Phonetics_like_analysis

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1. ANALYZE DATA LIKE PREREGISTERED

Take the local context (language of previous and following word) to predict differences in aspects of pronunciation.

Descriptives: How are the local contexts distributed? –> Fairly unequally

```
#very unequal distribution of counts
data_duration_like_lai_ana %>%
  count(context)
```

```
## # A tibble: 4 x 2
##              context     n
##                <chr> <int>
## 1   English English   615
## 2  English Japanese    15
## 3  Japanese English     9
## 4 Japanese Japanese     7
```

Preregistered analysis below shows the follwowing: Predictions are confirmed for [lai] duration. We do find differences in F2 based on post_lang (not sure whether the direction makes sense). No other predictions (related to burst/closure) were confirmed.

```
#[lai] duration
#The duration is expected to be longer in Japanese contexts than English contexts
#this first model fails to converge
#duration_like_lai.full.lme = lmer(duration_lai ~ lang_pre * lang_post + (1 +lang_pre * lang_post | pai
#second model does not converge for red model
#duration_like_lai.full.lme = lmer(duration_lai ~ lang_pre * lang_post + (1 +lang_pre + lang_post | pai
duration_like_lai.full.lme = lmer(duration_lai ~ lang_pre * lang_post + (1 | pair/speaker), data_duratio
summary(duration_like_lai.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: duration_lai ~ lang_pre * lang_post + (1 | pair/speaker)
##    Data: data_duration_like_lai_ana
##
##      AIC      BIC   logLik deviance df.resid
##   6539.4   6570.7  -3262.7   6525.4      639
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.5180 -0.6930 -0.0681  0.5728  4.7817
##
## Random effects:
##  Groups       Name        Variance Std.Dev.
##  speaker:pair (Intercept)    0.00   0.000
##  pair         (Intercept)   35.02   5.918
##  Residual                 1411.48  37.570
## Number of obs: 646, groups:  speaker:pair, 14; pair, 7
```

```
##
## Fixed effects:
##                       Estimate Std. Error t value
## (Intercept)            130.363      5.856  22.263
## lang_pre1               10.423      5.377   1.939
## lang_post1               8.256      5.363   1.539
## lang_pre1:lang_post1    13.797      5.341   2.583
##
## Correlation of Fixed Effects:
##             (Intr) lng_pr1 lng_ps1
## lang_pre1    0.528
## lang_post1   0.274 -0.091
## lng_pr1:l_1 -0.101  0.295   0.571
```

```
#taking away IA to check for significance
duration_like_lai.red1.lme = lmer(duration_lai ~ lang_pre + lang_post + (1  | pair/speaker), data_durati
anova(duration_like_lai.full.lme,duration_like_lai.red1.lme)
```

```
## Data: data_duration_like_lai_ana
## Models:
## duration_like_lai.red1.lme: duration_lai ~ lang_pre + lang_post + (1 | pair/speaker)
## duration_like_lai.full.lme: duration_lai ~ lang_pre * lang_post + (1 | pair/speaker)
##                            Df    AIC    BIC  logLik deviance Chisq Chi Df
## duration_like_lai.red1.lme  6 6544.1 6570.9 -3266.0   6532.1
## duration_like_lai.full.lme  7 6539.4 6570.7 -3262.7   6525.4 6.637      1
##                            Pr(>Chisq)
## duration_like_lai.red1.lme
## duration_like_lai.full.lme   0.009988 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#significant effect: Japanese-Japanese context most long (like predicted)

data_duration_like_lai_ana  %>%
  group_by(context) %>%
  summarize(mean = mean(duration_lai, na.rm = T))
```

```
## # A tibble: 4 x 2
##             context     mean
##               <chr>    <dbl>
## 1   English English 127.1876
## 2  English Japanese 114.5227
## 3  Japanese English 116.4679
## 4 Japanese Japanese 160.0077
```

```
#[lai] formants
#We predict quality differences early on and later
#f1
#this first model fails to converge
#formants_like_f1.full.lme = lmer(f1_norm_sum ~ lang_pre * lang_post * percentage +(1 + lang_pre * lang
formants_like_f1.full.lme = lmer(f1_norm_sum ~ lang_pre * lang_post * percentage +(1 + lang_pre + lang_
summary(formants_like_f1.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula:
## f1_norm_sum ~ lang_pre * lang_post * percentage + (1 + lang_pre +
```

```
##     lang_post + percentage | pair/speaker)
##    Data: data_formants_like_lai_ana
##
##      AIC      BIC   logLik deviance df.resid
##  15334.9  15534.1  -7638.5  15276.9     7077
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.0140 -0.5711  0.0273  0.6095  3.6037
##
## Random effects:
##  Groups       Name        Variance  Std.Dev. Corr
##  speaker:pair (Intercept) 2.378e-02 0.154200
##               lang_pre1   5.419e-05 0.007362  1.00
##               lang_post1  1.283e-03 0.035823  1.00  1.00
##               percentage  1.089e-01 0.329958 -1.00 -1.00 -1.00
##  pair         (Intercept) 2.752e-01 0.524595
##               lang_pre1   6.228e-03 0.078920  0.63
##               lang_post1  1.211e-02 0.110065 -0.84 -0.95
##               percentage  4.886e-02 0.221045 -0.80 -0.97  1.00
##  Residual                 4.971e-01 0.705080
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                                 Estimate Std. Error t value
## (Intercept)                      8.03799    0.21127   38.05
## lang_pre1                        0.05031    0.06674    0.75
## lang_post1                      -0.05792    0.07407   -0.78
## percentage                       0.59853    0.15870    3.77
## lang_pre1:lang_post1             0.07642    0.05714    1.34
## lang_pre1:percentage             0.03899    0.09745    0.40
## lang_post1:percentage           -0.01593    0.09737   -0.16
## lang_pre1:lang_post1:percentage -0.10535    0.09598   -1.10
##
## Correlation of Fixed Effects:
##             (Intr) lng_pr1 lng_ps1 prcntg ln_1:_1 lng_pr1: lng_ps1:
## lang_pre1    0.408
## lang_post1  -0.347 -0.329
## percentage  -0.660 -0.517   0.096
## lng_pr1:l_1 -0.030  0.252   0.450   0.054
## lng_pr1:prc -0.137 -0.735   0.041   0.359 -0.255
## lng_pst1:pr -0.073  0.048  -0.663   0.190 -0.483  -0.069
## lng_pr1:_1:  0.025 -0.213  -0.378  -0.067 -0.842   0.298    0.569
```

```
formants_like_f1.red1.lme = lmer(f1_norm_sum ~ lang_pre * lang_post + percentage + (1 + lang_pre + lang
formants_like_f1.red2.lme = lmer(f1_norm_sum ~ lang_pre + lang_post + percentage + (1 + lang_pre + lang
summary(formants_like_f1.red2.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula:
## f1_norm_sum ~ lang_pre + lang_post + percentage + (1 + lang_pre +
##     lang_post + percentage | pair/speaker)
##    Data: data_formants_like_lai_ana
##
##      AIC      BIC   logLik deviance df.resid
```

```
##  15329.9  15501.6  -7640.0  15279.9     7081
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.0140 -0.5708  0.0281  0.6078  3.6100
##
## Random effects:
##  Groups       Name        Variance  Std.Dev. Corr
##  speaker:pair (Intercept) 2.349e-02 0.153265
##               lang_pre1   9.064e-05 0.009521  1.00
##               lang_post1  9.526e-04 0.030865  1.00  1.00
##               percentage  1.118e-01 0.334291 -1.00 -1.00 -1.00
##  pair         (Intercept) 2.776e-01 0.526890
##               lang_pre1   7.024e-03 0.083809  0.66
##               lang_post1  1.243e-02 0.111485 -0.82 -0.97
##               percentage  4.744e-02 0.217805 -0.78 -0.98  1.00
##  Residual                 4.973e-01 0.705210
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  8.09602    0.20677   39.15
## lang_pre1    0.06301    0.04584    1.37
## lang_post1  -0.08185    0.05287   -1.55
## percentage   0.48295    0.12940    3.73
##
## Correlation of Fixed Effects:
##            (Intr) lng_pr1 lng_ps1
## lang_pre1   0.508
## lang_post1 -0.563 -0.729
## percentage -0.648 -0.481   0.399
```

```
formants_like_f1.red3.lme = lmer(f1_norm_sum ~ lang_pre + lang_post + (1 + lang_pre + lang_post + percer
summary(formants_like_f1.red3.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: f1_norm_sum ~ lang_pre + lang_post + (1 + lang_pre + lang_post +
##     percentage | pair/speaker)
##    Data: data_formants_like_lai_ana
##
##      AIC      BIC   logLik deviance df.resid
##  15335.7  15500.5  -7643.8  15287.7     7082
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.0118 -0.5710  0.0276  0.6076  3.6106
##
## Random effects:
##  Groups       Name        Variance Std.Dev. Corr
##  speaker:pair (Intercept) 0.033788 0.18382
##               lang_pre1   0.000110 0.01049   1.00
##               lang_post1  0.001308 0.03617   1.00  1.00
##               percentage  0.157638 0.39704  -1.00 -1.00 -1.00
##  pair         (Intercept) 0.527847 0.72653
##               lang_pre1   0.014570 0.12071   0.84
```

