

Experiment 2

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 2.csv", sep = ",", de
colnames(datafile)
```

## [1]	"participant"	"item"	"predictability"
## [4]	"target_word_length"	"cloze_scores"	"norm_scores"
## [7]	"ortho_frequency"	"word.class"	"TRT"
## [10]	"SFD"	"FFD"	"GD"
## [13]	"RP"	"FFC"	"LP"
## [16]	"LS"	"LS_M"	"SA"
## [19]	"FC"	"RI"	"RO"
## [22]	"RPD"	"SKIP"	"SPILLOVER"
## [25]	"Blinks"	"Track_loss"	"Long_saccades"
## [28]	"Index"	"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" "Predictable" "Predictable" "Unpredictable" ...
## $ target_word_length: int 4 4 3 3 3 3 3 3 3 3 ...
## $ cloze_scores : num 95.8 100 91.7 0 95.8 0 4.2 0 95.8 87.5 ...
## $ norm_scores : num 4.7 4.8 4.8 3 4.8 3.9 2.9 3.3 4.8 4.8 ...
## $ ortho_frequency : num 42.5 73.1 138.4 34 23.9 ...
## $ word.class : chr "noun" "noun" "noun" "noun" ...
## $ TRT : int NA NA 260 186 244 NA NA NA NA 242 ...
## $ SFD : int NA NA 260 186 244 NA NA NA NA 242 ...
## $ FFD : int NA NA 260 186 244 NA NA NA NA 242 ...
## $ GD : int NA NA 260 186 244 NA NA NA NA 242 ...
## $ RP : int NA NA 0 0 0 NA NA NA NA 0 ...
## $ FFC : int NA NA 1 1 1 NA NA NA NA 1 ...
## $ LP : num NA NA 31.5 22.3 3.4 NA NA NA NA 37.6 ...
## $ LS : num 2.6 NA 26.3 15.4 46.6 NA NA 8.3 30.3 46.5 ...
## $ LS_M : num 2.6 NA 26.3 15.4 46.6 NA NA 8.3 30.3 46.5 ...
## $ SA : num NA NA 0.94 0.32 0.66 NA NA NA NA 1.24 ...
## $ FC : int 0 NA 1 1 1 NA NA 0 0 1 ...
## $ RI : int NA NA 0 0 0 NA NA NA NA 0 ...
## $ RO : int NA NA 0 0 1 NA NA NA NA 0 ...
## $ RPD : int NA NA 260 186 710 NA NA NA NA 242 ...
## $ SKIP : int 1 NA 0 0 0 NA NA 1 1 0 ...
## $ SPILLOVER : int NA NA 221 438 245 NA NA NA NA 184 ...
## $ Blinks : int 0 1 0 0 0 1 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 "p1i50" "p1i58" "p1i3" "p1i4" ...
## $ remove.trial : int 0 1 0 0 0 1 1 0 0 0 ...
## $ depvar : num NA NA 260 186 244 NA NA NA NA 242 ...
## $ 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 1 1 2 1 2 2 2 1 1 ...
## $ 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.    :3.0
## Class :character     Class :character    Class :character    1st Qu.:3.0
## Mode  :character     Mode  :character    Mode  :character    Median :3.5
##                                     Mean  :3.5
##                                     3rd Qu.:4.0
##                                     Max.   :4.0
##
## cloze_scores          norm_scores    ortho_frequency      word.class
## Min.    : 0.00        Min.    :2.000        Min.    : 0.75        Length:2880
## 1st Qu.: 0.00        1st Qu.:3.500        1st Qu.: 18.05        Class :character
## Median : 39.60        Median :4.400        Median : 39.34        Mode  :character
## Mean    : 45.23        Mean    :4.032        Mean    : 81.04
## 3rd Qu.: 91.70        3rd Qu.:4.700        3rd Qu.: 99.89
## Max.    :100.00        Max.    :4.900        Max.    :1325.74
##
##      TRT              SFD              FFD              GD
## Min.    : 85.0        Min.    : 85.0        Min.    : 85.0        Min.    : 85.0
## 1st Qu.: 205.0        1st Qu.:191.0        1st Qu.:190.0        1st Qu.: 197.0
## Median : 263.0        Median :232.0        Median :231.0        Median : 245.0
## Mean    : 320.5        Mean    :251.9        Mean    :250.3        Mean    : 279.3
## 3rd Qu.: 383.0        3rd Qu.:287.0        3rd Qu.:287.0        3rd Qu.: 326.0
## Max.    :1997.0        Max.    :968.0        Max.    :968.0        Max.    :1287.0
## NA's    :769          NA's    :1124        NA's    :863          NA's    :863
##
##      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.:13.00        1st Qu.: 18.05
## Median :0.0000        Median :1.000        Median :24.80        Median : 33.20
## Mean    :0.1294        Mean    :1.139        Mean    :25.07        Mean    : 37.51
## 3rd Qu.:0.0000        3rd Qu.:1.000        3rd Qu.:36.20        3rd Qu.: 53.90
## Max.    :1.0000        Max.    :5.000        Max.    :73.30        Max.    :430.10
## NA's    :863          NA's    :863          NA's    :863          NA's    :209
##
##      LS_M            SA              FC              RI
## Min.    : 0.10        Min.    :0.200        Min.    :0.000        Min.    :0.0000
## 1st Qu.: 18.50        1st Qu.:1.110        1st Qu.:1.000        1st Qu.:0.0000
## Median : 33.90        Median :1.430        Median :1.000        Median :0.0000
## Mean    : 38.89        Mean    :1.458        Mean    :1.051        Mean    :0.0873
## 3rd Qu.: 55.10        3rd Qu.:1.790        3rd Qu.:1.000        3rd Qu.:0.0000
## Max.    :430.10        Max.    :2.760        Max.    :6.000        Max.    :1.0000
## NA's    :211          NA's    :769          NA's    :209          NA's    :863
##
##      RO              RPD              SKIP              SPILLOVER
## Min.    :0.0000        Min.    : 85        Min.    :0.0000        Min.    : 84.0
## 1st Qu.:0.0000        1st Qu.: 204        1st Qu.:0.0000        1st Qu.:183.0
## Median :0.0000        Median : 255        Median :0.0000        Median :221.0
## Mean    :0.0823        Mean    : 319        Mean    :0.2449        Mean    :238.6
## 3rd Qu.:0.0000        3rd Qu.: 358        3rd Qu.:0.0000        3rd Qu.:268.0
## Max.    :1.0000        Max.    :3101        Max.    :1.0000        Max.    :922.0
## NA's    :863          NA's    :863        NA's    :209          NA's    :1410
##
##      Blinks          Track_loss          Long_saccades          Index
## Min.    :0.00000        Min.    :0.0000000        Min.    :0.00000        Length:2880
## 1st Qu.:0.00000        1st Qu.:0.0000000        1st Qu.:0.00000        Class :character
```

```

## Median :0.00000 Median :0.0000000 Median :0.00000 Mode :character
## Mean :0.05833 Mean :0.0006944 Mean :0.01528
## 3rd Qu.:0.00000 3rd Qu.:0.0000000 3rd Qu.:0.00000
## Max. :1.00000 Max. :1.0000000 Max. :1.00000
##
## remove.trial depvar pp condition
## Min. :0.00000 Min. : 85.0 p1 : 72 Predictable :1440
## 1st Qu.:0.00000 1st Qu.:190.0 p10 : 72 Unpredictable:1440
## Median :0.00000 Median :231.0 p11 : 72
## Mean :0.07257 Mean :250.3 p12 : 72
## 3rd Qu.:0.00000 3rd Qu.:287.0 p13 : 72
## Max. :1.00000 Max. :968.0 p14 : 72
## NA's :863 (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 244.1500 290.3913
## p10 242.8000 268.1200
## p11 185.4348 204.1034
## p12 256.1905 228.3684
## p13 290.4583 267.3333
## p14 245.2308 274.9643
## p15 257.5000 271.2800
## p16 269.1364 340.2800
## p17 279.4762 284.4167
## p18 226.4828 220.6296
## p19 243.1852 304.3636
## p2 254.8214 284.8571
## p20 228.7500 245.4000
## p21 254.5263 260.2083
## p22 228.2917 246.0714
## p23 250.3077 280.9630
## p24 214.7812 279.6667
## p25 258.1000 273.0000
## p26 274.4167 296.4118
## p27 284.6333 294.7333
## p28 250.7273 247.7241
## p29 206.6842 230.0952
## p3 205.1333 319.3226
## p30 271.2759 278.7200
## p31 246.7667 314.1200
## p32 211.4333 219.5385
## p33 245.5000 239.1364

```

```
## p34      214.8182      233.0000
## p35      208.7333      231.2667
## p36      232.0385      231.9048
## p37      312.7895      295.5000
## p38      244.8519      254.2069
## p39      196.4762      210.6538
## p4       208.8710      210.4194
## p40      227.3000      237.3929
## p5       211.7308      235.5484
## p6       235.6429      247.4545
## p7       202.3333      196.0690
## p8       229.5000      271.3182
## p9       294.3125      324.5455
```

