Analysis.R

This document shows the scripts written to undertake the statistic analysis in R for the RESPECT pilot study.

```
# OddsRatio and GLM
# This script produces odds ratio calculations, a simple GLM and then GLM with random effects

# Load in data
 load("FSD4knitr99.Rdata")

# Create data frame (saves having to amend everything)
# FinalStudy99 marks all non-answers (timed out) as incorrect

 FinalStudyData99$classification <- factor(FinalStudyData99$classification)

#  FSD99CC - Return subset of data where computer was correct
FSD99CC <- subset(FinalStudyData99,FinalStudyData99$truepos==1|FinalStudyData99$trueneg==1)
# FSD99CI <- Return subset of data where computer was incorrect
FSD99CI <- subset(FinalStudyData99,FinalStudyData99$falsepos==1|FinalStudyData99$falseneg==1)

cat("Preparing Odds Ratio table...\n\n")
```

```
Preparing Odds Ratio table...
```

```

# Load in epitools package
require('epitools')
```

```
Loading required package: epitools
```

```
require('xtable')
```

```
Loading required package: xtable
```

```

#------ ODDS RATIO TABLE -------
cat("Odds ratio table and statistics\n")
```

```
Odds ratio table and statistics
```

```

 # Function to create basic OR tables with percentages

 makeBasicORTable <- function(ORtableName='') {
   # NULL is FinalStudyData99 i.e. all data pairs
   # FSD99CC - only includes data with correct computer interpretation
   # FSD99CI - only includes data with incorrect computer interpretation
   if(ORtableName=='FSD99CC') FSD = FSD99CC
   else if(ORtableName=='FSD99CI') FSD = FSD99CI
   else FSD = FinalStudyData99
   ORT <- epitools::oddsratio(FSD$diag_correct,FSD$message_visible,verbose=T)
   print(ORT)
 }

 # OR table for both computer correct and incorrect
 ORtable <- makeBasicORTable()
```

```
$x
         Outcome
Predictor    0    1
        0  366  385
        1 1500 1481

$data
         Outcome
Predictor    0    1 Total
    0      366  385   751
    1     1500 1481  2981
    Total 1866 1866  3732

$p.exposed
         Outcome
Predictor      0      1  Total
    0     0.1961 0.2063 0.2012
    1     0.8039 0.7937 0.7988
    Total 1.0000 1.0000 1.0000

$p.outcome
         Outcome
Predictor      0      1 Total
    0     0.4874 0.5126     1
    1     0.5032 0.4968     1
    Total 0.5000 0.5000     1

$measure
         odds ratio with 95% C.I.
Predictor estimate  lower upper
        0   1.0000     NA    NA
        1   0.9386 0.7996 1.102

$conf.level
[1] 0.95

$p.value
         two-sided
Predictor midp.exact fisher.exact chi.square
        0         NA           NA         NA
        1     0.4383       0.4624     0.4379

$correction
[1] FALSE

attr(,"method")
[1] "median-unbiased estimate & mid-p exact CI"
```

```r
# OR table for both computer correct results
ORtableCC <- makeBasicORTable("FSD99CC")
```

```
$x
         Outcome
Predictor   0   1
        0 148 117
        1 785 816

$data
         Outcome
Predictor   0   1 Total
    0     148 117   265
    1     785 816  1601
    Total 933 933  1866

$p.exposed
         Outcome
Predictor      0      1 Total
    0     0.1586 0.1254 0.142
    1     0.8414 0.8746 0.858
    Total 1.0000 1.0000 1.000

$p.outcome
         Outcome
Predictor      0      1 Total
    0     0.5585 0.4415     1
    1     0.4903 0.5097     1
    Total 0.5000 0.5000     1

$measure
         odds ratio with 95% C.I.
Predictor estimate lower upper
        0    1.000    NA    NA
        1    1.314 1.012  1.71

$conf.level
[1] 0.95

$p.value
         two-sided
Predictor midp.exact fisher.exact chi.square
        0         NA           NA         NA
        1    0.04008      0.04649    0.03979

$correction
[1] FALSE

attr(,"method")
[1] "median-unbiased estimate & mid-p exact CI"
```

```r
# OR table for both computer incorrect results
ORtableCI <- makeBasicORTable("FSD99CI")
```

```
$x
         Outcome
Predictor   0   1
        0 218 268
        1 715 665

$data
         Outcome
Predictor   0   1 Total
    0     218 268   486
    1     715 665  1380
    Total 933 933  1866

$p.exposed
         Outcome
Predictor      0      1  Total
    0     0.2337 0.2872 0.2605
    1     0.7663 0.7128 0.7395
    Total 1.0000 1.0000 1.0000

$p.outcome
         Outcome
Predictor      0      1 Total
    0     0.4486 0.5514     1
    1     0.5181 0.4819     1
    Total 0.5000 0.5000     1

$measure
         odds ratio with 95% C.I.
Predictor estimate  lower  upper
        0   1.0000     NA     NA
        1   0.7567 0.6145 0.9311

$conf.level
[1] 0.95

$p.value
         two-sided
Predictor midp.exact fisher.exact chi.square
        0         NA           NA         NA
        1   0.008408     0.009708   0.008356

$correction
[1] FALSE

attr(,"method")
[1] "median-unbiased estimate & mid-p exact CI"
```

```
#------ GLM WITHOUT RANDOM EFFECTS -------------

cat("Unadjusted GLM without random effects - message visibility\n")
```

```
Unadjusted GLM without random effects - message visibility
```

```
# GLM model all computer messages
fit <-  glm(diag_correct~message_visible,data=FinalStudyData99,family=binomial("logit"))
summary(fit)
```

```
Call:
glm(formula = diag_correct ~ message_visible, family = binomial("logit"),
    data = FinalStudyData99)

Deviance Residuals:
   Min      1Q  Median      3Q     Max
-1.805   0.661   0.661   0.680   0.680

Coefficients:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)       1.4106     0.0583   24.20   <2e-16 ***
message_visible  -0.0634     0.0817   -0.78     0.44
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 3747.7  on 3731  degrees of freedom
Residual deviance: 3747.1  on 3730  degrees of freedom
AIC: 3751

Number of Fisher Scoring iterations: 4
```

```r
#GLM model with only computer correct messages
fitcc <-  glm(diag_correct~message_visible,data=FSD99CC,family=binomial("logit"))
summary(fitcc)
```

```
Call:
glm(formula = diag_correct ~ message_visible, family = binomial("logit"),
    data = FSD99CC)

Deviance Residuals:
   Min      1Q  Median      3Q     Max
-2.038   0.518   0.518   0.588   0.588

Coefficients:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)       1.6685     0.0896   18.62   <2e-16 ***
message_visible   0.2738     0.1334    2.05     0.04 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1524.9  on 1865  degrees of freedom
Residual deviance: 1520.7  on 1864  degrees of freedom
AIC: 1525

Number of Fisher Scoring iterations: 4
```

```r
#GLM model with only computer INCORRECT messages
fitci <-  glm(diag_correct~message_visible,data=FSD99CI,family=binomial("logit"))
summary(fitcc)
```

```
Call:
glm(formula = diag_correct ~ message_visible, family = binomial("logit"),
    data = FSD99CC)

Deviance Residuals:
   Min      1Q  Median      3Q     Max
-2.038   0.518   0.518   0.588   0.588

Coefficients:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)       1.6685     0.0896   18.62   <2e-16 ***
message_visible   0.2738     0.1334    2.05     0.04 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

(Dispersion parameter for binomial family taken to be 1)

    Null deviance: 1524.9  on 1865  degrees of freedom
Residual deviance: 1520.7  on 1864  degrees of freedom
AIC: 1525

Number of Fisher Scoring iterations: 4
```

```
 #------ FUNCTIONS FOR GLM WITH RANDOM EFFECTS -------------
 suppressPackageStartupMessages(require(lme4))
```

```
Warning: package 'Matrix' was built under R version 2.15.3
```

```
Warning: package 'lattice' was built under R version 2.15.3
```

```
 makeTablesGLMERexp <- function(tableX,nameX) {
   #tableOUT <- data.frame((coef(summary(tableX))[,c("Estimate","Std. Error","z
value","Pr(>|z|)")]),check.names=F)
   tableOUT <- as.data.frame(coef(summary(tableX)))
   lower <- tableOUT[,1] + qnorm(.025)*tableOUT[,2]
   upper <- tableOUT[,1] + qnorm(.975)*tableOUT[,2]
   tableOUT[,1] <- exp(tableOUT[,1])
   tableOUTCIfinal <- paste(round(exp(lower),3),round(exp(upper),3),sep=' to ')
   tableOUT <- cbind(round(tableOUT,3), tableOUTCIfinal)
   tableOUT[,2] <- NULL
   parameters<- c("Constant",nameX)
   tableOUT <- cbind(parameters, tableOUT)
   colnames(tableOUT) <- c("Parameters","OR","z","P>|z|","95% CI")
   return(tableOUT)
 }


 #------ GLMs WITH RANDOM EFFECTS -------------

 #cat("GLM model with random effects - message visibilty and classification\n")
# fitGLMAll <- glmer(diag_correct~1+message_visible+falseneg+falsepos+trueneg+(1|ecg_id)+
(1|participant_id),data=FinalStudyData99,family=binomial("logit"))
 #summary(fitGLMAll)

# cat("GLM mode with only random effects, no fixed effects\n")
 #fitGLMOne <- glmer(diag_correct~1+(1|ecg_id)+
(1|participant_id),REML=F,data=FinalStudyData99,family=binomial("logit"))
 #summary(fitGLMOne)

 cat("GLM model with random effects - message visibility\n")
```

```
GLM model with random effects - message visibility
```

```r
 # GLM model with random effects - all computer messages
fitGLM <- glmer(diag_correct~1+message_visible+(1|ecg_id)+
(1|participant_id),data=FinalStudyData99,family=binomial("logit"))
summary(fitGLM)
```

```
Generalized linear mixed model fit by the Laplace approximation
Formula: diag_correct ~ 1 + message_visible + (1 | ecg_id) + (1 | participant_id)
   Data: FinalStudyData99
  AIC  BIC logLik deviance
 3210 3235  -1601     3202
Random effects:
 Groups         Name        Variance Std.Dev.
 participant_id (Intercept) 0.208    0.456
 ecg_id         (Intercept) 1.571    1.253
Number of obs: 3732, groups: participant_id, 156; ecg_id, 48

Fixed effects:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)       1.8688     0.1984    9.42   <2e-16 ***
message_visible  -0.0798     0.0903   -0.88     0.38
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
            (Intr)
messag_vsbl -0.233
```

```r
 # GLM model with random effects - all correct computer messages
 fitGLMcc <- glmer(diag_correct~1+message_visible+(1|ecg_id)+
(1|participant_id),data=FSD99CC,family=binomial("logit"))
 summary(fitGLMcc)
```

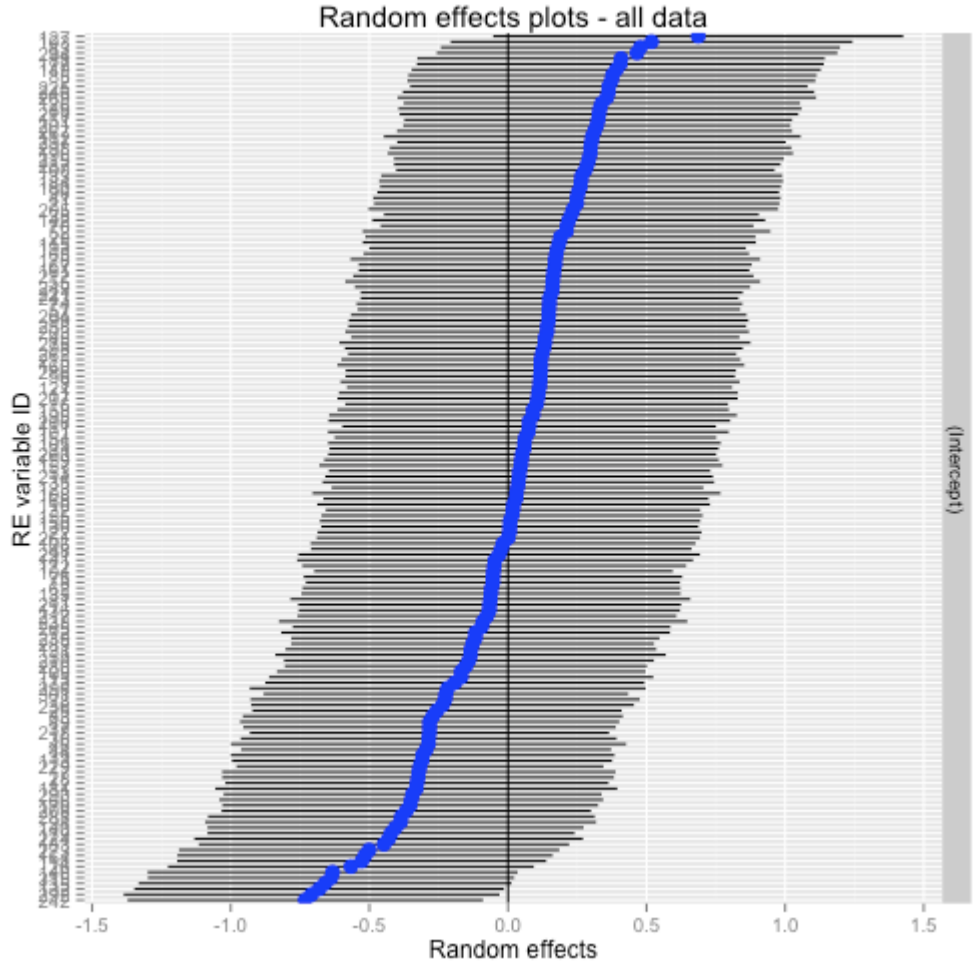
```
Generalized linear mixed model fit by the Laplace approximation
Formula: diag_correct ~ 1 + message_visible + (1 | ecg_id) + (1 | participant_id)
   Data: FSD99CC
  AIC  BIC logLik deviance
 1322 1344   -657     1314
Random effects:
 Groups         Name        Variance Std.Dev.