```
##               lang_post1  0.020471 0.14308  -0.92 -0.98
##               percentage  0.238003 0.48786  -0.88 -1.00  1.00
##  Residual                 0.497244 0.70516
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  8.60981    0.15641   55.05
## lang_pre1    0.14959    0.03936    3.80
## lang_post1  -0.17049    0.04768   -3.58
##
## Correlation of Fixed Effects:
##            (Intr) lng_pr1
## lang_pre1   0.294
## lang_post1 -0.435 -0.655
```

```
formants_like_f1.red4.lme = lmer(f1_norm_sum ~ lang_post + (1 + lang_pre + lang_post + percentage | pai
formants_like_f1.red5.lme = lmer(f1_norm_sum ~ 1 + (1 + lang_pre + lang_post + percentage | pair/speake
anova(formants_like_f1.full.lme,formants_like_f1.red1.lme,formants_like_f1.red2.lme,formants_like_f1.re
```

```
## Data: data_formants_like_lai_ana
## Models:
## formants_like_f1.red5.lme: f1_norm_sum ~ 1 + (1 + lang_pre + lang_post + percentage | pair/speaker)
## formants_like_f1.red4.lme: f1_norm_sum ~ lang_post + (1 + lang_pre + lang_post + percentage |
## formants_like_f1.red4.lme:     pair/speaker)
## formants_like_f1.red3.lme: f1_norm_sum ~ lang_pre + lang_post + (1 + lang_pre + lang_post +
## formants_like_f1.red3.lme:     percentage | pair/speaker)
## formants_like_f1.red2.lme: f1_norm_sum ~ lang_pre + lang_post + percentage + (1 + lang_pre +
## formants_like_f1.red2.lme:     lang_post + percentage | pair/speaker)
## formants_like_f1.red1.lme: f1_norm_sum ~ lang_pre * lang_post + percentage + (1 + lang_pre +
## formants_like_f1.red1.lme:     lang_post + percentage | pair/speaker)
## formants_like_f1.full.lme: f1_norm_sum ~ lang_pre * lang_post * percentage + (1 + lang_pre +
## formants_like_f1.full.lme:     lang_post + percentage | pair/speaker)
##                            Df   AIC   BIC  logLik deviance  Chisq Chi Df
## formants_like_f1.red5.lme 22 15336 15487 -7645.8    15292
## formants_like_f1.red4.lme 23 15336 15494 -7644.9    15290 1.9136      1
## formants_like_f1.red3.lme 24 15336 15500 -7643.8    15288 2.0421      1
## formants_like_f1.red2.lme 25 15330 15502 -7640.0    15280 7.7435      1
## formants_like_f1.red1.lme 26 15331 15510 -7639.7    15279 0.5468      1
## formants_like_f1.full.lme 29 15335 15534 -7638.5    15277 2.4610      3
##                            Pr(>Chisq)
## formants_like_f1.red5.lme
## formants_like_f1.red4.lme   0.166560
## formants_like_f1.red3.lme   0.153002
## formants_like_f1.red2.lme   0.005391 **
## formants_like_f1.red1.lme   0.459610
## formants_like_f1.full.lme   0.482378
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#significant main effect of percentage into vowel sound (decreasing F1)


#f2
#first two models fail to converge
```

```r
#formants_like_f2.full.lme = lmer(f2_norm_sum ~ lang_pre * lang_post * percentage +(1 + lang_pre * lang
#formants_like_f2.full.lme = lmer(f2_norm_sum ~ lang_pre * lang_post * percentage +(1 + lang_pre + lang
formants_like_f2.full.lme = lmer(f2_norm_sum ~ lang_pre * lang_post * percentage +(1 + lang_pre + lang_
summary(formants_like_f2.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula:
## f2_norm_sum ~ lang_pre * lang_post * percentage + (1 + lang_pre +
##     lang_post | pair/speaker)
##    Data: data_formants_like_lai_ana
##
##      AIC      BIC   logLik deviance df.resid
##  10765.6  10909.8  -5361.8  10723.6     7085
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.3067 -0.6762 -0.1081  0.5687  6.8748
##
## Random effects:
##  Groups       Name        Variance  Std.Dev.  Corr
##  speaker:pair (Intercept) 6.101e-03 0.0781058
##               lang_pre1   2.285e-04 0.0151161  1.00
##               lang_post1  1.971e-05 0.0044401 -1.00 -1.00
##  pair         (Intercept) 1.840e-02 0.1356575
##               lang_pre1   2.321e-05 0.0048176 -1.00
##               lang_post1  4.026e-07 0.0006345 -1.00  1.00
##  Residual                 2.633e-01 0.5131374
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                                 Estimate Std. Error t value
## (Intercept)                     3.413159   0.069746   48.94
## lang_pre1                       0.003519   0.041921    0.08
## lang_post1                     -0.030159   0.041432   -0.73
## percentage                     -0.843669   0.069435  -12.15
## lang_pre1:lang_post1            0.021813   0.041207    0.53
## lang_pre1:percentage            0.044934   0.069435    0.65
## lang_post1:percentage          -0.077445   0.069435   -1.12
## lang_pre1:lang_post1:percentage -0.073797   0.069435   -1.06
##
## Correlation of Fixed Effects:
##             (Intr) lng_pr1 lng_ps1 prcntg ln_1:_1 lng_pr1: lng_ps1:
## lang_pre1    0.347
## lang_post1   0.166 -0.092
## percentage  -0.498 -0.477  -0.252
## lng_pr1:l_1 -0.061  0.297   0.574   0.087
## lng_pr1:prc -0.287 -0.828   0.087   0.576 -0.253
## lng_pst1:pr -0.149  0.086  -0.838   0.300 -0.485  -0.103
## lng_pr1:_1:  0.051 -0.249  -0.483  -0.103 -0.843   0.300    0.576
```

```r
formants_like_f2.red1.lme = lmer(f2_norm_sum ~ lang_pre * lang_post + percentage  +(1 + lang_pre + lang
formants_like_f2.red2.lme = lmer(f2_norm_sum ~ lang_pre + lang_post + percentage  +(1 + lang_pre + lang
formants_like_f2.red3.lme = lmer(f2_norm_sum ~ lang_pre + lang_post   +(1 + lang_pre + lang_post | pair/
summary(formants_like_f2.red3.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: f2_norm_sum ~ lang_pre + lang_post + (1 + lang_pre + lang_post |
##     pair/speaker)
##    Data: data_formants_like_lai_ana
##
##      AIC      BIC   logLik deviance df.resid
##  12598.5  12708.4  -6283.3  12566.5     7090
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.0250 -0.6389 -0.0767  0.5384  5.2854
##
## Random effects:
##  Groups       Name        Variance  Std.Dev.  Corr
##  speaker:pair (Intercept) 5.775e-03 0.0759947
##               lang_pre1   1.493e-04 0.0122198  1.00
##               lang_post1  4.151e-06 0.0020373 -1.00 -1.00
##  pair         (Intercept) 1.800e-02 0.1341612
##               lang_pre1   2.986e-05 0.0054647 -1.00
##               lang_post1  5.532e-08 0.0002352  1.00 -1.00
##  Residual                 3.414e-01 0.5843326
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  2.98991    0.06108   48.95
## lang_pre1    0.02998    0.02513    1.19
## lang_post1  -0.05934    0.02110   -2.81
##
## Correlation of Fixed Effects:
##            (Intr) lng_pr1
## lang_pre1   0.256
## lang_post1  0.184 -0.292
```

```
formants_like_f2.red4.lme = lmer(f2_norm_sum ~ lang_pre    +(1 + lang_pre + lang_post | pair/speaker),da
formants_like_f2.red5.lme = lmer(f2_norm_sum ~ 1  +(1 + lang_pre + lang_post | pair/speaker),data_formar
anova(formants_like_f2.full.lme,formants_like_f2.red1.lme,formants_like_f2.red2.lme,formants_like_f2.red
```

```
## Data: data_formants_like_lai_ana
## Models:
## formants_like_f2.red5.lme: f2_norm_sum ~ 1 + (1 + lang_pre + lang_post | pair/speaker)
## formants_like_f2.red4.lme: f2_norm_sum ~ lang_pre + (1 + lang_pre + lang_post | pair/speaker)
## formants_like_f2.red3.lme: f2_norm_sum ~ lang_pre + lang_post + (1 + lang_pre + lang_post |
## formants_like_f2.red3.lme:     pair/speaker)
## formants_like_f2.red2.lme: f2_norm_sum ~ lang_pre + lang_post + percentage + (1 + lang_pre +
## formants_like_f2.red2.lme:     lang_post | pair/speaker)
## formants_like_f2.red1.lme: f2_norm_sum ~ lang_pre * lang_post + percentage + (1 + lang_pre +
## formants_like_f2.red1.lme:     lang_post | pair/speaker)
## formants_like_f2.full.lme: f2_norm_sum ~ lang_pre * lang_post * percentage + (1 + lang_pre +
## formants_like_f2.full.lme:     lang_post | pair/speaker)
##                            Df   AIC   BIC  logLik deviance     Chisq Chi Df
## formants_like_f2.red5.lme 14 12600 12696 -6286.2    12572
## formants_like_f2.red4.lme 15 12602 12705 -6286.2    12572    0.0049      1
## formants_like_f2.red3.lme 16 12598 12708 -6283.3    12566    5.8306      1
## formants_like_f2.red2.lme 17 10760 10877 -5363.1    10726 1840.2488      1
```

```
## formants_like_f2.red1.lme 18 10762 10886 -5362.9    10726    0.4473      1
## formants_like_f2.full.lme 21 10766 10910 -5361.8    10724    2.2307      3
##                            Pr(>Chisq)
## formants_like_f2.red5.lme
## formants_like_f2.red4.lme    0.94392
## formants_like_f2.red3.lme    0.01575 *
## formants_like_f2.red2.lme    < 2e-16 ***
## formants_like_f2.red1.lme    0.50363
## formants_like_f2.full.lme    0.52593
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#significant main effect of percentage into vowel sound (increasing F2)
#sign main effect of lang_post: higher F2 in English contexts (does that make sense?)
