S&DS 363 Homework 6

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```
# clear env
rm(list=ls())

# Load packages
library(car)
library(tidyverse)
library(MASS)
library(DiscriMiner)
library(klaR)
#library(aplpack)
library(fpc)
library(cluster)
library(ape)
library(amap)

# Packages pertinent to Ordination
library(vegan) # eggplant
#library(vegan3d)
library(mgcv)
#library(rgl)
library(dplyr)
library(magrittr)
```

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The Dataset

Raw dataset: COVID-19 infection and death statistics from U.S. counties (sourced from NYT), combined with economic, education, and population data (sourced from various government agencies) and also survey responses about mask-wearing frequencies (sourced from NYT). 3141 complete observations on 19 metric variables and 6 categorical variables. To avoid any outliers due to population size differences between counties, all variables are scaled as a percentage of population. Variable descriptions can be found here.

Data of relevance for this pset:

This pset only explores the 67 counties in the best state, Florida.

We look at five continuous variables describing each county: `Always_Wear_Mask_Survey`, `Median_Household_Income_Percen` `Percent_Poverty_2019`, `Percent_Adults_Less_Than_HS`, and `Covid_Confirmed_Cases_as_pct`. Note that `Always_Wear_Mask_Survey` and `Covid_Confirmed_Cases_as_pct` were multiplied by 100 to convert the value from a fraction to percent value (like the other variables). This data is stored in `data_ord_base`.

For additional continuous variables, we make an environmental dataset. We look at five additional continuous variables describing each county: `Unemployment_Rate_2019`, `Death_Rate_2019`, `Birth_Rate_2019`, `Civilian_Labor_Force_2019_as_pct`, `Percent_Adults_Bachelors_or_Higher`. Note that `Civilian_Labor_Force_2019_as_pct` was multiplied by 100 to convert the value from a fraction to percent value (like the other variables). This data is stored in `data_ord_env`.

```
# Process raw dataset as we have done in preceding psets

raw <- read.csv("https://evancollins.com/covid_and_demographics.csv")

# create categorical variables: rural-urban code (3 levels), region (4 variables)

# log transformations of our continuous variables
raw$logMedian_Household_Income_2019 <- log(raw$Median_Household_Income_2019 + 0.0001)
raw$logPercent_Poverty_2019 <- log(raw$Percent_Poverty_2019 + 0.0001)
raw$logCovid_Confirmed_Cases_as_pct <- log(raw$Covid_Confirmed_Cases_as_pct + 0.0001)
```

```
# Base dataset of interest for this pset - data_ord_base
data_ord <- raw[raw$State_Name=="Florida", ]
data_ord <- data_ord[, c(2, 9, 12, 13, 14, 22)]

data_ord_base <- data_ord
data_ord_base$Covid_Confirmed_Cases_as_pct <- 100*data_ord_base$Covid_Confirmed_Cases_as_pct
data_ord_base$Always_Wear_Mask_Survey <- 100*data_ord_base$Always_Wear_Mask_Survey

data_ord_base1 <- data_ord_base
data_ord_base <- data_ord_base1[,-1]
rownames(data_ord_base) <- data_ord_base1[,1] # roumames are county names

dim(data_ord_base)
```

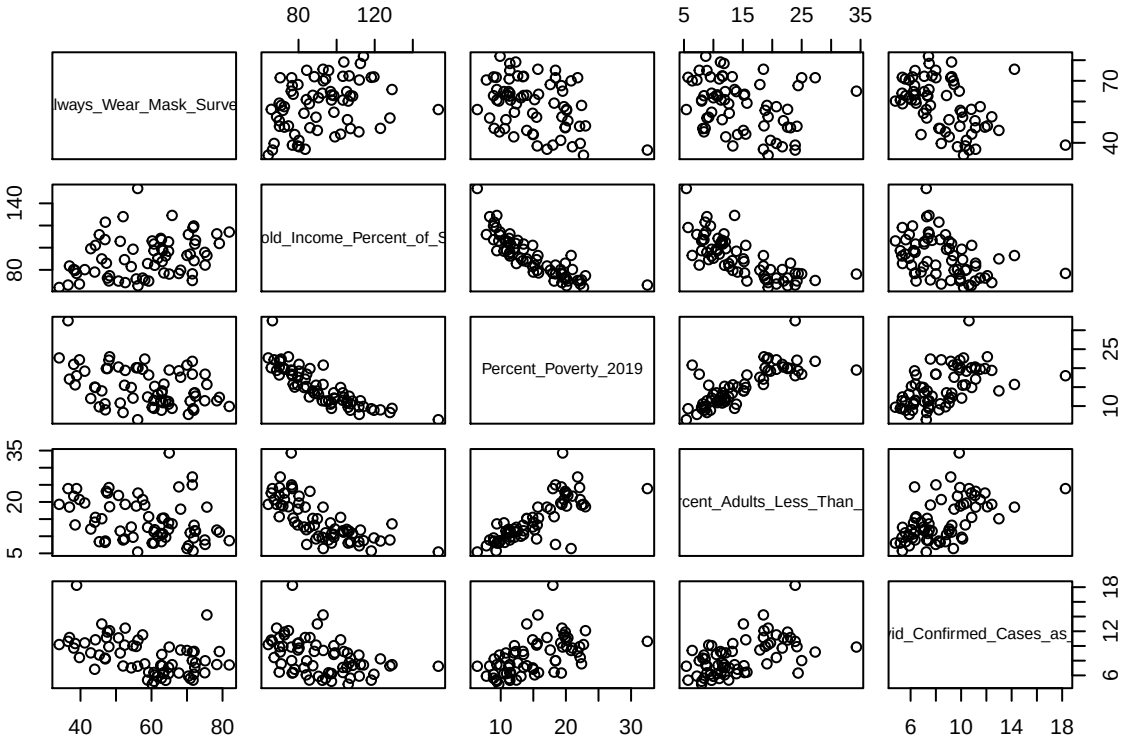
```
## [1] 67  5
```

```
head(data_ord_base)
```

```
##          Always_Wear_Mask_Survey
## Alachua                    75.1
## Baker                      44.2
## Bay                        54.8
## Bradford                   38.1
## Brevard                    60.7
## Broward                    79.1
##          Median_Household_Income_Percent_of_State_Total_2019
## Alachua                                                84.3
## Baker                                                 102.1
## Bay                                                    98.6
## Bradford                                               80.3
## Brevard                                                97.3
## Broward                                               103.8
##          Percent_Poverty_2019 Percent_Adults_Less_Than_HS
## Alachua                 18.4                         7.6
```

```
## Baker                     14.9                          15.5
## Bay                       12.1                           9.7
## Bradford                  21.0                          21.7
## Brevard                    9.4                           8.0
## Broward                   12.3                          11.2
##          Covid_Confirmed_Cases_as_pct
## Alachua                      7.984597
## Baker                       10.838754
## Bay                         10.043788
## Bradford                     9.712422
## Brevard                      5.189537
## Broward                      9.243293
```

```r
plot(data_ord_base)
```




```r
# Enviromental variables dataset - data_ord_env
data_ord_env_county <- raw[raw$State_Name=="Florida", ]
data_ord_env_county <- data_ord_env_county[, c(2, 10, 18, 19, 25, 15)]

data_ord_env <- data_ord_env_county
data_ord_env$Civilian_Labor_Force_2019_as_pct <- 100*data_ord_env$Civilian_Labor_Force_2019_as_pct

data_ord_env1 <- data_ord_env
data_ord_env <- data_ord_env1[,-1]
rownames(data_ord_env) <- data_ord_env1[,1] # rownames are county names

dim(data_ord_env)
```

```
## [1] 67  5
```

```r
head(data_ord_env)
```

```
##          Unemployment_Rate_2019 Death_Rate_2019 Birth_Rate_2019
## Alachua                     2.9             7.7            10.3
## Baker                       3.1             9.5            11.2
## Bay                         3.9            11.0            12.3
## Bradford                    3.1            12.5            10.2
## Brevard                     3.2            12.5             8.8
## Broward                     3.0             8.2            11.2
##          Civilian_Labor_Force_2019_as_pct Percent_Adults_Bachelors_or_Higher
## Alachua                          51.74526                               42.5
## Baker                            40.57515                               13.4
## Bay                              48.21556                               22.8
## Bradford                         39.22556                               10.6
## Brevard                          47.19508                               29.3
## Broward                          53.28404                               31.9
```

1

Fit Correspondence Analysis to your data.

All columns of `data_ord_base` contains the variable data. Correspondence analysis is performed using the `cca()` function.

```r
# No negative data anyways
# data_ord_base <- data_ord_base[apply(data_ord_base, 1, sum) > 0, ]

#Perform correspondence analysis
data_ord_base_ca <- cca(data_ord_base)

# inertia is measure of departure from ind model; if no relationships
#from rows and columns; in this case, household income, percent poverty
# are related; other variables are not so strongly related; if inertia smaller
# - less structure to data in 5-D
```

2

Discuss the inertia, make a two dimensional plot of the first two CA directions.

```r
summary(data_ord_base_ca)
```

```
##
## Call:
## cca(X = data_ord_base)
##
## Partitioning of scaled Chi-square:
##               Inertia Proportion
## Total         0.05033          1
## Unconstrained 0.05033          1
##
## Eigenvalues, and their contribution to the scaled Chi-square
##
## Importance of components:
##                            CA1      CA2      CA3      CA4
```

```
## Eigenvalue            0.03606 0.009955 0.002521 0.001793
## Proportion Explained  0.71649 0.197808 0.050087 0.035616
## Cumulative Proportion 0.71649 0.914297 0.964384 1.000000
##
## Scaling 2 for species and site scores
## * Species are scaled proportional to eigenvalues
## * Sites are unscaled: weighted dispersion equal on all dimensions
##
##
## Species scores
##
##                                                        CA1      CA2       CA3
## Always_Wear_Mask_Survey                            -0.04389 -0.14340  0.002602
## Median_Household_Income_Percent_of_State_Total_2019 -0.12367  0.07293 -0.005506
## Percent_Poverty_2019                                0.36607  0.01375  0.119450
## Percent_Adults_Less_Than_HS                         0.43620  0.01442 -0.127072
## Covid_Confirmed_Cases_as_pct                        0.23445  0.14590  0.048594
##                                                        CA4
## Always_Wear_Mask_Survey                            0.01398
## Median_Household_Income_Percent_of_State_Total_2019 -0.01211
## Percent_Poverty_2019                               -0.06152
## Percent_Adults_Less_Than_HS                        -0.01670
## Covid_Confirmed_Cases_as_pct                        0.17146
##
##
## Site scores (weighted averages of species scores)
##
##                    CA1      CA2      CA3       CA4
## Alachua      -0.2579870 -1.60706  2.77217  0.400127
## Baker         0.0280475  1.66967 -0.23324  0.190358
## Bay          -0.5365473  0.59860  0.64355  1.166522
## Bradford      1.2707134  1.41794 -0.27880 -1.401618
## Brevard      -1.0058699 -0.33752 -0.04251 -0.470399
## Broward      -0.6113475 -0.97532  0.23822  1.265977
## Calhoun       1.3900689  0.02428 -0.16307  0.484268
## Charlotte    -0.6966676 -0.74566  0.09810 -0.536160
## Citrus       -0.1394691 -0.75200  0.65413 -0.816689
## Clay         -1.2865849  1.56298 -0.68961 -0.642613
## Collier      -0.9516428  0.62048 -1.37787 -0.424347
## Columbia      0.4255024  1.39936  0.85239  0.584438
## DeSoto        1.4124015 -1.54893 -1.23015 -0.215095
## Dixie         1.5911653  0.66090  0.41171 -1.853031
## Duval        -0.4777867 -0.10803  0.67291  0.565342
## Escambia     -0.1999783  0.46290  1.84232  0.884221
## Flagler      -1.1162511  0.02829 -0.11021 -1.040040
## Franklin      1.0293941  1.18179 -0.08849 -0.391357
## Gadsden       1.1331068 -0.38765  0.06956  1.041970
## Gilchrist     0.2923450  0.49907  0.04248 -1.120320
## Glades        0.9602104 -1.33106 -1.49877 -1.420773
## Gulf          0.2524635  1.27854  0.02130  2.094265
## Hamilton      2.4514005  1.14909  2.54929 -2.856752
## Hardee        1.6243491  0.18401 -0.48894 -0.778705
## Hendry        1.6425587 -0.76661 -3.48737 -0.265267
## Hernando     -0.2998987 -0.60987 -0.40381 -0.858329
```

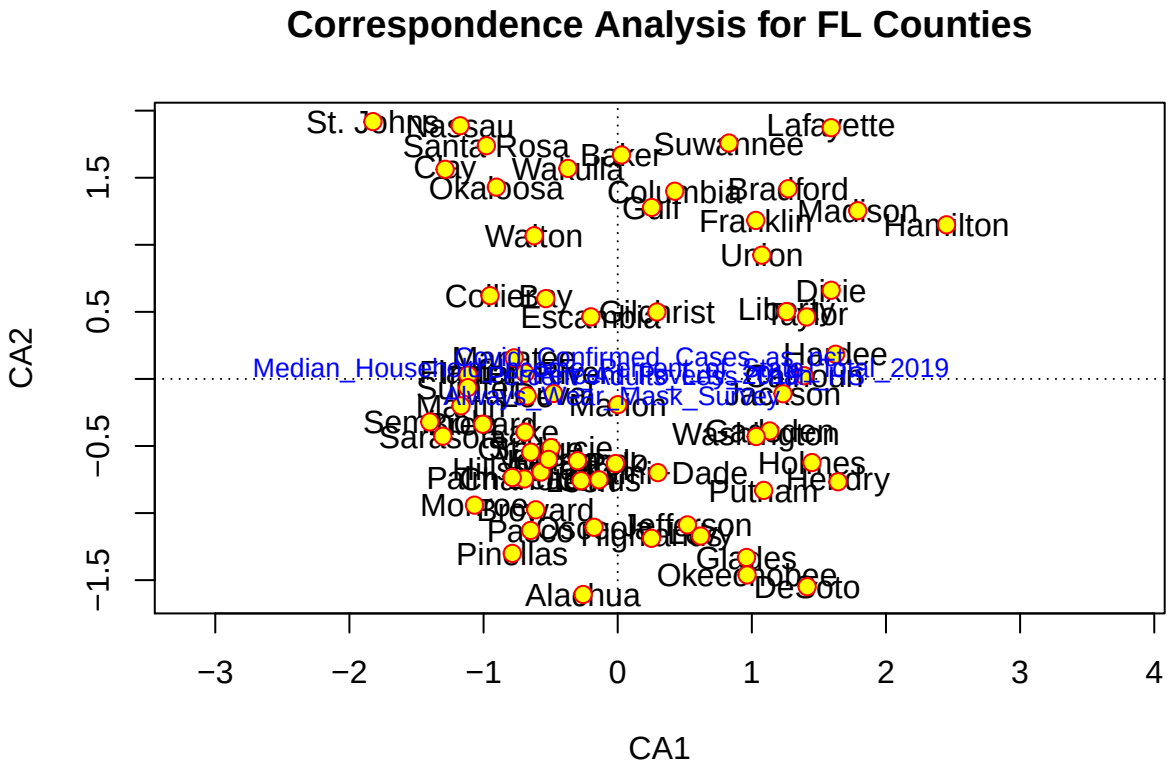
```
## Highlands     0.2519377 -1.18798 -0.01501 -0.567841
## Hillsborough -0.5718720 -0.69371  0.19420 -0.141031
## Holmes        1.4478480 -0.62345 -0.36468  0.727175
## Indian River -0.6894247  0.04277 -0.33385 -0.587752
## Jackson       1.2323901 -0.11028  0.52615  1.685731
## Jefferson     0.5199624 -1.08804  0.05242  0.654107
## Lafayette     1.5911661  1.87293 -0.72446  3.927492
## Lake         -0.6913000 -0.39668 -0.26513 -0.220985
## Lee          -0.6743885 -0.12695 -0.50324 -0.126535
## Leon         -0.2733104 -0.75881  3.57284  0.209794
## Levy          0.6182007 -1.17123  0.61102 -0.978715
## Liberty       1.2580903  0.50200  1.53857  0.360751
## Madison       1.7895438  1.25426  1.29302 -1.010829
## Manatee      -0.7719348  0.15722 -0.19547 -0.142531
## Marion        0.0007508 -0.19202  0.44339 -0.551968
## Martin       -1.1684693 -0.20071 -0.58139 -0.246356
## Miami-Dade    0.2996775 -0.69843 -0.18127  2.816490
## Monroe       -1.0677179 -0.94099  0.03983  0.703280
## Nassau       -1.1748135  1.88767 -0.34885 -0.333700
## Okaloosa     -0.9045129  1.42972  0.35211 -0.007087
## Okeechobee    0.9644400 -1.46129 -1.64082 -0.286844
## Orange       -0.6481869 -0.54586  0.03647  0.195285
## Osceola      -0.1761811 -1.10587  0.15055  1.364315
## Palm Beach   -0.7863143 -0.73505 -0.34040  0.290999
## Pasco        -0.6495546 -1.12949 -0.22874 -0.211219
## Pinellas     -0.7857529 -1.30050  0.41633  0.359708
## Polk         -0.0173068 -0.63077 -0.47020 -0.120923
## Putnam        1.0882213 -0.83097  0.84041 -1.396901
## St. Johns    -1.8246946  1.91832 -0.46595 -0.771806
## St. Lucie    -0.4973983 -0.51158 -1.18380 -0.222083
## Santa Rosa   -0.9793112  1.73872  0.06881  0.120004
## Sarasota     -1.3034658 -0.42690 -0.25311  0.107948
## Seminole     -1.4009072 -0.32091  0.34367 -0.478166
## Sumter       -1.1177304 -0.06506 -0.32542 -0.421412
## Suwannee      0.8290661  1.75865 -0.30903  0.183506
## Taylor        1.4076618  0.46177 -0.43854  0.710780
## Union         1.0743577  0.92255 -0.77718 -0.237763
## Volusia      -0.5157772 -0.59935  0.52913 -0.612641
## Wakulla      -0.3710730  1.56935 -0.22170  0.039781
## Walton       -0.6230454  1.06728 -0.38047  0.383858
## Washington    1.0322373 -0.42952  0.54986  0.195862
```

Inertia (equal to squared eigenvalues) is like variance and measures departures from the independence model. We see that the inertia value is 0.05033. The magnitude of inertia does not reflect more or less variance per se; it is reflective of the magnitude of the data. (Note that multiplying fractions by 100 to make values as percents did not increase this inertia magnitude).

In the "Proportion Explained" row, we can see that first CA direction explains 0.71649 (~72%) of the relation. The "Cumulative Proportion" by the second CA direction is 0.914297; hence, the first and second CA directions explain the vast majority of total inertia. The third and fourth CA directions have significantly smaller "Proportion Explained" values. This suggests that there are likely two major underlying discriminatory dimensions captured by the data.

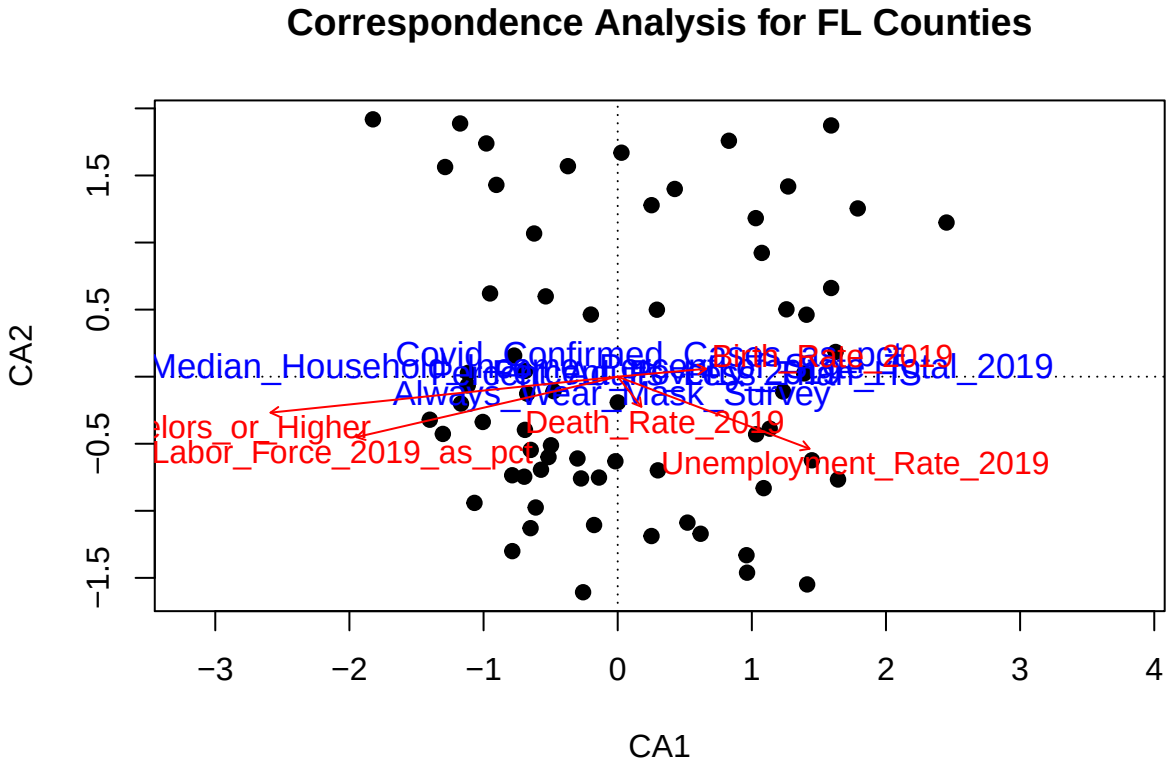
```r
#plot results
plot(data_ord_base_ca, main = "Correspondence Analysis for FL Counties", type = "n")
```

```
text(data_ord_base_ca, dis = "wa", labels = rownames(data_ord_base))
points(data_ord_base_ca, pch = 21, col = "red", bg = "yellow", cex = 1.2)
text(data_ord_base_ca, "species", col = "blue", cex = 0.8)
```



Add environmental variables.

```
plot(data_ord_base_ca, main = "Correspondence Analysis for FL Counties", type = "n")
points(data_ord_base_ca, pch = 19, col = "black", cex = 1)
text(data_ord_base_ca, "species", col = "blue", cex = 1.1)
#add environmental variables
fit <- envfit(data_ord_base_ca, data_ord_env, permutations = 1000)
plot(fit, col = "red", lwd = 3)
```




```
#get significance - all environmental variables are significant
fit
```

```
##
## ***VECTORS
##
##                                      CA1      CA2     r2   Pr(>r)
## Unemployment_Rate_2019             0.93609 -0.35176 0.2400 0.000999 ***
## Death_Rate_2019                    0.61828 -0.78596 0.0084 0.790210
## Birth_Rate_2019                    0.99605  0.08877 0.0450 0.243756
## Civilian_Labor_Force_2019_as_pct   -0.97424 -0.22551 0.4110 0.000999 ***
## Percent_Adults_Bachelors_or_Higher -0.99468 -0.10305 0.6962 0.000999 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## Permutation: free
## Number of permutations: 1000
```

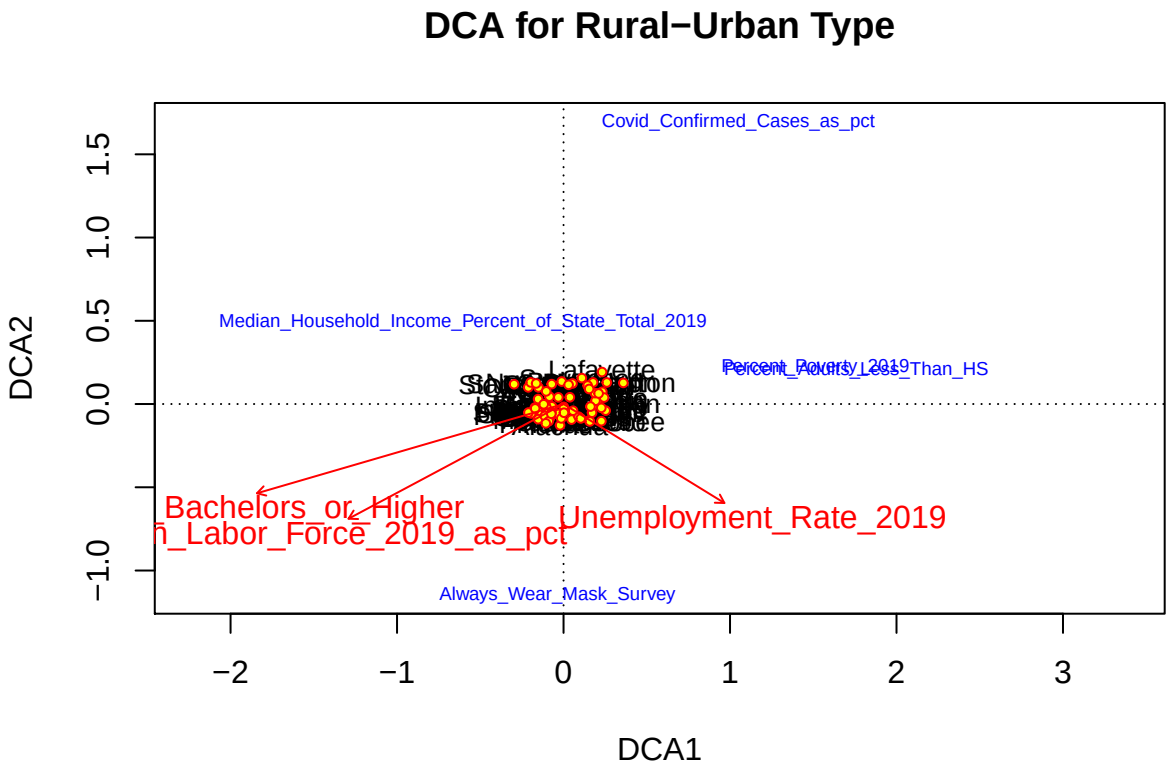
We can see that all environmental variables are significant ($p < 0.05$) except `Birth_Rate_2019` and `Death_Rate_2019`. We will omit these variables from the environmental variable dataset for future analyses.

```
data_ord_env <- subset(data_ord_env, select=-2)
data_ord_env <- subset(data_ord_env, select=-2)
```

This plot is somewhat hard to read, so we try detrended correspondence analysis. This is even harder to read. DCA uses the `decorana()` function.

```
#detrended correspondence analysis
data_ord_base_dca <- decorana(data_ord_base)
plot(data_ord_base_dca, main = "DCA for Rural-Urban Type", type = "n")
text(data_ord_base_dca, display = c("sites"), labels = rownames(data_ord_base), cex = 0.86)
points(data_ord_base_dca, pch = 21, col = "red", bg = "yellow", cex = 0.6)
text(data_ord_base_dca, "species", col = "blue", cex = 0.6)
```

```
#add environmental variables
fit <- envfit(data_ord_base_dca, data_ord_env, permutations = 1000)
plot(fit, col = "red", lwd = 3)
```



3

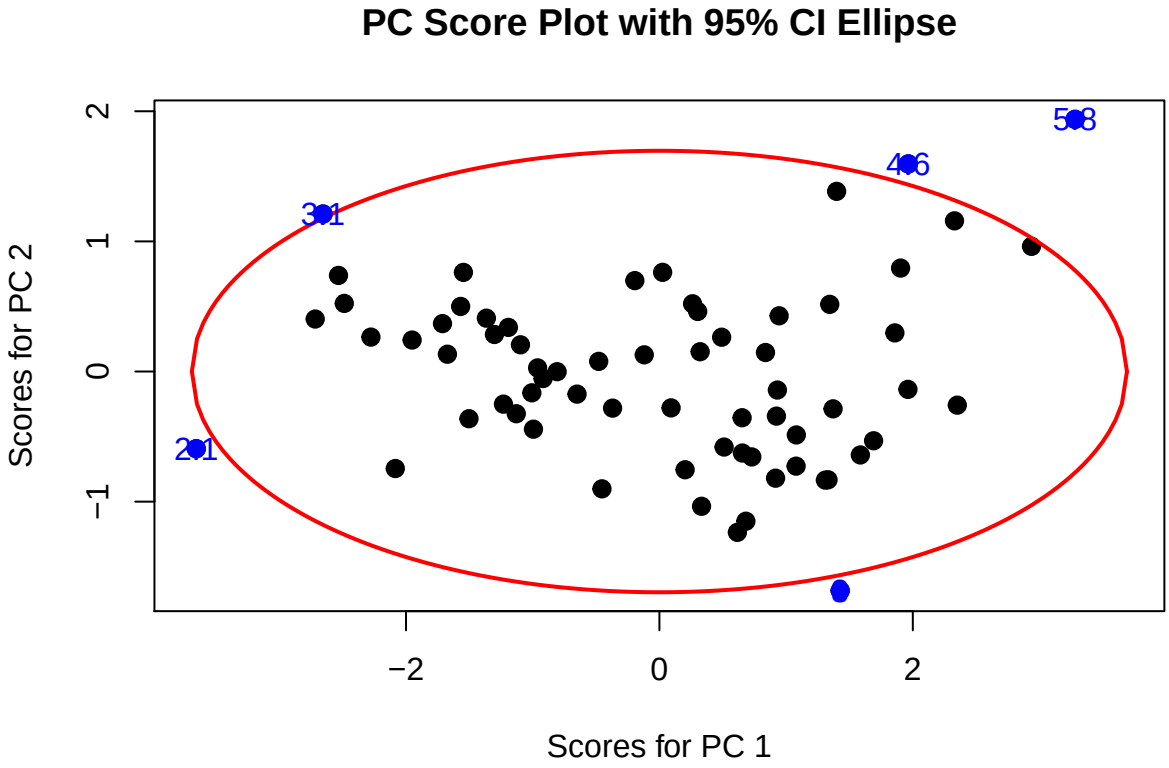
Comment on whether or not there is any evidence of 'data snaking' in higher dimensional space.

```
pc1 <- princomp(data_ord_env, cor=TRUE)

source("http://reuningscherer.net/multivariate/r/ciscoreplot.R.txt")
ciscoreplot(pc1,c(1,2),data_ord_env[,1])
```

```
## Warning in sqrt((5.99 - (y1vec^2)/x$sdev[comps[1]]^2) * x$sdev[comps[2]]^2):
## NaNs produced

## Warning in sqrt((5.99 - (y1vec^2)/x$sdev[comps[1]]^2) * x$sdev[comps[2]]^2):
## NaNs produced
```



There is no evidence of data snaking in higher dimensional space. Evidence of snaking would be a PCA score plot that looks like a horseshoe. However, the above scoreplot appears random and therefore does not indicate data snaking.

4

In a few sentences, describe what you conclude from your plot.

From our first plot in (2) of the first two CA directions, we should be able to find which counties are similar and what are the columns on which they are similar. Overall, the counties seem evenly and randomly scattered between the 4 quadrants- we do not note rows near columns, so there is not association not accounted for by the independence model. Generally, the first correspondence axis is associated with low income and low education and high COVID-19 rates, while the second correspondence axis is associated primarily with poor masking behaviors and high COVID-19 rates, perhaps indicating two different types of counties that are associated with high COVID-19 rates (those in poorer, disadvantaged areas and also those with poor masking behaviors). As one may expect, the percent poverty and percent of adults with less than a high school degree point in the same direction, while the median household income points in the opposite direction.

5

Perform Multidimensional Scaling (metric or non-metric) for 1, 2, and 3 dimensions.

