

Resubmit Exclusions

This document responds to some questions raised by reviewers during the review process. You will need to get the private metadata csv file from the BabbleCor authors (and our data) in order to reproduce these results.

The reviewers expressed some confusion as to why we used the exclusion criteria that we used. Our main purpose was to create a homogeneous sample of participants in order to remove potential confounds. However, at the request of the reviewers, we include some analyses here that don't exclude based on the sociodemographic information collected.

Firstly, we can run the analyses again without any exclusion criteria. The full results are below for the reader to examine but the overall conclusions are the same as those with exclusions reported in the paper.

```
##### TRIAL DATA #####
# get data before exclusions
library(here)
d <- read.csv(here::here("data","trial_data.csv"))
library(ggplot2)

# refactor the group so the order is correct in the graphs
d$stim_ageGroup<-factor(d$stim_ageGroup,levels = c("0-7","8-18","19-36"))

agg<-aggregate(correct~phase*subject_ID, data = d, mean)
t.test(x = subset(agg,agg$phase=="Age")$correct, mu = 1/3)
```

```
##
## One Sample t-test
##
## data: subset(agg, agg$phase == "Age")$correct
## t = 20.217, df = 625, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0.3333333
## 95 percent confidence interval:
## 0.4377781 0.4602517
## sample estimates:
## mean of x
## 0.4490149
```

```
t.test(x = subset(agg,agg$phase=="Language")$correct, mu = 1/3)
```

```
##
## One Sample t-test
##
## data: subset(agg, agg$phase == "Language")$correct
## t = 34.64, df = 625, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0.3333333
## 95 percent confidence interval:
```

```
## 0.5154152 0.5373005
## sample estimates:
## mean of x
## 0.5263578
```

```
t.test(x = subset(agg,agg$phase=="Sex")$correct, mu = 1/3)
```

```
##
## One Sample t-test
##
## data: subset(agg, agg$phase == "Sex")$correct
## t = 23.496, df = 625, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0.3333333
## 95 percent confidence interval:
## 0.4665998 0.4909082
## sample estimates:
## mean of x
## 0.478754
```

```
##### Testing the Age data #####
# Random intercept Model: Baseline
library(lme4)
```

```
## Loading required package: Matrix
```

```
##
## Attaching package: 'Matrix'
```

```
## The following objects are masked from 'package:tidyr':
##
## expand, pack, unpack
```

```
model1<- glmer(correct~1+(1|subject_ID),
               data = subset(d,d$phase=="Age"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + (1 | subject_ID)
## Data: subset(d, d$phase == "Age")
##
##      AIC      BIC    logLik deviance df.resid
## 10339.6 10353.4 -5167.8 10335.6      7510
##
## Scaled residuals:
```

```
##      Min      1Q  Median      3Q      Max
## -0.9027 -0.9027 -0.9027  1.1077  1.1077
##
## Random effects:
##   Groups      Name      Variance Std.Dev.
##  subject_ID (Intercept) 1.726e-13 4.155e-07
## Number of obs: 7512, groups:  subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  -0.2046      0.0232  -8.823  <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Adding level 1 predictors: childcare & caregiver
model2<- glmer(correct~1+childcare+caregiver+(1|subject_ID),
               data = subset(d,d$phase=="Age"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## Data: subset(d, d$phase == "Age")
##
##      AIC      BIC    logLik deviance df.resid
## 10337.8 10365.5 -5164.9 10329.8      7508
##
## Scaled residuals:
##      Min      1Q  Median      3Q      Max
## -1.0440 -0.8941 -0.8941  1.1184  1.3205
##
## Random effects:
##   Groups      Name      Variance Std.Dev.
##  subject_ID (Intercept) 4e-12      2e-06
## Number of obs: 7512, groups:  subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.223881    0.025150  -8.902  <2e-16 ***
## childcare    0.005168    0.002156   2.397   0.0165 *
## caregiver    -0.003825    0.003336  -1.147   0.2515
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) chldcr
```

```
## childcare -0.338
## caregiver -0.039 -0.388
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model1,model2)
```

```
## Data: subset(d, d$phase == "Age")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
##      npar   AIC   BIC logLik deviance Chisq Df Pr(>Chisq)
## model1    2 10340 10353 -5167.8   10336
## model2    4 10338 10366 -5164.9   10330 5.8105  2    0.05474 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#additional model with only childcare
```

```
model4<- glmer(correct~1+childcare+(1|subject_ID),
               data = subset(d,d$phase=="Age"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + (1 | subject_ID)
## Data: subset(d, d$phase == "Age")
##
##      AIC      BIC   logLik deviance df.resid
## 10337.1 10357.9 -5165.6 10331.1      7509
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.1504 -0.8936 -0.8936  1.1191  1.1191
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 4.84e-12 2.2e-06
## Number of obs: 7512, groups: subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.225042   0.025131  -8.955   <2e-16 ***
## childcare    0.004210   0.001989   2.116   0.0343 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
##
## Correlation of Fixed Effects:
##      (Intr)
## childcare -0.384
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular

#compare to baseline model
anova(model1,model4)

## Data: subset(d, d$phase == "Age")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model4: correct ~ 1 + childcare + (1 | subject_ID)
##      npar    AIC    BIC logLik deviance  Chisq Df Pr(>Chisq)
## model1     2 10340 10353 -5167.8    10336
## model4     3 10337 10358 -5165.6    10331 4.4829  1    0.03424 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Adding level 2 predictor: Participant's gender
model3<- glmer(correct~1+childcare+caregiver+gender+(1|subject_ID),
               data = subset(d,d$phase=="Age"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model3)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
## Data: subset(d, d$phase == "Age")
##
##      AIC      BIC   logLik deviance df.resid
## 10341.4 10382.9 -5164.7 10329.4      7506
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0451 -0.9023 -0.8887  1.1082  1.3146
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 2.38e-12 1.543e-06
## Number of obs: 7512, groups: subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -0.235952   0.032286  -7.308 2.71e-13 ***
## childcare      0.005403   0.002193   2.464  0.0137 *
## caregiver     -0.003940   0.003341  -1.179  0.2383
```

```
## genderMale          0.030401  0.048886  0.622  0.5340
## genderOther_gender -0.032897  0.262488 -0.125  0.9003
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##          (Intr) chldcr cargvr gndrMl
## childcare  -0.374
## caregiver   0.004 -0.391
## genderMale  -0.623  0.181 -0.055
## gndrOthr_gn -0.122  0.045 -0.004  0.076
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model2,model3)
```

```
## Data: subset(d, d$phase == "Age")
## Models:
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## model3: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
##      npar   AIC   BIC logLik deviance Chisq Df Pr(>Chisq)
## model2    4 10338 10366 -5164.9    10330
## model3    6 10341 10383 -5164.7    10329 0.4167  2    0.8119
```

```
##### Testing the Language data #####
# Random intercept Model: Baseline
library(lme4)
model1<- glmer(correct~1+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC   logLik deviance df.resid
## 10397.0 10410.8 -5196.5 10393.0    7510
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0542 -1.0542  0.9486  0.9486  0.9486
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 0          0
```

```
## Number of obs: 7512, groups:  subject_ID, 626
##
## Fixed effects:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.10553    0.02311   4.567 4.95e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Adding level 1 predictors: childcare & caregiver
model2<- glmer(correct~1+childcare+caregiver+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC    logLik deviance df.resid
## 10398.2 10425.9 -5195.1 10390.2      7508
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.2609 -1.0459  0.9083  0.9561  0.9631
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 1e-12      1e-06
## Number of obs: 7512, groups:  subject_ID, 626
##
## Fixed effects:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.0897084  0.0250428   3.582 0.000341 ***
## childcare    0.0034199  0.0021645   1.580 0.114111
## caregiver    -0.0004055  0.0033013  -0.123 0.902232
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr) chldcr
## childcare -0.338
## caregiver -0.043 -0.379
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model1,model2)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
##      npar   AIC   BIC logLik deviance Chisq Df Pr(>Chisq)
## model1    2 10397 10411 -5196.5    10393
## model2    4 10398 10426 -5195.1    10390 2.7786  2    0.2493
```

```
#additional model with only childcare
```

```
model4<- glmer(correct~1+childcare+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC   logLik deviance df.resid
## 10396.2 10417.0 -5195.1 10390.2      7509
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.2763 -1.0458  0.9098  0.9562  0.9562
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 1.034e-12 1.017e-06
## Number of obs: 7512, groups: subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) 0.089576   0.025021   3.580 0.000343 ***
## childcare   0.003319   0.002004   1.656 0.097663 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr)
## childcare -0.383
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```