 participant_id (Intercept) 0.559    0.748
 ecg_id         (Intercept) 1.320    1.149
Number of obs: 1866, groups: participant_id, 156; ecg_id, 24

Fixed effects:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)        2.214      0.266    8.32   <2e-16 ***
message_visible    0.347      0.147    2.36    0.018 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
            (Intr)
messag_vsbl -0.243
```

```r
 # GLM model with random effects - all incorrect computer messages
 fitGLMci <- glmer(diag_correct~1+message_visible+(1|ecg_id)+
(1|participant_id),data=FSD99CI,family=binomial("logit"))
 summary(fitGLMci)
```

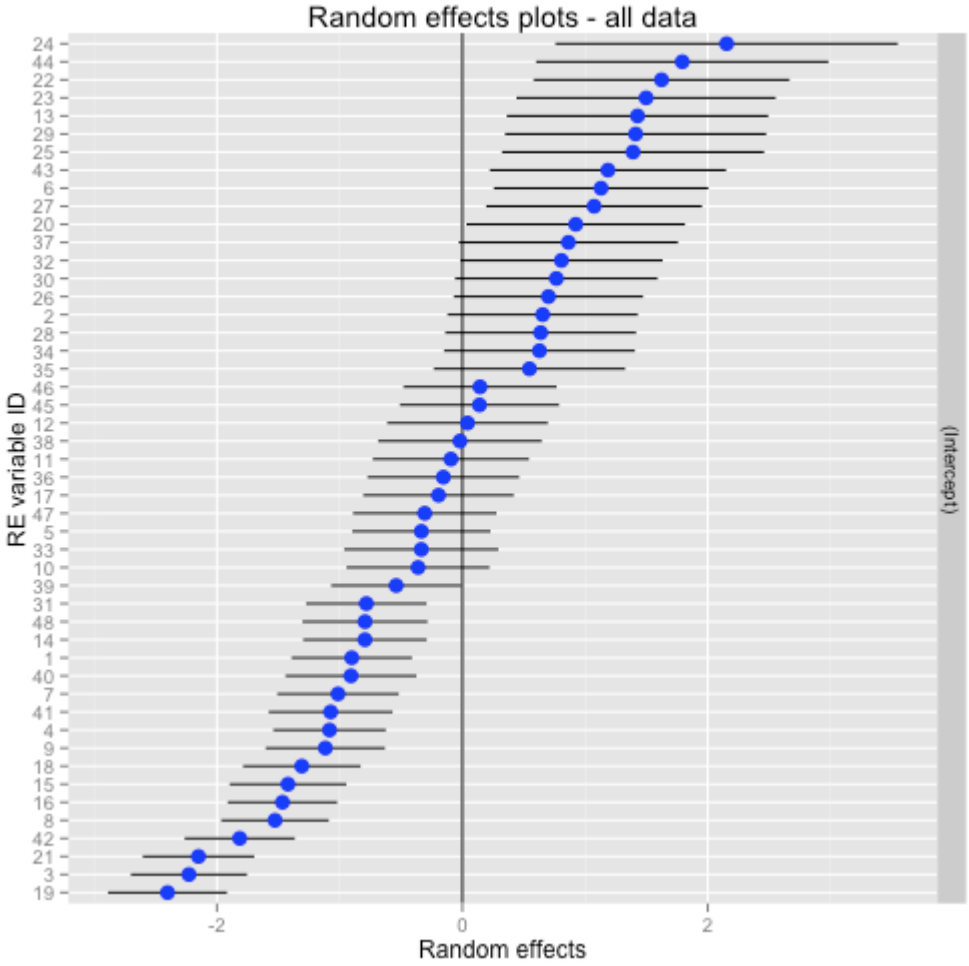
```
Generalized linear mixed model fit by the Laplace approximation
Formula: diag_correct ~ 1 + message_visible + (1 | ecg_id) + (1 | participant_id)
   Data: FSD99CI
  AIC  BIC logLik deviance
 1863 1885   -927     1855
Random effects:
 Groups         Name        Variance Std.Dev.
 participant_id (Intercept) 0.291    0.539
 ecg_id         (Intercept) 1.561    1.250
Number of obs: 1866, groups: participant_id, 156; ecg_id, 24

Fixed effects:
                Estimate Std. Error z value Pr(>|z|)
(Intercept)        1.599      0.275    5.80  6.5e-09 ***
message_visible   -0.354      0.117   -3.03   0.0025 **
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Correlation of Fixed Effects:
            (Intr)
messag_vsbl -0.229
```

```r
 #------- QQPlots ----------
 #  http://stackoverflow.com/questions/13847936/in-r-plotting-random-effects-from-lmer-lme4-package-using-qqmath-or-dotplot
 ggCaterpillar <- function(re, QQ=TRUE, likeDotplot=TRUE,thetitle="ggCaterpillar") {
   require(ggplot2)
   f <- function(x) {
     pv   <- attr(x, "postVar")
     cols <- 1:(dim(pv)[1])
     se   <- unlist(lapply(cols, function(i) sqrt(pv[i, i, ])))
     ord  <- unlist(lapply(x, order)) + rep((0:(ncol(x) - 1)) * nrow(x), each=nrow(x))
     pDf  <- data.frame(y=unlist(x)[ord],
                        ci=1.96*se[ord],
                        nQQ=rep(qnorm(ppoints(nrow(x))), ncol(x)),
                        ID=factor(rep(rownames(x), ncol(x))[ord], levels=rownames(x)[ord]),
                        ind=gl(ncol(x), nrow(x), labels=names(x)))
     if(QQ) {  ## normal QQ-plot
       p <- ggplot(pDf, aes(nQQ, y))
       p <- p + facet_wrap(~ ind, scales="free")
       p <- p + xlab("Standard normal quantiles") + ylab("Random effect quantiles")
     } else {  ## caterpillar dotplot
       p <- ggplot(pDf, aes(ID, y)) + coord_flip()
       if(likeDotplot) {  ## imitate dotplot() -> same scales for random effects
