Analysis of multimodal condition

This script uses data compiled by *analyseData.R*.

Load libraries

```
library(lme4)
library(sjPlot)
library(ggplot2)
library(lattice)
library(influence.ME)
```

Load data

```
d = read.csv("../../data/Final_Turn_data.csv", stringsAsFactors = F)
d = d[d$modalityCondition == "multi",]
```

Analysis

```
d2 = d[!duplicated(d$trialString),]

x = tapply(d[d$turnType=="T1",]$turnModalityType, d[d$turnType=="T1",]$trialString,head,n=1)
d2$turnModality.T1 = x[d2$trialString]


d2 = d2[!is.na(d2$turnModality.T1),]

d2$turnModality.T1 = relevel(factor(as.character(d2$turnModality.T1)),"unimodal visual")


x = tapply(d[d$turnType=="T2",]$turnModalityType, d[d$turnType=="T2",]$trialString,head,n=1)
d2$turnModality.T2 = x[d2$trialString]

d2$turnModality.T2[is.na(d2$turnModality.T2)] = "none"

d2$turnModality.T2 = relevel(factor(d2$turnModality.T2),'none')

d2$condition= relevel(factor(d2$condition),"Visual")


d2$trialTotal = d2$trial + (d2$game * (max(d2$trial)+1))
# Convert to proportion of games played, so that estimates reflect change per game.
d2$trialTotal = d2$trialTotal / 16
# Center the trialTotal variable so intercept reflects after the first game
d2$trialTotal = d2$trialTotal - 1

d2$incorrect = !d2$correct
```

```
d2$trialLength.logcenter = log(d2$trialLength)
d2$trialLength.logcenter = d2$trialLength.logcenter - mean(d2$trialLength.logcenter)
```

```
m0 = glmer(turnModality.T2 == "multi" ~
            (turnModality.T1=='multi')*condition +
            (1 | dyadNumber)+
            (1 | itemId),
          data= d2[!d2$turnModality.T2 %in% c("none","unimodal mixed"),], family = binomial)
summary(m0)
```

```
## Generalized linear mixed model fit by maximum likelihood (Laplace
##   Approximation) [glmerMod]
##  Family: binomial  ( logit )
## Formula:
## turnModality.T2 == "multi" ~ (turnModality.T1 == "multi") * condition +
##     (1 | dyadNumber) + (1 | itemId)
##    Data: d2[!d2$turnModality.T2 %in% c("none", "unimodal mixed"), ]
##
##      AIC      BIC   logLik deviance df.resid
##     54.5     65.4    -21.2     42.5       40
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.5163 -0.5528 -0.1435  0.2850  1.8091
##
## Random effects:
##  Groups     Name        Variance Std.Dev.
##  itemId     (Intercept)  0.00    0.00
##  dyadNumber (Intercept) 10.05    3.17
## Number of obs: 46, groups:  itemId, 15; dyadNumber, 5
##
## Fixed effects:
##                                                Estimate Std. Error
## (Intercept)                                     -4.0479     3.4769
## turnModality.T1 == "multi"TRUE                  -0.4718     1.4395
## conditionAuditory                                2.0254     2.2367
## turnModality.T1 == "multi"TRUE:conditionAuditory   0.5509     2.5177
##                                                z value Pr(>|z|)
## (Intercept)                                     -1.164    0.244
## turnModality.T1 == "multi"TRUE                  -0.328    0.743
## conditionAuditory                                0.906    0.365
## turnModality.T1 == "multi"TRUE:conditionAuditory   0.219    0.827
##
## Correlation of Fixed Effects:
##               (Intr) trM.T1==""TRUE cndtnA
## trM.T1==""TRUE  0.037
## condtnAdtry    -0.567 -0.014
## tM.T1==""TRUE:  0.311 -0.526         -0.708
```

```
m0 = lmer(trialLength.logcenter ~
         turnModality.T1 * condition *
              incorrect +
             trialTotal +
```

```
            I(trialTotal^2) +
            (1 | dyadNumber)+
            (1 | itemId),
          data= d2)
```

```
## fixed-effect model matrix is rank deficient so dropping 2 columns / coefficients
```

```
summary(m0)
```

