

Multidimensional Scaling III

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1 Preliminaries

In this section, the RStudio workspace and console panes are cleared of old output, variables, and other miscellaneous debris. Packages are loaded and any required data files are retrieved.

```
options(replace.assign = TRUE, width = 65, digits = 4, scipen = 4, fig.width = 4,
       fig.height = 4)
# Clear the workspace and console.
rm(list = ls(all = TRUE))
cat("\f")
```

```
# Turn off showing of significance asterisks.
options(show.signif.stars = F)
# Set the contrast option; important for ANOVAs.
options(contrasts = c("contr.sum", "contr.poly"))
how_long <- Sys.time()
set.seed(123)
library(knitr)
```

```
library(psych)
library(ggplot2)

##
## Attaching package:  'ggplot2'
## The following objects are masked from 'package:psych':
##
##     %+%, alpha

library(MASS)
library(sciplot)
library(ggplot2)
library(vegan)

## Warning:  package 'vegan' was built under R version 3.5.1
## Loading required package:  permute
## Warning:  package 'permute' was built under R version 3.5.1
## Loading required package:  lattice
## This is vegan 2.5-2

library(smacof)
```

```

## Warning: package 'smacof' was built under R version 3.5.1
## Loading required package: plotrix
##
## Attaching package: 'plotrix'
## The following object is masked from 'package:psych':
##   rescale
##
## Attaching package: 'smacof'
## The following object is masked from 'package:base':
##   transform

library(ape)
library(ade4)

## Warning: package 'ade4' was built under R version 3.5.1

library(ecodist)

## Warning: package 'ecodist' was built under R version 3.5.1
##
## Attaching package: 'ecodist'
## The following object is masked from 'package:vegan':
##   mantel

library(scatterplot3d)

```

1.1 Main Data File

Data are from 13 surveys conducted between 1982 and 2011 that asked participants to rank U.S. presidents according to their overall quality. The rankings for presidents from Washington through Reagan are included here. The surveys were sponsored by a variety of entities: Wall Street Journal, C-SPAN, Siena College, The Times (British), Chicago Tribune, etc.

The sources ranged widely in their nature. Some were popular opinion polls, some were academics (political scientists, law professors), some were political journalists, some were a blend of various sources. Sample sizes varied widely.

```

# Get the drug use data from the working directory.
setwd("C:\\\\Courses\\\\Psychology 516\\\\PowerPoint\\\\2018")
Presidents <- read.table("presidents_transposed.csv", sep = ",", header = TRUE)
Presidents <- as.data.frame(Presidents)
row.names(Presidents) <- Presidents$Name
# Normalize the ranks.
for (i in seq(2, 14)) {
  M <- max(Presidents[, i]) - 1
  for (j in seq(1, length(Presidents[, 1]))) {
    Presidents[j, i] <- (Presidents[j, i] - 1)/M
  }
}
# Create distance matrices

```

```

Presidents_Dist_1 <- dist(Presidents[, 2], method = "euclidean", diag = TRUE)
Presidents_Dist_2 <- dist(Presidents[, 3], method = "euclidean", diag = TRUE)
Presidents_Dist_3 <- dist(Presidents[, 4], method = "euclidean", diag = TRUE)
Presidents_Dist_4 <- dist(Presidents[, 5], method = "euclidean", diag = TRUE)
Presidents_Dist_5 <- dist(Presidents[, 6], method = "euclidean", diag = TRUE)
Presidents_Dist_6 <- dist(Presidents[, 7], method = "euclidean", diag = TRUE)
Presidents_Dist_7 <- dist(Presidents[, 8], method = "euclidean", diag = TRUE)
Presidents_Dist_8 <- dist(Presidents[, 9], method = "euclidean", diag = TRUE)
Presidents_Dist_9 <- dist(Presidents[, 10], method = "euclidean",
    diag = TRUE)
Presidents_Dist_10 <- dist(Presidents[, 11], method = "euclidean",
    diag = TRUE)
Presidents_Dist_11 <- dist(Presidents[, 12], method = "euclidean",
    diag = TRUE)
Presidents_Dist_12 <- dist(Presidents[, 13], method = "euclidean",
    diag = TRUE)
Presidents_Dist_13 <- dist(Presidents[, 14], method = "euclidean",
    diag = TRUE)
# Combine into a list.
Presidents_Dist <- list(Presidents_Dist_1, Presidents_Dist_2, Presidents_Dist_3,
    Presidents_Dist_4, Presidents_Dist_5, Presidents_Dist_6, Presidents_Dist_7,
    Presidents_Dist_8, Presidents_Dist_9, Presidents_Dist_10, Presidents_Dist_11,
    Presidents_Dist_12, Presidents_Dist_13)

```

1.2 Additional Data Files

There is additional information about the sources that could prove useful in interpreting the MDS outcomes. Likewise, there is additional information about the objects (Presidents) that could be important. In the latter case, it comes from two places. First, there is objective information (age, height, etc.) that could prove interesting. Second, other surveys, in particular the Siena survey, could be revealing. The Siena survey used here comes from 2010, includes historians and presidential experts, and asked the participants to rank the presidents on the following dimensions:

*Background
 Imagination
 Integrity
 Intelligence
 Luck
 Willing to take risks
 Avoid crucial mistakes
 Court appointments
 Domestic accomplishments
 Executive Appointments
 Foreign policy accomplishments
 Handling of U.S. economy
 Party leadership
 Relationship with Congress
 Ability to compromise
 Communication ability
 Executive ability
 Leadership ability
 Overall ability*

```

source_info <- read.table("source_info.csv", sep = ",", header = TRUE)
source_info <- as.data.frame(source_info)
 prez_info <- read.table("presidents_height_age.csv", sep = ",", header = TRUE)
 prez_info <- as.data.frame(prez_info)
 siena_info <- read.table("siena_info.csv", sep = ",", header = TRUE)
 siena_info <- as.data.frame(siena_info)

```

2 Function

The smacofIndDiff() function can be used for three-way or individual differences MDS. It will provide the following values in the fit object.

delta: Observed dissimilarities

obsdiss: List of observed dissimilarities, normalized

confdiss: List of configuration dissimilarities

conf: List of matrices of final configurations

gspace: Joint configurations aka group stimulus space

cweights: Configuration weights

stress.m: stress value for metric MDS

stress.nm: stress value for non-metric MDS (if computed)

stress.co: Constrained stress value

spp: Stress per point

sps: Stress per subject (matrix)

ndim: Number of dimensions

model: Type of smacof model

niter: Number of iterations

nobj: Number of objects

3 Equality Constraint

Addtional weight restrictions can be imposed with "identity" which restricts the configurations across individuals/replications/ways to be equal. This is useful to get an overall or combined plot. This solution can be compared to that for diagonal constraint and no constraint to determine if the latter complexity is warranted. As an initial stage,

models with different numbers of dimensions can be examined to determine the best number for additional examination.

3.1 Basic Model Fit

The basic model is fit by specifying the type of analysis (ordinal here), the constraint (equality here), and the number of dimensions (2 here). The maximum number of iterations is also specified here to insure that a solution can be found.

```
identity_fit <- smacofIndDiff(Presidents_Dist, ndim = 2, constraint = "identity",
                                itmax = 1000, type = "ordinal")
summary(identity_fit)

##
## Group Stimulus Space (Joint Configurations):
##      D1      D2
## 1 -0.9938  0.1621
## 2 -0.3945 -0.0494
## 3 -0.8857  0.2240
## 4 -0.4010 -0.3358
## 5 -0.3557 -0.2362
## 6 -0.0979 -0.1780
## 7 -0.5581  0.0948
## 8  0.2235 -0.3397
## 9  0.8092  0.0726
## 10 -0.4718  0.2467
## 11  0.6081  0.1302
## 12  0.8219 -0.1084
## 13  0.9737 -0.2033
## 14  1.1175 -0.0804
## 15 -1.0599 -0.1572
## 16  0.9781  0.2808
## 17  0.6085  0.3888
## 18  0.3049 -0.0546
## 19  0.3932  0.1169
## 20 -0.1488  0.0781
## 21  0.5459 -0.0496
## 22 -0.1638  0.1934
## 23 -0.8979 -0.1583
## 24  0.1029 -0.1107
## 25 -0.7212 -0.1852
## 26  1.0591  0.0989
## 27  0.4567  0.2787
## 28  0.5836 -0.2437
## 29 -1.0608  0.0084
## 30 -0.7633  0.0203
## 31 -0.6170  0.2185
## 32 -0.4924 -0.2118
## 33 -0.3618  0.0934
## 34  0.4728 -0.3337
## 35  0.3157  0.2386
## 36  0.3374 -0.3090
## 37 -0.2674  0.3996
##
```

```

## 
## Stress per point:
##   1    2    3    4    5    6    7    8    9    10   11   12   13
## 2.18 2.09 2.31 4.09 3.16 2.12 2.79 3.65 1.73 2.35 2.12 1.87 2.02
## 14   15   16   17   18   19   20   21   22   23   24   25   26
## 1.97 1.90 2.52 5.29 2.40 2.45 2.47 2.53 2.07 1.89 1.99 2.03 1.84
## 27   28   29   30   31   32   33   34   35   36   37
## 3.03 3.13 1.94 1.87 2.23 3.28 2.46 4.45 2.39 5.04 6.36

```

3.2 Additional Information

As with other MDS procedures, additional, largely graphical, information can be consulted to determine the nature of the solution and its adequacy.

3.2.1 Stress Plots

Stress can be viewed in several ways. First, there will be an overall stress value for the solution, as with any MDS. Second, the proportion of that stress value that is due to different objects can be illustrated. Third, the stress due to different sources can be illustrated. The latter two can help identify the reasons for good and poor fit.

```

identity_fit$stress
## [1] 0.1921

```

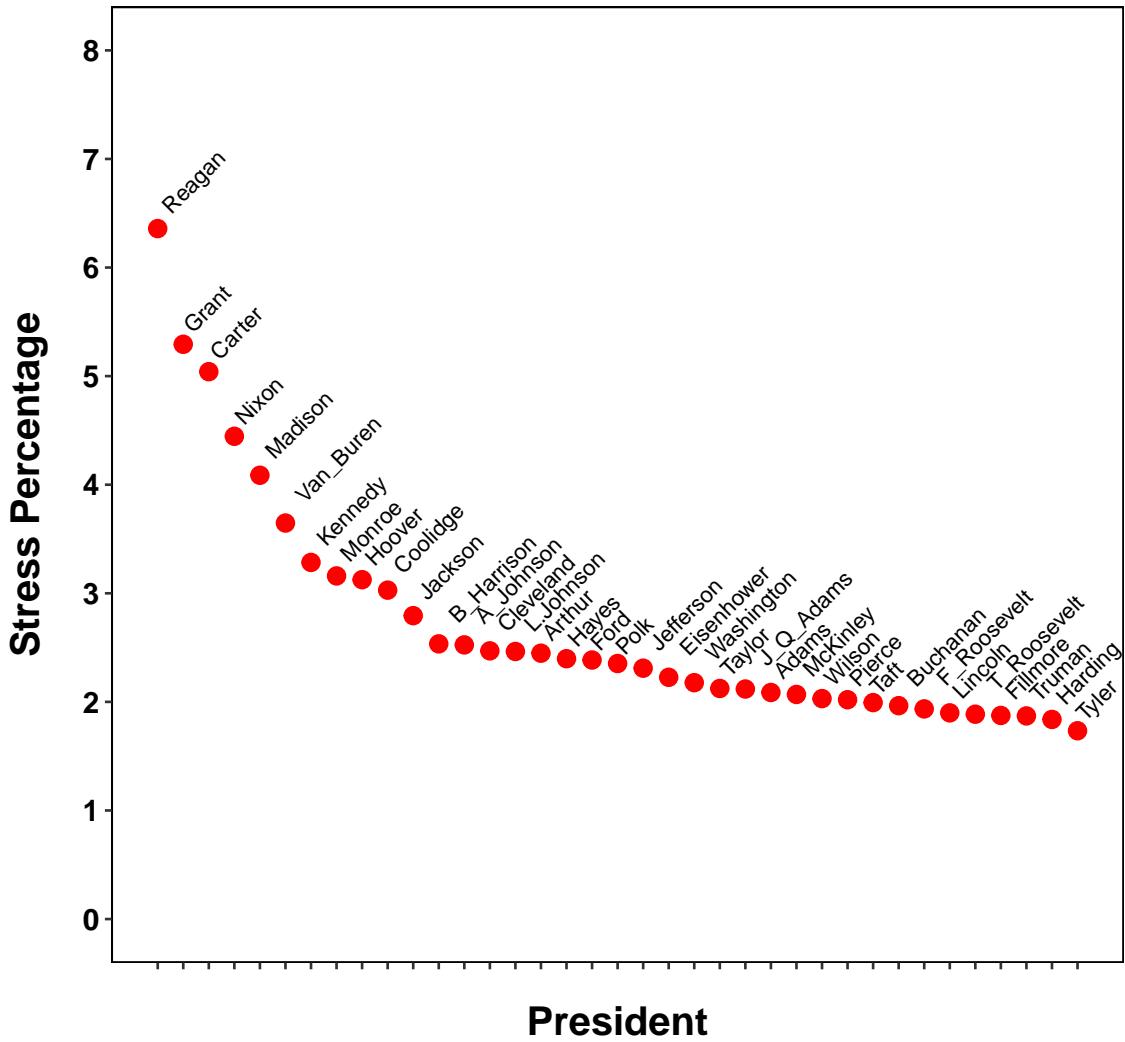
```

plot_data <- as.data.frame(identity_fit$spp)
names(plot_data) <- c("SP")
plot_data>Name <- Presidents>Name
plot_data <- plot_data[order(-plot_data[, 1]), ]
plot_data$Index <- seq(1, length(plot_data[, 1]))

ggplot(plot_data, aes(x = Index, y = SP)) + geom_point(shape = 19,
  size = 3, color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  8, 1))) + scale_x_continuous(breaks = c(seq(1, 37, 1))) + geom_text(aes(label = Name),
  hjust = -0.25, vjust = 0, size = 3, angle = 45) + coord_cartesian(xlim = c(1,
  37), ylim = c(0, 8)) + xlab("President") + ylab("Stress Percentage") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_blank(),
  axis.title.x = element_text(margin = margin(15, 0, 0, 0),
  size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(),
  axis.line.y = element_blank(), plot.title = element_text(size = 16,
  face = "bold", margin = margin(0, 0, 20, 0), hjust = 0.5),
  panel.background = element_rect(fill = "white", linetype = 1,
  color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Stress Decomposition for Objects")

