

Experiment 1

Load packages and data files

```
library(languageR)
library(Matrix)
library(lme4)
library(lattice)
library(MASS)
library(plyr)
library(tables)

rm(list=ls())

datafile = read.csv("/Users/maryamaljassmi/Arabic Predictability Study/Experiment 1.csv", sep = ",", de
colnames(datafile)

## [1] "participant"          "item"
## [3] "predictability"       "target_word_length"
## [5] "ortho_frequency"      "cloze_scores"
## [7] "norm_scores"          "word.class"
## [9] "TRT"                  "SFD"
## [11] "FFD"                  "GD"
## [13] "RP"                   "FFC"
## [15] "LP"                   "LS"
## [17] "LS_including_skipped_TW" "SA"
## [19] "FC"                   "RI"
## [21] "RO"                   "RPD"
## [23] "SKIP"                 "SPILLOVER"
## [25] "Blinks"               "Track_loss"
## [27] "Long_saccades"        "Index"
## [29] "remove.trial"

#### Specify which column your participant, stimuli and condition are in ####
col.subject = 1
col.stim = 2
col.condition = 3

#### Set exclusion criteria
crit = 2.5

# choose dependent variable
measure = "FFD"

# add to dataframe
datafile$depvar = datafile[,measure]
```

Assign the correct class

```
# Work out which columns the fixed and random factors are in
datafile$pp = datafile[,col.subject]
datafile$condition = datafile[,col.condition]
datafile$stim = datafile[,col.stim]

# make sure all the variables are from the correct class
datafile$depvar = as.numeric(datafile$depvar)
datafile$pp = as.factor(datafile$pp)
datafile$stim = as.factor(datafile$stim)
datafile$condition = as.factor(datafile$condition)

#### Inspect and double check ####
str(datafile)
```

```
## 'data.frame': 2880 obs. of 33 variables:
## $ participant : chr "p1" "p1" "p1" "p1" ...
## $ item : chr "i1" "i2" "i3" "i4" ...
## $ predictability : chr "Predictable" "Unpredictable" "Predictable" "Unpredictable" ...
## $ target_word_length : int 7 6 5 6 7 8 8 6 6 6 ...
## $ ortho_frequency : num 109.1 101.6 30.7 10.8 17.4 ...
## $ cloze_scores : num 100 0 100 0 91.7 91.7 79.2 100 66.7 0 ...
## $ norm_scores : num 4.8 3.5 4.9 3.3 4.7 4.5 4.9 4.6 4.8 3.5 ...
## $ word.class : chr "noun" "noun" "noun" "noun" ...
## $ TRT : int 228 NA 392 NA 411 225 NA 187 207 499 ...
## $ SFD : int 228 NA 392 NA 411 225 NA 187 207 NA ...
## $ FFD : int 228 NA 392 NA 411 225 NA 187 207 320 ...
## $ GD : int 228 NA 392 NA 411 225 NA 187 207 499 ...
## $ RP : int 0 NA 0 NA 0 0 NA 0 0 1 ...
## $ FFC : int 1 NA 1 NA 1 1 NA 1 1 2 ...
## $ LP : num 43.6 NA 11.2 NA 53.4 23.8 NA 37.6 24.5 10 ...
## $ LS : num 28.1 NA 66.3 NA 28.5 62.8 NA 57.7 39.9 52.7 ...
## $ LS_including_skipped_TW: num 28.1 NA 66.3 NA 28.5 62.8 NA 57.7 39.9 52.7 ...
## $ SA : num 1.56 NA 1.63 NA 1.4 1.78 NA 1.67 1.12 1.34 ...
## $ FC : int 1 NA 1 NA 1 1 NA 1 1 2 ...
## $ RI : int 0 NA 0 NA 0 0 NA 0 0 0 ...
## $ RO : int 0 NA 0 NA 0 1 NA 1 0 0 ...
## $ RPD : int 228 NA 392 NA 411 427 NA 582 207 499 ...
## $ SKIP : int 0 NA 0 NA 0 0 NA 0 0 0 ...
## $ SPILLOVER : int 197 NA 421 NA 410 291 NA 379 NA NA ...
## $ Blinks : int 0 1 0 1 0 0 1 0 0 0 ...
## $ Track_loss : int 0 0 0 0 0 0 0 0 0 0 ...
## $ Long_saccades : int 0 0 0 0 0 0 0 0 0 0 ...
## $ Index : chr "p1i7" "p1i6" "p1i9" "p1i11" ...
## $ remove.trial : int 0 1 0 1 0 0 1 0 0 0 ...
## $ depvar : num 228 NA 392 NA 411 225 NA 187 207 320 ...
## $ pp : Factor w/ 40 levels "p1","p10","p11",...: 1 1 1 1 1 1 1 1 1 1 ...
## $ condition : Factor w/ 2 levels "Predictable",...: 1 2 1 2 1 1 1 1 2 ...
## $ stim : Factor w/ 72 levels "i1","i10","i11",...: 1 12 23 34 45 56 67 71 72 2 ...
```

```
summary(datafile)
```

```
