Suplementary Material 2: Prerregistered analyses for experiment

Angel V. Jimenez

4 July 2019

```
# DATASET
# DATASET
setwd("C:/files/Angel/tablets/experiment")
d<-read.csv("tablets_exp.csv")
# Gender as factor
d$GENDER <- ifelse((d$GENDER==1),"Male",
                   ifelse((d$GENDER==2),"female","other"))
d$GENDER <- as.factor(d$GENDER)
```

HYPOTHESES

We will test two hypotheses:

H1: The arguments provided by high prestige sources are better recalled than arguments provided by low prestige sources.

H2: The arguments provided by a high prestige source within the relevant domain will be better recalled than the arguments provided by a high prestige source outside the relevant domain.

```
# Explore variables in dataset
str(d)
```

```
## 'data.frame':    384 obs. of  22 variables:
##  $ X           : int  1 2 1 2 1 2 1 2 1 2 ...
##  $ OBSERVATION : int  1 2 3 4 5 6 7 8 9 10 ...
##  $ PARTICIPANT : int  1 1 2 2 3 3 4 4 5 5 ...
##  $ PRE_AGREE   : int  -2 -2 -1 -1 -2 -2 2 2 0 0 ...
##  $ PRE_FAMILIAR: int  1 1 3 3 3 3 3 2 2 ...
##  $ AGE         : int  47 47 59 59 22 22 30 30 21 21 ...
##  $ GENDER      : Factor w/ 1 level "other": 1 1 1 1 1 1 1 1 1 1 ...
##  $ NATIONALITY : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ ENGLISH     : int  1 1 1 1 1 1 1 1 1 1 ...
##  $ POSTTEST    : int  -2 -2 -1 -1 -1 -1 2 2 -1 -1 ...
##  $ GENERATION  : Factor w/ 4 levels "F1","F2","F3",..: 1 1 2 2 3 3 4 4 1 1 ...
##  $ RECALL      : int  4 5 3 4 1 3 1 3 6 6 ...
##  $ CHAIN       : Factor w/ 48 levels "CH1","CH10","CH11",..: 1 1 1 1 1 1 1 1 12 12 ...
##  $ CONDITION   : Factor w/ 3 levels "C1","C2","C3": 1 1 1 1 1 1 1 1 1 1 ...
##  $ CONDITION.2 : Factor w/ 6 levels "A","B","C","D",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ ORDER       : Factor w/ 2 levels "FIRST","SECOND": 1 2 1 2 1 2 1 2 1 2 ...
##  $ SOURCE      : Factor w/ 3 levels "CLEANER","EDUCATOR",..: 1 2 1 2 1 2 1 2 1 2 ...
##  $ VIEW        : Factor w/ 2 levels "ANTITABLETS",..: 2 1 2 1 2 1 2 1 2 1 ...
##  $ PRESTIGE    : int  3 4 2 3 2 3 3 4 3 3 ...
##  $ RELEVANCE   : int  3 3 -1 3 -1 2 0 3 1 1 ...
##  $ T_RECALL    : num  185 201 300 300 101 ...
##  $ T_SOURCE    : num  49.8 31.1 81.5 57 19.6 ...
```

```r
# Summary statistics to check that everything is right
summary(d)
```

```
##        X         OBSERVATION      PARTICIPANT       PRE_AGREE
##  Min.   :1.0   Min.   :  1.00   Min.   :  1.00   Min.   :-3.000
##  1st Qu.:1.0   1st Qu.: 96.75   1st Qu.: 48.75   1st Qu.:-2.000
##  Median :1.5   Median :192.50   Median : 96.50   Median :-1.000
##  Mean   :1.5   Mean   :192.50   Mean   : 96.50   Mean   :-1.193
##  3rd Qu.:2.0   3rd Qu.:288.25   3rd Qu.:144.25   3rd Qu.: 0.000
##  Max.   :2.0   Max.   :384.00   Max.   :192.00   Max.   : 3.000
##
##   PRE_FAMILIAR        AGE          GENDER     NATIONALITY    ENGLISH
##  Min.   :-2.00   Min.   :18.00   other:384   Min.   :1    Min.   :1
##  1st Qu.: 2.00   1st Qu.:27.00               1st Qu.:1    1st Qu.:1
##  Median : 3.00   Median :33.00               Median :1    Median :1
##  Mean   : 2.49   Mean   :35.10               Mean   :1    Mean   :1
##  3rd Qu.: 3.00   3rd Qu.:42.25               3rd Qu.:1    3rd Qu.:1
##  Max.   : 3.00   Max.   :61.00               Max.   :1    Max.   :1
##
##     POSTTEST       GENERATION     RECALL          CHAIN     CONDITION
##  Min.   :-3.0000   F1:96      Min.   :0.000   CH1    :  8   C1:128
##  1st Qu.:-2.0000   F2:96      1st Qu.:2.000   CH10   :  8   C2:128
##  Median :-1.0000   F3:96      Median :3.000   CH11   :  8   C3:128
##  Mean   :-0.6094   F4:96      Mean   :3.036   CH12   :  8
##  3rd Qu.: 1.0000              3rd Qu.:4.000   CH13   :  8
##  Max.   : 3.0000              Max.   :9.000   CH14   :  8
##                                               (Other):336
##  CONDITION.2    ORDER          SOURCE             VIEW        PRESTIGE
##  A:64        FIRST :192   CLEANER :128   ANTITABLETS:192   Min.   :1.000
##  B:64        SECOND:192   EDUCATOR:128   PROTABLETS :192   1st Qu.:2.000
##  C:64                     PILOT   :128                     Median :3.000
##  D:64                                                      Mean   :2.971
##  E:64                                                      3rd Qu.:4.000
##  F:64                                                      Max.   :5.000
##
##    RELEVANCE         T_RECALL         T_SOURCE
##  Min.   :-3.000   Min.   : 18.40   Min.   :  10.74
##  1st Qu.: 0.000   1st Qu.: 72.29   1st Qu.:  20.83
##  Median : 1.000   Median :120.19   Median :  28.82
##  Mean   : 1.008   Mean   :118.68   Mean   :  39.67
##  3rd Qu.: 2.000   3rd Qu.:153.83   3rd Qu.:  40.86
##  Max.   : 3.000   Max.   :301.49   Max.   :1764.87
##                                    NA's   :1
```

```r
# 6 first observations
head(d)
```

```
##   X OBSERVATION PARTICIPANT PRE_AGREE PRE_FAMILIAR AGE GENDER NATIONALITY
## 1 1           1           1        -2            1  47  other           1
## 2 2           2           1        -2            1  47  other           1
## 3 1           3           2        -1            3  59  other           1
## 4 2           4           2        -1            3  59  other           1
## 5 1           5           3        -2            3  22  other           1
## 6 2           6           3        -2            3  22  other           1
##   ENGLISH POSTTEST GENERATION RECALL CHAIN CONDITION CONDITION.2  ORDER
```

```
## 1       1       -2         F1      4   CH1        C1           A  FIRST
## 2       1       -2         F1      5   CH1        C1           A SECOND
## 3       1       -1         F2      3   CH1        C1           A  FIRST
## 4       1       -1         F2      4   CH1        C1           A SECOND
## 5       1       -1         F3      1   CH1        C1           A  FIRST
## 6       1       -1         F3      3   CH1        C1           A SECOND
##     SOURCE        VIEW PRESTIGE RELEVANCE T_RECALL T_SOURCE
## 1  CLEANER  PROTABLETS        3         3  185.360   49.780
## 2 EDUCATOR ANTITABLETS        4         3  200.689   31.139
## 3  CLEANER  PROTABLETS        2        -1  300.108   81.496
## 4 EDUCATOR ANTITABLETS        3         3  300.010   56.995
## 5  CLEANER  PROTABLETS        2        -1  100.889   19.610
## 6 EDUCATOR ANTITABLETS        3         2   46.682   26.031
```

```
# 6 last observations
tail(d)
```

```
##     X OBSERVATION PARTICIPANT PRE_AGREE PRE_FAMILIAR AGE GENDER
## 379 1         379         190        -2            2  28  other
## 380 2         380         190        -2            2  28  other
## 381 1         381         191         1            2  22  other
## 382 2         382         191         1            2  22  other
## 383 1         383         192        -1            3  31  other
## 384 2         384         192        -1            3  31  other
##     NATIONALITY ENGLISH POSTTEST GENERATION RECALL CHAIN CONDITION
## 379           1       1       -2         F2      1  CH48        C3
## 380           1       1       -2         F2      3  CH48        C3
## 381           1       1        2         F3      2  CH48        C3
## 382           1       1        2         F3      3  CH48        C3
## 383           1       1        1         F4      2  CH48        C3
## 384           1       1        1         F4      3  CH48        C3
##     CONDITION.2  ORDER   SOURCE        VIEW PRESTIGE RELEVANCE T_RECALL
## 379           F  FIRST EDUCATOR  PROTABLETS        3         2   62.638
## 380           F SECOND    PILOT ANTITABLETS        3         0   68.001
## 381           F  FIRST EDUCATOR  PROTABLETS        4         2  153.012
## 382           F SECOND    PILOT ANTITABLETS        3        -1   92.696
## 383           F  FIRST EDUCATOR  PROTABLETS        4         3  197.776
## 384           F SECOND    PILOT ANTITABLETS        3        -1  159.260
##     T_SOURCE
## 379   24.248
## 380   19.119
## 381   21.109
## 382   33.859
## 383   29.064
## 384   25.943
```

DEMOGRAPHICS

```
# Creating new dataset with only one row per participant
dat <- d[ which(d$X=='1'), ]
# Frequencies by gender
summary(dat$GENDER)
```

```
## other
##   192
```

```
# Range of ages
range(dat$AGE)
```

```
## [1] 18 61
```

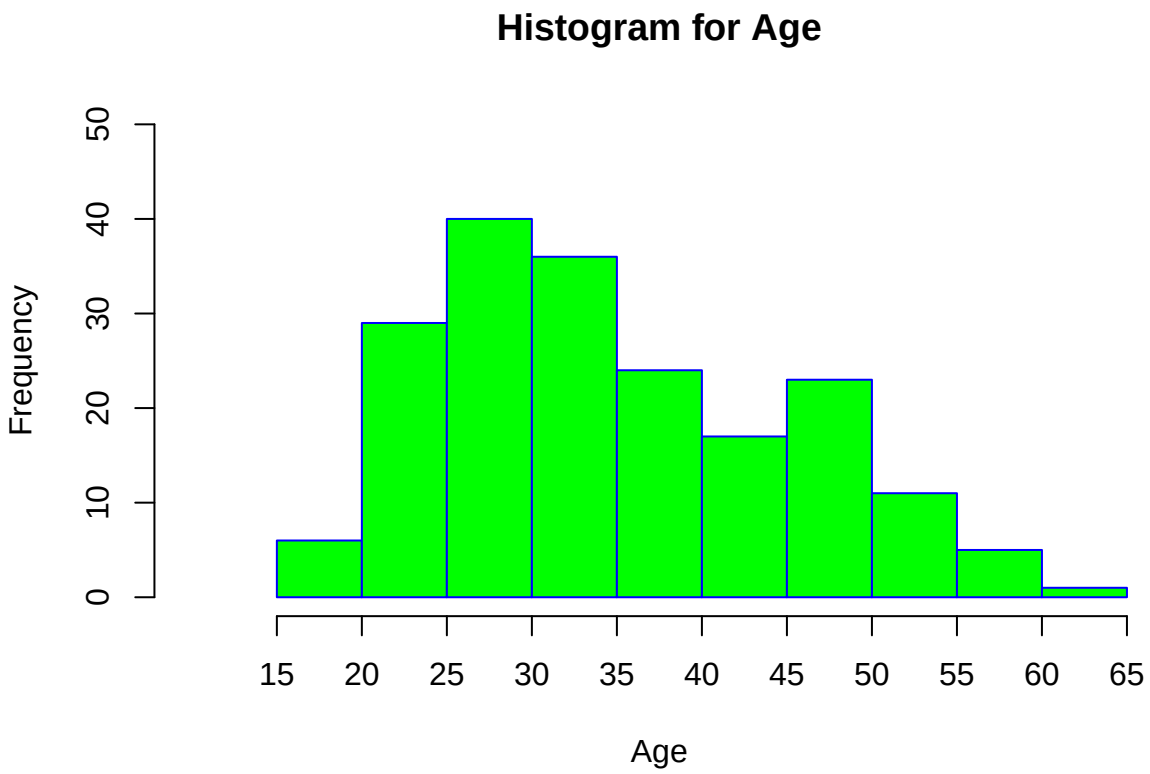
```
# Mean of age
mean(dat$AGE)
```

```
## [1] 35.10417
```

```
# Standard Deviation of age
sd(dat$AGE)
```

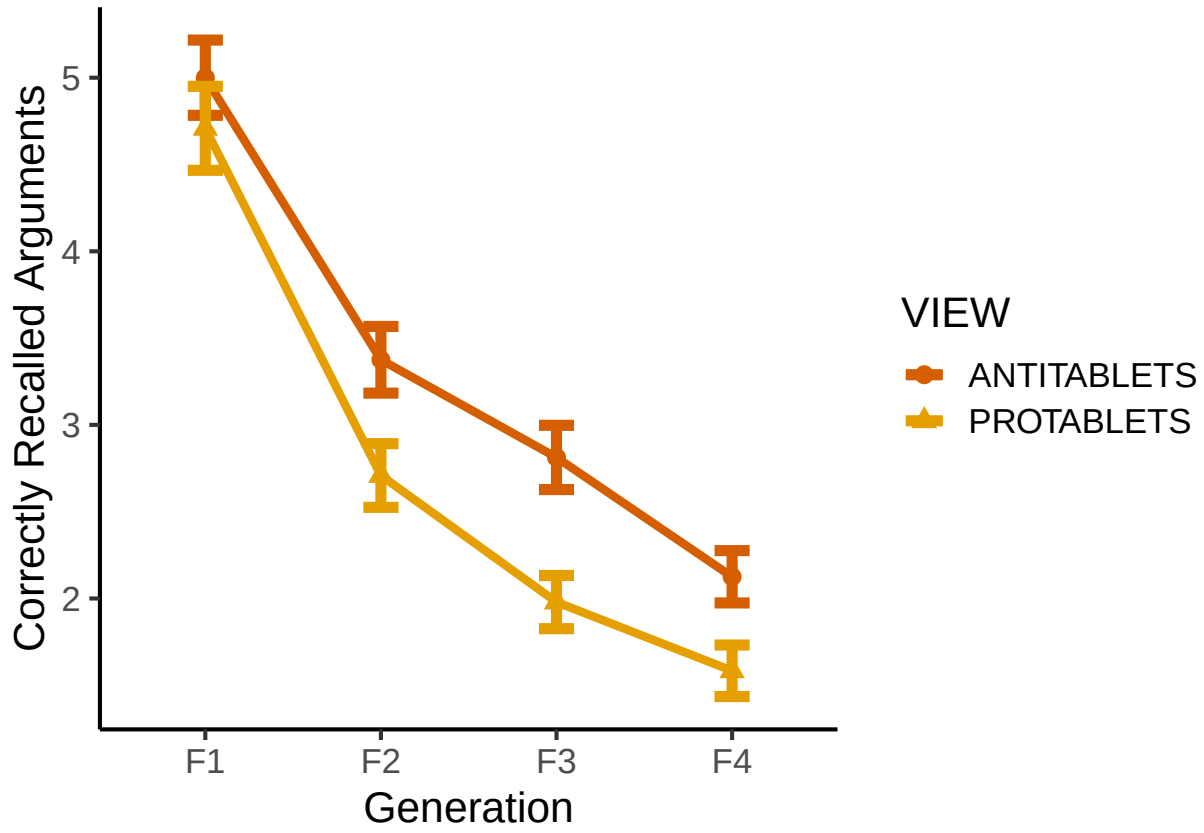
```
## [1] 10.1114
```

```
# Histogram for age
breaks<-c(15, 20, 25, 30, 35, 40, 45, 50, 55, 60, 65)
hist(dat$AGE,
     main="Histogram for Age",
     xlab="Age",
     border="blue",
     col="green",
     breaks = breaks,
     xlim=c(10,65),
     ylim=c(0,50),
     prob = FALSE,
     xaxt ="n")
axis(side=1, at=seq(15,65, 5), labels=seq(15,65,5))
```