data_formants_like_lai_ana  %>%
  group_by(lang_post) %>%
  summarize(mean = mean(f2_norm_sum, na.rm = T))
```

```
## # A tibble: 2 x 2
##   lang_post     mean
##      <fctr>    <dbl>
## 1   English 3.056643
## 2  Japanese 2.884665
```

```
#[k]-closure presence
#The closure is predicted to be more likely in Japanese contexts than English contexts
#k_closure_presence_like.full.lme = glmer(presence ~ lang_pre * lang_post +(1 + lang_pre * lang_post | 
#k_closure_presence_like.full.lme = glmer(presence ~ lang_pre * lang_post +(1 + lang_pre + lang_post | 
k_closure_presence_like.full.lme = glmer(presence ~ lang_pre * lang_post +(1  | pair/speaker), data_pres
summary(k_closure_presence_like.full.lme)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: presence ~ lang_pre * lang_post + (1 | pair/speaker)
##    Data: data_presence_like_kclosure_ana
##
##      AIC      BIC   logLik deviance df.resid
##     55.2     82.0    -21.6     43.2      640
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -10.9771   0.0472   0.0533   0.0542   0.5057
##
## Random effects:
##  Groups       Name        Variance  Std.Dev.
##  speaker:pair (Intercept) 1.203e+00 1.097e+00
##  pair         (Intercept) 1.071e-12 1.035e-06
## Number of obs: 646, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)             27.33     145.17   0.188    0.851
## lang_pre1              -12.59     125.57  -0.100    0.920
## lang_post1              10.83     125.57   0.086    0.931
```

```
## lang_pre1:lang_post1   -23.53     145.17  -0.162    0.871
##
## Correlation of Fixed Effects:
##             (Intr) lng_pr1 lng_ps1
## lang_pre1   -0.171
## lang_post1   0.171 -1.000
## lng_pr1:l_1 -1.000  0.171  -0.171
```

```
k_closure_presence_like.red1.lme = glmer(presence ~ lang_pre + lang_post +(1  | pair/speaker), data_pres
k_closure_presence_like.red2.lme = glmer(presence ~ 1 +(1  | pair/speaker), data_presence_like_kclosure_
anova(k_closure_presence_like.full.lme,k_closure_presence_like.red1.lme,k_closure_presence_like.red2.lm
```

```
## Data: data_presence_like_kclosure_ana
## Models:
## k_closure_presence_like.red2.lme: presence ~ 1 + (1 | pair/speaker)
## k_closure_presence_like.red1.lme: presence ~ lang_pre + lang_post + (1 | pair/speaker)
## k_closure_presence_like.full.lme: presence ~ lang_pre * lang_post + (1 | pair/speaker)
##                                  Df    AIC    BIC  logLik deviance  Chisq
## k_closure_presence_like.red2.lme  3 53.713 67.125 -23.856   47.713
## k_closure_presence_like.red1.lme  5 54.352 76.706 -22.176   44.352 3.3611
## k_closure_presence_like.full.lme  6 55.210 82.035 -21.605   43.210 1.1419
##                                  Chi Df Pr(>Chisq)
## k_closure_presence_like.red2.lme
## k_closure_presence_like.red1.lme      2     0.1863
## k_closure_presence_like.full.lme      1     0.2852
```

```
#no effect

#[k]-burst presence
#The burst is predicted to be more likely in Japanese contexts than English contexts
#k_burst_presence_like.full.lme = glmer(presence ~ lang_pre * lang_post +(lang_pre * lang_post | pair/s
#k_burst_presence_like.full.lme = glmer(presence ~ lang_pre * lang_post +(lang_pre + lang_post | pair/s
#k_burst_presence_like.full.lme = glmer(presence ~ lang_pre * lang_post +(1 | pair/speaker), data_prese
k_burst_presence_like.full.lme = glmer(presence ~ lang_pre * lang_post +(1 | pair), data_presence_like_
summary(k_burst_presence_like.full.lme)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: presence ~ lang_pre * lang_post + (1 | pair)
##    Data: data_presence_like_kburst_ana
##
##      AIC      BIC   logLik deviance df.resid
##    551.1    573.5   -270.5    541.1      641
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.5213  0.2840  0.2840  0.4719  0.8790
##
## Random effects:
##  Groups Name        Variance Std.Dev.
##  pair   (Intercept) 0.4311   0.6566
## Number of obs: 646, groups:  pair, 7
##
## Fixed effects:
```

```
##                       Estimate Std. Error z value Pr(>|z|)
## (Intercept)            0.87715    0.41046   2.137   0.0326 *
## lang_pre1             -0.09303    0.32305  -0.288   0.7734
## lang_post1            -0.10666    0.32323  -0.330   0.7414
## lang_pre1:lang_post1   0.31877    0.32109   0.993   0.3208
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr) lng_pr1 lng_ps1
## lang_pre1    0.414
## lang_post1   0.276 -0.081
## lng_pr1:l_1 -0.090  0.342   0.508
```

```
k_burst_presence_like.red1.lme = glmer(presence ~ lang_pre + lang_post +(1 | pair), data_presence_like_k
k_burst_presence_like.red2.lme = glmer(presence ~ 1 +(1 | pair), data_presence_like_kburst_ana, family =
anova(k_burst_presence_like.full.lme,k_burst_presence_like.red1.lme,k_burst_presence_like.red2.lme)
```

```
## Data: data_presence_like_kburst_ana
## Models:
## k_burst_presence_like.red2.lme: presence ~ 1 + (1 | pair)
## k_burst_presence_like.red1.lme: presence ~ lang_pre + lang_post + (1 | pair)
## k_burst_presence_like.full.lme: presence ~ lang_pre * lang_post + (1 | pair)
##                                 Df    AIC    BIC  logLik deviance  Chisq
## k_burst_presence_like.red2.lme  2 547.82 556.76 -271.91   543.82
## k_burst_presence_like.red1.lme  4 550.08 567.96 -271.04   542.08 1.7416
## k_burst_presence_like.full.lme  5 551.10 573.45 -270.55   541.10 0.9814
##                                 Chi Df Pr(>Chisq)
## k_burst_presence_like.red2.lme
## k_burst_presence_like.red1.lme      2     0.4186
## k_burst_presence_like.full.lme      1     0.3218
```

```
#no effect

#[k]-burst duration
#Japanese tokens are predicted to have a shorter duration
k_burst_duration_like.full.lme = lmer(duration ~ lang_pre * lang_post +( 1+ lang_pre * lang_post| pair/s
summary(k_burst_duration_like.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: duration ~ lang_pre * lang_post + (1 + lang_pre * lang_post |
##     pair/speaker)
##    Data: data_presence_like_kburst_ana
##
##      AIC      BIC   logLik deviance df.resid
##  -2908.3  -2796.5   1479.2  -2958.3      621
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.1144 -0.5564 -0.3202  0.2612  7.5757
##
## Random effects:
##  Groups       Name                Variance  Std.Dev.  Corr
##  speaker:pair (Intercept)         1.492e-04 1.222e-02
##               lang_pre1           1.462e-05 3.824e-03  1.00
```

```
##                lang_post1           7.746e-06 2.783e-03 -1.00 -1.00
##                lang_pre1:lang_post1 1.533e-05 3.916e-03 -1.00 -1.00  1.00
##  pair          (Intercept)          0.000e+00 0.000e+00
##                lang_pre1            2.766e-17 5.260e-09   NaN
##                lang_post1           2.047e-17 4.525e-09   NaN -0.79
##                lang_pre1:lang_post1 9.073e-18 3.012e-09   NaN  0.38  0.23
##  Residual                           5.826e-04 2.414e-02
## Number of obs: 646, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                          Estimate Std. Error t value
## (Intercept)            0.0200479  0.0051529   3.891
## lang_pre1             -0.0022851  0.0038210  -0.598
## lang_post1            -0.0003618  0.0036656  -0.099
## lang_pre1:lang_post1 -0.0003522  0.0037418  -0.094
##
## Correlation of Fixed Effects:
##             (Intr) lng_pr1 lng_ps1
## lang_pre1    0.593
## lang_post1   0.035 -0.193
## lng_pr1:l_1 -0.335  0.149   0.562
```

```
k_burst_duration_like.red1.lme = lmer(duration ~ lang_pre + lang_post +( 1+ lang_pre * lang_post| pair/
k_burst_duration_like.red2.lme = lmer(duration ~ 1 +( 1+ lang_pre * lang_post| pair/speaker), data_pres
