```
> #DV: Spelling
> model0_mijiref_spell<-
lmer(spell~male+BL_ses+age_child+wave+(1+wave|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_spell)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method [
lmerModLmerTest]
Formula: spell ~ male + BL_ses + age_child + wave + (1 + wave |
child_id)
   Data: kenyadata

REML criterion at convergence: 35392.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.8979 -0.5451 -0.0095  0.5457  3.1441

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 6.3911   2.5281
          wave        0.6383   0.7989   -0.61
 Residual             7.4473   2.7290
Number of obs: 6513, groups:  child_id, 2428

Fixed effects:
                   Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)         12.73122    0.35618 2426.04756  35.744  <
2e-16 ***
maleMale            -0.11520    0.14190 2357.05615  -0.812
0.416973
BL_sesLess poor     -0.89737    0.23127 2352.96133  -3.880
0.000107 ***
BL_sesMedian poor   -1.46856    0.23083 2366.38700  -6.362
2.38e-10 ***
BL_sesPoor          -1.56889    0.23009 2380.91786  -6.818
1.16e-11 ***
BL_sesPoorest       -2.06089    0.22462 2359.95853  -9.175  <
2e-16 ***
age_child            0.06523    0.04260 2397.37725   1.531
0.125882
wave                 1.73631    0.04517 2280.00252  38.437  <
2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.082
BL_sesLsspr -0.299 -0.009
BL_sesMdnpr -0.260 -0.022  0.523
BL_sesPoor  -0.234 -0.026  0.526  0.533
BL_sesPorst -0.211 -0.001  0.541  0.549  0.555
age_child   -0.858 -0.123 -0.041 -0.084 -0.113   -0.155
wave         0.087 -0.006 -0.008 -0.005 -0.001   -0.008    0.008
>
> model1_mijiref_spell<-
lmer(spell~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgsnd
s+BL_gll3_rcplang+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_spell)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method [
lmerModLmerTest]
Formula:
spell ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 34902.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.7264 -0.5607 -0.0201  0.5531  2.8991

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 5.1777   2.2755
          wave        0.6814   0.8255   -0.29
 Residual             7.4072   2.7216
Number of obs: 6513, groups:  child_id, 2428

Fixed effects:
                        Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)              7.42414    0.44473 2432.61222  16.694
< 2e-16 ***
maleMale                -0.32542    0.12865 2357.23954  -2.530
0.0115 *
BL_sesLess poor         -0.49794    0.21035 2346.49283  -2.367
0.0180 *
```

```
BL_sesMedian poor       -0.84167    0.21127 2362.37708  -3.984
6.98e-05 ***
BL_sesPoor              -0.87029    0.21187 2375.61088  -4.108
4.13e-05 ***
BL_sesPoorest           -1.24476    0.20847 2351.66155  -5.971
2.72e-09 ***
age_child               -0.09984    0.03983 2396.54206  -2.507
0.0123 *
wave                     1.73576    0.04533 2262.95891  38.295
< 2e-16 ***
lang3_swarefMijikenda   -0.06744    0.18731 2394.46983  -0.360
0.7188
lang3_swarefKamba        0.23148    0.23932 2360.78041   0.967
0.3335
BL_gll1_bgsnds           0.44322    0.02810 2336.13281  15.774
< 2e-16 ***
BL_gll3_rcplang          0.21290    0.01685 2374.39137  12.635
< 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M
maleMale     0.008
BL_sesLsspr -0.241 -0.016
BL_sesMdnpr -0.268 -0.036  0.529
BL_sesPoor  -0.236 -0.040  0.532  0.547
BL_sesPorst -0.229 -0.017  0.543  0.563  0.575
age_child   -0.505 -0.107 -0.051 -0.091 -0.111   -0.146
wave         0.089 -0.005 -0.007 -0.005 -0.001   -0.007    0.008
lng3_swrfMj -0.276 -0.015 -0.073 -0.060 -0.116   -0.137   -0.124
-0.010
lng3_swrfKm -0.300 -0.023 -0.089 -0.021 -0.037   -0.030    0.024
-0.012  0.623
BL_gll1_bgs -0.034  0.001  0.020  0.014  0.039    0.045   -0.148
-0.001 -0.021
BL_gll3_rcp -0.595 -0.095  0.073  0.141  0.127    0.141   -0.081
-0.003  0.092
            lng3_K BL_g1_
maleMale
BL_sesLsspr
BL_sesMdnpr
BL_sesPoor
BL_sesPorst
age_child
wave
```

```
lng3_swrfMj
lng3_swrfKm
BL_gll1_bgs -0.017
BL_gll3_rcp  0.068 -0.294
>
> model2_mijiref_spell<-
lmer(spell~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_rc
plang)+lang3_swaref*(BL_gll1_bgsnds+BL_gll3_rcplang)+(1+wave|chi
ld_id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_spell)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method [
lmerModLmerTest]
Formula: spell ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref * (BL_gll1_bgsnds +
BL_gll3_rcplang) +
    (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 34836.4

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.92523 -0.56079 -0.00406  0.55810  2.89969

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 4.990    2.2338
          wave        0.469    0.6848   -0.48
 Residual             7.444    2.7283
Number of obs: 6513, groups:  child_id, 2428

Fixed effects:
                                        Estimate Std. Error
df t value
(Intercept)                              7.65605    0.88502
2561.56915   8.651
maleMale                                -0.32288    0.12851
2354.88008  -2.513
BL_sesLess poor                         -0.46249    0.21047
2343.27631  -2.197
BL_sesMedian poor                       -0.80936    0.21147
2359.23838  -3.827
BL_sesPoor                              -0.85617    0.21163
2372.69874  -4.046
```

```
BL_sesPoorest                                -1.22458    0.20832
2348.43990  -5.878
age_child                                    -0.10191    0.03988
2392.82211  -2.555
wave                                          3.24531    0.20565
2273.92917  15.781
BL_gll1_bgsnds                                0.26631    0.07598
2573.47722   3.505
BL_gll3_rcplang                               0.24798    0.04566
2628.79734   5.430
lang3_swarefMijikenda                         1.00069    0.88691
2408.82236   1.128
lang3_swarefKamba                             2.20862    1.16371
2386.67764   1.898
wave:BL_gll1_bgsnds                          -0.14024    0.01941
2242.17180  -7.226
wave:BL_gll3_rcplang                         -0.04243    0.01153
2272.72242  -3.681
BL_gll1_bgsnds:lang3_swarefMijikenda          0.06419    0.08089
2384.16009   0.794
BL_gll1_bgsnds:lang3_swarefKamba              0.10738    0.10705
2368.29613   1.003
BL_gll3_rcplang:lang3_swarefMijikenda        -0.07433    0.04828
2426.65782  -1.540
BL_gll3_rcplang:lang3_swarefKamba            -0.13780    0.06572
2404.01803  -2.097
                                            Pr(>|t|)
(Intercept)                                  < 2e-16 ***
maleMale                                    0.012053 *
BL_sesLess poor                             0.028084 *
BL_sesMedian poor                           0.000133 ***
BL_sesPoor                                  5.38e-05 ***
BL_sesPoorest                               4.73e-09 ***
age_child                                   0.010677 *
wave                                         < 2e-16 ***
BL_gll1_bgsnds                              0.000464 ***
BL_gll3_rcplang                             6.13e-08 ***
lang3_swarefMijikenda                       0.259310
lang3_swarefKamba                           0.057827 .
wave:BL_gll1_bgsnds                         6.77e-13 ***
wave:BL_gll3_rcplang                        0.000238 ***
BL_gll1_bgsnds:lang3_swarefMijikenda        0.427506
BL_gll1_bgsnds:lang3_swarefKamba            0.315906
BL_gll3_rcplang:lang3_swarefMijikenda       0.123799
BL_gll3_rcplang:lang3_swarefKamba           0.036123 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_spell<-
lmer(spell~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bgsn
ds+BL_gll3_rcplang)+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_spell)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method [
lmerModLmerTest]
Formula:
spell ~ male + BL_ses + age_child + wave * lang3_swaref *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 34851.3

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.96984 -0.56017 -0.00636  0.55962  2.90044

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 4.997    2.2355
          wave        0.471    0.6863   -0.48
 Residual             7.438    2.7274
Number of obs: 6513, groups:  child_id, 2428

Fixed effects:
                                            Estimate Std. Error
df
(Intercept)                                  7.80139    1.00198
2286.48884
maleMale                                    -0.32151    0.12852
2354.55386
BL_sesLess poor                             -0.46803    0.21050
2343.15261
BL_sesMedian poor                           -0.81273    0.21149
2359.02636
BL_sesPoor                                  -0.85937    0.21165
2372.61288
```

```
BL_sesPoorest                                  -1.22805    0.20835
2348.32865
age_child                                      -0.10215    0.03989
2392.45119
wave                                            3.40756    0.57641
2308.24512
lang3_swarefMijikenda                           0.89135    1.03929
2175.20742
lang3_swarefKamba                               1.86723    1.35041
2134.36699
BL_gll1_bgsnds                                  0.25097    0.08693
2179.89047
BL_gll3_rcplang                                 0.25357    0.05262
2223.61563
wave:lang3_swarefMijikenda                     -0.12511    0.62439
2303.63273
wave:lang3_swarefKamba                         -0.40303    0.81027
2250.29899
wave:BL_gll1_bgsnds                            -0.15678    0.05241
2309.25115
wave:BL_gll3_rcplang                           -0.03633    0.03152
2353.04172
lang3_swarefMijikenda:BL_gll1_bgsnds            0.09292    0.09463
2164.38207
lang3_swarefKamba:BL_gll1_bgsnds                0.06080    0.12485
2161.49759
lang3_swarefMijikenda:BL_gll3_rcplang          -0.08584    0.05697
2205.62077
lang3_swarefKamba:BL_gll3_rcplang              -0.12196    0.07677
2158.58213
wave:lang3_swarefMijikenda:BL_gll1_bgsnds       0.03293    0.05710
2294.88606
wave:lang3_swarefKamba:BL_gll1_bgsnds          -0.05762    0.07557
2289.17789
wave:lang3_swarefMijikenda:BL_gll3_rcplang     -0.01325    0.03426
2338.60543
wave:lang3_swarefKamba:BL_gll3_rcplang          0.01929    0.04610
2282.43309
                                              t value Pr(>|t|)
(Intercept)                                     7.786 1.04e-14 ***
maleMale                                       -2.502 0.012427 *
BL_sesLess poor                                -2.223 0.026279 *
BL_sesMedian poor                              -3.843 0.000125 ***
BL_sesPoor                                     -4.060 5.06e-05 ***
BL_sesPoorest                                  -5.894 4.30e-09 ***
age_child                                      -2.561 0.010500 *
wave                                            5.912 3.89e-09 ***
```

```
lang3_swarefMijikenda                            0.858 0.391176
lang3_swarefKamba                                1.383 0.166898
BL_gll1_bgsnds                                   2.887 0.003927 **
BL_gll3_rcplang                                  4.819 1.54e-06 ***
wave:lang3_swarefMijikenda                      -0.200 0.841203
wave:lang3_swarefKamba                          -0.497 0.618953
wave:BL_gll1_bgsnds                             -2.991 0.002807 **
wave:BL_gll3_rcplang                            -1.153 0.249203
lang3_swarefMijikenda:BL_gll1_bgsnds             0.982 0.326206
lang3_swarefKamba:BL_gll1_bgsnds                 0.487 0.626306
lang3_swarefMijikenda:BL_gll3_rcplang           -1.507 0.132026
lang3_swarefKamba:BL_gll3_rcplang               -1.589 0.112275
wave:lang3_swarefMijikenda:BL_gll1_bgsnds        0.577 0.564164
wave:lang3_swarefKamba:BL_gll1_bgsnds           -0.762 0.445897
wave:lang3_swarefMijikenda:BL_gll3_rcplang      -0.387 0.699000
wave:lang3_swarefKamba:BL_gll3_rcplang           0.418 0.675708
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_spell,model1_mijiref_spell,model2_mijiref_s
pell,model3_mijiref_spell)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_spell: spell ~ male + BL_ses + age_child + wave +
(1 + wave | child_id)
model1_mijiref_spell: spell ~ male + BL_ses + age_child + wave +
lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_spell:     BL_gll3_rcplang + (1 + wave |
child_id)
model2_mijiref_spell: spell ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
model2_mijiref_spell:     BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_spell:     (1 + wave | child_id)
model3_mijiref_spell: spell ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_spell:     BL_gll3_rcplang) + (1 + wave |
child_id)
                    Df   AIC   BIC logLik deviance    Chisq Chi
Df Pr(>Chisq)
```

```
model0_mijiref_spell 12 35396 35477 -17686    35372
model1_mijiref_spell 16 34898 35007 -17433    34866 505.5986
4     <2e-16
model2_mijiref_spell 22 34816 34965 -17386    34772  94.5872
6     <2e-16
model3_mijiref_spell 28 34820 35010 -17382    34764   7.4454
6     0.2816

model0_mijiref_spell
model1_mijiref_spell ***
model2_mijiref_spell ***
model3_mijiref_spell
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model2_mijiref_spell, show.se=TRUE, show.std=TRUE)
Caution! ICC for random-slope-intercept models usually not
meaningful. Use `adjusted = TRUE` to use the mean random effect
variance to calculate the ICC. See 'Note' in `?icc`.
> ranova(model2_mijiref_spell)
ANOVA-like table for random-effects: Single term deletions

Model:
spell ~ male + BL_ses + age_child + wave + BL_gll1_bgsnds +
BL_gll3_rcplang +
    lang3_swaref + (1 + wave | child_id) + wave:BL_gll1_bgsnds +
    wave:BL_gll3_rcplang + BL_gll1_bgsnds:lang3_swaref +
BL_gll3_rcplang:lang3_swaref
                              npar logLik   AIC    LRT Df
Pr(>Chisq)
<none>                          22 -17418 34880
wave in (1 + wave | child_id)   20 -17461 34962 85.432  2  <
2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
> #DV: English Letter per Minute
> model0_mijiref_leng<-
lmer(lpm_eng~male+BL_ses+age_child+wave+(1+wave|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_leng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method [
lmerModLmerTest]
Formula: lpm_eng ~ male + BL_ses + age_child + wave + (1 + wave
| child_id)
   Data: kenyadata
```

```
REML criterion at convergence: 52936.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.7780 -0.4827 -0.0685  0.4502  4.2362

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 259.78   16.118
          wave         29.33    5.416   0.67
 Residual              94.18    9.705
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                   Estimate Std. Error        df t value
Pr(>|t|)
(Intercept)         31.2300     1.4609 2591.6920  21.377  < 2e-
16 ***
maleMale            -0.5936     0.5764 2416.4996  -1.030
0.30323
BL_sesLess poor     -1.4026     0.9386 2408.2460  -1.494
0.13523
BL_sesMedian poor   -0.8471     0.9361 2413.1189  -0.905
0.36559
BL_sesPoor          -1.6912     0.9316 2417.4932  -1.815
0.06959 .
BL_sesPoorest       -2.9053     0.9129 2410.4807  -3.183
0.00148 **
age_child            0.3553     0.1723 2424.3335   2.063
0.03926 *
wave                 8.2504     0.1925 2147.9469  42.854  < 2e-
16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.084
BL_sesLsspr -0.294 -0.008
BL_sesMdnpr -0.254 -0.019  0.521
BL_sesPoor  -0.228 -0.024  0.524  0.532
BL_sesPorst -0.204  0.002  0.537  0.545  0.553
age_child   -0.846 -0.122 -0.042 -0.086 -0.117   -0.158
wave         0.188 -0.004 -0.002 -0.002  0.000   -0.003    0.003
>
> model1_mijiref_leng<-
lmer(lpm_eng~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgs
```

```
nds+BL_gll3_rcplang+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_leng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method [
lmerModLmerTest]
Formula:
lpm_eng ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 52688.3

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.8062 -0.4888 -0.0600  0.4459  4.2642

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 238.68   15.449
          wave         29.47    5.429   0.69
 Residual              94.11    9.701
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                       Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)            17.35959    1.90698 2524.26994   9.103
< 2e-16 ***
maleMale               -1.23189    0.55042 2410.30575  -2.238
0.0253 *
BL_sesLess poor        -0.29313    0.89963 2398.65510  -0.326
0.7446
BL_sesMedian poor       1.03720    0.90272 2404.98577   1.149
0.2507
BL_sesPoor              0.56635    0.90413 2408.81842   0.626
0.5311
BL_sesPoorest          -0.35921    0.89286 2402.06830  -0.402
0.6875
age_child              -0.09087    0.16972 2417.44079  -0.535
0.5924
wave                    8.25086    0.19250 2149.73809  42.860
< 2e-16 ***
lang3_swarefMijikenda  -1.13621    0.79744 2416.75598  -1.425
0.1543
```

```
lang3_swarefKamba        1.17691    1.02276 2407.00141   1.151
0.2500
BL_gll1_bgsnds           1.37997    0.12041 2394.43272  11.461
< 2e-16 ***
BL_gll3_rcplang          0.51975    0.07208 2425.13979   7.210
7.43e-13 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M
maleMale     0.007
BL_sesLsspr -0.240 -0.015
BL_sesMdnpr -0.265 -0.034  0.527
BL_sesPoor  -0.234 -0.038  0.530  0.546
BL_sesPorst -0.224 -0.015  0.540  0.560  0.574
age_child   -0.498 -0.105 -0.053 -0.093 -0.115   -0.150
wave         0.145 -0.004 -0.002 -0.002  0.000   -0.003    0.003
lng3_swrfMj -0.272 -0.014 -0.075 -0.063 -0.118   -0.141   -0.126
-0.004
lng3_swrfKm -0.293 -0.022 -0.092 -0.023 -0.038   -0.033    0.020
-0.005  0.618
BL_gll1_bgs -0.035  0.001  0.022  0.015  0.043    0.048   -0.151
-0.001 -0.023
BL_gll3_rcp -0.593 -0.098  0.076  0.142  0.127    0.141   -0.084
0.000  0.094
            lng3_K BL_g1_
maleMale
BL_sesLsspr
BL_sesMdnpr
BL_sesPoor
BL_sesPorst
age_child
wave
lng3_swrfMj
lng3_swrfKm
BL_gll1_bgs -0.018
BL_gll3_rcp  0.069 -0.293
>
> model2_mijiref_leng<-
lmer(lpm_eng~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_
rcplang)+lang3_swaref*(BL_gll1_bgsnds+BL_gll3_rcplang)+(1+wave|c
hild_id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_leng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method [
```

```
lmerModLmerTest]
Formula: lpm_eng ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref * (BL_gll1_bgsnds +
BL_gll3_rcplang) +
    (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 52695.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.8063 -0.4864 -0.0611  0.4466  4.2591

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 238.93   15.457
          wave         29.42    5.424   0.69
 Residual              94.14    9.702
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                                    Estimate Std. Error
df t value
(Intercept)                         16.62469    3.92442
2921.98136   4.236
maleMale                            -1.22347    0.55079
2406.09917  -2.221
BL_sesLess poor                     -0.26274    0.90180
2394.30227  -0.291
BL_sesMedian poor                    1.03048    0.90520
2400.02334   1.138
BL_sesPoor                           0.56745    0.90473
2404.51996   0.627
BL_sesPoorest                       -0.34719    0.89388
2397.85218  -0.388
age_child                           -0.09789    0.17027
2412.74816  -0.575
wave                                 7.37017    0.89420
2176.29752   8.242
BL_gll1_bgsnds                       0.98981    0.33776
2962.15834   2.931
BL_gll3_rcplang                      0.67471    0.20284
3004.48546   3.326
lang3_swarefMijikenda               -1.57377    3.81072
2467.46552  -0.413
```

```
lang3_swarefKamba                          -0.05912    4.99645
2454.54223  -0.012
wave:BL_gll1_bgsnds                        -0.08123    0.08410
2146.98999  -0.966
wave:BL_gll3_rcplang                        0.07265    0.05004
2175.87334   1.452
BL_gll1_bgsnds:lang3_swarefMijikenda        0.30278    0.34492
2398.06619   0.878
BL_gll1_bgsnds:lang3_swarefKamba            0.42231    0.45751
2394.35306   0.923
BL_gll3_rcplang:lang3_swarefMijikenda      -0.06198    0.20613
2444.22326  -0.301
BL_gll3_rcplang:lang3_swarefKamba          -0.05257    0.28076
2437.94959  -0.187
                                          Pr(>|t|)
(Intercept)                               2.34e-05 ***
maleMale                                  0.026423 *
BL_sesLess poor                           0.770806
BL_sesMedian poor                         0.255067
BL_sesPoor                                0.530585
BL_sesPoorest                             0.697751
age_child                                 0.565384
wave                                      2.89e-16 ***
BL_gll1_bgsnds                            0.003410 **
BL_gll3_rcplang                           0.000891 ***
lang3_swarefMijikenda                     0.679654
lang3_swarefKamba                         0.990560
wave:BL_gll1_bgsnds                       0.334193
wave:BL_gll3_rcplang                      0.146667
BL_gll1_bgsnds:lang3_swarefMijikenda      0.380127
BL_gll1_bgsnds:lang3_swarefKamba          0.356070
BL_gll3_rcplang:lang3_swarefMijikenda     0.763677
BL_gll3_rcplang:lang3_swarefKamba         0.851496
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_leng<-
lmer(lpm_eng~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bg
snds+BL_gll3_rcplang)+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_leng)
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's
method [
lmerModLmerTest]
Formula:
lpm_eng ~ male + BL_ses + age_child + wave * lang3_swaref *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 52696.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.8061 -0.4855 -0.0596  0.4477  4.2954

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 239.00   15.460
          wave         29.52    5.433   0.69
 Residual              94.13    9.702
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                                          Estimate Std. Error
df
(Intercept)                               16.58398    5.16170
2433.65812
maleMale                                  -1.22371    0.55076
2405.94523
BL_sesLess poor                           -0.25818    0.90179
2394.32823
BL_sesMedian poor                          1.02569    0.90516
2399.94012
BL_sesPoor                                 0.56730    0.90468
2404.41028
BL_sesPoorest                             -0.34962    0.89384
2397.78790
age_child                                 -0.09782    0.17027
2412.64964
wave                                       7.31065    2.54772
2241.10680
lang3_swarefMijikenda                     -1.93592    5.42929
2288.65361
lang3_swarefKamba                          3.48435    7.08112
2236.80438
BL_gll1_bgsnds                             1.34217    0.45409
2301.67260
```

```
BL_gll3_rcplang                                0.60570    0.27370
2349.70650
wave:lang3_swarefMijikenda                    -0.22618    2.75261
2231.62704
wave:lang3_swarefKamba                         2.51112    3.55104
2158.93165
wave:BL_gll1_bgsnds                            0.16504    0.22773
2212.34342
wave:BL_gll3_rcplang                           0.02603    0.13852
2273.64102
lang3_swarefMijikenda:BL_gll1_bgsnds          -0.12965    0.49498
2284.95237
lang3_swarefKamba:BL_gll1_bgsnds               0.22809    0.65299
2281.14842
lang3_swarefMijikenda:BL_gll3_rcplang          0.04146    0.29688
2325.52984
lang3_swarefKamba:BL_gll3_rcplang             -0.19434    0.40167
2266.52845
wave:lang3_swarefMijikenda:BL_gll1_bgsnds     -0.30288    0.24802
2197.54021
wave:lang3_swarefKamba:BL_gll1_bgsnds         -0.13622    0.32772
2201.70069
wave:lang3_swarefMijikenda:BL_gll3_rcplang     0.07105    0.15025
2256.63141
wave:lang3_swarefKamba:BL_gll3_rcplang        -0.10044    0.20123
2179.27185
                                            t value Pr(>|t|)
(Intercept)                                   3.213  0.00133 **
maleMale                                     -2.222  0.02639 *
BL_sesLess poor                              -0.286  0.77468
BL_sesMedian poor                             1.133  0.25727
BL_sesPoor                                    0.627  0.53067
BL_sesPoorest                                -0.391  0.69573
age_child                                    -0.575  0.56568
wave                                          2.869  0.00415 **
lang3_swarefMijikenda                        -0.357  0.72145
lang3_swarefKamba                             0.492  0.62272
BL_gll1_bgsnds                                2.956  0.00315 **
BL_gll3_rcplang                               2.213  0.02699 *
wave:lang3_swarefMijikenda                   -0.082  0.93452
wave:lang3_swarefKamba                        0.707  0.47955
wave:BL_gll1_bgsnds                           0.725  0.46870
wave:BL_gll3_rcplang                          0.188  0.85098
lang3_swarefMijikenda:BL_gll1_bgsnds         -0.262  0.79340
lang3_swarefKamba:BL_gll1_bgsnds              0.349  0.72690
lang3_swarefMijikenda:BL_gll3_rcplang         0.140  0.88894
lang3_swarefKamba:BL_gll3_rcplang            -0.484  0.62855
```

```
wave:lang3_swarefMijikenda:BL_gll1_bgsnds   -1.221  0.22215
wave:lang3_swarefKamba:BL_gll1_bgsnds       -0.416  0.67769
wave:lang3_swarefMijikenda:BL_gll3_rcplang   0.473  0.63632
wave:lang3_swarefKamba:BL_gll3_rcplang      -0.499  0.61775
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_leng,model1_mijiref_leng,model2_mijiref_len
g,model3_mijiref_leng)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_leng: lpm_eng ~ male + BL_ses + age_child + wave
+ (1 + wave | child_id)
model1_mijiref_leng: lpm_eng ~ male + BL_ses + age_child + wave
+ lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_leng:     BL_gll3_rcplang + (1 + wave | child_id)
model2_mijiref_leng: lpm_eng ~ male + BL_ses + age_child + wave
* (BL_gll1_bgsnds +
model2_mijiref_leng:     BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_leng:     (1 + wave | child_id)
model3_mijiref_leng: lpm_eng ~ male + BL_ses + age_child + wave
* lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_leng:     BL_gll3_rcplang) + (1 + wave |
child_id)
                    Df   AIC   BIC logLik deviance    Chisq Chi
Df Pr(>Chisq)
model0_mijiref_leng 12 52963 53044 -26469    52939
model1_mijiref_leng 16 52719 52827 -26343    52687 251.7613
4     <2e-16
model2_mijiref_leng 22 52727 52876 -26342    52683   3.4143
6     0.7553
model3_mijiref_leng 28 52735 52925 -26340    52679   4.1408
6     0.6576

model0_mijiref_leng
model1_mijiref_leng ***
model2_mijiref_leng
model3_mijiref_leng
---
```