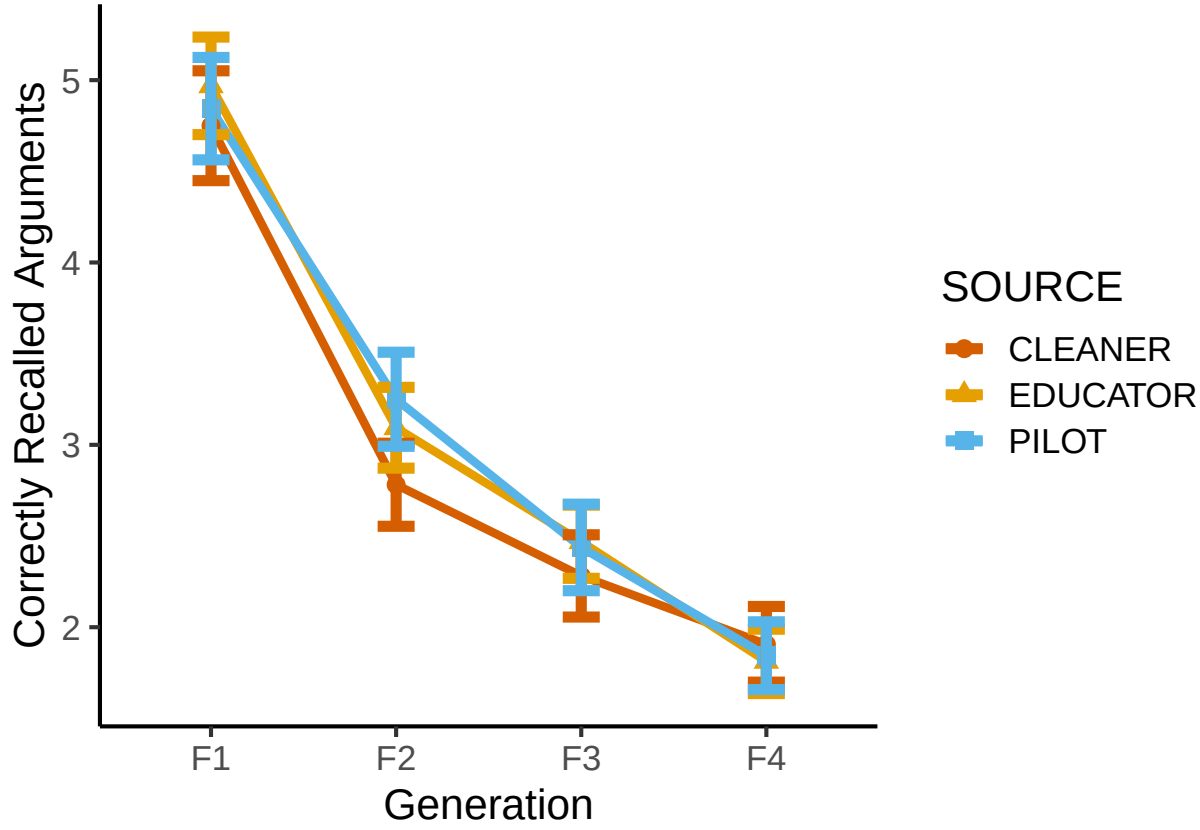


GRAPHICAL DISPLAYS OF THE RAW DATA

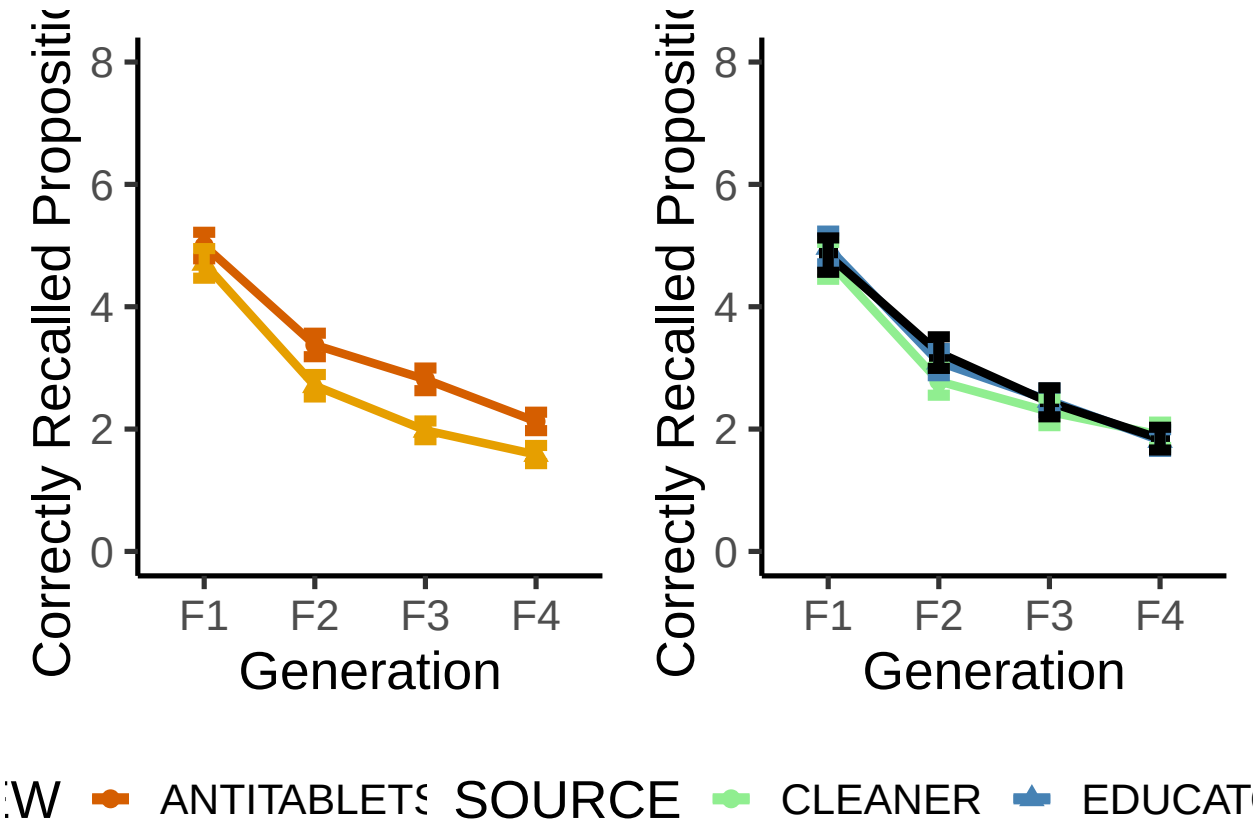
```
# Opening ggplot2 package
library(ggplot2)
# Creation of colorblind-friendly pallette
cbPalette <- c("#D55E00", "#E69F00", "#56B4E9", "#009E73", "#999999", "#CC79A7")

# Line plot of mean number of correctly recalled propositions recalled by each generation with 1.96 sta
# Plot
(viewplot<-ggplot(d, aes(GENERATION, RECALL, colour = VIEW)) + stat_summary(fun.y = mean, geom = "line"
```




```
# Plot
(source_plot<-ggplot(d, aes(GENERATION, RECALL, colour = SOURCE)) + stat_summary(fun.y = mean, geom = "
```




```
# Plot
viewplot<-ggplot(d, aes(GENERATION, RECALL, colour = VIEW)) + stat_summary(fun.y = mean, geom = "line",

# Line plot of mean number of correctly recalled propositions recalled by each generation with 1.96 sta



# Plot
source_plot<-ggplot(d, aes(GENERATION, RECALL, colour = SOURCE)) + stat_summary(fun.y = mean, geom = "li

library(gridExtra)
grid.arrange(viewplot, source_plot, ncol=2)
```




```
library(Hmisc)
```

```
## Loading required package: lattice
```

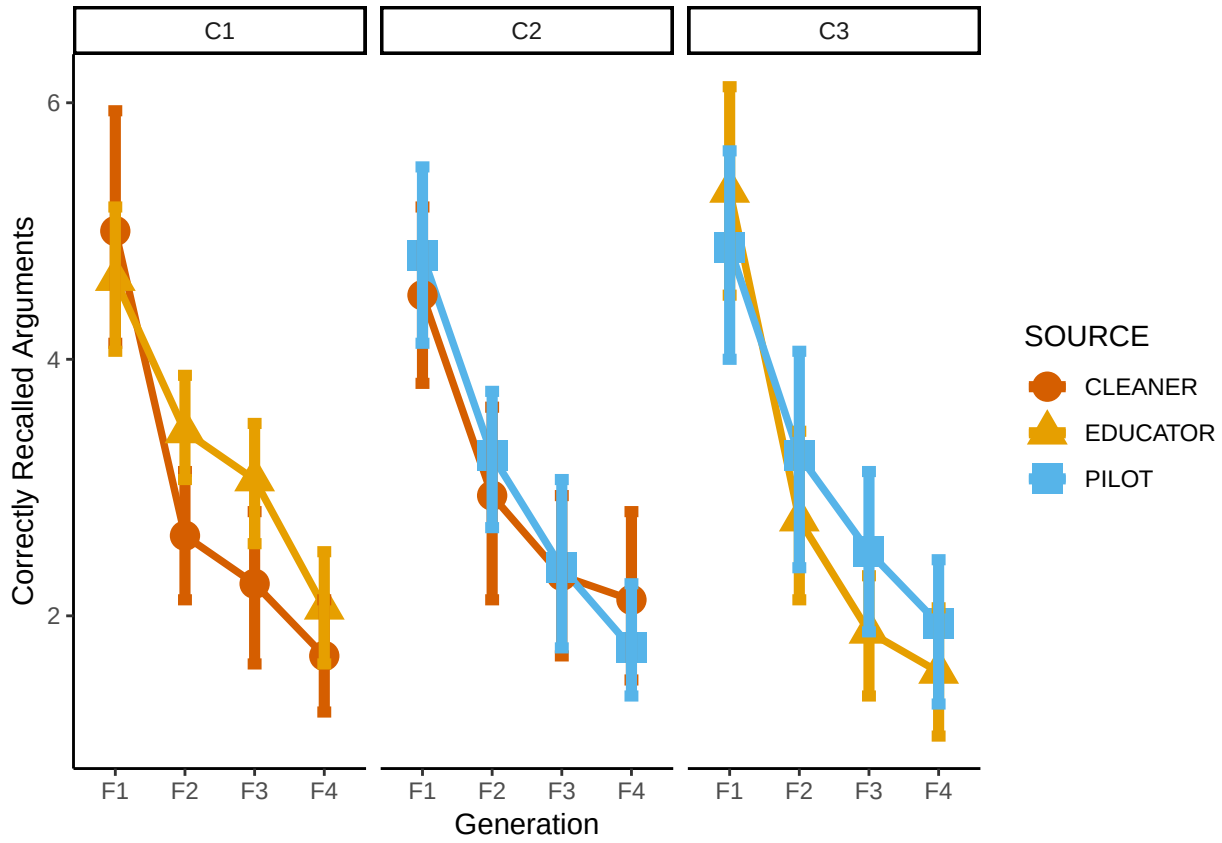
```
## Loading required package: survival
```

```
## Loading required package: Formula
```

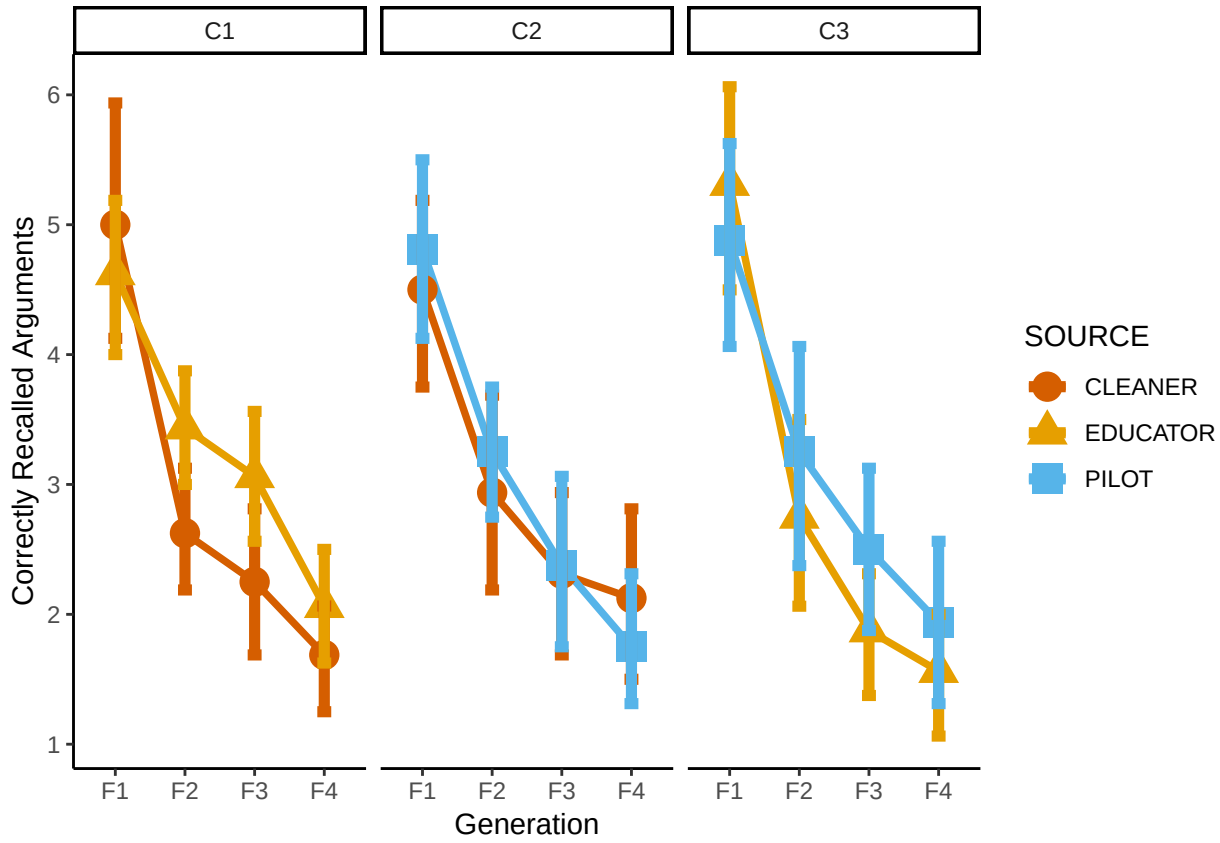
```
##
## Attaching package: 'Hmisc'
```

```
## The following objects are masked from 'package:base':
##
##     format.pval, units
```

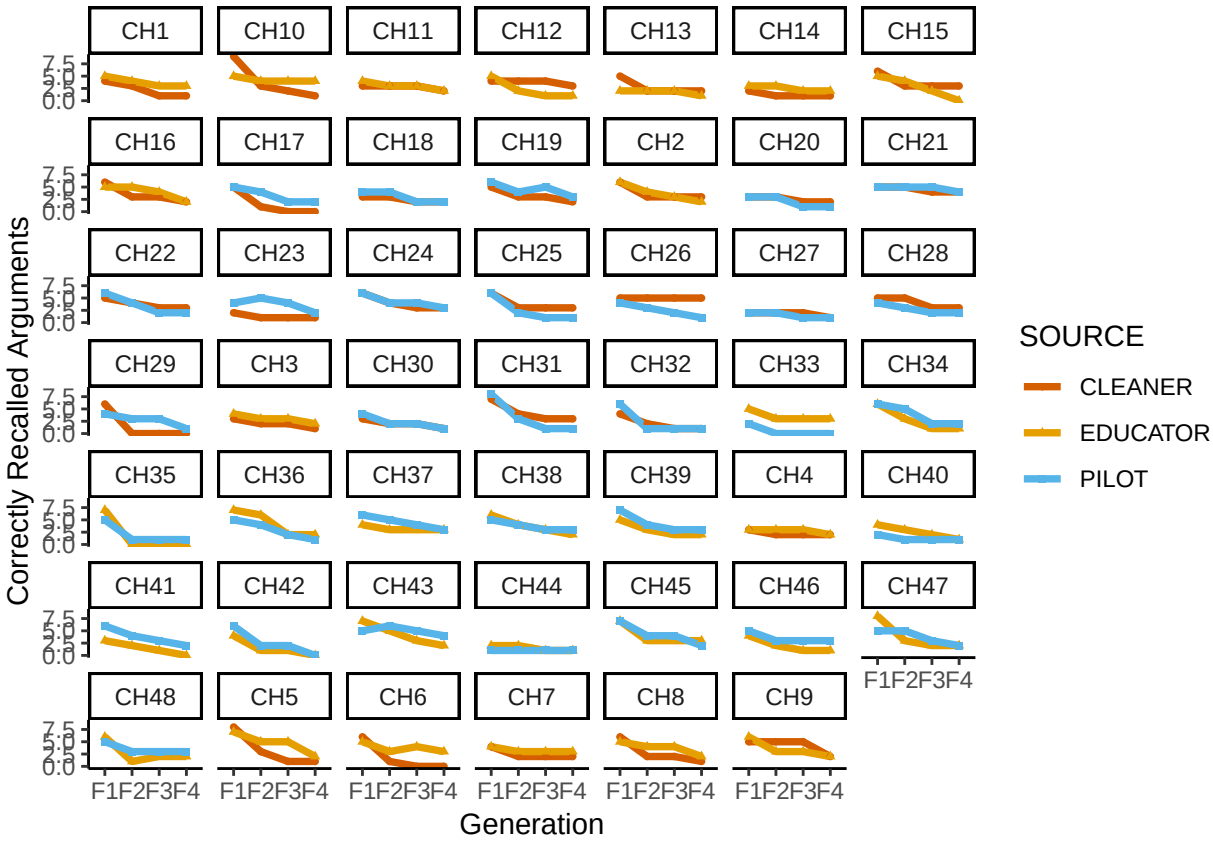
```
(split_plot<-ggplot(d, aes(GENERATION, RECALL, colour = SOURCE)) + stat_summary(fun.y = mean, geom = "li
```




```
(split_plot<-ggplot(d, aes(GENERATION, RECALL, colour = SOURCE)) + stat_summary(fun.y = mean, geom = "li
```



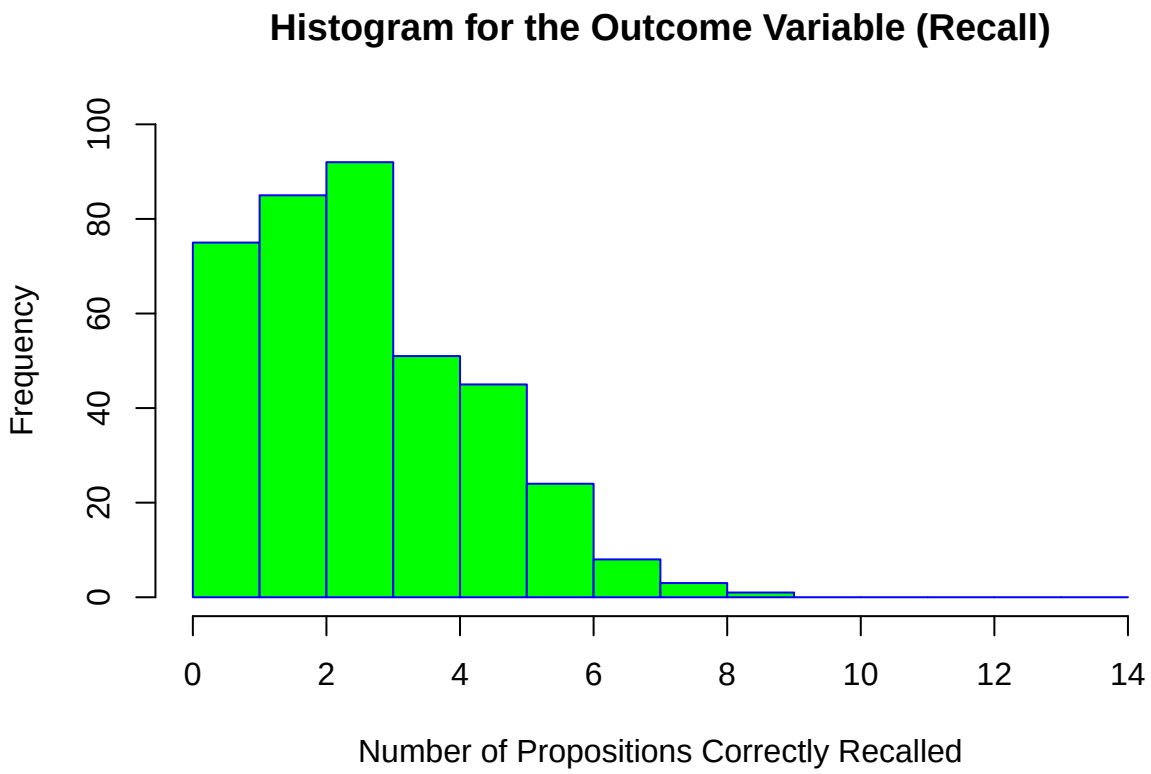

```
(chain_plot<-ggplot(d, aes(GENERATION, RECALL, colour = SOURCE)) + stat_summary(fun.y = mean, geom = "li
```



This graph shows the results for each of the chains.

EXPLORATORY ANALYSES OF THE OUTCOME VARIABLE (NUMBER OF CORRECTLY RECALLED PROPOSITIONS)

```
# Exploring the distribution of the outcome variable (Number of Propositions Correctly Recalled)
hist(d$RECALL,
     main="Histogram for the Outcome Variable (Recall)",
     xlab="Number of Propositions Correctly Recalled",
     border="blue",
     col="green",
     xlim=c(0,14),
     ylim=c(0,100),
     prob = FALSE, breaks = c(0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14))
```



The histogram shows that the most frequent number of propositions correctly recalled is 3 and the minimum 0.