```
results <- matrix(NA, 21, 5)
#j is number of dimensions to try
for (j in 1:5){
  for (i in 1:20){
    temp <- data_ord_base[shuffle(nrow(data_ord_base)), 1]
    for (k in 2:12) { temp <- cbind(temp, data_ord_base[shuffle(nrow(data_ord_base)), k]) }
```

```
    #store stress
    results[i, j] <- metaMDS(temp, k = j, distance = "euclidean")$stress
  }
  results[21, j] <- metaMDS(data_ord_base, k = j, distance = "euclidean")$stress
}
```

```
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3517365
## Run 1 stress 0.4579077
## Run 2 stress 0.5167097
## Run 3 stress 0.4715412
## Run 4 stress 0.4129543
## Run 5 stress 0.4199102
## Run 6 stress 0.5681576
## Run 7 stress 0.4295871
## Run 8 stress 0.5677152
## Run 9 stress 0.4359263
## Run 10 stress 0.4647577
## Run 11 stress 0.5681649
## Run 12 stress 0.487963
## Run 13 stress 0.5680782
## Run 14 stress 0.4908619
## Run 15 stress 0.4090163
## Run 16 stress 0.5678889
## Run 17 stress 0.5683505
## Run 18 stress 0.5053679
## Run 19 stress 0.4796725
## Run 20 stress 0.4193584
## *** No convergence -- monoMDS stopping criteria:
##      8: stress ratio > sratmax
##     12: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3774055
## Run 1 stress 0.5683842
## Run 2 stress 0.4225106
## Run 3 stress 0.5328436
## Run 4 stress 0.3762616
## ... New best solution
## ... Procrustes: rmse 0.0111182  max resid 0.07694516
## Run 5 stress 0.5085574
## Run 6 stress 0.4495479
## Run 7 stress 0.4439247
## Run 8 stress 0.5389717
## Run 9 stress 0.5685296
## Run 10 stress 0.5684031
## Run 11 stress 0.4801358
## Run 12 stress 0.5669239
## Run 13 stress 0.424747
## Run 14 stress 0.4869003
## Run 15 stress 0.4708988
## Run 16 stress 0.5686356
## Run 17 stress 0.5309114
```

```
## Run 18 stress 0.4789697
## Run 19 stress 0.5678988
## Run 20 stress 0.4201981
## *** No convergence -- monoMDS stopping criteria:
##      6: stress ratio > sratmax
##     14: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.4011867
## Run 1 stress 0.5683536
## Run 2 stress 0.5683104
## Run 3 stress 0.4850342
## Run 4 stress 0.5681869
## Run 5 stress 0.5334808
## Run 6 stress 0.4630312
## Run 7 stress 0.4702306
## Run 8 stress 0.5662399
## Run 9 stress 0.5661269
## Run 10 stress 0.4133075
## Run 11 stress 0.568352
## Run 12 stress 0.5676523
## Run 13 stress 0.5355229
## Run 14 stress 0.5679728
## Run 15 stress 0.5685746
## Run 16 stress 0.567774
## Run 17 stress 0.488488
## Run 18 stress 0.4352116
## Run 19 stress 0.5383612
## Run 20 stress 0.5668318
## *** No convergence -- monoMDS stopping criteria:
##      7: stress ratio > sratmax
##     13: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.341066
## Run 1 stress 0.5406779
## Run 2 stress 0.4708633
## Run 3 stress 0.5330268
## Run 4 stress 0.3758154
## Run 5 stress 0.5312795
## Run 6 stress 0.4116142
## Run 7 stress 0.4494682
## Run 8 stress 0.567659
## Run 9 stress 0.455379
## Run 10 stress 0.4519463
## Run 11 stress 0.5673283
## Run 12 stress 0.5395429
## Run 13 stress 0.342054
## Run 14 stress 0.3741566
## Run 15 stress 0.5680753
## Run 16 stress 0.5664963
## Run 17 stress 0.5446067
## Run 18 stress 0.5474373
## Run 19 stress 0.5676154
```

```
## Run 20 stress 0.4263013
## *** No convergence -- monoMDS stopping criteria:
##      4: stress ratio > sratmax
##     16: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3771611
## Run 1 stress 0.4762227
## Run 2 stress 0.5686494
## Run 3 stress 0.5336337
## Run 4 stress 0.4498639
## Run 5 stress 0.5618533
## Run 6 stress 0.5663398
## Run 7 stress 0.5342318
## Run 8 stress 0.3977822
## Run 9 stress 0.5330663
## Run 10 stress 0.4839508
## Run 11 stress 0.5686145
## Run 12 stress 0.4012139
## Run 13 stress 0.3798404
## Run 14 stress 0.5684268
## Run 15 stress 0.4423851
## Run 16 stress 0.5685476
## Run 17 stress 0.4481159
## Run 18 stress 0.4211661
## Run 19 stress 0.4025128
## Run 20 stress 0.4309527
## *** No convergence -- monoMDS stopping criteria:
##      6: stress ratio > sratmax
##     14: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3750039
## Run 1 stress 0.4385298
## Run 2 stress 0.427206
## Run 3 stress 0.5684162
## Run 4 stress 0.4659373
## Run 5 stress 0.5327106
## Run 6 stress 0.5510544
## Run 7 stress 0.5675092
## Run 8 stress 0.470097
## Run 9 stress 0.567846
## Run 10 stress 0.5671682
## Run 11 stress 0.5389928
## Run 12 stress 0.565934
## Run 13 stress 0.4242539
## Run 14 stress 0.3747265
## ... New best solution
## ... Procrustes: rmse 0.00586164  max resid 0.02925827
## Run 15 stress 0.5677584
## Run 16 stress 0.5685193
## Run 17 stress 0.4816219
## Run 18 stress 0.5682504
## Run 19 stress 0.5322533
```

```
## Run 20 stress 0.5686678
## *** No convergence -- monoMDS stopping criteria:
##      5: stress ratio > sratmax
##     15: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.4011848
## Run 1 stress 0.5655299
## Run 2 stress 0.5308139
## Run 3 stress 0.5657808
## Run 4 stress 0.5398422
## Run 5 stress 0.5388588
## Run 6 stress 0.5686481
## Run 7 stress 0.5684849
## Run 8 stress 0.5563364
## Run 9 stress 0.5682849
## Run 10 stress 0.4330363
## Run 11 stress 0.4362991
## Run 12 stress 0.5675624
## Run 13 stress 0.5669017
## Run 14 stress 0.5672055
## Run 15 stress 0.5675495
## Run 16 stress 0.5431671
## Run 17 stress 0.4355611
## Run 18 stress 0.5392588
## Run 19 stress 0.5678217
## Run 20 stress 0.538322
## *** No convergence -- monoMDS stopping criteria:
##     10: stress ratio > sratmax
##     10: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3233379
## Run 1 stress 0.5685286
## Run 2 stress 0.3235202
## ... Procrustes: rmse 0.005192464  max resid 0.02677105
## Run 3 stress 0.5683332
## Run 4 stress 0.4311357
## Run 5 stress 0.4731626
## Run 6 stress 0.3501961
## Run 7 stress 0.3234021
## ... Procrustes: rmse 0.002861164  max resid 0.0106634
## Run 8 stress 0.3792179
## Run 9 stress 0.5686422
## Run 10 stress 0.5670964
## Run 11 stress 0.5209874
## Run 12 stress 0.4545771
## Run 13 stress 0.5215531
## Run 14 stress 0.3234262
## ... Procrustes: rmse 0.004176663  max resid 0.01612675
## Run 15 stress 0.567912
## Run 16 stress 0.5682315
## Run 17 stress 0.568564
## Run 18 stress 0.4050826
```

```
## Run 19 stress 0.4872047
## Run 20 stress 0.441303
## *** No convergence -- monoMDS stopping criteria:
##      7: stress ratio > sratmax
##     13: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3631248
## Run 1 stress 0.4314057
## Run 2 stress 0.5686659
## Run 3 stress 0.5682132
## Run 4 stress 0.5680077
## Run 5 stress 0.3702395
## Run 6 stress 0.5684251
## Run 7 stress 0.504955
## Run 8 stress 0.4712715
## Run 9 stress 0.5673173
## Run 10 stress 0.5683054
## Run 11 stress 0.4748987
## Run 12 stress 0.5681704
## Run 13 stress 0.4390074
## Run 14 stress 0.3580478
## ... New best solution
## ... Procrustes: rmse 0.02712377  max resid 0.2001584
## Run 15 stress 0.4640363
## Run 16 stress 0.3681344
## Run 17 stress 0.5673088
## Run 18 stress 0.522641
## Run 19 stress 0.4862807
## Run 20 stress 0.4987627
## *** No convergence -- monoMDS stopping criteria:
##      5: stress ratio > sratmax
##     15: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3757496
## Run 1 stress 0.5662516
## Run 2 stress 0.5682591
## Run 3 stress 0.5176453
## Run 4 stress 0.4242291
## Run 5 stress 0.4204849
## Run 6 stress 0.4011279
## Run 7 stress 0.492797
## Run 8 stress 0.4180929
## Run 9 stress 0.406058
## Run 10 stress 0.400657
## Run 11 stress 0.4094932
## Run 12 stress 0.4218298
## Run 13 stress 0.4171994
## Run 14 stress 0.4463811
## Run 15 stress 0.5686101
## Run 16 stress 0.5683245
## Run 17 stress 0.5010699
## Run 18 stress 0.4738901
```

```
## Run 19 stress 0.4436842
## Run 20 stress 0.4866221
## *** No convergence -- monoMDS stopping criteria:
##      6: stress ratio > sratmax
##     14: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3635449
## Run 1 stress 0.500328
## Run 2 stress 0.3861361
## Run 3 stress 0.3972065
## Run 4 stress 0.4488121
## Run 5 stress 0.4912427
## Run 6 stress 0.5686208
## Run 7 stress 0.4527588
## Run 8 stress 0.5665384
## Run 9 stress 0.3664176
## Run 10 stress 0.4708678
## Run 11 stress 0.5685844
## Run 12 stress 0.4023699
## Run 13 stress 0.5681417
## Run 14 stress 0.5682028
## Run 15 stress 0.5684834
## Run 16 stress 0.4447455
## Run 17 stress 0.4959701
## Run 18 stress 0.5024555
## Run 19 stress 0.5680399
## Run 20 stress 0.5683069
## *** No convergence -- monoMDS stopping criteria:
##      4: stress ratio > sratmax
##     16: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.394227
## Run 1 stress 0.5681938
## Run 2 stress 0.4274866
## Run 3 stress 0.3940531
## ... New best solution
## ... Procrustes: rmse 0.02904256  max resid 0.1806521
## Run 4 stress 0.5511918
## Run 5 stress 0.5664223
## Run 6 stress 0.3942395
## ... Procrustes: rmse 0.04115536  max resid 0.2545277
## Run 7 stress 0.5679536
## Run 8 stress 0.567692
## Run 9 stress 0.5684337
## Run 10 stress 0.5679782
## Run 11 stress 0.4404001
## Run 12 stress 0.5684083
## Run 13 stress 0.5668238
## Run 14 stress 0.5681813
## Run 15 stress 0.5685236
## Run 16 stress 0.4496556
## Run 17 stress 0.5632525
```

```
## Run 18 stress 0.5684233
## Run 19 stress 0.4429899
## Run 20 stress 0.3950832
## *** No convergence -- monoMDS stopping criteria:
##      6: stress ratio > sratmax
##     14: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3646021
## Run 1 stress 0.4348944
## Run 2 stress 0.5684129
## Run 3 stress 0.364472
## ... New best solution
## ... Procrustes: rmse 0.005771471  max resid 0.02894301
## Run 4 stress 0.4489242
## Run 5 stress 0.5682131
## Run 6 stress 0.405979
## Run 7 stress 0.4174456
## Run 8 stress 0.5681885
## Run 9 stress 0.4480656
## Run 10 stress 0.5307128
## Run 11 stress 0.4483172
## Run 12 stress 0.4705803
## Run 13 stress 0.5519255
## Run 14 stress 0.5684502
## Run 15 stress 0.5685719
## Run 16 stress 0.5684748
## Run 17 stress 0.5685509
## Run 18 stress 0.4211307
## Run 19 stress 0.5276824
## Run 20 stress 0.5571021
## *** No convergence -- monoMDS stopping criteria:
##      6: stress ratio > sratmax
##     14: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3682575
## Run 1 stress 0.5172164
## Run 2 stress 0.4727454
## Run 3 stress 0.4193908
## Run 4 stress 0.5015563
## Run 5 stress 0.568403
## Run 6 stress 0.4698757
## Run 7 stress 0.4832318
## Run 8 stress 0.501676
## Run 9 stress 0.5671036
## Run 10 stress 0.4500066
## Run 11 stress 0.4049339
## Run 12 stress 0.5686678
## Run 13 stress 0.4366164
## Run 14 stress 0.3827803
## Run 15 stress 0.5136698
## Run 16 stress 0.4994955
## Run 17 stress 0.5683974
```

```
## Run 18 stress 0.5657936
## Run 19 stress 0.4356778
## Run 20 stress 0.4952909
## *** No convergence -- monoMDS stopping criteria:
##      5: stress ratio > sratmax
##     15: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3800152
## Run 1 stress 0.5672252
## Run 2 stress 0.5627173
## Run 3 stress 0.5373714
## Run 4 stress 0.5682594
## Run 5 stress 0.5069717
## Run 6 stress 0.4556034
## Run 7 stress 0.5095492
## Run 8 stress 0.4719363
## Run 9 stress 0.4345245
## Run 10 stress 0.4696021
## Run 11 stress 0.5463475
## Run 12 stress 0.469661
## Run 13 stress 0.3998475
## Run 14 stress 0.5157725
## Run 15 stress 0.4465658
## Run 16 stress 0.5686617
## Run 17 stress 0.4778391
## Run 18 stress 0.4535634
## Run 19 stress 0.4598991
## Run 20 stress 0.4117925
## *** No convergence -- monoMDS stopping criteria:
##      6: stress ratio > sratmax
##     14: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3601638
## Run 1 stress 0.5667956
## Run 2 stress 0.3965094
## Run 3 stress 0.4144219
## Run 4 stress 0.5664413
## Run 5 stress 0.5683517
## Run 6 stress 0.528599
## Run 7 stress 0.4187658
## Run 8 stress 0.4283142
## Run 9 stress 0.4184478
## Run 10 stress 0.5530928
## Run 11 stress 0.3979478
## Run 12 stress 0.5625346
## Run 13 stress 0.5649802
## Run 14 stress 0.4938893
## Run 15 stress 0.5593977
## Run 16 stress 0.4514616
## Run 17 stress 0.5673638
## Run 18 stress 0.5620799
## Run 19 stress 0.5306267
```

```
## Run 20 stress 0.5673966
## *** No convergence -- monoMDS stopping criteria:
##      1: stress ratio > sratmax
##     19: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3717316
## Run 1 stress 0.3787283
## Run 2 stress 0.4478809
## Run 3 stress 0.5673267
## Run 4 stress 0.4594949
## Run 5 stress 0.5685097
## Run 6 stress 0.4545879
## Run 7 stress 0.4901621
## Run 8 stress 0.5684444
## Run 9 stress 0.4730908
## Run 10 stress 0.565617
## Run 11 stress 0.4206689
## Run 12 stress 0.4629492
## Run 13 stress 0.5685879
## Run 14 stress 0.5686474
## Run 15 stress 0.5651019
## Run 16 stress 0.5674841
## Run 17 stress 0.4636374
## Run 18 stress 0.5684963
## Run 19 stress 0.4494445
## Run 20 stress 0.5500859
## *** No convergence -- monoMDS stopping criteria:
##      6: stress ratio > sratmax
##     14: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3770613
## Run 1 stress 0.4767932
## Run 2 stress 0.3970327
## Run 3 stress 0.4768208
## Run 4 stress 0.4444649
## Run 5 stress 0.5683843
## Run 6 stress 0.4941672
## Run 7 stress 0.3806581
## Run 8 stress 0.5103081
## Run 9 stress 0.4678033
## Run 10 stress 0.568556
## Run 11 stress 0.5663765
## Run 12 stress 0.4263196
## Run 13 stress 0.3757956
## ... New best solution
## ... Procrustes: rmse 0.01465859  max resid 0.09400955
## Run 14 stress 0.450979
## Run 15 stress 0.5123037
## Run 16 stress 0.4705743
## Run 17 stress 0.376999
## Run 18 stress 0.4759685
## Run 19 stress 0.4174335
```

```
## Run 20 stress 0.5681265
## *** No convergence -- monoMDS stopping criteria:
##      9: stress ratio > sratmax
##     11: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3280992
## Run 1 stress 0.5671033
## Run 2 stress 0.5322175
## Run 3 stress 0.5686384
## Run 4 stress 0.4238676
## Run 5 stress 0.3862703
## Run 6 stress 0.4528998
## Run 7 stress 0.5640002
## Run 8 stress 0.4029901
## Run 9 stress 0.5681117
## Run 10 stress 0.5337041
## Run 11 stress 0.4144377
## Run 12 stress 0.5686119
## Run 13 stress 0.4178453
## Run 14 stress 0.5686612
## Run 15 stress 0.3285528
## ... Procrustes: rmse 0.005444763  max resid 0.02121631
## Run 16 stress 0.5668888
## Run 17 stress 0.553705
## Run 18 stress 0.4915695
## Run 19 stress 0.3757346
## Run 20 stress 0.5680929
## *** No convergence -- monoMDS stopping criteria:
##      4: stress ratio > sratmax
##     16: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.3503658
## Run 1 stress 0.4460689
## Run 2 stress 0.5311755
## Run 3 stress 0.5484704
## Run 4 stress 0.5676408
## Run 5 stress 0.5686648
## Run 6 stress 0.4142647
## Run 7 stress 0.4529756
## Run 8 stress 0.5684842
## Run 9 stress 0.4550182
## Run 10 stress 0.5683235
## Run 11 stress 0.5426237
## Run 12 stress 0.380658
## Run 13 stress 0.5686233
## Run 14 stress 0.491671
## Run 15 stress 0.5679617
## Run 16 stress 0.4469457
## Run 17 stress 0.5680545
## Run 18 stress 0.5685118
## Run 19 stress 0.5684207
## Run 20 stress 0.5679674
```

```
## *** No convergence -- monoMDS stopping criteria:
##      5: stress ratio > sratmax
##     15: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1901664
## Run 1 stress 0.5685828
## Run 2 stress 0.3380201
## Run 3 stress 0.5679613
## Run 4 stress 0.5667504
## Run 5 stress 0.5675535
## Run 6 stress 0.3383836
## Run 7 stress 0.5682335
## Run 8 stress 0.2736841
## Run 9 stress 0.5675012
## Run 10 stress 0.5492909
## Run 11 stress 0.2736663
## Run 12 stress 0.5479633
## Run 13 stress 0.5685755
## Run 14 stress 0.3246719
## Run 15 stress 0.568414
## Run 16 stress 0.5682649
## Run 17 stress 0.55551
## Run 18 stress 0.5422122
## Run 19 stress 0.5513842
## Run 20 stress 0.5442484
## *** No convergence -- monoMDS stopping criteria:
##      3: stress ratio > sratmax
##     17: scale factor of the gradient < sfgrmin
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1682651
## Run 1 stress 0.1682651
## ... New best solution
## ... Procrustes: rmse 5.455528e-05  max resid 0.000273329
## ... Similar to previous best
## Run 2 stress 0.2044311
## Run 3 stress 0.2044301
## Run 4 stress 0.2049617
## Run 5 stress 0.1887138
## Run 6 stress 0.1887025
## Run 7 stress 0.168265
## ... New best solution
## ... Procrustes: rmse 4.225874e-05  max resid 0.0002961808
## ... Similar to previous best
## Run 8 stress 0.1682651
## ... Procrustes: rmse 5.604982e-05  max resid 0.0003787479
## ... Similar to previous best
## Run 9 stress 0.1682651
## ... Procrustes: rmse 7.753685e-05  max resid 0.0004344838
## ... Similar to previous best
## Run 10 stress 0.1682668
## ... Procrustes: rmse 0.0003531089  max resid 0.002305223
## ... Similar to previous best
```

```
## Run 11 stress 0.1682651
## ... Procrustes: rmse 5.378076e-05  max resid 0.0002768145
## ... Similar to previous best
## Run 12 stress 0.168265
## ... New best solution
## ... Procrustes: rmse 2.535816e-05  max resid 0.0001550301
## ... Similar to previous best
## Run 13 stress 0.1682651
## ... Procrustes: rmse 5.997006e-05  max resid 0.0003718014
## ... Similar to previous best
## Run 14 stress 0.1886341
## Run 15 stress 0.168265
## ... Procrustes: rmse 1.76608e-05  max resid 6.979733e-05
## ... Similar to previous best
## Run 16 stress 0.188635
## Run 17 stress 0.168265
## ... Procrustes: rmse 8.982002e-06  max resid 5.491524e-05
## ... Similar to previous best
## Run 18 stress 0.168265
## ... Procrustes: rmse 2.027978e-05  max resid 0.0001042265
## ... Similar to previous best
## Run 19 stress 0.1682654
## ... Procrustes: rmse 5.911068e-05  max resid 0.0001592934
## ... Similar to previous best
## Run 20 stress 0.2044353
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1613766
## Run 1 stress 0.1612919
## ... New best solution
## ... Procrustes: rmse 0.006822706  max resid 0.05381748
## Run 2 stress 0.161227
## ... New best solution
## ... Procrustes: rmse 0.01187056  max resid 0.09397239
## Run 3 stress 0.1612917
## ... Procrustes: rmse 0.01174579  max resid 0.09297045
## Run 4 stress 0.161227
## ... New best solution
## ... Procrustes: rmse 6.459677e-06  max resid 2.895039e-05
## ... Similar to previous best
## Run 5 stress 0.2300077
## Run 6 stress 0.1613096
## ... Procrustes: rmse 0.009861622  max resid 0.07767864
## Run 7 stress 0.1612916
## ... Procrustes: rmse 0.01174616  max resid 0.09297328
## Run 8 stress 0.1612271
## ... Procrustes: rmse 9.698729e-05  max resid 0.0007385254
## ... Similar to previous best
## Run 9 stress 0.1612915
## ... Procrustes: rmse 0.01184469  max resid 0.09376344
## Run 10 stress 0.1853759
## Run 11 stress 0.161227
## ... New best solution
```

```
## ... Procrustes: rmse 8.89676e-06  max resid 5.102608e-05
## ... Similar to previous best
## Run 12 stress 0.1612915
## ... Procrustes: rmse 0.01184726  max resid 0.09379718
## Run 13 stress 0.1727753
## Run 14 stress 0.1612276
## ... Procrustes: rmse 0.0002308591  max resid 0.00176539
## ... Similar to previous best
## Run 15 stress 0.1612927
## ... Procrustes: rmse 0.01150352  max resid 0.09103341
## Run 16 stress 0.2027298
## Run 17 stress 0.1612919
## ... Procrustes: rmse 0.011934  max resid 0.09440298
## Run 18 stress 0.1727746
## Run 19 stress 0.1612272
## ... Procrustes: rmse 0.0001210766  max resid 0.0009018744
## ... Similar to previous best
## Run 20 stress 0.161292
## ... Procrustes: rmse 0.0118132  max resid 0.09356522
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.155867
## Run 1 stress 0.155867
## ... Procrustes: rmse 0.0001176003  max resid 0.0005310283
## ... Similar to previous best
## Run 2 stress 0.1558677
## ... Procrustes: rmse 0.0003687341  max resid 0.002238263
## ... Similar to previous best
## Run 3 stress 0.155867
## ... Procrustes: rmse 3.845797e-05  max resid 0.0001865679
## ... Similar to previous best
## Run 4 stress 0.1558672
## ... Procrustes: rmse 0.0002422104  max resid 0.001533422
## ... Similar to previous best
## Run 5 stress 0.1558673
## ... Procrustes: rmse 0.0002738901  max resid 0.001687337
## ... Similar to previous best
## Run 6 stress 0.155867
## ... Procrustes: rmse 0.0001629031  max resid 0.001052487
## ... Similar to previous best
## Run 7 stress 0.155868
## ... Procrustes: rmse 0.0004173933  max resid 0.002499464
## ... Similar to previous best
## Run 8 stress 0.1558672
## ... Procrustes: rmse 0.0001020001  max resid 0.0006005014
## ... Similar to previous best
## Run 9 stress 0.155867
## ... Procrustes: rmse 3.35122e-05  max resid 0.0001848033
## ... Similar to previous best
## Run 10 stress 0.1558669
## ... New best solution
## ... Procrustes: rmse 7.15657e-05  max resid 0.0004587032
## ... Similar to previous best
```

```
## Run 11 stress 0.1558671
## ... Procrustes: rmse 0.0001370015  max resid 0.0008497393
## ... Similar to previous best
## Run 12 stress 0.1558669
## ... Procrustes: rmse 1.860429e-05  max resid 0.000120227
## ... Similar to previous best
## Run 13 stress 0.1558677
## ... Procrustes: rmse 0.0002874301  max resid 0.001870302
## ... Similar to previous best
## Run 14 stress 0.1558672
## ... Procrustes: rmse 0.0001655614  max resid 0.001056945
## ... Similar to previous best
## Run 15 stress 0.1558675
## ... Procrustes: rmse 0.0002157407  max resid 0.001299121
## ... Similar to previous best
## Run 16 stress 0.1558676
## ... Procrustes: rmse 0.0002732325  max resid 0.00167364
## ... Similar to previous best
## Run 17 stress 0.1558672
## ... Procrustes: rmse 0.0001721658  max resid 0.001110627
## ... Similar to previous best
## Run 18 stress 0.1558674
## ... Procrustes: rmse 0.0002285671  max resid 0.001390865
## ... Similar to previous best
## Run 19 stress 0.155867
## ... Procrustes: rmse 7.848681e-05  max resid 0.0004398878
## ... Similar to previous best
## Run 20 stress 0.1558671
## ... Procrustes: rmse 0.0001177143  max resid 0.0007408001
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.2070983
## Run 1 stress 0.2070979
## ... New best solution
## ... Procrustes: rmse 0.0002485699  max resid 0.001463348
## ... Similar to previous best
## Run 2 stress 0.207098
## ... Procrustes: rmse 0.0001626741  max resid 0.0009612266
## ... Similar to previous best
## Run 3 stress 0.2097383
## Run 4 stress 0.209723
## Run 5 stress 0.2174571
## Run 6 stress 0.2097293
## Run 7 stress 0.2097354
## Run 8 stress 0.2174011
## Run 9 stress 0.2070979
## ... Procrustes: rmse 4.851118e-05  max resid 0.0002364045
## ... Similar to previous best
## Run 10 stress 0.2091201
## Run 11 stress 0.208425
## Run 12 stress 0.2070979
## ... New best solution
```

```
## ... Procrustes: rmse 2.203637e-05  max resid 8.551873e-05
## ... Similar to previous best
## Run 13 stress 0.2070983
## ... Procrustes: rmse 0.0002304857  max resid 0.001197895
## ... Similar to previous best
## Run 14 stress 0.208429
## Run 15 stress 0.2077223
## Run 16 stress 0.2070981
## ... Procrustes: rmse 0.0001627727  max resid 0.0009004959
## ... Similar to previous best
## Run 17 stress 0.2070979
## ... New best solution
## ... Procrustes: rmse 1.738706e-05  max resid 6.472029e-05
## ... Similar to previous best
## Run 18 stress 0.2070982
## ... Procrustes: rmse 0.0001983729  max resid 0.001050352
## ... Similar to previous best
## Run 19 stress 0.2097205
## Run 20 stress 0.2070982
## ... Procrustes: rmse 0.000130803  max resid 0.0007783329
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1935812
## Run 1 stress 0.192593
## ... New best solution
## ... Procrustes: rmse 0.01581781  max resid 0.0904917
## Run 2 stress 0.1929641
## ... Procrustes: rmse 0.01063036  max resid 0.07968417
## Run 3 stress 0.1972969
## Run 4 stress 0.2040422
## Run 5 stress 0.1972969
## Run 6 stress 0.1958133
## Run 7 stress 0.1980596
## Run 8 stress 0.1970969
## Run 9 stress 0.1960589
## Run 10 stress 0.1958132
## Run 11 stress 0.1952935
## Run 12 stress 0.1938949
## Run 13 stress 0.2256915
## Run 14 stress 0.1953408
## Run 15 stress 0.1958132
## Run 16 stress 0.1953308
## Run 17 stress 0.2076776
## Run 18 stress 0.1958132
## Run 19 stress 0.1958132
## Run 20 stress 0.1929659
## ... Procrustes: rmse 0.01069366  max resid 0.08016094
## *** No convergence -- monoMDS stopping criteria:
##     20: stress ratio > sratmax
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1821624
```

```
## Run 1 stress 0.1824967
## ... Procrustes: rmse 0.01090079  max resid 0.06609952
## Run 2 stress 0.1964774
## Run 3 stress 0.2020068
## Run 4 stress 0.4077291
## Run 5 stress 0.1964774
## Run 6 stress 0.2138619
## Run 7 stress 0.2298011
## Run 8 stress 0.1824806
## ... Procrustes: rmse 0.0127027  max resid 0.07066479
## Run 9 stress 0.1822094
## ... Procrustes: rmse 0.007122054  max resid 0.04910433
## Run 10 stress 0.2124414
## Run 11 stress 0.2049023
## Run 12 stress 0.1824806
## ... Procrustes: rmse 0.01268122  max resid 0.07050684
## Run 13 stress 0.1822074
## ... Procrustes: rmse 0.007128912  max resid 0.04931355
## Run 14 stress 0.2031147
## Run 15 stress 0.1824806
## ... Procrustes: rmse 0.01269444  max resid 0.07060311
## Run 16 stress 0.2280362
## Run 17 stress 0.2270628
## Run 18 stress 0.2280233
## Run 19 stress 0.1821783
## ... Procrustes: rmse 0.008594327  max resid 0.05085296
## Run 20 stress 0.1824968
## ... Procrustes: rmse 0.01072743  max resid 0.06300637
## *** No convergence -- monoMDS stopping criteria:
##      1: no. of iterations >= maxit
##     19: stress ratio > sratmax
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1507339
## Run 1 stress 0.1507339
## ... New best solution
## ... Procrustes: rmse 9.58243e-06  max resid 4.036206e-05
## ... Similar to previous best
## Run 2 stress 0.1507339
## ... Procrustes: rmse 2.377371e-05  max resid 0.0001257781
## ... Similar to previous best
## Run 3 stress 0.1507339
## ... Procrustes: rmse 7.323102e-06  max resid 3.87154e-05
## ... Similar to previous best
## Run 4 stress 0.1507339
## ... Procrustes: rmse 1.325726e-05  max resid 6.059472e-05
## ... Similar to previous best
## Run 5 stress 0.1830046
## Run 6 stress 0.1507339
## ... Procrustes: rmse 3.792267e-05  max resid 0.0001720684
## ... Similar to previous best
## Run 7 stress 0.1507339
## ... Procrustes: rmse 1.185255e-05  max resid 6.052891e-05
## ... Similar to previous best
```

```
## Run 8 stress 0.1507339
## ... Procrustes: rmse 2.628614e-06  max resid 1.688159e-05
## ... Similar to previous best
## Run 9 stress 0.1507339
## ... Procrustes: rmse 9.317882e-06  max resid 3.654657e-05
## ... Similar to previous best
## Run 10 stress 0.1507339
## ... Procrustes: rmse 4.099017e-06  max resid 1.905917e-05
## ... Similar to previous best
## Run 11 stress 0.150734
## ... Procrustes: rmse 3.086955e-05  max resid 0.0001222313
## ... Similar to previous best
## Run 12 stress 0.1507339
## ... Procrustes: rmse 8.261637e-06  max resid 2.399201e-05
## ... Similar to previous best
## Run 13 stress 0.1830064
## Run 14 stress 0.150734
## ... Procrustes: rmse 3.554215e-05  max resid 0.0001559016
## ... Similar to previous best
## Run 15 stress 0.1507339
## ... Procrustes: rmse 4.609454e-06  max resid 2.542901e-05
## ... Similar to previous best
## Run 16 stress 0.1507339
## ... Procrustes: rmse 3.09926e-05  max resid 0.0001440939
## ... Similar to previous best
## Run 17 stress 0.1830047
## Run 18 stress 0.1507339
## ... Procrustes: rmse 3.066614e-05  max resid 0.0001569531
## ... Similar to previous best
## Run 19 stress 0.1507339
## ... Procrustes: rmse 3.310406e-06  max resid 1.436852e-05
## ... Similar to previous best
## Run 20 stress 0.150734
## ... Procrustes: rmse 3.404287e-05  max resid 0.0001596513
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1768171
## Run 1 stress 0.1768173
## ... Procrustes: rmse 0.0001929358  max resid 0.001333374
## ... Similar to previous best
## Run 2 stress 0.1768235
## ... Procrustes: rmse 0.001303776  max resid 0.008563742
## ... Similar to previous best
## Run 3 stress 0.1768243
## ... Procrustes: rmse 0.001322519  max resid 0.008587541
## ... Similar to previous best
## Run 4 stress 0.1768174
## ... Procrustes: rmse 0.0002209547  max resid 0.001525143
## ... Similar to previous best
## Run 5 stress 0.1768237
## ... Procrustes: rmse 0.001305934  max resid 0.008569396
## ... Similar to previous best
```

```
## Run 6 stress 0.1768173
## ... Procrustes: rmse 0.0002108579  max resid 0.001446967
## ... Similar to previous best
## Run 7 stress 0.1768171
## ... New best solution
## ... Procrustes: rmse 0.0001043475  max resid 0.0007283043
## ... Similar to previous best
## Run 8 stress 0.1768171
## ... New best solution
## ... Procrustes: rmse 3.367771e-05  max resid 0.0002274769
## ... Similar to previous best
## Run 9 stress 0.2155353
## Run 10 stress 0.1768174
## ... Procrustes: rmse 0.00019684  max resid 0.001369452
## ... Similar to previous best
## Run 11 stress 0.2731616
## Run 12 stress 0.1768171
## ... New best solution
## ... Procrustes: rmse 1.583396e-05  max resid 9.513424e-05
## ... Similar to previous best
## Run 13 stress 0.1768174
## ... Procrustes: rmse 0.0001808529  max resid 0.001259405
## ... Similar to previous best
## Run 14 stress 0.1768235
## ... Procrustes: rmse 0.001306431  max resid 0.008578974
## ... Similar to previous best
## Run 15 stress 0.1768238
## ... Procrustes: rmse 0.001305205  max resid 0.008574372
## ... Similar to previous best
## Run 16 stress 0.1768172
## ... Procrustes: rmse 0.0001210859  max resid 0.0008416182
## ... Similar to previous best
## Run 17 stress 0.1768235
## ... Procrustes: rmse 0.001306245  max resid 0.008548868
## ... Similar to previous best
## Run 18 stress 0.4077517
## Run 19 stress 0.1768236
## ... Procrustes: rmse 0.001307424  max resid 0.008571603
## ... Similar to previous best
## Run 20 stress 0.2155357
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1968715
## Run 1 stress 0.1987044
## Run 2 stress 0.2153081
## Run 3 stress 0.1986267
## Run 4 stress 0.1975236
## Run 5 stress 0.1974113
## Run 6 stress 0.1987042
## Run 7 stress 0.2087348
## Run 8 stress 0.1975549
## Run 9 stress 0.2452915
## Run 10 stress 0.2303631
```

```
## Run 11 stress 0.1966482
## ... New best solution
## ... Procrustes: rmse 0.007114999  max resid 0.05073444
## Run 12 stress 0.2121132
## Run 13 stress 0.2121132
## Run 14 stress 0.2106124
## Run 15 stress 0.2086704
## Run 16 stress 0.1978623
## Run 17 stress 0.1976798
## Run 18 stress 0.1964974
## ... New best solution
## ... Procrustes: rmse 0.02657257  max resid 0.1372514
## Run 19 stress 0.1977124
## Run 20 stress 0.1991462
## *** No convergence -- monoMDS stopping criteria:
##     20: stress ratio > sratmax
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.2018881
## Run 1 stress 0.20189
## ... Procrustes: rmse 0.0006128079  max resid 0.003606153
## ... Similar to previous best
## Run 2 stress 0.2126028
## Run 3 stress 0.2018945
## ... Procrustes: rmse 0.0008880957  max resid 0.003936207
## ... Similar to previous best
## Run 4 stress 0.2126107
## Run 5 stress 0.2018878
## ... New best solution
## ... Procrustes: rmse 0.001435809  max resid 0.009466884
## ... Similar to previous best
## Run 6 stress 0.2147341
## Run 7 stress 0.2018883
## ... Procrustes: rmse 0.001401972  max resid 0.008884309
## ... Similar to previous best
## Run 8 stress 0.2018868
## ... New best solution
## ... Procrustes: rmse 0.0004236446  max resid 0.002903487
## ... Similar to previous best
## Run 9 stress 0.2124268
## Run 10 stress 0.2124268
## Run 11 stress 0.2018874
## ... Procrustes: rmse 0.000715349  max resid 0.004315596
## ... Similar to previous best
## Run 12 stress 0.2018881
## ... Procrustes: rmse 0.0005471337  max resid 0.003725315
## ... Similar to previous best
## Run 13 stress 0.2121699
## Run 14 stress 0.201888
## ... Procrustes: rmse 0.0005266234  max resid 0.003541002
## ... Similar to previous best
## Run 15 stress 0.2018881
## ... Procrustes: rmse 0.0005506789  max resid 0.003751727
## ... Similar to previous best
```

