at 12 months.

The count of all infant gestures together (HoG, points, reaches) is in a significant interaction with months when the outcome variable is understood/said words: the count of infant gestures is positively correlated with understood/said words at 18 months, but not really at 12 months. A similar pattern can be seen with the H&G and points count, and the contingent talks count. The effect of count of maternal utterances and reaches on understood and understood/said word count is not significant.

2 All infant gestures

A model with number of understood words as outcome; as predictors: infant gestures count, months, background, all interactions; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ count_tot * months * background + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1180.8
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.74717 -0.54694  0.01362  0.40251  1.85188
##
## Random effects:
## Groups   Name                Variance Std.Dev.
## dyad     (Intercept) 2671      51.68
## Residual                2299      47.95
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##                                Estimate Std. Error    df
## (Intercept)                -11.53326    90.20899  60.50470
## count_tot                   -1.71945     2.03317  60.50470
```

```

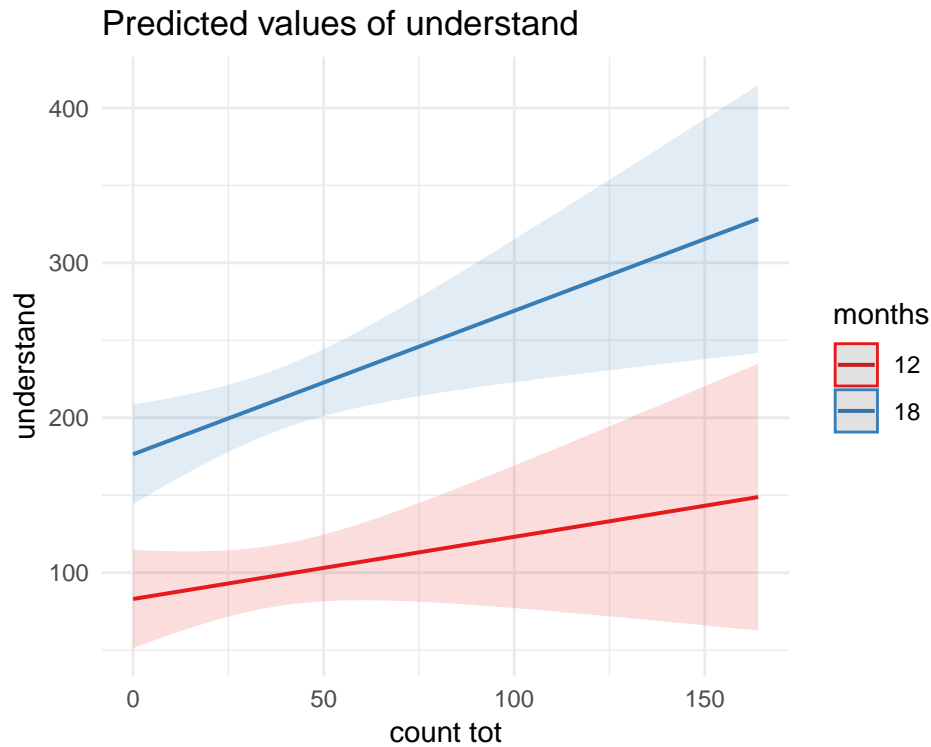
## months                10.30257    5.65012    47.87064
## backgroundChinese     -215.33019   116.59958    60.50470
## backgroundEnglish     -90.30873   106.47214    60.64043
## count_tot:months       0.11738    0.12734    47.87064
## count_tot:backgroundChinese  3.78521    2.52892    60.50470
## count_tot:backgroundEnglish -0.24189    2.31867    60.53955
## months:backgroundChinese  9.90219    7.30306    47.87064
## months:backgroundEnglish  6.81052    6.69456    48.26704
## count_tot:months:backgroundChinese -0.10980    0.15840    47.87064
## count_tot:months:backgroundEnglish  0.01585    0.14537    47.97274
##
##               t value Pr(>|t|)
## (Intercept)    -0.128   0.8987
## count_tot      -0.846   0.4011
## months         1.823   0.0745 .
## backgroundChinese -1.847   0.0697 .
## backgroundEnglish -0.848   0.3997
## count_tot:months  0.922   0.3613
## count_tot:backgroundChinese  1.497   0.1397
## count_tot:backgroundEnglish -0.104   0.9173
## months:backgroundChinese  1.356   0.1815
## months:backgroundEnglish  1.017   0.3141
## count_tot:months:backgroundChinese -0.693   0.4915
## count_tot:months:backgroundEnglish  0.109   0.9136
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##               (Intr) cnt_tt months bckgrC bckgrE cnt_t: cnt_:C cnt_:E mnth:C
## count_tot    -0.888
## months       -0.940  0.835
## bckgrndChns -0.774  0.687  0.727
## bckgrndEngl -0.847  0.753  0.796  0.655
## cnt_tt:mnth  0.835 -0.940 -0.888 -0.646 -0.707
## cnt_tt:bckC  0.714 -0.804 -0.671 -0.861 -0.605  0.755
## cnt_tt:bckE  0.779 -0.877 -0.732 -0.603 -0.826  0.824  0.705
## mnths:bckgC  0.727 -0.646 -0.774 -0.940 -0.616  0.687  0.809  0.566
## mnths:bckgE  0.793 -0.705 -0.844 -0.613 -0.940  0.750  0.566  0.775  0.653
## cnt_tt:mn:C -0.671  0.755  0.714  0.809  0.569 -0.804 -0.940 -0.662 -0.861
## cnt_tt:mn:E -0.731  0.823  0.778  0.566  0.777 -0.876 -0.662 -0.940 -0.602
##               mnth:E cn_::C
## count_tot
## months
## bckgrndChns
## bckgrndEngl
## cnt_tt:mnth
## cnt_tt:bckC
## cnt_tt:bckE
## mnths:bckgC

```