NULL MODELS FOR PREDICTING RECALL

```
# mo.0: fixed intercept model
mo.0<-glm(RECALL~1, data = d, family="poisson")
# mo.0a: random intercept model with chain as a random effect
library(lme4)
```

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

```
mo.0a<-glmer(RECALL ~ 1 + (1|CHAIN), data = d, family = "poisson")
# mo.0b: random intercept model with participant as a random effect
mo.0b<-glmer(RECALL ~ 1 + (1|PARTICIPANT), data = d, family = "poisson")
# mo.0c: random intercept model with participant nested within chain as random effects
mo.0c<-glmer(RECALL ~ 1 + (1|CHAIN/PARTICIPANT), data = d, family = "poisson")
#
# Model comparisons
AIC(mo.0, mo.0a, mo.0b, mo.0c)
```

```
##       df      AIC
## mo.0   1 1487.859
## mo.0a  2 1479.631
## mo.0b  2 1467.701
```

```
## mo.0c  3 1468.811
```

The random intercept models with participant as a random effect (AIC=1467.701) and with participant nested within chain as random effects (AIC=1468.811) have a similar fit and their fit is better to the data than both the fixed intercept model (AIC=1487.859) and the random intercept model with chain as random effect (AIC=1479.631)

```
# GENERATION MODELs
# Generation model with participant nested within chain as random effects
mo.1a<-glmer(RECALL ~ GENERATION + (1|CHAIN/PARTICIPANT), data = d, family = "poisson")
```

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

```
# Generation model with chain as random effect
mo.1b<-glmer(RECALL ~ GENERATION + (1|CHAIN), data = d, family = "poisson")
# Model fit comparisons
AIC(mo.1a, mo.1b)
```

```
##       df      AIC
## mo.1a  6 1333.987
## mo.1b  5 1331.987
```

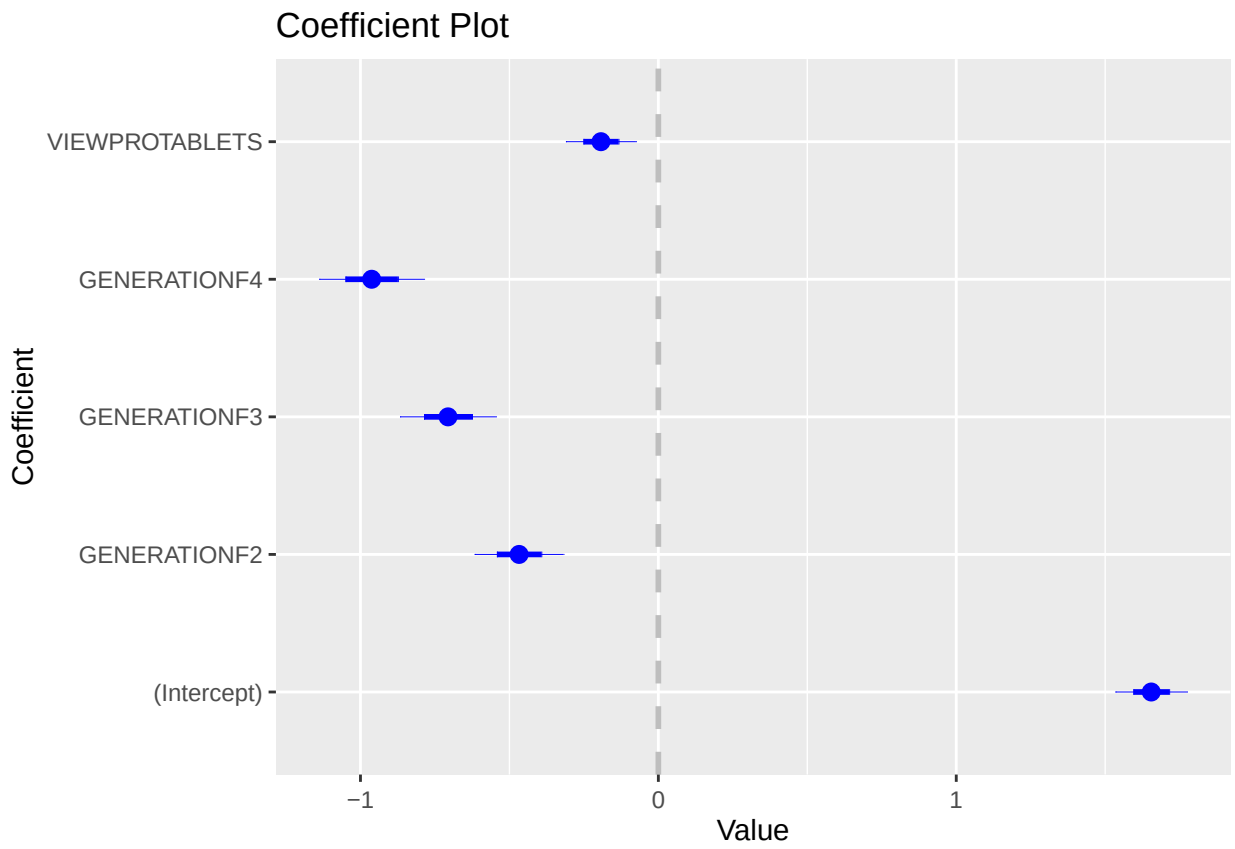
The model fit of the generation model with chain as random effect (AIC = 1333.987) is better than the fit of the generation model with participant nested within chain as random effects (AIC = 1331.987). We decided to use the generation model with chain as unique random effect as a base for the following models.

```
# CONTROL MODELS
# View model
mo.2a<-glmer(RECALL ~ GENERATION + VIEW + (1|CHAIN), data = d, family = "poisson")
# View model with its interaction with generation
mo.2b<-glmer(RECALL ~ GENERATION * VIEW + (1|CHAIN), data = d, family = "poisson")
# Pretest model
mo.3a<-glmer(RECALL ~ GENERATION + VIEW * PRE_AGREE + (1|CHAIN), data = d, family = "poisson")

# Model comparisons
AIC(mo.1b, mo.2a, mo.2b, mo.3a)
```

```
##       df      AIC
## mo.1b  5 1331.987
## mo.2a  6 1323.213
## mo.2b  9 1325.249
## mo.3a  8 1327.104
```

All the control models have a better fit than the selected generation model (AIC=1331.987). The best fitting model is the model with generation and view as fixed effects without interaction (AIC=1323.213)

```
# Coefficient Plot of the View Model with Chain as Random Effect
library(coefplot)
coefplot(mo.2a)
```




```
# Summary of View Model with Chain as Random Effect
library(arm)
```

```
## Loading required package: MASS
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)
```

```
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
```

```
##
## Attaching package: 'arm'
```

```
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(mo.2a)
```

```
## glmer(formula = RECALL ~ GENERATION + VIEW + (1 | CHAIN), data = d,
##     family = "poisson")
##                coef.est coef.se
## (Intercept)     1.65     0.06
## GENERATIONF2   -0.47     0.07
## GENERATIONF3   -0.71     0.08
## GENERATIONF4   -0.96     0.09
## VIEWPROTABLETS -0.19     0.06
##
## Error terms:
```

```
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.18
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1323.2, DIC = -931.1
## deviance = 190.1
```

The selected control model clearly shows a decreased in the number of propositions correctly recalled over generations and that the protablets views is worse recalled than the antitablets view.

```
# Test of H1: The arguments provided by high prestige sources are better recalled than arguments provid
# SOURCE MODELS
# Selecting "Cleaner" as reference category
d <- within(d, SOURCE <- relevel(SOURCE, ref = 'CLEANER'))
# Source model
mo.4a<-glmer(RECALL ~ GENERATION + SOURCE + (1|CHAIN), data = d, family = "poisson")
# Source model with its interaction with generation
mo.4b<-glmer(RECALL ~ GENERATION * SOURCE + (1|CHAIN), data = d, family = "poisson")
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl =
## control$checkConv, : Model failed to converge with max|grad| = 0.00120911
## (tol = 0.001, component 1)
```

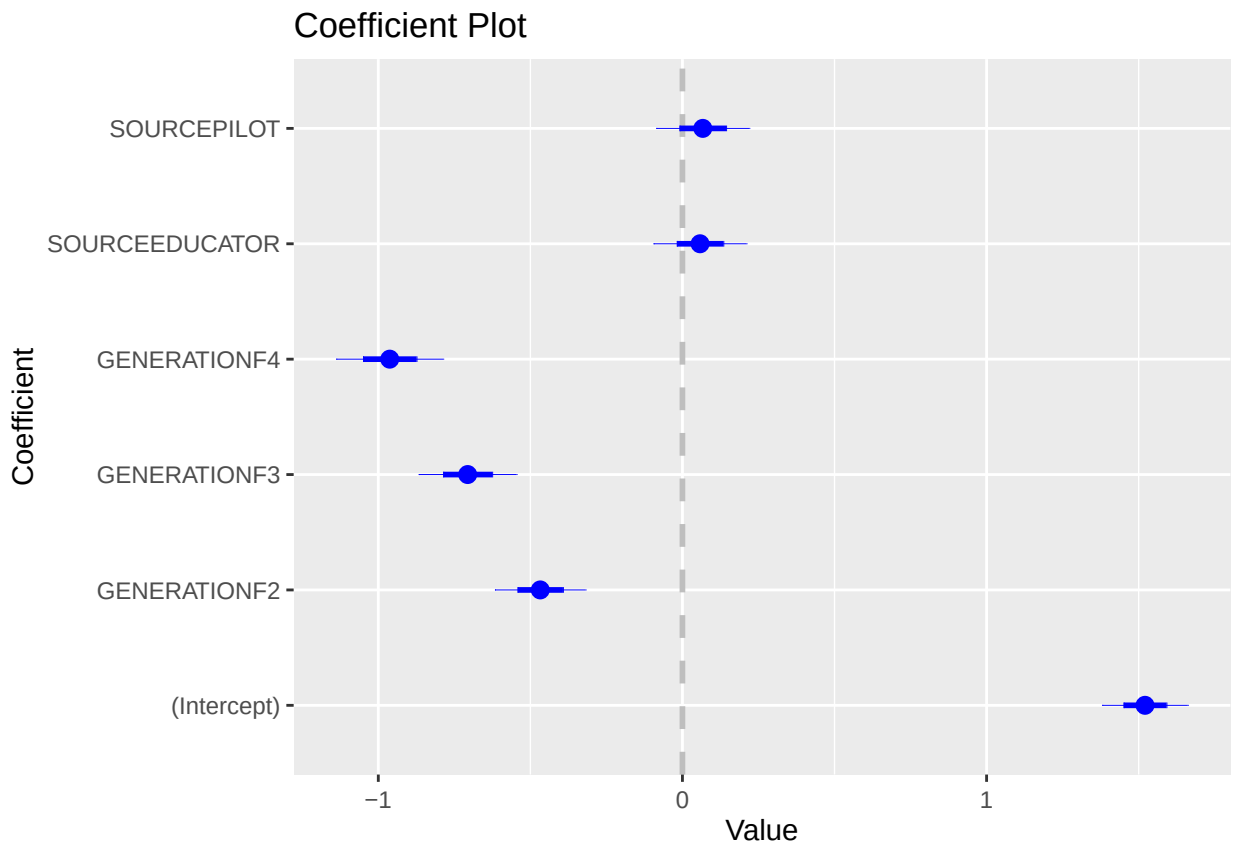
```
AIC(mo.1b, mo.2a, mo.4a, mo.4b)
```

```
##       df      AIC
## mo.1b  5 1331.987
## mo.2a  6 1323.213
## mo.4a  7 1335.088
## mo.4b 13 1346.096
```

```
library(arm)
display(mo.4a)
```

```
## glmer(formula = RECALL ~ GENERATION + SOURCE + (1 | CHAIN), data = d,
##     family = "poisson")
##                coef.est coef.se
## (Intercept)     1.52     0.07
## GENERATIONF2   -0.47     0.07
## GENERATIONF3   -0.71     0.08
## GENERATIONF4   -0.96     0.09
## SOURCEEDUCATOR  0.06     0.08
## SOURCEPILOT     0.07     0.08
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.19
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1335.1, DIC = -921.9
## deviance = 199.6
```

```
detach("package:arm", unload=TRUE)
library(coefplot)
coefplot(mo.4a)
```




```
library(arm)
```

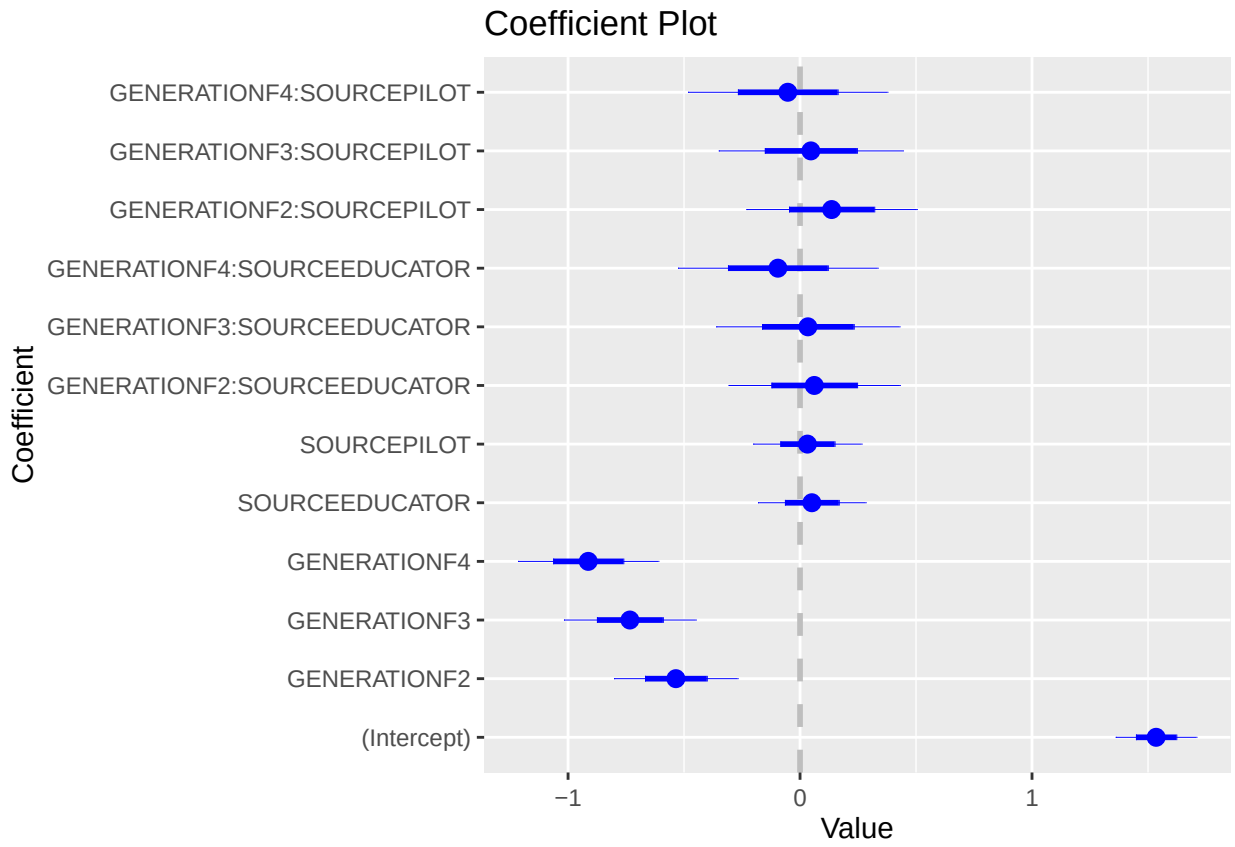
```
##
## arm (Version 1.10-1, built: 2018-4-12)
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
##
## Attaching package: 'arm'
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(mo.4b)
```

```
## glmer(formula = RECALL ~ GENERATION * SOURCE + (1 | CHAIN), data = d,
##     family = "poisson")
##                             coef.est coef.se
## (Intercept)                  1.53     0.09
## GENERATIONF2                -0.54     0.13
## GENERATIONF3                -0.73     0.14
## GENERATIONF4                -0.91     0.15
## SOURCEEDUCATOR               0.05     0.12
## SOURCEPILOT                  0.03     0.12
## GENERATIONF2:SOURCEEDUCATOR  0.06     0.18
## GENERATIONF3:SOURCEEDUCATOR  0.03     0.20
## GENERATIONF4:SOURCEEDUCATOR -0.10     0.22
## GENERATIONF2:SOURCEPILOT     0.14     0.18
```

```
## GENERATIONF3:SOURCEPILOT     0.05     0.20
## GENERATIONF4:SOURCEPILOT    -0.05     0.21
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.19
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1346.1, DIC = -922.9
## deviance = 198.6
```

```
detach("package:arm", unload=TRUE)
coefplot(mo.4b)
```



The source model (AIC = 1335.088) and the model with the interaction between source and generation (AIC=1346.096) have a worse fit than both the control (AIC=1331.987) and the view models (AIC=1346.096). This does not support H1.