```
## Run 16 stress 0.2149894
## Run 17 stress 0.217443
## Run 18 stress 0.2018905
## ... Procrustes: rmse 0.001082671  max resid 0.005228719
## ... Similar to previous best
## Run 19 stress 0.2441673
## Run 20 stress 0.2018872
## ... Procrustes: rmse 0.0001517613  max resid 0.0009939873
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.185415
## Run 1 stress 0.1849417
## ... New best solution
## ... Procrustes: rmse 0.01224021  max resid 0.06793312
## Run 2 stress 0.1857979
## Run 3 stress 0.1854474
## Run 4 stress 0.1854474
## Run 5 stress 0.1849564
## ... Procrustes: rmse 0.001356935  max resid 0.008022445
## ... Similar to previous best
## Run 6 stress 0.1849564
## ... Procrustes: rmse 0.001337944  max resid 0.0079698
## ... Similar to previous best
## Run 7 stress 0.1854461
## Run 8 stress 0.185798
## Run 9 stress 0.1849564
## ... Procrustes: rmse 0.001344839  max resid 0.007996976
## ... Similar to previous best
## Run 10 stress 0.1849565
## ... Procrustes: rmse 0.00153366  max resid 0.007634812
## ... Similar to previous best
## Run 11 stress 0.1849406
## ... New best solution
## ... Procrustes: rmse 0.0008515553  max resid 0.006082791
## ... Similar to previous best
## Run 12 stress 0.2373557
## Run 13 stress 0.1849563
## ... Procrustes: rmse 0.001654481  max resid 0.00825017
## ... Similar to previous best
## Run 14 stress 0.1854462
## Run 15 stress 0.1857977
## Run 16 stress 0.1854474
## Run 17 stress 0.1857978
## Run 18 stress 0.1849564
## ... Procrustes: rmse 0.00168647  max resid 0.008280096
## ... Similar to previous best
## Run 19 stress 0.1857977
## Run 20 stress 0.1857977
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1792856
```

```
## Run 1 stress 0.1792003
## ... New best solution
## ... Procrustes: rmse 0.00227337  max resid 0.01433299
## Run 2 stress 0.1792856
## ... Procrustes: rmse 0.002272251  max resid 0.01431808
## Run 3 stress 0.1792002
## ... New best solution
## ... Procrustes: rmse 2.328166e-05  max resid 0.0001154607
## ... Similar to previous best
## Run 4 stress 0.1995587
## Run 5 stress 0.1788812
## ... New best solution
## ... Procrustes: rmse 0.005390975  max resid 0.03796309
## Run 6 stress 0.2120828
## Run 7 stress 0.1792856
## ... Procrustes: rmse 0.006017772  max resid 0.0387746
## Run 8 stress 0.1792856
## ... Procrustes: rmse 0.006016481  max resid 0.03877079
## Run 9 stress 0.1792002
## ... Procrustes: rmse 0.005397509  max resid 0.03798617
## Run 10 stress 0.1788813
## ... Procrustes: rmse 2.621706e-05  max resid 0.0001378518
## ... Similar to previous best
## Run 11 stress 0.1792856
## ... Procrustes: rmse 0.00601659  max resid 0.0387627
## Run 12 stress 0.1792856
## ... Procrustes: rmse 0.00601308  max resid 0.03874175
## Run 13 stress 0.1995587
## Run 14 stress 0.1792856
## ... Procrustes: rmse 0.006007112  max resid 0.0387053
## Run 15 stress 0.1792002
## ... Procrustes: rmse 0.005390243  max resid 0.03793747
## Run 16 stress 0.1792002
## ... Procrustes: rmse 0.005394712  max resid 0.03796514
## Run 17 stress 0.1792856
## ... Procrustes: rmse 0.0060088  max resid 0.03871091
## Run 18 stress 0.2133665
## Run 19 stress 0.1792856
## ... Procrustes: rmse 0.006018026  max resid 0.03877319
## Run 20 stress 0.1995587
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1923372
## Run 1 stress 0.1922968
## ... New best solution
## ... Procrustes: rmse 0.00361217  max resid 0.0248498
## Run 2 stress 0.1943819
## Run 3 stress 0.2252616
## Run 4 stress 0.1956398
## Run 5 stress 0.1923218
## ... Procrustes: rmse 0.001358388  max resid 0.007881924
## ... Similar to previous best
## Run 6 stress 0.1951033
```

```
## Run 7 stress 0.1956397
## Run 8 stress 0.1943816
## Run 9 stress 0.192297
## ... Procrustes: rmse 4.890698e-05  max resid 0.0002236908
## ... Similar to previous best
## Run 10 stress 0.1955334
## Run 11 stress 0.1922952
## ... New best solution
## ... Procrustes: rmse 0.0004522853  max resid 0.002328623
## ... Similar to previous best
## Run 12 stress 0.1951033
## Run 13 stress 0.1943816
## Run 14 stress 0.1923223
## ... Procrustes: rmse 0.001510266  max resid 0.008344336
## ... Similar to previous best
## Run 15 stress 0.2004569
## Run 16 stress 0.1951034
## Run 17 stress 0.192323
## ... Procrustes: rmse 0.001570634  max resid 0.008542589
## ... Similar to previous best
## Run 18 stress 0.1923197
## ... Procrustes: rmse 0.001161487  max resid 0.006656965
## ... Similar to previous best
## Run 19 stress 0.2251979
## Run 20 stress 0.1955335
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1730312
## Run 1 stress 0.1730315
## ... Procrustes: rmse 9.635369e-05  max resid 0.0005534103
## ... Similar to previous best
## Run 2 stress 0.1729821
## ... New best solution
## ... Procrustes: rmse 0.001981738  max resid 0.01242088
## Run 3 stress 0.1729874
## ... Procrustes: rmse 0.001703047  max resid 0.01241525
## Run 4 stress 0.18927
## Run 5 stress 0.1892707
## Run 6 stress 0.1729875
## ... Procrustes: rmse 0.001727737  max resid 0.01258695
## Run 7 stress 0.1892702
## Run 8 stress 0.1730313
## ... Procrustes: rmse 0.001984042  max resid 0.01243135
## Run 9 stress 0.1729878
## ... Procrustes: rmse 0.001729916  max resid 0.01258719
## Run 10 stress 0.1892706
## Run 11 stress 0.1729876
## ... Procrustes: rmse 0.001726907  max resid 0.0125696
## Run 12 stress 0.1730426
## ... Procrustes: rmse 0.002123158  max resid 0.01215834
## Run 13 stress 0.1729875
## ... Procrustes: rmse 0.001700207  max resid 0.01238159
## Run 14 stress 0.1730313
```

```
## ... Procrustes: rmse 0.001977121  max resid 0.01239592
## Run 15 stress 0.1729821
## ... Procrustes: rmse 2.56763e-05  max resid 0.0001046523
## ... Similar to previous best
## Run 16 stress 0.1729875
## ... Procrustes: rmse 0.001711865  max resid 0.0124823
## Run 17 stress 0.1729822
## ... Procrustes: rmse 8.070946e-05  max resid 0.0004954557
## ... Similar to previous best
## Run 18 stress 0.1730312
## ... Procrustes: rmse 0.001983181  max resid 0.01242618
## Run 19 stress 0.1729877
## ... Procrustes: rmse 0.001682222  max resid 0.01219974
## Run 20 stress 0.1729876
## ... Procrustes: rmse 0.001731633  max resid 0.01260263
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1834774
## Run 1 stress 0.1834774
## ... Procrustes: rmse 1.107581e-05  max resid 7.588418e-05
## ... Similar to previous best
## Run 2 stress 0.1834774
## ... Procrustes: rmse 4.19352e-06  max resid 1.779124e-05
## ... Similar to previous best
## Run 3 stress 0.1834774
## ... Procrustes: rmse 6.929536e-06  max resid 3.01987e-05
## ... Similar to previous best
## Run 4 stress 0.1834775
## ... Procrustes: rmse 1.718779e-05  max resid 5.210262e-05
## ... Similar to previous best
## Run 5 stress 0.1834774
## ... Procrustes: rmse 8.955408e-06  max resid 5.962169e-05
## ... Similar to previous best
## Run 6 stress 0.1834775
## ... Procrustes: rmse 1.89446e-05  max resid 0.0001225482
## ... Similar to previous best
## Run 7 stress 0.1834774
## ... New best solution
## ... Procrustes: rmse 2.710643e-06  max resid 1.675733e-05
## ... Similar to previous best
## Run 8 stress 0.1834774
## ... Procrustes: rmse 9.262415e-06  max resid 4.19061e-05
## ... Similar to previous best
## Run 9 stress 0.1834774
## ... Procrustes: rmse 4.572674e-06  max resid 1.724749e-05
## ... Similar to previous best
## Run 10 stress 0.1834775
## ... Procrustes: rmse 1.849537e-05  max resid 0.0001251139
## ... Similar to previous best
## Run 11 stress 0.1834774
## ... Procrustes: rmse 2.539067e-06  max resid 7.347199e-06
## ... Similar to previous best
## Run 12 stress 0.184849
```

```
## Run 13 stress 0.1834774
## ... Procrustes: rmse 2.076445e-06  max resid 1.025976e-05
## ... Similar to previous best
## Run 14 stress 0.1834774
## ... Procrustes: rmse 3.12269e-06  max resid 1.308082e-05
## ... Similar to previous best
## Run 15 stress 0.184849
## Run 16 stress 0.1834775
## ... Procrustes: rmse 3.892223e-05  max resid 0.000232539
## ... Similar to previous best
## Run 17 stress 0.1847306
## Run 18 stress 0.1834774
## ... Procrustes: rmse 2.670892e-06  max resid 1.160795e-05
## ... Similar to previous best
## Run 19 stress 0.1834774
## ... Procrustes: rmse 3.449743e-06  max resid 2.281657e-05
## ... Similar to previous best
## Run 20 stress 0.1834774
## ... Procrustes: rmse 1.010135e-05  max resid 3.50951e-05
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1895874
## Run 1 stress 0.1896467
## ... Procrustes: rmse 0.001821856  max resid 0.01116201
## Run 2 stress 0.1895874
## ... New best solution
## ... Procrustes: rmse 5.064817e-05  max resid 0.0002588971
## ... Similar to previous best
## Run 3 stress 0.2158695
## Run 4 stress 0.2127281
## Run 5 stress 0.1929889
## Run 6 stress 0.212982
## Run 7 stress 0.1933065
## Run 8 stress 0.213623
## Run 9 stress 0.1932523
## Run 10 stress 0.1895876
## ... Procrustes: rmse 0.0001408283  max resid 0.0007632578
## ... Similar to previous best
## Run 11 stress 0.1895874
## ... Procrustes: rmse 1.60683e-05  max resid 6.757484e-05
## ... Similar to previous best
## Run 12 stress 0.1933061
## Run 13 stress 0.2169715
## Run 14 stress 0.1896467
## ... Procrustes: rmse 0.001801602  max resid 0.01105985
## Run 15 stress 0.2203248
## Run 16 stress 0.2290826
## Run 17 stress 0.1895874
## ... New best solution
## ... Procrustes: rmse 2.264052e-05  max resid 0.0001080732
## ... Similar to previous best
## Run 18 stress 0.1895874
```

```
## ... New best solution
## ... Procrustes: rmse 1.614767e-05  max resid 5.501442e-05
## ... Similar to previous best
## Run 19 stress 0.2157816
## Run 20 stress 0.2286651
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1760335
## Run 1 stress 0.1779237
## Run 2 stress 0.1779245
## Run 3 stress 0.1760786
## ... Procrustes: rmse 0.01180223  max resid 0.06595338
## Run 4 stress 0.1779238
## Run 5 stress 0.1779249
## Run 6 stress 0.1760377
## ... Procrustes: rmse 0.001970354  max resid 0.01173308
## Run 7 stress 0.1762014
## ... Procrustes: rmse 0.012795  max resid 0.06574519
## Run 8 stress 0.1779237
## Run 9 stress 0.1760744
## ... Procrustes: rmse 0.0119184  max resid 0.06627026
## Run 10 stress 0.1779239
## Run 11 stress 0.1760481
## ... Procrustes: rmse 0.01214249  max resid 0.06581673
## Run 12 stress 0.1760164
## ... New best solution
## ... Procrustes: rmse 0.004135121  max resid 0.02290425
## Run 13 stress 0.1762018
## ... Procrustes: rmse 0.01159549  max resid 0.06488563
## Run 14 stress 0.1779237
## Run 15 stress 0.1779237
## Run 16 stress 0.1762014
## ... Procrustes: rmse 0.01147585  max resid 0.06410464
## Run 17 stress 0.1762018
## ... Procrustes: rmse 0.0115936  max resid 0.06485658
## Run 18 stress 0.1779237
## Run 19 stress 0.1762016
## ... Procrustes: rmse 0.01153263  max resid 0.06447662
## Run 20 stress 0.1760895
## ... Procrustes: rmse 0.00985936  max resid 0.05449095
## *** No convergence -- monoMDS stopping criteria:
##     20: stress ratio > sratmax
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1886874
## Run 1 stress 0.1885785
## ... New best solution
## ... Procrustes: rmse 0.002894409  max resid 0.01789246
## Run 2 stress 0.2384133
## Run 3 stress 0.1885785
## ... New best solution
## ... Procrustes: rmse 4.112102e-05  max resid 0.0002212576
## ... Similar to previous best
```

```
## Run 4 stress 0.1887184
## ... Procrustes: rmse 0.003650728  max resid 0.01799397
## Run 5 stress 0.1885785
## ... Procrustes: rmse 7.199004e-05  max resid 0.000424181
## ... Similar to previous best
## Run 6 stress 0.1887183
## ... Procrustes: rmse 0.003656797  max resid 0.01797806
## Run 7 stress 0.1886899
## ... Procrustes: rmse 0.002910196  max resid 0.01742064
## Run 8 stress 0.2275372
## Run 9 stress 0.1885788
## ... Procrustes: rmse 0.0001843717  max resid 0.0009102948
## ... Similar to previous best
## Run 10 stress 0.1886921
## ... Procrustes: rmse 0.002973487  max resid 0.01726642
## Run 11 stress 0.1886874
## ... Procrustes: rmse 0.002907895  max resid 0.01795014
## Run 12 stress 0.1887144
## ... Procrustes: rmse 0.003442619  max resid 0.01791413
## Run 13 stress 0.1885785
## ... Procrustes: rmse 6.175734e-05  max resid 0.0003429393
## ... Similar to previous best
## Run 14 stress 0.1886917
## ... Procrustes: rmse 0.002960303  max resid 0.01724537
## Run 15 stress 0.2299647
## Run 16 stress 0.1887153
## ... Procrustes: rmse 0.003521129  max resid 0.01784728
## Run 17 stress 0.1886874
## ... Procrustes: rmse 0.002884506  max resid 0.01783244
## Run 18 stress 0.1885785
## ... Procrustes: rmse 2.021966e-05  max resid 0.0001092569
## ... Similar to previous best
## Run 19 stress 0.1885785
## ... Procrustes: rmse 2.032322e-05  max resid 8.314128e-05
## ... Similar to previous best
## Run 20 stress 0.1885785
## ... Procrustes: rmse 1.76803e-05  max resid 7.115623e-05
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.2002049
## Run 1 stress 0.2089795
## Run 2 stress 0.2114466
## Run 3 stress 0.2097967
## Run 4 stress 0.2106885
## Run 5 stress 0.2004511
## ... Procrustes: rmse 0.006195603  max resid 0.03707365
## Run 6 stress 0.210487
## Run 7 stress 0.206553
## Run 8 stress 0.2114465
## Run 9 stress 0.2042267
## Run 10 stress 0.2096613
## Run 11 stress 0.209843
```

```
## Run 12 stress 0.2104539
## Run 13 stress 0.2096198
## Run 14 stress 0.2100737
## Run 15 stress 0.2107516
## Run 16 stress 0.2087223
## Run 17 stress 0.2098003
## Run 18 stress 0.2217442
## Run 19 stress 0.2039076
## Run 20 stress 0.2101317
## *** No convergence -- monoMDS stopping criteria:
##     20: stress ratio > sratmax
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1710364
## Run 1 stress 0.1709466
## ... New best solution
## ... Procrustes: rmse 0.003962684  max resid 0.02104949
## Run 2 stress 0.1709466
## ... Procrustes: rmse 1.281073e-05  max resid 7.802449e-05
## ... Similar to previous best
## Run 3 stress 0.1709466
## ... Procrustes: rmse 5.000221e-05  max resid 0.0002077735
## ... Similar to previous best
## Run 4 stress 0.2180797
## Run 5 stress 0.1743399
## Run 6 stress 0.1743538
## Run 7 stress 0.1709466
## ... Procrustes: rmse 2.853227e-05  max resid 0.0001755955
## ... Similar to previous best
## Run 8 stress 0.1709466
## ... New best solution
## ... Procrustes: rmse 6.590368e-06  max resid 4.666948e-05
## ... Similar to previous best
## Run 9 stress 0.1709466
## ... Procrustes: rmse 3.843419e-05  max resid 0.000182101
## ... Similar to previous best
## Run 10 stress 0.1709466
## ... Procrustes: rmse 1.469106e-05  max resid 9.011842e-05
## ... Similar to previous best
## Run 11 stress 0.2022976
## Run 12 stress 0.4011236
## Run 13 stress 0.1709466
## ... Procrustes: rmse 1.403589e-05  max resid 5.952493e-05
## ... Similar to previous best
## Run 14 stress 0.1709466
## ... New best solution
## ... Procrustes: rmse 9.184254e-06  max resid 3.591274e-05
## ... Similar to previous best
## Run 15 stress 0.1709467
## ... Procrustes: rmse 5.938767e-05  max resid 0.0003041307
## ... Similar to previous best
## Run 16 stress 0.1709961
## ... Procrustes: rmse 0.003685875  max resid 0.02117285
## Run 17 stress 0.1710364
```

```
## ... Procrustes: rmse 0.003945232  max resid 0.02097326
## Run 18 stress 0.2208251
## Run 19 stress 0.1743537
## Run 20 stress 0.1709466
## ... Procrustes: rmse 1.132338e-05  max resid 7.568538e-05
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.0762502
## Run 1 stress 0.111062
## Run 2 stress 0.1060732
## Run 3 stress 0.08194625
## Run 4 stress 0.08619569
## Run 5 stress 0.0762502
## ... New best solution
## ... Procrustes: rmse 1.290809e-05  max resid 7.954342e-05
## ... Similar to previous best
## Run 6 stress 0.08194625
## Run 7 stress 0.07130159
## ... New best solution
## ... Procrustes: rmse 0.03266267  max resid 0.2604153
## Run 8 stress 0.0762502
## Run 9 stress 0.08194625
## Run 10 stress 0.08194626
## Run 11 stress 0.07130038
## ... New best solution
## ... Procrustes: rmse 0.0003077089  max resid 0.001864587
## ... Similar to previous best
## Run 12 stress 0.0762502
## Run 13 stress 0.08193683
## Run 14 stress 0.08194625
## Run 15 stress 0.4073716
## Run 16 stress 0.07625021
## Run 17 stress 0.0819357
## Run 18 stress 0.08619569
## Run 19 stress 0.1257269
## Run 20 stress 0.1088015
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.09805601
## Run 1 stress 0.1082711
## Run 2 stress 0.09902965
## Run 3 stress 0.09805474
## ... New best solution
## ... Procrustes: rmse 0.0002048096  max resid 0.001183255
## ... Similar to previous best
## Run 4 stress 0.09805525
## ... Procrustes: rmse 0.0001161803  max resid 0.0006462639
## ... Similar to previous best
## Run 5 stress 0.09903112
## Run 6 stress 0.09805811
## ... Procrustes: rmse 0.0004180881  max resid 0.002394503
```

```
## ... Similar to previous best
## Run 7 stress 0.09902906
## Run 8 stress 0.09903002
## Run 9 stress 0.09805834
## ... Procrustes: rmse 0.0004376848  max resid 0.002571385
## ... Similar to previous best
## Run 10 stress 0.09903194
## Run 11 stress 0.09805641
## ... Procrustes: rmse 0.0002770794  max resid 0.001439817
## ... Similar to previous best
## Run 12 stress 0.0990301
## Run 13 stress 0.09806511
## ... Procrustes: rmse 0.003715859  max resid 0.01986668
## Run 14 stress 0.09903174
## Run 15 stress 0.09806186
## ... Procrustes: rmse 0.003375461  max resid 0.01805743
## Run 16 stress 0.09903178
## Run 17 stress 0.1056529
## Run 18 stress 0.09806348
## ... Procrustes: rmse 0.003608615  max resid 0.01936133
## Run 19 stress 0.09902944
## Run 20 stress 0.09805973
## ... Procrustes: rmse 0.002871136  max resid 0.0154712
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.08136811
## Run 1 stress 0.08136803
## ... New best solution
## ... Procrustes: rmse 4.218071e-05  max resid 0.0001568391
## ... Similar to previous best
## Run 2 stress 0.08136963
## ... Procrustes: rmse 0.000280835  max resid 0.0009618548
## ... Similar to previous best
## Run 3 stress 0.08136831
## ... Procrustes: rmse 9.500967e-05  max resid 0.0003055545
## ... Similar to previous best
## Run 4 stress 0.08136896
## ... Procrustes: rmse 0.000202931  max resid 0.0006634104
## ... Similar to previous best
## Run 5 stress 0.08136875
## ... Procrustes: rmse 0.0001440666  max resid 0.0004686589
## ... Similar to previous best
## Run 6 stress 0.08137005
## ... Procrustes: rmse 0.0003171827  max resid 0.001066771
## ... Similar to previous best
## Run 7 stress 0.08136797
## ... New best solution
## ... Procrustes: rmse 0.0001226532  max resid 0.0003993071
## ... Similar to previous best
## Run 8 stress 0.08136843
## ... Procrustes: rmse 0.0001373716  max resid 0.0004111485
## ... Similar to previous best
## Run 9 stress 0.08136852
```

```
## ... Procrustes: rmse 0.0001488719  max resid 0.000438169
## ... Similar to previous best
## Run 10 stress 0.08136902
## ... Procrustes: rmse 0.0003278884  max resid 0.001079454
## ... Similar to previous best
## Run 11 stress 0.08136804
## ... Procrustes: rmse 0.0001245083  max resid 0.0004049829
## ... Similar to previous best
## Run 12 stress 0.08136816
## ... Procrustes: rmse 7.220049e-05  max resid 0.0002839234
## ... Similar to previous best
## Run 13 stress 0.08136833
## ... Procrustes: rmse 0.0002129954  max resid 0.0006914296
## ... Similar to previous best
## Run 14 stress 0.08136861
## ... Procrustes: rmse 0.0001725888  max resid 0.000520573
## ... Similar to previous best
## Run 15 stress 0.08136895
## ... Procrustes: rmse 0.0002201689  max resid 0.0006594211
## ... Similar to previous best
## Run 16 stress 0.08136864
## ... Procrustes: rmse 0.0001784086  max resid 0.0005318691
## ... Similar to previous best
## Run 17 stress 0.08136988
## ... Procrustes: rmse 0.0003875268  max resid 0.00129858
## ... Similar to previous best
## Run 18 stress 0.08136819
## ... Procrustes: rmse 0.0001687459  max resid 0.0005471988
## ... Similar to previous best
## Run 19 stress 0.08136874
## ... Procrustes: rmse 0.0002643832  max resid 0.0009073916
## ... Similar to previous best
## Run 20 stress 0.08136807
## ... Procrustes: rmse 5.380014e-05  max resid 0.0001628531
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1019338
## Run 1 stress 0.101934
## ... Procrustes: rmse 0.0003234926  max resid 0.00192033
## ... Similar to previous best
## Run 2 stress 0.1019336
## ... New best solution
## ... Procrustes: rmse 9.220641e-05  max resid 0.0006298795
## ... Similar to previous best
## Run 3 stress 0.1366432
## Run 4 stress 0.1019342
## ... Procrustes: rmse 0.0001431236  max resid 0.0008597125
## ... Similar to previous best
## Run 5 stress 0.1019343
## ... Procrustes: rmse 0.0002914278  max resid 0.001747772
## ... Similar to previous best
## Run 6 stress 0.1019342
```

```
## ... Procrustes: rmse 0.0002852492  max resid 0.001326226
## ... Similar to previous best
## Run 7 stress 0.1019341
## ... Procrustes: rmse 0.0002843483  max resid 0.001841346
## ... Similar to previous best
## Run 8 stress 0.1019354
## ... Procrustes: rmse 0.0003440262  max resid 0.002105161
## ... Similar to previous best
## Run 9 stress 0.1019336
## ... Procrustes: rmse 1.875726e-05  max resid 0.0001134624
## ... Similar to previous best
## Run 10 stress 0.1019338
## ... Procrustes: rmse 0.0001747938  max resid 0.00107026
## ... Similar to previous best
## Run 11 stress 0.1019336
## ... Procrustes: rmse 1.933483e-05  max resid 0.0001091996
## ... Similar to previous best
## Run 12 stress 0.1019339
## ... Procrustes: rmse 0.000126873  max resid 0.0006472251
## ... Similar to previous best
## Run 13 stress 0.1019352
## ... Procrustes: rmse 0.0002942425  max resid 0.001750233
## ... Similar to previous best
## Run 14 stress 0.1019336
## ... New best solution
## ... Procrustes: rmse 2.180737e-05  max resid 0.0001347881
## ... Similar to previous best
## Run 15 stress 0.1019343
## ... Procrustes: rmse 0.0002467221  max resid 0.001365539
## ... Similar to previous best
## Run 16 stress 0.101934
## ... Procrustes: rmse 0.0001682485  max resid 0.001032359
## ... Similar to previous best
## Run 17 stress 0.1019336
## ... Procrustes: rmse 8.073071e-05  max resid 0.0004926763
## ... Similar to previous best
## Run 18 stress 0.1019347
## ... Procrustes: rmse 0.0002520255  max resid 0.001449936
## ... Similar to previous best
## Run 19 stress 0.1019346
## ... Procrustes: rmse 0.0002756946  max resid 0.001698775
## ... Similar to previous best
## Run 20 stress 0.1019336
## ... Procrustes: rmse 6.842212e-05  max resid 0.0004314969
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.07487157
## Run 1 stress 0.07486991
## ... New best solution
## ... Procrustes: rmse 0.0005540151  max resid 0.003201674
## ... Similar to previous best
## Run 2 stress 0.07450143
```

```
## ... New best solution
## ... Procrustes: rmse 0.01124638  max resid 0.08194874
## Run 3 stress 0.07450065
## ... New best solution
## ... Procrustes: rmse 0.0001903383  max resid 0.0009648879
## ... Similar to previous best
## Run 4 stress 0.07450071
## ... Procrustes: rmse 0.0001365371  max resid 0.0008192313
## ... Similar to previous best
## Run 5 stress 0.0745025
## ... Procrustes: rmse 0.0002676488  max resid 0.001429424
## ... Similar to previous best
## Run 6 stress 0.07486973
## ... Procrustes: rmse 0.01106727  max resid 0.08115674
## Run 7 stress 0.07487137
## ... Procrustes: rmse 0.01132151  max resid 0.08249608
## Run 8 stress 0.07486986
## ... Procrustes: rmse 0.01109694  max resid 0.08130184
## Run 9 stress 0.0745007
## ... Procrustes: rmse 0.0001153367  max resid 0.0006011775
## ... Similar to previous best
## Run 10 stress 0.07487224
## ... Procrustes: rmse 0.0113803  max resid 0.08280657
## Run 11 stress 0.07487199
## ... Procrustes: rmse 0.0113836  max resid 0.08289939
## Run 12 stress 0.07450195
## ... Procrustes: rmse 0.0002631827  max resid 0.001326228
## ... Similar to previous best
## Run 13 stress 0.0748703
## ... Procrustes: rmse 0.01123014  max resid 0.08213425
## Run 14 stress 0.07486975
## ... Procrustes: rmse 0.01099282  max resid 0.08070473
## Run 15 stress 0.07450215
## ... Procrustes: rmse 0.0002856066  max resid 0.001485889
## ... Similar to previous best
## Run 16 stress 0.07487016
## ... Procrustes: rmse 0.01119636  max resid 0.08186685
## Run 17 stress 0.0748724
## ... Procrustes: rmse 0.01142439  max resid 0.08319594
## Run 18 stress 0.0745008
## ... Procrustes: rmse 6.265864e-05  max resid 0.0002766216
## ... Similar to previous best
## Run 19 stress 0.07487126
## ... Procrustes: rmse 0.01071667  max resid 0.07898199
## Run 20 stress 0.07450134
## ... Procrustes: rmse 0.0001755822  max resid 0.0008744717
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.09569703
## Run 1 stress 0.1018837
## Run 2 stress 0.09569754
## ... Procrustes: rmse 0.0002070367  max resid 0.000622392
```

```
## ... Similar to previous best
## Run 3 stress 0.09569844
## ... Procrustes: rmse 0.0003319284  max resid 0.0008566961
## ... Similar to previous best
## Run 4 stress 0.1104343
## Run 5 stress 0.09569793
## ... Procrustes: rmse 0.0002508828  max resid 0.0007250143
## ... Similar to previous best
## Run 6 stress 0.09569767
## ... Procrustes: rmse 0.0002299461  max resid 0.0006621573
## ... Similar to previous best
## Run 7 stress 0.09569746
## ... Procrustes: rmse 0.0001790058  max resid 0.0004715768
## ... Similar to previous best
## Run 8 stress 0.09569785
## ... Procrustes: rmse 0.0002180423  max resid 0.0006188315
## ... Similar to previous best
## Run 9 stress 0.09569817
## ... Procrustes: rmse 0.0003127373  max resid 0.000881823
## ... Similar to previous best
## Run 10 stress 0.1266752
## Run 11 stress 0.1017197
## Run 12 stress 0.09569745
## ... Procrustes: rmse 6.876232e-05  max resid 0.0002144631
## ... Similar to previous best
## Run 13 stress 0.09569783
## ... Procrustes: rmse 0.0002269229  max resid 0.0006712892
## ... Similar to previous best
## Run 14 stress 0.108203
## Run 15 stress 0.1104362
## Run 16 stress 0.1017204
## Run 17 stress 0.1082029
## Run 18 stress 0.0956975
## ... Procrustes: rmse 0.0001838783  max resid 0.0005571681
## ... Similar to previous best
## Run 19 stress 0.09569703
## ... New best solution
## ... Procrustes: rmse 8.377211e-05  max resid 0.0002699208
## ... Similar to previous best
## Run 20 stress 0.1018534
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.0743266
## Run 1 stress 0.07432661
## ... Procrustes: rmse 9.927526e-06  max resid 5.740344e-05
## ... Similar to previous best
## Run 2 stress 0.07432661
## ... Procrustes: rmse 5.033851e-06  max resid 2.686897e-05
## ... Similar to previous best
## Run 3 stress 0.07432662
## ... Procrustes: rmse 1.965486e-05  max resid 0.0001148195
## ... Similar to previous best
## Run 4 stress 0.07432661
```

```
## ... Procrustes: rmse 1.188875e-05  max resid 4.130882e-05
## ... Similar to previous best
## Run 5 stress 0.07432661
## ... Procrustes: rmse 6.741767e-06  max resid 3.466425e-05
## ... Similar to previous best
## Run 6 stress 0.07432661
## ... Procrustes: rmse 2.696584e-06  max resid 8.061931e-06
## ... Similar to previous best
## Run 7 stress 0.07432661
## ... Procrustes: rmse 4.303116e-06  max resid 1.32997e-05
## ... Similar to previous best
## Run 8 stress 0.07432665
## ... Procrustes: rmse 3.30411e-05  max resid 0.0001352129
## ... Similar to previous best
## Run 9 stress 0.07432666
## ... Procrustes: rmse 3.773787e-05  max resid 0.0002058157
## ... Similar to previous best
## Run 10 stress 0.07432661
## ... Procrustes: rmse 6.743445e-06  max resid 2.003664e-05
## ... Similar to previous best
## Run 11 stress 0.07432661
## ... Procrustes: rmse 7.549655e-06  max resid 4.085028e-05
## ... Similar to previous best
## Run 12 stress 0.0743266
## ... New best solution
## ... Procrustes: rmse 2.218996e-06  max resid 1.001951e-05
## ... Similar to previous best
## Run 13 stress 0.07432661
## ... Procrustes: rmse 1.27864e-05  max resid 7.634627e-05
## ... Similar to previous best
## Run 14 stress 0.07432662
## ... Procrustes: rmse 1.555641e-05  max resid 6.782233e-05
## ... Similar to previous best
## Run 15 stress 0.07432661
## ... Procrustes: rmse 7.311949e-06  max resid 2.763288e-05
## ... Similar to previous best
## Run 16 stress 0.0743266
## ... Procrustes: rmse 2.389051e-06  max resid 1.108813e-05
## ... Similar to previous best
## Run 17 stress 0.07432661
## ... Procrustes: rmse 1.362753e-05  max resid 6.748739e-05
## ... Similar to previous best
## Run 18 stress 0.07432661
## ... Procrustes: rmse 7.196812e-06  max resid 3.147951e-05
## ... Similar to previous best
## Run 19 stress 0.0743267
## ... Procrustes: rmse 1.798129e-05  max resid 6.728123e-05
## ... Similar to previous best
## Run 20 stress 0.07432661
## ... Procrustes: rmse 3.669182e-06  max resid 1.934917e-05
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
```

```
## Run 0 stress 0.06453119
## Run 1 stress 0.06453119
## ... New best solution
## ... Procrustes: rmse 8.852596e-06  max resid 4.910571e-05
## ... Similar to previous best
## Run 2 stress 0.0645312
## ... Procrustes: rmse 1.012931e-05  max resid 4.901338e-05
## ... Similar to previous best
## Run 3 stress 0.06453132
## ... Procrustes: rmse 2.048007e-05  max resid 9.819217e-05
## ... Similar to previous best
## Run 4 stress 0.0645312
## ... Procrustes: rmse 2.082389e-05  max resid 8.178695e-05
## ... Similar to previous best
## Run 5 stress 0.0645313
## ... Procrustes: rmse 5.58244e-05  max resid 0.0003496398
## ... Similar to previous best
## Run 6 stress 0.06453136
## ... Procrustes: rmse 5.735076e-05  max resid 0.0003320801
## ... Similar to previous best
## Run 7 stress 0.06453122
## ... Procrustes: rmse 3.426044e-05  max resid 0.0002316299
## ... Similar to previous best
## Run 8 stress 0.06453119
## ... Procrustes: rmse 1.179131e-05  max resid 6.665158e-05
## ... Similar to previous best
## Run 9 stress 0.06453125
## ... Procrustes: rmse 4.500678e-05  max resid 0.0002650967
## ... Similar to previous best
## Run 10 stress 0.0645314
## ... Procrustes: rmse 8.688306e-05  max resid 0.0004914441
## ... Similar to previous best
## Run 11 stress 0.0645312
## ... Procrustes: rmse 2.205213e-05  max resid 0.0001320985
## ... Similar to previous best
## Run 12 stress 0.06453126
## ... Procrustes: rmse 4.637335e-05  max resid 0.0002848014
## ... Similar to previous best
## Run 13 stress 0.0645312
## ... Procrustes: rmse 1.063767e-05  max resid 5.238435e-05
## ... Similar to previous best
## Run 14 stress 0.06453119
## ... Procrustes: rmse 7.112316e-06  max resid 4.049066e-05
## ... Similar to previous best
## Run 15 stress 0.06453119
## ... Procrustes: rmse 7.718917e-06  max resid 3.993146e-05
## ... Similar to previous best
## Run 16 stress 0.06453124
## ... Procrustes: rmse 4.199706e-05  max resid 0.0002404042
## ... Similar to previous best
## Run 17 stress 0.06453121
## ... Procrustes: rmse 2.127443e-05  max resid 0.0001244075
## ... Similar to previous best
## Run 18 stress 0.06453119
```