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model1_mijiref_leng, show.se=TRUE, show.std=TRUE)
Caution! ICC for random-slope-intercept models usually not
meaningful. Use `adjusted = TRUE` to use the mean random effect
variance to calculate the ICC. See 'Note' in `?icc`.
> ranova(model1_mijiref_leng)
ANOVA-like table for random-effects: Single term deletions

Model:
lpm_eng ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 + wave | child_id)
                              npar logLik   AIC   LRT Df
Pr(>Chisq)
<none>                          16 -26344 52720
wave in (1 + wave | child_id)   14 -26457 52942 225.8  2  <
2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
> #DV: English Word per Minute
>
> model0_mijiref_weng2<-
lmer(wpm_eng~male+BL_ses+age_child+wave+(1+wave|child_id),
data=kenyadata, na.action=na.omit)
singular fit
> summary(model0_mijiref_weng) #singular fit
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 46471.4

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.3348 -0.5116 -0.1201  0.3633  9.6175

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 31.67    5.628
 Residual             53.43    7.310
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
```

```
                   Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)         14.97094    0.75155 2653.93771  19.920  <
2e-16 ***
maleMale             0.02178    0.29702 2499.76288   0.073
0.9416
BL_sesLess poor     -1.03677    0.48364 2490.97970  -2.144
0.0322 *
BL_sesMedian poor   -2.31885    0.48260 2502.80923  -4.805
1.64e-06 ***
BL_sesPoor          -2.98209    0.48090 2515.94130  -6.201
6.53e-10 ***
BL_sesPoorest       -3.52661    0.47019 2495.04220  -7.500
8.79e-14 ***
age_child           -0.12643    0.08901 2529.55927  -1.420
0.1556
wave                 5.70024    0.11331 4443.08104  50.306  <
2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.083
BL_sesLsspr -0.297 -0.008
BL_sesMdnpr -0.257 -0.020  0.522
BL_sesPoor  -0.231 -0.025  0.525  0.532
BL_sesPorst -0.208  0.001  0.539  0.547  0.553
age_child   -0.850 -0.123 -0.041 -0.085 -0.114   -0.155
wave         0.163 -0.006 -0.007 -0.005 -0.002   -0.008    0.007
>
> model0_mijiref_weng<-
lmer(wpm_eng~male+BL_ses+age_child+wave+(1|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_weng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 46471.4

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.3348 -0.5116 -0.1201  0.3633  9.6175
```

```
Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 31.67    5.628
 Residual             53.43    7.310
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                    Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)         14.97094    0.75155 2653.93771  19.920  <
2e-16 ***
maleMale             0.02178    0.29702 2499.76288   0.073
0.9416
BL_sesLess poor     -1.03677    0.48364 2490.97970  -2.144
0.0322 *
BL_sesMedian poor   -2.31885    0.48260 2502.80923  -4.805
1.64e-06 ***
BL_sesPoor          -2.98209    0.48090 2515.94130  -6.201
6.53e-10 ***
BL_sesPoorest       -3.52661    0.47019 2495.04220  -7.500
8.79e-14 ***
age_child           -0.12643    0.08901 2529.55927  -1.420
0.1556
wave                 5.70024    0.11331 4443.08104  50.306  <
2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.083
BL_sesLsspr -0.297 -0.008
BL_sesMdnpr -0.257 -0.020  0.522
BL_sesPoor  -0.231 -0.025  0.525  0.532
BL_sesPorst -0.208  0.001  0.539  0.547  0.553
age_child   -0.850 -0.123 -0.041 -0.085 -0.114   -0.155
wave         0.163 -0.006 -0.007 -0.005 -0.002   -0.008    0.007
>
> model1_mijiref_weng<-
lmer(wpm_eng~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgs
nds+BL_gll3_rcplang+(1|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_weng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
```

```
Formula: wpm_eng ~ male + BL_ses + age_child + wave +
lang3_swaref + BL_gll1_bgsnds +      BL_gll3_rcplang + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 46169.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1870 -0.5295 -0.1211  0.3572  9.7663