```
#compare to baseline model
anova(model1,model4)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model4: correct ~ 1 + childcare + (1 | subject_ID)
##      npar    AIC    BIC logLik deviance  Chisq Df Pr(>Chisq)
## model1     2 10397 10411 -5196.5    10393
## model4     3 10396 10417 -5195.1    10390 2.7635  1    0.09644 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Adding level 2 predictor: Participant's gender
model3<- glmer(correct~1+childcare+caregiver+gender+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model3)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC   logLik deviance df.resid
## 10402.0 10443.5 -5195.0 10390.0      7506
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.2613 -1.0470  0.9051  0.9551  0.9621
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 4.34e-16 2.083e-08
## Number of obs: 7512, groups: subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    0.0918832  0.0321353   2.859  0.00425 **
## childcare      0.0033855  0.0022016   1.538  0.12411
## caregiver     -0.0003763  0.0033062  -0.114  0.90938
## genderMale    -0.0077828  0.0486774  -0.160  0.87297
## genderOther_gender 0.1075841  0.2614335   0.412  0.68069
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) chldcr cargvr gndrM1
```

```
## childcare -0.373
## caregiver 0.001 -0.382
## genderMale -0.622 0.180 -0.055
## gndr0thr_gn -0.122 0.044 -0.004 0.076
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model2,model3)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## model3: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
##      npar   AIC   BIC logLik deviance Chisq Df Pr(>Chisq)
## model2    4 10398 10426 -5195.1    10390
## model3    6 10402 10444 -5195.0    10390 0.2067 2    0.9018
```

```
##### Testing the Sex data #####
# Random intercept Model: Baseline
library(lme4)
model1<- glmer(correct~1+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC   logLik deviance df.resid
## 8670.9   8684.4 -4333.4   8666.9     6258
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.9584 -0.9584 -0.9584  1.0434  1.0434
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 1e-12      1e-06
## Number of obs: 6260, groups: subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.08504    0.02530  -3.361 0.000777 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```