```
## ... Procrustes: rmse 5.92878e-06  max resid 2.493759e-05
## ... Similar to previous best
## Run 19 stress 0.0645312
## ... Procrustes: rmse 1.265564e-05  max resid 5.463905e-05
## ... Similar to previous best
## Run 20 stress 0.06453128
## ... Procrustes: rmse 1.72289e-05  max resid 8.281116e-05
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.1020879
## Run 1 stress 0.09778335
## ... New best solution
## ... Procrustes: rmse 0.02062436  max resid 0.1534971
## Run 2 stress 0.09625419
## ... New best solution
## ... Procrustes: rmse 0.01607923  max resid 0.1036088
## Run 3 stress 0.1030131
## Run 4 stress 0.1020962
## Run 5 stress 0.09625483
## ... Procrustes: rmse 0.0003795216  max resid 0.001919724
## ... Similar to previous best
## Run 6 stress 0.1030141
## Run 7 stress 0.1030167
## Run 8 stress 0.1108937
## Run 9 stress 0.1008178
## Run 10 stress 0.1008171
## Run 11 stress 0.1008171
## Run 12 stress 0.09778386
## Run 13 stress 0.1008156
## Run 14 stress 0.1030106
## Run 15 stress 0.1005525
## Run 16 stress 0.09625874
## ... Procrustes: rmse 0.0008045224  max resid 0.004214674
## ... Similar to previous best
## Run 17 stress 0.09625707
## ... Procrustes: rmse 0.0006851897  max resid 0.003575302
## ... Similar to previous best
## Run 18 stress 0.09625515
## ... Procrustes: rmse 0.0002543427  max resid 0.001302075
## ... Similar to previous best
## Run 19 stress 0.09625476
## ... Procrustes: rmse 0.0001532702  max resid 0.0007676749
## ... Similar to previous best
## Run 20 stress 0.1005476
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.08455746
## Run 1 stress 0.08455775
## ... Procrustes: rmse 9.480665e-05  max resid 0.0004975355
## ... Similar to previous best
## Run 2 stress 0.08455743
```

```
## ... New best solution
## ... Procrustes: rmse 3.772108e-05  max resid 0.0002076341
## ... Similar to previous best
## Run 3 stress 0.0845579
## ... Procrustes: rmse 5.281173e-05  max resid 0.0001940918
## ... Similar to previous best
## Run 4 stress 0.08455744
## ... Procrustes: rmse 2.127077e-05  max resid 0.0001167129
## ... Similar to previous best
## Run 5 stress 0.08455753
## ... Procrustes: rmse 4.365256e-05  max resid 0.0002010812
## ... Similar to previous best
## Run 6 stress 0.08455759
## ... Procrustes: rmse 7.553055e-05  max resid 0.000394696
## ... Similar to previous best
## Run 7 stress 0.08455752
## ... Procrustes: rmse 8.508863e-05  max resid 0.0004103734
## ... Similar to previous best
## Run 8 stress 0.0845586
## ... Procrustes: rmse 6.686345e-05  max resid 0.0003756482
## ... Similar to previous best
## Run 9 stress 0.08455749
## ... Procrustes: rmse 5.808837e-05  max resid 0.0002152601
## ... Similar to previous best
## Run 10 stress 0.08455765
## ... Procrustes: rmse 0.0001011812  max resid 0.0005482687
## ... Similar to previous best
## Run 11 stress 0.08455765
## ... Procrustes: rmse 2.716473e-05  max resid 0.0001331484
## ... Similar to previous best
## Run 12 stress 0.08455744
## ... Procrustes: rmse 2.944392e-05  max resid 0.0001019606
## ... Similar to previous best
## Run 13 stress 0.08455769
## ... Procrustes: rmse 0.0001114117  max resid 0.000701373
## ... Similar to previous best
## Run 14 stress 0.08455782
## ... Procrustes: rmse 0.0001436015  max resid 0.0006719717
## ... Similar to previous best
## Run 15 stress 0.08455746
## ... Procrustes: rmse 6.549721e-05  max resid 0.000320788
## ... Similar to previous best
## Run 16 stress 0.08455749
## ... Procrustes: rmse 7.903693e-05  max resid 0.0003769412
## ... Similar to previous best
## Run 17 stress 0.0845579
## ... Procrustes: rmse 0.0001466891  max resid 0.000786494
## ... Similar to previous best
## Run 18 stress 0.08455754
## ... Procrustes: rmse 6.537394e-05  max resid 0.0003248003
## ... Similar to previous best
## Run 19 stress 0.08455742
## ... New best solution
## ... Procrustes: rmse 1.328235e-05  max resid 4.692099e-05
```

```
## ... Similar to previous best
## Run 20 stress 0.08455801
## ... Procrustes: rmse 0.0001873709  max resid 0.001112779
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.08935757
## Run 1 stress 0.08935761
## ... Procrustes: rmse 1.706074e-05  max resid 8.613228e-05
## ... Similar to previous best
## Run 2 stress 0.08935813
## ... Procrustes: rmse 7.596724e-05  max resid 0.0003531657
## ... Similar to previous best
## Run 3 stress 0.08935733
## ... New best solution
## ... Procrustes: rmse 0.0002257131  max resid 0.00115036
## ... Similar to previous best
## Run 4 stress 0.08935725
## ... New best solution
## ... Procrustes: rmse 8.550462e-05  max resid 0.0004332024
## ... Similar to previous best
## Run 5 stress 0.08935756
## ... Procrustes: rmse 0.0001996366  max resid 0.0009906921
## ... Similar to previous best
## Run 6 stress 0.08935725
## ... Procrustes: rmse 5.592358e-05  max resid 0.0002843739
## ... Similar to previous best
## Run 7 stress 0.08935761
## ... Procrustes: rmse 0.0001549577  max resid 0.0007917304
## ... Similar to previous best
## Run 8 stress 0.0893573
## ... Procrustes: rmse 0.0001023851  max resid 0.0005207843
## ... Similar to previous best
## Run 9 stress 0.0893574
## ... Procrustes: rmse 0.0001370129  max resid 0.0007561887
## ... Similar to previous best
## Run 10 stress 0.08935745
## ... Procrustes: rmse 0.0001023293  max resid 0.000516983
## ... Similar to previous best
## Run 11 stress 0.08935842
## ... Procrustes: rmse 0.0002977939  max resid 0.001533084
## ... Similar to previous best
## Run 12 stress 0.08935743
## ... Procrustes: rmse 0.0001641541  max resid 0.0008356657
## ... Similar to previous best
## Run 13 stress 0.0893582
## ... Procrustes: rmse 0.0002507852  max resid 0.001288807
## ... Similar to previous best
## Run 14 stress 0.08935732
## ... Procrustes: rmse 1.612751e-05  max resid 7.100579e-05
## ... Similar to previous best
## Run 15 stress 0.08935784
## ... Procrustes: rmse 0.0002073433  max resid 0.00106436
```

```
## ... Similar to previous best
## Run 16 stress 0.08935765
## ... Procrustes: rmse 0.0001559017  max resid 0.0007934048
## ... Similar to previous best
## Run 17 stress 0.08935853
## ... Procrustes: rmse 0.0003191278  max resid 0.001643889
## ... Similar to previous best
## Run 18 stress 0.08935737
## ... Procrustes: rmse 0.0001391803  max resid 0.0006517231
## ... Similar to previous best
## Run 19 stress 0.08935755
## ... Procrustes: rmse 0.000198918  max resid 0.0009920984
## ... Similar to previous best
## Run 20 stress 0.08935727
## ... Procrustes: rmse 7.969323e-05  max resid 0.0004058735
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.0910279
## Run 1 stress 0.09102798
## ... Procrustes: rmse 6.678051e-05  max resid 0.0003225016
## ... Similar to previous best
## Run 2 stress 0.0910279
## ... Procrustes: rmse 1.733252e-05  max resid 7.274878e-05
## ... Similar to previous best
## Run 3 stress 0.09102819
## ... Procrustes: rmse 0.0001238892  max resid 0.0007381142
## ... Similar to previous best
## Run 4 stress 0.09102814
## ... Procrustes: rmse 0.0001182938  max resid 0.0006190591
## ... Similar to previous best
## Run 5 stress 0.09102795
## ... Procrustes: rmse 5.659984e-05  max resid 0.0002487967
## ... Similar to previous best
## Run 6 stress 0.09102793
## ... Procrustes: rmse 3.810745e-05  max resid 0.0001725989
## ... Similar to previous best
## Run 7 stress 0.0910279
## ... Procrustes: rmse 1.861279e-05  max resid 8.188919e-05
## ... Similar to previous best
## Run 8 stress 0.09102832
## ... Procrustes: rmse 0.0001238056  max resid 0.0005923606
## ... Similar to previous best
## Run 9 stress 0.09102795
## ... Procrustes: rmse 3.258347e-05  max resid 0.0001374477
## ... Similar to previous best
## Run 10 stress 0.09102882
## ... Procrustes: rmse 0.0002413423  max resid 0.001150843
## ... Similar to previous best
## Run 11 stress 0.0910279
## ... New best solution
## ... Procrustes: rmse 1.47656e-05  max resid 8.481332e-05
## ... Similar to previous best
```

```
## Run 12 stress 0.09102851
## ... Procrustes: rmse 0.0002054969  max resid 0.001048755
## ... Similar to previous best
## Run 13 stress 0.09102798
## ... Procrustes: rmse 6.635376e-05  max resid 0.0003428762
## ... Similar to previous best
## Run 14 stress 0.09102791
## ... Procrustes: rmse 3.358761e-05  max resid 0.0002042429
## ... Similar to previous best
## Run 15 stress 0.09102801
## ... Procrustes: rmse 6.775152e-05  max resid 0.0003737345
## ... Similar to previous best
## Run 16 stress 0.09102832
## ... Procrustes: rmse 0.0001440946  max resid 0.0007077039
## ... Similar to previous best
## Run 17 stress 0.09102898
## ... Procrustes: rmse 0.0002477593  max resid 0.001296257
## ... Similar to previous best
## Run 18 stress 0.091028
## ... Procrustes: rmse 9.156976e-05  max resid 0.0004303638
## ... Similar to previous best
## Run 19 stress 0.0910285
## ... Procrustes: rmse 0.0001931092  max resid 0.000927852
## ... Similar to previous best
## Run 20 stress 0.0910279
## ... New best solution
## ... Procrustes: rmse 9.363494e-06  max resid 5.35953e-05
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.08342822
## Run 1 stress 0.08342854
## ... Procrustes: rmse 0.0004159916  max resid 0.001767955
## ... Similar to previous best
## Run 2 stress 0.08342786
## ... New best solution
## ... Procrustes: rmse 0.0001204641  max resid 0.0004832925
## ... Similar to previous best
## Run 3 stress 0.08342816
## ... Procrustes: rmse 0.0001675928  max resid 0.001140517
## ... Similar to previous best
## Run 4 stress 0.08342861
## ... Procrustes: rmse 0.0001875155  max resid 0.000823762
## ... Similar to previous best
## Run 5 stress 0.08342798
## ... Procrustes: rmse 0.0001799635  max resid 0.0007484635
## ... Similar to previous best
## Run 6 stress 0.08342941
## ... Procrustes: rmse 0.0002846912  max resid 0.001261909
## ... Similar to previous best
## Run 7 stress 0.08342818
## ... Procrustes: rmse 0.0001026561  max resid 0.0004427686
## ... Similar to previous best
```

```
## Run 8 stress 0.08342822
## ... Procrustes: rmse 0.0001158  max resid 0.0004997678
## ... Similar to previous best
## Run 9 stress 0.08342799
## ... Procrustes: rmse 5.822052e-05  max resid 0.0002523573
## ... Similar to previous best
## Run 10 stress 0.08342951
## ... Procrustes: rmse 0.000295433  max resid 0.001313932
## ... Similar to previous best
## Run 11 stress 0.08342804
## ... Procrustes: rmse 7.089789e-05  max resid 0.0003025136
## ... Similar to previous best
## Run 12 stress 0.08342857
## ... Procrustes: rmse 0.0001970654  max resid 0.000801264
## ... Similar to previous best
## Run 13 stress 0.08342873
## ... Procrustes: rmse 0.0003379896  max resid 0.001412369
## ... Similar to previous best
## Run 14 stress 0.08342843
## ... Procrustes: rmse 0.000153855  max resid 0.0006726046
## ... Similar to previous best
## Run 15 stress 0.08342942
## ... Procrustes: rmse 0.0002750752  max resid 0.001216322
## ... Similar to previous best
## Run 16 stress 0.08342816
## ... Procrustes: rmse 0.0002080491  max resid 0.0008707048
## ... Similar to previous best
## Run 17 stress 0.08342907
## ... Procrustes: rmse 0.0002514832  max resid 0.001114878
## ... Similar to previous best
## Run 18 stress 0.08342781
## ... New best solution
## ... Procrustes: rmse 5.737725e-05  max resid 0.0002692395
## ... Similar to previous best
## Run 19 stress 0.08342927
## ... Procrustes: rmse 0.0003245875  max resid 0.001441426
## ... Similar to previous best
## Run 20 stress 0.08342845
## ... Procrustes: rmse 0.0001619744  max resid 0.000685312
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.08923186
## Run 1 stress 0.08772695
## ... New best solution
## ... Procrustes: rmse 0.01789453  max resid 0.1364971
## Run 2 stress 0.08923113
## Run 3 stress 0.1069148
## Run 4 stress 0.08923201
## Run 5 stress 0.1040468
## Run 6 stress 0.08923103
## Run 7 stress 0.0892309
## Run 8 stress 0.08772696
```

```
## ... Procrustes: rmse 1.061573e-05  max resid 5.984216e-05
## ... Similar to previous best
## Run 9 stress 0.1069152
## Run 10 stress 0.1069141
## Run 11 stress 0.087727
## ... Procrustes: rmse 4.663253e-05  max resid 0.0002369693
## ... Similar to previous best
## Run 12 stress 0.1069142
## Run 13 stress 0.08772732
## ... Procrustes: rmse 0.0001397726  max resid 0.0006218026
## ... Similar to previous best
## Run 14 stress 0.08923087
## Run 15 stress 0.0892319
## Run 16 stress 0.08923084
## Run 17 stress 0.08923129
## Run 18 stress 0.08772709
## ... Procrustes: rmse 8.232548e-05  max resid 0.0003039886
## ... Similar to previous best
## Run 19 stress 0.08772709
## ... Procrustes: rmse 9.009411e-05  max resid 0.0004417582
## ... Similar to previous best
## Run 20 stress 0.08772722
## ... Procrustes: rmse 9.646099e-05  max resid 0.0005834849
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.09235685
## Run 1 stress 0.09235831
## ... Procrustes: rmse 0.000370334  max resid 0.001973307
## ... Similar to previous best
## Run 2 stress 0.09235671
## ... New best solution
## ... Procrustes: rmse 7.129691e-05  max resid 0.0003603869
## ... Similar to previous best
## Run 3 stress 0.09235738
## ... Procrustes: rmse 0.0002126556  max resid 0.001062
## ... Similar to previous best
## Run 4 stress 0.0923575
## ... Procrustes: rmse 0.0003533515  max resid 0.001778654
## ... Similar to previous best
## Run 5 stress 0.09236009
## ... Procrustes: rmse 0.0005432176  max resid 0.002939278
## ... Similar to previous best
## Run 6 stress 0.09235715
## ... Procrustes: rmse 0.0001977618  max resid 0.000976377
## ... Similar to previous best
## Run 7 stress 0.09235827
## ... Procrustes: rmse 0.0003424997  max resid 0.001759684
## ... Similar to previous best
## Run 8 stress 0.09235751
## ... Procrustes: rmse 0.0003487293  max resid 0.001814422
## ... Similar to previous best
## Run 9 stress 0.0923572
```

```
## ... Procrustes: rmse 0.0002395635  max resid 0.001674144
## ... Similar to previous best
## Run 10 stress 0.092358
## ... Procrustes: rmse 0.0004216191  max resid 0.002279771
## ... Similar to previous best
## Run 11 stress 0.09235799
## ... Procrustes: rmse 0.0002866608  max resid 0.00142388
## ... Similar to previous best
## Run 12 stress 0.09235705
## ... Procrustes: rmse 0.0001367133  max resid 0.0007111267
## ... Similar to previous best
## Run 13 stress 0.09235723
## ... Procrustes: rmse 0.0002990604  max resid 0.001713623
## ... Similar to previous best
## Run 14 stress 0.09235813
## ... Procrustes: rmse 0.0003293811  max resid 0.001802274
## ... Similar to previous best
## Run 15 stress 0.09235764
## ... Procrustes: rmse 0.0002585073  max resid 0.001386303
## ... Similar to previous best
## Run 16 stress 0.09235686
## ... Procrustes: rmse 0.0001596196  max resid 0.001059792
## ... Similar to previous best
## Run 17 stress 0.09235883
## ... Procrustes: rmse 0.0004075953  max resid 0.002276663
## ... Similar to previous best
## Run 18 stress 0.09235715
## ... Procrustes: rmse 0.0002775663  max resid 0.001416736
## ... Similar to previous best
## Run 19 stress 0.09235735
## ... Procrustes: rmse 0.0003181838  max resid 0.00159641
## ... Similar to previous best
## Run 20 stress 0.09235916
## ... Procrustes: rmse 0.0004256179  max resid 0.002304953
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.09424739
## Run 1 stress 0.09424746
## ... Procrustes: rmse 8.91965e-05  max resid 0.0005550343
## ... Similar to previous best
## Run 2 stress 0.09424752
## ... Procrustes: rmse 9.2153e-05  max resid 0.0006052788
## ... Similar to previous best
## Run 3 stress 0.09424759
## ... Procrustes: rmse 0.0001272203  max resid 0.000820278
## ... Similar to previous best
## Run 4 stress 0.09424739
## ... Procrustes: rmse 1.639594e-05  max resid 9.231914e-05
## ... Similar to previous best
## Run 5 stress 0.09424882
## ... Procrustes: rmse 0.0003443128  max resid 0.002250641
## ... Similar to previous best
```

```
## Run 6 stress 0.0942478
## ... Procrustes: rmse 0.000175994  max resid 0.001155546
## ... Similar to previous best
## Run 7 stress 0.09424787
## ... Procrustes: rmse 0.0001897693  max resid 0.001248718
## ... Similar to previous best
## Run 8 stress 0.09424812
## ... Procrustes: rmse 0.0001829498  max resid 0.001186432
## ... Similar to previous best
## Run 9 stress 0.0942474
## ... Procrustes: rmse 4.660895e-05  max resid 0.00030886
## ... Similar to previous best
## Run 10 stress 0.09424761
## ... Procrustes: rmse 6.605748e-05  max resid 0.0004008287
## ... Similar to previous best
## Run 11 stress 0.09424739
## ... Procrustes: rmse 1.120798e-05  max resid 6.968674e-05
## ... Similar to previous best
## Run 12 stress 0.09424784
## ... Procrustes: rmse 0.0002109439  max resid 0.001398177
## ... Similar to previous best
## Run 13 stress 0.09424905
## ... Procrustes: rmse 0.0003106427  max resid 0.002017877
## ... Similar to previous best
## Run 14 stress 0.09424811
## ... Procrustes: rmse 0.0002584487  max resid 0.001705796
## ... Similar to previous best
## Run 15 stress 0.09424761
## ... Procrustes: rmse 0.0001023402  max resid 0.0006607637
## ... Similar to previous best
## Run 16 stress 0.09424903
## ... Procrustes: rmse 0.0003743154  max resid 0.002460909
## ... Similar to previous best
## Run 17 stress 0.09424791
## ... Procrustes: rmse 0.0001546846  max resid 0.0009984772
## ... Similar to previous best
## Run 18 stress 0.09424805
## ... Procrustes: rmse 0.0002115129  max resid 0.00138633
## ... Similar to previous best
## Run 19 stress 0.09424765
## ... Procrustes: rmse 0.0001404683  max resid 0.0009257097
## ... Similar to previous best
## Run 20 stress 0.09424838
## ... Procrustes: rmse 0.0002823705  max resid 0.001902535
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.09601408
## Run 1 stress 0.09601452
## ... Procrustes: rmse 0.0002304113  max resid 0.001008109
## ... Similar to previous best
## Run 2 stress 0.1319569
## Run 3 stress 0.09601421
```

```
## ... Procrustes: rmse 0.0001708078  max resid 0.0008519846
## ... Similar to previous best
## Run 4 stress 0.09601429
## ... Procrustes: rmse 7.427242e-05  max resid 0.0003109356
## ... Similar to previous best
## Run 5 stress 0.09601433
## ... Procrustes: rmse 0.0001980978  max resid 0.0009618705
## ... Similar to previous best
## Run 6 stress 0.096015
## ... Procrustes: rmse 0.0003157902  max resid 0.001355099
## ... Similar to previous best
## Run 7 stress 0.09601413
## ... Procrustes: rmse 0.0001394311  max resid 0.0006502796
## ... Similar to previous best
## Run 8 stress 0.09601411
## ... Procrustes: rmse 8.024852e-05  max resid 0.000442433
## ... Similar to previous best
## Run 9 stress 0.09601414
## ... Procrustes: rmse 0.0001340654  max resid 0.0005796259
## ... Similar to previous best
## Run 10 stress 0.09601415
## ... Procrustes: rmse 0.0001497242  max resid 0.000706839
## ... Similar to previous best
## Run 11 stress 0.09601427
## ... Procrustes: rmse 0.0001272194  max resid 0.0005397144
## ... Similar to previous best
## Run 12 stress 0.0960149
## ... Procrustes: rmse 0.0002940971  max resid 0.001178963
## ... Similar to previous best
## Run 13 stress 0.09601425
## ... Procrustes: rmse 0.0001594416  max resid 0.0006722164
## ... Similar to previous best
## Run 14 stress 0.09601412
## ... Procrustes: rmse 0.0001349828  max resid 0.0006954156
## ... Similar to previous best
## Run 15 stress 0.09601426
## ... Procrustes: rmse 3.609001e-05  max resid 0.0001404605
## ... Similar to previous best
## Run 16 stress 0.09601475
## ... Procrustes: rmse 0.0001245438  max resid 0.0005545034
## ... Similar to previous best
## Run 17 stress 0.09601468
## ... Procrustes: rmse 0.0001617106  max resid 0.0007781589
## ... Similar to previous best
## Run 18 stress 0.09601423
## ... Procrustes: rmse 0.0001682052  max resid 0.0006910226
## ... Similar to previous best
## Run 19 stress 0.09601454
## ... Procrustes: rmse 0.0002286484  max resid 0.0009989912
## ... Similar to previous best
## Run 20 stress 0.1324774
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
```

```
## Run 0 stress 0.09472503
## Run 1 stress 0.09472682
## ... Procrustes: rmse 0.0002208132  max resid 0.001414599
## ... Similar to previous best
## Run 2 stress 0.09472747
## ... Procrustes: rmse 0.0003590675  max resid 0.002095346
## ... Similar to previous best
## Run 3 stress 0.09472722
## ... Procrustes: rmse 0.002096827  max resid 0.01296893
## Run 4 stress 0.09472752
## ... Procrustes: rmse 0.002011362  max resid 0.01248053
## Run 5 stress 0.09472636
## ... Procrustes: rmse 0.0002212621  max resid 0.001305438
## ... Similar to previous best
## Run 6 stress 0.09472439
## ... New best solution
## ... Procrustes: rmse 0.000203852  max resid 0.0009023277
## ... Similar to previous best
## Run 7 stress 0.09472515
## ... Procrustes: rmse 0.0001782117  max resid 0.0008047155
## ... Similar to previous best
## Run 8 stress 0.0947262
## ... Procrustes: rmse 0.001798226  max resid 0.0113077
## Run 9 stress 0.09472702
## ... Procrustes: rmse 0.001907386  max resid 0.01194911
## Run 10 stress 0.09472623
## ... Procrustes: rmse 0.001804555  max resid 0.01135724
## Run 11 stress 0.09472939
## ... Procrustes: rmse 0.002136482  max resid 0.01316567
## Run 12 stress 0.09472708
## ... Procrustes: rmse 0.001903702  max resid 0.01190951
## Run 13 stress 0.09472681
## ... Procrustes: rmse 0.001841795  max resid 0.0115636
## Run 14 stress 0.09472587
## ... Procrustes: rmse 0.0003444365  max resid 0.001785418
## ... Similar to previous best
## Run 15 stress 0.09472377
## ... New best solution
## ... Procrustes: rmse 0.001230636  max resid 0.007946818
## ... Similar to previous best
## Run 16 stress 0.09472472
## ... Procrustes: rmse 0.001316099  max resid 0.008490678
## ... Similar to previous best
## Run 17 stress 0.09472789
## ... Procrustes: rmse 0.001673659  max resid 0.01069767
## Run 18 stress 0.09472875
## ... Procrustes: rmse 0.0009011056  max resid 0.004764547
## ... Similar to previous best
## Run 19 stress 0.0947243
## ... Procrustes: rmse 0.000312979  max resid 0.00127844
## ... Similar to previous best
## Run 20 stress 0.09472512
## ... Procrustes: rmse 0.0004601573  max resid 0.002360466
## ... Similar to previous best
```

```
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.07990144
## Run 1 stress 0.07989671
## ... New best solution
## ... Procrustes: rmse 0.001752819  max resid 0.01296024
## Run 2 stress 0.08089846
## Run 3 stress 0.07990069
## ... Procrustes: rmse 0.0003851105  max resid 0.002807479
## ... Similar to previous best
## Run 4 stress 0.07990054
## ... Procrustes: rmse 0.0004491089  max resid 0.003282599
## ... Similar to previous best
## Run 5 stress 0.07989836
## ... Procrustes: rmse 0.000240628  max resid 0.001730312
## ... Similar to previous best
## Run 6 stress 0.07990258
## ... Procrustes: rmse 0.0006295855  max resid 0.004606242
## ... Similar to previous best
## Run 7 stress 0.08009121
## ... Procrustes: rmse 0.01852948  max resid 0.13924
## Run 8 stress 0.07989706
## ... Procrustes: rmse 8.132632e-05  max resid 0.0005758311
## ... Similar to previous best
## Run 9 stress 0.08009514
## ... Procrustes: rmse 0.01940638  max resid 0.1459268
## Run 10 stress 0.08009495
## ... Procrustes: rmse 0.01937721  max resid 0.1457059
## Run 11 stress 0.07989806
## ... Procrustes: rmse 0.0002102321  max resid 0.001530167
## ... Similar to previous best
## Run 12 stress 0.08090861
## Run 13 stress 0.08090449
## Run 14 stress 0.07989604
## ... New best solution
## ... Procrustes: rmse 0.001059502  max resid 0.007757111
## ... Similar to previous best
## Run 15 stress 0.07989942
## ... Procrustes: rmse 0.001416221  max resid 0.0103772
## Run 16 stress 0.07990182
## ... Procrustes: rmse 0.001438798  max resid 0.0105353
## Run 17 stress 0.07990143
## ... Procrustes: rmse 0.001595856  max resid 0.01169156
## Run 18 stress 0.0799011
## ... Procrustes: rmse 0.001418289  max resid 0.01031601
## Run 19 stress 0.07989672
## ... Procrustes: rmse 0.001081759  max resid 0.007922662
## ... Similar to previous best
## Run 20 stress 0.08091315
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.07555149
```

```
## Run 1 stress 0.07555149
## ... New best solution
## ... Procrustes: rmse 8.868896e-06  max resid 2.955781e-05
## ... Similar to previous best
## Run 2 stress 0.07555164
## ... Procrustes: rmse 5.649389e-05  max resid 0.000183791
## ... Similar to previous best
## Run 3 stress 0.07555149
## ... Procrustes: rmse 1.533697e-05  max resid 5.599305e-05
## ... Similar to previous best
## Run 4 stress 0.07555155
## ... Procrustes: rmse 4.544392e-05  max resid 0.0001751562
## ... Similar to previous best
## Run 5 stress 0.07555148
## ... New best solution
## ... Procrustes: rmse 1.408191e-05  max resid 5.391425e-05
## ... Similar to previous best
## Run 6 stress 0.07555157
## ... Procrustes: rmse 1.698565e-05  max resid 7.980671e-05
## ... Similar to previous best
## Run 7 stress 0.07555153
## ... Procrustes: rmse 1.857163e-05  max resid 6.207837e-05
## ... Similar to previous best
## Run 8 stress 0.07555152
## ... Procrustes: rmse 2.924477e-05  max resid 0.0001109019
## ... Similar to previous best
## Run 9 stress 0.07555149
## ... Procrustes: rmse 9.817607e-06  max resid 3.844229e-05
## ... Similar to previous best
## Run 10 stress 0.0755515
## ... Procrustes: rmse 1.968471e-05  max resid 6.88414e-05
## ... Similar to previous best
## Run 11 stress 0.07555149
## ... Procrustes: rmse 1.213534e-05  max resid 6.425222e-05
## ... Similar to previous best
## Run 12 stress 0.07555154
## ... Procrustes: rmse 2.491242e-05  max resid 0.0001170397
## ... Similar to previous best
## Run 13 stress 0.07555153
## ... Procrustes: rmse 1.616494e-05  max resid 5.317444e-05
## ... Similar to previous best
## Run 14 stress 0.07555154
## ... Procrustes: rmse 3.880117e-05  max resid 0.0001307287
## ... Similar to previous best
## Run 15 stress 0.07555148
## ... New best solution
## ... Procrustes: rmse 1.214109e-05  max resid 4.87655e-05
## ... Similar to previous best
## Run 16 stress 0.07555156
## ... Procrustes: rmse 1.714552e-05  max resid 7.357289e-05
## ... Similar to previous best
## Run 17 stress 0.07555149
## ... Procrustes: rmse 7.690602e-06  max resid 3.876025e-05
## ... Similar to previous best
```

```
## Run 18 stress 0.07555163
## ... Procrustes: rmse 6.89911e-05  max resid 0.0002674364
## ... Similar to previous best
## Run 19 stress 0.07555149
## ... Procrustes: rmse 1.136928e-05  max resid 3.947328e-05
## ... Similar to previous best
## Run 20 stress 0.07555153
## ... Procrustes: rmse 3.477198e-05  max resid 0.0001254631
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.08859528
## Run 1 stress 0.09076358
## Run 2 stress 0.09216593
## Run 3 stress 0.09076106
## Run 4 stress 0.1043479
## Run 5 stress 0.09075895
## Run 6 stress 0.09216648
## Run 7 stress 0.08859534
## ... Procrustes: rmse 1.530878e-05  max resid 7.849149e-05
## ... Similar to previous best
## Run 8 stress 0.08859422
## ... New best solution
## ... Procrustes: rmse 0.0005624185  max resid 0.002617789
## ... Similar to previous best
## Run 9 stress 0.09216686
## Run 10 stress 0.09077056
## Run 11 stress 0.09216683
## Run 12 stress 0.09075962
## Run 13 stress 0.08859435
## ... Procrustes: rmse 0.0004184359  max resid 0.00199942
## ... Similar to previous best
## Run 14 stress 0.09076406
## Run 15 stress 0.09076698
## Run 16 stress 0.09075836
## Run 17 stress 0.09216669
## Run 18 stress 0.09216602
## Run 19 stress 0.08859437
## ... Procrustes: rmse 0.0004280726  max resid 0.002064693
## ... Similar to previous best
## Run 20 stress 0.09216623
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.03145116
## Run 1 stress 0.05306941
## Run 2 stress 0.04817578
## Run 3 stress 0.03156669
## ... Procrustes: rmse 0.003906841  max resid 0.02300721
## Run 4 stress 0.03387771
## Run 5 stress 0.03145143
## ... Procrustes: rmse 0.001068482  max resid 0.005518348
## ... Similar to previous best
```

```
## Run 6 stress 0.04873269
## Run 7 stress 0.03145084
## ... New best solution
## ... Procrustes: rmse 0.001024607  max resid 0.005303408
## ... Similar to previous best
## Run 8 stress 0.04932659
## Run 9 stress 0.03387913
## Run 10 stress 0.03145131
## ... Procrustes: rmse 3.816667e-05  max resid 0.0001949736
## ... Similar to previous best
## Run 11 stress 0.03474624
## Run 12 stress 0.03146329
## ... Procrustes: rmse 0.0006984418  max resid 0.003894951
## ... Similar to previous best
## Run 13 stress 0.03144914
## ... New best solution
## ... Procrustes: rmse 0.0005028921  max resid 0.003252038
## ... Similar to previous best
## Run 14 stress 0.03240354
## Run 15 stress 0.05020806
## Run 16 stress 0.03474795
## Run 17 stress 0.0330839
## Run 18 stress 0.03474747
## Run 19 stress 0.0332053
## Run 20 stress 0.03240297
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 8.972798e-05
## ... Procrustes: rmse 0.0001493974  max resid 0.0005798852
## ... Similar to previous best
## Run 2 stress 9.697226e-05
## ... Procrustes: rmse 0.0001708517  max resid 0.0005501854
## ... Similar to previous best
## Run 3 stress 9.325606e-05
## ... Procrustes: rmse 0.0001626587  max resid 0.0005454787
## ... Similar to previous best
## Run 4 stress 9.692e-05
## ... Procrustes: rmse 0.0001624666  max resid 0.000457971
## ... Similar to previous best
## Run 5 stress 9.082375e-05
## ... Procrustes: rmse 0.0001654292  max resid 0.0006216953
## ... Similar to previous best
## Run 6 stress 9.081022e-05
## ... Procrustes: rmse 0.0001516509  max resid 0.0006892098
## ... Similar to previous best
## Run 7 stress 9.384573e-05
## ... Procrustes: rmse 0.0001706565  max resid 0.000628453
## ... Similar to previous best
## Run 8 stress 9.370543e-05
## ... Procrustes: rmse 0.0001604988  max resid 0.0006123461
## ... Similar to previous best
## Run 9 stress 9.604155e-05
```