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 25.44    5.044
 Residual             53.42    7.309
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                       Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)             7.82447    0.97128 2601.43438   8.056
1.19e-15 ***
maleMale               -0.30207    0.28002 2488.14305  -1.079
0.280807
BL_sesLess poor        -0.48633    0.45745 2472.67118  -1.063
0.287826
BL_sesMedian poor      -1.32602    0.45937 2487.36514  -2.887
0.003928 **
BL_sesPoor             -1.73892    0.46069 2500.44615  -3.775
0.000164 ***
BL_sesPoorest          -2.11164    0.45378 2476.09594  -4.653
3.44e-06 ***
age_child              -0.35292    0.08659 2519.45027  -4.076
4.72e-05 ***
wave                    5.70230    0.11309 4463.29785  50.423
< 2e-16 ***
lang3_swarefMijikenda  -0.96734    0.40695 2517.50994  -2.377
0.017527 *
lang3_swarefKamba       0.89491    0.52052 2491.53840   1.719
0.085692 .
BL_gll1_bgsnds          0.83193    0.06115 2465.68193  13.606
< 2e-16 ***
BL_gll3_rcplang         0.24119    0.03671 2510.77755   6.571
6.07e-11 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M lng3_K BL_g1_
maleMale     0.008
BL_sesLsspr -0.240 -0.015
BL_sesMdnpr -0.267 -0.035  0.528
BL_sesPoor  -0.235 -0.039  0.531  0.546
BL_sesPorst -0.228 -0.015  0.542  0.561  0.574
age_child   -0.500 -0.106 -0.051 -0.091 -0.112   -0.147
wave         0.129 -0.006 -0.007 -0.005 -0.001   -0.007    0.007
lng3_swrfMj -0.275 -0.015 -0.074 -0.061 -0.117   -0.138   -0.125
-0.008
lng3_swrfKm -0.297 -0.023 -0.090 -0.022 -0.037   -0.031    0.022
-0.010  0.621
BL_gll1_bgs -0.035  0.001  0.020  0.014  0.040    0.046   -0.150
-0.001 -0.021 -0.017
BL_gll3_rcp -0.594 -0.097  0.074  0.142  0.127    0.141   -0.082
0.000  0.093  0.069 -0.292
>
> model2_mijiref_weng<-
lmer(wpm_eng~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_
rcplang)+lang3_swaref+(BL_gll1_bgsnds+BL_gll3_rcplang)+(1|child_
id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_weng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref + (BL_gll1_bgsnds +
BL_gll3_rcplang) +      (1 | child_id)
   Data: kenyadata

REML criterion at convergence: 45914.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1332 -0.4997 -0.1013  0.3230  9.6077

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 26.43    5.141
 Residual             50.24    7.088
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                      Estimate Std. Error         df t value
Pr(>|t|)
```

```
(Intercept)              0.14675    1.11160 3996.01912   0.132
0.894980
maleMale                -0.29393    0.27938 2487.09154  -1.052
0.292866
BL_sesLess poor         -0.54746    0.45647 2472.20430  -1.199
0.230513
BL_sesMedian poor       -1.34877    0.45833 2486.10138  -2.943
0.003283 **
BL_sesPoor              -1.77407    0.45962 2498.79274  -3.860
0.000116 ***
BL_sesPoorest           -2.13627    0.45278 2475.10991  -4.718
2.51e-06 ***
age_child               -0.34539    0.08637 2517.14301  -3.999
6.55e-05 ***
wave                    -1.30988    0.51014 4483.91762  -2.568
0.010270 *
BL_gll1_bgsnds           1.41109    0.08036 5260.69449  17.560
< 2e-16 ***
BL_gll3_rcplang          0.49412    0.04817 5267.69822  10.258
< 2e-16 ***
lang3_swarefMijikenda   -0.97025    0.40596 2515.65519  -2.390
0.016921 *
lang3_swarefKamba        0.90671    0.51932 2490.08518   1.746
0.080943 .
wave:BL_gll1_bgsnds      0.53301    0.04800 4432.10390  11.105
< 2e-16 ***
wave:BL_gll3_rcplang     0.23136    0.02857 4473.99162   8.099
7.06e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 14 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_weng<-
lmer(wpm_eng~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bg
snds+BL_gll3_rcplang)+(1|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_weng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +      BL_gll3_rcplang) + (1 |
child_id)
   Data: kenyadata
```

```
REML criterion at convergence: 45866.4

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1975 -0.5016 -0.0969  0.3211  9.3889

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 26.58    5.156
 Residual             49.59    7.042
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                                          Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                               -1.25876    2.46454
5212.55536  -0.511 0.609549
maleMale                                  -0.29432    0.27914
2484.06944  -1.054 0.291810
BL_sesLess poor                           -0.53979    0.45684
2468.66231  -1.182 0.237485
BL_sesMedian poor                         -1.33897    0.45887
2482.36799  -2.918 0.003555 **
BL_sesPoor                                -1.78412    0.45920
2495.69193  -3.885 0.000105 ***
BL_sesPoorest                             -2.15992    0.45257
2471.69245  -4.773 1.93e-06 ***
age_child                                 -0.34742    0.08651
2512.97356  -4.016 6.09e-05 ***
wave                                      -0.82843    1.44375
4571.21457  -0.574 0.566127
lang3_swarefMijikenda                      1.17485    2.58090
5411.19278   0.455 0.648976
lang3_swarefKamba                          0.98566    3.35007
5316.27986   0.294 0.768602
BL_gll1_bgsnds                             1.48688    0.21580
5428.23580   6.890 6.21e-12 ***
BL_gll3_rcplang                            0.62550    0.13072
5496.25043   4.785 1.75e-06 ***
wave:lang3_swarefMijikenda                -0.34790    1.55991
4557.07624  -0.223 0.823524
wave:lang3_swarefKamba                    -0.43053    2.00893
4497.68487  -0.214 0.830318
wave:BL_gll1_bgsnds                        0.50248    0.12894
4478.73277   3.897 9.88e-05 ***
```

```
wave:BL_gll3_rcplang                              0.28391    0.07849
4564.06869   3.617 0.000301 ***
lang3_swarefMijikenda:BL_gll1_bgsnds         -0.06425    0.23493
5401.19053  -0.273 0.784487
lang3_swarefKamba:BL_gll1_bgsnds             -0.18691    0.30977
5378.87236  -0.603 0.546273
lang3_swarefMijikenda:BL_gll3_rcplang        -0.20786    0.14159
5483.58199  -1.468 0.142130
lang3_swarefKamba:BL_gll3_rcplang             0.05963    0.19061
5384.24873   0.313 0.754426
wave:lang3_swarefMijikenda:BL_gll1_bgsnds     0.04976    0.14046
4467.86604   0.354 0.723166
wave:lang3_swarefKamba:BL_gll1_bgsnds         0.01930    0.18585
4456.85866   0.104 0.917291
wave:lang3_swarefMijikenda:BL_gll3_rcplang   -0.09591    0.08515
4547.49578  -1.126 0.260118
wave:lang3_swarefKamba:BL_gll3_rcplang        0.02619    0.11385
4497.08076   0.230 0.818090
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_weng,model1_mijiref_weng,model2_mijiref_wen
g,model3_mijiref_weng)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_weng: wpm_eng ~ male + BL_ses + age_child + wave
+ (1 | child_id)
model1_mijiref_weng: wpm_eng ~ male + BL_ses + age_child + wave
+ lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_weng:     BL_gll3_rcplang + (1 | child_id)
model2_mijiref_weng: wpm_eng ~ male + BL_ses + age_child + wave
* (BL_gll1_bgsnds +
model2_mijiref_weng:     BL_gll3_rcplang) + lang3_swaref +
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_weng:     (1 | child_id)
model3_mijiref_weng: wpm_eng ~ male + BL_ses + age_child + wave
* lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_weng:     BL_gll3_rcplang) + (1 | child_id)
                    Df   AIC   BIC logLik deviance   Chisq Chi
Df Pr(>Chisq)
```

```
model0_mijiref_weng 10 46483 46551 -23232    46463
model1_mijiref_weng 14 46180 46275 -23076    46152 311.682
4  < 2.2e-16 ***
model2_mijiref_weng 16 45919 46027 -22943    45887 264.866
2  < 2.2e-16 ***
model3_mijiref_weng 26 45871 46047 -22909    45819  67.962
10  1.096e-10 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model3_mijiref_weng, show.se=TRUE, show.std=TRUE)
> ranova(model3_mijiref_weng)
ANOVA-like table for random-effects: Single term deletions

Model:
wpm_eng ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 | child_id) + wave:lang3_swaref +
wave:BL_gll1_bgsnds +
    wave:BL_gll3_rcplang + lang3_swaref:BL_gll1_bgsnds +
lang3_swaref:BL_gll3_rcplang +
    wave:lang3_swaref:BL_gll1_bgsnds +
wave:lang3_swaref:BL_gll3_rcplang
               npar logLik   AIC    LRT Df Pr(>Chisq)
<none>           26 -22933 45918
(1 | child_id)   25 -23289 46627 710.97  1  < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>

> #DV: Swahili Letter per Minute
> model0_mijiref_lswa<-
lmer(lpm_swa~male+BL_ses+age_child+wave+(1+wave|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_lswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
  method [lmerModLmerTest]
Formula:
lpm_swa ~ male + BL_ses + age_child + wave + (1 + wave |
child_id)
   Data: kenyadata

REML criterion at convergence: 49579.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9652 -0.4213 -0.2499  0.2226  6.3475
```

```
Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 119.08   10.913
          wave         20.90    4.572   0.85
 Residual              78.95    8.885
Number of obs: 6454, groups:  child_id, 2423

Fixed effects:
                    Estimate Std. Error         df t value
(Intercept)         13.91909    0.92541 2771.07303  15.041
maleMale            -0.02515    0.35859 2429.21592  -0.070
BL_sesLess poor     -2.19983    0.58363 2419.35143  -3.769
BL_sesMedian poor   -3.96666    0.58229 2426.52458  -6.812
BL_sesPoor          -4.01717    0.57979 2433.62222  -6.929
BL_sesPoorest       -4.71109    0.56755 2421.86802  -8.301
age_child           -0.25650    0.10729 2444.33452  -2.391
wave                 1.23780    0.17120 2233.44388   7.230
                   Pr(>|t|)
(Intercept)         < 2e-16 ***
maleMale           0.944088
BL_sesLess poor    0.000168 ***
BL_sesMedian poor 1.21e-11 ***
BL_sesPoor        5.42e-12 ***
BL_sesPoorest       < 2e-16 ***
age_child          0.016887 *
wave               6.59e-13 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs
maleMale    -0.083
BL_sesLsspr -0.289 -0.007
BL_sesMdnpr -0.250 -0.019  0.521
BL_sesPoor  -0.224 -0.024  0.524  0.531
BL_sesPorst -0.201  0.001  0.537  0.545  0.553
age_child   -0.832 -0.122 -0.042 -0.086 -0.116   -0.157
wave         0.260 -0.004 -0.003 -0.003 -0.001   -0.005
            ag_chl
maleMale
BL_sesLsspr
BL_sesMdnpr
BL_sesPoor
BL_sesPorst
age_child
wave         0.004
>
```

```
> model1_mijiref_lswa<-
lmer(lpm_swa~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgs
nds+BL_gll3_rcplang+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_lswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
  method [lmerModLmerTest]
Formula:
lpm_swa ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 49362.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9911 -0.4460 -0.2184  0.2378  6.3235

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 108.25   10.404
          wave         21.03    4.586   0.86
 Residual              78.82    8.878
Number of obs: 6454, groups:  child_id, 2423

Fixed effects:
                        Estimate Std. Error         df t value
(Intercept)              5.57724    1.20625 2631.80835   4.624
maleMale                -0.43307    0.34441 2422.77401  -1.257
BL_sesLess poor         -1.45492    0.56249 2408.18575  -2.587
BL_sesMedian poor       -2.86877    0.56472 2417.68948  -5.080
BL_sesPoor              -2.75643    0.56588 2423.87810  -4.871
BL_sesPoorest           -3.33438    0.55827 2412.78690  -5.973
age_child               -0.56904    0.10631 2437.22432  -5.353
wave                     1.24669    0.17099 2240.65712   7.291
lang3_swarefMijikenda   -0.47763    0.49944 2433.57693  -0.956
lang3_swarefKamba       -0.63267    0.63982 2419.19480  -0.989
BL_gll1_bgsnds           0.76136    0.07523 2401.00616  10.120
BL_gll3_rcplang          0.35793    0.04516 2441.11813   7.926
                       Pr(>|t|)
(Intercept)            3.95e-06 ***
maleMale                0.20872
BL_sesLess poor         0.00975 **
BL_sesMedian poor      4.06e-07 ***
BL_sesPoor             1.18e-06 ***
BL_sesPoorest          2.68e-09 ***
```

```
age_child             9.47e-08 ***
wave                  4.24e-13 ***
lang3_swarefMijikenda  0.33900
lang3_swarefKamba      0.32285
BL_gll1_bgsnds         < 2e-16 ***
BL_gll3_rcplang       3.42e-15 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs
maleMale     0.008
BL_sesLsspr -0.237 -0.015
BL_sesMdnpr -0.262 -0.034  0.527
BL_sesPoor  -0.231 -0.039  0.530  0.546
BL_sesPorst -0.223 -0.015  0.540  0.560  0.574
age_child   -0.493 -0.105 -0.052 -0.093 -0.114   -0.149
wave         0.198 -0.004 -0.003 -0.003 -0.001   -0.005
lng3_swrfMj -0.271 -0.015 -0.075 -0.063 -0.118   -0.140
lng3_swrfKm -0.292 -0.022 -0.092 -0.024 -0.038   -0.032
BL_gll1_bgs -0.035  0.002  0.021  0.015  0.041    0.047
BL_gll3_rcp -0.588 -0.099  0.074  0.142  0.127    0.141
            ag_chl wave   lng3_M lng3_K BL_g1_
maleMale
BL_sesLsspr
BL_sesMdnpr
BL_sesPoor
BL_sesPorst
age_child
wave         0.004
lng3_swrfMj -0.126 -0.005
lng3_swrfKm  0.020 -0.007  0.619
BL_gll1_bgs -0.151  0.000 -0.022 -0.018
BL_gll3_rcp -0.084  0.000  0.095  0.069 -0.291
>
> model2_mijiref_lswa<-
lmer(lpm_swa~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_
rcplang)+lang3_swaref*(BL_gll1_bgsnds+BL_gll3_rcplang)+(1+wave|c
hild_id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_lswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_swa ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +      BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
    (1 + wave | child_id)
   Data: kenyadata
```

```
REML criterion at convergence: 49362.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9907 -0.4458 -0.2188  0.2328  6.3108

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 107.59   10.373
          wave         20.70    4.549   0.86
 Residual              78.81    8.878
Number of obs: 6454, groups:  child_id, 2423

Fixed effects:
                                          Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                               1.426e+00  2.577e+00
3.279e+03   0.554 0.579945
maleMale                                 -4.288e-01  3.446e-01
2.418e+03  -1.245 0.213432
BL_sesLess poor                          -1.465e+00  5.637e-01
2.403e+03  -2.599 0.009403 **
BL_sesMedian poor                        -2.886e+00  5.661e-01
2.412e+03  -5.098 3.69e-07 ***
BL_sesPoor                               -2.768e+00  5.661e-01
2.419e+03  -4.889 1.08e-06 ***
BL_sesPoorest                            -3.344e+00  5.588e-01
2.408e+03  -5.984 2.51e-09 ***
age_child                                -5.755e-01  1.066e-01
2.431e+03  -5.398 7.39e-08 ***
wave                                     -1.665e+00  7.894e-01
2.260e+03  -2.110 0.035010 *
BL_gll1_bgsnds                            8.329e-01  2.235e-01
3.385e+03   3.727 0.000197 ***
BL_gll3_rcplang                           5.691e-01  1.344e-01
3.423e+03   4.235 2.35e-05 ***
lang3_swarefMijikenda                     1.713e-02  2.395e+00
2.483e+03   0.007 0.994297
lang3_swarefKamba                        -2.036e+00  3.139e+00
2.478e+03  -0.649 0.516652
wave:BL_gll1_bgsnds                       6.837e-02  7.458e-02
2.234e+03   0.917 0.359369
wave:BL_gll3_rcplang                      1.411e-01  4.425e-02
2.262e+03   3.188 0.001450 **
BL_gll1_bgsnds:lang3_swarefMijikenda  -1.022e-03  2.158e-01
2.415e+03  -0.005 0.996223
```