```

Stress Decomposition for Objects



```

plot_data <- as.data.frame(identity_fit$sps)
names(plot_data) <- c("SS")
plot_data$Name <- c(paste("Source ", seq(1, 13)))
plot_data <- plot_data[order(-plot_data[, 1]), ]
plot_data$Index <- seq(1, length(plot_data[, 1]))

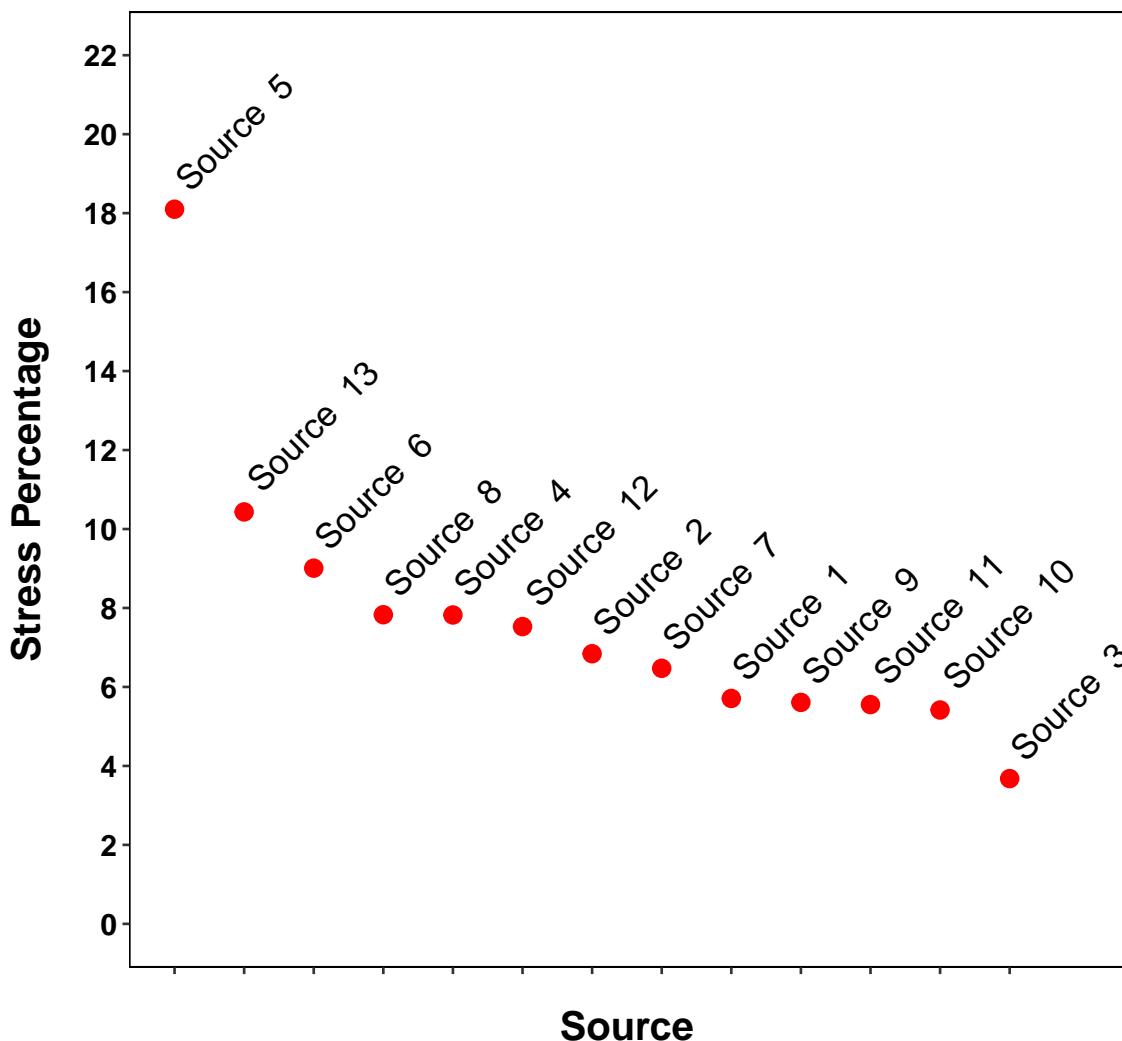
ggplot(plot_data, aes(x = Index, y = SS)) + geom_point(shape = 19,
  size = 3, color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  22, 2))) + scale_x_continuous(breaks = c(seq(1, 13, 1))) + geom_text(aes(label = Name),
  hjust = -0.15, vjust = 0, size = 5, angle = 45) + coord_cartesian(xlim = c(1,
  14), ylim = c(0, 22)) + xlab("Source") + ylab("Stress Percentage") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_blank())
  
```

```

axis.title.x = element_text(margin = margin(15, 0, 0, 0),
    size = 16), axis.title.y = element_text(margin = margin(0,
    15, 0, 0), size = 16), axis.line.x = element_blank(),
axis.line.y = element_blank(), plot.title = element_text(size = 16,
    face = "bold", margin = margin(0, 0, 20, 0), hjust = 0.5),
panel.background = element_rect(fill = "white", linetype = 1,
    color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Stress Decomposition for Sources")

```

Stress Decomposition for Sources



3.2.2 Group Configuration Plot

The group configuration plot shows the aggregate solution or group solution.

```

plot_data <- as.data.frame(identity_fit$gspace)
names(plot_data) <- c("D1", "D2")
plot_data$Stress <- identity_fit$spp
plot_data>Name <- Presidents>Name

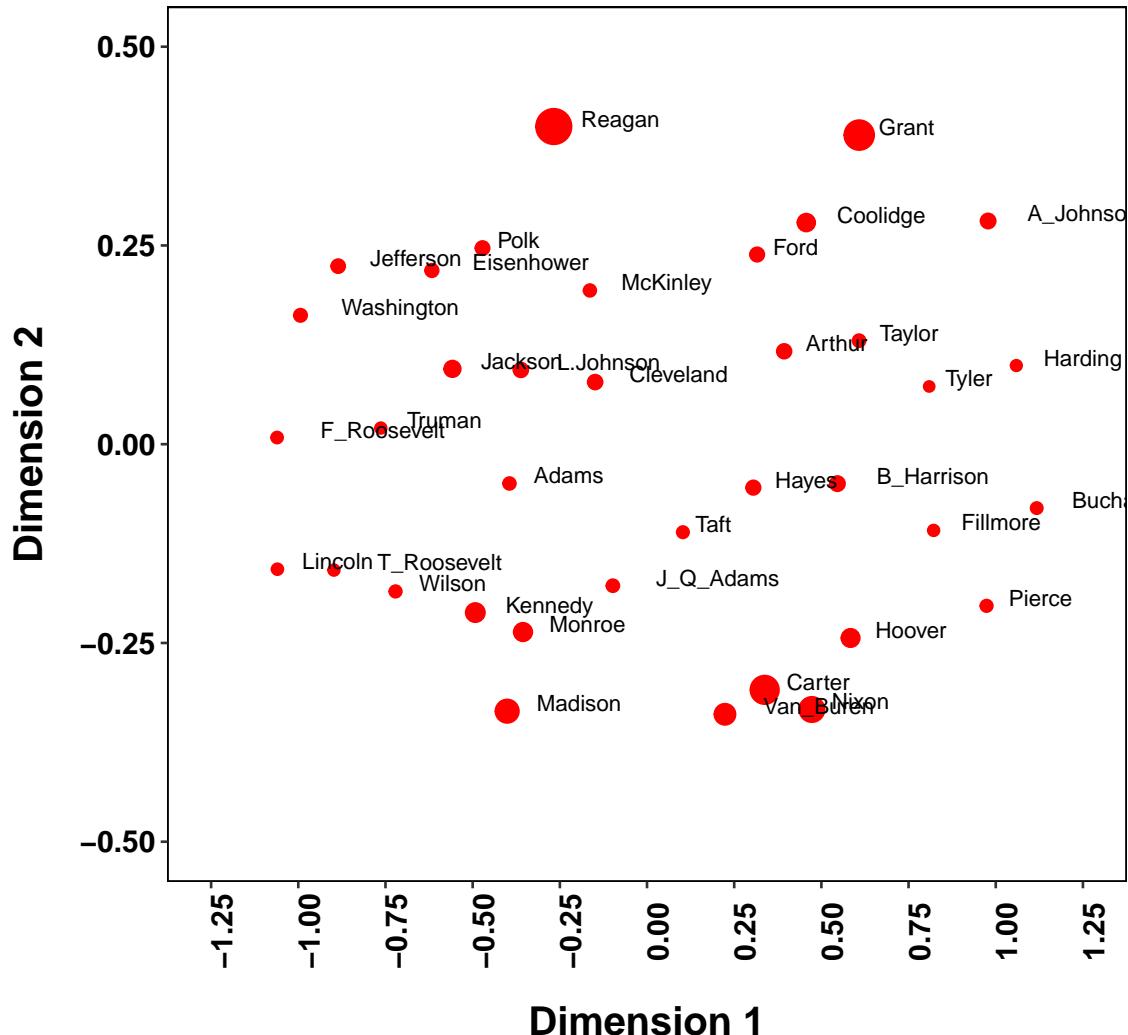
```

```

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = plot_data$Stress,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-0.5,
0.5, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
0.25))) + geom_text(aes(label = Name), hjust = -0.35, vjust = 0,
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.5,
0.5)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16, face = "bold", margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Size = Object Stress)")

```

Two-Dimensional Space (Size = Object Stress)



3.2.3 Source Configuration Plots

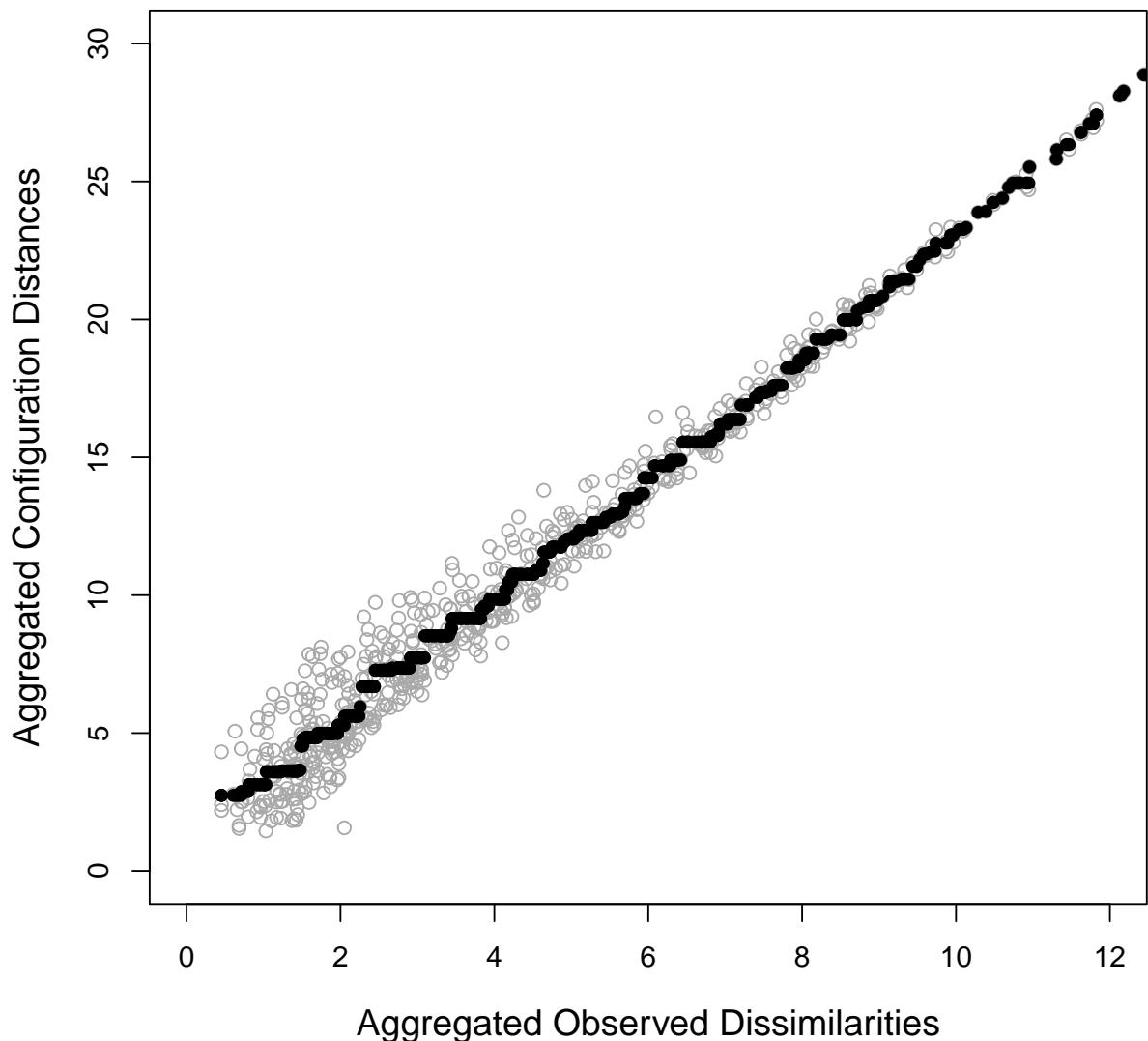
The configuration plots for individual sources are forced to be identical in this solution.

3.2.4 Shepard Plots

The following Shepard plots show the relationship between aggregated observed dissimilarities and the aggregated configuration distances.

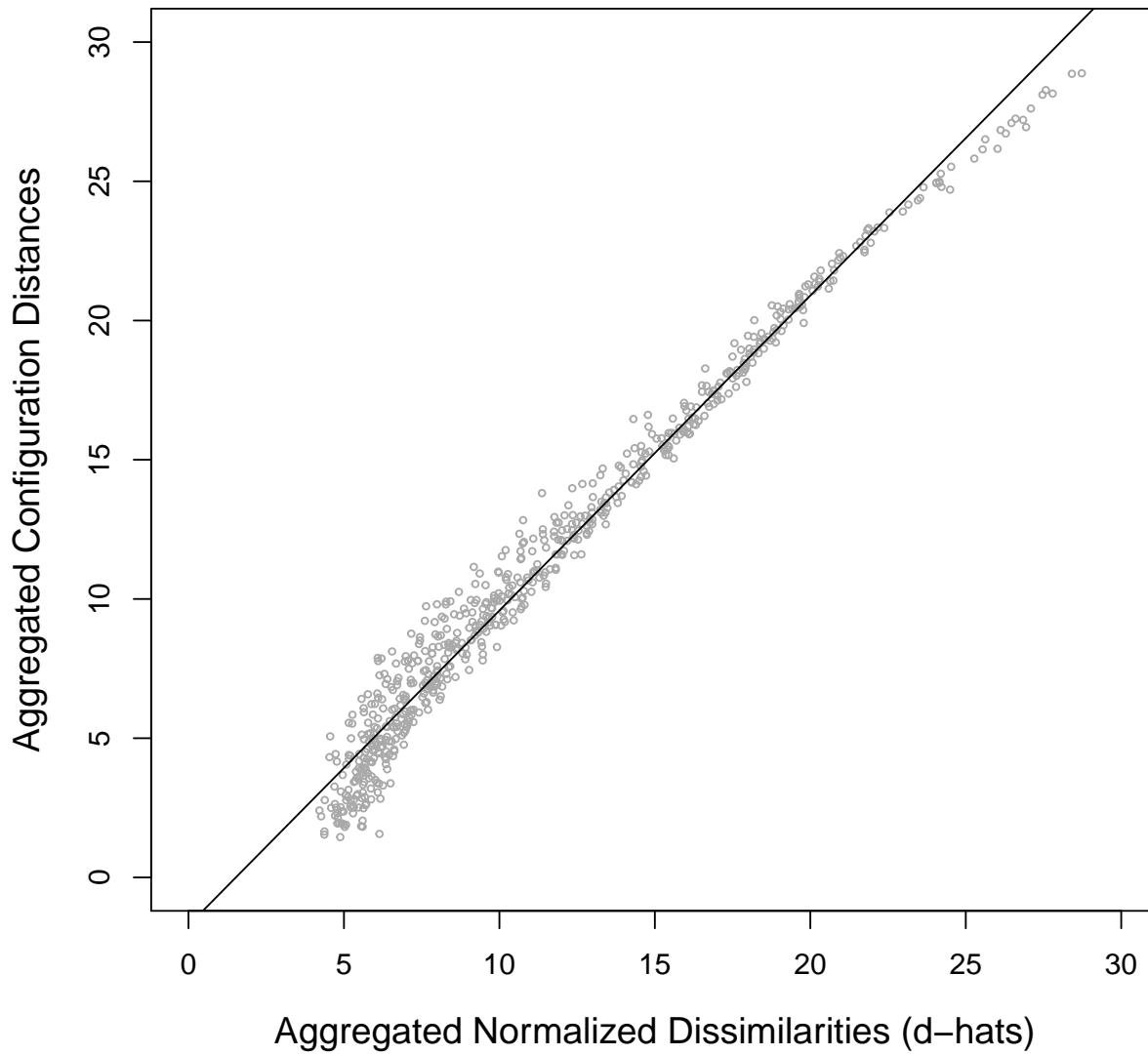
```
plot(identity_fit, plot.type = "Shepard", xlab = list("Aggregated Observed Dissimilarities",
cex = 1.25), ylab = list("Aggregated Configuration Distances",
cex = 1.25), main = list("Shepard Plot", cex = 1.5), xlim = c(0,
12), ylim = c(0, 30))
```

Shepard Plot



```
# The same information is contained in the residual plot, but a
# best-fit line also included. This is really more appropriate for
# a metric MDS, but does provide useful information for fit.
plot(identity_fit, plot.type = "resplot", xlab = list("Aggregated Normalized Dissimilarities (d-hats)",
cex = 1.25), ylab = list("Aggregated Configuration Distances",
cex = 1.25), main = list("Residual Plot", cex = 1.5), xlim = c(0,
30), ylim = c(0, 30))
```