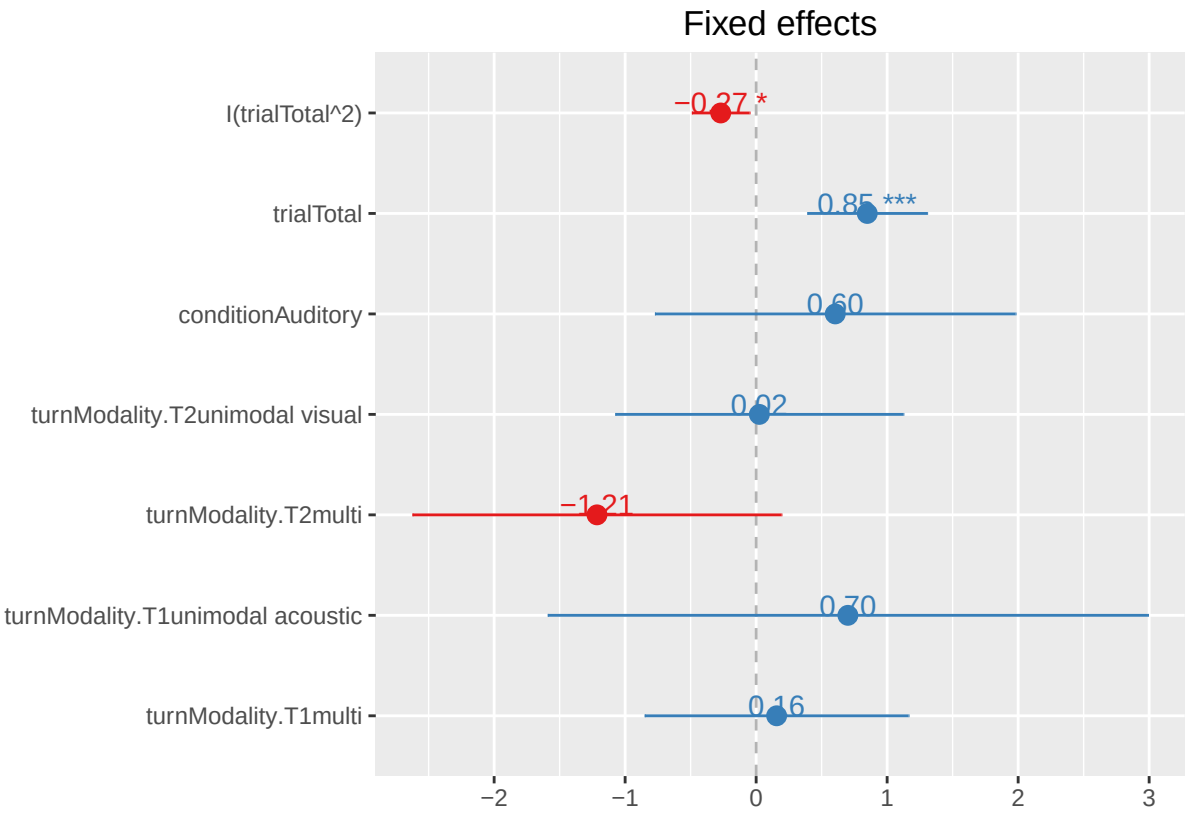
```
## Linear mixed model fit by REML ['lmerMod']
## Formula:
## trialLength.logcenter ~ turnModality.T1 * condition * incorrect +
##     trialTotal + I(trialTotal^2) + (1 | dyadNumber) + (1 | itemId)
##    Data: d2
##
## REML criterion at convergence: 945.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -2.6273 -0.5908 -0.1403  0.4769  4.8547
##
## Random effects:
##  Groups     Name        Variance Std.Dev.
##  itemId     (Intercept) 0.03012  0.1736
##  dyadNumber (Intercept) 0.02801  0.1674
##  Residual               0.24295  0.4929
## Number of obs: 621, groups:  itemId, 16; dyadNumber, 5
##
## Fixed effects:
##                                                    Estimate Std. Error
## (Intercept)                                         0.30423    0.10347
## turnModality.T1multi                               -0.09566    0.12141
## turnModality.T1unimodal acoustic                    0.06811    0.13986
## conditionAuditory                                  -0.32937    0.11682
## incorrectTRUE                                       0.35351    0.08988
## trialTotal                                         -0.40931    0.03690
## I(trialTotal^2)                                     0.10272    0.01678
## turnModality.T1multi:conditionAuditory              0.07913    0.14205
## turnModality.T1multi:incorrectTRUE                  0.12002    0.32168
## turnModality.T1unimodal acoustic:incorrectTRUE      0.74435    0.54558
## conditionAuditory:incorrectTRUE                    -0.23344    0.22207
## turnModality.T1multi:conditionAuditory:incorrectTRUE -0.07258    0.39959
##                                                    t value
## (Intercept)                                          2.940
## turnModality.T1multi                                -0.788
## turnModality.T1unimodal acoustic                     0.487
## conditionAuditory                                   -2.819
## incorrectTRUE                                        3.933
## trialTotal                                         -11.093