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

```
##      Predictable Unpredictable
## p1      37.73910      126.73621
## p10     104.88208      94.61515
## p11      38.71789      51.67988
## p12      84.42963     102.85060
## p13     133.27317     110.96111
## p14      71.44526      61.54461
## p15      64.11130      98.46130
## p16      56.92459     139.64673
## p17     113.07237      95.72057
## p18      67.10313      70.46666
## p19      92.36260     189.02411
## p2       87.21411      88.91640
## p20      52.60566      77.24744
## p21      69.43692      83.94770
## p22      69.50413      87.15840
## p23      61.03230      79.26901
## p24      69.10895     102.11128
## p25      75.49897      72.43342
## p26      74.97570     125.33707
## p27      88.39273      89.38562
## p28      88.52827     103.70697
## p29      50.01672      82.87274
## p3       62.85053     148.43571
## p30      90.89983      89.16675
## p31      75.97944     167.23569
## p32      70.74270      59.82791
## p33      69.58486      94.36873
## p34      51.33052      54.06416
## p35      58.60677      47.75652
## p36      65.03075      89.01287
## p37     110.34319      94.03229
## p38      83.28205     110.15099
## p39      34.88068      47.70236
## p4       63.10295      68.66818
## p40      49.93269      71.52225
```

```
## p5      59.00343      71.87064
## p6      57.22355      75.12993
## p7      82.12982      52.09670
## p8      73.61116      94.26325
## p9      74.27491      79.39277
```

```
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 cloze_scores norm_scores
## 1          p1 i1      Predictable              4          95.8          4.7
## 2          p1 i2      Predictable              4          100.0         4.8
## 3          p1 i3      Predictable              3          91.7          4.8
## 4          p1 i4      Unpredictable            3           0.0          3.0
## 5          p1 i5      Predictable              3          95.8          4.8
## 6          p1 i6      Unpredictable            3           0.0          3.9
## ortho_frequency word.class TRT SFD FFD GD RP FFC LP LS LS_M SA FC RI
## 1          42.50      noun  NA  NA  NA  NA NA NA  NA  NA  2.6  2.6  NA  0  NA
## 2          73.14      noun  NA  NA  NA  NA NA NA  NA  NA  NA  NA  NA  NA  NA
## 3          138.37     noun 260 260 260 260 0  1 31.5 26.3 26.3 0.94 1  0
## 4          34.02      noun 186 186 186 186 0  1 22.3 15.4 15.4 0.32 1  0
## 5          23.93      noun 244 244 244 244 0  1  3.4 46.6 46.6 0.66 1  0
## 6          17.56      noun  NA  NA  NA  NA NA NA  NA  NA  NA  NA  NA  NA
## RO RPD SKIP SPILLOVER Blinks Track_loss Long_saccades Index remove.trial
## 1 NA  NA  1      NA      0      0      0 p1i50      0
## 2 NA  NA  NA      NA      1      0      0 p1i58      1
## 3 0 260  0      221     0      0      0 p1i3       0
## 4 0 186  0      438     0      0      0 p1i4       0
## 5 1 710  0      245     0      0      0 p1i5       0
## 6 NA  NA  NA      NA      1      0      0 p1i6       1
## depvar pp      condition stim
## 1      NA p1      Predictable i1
## 2      NA p1      Predictable i2
## 3      260 p1      Predictable i3
## 4      186 p1      Unpredictable i4
## 5      244 p1      Predictable i5
## 6      NA p1      Unpredictable 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 cloze_scores
## NA          <NA> <NA>          <NA>          NA          NA
## NA.1        <NA> <NA>          <NA>          NA          NA
## 3           p1 i3      Predictable              3          91.7
```