Residual Plot



Individual source Shepard plots can also be constructed. These provide a way to visual individual fit. Note that although the configuration plots are forced to be the same for all sources, the fit of that common solution will not be the same for all sources.

```
plot_data <- matrix(cbind(unlist(identity_fit$delta[[1]]), unlist(identity_fit$confdist[[1]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")

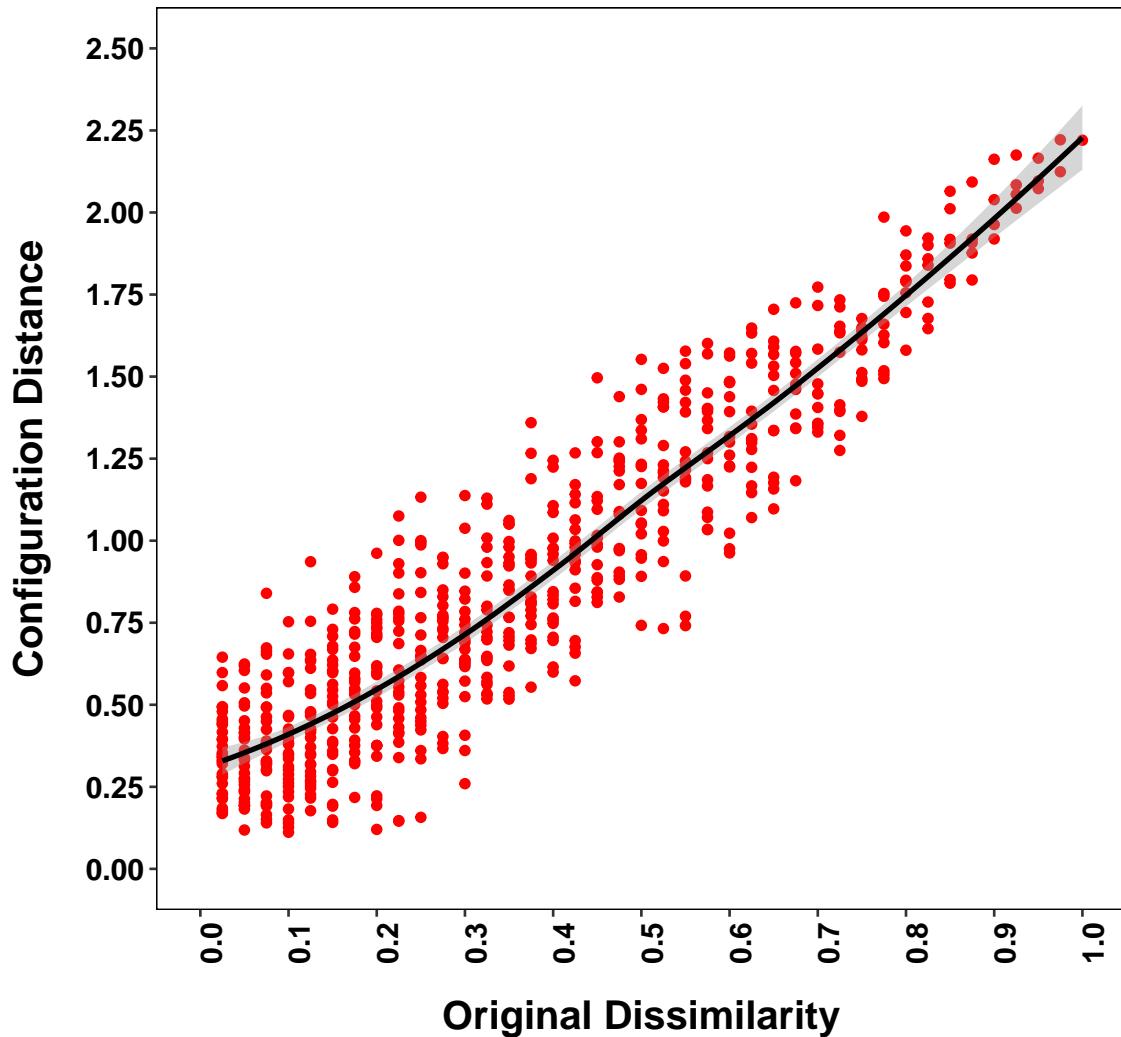
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
```

```

theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 1")

```

Two-Dimensional Space: Source 1



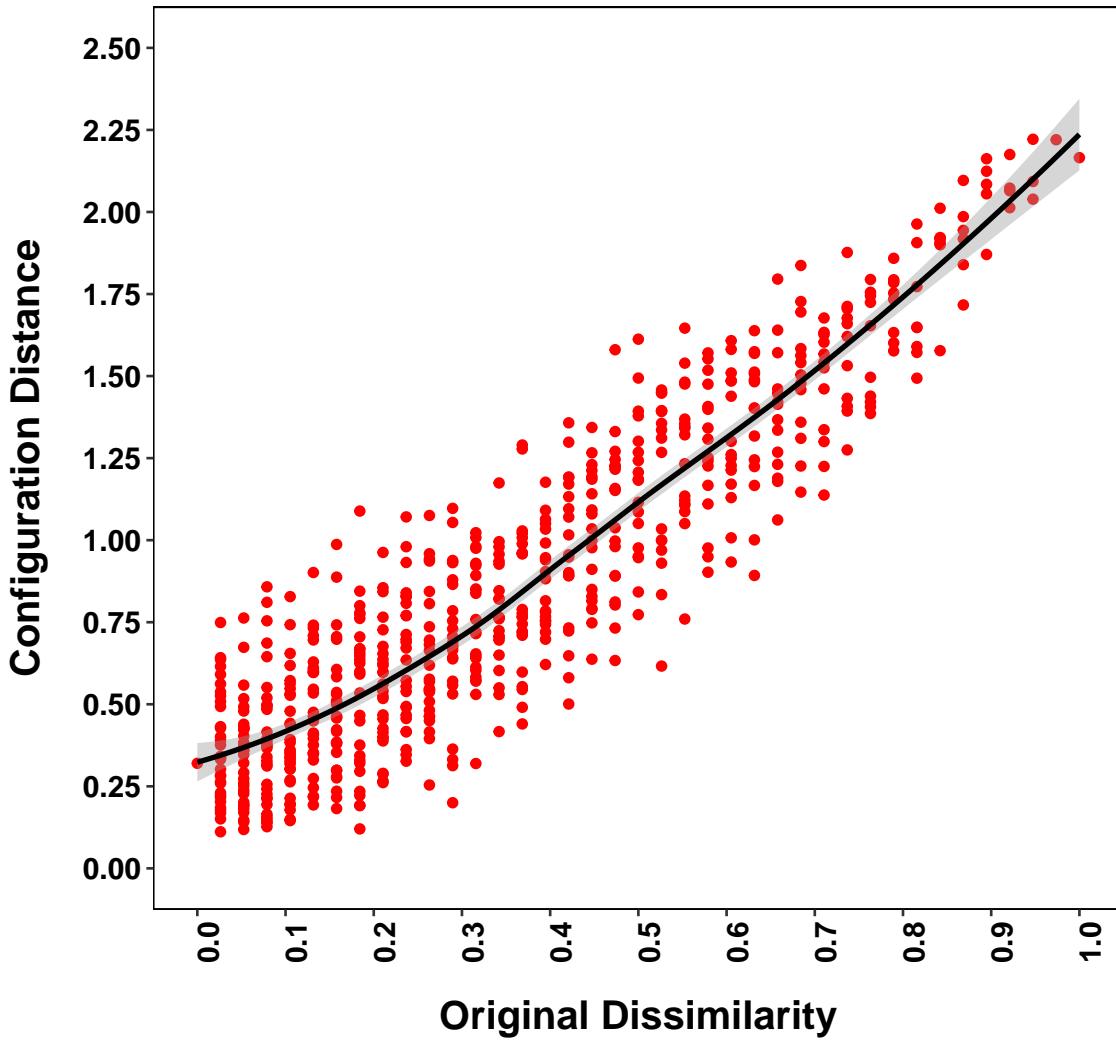
```

plot_data <- matrix(cbind(unlist(identity_fit$delta[[2]]), unlist(identity_fit$confdist[[2]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
    face = "bold"), axis.text.y = element_text(colour = "black",
    size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
    size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
    0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
    15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
    plot.title = element_text(size = 16, face = "bold", margin = margin(0,
    0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
    linetype = 1, color = "black"), panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
    plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
    legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 2")

```

Two-Dimensional Space: Source 2



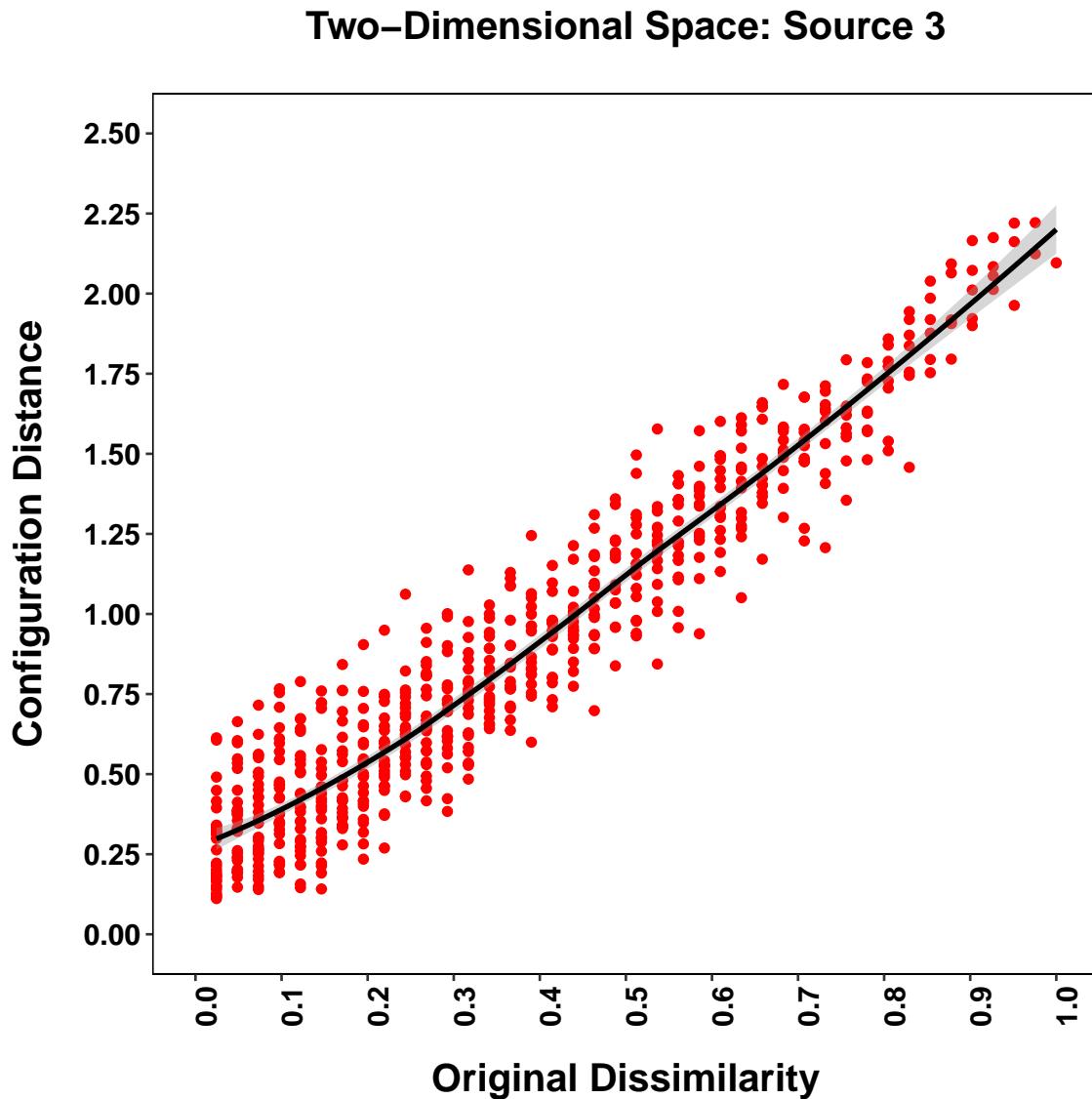
```
plot_data <- matrix(cbind(unlist(identity_fit$delta[[3]]), unlist(identity_fit$confdist[[3]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 3")

```



```

plot_data <- matrix(cbind(unlist(identity_fit$delta[[4]]), unlist(identity_fit$confdist[[4]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

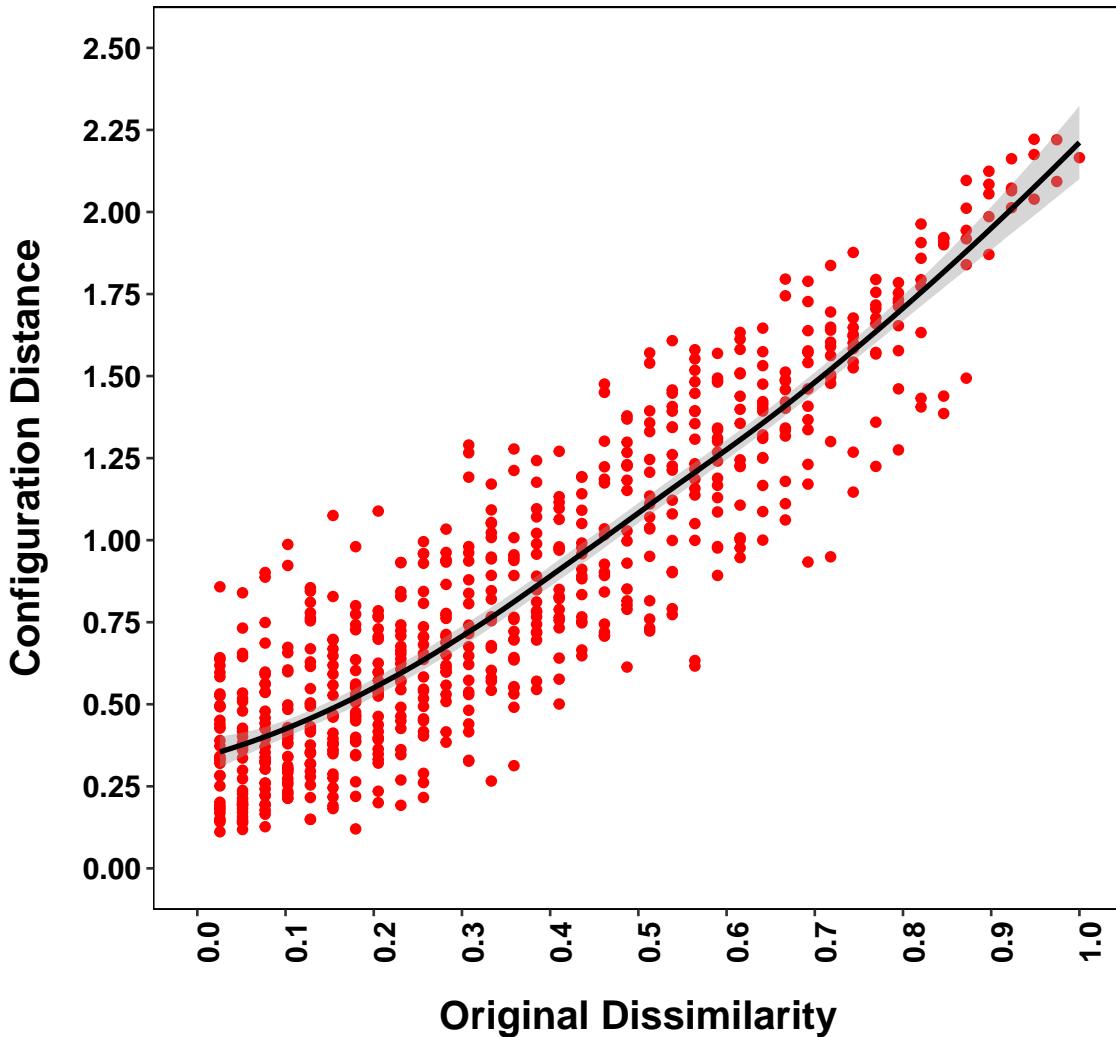
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 4")

