

Reproducible code for Castanho Silva et al., 2017

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Required libraries

```
library(lavaan)
library(mirt)
library(semTools)
library(lattice)
library(gridExtra)
library(psych)
library(ggplot2)
library(extrafont)
library(nFactors)
loadfonts()
```

Data for Figures 7.2, 7.3, 7.4, 7.5, and 7.6, and Table 7.2:

```
data<-read.csv('data.merged_mar17.csv',header=F)

varnames<-unlist(strsplit(readLines('varnames_mar17.txt'), '\t'))
names(data)<-varnames

data[data==--999]<-NA

data<-subset(data, country != 10)

data$simple8.r<-8-data$simple8
data$rwpop8.r<-8-data$rwpop8
data$manich13.r<-8-data$manich13
```

Figure 7.2

CFA model results

```
model.cfa.ours<- '
antiel =~ antiel23 + rwpop8.r + antiel21
people =~ gewill17 + simple8.r + gewill13
manich =~ manich15 + manich13.r + manich14
method =~ gewill13 + b1*antiel23 + b1*antiel21 + b1*gewill17 + b1*manich15 + b1*manich14
method ~~ 0*antiel + 0*people + 0*manich
'

ours.cfa.fit<-cfa(data=data,model=model.cfa.ours,estimator='mlr',missing='fiml',
                  group='country',group.equal='loadings')

summary(ours.cfa.fit,fit.measures=T)
```

Table 2

```

ours.mgcfa<-'
antiel =~ antiel23 + rwpop8.r + antiel21
people =~ gewill17 + simple8.r + gewill3
manich =~ manich15 + manich13.r + manich14
method =~ gewill3 + b1*antiel23 + b1*antiel21 + b1*gewill17 + b1*manich15 + b1*manich14
method ~~ 0*antiel + 0*people + 0*manich
'

measurementInvariance(ours.mgcfa,data=data,estimator='mlr',missing='fiml',group='country')

##
## Measurement invariance models:
##
## Model 1 : fit.configural
## Model 2 : fit.loadings
## Model 3 : fit.intercepts
## Model 4 : fit.means
##
## Scaled Chi Square Difference Test (method = "satorra.bentler.2001")
##
##           Df    AIC    BIC   Chisq Chisq diff Df diff Pr(>Chisq)
## fit.configural 166 80646 82511  440.58
## fit.loadings   254 80628 81980  599.12    102.17    88    0.1434
## fit.intercepts 294 80862 81981  912.57    322.17    40    <2e-16 ***
## fit.means      326 81542 82474 1656.35    591.67    32    <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## Fit measures:
##
##           cfi.scaled rmsea.scaled cfi.scaled.delta rmsea.scaled.delta
## fit.configural      0.902      0.080              NA              NA
## fit.loadings        0.913      0.061              0.011             0.019
## fit.intercepts      0.830      0.079              0.083             0.018
## fit.means           0.626      0.111              0.203             0.032

akkerman.mgcfa<-'pop =~ akker1 + akker2 + akker3 + akker4 + akker5 + akker6'
measurementInvariance(model=akkerman.mgcfa,data=data,estimator='mlr',missing='fiml',
                      group = 'country')

##
## Measurement invariance models:
##
## Model 1 : fit.configural
## Model 2 : fit.loadings
## Model 3 : fit.intercepts
## Model 4 : fit.means
##
## Scaled Chi Square Difference Test (method = "satorra.bentler.2001")
##
##           Df    AIC    BIC   Chisq Chisq diff Df diff Pr(>Chisq)
## fit.configural  81 36410 37335  230.76

```

```
## fit.loadings      121 36397 37093 297.15      59.935      40      0.02217 *
## fit.intercepts    161 36573 37040 553.11      253.283      40      < 2e-16 ***
## fit.means         169 36713 37135 709.22      137.733       8      < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
##
## Fit measures:
##
##               cfi.scaled rmsea.scaled cfi.scaled.delta rmsea.scaled.delta
## fit.configural      0.946      0.067              NA              NA
## fit.loadings        0.933      0.061              0.014              0.005
## fit.intercepts      0.821      0.086              0.111              0.025
## fit.means           0.747      0.100              0.074              0.014
```