```
BL_gll1_bgsnds:lang3_swarefKamba       1.742e-01  2.861e-01
2.407e+03   0.609 0.542565
BL_gll3_rcplang:lang3_swarefMijikenda -2.630e-02  1.294e-01
2.464e+03  -0.203 0.838956
BL_gll3_rcplang:lang3_swarefKamba      2.791e-02  1.762e-01
2.463e+03   0.158 0.874136
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_lswa<-
lmer(lpm_swa~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bg
snds+BL_gll3_rcplang)+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_lswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_swa ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +      BL_gll3_rcplang) + (1 +
wave | child_id)
   Data: kenyadata

REML criterion at convergence: 49351.3

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9890 -0.4470 -0.2163  0.2347  6.3087

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 106.91   10.340
          wave         20.28    4.503   0.86
 Residual              78.86    8.880
Number of obs: 6454, groups:  child_id, 2423

Fixed effects:
                                              Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                                    1.49457    3.86768
2354.76127   0.386  0.69922
maleMale                                      -0.42890    0.34468
2417.28450  -1.244  0.21349
```

```
BL_sesLess poor                                -1.47503    0.56391
2402.24954  -2.616  0.00896 **
BL_sesMedian poor                              -2.89600    0.56629
2411.27074  -5.114 3.40e-07 ***
BL_sesPoor                                     -2.76440    0.56631
2418.20740  -4.881 1.12e-06 ***
BL_sesPoorest                                  -3.35051    0.55896
2407.02745  -5.994 2.35e-09 ***
age_child                                      -0.57589    0.10666
2430.37706  -5.400 7.33e-08 ***
wave                                           -1.68793    2.23351
2328.92051  -0.756  0.44989
lang3_swarefMijikenda                           0.72153    4.10259
2229.10077   0.176  0.86041
lang3_swarefKamba                              -4.22678    5.33583
2179.30193  -0.792  0.42836
BL_gll1_bgsnds                                  1.52569    0.34508
2267.42717   4.421 1.03e-05 ***
BL_gll3_rcplang                                 0.45858    0.20848
2306.76102   2.200  0.02793 *
wave:lang3_swarefMijikenda                      0.57337    2.41433
2317.89663   0.237  0.81230
wave:lang3_swarefKamba                         -1.49384    3.12079
2247.89127  -0.479  0.63222
wave:BL_gll1_bgsnds                             0.56439    0.20156
2310.23689   2.800  0.00515 **
wave:BL_gll3_rcplang                            0.06528    0.12227
2379.98787   0.534  0.59344
lang3_swarefMijikenda:BL_gll1_bgsnds           -0.75361    0.37563
2249.05435  -2.006  0.04495 *
lang3_swarefKamba:BL_gll1_bgsnds               -0.87847    0.49429
2243.74926  -1.777  0.07566 .
lang3_swarefMijikenda:BL_gll3_rcplang           0.04395    0.22588
2283.55662   0.195  0.84576
lang3_swarefKamba:BL_gll3_rcplang               0.34751    0.30400
2216.75441   1.143  0.25311
wave:lang3_swarefMijikenda:BL_gll1_bgsnds      -0.53893    0.21946
2293.12989  -2.456  0.01414 *
wave:lang3_swarefKamba:BL_gll1_bgsnds          -0.75578    0.28965
2287.63734  -2.609  0.00913 **
wave:lang3_swarefMijikenda:BL_gll3_rcplang      0.04676    0.13258
2358.72317   0.353  0.72433
wave:lang3_swarefKamba:BL_gll3_rcplang          0.22546    0.17741
2276.35739   1.271  0.20392
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_lswa,model1_mijiref_lswa,model2_mijiref_lsw
a,model3_mijiref_lswa)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_lswa: lpm_swa ~ male + BL_ses + age_child + wave
+ (1 + wave | child_id)
model1_mijiref_lswa: lpm_swa ~ male + BL_ses + age_child + wave
+ lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_lswa:     BL_gll3_rcplang + (1 + wave | child_id)
model2_mijiref_lswa: lpm_swa ~ male + BL_ses + age_child + wave
* (BL_gll1_bgsnds +
model2_mijiref_lswa:     BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_lswa:     (1 + wave | child_id)
model3_mijiref_lswa: lpm_swa ~ male + BL_ses + age_child + wave
* lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_lswa:     BL_gll3_rcplang) + (1 + wave |
child_id)
                     Df   AIC   BIC logLik deviance   Chisq Chi
Df Pr(>Chisq)
model0_mijiref_lswa 12 49599 49680 -24787    49575
model1_mijiref_lswa 16 49383 49491 -24675    49351 223.947
4  < 2.2e-16 ***
model2_mijiref_lswa 22 49379 49528 -24668    49335  15.495
6   0.016740 *
model3_mijiref_lswa 28 49374 49564 -24659    49318  17.072
6   0.009024 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model3_mijiref_lswa, show.se=TRUE, show.std=TRUE)
Caution! ICC for random-slope-intercept models usually not
meaningful. Use `adjusted = TRUE` to use the mean random effect
variance to calculate the ICC. See 'Note' in `?icc`.
> ranova(model3_mijiref_lswa)
ANOVA-like table for random-effects: Single term deletions

Model:
lpm_swa ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
```

```
    BL_gll3_rcplang + (1 + wave | child_id) + wave:lang3_swaref
+
    wave:BL_gll1_bgsnds + wave:BL_gll3_rcplang +
lang3_swaref:BL_gll1_bgsnds +
    lang3_swaref:BL_gll3_rcplang +
wave:lang3_swaref:BL_gll1_bgsnds +
    wave:lang3_swaref:BL_gll3_rcplang
                              npar logLik   AIC    LRT Df
Pr(>Chisq)
<none>                          28 -24676 49407
wave in (1 + wave | child_id)   26 -24816 49683 279.87  2  <
2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
> #DV: Swahili Word per Minute
> model0_mijiref_wswa<-
lmer(wpm_swa~male+BL_ses+age_child+wave+(1|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_wswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_swa ~ male + BL_ses + age_child + wave + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 49567.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.8890 -0.5755 -0.0990  0.4686  5.3036

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 46.03    6.785
 Residual             92.38    9.612
Number of obs: 6457, groups:  child_id, 2423

Fixed effects:
                    Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)         20.10426    0.94100 2673.02510  21.365  <
2e-16 ***
maleMale            -0.56981    0.37136 2506.86077  -1.534
0.12506
BL_sesLess poor     -1.16223    0.60445 2495.27817  -1.923
0.05462 .
```

```
BL_sesMedian poor   -2.14986    0.60300 2504.23258  -3.565
0.00037 ***
BL_sesPoor          -3.14537    0.60113 2520.67199  -5.232
1.81e-07 ***
BL_sesPoorest       -3.61251    0.58800 2504.75430  -6.144
9.35e-10 ***
age_child           -0.00779    0.11132 2538.55023  -0.070
0.94422
wave                 8.62175    0.14940 4453.56611  57.708  <
2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.083
BL_sesLsspr -0.296 -0.009
BL_sesMdnpr -0.256 -0.020  0.522
BL_sesPoor  -0.230 -0.025  0.525  0.532
BL_sesPorst -0.207  0.001  0.538  0.547  0.553
age_child   -0.849 -0.123 -0.040 -0.084 -0.114   -0.155
wave         0.171 -0.006 -0.006 -0.006 -0.001   -0.006    0.008
>
> model1_mijiref_wswa<-
lmer(wpm_swa~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgs
nds+BL_gll3_rcplang+(1|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_wswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_swa ~ male + BL_ses + age_child + wave +
lang3_swaref + BL_gll1_bgsnds +      BL_gll3_rcplang + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 49246.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.8942 -0.5782 -0.1130  0.4562  5.4436

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 35.78    5.982
 Residual             92.36    9.610
Number of obs: 6457, groups:  child_id, 2423
```

```
Fixed effects:
                        Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)             10.89499    1.21111 2613.14454   8.996
< 2e-16 ***
maleMale                -0.98682    0.34875 2491.35259  -2.830
0.00470 **
BL_sesLess poor         -0.44190    0.56939 2471.88746  -0.776
0.43777
BL_sesMedian poor       -0.86432    0.57172 2484.57547  -1.512
0.13071
BL_sesPoor              -1.54647    0.57367 2501.81061  -2.696
0.00707 **
BL_sesPoorest           -1.79558    0.56525 2481.58503  -3.177
0.00151 **
age_child               -0.30260    0.10788 2525.69931  -2.805
0.00507 **
wave                     8.62257    0.14907 4474.94122  57.842
< 2e-16 ***
lang3_swarefMijikenda   -1.26423    0.50720 2525.62990  -2.493
0.01275 *
lang3_swarefKamba        1.01687    0.64849 2497.83855   1.568
0.11700
BL_gll1_bgsnds           1.06294    0.07617 2471.98933  13.955
< 2e-16 ***
BL_gll3_rcplang          0.31611    0.04571 2511.92443   6.915
5.9e-12 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M lng3_K BL_g1_
maleMale     0.008
BL_sesLsspr -0.240 -0.016
BL_sesMdnpr -0.267 -0.035  0.528
BL_sesPoor  -0.234 -0.039  0.531  0.546
BL_sesPorst -0.227 -0.016  0.541  0.561  0.574
age_child   -0.499 -0.106 -0.050 -0.091 -0.112   -0.147
wave         0.137 -0.006 -0.005 -0.006  0.000   -0.005    0.009
lng3_swrfMj -0.276 -0.016 -0.073 -0.061 -0.117   -0.137   -0.125
-0.011
lng3_swrfKm -0.298 -0.023 -0.089 -0.022 -0.037   -0.031    0.021
-0.011  0.622
BL_gll1_bgs -0.035  0.001  0.020  0.014  0.040    0.045   -0.150
-0.002 -0.020 -0.016
```

```
BL_gll3_rcp -0.593 -0.097  0.073  0.142  0.127    0.141   -0.083
-0.001  0.094  0.069 -0.292
>
> model2_mijiref_wswa<-
lmer(wpm_swa~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_
rcplang)+lang3_swaref*(BL_gll1_bgsnds+BL_gll3_rcplang)+(1|child_
id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_wswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_swa ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref * (BL_gll1_bgsnds +
BL_gll3_rcplang) +      (1 | child_id)
   Data: kenyadata

REML criterion at convergence: 49044

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.2826 -0.5662 -0.0946  0.4227  5.5813

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 37.12    6.093
 Residual             87.91    9.376
Number of obs: 6457, groups:  child_id, 2423

Fixed effects:
                                    Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                         -1.37248    2.47606
3027.91612  -0.554  0.57941
maleMale                            -0.96866    0.34800
2487.90720  -2.784  0.00542 **
BL_sesLess poor                     -0.45711    0.56914
2468.03205  -0.803  0.42196
BL_sesMedian poor                   -0.82089    0.57165
2480.29942  -1.436  0.15113
BL_sesPoor                          -1.58671    0.57238
2497.73811  -2.772  0.00561 **
BL_sesPoorest                       -1.81220    0.56426
2477.28771  -3.212  0.00134 **
age_child                           -0.29587    0.10790
2520.27435  -2.742  0.00615 **
wave                                 0.28469    0.67610
4499.73379   0.421  0.67372
```

```
BL_gll1_bgsnds                              1.64660    0.21255
3088.61075   7.747 1.27e-14 ***
BL_gll3_rcplang                             0.80875    0.12819
3151.06086   6.309 3.20e-10 ***
lang3_swarefMijikenda                       2.13945    2.41984
2582.26973   0.884  0.37671
lang3_swarefKamba                           5.32833    3.16767
2553.41422   1.682  0.09267 .
wave:BL_gll1_bgsnds                         0.63775    0.06377
4450.49313  10.001  < 2e-16 ***
wave:BL_gll3_rcplang                        0.27343    0.03781
4485.05348   7.232 5.59e-13 ***
BL_gll1_bgsnds:lang3_swarefMijikenda        0.14958    0.21853
2506.54881   0.684  0.49373
BL_gll1_bgsnds:lang3_swarefKamba            0.03293    0.28959
2503.44808   0.114  0.90949
BL_gll3_rcplang:lang3_swarefMijikenda      -0.22174    0.13108
2574.71581  -1.692  0.09082 .
BL_gll3_rcplang:lang3_swarefKamba          -0.23696    0.17830
2552.33540  -1.329  0.18395
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_wswa<-
lmer(wpm_swa~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bg
snds+BL_gll3_rcplang)+(1|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_wswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_swa ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +      BL_gll3_rcplang) + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 49008.4

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.3244 -0.5612 -0.0878  0.4106  5.3970

Random effects:
```

```
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 37.30    6.107
 Residual             87.18    9.337
Number of obs: 6457, groups:  child_id, 2423

Fixed effects:
                                          Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                                -0.3451     3.1823
5454.2469  -0.108 0.913635
maleMale                                   -0.9659     0.3478
2488.1618  -2.778 0.005517 **
BL_sesLess poor                            -0.4480     0.5688
2468.7057  -0.788 0.430964
BL_sesMedian poor                          -0.8245     0.5713
2480.7216  -1.443 0.149062
BL_sesPoor                                 -1.5992     0.5720
2498.3123  -2.796 0.005217 **
BL_sesPoorest                              -1.8316     0.5639
2477.8432  -3.248 0.001177 **
age_child                                  -0.2963     0.1078
2520.3338  -2.748 0.006039 **
wave                                        1.2600     1.9308
4609.7218   0.653 0.514052
lang3_swarefMijikenda                       0.5307     3.3373
5638.8538   0.159 0.873671
lang3_swarefKamba                           7.5703     4.3141
5536.4611   1.755 0.079352 .
BL_gll1_bgsnds                              1.2439     0.2781
5637.9371   4.472 7.88e-06 ***
BL_gll3_rcplang                             0.9449     0.1690
5706.6909   5.591 2.36e-08 ***
wave:lang3_swarefMijikenda                 -1.5114     2.0838
4592.4436  -0.725 0.468300
wave:lang3_swarefKamba                      2.0739     2.6768
4521.8992   0.775 0.438510
wave:BL_gll1_bgsnds                         0.2878     0.1718
4504.7309   1.675 0.093944 .
wave:BL_gll3_rcplang                        0.3880     0.1048
4598.5453   3.703 0.000215 ***
lang3_swarefMijikenda:BL_gll1_bgsnds        0.6314     0.3026
5613.1353   2.086 0.036987 *
lang3_swarefKamba:BL_gll1_bgsnds            0.5094     0.4003
5616.2678   1.273 0.203225
lang3_swarefMijikenda:BL_gll3_rcplang      -0.3825     0.1828
5690.4596  -2.093 0.036406 *
```