# Adding level 1 predictors: childcare & caregiver
model2<- glmer(correct~1+childcare+caregiver+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))

## boundary (singular) fit: see ?isSingular

summary(model2)

## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC   logLik deviance df.resid
##  8673.5   8700.4  -4332.7   8665.5     6256
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0286 -0.9552 -0.9507  1.0470  1.2257
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 1.934e-12 1.391e-06
## Number of obs: 6260, groups:  subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.091769   0.027417  -3.347 0.000816 ***
## childcare    0.002468   0.002357   1.047 0.295063
## caregiver   -0.003408   0.003626  -0.940 0.347199
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##          (Intr) chldcr
## childcare -0.338
## caregiver -0.040 -0.386
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular

# Compare two models
anova(model1,model2)

## Data: subset(d, d$phase == "Sex")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
##      npar    AIC    BIC logLik deviance Chisq Df Pr(>Chisq)
## model1    2 8670.9 8684.4 -4333.4   8666.9
## model2    4 8673.5 8700.4 -4332.7   8665.5 1.4394  2    0.4869

```

```
#additional model with only childcare
```

```
model4<- glmer(correct~1+childcare+(1|subject_ID),  
              data = subset(d,d$phase=="Sex"),  
              family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace  
## Approximation) [glmerMod]  
## Family: binomial ( logit )  
## Formula: correct ~ 1 + childcare + (1 | subject_ID)  
## Data: subset(d, d$phase == "Sex")  
##  
##           AIC          BIC    logLik deviance df.resid  
##    8672.3    8692.6  -4333.2   8666.3     6257  
##  
## Scaled residuals:  
##      Min       1Q   Median       3Q      Max   
## -1.0516 -0.9546 -0.9546   1.0475   1.0475   
##  
## Random effects:  
## Groups      Name                Variance Std.Dev.  
## subject_ID (Intercept) 2.826e-15 5.316e-08  
## Number of obs: 6260, groups: subject_ID, 626  
##  
## Fixed effects:  
##              Estimate Std. Error z value Pr(>|z|)      
## (Intercept) -0.092817   0.027393  -3.388 0.000703 ***  
## childcare    0.001612   0.002174   0.742 0.458363      
## ---  
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1  
##  
## Correlation of Fixed Effects:  
##              (Intr)  
## childcare -0.383  
## optimizer (Nelder_Mead) convergence code: 0 (OK)  
## boundary (singular) fit: see ?isSingular
```

```
#compare to baseline model
```

```
anova(model1,model4)
```

```
## Data: subset(d, d$phase == "Sex")  
## Models:  
## model1: correct ~ 1 + (1 | subject_ID)  
## model4: correct ~ 1 + childcare + (1 | subject_ID)  
##           npar      AIC      BIC  logLik deviance  Chisq Df Pr(>Chisq)  
## model1      2 8670.9 8684.4 -4333.4   8666.9  
## model4      3 8672.3 8692.6 -4333.2   8666.3 0.5499  1    0.4584
```

```

# Adding level 2 predictor: Participant's gender
model3<- glmer(correct~1+childcare+caregiver+gender+(1|subject_ID),
              data = subset(d,d$phase=="Sex"),
              family = binomial(link=logit))

## boundary (singular) fit: see ?isSingular

summary(model3)

## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC   logLik deviance df.resid
##  8675.5   8715.9  -4331.7   8663.5     6254
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0257 -0.9658 -0.9404  1.0355  1.2328
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 9.33e-15 9.659e-08
## Number of obs: 6260, groups:  subject_ID, 626
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -0.069686   0.035166  -1.982   0.0475 *
## childcare      0.002007   0.002398   0.837   0.4025
## caregiver     -0.003234   0.003632  -0.890   0.3733
## genderMale    -0.046807   0.053325  -0.878   0.3801
## genderOther_gender -0.335289  0.290762  -1.153   0.2489
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) chldcr cargvr gndrMl
## childcare   -0.373
## caregiver    0.003 -0.388
## genderMale  -0.622  0.180 -0.055
## gndrOthr_gn -0.120  0.044 -0.004  0.075
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular

# Compare two models
anova(model2,model3)

## Data: subset(d, d$phase == "Sex")
## Models:
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)

```

```
## model3: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
##      npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model2    4 8673.5 8700.4 -4332.7   8665.5
## model3    6 8675.5 8715.9 -4331.7   8663.5 1.9798  2    0.3716
```

Next we ran the same analyses but excluding those who failed our attention check, audio check, or gave negligent responses (gave the same response for an entire phase of trials). Again, the full results are below but the conclusions are the same as before.