```
## ... Procrustes: rmse 0.0001592826  max resid 0.0006802292
## ... Similar to previous best
## Run 10 stress 9.100213e-05
## ... Procrustes: rmse 0.0001507467  max resid 0.0005420307
## ... Similar to previous best
## Run 11 stress 8.83901e-05
## ... Procrustes: rmse 0.0001594622  max resid 0.0005342634
## ... Similar to previous best
## Run 12 stress 9.054632e-05
## ... Procrustes: rmse 0.0001478663  max resid 0.000445557
## ... Similar to previous best
## Run 13 stress 9.114818e-05
## ... Procrustes: rmse 0.0001675974  max resid 0.0005157991
## ... Similar to previous best
## Run 14 stress 9.720966e-05
## ... Procrustes: rmse 0.000171533  max resid 0.0006139288
## ... Similar to previous best
## Run 15 stress 8.627951e-05
## ... Procrustes: rmse 0.0001453618  max resid 0.0005125612
## ... Similar to previous best
## Run 16 stress 9.561763e-05
## ... Procrustes: rmse 0.0001554079  max resid 0.0006152177
## ... Similar to previous best
## Run 17 stress 9.125867e-05
## ... Procrustes: rmse 0.0001563411  max resid 0.000535926
## ... Similar to previous best
## Run 18 stress 9.567127e-05
## ... Procrustes: rmse 0.0001635176  max resid 0.0006398728
## ... Similar to previous best
## Run 19 stress 9.406434e-05
## ... Procrustes: rmse 0.0001528549  max resid 0.0005976447
## ... Similar to previous best
## Run 20 stress 8.430911e-05
## ... Procrustes: rmse 0.0001453855  max resid 0.0006155761
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.637626e-05
## ... Procrustes: rmse 0.0002032643  max resid 0.001284723
## ... Similar to previous best
## Run 2 stress 9.299912e-05
## ... Procrustes: rmse 0.0001638325  max resid 0.0006143034
## ... Similar to previous best
## Run 3 stress 9.328557e-05
## ... Procrustes: rmse 0.0001898949  max resid 0.001071655
## ... Similar to previous best
## Run 4 stress 9.621888e-05
## ... Procrustes: rmse 0.0001989426  max resid 0.001210534
## ... Similar to previous best
## Run 5 stress 7.828701e-05
## ... Procrustes: rmse 0.0001612962  max resid 0.0009794026
## ... Similar to previous best
```

```
## Run 6 stress 9.91262e-05
## ... Procrustes: rmse 0.0001984134  max resid 0.001098952
## ... Similar to previous best
## Run 7 stress 9.632025e-05
## ... Procrustes: rmse 0.0001890159  max resid 0.001103662
## ... Similar to previous best
## Run 8 stress 9.2262e-05
## ... Procrustes: rmse 0.0001890831  max resid 0.001193196
## ... Similar to previous best
## Run 9 stress 9.84343e-05
## ... Procrustes: rmse 0.0001944627  max resid 0.001253752
## ... Similar to previous best
## Run 10 stress 9.491735e-05
## ... Procrustes: rmse 0.0001879582  max resid 0.00105238
## ... Similar to previous best
## Run 11 stress 9.123309e-05
## ... Procrustes: rmse 0.0001646751  max resid 0.0005903754
## ... Similar to previous best
## Run 12 stress 9.75034e-05
## ... Procrustes: rmse 0.000191593  max resid 0.001219638
## ... Similar to previous best
## Run 13 stress 9.483071e-05
## ... Procrustes: rmse 0.0001911277  max resid 0.001001438
## ... Similar to previous best
## Run 14 stress 9.431543e-05
## ... Procrustes: rmse 0.0001592555  max resid 0.0009404788
## ... Similar to previous best
## Run 15 stress 8.996059e-05
## ... Procrustes: rmse 0.0001801616  max resid 0.00112899
## ... Similar to previous best
## Run 16 stress 8.328044e-05
## ... Procrustes: rmse 0.0001848543  max resid 0.001180073
## ... Similar to previous best
## Run 17 stress 9.13551e-05
## ... Procrustes: rmse 0.0001809516  max resid 0.001068185
## ... Similar to previous best
## Run 18 stress 9.860801e-05
## ... Procrustes: rmse 0.0001969612  max resid 0.001288184
## ... Similar to previous best
## Run 19 stress 9.955814e-05
## ... Procrustes: rmse 0.0001970447  max resid 0.001009894
## ... Similar to previous best
## Run 20 stress 8.949666e-05
## ... Procrustes: rmse 0.0001664656  max resid 0.0009828279
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.790835e-05
## ... Procrustes: rmse 0.0001731664  max resid 0.0007065604
## ... Similar to previous best
## Run 2 stress 9.341976e-05
## ... Procrustes: rmse 0.0001683132  max resid 0.0005724093
```

```
## ... Similar to previous best
## Run 3 stress 9.441919e-05
## ... Procrustes: rmse 0.0001553247  max resid 0.0006228464
## ... Similar to previous best
## Run 4 stress 9.538565e-05
## ... Procrustes: rmse 0.0001525594  max resid 0.0007295033
## ... Similar to previous best
## Run 5 stress 9.815104e-05
## ... Procrustes: rmse 0.0001779752  max resid 0.0008115654
## ... Similar to previous best
## Run 6 stress 8.927366e-05
## ... Procrustes: rmse 0.0001599352  max resid 0.0006969801
## ... Similar to previous best
## Run 7 stress 9.900072e-05
## ... Procrustes: rmse 0.0001553053  max resid 0.0006570253
## ... Similar to previous best
## Run 8 stress 9.965175e-05
## ... Procrustes: rmse 0.0001621585  max resid 0.0007116099
## ... Similar to previous best
## Run 9 stress 9.849489e-05
## ... Procrustes: rmse 0.0001422702  max resid 0.0004600265
## ... Similar to previous best
## Run 10 stress 9.956441e-05
## ... Procrustes: rmse 0.0001751602  max resid 0.0006279416
## ... Similar to previous best
## Run 11 stress 9.907279e-05
## ... Procrustes: rmse 0.0001619888  max resid 0.0005352257
## ... Similar to previous best
## Run 12 stress 9.162582e-05
## ... Procrustes: rmse 0.0001510516  max resid 0.0004295825
## ... Similar to previous best
## Run 13 stress 9.140966e-05
## ... Procrustes: rmse 0.0001561224  max resid 0.0007768174
## ... Similar to previous best
## Run 14 stress 8.96734e-05
## ... Procrustes: rmse 0.0001387464  max resid 0.0004611138
## ... Similar to previous best
## Run 15 stress 9.189376e-05
## ... Procrustes: rmse 0.000169765  max resid 0.0007812288
## ... Similar to previous best
## Run 16 stress 9.631162e-05
## ... Procrustes: rmse 0.0001670126  max resid 0.0007018168
## ... Similar to previous best
## Run 17 stress 9.669183e-05
## ... Procrustes: rmse 0.0001542638  max resid 0.0006566531
## ... Similar to previous best
## Run 18 stress 9.851681e-05
## ... Procrustes: rmse 0.0001478131  max resid 0.0004683334
## ... Similar to previous best
## Run 19 stress 9.187439e-05
## ... Procrustes: rmse 0.0001600257  max resid 0.0005261361
## ... Similar to previous best
## Run 20 stress 9.908278e-05
## ... Procrustes: rmse 0.0001679537  max resid 0.0007211756
```

```
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.961809e-05
## ... Procrustes: rmse 0.0001908019  max resid 0.001248621
## ... Similar to previous best
## Run 2 stress 9.509564e-05
## ... Procrustes: rmse 0.0001984957  max resid 0.001311851
## ... Similar to previous best
## Run 3 stress 9.183759e-05
## ... Procrustes: rmse 0.0001783465  max resid 0.0008412006
## ... Similar to previous best
## Run 4 stress 9.789057e-05
## ... Procrustes: rmse 0.0001968875  max resid 0.001276929
## ... Similar to previous best
## Run 5 stress 9.21466e-05
## ... Procrustes: rmse 0.0001842128  max resid 0.0008720651
## ... Similar to previous best
## Run 6 stress 9.678698e-05
## ... Procrustes: rmse 0.0001998631  max resid 0.001283746
## ... Similar to previous best
## Run 7 stress 9.511551e-05
## ... Procrustes: rmse 0.0001928869  max resid 0.001130419
## ... Similar to previous best
## Run 8 stress 8.169346e-05
## ... Procrustes: rmse 0.0001540194  max resid 0.0006003267
## ... Similar to previous best
## Run 9 stress 9.680668e-05
## ... Procrustes: rmse 0.0001699307  max resid 0.0007789494
## ... Similar to previous best
## Run 10 stress 9.941752e-05
## ... Procrustes: rmse 0.0001978153  max resid 0.0009769369
## ... Similar to previous best
## Run 11 stress 9.639284e-05
## ... Procrustes: rmse 0.0001963358  max resid 0.001252117
## ... Similar to previous best
## Run 12 stress 9.96255e-05
## ... Procrustes: rmse 0.000213385  max resid 0.001278538
## ... Similar to previous best
## Run 13 stress 9.109334e-05
## ... Procrustes: rmse 0.0001979108  max resid 0.001166362
## ... Similar to previous best
## Run 14 stress 9.612857e-05
## ... Procrustes: rmse 0.0001958318  max resid 0.00114592
## ... Similar to previous best
## Run 15 stress 7.01955e-05
## ... Procrustes: rmse 0.000154782  max resid 0.0007034777
## ... Similar to previous best
## Run 16 stress 8.171607e-05
## ... Procrustes: rmse 0.0001812542  max resid 0.001195404
## ... Similar to previous best
## Run 17 stress 9.786653e-05
```

```
## ... Procrustes: rmse 0.000183102  max resid 0.0008806659
## ... Similar to previous best
## Run 18 stress 9.973411e-05
## ... Procrustes: rmse 0.0001883367  max resid 0.0009828955
## ... Similar to previous best
## Run 19 stress 9.49567e-05
## ... Procrustes: rmse 0.0001991164  max resid 0.00134111
## ... Similar to previous best
## Run 20 stress 9.722365e-05
## ... Procrustes: rmse 0.0002040861  max resid 0.001318718
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 8.953813e-05
## ... Procrustes: rmse 0.0001842266  max resid 0.00100343
## ... Similar to previous best
## Run 2 stress 9.693422e-05
## ... Procrustes: rmse 0.0001876654  max resid 0.001186599
## ... Similar to previous best
## Run 3 stress 9.681985e-05
## ... Procrustes: rmse 0.000196776  max resid 0.001249101
## ... Similar to previous best
## Run 4 stress 9.051733e-05
## ... Procrustes: rmse 0.0001945225  max resid 0.001301244
## ... Similar to previous best
## Run 5 stress 9.471909e-05
## ... Procrustes: rmse 0.0001860837  max resid 0.001005667
## ... Similar to previous best
## Run 6 stress 7.623723e-05
## ... Procrustes: rmse 0.0001514647  max resid 0.0009647989
## ... Similar to previous best
## Run 7 stress 9.074644e-05
## ... Procrustes: rmse 0.0001672142  max resid 0.001055106
## ... Similar to previous best
## Run 8 stress 9.390766e-05
## ... Procrustes: rmse 0.0001803472  max resid 0.0009959206
## ... Similar to previous best
## Run 9 stress 9.773181e-05
## ... Procrustes: rmse 0.0001818828  max resid 0.0009222368
## ... Similar to previous best
## Run 10 stress 8.37317e-05
## ... Procrustes: rmse 0.0001756842  max resid 0.001102854
## ... Similar to previous best
## Run 11 stress 9.32873e-05
## ... Procrustes: rmse 0.0002014435  max resid 0.001306944
## ... Similar to previous best
## Run 12 stress 9.471308e-05
## ... Procrustes: rmse 0.0001627361  max resid 0.0007226594
## ... Similar to previous best
## Run 13 stress 9.479568e-05
## ... Procrustes: rmse 0.0001705854  max resid 0.0006874276
## ... Similar to previous best
```

```
## Run 14 stress 8.947652e-05
## ... Procrustes: rmse 0.0001750878  max resid 0.0005769885
## ... Similar to previous best
## Run 15 stress 9.896067e-05
## ... Procrustes: rmse 0.0001954452  max resid 0.001217897
## ... Similar to previous best
## Run 16 stress 9.432307e-05
## ... Procrustes: rmse 0.0001899479  max resid 0.001203134
## ... Similar to previous best
## Run 17 stress 9.823907e-05
## ... Procrustes: rmse 0.000190771  max resid 0.001272713
## ... Similar to previous best
## Run 18 stress 9.867406e-05
## ... Procrustes: rmse 0.0002062208  max resid 0.001350012
## ... Similar to previous best
## Run 19 stress 9.424488e-05
## ... Procrustes: rmse 0.0001697387  max resid 0.0008006311
## ... Similar to previous best
## Run 20 stress 9.845146e-05
## ... Procrustes: rmse 0.0001928162  max resid 0.001128992
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 8.204796e-05
## ... Procrustes: rmse 0.0001877854  max resid 0.001069854
## ... Similar to previous best
## Run 2 stress 9.281693e-05
## ... Procrustes: rmse 0.0002068188  max resid 0.001285421
## ... Similar to previous best
## Run 3 stress 9.886192e-05
## ... Procrustes: rmse 0.0002055939  max resid 0.001072714
## ... Similar to previous best
## Run 4 stress 9.852055e-05
## ... Procrustes: rmse 0.0002172624  max resid 0.001427988
## ... Similar to previous best
## Run 5 stress 9.787024e-05
## ... Procrustes: rmse 0.0002110056  max resid 0.001292345
## ... Similar to previous best
## Run 6 stress 9.384849e-05
## ... Procrustes: rmse 0.0002094402  max resid 0.001353706
## ... Similar to previous best
## Run 7 stress 9.794917e-05
## ... Procrustes: rmse 0.0001985806  max resid 0.001197287
## ... Similar to previous best
## Run 8 stress 9.816057e-05
## ... Procrustes: rmse 0.0002148172  max resid 0.001481755
## ... Similar to previous best
## Run 9 stress 9.016236e-05
## ... Procrustes: rmse 0.0001841092  max resid 0.001185857
## ... Similar to previous best
## Run 10 stress 8.542434e-05
## ... Procrustes: rmse 0.0002007326  max resid 0.001283195
```

```
## ... Similar to previous best
## Run 11 stress 8.798317e-05
## ... Procrustes: rmse 0.0002053364  max resid 0.001345632
## ... Similar to previous best
## Run 12 stress 9.629573e-05
## ... Procrustes: rmse 0.0002070917  max resid 0.001359971
## ... Similar to previous best
## Run 13 stress 9.413774e-05
## ... Procrustes: rmse 0.000175161  max resid 0.0006603827
## ... Similar to previous best
## Run 14 stress 9.678474e-05
## ... Procrustes: rmse 0.0002119328  max resid 0.001349898
## ... Similar to previous best
## Run 15 stress 9.622673e-05
## ... Procrustes: rmse 0.000211691  max resid 0.00135833
## ... Similar to previous best
## Run 16 stress 9.535358e-05
## ... Procrustes: rmse 0.0001848189  max resid 0.001152812
## ... Similar to previous best
## Run 17 stress 9.418927e-05
## ... Procrustes: rmse 0.0002118308  max resid 0.001364598
## ... Similar to previous best
## Run 18 stress 9.255251e-05
## ... Procrustes: rmse 0.0001931052  max resid 0.00122354
## ... Similar to previous best
## Run 19 stress 9.899207e-05
## ... Procrustes: rmse 0.0002188934  max resid 0.001425991
## ... Similar to previous best
## Run 20 stress 9.796814e-05
## ... Procrustes: rmse 0.0002091449  max resid 0.001223643
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.529796e-05
## ... Procrustes: rmse 0.000158485  max resid 0.0004914614
## ... Similar to previous best
## Run 2 stress 8.963575e-05
## ... Procrustes: rmse 0.0001425663  max resid 0.0005171062
## ... Similar to previous best
## Run 3 stress 9.017698e-05
## ... Procrustes: rmse 0.0001294806  max resid 0.0003802394
## ... Similar to previous best
## Run 4 stress 8.997258e-05
## ... Procrustes: rmse 0.0001513034  max resid 0.0004897605
## ... Similar to previous best
## Run 5 stress 8.669615e-05
## ... Procrustes: rmse 0.0001435088  max resid 0.000529844
## ... Similar to previous best
## Run 6 stress 8.955231e-05
## ... Procrustes: rmse 0.0001516763  max resid 0.0005261973
## ... Similar to previous best
## Run 7 stress 9.533e-05
```

```
## ... Procrustes: rmse 0.0001588586  max resid 0.0007491292
## ... Similar to previous best
## Run 8 stress 9.125699e-05
## ... Procrustes: rmse 0.0001490434  max resid 0.0005780014
## ... Similar to previous best
## Run 9 stress 8.929927e-05
## ... Procrustes: rmse 0.0001233799  max resid 0.0005013294
## ... Similar to previous best
## Run 10 stress 8.988826e-05
## ... Procrustes: rmse 0.0001485901  max resid 0.0006055742
## ... Similar to previous best
## Run 11 stress 9.884518e-05
## ... Procrustes: rmse 0.0001617228  max resid 0.0008131332
## ... Similar to previous best
## Run 12 stress 4.802043e-05
## ... Procrustes: rmse 0.0001015052  max resid 0.000320754
## ... Similar to previous best
## Run 13 stress 8.941222e-05
## ... Procrustes: rmse 0.0001543427  max resid 0.0006921344
## ... Similar to previous best
## Run 14 stress 9.911342e-05
## ... Procrustes: rmse 0.0001601857  max resid 0.000634193
## ... Similar to previous best
## Run 15 stress 9.124737e-05
## ... Procrustes: rmse 0.000154684  max resid 0.0005169808
## ... Similar to previous best
## Run 16 stress 9.538276e-05
## ... Procrustes: rmse 0.0001698838  max resid 0.0005593906
## ... Similar to previous best
## Run 17 stress 9.492632e-05
## ... Procrustes: rmse 0.000156035  max resid 0.000632233
## ... Similar to previous best
## Run 18 stress 8.88959e-05
## ... Procrustes: rmse 0.000150243  max resid 0.0005346372
## ... Similar to previous best
## Run 19 stress 9.941789e-05
## ... Procrustes: rmse 0.000169374  max resid 0.0007084072
## ... Similar to previous best
## Run 20 stress 9.020609e-05
## ... Procrustes: rmse 0.000154802  max resid 0.0007304892
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 8.810089e-05
## ... Procrustes: rmse 0.0002043485  max resid 0.001184781
## ... Similar to previous best
## Run 2 stress 9.291194e-05
## ... Procrustes: rmse 0.0001797321  max resid 0.0006685445
## ... Similar to previous best
## Run 3 stress 8.575676e-05
## ... Procrustes: rmse 0.0001535783  max resid 0.0008308051
## ... Similar to previous best
```

```
## Run 4 stress 9.786348e-05
## ... Procrustes: rmse 0.0001981746  max resid 0.001262163
## ... Similar to previous best
## Run 5 stress 8.370753e-05
## ... Procrustes: rmse 0.0001887212  max resid 0.0009925118
## ... Similar to previous best
## Run 6 stress 9.762321e-05
## ... Procrustes: rmse 0.0002100243  max resid 0.001291872
## ... Similar to previous best
## Run 7 stress 8.929831e-05
## ... Procrustes: rmse 0.0001994152  max resid 0.001247329
## ... Similar to previous best
## Run 8 stress 9.702794e-05
## ... Procrustes: rmse 0.0001762061  max resid 0.000674863
## ... Similar to previous best
## Run 9 stress 8.956756e-05
## ... Procrustes: rmse 0.0002103067  max resid 0.001168094
## ... Similar to previous best
## Run 10 stress 9.20644e-05
## ... Procrustes: rmse 0.0001989747  max resid 0.001169278
## ... Similar to previous best
## Run 11 stress 9.659986e-05
## ... Procrustes: rmse 0.0002011779  max resid 0.001089027
## ... Similar to previous best
## Run 12 stress 9.696131e-05
## ... Procrustes: rmse 0.000195671  max resid 0.0008577162
## ... Similar to previous best
## Run 13 stress 9.527623e-05
## ... Procrustes: rmse 0.0002153383  max resid 0.001094378
## ... Similar to previous best
## Run 14 stress 8.314792e-05
## ... Procrustes: rmse 0.000176333  max resid 0.0008571348
## ... Similar to previous best
## Run 15 stress 9.137592e-05
## ... Procrustes: rmse 0.0001875108  max resid 0.001089312
## ... Similar to previous best
## Run 16 stress 9.68741e-05
## ... Procrustes: rmse 0.0001808667  max resid 0.0008852582
## ... Similar to previous best
## Run 17 stress 9.60179e-05
## ... Procrustes: rmse 0.0001915683  max resid 0.0007641183
## ... Similar to previous best
## Run 18 stress 8.901095e-05
## ... Procrustes: rmse 0.000188035  max resid 0.0008930037
## ... Similar to previous best
## Run 19 stress 9.54616e-05
## ... Procrustes: rmse 0.0002155113  max resid 0.001099573
## ... Similar to previous best
## Run 20 stress 9.421786e-05
## ... Procrustes: rmse 0.0001881724  max resid 0.0006133379
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
```

```
## Run 0 stress 0
## Run 1 stress 9.259096e-05
## ... Procrustes: rmse 0.0002017857  max resid 0.00121502
## ... Similar to previous best
## Run 2 stress 9.735683e-05
## ... Procrustes: rmse 0.0002058194  max resid 0.001201816
## ... Similar to previous best
## Run 3 stress 9.46505e-05
## ... Procrustes: rmse 0.0002104058  max resid 0.001278496
## ... Similar to previous best
## Run 4 stress 9.734798e-05
## ... Procrustes: rmse 0.0002063712  max resid 0.001182631
## ... Similar to previous best
## Run 5 stress 9.933734e-05
## ... Procrustes: rmse 0.0001866608  max resid 0.001087816
## ... Similar to previous best
## Run 6 stress 9.498634e-05
## ... Procrustes: rmse 0.0001889391  max resid 0.001218577
## ... Similar to previous best
## Run 7 stress 9.14265e-05
## ... Procrustes: rmse 0.0002018155  max resid 0.001227459
## ... Similar to previous best
## Run 8 stress 9.214362e-05
## ... Procrustes: rmse 0.0002044793  max resid 0.001268221
## ... Similar to previous best
## Run 9 stress 9.702443e-05
## ... Procrustes: rmse 0.0002083719  max resid 0.001284079
## ... Similar to previous best
## Run 10 stress 9.405164e-05
## ... Procrustes: rmse 0.0002071184  max resid 0.001231012
## ... Similar to previous best
## Run 11 stress 8.419357e-05
## ... Procrustes: rmse 0.0001701417  max resid 0.001016172
## ... Similar to previous best
## Run 12 stress 7.755108e-05
## ... Procrustes: rmse 0.0001781595  max resid 0.001016611
## ... Similar to previous best
## Run 13 stress 9.063835e-05
## ... Procrustes: rmse 0.0001687048  max resid 0.0008798665
## ... Similar to previous best
## Run 14 stress 9.46565e-05
## ... Procrustes: rmse 0.0002092708  max resid 0.001235929
## ... Similar to previous best
## Run 15 stress 9.442667e-05
## ... Procrustes: rmse 0.0001852774  max resid 0.001107869
## ... Similar to previous best
## Run 16 stress 9.619292e-05
## ... Procrustes: rmse 0.000198584  max resid 0.001281599
## ... Similar to previous best
## Run 17 stress 9.250783e-05
## ... Procrustes: rmse 0.0001791602  max resid 0.0009906121
## ... Similar to previous best
## Run 18 stress 9.802626e-05
## ... Procrustes: rmse 0.0002014496  max resid 0.001115789
```

```
## ... Similar to previous best
## Run 19 stress 9.449312e-05
## ... Procrustes: rmse 0.0001919387  max resid 0.001133321
## ... Similar to previous best
## Run 20 stress 9.41514e-05
## ... Procrustes: rmse 0.0002037016  max resid 0.001280181
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.425391e-05
## ... Procrustes: rmse 0.0001828438  max resid 0.0008857957
## ... Similar to previous best
## Run 2 stress 9.214951e-05
## ... Procrustes: rmse 0.0001898912  max resid 0.0009886963
## ... Similar to previous best
## Run 3 stress 9.971271e-05
## ... Procrustes: rmse 0.000178544  max resid 0.0007232331
## ... Similar to previous best
## Run 4 stress 9.335043e-05
## ... Procrustes: rmse 0.0001802782  max resid 0.001049084
## ... Similar to previous best
## Run 5 stress 9.940002e-05
## ... Procrustes: rmse 0.0001765001  max resid 0.0007343419
## ... Similar to previous best
## Run 6 stress 9.347742e-05
## ... Procrustes: rmse 0.0001786153  max resid 0.0008442868
## ... Similar to previous best
## Run 7 stress 9.387233e-05
## ... Procrustes: rmse 0.0001923062  max resid 0.001115199
## ... Similar to previous best
## Run 8 stress 9.688809e-05
## ... Procrustes: rmse 0.0002007283  max resid 0.001082935
## ... Similar to previous best
## Run 9 stress 8.675298e-05
## ... Procrustes: rmse 0.0001594253  max resid 0.0007167972
## ... Similar to previous best
## Run 10 stress 9.441071e-05
## ... Procrustes: rmse 0.0001836824  max resid 0.0009198211
## ... Similar to previous best
## Run 11 stress 9.942605e-05
## ... Procrustes: rmse 0.0001705384  max resid 0.0005706903
## ... Similar to previous best
## Run 12 stress 9.38992e-05
## ... Procrustes: rmse 0.0001803955  max resid 0.0009423302
## ... Similar to previous best
## Run 13 stress 9.6807e-05
## ... Procrustes: rmse 0.0001816686  max resid 0.0008508227
## ... Similar to previous best
## Run 14 stress 9.296382e-05
## ... Procrustes: rmse 0.0001731257  max resid 0.0009093493
## ... Similar to previous best
## Run 15 stress 9.533637e-05
```

```
## ... Procrustes: rmse 0.0001852313  max resid 0.0009383556
## ... Similar to previous best
## Run 16 stress 9.670675e-05
## ... Procrustes: rmse 0.0001760133  max resid 0.0009519027
## ... Similar to previous best
## Run 17 stress 9.889839e-05
## ... Procrustes: rmse 0.00017875  max resid 0.0009466296
## ... Similar to previous best
## Run 18 stress 9.835632e-05
## ... Procrustes: rmse 0.000175236  max resid 0.0007701997
## ... Similar to previous best
## Run 19 stress 9.072499e-05
## ... Procrustes: rmse 0.0001843755  max resid 0.0009744954
## ... Similar to previous best
## Run 20 stress 9.27149e-05
## ... Procrustes: rmse 0.0001756829  max resid 0.0008161593
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.131443e-05
## ... Procrustes: rmse 0.0001575517  max resid 0.0006243658
## ... Similar to previous best
## Run 2 stress 9.998034e-05
## ... Procrustes: rmse 0.000172326  max resid 0.0006693208
## ... Similar to previous best
## Run 3 stress 7.56038e-05
## ... Procrustes: rmse 0.0001303095  max resid 0.000373896
## ... Similar to previous best
## Run 4 stress 9.244119e-05
## ... Procrustes: rmse 0.0001600023  max resid 0.0007097145
## ... Similar to previous best
## Run 5 stress 6.62893e-05
## ... Procrustes: rmse 0.0001278413  max resid 0.0005778058
## ... Similar to previous best
## Run 6 stress 8.626472e-05
## ... Procrustes: rmse 0.0001498266  max resid 0.0005480047
## ... Similar to previous best
## Run 7 stress 9.047574e-05
## ... Procrustes: rmse 0.0001724447  max resid 0.0006540147
## ... Similar to previous best
## Run 8 stress 9.126514e-05
## ... Procrustes: rmse 0.0001629253  max resid 0.0005713585
## ... Similar to previous best
## Run 9 stress 9.233134e-05
## ... Procrustes: rmse 0.0001601733  max resid 0.000610046
## ... Similar to previous best
## Run 10 stress 9.937216e-05
## ... Procrustes: rmse 0.0001658048  max resid 0.0007212818
## ... Similar to previous best
## Run 11 stress 8.986288e-05
## ... Procrustes: rmse 0.0001627962  max resid 0.0006235381
## ... Similar to previous best
```

```
## Run 12 stress 9.460908e-05
## ... Procrustes: rmse 0.000165246  max resid 0.0005607497
## ... Similar to previous best
## Run 13 stress 8.897334e-05
## ... Procrustes: rmse 0.000147111  max resid 0.0004448817
## ... Similar to previous best
## Run 14 stress 9.896473e-05
## ... Procrustes: rmse 0.0001571154  max resid 0.0006185543
## ... Similar to previous best
## Run 15 stress 9.015266e-05
## ... Procrustes: rmse 0.0001635575  max resid 0.0005814747
## ... Similar to previous best
## Run 16 stress 8.912538e-05
## ... Procrustes: rmse 0.0001540358  max resid 0.0005980807
## ... Similar to previous best
## Run 17 stress 9.369548e-05
## ... Procrustes: rmse 0.0001676329  max resid 0.0005770268
## ... Similar to previous best
## Run 18 stress 9.268109e-05
## ... Procrustes: rmse 0.0001620586  max resid 0.0006226722
## ... Similar to previous best
## Run 19 stress 9.906068e-05
## ... Procrustes: rmse 0.0001683791  max resid 0.0007293263
## ... Similar to previous best
## Run 20 stress 8.70098e-05
## ... Procrustes: rmse 0.0001668612  max resid 0.0005152346
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.666856e-05
## ... Procrustes: rmse 0.0001605683  max resid 0.0006798239
## ... Similar to previous best
## Run 2 stress 8.84909e-05
## ... Procrustes: rmse 0.0001472354  max resid 0.0007028882
## ... Similar to previous best
## Run 3 stress 9.705681e-05
## ... Procrustes: rmse 0.0001763978  max resid 0.0008445377
## ... Similar to previous best
## Run 4 stress 9.624161e-05
## ... Procrustes: rmse 0.0001592723  max resid 0.0006677742
## ... Similar to previous best
## Run 5 stress 8.902703e-05
## ... Procrustes: rmse 0.0001508257  max resid 0.000614318
## ... Similar to previous best
## Run 6 stress 8.286132e-05
## ... Procrustes: rmse 0.0001416399  max resid 0.0006270895
## ... Similar to previous best
## Run 7 stress 8.988478e-05
## ... Procrustes: rmse 0.0001612023  max resid 0.0008976614
## ... Similar to previous best
## Run 8 stress 8.907501e-05
## ... Procrustes: rmse 0.0001456318  max resid 0.0005873636
```

```
## ... Similar to previous best
## Run 9 stress 9.243603e-05
## ... Procrustes: rmse 0.0001532081  max resid 0.0006453231
## ... Similar to previous best
## Run 10 stress 9.311364e-05
## ... Procrustes: rmse 0.0001597698  max resid 0.0007420998
## ... Similar to previous best
## Run 11 stress 9.243338e-05
## ... Procrustes: rmse 0.0001553883  max resid 0.0006008961
## ... Similar to previous best
## Run 12 stress 7.699993e-05
## ... Procrustes: rmse 0.0001307089  max resid 0.0006436482
## ... Similar to previous best
## Run 13 stress 9.010632e-05
## ... Procrustes: rmse 0.0001593868  max resid 0.0005084339
## ... Similar to previous best
## Run 14 stress 9.010165e-05
## ... Procrustes: rmse 0.0001730883  max resid 0.0007702244
## ... Similar to previous best
## Run 15 stress 8.742837e-05
## ... Procrustes: rmse 0.0001508036  max resid 0.0007782496
## ... Similar to previous best
## Run 16 stress 9.844967e-05
## ... Procrustes: rmse 0.000186859  max resid 0.0007596025
## ... Similar to previous best
## Run 17 stress 9.489082e-05
## ... Procrustes: rmse 0.000148931  max resid 0.0005371985
## ... Similar to previous best
## Run 18 stress 7.519042e-05
## ... Procrustes: rmse 0.0001404414  max resid 0.0005605763
## ... Similar to previous best
## Run 19 stress 9.330285e-05
## ... Procrustes: rmse 0.0001357954  max resid 0.0004098203
## ... Similar to previous best
## Run 20 stress 8.944198e-05
## ... Procrustes: rmse 0.0001620185  max resid 0.0006673891
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 8.586578e-05
## ... Procrustes: rmse 0.000190579  max resid 0.0009501906
## ... Similar to previous best
## Run 2 stress 9.675711e-05
## ... Procrustes: rmse 0.0001921932  max resid 0.0009573689
## ... Similar to previous best
## Run 3 stress 9.970147e-05
## ... Procrustes: rmse 0.0001797223  max resid 0.0008962309
## ... Similar to previous best
## Run 4 stress 9.636917e-05
## ... Procrustes: rmse 0.0001870791  max resid 0.0008730441
## ... Similar to previous best
## Run 5 stress 9.440517e-05
```

```
## ... Procrustes: rmse 0.0001849344  max resid 0.0005400559
## ... Similar to previous best
## Run 6 stress 9.477775e-05
## ... Procrustes: rmse 0.000195485  max resid 0.0009073033
## ... Similar to previous best
## Run 7 stress 9.463477e-05
## ... Procrustes: rmse 0.0001933765  max resid 0.001082198
## ... Similar to previous best
## Run 8 stress 9.369381e-05
## ... Procrustes: rmse 0.0001808279  max resid 0.000865994
## ... Similar to previous best
## Run 9 stress 9.536843e-05
## ... Procrustes: rmse 0.0001754183  max resid 0.0009766935
## ... Similar to previous best
## Run 10 stress 9.11529e-05
## ... Procrustes: rmse 0.0001926739  max resid 0.0006539093
## ... Similar to previous best
## Run 11 stress 9.141411e-05
## ... Procrustes: rmse 0.0001990687  max resid 0.00104696
## ... Similar to previous best
## Run 12 stress 9.411154e-05
## ... Procrustes: rmse 0.0001837546  max resid 0.0008053038
## ... Similar to previous best
## Run 13 stress 8.043311e-05
## ... Procrustes: rmse 0.0001691902  max resid 0.0009190093
## ... Similar to previous best
## Run 14 stress 9.773277e-05
## ... Procrustes: rmse 0.0002050084  max resid 0.001140297
## ... Similar to previous best
## Run 15 stress 9.951788e-05
## ... Procrustes: rmse 0.0002105904  max resid 0.001174419
## ... Similar to previous best
## Run 16 stress 9.584583e-05
## ... Procrustes: rmse 0.0001827247  max resid 0.0006233859
## ... Similar to previous best
## Run 17 stress 9.751862e-05
## ... Procrustes: rmse 0.0001744599  max resid 0.000556029
## ... Similar to previous best
## Run 18 stress 0.003525612
## Run 19 stress 9.799167e-05
## ... Procrustes: rmse 0.000189227  max resid 0.0009541723
## ... Similar to previous best
## Run 20 stress 9.576286e-05
## ... Procrustes: rmse 0.0001831062  max resid 0.0007297522
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.527797e-05
## ... Procrustes: rmse 0.0001650028  max resid 0.0007192111
## ... Similar to previous best
## Run 2 stress 9.223916e-05
## ... Procrustes: rmse 0.000180025  max resid 0.001053214
```

