

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 = "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" "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.: 197.0 p10 : 72 Unpredictable:1440
## Median :0.00000 Median : 245.0 p11 : 72
## Mean :0.07257 Mean : 279.3 p12 : 72
## 3rd Qu.:0.00000 3rd Qu.: 326.0 p13 : 72
## Max. :1.00000 Max. :1287.0 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 282.5000 349.8261
## p10 254.1200 276.8800
## p11 198.8261 235.4828
## p12 286.5238 245.4737
## p13 296.7917 276.1000
## p14 263.1538 306.7500
## p15 309.8929 294.4400
## p16 279.5909 374.7200
## p17 292.2381 309.4167
## p18 289.2069 251.3333
## p19 295.4444 441.0909
## p2 288.2500 331.6786
## p20 257.5500 312.8000
## p21 292.9474 260.2083
## p22 279.2083 264.8214
## p23 258.1923 280.9630
## p24 235.9375 290.5667
## p25 258.1000 273.0000
## p26 291.8333 319.3529
## p27 312.6000 335.1000
## p28 263.9091 272.4483
## p29 226.3158 268.6667
## p3 220.4333 370.1935
## p30 277.0000 303.8800
## p31 291.8000 346.4400
## p32 243.4333 234.4231
## p33 265.6500 247.2727
```

## p34	214.8182	248.2500
## p35	214.0667	254.6667
## p36	270.3462	280.0000
## p37	312.7895	315.1818
## p38	287.1481	275.5517
## p39	204.4286	219.3462
## p4	228.9677	273.0645
## p40	236.3000	237.3929
## p5	221.0000	266.9355
## p6	286.7500	310.7273
## p7	266.7407	254.9310
## p8	248.8333	314.9091
## p9	306.6250	372.9545