```
## mnths:bckgE
## cnt_tt:mn:C -0.603
## cnt_tt:mn:E -0.825  0.704
```

A model with number of understood words as outcome; as predictors: infant gestures count, months, and interaction between the two; by-dyad random intercepts.

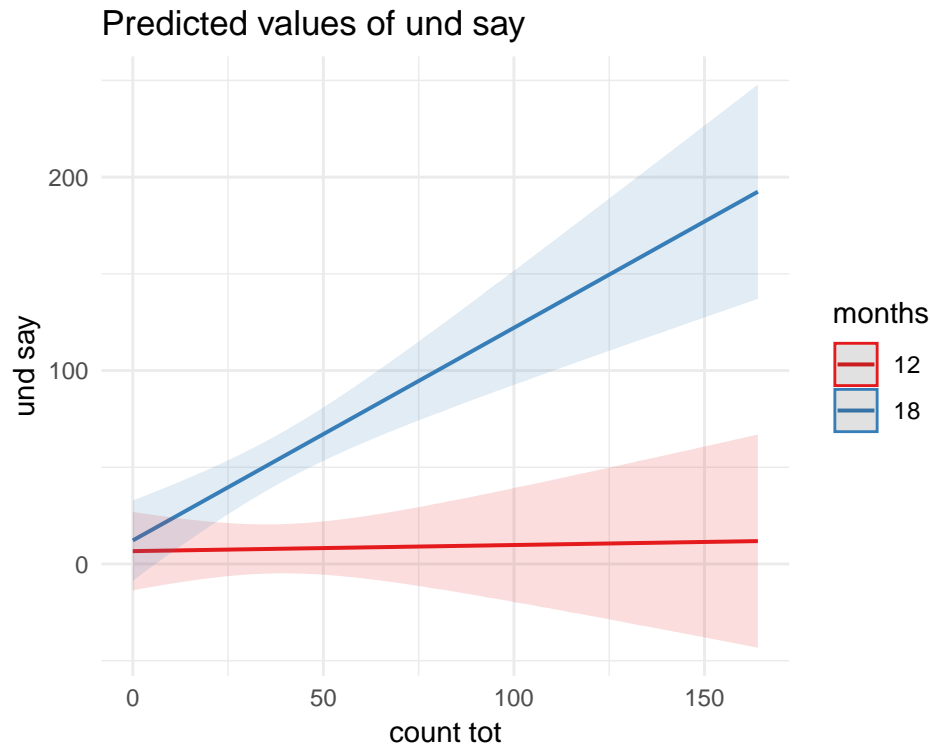
```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ count_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1220.4
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.53820 -0.47681 -0.09134  0.45523  1.97984
##
## Random effects:
## Groups   Name                Variance Std.Dev.
## dyad     (Intercept) 3279      57.26
## Residual                2365      48.63
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)   -103.79077   40.02556  67.41098  -2.593   0.0117 *
## count_tot      -0.64884    0.83279  67.33012  -0.779   0.4386
## months         15.56858    2.50342  52.42242   6.219 8.42e-08 ***
## count_tot:months  0.08750    0.05192  52.11407   1.685   0.0979 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) cnt_tt months
## count_tot    -0.781
## months       -0.933  0.728
## cnt_tt:mnth   0.731 -0.932 -0.783
```



A model with number of understood/said words as outcome; as predictors: infant gestures count, months, and interaction between the two; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: und_say ~ count_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1147.1
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.6451 -0.2949 -0.0400  0.1150  5.1936
##
## Random effects:
## Groups   Name                Variance Std.Dev.
## dyad     (Intercept)         281      16.76
## Residual                    2026      45.01
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##              Estimate Std. Error    df t value Pr(>|t|)
## (Intercept)   -4.40898   35.33834 58.60030  -0.125  0.901137
## count_tot     -2.10393    0.73592 58.32093  -2.859  0.005887 **
## months         0.92064    2.30729 53.64769   0.399  0.691468
## count_tot:months 0.17796    0.04795 53.17912   3.711  0.000495 ***
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) cnt_tt months
## count_tot    -0.781
## months        -0.975  0.761
## cnt_tt:mnth   0.763 -0.975 -0.782
```



3 HoGs and points

A model with number of understood words as outcome; as predictors: H&G and points count, months, background and all interaction; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ hgp_tot * months * background + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1183.1
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.64675 -0.51967 -0.00448  0.42619  1.76485
##
## Random effects:
```

