```
# Download and install R on your computer (from http://www.r-project.org/).
# Install the following packages: lme4 and foreign as follows:
#    install.packages("lme4")
#    install.packages("foreign")
#
# Put all data files (reshape_corr_patients.csv, data_patients.csv, reshape_corr_twin.csv,
#                     data_twins.csv, results_dep.txt, results_gen.txt)
#    and this file with R code in a directory.
# This directory will become your working directory.

setwd("C:\\Folder\\Subfolder") # set this to your working directory

require(lme4)
require(nlme)
require(foreign)

############################
### DEPRESSED SAMPLE #######
############################

#####################################################################
### variance and correlation analysis for depressed patients #######
#####################################################################

rm(list=ls())

dat <- read.table("reshape_corr_patients.csv", header=TRUE, sep=",")
dat <- dat[order(dat$subjno),]
dat$beep <- rep(sequence(sapply(split(dat$subjno, dat$subjno), length)/4), each=4)

### hdrs_tert==1
res1 <- lme(affect ~ dum_opg + dum_tev + dum_ang + dum_som - 1,
            random = ~ factor(item) - 1 | subjno,
            weights = varIdent(form = ~ 1 | item),
            correlation = corSymm(form = ~ 1 | subjno/beep),
            data=dat, na.action=na.omit,
            control=list(msVerbose=TRUE, maxIter=500, msMaxIter=500), subset=hdrs_tert==1)
summary(res1)

### hdrs_tert==2
res2 <- lme(affect ~ dum_opg + dum_tev + dum_ang + dum_som - 1,
            random = ~ factor(item) - 1 | subjno,
            weights = varIdent(form = ~ 1 | item),
            correlation = corSymm(form = ~ 1 | subjno/beep),
            data=dat, na.action=na.omit,
            control=list(msVerbose=TRUE, maxIter=500, msMaxIter=500), subset=hdrs_tert==2)
summary(res2)

### hdrs_tert==3
res3 <- lme(affect ~ dum_opg + dum_tev + dum_ang + dum_som - 1,
            random = ~ factor(item) - 1 | subjno,
            weights = varIdent(form = ~ 1 | item),
            correlation = corSymm(form = ~ 1 | subjno/beep),
            data=dat, na.action=na.omit,
            control=list(msVerbose=TRUE, maxIter=500, msMaxIter=500), subset=hdrs_tert==3)
summary(res3)

#############################################################
### autocorrelation analysis for depressed patients #######
#############################################################

rm(list=ls())
dat2 <- read.table("data_patients.csv", header=TRUE, sep=";")

################
### cheerful ###
################

### hdrs_change as linear term
auto1lmer <- lmer(opgew_dev ~ opgewkt_dl*hdrs_change + (-1+opgewkt_dl|subjno),
                  control=list(msVerbose=TRUE, maxIter=500), data=dat2, na.action=na.exclude, REML=FALSE)
summary(auto1lmer)

auto1lmer <- lme(opgew_dev ~ opgewkt_dl*hdrs_change, random = ~ -1+opgewkt_dl|subjno,
                 control=list(msVerbose=TRUE, maxIter=500), data=dat2, na.action=na.exclude, method="ML")
summary(auto1lmer)

### hdrs_tert = tertiles
auto1lmerT <- lmer(opgew_dev ~ opgewkt_dl*factor(hdrs_tert) + (-1+opgewkt_dl|subjno),
                   control=list(msVerbose=TRUE, maxIter=500), data=dat2, na.action=na.exclude)
summary(auto1lmerT)
auto1lmerT@fixef[2]+c(0,auto1lmerT@fixef[5:6])

################
### content  ###
################
```

```
### hdrs_change as linear term
auto2lmer<-lmer(tevr_dev ~ tevreden_dl*hdrs_change + (-1+tevreden_dl|subjno),
                control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto2lmer)

### hdrs_tert = tertiles
auto2lmerT<-lmer(tevr_dev ~ tevreden_dl*factor(hdrs_tert) + (-1+tevreden_dl|subjno),