```
##### TRIAL DATA #####
# get data before exclusions
library(here)
d <- read.csv(here::here("data", "trial_data.csv"))
library(ggplot2)

sum_data <- read.csv(here::here("data", "summarized_data.csv"))
attention_exc<-unique(subset(sum_data, sum_data$n_attention_checks<=5)$subject_ID)
audio_exc<-unique(subset(sum_data, sum_data$n_audio_checks<=5)$subject_ID)
neglig_exc<-unique(subset(sum_data, sum_data$var_sex<=5 & sum_data$var_lang<=5 & sum_data$var_age<=5)$subject_ID)

# refactor the group so the order is correct in the graphs
d$stim_ageGroup<-factor(d$stim_ageGroup, levels = c("0-7", "8-18", "19-36"))

# exclude those who failed our attention check and audio check criteria
d <- d[d$subject_ID%in%attention_exc, ]
d <- d[d$subject_ID%in%audio_exc, ]
# exclude those who clicked the same button for an entire experimental phase
d <- d[d$subject_ID%in%neglig_exc, ]

# d <- d[d$gender %in% c("Female", "Male"), ]
# d <- d[d$country %in% c("Canada", "USA"), ]
# d <- d[d$eng_first == "Yes", ]
# d <- d[d$know_corp_lang == "None", ]

agg<-aggregate(correct~phase*subject_ID, data = d, mean)
t.test(x = subset(agg, agg$phase=="Age")$correct, mu = 1/3)
```

```
##
## One Sample t-test
##
## data: subset(agg, agg$phase == "Age")$correct
## t = 19.447, df = 567, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0.3333333
## 95 percent confidence interval:
## 0.4388500 0.4625585
## sample estimates:
## mean of x
## 0.4507042
```

```
t.test(x = subset(agg, agg$phase=="Language")$correct, mu = 1/3)
```

```
##
```

```
## One Sample t-test
##
## data: subset(agg, agg$phase == "Language")$correct
## t = 33.713, df = 567, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0.3333333
## 95 percent confidence interval:
## 0.5175083 0.5402968
## sample estimates:
## mean of x
## 0.5289026
```

```
t.test(x = subset(agg, agg$phase=="Sex")$correct, mu = 1/3)
```

```
##
## One Sample t-test
##
## data: subset(agg, agg$phase == "Sex")$correct
## t = 22.338, df = 567, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0.3333333
## 95 percent confidence interval:
## 0.4668789 0.4926281
## sample estimates:
## mean of x
## 0.4797535
```

```
##### Testing the Age data #####
# Random intercept Model: Baseline
library(lme4)
model1<- glmer(correct~1+(1|subject_ID),
               data = subset(d,d$phase=="Age"),
               family = binomial(link=logit))
summary(model1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + (1 | subject_ID)
## Data: subset(d, d$phase == "Age")
##
##      AIC      BIC    logLik deviance df.resid
## 9386.6   9400.3  -4691.3   9382.6     6814
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.9066 -0.9058 -0.9054  1.1039  1.1049
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 0.0003602 0.01898
## Number of obs: 6816, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
```

```
## (Intercept) -0.19784    0.02438   -8.116 4.83e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Adding level 1 predictors: childcare & caregiver
model2<- glmer(correct~1+childcare+caregiver+(1|subject_ID),
               data = subset(d,d$phase=="Age"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## Data: subset(d, d$phase == "Age")
##
##      AIC      BIC    logLik deviance df.resid
##  9385.7   9413.0  -4688.8   9377.7     6812
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0414 -0.8969 -0.8969   1.1150   1.2024
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 0          0
## Number of obs: 6816, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.217659   0.026479  -8.220  <2e-16 ***
## childcare    0.004981   0.002236   2.228  0.0259 *
## caregiver    -0.004195   0.004043  -1.038  0.2995
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr) chldcr
## childcare -0.342
## caregiver -0.021 -0.446
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model1,model2)
```

```
## Data: subset(d, d$phase == "Age")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
```



```
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
##      npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model1  2 9386.6 9400.3 -4691.3   9382.6
## model2  4 9385.7 9413.0 -4688.8   9377.7 4.9642  2    0.08357 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
#additional model with only childcare
```

```
model4<- glmer(correct~1+childcare+(1|subject_ID),
               data = subset(d,d$phase=="Age"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + (1 | subject_ID)
## Data: subset(d, d$phase == "Age")
##
##      AIC      BIC   logLik deviance df.resid
##  9384.7   9405.2 -4689.4   9378.7     6813
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.1363 -0.8966 -0.8966  1.1153  1.1153
##
## Random effects:
## Groups      Name      Variance Std.Dev.
## subject_ID (Intercept) 0          0
## Number of obs: 6816, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.218250   0.026474  -8.244   <2e-16 ***
## childcare    0.003948   0.002003   1.970   0.0488 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr)
## childcare -0.392
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
#compare to baseline model
```

```
anova(model1,model4)
```

```
## Data: subset(d, d$phase == "Age")
```

```

## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model4: correct ~ 1 + childcare + (1 | subject_ID)
##      npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model1     2 9386.6 9400.3 -4691.3   9382.6
## model4     3 9384.7 9405.2 -4689.4   9378.7 3.8846  1    0.04873 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

# Adding level 2 predictor: Participant's gender
model3<- glmer(correct~1+childcare+caregiver+gender+(1|subject_ID),
               data = subset(d,d$phase=="Age"),
               family = binomial(link=logit))

## boundary (singular) fit: see ?isSingular

summary(model3)

## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
## Data: subset(d, d$phase == "Age")
##
##      AIC      BIC   logLik deviance df.resid
##  9389.2   9430.2 -4688.6   9377.2     6810
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0424 -0.9061 -0.8909  1.1036  1.2127
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 1e-12      1e-06
## Number of obs: 6816, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -0.231055   0.033753  -6.846 7.62e-12 ***
## childcare      0.005233   0.002272   2.303  0.0213 *
## caregiver     -0.004297   0.004047  -1.062  0.2884
## genderMale     0.033936   0.051530   0.659  0.5102
## genderOther_gender -0.020259  0.292895  -0.069  0.9449
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) chldcr cargvr gndrMl
## childcare   -0.374
## caregiver    0.007 -0.445
## genderMale  -0.616  0.174 -0.038
## gndrOthr_gn -0.115  0.043 -0.001  0.071
## optimizer (Nelder-Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular

```