```
## ... Similar to previous best
## Run 3 stress 9.53076e-05
## ... Procrustes: rmse 0.0001694196  max resid 0.0008223818
## ... Similar to previous best
## Run 4 stress 8.421924e-05
## ... Procrustes: rmse 0.0001765154  max resid 0.0009520782
## ... Similar to previous best
## Run 5 stress 9.137712e-05
## ... Procrustes: rmse 0.0001728578  max resid 0.0006671934
## ... Similar to previous best
## Run 6 stress 8.611193e-05
## ... Procrustes: rmse 0.0001653865  max resid 0.0009427192
## ... Similar to previous best
## Run 7 stress 9.746915e-05
## ... Procrustes: rmse 0.0001828169  max resid 0.0007896712
## ... Similar to previous best
## Run 8 stress 9.239575e-05
## ... Procrustes: rmse 0.0001824641  max resid 0.0009339379
## ... Similar to previous best
## Run 9 stress 9.943169e-05
## ... Procrustes: rmse 0.0001830377  max resid 0.000740181
## ... Similar to previous best
## Run 10 stress 9.345794e-05
## ... Procrustes: rmse 0.0001750533  max resid 0.0007658523
## ... Similar to previous best
## Run 11 stress 8.714484e-05
## ... Procrustes: rmse 0.000176391  max resid 0.0009034548
## ... Similar to previous best
## Run 12 stress 9.470506e-05
## ... Procrustes: rmse 0.0001755555  max resid 0.0009779726
## ... Similar to previous best
## Run 13 stress 9.892867e-05
## ... Procrustes: rmse 0.0001847574  max resid 0.0007538552
## ... Similar to previous best
## Run 14 stress 9.223197e-05
## ... Procrustes: rmse 0.0001566304  max resid 0.0005326692
## ... Similar to previous best
## Run 15 stress 9.78697e-05
## ... Procrustes: rmse 0.0001890088  max resid 0.0009390603
## ... Similar to previous best
## Run 16 stress 9.7225e-05
## ... Procrustes: rmse 0.0001901114  max resid 0.001160775
## ... Similar to previous best
## Run 17 stress 9.788115e-05
## ... Procrustes: rmse 0.0001562032  max resid 0.0007109382
## ... Similar to previous best
## Run 18 stress 9.374953e-05
## ... Procrustes: rmse 0.0001838447  max resid 0.0009239894
## ... Similar to previous best
## Run 19 stress 8.560924e-05
## ... Procrustes: rmse 0.0001762491  max resid 0.001041851
## ... Similar to previous best
## Run 20 stress 9.036465e-05
## ... Procrustes: rmse 0.0001657919  max resid 0.0007729324
```

```
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.347447e-05
## ... Procrustes: rmse 0.0002178283  max resid 0.00140838
## ... Similar to previous best
## Run 2 stress 9.520285e-05
## ... Procrustes: rmse 0.0001941523  max resid 0.001156445
## ... Similar to previous best
## Run 3 stress 9.425168e-05
## ... Procrustes: rmse 0.0002097361  max resid 0.001340081
## ... Similar to previous best
## Run 4 stress 9.287836e-05
## ... Procrustes: rmse 0.0002037067  max resid 0.001287143
## ... Similar to previous best
## Run 5 stress 9.31222e-05
## ... Procrustes: rmse 0.000178548  max resid 0.0007708864
## ... Similar to previous best
## Run 6 stress 9.528704e-05
## ... Procrustes: rmse 0.000210693  max resid 0.001342004
## ... Similar to previous best
## Run 7 stress 8.188843e-05
## ... Procrustes: rmse 0.0001912548  max resid 0.001180632
## ... Similar to previous best
## Run 8 stress 9.847782e-05
## ... Procrustes: rmse 0.0002003229  max resid 0.001246172
## ... Similar to previous best
## Run 9 stress 9.727289e-05
## ... Procrustes: rmse 0.0001962722  max resid 0.00127136
## ... Similar to previous best
## Run 10 stress 7.584885e-05
## ... Procrustes: rmse 0.0001692597  max resid 0.001097674
## ... Similar to previous best
## Run 11 stress 9.356956e-05
## ... Procrustes: rmse 0.0002068289  max resid 0.001317855
## ... Similar to previous best
## Run 12 stress 9.734276e-05
## ... Procrustes: rmse 0.0002083929  max resid 0.001318667
## ... Similar to previous best
## Run 13 stress 9.298613e-05
## ... Procrustes: rmse 0.0002065916  max resid 0.001318633
## ... Similar to previous best
## Run 14 stress 9.981899e-05
## ... Procrustes: rmse 0.0002166926  max resid 0.001387089
## ... Similar to previous best
## Run 15 stress 9.965483e-05
## ... Procrustes: rmse 0.0001979928  max resid 0.001262407
## ... Similar to previous best
## Run 16 stress 9.936818e-05
## ... Procrustes: rmse 0.000200203  max resid 0.001229901
## ... Similar to previous best
## Run 17 stress 9.110733e-05
```

```
## ... Procrustes: rmse 0.0002177868  max resid 0.001403465
## ... Similar to previous best
## Run 18 stress 9.866576e-05
## ... Procrustes: rmse 0.0002085899  max resid 0.001301738
## ... Similar to previous best
## Run 19 stress 9.088638e-05
## ... Procrustes: rmse 0.0001962877  max resid 0.00126712
## ... Similar to previous best
## Run 20 stress 9.559167e-05
## ... Procrustes: rmse 0.0002117876  max resid 0.001342558
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 8.828486e-05
## ... Procrustes: rmse 0.0001403184  max resid 0.0007319857
## ... Similar to previous best
## Run 2 stress 9.527451e-05
## ... Procrustes: rmse 0.0001737948  max resid 0.0007207865
## ... Similar to previous best
## Run 3 stress 9.492769e-05
## ... Procrustes: rmse 0.0001585522  max resid 0.0006387591
## ... Similar to previous best
## Run 4 stress 9.161311e-05
## ... Procrustes: rmse 0.0001715568  max resid 0.0008305876
## ... Similar to previous best
## Run 5 stress 9.64027e-05
## ... Procrustes: rmse 0.0001699716  max resid 0.0007118499
## ... Similar to previous best
## Run 6 stress 9.333094e-05
## ... Procrustes: rmse 0.0001734416  max resid 0.00098656
## ... Similar to previous best
## Run 7 stress 9.197542e-05
## ... Procrustes: rmse 0.0001627776  max resid 0.0006105371
## ... Similar to previous best
## Run 8 stress 9.469058e-05
## ... Procrustes: rmse 0.0001610646  max resid 0.0007465091
## ... Similar to previous best
## Run 9 stress 9.229734e-05
## ... Procrustes: rmse 0.0001719076  max resid 0.0007981661
## ... Similar to previous best
## Run 10 stress 9.90907e-05
## ... Procrustes: rmse 0.0001852897  max resid 0.0009963772
## ... Similar to previous best
## Run 11 stress 9.503676e-05
## ... Procrustes: rmse 0.0001705165  max resid 0.0006727261
## ... Similar to previous best
## Run 12 stress 9.290825e-05
## ... Procrustes: rmse 0.0001752543  max resid 0.0009430597
## ... Similar to previous best
## Run 13 stress 9.226134e-05
## ... Procrustes: rmse 0.0001595843  max resid 0.000627669
## ... Similar to previous best
```

```
## Run 14 stress 9.426196e-05
## ... Procrustes: rmse 0.0001660648  max resid 0.0006058392
## ... Similar to previous best
## Run 15 stress 9.087257e-05
## ... Procrustes: rmse 0.0001653512  max resid 0.0009130423
## ... Similar to previous best
## Run 16 stress 9.630209e-05
## ... Procrustes: rmse 0.0001764221  max resid 0.0007578721
## ... Similar to previous best
## Run 17 stress 9.392617e-05
## ... Procrustes: rmse 0.0001689906  max resid 0.000995975
## ... Similar to previous best
## Run 18 stress 9.804599e-05
## ... Procrustes: rmse 0.0001754667  max resid 0.0008798573
## ... Similar to previous best
## Run 19 stress 9.576034e-05
## ... Procrustes: rmse 0.0001715226  max resid 0.000490811
## ... Similar to previous best
## Run 20 stress 9.707759e-05
## ... Procrustes: rmse 0.0001742476  max resid 0.0009055023
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.996803e-05
## ... Procrustes: rmse 0.0001681711  max resid 0.0006385668
## ... Similar to previous best
## Run 2 stress 9.089238e-05
## ... Procrustes: rmse 0.0001563529  max resid 0.0006679759
## ... Similar to previous best
## Run 3 stress 9.959176e-05
## ... Procrustes: rmse 0.0001673804  max resid 0.000658251
## ... Similar to previous best
## Run 4 stress 8.849866e-05
## ... Procrustes: rmse 0.0001485155  max resid 0.0005904721
## ... Similar to previous best
## Run 5 stress 9.951491e-05
## ... Procrustes: rmse 0.0001618976  max resid 0.0008457537
## ... Similar to previous best
## Run 6 stress 9.207833e-05
## ... Procrustes: rmse 0.0001514988  max resid 0.00046431
## ... Similar to previous best
## Run 7 stress 9.635708e-05
## ... Procrustes: rmse 0.0001630023  max resid 0.0005421724
## ... Similar to previous best
## Run 8 stress 9.838427e-05
## ... Procrustes: rmse 0.0001604944  max resid 0.0006365623
## ... Similar to previous best
## Run 9 stress 9.53537e-05
## ... Procrustes: rmse 0.000157115  max resid 0.0004894807
## ... Similar to previous best
## Run 10 stress 8.890921e-05
## ... Procrustes: rmse 0.0001452133  max resid 0.0005436088
```

```
## ... Similar to previous best
## Run 11 stress 9.928048e-05
## ... Procrustes: rmse 0.0001651768  max resid 0.0007306019
## ... Similar to previous best
## Run 12 stress 8.984602e-05
## ... Procrustes: rmse 0.0001578833  max resid 0.000594941
## ... Similar to previous best
## Run 13 stress 9.214687e-05
## ... Procrustes: rmse 0.0001594246  max resid 0.0006868768
## ... Similar to previous best
## Run 14 stress 9.695168e-05
## ... Procrustes: rmse 0.0001586142  max resid 0.000607706
## ... Similar to previous best
## Run 15 stress 9.847493e-05
## ... Procrustes: rmse 0.000151548  max resid 0.0007369327
## ... Similar to previous best
## Run 16 stress 7.940424e-05
## ... Procrustes: rmse 0.0001394401  max resid 0.0004423488
## ... Similar to previous best
## Run 17 stress 8.991189e-05
## ... Procrustes: rmse 0.0001552926  max resid 0.0005034981
## ... Similar to previous best
## Run 18 stress 9.112232e-05
## ... Procrustes: rmse 0.0001458085  max resid 0.0006302201
## ... Similar to previous best
## Run 19 stress 8.741626e-05
## ... Procrustes: rmse 0.0001425338  max resid 0.0005484313
## ... Similar to previous best
## Run 20 stress 9.061277e-05
## ... Procrustes: rmse 0.0001507336  max resid 0.0006262661
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.639195e-05
## ... Procrustes: rmse 0.0001673223  max resid 0.0008702021
## ... Similar to previous best
## Run 2 stress 9.370116e-05
## ... Procrustes: rmse 0.0001683662  max resid 0.000771425
## ... Similar to previous best
## Run 3 stress 9.616789e-05
## ... Procrustes: rmse 0.0001752793  max resid 0.0006950884
## ... Similar to previous best
## Run 4 stress 8.877291e-05
## ... Procrustes: rmse 0.0001495175  max resid 0.0006654107
## ... Similar to previous best
## Run 5 stress 9.180077e-05
## ... Procrustes: rmse 0.000162168  max resid 0.0008772006
## ... Similar to previous best
## Run 6 stress 9.660431e-05
## ... Procrustes: rmse 0.0001834716  max resid 0.0009564613
## ... Similar to previous best
## Run 7 stress 9.440625e-05
```

```
## ... Procrustes: rmse 0.0001673068  max resid 0.0005998065
## ... Similar to previous best
## Run 8 stress 9.289379e-05
## ... Procrustes: rmse 0.0001780796  max resid 0.0008101718
## ... Similar to previous best
## Run 9 stress 8.976232e-05
## ... Procrustes: rmse 0.0001696302  max resid 0.0007643395
## ... Similar to previous best
## Run 10 stress 9.555976e-05
## ... Procrustes: rmse 0.0001762884  max resid 0.0008570177
## ... Similar to previous best
## Run 11 stress 8.421144e-05
## ... Procrustes: rmse 0.0001561478  max resid 0.0007760981
## ... Similar to previous best
## Run 12 stress 9.090034e-05
## ... Procrustes: rmse 0.0001725146  max resid 0.000907623
## ... Similar to previous best
## Run 13 stress 9.794319e-05
## ... Procrustes: rmse 0.0001649303  max resid 0.0006069069
## ... Similar to previous best
## Run 14 stress 9.420776e-05
## ... Procrustes: rmse 0.0001671498  max resid 0.0008843934
## ... Similar to previous best
## Run 15 stress 9.249748e-05
## ... Procrustes: rmse 0.0001628405  max resid 0.0007195104
## ... Similar to previous best
## Run 16 stress 9.560576e-05
## ... Procrustes: rmse 0.0001707098  max resid 0.0007592248
## ... Similar to previous best
## Run 17 stress 9.452904e-05
## ... Procrustes: rmse 0.0001780538  max resid 0.0006303515
## ... Similar to previous best
## Run 18 stress 9.693114e-05
## ... Procrustes: rmse 0.0001494374  max resid 0.0007452024
## ... Similar to previous best
## Run 19 stress 9.271752e-05
## ... Procrustes: rmse 0.000178843  max resid 0.0007920848
## ... Similar to previous best
## Run 20 stress 9.617496e-05
## ... Procrustes: rmse 0.0001671705  max resid 0.0005981422
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 9.199271e-05
## ... Procrustes: rmse 0.0001936941  max resid 0.0009110833
## ... Similar to previous best
## Run 2 stress 9.945721e-05
## ... Procrustes: rmse 0.0001776898  max resid 0.001009864
## ... Similar to previous best
## Run 3 stress 9.52688e-05
## ... Procrustes: rmse 0.000188384  max resid 0.001147493
## ... Similar to previous best
```

```
## Run 4 stress 9.972367e-05
## ... Procrustes: rmse 0.0001992134  max resid 0.001099725
## ... Similar to previous best
## Run 5 stress 9.951669e-05
## ... Procrustes: rmse 0.0002018287  max resid 0.0009600118
## ... Similar to previous best
## Run 6 stress 9.597674e-05
## ... Procrustes: rmse 0.0001920855  max resid 0.0008499154
## ... Similar to previous best
## Run 7 stress 9.912448e-05
## ... Procrustes: rmse 0.0001720998  max resid 0.0008044301
## ... Similar to previous best
## Run 8 stress 9.243606e-05
## ... Procrustes: rmse 0.000181522  max resid 0.001011757
## ... Similar to previous best
## Run 9 stress 9.074232e-05
## ... Procrustes: rmse 0.0001826933  max resid 0.00104506
## ... Similar to previous best
## Run 10 stress 9.857714e-05
## ... Procrustes: rmse 0.0001895088  max resid 0.0008324255
## ... Similar to previous best
## Run 11 stress 9.46509e-05
## ... Procrustes: rmse 0.0001942226  max resid 0.001040211
## ... Similar to previous best
## Run 12 stress 8.595093e-05
## ... Procrustes: rmse 0.00018257  max resid 0.0009997455
## ... Similar to previous best
## Run 13 stress 9.162592e-05
## ... Procrustes: rmse 0.000164509  max resid 0.0009843843
## ... Similar to previous best
## Run 14 stress 9.083991e-05
## ... Procrustes: rmse 0.0001764263  max resid 0.000991818
## ... Similar to previous best
## Run 15 stress 8.209272e-05
## ... Procrustes: rmse 0.0001759672  max resid 0.0007998617
## ... Similar to previous best
## Run 16 stress 9.268093e-05
## ... Procrustes: rmse 0.0001752411  max resid 0.0009289068
## ... Similar to previous best
## Run 17 stress 8.984601e-05
## ... Procrustes: rmse 0.0001857786  max resid 0.000977367
## ... Similar to previous best
## Run 18 stress 9.228946e-05
## ... Procrustes: rmse 0.0001908763  max resid 0.0008463383
## ... Similar to previous best
## Run 19 stress 9.076317e-05
## ... Procrustes: rmse 0.0001749896  max resid 0.001028378
## ... Similar to previous best
## Run 20 stress 9.889401e-05
## ... Procrustes: rmse 0.0001928337  max resid 0.0009033782
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
```

```
## Run 0 stress 0
## Run 1 stress 8.801473e-05
## ... Procrustes: rmse 0.0001481133  max resid 0.0006607918
## ... Similar to previous best
## Run 2 stress 9.553611e-05
## ... Procrustes: rmse 0.0001566456  max resid 0.0006996749
## ... Similar to previous best
## Run 3 stress 9.562668e-05
## ... Procrustes: rmse 0.0001742606  max resid 0.0007537457
## ... Similar to previous best
## Run 4 stress 8.94195e-05
## ... Procrustes: rmse 0.0001579427  max resid 0.0006739024
## ... Similar to previous best
## Run 5 stress 8.977816e-05
## ... Procrustes: rmse 0.0001720562  max resid 0.0007701845
## ... Similar to previous best
## Run 6 stress 9.571395e-05
## ... Procrustes: rmse 0.0001772331  max resid 0.001086672
## ... Similar to previous best
## Run 7 stress 9.037947e-05
## ... Procrustes: rmse 0.000171303  max resid 0.0008474838
## ... Similar to previous best
## Run 8 stress 9.431359e-05
## ... Procrustes: rmse 0.00016963  max resid 0.0006558064
## ... Similar to previous best
## Run 9 stress 9.303618e-05
## ... Procrustes: rmse 0.0001677162  max resid 0.0009702692
## ... Similar to previous best
## Run 10 stress 8.311488e-05
## ... Procrustes: rmse 0.0001586398  max resid 0.0007233662
## ... Similar to previous best
## Run 11 stress 9.749948e-05
## ... Procrustes: rmse 0.0001855344  max resid 0.0008563591
## ... Similar to previous best
## Run 12 stress 9.581265e-05
## ... Procrustes: rmse 0.0001407212  max resid 0.0005172756
## ... Similar to previous best
## Run 13 stress 9.928448e-05
## ... Procrustes: rmse 0.0001828243  max resid 0.0007874096
## ... Similar to previous best
## Run 14 stress 9.975066e-05
## ... Procrustes: rmse 0.0001732614  max resid 0.0007715249
## ... Similar to previous best
## Run 15 stress 9.3376e-05
## ... Procrustes: rmse 0.0001666731  max resid 0.0007504335
## ... Similar to previous best
## Run 16 stress 9.789207e-05
## ... Procrustes: rmse 0.0001926049  max resid 0.0009612822
## ... Similar to previous best
## Run 17 stress 9.77663e-05
## ... Procrustes: rmse 0.0001751456  max resid 0.0008085936
## ... Similar to previous best
## Run 18 stress 9.467427e-05
## ... Procrustes: rmse 0.000165892  max resid 0.0006453143
```

```
## ... Similar to previous best
## Run 19 stress 7.659572e-05
## ... Procrustes: rmse 0.0001566015  max resid 0.0008234099
## ... Similar to previous best
## Run 20 stress 9.683355e-05
## ... Procrustes: rmse 0.0001406145  max resid 0.0008182578
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0001034122
## ... Procrustes: rmse 0.0003964495  max resid 0.002597476
## ... Similar to previous best
## Run 2 stress 0.0001018465
## ... Procrustes: rmse 0.0004113917  max resid 0.002564023
## ... Similar to previous best
## Run 3 stress 0.02204897
## Run 4 stress 0.0001014483
## ... Procrustes: rmse 0.0003607402  max resid 0.001674581
## ... Similar to previous best
## Run 5 stress 9.412339e-05
## ... Procrustes: rmse 0.000374416  max resid 0.001644742
## ... Similar to previous best
## Run 6 stress 0.0002051831
## ... Procrustes: rmse 0.0005778909  max resid 0.004086791
## ... Similar to previous best
## Run 7 stress 0.0002857264
## ... Procrustes: rmse 0.0007193794  max resid 0.005071844
## ... Similar to previous best
## Run 8 stress 0.0001056751
## ... Procrustes: rmse 0.0003982095  max resid 0.002672929
## ... Similar to previous best
## Run 9 stress 0.0001058013
## ... Procrustes: rmse 0.0004036258  max resid 0.001785701
## ... Similar to previous best
## Run 10 stress 0.0001065743
## ... Procrustes: rmse 0.0004134249  max resid 0.002307142
## ... Similar to previous best
## Run 11 stress 0.0001094126
## ... Procrustes: rmse 0.0004297859  max resid 0.002468637
## ... Similar to previous best
## Run 12 stress 0.0001215346
## ... Procrustes: rmse 0.0004602514  max resid 0.002711435
## ... Similar to previous best
## Run 13 stress 9.584554e-05
## ... Procrustes: rmse 0.0003373276  max resid 0.001444334
## ... Similar to previous best
## Run 14 stress 0.003326578
## Run 15 stress 0.0001030799
## ... Procrustes: rmse 0.0004057642  max resid 0.002782541
## ... Similar to previous best
## Run 16 stress 0.0001074357
## ... Procrustes: rmse 0.0003990534  max resid 0.00279126
```

```
## ... Similar to previous best
## Run 17 stress 0.0001096832
## ... Procrustes: rmse 0.0004317807  max resid 0.002572183
## ... Similar to previous best
## Run 18 stress 0.0001185781
## ... Procrustes: rmse 0.0004488155  max resid 0.002489298
## ... Similar to previous best
## Run 19 stress 9.977048e-05
## ... Procrustes: rmse 0.0003378836  max resid 0.001098869
## ... Similar to previous best
## Run 20 stress 0.0001111739
## ... Procrustes: rmse 0.0004171884  max resid 0.002074953
## ... Similar to previous best
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0003006906
## ... Procrustes: rmse 0.004136541  max resid 0.009870233
## ... Similar to previous best
## Run 2 stress 0.0003943916
## ... Procrustes: rmse 0.004556804  max resid 0.01173889
## Run 3 stress 0.0007189781
## Run 4 stress 0.0004475706
## ... Procrustes: rmse 0.004906367  max resid 0.01156816
## Run 5 stress 0.0004870187
## ... Procrustes: rmse 0.005264447  max resid 0.01262796
## Run 6 stress 0.0004460853
## ... Procrustes: rmse 0.00477103  max resid 0.01317697
## Run 7 stress 0.0004339877
## ... Procrustes: rmse 0.005026015  max resid 0.01892383
## Run 8 stress 0.0005792771
## Run 9 stress 0.0004778679
## ... Procrustes: rmse 0.005242925  max resid 0.01729233
## Run 10 stress 0.0004041508
## ... Procrustes: rmse 0.004620475  max resid 0.01253515
## Run 11 stress 0.0004093235
## ... Procrustes: rmse 0.004589951  max resid 0.01042303
## Run 12 stress 0.000485927
## ... Procrustes: rmse 0.004855969  max resid 0.0133175
## Run 13 stress 0.0003664352
## ... Procrustes: rmse 0.004326507  max resid 0.0111927
## Run 14 stress 0.0004389027
## ... Procrustes: rmse 0.004756366  max resid 0.01045323
## Run 15 stress 0.00040157
## ... Procrustes: rmse 0.004680492  max resid 0.01137181
## Run 16 stress 0.0005533469
## Run 17 stress 0.0003814096
## ... Procrustes: rmse 0.004465433  max resid 0.01120432
## Run 18 stress 0.0008259883
## Run 19 stress 0.0004278766
## ... Procrustes: rmse 0.00461902  max resid 0.01065397
## Run 20 stress 0.000759273
## *** Solution reached
```

```
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0005597477
## Run 2 stress 0.0004408282
## ... Procrustes: rmse 0.00490711  max resid 0.01224915
## Run 3 stress 0.0007705224
## Run 4 stress 0.000567342
## Run 5 stress 0.0003640258
## ... Procrustes: rmse 0.004779031  max resid 0.01331774
## Run 6 stress 0.0004369307
## ... Procrustes: rmse 0.00559493  max resid 0.01557626
## Run 7 stress 0.0004414538
## ... Procrustes: rmse 0.005508008  max resid 0.02349115
## Run 8 stress 0.0006997437
## Run 9 stress 0.0006190036
## Run 10 stress 0.0004744208
## ... Procrustes: rmse 0.005461484  max resid 0.01852372
## Run 11 stress 0.0006368432
## Run 12 stress 0.0004353216
## ... Procrustes: rmse 0.0053626  max resid 0.01695573
## Run 13 stress 0.0008172038
## Run 14 stress 0.0004972976
## ... Procrustes: rmse 0.005607538  max resid 0.02026978
## Run 15 stress 0.0005894736
## Run 16 stress 0.0004998589
## ... Procrustes: rmse 0.005768746  max resid 0.0227529
## Run 17 stress 0.0005850131
## Run 18 stress 0.00067194
## Run 19 stress 0.0007715856
## Run 20 stress 0.000702014
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004235577
## ... Procrustes: rmse 0.004802814  max resid 0.01113963
## Run 2 stress 0.0004914107
## ... Procrustes: rmse 0.005304181  max resid 0.01600663
## Run 3 stress 0.0004543416
## ... Procrustes: rmse 0.004971461  max resid 0.01573889
## Run 4 stress 0.0004870712
## ... Procrustes: rmse 0.005173757  max resid 0.01265451
## Run 5 stress 0.000380812
## ... Procrustes: rmse 0.004590491  max resid 0.01268182
## Run 6 stress 0.0004415894
## ... Procrustes: rmse 0.005151133  max resid 0.0150547
## Run 7 stress 0.0005028445
## Run 8 stress 0.0004294057
## ... Procrustes: rmse 0.004783645  max resid 0.01300869
## Run 9 stress 0.0004235904
## ... Procrustes: rmse 0.004648896  max resid 0.0117604
## Run 10 stress 0.0006861348
```

```
## Run 11 stress 0.0003575567
## ... Procrustes: rmse 0.004409186  max resid 0.01168258
## Run 12 stress 0.0003548902
## ... Procrustes: rmse 0.00458863  max resid 0.01151932
## Run 13 stress 0.0005655429
## Run 14 stress 0.0004796423
## ... Procrustes: rmse 0.005379189  max resid 0.01480584
## Run 15 stress 0.0003786999
## ... Procrustes: rmse 0.004668148  max resid 0.01232165
## Run 16 stress 0.0004267618
## ... Procrustes: rmse 0.004902948  max resid 0.01518281
## Run 17 stress 0.0004413424
## ... Procrustes: rmse 0.005081167  max resid 0.01430667
## Run 18 stress 0.000438623
## ... Procrustes: rmse 0.004903607  max resid 0.0116612
## Run 19 stress 0.0005965875
## Run 20 stress 0.0005115285
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0005689108
## Run 2 stress 0.0006754142
## Run 3 stress 0.0005333676
## Run 4 stress 0.0004147717
## ... Procrustes: rmse 0.005024588  max resid 0.01451646
## Run 5 stress 0.0004565973
## ... Procrustes: rmse 0.005109352  max resid 0.01391354
## Run 6 stress 0.0005159957
## Run 7 stress 0.0005156686
## Run 8 stress 0.000518462
## Run 9 stress 0.000525133
## Run 10 stress 0.0003916556
## ... Procrustes: rmse 0.004606435  max resid 0.01114865
## Run 11 stress 0.0004498436
## ... Procrustes: rmse 0.005510197  max resid 0.02212071
## Run 12 stress 0.0005279327
## Run 13 stress 0.0004738844
## ... Procrustes: rmse 0.00553867  max resid 0.0170467
## Run 14 stress 0.0004560996
## ... Procrustes: rmse 0.005712785  max resid 0.01890034
## Run 15 stress 0.0004970096
## ... Procrustes: rmse 0.005717196  max resid 0.01831087
## Run 16 stress 0.0004476995
## ... Procrustes: rmse 0.005192685  max resid 0.02281701
## Run 17 stress 0.0006047168
## Run 18 stress 0.0004805207
## ... Procrustes: rmse 0.006078292  max resid 0.02986133
## Run 19 stress 0.0004473231
## ... Procrustes: rmse 0.005152894  max resid 0.01921683
## Run 20 stress 0.001147007
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
```

```
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.000458647
## ... Procrustes: rmse 0.005131152  max resid 0.01587224
## Run 2 stress 0.0004081924
## ... Procrustes: rmse 0.00475239  max resid 0.01423671
## Run 3 stress 0.0005947272
## Run 4 stress 0.0004192741
## ... Procrustes: rmse 0.005235056  max resid 0.0173711
## Run 5 stress 0.0003988062
## ... Procrustes: rmse 0.004913503  max resid 0.01745614
## Run 6 stress 0.0004874076
## ... Procrustes: rmse 0.005425429  max resid 0.0162259
## Run 7 stress 0.0004926066
## ... Procrustes: rmse 0.005424713  max resid 0.01855463
## Run 8 stress 0.0005921917
## Run 9 stress 0.001124558
## Run 10 stress 0.0003346649
## ... Procrustes: rmse 0.004423909  max resid 0.01497762
## Run 11 stress 0.0004706018
## ... Procrustes: rmse 0.005392677  max resid 0.0155085
## Run 12 stress 0.0004641669
## ... Procrustes: rmse 0.005035595  max resid 0.01451768
## Run 13 stress 0.0004052703
## ... Procrustes: rmse 0.005007414  max resid 0.01783611
## Run 14 stress 0.0005682315
## Run 15 stress 0.0003885082
## ... Procrustes: rmse 0.004627016  max resid 0.01307748
## Run 16 stress 0.0004787006
## ... Procrustes: rmse 0.005225682  max resid 0.01749443
## Run 17 stress 0.000412353
## ... Procrustes: rmse 0.004813917  max resid 0.01589261
## Run 18 stress 0.0004771856
## ... Procrustes: rmse 0.005494684  max resid 0.01854423
## Run 19 stress 0.0008165965
## Run 20 stress 0.0009529021
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004386872
## ... Procrustes: rmse 0.005167476  max resid 0.01320342
## Run 2 stress 0.0003851627
## ... Procrustes: rmse 0.004529108  max resid 0.009046003
## ... Similar to previous best
## Run 3 stress 0.000440222
## ... Procrustes: rmse 0.005020713  max resid 0.01528649
## Run 4 stress 0.0003862654
## ... Procrustes: rmse 0.004478915  max resid 0.01064947
## Run 5 stress 0.0003940104
## ... Procrustes: rmse 0.004801775  max resid 0.01256647
## Run 6 stress 0.0005482411
```

```
## Run 7 stress 0.000469529
## ... Procrustes: rmse 0.005339528  max resid 0.01536286
## Run 8 stress 0.0004441353
## ... Procrustes: rmse 0.004868276  max resid 0.01541422
## Run 9 stress 0.0005988357
## Run 10 stress 0.0004795674
## ... Procrustes: rmse 0.00489061  max resid 0.01604775
## Run 11 stress 0.0003364405
## ... Procrustes: rmse 0.004092695  max resid 0.009490261
## ... Similar to previous best
## Run 12 stress 0.0004713467
## ... Procrustes: rmse 0.005590559  max resid 0.0196877
## Run 13 stress 0.0005163153
## Run 14 stress 0.0003713653
## ... Procrustes: rmse 0.004687037  max resid 0.01607599
## Run 15 stress 0.0004773189
## ... Procrustes: rmse 0.005184948  max resid 0.01398926
## Run 16 stress 0.0003916446
## ... Procrustes: rmse 0.004660675  max resid 0.01455021
## Run 17 stress 0.0004617779
## ... Procrustes: rmse 0.005690114  max resid 0.01826704
## Run 18 stress 0.0006971087
## Run 19 stress 0.0004657464
## ... Procrustes: rmse 0.00561442  max resid 0.01698894
## Run 20 stress 0.0005037241
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004611626
## ... Procrustes: rmse 0.005184231  max resid 0.01459329
## Run 2 stress 0.0006643243
## Run 3 stress 0.0006510184
## Run 4 stress 0.0004826312
## ... Procrustes: rmse 0.005788346  max resid 0.01739141
## Run 5 stress 0.000418844
## ... Procrustes: rmse 0.004959508  max resid 0.01611533
## Run 6 stress 0.0007168619
## Run 7 stress 0.0008536065
## Run 8 stress 0.0004260006
## ... Procrustes: rmse 0.005130427  max resid 0.01489645
## Run 9 stress 0.0004783801
## ... Procrustes: rmse 0.005709284  max resid 0.01843894
## Run 10 stress 0.0005878764
## Run 11 stress 0.0005341017
## Run 12 stress 0.000436948
## ... Procrustes: rmse 0.005123799  max resid 0.01687579
## Run 13 stress 0.0006186388
## Run 14 stress 0.0005926729
## Run 15 stress 0.0005231585
## Run 16 stress 0.0004197504
## ... Procrustes: rmse 0.004928602  max resid 0.01458952
## Run 17 stress 0.0005985698
## Run 18 stress 0.0005933783
```

```
## Run 19 stress 0.0004937202
## ... Procrustes: rmse 0.005507648  max resid 0.01613101
## Run 20 stress 0.0005452212
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0003884745
## ... Procrustes: rmse 0.004730829  max resid 0.01403896
## Run 2 stress 0.0003945108
## ... Procrustes: rmse 0.004639343  max resid 0.0153742
## Run 3 stress 0.0003610633
## ... Procrustes: rmse 0.004466712  max resid 0.01179973
## Run 4 stress 0.0005295042
## Run 5 stress 0.0005499426
## Run 6 stress 0.000599463
## Run 7 stress 0.0005337307
## Run 8 stress 0.0006048186
## Run 9 stress 0.0004479166
## ... Procrustes: rmse 0.004967468  max resid 0.01241223
## Run 10 stress 0.0006116628
## Run 11 stress 0.0004664923
## ... Procrustes: rmse 0.004921696  max resid 0.01548568
## Run 12 stress 0.0004181723
## ... Procrustes: rmse 0.004724541  max resid 0.01479745
## Run 13 stress 0.0004401978
## ... Procrustes: rmse 0.00505685  max resid 0.01538469
## Run 14 stress 0.0004269552
## ... Procrustes: rmse 0.005109963  max resid 0.01661592
## Run 15 stress 0.0005831848
## Run 16 stress 0.000594683
## Run 17 stress 0.0004590805
## ... Procrustes: rmse 0.004808403  max resid 0.01476721
## Run 18 stress 0.0004194164
## ... Procrustes: rmse 0.004899752  max resid 0.01314893
## Run 19 stress 0.0005125512
## Run 20 stress 0.0006794644
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004501983
## ... Procrustes: rmse 0.005347039  max resid 0.02020663
## Run 2 stress 0.0005387694
## Run 3 stress 0.0003533458
## ... Procrustes: rmse 0.004341918  max resid 0.01071061
## Run 4 stress 0.0003715181
## ... Procrustes: rmse 0.004403228  max resid 0.01042339
## Run 5 stress 0.000371798
## ... Procrustes: rmse 0.004466793  max resid 0.0123604
## Run 6 stress 0.0004993743
## ... Procrustes: rmse 0.005231187  max resid 0.01324982
```