## participant          item          predictability    target_word_length
## Length:2880          Length:2880          Length:2880          Min.    :4.000
## Class :character      Class :character      Class :character      1st Qu.:5.000
## Mode  :character      Mode  :character      Mode  :character      Median :6.000
##                                                                Mean  :5.958
##                                                                3rd Qu.:7.000
##                                                                Max.   :8.000
##
## ortho_frequency      cloze_scores      norm_scores      word.class
## Min.    : 0.030      Min.    : 0.00      Min.    :2.400      Length:2880
## 1st Qu.: 5.195      1st Qu.: 0.00      1st Qu.:3.600      Class :character
## Median : 23.640      Median : 37.50      Median :4.400      Mode  :character
## Mean    : 68.271      Mean    : 44.47      Mean    :4.117
## 3rd Qu.: 57.653      3rd Qu.: 91.70      3rd Qu.:4.700
## Max.    :1388.180      Max.    :100.00      Max.    :5.000
##
##          TRT          SFD          FFD          GD
## Min.    : 82.0      Min.    : 82.0      Min.    : 82.0      Min.    : 82.0
## 1st Qu.: 223.5      1st Qu.: 207.0      1st Qu.: 201.0      1st Qu.: 215.0
## Median : 290.0      Median : 246.0      Median : 241.0      Median : 267.0
## Mean    : 349.7      Mean    : 267.1      Mean    : 262.2      Mean    : 306.9
## 3rd Qu.: 422.0      3rd Qu.: 300.0      3rd Qu.: 295.0      3rd Qu.: 363.0
## Max.    :1462.0      Max.    :1033.0      Max.    :1033.0      Max.    :1420.0
## NA's    :501        NA's    :984        NA's    :529        NA's    :529
##          RP          FFC          LP          LS
## Min.    :0.0000      Min.    :1.000      Min.    : 0.10      Min.    : 0.10
## 1st Qu.:0.0000      1st Qu.:1.000      1st Qu.:16.75      1st Qu.: 17.60
## Median :0.0000      Median :1.000      Median :29.50      Median : 34.55
## Mean    :0.1935      Mean    :1.205      Mean    :29.88      Mean    : 39.19
## 3rd Qu.:0.0000      3rd Qu.:1.000      3rd Qu.:42.30      3rd Qu.: 56.58
## Max.    :1.0000      Max.    :4.000      Max.    :74.90      Max.    :327.00
## NA's    :529        NA's    :529        NA's    :529        NA's    :338
## LS_including_skipped_TW      SA          FC          RI
## Min.    : 0.10          Min.    :0.200      Min.    :0.000      Min.    :0.0000
## 1st Qu.: 17.60          1st Qu.:1.120      1st Qu.:1.000      1st Qu.:0.0000
## Median : 34.55          Median :1.430      Median :1.000      Median :0.0000
## Mean    : 39.19          Mean    :1.455      Mean    :1.297      Mean    :0.0621
## 3rd Qu.: 56.58          3rd Qu.:1.770      3rd Qu.:2.000      3rd Qu.:0.0000
## Max.    :327.00          Max.    :2.760      Max.    :6.000      Max.    :1.0000
## NA's    :338          NA's    :501        NA's    :338        NA's    :529
##          RO          RPD          SKIP          SPILLOVER
## Min.    :0.00          Min.    : 82.0      Min.    :0.0000      Min.    : 82.0
## 1st Qu.:0.00          1st Qu.: 221.0      1st Qu.:0.0000      1st Qu.: 199.0
## Median :0.00          Median : 277.0      Median :0.0000      Median : 239.0
## Mean    :0.06          Mean    : 336.5      Mean    :0.0751      Mean    : 260.1
## 3rd Qu.:0.00          3rd Qu.: 388.5      3rd Qu.:0.0000      3rd Qu.: 297.0
## Max.    :1.00          Max.    :2714.0      Max.    :1.0000      Max.    :1036.0
## NA's    :529          NA's    :529        NA's    :338        NA's    :1313
##          Blinks      Track_loss      Long_saccades      Index
## Min.    :0.0000      Min.    :0.0000000      Min.    :0.0000      Length:2880
## 1st Qu.:0.0000      1st Qu.:0.0000000      1st Qu.:0.0000      Class :character
```

```