         p <- p + facet_wrap(~ ind)
       } else {           ## different scales for random effects
         p <- p + facet_grid(ind ~ ., scales="free_y")
       }
       # Custom xlabels just for this study
       p <- p + xlab("RE variable ID") + ylab("Random effects")
     }

     p <- p + theme(legend.position="none")
     p <- p + geom_hline(yintercept=0)
     p <- p + geom_errorbar(aes(ymin=y-ci, ymax=y+ci), width=0, colour="black")
     p <- p + geom_point(aes(size=1.2), colour="blue")
     p <- p + ggtitle(thetitle)
     return(p)
   }

   lapply(re, f)
 }

 # Print plots for RE variance
 print(ggCaterpillar(ranef(fitGLM, postVar=TRUE), QQ=FALSE, likeDotplot=FALSE,"Random effects plots - all data"))
```

```
$participant_id
```

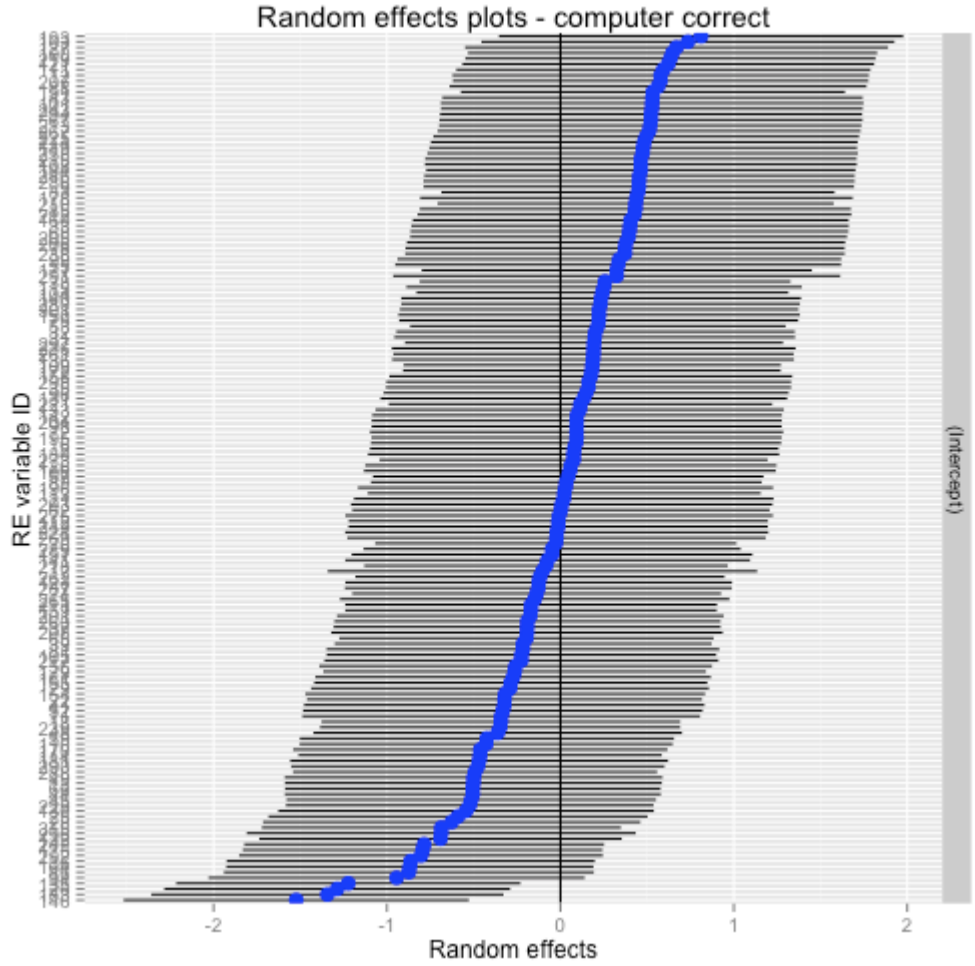

Random effects plots - all data
RE variable ID
(Intercept)
-1.5
-1.0
-0.5
0.0
0.5
1.0
1.5
Random effects

```
$ecg_id
```

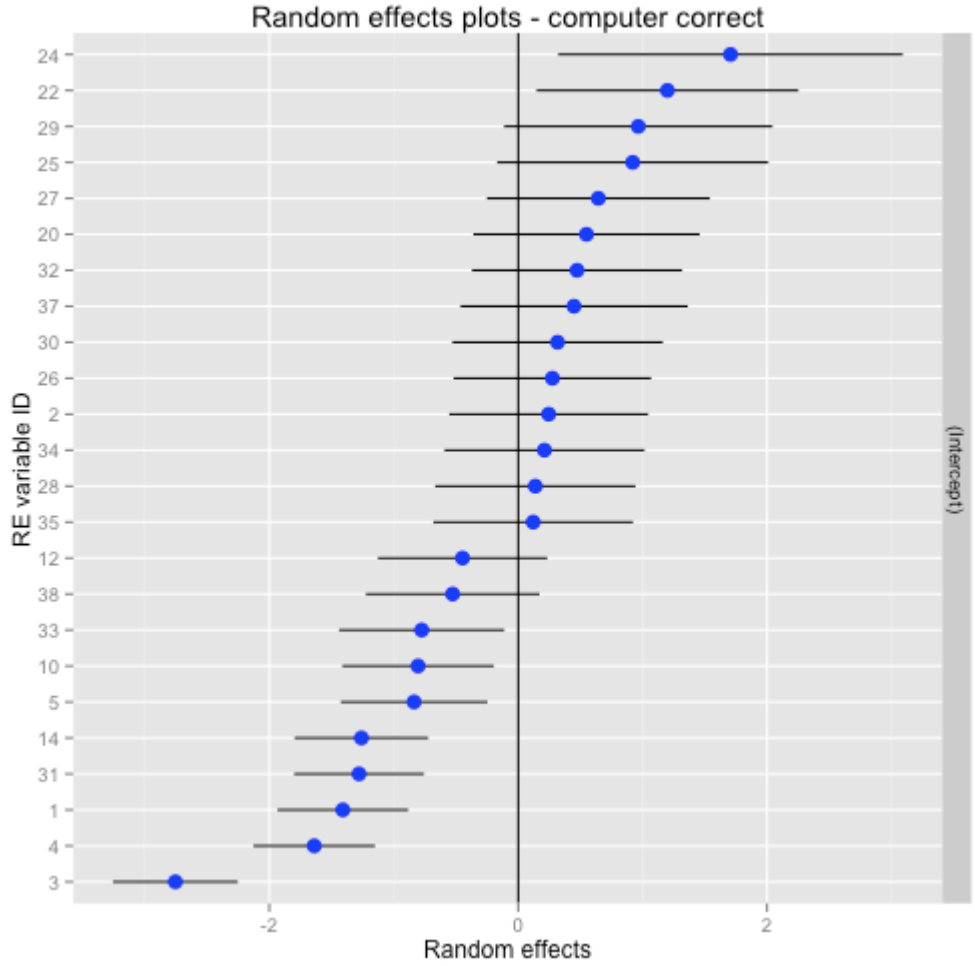



```
 # Just correct computer interpretations
 print(ggCaterpillar(ranef(fitGLMcc, postVar=TRUE), QQ=FALSE, likeDotplot=FALSE,"Random effects
plots - computer correct"))
```

```
$participant_id
```

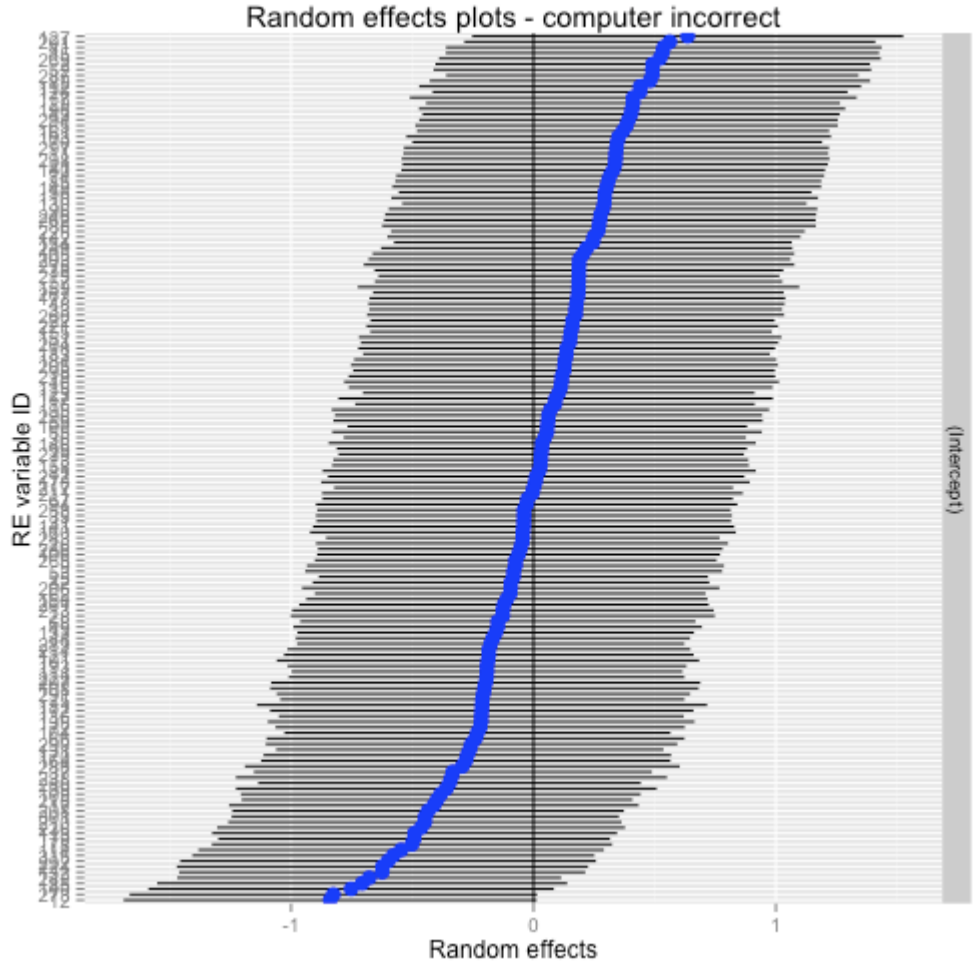

Random effects plots - computer correct
RE variable ID
(Intercept)
-2
-1
0
1
2
Random effects

```
$ecg_id
```

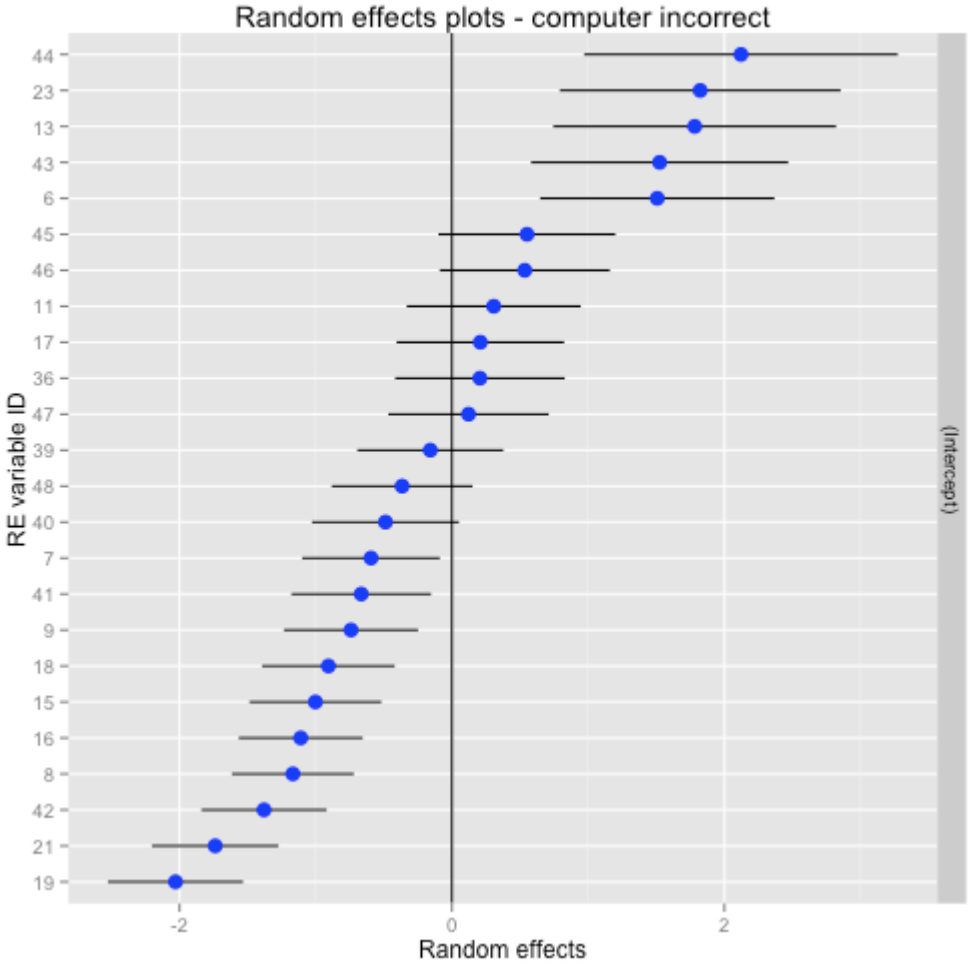



```
 # Just incorrect computer interpretations
 print(ggCaterpillar(ranef(fitGLMci, postVar=TRUE), QQ=FALSE, likeDotplot=FALSE,"Random effects
plots - computer incorrect"))
```

```
$participant_id
```


Random effects plots - computer incorrect
RE variable ID
(Intercept)
-1
0
1
Random effects

```
$ecg_id
```


Random effects plots - computer incorrect
RE variable ID
44
23
13
43
6
45
46
11
17
36
47
39
48
40
7
41
9
18
15
16
8
42
21
19
(Intercept)
-2
0
2
Random effects

```
 #------- COMBINED logOR TABLES -----------

 combiTable <- function(glm,glmre,caption1,label1,filename) {
   tableOUT <- data.frame((coef(summary(glm))[,c("Estimate","Std. Error","z
value","Pr(>|z|)")]),check.names=F)
   tableOUTCI <- confint(glm)
   tableOUTCIfinal <- paste(sprintf("%.2f",
(tableOUTCI[,1])),sprintf("%.2f",tableOUTCI[,2]),sep=' to ')
   tableOUT[,1] <- sprintf("%.2f",tableOUT[,1])
   tableOUT[,2] <- sprintf("%.2f",tableOUT[,2])
   tableOUT[,3] <- sprintf("%.2f",tableOUT[,3])
   tableOUT[,4] <- sprintf("%.2f",tableOUT[,4])
   tableOUT <- cbind(tableOUT, tableOUTCIfinal)
   parameters<- c("Constant","Message")
   tableOUT <- cbind(parameters, tableOUT)
