

Statistical testing I

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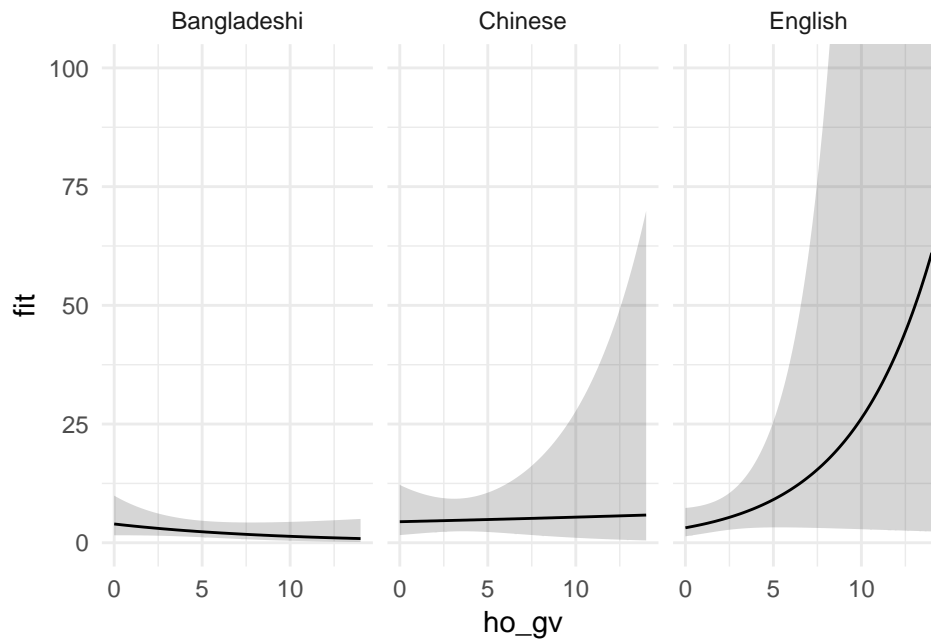
This report presents the results from linear models which test the relationship between gestures/utterances and infant pointing.

1 Hold out and gives

```
hg_point_lm <- glmer(
  lead_point ~
    ho_gv *
    background +
    (1|dyad),
  data = filter(hg_point_lead, ho_gv < 20),
  family = negbin(0.2606)
)
summary(hg_point_lm)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##   Family: Negative Binomial(0.261)   ( log )
## Formula: lead_point ~ ho_gv * background + (1 | dyad)
##   Data: filter(hg_point_lead, ho_gv < 20)
##
##           AIC          BIC    logLik deviance df.resid
##      503.8       525.3    -243.9    487.8      101
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.5080 -0.4942 -0.3979  0.1241  6.0969
##
## Random effects:
##   Groups Name            Variance Std.Dev.
##   dyad   (Intercept) 1.41e-10 1.187e-05
## Number of obs: 109, groups: dyad, 57
##
## Fixed effects:
##
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)      1.37529    0.46393   2.964  0.00303 **
## ho_gv           -0.10718    0.08031  -1.335  0.18200
## backgroundChinese    0.11400    0.68904   0.165  0.86859
## backgroundEnglish  -0.22613    0.62893  -0.360  0.71919
## ho_gv:backgroundChinese 0.12680    0.13875   0.914  0.36081
## ho_gv:backgroundEnglish 0.31880    0.15566   2.048  0.04056 *
```

```
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) ho_gv  bckgrC bckgrE h_gv:C
## ho_gv          -0.681
## bckgrndChns -0.673  0.459
## bckgrndEngl -0.738  0.502  0.497
## h_gv:bckgrC  0.394 -0.579 -0.714 -0.291
## h_gv:bckgrE  0.351 -0.516 -0.237 -0.621  0.299
```



The count of HoGs has a slightly negative (but not significant) effect on number of pointing gestures in Bangladeshi infants. The count of HoGs has more or less no effect in Chinese infants and a slightly positive (significant) effect in English children. In English children, for every unit increase of HoG gestures, pointing in the next visit is 1.25 times higher.

According to model comparison though, including an interaction between HoG counts and background does not significantly improve the model fit.