Because we have shown than the view about tablets has an effect, we decided to run additional source models including view as an additional fixed effect.

```
# Selecting "Cleaner" as reference category
d <- within(d, SOURCE <- relevel(SOURCE, ref = 'CLEANER'))
# Source model + VIEW
mo.4c<-glmer(RECALL ~ GENERATION + SOURCE + VIEW + (1|CHAIN), data = d, family = "poisson")
mo.4d<-glmer(RECALL ~ GENERATION * SOURCE + VIEW + (1|CHAIN), data = d, family = "poisson")
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl =
```

```
## control$checkConv, : Model failed to converge with max|grad| = 0.00312795
## (tol = 0.001, component 1)
```

```
mo.4e<-glmer(RECALL ~ GENERATION + SOURCE * VIEW + (1|CHAIN), data = d, family = "poisson")
AIC(mo.1b, mo.2a, mo.4c, mo.4d, mo.4e)
```

```
##       df      AIC
## mo.1b  5 1331.987
## mo.2a  6 1323.213
## mo.4c  8 1326.398
## mo.4d 14 1337.406
## mo.4e 10 1330.022
```

```
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)
```

```
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
```

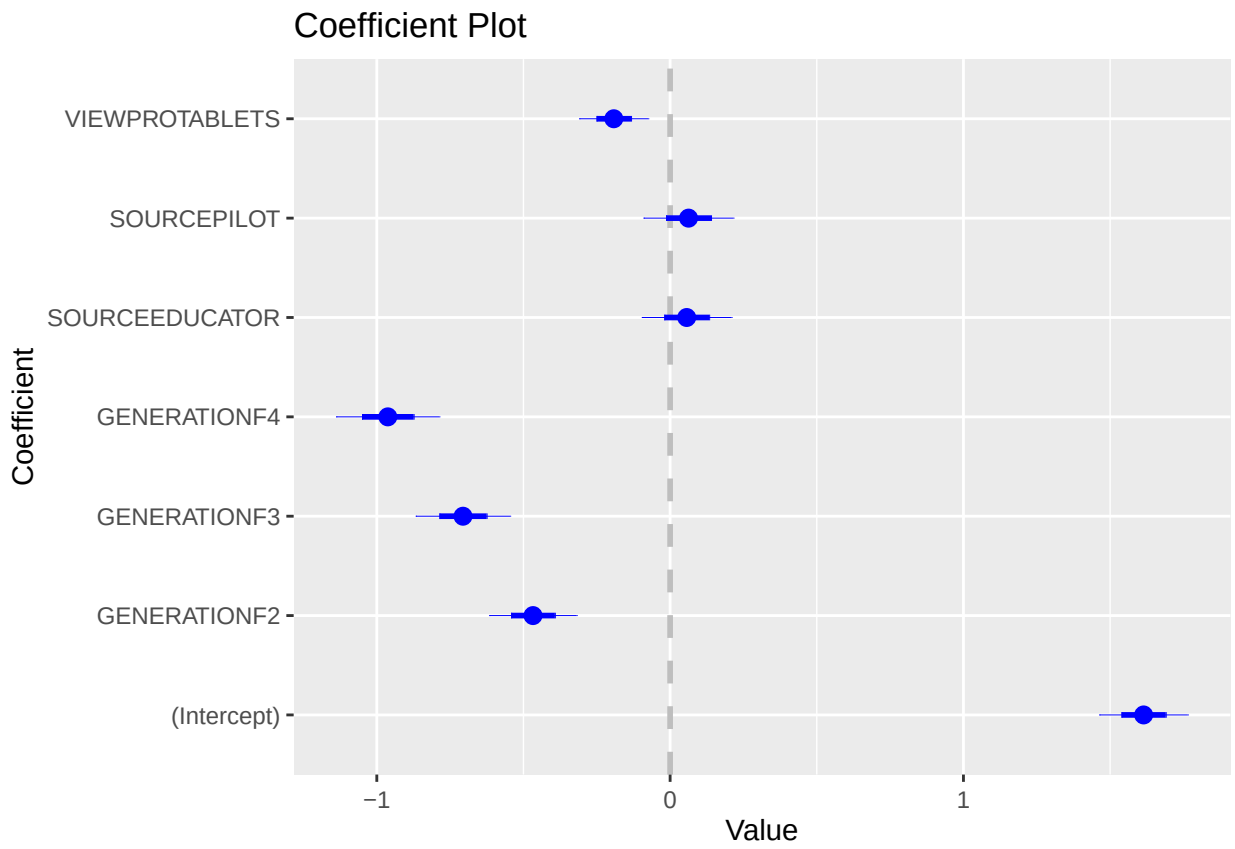
```
##
## Attaching package: 'arm'
```

```
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(mo.4c)
```

```
## glmer(formula = RECALL ~ GENERATION + SOURCE + VIEW + (1 | CHAIN),
##     data = d, family = "poisson")
##                coef.est coef.se
## (Intercept)     1.61     0.08
## GENERATIONF2   -0.47     0.07
## GENERATIONF3   -0.71     0.08
## GENERATIONF4   -0.96     0.09
## SOURCEEDUCATOR  0.06     0.08
## SOURCEPILOT     0.06     0.08
## VIEWPROTABLETS -0.19     0.06
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.19
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1326.4, DIC = -932.2
## deviance = 189.1
```

```
detach("package:arm", unload=TRUE)
coefplot(mo.4c)
```



The model fit of these models is worse than the view model.

```
# Test of H2: The arguments provided by high relevance sources are better recalled than arguments provi
# SOURCE MODELS
# Selecting "Head of Education" as reference category
d <- within(d, SOURCE <- relevel(SOURCE, ref = 'EDUCATOR'))
# Source model
mo.4a<-glmer(RECALL ~ GENERATION + SOURCE + (1|CHAIN), data = d, family = "poisson")
# Source model with its interaction with generation
mo.4b<-glmer(RECALL ~ GENERATION * SOURCE + (1|CHAIN), data = d, family = "poisson")
```

```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl =
## control$checkConv, : Model failed to converge with max|grad| = 0.0042506
## (tol = 0.001, component 1)
```

```
AIC(mo.1b, mo.2a, mo.4a, mo.4b)
```

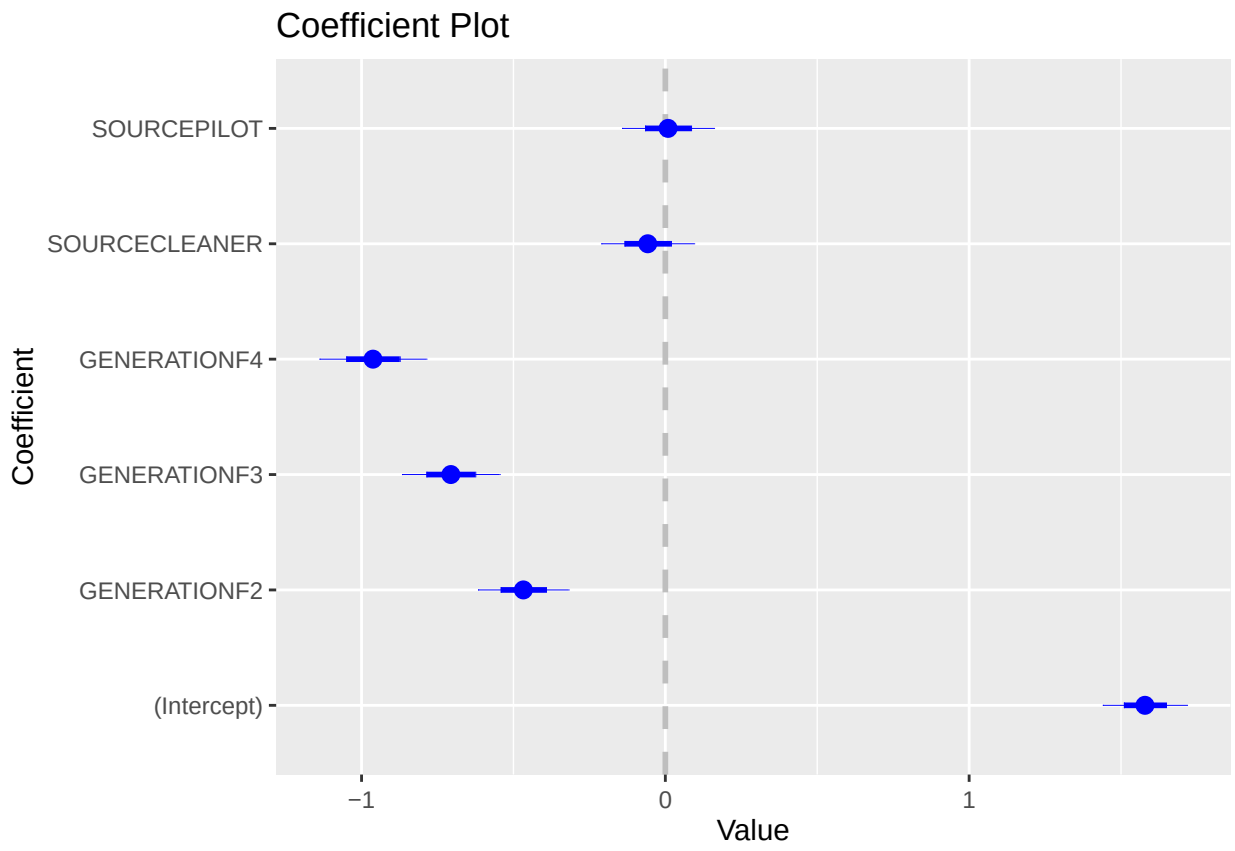
```
##       df      AIC
## mo.1b  5 1331.987
## mo.2a  6 1323.213
## mo.4a  7 1335.088
## mo.4b 13 1346.096
```

```
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)
```

```
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
```

```
##
## Attaching package: 'arm'
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
display(mo.4a)
## glmer(formula = RECALL ~ GENERATION + SOURCE + (1 | CHAIN), data = d,
##     family = "poisson")
##               coef.est coef.se
## (Intercept)    1.58     0.07
## GENERATIONF2  -0.47     0.07
## GENERATIONF3  -0.71     0.08
## GENERATIONF4  -0.96     0.09
## SOURCECLEANER -0.06     0.08
## SOURCEPILOT    0.01     0.08
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.19
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1335.1, DIC = -921.9
## deviance = 199.6
detach("package:arm", unload=TRUE)
library(coefplot)
coefplot(mo.4a)
```




```
library(arm)
```

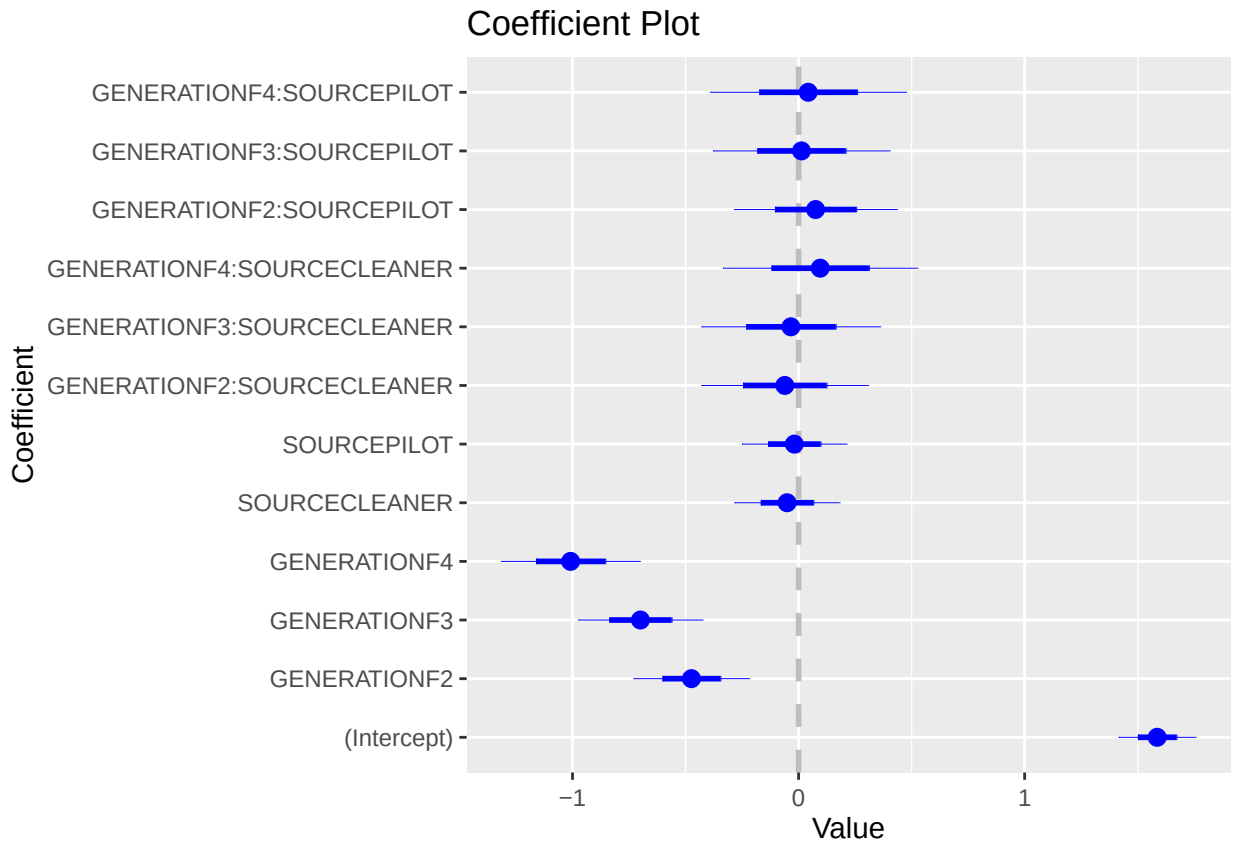
```
##
## arm (Version 1.10-1, built: 2018-4-12)
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
##
## Attaching package: 'arm'
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(mo.4b)
```

```
## glmer(formula = RECALL ~ GENERATION * SOURCE + (1 | CHAIN), data = d,
##     family = "poisson")
##                             coef.est coef.se
## (Intercept)                  1.59     0.09
## GENERATIONF2                -0.47     0.13
## GENERATIONF3                -0.70     0.14
## GENERATIONF4                -1.01     0.15
## SOURCECLEANER               -0.05     0.12
## SOURCEPILOT                 -0.02     0.12
## GENERATIONF2:SOURCECLEANER -0.06     0.18
## GENERATIONF3:SOURCECLEANER -0.03     0.20
## GENERATIONF4:SOURCECLEANER  0.10     0.22
## GENERATIONF2:SOURCEPILOT    0.08     0.18
```

```
## GENERATIONF3:SOURCEPILOT    0.01     0.20
## GENERATIONF4:SOURCEPILOT    0.04     0.22
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.19
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1346.1, DIC = -923
## deviance = 198.6
```

```
detach("package:arm", unload=TRUE)
coefplot(mo.4b)
```



These are the same models. The only change is that the reference category is "educator" now

MODEL VALIDATION FOR BEST FITTING MODEL TO PREDICT RECALL

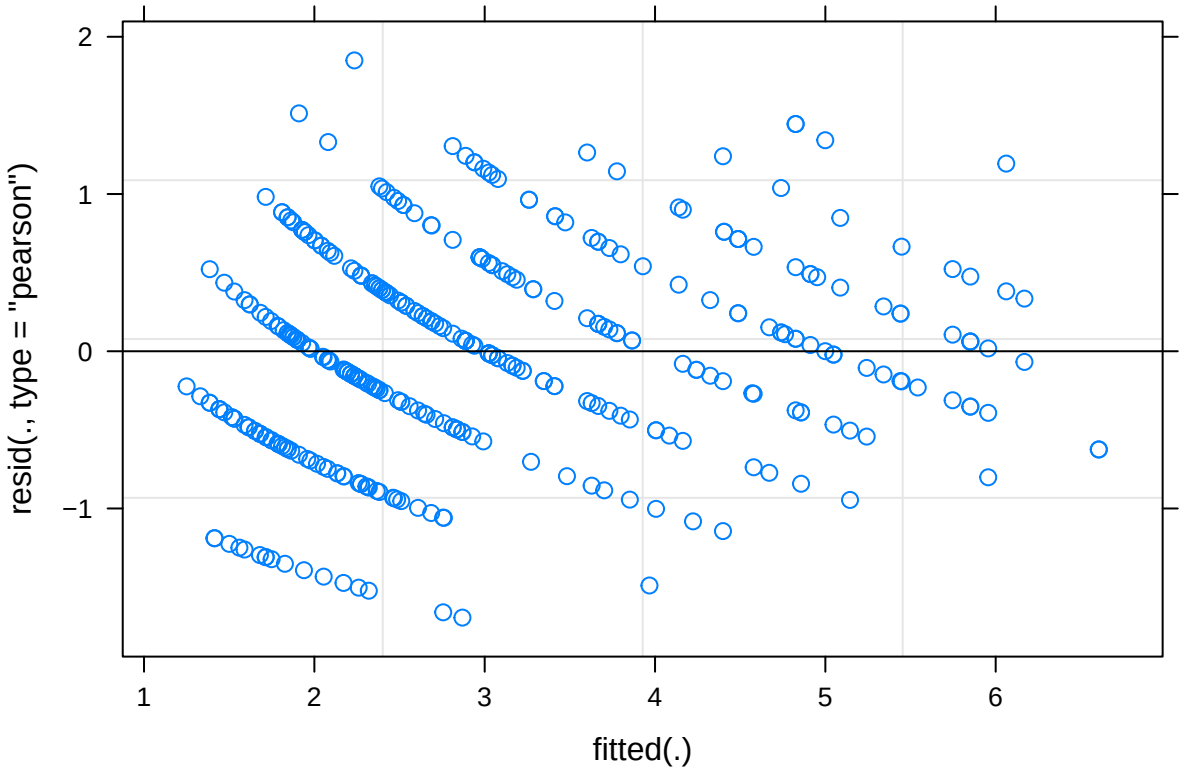
```
# ANALYSIS OF OVERDISPERSION
# FUNCTION BY HARRISON (2014)
od.point<-function(modelobject){
  x<-sum(resid(modelobject,type="pearson")^2)
  rdf<-summary(modelobject)$AICtab[5]
```

```
  return(x/rdf)
}
od.point(mo.2a)
```

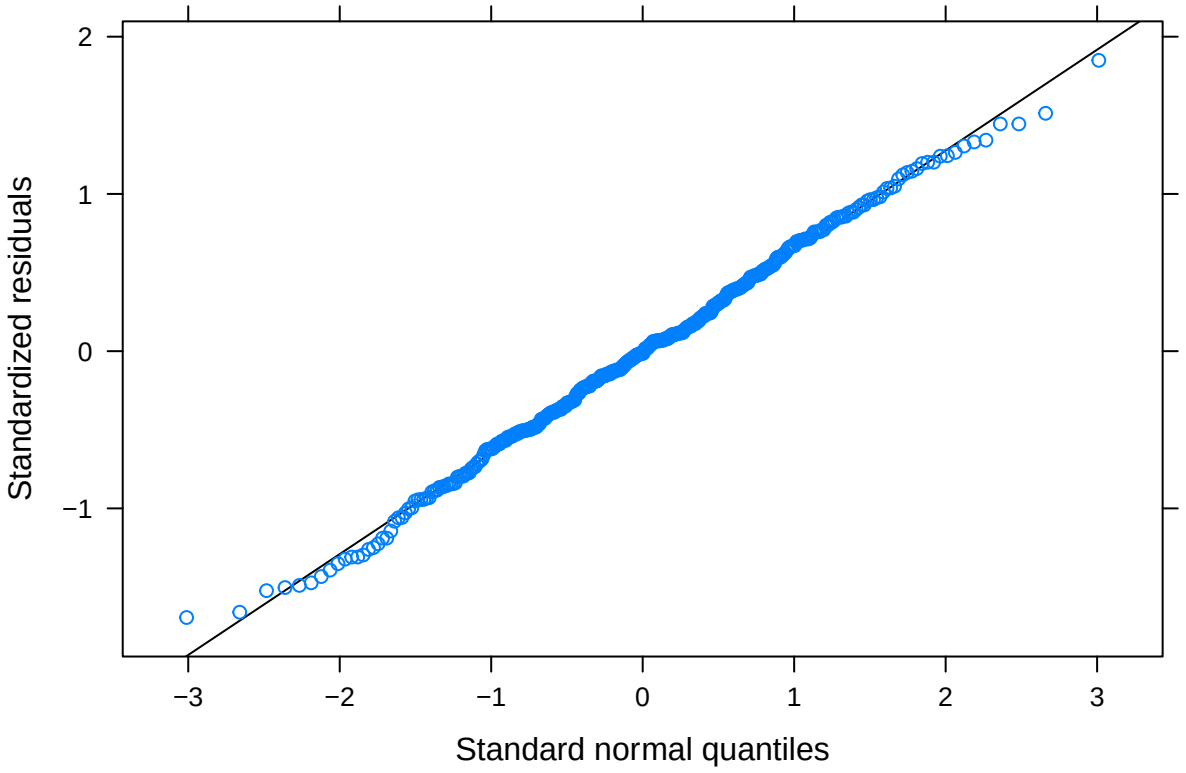
```
##  df.resid
## 0.4185897
```

There is not overdispersion, as the od.point is lower than 1.

```
# Fitted vs residual plot
plot(mo.2a)
```




```
library(lattice)
#QQPlot
qqmath(mo.2a)
```