```

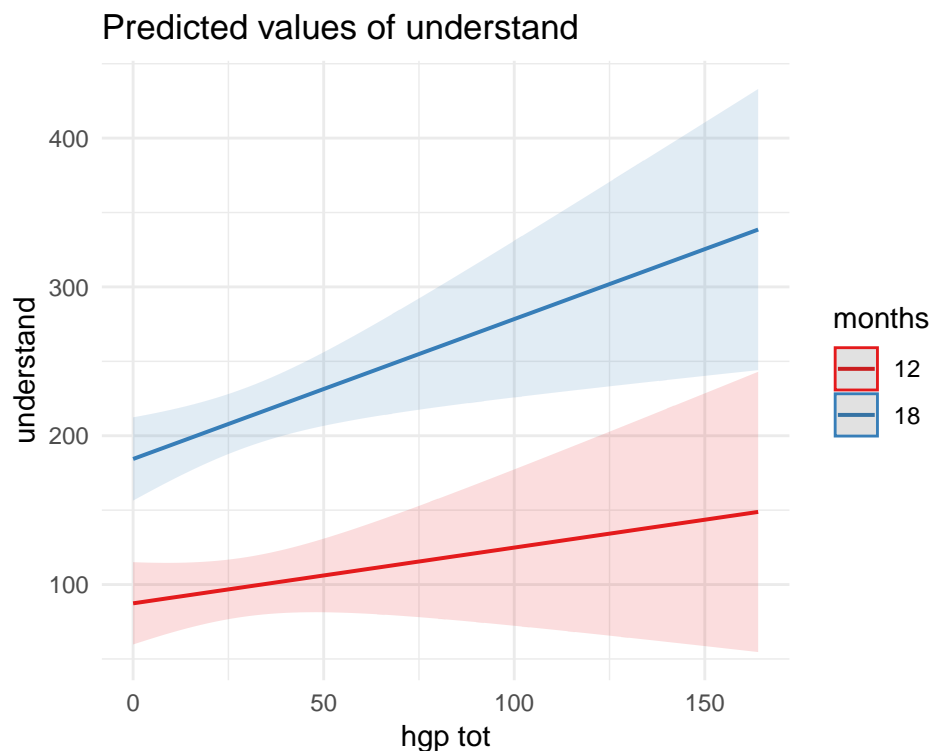
## Groups      Name      Variance Std.Dev.
## dyad        (Intercept) 2890      53.75
## Residual                2304      48.00
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##
##              Estimate Std. Error      df t value
## (Intercept)    -3.025e+01  7.880e+01  6.121e+01  -0.384
## hgp_tot        -1.743e+00  2.377e+00  6.121e+01  -0.733
## months         1.113e+01  4.919e+00  4.790e+01   2.262
## backgroundChinese -1.724e+02  1.018e+02  6.121e+01  -1.694
## backgroundEnglish -8.627e+01  9.437e+01  6.133e+01  -0.914
## hgp_tot:months   1.350e-01  1.484e-01  4.790e+01   0.910
## hgp_tot:backgroundChinese 3.597e+00  2.822e+00  6.121e+01   1.275
## hgp_tot:backgroundEnglish -1.949e-01  2.624e+00  6.123e+01  -0.074
## months:backgroundChinese 9.052e+00  6.353e+00  4.790e+01   1.425
## months:backgroundEnglish 7.037e+00  5.916e+00  4.830e+01   1.189
## hgp_tot:months:backgroundChinese -1.246e-01  1.762e-01  4.790e+01  -0.707
## hgp_tot:months:backgroundEnglish -5.375e-03  1.639e-01  4.797e+01  -0.033
##
##              Pr(>|t|)
## (Intercept)      0.7024
## hgp_tot          0.4664
## months           0.0283 *
## backgroundChinese 0.0954 .
## backgroundEnglish 0.3642
## hgp_tot:months   0.3676
## hgp_tot:backgroundChinese 0.2073
## hgp_tot:backgroundEnglish 0.9410
## months:backgroundChinese 0.1607
## months:backgroundEnglish 0.2401
## hgp_tot:months:backgroundChinese 0.4829
## hgp_tot:months:backgroundEnglish 0.9740
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) hgp_tt months bckgrC bckgrE hgp_t: hgp_:C hgp_:E mnth:C
## hgp_tot      -0.850
## months       -0.936  0.796
## bckgrndChns -0.774  0.658  0.725
## bckgrndEngl -0.835  0.709  0.782  0.647
## hgp_tt:mnth  0.796 -0.936 -0.850 -0.616 -0.664
## hgp_tt:bckC  0.716 -0.842 -0.670 -0.809 -0.597  0.789
## hgp_tt:bckE  0.770 -0.906 -0.721 -0.596 -0.771  0.848  0.763
## mnths:bckgC  0.725 -0.616 -0.774 -0.936 -0.605  0.658  0.758  0.558
## mnths:bckgE  0.779 -0.661 -0.831 -0.603 -0.937  0.706  0.557  0.721  0.644
## hgp_tt:mn:C -0.670  0.789  0.716  0.758  0.559 -0.842 -0.936 -0.715 -0.809
## hgp_tt:mn:E -0.720  0.848  0.769  0.558  0.724 -0.905 -0.714 -0.937 -0.596

```

```
##          mnth:E hg_::C
## hgp_tot
## months
## bckgrndChns
## bckgrndEngl
## hgp_tt:mnth
## hgp_tt:bckC
## hgp_tt:bckE
## mnths:bckgC
## mnths:bckgE
## hgp_tt:mn:C -0.595
## hgp_tt:mn:E -0.771  0.763
```

A model with number of understood words as outcome; as predictors: H&G and points count, months, and interaction between the two; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ hgp_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1220.2
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.48779 -0.47461 -0.06162  0.46424  1.92329
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## dyad      (Intercept) 3315         57.58
## Residual                2349         48.47
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)  -106.62133   34.78108  67.61030  -3.065  0.00312 **
## hgp_tot       -0.75634    0.84955   67.53140  -0.890  0.37648
## months        16.16696    2.17268   52.40323   7.441  9.39e-10 ***
## hgp_tot:months  0.09424    0.05290   52.09060   1.782  0.08065 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) hgp_tt months
## hgp_tot      -0.698
## months      -0.932  0.650
## hgp_tt:mnth  0.652 -0.932 -0.700
```