## Median :0.0000 Median :0.0000000 Median :0.0000 Mode :character
## Mean :0.1052 Mean :0.0003472 Mean :0.0125
## 3rd Qu.:0.0000 3rd Qu.:0.0000000 3rd Qu.:0.0000
## Max. :1.0000 Max. :1.0000000 Max. :1.0000
##
## remove.trial      depvar      pp      condition
## Min. :0.0000 Min. : 82.0 p1 : 72 Predictable :1440
## 1st Qu.:0.0000 1st Qu.: 201.0 p10 : 72 Unpredictable:1440
## Median :0.0000 Median : 241.0 p11 : 72
## Mean :0.1174 Mean : 262.2 p12 : 72
## 3rd Qu.:0.0000 3rd Qu.: 295.0 p13 : 72
## Max. :1.0000 Max. :1033.0 p14 : 72
## NA's :529 (Other):2448
##
## stim
## i1 : 40
## i10 : 40
## i11 : 40
## i12 : 40
## i13 : 40
## i14 : 40
## (Other):2640
```

```
#find means (per participant, per condition)
```

```
mean.tt = tapply(datafile$depvar, list(datafile$pp, datafile$condition), mean, na.rm = T)
mean.tt
```

```
## Predictable Unpredictable
## p1 253.5600 301.8333
## p10 216.5000 229.2500
## p11 218.7742 222.5938
## p12 230.7742 240.5667
## p13 338.0000 336.5667
## p14 224.3000 224.7879
## p15 234.6875 261.9375
## p16 256.0294 257.5294
## p17 252.5333 247.3750
## p18 270.2222 292.4800
## p19 212.5312 219.6765
## p2 234.0000 277.4516
## p20 330.5185 392.2917
## p21 253.2308 243.8966
## p22 281.8966 317.3929
## p23 303.4286 346.7727
## p24 249.2069 290.9688
## p25 275.9118 285.7714
## p26 220.9000 247.1613
## p27 233.0938 236.7241
## p28 221.1600 303.1818
## p29 245.0741 228.8966
## p3 261.7576 244.8966
## p30 231.6562 242.5152
## p31 253.6562 271.5862
## p32 222.9310 224.2333
## p33 240.2188 247.3333
```

```
## p34      294.8485      320.4194
## p35      281.1071      321.5625
## p36      334.0323      311.2121
## p37      240.0938      290.8125
## p38      277.7500      254.6667
## p39      239.6818      280.7059
## p4       282.5789      283.6667
## p40      277.8710      269.4828
## p5       233.6562      258.9286
## p6       221.4412      235.5806
## p7       259.5714      309.6364
## p8       290.2593      281.9655
## p9       225.0909      227.6857
```

```
#find sds (per participant, per condition)
sd.tt = apply(datafile$depvar, list(datafile$pp, datafile$condition), sd, na.rm = T)
sd.tt
```

```
##      Predictable Unpredictable
## p1      73.06166      79.72323
## p10     50.07478      66.05140
## p11     60.92603      59.31972
## p12     76.14053     146.27529
## p13    152.74816     143.98580
## p14     66.73372      75.09442
## p15     53.14159     131.19327
## p16     96.50702     107.96274
## p17     79.42584      55.51092
## p18     67.07535     104.14978
## p19     64.44552      56.51265
## p2      50.86809     110.46865
## p20    118.82837     165.05427
## p21    118.65759      90.82965
## p22     92.52195     129.61977
## p23    118.95671     205.29095
## p24     86.53545     110.19469
## p25     50.22758     103.10762
## p26     43.82910      65.47829
## p27     68.72590      93.93269
## p28     65.13299      84.65990
## p29     46.22680      43.85801
## p3     100.22195     118.32804
## p30     88.92244      82.46443
## p31     80.14246     124.11070
## p32     52.13782      43.57133
## p33     67.01070      60.36003
## p34     82.67713     128.95549
## p35     55.88105      81.31021
## p36    141.34225      92.58738
## p37     66.44151     103.79677
## p38     49.08666      56.09950
## p39     61.73012      54.78454
## p4      91.29885      62.92323
## p40     95.76734      99.86906
```

```
## p5      77.20213      82.56532
## p6      60.33301      64.71876
## p7      41.06042     102.46366
## p8     166.73392      75.65074
## p9      64.03093      45.06190
```

```
nrcolumns = ncol(datafile)  # We'll be using this for cleanup later

#let's first have a look
head(datafile)
```