Figures 7.3-7.6

```
data$Ant1<-data$antiel23
data$Ant2<-data$rwpop8.r
data$Ant3<-data$antiel21

data$Ppl1<-data$gewill17
data$Ppl2<-data$simple8.r
data$Ppl3<-data$gewill13

data$Man1<-data$manich15
data$Man2<-data$manich13.r
data$Man3<-data$manich1

bwtheme <- standard.theme(color=FALSE)

# 7.3:
model.people<-mirt(data['country' != 10,c('Ppl1','Ppl2','Ppl3')],1,itemtype='grsm',
  technical = list(removeEmptyRows=T))
```

```
##
Iteration: 1, Log-Lik: -35448.876, Max-Change: 9.00096
Iteration: 2, Log-Lik: -13012.247, Max-Change: 0.52809
Iteration: 3, Log-Lik: -12565.280, Max-Change: 0.20706
Iteration: 4, Log-Lik: -12475.374, Max-Change: 0.11266
Iteration: 5, Log-Lik: -12448.141, Max-Change: 0.07825
Iteration: 6, Log-Lik: -12438.509, Max-Change: 0.05235
Iteration: 7, Log-Lik: -12434.870, Max-Change: 0.03442
Iteration: 8, Log-Lik: -12433.443, Max-Change: 0.02243
Iteration: 9, Log-Lik: -12432.872, Max-Change: 0.01456
Iteration: 10, Log-Lik: -12432.533, Max-Change: 0.00573
Iteration: 11, Log-Lik: -12432.499, Max-Change: 0.00377
Iteration: 12, Log-Lik: -12432.486, Max-Change: 0.00253
Iteration: 13, Log-Lik: -12432.477, Max-Change: 0.00045
Iteration: 14, Log-Lik: -12432.477, Max-Change: 0.00013
Iteration: 15, Log-Lik: -12432.477, Max-Change: 0.00028
Iteration: 16, Log-Lik: -12432.477, Max-Change: 0.00010
Iteration: 17, Log-Lik: -12432.477, Max-Change: 0.00003
```

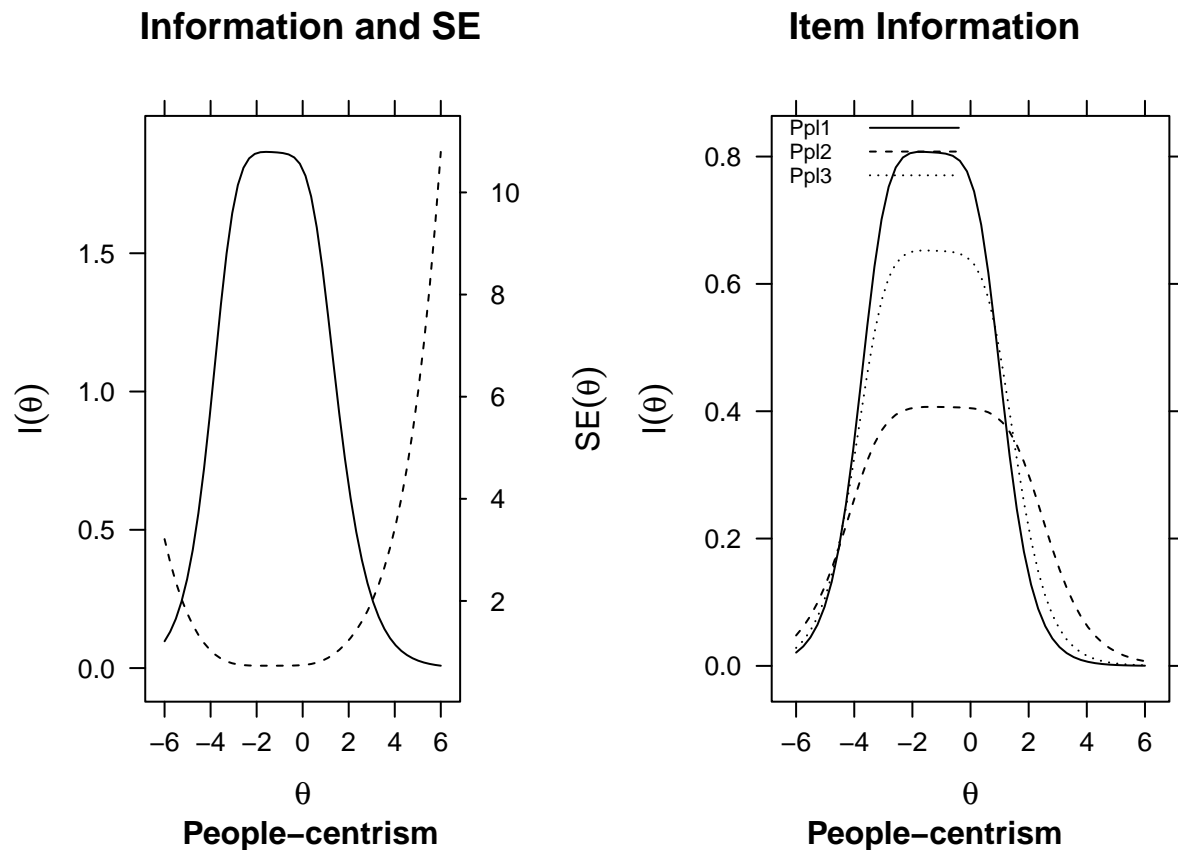
```

p.people<-plot(model.people, type = 'infoSE', sub='People-centrism',
              facet_items=F)
p.people<-update(p.people,sub='People-centrism',main='Information and SE',
               par.settings=bwtheme)

p.people.trace<-plot(model.people, type = 'infotrace',
                    facet_items=F)
p.people.trace<-update(p.people.trace, sub = 'People-centrism',main='Item Information',
                     par.settings=bwtheme,legend=NULL,
                     auto.key = list(space = "inside", points = FALSE, lines = TRUE,
                                     cex=0.7))

grid.arrange(p.people,p.people.trace,ncol=2)