```
#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	94.74981	148.10182
## p10	110.92164	103.54843
## p11	61.53909	119.97578
## p12	91.48312	108.11433
## p13	144.65701	109.87559
## p14	107.68015	103.05936
## p15	141.96174	97.56967
## p16	78.11509	155.82670
## p17	137.76789	138.43156
## p18	127.09287	113.95782
## p19	131.04971	255.38774
## p2	138.96965	130.51892
## p20	73.42485	229.70343
## p21	109.10824	83.94770
## p22	130.37837	115.13890
## p23	67.56805	79.26901
## p24	91.43019	103.73630
## p25	75.49897	72.43342
## p26	115.37593	145.94603
## p27	117.80129	109.06668
## p28	107.56345	122.33928
## p29	78.49491	142.56800
## p3	81.75433	179.53652
## p30	99.00794	105.74786
## p31	137.42394	177.11157
## p32	128.50968	79.56641
## p33	90.99177	102.94760
## p34	51.33052	76.57110
## p35	65.33729	91.02040
## p36	83.34360	125.40375
## p37	110.34319	108.85580
## p38	93.26295	130.97753
## p39	47.63987	67.07723
## p4	83.39644	171.12996
## p40	74.98919	71.52225

```
## p5      57.84739      84.30023
## p6     130.18125     182.41270
## p7     146.18918     126.71000
## p8      85.38234     104.98340
## p9     107.02266     115.28948
```

```
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 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
## NA.1    NA  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      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      282.5000      349.8261
## p10     254.1200      276.8800
## p11     198.8261      235.4828
## p12     286.5238      245.4737
## p13     296.7917      276.1000
## p14     263.1538      306.7500
## p15     309.8929      294.4400
## p16     279.5909      374.7200
## p17     292.2381      309.4167
## p18     289.2069      251.3333
## p19     295.4444      441.0909
## p2      288.2500      331.6786
## p20     257.5500      312.8000
## p21     292.9474      260.2083
## p22     279.2083      264.8214
## p23     258.1923      280.9630
## p24     235.9375      290.5667
## p25     258.1000      273.0000
## p26     291.8333      319.3529
## p27     312.6000      335.1000
## p28     263.9091      272.4483
## p29     226.3158      268.6667
```

```
## p3      220.4333      370.1935
## p30     277.0000      303.8800
## p31     291.8000      346.4400
## p32     243.4333      234.4231
## p33     265.6500      247.2727
## p34     214.8182      248.2500
## p35     214.0667      254.6667
## p36     270.3462      280.0000
## p37     312.7895      315.1818
## p38     287.1481      275.5517
## p39     204.4286      219.3462
## p4      228.9677      273.0645
## p40     236.3000      237.3929
## p5      221.0000      266.9355
## p6      286.7500      310.7273
## p7      266.7407      254.9310
## p8      248.8333      314.9091
## p9      306.6250      372.9545
```

```
#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      94.74981    148.10182
## p10     110.92164    103.54843
## p11      61.53909    119.97578
## p12      91.48312    108.11433
## p13     144.65701    109.87559
## p14     107.68015    103.05936
## p15     141.96174     97.56967
## p16      78.11509    155.82670
## p17     137.76789    138.43156
## p18     127.09287    113.95782
## p19     131.04971    255.38774
## p2      138.96965    130.51892
## p20      73.42485    229.70343
## p21     109.10824     83.94770
## p22     130.37837    115.13890
## p23      67.56805     79.26901
## p24      91.43019    103.73630
## p25      75.49897     72.43342
## p26     115.37593    145.94603
## p27     117.80129    109.06668
## p28     107.56345    122.33928
## p29      78.49491    142.56800
## p3      81.75433    179.53652
## p30      99.00794    105.74786
## p31     137.42394    177.11157
## p32     128.50968     79.56641
## p33      90.99177    102.94760
## p34      51.33052     76.57110
## p35      65.33729     91.02040
## p36      83.34360    125.40375
```



```
## p37    110.34319    108.85580
## p38     93.26295    130.97753
## p39     47.63987     67.07723
## p4      83.39644    171.12996
## p40     74.98919     71.52225
## p5      57.84739     84.30023
## p6     130.18125    182.41270
## p7     146.18918    126.71000
## p8      85.38234    104.98340
## p9     107.02266    115.28948
```

```
#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    265.25658    292.43100
## grand.sd      100.16464    122.24201
## grand.se       15.83742     19.32816
```

```
#### 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 255.4266  91.43519  954 2.960324
## 2      Unpredictable 281.4230 115.17873 1007 3.629590
```

```
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: 23607.2
## Random effects:
## Groups      Name          Std.Dev. Corr
## item        (Intercept)    18.01
##              predictability 13.83    0.07
## participant (Intercept)    30.47
```

```
##           predictability 36.73    0.67
## Residual                95.91
## Number of obs: 1961, groups: item, 72; participant, 40
## Fixed Effects:
##   (Intercept) predictability
##           267.5           25.3
```

```
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: 23607.2
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.3428 -0.6460 -0.2183  0.4566  5.6283
##
## Random effects:
## Groups      Name                Variance Std.Dev. Corr
## item        (Intercept)         324.3    18.01
##              predictability     191.3    13.83    0.07
## participant (Intercept)         928.4    30.47
##              predictability    1349.2    36.73    0.67
## Residual                9198.7    95.91
## Number of obs: 1961, groups: item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    267.519      5.713   46.828
## predictability  25.299      7.467    3.388
```

```
# 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: 23607.83
## Random effects:
## Groups      Name                Std.Dev. Corr
## item        (Intercept)         18.03
## participant (Intercept)         30.44
##              predictability     36.68    0.67
## Residual                96.16
## Number of obs: 1961, groups: item, 72; participant, 40
## Fixed Effects:
##   (Intercept) predictability
##           267.54           25.19
```

```
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: 23607.8
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -3.3779 -0.6440 -0.2185  0.4539  5.6288
##
## Random effects:
##      Groups      Name              Variance Std.Dev. Corr
##      item       (Intercept)         325.3   18.03
##      participant (Intercept)         926.5   30.44
##                predictability 1345.5   36.68   0.67
##      Residual                9247.1   96.16
## Number of obs: 1961, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    267.540     5.711  46.843
## predictability   25.187     7.281   3.459
```

```
# 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: 23648.27
## Random effects:
##      Groups      Name              Std.Dev. Corr
##      item       (Intercept)         17.98
##                predictability 12.12   0.10
##      participant (Intercept)         31.35
##      Residual                97.72
## Number of obs: 1961, groups:  item, 72; participant, 40
## Fixed Effects:
##      (Intercept) predictability
##           267.79           26.06
```

```
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: 23648.3
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.7681 -0.6608 -0.2271  0.4547  6.0470
##
## Random effects:
##   Groups      Name             Variance Std.Dev. Corr
##   item        (Intercept)      323.3    17.98
##                predictability  146.9    12.12    0.10
##   participant (Intercept)      983.1    31.35
##   Residual                9548.2    97.72
## Number of obs: 1961, groups:  item, 72; participant, 40
##
## Fixed effects:
##              Estimate Std. Error t value
## (Intercept)    267.786      5.845  45.811
## predictability   26.060      4.674   5.575

# 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: 23648.64
## Random effects:
##   Groups      Name             Std.Dev.
##   item        (Intercept)  18.01
##   participant (Intercept)  31.35
##   Residual                97.90
## Number of obs: 1961, groups:  item, 72; participant, 40
## Fixed Effects:
##      (Intercept) predictability
##           267.79           25.99
```

```
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: 23648.6
##
## Scaled residuals:
##      Min       1Q   Median       3Q      Max
## -2.7954 -0.6582 -0.2275  0.4634  6.0486
##
## Random effects:
##   Groups      Name             Variance Std.Dev.
##   item        (Intercept)    324.3    18.01
```

```

## participant (Intercept) 982.7 31.35
## Residual 9584.6 97.90
## Number of obs: 1961, groups: item, 72; participant, 40
##
## Fixed effects:
## Estimate Std. Error t value
## (Intercept) 267.795 5.847 45.803
## predictability 25.987 4.451 5.839

```