

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 = "GD"

# 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 187 207 499 ...
## $ 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.: 215.0 p10 : 72 Unpredictable:1440
## Median :0.0000 Median : 267.0 p11 : 72
## Mean :0.1174 Mean : 306.9 p12 : 72
## 3rd Qu.:0.0000 3rd Qu.: 363.0 p13 : 72
## Max. :1.0000 Max. :1420.0 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 360.0556
## p10 237.7500 263.3571
## p11 248.2258 242.1562
## p12 316.2903 357.7000
## p13 434.6296 425.5333
## p14 281.0333 254.2727
## p15 336.2500 330.1250
## p16 281.3824 303.6765
## p17 304.7333 304.5833
## p18 327.2222 352.0400
## p19 241.1562 251.8824
## p2 254.4242 294.6774
## p20 370.1481 417.8333
## p21 296.1154 290.6897
## p22 315.5862 368.6786
## p23 358.2857 399.7273
## p24 275.2069 317.8438
## p25 275.9118 309.2857
## p26 220.9000 252.9032
## p27 249.3125 284.4483
## p28 239.8400 344.5909
## p29 278.6667 279.7931
## p3 316.1818 328.8621
## p30 289.2500 347.6061
## p31 310.4062 337.2414
## p32 253.4483 272.5000
## p33 277.8438 277.7667

```

```
## p34      335.7576      336.0000
## p35      391.1786      337.8438
## p36      373.4839      370.5758
## p37      261.2188      348.1875
## p38      306.9583      316.8148
## p39      290.4091      347.7059
## p4       332.0000      309.7619
## p40      375.2581      383.2414
## p5       262.0312      297.0357
## p6       256.3235      286.4839
## p7       287.6000      380.0303
## p8       318.8889      327.7586
## p9       225.0909      245.2857
```

```
#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    110.88493
## p10     79.28430    133.20694
## p11    119.12506     67.59419
## p12    135.90369    205.44152
## p13    185.52921    190.24281
## p14    119.76600     91.28570
## p15    135.41859    198.13921
## p16    116.65152    132.64391
## p17    111.27596    105.08544
## p18    154.77685    159.88837
## p19     96.80513     84.13725
## p2     100.12618    120.31386
## p20    149.32095    164.31192
## p21    163.74329    120.41004
## p22    102.10797    181.95300
## p23    159.44251    208.16756
## p24     95.15903    136.70338
## p25     50.22758    130.27721
## p26     43.82910     72.68991
## p27     74.12693    114.85444
## p28    100.14851    119.14843
## p29     98.68014     91.38083
## p3     130.71449    130.42697
## p30    133.85115    126.08676
## p31    121.93093    138.89787
## p32     72.94694    124.19388
## p33    102.10119     79.24153
## p34    116.25458    133.82252
## p35    139.54239     96.28657
## p36    151.26486    221.71026
## p37     83.04555    137.19058
## p38     87.17373    135.88090
## p39     96.08412    104.50345
## p4     150.66335     76.50745
## p40    148.69879    193.46182
```

```
## p5      100.62402      124.10016
## p6      102.57672       88.27226
## p7       84.36970      141.03556
## p8      181.47077      151.59006
## p9       64.03093       79.29861
```

```
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    360.0556
## p10     237.7500    263.3571
## p11     248.2258    242.1562
## p12     316.2903    357.7000
## p13     434.6296    425.5333
## p14     281.0333    254.2727
## p15     336.2500    330.1250
## p16     281.3824    303.6765
## p17     304.7333    304.5833
## p18     327.2222    352.0400
## p19     241.1562    251.8824
## p2      254.4242    294.6774
## p20     370.1481    417.8333
## p21     296.1154    290.6897
## p22     315.5862    368.6786
## p23     358.2857    399.7273
## p24     275.2069    317.8438
## p25     275.9118    309.2857
## p26     220.9000    252.9032
## p27     249.3125    284.4483
## p28     239.8400    344.5909
## p29     278.6667    279.7931
```

```
## p3      316.1818      328.8621
## p30     289.2500      347.6061
## p31     310.4062      337.2414
## p32     253.4483      272.5000
## p33     277.8438      277.7667
## p34     335.7576      336.0000
## p35     391.1786      337.8438
## p36     373.4839      370.5758
## p37     261.2188      348.1875
## p38     306.9583      316.8148
## p39     290.4091      347.7059
## p4      332.0000      309.7619
## p40     375.2581      383.2414
## p5      262.0312      297.0357
## p6      256.3235      286.4839
## p7      287.6000      380.0303
## p8      318.8889      327.7586
## p9      225.0909      245.2857
```

