

Supplementary information: R code

Aada Ståhl, Milla Salonen, Emma Hakanen, Salla Mikkola, Sini Sulkama, Jari Lahti, Hannes Lohi

PACKAGES

```
library(dplyr)
library(lavaan)
library(semTools)
```

DATA EDITS

```
#first read in data
```

```
onep.paq <- read.table()
```

```
# owner's gender
```

```
levels(onep.paq$owner_gender) <- c("not_woman", "not_woman", "not_woman", "woman")
levels(onep.paq$owner_gender) <- c(1,2)
onep.paq$owner_gender <- as.numeric(as.character(onep.paq$owner_gender))
```

```
# age
```

```
levels(onep.paq$owner_age) <- c(2,3,4,5,6,7,8,9,1,NA)
```

```
# children
```

```
levels(onep.paq$children) <- c(0,1)
onep.paq$children <- as.numeric(as.character(onep.paq$children))
```

```
# scale PAQ traits as contain much more variance than other variables
```

```
onep.paq$PAQ_Anxiety_scaled <- scale(onep.paq$PAQ_Anxiety)
onep.paq$PAQ_Avoidance_scaled <- scale(onep.paq$PAQ_Avoidance)
```

DOGS

```
# filter dogs
```

```
paq.dogs <- filter(onep.paq, species=="dog")
paq.dogs <- droplevels(paq.dogs)
```

** Model selection

**** Dog model 1: Total wellbeing, scales, Large personality

```
paq.sem.dog.1 <- '
  # latent variables
  Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
  CESD.10 + GAD.7
```

```

fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
                DOG_surface_phobia + DOG_fearfulness
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity

```

```
# regressions
```

```

PAQ_Avoidance_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
                    NeuroticismM + OpennessM +
                    fearaggre + aggression + adhd +
                    owner_gender + owner_age_num +
                    children + Total_wellbeing

```

```

PAQ_Anxiety_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
                  NeuroticismM +
                  fearaggre + fear.related +
                  owner_gender + owner_age_num +
                  children + Total_wellbeing

```

```
Total_wellbeing ~ NeuroticismM + ExtraversionM
```

```
NeuroticismM ~ owner_gender + owner_age_num
```

```
Agreeableness2M ~ owner_gender + owner_age_num
```

```
ConscientiousnessM ~ owner_age_num
```

```
# correlations
```

```
Total_wellbeing ~~ owner_gender
```

```
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
```

```
fearaggre ~~ aggression
```

```
fear.related ~~ adhd
```

```
NeuroticismM ~~ ConscientiousnessM
```

```
NeuroticismM ~~ ExtraversionM
```

```
OpennessM ~~ ExtraversionM
```

```
ExtraversionM ~~ ConscientiousnessM
```

```
Agreeableness2M ~~ NeuroticismM + OpennessM
```

```
# run the model
```

```
fit.paq.sem.dog.1 <- sem(paq.sem.dog.1, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.dogs)
```

```
# extract model fit measures
```

```
totwell.scale.large.dog <- fitmeasures(fit.paq.sem.dog.1, c("cfi","tli","rmsea","srmr"))
```

```
#### **** Dog model 2: Total wellbeing, latent paq, large personality ####
```

```
paq.sem.dog.2 <- '
```

```
# latent variables
```

```
Anxiety =~ Anx1 + Anx2 + Anx3 + Anx4 + Anx5 + Anx6 + Anx7 + Anx8 + Anx9 + Anx10 +
Anx11 + Anx12 + Anx13
```

```
Avoidance =~ Avoid1 + Avoid2 + Avoid3 + Avoid4 + Avoid5 + Avoid6 + Avoid7 + Avoid8 +
                Avoid9 + Avoid10 + Avoid11 + Avoid12 + Avoid13
```

```

Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
  CESD.10 + GAD.7
fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
  DOG_surface_phobia + DOG_fearfulness
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity

```

```
# regressions
```

```

Avoidance ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
  NeuroticismM + OpennessM +
  fearaggre + aggression + adhd +
  owner_gender + owner_age_num +
  children + Total_wellbeing

```

```

Anxiety ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
  NeuroticismM +
  fearaggre + fear.related +
  owner_gender + owner_age_num +
  children + Total_wellbeing