anova(k_burst_duration_like.full.lme,k_burst_duration_like.red1.lme,k_burst_duration_like.red2.lme)
```

```
## Data: data_presence_like_kburst_ana
## Models:
## k_burst_duration_like.red2.lme: duration ~ 1 + (1 + lang_pre * lang_post | pair/speaker)
## k_burst_duration_like.red1.lme: duration ~ lang_pre + lang_post + (1 + lang_pre * lang_post |
## k_burst_duration_like.red1.lme:     pair/speaker)
## k_burst_duration_like.full.lme: duration ~ lang_pre * lang_post + (1 + lang_pre * lang_post |
## k_burst_duration_like.full.lme:     pair/speaker)
##                                Df     AIC     BIC logLik deviance  Chisq
## k_burst_duration_like.red2.lme 22 -2914.1 -2815.7 1479.0  -2958.1
## k_burst_duration_like.red1.lme 24 -2910.3 -2803.0 1479.2  -2958.3 0.2072
## k_burst_duration_like.full.lme 25 -2908.3 -2796.5 1479.2  -2958.3 0.0068
##                                Chi Df Pr(>Chisq)
## k_burst_duration_like.red2.lme
## k_burst_duration_like.red1.lme      2     0.9016
## k_burst_duration_like.full.lme      1     0.9344
```

```
#no effect
```

ALTERNATIVE ANALYSIS DUE TO SMALL NUMBER OF CODE SWITCHING TOKENS

Here we use the global percentage of time spoken one language in a given conversation as a predictor instead. Specifically: percentage English by speaker/prompt/pair

These analyses show some significant effects for formants; however, they do not seem very consistent wrt the speech context.

```r
#[lai] duration
#The duration is expected to be longer in Japanese contexts than English contexts
duration_like_lai_global.full.lme = lmer(duration_lai ~ eng_percent + (1 +eng_percent | pair/speaker), c
duration_like_lai_global.red1.lme = lmer(duration_lai ~ 1+ (1 +eng_percent | pair/speaker), data_duratio
anova(duration_like_lai_global.full.lme,duration_like_lai_global.red1.lme)
```

```
## Data: data_duration_like_lai
## Models:
## duration_like_lai_global.red1.lme: duration_lai ~ 1 + (1 + eng_percent | pair/speaker)
## duration_like_lai_global.full.lme: duration_lai ~ eng_percent + (1 + eng_percent | pair/speaker)
##                                   Df    AIC    BIC  logLik deviance Chisq
## duration_like_lai_global.red1.lme  8 6548.6 6584.3 -3266.3   6532.6
## duration_like_lai_global.full.lme  9 6550.1 6590.3 -3266.1   6532.1 0.475
##                                   Chi Df Pr(>Chisq)
## duration_like_lai_global.red1.lme
## duration_like_lai_global.full.lme      1     0.4907
```

```r
#no effect

#[lai] formants
#We predict quality differences early on (during the [l]) as a postalveolar flap will be used in Japane
#and an alveolar lateral approximant in English contexts, as Japanese lacks the lateral approximant [@O
#There will also be differences later on in the production, as English uses the lower and more central
#while Japanese will use the higher and more fronted [i] vowel.
#f1
#formants_like_f1.full.lme = lmer(f1_norm_sum ~ eng_percent * percentage +(1 + eng_percent * percentage
#fails to converge for red 2 model
#formants_like_f1_global.full.lme = lmer(f1_norm_sum ~ eng_percent * percentage +(1 + eng_percent + per
#formants_like_f1_global.full.lme = lmer(f1_norm_sum ~ eng_percent * percentage +(1 + eng_percent  | pa
formants_like_f1_global.full.lme = lmer(f1_norm_sum ~ eng_percent * percentage +(1 | pair/speaker),data_
summary(formants_like_f1_global.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: f1_norm_sum ~ eng_percent * percentage + (1 | pair/speaker)
##    Data: data_formants_like_lai_ana_global
##
##      AIC      BIC   logLik deviance df.resid
##  15450.5  15498.5  -7718.2  15436.5     7099
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.1096 -0.5732  0.0227  0.6208  3.5632
##
## Random effects:
##  Groups       Name        Variance Std.Dev.
##  speaker:pair (Intercept) 0.001533 0.03915
##  pair         (Intercept) 0.219790 0.46882
##  Residual                 0.510814 0.71471
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                       Estimate Std. Error t value
## (Intercept)             7.8926     0.1911   41.29
## eng_percent             0.2732     0.0922    2.96
```

```
## percentage               0.7835     0.1003    7.81
## eng_percent:percentage  -0.3426     0.1153   -2.97
##
## Correlation of Fixed Effects:
##             (Intr) eng_pr prcntg
## eng_percent -0.355
## percentage  -0.262  0.602
## eng_prcnt:p  0.253 -0.625 -0.964
```

```
formants_like_f1_global.red1.lme = lmer(f1_norm_sum ~ eng_percent + percentage +(1  | pair/speaker),data
summary(formants_like_f1_global.red1.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: f1_norm_sum ~ eng_percent + percentage + (1 | pair/speaker)
##    Data: data_formants_like_lai_ana_global
##
##      AIC      BIC   logLik deviance df.resid
##  15457.3  15498.5  -7722.6  15445.3     7100
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.1402 -0.5732  0.0227  0.6207  3.5405
##
## Random effects:
##  Groups       Name        Variance Std.Dev.
##  speaker:pair (Intercept) 0.001531 0.03913
##  pair         (Intercept) 0.219784 0.46881
##  Residual                 0.511450 0.71516
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)  8.03625    0.18493   43.46
## eng_percent  0.10193    0.07201    1.42
## percentage   0.49633    0.02683   18.50
##
## Correlation of Fixed Effects:
##             (Intr) eng_pr
## eng_percent -0.261
## percentage  -0.073  0.000
```

```
formants_like_f1_global.red2.lme = lmer(f1_norm_sum ~ eng_percent +(1 | pair/speaker),data_formants_lik
formants_like_f1_global.red3.lme = lmer(f1_norm_sum ~ 1 +(1 | pair/speaker),data_formants_like_lai_ana_
anova(formants_like_f1_global.full.lme,formants_like_f1_global.red1.lme,formants_like_f1_global.red2.lm
```

```
## Data: data_formants_like_lai_ana_global
## Models:
## formants_like_f1_global.red3.lme: f1_norm_sum ~ 1 + (1 | pair/speaker)
## formants_like_f1_global.red2.lme: f1_norm_sum ~ eng_percent + (1 | pair/speaker)
## formants_like_f1_global.red1.lme: f1_norm_sum ~ eng_percent + percentage + (1 | pair/speaker)
## formants_like_f1_global.full.lme: f1_norm_sum ~ eng_percent * percentage + (1 | pair/speaker)
##                                  Df   AIC   BIC  logLik deviance    Chisq
## formants_like_f1_global.red3.lme  4 15789 15817 -7890.7    15781
## formants_like_f1_global.red2.lme  5 15790 15824 -7889.8    15780   1.8755
## formants_like_f1_global.red1.lme  6 15457 15498 -7722.6    15445 334.2681
```

```
## formants_like_f1_global.full.lme  7 15450 15498 -7718.2    15436   8.8267
##                                  Chi Df Pr(>Chisq)
## formants_like_f1_global.red3.lme
## formants_like_f1_global.red2.lme      1   0.170847
## formants_like_f1_global.red1.lme      1  < 2.2e-16 ***
## formants_like_f1_global.full.lme      1   0.002969 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#significant IA effect
#significant main effect of percentage into vowel
#figure suggests rather inconsistent differences (i.e., the lowes and highest english percentages kind

#follow-up:analyse high & low % into vowel
formants_like_f1.02.full.lme = lmer(f1_norm_sum ~ eng_percent+(1 | pair/speaker),data_formants_like_lai
summary(formants_like_f1.02.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: f1_norm_sum ~ eng_percent + (1 | pair/speaker)
##    Data:
## data_formants_like_lai_ana_global[data_formants_like_lai_ana_global$percentage <
##     0.3, ]
##
##      AIC      BIC   logLik deviance df.resid
##   4110.0   4137.8  -2050.0   4100.0     1933
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.4690 -0.5832  0.0091  0.6131  3.5988