```



```

# 7.4:
model.antiel<-mirt(data['country' != 10,c('Ant1','Ant2','Ant3')],1,itemtype='grsm',
                  technical = list(removeEmptyRows=T))

```

```

##
Iteration: 1, Log-Lik: -34400.231, Max-Change: 8.69240
Iteration: 2, Log-Lik: -13114.431, Max-Change: 0.52182
Iteration: 3, Log-Lik: -12529.994, Max-Change: 0.26542
Iteration: 4, Log-Lik: -12372.052, Max-Change: 0.19412
Iteration: 5, Log-Lik: -12314.640, Max-Change: 0.13302
Iteration: 6, Log-Lik: -12291.012, Max-Change: 0.08913
Iteration: 7, Log-Lik: -12280.438, Max-Change: 0.05942
Iteration: 8, Log-Lik: -12275.413, Max-Change: 0.03968

```

```

Iteration: 9, Log-Lik: -12272.914, Max-Change: 0.02660
Iteration: 10, Log-Lik: -12270.329, Max-Change: 0.00676
Iteration: 11, Log-Lik: -12270.242, Max-Change: 0.00634
Iteration: 12, Log-Lik: -12270.193, Max-Change: 0.00339
Iteration: 13, Log-Lik: -12270.166, Max-Change: 0.00323
Iteration: 14, Log-Lik: -12270.147, Max-Change: 0.00149
Iteration: 15, Log-Lik: -12270.144, Max-Change: 0.00193
Iteration: 16, Log-Lik: -12270.134, Max-Change: 0.00152
Iteration: 17, Log-Lik: -12270.129, Max-Change: 0.00106
Iteration: 18, Log-Lik: -12270.127, Max-Change: 0.00096
Iteration: 19, Log-Lik: -12270.126, Max-Change: 0.00235
Iteration: 20, Log-Lik: -12270.124, Max-Change: 0.00061
Iteration: 21, Log-Lik: -12270.124, Max-Change: 0.00014
Iteration: 22, Log-Lik: -12270.124, Max-Change: 0.00013
Iteration: 23, Log-Lik: -12270.124, Max-Change: 0.00033
Iteration: 24, Log-Lik: -12270.124, Max-Change: 0.00008