```

Two-Dimensional Space: Source 4



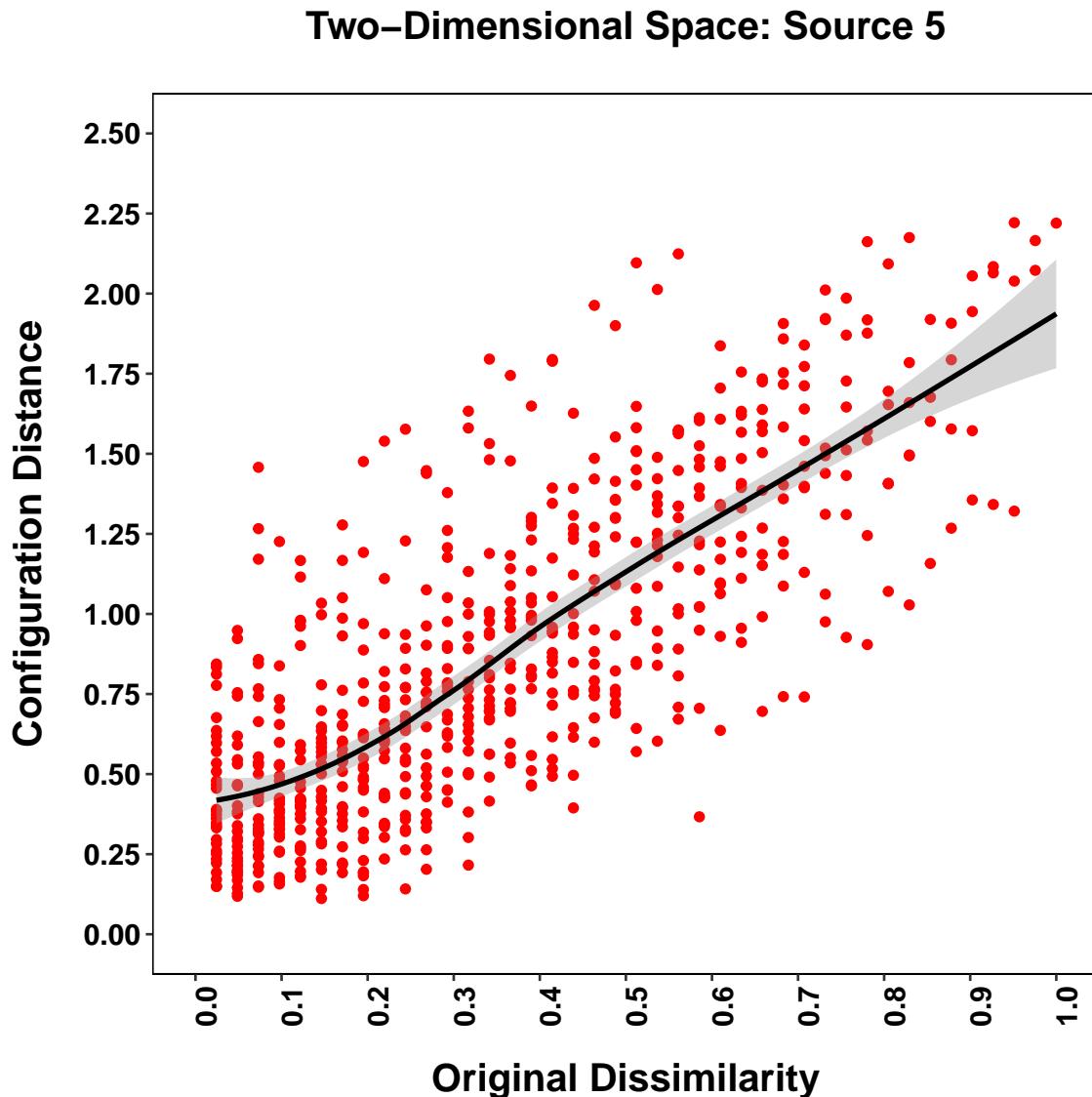
```
plot_data <- matrix(cbind(unlist(identity_fit$delta[[5]]), unlist(identity_fit$confdist[[5]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 5")

```



```

plot_data <- matrix(cbind(unlist(identity_fit$delta[[6]]), unlist(identity_fit$confdist[[6]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

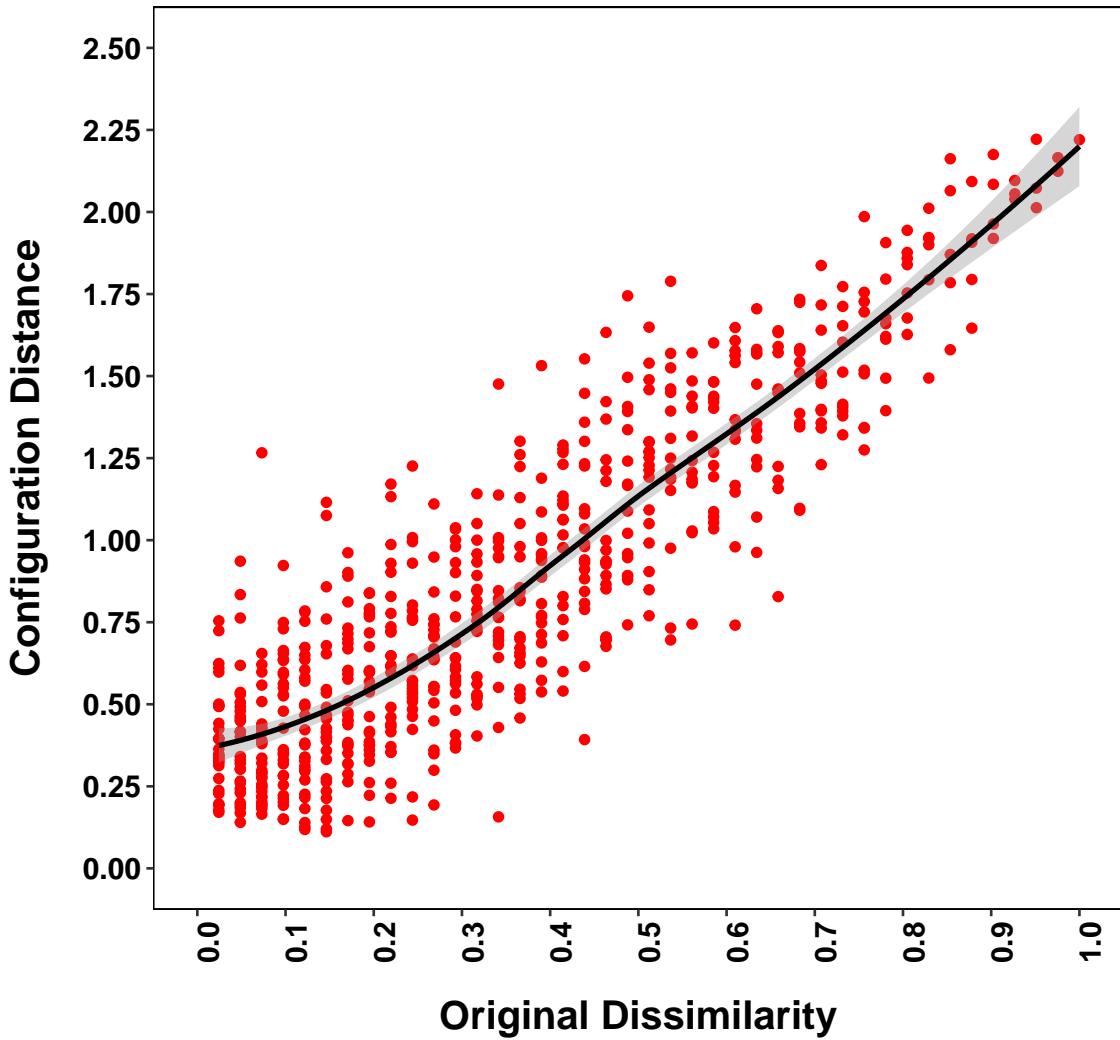
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 6")

```

Two-Dimensional Space: Source 6



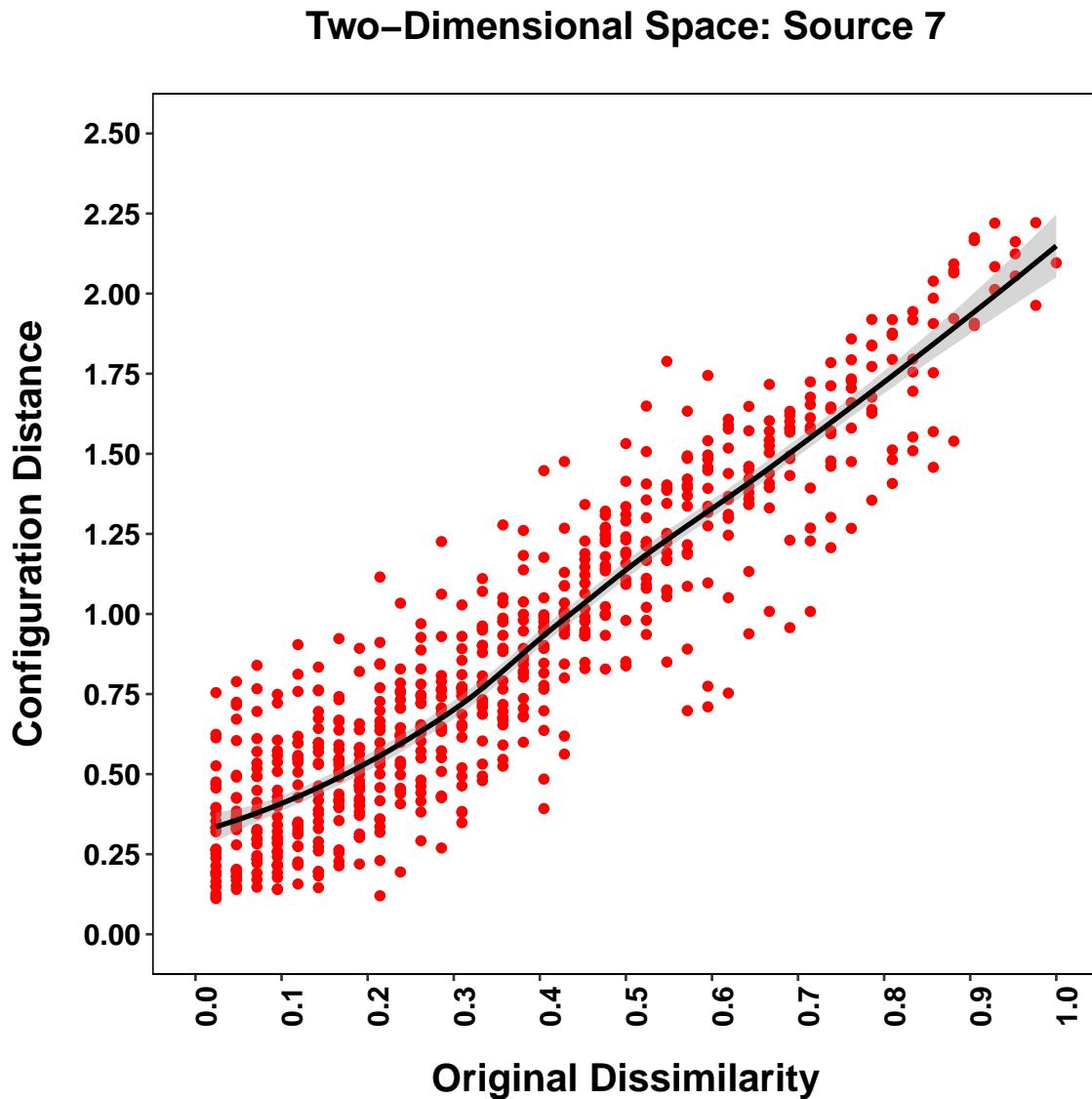
```
plot_data <- matrix(cbind(unlist(identity_fit$delta[[7]]), unlist(identity_fit$confdist[[7]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 7")

```



```

plot_data <- matrix(cbind(unlist(identity_fit$delta[[8]]), unlist(identity_fit$confdist[[8]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

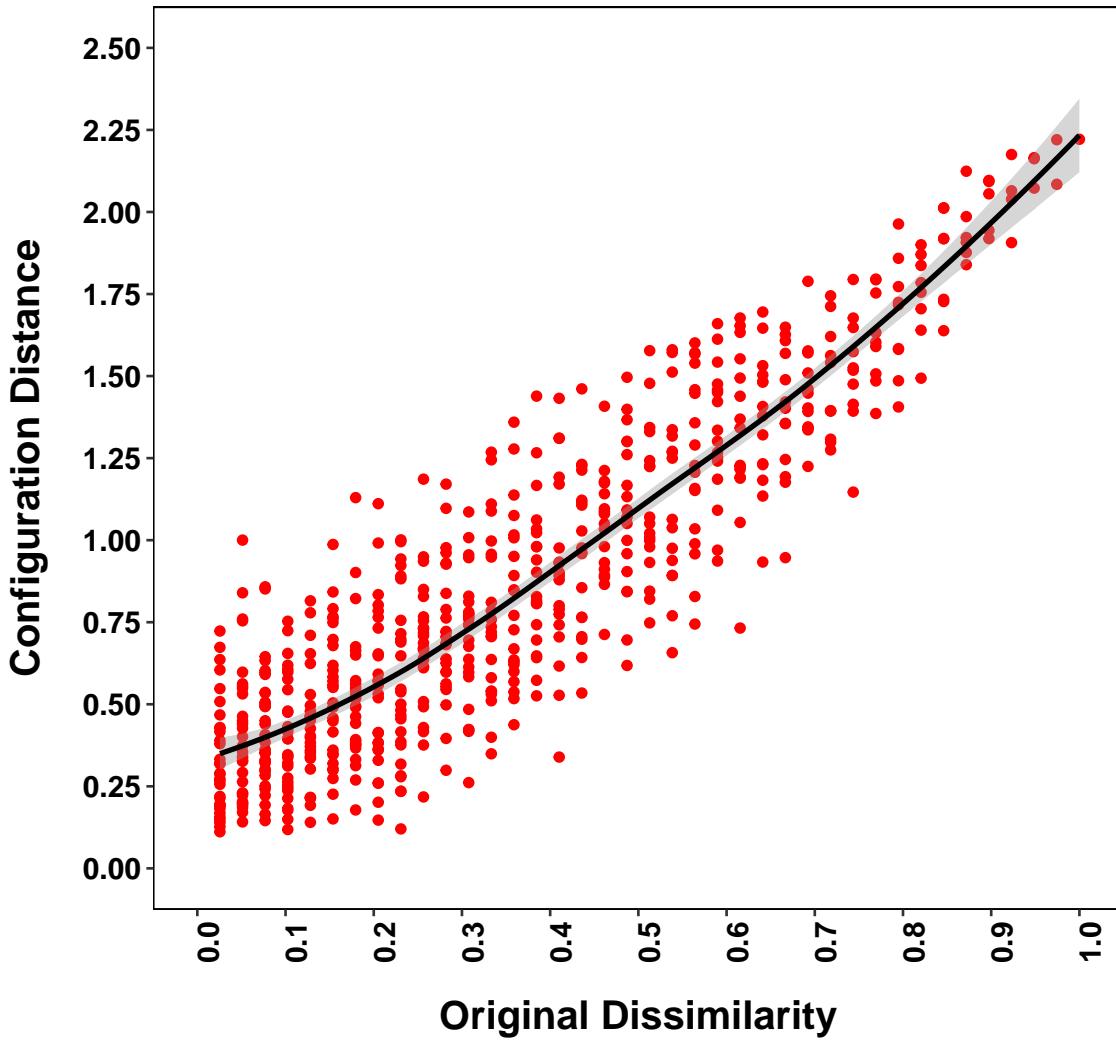
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 8")

```

Two-Dimensional Space: Source 8



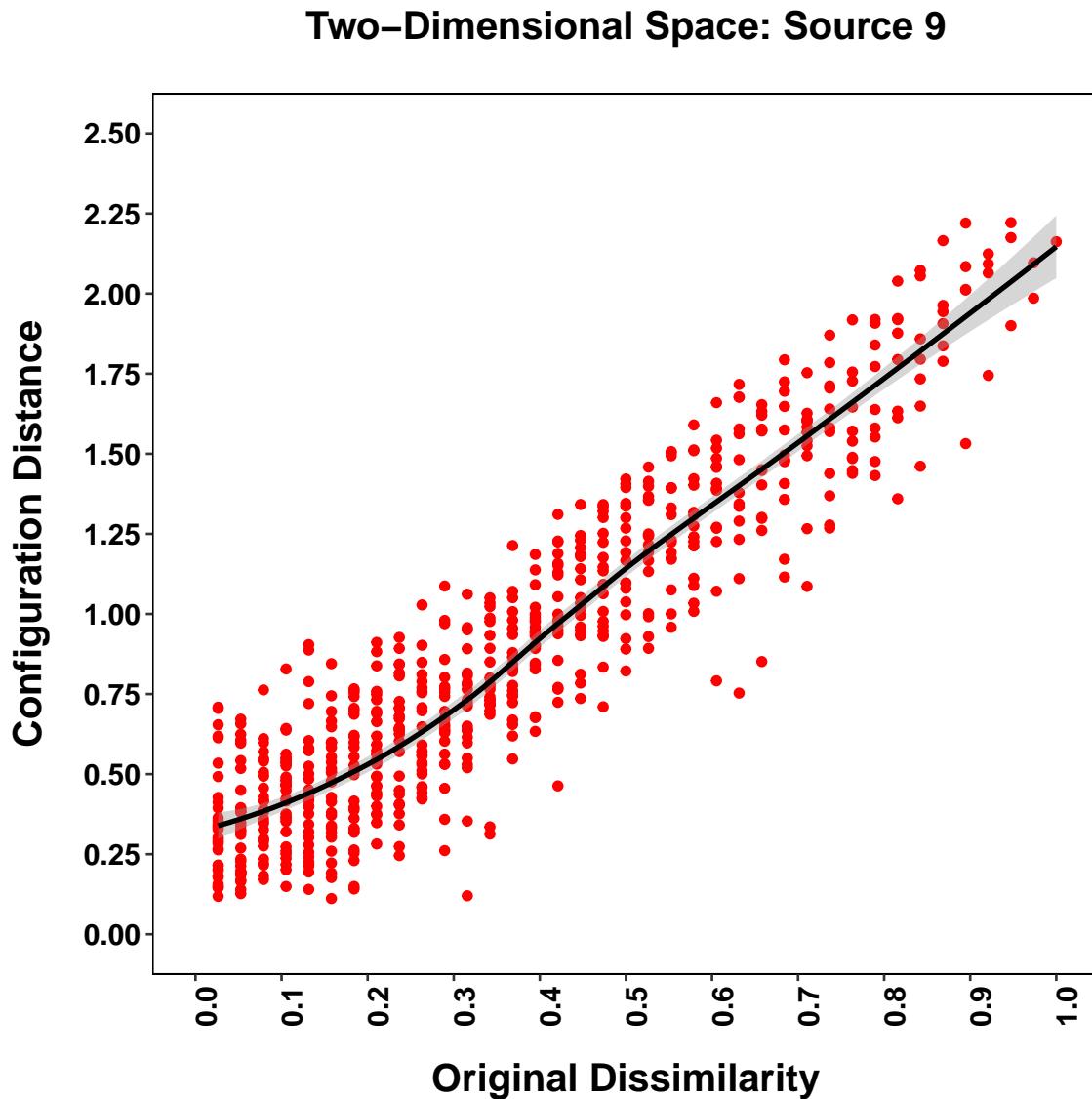
```
plot_data <- matrix(cbind(unlist(identity_fit$delta[[9]]), unlist(identity_fit$confdist[[9]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 9")