Remove outliers

```
## participant item predictability target_word_length ortho_frequency
## 1          p1 i1 Predictable                7          109.13
## 2          p1 i2 Unpredictable              6          101.59
## 3          p1 i3 Predictable                5           30.69
## 4          p1 i4 Unpredictable              6           10.85
## 5          p1 i5 Predictable                7           17.37
## 6          p1 i6 Predictable                8           74.96
## cloze_scores norm_scores word.class TRT SFD FFD GD RP FFC LP LS
## 1          100.0         4.8      noun  228 228 228 228 0  1 43.6 28.1
## 2           0.0         3.5      noun   NA  NA  NA  NA NA NA  NA  NA
## 3          100.0         4.9      noun  392 392 392 392 0  1 11.2 66.3
## 4           0.0         3.3      noun   NA  NA  NA  NA NA NA  NA  NA
## 5          91.7         4.7      noun  411 411 411 411 0  1 53.4 28.5
## 6          91.7         4.5      noun  225 225 225 225 0  1 23.8 62.8
## LS_including_skipped_TW SA FC RI RO RPD SKIP SPILLOVER Blinks Track_loss
## 1          28.1 1.56  1  0  0 228  0          197  0          0
## 2           NA  NA NA NA NA NA  NA          NA  1          0
## 3          66.3 1.63  1  0  0 392  0          421  0          0
## 4           NA  NA NA NA NA NA  NA          NA  1          0
## 5          28.5 1.40  1  0  0 411  0          410  0          0
## 6          62.8 1.78  1  0  1 427  0          291  0          0
## Long_saccades Index remove.trial depvar pp condition stim
## 1           0 p1i7              0    228 p1 Predictable i1
## 2           0 p1i6              1     NA p1 Unpredictable i2
## 3           0 p1i9              0    392 p1 Predictable i3
## 4           0 p1i11             1     NA p1 Unpredictable i4
## 5           0 p1i12             0    411 p1 Predictable i5
## 6           0 p1i16             0    225 p1 Predictable i6
```

```
# make a new datafile with fixation durations > 0 ms
datafile_2 = datafile[datafile$depvar > 0, ]
head(datafile_2)
```

```
## participant item predictability target_word_length ortho_frequency
## 1          p1 i1 Predictable                7          109.13
## NA         <NA> <NA>          <NA>            NA           NA
## 3          p1 i3 Predictable                5           30.69
```

```

## NA.1      <NA> <NA>      <NA>      NA      NA
## 5         p1  i5    Predictable      7      17.37
## 6         p1  i6    Predictable      8      74.96
##      cloze_scores norm_scores word.class TRT SFD FFD  GD RP FFC  LP  LS
## 1         100.0      4.8      noun 228 228 228 228 0  1 43.6 28.1
## NA         NA      NA      <NA>  NA  NA  NA  NA NA  NA  NA  NA
## 3         100.0      4.9      noun 392 392 392 392 0  1 11.2 66.3
## NA.1       NA      NA      <NA>  NA  NA  NA  NA NA  NA  NA  NA
## 5         91.7      4.7      noun 411 411 411 411 0  1 53.4 28.5
## 6         91.7      4.5      noun 225 225 225 225 0  1 23.8 62.8
##      LS_including_skipped_TW  SA FC RI RO RPD SKIP SPILLOVER Blinks Track_loss
## 1         28.1 1.56 1 0 0 228 0 197 0 0
## NA         NA  NA NA NA NA NA  NA  NA  NA  NA
## 3         66.3 1.63 1 0 0 392 0 421 0 0
## NA.1       NA  NA NA NA NA NA  NA  NA  NA  NA
## 5         28.5 1.40 1 0 0 411 0 410 0 0
## 6         62.8 1.78 1 0 1 427 0 291 0 0
##      Long_saccades Index remove.trial depvar  pp  condition stim
## 1         0 p1i7      0 228 p1 Predictable i1
## NA         NA <NA>      NA  NA <NA>      <NA> <NA>
## 3         0 p1i9      0 392 p1 Predictable i3
## NA.1       NA <NA>      NA  NA <NA>      <NA> <NA>
## 5         0 p1i12     0 411 p1 Predictable i5
## 6         0 p1i16     0 225 p1 Predictable i6