They look fine

POST-HOC TESTS FOR CONDITION 1

```
d <- within(d, SOURCE <- relevel(SOURCE, ref = 'CLEANER'))
#  Condition 1: cleaner vs Head of the Department of Education of a leading university
newdata1 <- d[ which(d$CONDITION=="C1"), ] # Select data from condition 1
# Source model for Condition 1
post.hoc1<-glmer(RECALL ~ GENERATION + SOURCE + (1|CHAIN), newdata1, family = "poisson")
# Interaction model for Condition 1
interaction.post.hoc1<-glmer(RECALL ~ GENERATION * SOURCE + (1|CHAIN), newdata1, family = "poisson")
# Generation-only model for condition 1
generation.post.hoc1<-glmer(RECALL ~ GENERATION + (1|CHAIN), newdata1, family="poisson")
# View model for condition 1
view.post.hoc1<-glmer(RECALL ~ GENERATION + VIEW + (1|CHAIN), newdata1, family = "poisson")
# Source + view model
sourceview.post.hoc1<-glmer(RECALL ~ GENERATION + SOURCE+ VIEW + (1|CHAIN), newdata1, family = "poisson
# Model comparisons
AIC(post.hoc1, generation.post.hoc1, interaction.post.hoc1, view.post.hoc1, sourceview.post.hoc1)
```

```
##                         df      AIC
## post.hoc1                6 440.8914
## generation.post.hoc1     5 440.5997
## interaction.post.hoc1    9 444.0213
## view.post.hoc1           6 438.5524
```

```
## sourceview.post.hoc1   7 438.8433
```

```
# Summary of the Source Model for Condition 1
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)
```

```
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
```

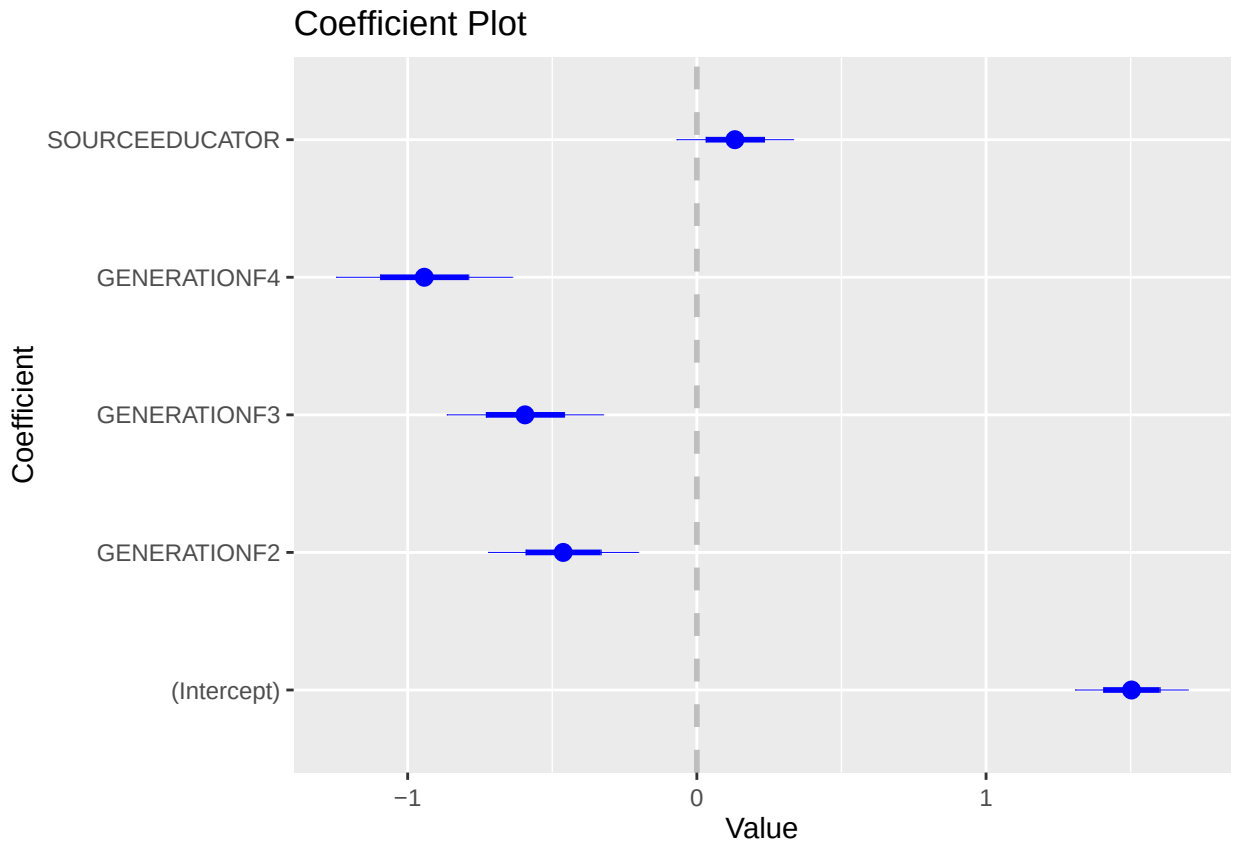
```
##
## Attaching package: 'arm'
```

```
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(post.hoc1)
```

```
## glmer(formula = RECALL ~ GENERATION + SOURCE + (1 | CHAIN), data = newdata1,
##     family = "poisson")
##                coef.est coef.se
## (Intercept)     1.50     0.10
## GENERATIONF2   -0.46     0.13
## GENERATIONF3   -0.59     0.14
## GENERATIONF4   -0.94     0.15
## SOURCEEDUCATOR  0.13     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.03
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 440.9, DIC = -306
## deviance = 61.4
```

```
# Coefficient Plot of the Source Model for Condition 1
detach("package:arm", unload=TRUE)
coefplot(post.hoc1)
```




```
# Summary of the Interaction Model for Condition 1
library(arm)
```

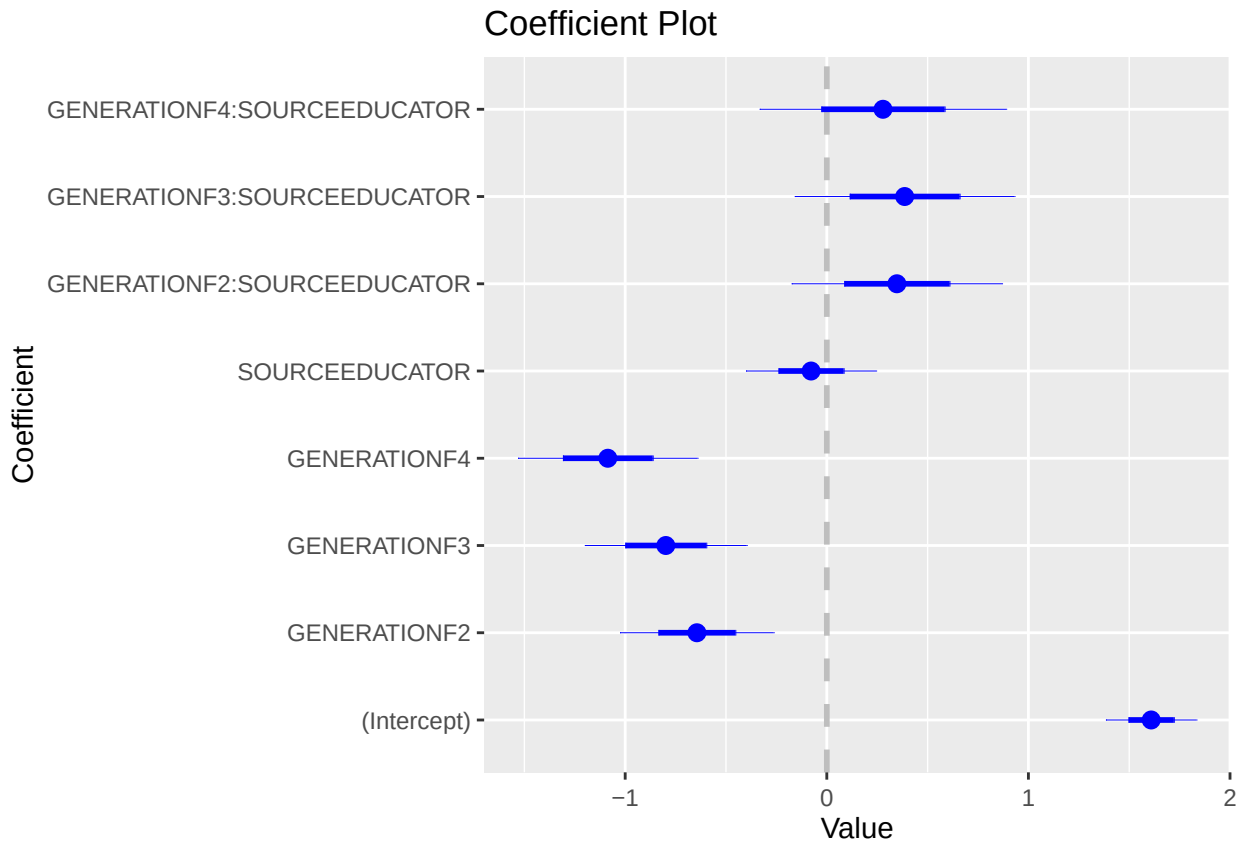
```
##
## arm (Version 1.10-1, built: 2018-4-12)
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
##
## Attaching package: 'arm'
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(interaction.post.hoc1)
```

```
## glmer(formula = RECALL ~ GENERATION * SOURCE + (1 | CHAIN), data = newdata1,
##     family = "poisson")
##                             coef.est coef.se
## (Intercept)                  1.61     0.11
## GENERATIONF2                -0.64     0.19
## GENERATIONF3                -0.80     0.20
## GENERATIONF4                -1.09     0.22
## SOURCEEDUCATOR              -0.08     0.16
## GENERATIONF2:SOURCEEDUCATOR  0.35     0.26
## GENERATIONF3:SOURCEEDUCATOR  0.39     0.27
## GENERATIONF4:SOURCEEDUCATOR  0.28     0.31
##
```

```
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.03
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 444, DIC = -308.9
## deviance = 58.6
```

```
# Coefficient Plot for the Interaction Model for Condition 1
detach("package:arm", unload=TRUE)
coefplot(interaction.post.hoc1)
```



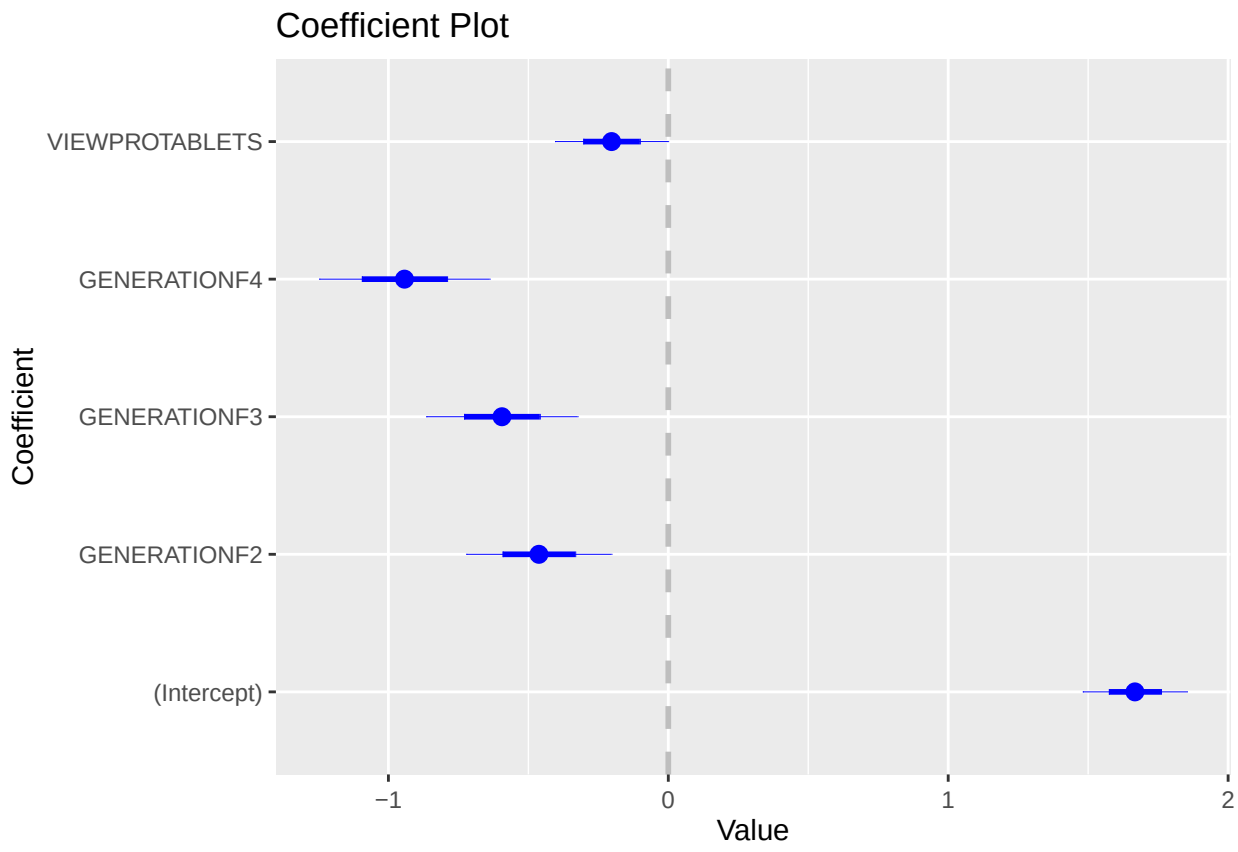

```
# Summary of the View Model for Condition 1
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)

## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a

##
## Attaching package: 'arm'

## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(view.post.hoc1)
```

```
## glmer(formula = RECALL ~ GENERATION + VIEW + (1 | CHAIN), data = newdata1,
##     family = "poisson")
##                coef.est coef.se
## (Intercept)     1.67     0.09
## GENERATIONF2   -0.46     0.13
## GENERATIONF3   -0.59     0.14
## GENERATIONF4   -0.94     0.15
## VIEWPROTABLETS -0.20     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.03
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 438.6, DIC = -308.3
## deviance = 59.1
```

```
# Coefficient Plot of the Source Model for Condition 1
detach("package:arm", unload=TRUE)
coefplot(view.post.hoc1)
```



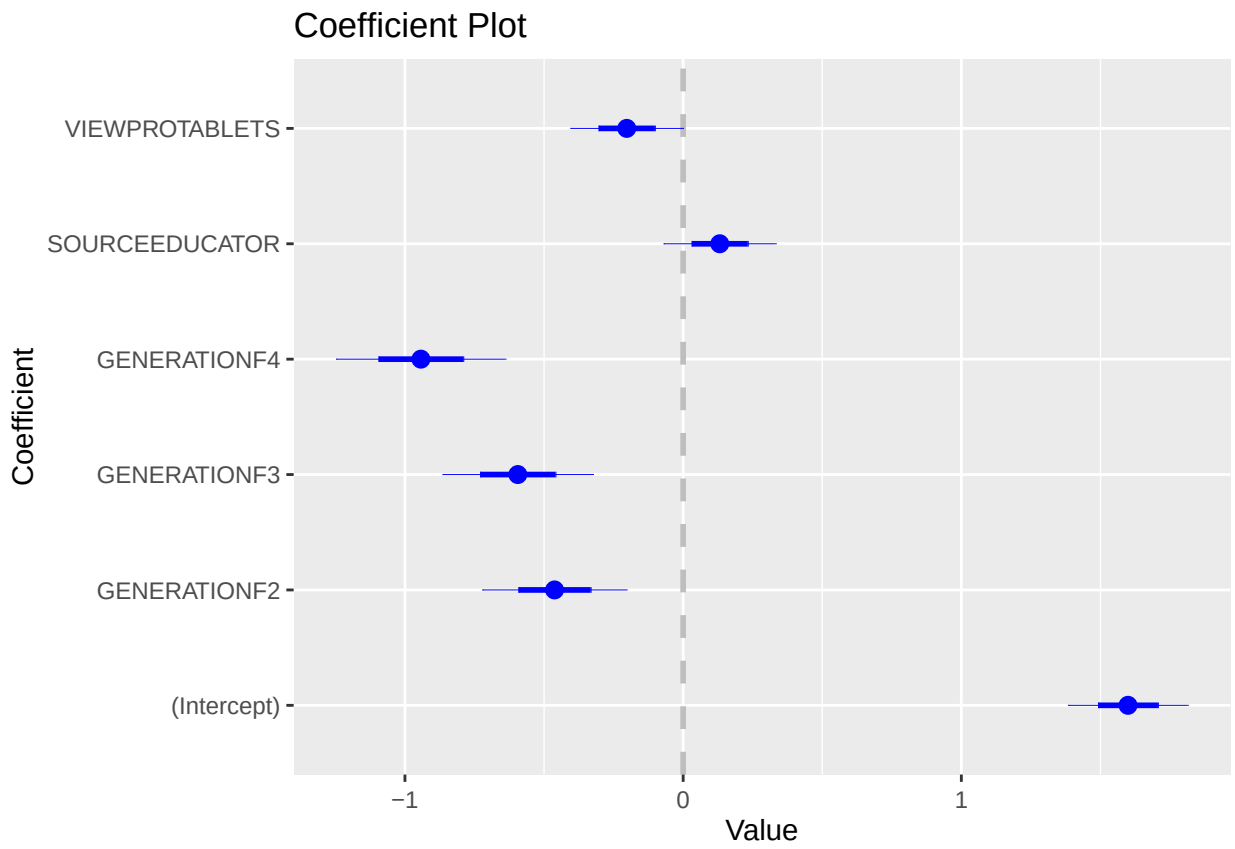

```
# Summary of the View Model for Condition 1
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)

## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a

##
## Attaching package: 'arm'

## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(sourceview.post.hoc1)
```

```
## glmer(formula = RECALL ~ GENERATION + SOURCE + VIEW + (1 | CHAIN),
##     data = newdata1, family = "poisson")
##                coef.est coef.se
## (Intercept)     1.60     0.11
## GENERATIONF2   -0.46     0.13
## GENERATIONF3   -0.59     0.14
## GENERATIONF4   -0.94     0.15
## SOURCEEDUCATOR  0.13     0.10
## VIEWPROTABLETS -0.20     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.03
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 438.8, DIC = -310.2
## deviance = 57.3
```

```
# Coefficient Plot of the Source Model for Condition 1
detach("package:arm", unload=TRUE)
coefplot(sourceview.post.hoc1)
```