```
## 4          p1  i4 Unpredictable          3          0.0
## 5          p1  i5 Predictable          3          95.8
## NA.2        <NA> <NA>          <NA>          NA          NA
##      norm_scores ortho_frequency word.class TRT SFD FFD  GD RP FFC  LP  LS
## NA          NA          NA          <NA> NA  NA  NA  NA NA  NA  NA  NA
## NA.1          NA          NA          <NA> NA  NA  NA  NA NA  NA  NA  NA
## 3          4.8          138.37      noun 260 260 260 260 0  1 31.5 26.3
## 4          3.0          34.02      noun 186 186 186 186 0  1 22.3 15.4
## 5          4.8          23.93      noun 244 244 244 244 0  1  3.4 46.6
## NA.2          NA          NA          <NA> NA  NA  NA  NA NA  NA  NA  NA
##      LS_M  SA FC RI RO RPD SKIP SPILLOVER Blinks Track_loss Long_saccades
## NA          NA  NA NA NA NA  NA  NA          NA          NA          NA
## NA.1        NA  NA NA NA NA  NA  NA          NA          NA          NA
## 3      26.3 0.94  1  0  0 260  0      221  0          0          0
## 4      15.4 0.32  1  0  0 186  0      438  0          0          0
## 5      46.6 0.66  1  0  1 710  0      245  0          0          0
## NA.2        NA  NA NA NA NA  NA  NA          NA          NA          NA
##      Index remove.trial depvar  pp      condition stim
## NA      <NA>          NA      NA <NA>          <NA> <NA>
## NA.1    <NA>          NA      NA <NA>          <NA> <NA>
## 3      p1i3          0      260  p1 Predictable  i3
## 4      p1i4          0      186  p1 Unpredictable i4
## 5      p1i5          0      244  p1 Predictable  i5
## NA.2    <NA>          NA      NA <NA>          <NA> <NA>
```

```
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      244.1500      290.3913
## p10     242.8000      268.1200
## p11     185.4348      204.1034
## p12     256.1905      228.3684
## p13     290.4583      267.3333
## p14     245.2308      274.9643
## p15     257.5000      271.2800
## p16     269.1364      340.2800
## p17     279.4762      284.4167
## p18     226.4828      220.6296
## p19     243.1852      304.3636
## p2      254.8214      284.8571
## p20     228.7500      245.4000
## p21     254.5263      260.2083
## p22     228.2917      246.0714
## p23     250.3077      280.9630
## p24     214.7812      279.6667
## p25     258.1000      273.0000
## p26     274.4167      296.4118
## p27     284.6333      294.7333
## p28     250.7273      247.7241
## p29     206.6842      230.0952
```

```
## p3      205.1333      319.3226
## p30     271.2759      278.7200
## p31     246.7667      314.1200
## p32     211.4333      219.5385
## p33     245.5000      239.1364
## p34     214.8182      233.0000
## p35     208.7333      231.2667
## p36     232.0385      231.9048
## p37     312.7895      295.5000
## p38     244.8519      254.2069
## p39     196.4762      210.6538
## p4      208.8710      210.4194
## p40     227.3000      237.3929
## p5      211.7308      235.5484
## p6      235.6429      247.4545
## p7      202.3333      196.0690
## p8      229.5000      271.3182
## p9      294.3125      324.5455
```

```
#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      37.73910      126.73621