```

```
datafile_2 = datafile
```

#make a matrix with the means per subject and per condition for the dependent variable

```
mean.matrix = tapply(datafile_2$depvar, list(datafile_2$pp, datafile_2$condition), mean, na.rm = T)
mean.matrix
```

```

##      Predictable Unpredictable
## p1      253.5600    301.8333
## p10     216.5000    229.2500
## p11     218.7742    222.5938
## p12     230.7742    240.5667
## p13     338.0000    336.5667
## p14     224.3000    224.7879
## p15     234.6875    261.9375
## p16     256.0294    257.5294
## p17     252.5333    247.3750
## p18     270.2222    292.4800
## p19     212.5312    219.6765
## p2      234.0000    277.4516
## p20     330.5185    392.2917
## p21     253.2308    243.8966
## p22     281.8966    317.3929
## p23     303.4286    346.7727
## p24     249.2069    290.9688
## p25     275.9118    285.7714
## p26     220.9000    247.1613
## p27     233.0938    236.7241
## p28     221.1600    303.1818
## p29     245.0741    228.8966

```

```
## p3      261.7576      244.8966
## p30     231.6562      242.5152
## p31     253.6562      271.5862
## p32     222.9310      224.2333
## p33     240.2188      247.3333
## p34     294.8485      320.4194
## p35     281.1071      321.5625
## p36     334.0323      311.2121
## p37     240.0938      290.8125
## p38     277.7500      254.6667
## p39     239.6818      280.7059
## p4      282.5789      283.6667
## p40     277.8710      269.4828
## p5      233.6562      258.9286
## p6      221.4412      235.5806
## p7      259.5714      309.6364
## p8      290.2593      281.9655
## p9      225.0909      227.6857
```

```
#make a matrix with the standard deviations per subject and per condition for the dependent variable
sd.matrix = tapply(datafile_2$devar, list(datafile_2$pp, datafile_2$condition), sd, na.rm = T)
sd.matrix
```

```
##      Predictable Unpredictable
## p1      73.06166      79.72323
## p10     50.07478      66.05140
## p11     60.92603      59.31972
## p12     76.14053     146.27529
## p13    152.74816     143.98580
## p14     66.73372      75.09442
## p15     53.14159     131.19327
## p16     96.50702     107.96274
## p17     79.42584      55.51092
## p18     67.07535     104.14978
## p19     64.44552      56.51265
## p2      50.86809     110.46865
## p20    118.82837     165.05427
## p21    118.65759      90.82965
## p22     92.52195     129.61977
## p23    118.95671     205.29095
## p24     86.53545     110.19469
## p25     50.22758     103.10762
## p26     43.82910      65.47829
## p27     68.72590      93.93269
## p28     65.13299      84.65990
## p29     46.22680      43.85801
## p3     100.22195     118.32804
## p30     88.92244      82.46443
## p31     80.14246     124.11070
## p32     52.13782      43.57133
## p33     67.01070      60.36003
## p34     82.67713     128.95549
## p35     55.88105      81.31021
## p36    141.34225      92.58738
```



```
## p37      66.44151      103.79677
## p38      49.08666      56.09950
## p39      61.73012      54.78454
## p4       91.29885      62.92323
## p40      95.76734      99.86906
## p5       77.20213      82.56532
## p6       60.33301      64.71876
## p7       41.06042     102.46366
## p8      166.73392      75.65074
## p9       64.03093      45.06190
```