Similar results as for all data together

POST-HOC TESTS FOR CONDITION 2

```
d <- within(d, SOURCE <- relevel(SOURCE, ref = 'CLEANER'))
#  Condition 2: cleaner vs Head of the Department of Education of a leading university
newdata2 <- d[ which(d$CONDITION=="C2"), ] # Select data from condition 2
# Source model for Condition 2
post.hoc2<-glmer(RECALL ~ GENERATION + SOURCE + (1|CHAIN), newdata2, family = "poisson")
# Interaction model for Condition 2
interaction.post.hoc2<-glmer(RECALL ~ GENERATION * SOURCE + (1|CHAIN), newdata2, family = "poisson")
# Generation-only model for condition 2
generation.post.hoc2<-glmer(RECALL ~ GENERATION + (1|CHAIN), newdata2, family="poisson")
# View model for condition 2
view.post.hoc2<-glmer(RECALL ~ GENERATION + VIEW + (1|CHAIN), newdata2, family = "poisson")
# Source + view model
sourceview.post.hoc2<-glmer(RECALL ~ GENERATION + SOURCE+ VIEW + (1|CHAIN), newdata2, family = "poisson
# Model comparisons
AIC(post.hoc2, generation.post.hoc2, interaction.post.hoc2, view.post.hoc2, sourceview.post.hoc2)
```

```
##                         df      AIC
## post.hoc2                6 453.1400
## generation.post.hoc2     5 451.2050
## interaction.post.hoc2    9 458.1896
## view.post.hoc2           6 448.8304
```

```
## sourceview.post.hoc2   7 450.8025
```

```
# Summary of the Source Model for Condition 2
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)
```

```
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
```

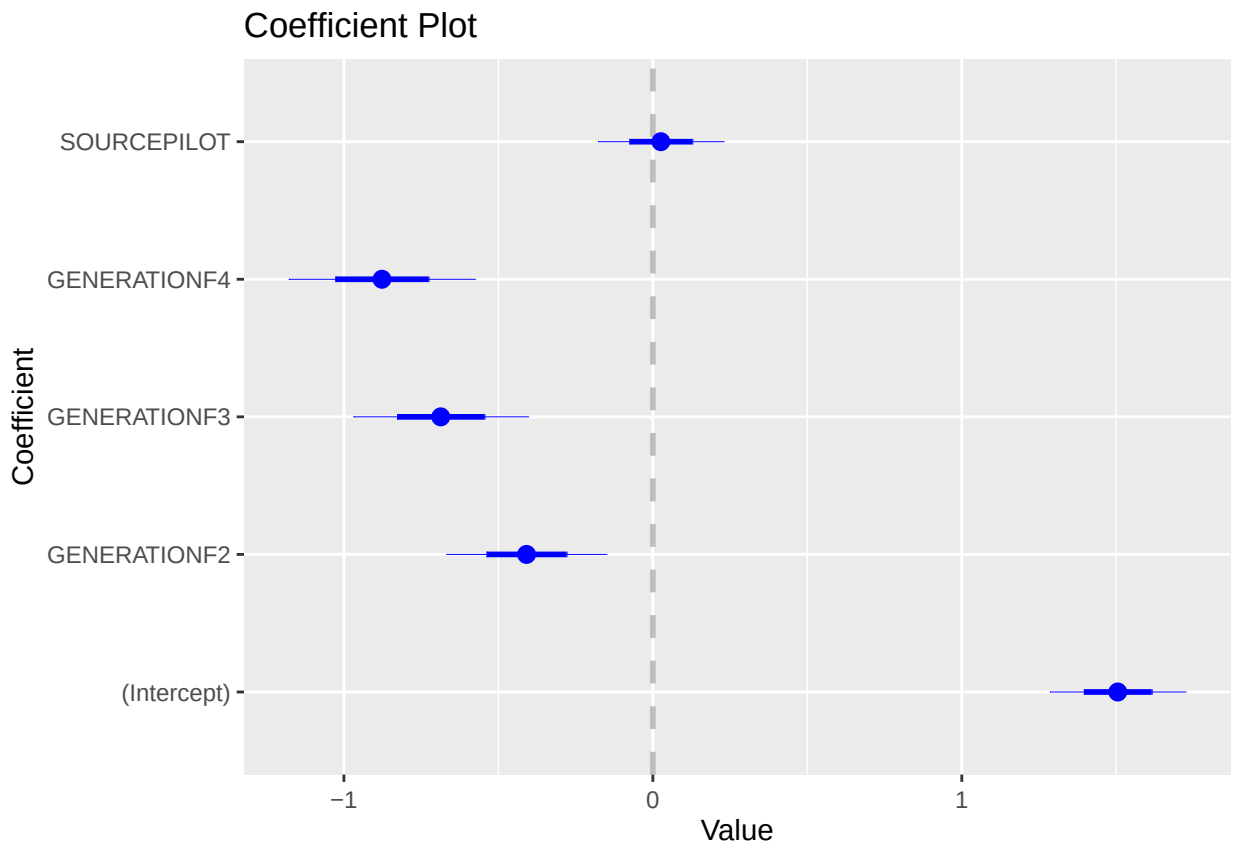
```
##
## Attaching package: 'arm'
```

```
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(post.hoc2)
```

```
## glmer(formula = RECALL ~ GENERATION + SOURCE + (1 | CHAIN), data = newdata2,
##     family = "poisson")
##              coef.est coef.se
## (Intercept)   1.50     0.11
## GENERATIONF2 -0.41     0.13
## GENERATIONF3 -0.69     0.14
## GENERATIONF4 -0.88     0.15
## SOURCEPILOT   0.03     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.20
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 453.1, DIC = -309.9
## deviance = 65.6
```

```
# Coefficient Plot of the Source Model for Condition 2
detach("package:arm", unload=TRUE)
coefplot(post.hoc2)
```




```
# Summary of the Interaction Model for Condition 2
library(arm)
```

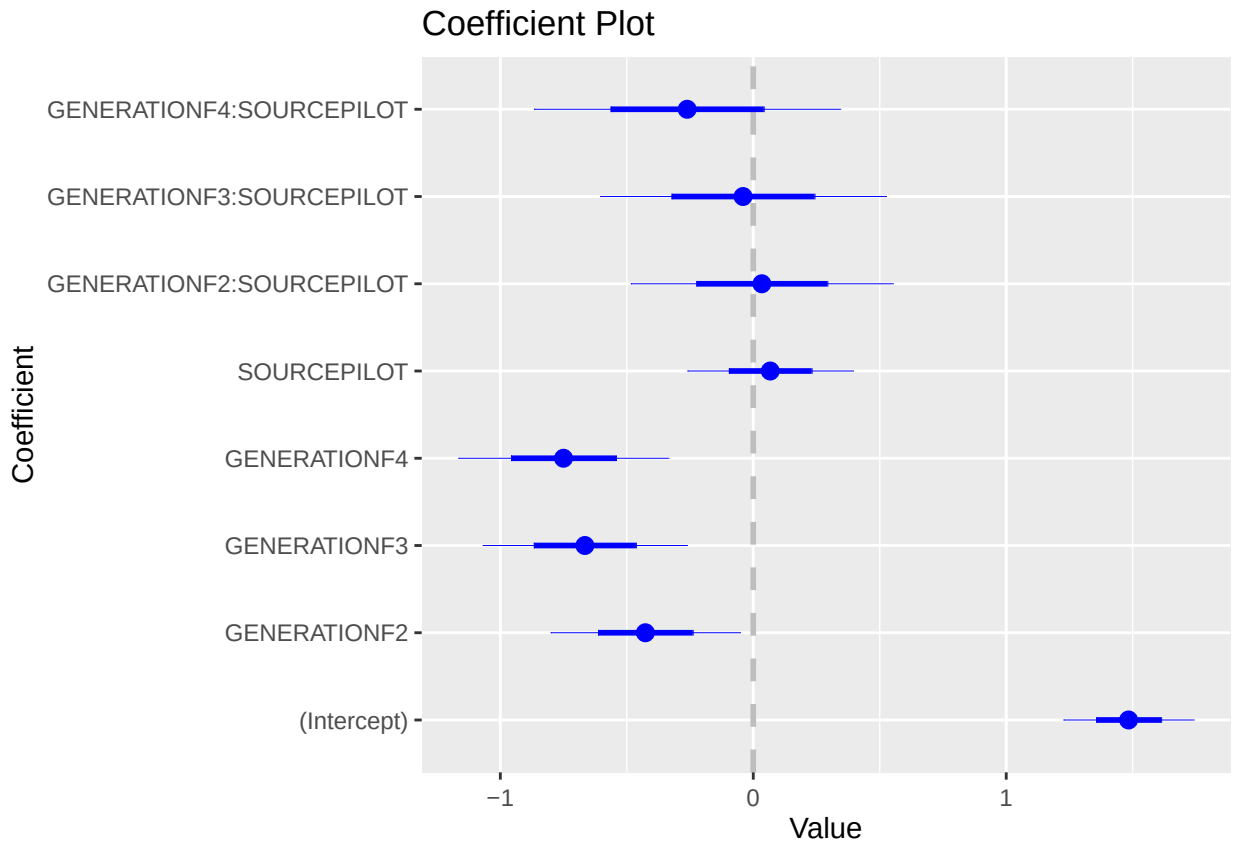
```
##
## arm (Version 1.10-1, built: 2018-4-12)
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
##
## Attaching package: 'arm'
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(interaction.post.hoc2)
```

```
## glmer(formula = RECALL ~ GENERATION * SOURCE + (1 | CHAIN), data = newdata2,
##     family = "poisson")
##                           coef.est coef.se
## (Intercept)                1.48     0.13
## GENERATIONF2              -0.43     0.19
## GENERATIONF3              -0.67     0.20
## GENERATIONF4              -0.75     0.21
## SOURCEPILOT                0.07     0.16
## GENERATIONF2:SOURCEPILOT   0.03     0.26
## GENERATIONF3:SOURCEPILOT  -0.04     0.28
## GENERATIONF4:SOURCEPILOT  -0.26     0.30
##
```

```
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.20
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 458.2, DIC = -310.8
## deviance = 64.7
```

```
# Coefficient Plot for the Interaction Model for Condition 2
detach("package:arm", unload=TRUE)
coefplot(interaction.post.hoc2)
```



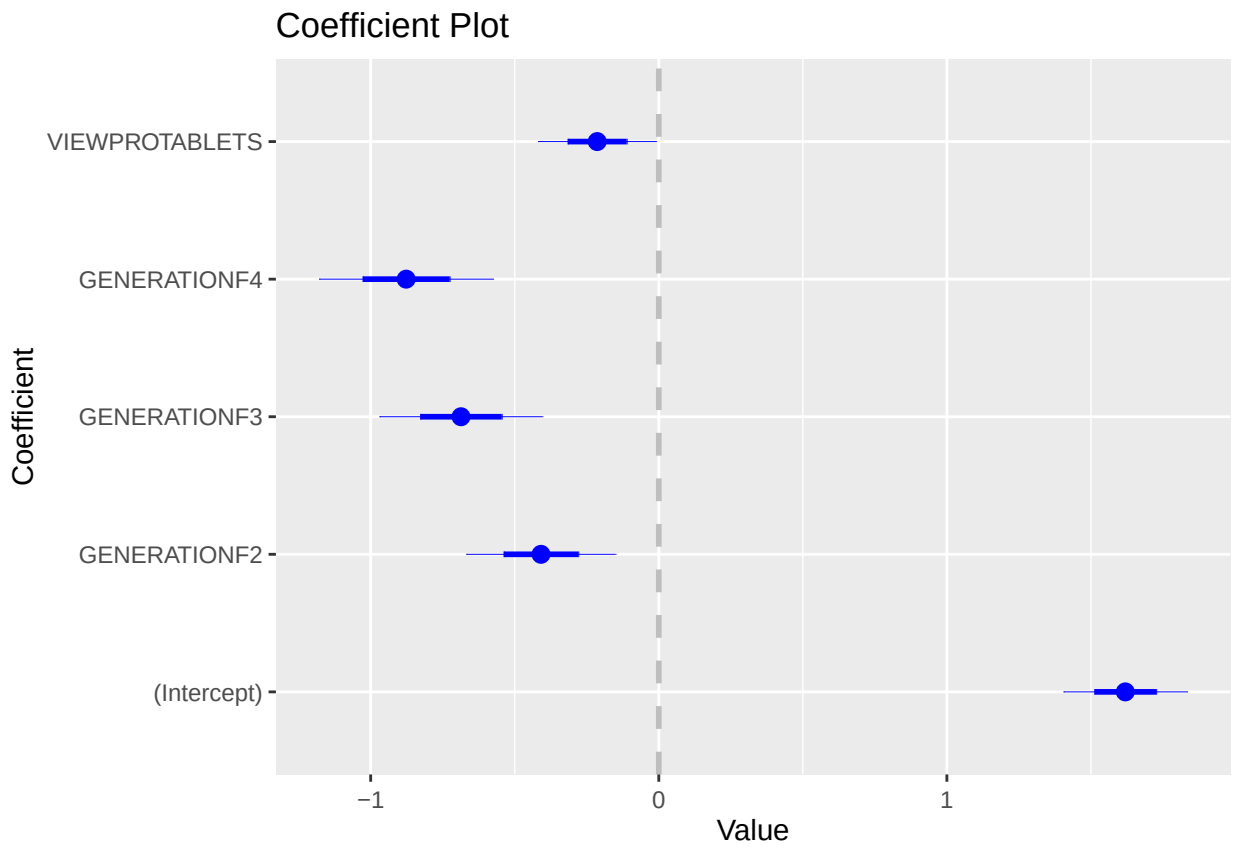

```
# Summary of the View Model for Condition 2
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)

## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a

##
## Attaching package: 'arm'

## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(view.post.hoc2)
```

```
## glmer(formula = RECALL ~ GENERATION + VIEW + (1 | CHAIN), data = newdata2,
##     family = "poisson")
##                coef.est coef.se
## (Intercept)     1.62     0.11
## GENERATIONF2   -0.41     0.13
## GENERATIONF3   -0.69     0.14
## GENERATIONF4   -0.88     0.15
## VIEWPROTABLETS -0.21     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.20
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 448.8, DIC = -314.2
## deviance = 61.3
```

```
# Coefficient Plot of the Source Model for Condition 2
detach("package:arm", unload=TRUE)
coefplot(view.post.hoc2)
```



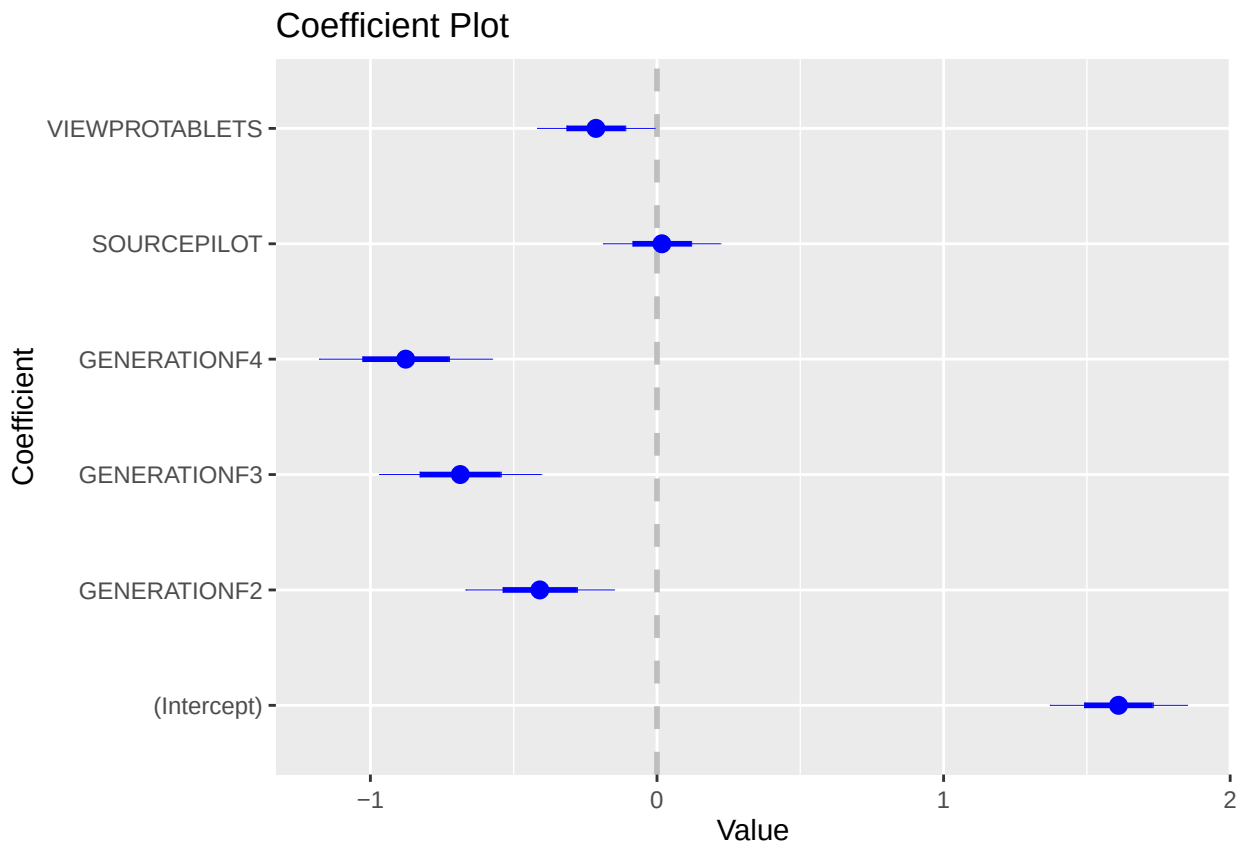

```
# Summary of the View Model for Condition 2
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)

## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a

##
## Attaching package: 'arm'

## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(sourceview.post.hoc2)
```

```
## glmer(formula = RECALL ~ GENERATION + SOURCE + VIEW + (1 | CHAIN),
##     data = newdata2, family = "poisson")
##                coef.est coef.se
## (Intercept)     1.61     0.12
## GENERATIONF2   -0.41     0.13
## GENERATIONF3   -0.69     0.14
## GENERATIONF4   -0.88     0.15
## SOURCEPILOT     0.02     0.10
## VIEWPROTABLETS -0.21     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.20
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 450.8, DIC = -314.1
## deviance = 61.3
```

```
# Coefficient Plot of the Source Model for Condition 2
detach("package:arm", unload=TRUE)
coefplot(sourceview.post.hoc2)
```



Identical conclusion as for the entire dataset

POSTHOC TEST FOR CONDITION 3

```
d <- within(d, SOURCE <- relevel(SOURCE, ref = 'PILOT'))
#  Condition 3: cleaner vs Head of the Department of Education of a leading university
newdata3 <- d[ which(d$CONDITION=="C3"), ] # Select data from condition 3
# Source model for Condition 3
post.hoc3<-glmer(RECALL ~ GENERATION + SOURCE + (1|CHAIN), newdata3, family = "poisson")
# Interaction model for Condition 3
interaction.post.hoc3<-glmer(RECALL ~ GENERATION * SOURCE + (1|CHAIN), newdata3, family = "poisson")
# Generation-only model for condition 3
generation.post.hoc3<-glmer(RECALL ~ GENERATION + (1|CHAIN), newdata3, family="poisson")
# View model for condition 3
view.post.hoc3<-glmer(RECALL ~ GENERATION + VIEW + (1|CHAIN), newdata3, family = "poisson")
# Source + view model
sourceview.post.hoc3<-glmer(RECALL ~ GENERATION + SOURCE+ VIEW + (1|CHAIN), newdata3, family = "poisson
# Model comparisons
AIC(post.hoc3, generation.post.hoc3, interaction.post.hoc3, view.post.hoc3, sourceview.post.hoc3)
```

```
##                        df      AIC
## post.hoc3               6 455.6835
## generation.post.hoc3    5 454.4344
## interaction.post.hoc3   9 459.3887
## view.post.hoc3          6 453.9356
```

```
## sourceview.post.hoc3   7 455.1987
```

```
# Summary of the Source Model for Condition 3
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)
```

```
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
```