```

```
Total_wellbeing ~ NeuroticismM + ExtraversionM
```

```
NeuroticismM ~ owner_gender + owner_age_num
```

```
Agreeableness2M ~ owner_gender + owner_age_num
```

```
ConscientiousnessM ~ owner_age_num
```

```
# correlations
```

```
Total_wellbeing ~~ owner_gender
```

```
Avoidance ~~ 0*Anxiety
```

```
fearaggre ~~ aggression
```

```
fear.related ~~ adhd
```

```
NeuroticismM ~~ ConscientiousnessM
```

```
NeuroticismM ~~ ExtraversionM
```

```
OpennessM ~~ ExtraversionM
```

```
ExtraversionM ~~ ConscientiousnessM
```

```
Agreeableness2M ~~ NeuroticismM + OpennessM
```

```
fit.paq.sem.dog.2 <- sem(paq.sem.dog.2, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.dogs)
```

```
totwell.latent.large.dog <- fitmeasures(fit.paq.sem.dog.2, c("cfi","tli","rmsea","srmr"))
```

```
#### **** Dog model 3: Total wellbeing, scales, small personality ####
```

```
paq.sem.dog.3 <- '
```

```
# latent variables
```

```

Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
  CESD.10 + GAD.7

```

```
fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
```

```
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
```

```
  DOG_surface_phobia + DOG_fearfulness
```

```
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
```

```
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity
```

```
# regressions
```

```

PAQ_Avoidance_scaled ~ ConscientiousnessM + ExtraversionM +
                        OpennessM +
                        fearaggre + aggression + adhd +
                        owner_gender + owner_age_num +
                        children + Total_wellbeing
PAQ_Anxiety_scaled ~   NeuroticismM +
                        fearaggre + fear.related +
                        owner_gender + owner_age_num +
                        children + Total_wellbeing
Total_wellbeing ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

```

```

# correlations
Total_wellbeing ~~ owner_gender
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
fearaggre ~~ aggression
fear.related ~~ adhd
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM

```

```

fit.paq.sem.dog.3 <- sem(paq.sem.dog.3, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.dogs)
totwell.scale.small.dog <- fitmeasures(fit.paq.sem.dog.3, c("cfi","tli","rmsea","srmr"))

```

** Dog model 4: Total wellbeing, latent paq, small personality ####**

```

paq.sem.dog.4 <- '
# latent variables
Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
                  CESD.10 + GAD.7
Anxiety =~ Anx1 + Anx2 + Anx3 + Anx4 + Anx5 + Anx6 + Anx7 + Anx8 + Anx9 + Anx10 +
Anx11 + Anx12 + Anx13
Avoidance =~ Avoid1 + Avoid2 + Avoid3 + Avoid4 + Avoid5 + Avoid6 + Avoid7 + Avoid8 +
            Avoid9 + Avoid10 + Avoid11 + Avoid12 + Avoid13
fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
              DOG_surface_phobia + DOG_fearfulness
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity

# regressions
Avoidance ~ ConscientiousnessM + ExtraversionM +
            OpennessM +
            fearaggre + aggression + adhd +
            owner_gender + owner_age_num +
            children + Total_wellbeing
Anxiety ~   NeuroticismM +

```

```

        fearaggre + fear.related +
        owner_gender + owner_age_num +
        children + Total_wellbeing
Total_wellbeing ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Total_wellbeing ~~ owner_gender
Avoidance ~~ 0*Anxiety
fearaggre ~~ aggression
fear.related ~~ adhd
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM
,

fit.paq.sem.dog.4 <- sem(paq.sem.dog.4, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.dogs)
totwell.latent.small.dog <- fitmeasures(fit.paq.sem.dog.4, c("cfi","tli","rmsea","srmr"))

```

** Dog model 5: Positive & negative wellbeing, scales, large personality ####**

```

paq.sem.dog.5 <- '
# latent variables
Positive_well =~ Life.satisfaction + Wellbeing
Negative_well =~ Perceived.stress + CESD.10 + GAD.7
fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
                DOG_surface_phobia + DOG_fearfulness
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity

# regressions
PAQ_Avoidance_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
                    NeuroticismM + OpennessM +
                    fearaggre + aggression + adhd +
                    owner_gender + owner_age_num +
                    children + Positive_well + Negative_well
PAQ_Anxiety_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
                    NeuroticismM +
                    fearaggre + fear.related +
                    owner_gender + owner_age_num +
                    children + Positive_well + Negative_well
Positive_well ~ NeuroticismM + ExtraversionM
Negative_well ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
Agreeableness2M ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations

```

```

Positive_well ~~ owner_gender
Negative_well ~~ owner_gender
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
fearaggre ~~ aggression
fear.related ~~ adhd
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM

```

```

fit.paq.sem.dog.5 <- sem(paq.sem.dog.5, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.dogs)
posinegawell.scale.large.dog <- fitmeasures(fit.paq.sem.dog.5,
c("cfi","tli","rmsea","srmr"))

```

** Dog model 6: Positive & negative wellbeing, latent paq, large personality ####**

```

paq.sem.dog.6 <- '
# latent variables
Anxiety =~ Anx1 + Anx2 + Anx3 + Anx4 + Anx5 + Anx6 + Anx7 + Anx8 + Anx9 + Anx10 +
Anx11 + Anx12 + Anx13
Avoidance =~ Avoid1 + Avoid2 + Avoid3 + Avoid4 + Avoid5 + Avoid6 + Avoid7 + Avoid8 +
Avoid9 + Avoid10 + Avoid11 + Avoid12 + Avoid13

Positive_well =~ Life.satisfaction + Wellbeing
Negative_well =~ Perceived.stress + CESD.10 + GAD.7
fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
DOG_surface_phobia + DOG_fearfulness
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity

# regressions
Avoidance ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
NeuroticismM + OpennessM +
fearaggre + aggression + adhd +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Anxiety ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
NeuroticismM +
fearaggre + fear.related +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Positive_well ~ NeuroticismM + ExtraversionM
Negative_well ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
Agreeableness2M ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

```

```

# correlations
Positive_well ~~ owner_gender
Negative_well ~~ owner_gender
Avoidance ~~ 0*Anxiety
fearaggre ~~ aggression
fear.related ~~ adhd
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM

```

```

fit.paq.sem.dog.6 <- sem(paq.sem.dog.6, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.dogs)
posinegawell.latent.large.dog <- fitmeasures(fit.paq.sem.dog.6,
c("cfi","tli","rmsea","srmr"))

```

** Dog model 7: Positive & negative wellbeing, scales, small personality ####**

```

paq.sem.dog.7 <- '
# latent variables
Positive_well =~ Life.satisfaction + Wellbeing
Negative_well =~ Perceived.stress + CESD.10 + GAD.7
fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
                DOG_surface_phobia + DOG_fearfulness
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity

# regressions
PAQ_Avoidance_scaled ~ ConscientiousnessM + ExtraversionM +
                        OpennessM +
                        fearaggre + aggression + adhd +
                        owner_gender + owner_age_num +
                        children + Positive_well + Negative_well
PAQ_Anxiety_scaled ~   NeuroticismM +
                        fearaggre + fear.related +
                        owner_gender + owner_age_num +
                        children + Positive_well + Negative_well
Positive_well ~ NeuroticismM + ExtraversionM
Negative_well ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Positive_well ~~ owner_gender
Negative_well ~~ owner_gender
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
fearaggre ~~ aggression
fear.related ~~ adhd
NeuroticismM ~~ ConscientiousnessM

```

```

NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM
,

```

```

fit.paq.sem.dog.7 <- sem(paq.sem.dog.7, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.dogs)
posinegawell.scale.small.dog <- fitmeasures(fit.paq.sem.dog.7,
c("cfi","tli","rmsea","srmr"))

```

** Dog model 8: Positive & negative wellbeing, latent paq, small personality ####**

```

paq.sem.dog.8 <- '
# latent variables
Positive_well =~ Life.satisfaction + Wellbeing
Negative_well =~ Perceived.stress + CESD.10 + GAD.7
Anxiety =~ Anx1 + Anx2 + Anx3 + Anx4 + Anx5 + Anx6 + Anx7 + Anx8 + Anx9 + Anx10 +
Anx11 + Anx12 + Anx13
Avoidance =~ Avoid1 + Avoid2 + Avoid3 + Avoid4 + Avoid5 + Avoid6 + Avoid7 + Avoid8 +
Avoid9 + Avoid10 + Avoid11 + Avoid12 + Avoid13
fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
DOG_surface_phobia + DOG_fearfulness
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity

# regressions
Avoidance ~ ConscientiousnessM + ExtraversionM +
OpennessM +
fearaggre + aggression + adhd +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Anxiety ~ NeuroticismM +
fearaggre + fear.related +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Positive_well ~ NeuroticismM + ExtraversionM
Negative_well ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Positive_well ~~ owner_gender
Negative_well ~~ owner_gender
Avoidance ~~ 0*Anxiety
fearaggre ~~ aggression
fear.related ~~ adhd
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM

```



```

    ExtraversionM ~~ ConscientiousnessM
    Agreeableness2M ~~ NeuroticismM + OpennessM
  ,

fit.paq.sem.dog.8 <- sem(paq.sem.dog.8, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.dogs)
# vcov not positive definite
# cfi = 0.741, tli = 0.722, rmsea = 0.057, srmr = 0.075
posinegawell.latent.small.dog <- fitmeasures(fit.paq.sem.dog.8,
c("cfi","tli","rmsea","srmr"))

#### ** Model fit comparison ####

rbind(totwell.scale.large.dog,totwell.latent.large.dog,
totwell.scale.small.dog,totwell.latent.small.dog,
posinegawell.scale.large.dog,posinegawell.latent.large.dog,
posinegawell.scale.small.dog,posinegawell.latent.small.dog)

# cfi: 1&3 equal, 5&7 pretty close
# tli: 1&3 equal, 5&7 pretty close
# rmsea: 1&3 equal, 2&4 kinda close
# srmr: 1 best, 3 then, 2 next

### FIRST OVERALL BEST

#### ** Final dog model: 1st model with human sociability and perseverance ####

paq.sem.dog.final <- '
# latent variables
Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
CESD.10 + GAD.7
fearaggre =~ DOG_fearfulness + DOG_barking + DOG_stranger_aggression
fear.related =~ DOG_noise_sensitivity + DOG_separation_behavior +
DOG_surface_phobia + DOG_fearfulness
aggression =~ DOG_owner_aggression + DOG_dog_aggression + DOG_stranger_aggression
adhd =~ DOG_Vas_inattention + DOG_Vas_impulsivity

# regressions
PAQ_Avoidance_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
NeuroticismM + OpennessM +
fearaggre + aggression + adhd +
owner_gender + owner_age_num +
children + Total_wellbeing + DOG_human_sociability
PAQ_Anxiety_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
NeuroticismM +
fearaggre + fear.related +
owner_gender + owner_age_num +
children + Total_wellbeing + DOG_perseverance
Total_wellbeing ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
Agreeableness2M ~ owner_gender + owner_age_num

```

```

ConscientiousnessM ~ owner_age_num

# correlations
Total_wellbeing ~~ owner_gender
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
fearaggre ~~ aggression
fear.related ~~ adhd
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM
,

# run the model
fit.paq.sem.dog.final <- sem(paq.sem.dog.final, estimator="MLR", missing="ml.x",
fixed.x=T, data = paq.dogs)

# extract model fit measures
final.dog.model <- fitmeasures(fit.paq.sem.dog.final, c("cfi","tli","rmsea","srmr"))

# obtain the standardized and unstandardized estimates
standardizedSolution(fit.paq.sem.dog.final , type="std.all", output="pretty")
parameterEstimates(fit.paq.sem.dog.final)

#### ** RMSEA of null model ####

nullRMSEA(fit.paq.sem.dog.final)

# "A reasonable rule of thumb is to examine the RMSEA for the null model and make sure
that is no
# smaller than 0.158. An RMSEA for the model of 0.05 and a TLI of .90, implies that the
RMSEA
# of the null model is 0.158. If the RMSEA for the null model is less than 0.158, an
incremental
# measure of fit may not be that informative."
# See also http://davidakenny.net/cm/fit.htm

#### CATS ####

# filter cats
paq.cats <- filter(onep.paq, species=="cat")
paq.cats <- droplevels(paq.cats)

#### ** Model selection ####

#### **** Cat model 1: Total wellbeing, scales, Large personality ####