```



```

plot_data <- matrix(cbind(unlist(identity_fit$delta[[10]]), unlist(identity_fit$confdist[[10]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

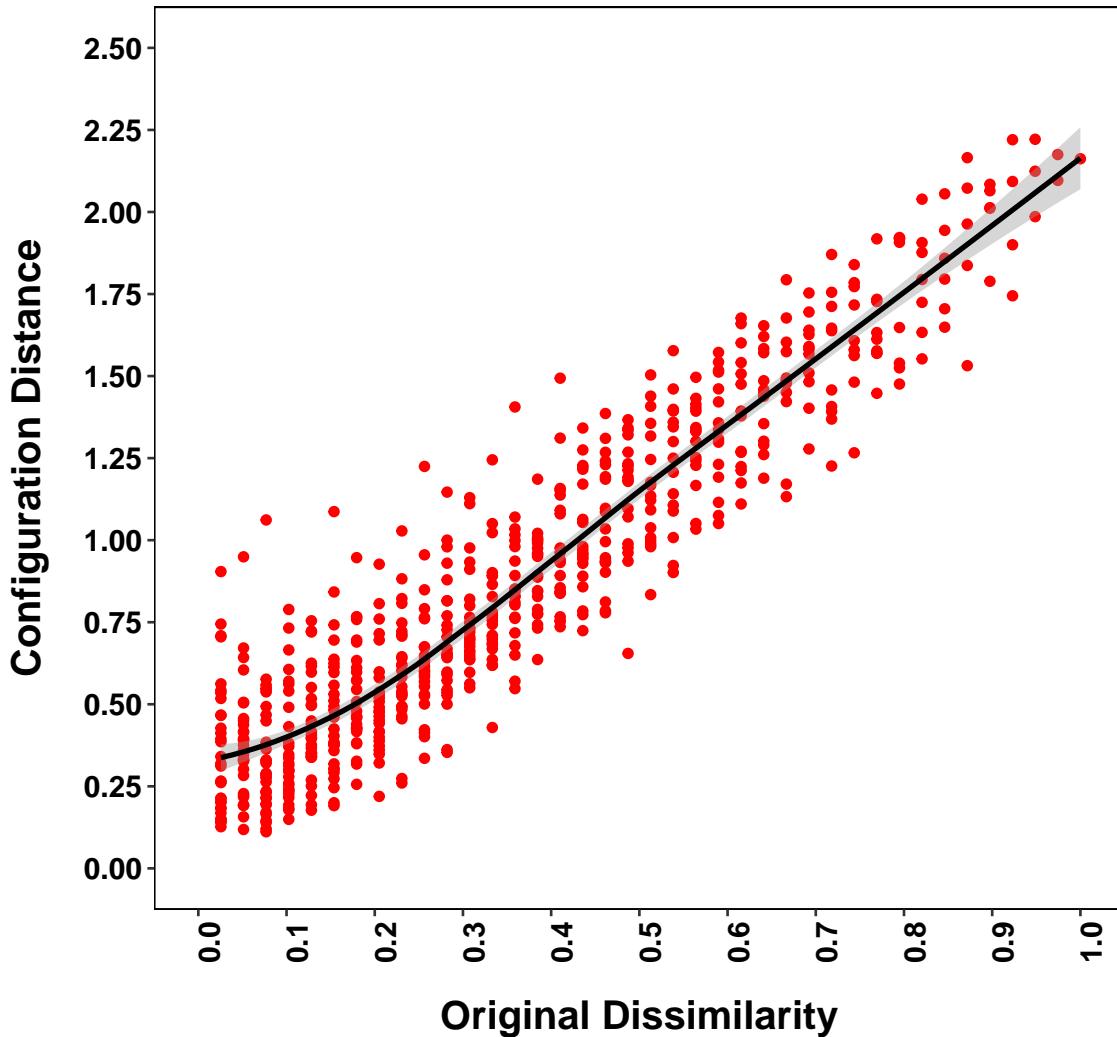
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 10")

```

Two-Dimensional Space: Source 10



```
plot_data <- matrix(cbind(unlist(identity_fit$delta[[11]]), unlist(identity_fit$confdist[[11]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

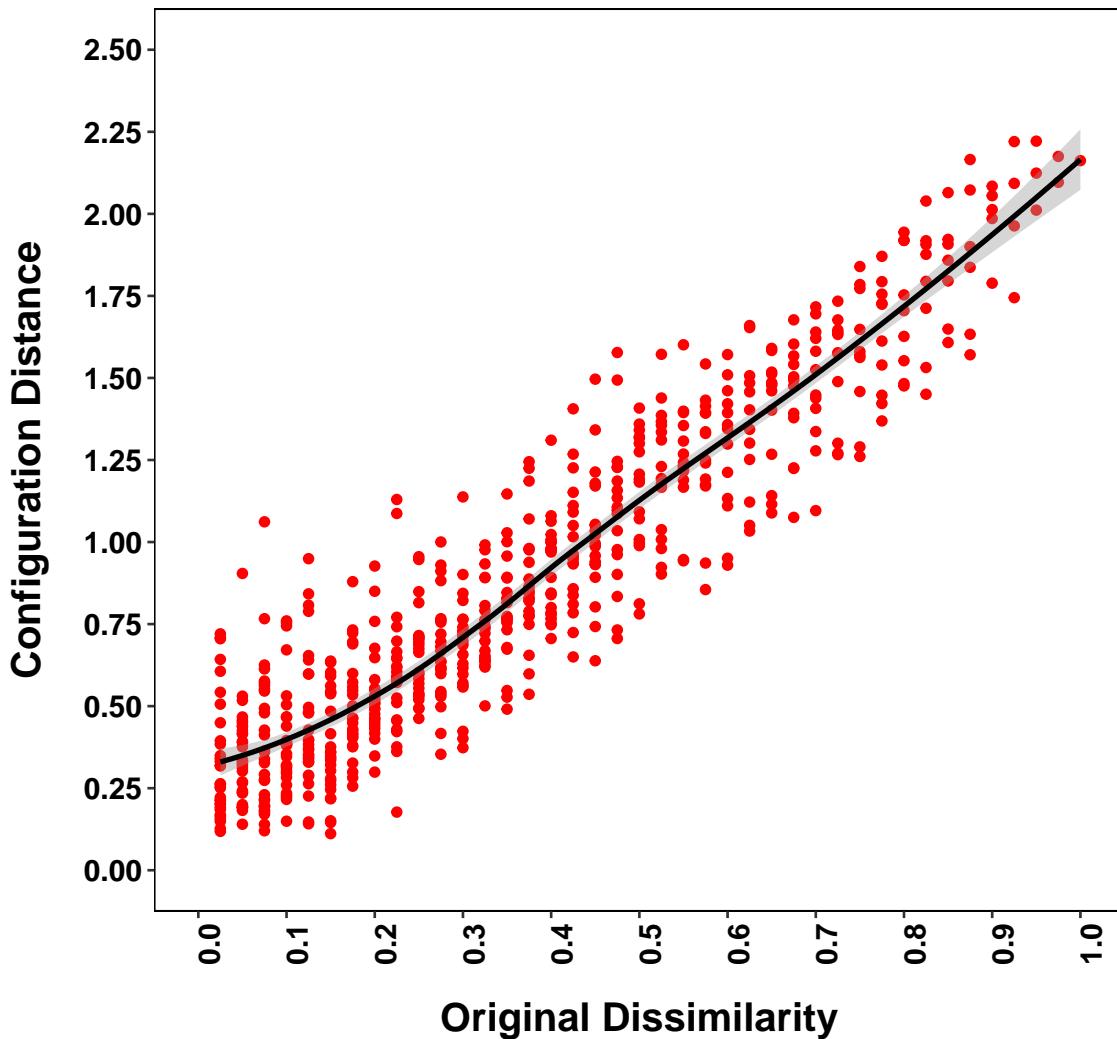
```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 11")

```

Two-Dimensional Space: Source 11



```

plot_data <- matrix(cbind(unlist(identity_fit$delta[[12]]), unlist(identity_fit$confdist[[12]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

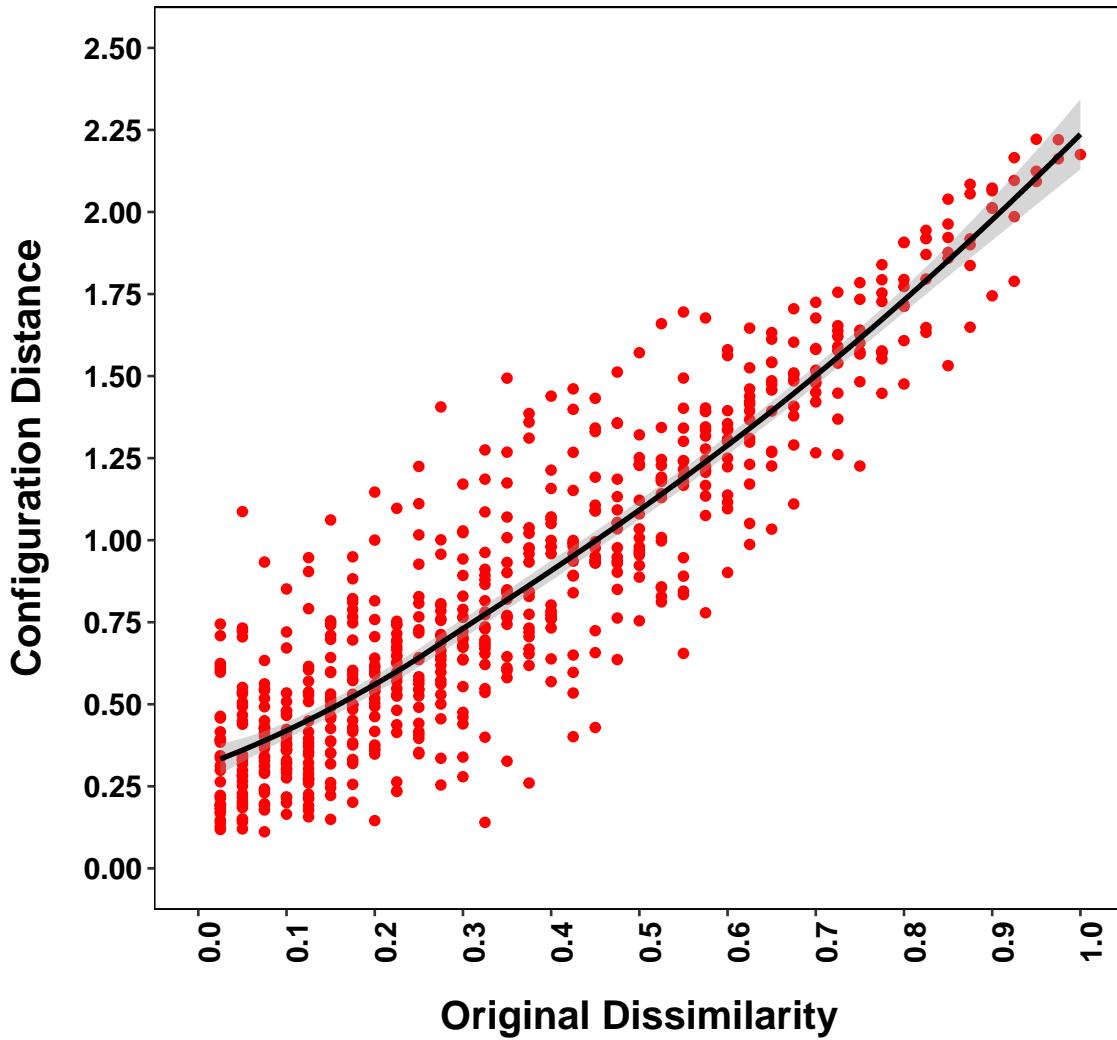
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 12")

```

Two-Dimensional Space: Source 12



```
plot_data <- matrix(cbind(unlist(identity_fit$delta[[13]]), unlist(identity_fit$confdist[[13]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

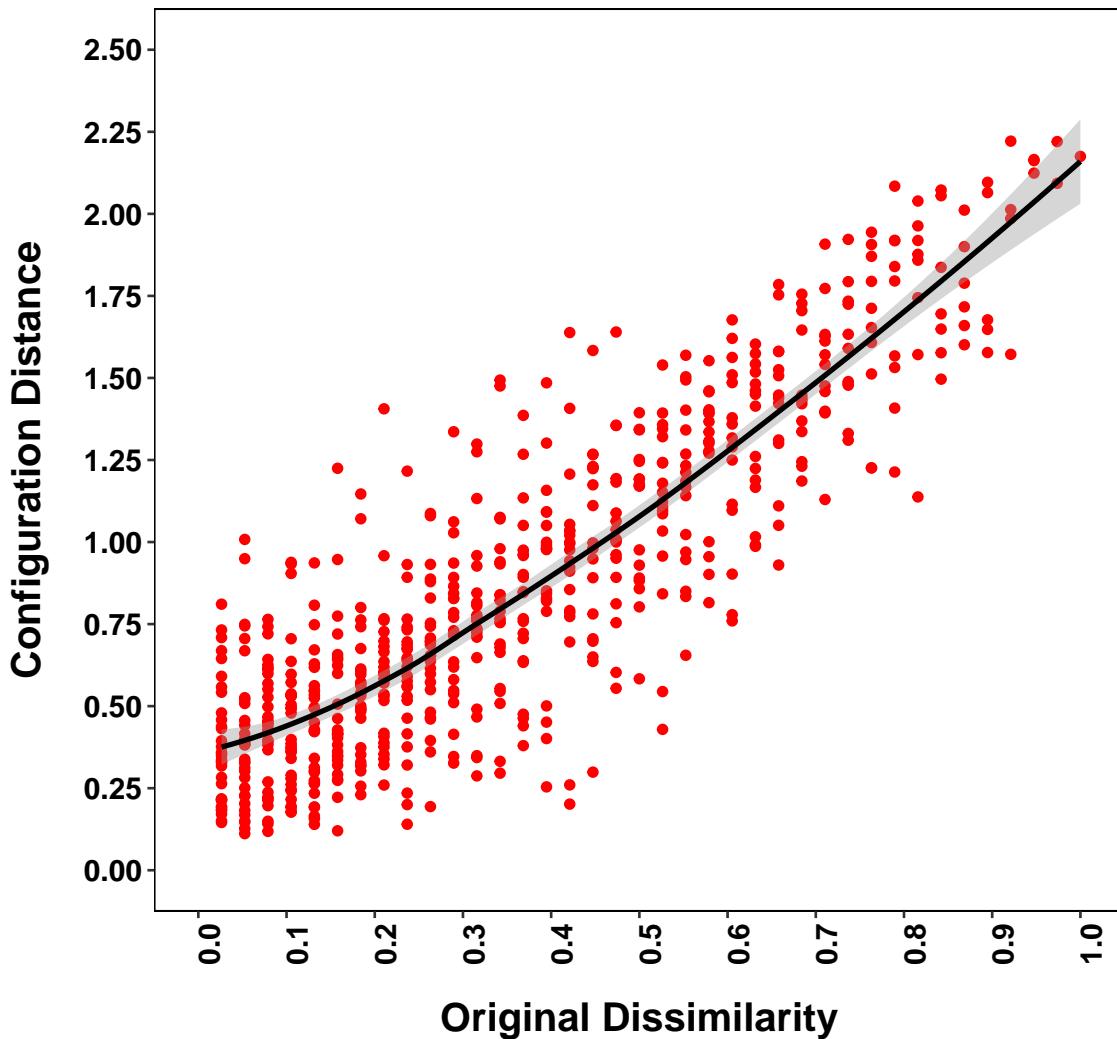
```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 13")