                 control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto2lmerT)
auto2lmerT@fixef[2]+c(0,auto2lmerT@fixef[5:6])

################
### anxious  ###
################

### hdrs_change as linear term
auto3lmer<-lmer(ang_dev ~ angstig_dl*hdrs_change + (-1+angstig_dl|subjno),
                control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto3lmer)

### hdrs_tert = tertiles
auto3lmerT<-lmer(ang_dev ~ angstig_dl*factor(hdrs_tert) + (-1+angstig_dl|subjno),
                 control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto3lmerT)
auto3lmerT@fixef[2]+c(0,auto3lmerT@fixef[5:6])

################
### sad      ###
################

### hdrs_change as linear term
auto4lmer<-lmer(som_dev ~ somber_dl*hdrs_change + (-1+somber_dl|subjno),
                control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto4lmer)

### hdrs_tert = tertiles
auto4lmerT<-lmer(som_dev ~ somber_dl*factor(hdrs_tert) + (-1+somber_dl|subjno),
                 control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto4lmerT)
auto4lmerT@fixef[2]+c(0,auto4lmerT@fixef[5:6])

############################
### COMMUNITY SAMPLE #######
############################

#########################################################################
### variance and correlation analysis for community sample   #######
#########################################################################

rm(list=ls())

dat <- read.table("reshape_corr_twin.csv", header=TRUE, sep=",")
dat <- dat[order(dat$subjno),]
dat$beep <- rep(sequence(sapply(split(dat$subjno, dat$subjno), length)/4), each=4)

### dep_mean_tert==1
res1 <- lme(affect ~ dum_opg + dum_tev + dum_ang + dum_som - 1,
            random = ~ factor(item) - 1 | subjno,
            weights=varIdent(form = ~ 1 | item),
            correlation = corSymm(form = ~ 1 | subjno/beep),
            data=dat, na.action=na.omit,
            control=list(msVerbose=TRUE, maxIter=500, msMaxIter=500), subset=dep_mean_tert==1)
summary(res1)

### dep_mean_tert==2
res2 <- lme(affect ~ dum_opg + dum_tev + dum_ang + dum_som - 1,
            random = ~ factor(item) - 1 | subjno,
            weights=varIdent(form = ~ 1 | item),
            correlation = corSymm(form = ~ 1 | subjno/beep),
            data=dat, na.action=na.omit,
            control=list(msVerbose=TRUE, maxIter=500, msMaxIter=500), subset=dep_mean_tert==2)
summary(res2)

### dep_mean_tert==3
res3 <- lme(affect ~ dum_opg + dum_tev + dum_ang + dum_som - 1,
            random = ~ factor(item) - 1 | subjno,
            weights=varIdent(form = ~ 1 | item),
            correlation = corSymm(form = ~ 1 | subjno/beep),
            data=dat, na.action=na.omit,
            control=list(msVerbose=TRUE, maxIter=500, msMaxIter=500), subset=dep_mean_tert==3)
summary(res3)

#############################################################
### autocorrelation analysis for community sample   #######
#############################################################

rm(list=ls())
dat2 <- read.table("data_twins.csv", header=TRUE, sep=",") #this may take some time
```

```
dat2 <- read.table("data_twins.csv", header=TRUE, sep=",") #this may take some time

################
### cheerful ###
################

### dep_fut as linear term
auto1lmer<-lmer(opgewkt_d ~ opgewkt_dl*dep_fut + dep1 + (-1+opgewkt_dl|subjno),
                control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto1lmer) # check interaction effect

### dep_mean_tert = tertiles
auto1lmerT<-lmer(opgewkt_d ~ opgewkt_dl*factor(dep_mean_tert) + dep1+ (-1+opgewkt_dl|subjno),