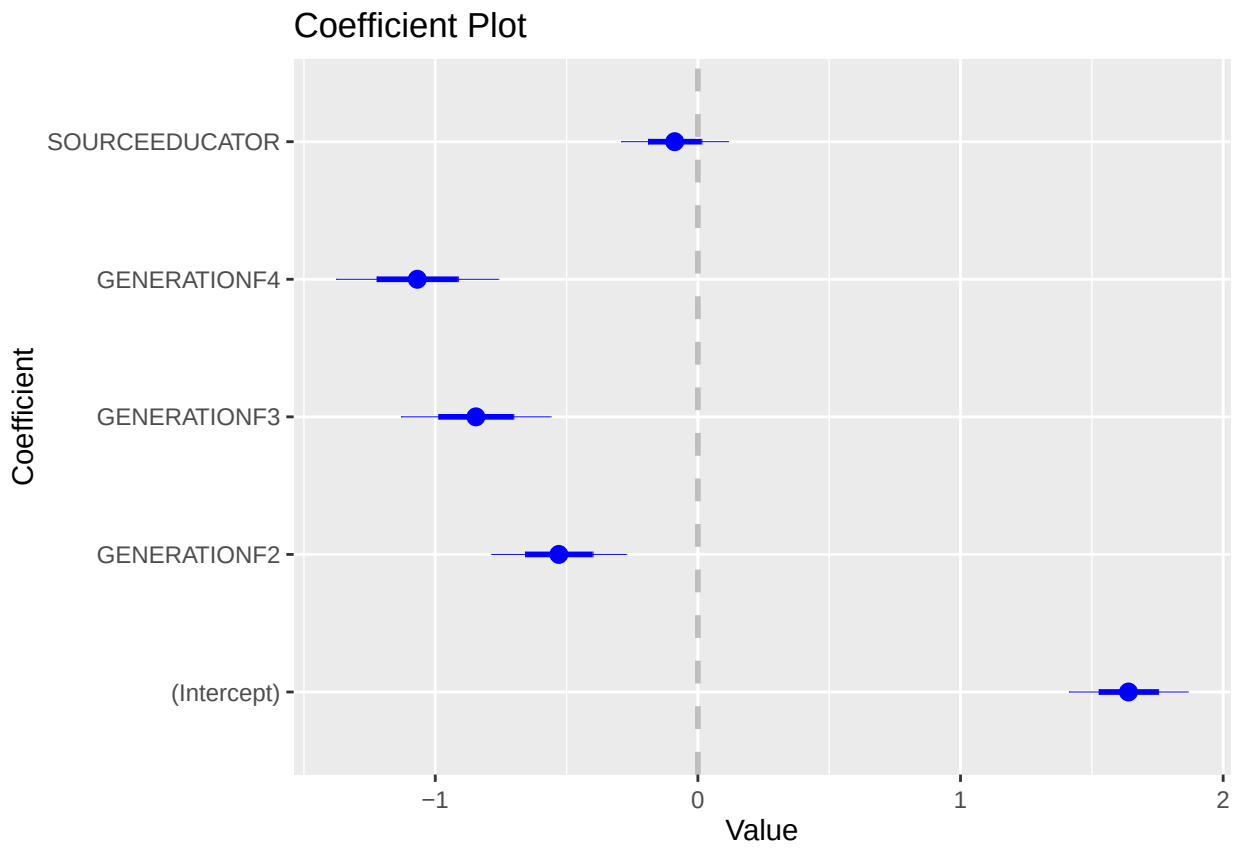
```
##
## Attaching package: 'arm'
```

```
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(post.hoc3)
```

```
## glmer(formula = RECALL ~ GENERATION + SOURCE + (1 | CHAIN), data = newdata3,
##     family = "poisson")
##                coef.est coef.se
## (Intercept)     1.64     0.11
## GENERATIONF2   -0.53     0.13
## GENERATIONF3   -0.85     0.14
## GENERATIONF4   -1.07     0.15
## SOURCEEDUCATOR -0.09     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.26
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 455.7, DIC = -299.5
## deviance = 72.1
```

```
# Coefficient Plot of the Source Model for Condition 3
detach("package:arm", unload=TRUE)
coefplot(post.hoc3)
```




```
# Summary of the Interaction Model for Condition 3
library(arm)
```

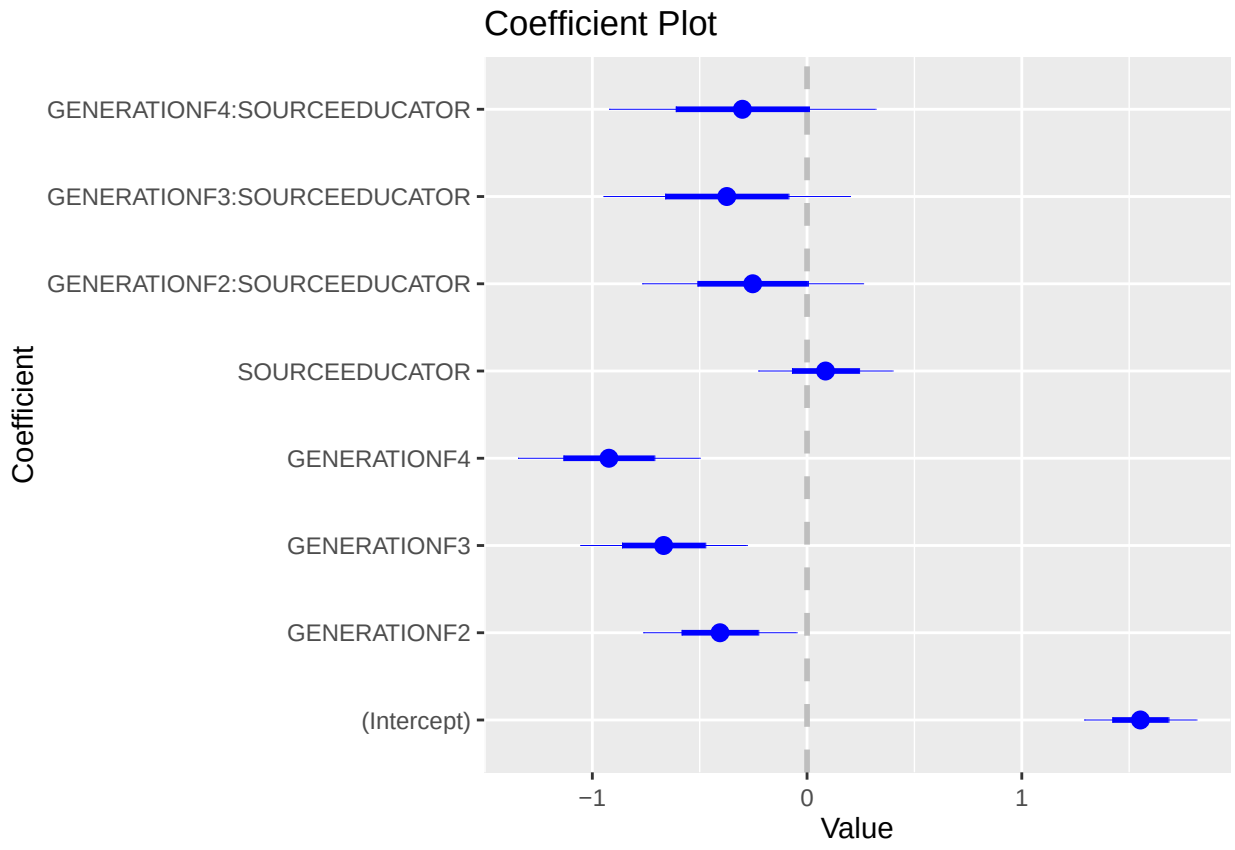
```
##
## arm (Version 1.10-1, built: 2018-4-12)
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
##
## Attaching package: 'arm'
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(interaction.post.hoc3)
```

```
## glmer(formula = RECALL ~ GENERATION * SOURCE + (1 | CHAIN), data = newdata3,
##     family = "poisson")
##                              coef.est coef.se
## (Intercept)                   1.55     0.13
## GENERATIONF2                 -0.41     0.18
## GENERATIONF3                 -0.67     0.19
## GENERATIONF4                 -0.92     0.21
## SOURCEEDUCATOR                0.09     0.16
## GENERATIONF2:SOURCEEDUCATOR -0.25     0.26
## GENERATIONF3:SOURCEEDUCATOR -0.37     0.29
## GENERATIONF4:SOURCEEDUCATOR -0.30     0.31
##
```

```
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.26
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 459.4, DIC = -301.8
## deviance = 69.8
```

```
# Coefficient Plot for the Interaction Model for Condition 3
detach("package:arm", unload=TRUE)
coefplot(interaction.post.hoc3)
```



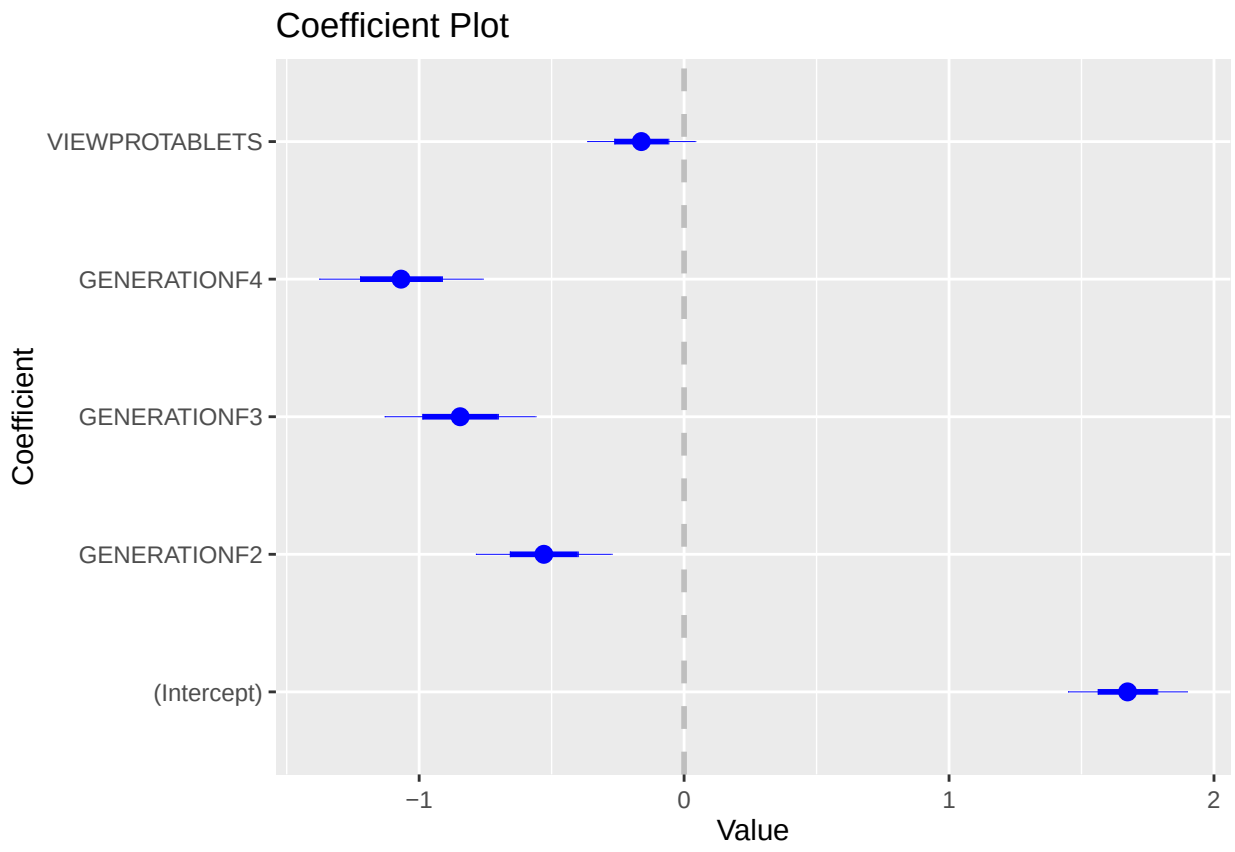

```
# Summary of the View Model for Condition 3
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)

## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a

##
## Attaching package: 'arm'

## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(view.post.hoc3)
```

```
## glmer(formula = RECALL ~ GENERATION + VIEW + (1 | CHAIN), data = newdata3,
##     family = "poisson")
##                coef.est coef.se
## (Intercept)     1.67     0.11
## GENERATIONF2   -0.53     0.13
## GENERATIONF3   -0.85     0.14
## GENERATIONF4   -1.07     0.15
## VIEWPROTABLETS -0.16     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.26
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 453.9, DIC = -301.2
## deviance = 70.3
```

```
# Coefficient Plot of the Source Model for Condition 3
detach("package:arm", unload=TRUE)
coefplot(view.post.hoc3)
```



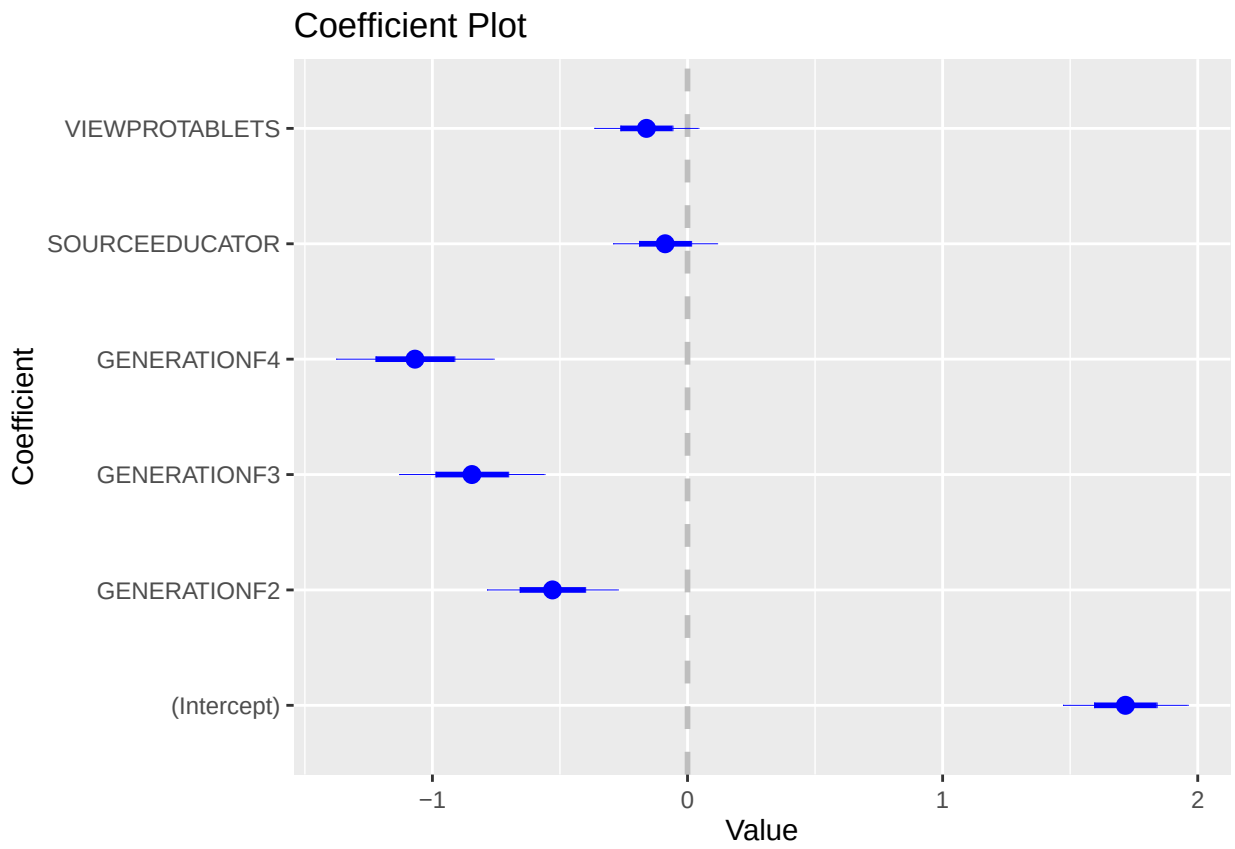

```
# Summary of the View Model for Condition 3
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)

## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a

##
## Attaching package: 'arm'

## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(sourceview.post.hoc3)
```

```
## glmer(formula = RECALL ~ GENERATION + SOURCE + VIEW + (1 | CHAIN),
##     data = newdata3, family = "poisson")
##                coef.est coef.se
## (Intercept)     1.72     0.12
## GENERATIONF2   -0.53     0.13
## GENERATIONF3   -0.85     0.14
## GENERATIONF4   -1.07     0.15
## SOURCEEDUCATOR -0.09     0.10
## VIEWPROTABLETS -0.16     0.10
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.26
##  Residual             1.00
## ---
## number of obs: 128, groups: CHAIN, 16
## AIC = 455.2, DIC = -302
## deviance = 69.6
```

```
# Coefficient Plot of the Source Model for Condition 3
detach("package:arm", unload=TRUE)
coefplot(sourceview.post.hoc3)
```



Conclusions are the same as for the entire dataset

ALTERNATIVE WAY TO ANALYSE THE DATA

Instead of assuming that both the Head of Education of a leading university and the Airline Pilot are high prestige for everybody and that the Head of Education is relevant for the topic but the Airline Pilot is not relevant, we use participants' ratings of prestige and relevance for predicting recall.

```
# Prestige model
mo.5a<-glmer(RECALL ~ GENERATION + PRESTIGE + (1|CHAIN), data = d, family = "poisson")
# Relevance Model
mo.5b<-glmer(RECALL ~ GENERATION + RELEVANCE + (1|CHAIN), data = d, family = "poisson")
# Prestige + Relevance Model
mo.5c<-glmer(RECALL ~ GENERATION + PRESTIGE + RELEVANCE + (1|CHAIN), data = d, family = "poisson")
# Interaction Model
mo.5d<-glmer(RECALL ~ GENERATION + PRESTIGE * RELEVANCE + (1|CHAIN), data = d, family = "poisson")
```