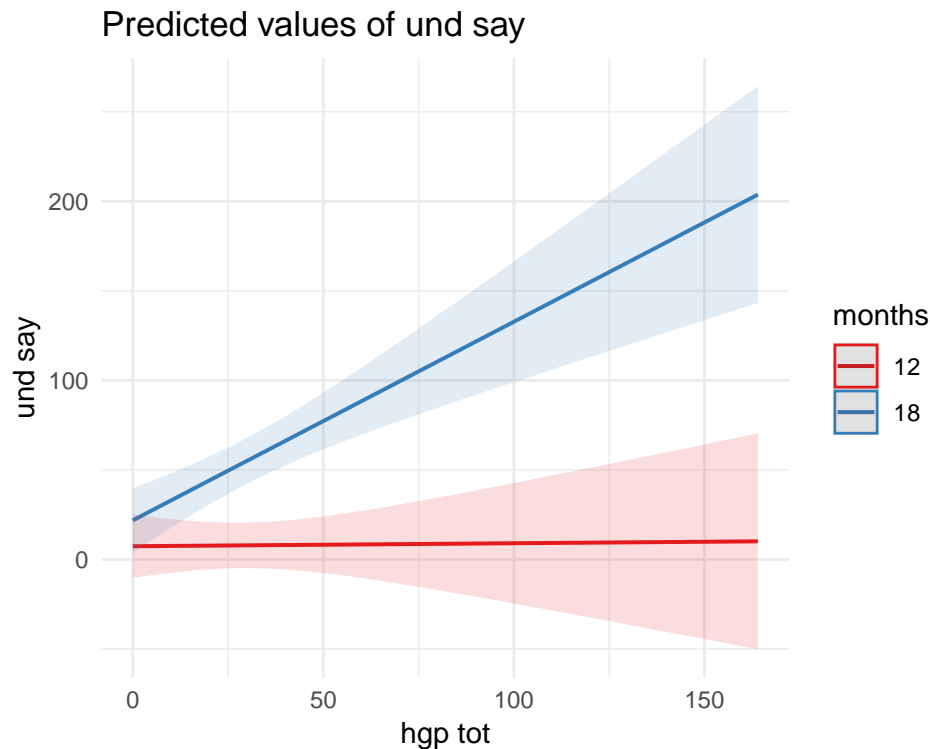


A model with number of understood/said words as outcome; as predictors: H&G and points count, months, and interaction between the two; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: und_say ~ hgp_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1147.5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.6473 -0.2989 -0.0408  0.1149  5.2699
##
## Random effects:
## Groups   Name                Variance Std.Dev.
## dyad     (Intercept)          296.9    17.23
## Residual                    2024.2    44.99
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)  -21.53337   30.78529   58.62260  -0.699  0.487025
## hgp_tot       -2.16893    0.75263   58.33881  -2.882  0.005525 **
## months         2.40664    2.00891   53.57824   1.198  0.236195
## hgp_tot:months  0.18213    0.04901   53.10111   3.716  0.000488 ***
## ---
```



```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) hgp_tt months
## hgp_tot      -0.697
## months       -0.975  0.680
## hgp_tt:mnth   0.681 -0.975 -0.699
```



4 Reaches

A model with number of understood words as outcome; as predictors: reaches count, months, background and all interaction; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ reach_tot * months * background + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1178.6
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.77264 -0.51430  0.02511  0.54580  1.62157
##
## Random effects:
```

```

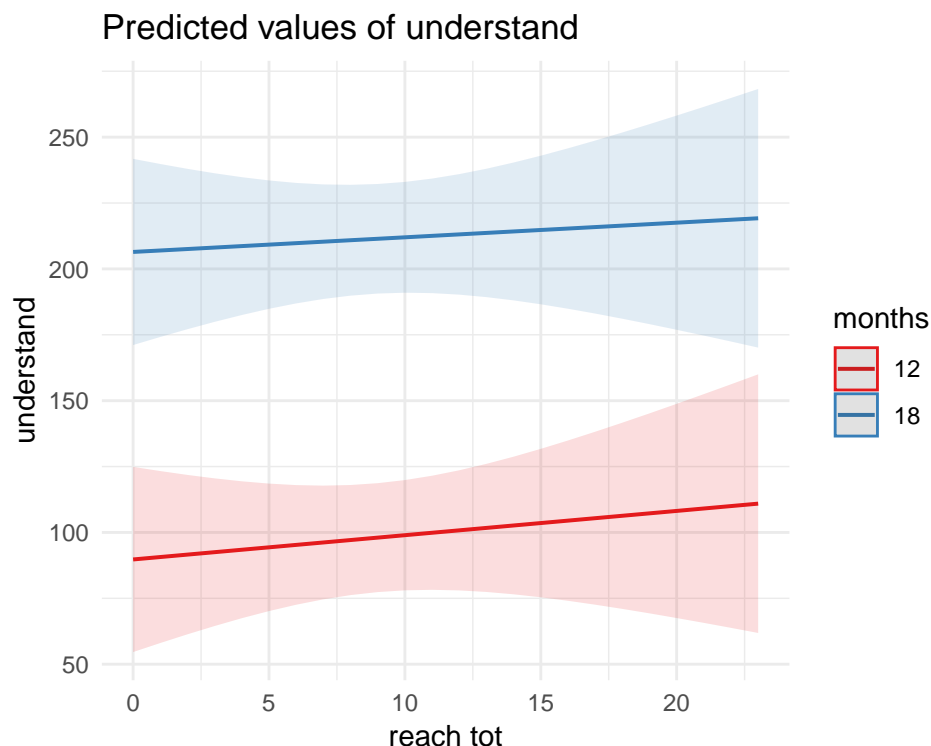
## Groups      Name      Variance Std.Dev.
## dyad        (Intercept) 3654      60.45
## Residual                2485      49.85
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##
##              Estimate Std. Error      df t value
## (Intercept)    -31.8808    86.6703   62.7555  -0.368
## reach_tot       -4.2115     6.6556   62.7555  -0.633
## months          12.9846     5.3702   47.8794   2.418
## backgroundChinese -163.7787  118.8588   62.7555  -1.378
## backgroundEnglish -138.0321  108.6959   62.8027  -1.270
## reach_tot:months    0.1727    0.4124   47.8794   0.419
## reach_tot:backgroundChinese 10.3022   10.4027   62.7555   0.990
## reach_tot:backgroundEnglish  4.5599    9.4843   62.7579   0.481
## months:backgroundChinese    8.1027    7.3647   47.8794   1.100
## months:backgroundEnglish    8.3412    6.7510   48.0873   1.236
## reach_tot:months:backgroundChinese -0.2407    0.6446   47.8794  -0.373
## reach_tot:months:backgroundEnglish -0.1323    0.5877   47.8900  -0.225
##
##              Pr(>|t|)
## (Intercept)    0.7142
## reach_tot      0.5292
## months         0.0195 *
## backgroundChinese 0.1731
## backgroundEnglish 0.2088
## reach_tot:months 0.6772
## reach_tot:backgroundChinese 0.3258
## reach_tot:backgroundEnglish 0.6323
## months:backgroundChinese 0.2767
## months:backgroundEnglish 0.2226
## reach_tot:months:backgroundChinese 0.7105
## reach_tot:months:backgroundEnglish 0.8229
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) rch_tt months bckgrC bckgrE rch_t: rch_:C rch_:E mnth:C
## reach_tot    -0.865
## months        -0.929  0.804
## bckgrndChns  -0.729  0.631  0.678
## bckgrndEngl  -0.797  0.690  0.741  0.581
## rch_tt:mnth  0.804 -0.929 -0.865 -0.586 -0.641
## rch_tt:bckC  0.553 -0.640 -0.514 -0.843 -0.441  0.595
## rch_tt:bckE  0.607 -0.702 -0.564 -0.443 -0.795  0.652  0.449
## mnths:bckgC  0.678 -0.586 -0.729 -0.929 -0.540  0.631  0.783  0.411
## mnths:bckgE  0.739 -0.639 -0.795 -0.539 -0.930  0.688  0.409  0.738  0.580
## rch_tt:mn:C -0.514  0.595  0.553  0.783  0.410 -0.640 -0.929 -0.417 -0.843
## rch_tt:mn:E -0.564  0.652  0.607  0.411  0.739 -0.702 -0.417 -0.929 -0.443