                 control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto1lmerT)
auto1lmerT@fixef[2]+c(0,auto1lmerT@fixef[6:7])

################
### content  ###
################

### dep_fut as linear term
auto2lmer<-lmer(tevreden_d ~ tevre_dl*dep_fut + dep1 + (-1+tevre_dl|subjno),
                control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto2lmer)

### dep_mean_tert  = tertiles
auto2lmerT<-lmer(tevreden_d ~ tevre_dl*factor(dep_mean_tert)+ dep1 + (-1+tevre_dl|subjno),
                 control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto2lmerT)
auto2lmerT@fixef[2]+c(0,auto2lmerT@fixef[6:7])

################
### anxious  ###
################

### dep_fut as linear term
auto3lmer<-lmer(angstig_d ~ angstig_dl*dep_fut+ dep1 + (-1+angstig_dl|subjno),
                control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto3lmer)

### dep_mean_tert = tertiles
auto3lmerT<-lmer(angstig_d ~ angstig_dl*factor(dep_mean_tert)+ dep1 + (-1+angstig_dl|subjno),
                 control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto3lmerT)
auto3lmerT@fixef[2]+c(0,auto3lmerT@fixef[6:7])

################
### sad      ###
################

### dep_fut as linear term
auto4lmer<-lmer(somber_d ~ somber_dl*dep_fut+ dep1 + (-1+somber_dl|subjno),
                control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto4lmer)

### dep_mean_tert = tertiles
auto4lmerT<-lmer(somber_d ~ somber_dl*factor(dep_mean_tert)+ dep1 + (-1+somber_dl|subjno),
                 control=list(msVerbose=TRUE, maxIter=500),data=dat2,na.action=na.exclude, REML=FALSE)
summary(auto4lmerT)
auto4lmerT@fixef[2]+c(0,auto4lmerT@fixef[6:7])

######################
### Wald tests #######
######################

rm(list=ls())

### select either results_dep.txt or results_gen.txt for patient or community sample
dat <- read.table("results_dep.txt", header=TRUE, as.is=TRUE)
#dat <- read.table("results_gen.txt", header=TRUE, as.is=TRUE)

vars <- unique(dat$var)

X2 <- rep(NA, length(vars))
b1 <- rep(NA, length(vars))
b2 <- rep(NA, length(vars))
b3 <- rep(NA, length(vars))

z12 <- rep(NA, length(vars))
z13 <- rep(NA, length(vars))
z23 <- rep(NA, length(vars))

for (i in 1:length(vars)) {

   dat.sub <- dat[dat$var == vars[i],]

   b  <- cbind(dat.sub$bi)
```

```
   se <- c(dat.sub$sei)
   V  <- diag(se^2)

   x1 <- c(1, -1,  0)
   x2 <- c(0,  1, -1)
   X  <- rbind(x1, x2)

   X2[i] <- t(X %*% b) %*% solve(X%*%V%*%t(X)) %*% (X %*% b)

   b1[i] <- b[1]; b2[i] <- b[2]; b3[i] <- b[3]

   X <- rbind(c(1, -1,  0))
   z12[i] <- sqrt(t(X %*% b) %*% solve(X%*%V%*%t(X)) %*% (X %*% b))

   X <- rbind(c(1,  0, -1))
   z13[i] <- sqrt(t(X %*% b) %*% solve(X%*%V%*%t(X)) %*% (X %*% b))

   X <- rbind(c(0,  1, -1))
   z23[i] <- sqrt(t(X %*% b) %*% solve(X%*%V%*%t(X)) %*% (X %*% b))

}

pvalX2  <- pchisq(X2, df=2, lower.tail=FALSE)
pvalz12 <- 2*pnorm(z12, lower.tail=FALSE)
pvalz13 <- 2*pnorm(z13, lower.tail=FALSE)
pvalz23 <- 2*pnorm(z23, lower.tail=FALSE)

res <- data.frame(grp1=formatC(b1, digits=2, format="f"),
                  grp2=formatC(b2, digits=2, format="f"),
                  grp3=formatC(b3, digits=2, format="f"),
                  X2=formatC(X2, digits=2, format="f"), df=2, pval=formatC(pvalX2, digits=3, format="f"),
                  z1vs2=formatC(z12, digits=2, format="f"), pval=formatC(pvalz12, digits=3, format="f"),
                  z1vs3=formatC(z13, digits=2, format="f"), pval=formatC(pvalz13, digits=3, format="f"),
                  z2vs3=formatC(z23, digits=2, format="f"), pval=formatC(pvalz23, digits=3, format="f"))
row.names(res) <- vars
print(res)
```