```
#add this data to the actual dataframe
for(i in 1:nrow(datafile_2)){datafile_2$mean.sc[i] = mean.matrix[datafile_2$pp[i],datafile_2$condition[i]]}
for(i in 1:nrow(datafile_2)){datafile_2$sd.sc[i] = sd.matrix[datafile_2$pp[i],datafile_2$condition[i]]}

#calculate z-scores
for(i in 1:nrow(datafile_2)) {datafile_2$zscore[i] = (datafile_2$depvar[i] - datafile_2$mean.sc[i])/datafile_2$sd.sc[i]}

# assign a zero value to cells with only 1 observation
datafile_2$zscore[is.na(datafile_2$zscore)] = 0

#make new matrix with only standard deviations below a certain criterium of z-score (in absolute value)
result = datafile_2[abs(datafile_2$zscore) < 2.5,]

#you might want to clean up this data file by removing the added columns
result = result[,1:nrcolumns]

datafile_2 = result      # insert the name from the datafile coming from the cleanup on the right
datafile = datafile_2
head(datafile)
```

```
## participant item predictability target_word_length ortho_frequency
## 1          p1  i1    Predictable                7          109.13
## 2          p1  i2    Unpredictable              6          101.59
## 3          p1  i3    Predictable                5           30.69
## 4          p1  i4    Unpredictable              6           10.85
## 5          p1  i5    Predictable                7           17.37
## 6          p1  i6    Predictable                8           74.96
## cloze_scores norm_scores word.class TRT SFD FFD  GD RP FFC  LP  LS
## 1          100.0        4.8      noun  228 228 228 228 0  1 43.6 28.1
## 2           0.0         3.5      noun   NA  NA  NA  NA NA NA  NA  NA
## 3          100.0        4.9      noun  392 392 392 392 0  1 11.2 66.3
## 4           0.0         3.3      noun   NA  NA  NA  NA NA NA  NA  NA
## 5          91.7         4.7      noun  411 411 411 411 0  1 53.4 28.5
## 6          91.7         4.5      noun  225 225 225 225 0  1 23.8 62.8
## LS_including_skipped_TW  SA FC RI RO RPD SKIP SPILLOVER Blinks Track_loss
## 1          28.1 1.56  1  0  0 228  0          197  0          0
## 2           NA  NA NA NA NA NA  NA          NA  1          0
## 3          66.3 1.63  1  0  0 392  0          421  0          0
## 4           NA  NA NA NA NA NA  NA          NA  1          0
## 5          28.5 1.40  1  0  0 411  0          410  0          0
## 6          62.8 1.78  1  0  1 427  0          291  0          0
## Long_saccades Index remove.trial depvar pp      condition stim
## 1           0 pli7          0    228 p1    Predictable  i1
```

```
## 2          0 pli6          1      NA p1 Unpredictable i2
## 3          0 pli9          0    392 p1 Predictable i3
## 4          0 pli11         1      NA p1 Unpredictable i4
## 5          0 pli12         0    411 p1 Predictable i5
## 6          0 pli16         0    225 p1 Predictable i6
```

```
grand.mean=apply(mean.tt, 2, mean, na.rm = T)
grand.sd=apply(sd.tt,2,mean, na.rm = T)
grand.se=grand.sd/sqrt(40) ## this number is the total number of participants from your data, so it is
summary.ds = rbind(grand.mean, grand.sd, grand.se)
summary.ds
```