```

```
##          mnth:E rc_::C
## reach_tot
## months
## bckgrndChns
## bckgrndEngl
## rch_tt:mnth
## rch_tt:bckC
## rch_tt:bckE
## mnths:bckgC
## mnths:bckgE
## rch_tt:mn:C -0.440
## rch_tt:mn:E -0.794  0.449
```

A model with number of understood words as outcome; as predictors: reaches count, months, and interaction between the two; by-dyad random intercepts.

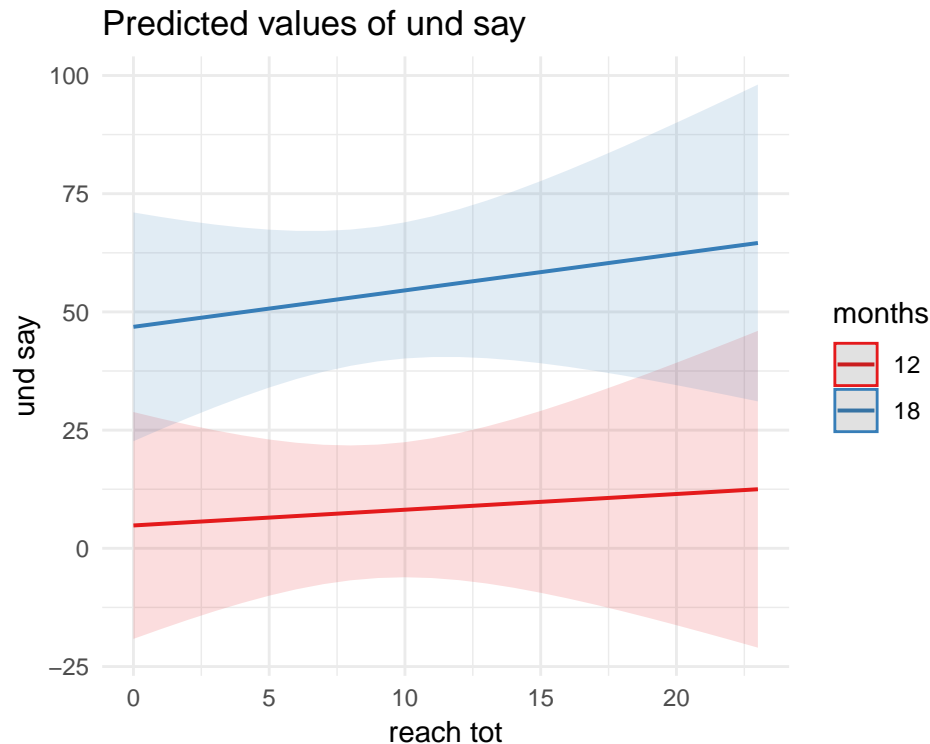
```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ reach_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1221.3
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.5140 -0.5941 -0.0561  0.5158  1.7552
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## dyad      (Intercept)          3640      60.34
## Residual                    2473      49.73
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)   -143.62983   43.54107   68.11489   -3.299  0.00155 **
## reach_tot        1.65200    3.91756   68.06536    0.422  0.67458
## months         19.44798    2.70583   52.22044    7.187 2.43e-09 ***
## reach_tot:months -0.06093    0.24289   52.00199   -0.251  0.80291
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) rch_tt months
## reach_tot   -0.809
## months      -0.930  0.751
## rch_tt:mnth  0.753 -0.929 -0.809
```