##
## Random effects:
##  Groups       Name        Variance Std.Dev.
##  speaker:pair (Intercept) 0.02339  0.1529
##  pair         (Intercept) 0.30114  0.5488
##  Residual                 0.47484  0.6891
## Number of obs: 1938, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)   8.2767     0.2316   35.74
## eng_percent  -0.0446     0.1361   -0.33
##
## Correlation of Fixed Effects:
##             (Intr)
## eng_percent -0.391
```

```
formants_like_f1.08.full.lme = lmer(f1_norm_sum ~ eng_percent+(1 | pair/speaker),data_formants_like_lai
summary(formants_like_f1.08.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: f1_norm_sum ~ eng_percent + (1 | pair/speaker)
##    Data:
## data_formants_like_lai_ana_global[data_formants_like_lai_ana_global$percentage >
##     0.7, ]
##
```

```
##      AIC      BIC   logLik deviance df.resid
##   4696.6   4724.5  -2343.3   4686.6     1933
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -5.4648 -0.5179  0.0903  0.6399  2.6377
##
## Random effects:
##  Groups       Name        Variance Std.Dev.
##  speaker:pair (Intercept) 0.03863  0.1966
##  pair         (Intercept) 0.18277  0.4275
##  Residual                 0.64406  0.8025
## Number of obs: 1938, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)   8.5301     0.2020   42.24
## eng_percent   0.1693     0.1567    1.08
##
## Correlation of Fixed Effects:
##             (Intr)
## eng_percent -0.517
```

```
#follow-up does not really show anything
#(this is one of the cases where model with fuller RE structure did not lead to diff between full & red

#[lai] formants
#f2
#this first model fails to converge
#formants_like_f2.full.lme = lmer(f2_norm_sum ~ eng_percent * percentage +(1 + eng_percent * percentage
formants_like_f2_global.full.lme = lmer(f2_norm_sum ~ eng_percent * percentage +(1 + eng_percent + perc
summary(formants_like_f2.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula:
## f2_norm_sum ~ lang_pre * lang_post * percentage + (1 + lang_pre +
##     lang_post | pair/speaker)
##    Data: data_formants_like_lai_ana
##
##      AIC      BIC   logLik deviance df.resid
##  10765.6  10909.8  -5361.8  10723.6     7085
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.3067 -0.6762 -0.1081  0.5687  6.8748
##
## Random effects:
##  Groups       Name        Variance  Std.Dev.  Corr
##  speaker:pair (Intercept) 6.101e-03 0.0781058
##               lang_pre1   2.285e-04 0.0151161  1.00
##               lang_post1  1.971e-05 0.0044401 -1.00 -1.00
##  pair         (Intercept) 1.840e-02 0.1356575
##               lang_pre1   2.321e-05 0.0048176 -1.00
##               lang_post1  4.026e-07 0.0006345 -1.00  1.00
##  Residual                 2.633e-01 0.5131374
```

```
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                                  Estimate Std. Error t value
## (Intercept)                       3.413159   0.069746   48.94
## lang_pre1                         0.003519   0.041921    0.08
## lang_post1                       -0.030159   0.041432   -0.73
## percentage                       -0.843669   0.069435  -12.15
## lang_pre1:lang_post1              0.021813   0.041207    0.53
## lang_pre1:percentage              0.044934   0.069435    0.65
## lang_post1:percentage            -0.077445   0.069435   -1.12
## lang_pre1:lang_post1:percentage -0.073797   0.069435   -1.06
##
## Correlation of Fixed Effects:
##             (Intr) lng_pr1 lng_ps1 prcntg ln_1:_1 lng_pr1: lng_ps1:
## lang_pre1    0.347
## lang_post1   0.166 -0.092
## percentage  -0.498 -0.477  -0.252
## lng_pr1:l_1 -0.061  0.297   0.574   0.087
## lng_pr1:prc -0.287 -0.828   0.087   0.576 -0.253
## lng_pst1:pr -0.149  0.086  -0.838   0.300 -0.485  -0.103
## lng_pr1:_1:  0.051 -0.249  -0.483  -0.103 -0.843   0.300    0.576
```

```
#dropping factors to check for significance
formants_like_f2_global.red1.lme = lmer(f2_norm_sum ~ eng_percent + percentage +(1 + eng_percent + perc
summary(formants_like_f2_global.red1.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula:
## f2_norm_sum ~ eng_percent + percentage + (1 + eng_percent + percentage |
##     pair/speaker)
##    Data: data_formants_like_lai_ana_global
##
##      AIC      BIC   logLik deviance df.resid
##   9799.5   9909.4  -4883.7   9767.5     7090
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.9796 -0.6382 -0.1024  0.5361  7.1233
##
## Random effects:
##  Groups       Name        Variance Std.Dev. Corr
##  speaker:pair (Intercept) 3.71140  1.9265
##               eng_percent 3.72679  1.9305   -1.00
##               percentage  0.01955  0.1398    0.54 -0.58
##  pair         (Intercept) 2.14480  1.4645
##               eng_percent 2.99484  1.7306   -0.98
##               percentage  0.17059  0.4130    0.60 -0.74
##  Residual                 0.22746  0.4769
## Number of obs: 7106, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##             Estimate Std. Error t value
## (Intercept)   2.3156     0.7719   3.000
## eng_percent   1.1429     0.8485   1.347
```

```
## percentage   -0.6955     0.1631  -4.266
##
## Correlation of Fixed Effects:
##             (Intr) eng_pr
## eng_percent -0.987
## percentage   0.496 -0.629
```

```
formants_like_f2_global.red2.lme = lmer(f2_norm_sum ~ eng_percent +(1 + eng_percent + percentage | pair/
formants_like_f2_global.red3.lme = lmer(f2_norm_sum ~ 1 +(1 + eng_percent + percentage | pair/speaker),d
anova(formants_like_f2_global.full.lme,formants_like_f2_global.red1.lme,formants_like_f2_global.red2.lme
```

```
## Data: data_formants_like_lai_ana_global
## Models:
## formants_like_f2_global.red3.lme: f2_norm_sum ~ 1 + (1 + eng_percent + percentage | pair/speaker)
## formants_like_f2_global.red2.lme: f2_norm_sum ~ eng_percent + (1 + eng_percent + percentage | pair/sp
## formants_like_f2_global.red1.lme: f2_norm_sum ~ eng_percent + percentage + (1 + eng_percent + percent
## formants_like_f2_global.red1.lme:     pair/speaker)
## formants_like_f2_global.full.lme: f2_norm_sum ~ eng_percent * percentage + (1 + eng_percent + percent
## formants_like_f2_global.full.lme:     pair/speaker)
##                                  Df    AIC    BIC  logLik deviance   Chisq
## formants_like_f2_global.red3.lme 14 9805.1 9901.3 -4888.6   9777.1
## formants_like_f2_global.red2.lme 15 9806.4 9909.4 -4888.2   9776.4  0.7237
## formants_like_f2_global.red1.lme 16 9799.5 9909.4 -4883.7   9767.5  8.9613
## formants_like_f2_global.full.lme 17 9791.0 9907.8 -4878.5   9757.0 10.4082
##                                  Chi Df Pr(>Chisq)
## formants_like_f2_global.red3.lme
## formants_like_f2_global.red2.lme      1   0.394934
## formants_like_f2_global.red1.lme      1   0.002758 **
## formants_like_f2_global.full.lme      1   0.001255 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#significant IA effect
#significant main effect of percentage into vowel
#figure again shows overlap between high and low english percentage

#[k]-closure presence
#The closure is predicted to be more likely in Japanese contexts than English contexts
k_closure_presence_like_global.full.lme = glmer(presence ~ eng_percent +(1 + eng_percent | pair/speaker)
summary(k_closure_presence_like.full.lme)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: presence ~ lang_pre * lang_post + (1 | pair/speaker)
##    Data: data_presence_like_kclosure_ana
##
##      AIC      BIC   logLik deviance df.resid
##     55.2     82.0    -21.6     43.2      640
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -10.9771   0.0472   0.0533   0.0542   0.5057
##
## Random effects:
```