```

Two-Dimensional Space: Source 13



```

plot_data <- matrix(cbind(unlist(identity_fit$delta[[1]]), unlist(identity_fit$confdist[[1]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

```

names(plot_data) <- c("Dissimilarity", "Distance")
for (j in seq(2, 13)) {
  plot_temp <- (matrix(cbind(unlist(identity_fit$delta[[j]]), unlist(identity_fit$confdist[[j]])),
    ncol = 2, byrow = FALSE))
  plot_temp <- as.data.frame(plot_temp)
  names(plot_temp) <- c("Dissimilarity", "Distance")
  plot_data <- rbind(plot_data, plot_temp)
}

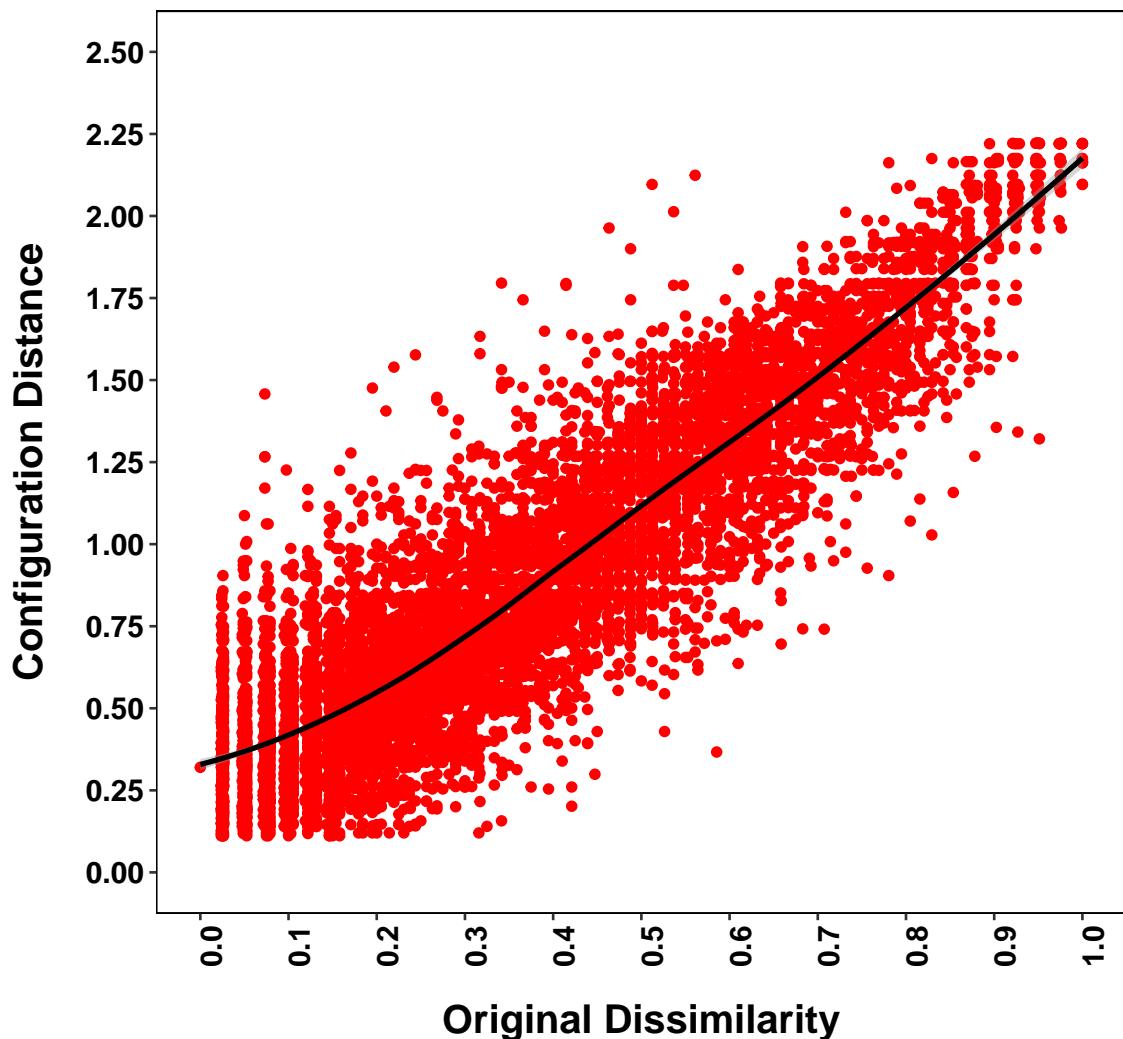
```

```

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
    face = "bold"), axis.text.y = element_text(colour = "black",
    size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
    size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
    0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
    15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
    0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
    linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space: All Sources")

```

Two-Dimensional Space: All Sources



3.2.5 Weights

The sources cannot weight the dimensions differently in this solution. To the extent that the INDSCAL solution shows variability in weights, the latter is more appropriate.

```
identity_fit$cweights  
## [[1]]  
##      D1  D2  
## D1  1  0  
## D2  0  1  
##  
## [[2]]  
##      D1  D2
```

```

## D1 1 0
## D2 0 1
##
## [[3]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[4]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[5]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[6]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[7]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[8]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[9]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[10]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[11]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[12]]
##   D1 D2
## D1 1 0
## D2 0 1
##
## [[13]]

```

```

##      D1 D2
## D1  1  0
## D2  0  1

```

3.2.6 Source and Object Information

Additional source information can be used to help identify the meaning behind source differences as indicated by source weights and stress. Likewise, additional object information can help identify the nature of MDS dimensions and relative fit for objects. Note that for this solution, the weights must be the same for all sources and so only source stress will vary.

```

prez_data <- as.data.frame(cbind(prez_info, siena_info[, 2:21], as.data.frame(identity_fit$gspace),
                                 as.data.frame(identity_fit$spp)))
round(cor(prez_data[, c(2:26)], prez_data[, 25:26], use = "pairwise.complete.obs"),
      2)

##                                     D1      D2
## Height                           -0.26   0.19
## Age                            0.00   0.21
## BMI                            0.03   0.06
## Background                      0.65   0.14
## Party_leadership                0.84  -0.02
## Communication_ability           0.92   0.03
## Relations_with_Congress         0.84  -0.06
## Court_appointments              0.89   0.03
## Handling_of_economy              0.87  -0.06
## Luck                            0.77  -0.28
## Ability_to_compromise           0.68  -0.04
## Willing_to_take_risks           0.86   0.06
## Executive_appointments          0.95   0.09
## Overall_ability                 0.96   0.13
## Imagination                     0.92   0.14
## Domestic_accomplishments       0.91   0.11
## Integrity                        0.72  -0.01
## Executive_ability                0.98   0.00
## Foreign_policy_accomplishments  0.84  -0.01
## Leadership_ability               0.91   0.02
## Intelligence                     0.83   0.25
## Avoid_crucial_mistakes          0.83  -0.15
## Experts_view                     0.98  -0.03
## D1                             1.00   0.00
## D2                             0.00   1.00

source_info

##      Survey Year Party Academic News
## 1      1 1999    D      0     1
## 2      2 2000    D      0     1
## 3      3 2002    R      1     0
## 4      4 2005    R      0     1
## 5      5 2008    R      0     1
## 6      6 2009    D      0     1
## 7      7 2010    D      1     0

```

```

## 8      8 2011    D      0      0
## 9      9 1982    R      1      0
## 10     10 1990   R      1      0
## 11     11 1994   D      1      0
## 12     12 1996   D      0      0
## 13     13 1996   D      0      0

source_info$Dems <- ifelse(source_info$Party == "D", 1, 0)
source_info$Stress <- identity_fit$sps
cor(source_info[, c(2, 4:7)])

##          Year Academic News    Dems Stress
## Year     1.0000 -0.4357 0.3871 0.26346 0.38357
## Academic -0.4357 1.0000 -0.6250 -0.35000 -0.53905
## News      0.3871 -0.6250 1.0000 -0.02500 0.41437
## Dems       0.2635 -0.3500 -0.0250 1.00000 -0.09943
## Stress    0.3836 -0.5391 0.4144 -0.09943 1.00000

```

4 Diagonal Constraint

INDSCAL is performed with configuration weight matrices restricted to be diagonal. As an initial stage, models with different numbers of dimensions can be examined to determine the best number for additional examination.

4.1 Basic Model Fit

The basic model is fit by specifying the type of analysis (ordinal here), the constraint (indscal here), and the number of dimensions (2 here). The maximum number of iterations is also specified here to insure that a solution can be found. This solution will allow the 13 sources to weight the dimensions differently, but require that the weight matrices are diagonal.

```

indscal_fit <- smacofIndDiff(Presidents_Dist, ndim = 2, constraint = "indscal",
                               itmax = 1000, type = "ordinal")
summary(indscal_fit)

##
## Group Stimulus Space (Joint Configurations):
##          D1      D2
## 1  -0.8951  0.1492
## 2  -0.4226  0.0389
## 3  -0.9099  0.1143
## 4  -0.6295 -0.0002
## 5  -0.5199  0.0047
## 6  -0.1594 -0.0034
## 7  -0.6284  0.0505
## 8   0.0016 -0.1033
## 9   0.8408 -0.0918
## 10  -0.3760  0.0891
## 11   0.6798 -0.0570
## 12   0.8017 -0.1101
## 13   0.9135 -0.1446
## 14   1.0482 -0.1583

```

```

## 15 -1.0345 0.1448
## 16 1.1816 -0.0626
## 17 0.8977 0.0023
## 18 0.2283 -0.0573
## 19 0.4374 -0.0365
## 20 -0.1334 0.0241
## 21 0.5525 -0.0669
## 22 -0.0795 0.0445
## 23 -0.9395 0.1053
## 24 -0.0274 -0.0476
## 25 -0.8382 0.0640
## 26 1.1470 -0.1093
## 27 0.6424 -0.0151
## 28 0.4237 -0.1183
## 29 -1.1147 0.1186
## 30 -0.7169 0.1060
## 31 -0.5283 0.1054
## 32 -0.4638 0.0686
## 33 -0.3133 0.0585
## 34 0.3086 -0.1115
## 35 0.4286 -0.0159
## 36 0.1792 -0.0869
## 37 0.0177 0.1078
##
##
## Stress per point:
##   1   2   3   4   5   6   7   8   9   10  11  12  13
## 1.78 2.36 2.34 3.33 3.36 2.51 3.19 3.25 2.04 2.17 2.52 2.25 1.72
## 14   15   16   17   18   19   20   21   22   23   24   25   26
## 1.70 1.82 3.06 4.37 2.52 2.93 2.84 2.58 1.91 2.07 2.01 1.91 1.55
## 27   28   29   30   31   32   33   34   35   36   37
## 2.95 2.81 1.78 1.78 2.09 4.16 2.66 4.75 2.64 5.47 4.83

```

4.2 Additional Information

As with other MDS procedures, additional, largely graphical, information can be consulted to determine the nature of the solution and its adequacy.

4.2.1 Stress Plots

Stress can be viewed in several ways. First, there will be an overall stress value for the solution, as with any MDS. Second, the proportion of that stress value that is due to different objects can be illustrated. Third, the stress due to different sources can be illustrated. The latter two can help identify the reasons for good and poor fit.

```

indscal_fit$stress
## [1] 0.1626

plot_data <- as.data.frame(indscal_fit$spp)
names(plot_data) <- c("SP")
plot_data$Name <- plot_data$Name <- Presidents$Name

```

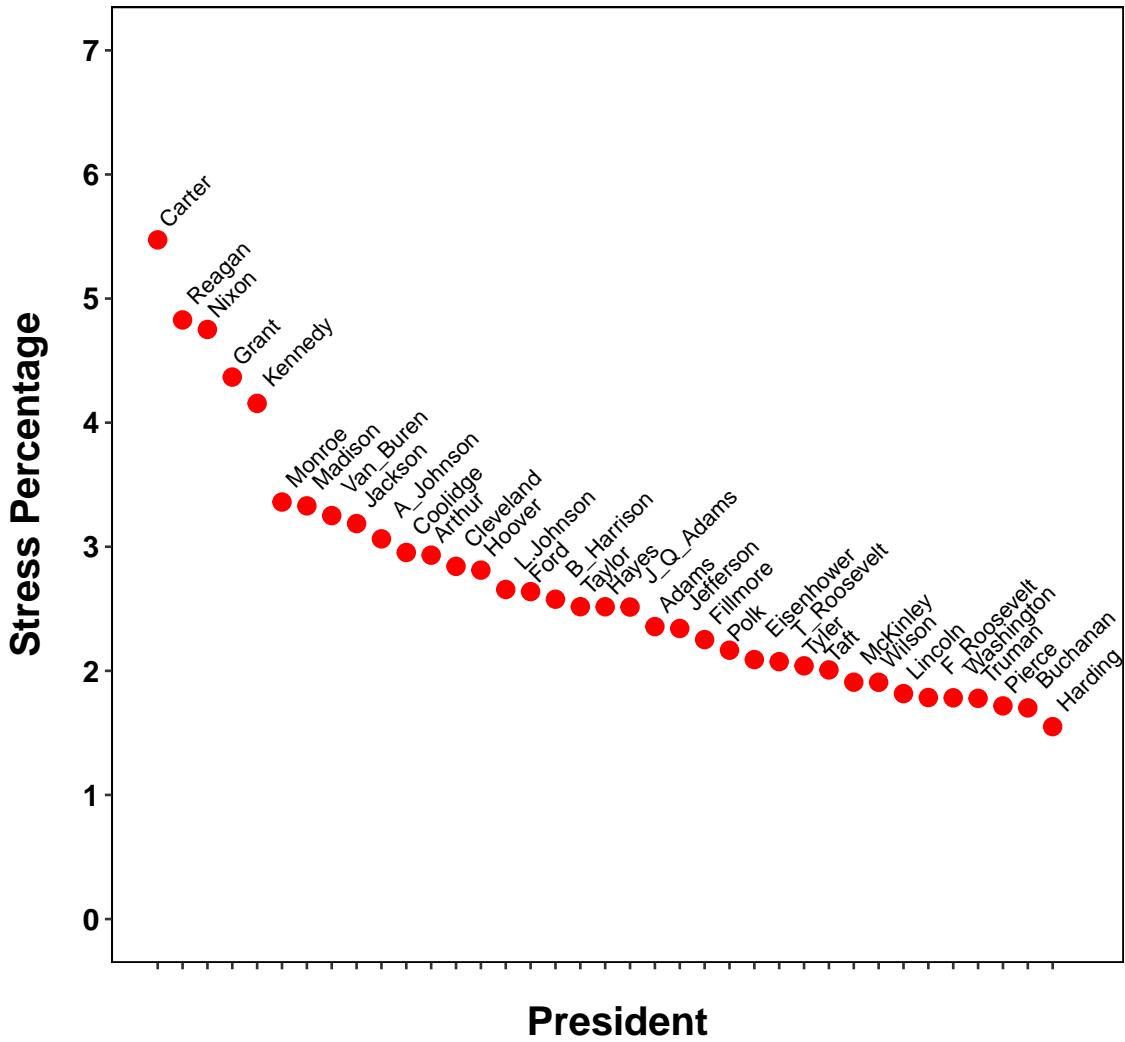
```

plot_data <- plot_data[order(-plot_data[, 1]), ]
plot_data$Index <- seq(1, length(plot_data[, 1]))

ggplot(plot_data, aes(x = Index, y = SP)) + geom_point(shape = 19,
  size = 3, color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  7, 1))) + scale_x_continuous(breaks = c(seq(1, 37, 1))) + geom_text(aes(label = Name),
  hjust = -0.25, vjust = 0, size = 3, angle = 45) + coord_cartesian(xlim = c(1,
  38), ylim = c(0, 7)) + xlab("President") + ylab("Stress Percentage") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_blank(),
  axis.title.x = element_text(margin = margin(15, 0, 0, 0),
  size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(),
  axis.line.y = element_blank(), plot.title = element_text(size = 16,
  face = "bold", margin = margin(0, 0, 20, 0), hjust = 0.5),
  panel.background = element_rect(fill = "white", linetype = 1,
  color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Stress Decomposition for Objects")

```

Stress Decomposition for Objects