A model with number of understood/said words as outcome; as predictors: reach count, months, and interaction between the two; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: und_say ~ reach_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1163.4
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0021 -0.5942 -0.0473  0.0622  4.8782
##
## Random effects:
## Groups   Name                Variance Std.Dev.
## dyad     (Intercept)         301.7    17.37
## Residual                    2548.9    50.49
## Number of obs: 109, groups: dyad, 55
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)   -79.18384   42.04927   58.12865   -1.883   0.0647 .
## reach_tot      -0.54333    3.78589   57.92651   -0.144   0.8864
## months          7.00150    2.74140   53.13124    2.554   0.0136 *
## reach_tot:months  0.07302    0.24647   52.79269    0.296   0.7682
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##          (Intr) rch_tt months
## reach_tot  -0.809
## months      -0.976  0.789
## rch_tt:mnth  0.790 -0.976 -0.809
```



5 Contingent talks

A model with number of understood words as outcome; as predictors: contingent talks count, months, background, and all interactions; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ ct_tot * months * background + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1158.5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.5331 -0.5368  0.0162  0.4602  1.6119
##
## Random effects:
```

```

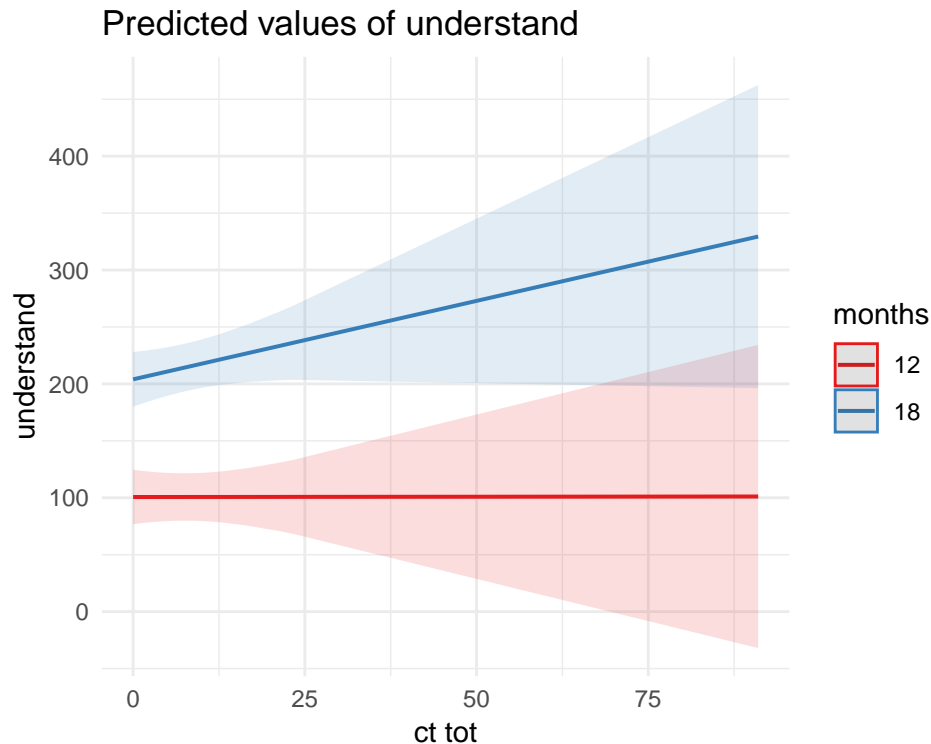
## Groups      Name      Variance Std.Dev.
## dyad        (Intercept) 3625      60.21
## Residual                2446      49.46
## Number of obs: 107, groups: dyad, 54
##
## Fixed effects:
##
##              Estimate Std. Error      df t value
## (Intercept)    -110.6215    53.7851   61.5684   -2.057
## ct_tot           9.8165     9.9876   61.5684    0.983
## months          16.6784     3.3313   46.9256    5.007
## backgroundChinese -47.4939    87.2923   61.5684   -0.544
## backgroundEnglish -18.8444    74.4312   61.6706   -0.253
## ct_tot:months    -0.4354     0.6186   46.9256   -0.704
## ct_tot:backgroundChinese -7.3882    11.7782   61.5684   -0.627
## ct_tot:backgroundEnglish -13.0948    10.2215   61.5696   -1.281
## months:backgroundChinese 2.4688     5.4067   46.9256    0.457
## months:backgroundEnglish 2.3351     4.6350   47.3826    0.504
## ct_tot:months:backgroundChinese 0.5818     0.7295   46.9256    0.797
## ct_tot:months:backgroundEnglish 0.6581     0.6331   46.9308    1.039
##
##              Pr(>|t|)
## (Intercept)      0.044 *
## ct_tot           0.330
## months          8.25e-06 ***
## backgroundChinese 0.588
## backgroundEnglish 0.801
## ct_tot:months    0.485
## ct_tot:backgroundChinese 0.533
## ct_tot:backgroundEnglish 0.205
## months:backgroundChinese 0.650
## months:backgroundEnglish 0.617
## ct_tot:months:backgroundChinese 0.429
## ct_tot:months:backgroundEnglish 0.304
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) ct_tot months bckgrC bckgrE ct_tt: ct_t:C ct_t:E mnth:C
## ct_tot        -0.596
## months        -0.929  0.554
## bckgrndChns   -0.616  0.367  0.572
## bckgrndEngl   -0.723  0.431  0.671  0.445
## ct_tt:mnths   0.554 -0.929 -0.596 -0.341 -0.400
## ct_tt:bckgC   0.506 -0.848 -0.470 -0.624 -0.365  0.788
## ct_tt:bckgE   0.583 -0.977 -0.541 -0.359 -0.493  0.908  0.829
## mnths:bckgC   0.572 -0.341 -0.616 -0.929 -0.414  0.367  0.579  0.333
## mnths:bckgE   0.668 -0.398 -0.719 -0.411 -0.930  0.428  0.338  0.456  0.443
## ct_tt:mnt:C   -0.470  0.788  0.506  0.579  0.339 -0.848 -0.929 -0.770 -0.624
## ct_tt:mnt:E   -0.541  0.908  0.583  0.333  0.458 -0.977 -0.770 -0.929 -0.359