```

```

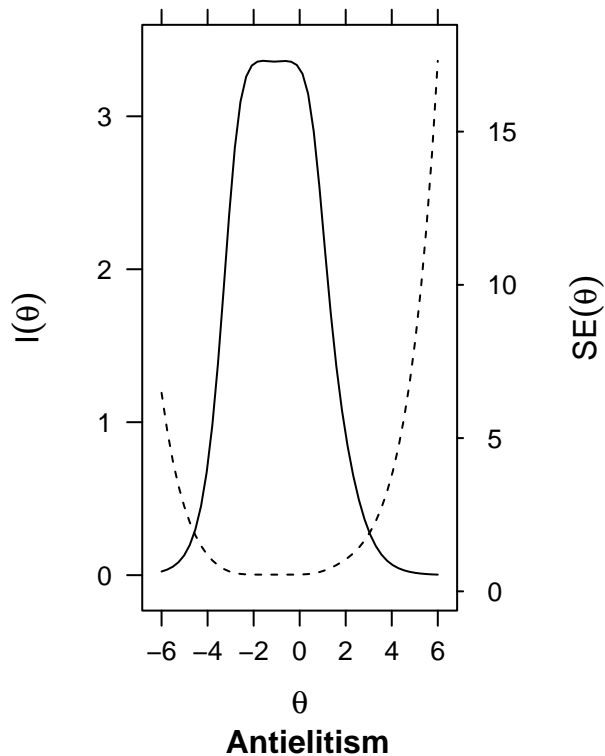
p.antiel<-plot(model.antiel, type = 'infoSE', main='Information and SE',
               facet_items=F)
p.antiel<-update(p.antiel,sub='Antielitism',par.settings=bwtheme)

p.antiel.trace<-plot(model.antiel, type = 'infotrace', main='Item Information',
                    facet_items=F)
p.antiel.trace<-update(p.antiel.trace,sub='Antielitism',par.settings=bwtheme,
                      legend=NULL,auto.key = list(space = "inside", points = FALSE,
                                                    lines = TRUE,cex=0.7))

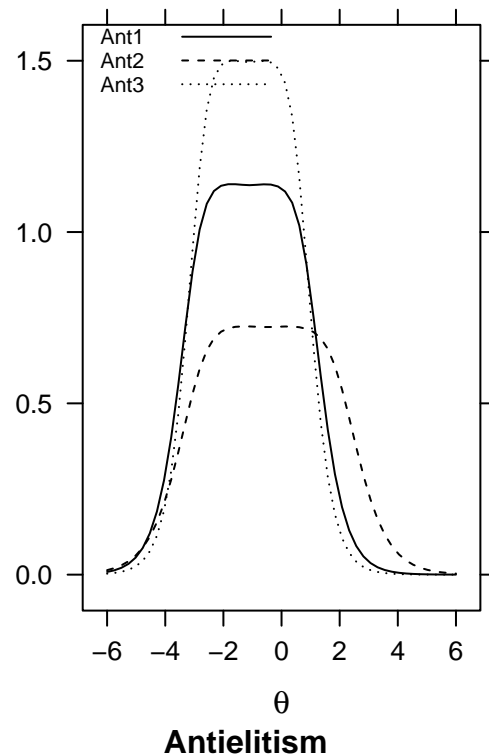
grid.arrange(p.antiel, p.antiel.trace, ncol=2)

```

Information and SE



Item Information



```
# 7.5:
model.manich<-mirt(data['country' != 10,c('Man1','Man2','Man3')],1,itemtype='grsm',
  technical = list(removeEmptyRows=T))
```

```
##
Iteration: 1, Log-Lik: -17980.716, Max-Change: 3.38056
Iteration: 2, Log-Lik: -13715.577, Max-Change: 0.54346
Iteration: 3, Log-Lik: -13403.318, Max-Change: 0.26205
Iteration: 4, Log-Lik: -13340.764, Max-Change: 0.14248
Iteration: 5, Log-Lik: -13323.513, Max-Change: 0.08142
Iteration: 6, Log-Lik: -13317.805, Max-Change: 0.04592
Iteration: 7, Log-Lik: -13315.943, Max-Change: 0.02647
Iteration: 8, Log-Lik: -13315.261, Max-Change: 0.01620
Iteration: 9, Log-Lik: -13315.022, Max-Change: 0.00954
Iteration: 10, Log-Lik: -13314.909, Max-Change: 0.00463
Iteration: 11, Log-Lik: -13314.892, Max-Change: 0.00224
Iteration: 12, Log-Lik: -13314.888, Max-Change: 0.00112
Iteration: 13, Log-Lik: -13314.887, Max-Change: 0.00081
Iteration: 14, Log-Lik: -13314.885, Max-Change: 0.00099
Iteration: 15, Log-Lik: -13314.885, Max-Change: 0.00079
Iteration: 16, Log-Lik: -13314.884, Max-Change: 0.00026
Iteration: 17, Log-Lik: -13314.884, Max-Change: 0.00014
Iteration: 18, Log-Lik: -13314.884, Max-Change: 0.00010
```