```
# Compare two models
anova(model2,model3)
```

```
## Data: subset(d, d$phase == "Age")
## Models:
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## model3: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
##      npar    AIC    BIC logLik deviance Chisq Df Pr(>Chisq)
## model2     4 9385.7 9413.0 -4688.8   9377.7
## model3     6 9389.2 9430.2 -4688.6   9377.2 0.4471  2    0.7997
```

```
##### Testing the Language data #####
# Random intercept Model: Baseline
library(lme4)
model1<- glmer(correct~1+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC   logLik deviance df.resid
##  9430.2   9443.8 -4713.1   9426.2     6814
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0596 -1.0596  0.9438  0.9438  0.9438
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 1.781e-15 4.221e-08
## Number of obs: 6816, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.11574    0.02427    4.77 1.85e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Adding level 1 predictors: childcare & caregiver
model2<- glmer(correct~1+childcare+caregiver+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##          AIC          BIC    logLik deviance df.resid
##    9431.5    9458.9   -4711.8   9423.5     6812
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.1735 -1.0520  0.9049  0.9506  1.0044
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 0          0
## Number of obs: 6816, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.101345   0.026373   3.843 0.000122 ***
## childcare    0.003645   0.002247   1.622 0.104700
## caregiver    -0.003056   0.004030  -0.758 0.448271
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##          (Intr) chldcr
## childcare -0.340
## caregiver -0.023 -0.444
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
```

```
anova(model1,model2)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
##      npar    AIC    BIC  logLik deviance Chisq Df Pr(>Chisq)
## model1    2 9430.2 9443.8 -4713.1   9426.2
## model2    4 9431.5 9458.9 -4711.8   9423.5 2.6459 2    0.2663
```

```
#additional model with only childcare
```

```
model4<- glmer(correct~1+childcare+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC    logLik deviance df.resid
##  9430.1   9450.6 -4712.1   9424.1     6813
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.2512 -1.0517  0.9104  0.9508  0.9508
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 0          0
## Number of obs: 6816, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) 0.100870   0.026371   3.825 0.000131 ***
## childcare   0.002895   0.002017   1.435 0.151257
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr)
## childcare -0.391
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
#compare to baseline model
```

```
anova(model1,model4)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model4: correct ~ 1 + childcare + (1 | subject_ID)
##      npar      AIC      BIC    logLik deviance  Chisq Df Pr(>Chisq)
## model1     2 9430.2 9443.8 -4713.1   9426.2
## model4     3 9430.1 9450.6 -4712.1   9424.1 2.0721  1      0.15
```

```
# Adding level 2 predictor: Participant's gender
```

```
model3<- glmer(correct~1+childcare+caregiver+gender+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model3)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC    logLik deviance df.resid
##  9434.9   9475.8  -4711.4   9422.9     6810
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.1730 -1.0584  0.8975  0.9448  1.0063
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 5.609e-13 7.489e-07
## Number of obs: 6816, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)      0.113490   0.033611   3.377 0.000734 ***
## childcare         0.003426   0.002282   1.502 0.133200
## caregiver        -0.002958   0.004033  -0.733 0.463288
## genderMale       -0.033246   0.051335  -0.648 0.517225
## genderOther_gender 0.137824   0.292897   0.471 0.637959
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) chldcr cargvr gndrMl
## childcare    -0.371
## caregiver     0.004 -0.443
## genderMale   -0.616  0.172 -0.036
## gndrOthr_gn -0.115  0.043  0.000  0.071
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model2,model3)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## model3: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
##      npar      AIC      BIC    logLik deviance  Chisq Df Pr(>Chisq)
## model2     4 9431.5 9458.9 -4711.8   9423.5
## model3     6 9434.9 9475.8 -4711.4   9422.9 0.6887  2      0.7087
```

```
##### Testing the Sex data #####
# Random intercept Model: Baseline
```

```
library(lme4)
model1<- glmer(correct~1+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC    logLik deviance df.resid
## 7868.8    7882.1  -3932.4   7864.8     5678
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.9603 -0.9603 -0.9603   1.0413   1.0413
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 3.24e-12 1.8e-06
## Number of obs: 5680, groups: subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.08103    0.02656  -3.051  0.00228 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Adding level 1 predictors: childcare & caregiver
model2<- glmer(correct~1+childcare+caregiver+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC    logLik deviance df.resid
```

```
##    7872.3    7898.9   -3932.1    7864.3      5676
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0109 -0.9569 -0.9561  1.0451  1.0761
##
## Random effects:
##   Groups      Name      Variance Std.Dev.
##  subject_ID (Intercept) 4e-14    2e-07
## Number of obs: 5680, groups:  subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.088172   0.028871  -3.054  0.00226 **
## childcare    0.001832   0.002444   0.750  0.45354
## caregiver   -0.001628   0.004404  -0.370  0.71168
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##          (Intr) chldcr
## childcare -0.341
## caregiver -0.022 -0.444
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model1,model2)
```