Descriptive statistics summary

```
##          Predictable Unpredictable
## grand.mean    255.61338    272.04990
## grand.sd       78.57029     92.69737
## grand.se       12.42305     14.65674
```

```
#### Setting contrasts and table of means ####
```

```
contrasts(datafile$condition) <- contr.sdif(2)
(table1 <- ddply(datafile, .(predictability), summarise, M=mean(depvar, na.rm = TRUE), SD=sd(depvar, na
```

```
##      predictability      M      SD      N      SE
## 1      Predictable 248.0888 75.27790 1160 2.210235
## 2      Unpredictable 259.7153 82.41568 1124 2.458254
```

```
datafile$predictability<-ifelse(datafile$condition=="Predictable",-1/2,1/2)
```

```
# Model 1
```

```
depvar.lmeM1 = lmer(depvar ~ predictability + (1 + predictability|participant) + (1 + predictability|i
print(depvar.lmeM1, corr = FALSE)
```

LME Models

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: depvar ~ predictability + (1 + predictability | participant) +
##      (1 + predictability | item)
##      Data: datafile
## REML criterion at convergence: 26107.52
## Random effects:
## Groups      Name          Std.Dev. Corr
## item        (Intercept)    14.370
##              predictability 9.981   -0.07
## participant (Intercept)    31.291
```

```
##           predictability 16.130    0.33
## Residual                70.631
## Number of obs: 2284, groups: item, 72; participant, 40
## Fixed Effects:
##   (Intercept) predictability
##           255.48           12.66
```

```
summary(depvar.lmeM1, corr = FALSE)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: depvar ~ predictability + (1 + predictability | participant) +
##   (1 + predictability | item)
## Data: datafile
##
## REML criterion at convergence: 26107.5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.1040 -0.6220 -0.1534  0.4270  5.8789
##
## Random effects:
## Groups      Name                Variance Std.Dev. Corr
## item        (Intercept)         206.49  14.370
##              predictability     99.62   9.981  -0.07
## participant (Intercept)         979.13  31.291
##              predictability     260.19  16.130   0.33
## Residual                4988.80  70.631
## Number of obs: 2284, groups: item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    255.481     5.440  46.965
## predictability  12.658     4.095   3.091
```