```

```

cats.sem.1 <- '
# latent variables
Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
                  CESD.10 + GAD.7

# regressions
PAQ_Avoidance_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
                      NeuroticismM + OpennessM +
                      CAT_fearfulness + CAT_human_aggression +
                      CAT_activity_playfulness + CAT_cat_sociability +
                      CAT_human_sociability + CAT_litterbox_issues +
                      CAT_excessive_grooming +
                      owner_gender + owner_age_num +
                      children + Total_wellbeing
PAQ_Anxiety_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
                   NeuroticismM +
                   CAT_fearfulness + CAT_human_aggression +
                   CAT_activity_playfulness + CAT_cat_sociability +
                   CAT_human_sociability + CAT_litterbox_issues +
                   CAT_excessive_grooming +
                   owner_gender + owner_age_num +
                   children + Total_wellbeing

Total_wellbeing ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
Agreeableness2M ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Total_wellbeing ~~ owner_gender
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM
CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +
CAT_litterbox_issues
CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness
CAT_human_aggression ~~ CAT_fearfulness
CAT_litterbox_issues ~~ CAT_excessive_grooming
,

fit.cat.sem.1 <- sem(cats.sem.1, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.cats)
totwell.scale.large.cat <- fitmeasures(fit.cat.sem.1, c("cfi","tli","rmsea","srmr"))

#### **** Cat model 2: Total wellbeing, Latent paq, Large personality ####

cats.sem.2 <- '
# latent variables

```

```

Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
                  CESD.10 + GAD.7
Anxiety =~ Anx1 + Anx2 + Anx3 + Anx4 + Anx5 + Anx6 + Anx7 + Anx8 + Anx9 + Anx10 +
Anx11 + Anx12 + Anx13
Avoidance =~ Avoid1 + Avoid2 + Avoid3 + Avoid4 + Avoid5 + Avoid6 + Avoid7 + Avoid8 +
            Avoid9 + Avoid10 + Avoid11 + Avoid12 + Avoid13

# regressions
Avoidance ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
            NeuroticismM + OpennessM +
            CAT_fearfulness + CAT_human_aggression +
            CAT_activity_playfulness + CAT_cat_sociability +
            CAT_human_sociability + CAT_litterbox_issues +
            CAT_excessive_grooming +
            owner_gender + owner_age_num +
            children + Total_wellbeing
Anxiety ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
            NeuroticismM +
            CAT_fearfulness + CAT_human_aggression +
            CAT_activity_playfulness + CAT_cat_sociability +
            CAT_human_sociability + CAT_litterbox_issues +
            CAT_excessive_grooming +
            owner_gender + owner_age_num +
            children + Total_wellbeing
Total_wellbeing ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
Agreeableness2M ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Total_wellbeing ~~ owner_gender
Avoidance ~~ 0*Anxiety
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM
CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +
CAT_litterbox_issues
CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness
CAT_human_aggression ~~ CAT_fearfulness
CAT_litterbox_issues ~~ CAT_excessive_grooming
,

fit.cat.sem.2 <- sem(cats.sem.2, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.cats)
totwell.latent.large.cat <- fitmeasures(fit.cat.sem.2, c("cfi","tli","rmsea","srmr"))

#### **** Cat model 3: Total wellbeing, scales, small personality ####

cats.sem.3 <- '
# latent variables

```

```

Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
                  CESD.10 + GAD.7

# regressions
PAQ_Avoidance_scaled ~ ConscientiousnessM + ExtraversionM +
                       OpennessM +
                       CAT_fearfulness + CAT_human_aggression +
                       CAT_activity_playfulness + CAT_cat_sociability +
                       CAT_human_sociability + CAT_litterbox_issues +
                       CAT_excessive_grooming +
                       owner_gender + owner_age_num +
                       children + Total_wellbeing

PAQ_Anxiety_scaled ~ NeuroticismM +
                    CAT_fearfulness + CAT_human_aggression +
                    CAT_activity_playfulness + CAT_cat_sociability +
                    CAT_human_sociability + CAT_litterbox_issues +
                    CAT_excessive_grooming +
                    owner_gender + owner_age_num +
                    children + Total_wellbeing

Total_wellbeing ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Total_wellbeing ~~ owner_gender
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +
CAT_litterbox_issues
CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness
CAT_human_aggression ~~ CAT_fearfulness
CAT_litterbox_issues ~~ CAT_excessive_grooming
,

fit.cat.sem.3 <- sem(cats.sem.3, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.cats)
totwell.scale.small.cat <- fitmeasures(fit.cat.sem.3, c("cfi","tli","rmsea","srmr"))

#### **** Cat model 4: Total wellbeing, latent paq, small personality ####

cats.sem.4 <- '
# latent variables
Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +
                  CESD.10 + GAD.7
Anxiety =~ Anx1 + Anx2 + Anx3 + Anx4 + Anx5 + Anx6 + Anx7 + Anx8 + Anx9 + Anx10 +
Anx11 + Anx12 + Anx13
Avoidance =~ Avoid1 + Avoid2 + Avoid3 + Avoid4 + Avoid5 + Avoid6 + Avoid7 + Avoid8 +
          Avoid9 + Avoid10 + Avoid11 + Avoid12 + Avoid13