```

```
##          mnth:E ct_::C
## ct_tot
## months
## bckgrndChns
## bckgrndEngl
## ct_tt:mnths
## ct_tt:bckgC
## ct_tt:bckgE
## mnths:bckgC
## mnths:bckgE
## ct_tt:mnt:C -0.363
## ct_tt:mnt:E -0.491  0.829
```

A model with number of understood words as outcome; as predictors: contingent talks count, months, and interaction between the two; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ ct_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1199.7
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.50281 -0.53484 -0.06465  0.45958  1.71123
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## dyad      (Intercept) 3680         60.67
## Residual                2393         48.92
## Number of obs: 107, groups: dyad, 54
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)  -105.9926   29.3160   67.3472  -3.616 0.000574 ***
## ct_tot        -2.7417    1.9235   67.2909  -1.425 0.158670
## months        17.2216    1.8184   51.2881   9.471 7.53e-13 ***
## ct_tot:months   0.2289    0.1189   51.0070   1.924 0.059887 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) ct_tot months
## ct_tot       -0.494
## months       -0.928  0.457
## ct_tt:mnths   0.459 -0.927 -0.494
```

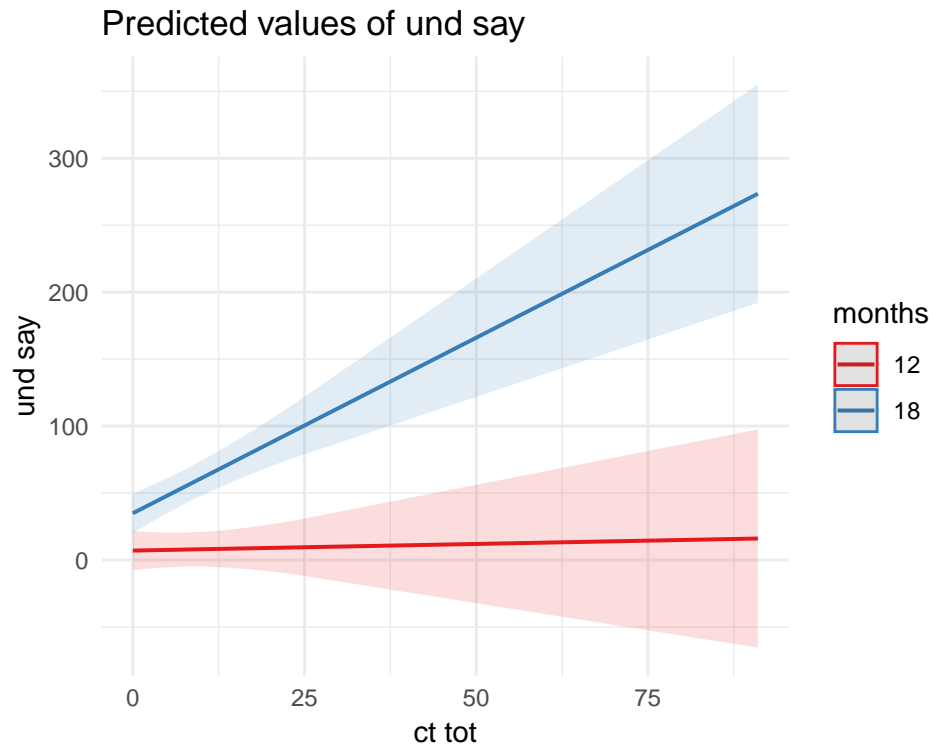


A model with number of understood/said words as outcome; as predictors: contingent talks count, months, and interaction between the two; by-dyad random intercepts.

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: und_say ~ ct_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1121.2
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.4538 -0.4998 -0.0264  0.0844  5.0390
##
## Random effects:
## Groups   Name                Variance Std.Dev.
## dyad     (Intercept)          272.8    16.52
## Residual                    2004.2    44.77
## Number of obs: 107, groups: dyad, 54
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)  -48.6655    25.4770   57.1883  -1.910  0.061130 .
## ct_tot       -4.9476     1.6731   56.9250  -2.957  0.004514 **
## months        4.6434     1.6602   52.1618   2.797  0.007210 **
## ct_tot:months  0.4205     0.1088   51.7189   3.864  0.000312 ***
## ---
```



```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##          (Intr) ct_tot months
## ct_tot    -0.494
## months    -0.975  0.481
## ct_tot:mnths  0.482 -0.975 -0.494
```



6 Maternal utterances

A model with number of understood words as outcome; as predictors: maternal utterances count, months, background, and all interactions; by-dyad random intercepts.