```
# Model 2
```

```
depvar.lmeM2 = lmer(depvar ~ predictability + (1 + predictability|participant) + (1 |item), datafile)
print(depvar.lmeM2, corr = FALSE)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: depvar ~ predictability + (1 + predictability | participant) +
##   (1 | item)
## Data: datafile
## REML criterion at convergence: 26108.33
## Random effects:
## Groups      Name                Std.Dev. Corr
## item        (Intercept)         14.35
## participant (Intercept)         31.30
##              predictability     16.09   0.33
## Residual                70.81
## Number of obs: 2284, groups: item, 72; participant, 40
## Fixed Effects:
##   (Intercept) predictability
##           255.49           12.63
```

```
summary(depvar.lmeM2, corr = FALSE)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: depvar ~ predictability + (1 + predictability | participant) +
##      (1 | item)
##      Data: datafile
##
## REML criterion at convergence: 26108.3
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.1142 -0.6232 -0.1598  0.4249  5.8748
##
## Random effects:
##      Groups      Name              Variance Std.Dev. Corr
##      item       (Intercept)         205.8   14.35
##      participant (Intercept)         979.5   31.30
##                predictability    258.8   16.09    0.33
##      Residual                5014.5   70.81
## Number of obs: 2284, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    255.488     5.441  46.959
## predictability  12.634     3.921   3.222
```

```
# Model 3
```

```
depvar.lmeM3 = lmer(depvar ~ predictability + (1 | participant) + (1 + predictability | item), datafile)
print(depvar.lmeM3, corr = FALSE)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: depvar ~ predictability + (1 | participant) + (1 + predictability |
##      item)
##      Data: datafile
## REML criterion at convergence: 26115.16
## Random effects:
##      Groups      Name              Std.Dev. Corr
##      item       (Intercept)         14.265
##                predictability    9.731   -0.08
##      participant (Intercept)         31.146
##      Residual                71.092
## Number of obs: 2284, groups:  item, 72; participant, 40
## Fixed Effects:
##      (Intercept) predictability
##              255.4             12.1
```

```
summary(depvar.lmeM3, corr = FALSE)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: depvar ~ predictability + (1 | participant) + (1 + predictability |
##      item)
##      Data: datafile
```

```
##
## REML criterion at convergence: 26115.2
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.8895 -0.6270 -0.1625  0.4322  5.9383
##
## Random effects:
##   Groups      Name             Variance Std.Dev. Corr
##   item        (Intercept)      203.48  14.265
##               predictability   94.69   9.731  -0.08
##   participant (Intercept)      970.08  31.146
##   Residual                5054.07  71.092
## Number of obs: 2284, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    255.369      5.418   47.14
## predictability  12.098      3.201    3.78

# Model 4
depvar.lmeM4 = lmer(depvar ~ predictability + (1 | participant) + (1 | item), datafile)
print(depvar.lmeM4, corr = FALSE)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: depvar ~ predictability + (1 | participant) + (1 | item)
##   Data: datafile
## REML criterion at convergence: 26115.89
## Random effects:
##   Groups      Name             Std.Dev.
##   item        (Intercept)  14.24
##   participant (Intercept)  31.15
##   Residual                71.26
## Number of obs: 2284, groups:  item, 72; participant, 40
## Fixed Effects:
##      (Intercept) predictability
##           255.38           12.08
```

```
summary(depvar.lmeM4, corr = FALSE)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: depvar ~ predictability + (1 | participant) + (1 | item)
##   Data: datafile
##
## REML criterion at convergence: 26115.9
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.8997 -0.6262 -0.1608  0.4321  5.9340
##
## Random effects:
##   Groups      Name             Variance Std.Dev.
##   item        (Intercept)   202.9    14.24
```

```

## participant (Intercept) 970.1 31.15
## Residual 5078.1 71.26
## Number of obs: 2284, groups: item, 72; participant, 40
##
## Fixed effects:
## Estimate Std. Error t value
## (Intercept) 255.377 5.418 47.138
## predictability 12.082 2.993 4.037

```