```
##  Groups       Name        Variance  Std.Dev.
##  speaker:pair (Intercept) 1.203e+00 1.097e+00
##  pair         (Intercept) 1.071e-12 1.035e-06
## Number of obs: 646, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                      Estimate Std. Error z value Pr(>|z|)
## (Intercept)             27.33     145.17   0.188    0.851
## lang_pre1              -12.59     125.57  -0.100    0.920
## lang_post1              10.83     125.57   0.086    0.931
## lang_pre1:lang_post1   -23.53     145.17  -0.162    0.871
##
## Correlation of Fixed Effects:
##             (Intr) lng_pr1 lng_ps1
## lang_pre1   -0.171
## lang_post1   0.171 -1.000
## lng_pr1:l_1 -1.000  0.171  -0.171
```

```
k_closure_presence_like_global.red1.lme = glmer(presence ~ 1 +(1 + eng_percent | pair/speaker), data_pr
anova(k_closure_presence_like_global.full.lme,k_closure_presence_like_global.red1.lme)
```

```
## Data: data_presence_like_kclosure_ana
## Models:
## k_closure_presence_like_global.red1.lme: presence ~ 1 + (1 + eng_percent | pair/speaker)
## k_closure_presence_like_global.full.lme: presence ~ eng_percent + (1 + eng_percent | pair/speaker)
##                                         Df    AIC    BIC  logLik deviance
## k_closure_presence_like_global.red1.lme  7 60.758 92.053 -23.379   46.758
## k_closure_presence_like_global.full.lme  8 62.743 98.509 -23.371   46.743
##                                         Chisq Chi Df Pr(>Chisq)
## k_closure_presence_like_global.red1.lme
## k_closure_presence_like_global.full.lme 0.015      1     0.9025
```

```
#no effect

#[k]-burst presence
#The burst is predicted to be more likely in Japanese contexts than English contexts
#nc k_burst_like.full.lme = glmer(presence ~ eng_percent +(1 + eng_percent | pair/speaker), data_presen
k_burst_presence_like_global.full.lme = glmer(presence ~ eng_percent +(1 | pair/speaker), data_presence_
summary(k_burst_presence_like_global.full.lme)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula: presence ~ eng_percent + (1 | pair/speaker)
##    Data: data_presence_like_kburst_ana
##
##      AIC      BIC   logLik deviance df.resid
##    542.2    560.1   -267.1    534.2      642
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -4.5515  0.2197  0.3728  0.5193  0.8429
##
## Random effects:
##  Groups       Name        Variance Std.Dev.
```

```
##  speaker:pair (Intercept) 0.61942  0.7870
##  pair         (Intercept) 0.02164  0.1471
## Number of obs: 646, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##             Estimate Std. Error z value Pr(>|z|)
## (Intercept)   1.7898     0.5475   3.269  0.00108 **
## eng_percent  -0.3787     0.6831  -0.554  0.57927
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##             (Intr)
## eng_percent -0.845
```

```
k_burst_presence_like_global.red1.lme = glmer(presence ~ 1 +(1 | pair/speaker), data_presence_like_kburs
anova(k_burst_presence_like_global.full.lme,k_burst_presence_like_global.red1.lme)
```

```
## Data: data_presence_like_kburst_ana
## Models:
## k_burst_presence_like_global.red1.lme: presence ~ 1 + (1 | pair/speaker)
## k_burst_presence_like_global.full.lme: presence ~ eng_percent + (1 | pair/speaker)
##                                       Df    AIC    BIC  logLik deviance
## k_burst_presence_like_global.red1.lme  3 540.53 553.94 -267.26   534.53
## k_burst_presence_like_global.full.lme  4 542.20 560.08 -267.10   534.20
##                                        Chisq Chi Df Pr(>Chisq)
## k_burst_presence_like_global.red1.lme
## k_burst_presence_like_global.full.lme 0.3313      1     0.5649
```

```
#no effect

#[k]-burst duration
#Japanese tokens are predicted to have a shorter duration
k_burst_duration_like_global.full.lme = lmer(duration ~ eng_percent +( 1+ eng_percent| pair/speaker), da
summary(k_burst_duration_like_global.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula: duration ~ eng_percent + (1 + eng_percent | pair/speaker)
##    Data: data_presence_like_kburst_ana
##
##      AIC      BIC   logLik deviance df.resid
##  -2948.6  -2908.3   1483.3  -2966.6      637
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -1.3259 -0.5535 -0.3155  0.2353  7.6617
##
## Random effects:
##  Groups       Name        Variance  Std.Dev.  Corr
##  speaker:pair (Intercept) 1.746e-04 1.321e-02
##               eng_percent 3.709e-04 1.926e-02 -1.00
##  pair         (Intercept) 0.000e+00 0.000e+00
##               eng_percent 2.845e-19 5.334e-10  NaN
##  Residual                 5.813e-04 2.411e-02
## Number of obs: 646, groups:  speaker:pair, 14; pair, 7
```

```
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)  0.032444   0.005539   5.858
## eng_percent -0.014603   0.007270  -2.009
##
## Correlation of Fixed Effects:
##             (Intr)
## eng_percent -0.961
```

```
k_burst_duration_like_global.red1.lme = lmer(duration ~ 1 +( 1+ eng_percent| pair/speaker), data_presen
anova(k_burst_duration_like_global.full.lme,k_burst_duration_like_global.red1.lme)
```

```
## Data: data_presence_like_kburst_ana
## Models:
## k_burst_duration_like_global.red1.lme: duration ~ 1 + (1 + eng_percent | pair/speaker)
## k_burst_duration_like_global.full.lme: duration ~ eng_percent + (1 + eng_percent | pair/speaker)
##                                       Df     AIC     BIC logLik deviance
## k_burst_duration_like_global.red1.lme  8 -2947.1 -2911.3 1481.6  -2963.1
## k_burst_duration_like_global.full.lme  9 -2948.6 -2908.3 1483.3  -2966.6
##                                        Chisq Chi Df Pr(>Chisq)
## k_burst_duration_like_global.red1.lme
## k_burst_duration_like_global.full.lme 3.4486      1     0.0633 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#marginally significant; actually slightly longer duration for Japanese
```

ALTERNATIVE ANALYSIS DUE TO SMALL NUMBER OF CODE SWITCHING TOKENS - ONLY ENGLISH-ENGLISH

This analysis also uses percent English as the only independent variable, however focusing on English-English tokens.

These analyses show some significant effects for formants; however, they do not seem very consistent wrt the speech context.