```

plot_data <- as.data.frame(indscal_fit$sp)
names(plot_data) <- c("SS")
plot_data$Name <- c(paste("Source ", seq(1, 13)))
plot_data <- plot_data[order(-plot_data[, 1]), ]
plot_data$Index <- seq(1, length(plot_data[, 1]))

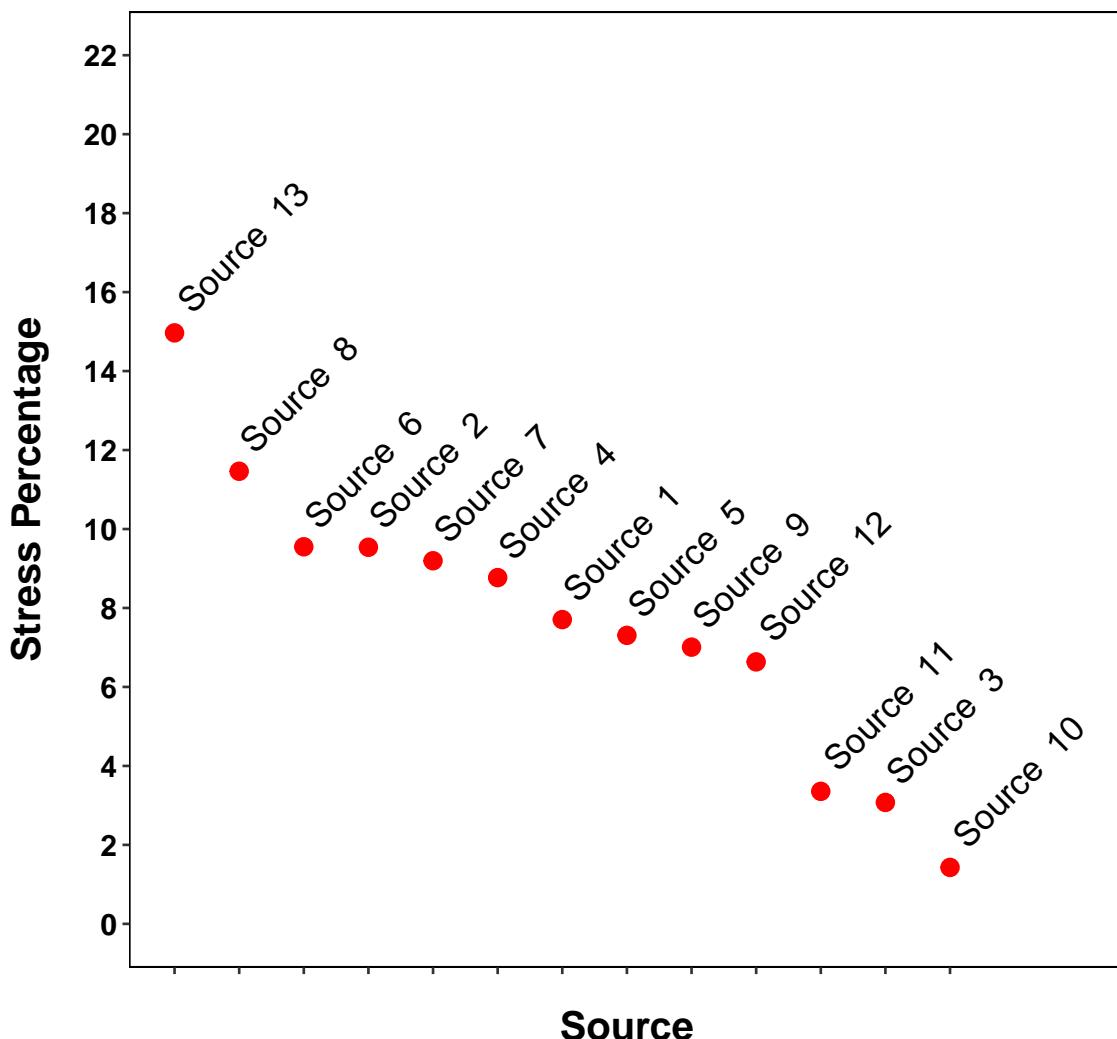
ggplot(plot_data, aes(x = Index, y = SS)) + geom_point(shape = 19,
  size = 3, color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  22, 2))) + scale_x_continuous(breaks = c(seq(1, 13, 1))) + geom_text(aes(label = Name),
  hjust = -0.15, vjust = 0, size = 5, angle = 45) + coord_cartesian(xlim = c(1,
  15), ylim = c(0, 22)) + xlab("Source") + ylab("Stress Percentage") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_blank())
  
```

```

axis.title.x = element_text(margin = margin(15, 0, 0, 0),
    size = 16), axis.title.y = element_text(margin = margin(0,
    15, 0, 0), size = 16), axis.line.x = element_blank(),
axis.line.y = element_blank(), plot.title = element_text(size = 16,
    face = "bold", margin = margin(0, 0, 20, 0), hjust = 0.5),
panel.background = element_rect(fill = "white", linetype = 1,
    color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Stress Decomposition for Sources")

```

Stress Decomposition for Sources



4.2.2 Group Configuration Plot

The group configuration plot shows the aggregate solution or group solution.

```

plot_data <- as.data.frame(indscal_fit$gspace)
names(plot_data) <- c("D1", "D2")
plot_data$Stress <- indscal_fit$spp
plot_data>Name <- Presidents>Name

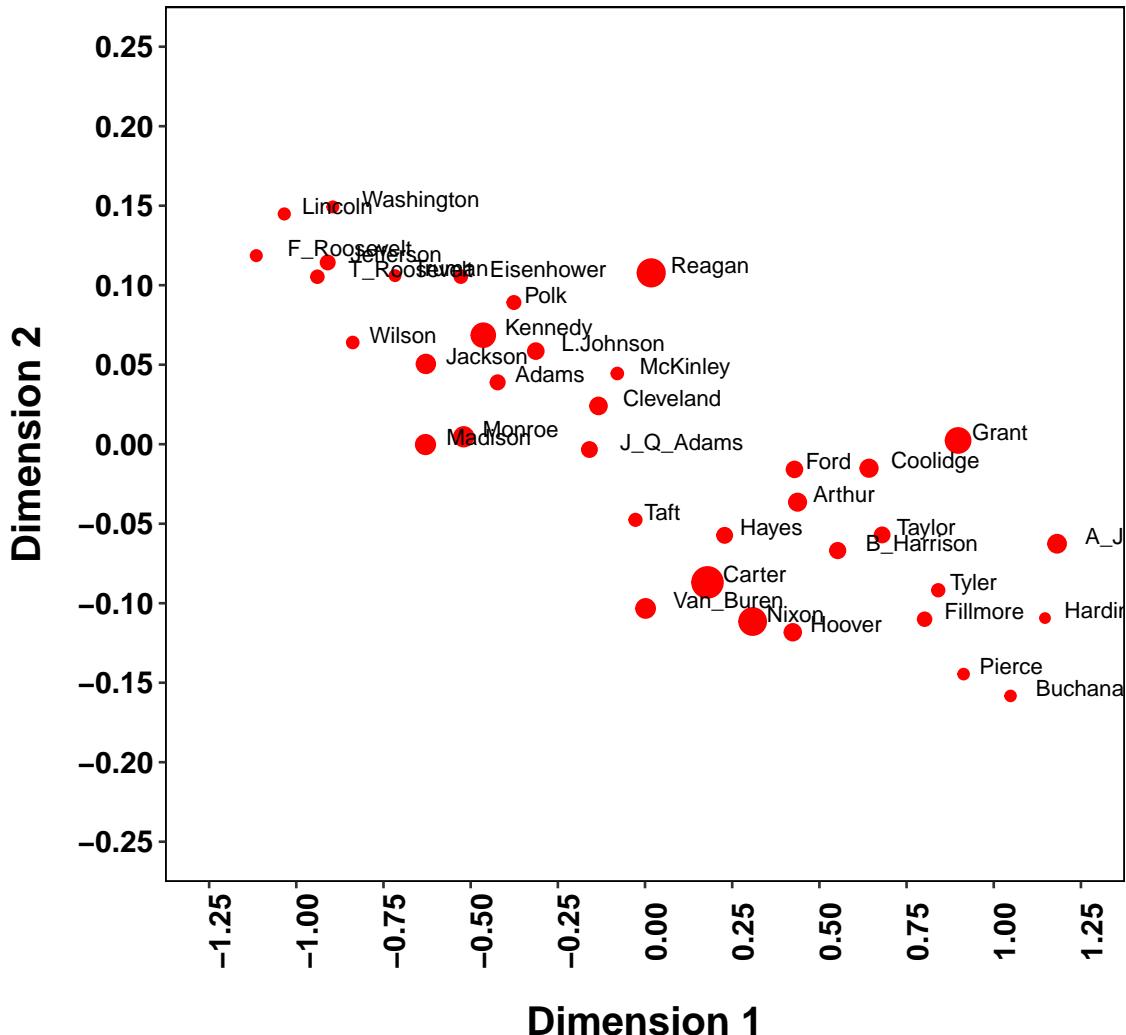
```

```

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = plot_data$Stress,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-0.25,
0.25, 0.05))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.25,
0.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16, face = "bold", margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Size = Object Stress)")

```

Two-Dimensional Space (Size = Object Stress)



4.2.3 Source Configuration Plots

The configuration plots for individual sources can be examined to determine if particular sources have maps that deviate markedly from the group.

```
plot_data <- as.data.frame(indscal_fit$conf[[1]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

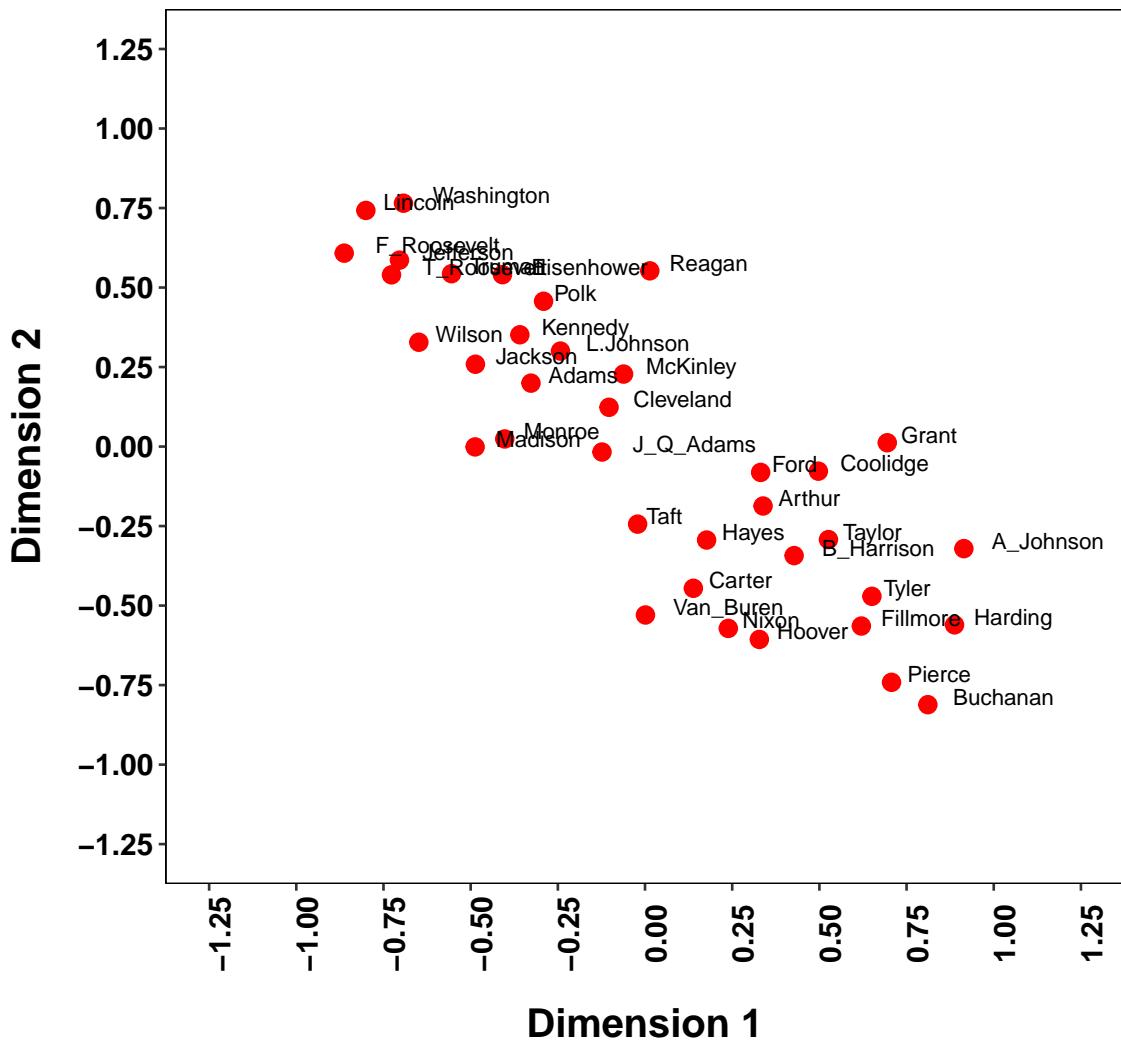
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
0.25))) + geom_text(aes(label = name), hjust = -0.25, vjust = 0,
```

```

size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 1)")

```

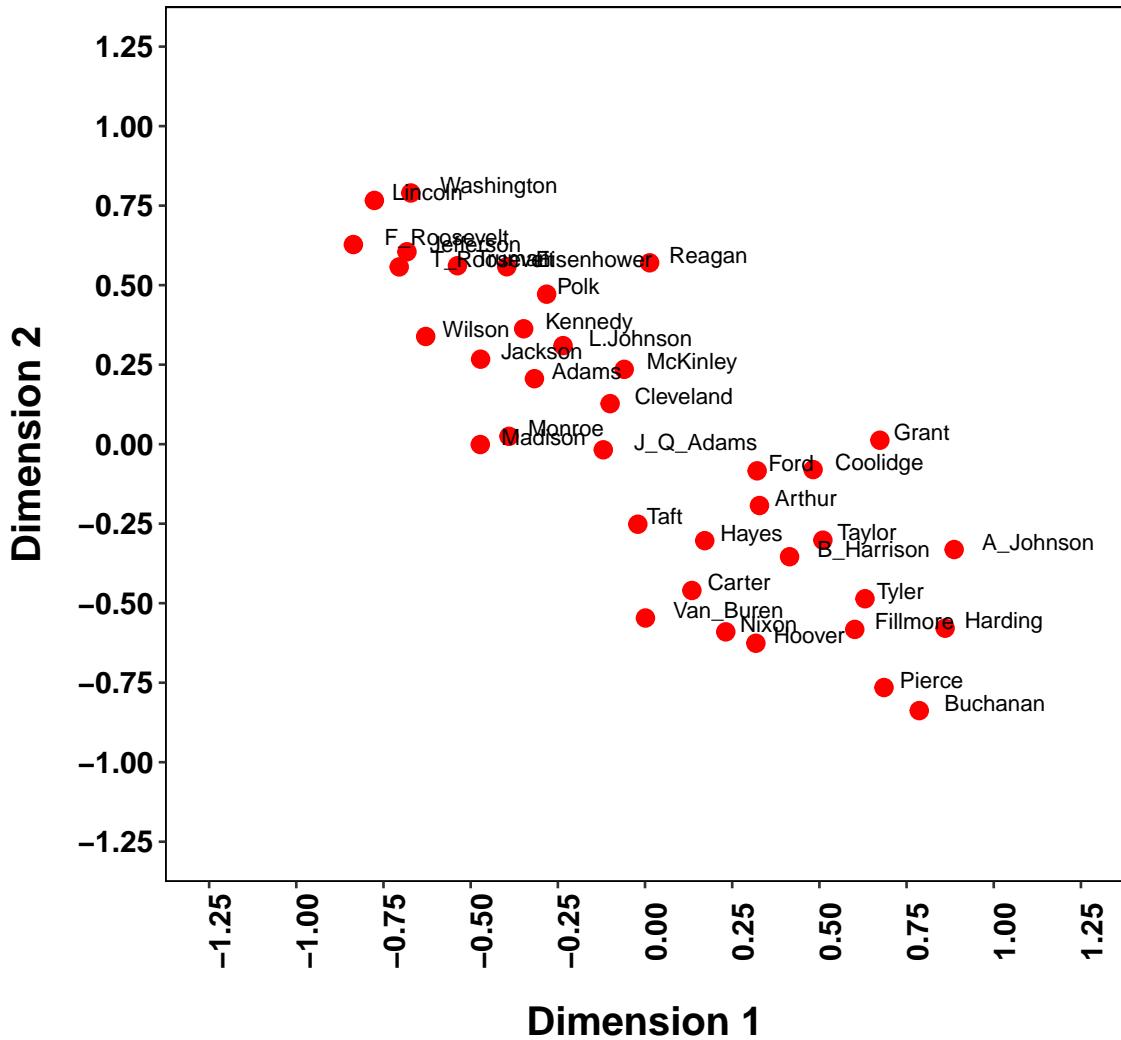
Two-Dimensional Space (Source 1)