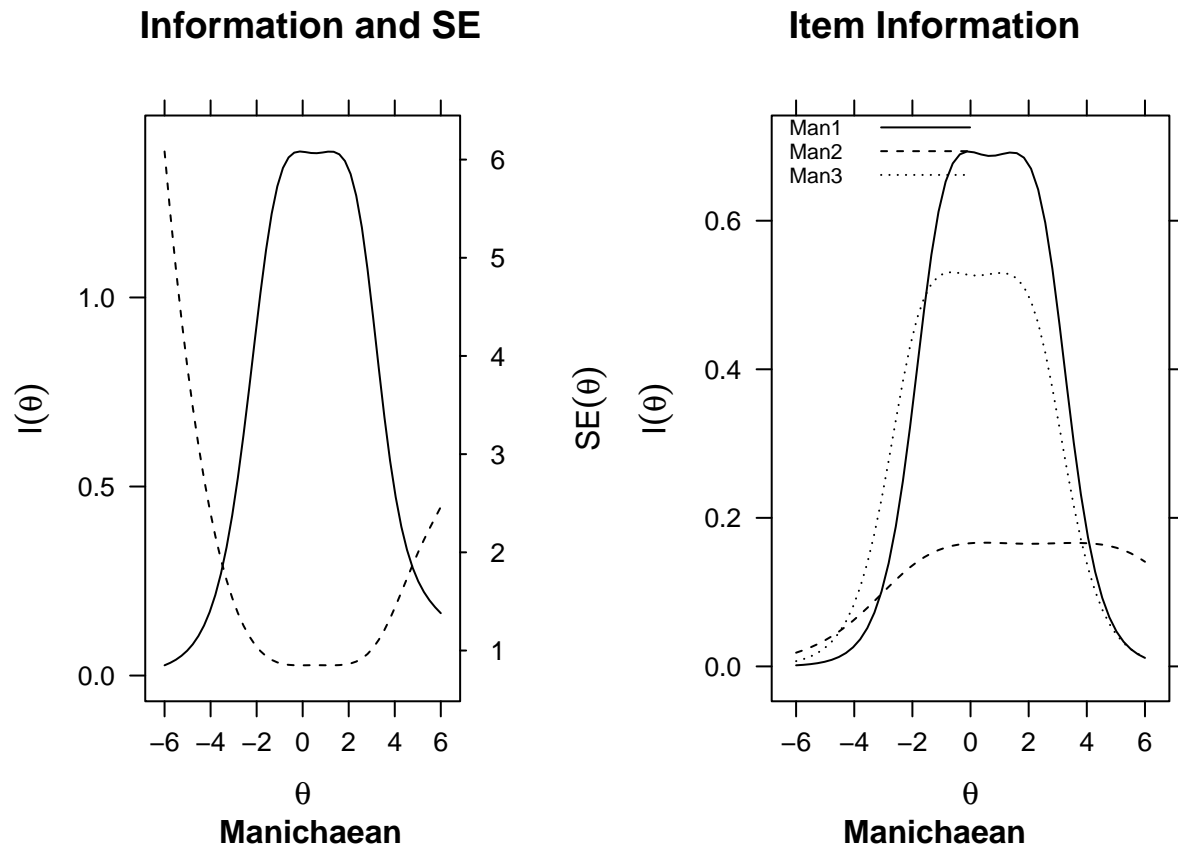
```
p.manich<-plot(model.manich, type = 'infoSE',
  facet_items=F)
p.manich<-update(p.manich, main='Information and SE',sub='Manichaeen',par.settings=bwtheme)
```

```

p.manich.trace<-plot(model.manich, type = 'infotrace',
                    facet_items=F)
p.manich.trace<-update(p.manich.trace, main='Item Information',sub='Manichaeen',
                      legend=NULL,par.settings=bwtheme,
                      auto.key = list(space = "inside", points = FALSE, lines = TRUE,
                                      cex=0.7))

grid.arrange(p.manich,p.manich.trace,ncol=2)

```



```

# 7.6:
model.populism.short<-mirt(data['country' != 10,c('antiel23','rwpop8.r','gewill17',
                                                  'simple8.r','manich15','manich13.r')],
                           1, itemtype='grsm', technical = list(removeEmptyRows=T))

```

```

##
Iteration: 1, Log-Lik: -75374.080, Max-Change: 13.92906
Iteration: 2, Log-Lik: -32319.993, Max-Change: 5.72046
Iteration: 3, Log-Lik: -27104.260, Max-Change: 1.00173
Iteration: 4, Log-Lik: -26183.651, Max-Change: 0.31885
Iteration: 5, Log-Lik: -25920.416, Max-Change: 0.19387
Iteration: 6, Log-Lik: -25853.548, Max-Change: 0.14737
Iteration: 7, Log-Lik: -25826.968, Max-Change: 0.09753
Iteration: 8, Log-Lik: -25816.879, Max-Change: 0.05358
Iteration: 9, Log-Lik: -25809.642, Max-Change: 0.03484
Iteration: 10, Log-Lik: -25807.173, Max-Change: 0.02283
Iteration: 11, Log-Lik: -25806.178, Max-Change: 0.01463
Iteration: 12, Log-Lik: -25805.754, Max-Change: 0.00920