```
lang3_swarefKamba:BL_gll3_rcplang            -0.4848     0.2454
5592.6209  -1.975 0.048294 *
wave:lang3_swarefMijikenda:BL_gll1_bgsnds     0.4227     0.1871
4492.1418   2.259 0.023903 *
wave:lang3_swarefKamba:BL_gll1_bgsnds         0.4122     0.2484
4490.1875   1.660 0.097070 .
wave:lang3_swarefMijikenda:BL_gll3_rcplang   -0.1375     0.1135
4578.3283  -1.211 0.225966
wave:lang3_swarefKamba:BL_gll3_rcplang       -0.2173     0.1516
4520.1212  -1.434 0.151769
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_wswa,model1_mijiref_wswa,model2_mijiref_wsw
a,model3_mijiref_wswa)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_wswa: wpm_swa ~ male + BL_ses + age_child + wave
+ (1 | child_id)
model1_mijiref_wswa: wpm_swa ~ male + BL_ses + age_child + wave
+ lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_wswa:     BL_gll3_rcplang + (1 | child_id)
model2_mijiref_wswa: wpm_swa ~ male + BL_ses + age_child + wave
* (BL_gll1_bgsnds +
model2_mijiref_wswa:     BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_wswa:     (1 | child_id)
model3_mijiref_wswa: wpm_swa ~ male + BL_ses + age_child + wave
* lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_wswa:     BL_gll3_rcplang) + (1 | child_id)
                    Df   AIC   BIC logLik deviance   Chisq Chi
Df Pr(>Chisq)
model0_mijiref_wswa 10 49583 49651 -24782    49563
model1_mijiref_wswa 14 49262 49357 -24617    49234 329.023
4  < 2.2e-16 ***
model2_mijiref_wswa 20 49056 49192 -24508    49016 218.077
6  < 2.2e-16 ***
model3_mijiref_wswa 26 49025 49201 -24486    48973  43.751
6  8.281e-08 ***
---
```

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model3_mijiref_wswa, show.se=TRUE, show.std=TRUE)
> ranova(model3_mijiref_wswa)
ANOVA-like table for random-effects: Single term deletions

Model:
wpm_swa ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 | child_id) + wave:lang3_swaref +
wave:BL_gll1_bgsnds +
    wave:BL_gll3_rcplang + lang3_swaref:BL_gll1_bgsnds +
lang3_swaref:BL_gll3_rcplang +
    wave:lang3_swaref:BL_gll1_bgsnds +
wave:lang3_swaref:BL_gll3_rcplang
                npar logLik   AIC    LRT Df Pr(>Chisq)
<none>            26 -24504 49060
(1 | child_id)    25 -24765 49580 522.01  1  < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> ###SWAHILI REFRENCE GROUP
> kenyadata$lang3_swaref<-relevel(kenyadata$lang3_swaref,
"Swahili")
>
> #DV: Spelling
> model0_mijiref_spell<-
lmer(spell~male+BL_ses+age_child+wave+(1+wave|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_spell)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: spell ~ male + BL_ses + age_child + wave + (1 + wave |
child_id)
   Data: kenyadata

REML criterion at convergence: 35392.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.8979 -0.5451 -0.0095  0.5457  3.1441

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 6.3911   2.5281
          wave        0.6383   0.7989   -0.61
 Residual             7.4473   2.7290
Number of obs: 6513, groups:  child_id, 2428
```

```
Fixed effects:
                   Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)         12.73122    0.35618 2426.04756  35.744  <
2e-16 ***
maleMale            -0.11520    0.14190 2357.05615  -0.812
0.416973
BL_sesLess poor     -0.89737    0.23127 2352.96133  -3.880
0.000107 ***
BL_sesMedian poor   -1.46856    0.23083 2366.38700  -6.362
2.38e-10 ***
BL_sesPoor          -1.56889    0.23009 2380.91786  -6.818
1.16e-11 ***
BL_sesPoorest       -2.06089    0.22462 2359.95853  -9.175  <
2e-16 ***
age_child            0.06523    0.04260 2397.37725   1.531
0.125882
wave                 1.73631    0.04517 2280.00252  38.437  <
2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.082
BL_sesLsspr -0.299 -0.009
BL_sesMdnpr -0.260 -0.022  0.523
BL_sesPoor  -0.234 -0.026  0.526  0.533
BL_sesPorst -0.211 -0.001  0.541  0.549  0.555
age_child   -0.858 -0.123 -0.041 -0.084 -0.113   -0.155
wave         0.087 -0.006 -0.008 -0.005 -0.001   -0.008    0.008
>
> model1_mijiref_spell<-
lmer(spell~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgsnd
s+BL_gll3_rcplang+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_spell)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: spell ~ male + BL_ses + age_child + wave + lang3_swaref
+ BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 34902.8
```

```
Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.7264 -0.5607 -0.0201  0.5531  2.8991

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 5.1777   2.2755
          wave        0.6814   0.8255   -0.29
 Residual             7.4072   2.7216
Number of obs: 6513, groups:  child_id, 2428

Fixed effects:
                        Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)              7.42414    0.44473 2432.61222  16.694
< 2e-16 ***
maleMale                -0.32542    0.12865 2357.23954  -2.530
0.0115 *
BL_sesLess poor         -0.49794    0.21035 2346.49283  -2.367
0.0180 *
BL_sesMedian poor       -0.84167    0.21127 2362.37708  -3.984
6.98e-05 ***
BL_sesPoor              -0.87029    0.21187 2375.61088  -4.108
4.13e-05 ***
BL_sesPoorest           -1.24476    0.20847 2351.66155  -5.971
2.72e-09 ***
age_child               -0.09984    0.03983 2396.54206  -2.507
0.0123 *
wave                     1.73576    0.04533 2262.95891  38.295
< 2e-16 ***
lang3_swarefMijikenda   -0.06744    0.18731 2394.46983  -0.360
0.7188
lang3_swarefKamba        0.23148    0.23932 2360.78041   0.967
0.3335
BL_gll1_bgsnds           0.44322    0.02810 2336.13281  15.774
< 2e-16 ***
BL_gll3_rcplang          0.21290    0.01685 2374.39137  12.635
< 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M lng3_K BL_g1_
maleMale     0.008
BL_sesLsspr -0.241 -0.016
BL_sesMdnpr -0.268 -0.036  0.529
```

```
BL_sesPoor  -0.236 -0.040  0.532  0.547
BL_sesPorst -0.229 -0.017  0.543  0.563  0.575
age_child   -0.505 -0.107 -0.051 -0.091 -0.111   -0.146
wave         0.089 -0.005 -0.007 -0.005 -0.001   -0.007    0.008
lng3_swrfMj -0.276 -0.015 -0.073 -0.060 -0.116   -0.137   -0.124
-0.010
lng3_swrfKm -0.300 -0.023 -0.089 -0.021 -0.037   -0.030    0.024
-0.012  0.623
BL_gll1_bgs -0.034  0.001  0.020  0.014  0.039    0.045   -0.148
-0.001 -0.021 -0.017
BL_gll3_rcp -0.595 -0.095  0.073  0.141  0.127    0.141   -0.081
-0.003  0.092  0.068 -0.294
>
> model2_mijiref_spell<-
lmer(spell~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_rc
plang)+lang3_swaref*(BL_gll1_bgsnds+BL_gll3_rcplang)+(1+wave|chi
ld_id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_spell)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: spell ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref * (BL_gll1_bgsnds +
BL_gll3_rcplang) +      (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 34836.4

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.92523 -0.56079 -0.00406  0.55810  2.89969

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 4.990    2.2338
          wave        0.469    0.6848   -0.48
 Residual             7.444    2.7283
Number of obs: 6513, groups:  child_id, 2428

Fixed effects:
                                     Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                           7.65605    0.88502
2561.56915   8.651  < 2e-16 ***
maleMale                             -0.32288    0.12851
2354.88008  -2.513 0.012053 *
```

```
BL_sesLess poor                          -0.46249    0.21047
2343.27631  -2.197 0.028084 *
BL_sesMedian poor                        -0.80936    0.21147
2359.23838  -3.827 0.000133 ***
BL_sesPoor                               -0.85617    0.21163
2372.69874  -4.046 5.38e-05 ***
BL_sesPoorest                            -1.22458    0.20832
2348.43990  -5.878 4.73e-09 ***
age_child                                -0.10191    0.03988
2392.82211  -2.555 0.010677 *
wave                                      3.24531    0.20565
2273.92917  15.781  < 2e-16 ***
BL_gll1_bgsnds                            0.26631    0.07598
2573.47722   3.505 0.000464 ***
BL_gll3_rcplang                           0.24798    0.04566
2628.79734   5.430 6.13e-08 ***
lang3_swarefMijikenda                     1.00069    0.88691
2408.82236   1.128 0.259310
lang3_swarefKamba                         2.20862    1.16371
2386.67764   1.898 0.057827 .
wave:BL_gll1_bgsnds                      -0.14024    0.01941
2242.17180  -7.226 6.77e-13 ***
wave:BL_gll3_rcplang                     -0.04243    0.01153
2272.72242  -3.681 0.000238 ***
BL_gll1_bgsnds:lang3_swarefMijikenda      0.06419    0.08089
2384.16009   0.794 0.427506
BL_gll1_bgsnds:lang3_swarefKamba          0.10738    0.10705
2368.29613   1.003 0.315906
BL_gll3_rcplang:lang3_swarefMijikenda    -0.07433    0.04828
2426.65782  -1.540 0.123799
BL_gll3_rcplang:lang3_swarefKamba        -0.13780    0.06572
2404.01803  -2.097 0.036123 *
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_spell<-
lmer(spell~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bgsn
ds+BL_gll3_rcplang)+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_spell)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
```

```
Formula: spell ~ male + BL_ses + age_child + wave * lang3_swaref
* (BL_gll1_bgsnds +      BL_gll3_rcplang) + (1 + wave |
child_id)
   Data: kenyadata

REML criterion at convergence: 34851.3

Scaled residuals:
     Min       1Q   Median       3Q      Max
-2.96984 -0.56017 -0.00636  0.55962  2.90044

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 4.997    2.2355
          wave        0.471    0.6863   -0.48
 Residual             7.438    2.7274
Number of obs: 6513, groups:  child_id, 2428

Fixed effects:
                                          Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                                7.80139    1.00198
2286.48884   7.786 1.04e-14 ***
maleMale                                  -0.32151    0.12852
2354.55386  -2.502 0.012427 *
BL_sesLess poor                           -0.46803    0.21050
2343.15261  -2.223 0.026279 *
BL_sesMedian poor                         -0.81273    0.21149
2359.02636  -3.843 0.000125 ***
BL_sesPoor                                -0.85937    0.21165
2372.61288  -4.060 5.06e-05 ***
BL_sesPoorest                             -1.22805    0.20835
2348.32865  -5.894 4.30e-09 ***
age_child                                 -0.10215    0.03989
2392.45119  -2.561 0.010500 *
wave                                       3.40756    0.57641
2308.24512   5.912 3.89e-09 ***
lang3_swarefMijikenda                      0.89135    1.03929
2175.20742   0.858 0.391176
lang3_swarefKamba                          1.86723    1.35041
2134.36699   1.383 0.166898
BL_gll1_bgsnds                             0.25097    0.08693
2179.89047   2.887 0.003927 **
BL_gll3_rcplang                            0.25357    0.05262
2223.61563   4.819 1.54e-06 ***
wave:lang3_swarefMijikenda                -0.12511    0.62439
2303.63273  -0.200 0.841203
```

```
wave:lang3_swarefKamba                          -0.40303    0.81027
2250.29899  -0.497 0.618953
wave:BL_gll1_bgsnds                             -0.15678    0.05241
2309.25115  -2.991 0.002807 **
wave:BL_gll3_rcplang                            -0.03633    0.03152
2353.04172  -1.153 0.249203
lang3_swarefMijikenda:BL_gll1_bgsnds             0.09292    0.09463
2164.38207   0.982 0.326206
lang3_swarefKamba:BL_gll1_bgsnds                 0.06080    0.12485
2161.49759   0.487 0.626306
lang3_swarefMijikenda:BL_gll3_rcplang           -0.08584    0.05697
2205.62077  -1.507 0.132026
lang3_swarefKamba:BL_gll3_rcplang               -0.12196    0.07677
2158.58213  -1.589 0.112275
wave:lang3_swarefMijikenda:BL_gll1_bgsnds         0.03293    0.05710
2294.88606   0.577 0.564164
wave:lang3_swarefKamba:BL_gll1_bgsnds           -0.05762    0.07557
2289.17789  -0.762 0.445897
wave:lang3_swarefMijikenda:BL_gll3_rcplang      -0.01325    0.03426
2338.60543  -0.387 0.699000
wave:lang3_swarefKamba:BL_gll3_rcplang           0.01929    0.04610
2282.43309   0.418 0.675708
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_spell,model1_mijiref_spell,model2_mijiref_s
pell,model3_mijiref_spell)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_spell: spell ~ male + BL_ses + age_child + wave +
(1 + wave | child_id)
model1_mijiref_spell: spell ~ male + BL_ses + age_child + wave +
lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_spell:     BL_gll3_rcplang + (1 + wave |
child_id)
model2_mijiref_spell: spell ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
model2_mijiref_spell:     BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_spell:     (1 + wave | child_id)
```

```
model3_mijiref_spell: spell ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_spell:     BL_gll3_rcplang) + (1 + wave |
child_id)
                     Df   AIC   BIC logLik deviance    Chisq Chi
Df Pr(>Chisq)
model0_mijiref_spell 12 35396 35477 -17686    35372
model1_mijiref_spell 16 34898 35007 -17433    34866 505.5986
4     <2e-16 ***
model2_mijiref_spell 22 34816 34965 -17386    34772  94.5872
6     <2e-16 ***
model3_mijiref_spell 28 34820 35010 -17382    34764   7.4454
6     0.2816
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model2_mijiref_spell, show.se=TRUE, show.std=TRUE)
Caution! ICC for random-slope-intercept models usually not
meaningful. Use `adjusted = TRUE` to use the mean random effect
variance to calculate the ICC. See 'Note' in `?icc`.
> ranova(model2_mijiref_spell)
ANOVA-like table for random-effects: Single term deletions

Model:
spell ~ male + BL_ses + age_child + wave + BL_gll1_bgsnds +
BL_gll3_rcplang +
    lang3_swaref + (1 + wave | child_id) + wave:BL_gll1_bgsnds +
    wave:BL_gll3_rcplang + BL_gll1_bgsnds:lang3_swaref +
BL_gll3_rcplang:lang3_swaref
                             npar logLik   AIC    LRT Df
Pr(>Chisq)
<none>                         22 -17418 34880
wave in (1 + wave | child_id)   20 -17461 34962 85.432  2  <
2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
> #DV: English Letter per Minute
> model0_mijiref_leng<-
lmer(lpm_eng~male+BL_ses+age_child+wave+(1+wave|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_leng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_eng ~ male + BL_ses + age_child + wave + (1 + wave
| child_id)
   Data: kenyadata
```

```
REML criterion at convergence: 52936.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.7780 -0.4827 -0.0685  0.4502  4.2362

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 259.78   16.118
          wave         29.33    5.416   0.67
 Residual              94.18    9.705
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                   Estimate Std. Error        df t value
Pr(>|t|)
(Intercept)         31.2300     1.4609 2591.6920  21.377  < 2e-
16 ***
maleMale            -0.5936     0.5764 2416.4996  -1.030
0.30323
BL_sesLess poor     -1.4026     0.9386 2408.2460  -1.494
0.13523
BL_sesMedian poor   -0.8471     0.9361 2413.1189  -0.905
0.36559
BL_sesPoor          -1.6912     0.9316 2417.4932  -1.815
0.06959 .
BL_sesPoorest       -2.9053     0.9129 2410.4807  -3.183
0.00148 **
age_child            0.3553     0.1723 2424.3335   2.063
0.03926 *
wave                 8.2504     0.1925 2147.9469  42.854  < 2e-
16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.084
BL_sesLsspr -0.294 -0.008
BL_sesMdnpr -0.254 -0.019  0.521
BL_sesPoor  -0.228 -0.024  0.524  0.532
BL_sesPorst -0.204  0.002  0.537  0.545  0.553
age_child   -0.846 -0.122 -0.042 -0.086 -0.117   -0.158
wave         0.188 -0.004 -0.002 -0.002  0.000   -0.003    0.003
>
> model1_mijiref_leng<-
lmer(lpm_eng~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgs
```

```
nds+BL_gll3_rcplang+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_leng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_eng ~ male + BL_ses + age_child + wave +
lang3_swaref + BL_gll1_bgsnds +      BL_gll3_rcplang + (1 + wave
| child_id)
   Data: kenyadata

REML criterion at convergence: 52688.3

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.8062 -0.4888 -0.0600  0.4459  4.2642

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 238.68   15.449
          wave         29.47    5.429   0.69
 Residual              94.11    9.701
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                         Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)              17.35959    1.90698 2524.26994   9.103
< 2e-16 ***
maleMale                 -1.23189    0.55042 2410.30575  -2.238
0.0253 *
BL_sesLess poor          -0.29313    0.89963 2398.65510  -0.326
0.7446
BL_sesMedian poor         1.03720    0.90272 2404.98577   1.149
0.2507
BL_sesPoor                0.56635    0.90413 2408.81842   0.626
0.5311
BL_sesPoorest            -0.35921    0.89286 2402.06830  -0.402
0.6875
age_child                -0.09087    0.16972 2417.44079  -0.535
0.5924
wave                      8.25086    0.19250 2149.73809  42.860
< 2e-16 ***
lang3_swarefMijikenda    -1.13621    0.79744 2416.75598  -1.425
0.1543
lang3_swarefKamba         1.17691    1.02276 2407.00141   1.151
0.2500
```

```
BL_gll1_bgsnds           1.37997    0.12041 2394.43272  11.461
< 2e-16 ***
BL_gll3_rcplang          0.51975    0.07208 2425.13979   7.210
7.43e-13 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M lng3_K BL_g1_
maleMale     0.007
BL_sesLsspr -0.240 -0.015
BL_sesMdnpr -0.265 -0.034  0.527
BL_sesPoor  -0.234 -0.038  0.530  0.546
BL_sesPorst -0.224 -0.015  0.540  0.560  0.574
age_child   -0.498 -0.105 -0.053 -0.093 -0.115   -0.150
wave         0.145 -0.004 -0.002 -0.002  0.000   -0.003    0.003
lng3_swrfMj -0.272 -0.014 -0.075 -0.063 -0.118   -0.141   -0.126
-0.004
lng3_swrfKm -0.293 -0.022 -0.092 -0.023 -0.038   -0.033    0.020
-0.005  0.618
BL_gll1_bgs -0.035  0.001  0.022  0.015  0.043    0.048   -0.151
-0.001 -0.023 -0.018
BL_gll3_rcp -0.593 -0.098  0.076  0.142  0.127    0.141   -0.084
0.000  0.094  0.069 -0.293
>
> model2_mijiref_leng<-
lmer(lpm_eng~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_
rcplang)+lang3_swaref*(BL_gll1_bgsnds+BL_gll3_rcplang)+(1+wave|c
hild_id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_leng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_eng ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref * (BL_gll1_bgsnds +
BL_gll3_rcplang) +      (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 52695.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.8063 -0.4864 -0.0611  0.4466  4.2591

Random effects:
 Groups   Name        Variance Std.Dev. Corr
```

```
 child_id (Intercept) 238.93   15.457
          wave         29.42    5.424   0.69
 Residual              94.14    9.702
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                                        Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                             16.62469    3.92442
2921.98136   4.236 2.34e-05 ***
maleMale                                -1.22347    0.55079
2406.09917  -2.221 0.026423 *
BL_sesLess poor                         -0.26274    0.90180
2394.30227  -0.291 0.770806
BL_sesMedian poor                        1.03048    0.90520
2400.02334   1.138 0.255067
BL_sesPoor                               0.56745    0.90473
2404.51996   0.627 0.530585
BL_sesPoorest                           -0.34719    0.89388
2397.85218  -0.388 0.697751
age_child                               -0.09789    0.17027
2412.74816  -0.575 0.565384
wave                                     7.37017    0.89420
2176.29752   8.242 2.89e-16 ***
BL_gll1_bgsnds                           0.98981    0.33776
2962.15834   2.931 0.003410 **
BL_gll3_rcplang                          0.67471    0.20284
3004.48546   3.326 0.000891 ***
lang3_swarefMijikenda                   -1.57377    3.81072
2467.46552  -0.413 0.679654
lang3_swarefKamba                       -0.05912    4.99645
2454.54223  -0.012 0.990560
wave:BL_gll1_bgsnds                     -0.08123    0.08410
2146.98999  -0.966 0.334193
wave:BL_gll3_rcplang                     0.07265    0.05004
2175.87334   1.452 0.146667
BL_gll1_bgsnds:lang3_swarefMijikenda     0.30278    0.34492
2398.06619   0.878 0.380127
BL_gll1_bgsnds:lang3_swarefKamba         0.42231    0.45751
2394.35306   0.923 0.356070
BL_gll3_rcplang:lang3_swarefMijikenda   -0.06198    0.20613
2444.22326  -0.301 0.763677
BL_gll3_rcplang:lang3_swarefKamba       -0.05257    0.28076
2437.94959  -0.187 0.851496
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