```
## Run 7 stress 0.0004117045
## ... Procrustes: rmse 0.004577465  max resid 0.01289122
## Run 8 stress 0.0004757492
## ... Procrustes: rmse 0.005274776  max resid 0.01479708
## Run 9 stress 0.000388695
## ... Procrustes: rmse 0.004704106  max resid 0.01454603
## Run 10 stress 0.0005454203
## Run 11 stress 0.0004261327
## ... Procrustes: rmse 0.004966054  max resid 0.01605063
## Run 12 stress 0.00056622
## Run 13 stress 0.0004921313
## ... Procrustes: rmse 0.005919409  max resid 0.02915295
## Run 14 stress 0.0004278361
## ... Procrustes: rmse 0.004804917  max resid 0.01327745
## Run 15 stress 0.0004094773
## ... Procrustes: rmse 0.004506446  max resid 0.01055224
## Run 16 stress 0.0004739816
## ... Procrustes: rmse 0.005077983  max resid 0.01462916
## Run 17 stress 0.0006347004
## Run 18 stress 0.0004725757
## ... Procrustes: rmse 0.005606579  max resid 0.02125889
## Run 19 stress 0.0005468089
## Run 20 stress 0.0004182963
## ... Procrustes: rmse 0.004580057  max resid 0.01271354
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0005930981
## Run 2 stress 0.0004007931
## ... Procrustes: rmse 0.004618928  max resid 0.01101441
## Run 3 stress 0.0004403594
## ... Procrustes: rmse 0.005029516  max resid 0.01418414
## Run 4 stress 0.000455233
## ... Procrustes: rmse 0.005122248  max resid 0.01587931
## Run 5 stress 0.0007016184
## Run 6 stress 0.0004458437
## ... Procrustes: rmse 0.004819854  max resid 0.013047
## Run 7 stress 0.0005337836
## Run 8 stress 0.0006325315
## Run 9 stress 0.0005003487
## Run 10 stress 0.0004494202
## ... Procrustes: rmse 0.004985834  max resid 0.01726439
## Run 11 stress 0.0003431561
## ... Procrustes: rmse 0.004293888  max resid 0.01061377
## Run 12 stress 0.0004898238
## ... Procrustes: rmse 0.005061923  max resid 0.01461245
## Run 13 stress 0.0005341613
## Run 14 stress 0.0005672028
## Run 15 stress 0.0004720184
## ... Procrustes: rmse 0.005441019  max resid 0.02222646
## Run 16 stress 0.0005002213
## Run 17 stress 0.0005640118
```

```
## Run 18 stress 0.0005462494
## Run 19 stress 0.0004525819
## ... Procrustes: rmse 0.005445559  max resid 0.01876027
## Run 20 stress 0.0004948557
## ... Procrustes: rmse 0.005414342  max resid 0.01860406
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004196063
## ... Procrustes: rmse 0.00477987  max resid 0.01325676
## Run 2 stress 0.0004611387
## ... Procrustes: rmse 0.004857467  max resid 0.01217926
## Run 3 stress 0.0004732843
## ... Procrustes: rmse 0.005359507  max resid 0.01884555
## Run 4 stress 0.0003751052
## ... Procrustes: rmse 0.004448399  max resid 0.01109394
## Run 5 stress 0.0003960318
## ... Procrustes: rmse 0.004783633  max resid 0.013874
## Run 6 stress 0.00042504
## ... Procrustes: rmse 0.005175027  max resid 0.01878656
## Run 7 stress 0.0003852573
## ... Procrustes: rmse 0.004461879  max resid 0.0105777
## Run 8 stress 0.0004606967
## ... Procrustes: rmse 0.004963918  max resid 0.01347311
## Run 9 stress 0.0004311905
## ... Procrustes: rmse 0.004810922  max resid 0.01267045
## Run 10 stress 0.0003685151
## ... Procrustes: rmse 0.004467154  max resid 0.01208761
## Run 11 stress 0.0003922678
## ... Procrustes: rmse 0.004615812  max resid 0.01053719
## Run 12 stress 0.0004792436
## ... Procrustes: rmse 0.005530123  max resid 0.02322893
## Run 13 stress 0.0004974978
## ... Procrustes: rmse 0.004964221  max resid 0.01092027
## Run 14 stress 0.0004675329
## ... Procrustes: rmse 0.005526609  max resid 0.02525665
## Run 15 stress 0.0004765358
## ... Procrustes: rmse 0.005248488  max resid 0.01546988
## Run 16 stress 0.0005948624
## Run 17 stress 0.0004206577
## ... Procrustes: rmse 0.004907211  max resid 0.01319157
## Run 18 stress 0.0007382036
## Run 19 stress 0.0004598609
## ... Procrustes: rmse 0.005223909  max resid 0.01439687
## Run 20 stress 0.0004196759
## ... Procrustes: rmse 0.004815639  max resid 0.01383896
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.000517777
```

```
## Run 2 stress 0.0005365675
## Run 3 stress 0.0005038109
## Run 4 stress 0.0008040117
## Run 5 stress 0.0005805951
## Run 6 stress 0.0005798173
## Run 7 stress 0.0006288577
## Run 8 stress 0.0004838384
## ... Procrustes: rmse 0.005835096  max resid 0.01811775
## Run 9 stress 0.0004026577
## ... Procrustes: rmse 0.004812336  max resid 0.01243242
## Run 10 stress 0.0005762296
## Run 11 stress 0.0005249393
## Run 12 stress 0.0004815223
## ... Procrustes: rmse 0.00570551  max resid 0.02910836
## Run 13 stress 0.0007275478
## Run 14 stress 0.0004772323
## ... Procrustes: rmse 0.005296696  max resid 0.01590608
## Run 15 stress 0.0005553102
## Run 16 stress 0.001517938
## Run 17 stress 0.0004610895
## ... Procrustes: rmse 0.005314352  max resid 0.01998285
## Run 18 stress 0.0008541508
## Run 19 stress 0.0003906438
## ... Procrustes: rmse 0.005222449  max resid 0.01906338
## Run 20 stress 0.0005818092
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.000536869
## Run 2 stress 0.0005944849
## Run 3 stress 0.0004382338
## ... Procrustes: rmse 0.005034645  max resid 0.01396779
## Run 4 stress 0.0005861781
## Run 5 stress 0.000607862
## Run 6 stress 0.0007920642
## Run 7 stress 0.0004670787
## ... Procrustes: rmse 0.005159995  max resid 0.01628386
## Run 8 stress 0.0005209596
## Run 9 stress 0.0004320094
## ... Procrustes: rmse 0.004802521  max resid 0.01557097
## Run 10 stress 0.0005673343
## Run 11 stress 0.0005455907
## Run 12 stress 0.000425836
## ... Procrustes: rmse 0.004732468  max resid 0.01241271
## Run 13 stress 0.0004602578
## ... Procrustes: rmse 0.005175783  max resid 0.01405638
## Run 14 stress 0.0005039158
## Run 15 stress 0.0004344303
## ... Procrustes: rmse 0.004921905  max resid 0.01176466
## Run 16 stress 0.0005325958
## Run 17 stress 0.0005487713
## Run 18 stress 0.000561914
```

```
## Run 19 stress 0.0004921097
## ... Procrustes: rmse 0.005517482  max resid 0.01565179
## Run 20 stress 0.0004958356
## ... Procrustes: rmse 0.005632037  max resid 0.01480135
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.00069802
## Run 2 stress 0.0005174692
## Run 3 stress 0.0004950533
## ... Procrustes: rmse 0.005671879  max resid 0.0276977
## Run 4 stress 0.0004735289
## ... Procrustes: rmse 0.006028648  max resid 0.02408865
## Run 5 stress 0.0005694497
## Run 6 stress 0.0005706884
## Run 7 stress 0.0006074378
## Run 8 stress 0.0006794041
## Run 9 stress 0.001068076
## Run 10 stress 0.0004280602
## ... Procrustes: rmse 0.00506947  max resid 0.01733427
## Run 11 stress 0.0005666571
## Run 12 stress 0.0005469742
## Run 13 stress 0.0007215599
## Run 14 stress 0.0006150994
## Run 15 stress 0.000660983
## Run 16 stress 0.000742661
## Run 17 stress 0.0005573478
## Run 18 stress 0.0006937485
## Run 19 stress 0.0005775004
## Run 20 stress 0.0008892378
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004518405
## ... Procrustes: rmse 0.004960556  max resid 0.0114167
## Run 2 stress 0.0003860508
## ... Procrustes: rmse 0.004620662  max resid 0.01077422
## Run 3 stress 0.0005063448
## Run 4 stress 0.0004810757
## ... Procrustes: rmse 0.005477601  max resid 0.01511289
## Run 5 stress 0.0004658155
## ... Procrustes: rmse 0.005566324  max resid 0.02096146
## Run 6 stress 0.0004594862
## ... Procrustes: rmse 0.005240058  max resid 0.01316132
## Run 7 stress 0.0004415514
## ... Procrustes: rmse 0.004811375  max resid 0.0105544
## Run 8 stress 0.0004765861
## ... Procrustes: rmse 0.005121637  max resid 0.01449769
## Run 9 stress 0.0004286306
## ... Procrustes: rmse 0.004970759  max resid 0.01212251
```

```
## Run 10 stress 0.0004157479
## ... Procrustes: rmse 0.004852042  max resid 0.01468665
## Run 11 stress 0.0007331697
## Run 12 stress 0.0006240698
## Run 13 stress 0.0005248582
## Run 14 stress 0.0003753505
## ... Procrustes: rmse 0.00439436  max resid 0.01051402
## Run 15 stress 0.0006559751
## Run 16 stress 0.0004912065
## ... Procrustes: rmse 0.005759792  max resid 0.01841622
## Run 17 stress 0.0004479244
## ... Procrustes: rmse 0.005274933  max resid 0.02013365
## Run 18 stress 0.0007462102
## Run 19 stress 0.0004569526
## ... Procrustes: rmse 0.004998256  max resid 0.01305544
## Run 20 stress 0.0006290575
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0005414361
## Run 2 stress 0.0004732816
## ... Procrustes: rmse 0.005497334  max resid 0.01490058
## Run 3 stress 0.000527007
## Run 4 stress 0.000403682
## ... Procrustes: rmse 0.005070657  max resid 0.01400513
## Run 5 stress 0.000644298
## Run 6 stress 0.0004745473
## ... Procrustes: rmse 0.005097033  max resid 0.01810327
## Run 7 stress 0.0004489529
## ... Procrustes: rmse 0.004716411  max resid 0.01142385
## Run 8 stress 0.0004504936
## ... Procrustes: rmse 0.005088421  max resid 0.01508153
## Run 9 stress 0.0006872354
## Run 10 stress 0.0005747361
## Run 11 stress 0.0004073331
## ... Procrustes: rmse 0.004798305  max resid 0.0146343
## Run 12 stress 0.0004870971
## ... Procrustes: rmse 0.004899019  max resid 0.01763566
## Run 13 stress 0.0005505772
## Run 14 stress 0.0005913461
## Run 15 stress 0.00046693
## ... Procrustes: rmse 0.005000532  max resid 0.01397347
## Run 16 stress 0.0003725427
## ... Procrustes: rmse 0.004476337  max resid 0.009891136
## ... Similar to previous best
## Run 17 stress 0.0004830932
## ... Procrustes: rmse 0.005207202  max resid 0.01305419
## Run 18 stress 0.0004906369
## ... Procrustes: rmse 0.005220622  max resid 0.01486686
## Run 19 stress 0.0004350859
## ... Procrustes: rmse 0.005237505  max resid 0.0181065
## Run 20 stress 0.0004510633
```

```
## ... Procrustes: rmse 0.004896955  max resid 0.0135501
## *** Solution reached
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004695579
## ... Procrustes: rmse 0.005284649  max resid 0.01441023
## Run 2 stress 0.0004663508
## ... Procrustes: rmse 0.005766387  max resid 0.02073439
## Run 3 stress 0.0004450881
## ... Procrustes: rmse 0.004676867  max resid 0.01021147
## Run 4 stress 0.0004649261
## ... Procrustes: rmse 0.005116957  max resid 0.01535129
## Run 5 stress 0.0005524984
## Run 6 stress 0.0006337814
## Run 7 stress 0.0005623941
## Run 8 stress 0.0005821114
## Run 9 stress 0.0004187652
## ... Procrustes: rmse 0.004772471  max resid 0.01415544
## Run 10 stress 0.0004183074
## ... Procrustes: rmse 0.005055107  max resid 0.01351353
## Run 11 stress 0.0004386209
## ... Procrustes: rmse 0.004967638  max resid 0.01669514
## Run 12 stress 0.0005223265
## Run 13 stress 0.000860948
## Run 14 stress 0.0005032378
## Run 15 stress 0.0006127553
## Run 16 stress 0.0004873431
## ... Procrustes: rmse 0.005380526  max resid 0.01424941
## Run 17 stress 0.0004517671
## ... Procrustes: rmse 0.005040282  max resid 0.01193889
## Run 18 stress 0.0005659553
## Run 19 stress 0.0004868749
## ... Procrustes: rmse 0.005432114  max resid 0.02035278
## Run 20 stress 0.0006329975
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0003895026
## ... Procrustes: rmse 0.004674401  max resid 0.01499304
## Run 2 stress 0.0004742204
## ... Procrustes: rmse 0.004935586  max resid 0.01044968
## Run 3 stress 0.0003978963
## ... Procrustes: rmse 0.004545107  max resid 0.0123453
## Run 4 stress 0.0004026084
## ... Procrustes: rmse 0.004845973  max resid 0.01615255
## Run 5 stress 0.0004858796
## ... Procrustes: rmse 0.004992176  max resid 0.01551884
## Run 6 stress 0.0006357634
## Run 7 stress 0.0004056945
## ... Procrustes: rmse 0.004742397  max resid 0.01347686
## Run 8 stress 0.0004130652
```

```
## ... Procrustes: rmse 0.004842058  max resid 0.01401873
## Run 9 stress 0.0005906639
## Run 10 stress 0.0003704242
## ... Procrustes: rmse 0.004401449  max resid 0.01189364
## Run 11 stress 0.0004341691
## ... Procrustes: rmse 0.005052587  max resid 0.0176683
## Run 12 stress 0.0004257157
## ... Procrustes: rmse 0.004921532  max resid 0.01275592
## Run 13 stress 0.0004936003
## ... Procrustes: rmse 0.005162558  max resid 0.0163476
## Run 14 stress 0.0003425155
## ... Procrustes: rmse 0.004415333  max resid 0.01322124
## Run 15 stress 0.0004821713
## ... Procrustes: rmse 0.005088705  max resid 0.01542911
## Run 16 stress 0.000563866
## Run 17 stress 0.0004270452
## ... Procrustes: rmse 0.004759913  max resid 0.01174576
## Run 18 stress 0.0004285081
## ... Procrustes: rmse 0.004896283  max resid 0.0159918
## Run 19 stress 0.0004678
## ... Procrustes: rmse 0.004718525  max resid 0.01122712
## Run 20 stress 0.0004834018
## ... Procrustes: rmse 0.005418878  max resid 0.01407444
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004512037
## ... Procrustes: rmse 0.005010605  max resid 0.01584659
## Run 2 stress 0.0009128472
## Run 3 stress 0.0008547077
## Run 4 stress 0.0005547805
## Run 5 stress 0.0006774786
## Run 6 stress 0.0006558865
## Run 7 stress 0.000510728
## Run 8 stress 0.0004031895
## ... Procrustes: rmse 0.004977315  max resid 0.0139397
## Run 9 stress 0.0005878435
## Run 10 stress 0.0003924614
## ... Procrustes: rmse 0.004879782  max resid 0.0134219
## Run 11 stress 0.0004641523
## ... Procrustes: rmse 0.005716633  max resid 0.02470892
## Run 12 stress 0.000563457
## Run 13 stress 0.0004739926
## ... Procrustes: rmse 0.006029207  max resid 0.02778633
## Run 14 stress 0.0004459624
## ... Procrustes: rmse 0.005216729  max resid 0.01602535
## Run 15 stress 0.001049379
## Run 16 stress 0.0006792044
## Run 17 stress 0.0009594222
## Run 18 stress 0.0004846038
## ... Procrustes: rmse 0.005373168  max resid 0.01353464
## Run 19 stress 0.0003940151
```

```
## ... Procrustes: rmse 0.004592631  max resid 0.01186574
## Run 20 stress 0.0004948971
## ... Procrustes: rmse 0.00547592  max resid 0.01500239
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0005378642
## Run 2 stress 0.0005798348
## Run 3 stress 0.0005534554
## Run 4 stress 0.0004328196
## ... Procrustes: rmse 0.004898754  max resid 0.01393035
## Run 5 stress 0.0004090224
## ... Procrustes: rmse 0.004644646  max resid 0.01342787
## Run 6 stress 0.0004445248
## ... Procrustes: rmse 0.005064931  max resid 0.01238682
## Run 7 stress 0.000439781
## ... Procrustes: rmse 0.005026963  max resid 0.01346465
## Run 8 stress 0.0004958564
## ... Procrustes: rmse 0.005603935  max resid 0.01843942
## Run 9 stress 0.0004718366
## ... Procrustes: rmse 0.005188415  max resid 0.01245324
## Run 10 stress 0.0003925296
## ... Procrustes: rmse 0.004725913  max resid 0.01430496
## Run 11 stress 0.0004094929
## ... Procrustes: rmse 0.004978857  max resid 0.0190283
## Run 12 stress 0.0004654914
## ... Procrustes: rmse 0.005194143  max resid 0.01736208
## Run 13 stress 0.0004598048
## ... Procrustes: rmse 0.00565439  max resid 0.02253329
## Run 14 stress 0.0004194712
## ... Procrustes: rmse 0.004895124  max resid 0.0144346
## Run 15 stress 0.0007202615
## Run 16 stress 0.0005172881
## Run 17 stress 0.0004462813
## ... Procrustes: rmse 0.005337336  max resid 0.02094668
## Run 18 stress 0.0004324458
## ... Procrustes: rmse 0.004835085  max resid 0.01245974
## Run 19 stress 0.000474525
## ... Procrustes: rmse 0.005375523  max resid 0.01820593
## Run 20 stress 0.0005250701
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.0004639148
## ... Procrustes: rmse 0.005600453  max resid 0.01767614
## Run 2 stress 0.0004579071
## ... Procrustes: rmse 0.005219756  max resid 0.01908389
## Run 3 stress 0.0006719859
## Run 4 stress 0.0007725451
## Run 5 stress 0.0004129012
```

```
## ... Procrustes: rmse 0.004854343  max resid 0.01831718
## Run 6 stress 0.0003739024
## ... Procrustes: rmse 0.004314367  max resid 0.01167401
## Run 7 stress 0.002877246
## Run 8 stress 0.0005742812
## Run 9 stress 0.0006448752
## Run 10 stress 0.0003972493
## ... Procrustes: rmse 0.004586098  max resid 0.01613808
## Run 11 stress 0.0005977732
## Run 12 stress 0.0004241251
## ... Procrustes: rmse 0.004954806  max resid 0.01376902
## Run 13 stress 0.0003905272
## ... Procrustes: rmse 0.0046248  max resid 0.01473119
## Run 14 stress 0.0004214236
## ... Procrustes: rmse 0.004663302  max resid 0.01854472
## Run 15 stress 0.0003283945
## ... Procrustes: rmse 0.003909506  max resid 0.01238647
## Run 16 stress 0.0004039646
## ... Procrustes: rmse 0.004626327  max resid 0.01494504
## Run 17 stress 0.0003902465
## ... Procrustes: rmse 0.004387353  max resid 0.01129036
## Run 18 stress 0.0007388838
## Run 19 stress 0.0004069744
## ... Procrustes: rmse 0.004759032  max resid 0.01372985
## Run 20 stress 0.0006459243
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
```

```
# Note: results are hidden (too long)
```

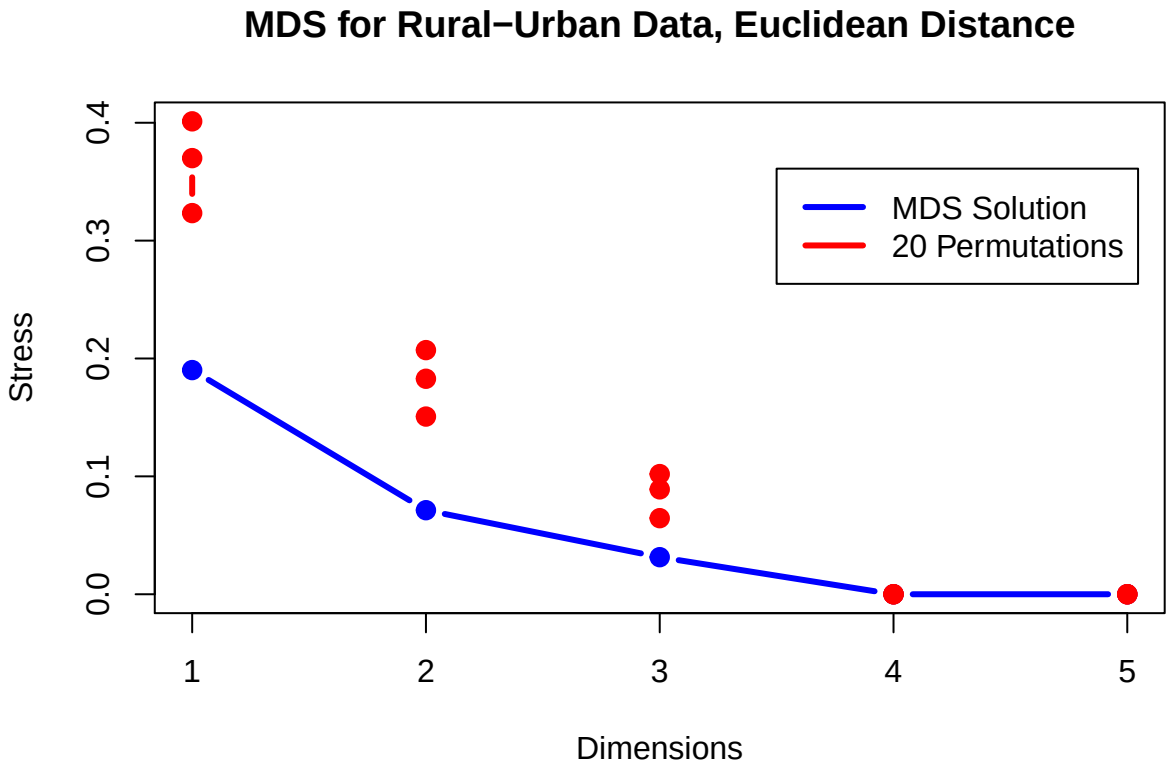
6

Discuss the stress (or SStress) of each dimensional solution. Make a scree plot if you're able.

```
#plot stress results

plot(c(1:5), results[21, ], type = "b", col = "blue", lwd = 3,
     ylim = c(0, max(results)), xlab = "Dimensions", ylab = "Stress", pch = 19,
     main = "MDS for Rural-Urban Data, Euclidean Distance")
mins <- apply(results[1:20, ], 2, min)
maxs <- apply(results[1:20, ], 2, max)
meds <- apply(results[1:20, ], 2, median)

for (i in 1:5){
  points(rep(i, 3), c(mins[i], meds[i], maxs[i]), type = "b", col = "red", lwd = 3, pch = 19)
}
legend(3.5, (.9*max(results)), c("MDS Solution", "20 Permutations"), lwd = 3, col = c("blue", "red"))
```



After performing multidimensional scaling for 1-5 dimensions, the above scree plot for stress illustrates an elbow at 2 dimensions. This stress level is below 10% and indicates a good fit. For 3 dimensions, the stress is below 5% and indicates an excellent fit. After 3 dimensions, random chance could result in comparable stress values.

Stress is a measure of the difference between actual pairwise distances and calculated reference distances; a lower stress indicates a better fit. As the dimensions exceeds that of the data (for 4 and 5 dimensions), the stress goes to 0.

7

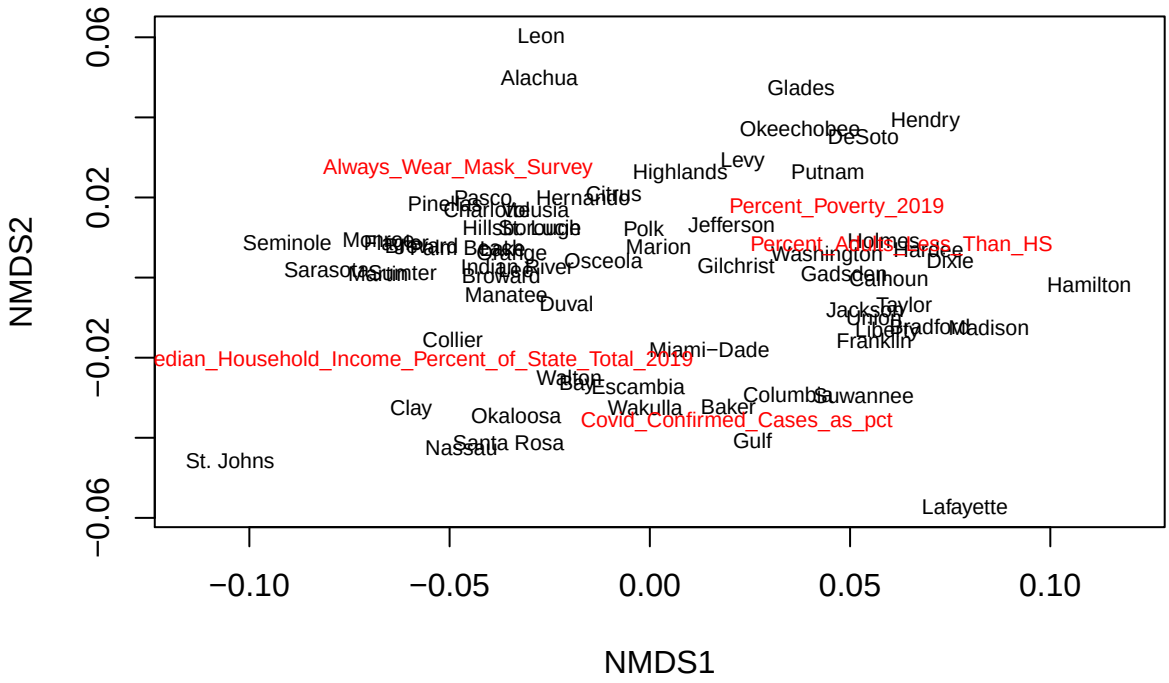
Make a two dimensional plot of your MDS results.

```
data_ord_base.mds2 <- metaMDS(data_ord_base, k = 2, distance = "euclidean")
```

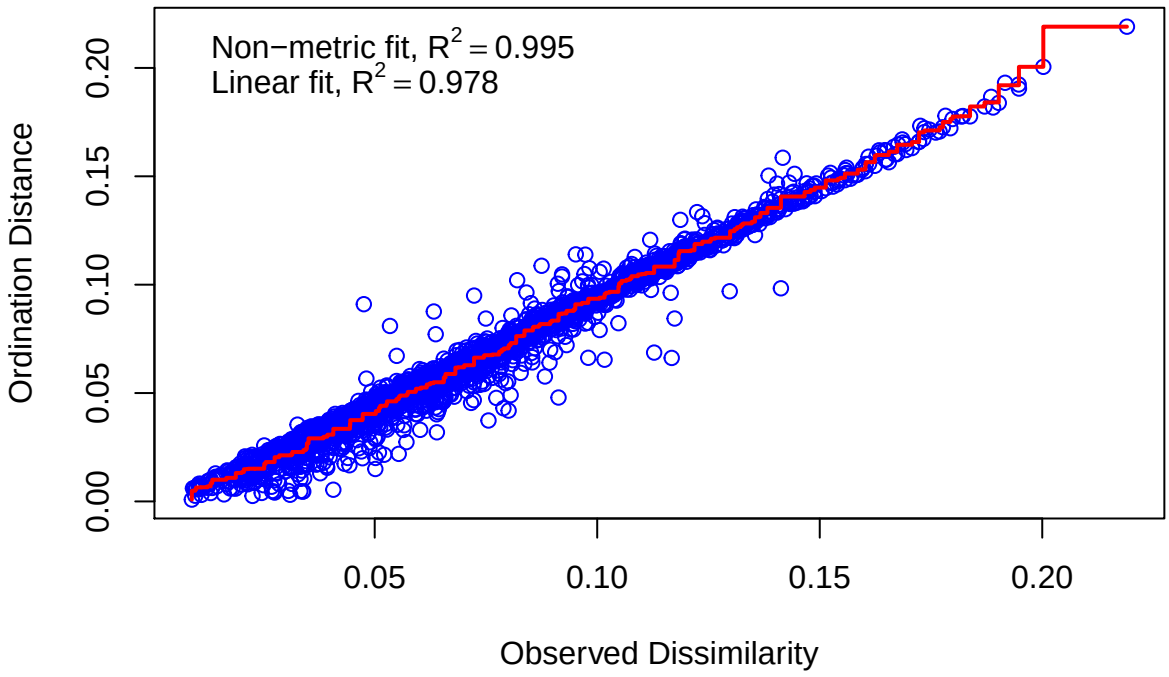
```
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0.0762502
## Run 1 stress 0.0762502
## ... Procrustes: rmse 1.859418e-05  max resid 0.000112468
## ... Similar to previous best
## Run 2 stress 0.1170143
## Run 3 stress 0.08194625
## Run 4 stress 0.07130038
## ... New best solution
## ... Procrustes: rmse 0.03267111  max resid 0.2604133
## Run 5 stress 0.08614369
## Run 6 stress 0.0762502
## Run 7 stress 0.08194625
## Run 8 stress 0.0762502
```

```
## Run 9 stress 0.1141897
## Run 10 stress 0.07130038
## ... Procrustes: rmse 3.113605e-05  max resid 0.0001531951
## ... Similar to previous best
## Run 11 stress 0.07130037
## ... New best solution
## ... Procrustes: rmse 1.728025e-05  max resid 8.461163e-05
## ... Similar to previous best
## Run 12 stress 0.07625026
## Run 13 stress 0.07130038
## ... Procrustes: rmse 1.476846e-05  max resid 8.558151e-05
## ... Similar to previous best
## Run 14 stress 0.07625021
## Run 15 stress 0.1140798
## Run 16 stress 0.08194626
## Run 17 stress 0.07130037
## ... New best solution
## ... Procrustes: rmse 1.115282e-05  max resid 5.662036e-05
## ... Similar to previous best
## Run 18 stress 0.1123923
## Run 19 stress 0.07130053
## ... Procrustes: rmse 2.161615e-05  max resid 9.346925e-05
## ... Similar to previous best
## Run 20 stress 0.1101749
## *** Solution reached
```

```
plot(data_ord_base.mds2, type = "t")
```




```
stressplot(data_ord_base.mds2)
```



The R-squared values seem sufficiently high with the two dimensional MDS result.

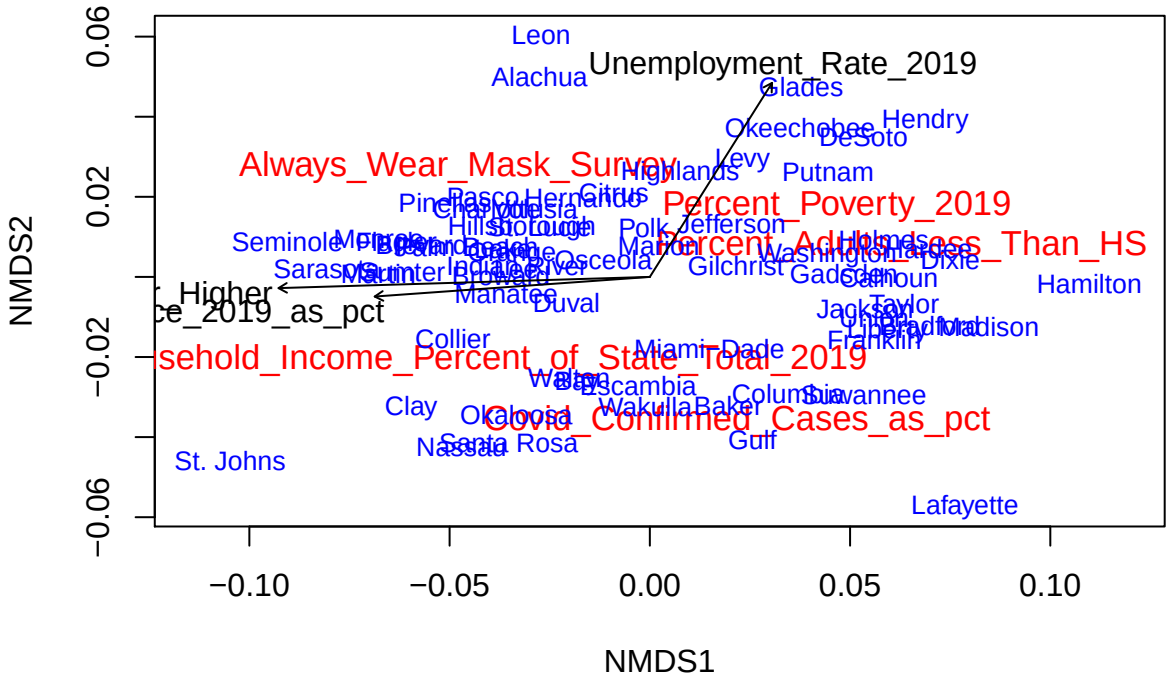
8

If possible, overlay some other continuous variable(s) to interpret your ordination axes. Calculate p-values for the overlaid additional variable(s). If you can, get some non-linear wireplots of the these overlaid variables (see examples online in R).

We can also add environmental variables to our plot.