```

```

# regressions
Avoidance ~ ConscientiousnessM + ExtraversionM +
              OpennessM +
              CAT_fearfulness + CAT_human_aggression +
              CAT_activity_playfulness + CAT_cat_sociability +
              CAT_human_sociability + CAT_litterbox_issues +
              CAT_excessive_grooming +
              owner_gender + owner_age_num +
              children + Total_wellbeing
Anxiety ~
              NeuroticismM +
              CAT_fearfulness + CAT_human_aggression +
              CAT_activity_playfulness + CAT_cat_sociability +
              CAT_human_sociability + CAT_litterbox_issues +
              CAT_excessive_grooming +
              owner_gender + owner_age_num +
              children + Total_wellbeing
Total_wellbeing ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Total_wellbeing ~~ owner_gender
Avoidance ~~ 0*Anxiety
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +
CAT_litterbox_issues
CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness
CAT_human_aggression ~~ CAT_fearfulness
CAT_litterbox_issues ~~ CAT_excessive_grooming
,

fit.cat.sem.4 <- sem(cats.sem.4, estimator="MLR", missing="mL.x", fixed.x=T, data =
paq.cats)
totwell.latent.small.cat <- fitmeasures(fit.cat.sem.4, c("cfi","tli","rmsea","srmr"))

#### **** Cat model 5: Positive & negative wellbeing, scales, large personality ####

cats.sem.5 <- '
# latent variables
Positive_well =~ Life.satisfaction + Wellbeing
Negative_well =~ Perceived.stress + CESD.10 + GAD.7

# regressions
PAQ_Avoidance_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
                      NeuroticismM + OpennessM +
                      CAT_fearfulness + CAT_human_aggression +
                      CAT_activity_playfulness + CAT_cat_sociability +

```

```

        CAT_human_sociability + CAT_litterbox_issues +
        CAT_excessive_grooming +
        owner_gender + owner_age_num +
        children + Positive_well + Negative_well
PAQ_Anxiety_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
        NeuroticismM +
        CAT_fearfulness + CAT_human_aggression +
        CAT_activity_playfulness + CAT_cat_sociability +
        CAT_human_sociability + CAT_litterbox_issues +
        CAT_excessive_grooming +
        owner_gender + owner_age_num +
        children + Positive_well + Negative_well
Negative_well ~ NeuroticismM + ExtraversionM
Positive_well ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
Agreeableness2M ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Negative_well ~~ owner_gender
Positive_well ~~ owner_gender
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM
CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +
CAT_litterbox_issues
CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness
CAT_human_aggression ~~ CAT_fearfulness
CAT_litterbox_issues ~~ CAT_excessive_grooming
,

fit.cat.sem.5 <- sem(cats.sem.5, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.cats)
posinegawell.scale.large.cat <- fitmeasures(fit.cat.sem.5, c("cfi","tli","rmsea","srmr"))

#### **** Cat model 6: Positive & negative wellbeing, latent paq, large personality ####

cats.sem.6 <- '
# latent variables
Positive_well =~ Life.satisfaction + Wellbeing
Negative_well =~ Perceived.stress + CESD.10 + GAD.7
Anxiety =~ Anx1 + Anx2 + Anx3 + Anx4 + Anx5 + Anx6 + Anx7 + Anx8 + Anx9 + Anx10 +
Anx11 + Anx12 + Anx13
Avoidance =~ Avoid1 + Avoid2 + Avoid3 + Avoid4 + Avoid5 + Avoid6 + Avoid7 + Avoid8 +
Avoid9 + Avoid10 + Avoid11 + Avoid12 + Avoid13

# regressions
Avoidance ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
        NeuroticismM + OpennessM +