```
Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_leng<-
lmer(lpm_eng~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bg
snds+BL_gll3_rcplang)+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_leng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_eng ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +      BL_gll3_rcplang) + (1 +
wave | child_id)
   Data: kenyadata

REML criterion at convergence: 52696.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-3.8061 -0.4855 -0.0596  0.4477  4.2954

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 239.00   15.460
          wave         29.52    5.433   0.69
 Residual              94.13    9.702
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                                          Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                               16.58398    5.16170
2433.65812   3.213  0.00133 **
maleMale                                  -1.22371    0.55076
2405.94523  -2.222  0.02639 *
BL_sesLess poor                           -0.25818    0.90179
2394.32823  -0.286  0.77468
BL_sesMedian poor                          1.02569    0.90516
2399.94012   1.133  0.25727
BL_sesPoor                                 0.56730    0.90468
2404.41028   0.627  0.53067
BL_sesPoorest                             -0.34962    0.89384
2397.78790  -0.391  0.69573
age_child                                 -0.09782    0.17027
2412.64964  -0.575  0.56568
```

```
wave                                          7.31065    2.54772
2241.10680   2.869  0.00415 **
lang3_swarefMijikenda                        -1.93592    5.42929
2288.65361  -0.357  0.72145
lang3_swarefKamba                             3.48435    7.08112
2236.80438   0.492  0.62272
BL_gll1_bgsnds                                1.34217    0.45409
2301.67260   2.956  0.00315 **
BL_gll3_rcplang                               0.60570    0.27370
2349.70650   2.213  0.02699 *
wave:lang3_swarefMijikenda                   -0.22618    2.75261
2231.62704  -0.082  0.93452
wave:lang3_swarefKamba                        2.51112    3.55104
2158.93165   0.707  0.47955
wave:BL_gll1_bgsnds                           0.16504    0.22773
2212.34342   0.725  0.46870
wave:BL_gll3_rcplang                          0.02603    0.13852
2273.64102   0.188  0.85098
lang3_swarefMijikenda:BL_gll1_bgsnds         -0.12965    0.49498
2284.95237  -0.262  0.79340
lang3_swarefKamba:BL_gll1_bgsnds              0.22809    0.65299
2281.14842   0.349  0.72690
lang3_swarefMijikenda:BL_gll3_rcplang         0.04146    0.29688
2325.52984   0.140  0.88894
lang3_swarefKamba:BL_gll3_rcplang            -0.19434    0.40167
2266.52845  -0.484  0.62855
wave:lang3_swarefMijikenda:BL_gll1_bgsnds    -0.30288    0.24802
2197.54021  -1.221  0.22215
wave:lang3_swarefKamba:BL_gll1_bgsnds        -0.13622    0.32772
2201.70069  -0.416  0.67769
wave:lang3_swarefMijikenda:BL_gll3_rcplang    0.07105    0.15025
2256.63141   0.473  0.63632
wave:lang3_swarefKamba:BL_gll3_rcplang       -0.10044    0.20123
2179.27185  -0.499  0.61775
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_leng,model1_mijiref_leng,model2_mijiref_len
g,model3_mijiref_leng)
refitting model(s) with ML (instead of REML)
Data: kenyadata
```

```
Models:
model0_mijiref_leng: lpm_eng ~ male + BL_ses + age_child + wave
+ (1 + wave | child_id)
model1_mijiref_leng: lpm_eng ~ male + BL_ses + age_child + wave
+ lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_leng:     BL_gll3_rcplang + (1 + wave | child_id)
model2_mijiref_leng: lpm_eng ~ male + BL_ses + age_child + wave
* (BL_gll1_bgsnds +
model2_mijiref_leng:     BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_leng:     (1 + wave | child_id)
model3_mijiref_leng: lpm_eng ~ male + BL_ses + age_child + wave
* lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_leng:     BL_gll3_rcplang) + (1 + wave |
child_id)
                     Df   AIC   BIC logLik deviance    Chisq Chi
Df Pr(>Chisq)
model0_mijiref_leng 12 52963 53044 -26469    52939
model1_mijiref_leng 16 52719 52827 -26343    52687 251.7613
4     <2e-16 ***
model2_mijiref_leng 22 52727 52876 -26342    52683   3.4143
6     0.7553
model3_mijiref_leng 28 52735 52925 -26340    52679   4.1408
6     0.6576
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model1_mijiref_leng, show.se=TRUE, show.std=TRUE)
Caution! ICC for random-slope-intercept models usually not
meaningful. Use `adjusted = TRUE` to use the mean random effect
variance to calculate the ICC. See 'Note' in `?icc`.
> ranova(model1_mijiref_leng)
ANOVA-like table for random-effects: Single term deletions

Model:
lpm_eng ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 + wave | child_id)
                               npar logLik   AIC   LRT Df
Pr(>Chisq)
<none>                           16 -26344 52720
wave in (1 + wave | child_id)   14 -26457 52942 225.8  2  <
2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
> #DV: English Word per Minute
>
```

```
> model0_mijiref_weng2<-
lmer(wpm_eng~male+BL_ses+age_child+wave+(1+wave|child_id),
data=kenyadata, na.action=na.omit)
singular fit
> summary(model0_mijiref_weng) #singular fit
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 46471.4

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.3348 -0.5116 -0.1201  0.3633  9.6175

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 31.67    5.628
 Residual             53.43    7.310
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                    Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)         14.97094    0.75155 2653.93771  19.920  <
2e-16 ***
maleMale             0.02178    0.29702 2499.76288   0.073
0.9416
BL_sesLess poor     -1.03677    0.48364 2490.97970  -2.144
0.0322 *
BL_sesMedian poor   -2.31885    0.48260 2502.80923  -4.805
1.64e-06 ***
BL_sesPoor          -2.98209    0.48090 2515.94130  -6.201
6.53e-10 ***
BL_sesPoorest       -3.52661    0.47019 2495.04220  -7.500
8.79e-14 ***
age_child           -0.12643    0.08901 2529.55927  -1.420
0.1556
wave                 5.70024    0.11331 4443.08104  50.306  <
2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
```

```
maleMale    -0.083
BL_sesLsspr -0.297 -0.008
BL_sesMdnpr -0.257 -0.020  0.522
BL_sesPoor  -0.231 -0.025  0.525  0.532
BL_sesPorst -0.208  0.001  0.539  0.547  0.553
age_child   -0.850 -0.123 -0.041 -0.085 -0.114   -0.155
wave         0.163 -0.006 -0.007 -0.005 -0.002   -0.008    0.007
>
> model0_mijiref_weng<-
lmer(wpm_eng~male+BL_ses+age_child+wave+(1|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_weng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 46471.4

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.3348 -0.5116 -0.1201  0.3633  9.6175

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 31.67    5.628
 Residual             53.43    7.310
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                   Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)         14.97094    0.75155 2653.93771  19.920  <
2e-16 ***
maleMale             0.02178    0.29702 2499.76288   0.073
0.9416
BL_sesLess poor     -1.03677    0.48364 2490.97970  -2.144
0.0322 *
BL_sesMedian poor   -2.31885    0.48260 2502.80923  -4.805
1.64e-06 ***
BL_sesPoor          -2.98209    0.48090 2515.94130  -6.201
6.53e-10 ***
BL_sesPoorest       -3.52661    0.47019 2495.04220  -7.500
8.79e-14 ***
age_child           -0.12643    0.08901 2529.55927  -1.420
0.1556
```

```
wave                 5.70024    0.11331 4443.08104  50.306  <
2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.083
BL_sesLsspr -0.297 -0.008
BL_sesMdnpr -0.257 -0.020  0.522
BL_sesPoor  -0.231 -0.025  0.525  0.532
BL_sesPorst -0.208  0.001  0.539  0.547  0.553
age_child   -0.850 -0.123 -0.041 -0.085 -0.114   -0.155
wave         0.163 -0.006 -0.007 -0.005 -0.002   -0.008    0.007
>
> model1_mijiref_weng<-
lmer(wpm_eng~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgs
nds+BL_gll3_rcplang+(1|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_weng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave +
lang3_swaref + BL_gll1_bgsnds +      BL_gll3_rcplang + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 46169.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1870 -0.5295 -0.1211  0.3572  9.7663

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 25.44    5.044
 Residual             53.42    7.309
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                      Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)            7.82447    0.97128 2601.43438   8.056
1.19e-15 ***
maleMale              -0.30207    0.28002 2488.14305  -1.079
0.280807
```

```
BL_sesLess poor         -0.48633    0.45745 2472.67118  -1.063
0.287826
BL_sesMedian poor       -1.32602    0.45937 2487.36514  -2.887
0.003928 **
BL_sesPoor              -1.73892    0.46069 2500.44615  -3.775
0.000164 ***
BL_sesPoorest           -2.11164    0.45378 2476.09594  -4.653
3.44e-06 ***
age_child               -0.35292    0.08659 2519.45027  -4.076
4.72e-05 ***
wave                     5.70230    0.11309 4463.29785  50.423
< 2e-16 ***
lang3_swarefMijikenda   -0.96734    0.40695 2517.50994  -2.377
0.017527 *
lang3_swarefKamba        0.89491    0.52052 2491.53840   1.719
0.085692 .
BL_gll1_bgsnds           0.83193    0.06115 2465.68193  13.606
< 2e-16 ***
BL_gll3_rcplang          0.24119    0.03671 2510.77755   6.571
6.07e-11 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M lng3_K BL_g1_
maleMale     0.008
BL_sesLsspr -0.240 -0.015
BL_sesMdnpr -0.267 -0.035  0.528
BL_sesPoor  -0.235 -0.039  0.531  0.546
BL_sesPorst -0.228 -0.015  0.542  0.561  0.574
age_child   -0.500 -0.106 -0.051 -0.091 -0.112   -0.147
wave         0.129 -0.006 -0.007 -0.005 -0.001   -0.007    0.007
lng3_swrfMj -0.275 -0.015 -0.074 -0.061 -0.117   -0.138   -0.125
-0.008
lng3_swrfKm -0.297 -0.023 -0.090 -0.022 -0.037   -0.031    0.022
-0.010  0.621
BL_gll1_bgs -0.035  0.001  0.020  0.014  0.040    0.046   -0.150
-0.001 -0.021 -0.017
BL_gll3_rcp -0.594 -0.097  0.074  0.142  0.127    0.141   -0.082
0.000  0.093  0.069 -0.292
>
> model2_mijiref_weng<-
lmer(wpm_eng~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_
rcplang)+lang3_swaref+(BL_gll1_bgsnds+BL_gll3_rcplang)+(1|child_
id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_weng)
```

```
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref + (BL_gll1_bgsnds +
BL_gll3_rcplang) +      (1 | child_id)
   Data: kenyadata

REML criterion at convergence: 45914.1

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1332 -0.4997 -0.1013  0.3230  9.6077

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 26.43    5.141
 Residual             50.24    7.088
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                        Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)              0.14675    1.11160 3996.01912   0.132
0.894980
maleMale                -0.29393    0.27938 2487.09154  -1.052
0.292866
BL_sesLess poor         -0.54746    0.45647 2472.20430  -1.199
0.230513
BL_sesMedian poor       -1.34877    0.45833 2486.10138  -2.943
0.003283 **
BL_sesPoor              -1.77407    0.45962 2498.79274  -3.860
0.000116 ***
BL_sesPoorest           -2.13627    0.45278 2475.10991  -4.718
2.51e-06 ***
age_child               -0.34539    0.08637 2517.14301  -3.999
6.55e-05 ***
wave                    -1.30988    0.51014 4483.91762  -2.568
0.010270 *
BL_gll1_bgsnds           1.41109    0.08036 5260.69449  17.560
< 2e-16 ***
BL_gll3_rcplang          0.49412    0.04817 5267.69822  10.258
< 2e-16 ***
lang3_swarefMijikenda   -0.97025    0.40596 2515.65519  -2.390
0.016921 *
lang3_swarefKamba        0.90671    0.51932 2490.08518   1.746
0.080943 .
```