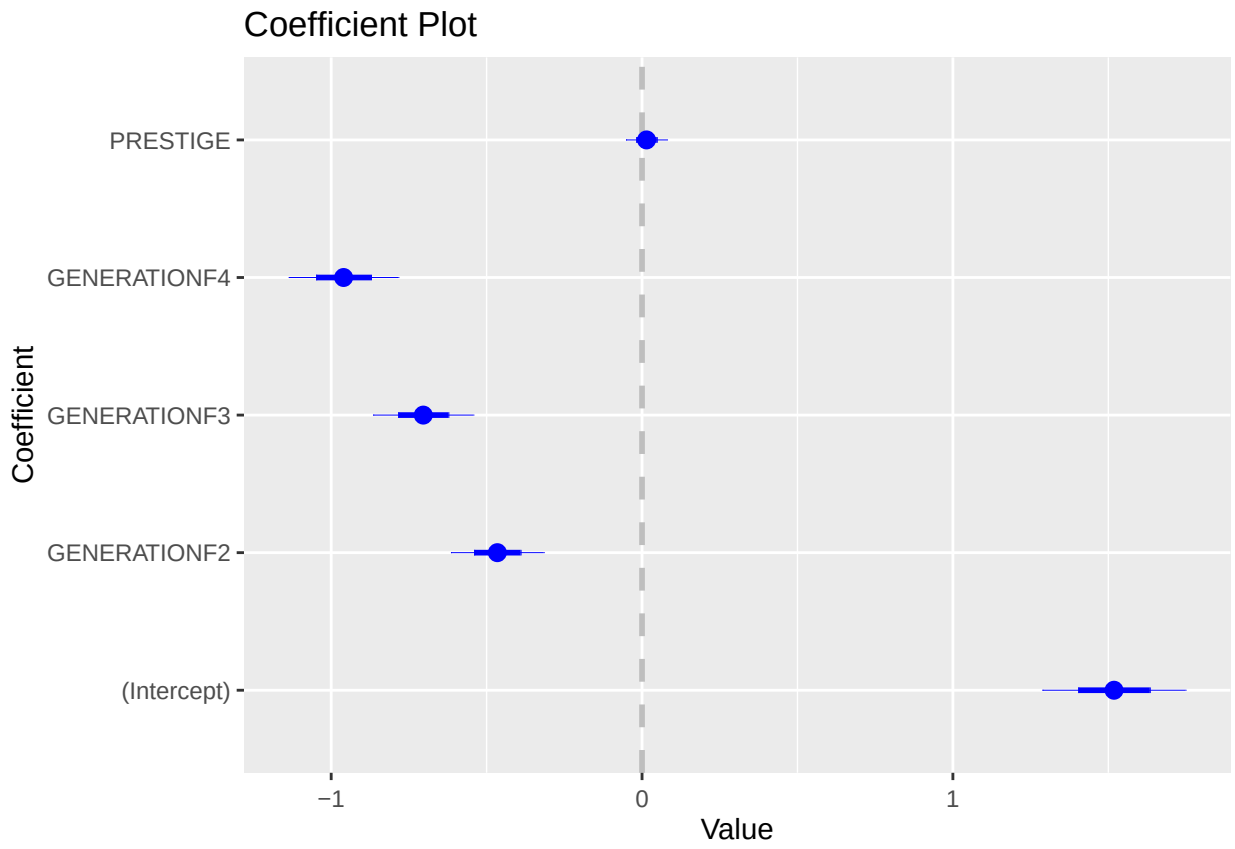
```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl =
## control$checkConv, : Model failed to converge with max|grad| = 0.00139646
## (tol = 0.001, component 1)
```

```
# Model Comparisons
AIC(mo.1b, mo.5a, mo.5b, mo.5c, mo.5d)
```

```
##       df      AIC
## mo.1b  5 1331.987
```

```
## mo.5a  6 1333.795
## mo.5b  6 1333.836
## mo.5c  7 1335.739
## mo.5d  8 1336.281
```

```
# Coefficient plot for Prestige Model
coefplot (mo.5a)
```




```
# Summary for Prestige Model
library(arm)
```

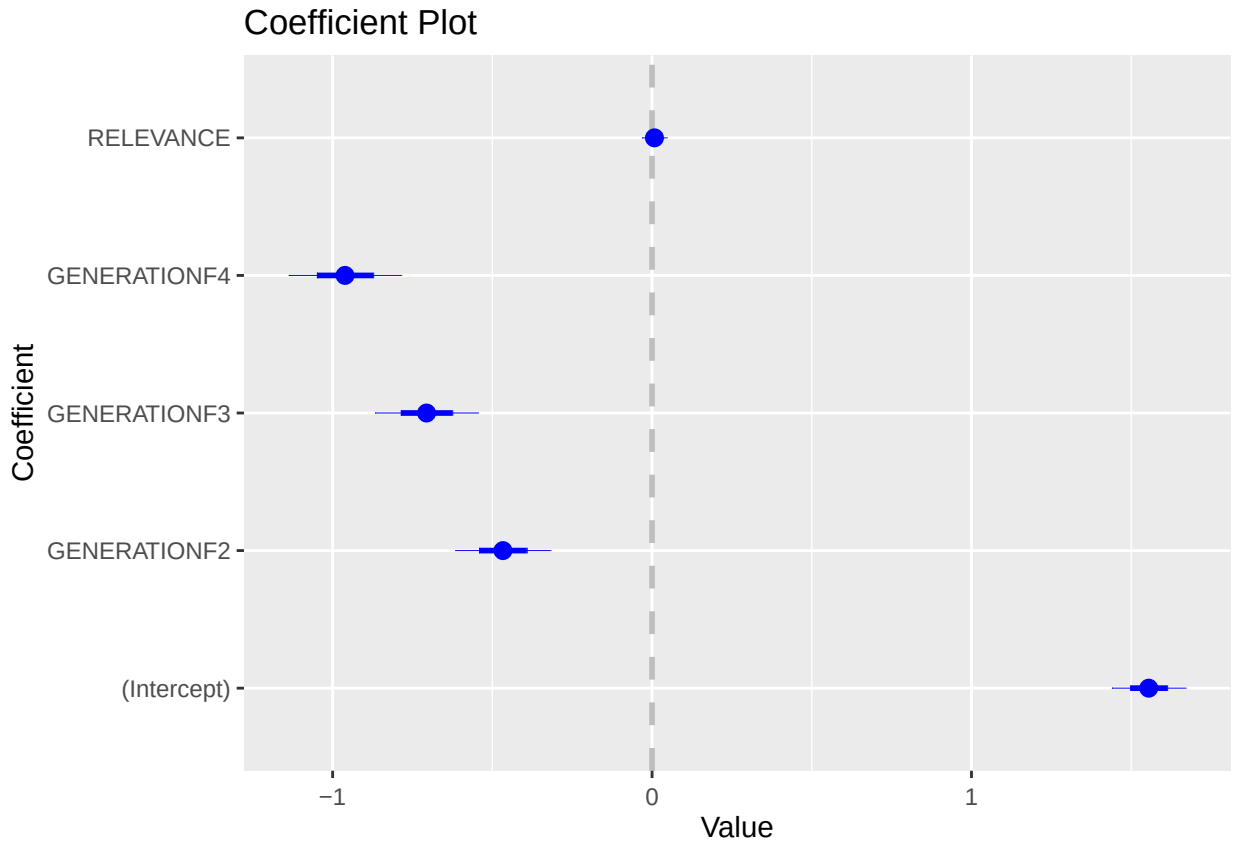
```
##
## arm (Version 1.10-1, built: 2018-4-12)
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
##
## Attaching package: 'arm'
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(mo.5a)
```

```
## glmer(formula = RECALL ~ GENERATION + PRESTIGE + (1 | CHAIN),
##     data = d, family = "poisson")
##              coef.est coef.se
## (Intercept)   1.52     0.12
## GENERATIONF2 -0.47     0.07
```

```
## GENERATIONF3 -0.70     0.08
## GENERATIONF4 -0.96     0.09
## PRESTIGE      0.01     0.03
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.18
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1333.8, DIC = -919.5
## deviance = 201.1
```

```
# Coefficient Plot for Relevance Model
detach("package:arm", unload=TRUE)
coefplot(mo.5b)
```




```
# Summary for Relevance Model
library(arm)
```

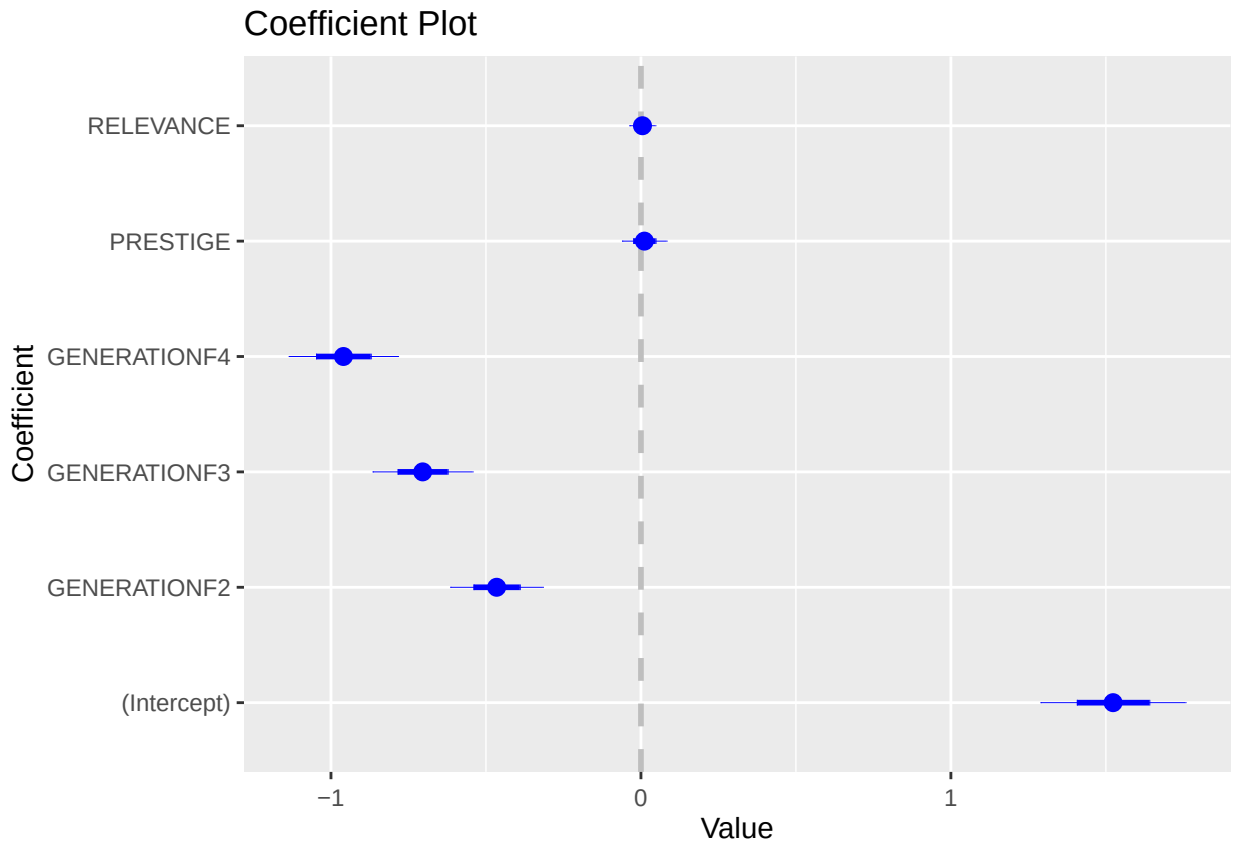
```
##
## arm (Version 1.10-1, built: 2018-4-12)

## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a

##
## Attaching package: 'arm'

## The following objects are masked from 'package:coefplot':
```

```
##
##     coefplot, coefplot.default, invlogit
```

```
display(mo.5b)
```

```
## glmer(formula = RECALL ~ GENERATION + RELEVANCE + (1 | CHAIN),
##     data = d, family = "poisson")
##              coef.est coef.se
## (Intercept)   1.55     0.06
## GENERATIONF2 -0.47     0.07
## GENERATIONF3 -0.71     0.08
## GENERATIONF4 -0.96     0.09
## RELEVANCE     0.01     0.02
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.18
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1333.8, DIC = -919.8
## deviance = 201.0
```

```
# Coefficient Plot for Interaction Model
detach("package:arm", unload=TRUE)
coefplot(mo.5c)
```



```r
# Summary for Interaction Model
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)
```

```
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
```

```
##
## Attaching package: 'arm'
```

```
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```r
display(mo.5c)
```

```
## glmer(formula = RECALL ~ GENERATION + PRESTIGE + RELEVANCE +
##     (1 | CHAIN), data = d, family = "poisson")
##              coef.est coef.se
## (Intercept)   1.52     0.12
## GENERATIONF2 -0.47     0.07
## GENERATIONF3 -0.70     0.08
## GENERATIONF4 -0.96     0.09
## PRESTIGE      0.01     0.04
## RELEVANCE     0.00     0.02
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.18
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1335.7, DIC = -919.4
## deviance = 201.2
```

same conclusion

```r
# Prestige model
mo.6a<-glmer(RECALL ~ GENERATION + PRESTIGE + VIEW + (1|CHAIN), data = d, family = "poisson")
# Relevance Model
mo.6b<-glmer(RECALL ~ GENERATION + RELEVANCE + VIEW + (1|CHAIN), data = d, family = "poisson")
# Prestige + Relevance Model
mo.6c<-glmer(RECALL ~ GENERATION + PRESTIGE + RELEVANCE + VIEW + (1|CHAIN), data = d, family = "poisson
# Interaction Model
mo.6d<-glmer(RECALL ~ GENERATION + PRESTIGE * RELEVANCE + VIEW +(1|CHAIN), data = d, family = "poisson"
```

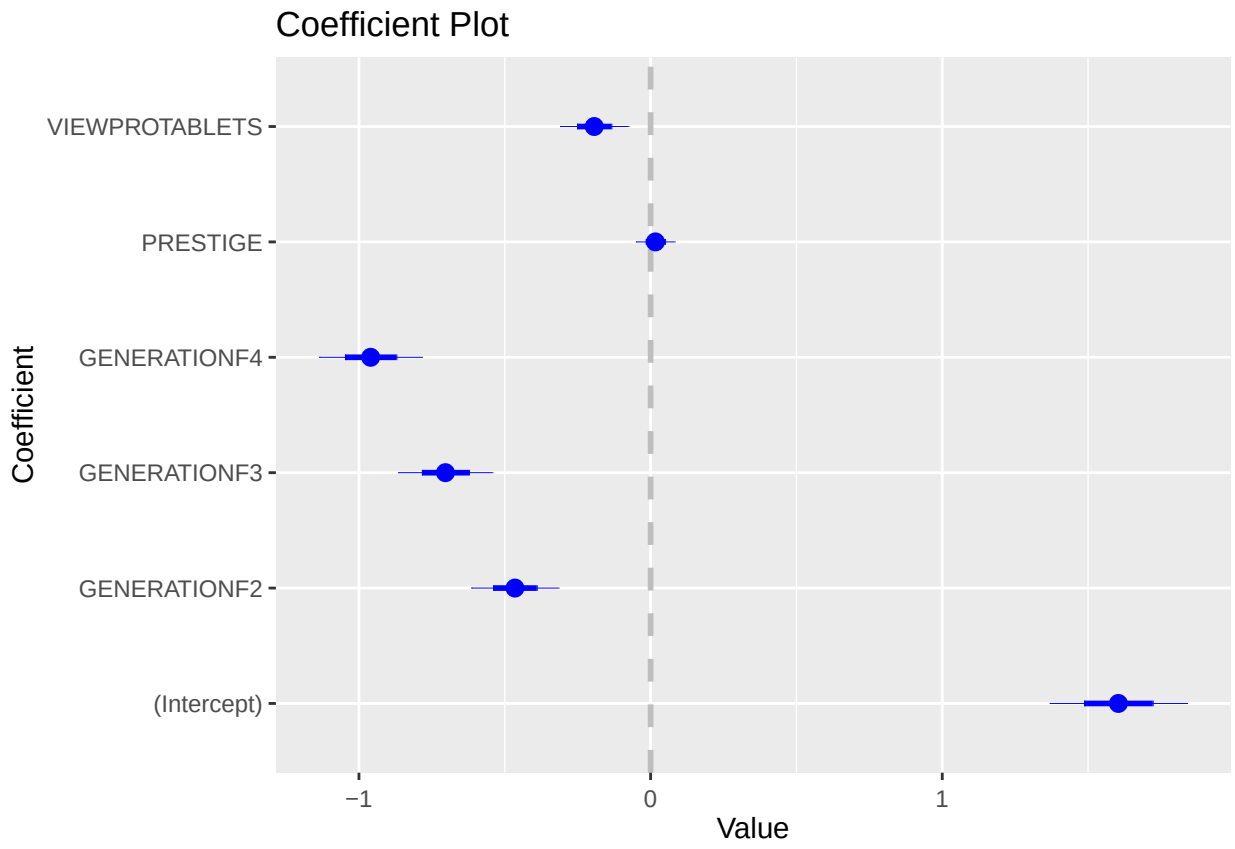
```
## Warning in checkConv(attr(opt, "derivs"), opt$par, ctrl =
## control$checkConv, : Model failed to converge with max|grad| = 0.00543 (tol
## = 0.001, component 1)
```

```r
AIC(mo.2a,mo.6a, mo.6b, mo.6c, mo.6d)
```

```
##       df      AIC
## mo.2a  6 1323.213
## mo.6a  7 1324.962
## mo.6b  7 1325.185
## mo.6c  8 1326.961
```

```
## mo.6d  9 1327.016
```

```
detach("package:arm", unload=TRUE)
coefplot(mo.6a)
```




```
# Summary for Interaction Model
library(arm)
```

```
##
## arm (Version 1.10-1, built: 2018-4-12)
## Working directory is C:/Users/aj419/OneDrive - University of Exeter/2019/THESIS/CHAPTER 4 (tablets)/a
##
## Attaching package: 'arm'
## The following objects are masked from 'package:coefplot':
##
##     coefplot, coefplot.default, invlogit
```

```
display(mo.6a)
```

```
## glmer(formula = RECALL ~ GENERATION + PRESTIGE + VIEW + (1 |
##     CHAIN), data = d, family = "poisson")
##                coef.est coef.se
## (Intercept)     1.60     0.12
## GENERATIONF2   -0.47     0.07
## GENERATIONF3   -0.70     0.08
## GENERATIONF4   -0.96     0.09
```

```
## PRESTIGE        0.02     0.03
## VIEWPROTABLETS -0.19     0.06
##
## Error terms:
##  Groups   Name        Std.Dev.
##  CHAIN    (Intercept) 0.18
##  Residual             1.00
## ---
## number of obs: 384, groups: CHAIN, 48
## AIC = 1325, DIC = -930.2
## deviance = 190.4
```

same conclusion

PROBLEMS

ratings of prestige and relevance are assumed to be continuous when they are ordinal. It would be better to model them as monotonic effects.

Similarly generation should be modelled as a monotonic effect.

REFERENCES

Harrison XA. (2014) Using observation-level random effects to model overdispersion in count data in ecology and evolution. PeerJ 2:e616 https://doi.org/10.7717/peerj.616