```
# [lai] duration
data_duration_like_lai_eng_eng = data_duration_like_lai %>%
  filter(lang_pre == "eng" & lang_post == "eng")

duration_like_lai_global_eng_eng.full.lme = lmer(duration_lai ~ eng_percent +
                                                   (1 +eng_percent | pair/speaker),
                                                   data_duration_like_lai_eng_eng, REML=FALSE)

duration_like_lai_global_eng_eng.red1.lme = lmer(duration_lai ~ 1 +
                                                  (1 +eng_percent | pair/speaker),
                                                  data_duration_like_lai_eng_eng, REML=FALSE)
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control
## $checkConv, : unable to evaluate scaled gradient
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control
## $checkConv, : Model failed to converge: degenerate Hessian with 2 negative
## eigenvalues
```

```r
anova(duration_like_lai_global_eng_eng.full.lme, duration_like_lai_global_eng_eng.red1.lme)
```

```
## Data: data_duration_like_lai_eng_eng
## Models:
## duration_like_lai_global_eng_eng.red1.lme: duration_lai ~ 1 + (1 + eng_percent | pair/speaker)
## duration_like_lai_global_eng_eng.full.lme: duration_lai ~ eng_percent + (1 + eng_percent | pair/speal
##                                           Df    AIC    BIC  logLik
## duration_like_lai_global_eng_eng.red1.lme  8 6208.2 6243.6 -3096.1
## duration_like_lai_global_eng_eng.full.lme  9 6206.3 6246.1 -3094.1
##                                           deviance Chisq Chi Df Pr(>Chisq)
## duration_like_lai_global_eng_eng.red1.lme   6192.2
## duration_like_lai_global_eng_eng.full.lme   6188.3 3.898      1    0.04834
##
## duration_like_lai_global_eng_eng.red1.lme
## duration_like_lai_global_eng_eng.full.lme *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
# Significant effect, longer duration more English


# Formants
data_formants_like_lai_global_eng_eng = data_formants_like %>%
  # Filter to only English-English tokens
  filter(lang_pre == "eng" & lang_post == "eng") %>%
  # Focus on the phoneme /lai/
  filter(sound == "l" | sound == "i") %>%
  # Update line number and time
  mutate(line_lai = ifelse(sound == "l", line, line - 1)) %>%
  # Update time column
  mutate(time_real = tmin + time) %>%
  # Get percentages
  group_by(pair, prompt, speaker, line_lai) %>%
  mutate(percentage = round((time_real - min(time_real)) /
                            (max(time_real) - min(time_real)), 1)) %>%
  # Get mean of percentage
  group_by(pair, prompt, speaker, eng_percent, line_lai, percentage) %>%
  summarise(f1_norm_sum = mean(f1_norm_bark, na.rm = T),
            f2_norm_sum = mean(f2_norm_bark, na.rm = T)) %>%
  ungroup()

# F1
formants_like_f1_global_eng_eng.full.lme = lmer(f1_norm_sum ~ eng_percent * percentage +
                                                  (1 + eng_percent + percentage | pair/speaker),
                                                  data_formants_like_lai_global_eng_eng, REML=FALSE)
summary(formants_like_f1_global_eng_eng.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula:
## f1_norm_sum ~ eng_percent * percentage + (1 + eng_percent + percentage |
##     pair/speaker)
##    Data: data_formants_like_lai_global_eng_eng
##
##      AIC      BIC   logLik deviance df.resid
```

```
##  14552.0  14667.9  -7259.0  14518.0     6748
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -6.0133 -0.5663  0.0229  0.6111  3.6153
##
## Random effects:
##  Groups       Name        Variance Std.Dev. Corr
##  speaker:pair (Intercept) 0.01084  0.1041
##               eng_percent 0.02047  0.1431   -0.36
##               percentage  0.14266  0.3777   -0.33 -0.76
##  pair         (Intercept) 0.21873  0.4677
##               eng_percent 0.02437  0.1561    1.00
##               percentage  0.00914  0.0956   -1.00 -1.00
##  Residual                 0.49501  0.7036
## Number of obs: 6765, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                         Estimate Std. Error t value
## (Intercept)               8.0611     0.2022   39.86
## eng_percent               0.1075     0.1536    0.70
## percentage                0.2783     0.1853    1.50
## eng_percent:percentage    0.2999     0.2059    1.46
##
## Correlation of Fixed Effects:
##             (Intr) eng_pr prcntg
## eng_percent -0.069
## percentage  -0.490  0.348
## eng_prcnt:p  0.343 -0.684 -0.774
```

```
formants_like_f1_global_eng_eng.red1.lme = lmer(f1_norm_sum ~ eng_percent + percentage +
                                                (1 + eng_percent + percentage | pair/speaker),
                                                data_formants_like_lai_global_eng_eng, REML=FALSE)
anova(formants_like_f1_global_eng_eng.full.lme, formants_like_f1_global_eng_eng.red1.lme)
```

```
## Data: data_formants_like_lai_global_eng_eng
## Models:
## formants_like_f1_global_eng_eng.red1.lme: f1_norm_sum ~ eng_percent + percentage + (1 + eng_percent +
## formants_like_f1_global_eng_eng.red1.lme:     pair/speaker)
## formants_like_f1_global_eng_eng.full.lme: f1_norm_sum ~ eng_percent * percentage + (1 + eng_percent +
## formants_like_f1_global_eng_eng.full.lme:     pair/speaker)
##                                            Df   AIC   BIC  logLik deviance
## formants_like_f1_global_eng_eng.red1.lme 16 14552 14661 -7259.9    14520
## formants_like_f1_global_eng_eng.full.lme 17 14552 14668 -7259.0    14518
##                                             Chisq Chi Df Pr(>Chisq)
## formants_like_f1_global_eng_eng.red1.lme
## formants_like_f1_global_eng_eng.full.lme 1.8083      1     0.1787
```

```
formants_like_f1_global_eng_eng.red2.lme = lmer(f1_norm_sum ~ eng_percent +
                                                   (1 + eng_percent + percentage | pair/speaker),
                                                   data_formants_like_lai_global_eng_eng, REML=FALSE)
anova(formants_like_f1_global_eng_eng.full.lme, formants_like_f1_global_eng_eng.red2.lme)
```

```
## Data: data_formants_like_lai_global_eng_eng
## Models:
```

```
## formants_like_f1_global_eng_eng.red2.lme: f1_norm_sum ~ eng_percent + (1 + eng_percent + percentage
## formants_like_f1_global_eng_eng.full.lme: f1_norm_sum ~ eng_percent * percentage + (1 + eng_percent +
## formants_like_f1_global_eng_eng.full.lme:     pair/speaker)
##                                          Df   AIC   BIC  logLik deviance
## formants_like_f1_global_eng_eng.red2.lme 15 14559 14661 -7264.3    14529
## formants_like_f1_global_eng_eng.full.lme 17 14552 14668 -7259.0    14518
##                                           Chisq Chi Df Pr(>Chisq)
## formants_like_f1_global_eng_eng.red2.lme
## formants_like_f1_global_eng_eng.full.lme 10.658      2   0.004849 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
formants_like_f1_global_eng_eng.red3.lme = lmer(f1_norm_sum ~ percentage +
                                                  (1 + eng_percent + percentage | pair/speaker),
                                                  data_formants_like_lai_global_eng_eng, REML=FALSE)
anova(formants_like_f1_global_eng_eng.full.lme, formants_like_f1_global_eng_eng.red3.lme)
```

```
## Data: data_formants_like_lai_global_eng_eng
## Models:
## formants_like_f1_global_eng_eng.red3.lme: f1_norm_sum ~ percentage + (1 + eng_percent + percentage |
## formants_like_f1_global_eng_eng.full.lme: f1_norm_sum ~ eng_percent * percentage + (1 + eng_percent +
## formants_like_f1_global_eng_eng.full.lme:     pair/speaker)
##                                          Df   AIC   BIC logLik deviance
## formants_like_f1_global_eng_eng.red3.lme 15 14554 14656  -7262    14524
## formants_like_f1_global_eng_eng.full.lme 17 14552 14668  -7259    14518
##                                           Chisq Chi Df Pr(>Chisq)
## formants_like_f1_global_eng_eng.red3.lme
## formants_like_f1_global_eng_eng.full.lme 5.9825      2    0.05022 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Significant effect of percentage
# Effect of percent English trending

# F2
formants_like_f2_global_eng_eng.full.lme = lmer(f2_norm_sum ~ eng_percent * percentage +
                                                  (1 + eng_percent + percentage | pair/speaker),
                                                  data_formants_like_lai_global_eng_eng, REML=FALSE)
summary(formants_like_f2_global_eng_eng.full.lme)
```

```
## Linear mixed model fit by maximum likelihood  ['lmerMod']
## Formula:
## f2_norm_sum ~ eng_percent * percentage + (1 + eng_percent + percentage |
##     pair/speaker)
##    Data: data_formants_like_lai_global_eng_eng
##
##      AIC      BIC   logLik deviance df.resid
##   9369.8   9485.8  -4667.9   9335.8     6748
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.9627 -0.6327 -0.0970  0.5329  7.0941
##
## Random effects:
##  Groups       Name        Variance Std.Dev. Corr
```

```
##  speaker:pair (Intercept) 3.99532  1.9988
##               eng_percent 4.02963  2.0074   -1.00
##               percentage  0.02222  0.1491    0.59 -0.62
##  pair         (Intercept) 1.60397  1.2665
##               eng_percent 2.68994  1.6401   -1.00
##               percentage  0.16680  0.4084    0.94 -0.97
##  Residual                 0.22864  0.4782
## Number of obs: 6765, groups:  speaker:pair, 14; pair, 7
##
## Fixed effects:
##                         Estimate Std. Error t value
## (Intercept)               2.5385     0.7354   3.452
## eng_percent               0.7902     0.8389   0.942
## percentage               -1.0207     0.1892  -5.395
## eng_percent:percentage    0.4918     0.1387   3.547
##
## Correlation of Fixed Effects:
##             (Intr) eng_pr prcntg
## eng_percent -0.989
## percentage   0.567 -0.630
## eng_prcnt:p  0.048 -0.081 -0.513
```