```

```

CAT_fearfulness + CAT_human_aggression +
CAT_activity_playfulness + CAT_cat_sociability +
CAT_human_sociability + CAT_litterbox_issues +
CAT_excessive_grooming +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Anxiety ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +
NeuroticismM +
CAT_fearfulness + CAT_human_aggression +
CAT_activity_playfulness + CAT_cat_sociability +
CAT_human_sociability + CAT_litterbox_issues +
CAT_excessive_grooming +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Positive_well ~ NeuroticismM + ExtraversionM
Negative_well ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
Agreeableness2M ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Positive_well ~~ owner_gender
Negative_well ~~ owner_gender
Avoidance ~~ 0*Anxiety
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
Agreeableness2M ~~ NeuroticismM + OpennessM
CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +
CAT_litterbox_issues
CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness
CAT_human_aggression ~~ CAT_fearfulness
CAT_litterbox_issues ~~ CAT_excessive_grooming
,

fit.cat.sem.6 <- sem(cats.sem.6, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.cats)
posinegawell.latent.large.cat <- fitmeasures(fit.cat.sem.6, c("cfi","tli","rmsea","srmr"))

#### **** Cat model 7: Positive & negative wellbeing, scales, small personality ####

cats.sem.7 <- '
# latent variables
Positive_well =~ Life.satisfaction + Wellbeing
Negative_well =~ Perceived.stress + CESD.10 + GAD.7

# regressions
PAQ_Avoidance_scaled ~ ConscientiousnessM + ExtraversionM +
OpennessM +

```



```

CAT_fearfulness + CAT_human_aggression +
CAT_activity_playfulness + CAT_cat_sociability +
CAT_human_sociability + CAT_litterbox_issues +
CAT_excessive_grooming +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
PAQ_Anxiety_scaled ~ NeuroticismM +
CAT_fearfulness + CAT_human_aggression +
CAT_activity_playfulness + CAT_cat_sociability +
CAT_human_sociability + CAT_litterbox_issues +
CAT_excessive_grooming +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Positive_well ~ NeuroticismM + ExtraversionM
Negative_well ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Positive_well ~~ owner_gender
Negative_well ~~ owner_gender
PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +
CAT_litterbox_issues
CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness
CAT_human_aggression ~~ CAT_fearfulness
CAT_litterbox_issues ~~ CAT_excessive_grooming
,

fit.cat.sem.7 <- sem(cats.sem.7, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.cats)
posinegawell.scale.small.cat <- fitmeasures(fit.cat.sem.7, c("cfi","tli","rmsea","srmr"))

#### **** Cat model 8: Positive & negative wellbeing, latent paq, small personality ####

cats.sem.8 <- '
# latent variables
Positive_well =~ Life.satisfaction + Wellbeing
Negative_well =~ Perceived.stress + CESD.10 + GAD.7
Anxiety =~ Anx1 + Anx2 + Anx3 + Anx4 + Anx5 + Anx6 + Anx7 + Anx8 + Anx9 + Anx10 +
Anx11 + Anx12 + Anx13
Avoidance =~ Avoid1 + Avoid2 + Avoid3 + Avoid4 + Avoid5 + Avoid6 + Avoid7 + Avoid8 +
Avoid9 + Avoid10 + Avoid11 + Avoid12 + Avoid13

# regressions
Avoidance ~ ConscientiousnessM + ExtraversionM +
OpennessM +