   colnames(tableOUT) <- c("Parameters","Log OR","Standard error","z","P>|z|","95% CI")
   tableOUT$Parameters <- as.character(tableOUT$Parameters)
   #Prepare GLM RE model
   tableOUT1 <- as.data.frame(coef(summary(glmre)))
   lower <- (tableOUT1[,1]+qnorm(.025)*tableOUT1[,2])
   upper <- (tableOUT1[,1]+qnorm(.975)*tableOUT1[,2])
   tableOUTCIfinal <- paste(sprintf("%.2f",lower),sprintf("%.2f",upper),sep=' to ')
   tableOUT1 <- cbind(round(tableOUT1,3), tableOUTCIfinal)
   parameters<- c("Constant","Message")
   tableOUT1[,1] <- sprintf("%.2f",tableOUT1[,1])
   tableOUT1[,2] <- sprintf("%.2f",tableOUT1[,2])
   tableOUT1[,3] <- sprintf("%.2f",tableOUT1[,3])
   tableOUT1[,4] <- sprintf("%.2f",tableOUT1[,4])
   tableOUT1 <- cbind(parameters, tableOUT1)
   colnames(tableOUT1) <- c("Parameters","Log OR","Standard error","z","P>|z|","95% CI")
   tableOUT <- rbind(c("GLM",NA,NA,NA,NA,NA),tableOUT)
   tableOUT <- rbind(tableOUT,c("RE",NA,NA,NA,NA,NA))
   tableOUT <- rbind(tableOUT,tableOUT1)
   tableOUT <- rbind(tableOUT,c("sigzma",NA,NA,NA,NA,NA))
   tableOUT <-
rbind(tableOUT,c("$\\sigma^2_{ecg}$",round(VarCorr(fitGLM)$ecg_id[1],2),NA,NA,NA,NA))
   tableOUT <-
rbind(tableOUT,c("$\\sigma^2_{participant}$",round(VarCorr(fitGLM)$participant[1],2),NA,NA,NA,NA))
   colnames(tableOUT) <- c("Parameters","Log OR","Standard error","z","P$>$$|z|$","95\\% CI")
   table1 <- xtable(tableOUT,caption=caption1,label=label1,align=c("l","l","c","c","c","c","c"))
   finalTable <-
print(table1,append=F,table.placement="htbp",caption.placement="top",include.rownames=FALSE,booktab
= function(x) x)
  # cat(finalTable)
   finalTable <- sub("GLM &  &  &  &  &  \\\\","\\textit{GLM no Random Effects} &  &  &  &  &
\\\\",finalTable,fixed=T)

   finalTable <- sub("RE &  &  &  &  &  \\\\","\\midrule
  \\textit{GLM with Random Effects} &  &  &  &  & \\\\",finalTable,fixed=T)

   finalTable <- sub("sigzma &  &  &  &  &  \\\\ ","\\midrule ",finalTable,fixed=T)
   finalTable <- sub("\\begin{tabular}{lccccc}",
                     "\\newcolumntype{U}{>{\\centering\\arraybackslash}p{0.08\\textwidth}}
\\newcolumntype{V}{>{\\centering\\arraybackslash}p{0.1\\textwidth}}
\\newcolumntype{W}{>{\\arraybackslash}p{0.31\\textwidth}}
\\newcolumntype{X}{>{\\centering\\arraybackslash}p{0.15\\textwidth}}
\\begin{tabular}{WUVUUX}",finalTable,fixed=T)
   print(finalTable)
   cat(finalTable)
   cat(finalTable,file=paste("Tables/",filename,sep=''))
 }

 combiTable(fit,fitGLM,"Log odds ratio of correct answer with all
messages","lormesgall","logORtablesmesg.tex")
```

```
Waiting for profiling to be done...