```
wave:BL_gll1_bgsnds      0.53301    0.04800 4432.10390  11.105
< 2e-16 ***
wave:BL_gll3_rcplang     0.23136    0.02857 4473.99162   8.099
7.06e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 14 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_weng<-
lmer(wpm_eng~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bg
snds+BL_gll3_rcplang)+(1|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_weng)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_eng ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +      BL_gll3_rcplang) + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 45866.4

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.1975 -0.5016 -0.0969  0.3211  9.3889

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 26.58    5.156
 Residual             49.59    7.042
Number of obs: 6484, groups:  child_id, 2423

Fixed effects:
                                          Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                               -1.25876    2.46454
5212.55536  -0.511 0.609549
maleMale                                  -0.29432    0.27914
2484.06944  -1.054 0.291810
BL_sesLess poor                           -0.53979    0.45684
2468.66231  -1.182 0.237485
BL_sesMedian poor                         -1.33897    0.45887
2482.36799  -2.918 0.003555 **
```

```
BL_sesPoor                                      -1.78412    0.45920
2495.69193  -3.885 0.000105 ***
BL_sesPoorest                                   -2.15992    0.45257
2471.69245  -4.773 1.93e-06 ***
age_child                                       -0.34742    0.08651
2512.97356  -4.016 6.09e-05 ***
wave                                            -0.82843    1.44375
4571.21457  -0.574 0.566127
lang3_swarefMijikenda                            1.17485    2.58090
5411.19278   0.455 0.648976
lang3_swarefKamba                                0.98566    3.35007
5316.27986   0.294 0.768602
BL_gll1_bgsnds                                   1.48688    0.21580
5428.23580   6.890 6.21e-12 ***
BL_gll3_rcplang                                  0.62550    0.13072
5496.25043   4.785 1.75e-06 ***
wave:lang3_swarefMijikenda                      -0.34790    1.55991
4557.07624  -0.223 0.823524
wave:lang3_swarefKamba                          -0.43053    2.00893
4497.68487  -0.214 0.830318
wave:BL_gll1_bgsnds                              0.50248    0.12894
4478.73277   3.897 9.88e-05 ***
wave:BL_gll3_rcplang                             0.28391    0.07849
4564.06869   3.617 0.000301 ***
lang3_swarefMijikenda:BL_gll1_bgsnds            -0.06425    0.23493
5401.19053  -0.273 0.784487
lang3_swarefKamba:BL_gll1_bgsnds                -0.18691    0.30977
5378.87236  -0.603 0.546273
lang3_swarefMijikenda:BL_gll3_rcplang           -0.20786    0.14159
5483.58199  -1.468 0.142130
lang3_swarefKamba:BL_gll3_rcplang                0.05963    0.19061
5384.24873   0.313 0.754426
wave:lang3_swarefMijikenda:BL_gll1_bgsnds        0.04976    0.14046
4467.86604   0.354 0.723166
wave:lang3_swarefKamba:BL_gll1_bgsnds            0.01930    0.18585
4456.85866   0.104 0.917291
wave:lang3_swarefMijikenda:BL_gll3_rcplang      -0.09591    0.08515
4547.49578  -1.126 0.260118
wave:lang3_swarefKamba:BL_gll3_rcplang           0.02619    0.11385
4497.08076   0.230 0.818090
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it
```

```
>
>
anova(model0_mijiref_weng,model1_mijiref_weng,model2_mijiref_wen
g,model3_mijiref_weng)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_weng: wpm_eng ~ male + BL_ses + age_child + wave
+ (1 | child_id)
model1_mijiref_weng: wpm_eng ~ male + BL_ses + age_child + wave
+ lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_weng:     BL_gll3_rcplang + (1 | child_id)
model2_mijiref_weng: wpm_eng ~ male + BL_ses + age_child + wave
* (BL_gll1_bgsnds +
model2_mijiref_weng:     BL_gll3_rcplang) + lang3_swaref +
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_weng:     (1 | child_id)
model3_mijiref_weng: wpm_eng ~ male + BL_ses + age_child + wave
* lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_weng:     BL_gll3_rcplang) + (1 | child_id)
                    Df   AIC   BIC logLik deviance   Chisq Chi
Df Pr(>Chisq)
model0_mijiref_weng 10 46483 46551 -23232    46463
model1_mijiref_weng 14 46180 46275 -23076    46152 311.682
4  < 2.2e-16 ***
model2_mijiref_weng 16 45919 46027 -22943    45887 264.866
2  < 2.2e-16 ***
model3_mijiref_weng 26 45871 46047 -22909    45819  67.962
10  1.096e-10 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model3_mijiref_weng, show.se=TRUE, show.std=TRUE)
> ranova(model3_mijiref_weng)
ANOVA-like table for random-effects: Single term deletions

Model:
wpm_eng ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 | child_id) + wave:lang3_swaref +
wave:BL_gll1_bgsnds +
    wave:BL_gll3_rcplang + lang3_swaref:BL_gll1_bgsnds +
lang3_swaref:BL_gll3_rcplang +
    wave:lang3_swaref:BL_gll1_bgsnds +
wave:lang3_swaref:BL_gll3_rcplang
                npar logLik   AIC    LRT Df Pr(>Chisq)
<none>            26 -22933 45918
(1 | child_id)    25 -23289 46627 710.97  1  < 2.2e-16 ***
```

```
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

> #DV: Swahili Letter per Minute
> model0_mijiref_lswa<-
lmer(lpm_swa~male+BL_ses+age_child+wave+(1+wave|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_lswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_swa ~ male + BL_ses + age_child + wave + (1 + wave
| child_id)
   Data: kenyadata

REML criterion at convergence: 49579.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9652 -0.4213 -0.2499  0.2226  6.3475

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 119.08   10.913
          wave         20.90    4.572   0.85
 Residual              78.95    8.885
Number of obs: 6454, groups:  child_id, 2423

Fixed effects:
                  Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)        13.91909    0.92541 2771.07303  15.041  <
2e-16 ***
maleMale           -0.02515    0.35859 2429.21592  -0.070
0.944088
BL_sesLess poor    -2.19983    0.58363 2419.35143  -3.769
0.000168 ***
BL_sesMedian poor  -3.96666    0.58229 2426.52458  -6.812
1.21e-11 ***
BL_sesPoor         -4.01717    0.57979 2433.62222  -6.929
5.42e-12 ***
BL_sesPoorest      -4.71109    0.56755 2421.86802  -8.301  <
2e-16 ***
age_child          -0.25650    0.10729 2444.33452  -2.391
0.016887 *
wave                1.23780    0.17120 2233.44388   7.230
6.59e-13 ***
---
```

```
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.083
BL_sesLsspr -0.289 -0.007
BL_sesMdnpr -0.250 -0.019  0.521
BL_sesPoor  -0.224 -0.024  0.524  0.531
BL_sesPorst -0.201  0.001  0.537  0.545  0.553
age_child   -0.832 -0.122 -0.042 -0.086 -0.116   -0.157
wave         0.260 -0.004 -0.003 -0.003 -0.001   -0.005    0.004
>
> model1_mijiref_lswa<-
lmer(lpm_swa~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgs
nds+BL_gll3_rcplang+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_lswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_swa ~ male + BL_ses + age_child + wave +
lang3_swaref + BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 49362.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9911 -0.4460 -0.2184  0.2378  6.3235

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 108.25   10.404
          wave         21.03    4.586   0.86
 Residual              78.82    8.878
Number of obs: 6454, groups:  child_id, 2423

Fixed effects:
                      Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)            5.57724    1.20625 2631.80835   4.624
3.95e-06 ***
maleMale              -0.43307    0.34441 2422.77401  -1.257
0.20872
BL_sesLess poor       -1.45492    0.56249 2408.18575  -2.587
0.00975 **
```

```
BL_sesMedian poor       -2.86877    0.56472 2417.68948  -5.080
4.06e-07 ***
BL_sesPoor              -2.75643    0.56588 2423.87810  -4.871
1.18e-06 ***
BL_sesPoorest           -3.33438    0.55827 2412.78690  -5.973
2.68e-09 ***
age_child               -0.56904    0.10631 2437.22432  -5.353
9.47e-08 ***
wave                     1.24669    0.17099 2240.65712   7.291
4.24e-13 ***
lang3_swarefMijikenda   -0.47763    0.49944 2433.57693  -0.956
0.33900
lang3_swarefKamba       -0.63267    0.63982 2419.19480  -0.989
0.32285
BL_gll1_bgsnds           0.76136    0.07523 2401.00616  10.120
< 2e-16 ***
BL_gll3_rcplang          0.35793    0.04516 2441.11813   7.926
3.42e-15 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M lng3_K BL_g1_
maleMale     0.008
BL_sesLsspr -0.237 -0.015
BL_sesMdnpr -0.262 -0.034  0.527
BL_sesPoor  -0.231 -0.039  0.530  0.546
BL_sesPorst -0.223 -0.015  0.540  0.560  0.574
age_child   -0.493 -0.105 -0.052 -0.093 -0.114   -0.149
wave         0.198 -0.004 -0.003 -0.003 -0.001   -0.005    0.004
lng3_swrfMj -0.271 -0.015 -0.075 -0.063 -0.118   -0.140   -0.126
-0.005
lng3_swrfKm -0.292 -0.022 -0.092 -0.024 -0.038   -0.032    0.020
-0.007  0.619
BL_gll1_bgs -0.035  0.002  0.021  0.015  0.041    0.047   -0.151
0.000 -0.022 -0.018
BL_gll3_rcp -0.588 -0.099  0.074  0.142  0.127    0.141   -0.084
0.000  0.095  0.069 -0.291
>
> model2_mijiref_lswa<-
lmer(lpm_swa~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_
rcplang)+lang3_swaref*(BL_gll1_bgsnds+BL_gll3_rcplang)+(1+wave|c
hild_id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_lswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
```

```
Formula: lpm_swa ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref * (BL_gll1_bgsnds +
BL_gll3_rcplang) +
    (1 + wave | child_id)
   Data: kenyadata

REML criterion at convergence: 49362.2

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9907 -0.4458 -0.2188  0.2328  6.3108

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 107.59   10.373
          wave         20.70    4.549   0.86
 Residual              78.81    8.878
Number of obs: 6454, groups:  child_id, 2423

Fixed effects:
                                    Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                         1.426e+00  2.577e+00
3.279e+03   0.554 0.579945
maleMale                           -4.288e-01  3.446e-01
2.418e+03  -1.245 0.213432
BL_sesLess poor                    -1.465e+00  5.637e-01
2.403e+03  -2.599 0.009403 **
BL_sesMedian poor                  -2.886e+00  5.661e-01
2.412e+03  -5.098 3.69e-07 ***
BL_sesPoor                         -2.768e+00  5.661e-01
2.419e+03  -4.889 1.08e-06 ***
BL_sesPoorest                      -3.344e+00  5.588e-01
2.408e+03  -5.984 2.51e-09 ***
age_child                          -5.755e-01  1.066e-01
2.431e+03  -5.398 7.39e-08 ***
wave                               -1.665e+00  7.894e-01
2.260e+03  -2.110 0.035010 *
BL_gll1_bgsnds                      8.329e-01  2.235e-01
3.385e+03   3.727 0.000197 ***
BL_gll3_rcplang                     5.691e-01  1.344e-01
3.423e+03   4.235 2.35e-05 ***
lang3_swarefMijikenda               1.713e-02  2.395e+00
2.483e+03   0.007 0.994297
lang3_swarefKamba                  -2.036e+00  3.139e+00
2.478e+03  -0.649 0.516652
```

```
wave:BL_gll1_bgsnds                     6.837e-02  7.458e-02
2.234e+03   0.917 0.359369
wave:BL_gll3_rcplang                    1.411e-01  4.425e-02
2.262e+03   3.188 0.001450 **
BL_gll1_bgsnds:lang3_swarefMijikenda  -1.022e-03  2.158e-01
2.415e+03  -0.005 0.996223
BL_gll1_bgsnds:lang3_swarefKamba       1.742e-01  2.861e-01
2.407e+03   0.609 0.542565
BL_gll3_rcplang:lang3_swarefMijikenda -2.630e-02  1.294e-01
2.464e+03  -0.203 0.838956
BL_gll3_rcplang:lang3_swarefKamba      2.791e-02  1.762e-01
2.463e+03   0.158 0.874136
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_lswa<-
lmer(lpm_swa~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bg
snds+BL_gll3_rcplang)+(1+wave|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_lswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: lpm_swa ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +      BL_gll3_rcplang) + (1 +
wave | child_id)
   Data: kenyadata

REML criterion at convergence: 49351.3

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.9890 -0.4470 -0.2163  0.2347  6.3087

Random effects:
 Groups   Name        Variance Std.Dev. Corr
 child_id (Intercept) 106.91   10.340
          wave         20.28    4.503   0.86
 Residual              78.86    8.880
Number of obs: 6454, groups:  child_id, 2423

Fixed effects:
```

```
                                                Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                                      1.49457    3.86768
2354.76127   0.386  0.69922
maleMale                                        -0.42890    0.34468
2417.28450  -1.244  0.21349
BL_sesLess poor                                 -1.47503    0.56391
2402.24954  -2.616  0.00896 **
BL_sesMedian poor                               -2.89600    0.56629
2411.27074  -5.114 3.40e-07 ***
BL_sesPoor                                      -2.76440    0.56631
2418.20740  -4.881 1.12e-06 ***
BL_sesPoorest                                   -3.35051    0.55896
2407.02745  -5.994 2.35e-09 ***
age_child                                       -0.57589    0.10666
2430.37706  -5.400 7.33e-08 ***
wave                                            -1.68793    2.23351
2328.92051  -0.756  0.44989
lang3_swarefMijikenda                            0.72153    4.10259
2229.10077   0.176  0.86041
lang3_swarefKamba                               -4.22678    5.33583
2179.30193  -0.792  0.42836
BL_gll1_bgsnds                                   1.52569    0.34508
2267.42717   4.421 1.03e-05 ***
BL_gll3_rcplang                                  0.45858    0.20848
2306.76102   2.200  0.02793 *
wave:lang3_swarefMijikenda                       0.57337    2.41433
2317.89663   0.237  0.81230
wave:lang3_swarefKamba                          -1.49384    3.12079
2247.89127  -0.479  0.63222
wave:BL_gll1_bgsnds                              0.56439    0.20156
2310.23689   2.800  0.00515 **
wave:BL_gll3_rcplang                             0.06528    0.12227
2379.98787   0.534  0.59344
lang3_swarefMijikenda:BL_gll1_bgsnds            -0.75361    0.37563
2249.05435  -2.006  0.04495 *
lang3_swarefKamba:BL_gll1_bgsnds                -0.87847    0.49429
2243.74926  -1.777  0.07566 .
lang3_swarefMijikenda:BL_gll3_rcplang            0.04395    0.22588
2283.55662   0.195  0.84576
lang3_swarefKamba:BL_gll3_rcplang                0.34751    0.30400
2216.75441   1.143  0.25311
wave:lang3_swarefMijikenda:BL_gll1_bgsnds       -0.53893    0.21946
2293.12989  -2.456  0.01414 *
wave:lang3_swarefKamba:BL_gll1_bgsnds           -0.75578    0.28965
2287.63734  -2.609  0.00913 **
```