```

```

Iteration: 13, Log-Lik: -25805.483, Max-Change: 0.00234
Iteration: 14, Log-Lik: -25805.471, Max-Change: 0.00168
Iteration: 15, Log-Lik: -25805.464, Max-Change: 0.00077
Iteration: 16, Log-Lik: -25805.461, Max-Change: 0.00009

p.short<-plot(model.populism.short,type = 'infoSE',
             main='Information curve - Six item scale')
p.short<-update(p.short, main='Information and SE',
              sub='New scale',par.settings=bwtheme)

p.short.trace<-plot(model.populism.short,type = 'infotrace',
                  main='Item Information',facet_items=F)
p.short.trace<-update(p.short.trace, main='Item Information',
                    sub='New scale',legend=NULL,par.settings=bwtheme,
                    auto.key = list(space = "inside", points = FALSE,
                                     lines = TRUE,cex=0.7))

model.akkerman<-mirt(data['country' != 10,c('akker1','akker2','akker3','akker4',
                                             'akker5','akker6')],
                    1, itemtype='grsm',technical = list(removeEmptyRows=T))

##
Iteration: 1, Log-Lik: -63215.893, Max-Change: 9.24906
Iteration: 2, Log-Lik: -21381.092, Max-Change: 1.06712
Iteration: 3, Log-Lik: -18369.087, Max-Change: 0.31383
Iteration: 4, Log-Lik: -17743.648, Max-Change: 0.20024
Iteration: 5, Log-Lik: -17505.366, Max-Change: 0.14656
Iteration: 6, Log-Lik: -17374.234, Max-Change: 0.13739
Iteration: 7, Log-Lik: -17312.923, Max-Change: 0.09023
Iteration: 8, Log-Lik: -17276.895, Max-Change: 0.07526
Iteration: 9, Log-Lik: -17253.940, Max-Change: 0.06710
Iteration: 10, Log-Lik: -17241.352, Max-Change: 0.04817
Iteration: 11, Log-Lik: -17234.266, Max-Change: 0.03614
Iteration: 12, Log-Lik: -17229.904, Max-Change: 0.02955
Iteration: 13, Log-Lik: -17222.980, Max-Change: 0.01507
Iteration: 14, Log-Lik: -17222.894, Max-Change: 0.00159
Iteration: 15, Log-Lik: -17222.890, Max-Change: 0.00108
Iteration: 16, Log-Lik: -17222.889, Max-Change: 0.00028
Iteration: 17, Log-Lik: -17222.889, Max-Change: 0.00012
Iteration: 18, Log-Lik: -17222.889, Max-Change: 0.00045
Iteration: 19, Log-Lik: -17222.888, Max-Change: 0.00041
Iteration: 20, Log-Lik: -17222.888, Max-Change: 0.00012
Iteration: 21, Log-Lik: -17222.888, Max-Change: 0.00027
Iteration: 22, Log-Lik: -17222.888, Max-Change: 0.00017
Iteration: 23, Log-Lik: -17222.888, Max-Change: 0.00039
Iteration: 24, Log-Lik: -17222.888, Max-Change: 0.00009

p.akkerman<-plot(model.akkerman,type='infoSE',facet_items=F, main=' ')
p.akkerman<-update(p.akkerman, sub='Akkerman et al. (2014) items',par.settings=bwtheme)

grid.arrange(p.short,p.akkerman,ncol=1)