```

```
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:25 2013
\begin{table}[htbp]
\centering
\caption{Log odds ratio of correct answer with all messages}
\label{lormesgall}
\begin{tabular}{lccccc}
  \toprule
Parameters & Log OR & Standard error & z & P$>$$|z|$ & 95\% CI \\
  \midrule
GLM &  &  &  &  &  \\
  Constant & 1.41 & 0.06 & 24.20 & 0.00 & 1.30 to 1.53 \\
  Message & -0.06 & 0.08 & -0.78 & 0.44 & -0.22 to 0.10 \\
  RE &  &  &  &  &  \\
  Constant & 1.87 & 0.20 & 9.42 & 0.00 & 1.48 to 2.26 \\
  Message & -0.08 & 0.09 & -0.88 & 0.38 & -0.26 to 0.10 \\
  sigzma &  &  &  &  &  \\
  $\sigma^2_{ecg}$ & 1.57 &  &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
[1] "% latex table generated in R 2.15.2 by xtable 1.7-1 package\n% Mon Jul 15 17:49:25 2013\n
\\begin{table}[htbp]\n\\centering\n\\caption{Log odds ratio of correct answer with all
messages} \n\\label{lormesgall}\n\\newcolumntype{U}{>{\\centering\\arraybackslash}p{0.08
\\textwidth}}\n\\newcolumntype{V}{>{\\centering\\arraybackslash}p{0.1\\textwidth}}
\n\\newcolumntype{W}{>{\\arraybackslash}p{0.31\\textwidth}}\n\\newcolumntype{X}{>{\\centering
\\arraybackslash}p{0.15\\textwidth}}\n\\begin{tabular}{WUVUUX}\n  \\toprule\nParameters & Log
OR & Standard error & z & P$>$$|z|$ & 95\\% CI \\\\ \n  \\midrule\n\\textit{GLM no Random
Effects} &  &  &  &  \\\\ \n  Constant & 1.41 & 0.06 & 24.20 & 0.00 & 1.30 to 1.53 \\\\ \n
Message & -0.06 & 0.08 & -0.78 & 0.44 & -0.22 to 0.10 \\\\ \n  \\midrule\n  \\textit{GLM with
Random Effects} &  &  &  &  \\\\ \n  Constant & 1.87 & 0.20 & 9.42 & 0.00 & 1.48 to 2.26 \\\\
\n  Message & -0.08 & 0.09 & -0.88 & 0.38 & -0.26 to 0.10 \\\\ \n  \\midrule \n
$\\sigma^2_{ecg}$ & 1.57 &  &  &  \\\\ \n  $\\sigma^2_{participant}$ & 0.21 &  &  &  \\\\
\n   \\bottomrule\n\\end{tabular}\n\\end{table}\n"
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:25 2013
\begin{table}[htbp]
\centering
\caption{Log odds ratio of correct answer with all messages}
\label{lormesgall}
\newcolumntype{U}{>{\centering\arraybackslash}p{0.08\textwidth}}
\newcolumntype{V}{>{\centering\arraybackslash}p{0.1\textwidth}}
\newcolumntype{W}{>{\arraybackslash}p{0.31\textwidth}}
\newcolumntype{X}{>{\centering\arraybackslash}p{0.15\textwidth}}
\begin{tabular}{WUVUUX}
  \toprule
Parameters & Log OR & Standard error & z & P$>$$|z|$ & 95\% CI \\
  \midrule
\textit{GLM no Random Effects} &  &  &  &  & \\
  Constant & 1.41 & 0.06 & 24.20 & 0.00 & 1.30 to 1.53 \\
  Message & -0.06 & 0.08 & -0.78 & 0.44 & -0.22 to 0.10 \\
  \midrule
  \textit{GLM with Random Effects} &  &  &  &  & \\
  Constant & 1.87 & 0.20 & 9.42 & 0.00 & 1.48 to 2.26 \\
  Message & -0.08 & 0.09 & -0.88 & 0.38 & -0.26 to 0.10 \\
  \midrule
  $\sigma^2_{ecg}$ & 1.57 &  &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
```

```
 combiTable(fitcc,fitGLMcc,"Log odds ratio of correct answer and correct computer
messages","lormesgcc","logORtablesmesgcc.tex")
```

```
Waiting for profiling to be done...
