

APPENDIX 11.1: R CODE FOR SIMULATING DATA AND CONDUCTING HOMOLOGY TESTS

```
#####Load Packages#####
```

```
library(lme4)
library(MASS)
library(pwr)
```

```
#####Generate Data#####
```

```
#1.) Group-Level
```

```
mu<-c(3.5,4,3)#specify means
covmx<-matrix(data=c(1,.32,.39,.32,1,.07,.39,.07,1),
  nrow=3,ncol=3)#specify covariance matrix
set.seed(5299)
gdata<-mvrnorm(22,mu,covmx,empirical=TRUE)#s
  imulate data
gdata<-data.frame(gdata)#remake as data frame
colnames(gdata)<-c("OCB","Agree","JSAT")#rename
  variables
cor(gdata)#confirm correlations match parameters
```

```
#2.) Individual-Level
```

```
set.seed(5299)
groupN<-sample(80:120,22,replace=T)#get Ns per
  group
groups<-rep(1:22,times=groupN)
covmx<-matrix(data=c(1,.45,.56,.45,1,.10,.56,.10,1),
  nrow=3,ncol=3)#specify covariance matrix
set.seed(5299)
idata<-mvrnorm(sum(groupN),mu,covmx,
  empirical=T)#simulate data
idata<-cbind(idata,groups)#add group coding column
  to data matrix
idata<-data.frame(idata)#remake as data frame
colnames(idata)<-c("OCB","Agree","JSAT","Group")
  #rename variables
cor(idata)#confirm correlations match parameters
```

```
#####Test 1: Metaphoric Homology#####
```

```
:#1.) Model MLM is a multilevel model for the
  nested individual-level data
ModelMLM<-lmer(OCB~Agree+JSAT+(1+Agree+
  JSAT|Group),data=idata)
```

```
#2.) Model 1 is a standard weighted least squares
  regression for the group-level data
```

```
Model1<-lm(OCB~Agree+JSAT,data=gdata,weights=
  groupN)
```

```
#3.) Examine whether pattern of significance
  converges across models
```

```
summary(ModelMLM)$coefficients
summary(Model1)$coefficients
#Determine appropriate alpha level (Here, we specified
  our desired power and got a reasonable #alpha)
pwr.r.test(n=22,r=.35,sig.level=NULL,power=.70)
```

```
#####Test 2: Proportional Homology#####
```

```
#1.) Store coefficients from Model MLM
params<-summary(ModelMLM)$coefficients[,1]
```

```
#2.) Model 2 is a standard weighted least squares
  regression with the parameters fixed to
```

```
#Model MLM and a proportionality parameter
Model2<-lm(OCB~I(params[2]*Agree+params[3]*
  JSAT),data=gdata,weights=groupN)
c<-summary(Model2)$coefficients[2]#proportionality
  parameter
```

```
#3.) Compare Model 2 with Model 1 using F-test
#Retrieve SSE and specify number of parameters
  in Model 1
```

```
SSE1<-deviance(Model1)
k1<-3
```

```
#Retrieve SSE and specify number of parameters
  in Model 2
```

```
SSE2<-deviance(Model2)
k2<-1
```

```
#Retrieve total N
```

```
N<-nobs(Model1)
```

```
#Calculate F-statistic
```

```
Fstat1<-((SSE2-SSE1)/(k1-k2))/(SSE1/(N-k1))
```

```
#Evaluate whether F-statistic is significant
```

```
 #(non-significance means we accept proportional
  model)
```

```
pf(q=Fstat1,df1=(k1-k2),df2=(N-k1),lower.tail=
  FALSE)
```

```
#Informally compare coefficients to see if proportional
  (ignore intercept)
```

```
params*c#Model MLM (individual level)
```

```
summary(Model1)$coefficients[,1]#Model 1
  (group level)
```

#####Test 3: Identical Homology#####

#1.) Model 3 is a weighted least squares regression
with all parameters fixed to

#Model MLM and no proportionality parameter
Model3<-lm(OCB~offset(params[2]*Agree)+
offset(params[3]*JSAT),data=gdata,weights=
groupN)

#2.) Compare Model 3 with Model 2 using F-test

#Retrieve SSE and specify number of parameters
in Model 3

SSE3<-deviance(Model3)

k3<-0

#Calculate F-statistic

Fstat2<-((SSE3-SSE2)/(k2-k3))/(SSE2/(N-k2))

#Evaluate whether F-statistic is significant (non-
significance means we accept identical model))

pf(q=Fstat2,df1=(k2-k3),df2=(N-k2),lower.

tail=FALSE)

#Informally compare coefficients to see if identical
(ignore intercept)

summary(ModelMLM)\$coefficients

summary(Model1)\$coefficients