

# Colour experiment

```
library(ggplot2)
library(lme4)

## Loading required package: Matrix
##
## Attaching package: 'lme4'
## The following object is masked from 'package:stats':
##
##      sigma
```

## Load data

```
variants = read.csv('../data/processedData/variants_summary.csv', stringsAsFactors = F)

variants$Teach = variants$Teach > 1
variants$TryMarked = variants$TryMarked > 1
```

## LMER models

```
m0 = lmer(log(1 + freq_week_4_withinColour) ~
          1
          + (1 | colourName),
          data=variants)
m1 = lmer(log(1 + freq_week_4_withinColour) ~
          (indexical) +
          + (1 | colourName),
          data=variants)
m2 = lmer(log(1 + freq_week_4_withinColour) ~
          (indexical) +
          (Teach)
          + (1 | colourName),
          data=variants)

m3 = lmer(log(1 + freq_week_4_withinColour) ~
          (indexical) +
          (Teach) + (TryMarked)
          + (1 | colourName),
          data=variants)

m4 = lmer(log(1 + freq_week_4_withinColour) ~
          (indexical) +
          Teach * TryMarked
          + (1 | colourName),
          data=variants)

## fixed-effect model matrix is rank deficient so dropping 1 column / coefficient
```

```
m5 = lmer(log(1 + freq_week_4_withinColour) ~
          (indexical) +
          (Teach * TryMarked) +
          log(freq_week_1+1)
          + (1 | colourName),
          data=variants)

## fixed-effect model matrix is rank deficient so dropping 1 column / coefficient
```

## Results

```
anova(m0,m1,m2,m3,m4,m5)

## refitting model(s) with ML (instead of REML)

## Warning in optwrap(optimizer, devfun, x@theta, lower = x@lower, calc.derivs
## = TRUE, : convergence code 3 from bobyqa: bobyqa -- a trust region step
## failed to reduce q

## Data: variants
## Models:
## m0: log(1 + freq_week_4_withinColour) ~ 1 + (1 | colourName)
## m1: log(1 + freq_week_4_withinColour) ~ (indexical) + +(1 | colourName)
## m2: log(1 + freq_week_4_withinColour) ~ (indexical) + (Teach) + (1 |
## m2: colourName)
## m3: log(1 + freq_week_4_withinColour) ~ (indexical) + (Teach) + (TryMarked) +
## m3: (1 | colourName)
## m4: log(1 + freq_week_4_withinColour) ~ (indexical) + Teach * TryMarked +
## m4: (1 | colourName)
## m5: log(1 + freq_week_4_withinColour) ~ (indexical) + (Teach * TryMarked) +
## m5: log(freq_week_1 + 1) + (1 | colourName)
##      Df      AIC      BIC logLik deviance  Chisq Chi Df Pr(>Chisq)
## m0   3 -59.076 -52.246 32.538 -65.076
## m1   5 -61.707 -50.324 35.853 -71.707  6.6311    2  0.03631 *
## m2   6 -60.252 -46.592 36.126 -72.252  0.5453    1  0.46023
## m3   7 -58.971 -43.034 36.485 -72.971  0.7187    1  0.39658
## m4   7 -58.971 -43.034 36.485 -72.971  0.0000    0  1.00000
## m5   8 -77.620 -59.406 46.810 -93.620 20.6487    1 5.517e-06 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

There was no significant main effect of try marking (  $\beta = -0.0055$  ,  $\text{std.err} = 0.036$  , Wald  $t = -0.15$  ; log likelihood difference = 0.36 ,  $df = 1$  , Chi Squared = 0.72 ,  $p = 0.4$  ).

There was a significant main effect of frequency in week 1 (  $\beta = 0.15$  ,  $\text{std.err} = 0.032$  , Wald  $t = 4.7$  ; log likelihood difference = 10 ,  $df = 1$  , Chi Squared = 20.65 ,  $p = 5.5e-06$  ).

There was a significant main effect of indexicality (  $\beta = 0.032$  ,  $\text{std.err} = 0.057$  , Wald  $t = 0.56$  ; log likelihood difference = 3.3 ,  $df = 2$  , Chi Squared = 6.63 ,  $p = 0.036$  ).

```
#sjp.lmer(m5, 'fe')
```