## I(trialTotal^2)                                      6.121
## turnModality.T1multi:conditionAuditory               0.557
## turnModality.T1multi:incorrectTRUE                   0.373
## turnModality.T1unimodal acoustic:incorrectTRUE       1.364
## conditionAuditory:incorrectTRUE                     -1.051
```

```
## turnModality.T1multi:conditionAuditory:incorrectTRUE  -0.182
##
## Correlation of Fixed Effects:
##             (Intr) trM.T1 trM.T1a cndtnA inTRUE trlTtl I(T^2) trM.T1:A
## trnMdlty.T1 -0.066
## trnMdlt.T1a -0.005 -0.005
## condtnAdtry -0.392  0.042 -0.328
## incrrctTRUE -0.127  0.065 -0.013   0.114
## trialTotal  -0.038  0.004 -0.014   0.041  0.120
## I(trlTtl^2) -0.050 -0.069  0.029  -0.038 -0.075 -0.879
## trnMdl.T1:A  0.054 -0.811  0.282  -0.361 -0.070 -0.041  0.093
## trM.T1:TRUE  0.019 -0.364  0.001  -0.024 -0.259  0.046 -0.005  0.305
## tM.T1a:TRUE  0.016  0.012 -0.215   0.067 -0.006 -0.005 -0.039 -0.067
## cndtnA:TRUE  0.045 -0.030  0.155  -0.227 -0.400 -0.008  0.009  0.181
## tM.T1:A:TRU -0.012  0.285 -0.090   0.123  0.208 -0.035 -0.005 -0.347
##             tM.T1:T tM.T1a: cA:TRU
## trnMdlty.T1
## trnMdlt.T1a
## condtnAdtry
## incrrctTRUE
## trialTotal
## I(trlTtl^2)
## trnMdl.T1:A
## trM.T1:TRUE
## tM.T1a:TRUE -0.007
## cndtnA:TRUE  0.111  -0.318
## tM.T1:A:TRU -0.804   0.184  -0.544
## fit warnings:
## fixed-effect model matrix is rank deficient so dropping 2 columns / coefficients
```

```
mx = glmer(correct ~
         turnModality.T1 + turnModality.T2 +
           condition +
             trialTotal +
            I(trialTotal^2) +
            (1 | dyadNumber)+
            (1 | itemId),
          data= d2[!d2$turnModality.T2 %in% c("unimodal mixed"),], family  = binomial)
```

```
sjp.lmer(mx,'fe', show.ci=T)
```

```
## Warning: Deprecated, use tibble::rownames_to_column() instead.
```


Fixed effects
I(trialTotal^2)
trialTotal
conditionAuditory
turnModality.T2unimodal visual
turnModality.T2multi
turnModality.T1unimodal acoustic
turnModality.T1multi
−0.27 *
0.85 ***
0.60
0.02
−1.21
0.70
0.16
−2
−1
0
1
2
3