```

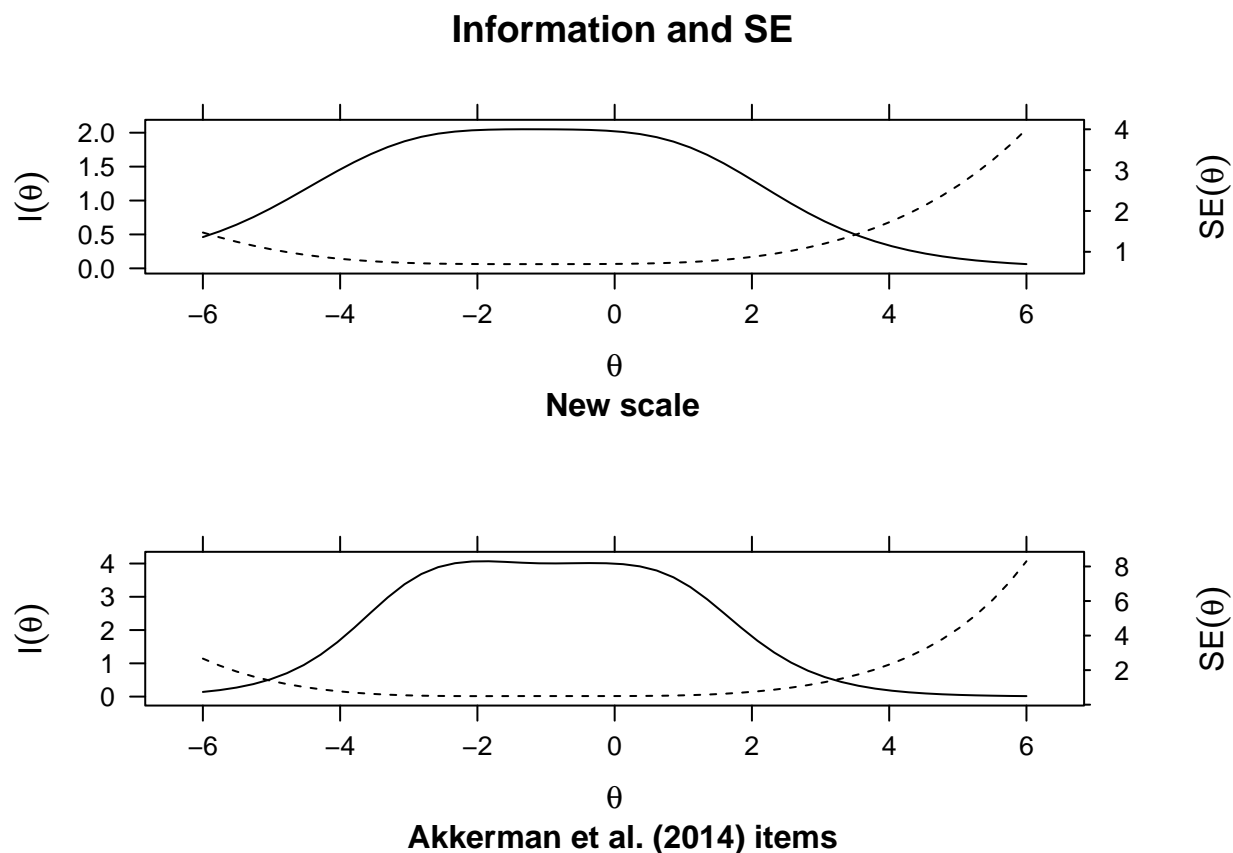



Figure 7A.1

```
pop1<-read.csv('populism_oct24_Mplus.csv',header=F)
vars<-c('Resp','Codect','praise1','praise2','praise3','praise4','praise5','praise6',
'praise7','praise8','praise9','praise10','praise11','praise12','gewill1',
'gewill2','gewill3','gewill4','gewill5','gewill6','gewill7','gewill8','gewill9',
'gewill10','gewill11','gewill12','gewill13','gewill14','gewill15','gewill16',
'gewill17','akker1','akker2','crisis1','crisis2','crisis3','crisis4','crisis5',
'crisis6','crisis7','strong1','strong2','strong3','strong4','strong5','strong6',
'strong7','strong8','strong9','strong10','strong11','strong12','strong13','strong14',
'simple1','simple2','simple3','simple4','simple5','simple6','simple7','simple8',
'simple9','simple10','simple11','simple12','simple13','simple14','manich1','manich2',
'manich3','manich4','manich5','manich6','manich7','manich8','manich9','manich10',
'manich11','manich12','manich13','manich14','manich15','manich16','manich17','manich18',
'manich19','manich20','manich21','antiel1','antiel2','antiel3','antiel4','antiel5',
'antiel6','antiel7','antiel8','antiel9','antiel10','antiel11','antiel12','antiel13',
'antiel14','antiel15','antiel16','antiel17','antiel18','antiel19','antiel20',
'antiel21','antiel22','antiel23','antiel24','rwpop1','rwpop2','rwpop3','rwpop4',
'rwpop5','rwpop6','rwpop7','rwpop8','rwpop9','rwpop10','rwpop11','rwpop12','lwpop1',
'lwpop2','lwpop3','lwpop4','lwpop5','lwpop6','lwpop7','lwpop8','lwpop9','lwpop10',
'lwpop11','lwpop12','any1','any2','any3','any4','any5','any6','any7','any8','any9',
'any10','conspop1','conspop2','conspop3','conspop4','conspop5','conspop6','conspop7',
'conspop8','consel1','consel2','consel3','consel4','consel5','consel6','consel7',
'consel8','consplu1','consplu2','consplu3','consplu4','consplu5','consplu6','consplu7',
'consplu8','wpc1','wpc2','wpc3','wpc4','wpc5','wpc6','wpc7','wpc8','wpc9','wpc10',