```
## Data: subset(d, d$phase == "Sex")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
##      npar    AIC    BIC logLik deviance Chisq Df Pr(>Chisq)
## model1     2 7868.8 7882.1 -3932.4   7864.8
## model2     4 7872.3 7898.9 -3932.1   7864.3 0.5634  2    0.7545
```

```
#additional model with only childcare
```

```
model4<- glmer(correct~1+childcare+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
```



```
##
##      AIC      BIC   logLik deviance df.resid
##  7870.4   7890.3 -3932.2   7864.4     5677
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0425 -0.9568 -0.9568   1.0452   1.0452
##
## Random effects:
##   Groups      Name      Variance Std.Dev.
##  subject_ID (Intercept) 4e-12     2e-06
## Number of obs: 5680, groups:  subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.088409   0.028864  -3.063  0.00219 **
## childcare    0.001431   0.002190   0.653  0.51358
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr)
## childcare -0.391
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
#compare to baseline model
anova(model1,model4)
```

```
## Data: subset(d, d$phase == "Sex")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model4: correct ~ 1 + childcare + (1 | subject_ID)
##      npar      AIC      BIC logLik deviance Chisq Df Pr(>Chisq)
## model1     2 7868.8 7882.1 -3932.4   7864.8
## model4     3 7870.4 7890.3 -3932.2   7864.4 0.4268  1     0.5136
```

```
# Adding level 2 predictor: Participant's gender
model3<- glmer(correct~1+childcare+caregiver+gender+(1|subject_ID),
              data = subset(d,d$phase=="Sex"),
              family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model3)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
```

```
##      AIC      BIC   logLik deviance df.resid
##    7874.7   7914.6 -3931.4   7862.7     5674
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0088 -0.9661 -0.9464   1.0351   1.2247
##
## Random effects:
##   Groups      Name      Variance Std.Dev.
##  subject_ID (Intercept) 4e-14     2e-07
## Number of obs: 5680, groups:  subject_ID, 568
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)   -0.068941   0.036769  -1.875   0.0608 .
## childcare      0.001441   0.002483   0.580   0.5618
## caregiver     -0.001518   0.004407  -0.344   0.7305
## genderMale    -0.041270   0.056221  -0.734   0.4629
## genderOther_gender -0.336524  0.324849  -1.036   0.3002
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) chldcr cargvr gndrMl
## childcare   -0.372
## caregiver    0.005 -0.443
## genderMale  -0.615  0.173 -0.037
## gndr0thr_gn -0.113  0.042 -0.001  0.070
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model2,model3)
```

```
## Data: subset(d, d$phase == "Sex")
## Models:
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## model3: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
##      npar      AIC      BIC   logLik deviance  Chisq Df Pr(>Chisq)
## model2     4 7872.3 7898.9 -3932.1   7864.3
## model3     6 7874.7 7914.6 -3931.4   7862.7 1.5303  2     0.4653
```

Finally, we ran the some analyses but excluding based on the sociodemographic information when it made sense to do so. Once again, the full results are below but the conclusions are the same as before.

Here is the suggested analysis of the sex data with only the gender based exclusion criteria:

```
##### TRIAL DATA #####
# get data before exclusions
library(here)
d <- read.csv(here::here("data","trial_data.csv"))
library(ggplot2)

# refactor the group so the order is correct in the graphs
```

```

d$stim_ageGroup<-factor(d$stim_ageGroup,levels = c("0-7","8-18","19-36"))

sum_data <- read.csv(here::here("data","summarized_data.csv"))
attention_exc<-unique(subset(sum_data,sum_data$n_attention_checks<=5)$subject_ID)
audio_exc<-unique(subset(sum_data,sum_data$n_audio_checks<=5)$subject_ID)
neglig_exc<-unique(subset(sum_data,sum_data$var_sex<=5 & sum_data$var_lang<=5 & sum_data$var_age<=5)$subject_ID)

# refactor the group so the order is correct in the graphs
d$stim_ageGroup<-factor(d$stim_ageGroup,levels = c("0-7","8-18","19-36"))

# exclude those who failed our attention check and audio check criteria
d <- d[d$subject_ID%in%attention_exc, ]
d <- d[d$subject_ID%in%audio_exc, ]
# exclude those who clicked the same button for an entire experimental phase
d <- d[d$subject_ID%in%neglig_exc, ]

d <- d[d$gender %in% c("Female", "Male"), ]
# d <- d[d$country %in% c("Canada", "USA"), ]
# d <- d[d$eng_first == "Yes", ]
# d <- d[d$know_corp_lang == "None", ]

agg<-aggregate(correct~phase*subject_ID, data = d, mean)
#t.test(x = subset(agg,agg$phase=="Age")$correct, mu = 1/3)
#t.test(x = subset(agg,agg$phase=="Language")$correct, mu = 1/3)
t.test(x = subset(agg,agg$phase=="Sex")$correct, mu = 1/3)

##
## One Sample t-test
##
## data: subset(agg, agg$phase == "Sex")$correct
## t = 22.303, df = 563, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0.3333333
## 95 percent confidence interval:
## 0.4673743 0.4932640
## sample estimates:
## mean of x
## 0.4803191