```

```

CAT_fearfulness + CAT_human_aggression +
CAT_activity_playfulness + CAT_cat_sociability +
CAT_human_sociability + CAT_litterbox_issues +
CAT_excessive_grooming +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Anxiety ~ NeuroticismM +
CAT_fearfulness + CAT_human_aggression +
CAT_activity_playfulness + CAT_cat_sociability +
CAT_human_sociability + CAT_litterbox_issues +
CAT_excessive_grooming +
owner_gender + owner_age_num +
children + Positive_well + Negative_well
Positive_well ~ NeuroticismM + ExtraversionM
Negative_well ~ NeuroticismM + ExtraversionM
NeuroticismM ~ owner_gender + owner_age_num
ConscientiousnessM ~ owner_age_num

# correlations
Positive_well ~~ owner_gender
Negative_well ~~ owner_gender
Avoidance ~~ 0*Anxiety
NeuroticismM ~~ ConscientiousnessM
NeuroticismM ~~ ExtraversionM
OpennessM ~~ ExtraversionM
ExtraversionM ~~ ConscientiousnessM
CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +
CAT_litterbox_issues
CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness
CAT_human_aggression ~~ CAT_fearfulness
CAT_litterbox_issues ~~ CAT_excessive_grooming
,

fit.cat.sem.8 <- sem(cats.sem.8, estimator="MLR", missing="ml.x", fixed.x=T, data =
paq.cats)
posinegawell.latent.small.catt <- fitmeasures(fit.cat.sem.8,
c("cfi","tli","rmsea","srmr"))

#### ** Model fit comparison ####

rbind(totwell.scale.large.cat,totwell.latent.large.cat,
totwell.scale.small.cat,totwell.latent.small.cat,
posinegawell.scale.large.cat,posinegawell.latent.large.cat,
posinegawell.scale.small.cat,posinegawell.latent.small.cat)

# cfi: 1&3 equal, 5&7 next but far behind
# tli: 1&3 equal
# rmsea: 1 best, then 3, then 2
# srmr: 3 best, then 1

### FIRST OVERALL BEST

```

```
#### ** Final cat model ####
```

```
## first model
```

```
cats.sem.final <- '  
  # latent variables  
  Total_wellbeing =~ Life.satisfaction + Perceived.stress + Wellbeing +  
                    CESD.10 + GAD.7  
  
  # regressions  
  PAQ_Avoidance_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +  
                        NeuroticismM + OpennessM +  
                        CAT_fearfulness + CAT_human_aggression +  
                        CAT_activity_playfulness + CAT_cat_sociability +  
                        CAT_human_sociability + CAT_litterbox_issues +  
                        CAT_excessive_grooming +  
                        owner_gender + owner_age_num +  
                        children + Total_wellbeing  
  PAQ_Anxiety_scaled ~ Agreeableness2M + ConscientiousnessM + ExtraversionM +  
                      NeuroticismM +  
                      CAT_fearfulness + CAT_human_aggression +  
                      CAT_activity_playfulness + CAT_cat_sociability +  
                      CAT_human_sociability + CAT_litterbox_issues +  
                      CAT_excessive_grooming +  
                      owner_gender + owner_age_num +  
                      children + Total_wellbeing  
  Total_wellbeing ~ NeuroticismM + ExtraversionM  
  NeuroticismM ~ owner_gender + owner_age_num  
  Agreeableness2M ~ owner_gender + owner_age_num  
  ConscientiousnessM ~ owner_age_num  
  
  # correlations  
  Total_wellbeing ~~ owner_gender  
  PAQ_Avoidance_scaled ~~ 0*PAQ_Anxiety_scaled  
  NeuroticismM ~~ ConscientiousnessM  
  NeuroticismM ~~ ExtraversionM  
  OpennessM ~~ ExtraversionM  
  ExtraversionM ~~ ConscientiousnessM  
  Agreeableness2M ~~ NeuroticismM + OpennessM  
  CAT_cat_sociability ~~ CAT_activity_playfulness + CAT_human_aggression +  
CAT_litterbox_issues  
  CAT_human_sociability ~~ CAT_activity_playfulness + CAT_fearfulness  
  CAT_human_aggression ~~ CAT_fearfulness  
  CAT_litterbox_issues ~~ CAT_excessive_grooming  
,  
  
# run the model  
fit.cat.sem.final <- sem(cats.sem.final, estimator="MLR", missing="ml.x", fixed.x=T, data  
= paq.cats)  
  
# extract model fit measures
```

```
final.cat.model <- fitmeasures(fit.cat.sem.final, c("cfi", "tli", "rmsea", "srmr"))

# standardized and unstandardized estimates
standardizedSolution(fit.cat.sem.final, output="pretty")
parameterEstimates(fit.cat.sem.final)

#### ** RMSEA of null model ####

nullRMSEA(fit.cat.sem.final)
```