```
wave:lang3_swarefMijikenda:BL_gll3_rcplang    0.04676    0.13258
2358.72317   0.353  0.72433
wave:lang3_swarefKamba:BL_gll3_rcplang        0.22546    0.17741
2276.35739   1.271  0.20392
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_lswa,model1_mijiref_lswa,model2_mijiref_lsw
a,model3_mijiref_lswa)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_lswa: lpm_swa ~ male + BL_ses + age_child + wave
+ (1 + wave | child_id)
model1_mijiref_lswa: lpm_swa ~ male + BL_ses + age_child + wave
+ lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_lswa:     BL_gll3_rcplang + (1 + wave | child_id)
model2_mijiref_lswa: lpm_swa ~ male + BL_ses + age_child + wave
* (BL_gll1_bgsnds +
model2_mijiref_lswa:     BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_lswa:     (1 + wave | child_id)
model3_mijiref_lswa: lpm_swa ~ male + BL_ses + age_child + wave
* lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_lswa:     BL_gll3_rcplang) + (1 + wave |
child_id)
                    Df   AIC   BIC logLik deviance   Chisq Chi
Df Pr(>Chisq)
model0_mijiref_lswa 12 49599 49680 -24787    49575
model1_mijiref_lswa 16 49383 49491 -24675    49351 223.947
4  < 2.2e-16 ***
model2_mijiref_lswa 22 49379 49528 -24668    49335  15.495
6   0.016740 *
model3_mijiref_lswa 28 49374 49564 -24659    49318  17.072
6   0.009024 **
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model3_mijiref_lswa, show.se=TRUE, show.std=TRUE)
Caution! ICC for random-slope-intercept models usually not
meaningful. Use `adjusted = TRUE` to use the mean random effect
variance to calculate the ICC. See 'Note' in `?icc`.
```

```
> ranova(model3_mijiref_lswa)
ANOVA-like table for random-effects: Single term deletions

Model:
lpm_swa ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 + wave | child_id) + wave:lang3_swaref
+
    wave:BL_gll1_bgsnds + wave:BL_gll3_rcplang +
lang3_swaref:BL_gll1_bgsnds +
    lang3_swaref:BL_gll3_rcplang +
wave:lang3_swaref:BL_gll1_bgsnds +
    wave:lang3_swaref:BL_gll3_rcplang
                              npar logLik   AIC    LRT Df
Pr(>Chisq)
<none>                          28 -24676 49407
wave in (1 + wave | child_id)   26 -24816 49683 279.87  2  <
2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
>
> #DV: Swahili Word per Minute
> model0_mijiref_wswa<-
lmer(wpm_swa~male+BL_ses+age_child+wave+(1|child_id),
data=kenyadata, na.action=na.omit)
> summary(model0_mijiref_wswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_swa ~ male + BL_ses + age_child + wave + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 49567.8

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.8890 -0.5755 -0.0990  0.4686  5.3036

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 46.03    6.785
 Residual             92.38    9.612
Number of obs: 6457, groups:  child_id, 2423

Fixed effects:
                  Estimate Std. Error         df t value
Pr(>|t|)
```

```
(Intercept)         20.10426    0.94100 2673.02510  21.365  <
2e-16 ***
maleMale            -0.56981    0.37136 2506.86077  -1.534
0.12506
BL_sesLess poor     -1.16223    0.60445 2495.27817  -1.923
0.05462 .
BL_sesMedian poor   -2.14986    0.60300 2504.23258  -3.565
0.00037 ***
BL_sesPoor          -3.14537    0.60113 2520.67199  -5.232
1.81e-07 ***
BL_sesPoorest       -3.61251    0.58800 2504.75430  -6.144
9.35e-10 ***
age_child           -0.00779    0.11132 2538.55023  -0.070
0.94422
wave                 8.62175    0.14940 4453.56611  57.708  <
2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
maleMale    -0.083
BL_sesLsspr -0.296 -0.009
BL_sesMdnpr -0.256 -0.020  0.522
BL_sesPoor  -0.230 -0.025  0.525  0.532
BL_sesPorst -0.207  0.001  0.538  0.547  0.553
age_child   -0.849 -0.123 -0.040 -0.084 -0.114   -0.155
wave         0.171 -0.006 -0.006 -0.006 -0.001   -0.006    0.008
>
> model1_mijiref_wswa<-
lmer(wpm_swa~male+BL_ses+age_child+wave+lang3_swaref+BL_gll1_bgs
nds+BL_gll3_rcplang+(1|child_id), data=kenyadata,
na.action=na.omit)
> summary(model1_mijiref_wswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_swa ~ male + BL_ses + age_child + wave +
lang3_swaref + BL_gll1_bgsnds +      BL_gll3_rcplang + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 49246.6

Scaled residuals:
    Min      1Q  Median      3Q     Max
-1.8942 -0.5782 -0.1130  0.4562  5.4436
```

```
Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 35.78    5.982
 Residual             92.36    9.610
Number of obs: 6457, groups:  child_id, 2423

Fixed effects:
                         Estimate Std. Error         df t value
Pr(>|t|)
(Intercept)              10.89499    1.21111 2613.14454   8.996
< 2e-16 ***
maleMale                 -0.98682    0.34875 2491.35259  -2.830
0.00470 **
BL_sesLess poor          -0.44190    0.56939 2471.88746  -0.776
0.43777
BL_sesMedian poor        -0.86432    0.57172 2484.57547  -1.512
0.13071
BL_sesPoor               -1.54647    0.57367 2501.81061  -2.696
0.00707 **
BL_sesPoorest            -1.79558    0.56525 2481.58503  -3.177
0.00151 **
age_child                -0.30260    0.10788 2525.69931  -2.805
0.00507 **
wave                      8.62257    0.14907 4474.94122  57.842
< 2e-16 ***
lang3_swarefMijikenda    -1.26423    0.50720 2525.62990  -2.493
0.01275 *
lang3_swarefKamba         1.01687    0.64849 2497.83855   1.568
0.11700
BL_gll1_bgsnds            1.06294    0.07617 2471.98933  13.955
< 2e-16 ***
BL_gll3_rcplang           0.31611    0.04571 2511.92443   6.915
5.9e-12 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation of Fixed Effects:
            (Intr) maleMl BL_sLp BL_sMp BL_sesPr BL_ssPrs ag_chl
wave   lng3_M lng3_K BL_g1_
maleMale     0.008
BL_sesLsspr -0.240 -0.016
BL_sesMdnpr -0.267 -0.035  0.528
BL_sesPoor  -0.234 -0.039  0.531  0.546
BL_sesPorst -0.227 -0.016  0.541  0.561  0.574
age_child   -0.499 -0.106 -0.050 -0.091 -0.112   -0.147
wave         0.137 -0.006 -0.005 -0.006  0.000   -0.005    0.009
```

```
lng3_swrfMj -0.276 -0.016 -0.073 -0.061 -0.117   -0.137   -0.125
-0.011
lng3_swrfKm -0.298 -0.023 -0.089 -0.022 -0.037   -0.031    0.021
-0.011  0.622
BL_gll1_bgs -0.035  0.001  0.020  0.014  0.040    0.045   -0.150
-0.002 -0.020 -0.016
BL_gll3_rcp -0.593 -0.097  0.073  0.142  0.127    0.141   -0.083
-0.001  0.094  0.069 -0.292
>
> model2_mijiref_wswa<-
lmer(wpm_swa~male+BL_ses+age_child+wave*(BL_gll1_bgsnds+BL_gll3_
rcplang)+lang3_swaref*(BL_gll1_bgsnds+BL_gll3_rcplang)+(1|child_
id), data=kenyadata, na.action=na.omit)
> summary(model2_mijiref_wswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_swa ~ male + BL_ses + age_child + wave *
(BL_gll1_bgsnds +
    BL_gll3_rcplang) + lang3_swaref * (BL_gll1_bgsnds +
BL_gll3_rcplang) +      (1 | child_id)
   Data: kenyadata

REML criterion at convergence: 49044

Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.2826 -0.5662 -0.0946  0.4227  5.5813

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 37.12    6.093
 Residual             87.91    9.376
Number of obs: 6457, groups:  child_id, 2423

Fixed effects:
                                    Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                         -1.37248    2.47606
3027.91612  -0.554  0.57941
maleMale                            -0.96866    0.34800
2487.90720  -2.784  0.00542 **
BL_sesLess poor                     -0.45711    0.56914
2468.03205  -0.803  0.42196
BL_sesMedian poor                   -0.82089    0.57165
2480.29942  -1.436  0.15113
BL_sesPoor                          -1.58671    0.57238
2497.73811  -2.772  0.00561 **
```

```
BL_sesPoorest                              -1.81220    0.56426
2477.28771  -3.212  0.00134 **
age_child                                  -0.29587    0.10790
2520.27435  -2.742  0.00615 **
wave                                        0.28469    0.67610
4499.73379   0.421  0.67372
BL_gll1_bgsnds                              1.64660    0.21255
3088.61075   7.747 1.27e-14 ***
BL_gll3_rcplang                             0.80875    0.12819
3151.06086   6.309 3.20e-10 ***
lang3_swarefMijikenda                       2.13945    2.41984
2582.26973   0.884  0.37671
lang3_swarefKamba                           5.32833    3.16767
2553.41422   1.682  0.09267 .
wave:BL_gll1_bgsnds                         0.63775    0.06377
4450.49313  10.001  < 2e-16 ***
wave:BL_gll3_rcplang                        0.27343    0.03781
4485.05348   7.232 5.59e-13 ***
BL_gll1_bgsnds:lang3_swarefMijikenda        0.14958    0.21853
2506.54881   0.684  0.49373
BL_gll1_bgsnds:lang3_swarefKamba            0.03293    0.28959
2503.44808   0.114  0.90949
BL_gll3_rcplang:lang3_swarefMijikenda      -0.22174    0.13108
2574.71581  -1.692  0.09082 .
BL_gll3_rcplang:lang3_swarefKamba          -0.23696    0.17830
2552.33540  -1.329  0.18395
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 18 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
> model3_mijiref_wswa<-
lmer(wpm_swa~male+BL_ses+age_child+wave*lang3_swaref*(BL_gll1_bg
snds+BL_gll3_rcplang)+(1|child_id), data=kenyadata,
na.action=na.omit)
> summary(model3_mijiref_wswa)
Linear mixed model fit by REML. t-tests use Satterthwaite's
method ['lmerModLmerTest']
Formula: wpm_swa ~ male + BL_ses + age_child + wave *
lang3_swaref * (BL_gll1_bgsnds +      BL_gll3_rcplang) + (1 |
child_id)
   Data: kenyadata

REML criterion at convergence: 49008.4
```

```
Scaled residuals:
    Min      1Q  Median      3Q     Max
-2.3244 -0.5612 -0.0878  0.4106  5.3970

Random effects:
 Groups   Name        Variance Std.Dev.
 child_id (Intercept) 37.30    6.107
 Residual             87.18    9.337
Number of obs: 6457, groups:  child_id, 2423

Fixed effects:
                                          Estimate Std. Error
df t value Pr(>|t|)
(Intercept)                                -0.3451     3.1823
5454.2469  -0.108 0.913635
maleMale                                   -0.9659     0.3478
2488.1618  -2.778 0.005517 **
BL_sesLess poor                            -0.4480     0.5688
2468.7057  -0.788 0.430964
BL_sesMedian poor                          -0.8245     0.5713
2480.7216  -1.443 0.149062
BL_sesPoor                                 -1.5992     0.5720
2498.3123  -2.796 0.005217 **
BL_sesPoorest                              -1.8316     0.5639
2477.8432  -3.248 0.001177 **
age_child                                  -0.2963     0.1078
2520.3338  -2.748 0.006039 **
wave                                        1.2600     1.9308
4609.7218   0.653 0.514052
lang3_swarefMijikenda                       0.5307     3.3373
5638.8538   0.159 0.873671
lang3_swarefKamba                           7.5703     4.3141
5536.4611   1.755 0.079352 .
BL_gll1_bgsnds                              1.2439     0.2781
5637.9371   4.472 7.88e-06 ***
BL_gll3_rcplang                             0.9449     0.1690
5706.6909   5.591 2.36e-08 ***
wave:lang3_swarefMijikenda                 -1.5114     2.0838
4592.4436  -0.725 0.468300
wave:lang3_swarefKamba                      2.0739     2.6768
4521.8992   0.775 0.438510
wave:BL_gll1_bgsnds                         0.2878     0.1718
4504.7309   1.675 0.093944 .
wave:BL_gll3_rcplang                        0.3880     0.1048
4598.5453   3.703 0.000215 ***
```

```
lang3_swarefMijikenda:BL_gll1_bgsnds          0.6314     0.3026
5613.1353   2.086 0.036987 *
lang3_swarefKamba:BL_gll1_bgsnds              0.5094     0.4003
5616.2678   1.273 0.203225
lang3_swarefMijikenda:BL_gll3_rcplang        -0.3825     0.1828
5690.4596  -2.093 0.036406 *
lang3_swarefKamba:BL_gll3_rcplang            -0.4848     0.2454
5592.6209  -1.975 0.048294 *
wave:lang3_swarefMijikenda:BL_gll1_bgsnds     0.4227     0.1871
4492.1418   2.259 0.023903 *
wave:lang3_swarefKamba:BL_gll1_bgsnds         0.4122     0.2484
4490.1875   1.660 0.097070 .
wave:lang3_swarefMijikenda:BL_gll3_rcplang   -0.1375     0.1135
4578.3283  -1.211 0.225966
wave:lang3_swarefKamba:BL_gll3_rcplang       -0.2173     0.1516
4520.1212  -1.434 0.151769
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Correlation matrix not shown by default, as p = 24 > 12.
Use print(x, correlation=TRUE)  or
    vcov(x)        if you need it

>
>
anova(model0_mijiref_wswa,model1_mijiref_wswa,model2_mijiref_wsw
a,model3_mijiref_wswa)
refitting model(s) with ML (instead of REML)
Data: kenyadata
Models:
model0_mijiref_wswa: wpm_swa ~ male + BL_ses + age_child + wave
+ (1 | child_id)
model1_mijiref_wswa: wpm_swa ~ male + BL_ses + age_child + wave
+ lang3_swaref + BL_gll1_bgsnds +
model1_mijiref_wswa:     BL_gll3_rcplang + (1 | child_id)
model2_mijiref_wswa: wpm_swa ~ male + BL_ses + age_child + wave
* (BL_gll1_bgsnds +
model2_mijiref_wswa:     BL_gll3_rcplang) + lang3_swaref *
(BL_gll1_bgsnds + BL_gll3_rcplang) +
model2_mijiref_wswa:     (1 | child_id)
model3_mijiref_wswa: wpm_swa ~ male + BL_ses + age_child + wave
* lang3_swaref * (BL_gll1_bgsnds +
model3_mijiref_wswa:     BL_gll3_rcplang) + (1 | child_id)
                    Df   AIC   BIC logLik deviance   Chisq Chi
Df Pr(>Chisq)
model0_mijiref_wswa 10 49583 49651 -24782    49563
```

```
model1_mijiref_wswa 14 49262 49357 -24617    49234 329.023
4  < 2.2e-16 ***
model2_mijiref_wswa 20 49056 49192 -24508    49016 218.077
6  < 2.2e-16 ***
model3_mijiref_wswa 26 49025 49201 -24486    48973  43.751
6  8.281e-08 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
> tab_model(model3_mijiref_wswa, show.se=TRUE, show.std=TRUE)
> ranova(model3_mijiref_wswa)
ANOVA-like table for random-effects: Single term deletions

Model:
wpm_swa ~ male + BL_ses + age_child + wave + lang3_swaref +
BL_gll1_bgsnds +
    BL_gll3_rcplang + (1 | child_id) + wave:lang3_swaref +
wave:BL_gll1_bgsnds +
    wave:BL_gll3_rcplang + lang3_swaref:BL_gll1_bgsnds +
lang3_swaref:BL_gll3_rcplang +
    wave:lang3_swaref:BL_gll1_bgsnds +
wave:lang3_swaref:BL_gll3_rcplang
               npar logLik   AIC    LRT Df Pr(>Chisq)
<none>           26 -24504 49060
(1 | child_id)   25 -24765 49580 522.01  1  < 2.2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```