```

```
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:26 2013
\begin{table}[htbp]
\centering
\caption{Log odds ratio of correct answer and correct computer messages}
\label{lormesgcc}
\begin{tabular}{lccccc}
  \toprule
Parameters & Log OR & Standard error & z & P$>$$|z|$ & 95\% CI \\
  \midrule
GLM &  &  &  &  &  \\
  Constant & 1.67 & 0.09 & 18.62 & 0.00 & 1.50 to 1.85 \\
  Message & 0.27 & 0.13 & 2.05 & 0.04 & 0.01 to 0.54 \\
  RE &  &  &  &  &  \\
  Constant & 2.21 & 0.27 & 8.32 & 0.00 & 1.69 to 2.74 \\
  Message & 0.35 & 0.15 & 2.36 & 0.02 & 0.06 to 0.64 \\
  sigzma &  &  &  &  &  \\
  $\sigma^2_{ecg}$ & 1.57 &  &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
[1] "% latex table generated in R 2.15.2 by xtable 1.7-1 package\n% Mon Jul 15 17:49:26 2013\n
\\begin{table}[htbp]\n\\centering\n\\caption{Log odds ratio of correct answer and correct
computer messages} \n\\label{lormesgcc}\n\\newcolumntype{U}{>{\\centering\\arraybackslash}p{0.08
\\textwidth}}\n\\newcolumntype{V}{>{\\centering\\arraybackslash}p{0.1\\textwidth}}
\n\\newcolumntype{W}{>{\\arraybackslash}p{0.31\\textwidth}}\n\\newcolumntype{X}{>{\\centering
\\arraybackslash}p{0.15\\textwidth}}\n\\begin{tabular}{WUVUUX}\n  \\toprule\nParameters & Log
OR & Standard error & z & P$>$$|z|$ & 95\\% CI \\\\ \n  \\midrule\n\\textit{GLM no Random
Effects} &  &  &  &  \\\\ \n  Constant & 1.67 & 0.09 & 18.62 & 0.00 & 1.50 to 1.85 \\\\ \n
Message & 0.27 & 0.13 & 2.05 & 0.04 & 0.01 to 0.54 \\\\ \n  \\midrule\n  \\textit{GLM with
Random Effects} &  &  &  &  \\\\ \n  Constant & 2.21 & 0.27 & 8.32 & 0.00 & 1.69 to 2.74 \\\\
\n  Message & 0.35 & 0.15 & 2.36 & 0.02 & 0.06 to 0.64 \\\\ \n  \\midrule \n  $\\sigma^2_{ecg}$
& 1.57 &  &  &  \\\\ \n  $\\sigma^2_{participant}$ & 0.21 &  &  &  \\\\ \n   \\bottomrule
\n\\end{tabular}\n\\end{table}\n"
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:26 2013
\begin{table}[htbp]
\centering
\caption{Log odds ratio of correct answer and correct computer messages}
\label{lormesgcc}
\newcolumntype{U}{>{\centering\arraybackslash}p{0.08\textwidth}}
\newcolumntype{V}{>{\centering\arraybackslash}p{0.1\textwidth}}
\newcolumntype{W}{>{\arraybackslash}p{0.31\textwidth}}
\newcolumntype{X}{>{\centering\arraybackslash}p{0.15\textwidth}}
\begin{tabular}{WUVUUX}
  \toprule
Parameters & Log OR & Standard error & z & P$>$$|z|$ & 95\% CI \\
  \midrule
\textit{GLM no Random Effects} &  &  &  &  & \\
  Constant & 1.67 & 0.09 & 18.62 & 0.00 & 1.50 to 1.85 \\
  Message & 0.27 & 0.13 & 2.05 & 0.04 & 0.01 to 0.54 \\
  \midrule
  \textit{GLM with Random Effects} &  &  &  &  & \\
  Constant & 2.21 & 0.27 & 8.32 & 0.00 & 1.69 to 2.74 \\
  Message & 0.35 & 0.15 & 2.36 & 0.02 & 0.06 to 0.64 \\
  \midrule
  $\sigma^2_{ecg}$ & 1.57 &  &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
```

```
 combiTable(fitci,fitGLMci,"Log odds ratio of correct answer and incorrect computer
messages","lormesgci","logORtablesmesgci.tex")
```

```
Waiting for profiling to be done...
```

```
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:26 2013
\begin{table}[htbp]
\centering
\caption{Log odds ratio of correct answer and incorrect computer messages}
\label{lormesgci}
\begin{tabular}{lccccc}
  \toprule
Parameters & Log OR & Standard error & z & P$>$$|z|$ & 95\% CI \\
  \midrule
GLM &  &  &  &  &  \\
  Constant & 1.19 & 0.08 & 15.35 & 0.00 & 1.04 to 1.34 \\
  Message & -0.28 & 0.11 & -2.63 & 0.01 & -0.49 to -0.07 \\
  RE &  &  &  &  &  \\
  Constant & 1.60 & 0.28 & 5.80 & 0.00 & 1.06 to 2.14 \\
  Message & -0.35 & 0.12 & -3.03 & 0.00 & -0.58 to -0.12 \\
  sigzma &  &  &  &  &  \\
  $\sigma^2_{ecg}$ & 1.57 &  &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
[1] "% latex table generated in R 2.15.2 by xtable 1.7-1 package\n% Mon Jul 15 17:49:26 2013\n
\\begin{table}[htbp]\n\\centering\n\\caption{Log odds ratio of correct answer and incorrect
computer messages} \n\\label{lormesgci}\n\\newcolumntype{U}{>{\\centering\\arraybackslash}p{0.08
\\textwidth}}\n\\newcolumntype{V}{>{\\centering\\arraybackslash}p{0.1\\textwidth}}
\n\\newcolumntype{W}{>{\\arraybackslash}p{0.31\\textwidth}}\n\\newcolumntype{X}{>{\\centering
\\arraybackslash}p{0.15\\textwidth}}\n\\begin{tabular}{WUVUUX}\n  \\toprule\nParameters & Log
OR & Standard error & z & P$>$$|z|$ & 95\\% CI \\\\ \n  \\midrule\n\\textit{GLM no Random
Effects} &  &  &  &  \\\\ \n  Constant & 1.19 & 0.08 & 15.35 & 0.00 & 1.04 to 1.34 \\\\ \n
Message & -0.28 & 0.11 & -2.63 & 0.01 & -0.49 to -0.07 \\\\ \n  \\midrule\n  \\textit{GLM with
Random Effects} &  &  &  &  \\\\ \n  Constant & 1.60 & 0.28 & 5.80 & 0.00 & 1.06 to 2.14 \\\\
\n  Message & -0.35 & 0.12 & -3.03 & 0.00 & -0.58 to -0.12 \\\\ \n  \\midrule \n
$\\sigma^2_{ecg}$ & 1.57 &  &  &  \\\\ \n  $\\sigma^2_{participant}$ & 0.21 &  &  &  \\\\
\n   \\bottomrule\n\\end{tabular}\n\\end{table}\n"
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:26 2013
\begin{table}[htbp]
\centering
\caption{Log odds ratio of correct answer and incorrect computer messages}
\label{lormesgci}
\newcolumntype{U}{>{\centering\arraybackslash}p{0.08\textwidth}}
\newcolumntype{V}{>{\centering\arraybackslash}p{0.1\textwidth}}
\newcolumntype{W}{>{\arraybackslash}p{0.31\textwidth}}
\newcolumntype{X}{>{\centering\arraybackslash}p{0.15\textwidth}}
\begin{tabular}{WUVUUX}
  \toprule
Parameters & Log OR & Standard error & z & P$>$$|z|$ & 95\% CI \\
  \midrule
\textit{GLM no Random Effects} &  &  &  &  & \\
  Constant & 1.19 & 0.08 & 15.35 & 0.00 & 1.04 to 1.34 \\
  Message & -0.28 & 0.11 & -2.63 & 0.01 & -0.49 to -0.07 \\
  \midrule
  \textit{GLM with Random Effects} &  &  &  &  & \\
  Constant & 1.60 & 0.28 & 5.80 & 0.00 & 1.06 to 2.14 \\
  Message & -0.35 & 0.12 & -3.03 & 0.00 & -0.58 to -0.12 \\
  \midrule
  $\sigma^2_{ecg}$ & 1.57 &  &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
```

```r
 #--------- COMBINED OR TABLES WITH RANDOM EFFECTS ----------
 combiTableEXP <- function(glm,glmre,caption1,label1,filename) {
   tableOUT <- data.frame((coef(summary(glm))[,c("Estimate","z
value","Pr(>|z|)")]),check.names=F)
   tableOUT[,1] <- exp(tableOUT[,1])
   tableOUTCI <- exp(confint(glm))