```
#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    110.88493
## p10     79.28430    133.20694
## p11    119.12506     67.59419
## p12    135.90369    205.44152
## p13    185.52921    190.24281
## p14    119.76600     91.28570
## p15    135.41859    198.13921
## p16    116.65152    132.64391
## p17    111.27596    105.08544
## p18    154.77685    159.88837
## p19     96.80513     84.13725
## p2     100.12618    120.31386
## p20    149.32095    164.31192
## p21    163.74329    120.41004
## p22    102.10797    181.95300
## p23    159.44251    208.16756
## p24     95.15903    136.70338
## p25     50.22758    130.27721
## p26     43.82910     72.68991
## p27     74.12693    114.85444
## p28    100.14851    119.14843
## p29     98.68014     91.38083
## p3     130.71449    130.42697
## p30    133.85115    126.08676
## p31    121.93093    138.89787
## p32     72.94694    124.19388
## p33    102.10119     79.24153
## p34    116.25458    133.82252
## p35    139.54239     96.28657
## p36    151.26486    221.71026
```



```
## p37      83.04555      137.19058
## p38      87.17373      135.88090
## p39      96.08412      104.50345
## p4       150.66335       76.50745
## p40      148.69879      193.46182
## p5       100.62402      124.10016
## p6       102.57672       88.27226
## p7       84.36970      141.03556
## p8       181.47077      151.59006
## p9       64.03093       79.29861
```

```
#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    296.49899    321.41387
## grand.sd      113.29636    130.53170
## grand.se       17.91373     20.63887
```

```
#### 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 287.3691 112.5286 1165 3.296855
## 2      Unpredictable 304.8781 115.3297 1124 3.439996
```

```
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: 27895.17
## Random effects:
## Groups      Name          Std.Dev. Corr
## item        (Intercept)    19.08
##              predictability 13.26  0.26
## participant (Intercept)    42.14
```

```
##           predictability 23.48   -0.23
## Residual                103.45
## Number of obs: 2289, groups:  item, 72; participant, 40
## Fixed Effects:
##   (Intercept) predictability
##           297.61           18.42
```

```
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: 27895.2
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.9442 -0.6472 -0.2345  0.4906  4.5830
##
## Random effects:
## Groups      Name                Variance Std.Dev. Corr
## item        (Intercept)          363.9   19.08
##              predictability      175.9   13.26  0.26
## participant (Intercept)        1775.8   42.14
##              predictability      551.3   23.48 -0.23
## Residual                10701.5  103.45
## Number of obs: 2289, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    297.606      7.365  40.406
## predictability  18.417      5.934   3.104
```

```
# 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: 27895.98
## Random effects:
## Groups      Name                Std.Dev. Corr
## item        (Intercept)          18.96
## participant (Intercept)          42.13
##              predictability      23.23  -0.23
## Residual                103.68
## Number of obs: 2289, groups:  item, 72; participant, 40
## Fixed Effects:
##   (Intercept) predictability
##           297.60           18.31
```

```
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: 27896
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.9442 -0.6479 -0.2362  0.4979  4.6300
##
## Random effects:
##      Groups      Name              Variance Std.Dev. Corr
##      item       (Intercept)         359.3   18.96
##      participant (Intercept)       1774.8   42.13
##               predictability      539.7   23.23  -0.23
##      Residual                10749.2  103.68
## Number of obs: 2289, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    297.595     7.360  40.432
## predictability  18.312     5.703   3.211
```

```
# 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: 27902.72
## Random effects:
##      Groups      Name              Std.Dev. Corr
##      item       (Intercept)         19.06
##               predictability      12.09   0.24
##      participant (Intercept)         42.08
##      Residual                104.14
## Number of obs: 2289, groups:  item, 72; participant, 40
## Fixed Effects:
##      (Intercept) predictability
##              297.5              18.2
```

```
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: 27902.7
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.7997 -0.6425 -0.2292  0.4932  4.5854
##
## Random effects:
##   Groups      Name             Variance Std.Dev. Corr
##   item        (Intercept)       363.1   19.06
##                predictability   146.1   12.09  0.24
##   participant (Intercept)     1770.7   42.08
##   Residual                10845.0  104.14
## Number of obs: 2289, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    297.503      7.360  40.422
## predictability  18.200      4.597   3.959

# 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: 27903.28
## Random effects:
##   Groups      Name             Std.Dev.
##   item        (Intercept)     18.95
##   participant (Intercept)     42.07
##   Residual                104.32
## Number of obs: 2289, groups:  item, 72; participant, 40
## Fixed Effects:
##      (Intercept) predictability
##           297.50           18.12
```

```
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: 27903.3
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.8019 -0.6449 -0.2293  0.4991  4.6240
##
## Random effects:
##   Groups      Name             Variance Std.Dev.
##   item        (Intercept)       359.2   18.95
```

```

## participant (Intercept) 1770.0 42.07
## Residual                10883.0 104.32
## Number of obs: 2289, groups: item, 72; participant, 40
##
## Fixed effects:
##      Estimate Std. Error t value
## (Intercept)    297.496     7.356  40.444
## predictability  18.119     4.375   4.141

```