# testing the sex data
# Random intercept Model: Baseline
library(lme4)
model1<- glmer(correct~1+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))

## boundary (singular) fit: see ?isSingular

summary(model1)

## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )

```

```
## Formula: correct ~ 1 + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC   logLik deviance df.resid
##  7814.0   7827.2 -3905.0   7810.0     5638
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.9614 -0.9614 -0.9614   1.0402   1.0402
##
## Random effects:
## Groups      Name             Variance Std.Dev.
## subject_ID (Intercept) 4e-14      2e-07
## Number of obs: 5640, groups: subject_ID, 564
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.07876    0.02665  -2.955  0.00312 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Adding level 1 predictors: childcare & caregiver
model2<- glmer(correct~1+childcare+caregiver+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC   logLik deviance df.resid
##  7817.4   7844.0 -3904.7   7809.4     5636
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0100 -0.9581 -0.9573   1.0437   1.0749
##
## Random effects:
## Groups      Name             Variance Std.Dev.
## subject_ID (Intercept) 8.337e-13 9.131e-07
## Number of obs: 5640, groups: subject_ID, 564
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.085550    0.028990  -2.951  0.00317 **
```

```
## childcare    0.001757    0.002446    0.718  0.47260
## caregiver    -0.001637    0.004404   -0.372  0.71018
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr) chldcr
## childcare -0.342
## caregiver -0.022 -0.444
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model1,model2)
```

```
## Data: subset(d, d$phase == "Sex")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
##      npar    AIC    BIC logLik deviance Chisq Df Pr(>Chisq)
## model1     2 7814.0 7827.2 -3905.0   7810.0
## model2     4 7817.4 7844.0 -3904.7   7809.4 0.5193  2    0.7713
```

```
#additional model with only childcare
```

```
model4<- glmer(correct~1+childcare+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC   logLik deviance df.resid
##  7815.6   7835.5  -3904.8   7809.6     5637
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.039 -0.958 -0.958  1.044  1.044
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 4e-12      2e-06
## Number of obs: 5640, groups: subject_ID, 564
##
## Fixed effects:
```

```
##               Estimate Std. Error z value Pr(>|z|)
## (Intercept) -0.085791   0.028983  -2.960  0.00308 **
## childcare   0.001353   0.002192   0.617  0.53698
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##           (Intr)
## childcare -0.393
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
#compare to baseline model
anova(model1,model4)
```

```
## Data: subset(d, d$phase == "Sex")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model4: correct ~ 1 + childcare + (1 | subject_ID)
##      npar    AIC    BIC logLik deviance Chisq Df Pr(>Chisq)
## model1     2 7814.0 7827.2 -3905.0   7810.0
## model4     3 7815.6 7835.5 -3904.8   7809.6 0.3811  1      0.537
```

```
# Adding level 2 predictor: Participant's gender
model3<- glmer(correct~1+childcare+caregiver+gender+(1|subject_ID),
               data = subset(d,d$phase=="Sex"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model3)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
## Data: subset(d, d$phase == "Sex")
##
##      AIC      BIC   logLik deviance df.resid
##  7818.9   7852.1 -3904.5   7808.9     5635
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0088 -0.9661 -0.9464  1.0351  1.0828
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 3.24e-12 1.8e-06
## Number of obs: 5640, groups: subject_ID, 564
##
## Fixed effects:
##               Estimate Std. Error z value Pr(>|z|)
```

```
## (Intercept) -0.068941  0.036769 -1.875  0.0608 .
## childcare  0.001441  0.002483  0.580  0.5618
## caregiver  -0.001518  0.004407 -0.344  0.7305
## genderMale -0.041270  0.056222 -0.734  0.4629
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr) chldcr cargvr
## childcare -0.372
## caregiver  0.005 -0.443
## genderMale -0.615  0.173 -0.037
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model2,model3)
```

```
## Data: subset(d, d$phase == "Sex")
## Models:
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## model3: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
##      npar    AIC    BIC logLik deviance Chisq Df Pr(>Chisq)
## model2     4 7817.4 7844.0 -3904.7   7809.4
## model3     5 7818.9 7852.1 -3904.5   7808.9 0.5389  1    0.4629
```

We also ran the analyses on the language data while only excluding those who knew any of the corpus languages with the same results as before:

```
##### TRIAL DATA #####
# get data before exclusions
library(here)
d <- read.csv(here::here("data","trial_data.csv"))
library(ggplot2)

# refactor the group so the order is correct in the graphs
d$stim_ageGroup<-factor(d$stim_ageGroup,levels = c("0-7","8-18","19-36"))

sum_data <- read.csv(here::here("data","summarized_data.csv"))
attention_exc<-unique(subset(sum_data,sum_data$n_attention_checks<=5)$subject_ID)
audio_exc<-unique(subset(sum_data,sum_data$n_audio_checks<=5)$subject_ID)
neglig_exc<-unique(subset(sum_data,sum_data$var_sex<=5 & sum_data$var_lang<=5 & sum_data$var_age<=5)$subject_ID)

# refactor the group so the order is correct in the graphs
d$stim_ageGroup<-factor(d$stim_ageGroup,levels = c("0-7","8-18","19-36"))

# exclude those who failed our attention check and audio check criteria
d <- d[d$subject_ID%in%attention_exc, ]
d <- d[d$subject_ID%in%audio_exc, ]
# exclude those who clicked the same button for an entire experimental phase
d <- d[d$subject_ID%in%neglig_exc, ]