   tableOUTCIfinal <- paste(sprintf("%.2f",tableOUTCI[,1]),sprintf("%.2f",tableOUTCI[,2]),sep='
to ')
   tableOUT[,1] <- sprintf("%.2f",tableOUT[,1])
   tableOUT[,2] <- sprintf("%.2f",tableOUT[,2])
   tableOUT[,3] <- sprintf("%.2f",tableOUT[,3])
   tableOUT <- cbind(tableOUT, tableOUTCIfinal)
   parameters<- c("Constant","Message")
   tableOUT <- cbind(parameters, tableOUT)
   colnames(tableOUT) <- c("Parameters","OR","z","P>|z|","95% CI")
   tableOUT$Parameters <- as.character(tableOUT$Parameters)
   #print(tableOUT)
   #Prepare GLM RE model
   tableOUT1 <- as.data.frame(coef(summary(glmre)))
   #str(tableOUT1)
   #print(tableOUT1)
   lower <- (tableOUT1[,1]+qnorm(.025)*tableOUT1[,2])
   upper <- (tableOUT1[,1]+qnorm(.975)*tableOUT1[,2])
   tableOUT1CIfinal <- paste(sprintf("%.2f",exp(lower)),sprintf("%.2f",exp(upper)),sep=' to ')
   #tableOUT1 <- cbind(tableOUT1, tableOUT1CIfinal)
   parameters<- c("Constant","Message")
   tableOUT1[,1] <- sprintf("%.2f",exp(tableOUT1[,1]))
   tableOUT1[,2] <- sprintf("%.2f",tableOUT1[,3])
   tableOUT1[,3] <- sprintf("%.2f",tableOUT1[,4])
   tableOUT1[,4] <- tableOUT1CIfinal
   tableOUT1 <- cbind(parameters, tableOUT1)
   colnames(tableOUT1) <- c("Parameters","OR","z","P>|z|","95% CI")
  # print(tableOUT1)
   tableOUT <- rbind(c("GLM",NA,NA,NA,NA),tableOUT)
   tableOUT <- rbind(tableOUT,c("RE",NA,NA,NA,NA))
   tableOUT <- rbind(tableOUT,tableOUT1)
   tableOUT <- rbind(tableOUT,c("sigzma",NA,NA,NA,NA))
   tableOUT <-
rbind(tableOUT,c("$\\sigma^2_{ecg}$",round(VarCorr(fitGLM)$ecg_id[1],2),NA,NA,NA))
   tableOUT <-
rbind(tableOUT,c("$\\sigma^2_{participant}$",round(VarCorr(fitGLM)$participant[1],2),NA,NA,NA))
   colnames(tableOUT) <- c("Parameters","OR","z","P$>$$|z|$","95\\% CI")
  # print(tableOUT)
   table1 <- xtable(tableOUT,caption=caption1,label=label1,align=c("l","l","c","c","c","c"))
   finalTable <-
print(table1,append=F,table.placement="htbp",caption.placement="top",include.rownames=FALSE,booktab
= function(x) x)
   # cat(finalTable)
   finalTable <- sub("GLM &  &  &  &  \\\\","\\textit{GLM no Random Effects}  &  &  &  &
\\\\",finalTable,fixed=T)

   finalTable <- sub("RE &  &  &  &  \\\\","\\midrule
  \\textit{GLM with Random Effects} &  &  &  & \\\\",finalTable,fixed=T)

   finalTable <- sub("sigzma &  &  &  &  \\\\ ","\\midrule ",finalTable,fixed=T)
   cat(finalTable,file=paste("Tables/",filename,sep=''))
 }

 combiTableEXP(fit,fitGLM,"Odds ratio of correct answer with all
messages","ormesgall","ORtablesmesg.tex")
```

```
Waiting for profiling to be done...
```

```
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:26 2013
\begin{table}[htbp]
\centering
\caption{Odds ratio of correct answer with all messages}
\label{ormesgall}
\begin{tabular}{lcccc}
  \toprule
Parameters & OR & z & P$>$$|z|$ & 95\% CI \\
  \midrule
GLM &  &  &  &  \\
  Constant & 4.10 & 24.20 & 0.00 & 3.66 to 4.60 \\
  Message & 0.94 & -0.78 & 0.44 & 0.80 to 1.10 \\
  RE &  &  &  &  \\
  Constant & 6.48 & 9.42 & 0.00 & 4.39 to 9.56 \\
  Message & 0.92 & -0.88 & 0.38 & 0.77 to 1.10 \\
  sigzma &  &  &  &  \\
  $\sigma^2_{ecg}$ & 1.57 &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
```

```
 combiTableEXP(fitcc,fitGLMcc,"Odds ratio of correct answer and correct computer
messages","ormesgcc","ORtablesmesgcc.tex")
```

```
Waiting for profiling to be done...
```

```
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:27 2013
\begin{table}[htbp]
\centering
\caption{Odds ratio of correct answer and correct computer messages}
\label{ormesgcc}
\begin{tabular}{lcccc}
  \toprule
Parameters & OR & z & P$>$$|z|$ & 95\% CI \\
  \midrule
GLM &  &  &  &  \\
  Constant & 5.30 & 18.62 & 0.00 & 4.46 to 6.35 \\
  Message & 1.31 & 2.05 & 0.04 & 1.01 to 1.71 \\
  RE &  &  &  &  \\
  Constant & 9.16 & 8.32 & 0.00 & 5.43 to 15.43 \\
  Message & 1.42 & 2.36 & 0.02 & 1.06 to 1.89 \\
  sigzma &  &  &  &  \\
  $\sigma^2_{ecg}$ & 1.57 &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
```

```
 combiTableEXP(fitci,fitGLMci,"Odds ratio of correct answer and incorrect computer
messages","ormesgci","ORtablesmesgci.tex")
```

```
Waiting for profiling to be done...
```

```
% latex table generated in R 2.15.2 by xtable 1.7-1 package
% Mon Jul 15 17:49:27 2013
\begin{table}[htbp]
\centering
\caption{Odds ratio of correct answer and incorrect computer messages}
\label{ormesgci}
\begin{tabular}{lcccc}
  \toprule
Parameters & OR & z & P$>$$|z|$ & 95\% CI \\
  \midrule
GLM &  &  &  &  \\
  Constant & 3.28 & 15.35 & 0.00 & 2.82 to 3.82 \\
  Message & 0.76 & -2.63 & 0.01 & 0.61 to 0.93 \\
  RE &  &  &  &  \\
  Constant & 4.95 & 5.80 & 0.00 & 2.88 to 8.49 \\
  Message & 0.70 & -3.03 & 0.00 & 0.56 to 0.88 \\
  sigzma &  &  &  &  \\
  $\sigma^2_{ecg}$ & 1.57 &  &  &  \\
  $\sigma^2_{participant}$ & 0.21 &  &  &  \\
   \bottomrule
\end{tabular}
\end{table}
```

```
#------- ICC CALCULATIONS ----------

# Create functions to calculate ICC

xVars <- function(model) {
  exvars = lme4::VarCorr(model)
  vars = c(exvars$ecg_id[1,1], exvars$participant_id[1,1])
  names(vars) <- c('ecg var', 'participant var')
  vars
}

# helper function for ICC(k) variations

icck <- function(variances, var='both') {
  # Binomial distribution (logit), residual variance fixed at pi*2/3
  # Need to discuss whether this is important - 1 is also sometimes used

  resVar <- (pi*2/3)
  if(var=='ecg')  icc = variances[1] / (variances[1] + variances[2] + resVar)
  else if(var=='participant') icc = variances[2] / (variances[1] + variances[2] + resVar)
  else icc = (variances[1] + variances[2]) / (variances[1] + variances[2] + resVar)
}

fitGLMOnly <- glmer(diag_correct~(1|ecg_id)+
(1|participant_id),data=FinalStudyData99,family=binomial("logit"))

cat("Calculate ICC values\n")
```

```
Calculate ICC values
```

```
# ICC calculation for participant and ECG
print(icck(xVars(fitGLMOnly)))
```

```
ecg var
 0.4591
```

```
# CC calculation for ECG only
print(icck(xVars(fitGLMOnly),'ecg'))
```

```
ecg var
 0.4055
```

```
# ICC calculation for participant only
print(icck(xVars(fitGLMOnly),'participant'))
```

```
participant var
        0.05362
```

```

```