## p10     104.88208      94.61515
## p11      38.71789      51.67988
## p12      84.42963     102.85060
## p13     133.27317     110.96111
## p14      71.44526      61.54461
## p15      64.11130      98.46130
## p16      56.92459     139.64673
## p17     113.07237      95.72057
## p18      67.10313      70.46666
## p19      92.36260     189.02411
## p2      87.21411      88.91640
## p20      52.60566      77.24744
## p21      69.43692      83.94770
## p22      69.50413      87.15840
## p23      61.03230      79.26901
## p24      69.10895     102.11128
## p25      75.49897      72.43342
## p26      74.97570     125.33707
## p27      88.39273      89.38562
## p28      88.52827     103.70697
## p29      50.01672      82.87274
## p3      62.85053     148.43571
## p30      90.89983      89.16675
## p31      75.97944     167.23569
## p32      70.74270      59.82791
## p33      69.58486      94.36873
## p34      51.33052      54.06416
## p35      58.60677      47.75652
## p36      65.03075      89.01287
```



```
## p37    110.34319      94.03229
## p38     83.28205     110.15099
## p39     34.88068      47.70236
## p4      63.10295      68.66818
## p40     49.93269      71.52225
## p5      59.00343      71.87064
## p6      57.22355      75.12993
## p7      82.12982      52.09670
## p8      73.61116      94.26325
## p9      74.27491      79.39277
```

```
#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 cloze_scores norm_scores
## 1          p1 i1    Predictable                4          95.8          4.7
## 2          p1 i2    Predictable                4          100.0         4.8
## 3          p1 i3    Predictable                3           91.7         4.8
## 4          p1 i4    Unpredictable              3           0.0          3.0
## 5          p1 i5    Predictable                3           95.8         4.8
## 6          p1 i6    Unpredictable              3           0.0          3.9
## ortho_frequency word.class TRT SFD FFD  GD RP FFC  LP  LS LS_M  SA FC RI
## 1          42.50      noun  NA  NA  NA  NA NA NA  NA  NA  2.6  2.6  NA  0 NA
## 2          73.14      noun  NA  NA  NA  NA NA NA  NA  NA  NA  NA  NA  NA NA
## 3          138.37     noun 260 260 260 260 0  1 31.5 26.3 26.3 0.94  1  0
## 4          34.02      noun 186 186 186 186 0  1 22.3 15.4 15.4 0.32  1  0
## 5          23.93      noun 244 244 244 244 0  1  3.4 46.6 46.6 0.66  1  0
## 6          17.56      noun  NA  NA  NA  NA NA NA  NA  NA  NA  NA  NA  NA NA
## RO RPD SKIP SPILLOVER Blinks Track_loss Long_saccades Index remove.trial
## 1 NA  NA  1      NA      0      0      0 p1i50      0
## 2 NA  NA  NA      NA      1      0      0 p1i58      1
## 3 0 260  0      221      0      0      0 p1i3       0
## 4 0 186  0      438      0      0      0 p1i4       0
## 5 1 710  0      245      0      0      0 p1i5       0
## 6 NA  NA  NA      NA      1      0      0 p1i6       1
## depvar pp      condition stim
## 1      NA p1    Predictable i1
```

```
## 2      NA p1    Predictable    i2
## 3     260 p1    Predictable    i3
## 4     186 p1 Unpredictable    i4
## 5     244 p1    Predictable    i5
## 6      NA p1 Unpredictable    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    241.13980    261.08748
## grand.sd       72.07964     91.21977
## grand.se       11.39679     14.42311
```

```
#### 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 234.0261 69.38209   959 2.240465
## 2      Unpredictable 252.3446 84.32676  1010 2.653412
```

```
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: 22539.43
## Random effects:
## Groups      Name          Std.Dev. Corr
## item        (Intercept)    10.14
##              predictability 14.68    0.21
## participant (Intercept)    26.14
```

```
##           predictability 16.99    0.27
## Residual                71.51
## Number of obs: 1969, groups:  item, 72; participant, 40
## Fixed Effects:
##   (Intercept) predictability
##       243.90         17.87
```

```
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: 22539.4