```

```

'wpc11','wpc12','wpc13','wpc14','wpc15','wpc16','wpc17','wpc18','wpc19','wpc20','wpl1',
'wpl2','wpl3','wpl4','wpl5','wpl6','wpl7','wpl8','wpl9','wpl10','wpl11','wpl12','wpl13',
'wpl14','wpl15','wpl16','wpl17','wpl18','wpl19','wpl20','lr','aneslr','year','marital',
'female','class','class1','class2','class3','class4')

names(pop1)<-vars

pop1[pop1 == -999]<-NA

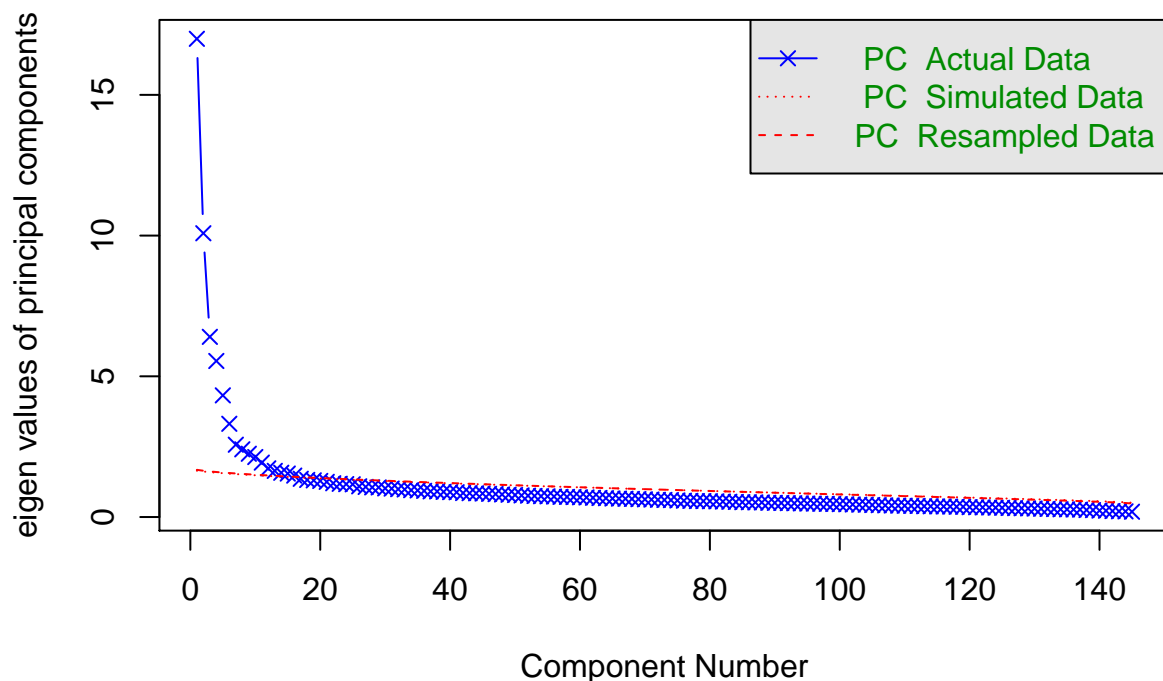
pop<-subset(pop1, Resp < 235 | Resp > 718)

eig<-c(15.84,9.645,6.941,5.514,4.283,3.245,2.696,2.317,2.215,2.104,1.868,1.695,1.662,1.625,1.555
,1.425,1.367,1.356,1.324,1.287,1.283,1.208,1.204,1.19,1.168,1.126,1.095,1.082,1.059,1.038
,1.024,1.005,0.998,0.975,0.971,0.954,0.944,0.934,0.916,0.914,0.89,0.889,0.882,0.87,0.858
) # Taken from efa_pooled4.out

a<-fa.parallel(pop[,3:147],fa='pc',fm='ml',n.iter=200,cor='cor',sim=T, use='pairwise')

```

Parallel Analysis Scree Plots



```

## Parallel analysis suggests that the number of factors = NA and the number of components = 16

eigen.sim<-a$pc.sim[1:length(eig)]
nfactors<-c(1:45)
data.gr<-data.frame(matrix(c(eig,eigen.sim,nfactors,nfactors),ncol=2,byrow=F))
data.gr$X3<-c(rep(1,45),rep(2,45))
p<-ggplot(data.gr,aes(X2,X1,linetype=factor(X3)))+geom_line()+
  scale_linetype_manual(values=c('solid','dashed'),labels=c('Sample','PA'),
    guide = guide_legend(title = NULL))+
  geom_vline(xintercept=8,linetype='dotted')+ylab('Eigenvalues')+xlab('Nr of factors')+
  scale_x_continuous(breaks = c(0,8,10,20,30,40,50))+

```

```
theme(panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
      panel.background = element_blank(), #axis.line.x = element_line(colour = 'black'),
      axis.line = element_line(colour = 'black'),
      axis.text.x = element_text(colour = 'black'), axis.text.y = element_text(colour = 'black'),
      legend.key = element_blank(), legend.title = element_blank(), legend.justification=c(1,1),
      legend.position=c(.8,.8))
```

p