```
formants_like_f2_global_eng_eng.red1.lme = lmer(f2_norm_sum ~ eng_percent + percentage +
                                                (1 + eng_percent + percentage | pair/speaker),
                                                data_formants_like_lai_global_eng_eng, REML=FALSE)
anova(formants_like_f2_global_eng_eng.full.lme, formants_like_f2_global_eng_eng.red1.lme)
```

```
## Data: data_formants_like_lai_global_eng_eng
## Models:
## formants_like_f2_global_eng_eng.red1.lme: f2_norm_sum ~ eng_percent + percentage + (1 + eng_percent +
## formants_like_f2_global_eng_eng.red1.lme:     pair/speaker)
## formants_like_f2_global_eng_eng.full.lme: f2_norm_sum ~ eng_percent * percentage + (1 + eng_percent +
## formants_like_f2_global_eng_eng.full.lme:     pair/speaker)
##                                            Df    AIC    BIC  logLik deviance
## formants_like_f2_global_eng_eng.red1.lme 16 9378.7 9487.8 -4673.3   9346.7
## formants_like_f2_global_eng_eng.full.lme 17 9369.8 9485.8 -4667.9   9335.8
##                                             Chisq Chi Df Pr(>Chisq)
## formants_like_f2_global_eng_eng.red1.lme
## formants_like_f2_global_eng_eng.full.lme 10.856      1  0.0009846 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
formants_like_f2_global_eng_eng.red2.lme = lmer(f2_norm_sum ~ eng_percent +
                                                   (1 + eng_percent + percentage | pair/speaker),
                                                   data_formants_like_lai_global_eng_eng, REML=FALSE)
```

```
## Warning in optwrap(optimizer, devfun, getStart(start, rho$lower, rho$pp), :
## convergence code 1 from bobyqa: bobyqa -- maximum number of function
## evaluations exceeded
```

```
anova(formants_like_f2_global_eng_eng.full.lme, formants_like_f2_global_eng_eng.red2.lme)
```

```
## Data: data_formants_like_lai_global_eng_eng
## Models:
## formants_like_f2_global_eng_eng.red2.lme: f2_norm_sum ~ eng_percent + (1 + eng_percent + percentage
## formants_like_f2_global_eng_eng.full.lme: f2_norm_sum ~ eng_percent * percentage + (1 + eng_percent +
```

```
## formants_like_f2_global_eng_eng.full.lme:     pair/speaker)
##                                          Df    AIC    BIC  logLik deviance
## formants_like_f2_global_eng_eng.red2.lme 15 9385.6 9487.9 -4677.8   9355.6
## formants_like_f2_global_eng_eng.full.lme 17 9369.8 9485.8 -4667.9   9335.8
##                                           Chisq Chi Df Pr(>Chisq)
## formants_like_f2_global_eng_eng.red2.lme
## formants_like_f2_global_eng_eng.full.lme 19.729      2  5.198e-05 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
formants_like_f2_global_eng_eng.red3.lme = lmer(f2_norm_sum ~ percentage +
                                                  (1 + eng_percent + percentage | pair/speaker),
                                                  data_formants_like_lai_global_eng_eng, REML=FALSE)
anova(formants_like_f2_global_eng_eng.full.lme, formants_like_f2_global_eng_eng.red3.lme)
```

```
## Data: data_formants_like_lai_global_eng_eng
## Models:
## formants_like_f2_global_eng_eng.red3.lme: f2_norm_sum ~ percentage + (1 + eng_percent + percentage |
## formants_like_f2_global_eng_eng.full.lme: f2_norm_sum ~ eng_percent * percentage + (1 + eng_percent +
## formants_like_f2_global_eng_eng.full.lme:     pair/speaker)
##                                          Df    AIC    BIC  logLik deviance
## formants_like_f2_global_eng_eng.red3.lme 15 9378.1 9480.4 -4674.0   9348.1
## formants_like_f2_global_eng_eng.full.lme 17 9369.8 9485.8 -4667.9   9335.8
##                                           Chisq Chi Df Pr(>Chisq)
## formants_like_f2_global_eng_eng.red3.lme
## formants_like_f2_global_eng_eng.full.lme 12.233      2   0.002206 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Significant interaction
# Significant effect of percentage
# Significant effect of percent English


# [k]-closure presence
data_presence_like_kclosure_ana_eng_eng = data_presence_like_kclosure_ana %>%
  filter(lang_pre == "eng" & lang_post == "eng")

k_closure_presence_like_global_eng_eng.full.lme = glmer(presence ~ eng_percent +
                                                          (1 + eng_percent | pair/speaker),
                                                          data_presence_like_kclosure_ana_eng_eng,
                                                          family = binomial)
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl = control
## $checkConv, : Model failed to converge with max|grad| = 0.0438702 (tol =
## 0.001, component 1)
```

```
k_closure_presence_like_global_eng_eng.red1.lme = glmer(presence ~ 1 +
                                                          (1 + eng_percent | pair/speaker),
                                                          data_presence_like_kclosure_ana_eng_eng,
                                                          family = binomial)

anova(k_closure_presence_like_global_eng_eng.full.lme, k_closure_presence_like_global_eng_eng.red1.lme)
```

```
## Data: data_presence_like_kclosure_ana_eng_eng
## Models:
```

```
## k_closure_presence_like_global_eng_eng.red1.lme: presence ~ 1 + (1 + eng_percent | pair/speaker)
## k_closure_presence_like_global_eng_eng.full.lme: presence ~ eng_percent + (1 + eng_percent | pair/spe
##                                                 Df    AIC    BIC  logLik
## k_closure_presence_like_global_eng_eng.red1.lme  7 50.722 81.685 -18.361
## k_closure_presence_like_global_eng_eng.full.lme  8 51.463 86.849 -17.732
##                                                 deviance  Chisq Chi Df
## k_closure_presence_like_global_eng_eng.red1.lme   36.722
## k_closure_presence_like_global_eng_eng.full.lme   35.463 1.2587      1
##                                                 Pr(>Chisq)
## k_closure_presence_like_global_eng_eng.red1.lme
## k_closure_presence_like_global_eng_eng.full.lme     0.2619
```

```
# No effect


# [k]-burst presence
data_presence_like_kburst_ana_eng_eng = data_presence_like_kburst_ana %>%
  filter(lang_pre == "English" & lang_post == "English")

k_burst_presence_like_global_eng_eng.full.lme = glmer(presence ~ eng_percent +
                                            (1 | pair/speaker),
                                            data_presence_like_kburst_ana_eng_eng,
                                            family = binomial)

k_burst_presence_like_global_eng_eng.red1.lme = glmer(presence ~ 1 +
                                                (1 | pair/speaker),
                                                data_presence_like_kburst_ana_eng_eng,
                                                family = binomial)

anova(k_burst_presence_like_global_eng_eng.full.lme, k_burst_presence_like_global_eng_eng.red1.lme)
```

```
## Data: data_presence_like_kburst_ana_eng_eng
## Models:
## k_burst_presence_like_global_eng_eng.red1.lme: presence ~ 1 + (1 | pair/speaker)
## k_burst_presence_like_global_eng_eng.full.lme: presence ~ eng_percent + (1 | pair/speaker)
##                                                Df    AIC    BIC  logLik
## k_burst_presence_like_global_eng_eng.red1.lme  3 502.96 516.23 -248.48
## k_burst_presence_like_global_eng_eng.full.lme  4 504.20 521.90 -248.10
##                                                deviance  Chisq Chi Df
## k_burst_presence_like_global_eng_eng.red1.lme   496.96
## k_burst_presence_like_global_eng_eng.full.lme   496.20 0.7595      1
##                                                Pr(>Chisq)
## k_burst_presence_like_global_eng_eng.red1.lme
## k_burst_presence_like_global_eng_eng.full.lme     0.3835
```

```
# No effect


# [k]-burst duration
k_burst_duration_like_global_eng_eng.full.lme = lmer(duration ~ eng_percent +
                                            (1+ eng_percent| pair/speaker),
                                            data_presence_like_kburst_ana_eng_eng, REML=FALSE)

k_burst_duration_like_global_eng_eng.red1.lme = lmer(duration ~ 1 +
                                                ( 1+ eng_percent| pair/speaker),
```

```
                                                    data_presence_like_kburst_ana_eng_eng,
                                                    REML=FALSE)

anova(k_burst_duration_like_global_eng_eng.full.lme, k_burst_duration_like_global_eng_eng.red1.lme)
```

```
## Data: data_presence_like_kburst_ana_eng_eng
## Models:
## k_burst_duration_like_global_eng_eng.red1.lme: duration ~ 1 + (1 + eng_percent | pair/speaker)
## k_burst_duration_like_global_eng_eng.full.lme: duration ~ eng_percent + (1 + eng_percent | pair/speal
##                                               Df     AIC     BIC logLik
## k_burst_duration_like_global_eng_eng.red1.lme  8 -2807.5 -2772.1 1411.7
## k_burst_duration_like_global_eng_eng.full.lme  9 -2808.4 -2768.6 1413.2
##                                               deviance Chisq Chi Df
## k_burst_duration_like_global_eng_eng.red1.lme  -2823.5
## k_burst_duration_like_global_eng_eng.full.lme  -2826.4 2.904      1
##                                               Pr(>Chisq)
## k_burst_duration_like_global_eng_eng.red1.lme
## k_burst_duration_like_global_eng_eng.full.lme    0.08836 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Marginally significant, shorter with more English in conversation
```