# d <- d[d$gender %in% c("Female", "Male"), ]
```

```
# d <- d[d$country %in% c("Canada", "USA"), ]
# d <- d[d$eng_first == "Yes", ]
d <- d[d$know_corp_lang == "list()", ]

agg<-aggregate(correct~phase*subject_ID, data = d, mean)
#t.test(x = subset(agg,agg$phase=="Age")$correct, mu = 1/3)
t.test(x = subset(agg,agg$phase=="Language")$correct, mu = 1/3)
```

```
##
## One Sample t-test
##
## data: subset(agg, agg$phase == "Language")$correct
## t = 31.689, df = 488, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0.3333333
## 95 percent confidence interval:
## 0.5206769 0.5454444
## sample estimates:
## mean of x
## 0.5330607
```

```
#t.test(x = subset(agg,agg$phase=="Sex")$correct, mu = 1/3)
```

```
# testing the sex data
# Random intercept Model: Baseline
library(lme4)
model1<- glmer(correct~1+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model1)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC   logLik deviance df.resid
##  8113.1   8126.5 -4054.6   8109.1     5866
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.0685 -1.0685  0.9359  0.9359  0.9359
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 2.309e-12 1.52e-06
## Number of obs: 5868, groups: subject_ID, 489
##
```



```
## Fixed effects:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.13244    0.02617   5.061 4.16e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Adding level 1 predictors: childcare & caregiver
model2<- glmer(correct~1+childcare+caregiver+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model2)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC    logLik deviance df.resid
##  8113.1   8139.9 -4052.6   8105.1     5864
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.2239 -1.0583  0.8915  0.9449  1.0183
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 3.24e-13 5.692e-07
## Number of obs: 5868, groups: subject_ID, 489
##
## Fixed effects:
##           Estimate Std. Error z value Pr(>|z|)
## (Intercept)  0.113363    0.028322   4.003 6.26e-05 ***
## childcare    0.004844    0.002443   1.983  0.0474 *
## caregiver    -0.004158    0.004447  -0.935  0.3497
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##      (Intr) chldcr
## childcare -0.337
## caregiver  0.000 -0.470
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model1,model2)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
##      npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model1     2 8113.1 8126.5 -4054.6   8109.1
## model2     4 8113.1 8139.9 -4052.6   8105.1 3.9594  2    0.1381
```

```
#additional model with only childcare
```

```
model4<- glmer(correct~1+childcare+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model4)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC   logLik deviance df.resid
##      8112      8132   -4053    8106     5865
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.3281 -1.0583  0.8928  0.9449  0.9449
##
## Random effects:
## Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 1.906e-12 1.381e-06
## Number of obs: 5868, groups: subject_ID, 489
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept) 0.113335   0.028332   4.000 6.33e-05 ***
## childcare   0.003784   0.002165   1.748  0.0804 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr)
## childcare -0.383
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
#compare to baseline model
```

```
anova(model1,model4)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model1: correct ~ 1 + (1 | subject_ID)
## model4: correct ~ 1 + childcare + (1 | subject_ID)
##      npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model1    2 8113.1 8126.5 -4054.6   8109.1
## model4    3 8112.0 8132.0 -4053.0   8106.0 3.0883  1   0.07886 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Adding level 2 predictor: Participant's gender
model3<- glmer(correct~1+childcare+caregiver+gender+(1|subject_ID),
               data = subset(d,d$phase=="Language"),
               family = binomial(link=logit))
```

```
## boundary (singular) fit: see ?isSingular
```

```
summary(model3)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: binomial ( logit )
## Formula: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
## Data: subset(d, d$phase == "Language")
##
##      AIC      BIC   logLik deviance df.resid
##  8116.5   8156.6 -4052.3   8104.5     5862
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -1.2237 -1.0651  0.8819  0.9389  1.0178
##
## Random effects:
##  Groups      Name                Variance Std.Dev.
## subject_ID (Intercept) 4e-14      2e-07
## Number of obs: 5868, groups: subject_ID, 489
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    0.126108  0.036076   3.496 0.000473 ***
## childcare      0.004629  0.002477   1.868 0.061702 .
## caregiver     -0.004026  0.004451  -0.905 0.365685
## genderMale    -0.035054  0.055193  -0.635 0.525350
## genderOther_gender 0.125206  0.293165   0.427 0.669317
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) chldcr cargvr gndrM1
## childcare   -0.363
## caregiver    0.029 -0.471
## genderMale  -0.615  0.162 -0.047
## gndrOthr_gn -0.123  0.045 -0.004  0.076
```

```
## optimizer (Nelder_Mead) convergence code: 0 (OK)
## boundary (singular) fit: see ?isSingular
```

```
# Compare two models
anova(model2,model3)
```

```
## Data: subset(d, d$phase == "Language")
## Models:
## model2: correct ~ 1 + childcare + caregiver + (1 | subject_ID)
## model3: correct ~ 1 + childcare + caregiver + gender + (1 | subject_ID)
##      npar    AIC    BIC  logLik deviance  Chisq Df Pr(>Chisq)
## model2     4 8113.1 8139.9 -4052.6   8105.1
## model3     6 8116.5 8156.6 -4052.3   8104.5 0.6314  2    0.7293
```