2 Reaches

```
reach_point_lm <- glmer(
  lead_point ~
    reach *
    background +
    (1|dyad),
  data = reach_point_lead,
  family = negbin(0.2681)
```

```

)
summary(reach_point_lm)

## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: Negative Binomial(0.268) ( log )
## Formula: lead_point ~ reach * background + (1 | dyad)
## Data: reach_point_lead
##
##      AIC      BIC   logLik deviance df.resid
##    523.3    545.1   -253.7    507.3     104
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.5066 -0.4982 -0.3934  0.1437  3.0203
##
## Random effects:
## Groups Name      Variance Std.Dev.
## dyad   (Intercept) 0.1569   0.396
## Number of obs: 112, groups: dyad, 57
##
## Fixed effects:
##
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)      0.72163    0.60141   1.200   0.230
## reach            0.06136    0.09716   0.632   0.528
## backgroundChinese 1.10777    0.72841   1.521   0.128
## backgroundEnglish 0.84357    0.68166   1.238   0.216
## reach:backgroundChinese -0.24686    0.16105  -1.533   0.125
## reach:backgroundEnglish -0.08716    0.13746  -0.634   0.526
##
## Correlation of Fixed Effects:
##              (Intr) reach  bckgrC bckgrE rch:bC
## reach          -0.724
## bckgrndChns -0.709  0.550
## bckgrndEngl -0.557  0.506  0.508
## rch:bckgrnC  0.453 -0.610 -0.710 -0.298
## rch:bckgrnE  0.449 -0.681 -0.366 -0.599  0.412

```

The effect of count of reaches as a predictor of pointing is approximately null and not significant.

3 Maternal contingent talks

```

ct_point_lm <- glmer(
  lead_point ~
    ct *
    background +

```

```

    (1|dyad),
    data = ct_point_lead,
    family = negbin(0.3247)
)
summary(ct_point_lm)

```

```

## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: Negative Binomial(0.325) ( log )
## Formula: lead_point ~ ct * background + (1 | dyad)
## Data: ct_point_lead
##
##      AIC      BIC   logLik deviance df.resid
##    511.0    532.8   -247.5   495.0     104
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.5548 -0.5386 -0.3835  0.2528  3.2206
##
## Random effects:
## Groups Name      Variance Std.Dev.
## dyad   (Intercept) 0         0
## Number of obs: 112, groups: dyad, 58
##
## Fixed effects:
##              Estimate Std. Error z value Pr(>|z|)
## (Intercept)    1.00146    0.30944   3.236  0.00121 **
## ct              0.22417    0.36286   0.618  0.53671
## backgroundChinese 0.10846    0.47100   0.230  0.81788
## backgroundEnglish -0.05062    0.45612  -0.111  0.91164
## ct:backgroundChinese 0.33982    0.50184   0.677  0.49832
## ct:backgroundEnglish -0.09408    0.36846  -0.255  0.79847
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) ct      bckgrC bckgrE ct:bcC
## ct              -0.284
## bckgrndChns    -0.657  0.187
## bckgrndEngl    -0.678  0.193  0.446
## ct:bckgrndC    0.206 -0.723 -0.402 -0.139
## ct:bckgrndE    0.280 -0.985 -0.184 -0.244  0.712

```

Pointing is 1.25 times higher for every unit increase of maternal CTs but this effect is not significant either.

4 Maternal utterances

```
utter_point_lm <- glmer(
  lead_point ~
    scale(utterances) *
    background +
    (1|dyad),
  data = utter_point_lead,
  family = negbin(0.2554)
)
summary(utter_point_lm)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
## Approximation) [glmerMod]
## Family: Negative Binomial(0.255) ( log )
## Formula: lead_point ~ scale(utterances) * background + (1 | dyad)
## Data: utter_point_lead
##
##      AIC      BIC    logLik deviance df.resid
##  501.2    522.8   -242.6    485.2     102
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -0.4920 -0.4863 -0.3562  0.1282  3.3639
##
## Random effects:
## Groups Name          Variance Std.Dev.
## dyad    (Intercept)  0.2413    0.4912
## Number of obs: 110, groups: dyad, 59
##
## Fixed effects:
##                                     Estimate Std. Error z value Pr(>|z|)
## (Intercept)                        0.95656    0.43324   2.208   0.0273 *
## scale(utterances)                   0.35409    0.37563   0.943   0.3459
## backgroundChinese                   0.37386    0.53074   0.704   0.4812
## backgroundEnglish                   0.25700    0.62975   0.408   0.6832
## scale(utterances):backgroundChinese -0.28114    0.52331  -0.537   0.5911
## scale(utterances):backgroundEnglish -0.04948    0.68102  -0.073   0.9421
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Correlation of Fixed Effects:
##              (Intr) scl(t) bckgrC bckgrE sc():C
## scl(ttrncs)  0.221
## bckgrndChns -0.617 -0.160
## bckgrndEngl -0.342 -0.117  0.449
## scl(ttrn):C -0.128 -0.715  0.116  0.110
```

```
## scl(ttrn):E -0.168 -0.556 0.085 -0.165 0.391
```

Pointing is about 1.4 times higher for every unit increase of normalised maternal utterances count in Bangladeshi and English infants, but this effect is not significant. The effect of maternal utterances is null in Chinese infants.

5 Power analysis

According to a power analysis, we have a power of around 65% for detecting an interaction between HoGs and background. We have a power of about 20% for detecting an effect of HoGs on pointing of a magnitude similar to what we see in the model. This means that respectively we have respectively a 35% and 80% chance of obtaining a false null result.