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.3799 -0.6421 -0.1698  0.4485  5.2109
##
## Random effects:
## Groups      Name                Variance Std.Dev. Corr
## item        (Intercept)         102.8    10.14
##              predictability     215.4    14.68    0.21
## participant (Intercept)         683.5    26.14
##              predictability     288.6    16.99    0.27
## Residual                5113.7    71.51
## Number of obs: 1969, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    243.897     4.608   52.926
## predictability  17.873     4.575    3.907
```

```
# 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: 22541.86
## Random effects:
## Groups      Name                Std.Dev. Corr
## item        (Intercept)         10.30
## participant (Intercept)         26.08
##              predictability     16.97    0.27
## Residual                71.87
## Number of obs: 1969, groups:  item, 72; participant, 40
## Fixed Effects:
##   (Intercept) predictability
##       243.87         17.72
```

```
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: 22541.9
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.4825 -0.6619 -0.1597  0.4398  5.2574
##
## Random effects:
##      Groups      Name      Variance Std.Dev. Corr
##      item      (Intercept)    106.1   10.30
##      participant (Intercept)   680.2   26.08
##                predictability  288.0   16.97   0.27
##      Residual                5165.8   71.87
## Number of obs: 1969, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    243.868     4.606  52.941
## predictability  17.716     4.235   4.184
```

```
# 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: 22547.54
## Random effects:
##      Groups      Name      Std.Dev. Corr
##      item      (Intercept)    10.02
##                predictability 14.47   0.22
##      participant (Intercept)   26.16
##      Residual                72.05
## Number of obs: 1969, groups:  item, 72; participant, 40
## Fixed Effects:
##      (Intercept) predictability
##           243.94           18.41
```

```
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: 22547.5
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.3227 -0.6423 -0.1744  0.4491  5.3085
##
## Random effects:
##   Groups      Name             Variance Std.Dev. Corr
##   item        (Intercept)      100.4    10.02
##               predictability  209.3    14.47    0.22
##   participant (Intercept)      684.3    26.16
##   Residual                    5190.7    72.05
## Number of obs: 1969, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    243.944      4.610  52.911
## predictability  18.411      3.698   4.979

# 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: 22549.81
## Random effects:
##   Groups      Name             Std.Dev.
##   item        (Intercept)  10.19
##   participant (Intercept)  26.10
##   Residual                    72.39
## Number of obs: 1969, groups:  item, 72; participant, 40
## Fixed Effects:
##      (Intercept) predictability
##           243.91           18.26
```

```
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: 22549.8
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.3313 -0.6516 -0.1624  0.4484  5.3541
##
## Random effects:
##   Groups      Name             Variance Std.Dev.
##   item        (Intercept)  103.7    10.19
```

```

## participant (Intercept) 681.4 26.10
## Residual 5240.9 72.39
## Number of obs: 1969, groups: item, 72; participant, 40
##
## Fixed effects:
## Estimate Std. Error t value
## (Intercept) 243.914 4.609 52.918
## predictability 18.259 3.283 5.562

```