```
fig <- ordiplot(data_ord_base.mds2, type = "none", cex = 1.1)
text(fig, "species", col = "red", cex = 1.1)
text(fig, "sites", col = "blue", cex = 0.8)

fit <- envfit(data_ord_base.mds2, data_ord_env, permutations = 1000)
plot(fit, col = "black", lwd = 3)
```




```
fit <- envfit(data_ord_base_ca, data_ord_env, permutations = 1000)
fit
```

```
##
## ***VECTORS
##
##                                     CA1      CA2     r2   Pr(>r)
## Unemployment_Rate_2019              0.93609 -0.35176 0.2400 0.001998 **
## Civilian_Labor_Force_2019_as_pct   -0.97424 -0.22551 0.4110 0.000999 ***
## Percent_Adults_Bachelors_or_Higher -0.99468 -0.10305 0.6962 0.000999 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## Permutation: free
## Number of permutations: 1000
```

The three overlaid continuous variables above are all significant with p<0.05. This is graphically suggested by the long length of the lines.

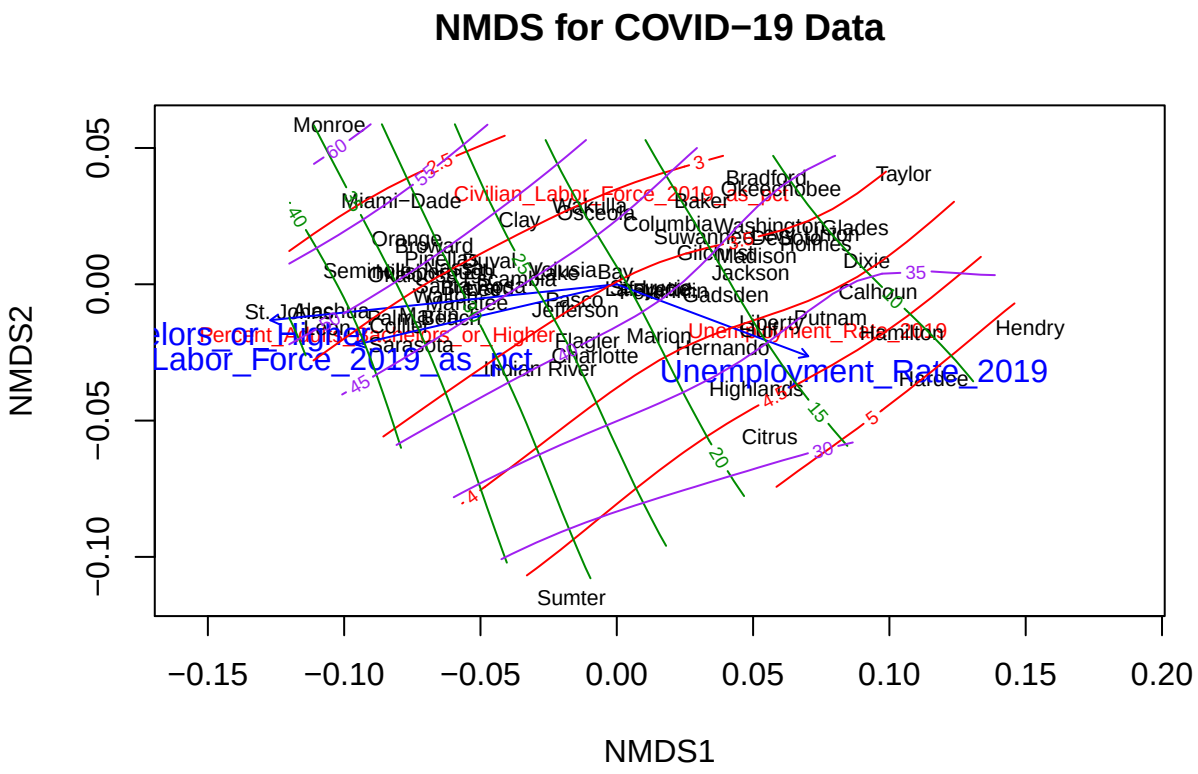
```
mds4 <- metaMDS(data_ord_env, distance="euclidean", k=4)
```

```
## Square root transformation
## Wisconsin double standardization
## Run 0 stress 0
## Run 1 stress 0.002553686
## Run 2 stress 0.0006303668
## Run 3 stress 0.0006968218
## Run 4 stress 0.0006541689
## Run 5 stress 0.0007425096
## Run 6 stress 0.0005384329
## Run 7 stress 0.0006075129
## Run 8 stress 0.0008262328
## Run 9 stress 0.0006916412
## Run 10 stress 0.0008063321
## Run 11 stress 0.0007344
```

```
## Run 12 stress 0.0006448313
## Run 13 stress 0.0007425081
## Run 14 stress 0.0008359579
## Run 15 stress 0.001081682
## Run 16 stress 0.0009508972
## Run 17 stress 0.0008044588
## Run 18 stress 0.004969711
## Run 19 stress 0.004780089
## Run 20 stress 0.0006587022
## *** No convergence -- monoMDS stopping criteria:
##     20: no. of iterations >= maxit
```

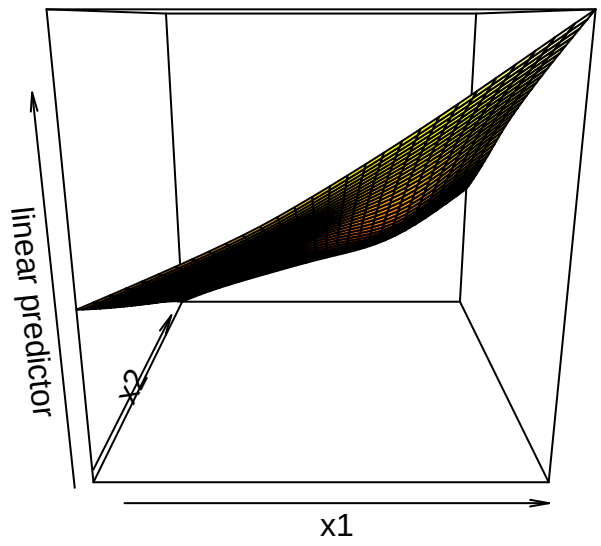
```
## Warning in metaMDS(data_ord_env, distance = "euclidean", k = 4): stress is
## (nearly) zero: you may have insufficient data
```

```
fig <- ordiplot(mds4, type = "none", cex = 1.1, main = "NMDS for COVID-19 Data")
text(fig, "species", col = "red", cex = 0.7)
text(fig, "sites", col = "black", cex = 0.7)
plot(fit)
tmp1 <- with(data_ord_env, ordisurf(mds4, Unemployment_Rate_2019, add = TRUE))
tmp2 <- with(data_ord_env, ordisurf(mds4, Percent_Adults_Bachelors_or_Higher,
                                    add = TRUE, col = "green4"))
tmp3 <- with(data_ord_env, ordisurf(mds4, Civilian_Labor_Force_2019_as_pct,
                                    add = TRUE, col = "purple"))
```



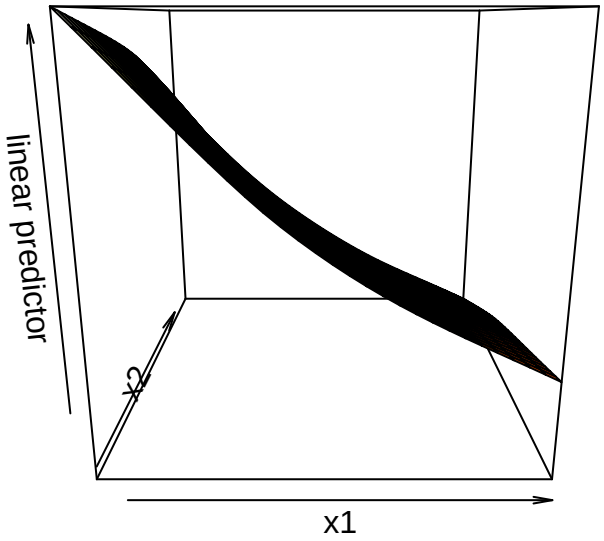

```
vis.gam(tmp1, main = "Unemployment Rate")
```

Unemployment Rate



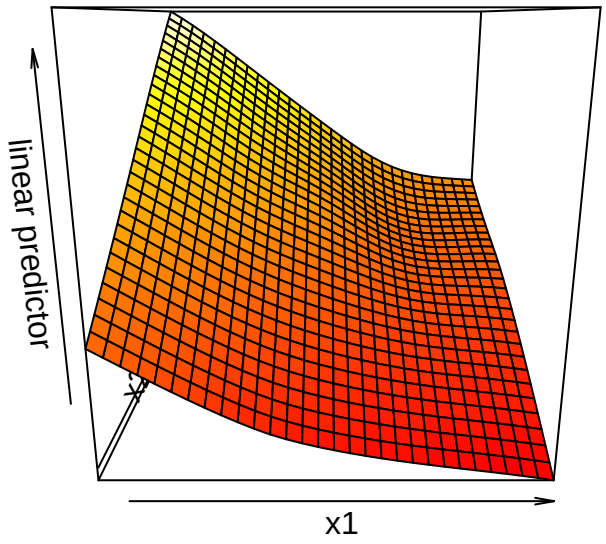

```
vis.gam(tmp2, main = "Percentage of Adults with Bachelor's or Higher")
```

Percentage of Adults with Bachelor's or Higher




```
vis.gam(tmp3, main = "Civilian Labor Force Percentage")
```

Civilian Labor Force Percentage



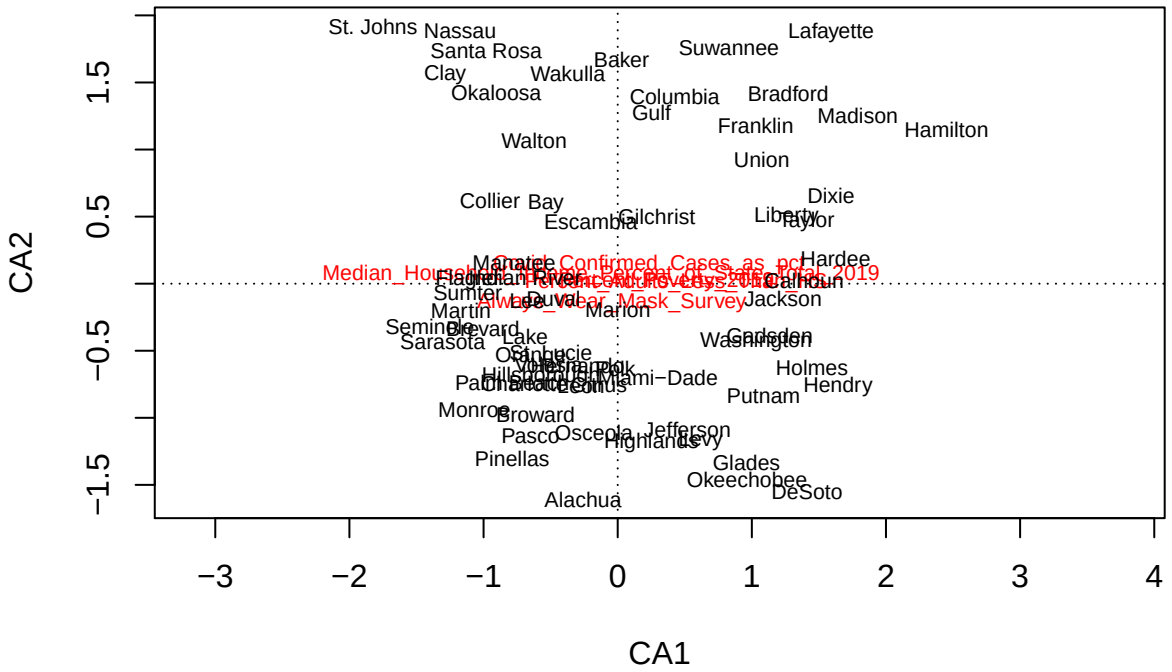
9

Again, assuming you have at least one additional continuous variable, perform canonical correspondence analysis.

As directed, here we'll perform CCA – both with and without (or the other way around) the environmental variables.

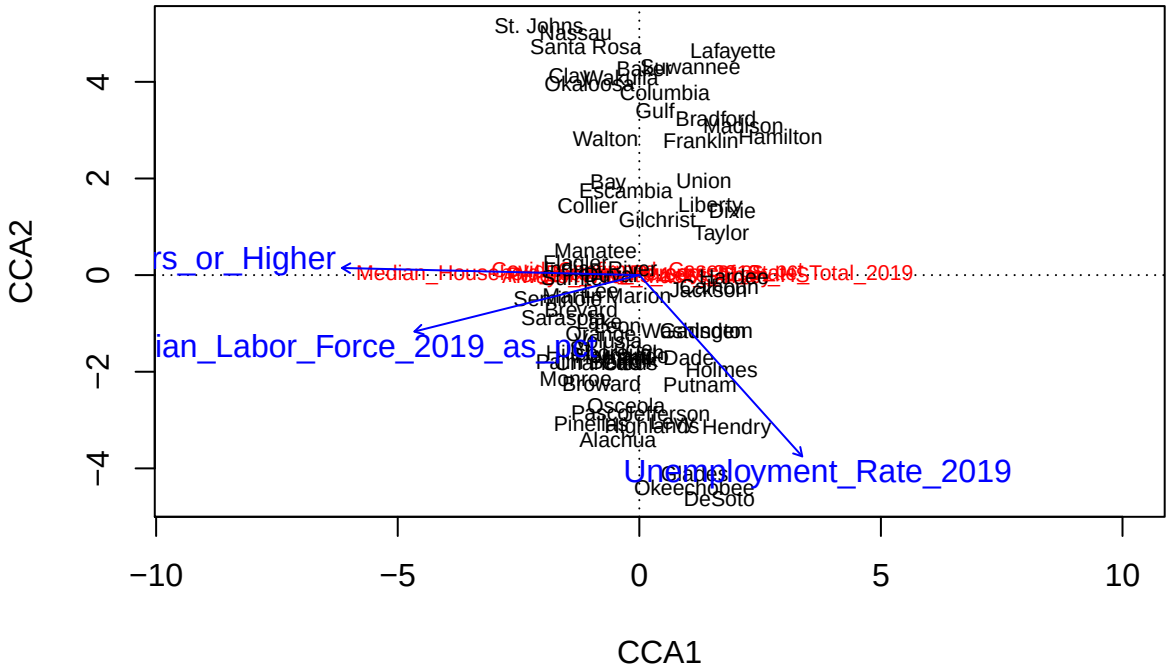
```
data_ord_base_cca1 <- cca(data_ord_base, scale="FALSE")
data_ord_base_cca2 <- cca(data_ord_base, data_ord_env, scale="FALSE")
plot(data_ord_base_cca1, main="CCA without env")
```

CCA without env




```
plot(data_ord_base_cca2, main="CCA with env")
```

CCA with env

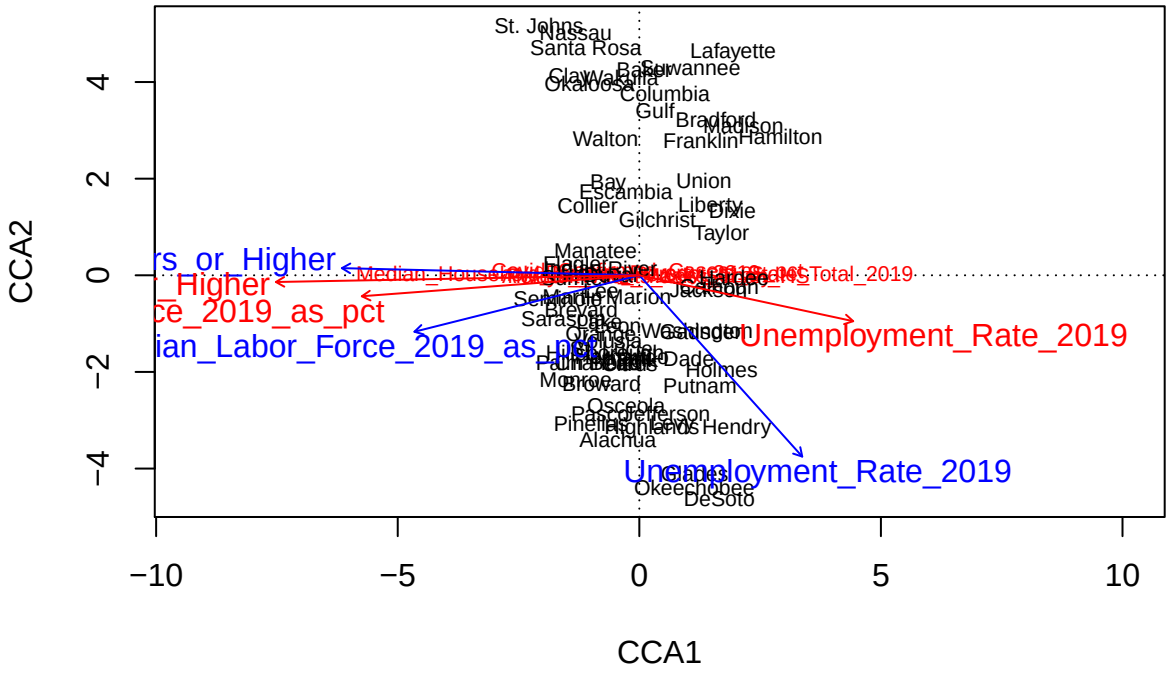



```
#plot(data_ord_base_cca, main = "CCA for Rural-Urban Type", type = "n")
#points(data_ord_base_cca, pch = 19, col = "red", cex = 1)
#text(data_ord_base_cca, "species", col = "blue", cex = 0.7)
#text(data_ord_base_cca, display = c("sites"), labels = rownames(data_ord_base), cex = 0.5)
```

```
(fit_cca <- envfit(data_ord_base_cca2, data_ord_env, permutations=1000))
```

```
##
## ***VECTORS
##
##                                      CCA1      CCA2     r2   Pr(>r)
## Unemployment_Rate_2019              0.977760 -0.209739 0.2553 0.000999 ***
## Civilian_Labor_Force_2019_as_pct   -0.997160 -0.075256 0.4131 0.000999 ***
## Percent_Adults_Bachelors_or_Higher -0.999830 -0.018480 0.7048 0.000999 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
## Permutation: free
## Number of permutations: 1000
```

```
plot(data_ord_base_cca2)
plot(fit_cca, col = "red", lwd = 3)
```




```
summary(data_ord_base_cca2)
```

```
##
## Call:
## cca(X = data_ord_base, Y = data_ord_env, scale = "FALSE")
##
## Partitioning of scaled Chi-square:
##               Inertia Proportion
## Total         0.05033     1.0000
## Constrained   0.02673     0.5312
## Unconstrained 0.02360     0.4688
##
## Eigenvalues, and their contribution to the scaled Chi-square
##
## Importance of components:
##                          CCA1     CCA2      CCA3     CA1     CA2      CA3
```

```
## Eigenvalue            0.02517 0.001433 0.0001286 0.01225 0.00795 0.002016
## Proportion Explained  0.50014 0.028465 0.0025542 0.24348 0.15796 0.040061
## Cumulative Proportion 0.50014 0.528601 0.5311551 0.77463 0.93259 0.972652
##                           CA4
## Eigenvalue            0.001376
## Proportion Explained  0.027348
## Cumulative Proportion 1.000000
##
## Accumulated constrained eigenvalues
## Importance of components:
##                          CCA1     CCA2      CCA3
## Eigenvalue            0.02517 0.001433 0.0001286
## Proportion Explained  0.94160 0.053590 0.0048088
## Cumulative Proportion 0.94160 0.995191 1.0000000
##
## Scaling 2 for species and site scores
## * Species are scaled proportional to eigenvalues
## * Sites are unscaled: weighted dispersion equal on all dimensions
##
##
## Species scores
##
##                                                        CCA1     CCA2      CCA3
## Always_Wear_Mask_Survey                             -0.05278 -0.05184  0.004032
## Median_Household_Income_Percent_of_State_Total_2019 -0.09263  0.02673 -0.003443
## Percent_Poverty_2019                                 0.28361  0.01487 -0.020196
## Percent_Adults_Less_Than_HS                          0.39865 -0.01652  0.001006
## Covid_Confirmed_Cases_as_pct                         0.17152  0.06858  0.043256
##                                                         CA1      CA2       CA3
## Always_Wear_Mask_Survey                             -0.03731  0.12488 -0.002997
## Median_Household_Income_Percent_of_State_Total_2019  0.09936 -0.03903  0.005827
## Percent_Poverty_2019                                -0.22620 -0.08500  0.111714
## Percent_Adults_Less_Than_HS                         -0.16894 -0.05727 -0.102570
## Covid_Confirmed_Cases_as_pct                        -0.12422 -0.18453 -0.063076
##
##
## Site scores (weighted averages of species scores)
##
##                 CCA1     CCA2      CCA3      CA1       CA2      CA3
## Alachua      -0.44270 -3.40786  -0.24161 -2.85980  0.330773  1.25210
## Baker         0.10024  4.26789   0.42300  1.55293 -0.777995  0.29274
## Bay          -0.64438  1.89645   3.41489  1.04832 -1.052120  0.56516
## Bradford      1.58692  3.23318  -4.78274 -0.08183 -1.114071  0.46772
## Brevard      -1.20371 -0.70458  -2.04920  0.64061  0.584208  0.35922
## Broward      -0.78323 -2.24673   4.48190 -0.56799  0.490985 -0.42667
## Calhoun       1.65422 -0.23416   2.50777 -0.54201 -0.193127 -0.38618
## Charlotte    -0.85407 -1.79553  -2.14568  0.79143  1.385045  0.58618
## Citrus       -0.20269 -1.81547  -3.34039  0.73548  0.866036  1.24778
## Clay         -1.44785  4.10021  -2.85479  2.36989 -0.826960  0.41909
## Collier      -1.06933  1.44385  -1.13605  0.10109 -0.693334 -1.60439
## Columbia      0.53112  3.77349   1.32211  0.49487 -1.132029  0.77115
## DeSoto        1.65614 -4.61067   1.16665 -1.24409  1.679176 -1.08893
## Dixie         1.92664  1.34252  -6.60205 -0.62286 -0.748921  1.16633
## Duval        -0.59565  0.02211   1.40287 -0.13757 -0.465944  0.39331
```

```
## Escambia     -0.27687  1.74232   1.67822 -0.22159 -0.703872  1.20944
## Flagler      -1.31372  0.20796  -4.24471  1.62497  0.553084  0.85203
## Franklin      1.27565  2.79012  -1.24754 -0.56045 -1.369445 -0.23333
## Gadsden       1.32128 -1.15008   4.38857 -1.08992 -0.501499 -0.58992
## Gilchrist     0.37703  1.16008  -4.16196  0.72436  0.130178  0.93945
## Glades        1.14550 -4.10171  -3.33032 -0.12684  1.473841 -0.30031
## Gulf          0.32654  3.40464   7.44655  0.81659 -2.320638 -0.66988
## Hamilton      2.92405  2.86542 -11.62673 -1.93242 -1.893437  3.02394
## Hardee        1.96030 -0.03744  -1.83912 -0.69453 -1.048443 -0.31393
## Hendry        2.01789 -3.18102   2.53173 -0.30451 -0.804561 -2.95680
## Hernando     -0.36066 -1.67076  -2.82344  1.06470  0.998128  0.50630
## Highlands     0.26128 -3.16753  -1.63842  0.06873  1.183650  0.38727
## Hillsborough -0.71013 -1.63661  -0.72228 -0.59068  0.236228  0.02218
## Holmes        1.70129 -1.95197   3.75463 -0.98807  0.815789 -0.73717
## Indian River -0.80417  0.13399  -2.23177  0.48561 -0.003610 -0.15747
## Jackson       1.43155 -0.29918   6.38724 -0.94451 -0.007011 -0.43450
## Jefferson     0.56973 -2.86330   2.89773 -1.17235  1.130851 -0.60445
## Lafayette     1.94225  4.61041  15.16637 -1.27467 -1.769550 -3.32407
## Lake         -0.82846 -0.95936  -0.81247  0.92437  1.089037  0.26855
## Lee          -0.79304 -0.31602  -0.35654  0.36711  0.453950 -0.39778
## Leon         -0.44762 -1.03335  -1.77355 -2.97313 -1.020685  1.87070
## Levy          0.68588 -3.08008  -3.45481 -0.10012  1.332323  1.50243
## Liberty       1.47275  1.42754   0.60829 -0.79446 -0.277589  0.99307
## Madison       2.15379  3.10521  -4.23025 -1.34032 -2.244500  1.29918
## Manatee      -0.90616  0.51169  -0.76392  0.39430  0.158330 -0.19494
## Marion       -0.01206 -0.42917  -2.30415  0.33564  0.456923  0.80712
## Martin       -1.38051 -0.43010  -0.93709  0.49063  0.525289 -0.53174
## Miami-Dade    0.30614 -1.71364  10.82034 -1.67193  0.359637 -1.97126
## Monroe       -1.31414 -2.14927   2.34747 -0.07716  0.763749  0.07965
## Nassau       -1.31454  5.01949  -2.01014  1.71006 -1.252636  0.07229
## Okaloosa     -1.03147  3.96982  -1.07972  0.72880 -0.963809  0.20686
## Okeechobee    1.13767 -4.39348   0.98386 -0.43563  1.593806 -1.01245
## Orange       -0.79477 -1.25250   0.55677 -0.56422 -0.031170 -0.22220
## Osceola      -0.26909 -2.68968   5.13622  0.14793  1.049223  0.03052
## Palm Beach   -0.95756 -1.79612   1.17823 -0.58413  0.254155 -0.87391
## Pasco        -0.80740 -2.85309  -0.58236  0.59090  1.567402  0.24828
## Pinellas     -0.99830 -3.07182   1.02956 -0.29765  1.202111  0.27183
## Polk         -0.03103 -1.74815   0.06866  0.23412  0.697029 -0.14035
## Putnam        1.25636 -2.27366  -5.04933 -0.62878  0.492432  1.52447
## St. Johns    -2.07921  5.17633  -3.83043  0.81310 -1.728165 -0.66101
## St. Lucie    -0.57847 -1.51729  -0.02183  1.10796  0.643239 -0.43374
## Santa Rosa   -1.10287  4.72538  -0.52166  1.32545 -1.239094  0.10723
## Sarasota     -1.56170 -0.88287   0.12730  0.35835  0.902196 -0.52889
## Seminole     -1.68298 -0.48667  -2.54127  0.12969  0.054256  0.43293
## Sumter       -1.31980 -0.04108  -1.78500  0.78670  0.750345 -0.72767
## Suwannee      1.05876  4.31106   0.78212  0.23530 -1.765324 -0.34052
## Taylor        1.69637  0.84303   3.43101 -0.16838 -0.384565 -0.46401
## Union         1.33550  1.95629  -0.08314  0.26188  0.379401 -0.54734
## Volusia      -0.64360 -1.35740  -2.70563  0.47984  0.739835  1.14598
## Wakulla      -0.37721  4.08455  -0.28765  1.52163 -0.774887  0.30464
## Walton       -0.69538  2.82575   1.12300  0.48687 -0.468831 -0.75593
## Washington    1.19601 -1.18162   0.88880 -0.50963  0.689445  0.59098
##
##
```

```
## Site constraints (linear combinations of constraining variables)
##
##                   CCA1      CCA2      CCA3      CA1       CA2      CA3
## Alachua      -2.007956 -0.002997 -0.399842 -2.85980  0.330773  1.25210
## Baker         0.922848  0.890041  0.902784  1.55293 -0.777995  0.29274
## Bay          -0.084847 -1.772954  0.592189  1.04832 -1.052120  0.56516
## Bradford      1.207997  1.058849  0.995538 -0.08183 -1.114071  0.46772
## Brevard      -0.688836 -0.098129  0.142918  0.64061  0.584208  0.35922
## Broward      -0.995305 -0.641658  0.970594 -0.56799  0.490985 -0.42667
## Calhoun       1.299548 -0.122155 -0.382269 -0.54201 -0.193127 -0.38618
## Charlotte    -0.020235  0.283009 -0.982653  0.79143  1.385045  0.58618
## Citrus        0.557753 -0.969861 -2.092434  0.73548  0.866036  1.24778
## Clay         -0.197145 -0.107359  1.164709  2.36989 -0.826960  0.41909
## Collier      -1.354230  0.267885 -0.607522  0.10109 -0.693334 -1.60439
## Columbia      0.696933  0.569731  0.755388  0.49487 -1.132029  0.77115
## DeSoto        1.138442  0.585270  0.344483 -1.24409  1.679176 -1.08893
## Dixie         1.351199  0.389223 -0.060075 -0.62286 -0.748921  1.16633
## Duval        -0.721987 -0.975451  0.769796 -0.13757 -0.465944  0.39331
## Escambia     -0.393925  0.069627  0.246089 -0.22159 -0.703872  1.20944
## Flagler      -0.166712 -0.352844 -0.719791  1.62497  0.553084  0.85203
## Franklin      0.574643  0.521513 -0.125193 -0.56045 -1.369445 -0.23333
## Gadsden       0.570257 -1.149294  0.011786 -1.08992 -0.501499 -0.58992
## Gilchrist     0.858024  0.652154  0.278065  0.72436  0.130178  0.93945
## Glades        1.258029 -0.506087  0.528679 -0.12684  1.473841 -0.30031
## Gulf          0.444904 -2.698311 -0.367362  0.81659 -2.320638 -0.66988
## Hamilton      1.397363  0.529928 -0.980435 -1.93242 -1.893437  3.02394
## Hardee        1.253258 -1.481501 -1.430620 -0.69453 -1.048443 -0.31393
## Hendry        1.393228 -4.009958 -0.790186 -0.30451 -0.804561 -2.95680
## Hernando      0.530182 -0.659333 -0.817613  1.06470  0.998128  0.50630
## Highlands     0.601215 -0.760695 -1.457619  0.06873  1.183650  0.38727
## Hillsborough -1.053212 -0.450856  0.441390 -0.59068  0.236228  0.02218
## Holmes        1.263857  0.876267  0.155464 -0.98807  0.815789 -0.73717
## Indian River -0.546316 -0.293234 -1.144739  0.48561 -0.003610 -0.15747
## Jackson       0.945306  0.485231 -0.005222 -0.94451 -0.007011 -0.43450
## Jefferson     0.092725  0.825488 -0.363288 -1.17235  1.130851 -0.60445
## Lafayette     0.756734  2.215306 -0.388922 -1.27467 -1.769550 -3.32407
## Lake         -0.009966  0.412752  0.248184  0.92437  1.089037  0.26855
## Lee          -0.520889  0.403451  0.042881  0.36711  0.453950 -0.39778
## Leon         -2.335794 -0.541335 -0.684923 -2.97313 -1.020685  1.87070
## Levy          0.988017 -0.273134  0.567823 -0.10012  1.332323  1.50243
## Liberty       1.065071  1.340765 -0.798182 -0.79446 -0.277589  0.99307
## Madison       0.867993 -0.465183  0.385345 -1.34032 -2.244500  1.29918
## Manatee      -0.661535  0.516213 -0.210707  0.39430  0.158330 -0.19494
## Marion        0.350330  0.080264 -0.686281  0.33564  0.456923  0.80712
## Martin       -1.034645  0.355132 -0.395475  0.49063  0.525289 -0.53174
## Miami-Dade   -0.656128  0.877023  1.313950 -1.67193  0.359637 -1.97126
## Monroe       -1.202339 -0.400639  2.963260 -0.07716  0.763749  0.07965
## Nassau       -0.567587  0.591939  0.341978  1.71006 -1.252636  0.07229
## Okaloosa     -0.790901  1.113859  0.119242  0.72880 -0.963809  0.20686
## Okeechobee    1.091179 -0.207662  1.140160 -0.43563  1.593806 -1.01245
## Orange       -1.191455 -0.644449  1.058354 -0.56422 -0.031170 -0.22220
## Osceola       0.145779 -0.756823  1.364936  0.14793  1.049223  0.03052
## Palm Beach   -1.330926 -0.477918 -0.338012 -0.58413  0.254155 -0.87391
## Pasco        -0.082094 -0.112526 -0.078787  0.59090  1.567402  0.24828
```

```
## Pinellas     -0.882716 -0.236182  0.647977 -0.29765  1.202111  0.27183
## Polk          0.250653 -0.446754  0.049231  0.23412  0.697029 -0.14035
## Putnam        1.037210 -0.715389 -0.546727 -0.62878  0.492432  1.52447
## St. Johns    -2.100531  0.890748 -0.620499  0.81310 -1.728165 -0.66101
## St. Lucie     0.196923 -1.166346  0.217540  1.10796  0.643239 -0.43374
## Santa Rosa   -0.545711  0.637809  0.042468  1.32545 -1.239094  0.10723
## Sarasota     -1.176335  0.780044 -0.981018  0.35835  0.902196 -0.52889
## Seminole     -1.613426 -0.471502  0.472865  0.12969  0.054256  0.43293
## Sumter       -0.681182  0.808735 -4.615416  0.78670  0.750345 -0.72767
## Suwannee      0.788376  0.307791  0.576808  0.23530 -1.765324 -0.34052
## Taylor        1.516638  0.180899  0.861904 -0.16838 -0.384565 -0.46401
## Union         1.519029  2.642363 -0.115282  0.26188  0.379401 -0.54734
## Volusia      -0.128104 -0.398469  0.452265  0.47984  0.739835  1.14598
## Wakulla       0.406747  0.785360  1.065397  1.52163 -0.774887  0.30464
## Walton       -0.547063  1.422236 -0.247075  0.48687 -0.468831 -0.75593
## Washington    1.105397  0.681665  0.482510 -0.50963  0.689445  0.59098
##
##
## Biplot scores for constraining variables
##
##                                       CCA1     CCA2     CCA3 CA1 CA2 CA3
## Unemployment_Rate_2019              0.5473 -0.60888 -0.57427   0   0   0
## Civilian_Labor_Force_2019_as_pct   -0.7554 -0.18958  0.62725   0   0   0
## Percent_Adults_Bachelors_or_Higher -0.9991  0.02401 -0.03542   0   0   0
```

The three overlaid continuous variables above are all significant with $p<0.001$. However, the continuous variables don't have a great distribution on this plot, so the discriminating ability is probably not as helpful as what we might like.

10

Finally, write a paragraph or so comparing the methods you've used, discuss what conclusions you reach, etc.

The counties are well distributed across the quadrants in each of our MDS methods, and we find significance in three of our environmental variables. Our two-dimensional MDS results are robust and suggest two dimensions are likely optimal, although three dimensions could also be considered. Our results for canonical correspondence analysis (CCA) are somewhat concentrated and difficult to read. In CCA, we find substantially more variation on the second CCA axis, which is inversely related to unemployment. Although our relatively high amount of counties (67) contributes to the difficulty in discerning the plot, the CCA plot is particularly concentrated. We believe the NMDS plot in #8 with contour lines optimally illustrates the distribution of the counties and their relations to the NMDS axes and environmental variables. It conveys a lot of information in a single plot. Moreover, we can see that the contour lines are not exactly perpendicular to their respective blue dimensional axes, suggesting a more complex (non-linear) significant pattern of counties according to the environmental variables of unemployment, bachelor's percentage, and civilian labor force percentage.