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
```

```
## Formula: understand ~ utt_tot * months * background + (1 | dyad)
```

```
## Data: vocab
```

```
##
```

```
## REML criterion at convergence: 1111.2
```

```
##
```

```

## Scaled residuals:
##      Min      1Q   Median      3Q      Max
## -1.51565 -0.49198  0.00639  0.48531  1.73592
##
## Random effects:
##      Groups      Name      Variance Std.Dev.
##      dyad      (Intercept) 3872      62.23
##      Residual      2410      49.09
## Number of obs: 99, groups: dyad, 50
##
## Fixed effects:
##
##              Estimate Std. Error      df t value
## (Intercept)    -8.473e+01  7.748e+01  5.740e+01  -1.094
## utt_tot         6.841e-03  1.028e-01  5.740e+01   0.067
## months         1.444e+01  4.778e+00  4.322e+01   3.021
## backgroundChinese -1.069e+02  1.257e+02  5.740e+01  -0.851
## backgroundEnglish  1.413e+02  2.405e+02  5.764e+01   0.587
## utt_tot:months    1.704e-03  6.341e-03  4.322e+01   0.269
## utt_tot:backgroundChinese  5.678e-02  1.572e-01  5.740e+01   0.361
## utt_tot:backgroundEnglish -2.117e-01  2.786e-01  5.756e+01  -0.760
## months:backgroundChinese  6.038e+00  7.750e+00  4.322e+01   0.779
## months:backgroundEnglish  1.574e+00  1.511e+01  4.459e+01   0.104
## utt_tot:months:backgroundChinese -1.938e-03  9.693e-03  4.322e+01  -0.200
## utt_tot:months:backgroundEnglish  1.116e-03  1.740e-02  4.414e+01   0.064
##
##              Pr(>|t|)
## (Intercept)      0.27869
## utt_tot          0.94718
## months          0.00422 **
## backgroundChinese 0.39851
## backgroundEnglish 0.55921
## utt_tot:months    0.78945
## utt_tot:backgroundChinese 0.71923
## utt_tot:backgroundEnglish 0.45037
## months:backgroundChinese 0.44021
## months:backgroundEnglish 0.91753
## utt_tot:months:backgroundChinese 0.84243
## utt_tot:months:backgroundEnglish 0.94916
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) utt_tt months bckgrC bckgrE utt_t: utt_:C utt_:E mnth:C
## utt_tot      -0.821
## months      -0.925  0.760
## bckgrndChns -0.617  0.506  0.570
## bckgrndEngl -0.322  0.265  0.298  0.199
## utt_tt:mnth  0.760 -0.925 -0.821 -0.468 -0.245
## utt_tt:bckC  0.537 -0.654 -0.497 -0.867 -0.173  0.605

```

```

## utt_tt:bckE  0.303 -0.369 -0.280 -0.187 -0.953  0.341  0.241
## mnths:bckgC  0.570 -0.468 -0.617 -0.925 -0.184  0.506  0.802  0.173
## mnths:bckgE  0.293 -0.240 -0.316 -0.180 -0.927  0.260  0.157  0.881  0.195
## utt_tt:mn:C -0.497  0.605  0.537  0.802  0.160 -0.654 -0.925 -0.223 -0.867
## utt_tt:mn:E -0.277  0.337  0.299  0.171  0.887 -0.364 -0.221 -0.926 -0.185
##          mnth:E ut_::C
## utt_tot
## months
## bckgrndChns
## bckgrndEngl
## utt_tt:mnth
## utt_tt:bckC
## utt_tt:bckE
## mnths:bckgC
## mnths:bckgE
## utt_tt:mn:C -0.170
## utt_tt:mn:E -0.954  0.238
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling

A model with number of understood words as outcome; as predictors: maternal utterances count,
months, and interaction between the two; by-dyad random intercepts.

## Warning: Some predictor variables are on very different scales: consider
## rescaling

## Warning: Some predictor variables are on very different scales: consider
## rescaling

## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
## Formula: understand ~ utt_tot * months + (1 | dyad)
## Data: vocab
##
## REML criterion at convergence: 1122.3
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.50968 -0.52981  0.00072  0.46811  1.80340
##
## Random effects:
## Groups   Name                Variance Std.Dev.
## dyad     (Intercept) 3963      62.95
## Residual                2290      47.86
## Number of obs: 99, groups: dyad, 50
##
## Fixed effects:
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)   -1.120e+02  5.767e+01  6.337e+01  -1.943   0.0565 .

```

```
## utt_tot          -2.221e-03  7.058e-02  6.336e+01  -0.031  0.9750
## months           1.661e+01  3.547e+00  4.711e+01   4.682  2.43e-05 ***
## utt_tot:months    1.959e-03  4.336e-03  4.701e+01   0.452  0.6534
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) utt_tt months
## utt_tot      -0.892
## months       -0.921  0.821
## utt_tt:mnth  0.822 -0.921 -0.891
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```

A model with number of understood/said words as outcome; as predictors: maternal utterances count, months, and interaction between the two; by-dyad random intercepts.

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
## Warning: Some predictor variables are on very different scales: consider
## rescaling
```

```
## Linear mixed model fit by REML. t-tests use Satterthwaite's method [
## lmerModLmerTest]
```

```
## Formula: und_say ~ utt_tot * months + (1 | dyad)
## Data: vocab
```

```
##
```

```
## REML criterion at convergence: 1048.3
```

```
##
```

```
## Scaled residuals:
```

```
##      Min      1Q  Median      3Q      Max
## -1.5455 -0.3786 -0.0439  0.0721  4.9551
```

```
##
```

```
## Random effects:
```

```
## Groups   Name              Variance Std.Dev.
## dyad     (Intercept) 252.7    15.90
## Residual                1988.0   44.59
```

```
## Number of obs: 99, groups: dyad, 50
```

```
##
```

```
## Fixed effects:
```

```
##              Estimate Std. Error      df t value Pr(>|t|)
## (Intercept)  -17.010657  50.696871  52.550812  -0.336  0.7386
## utt_tot       -0.078926   0.062078  52.447768  -1.271  0.2092
## months        1.684411   3.301037  47.882950   0.510  0.6122
## utt_tot:months  0.006948   0.004039  47.709819   1.720  0.0919 .
```

```
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
```

```
## Correlation of Fixed Effects:
##           (Intr) utt_tt months
## utt_tot    -0.892
## months     -0.976  0.870
## utt_tt:mnth 0.871 -0.976 -0.892
## fit warnings:
## Some predictor variables are on very different scales: consider rescaling
```