```
plot_data <- as.data.frame(indscal_fit$conf[[2]])  
names(plot_data) <- c("D1", "D2")  
plot_data$Name <- Presidents$Name
```

```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,  
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,  
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,  
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,  
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,  
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,  
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",  
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",  
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,  
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,  
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),  
plot.title = element_text(size = 16, face = "bold", margin = margin(0,  
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",  
linetype = 1, color = "black"), panel.grid.major = element_blank(),  
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),  
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",  
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 2)")
```

Two-Dimensional Space (Source 2)



```
plot_data <- as.data.frame(indscal_fit$conf[[3]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

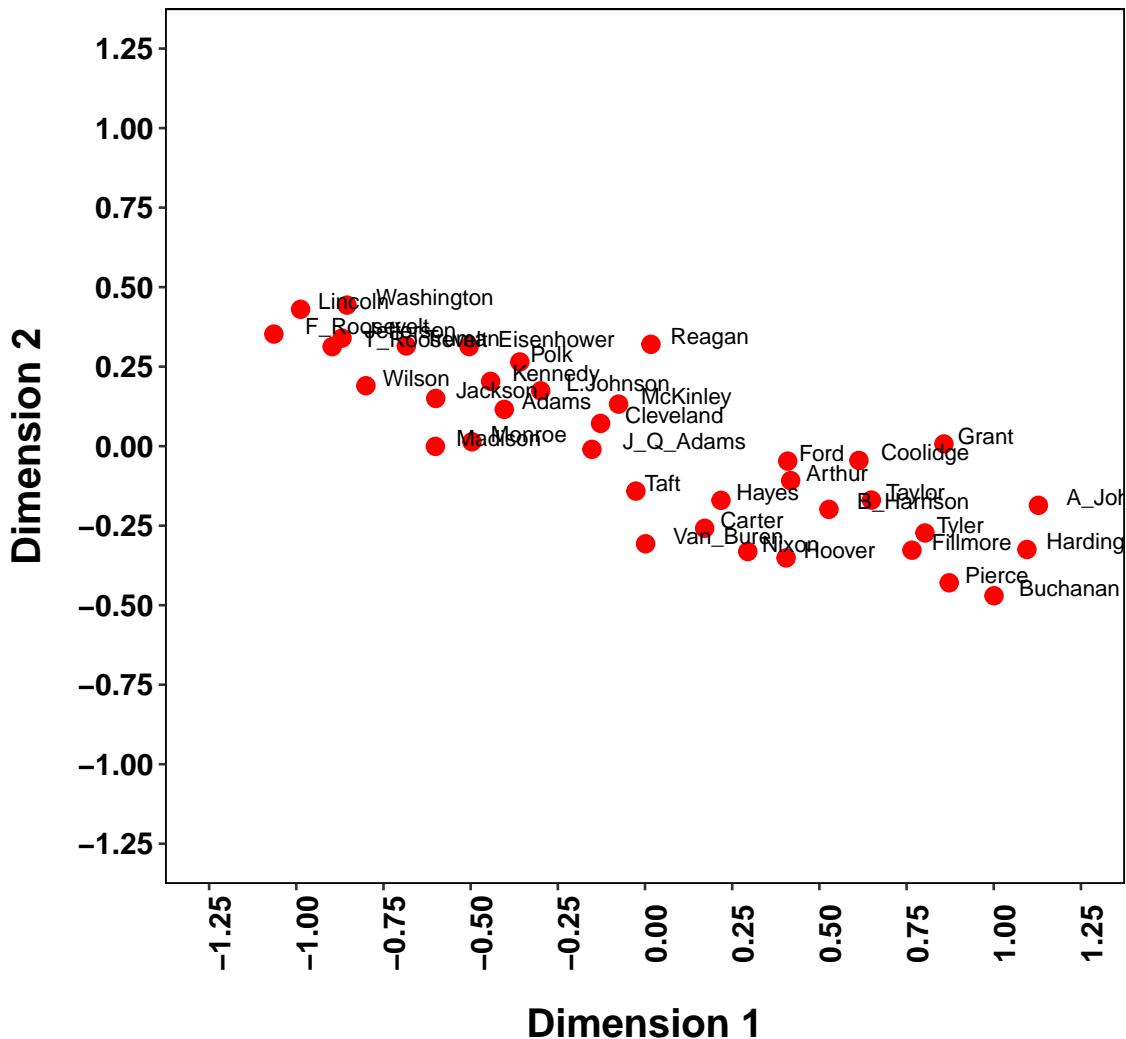
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 3)")

```

Two-Dimensional Space (Source 3)



```

plot_data <- as.data.frame(indscal_fit$conf[[4]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

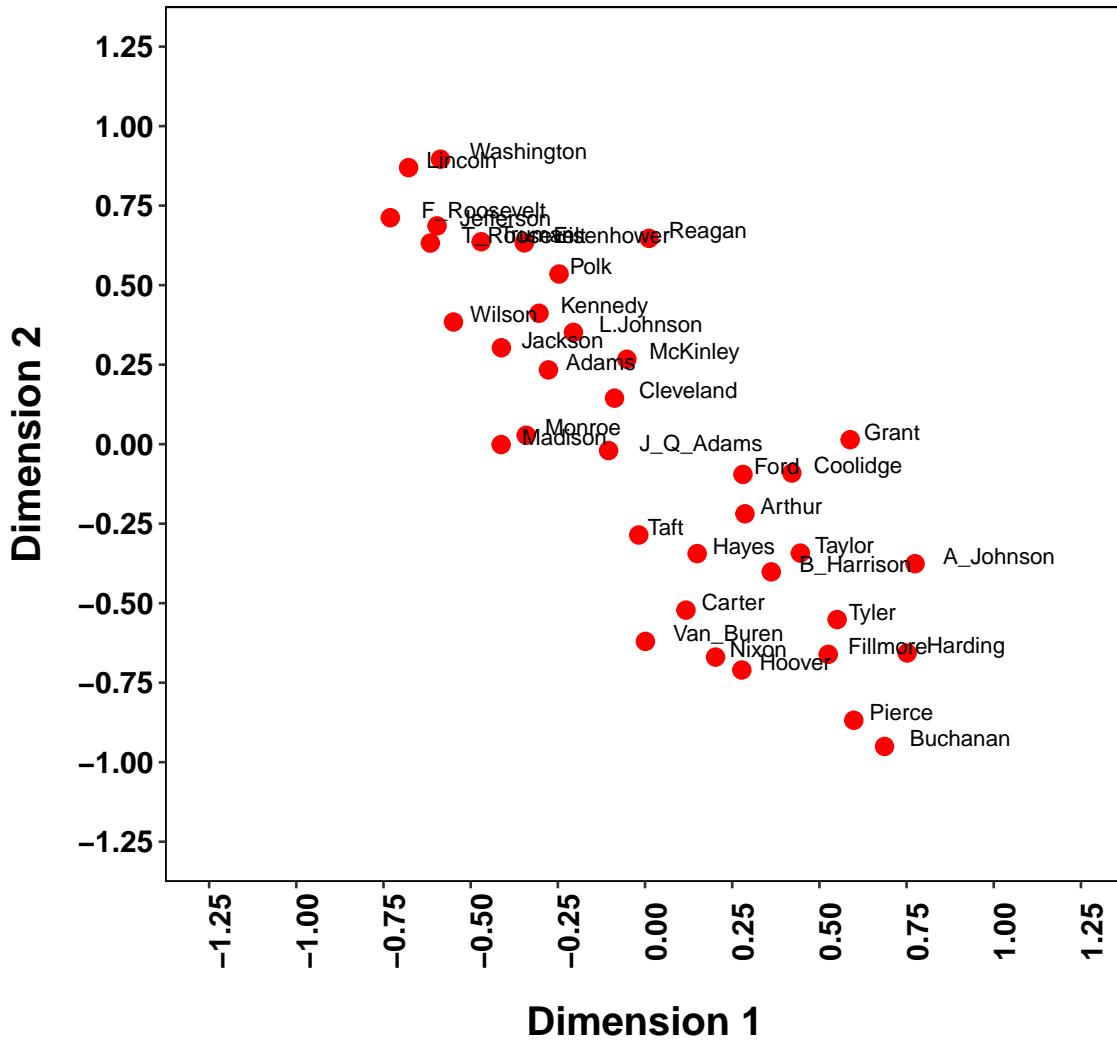
```

```

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 4)")

```

Two-Dimensional Space (Source 4)



```
plot_data <- as.data.frame(indscal_fit$conf[[5]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

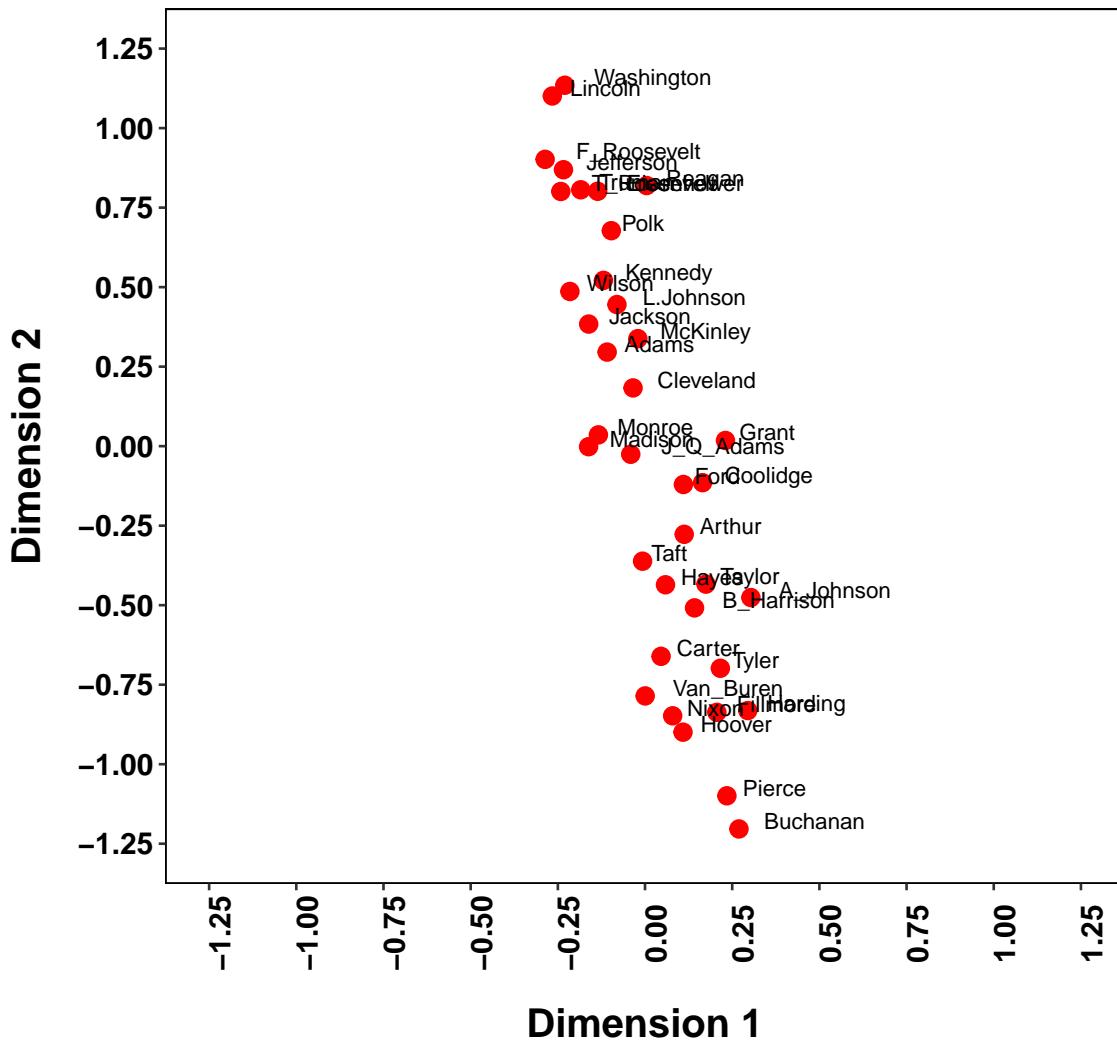
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 5)")

```

Two-Dimensional Space (Source 5)



```

plot_data <- as.data.frame(indscal_fit$conf[[6]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

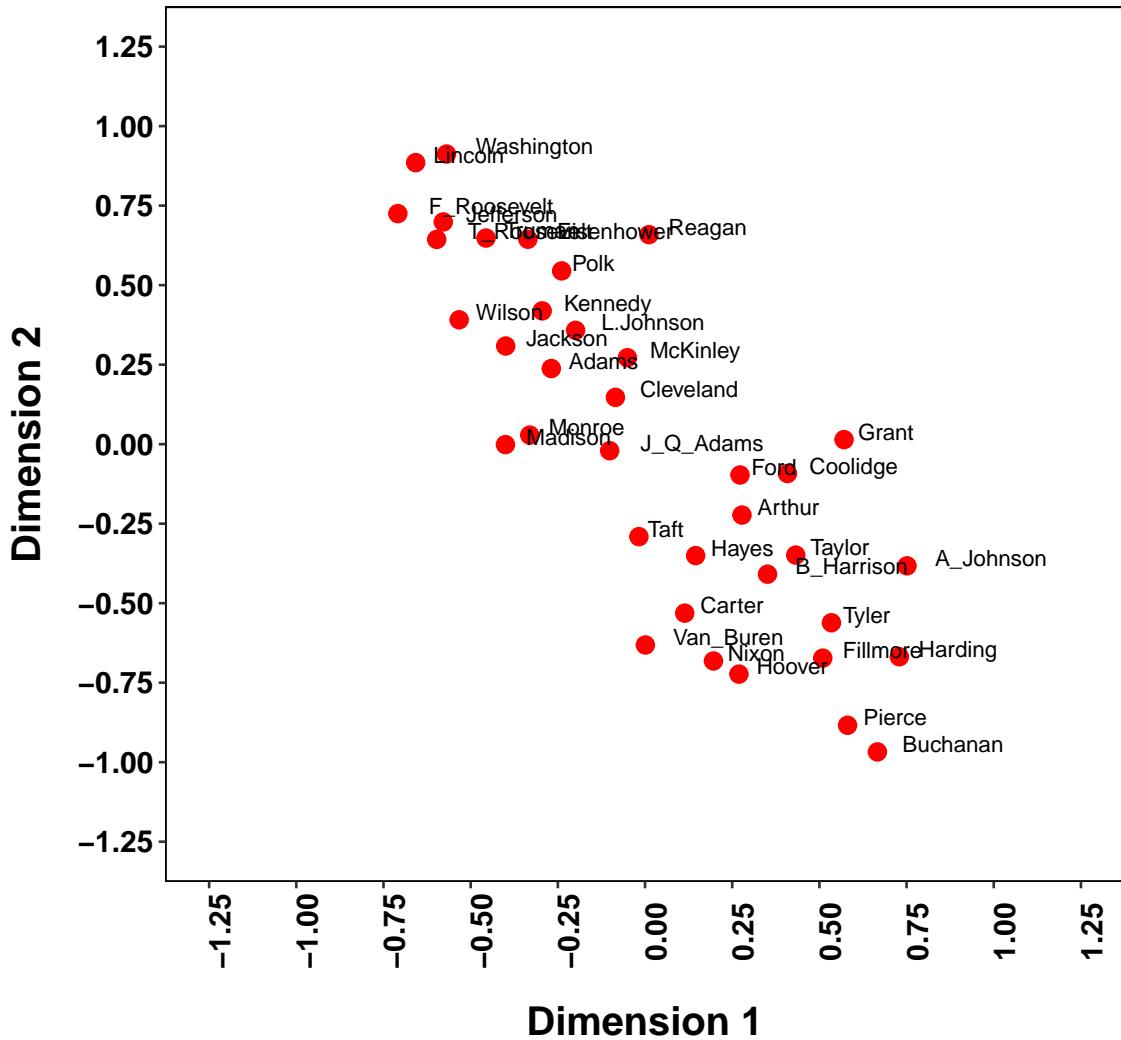
```

```

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 6)")

```

Two-Dimensional Space (Source 6)



```
plot_data <- as.data.frame(indscal_fit$conf[[7]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

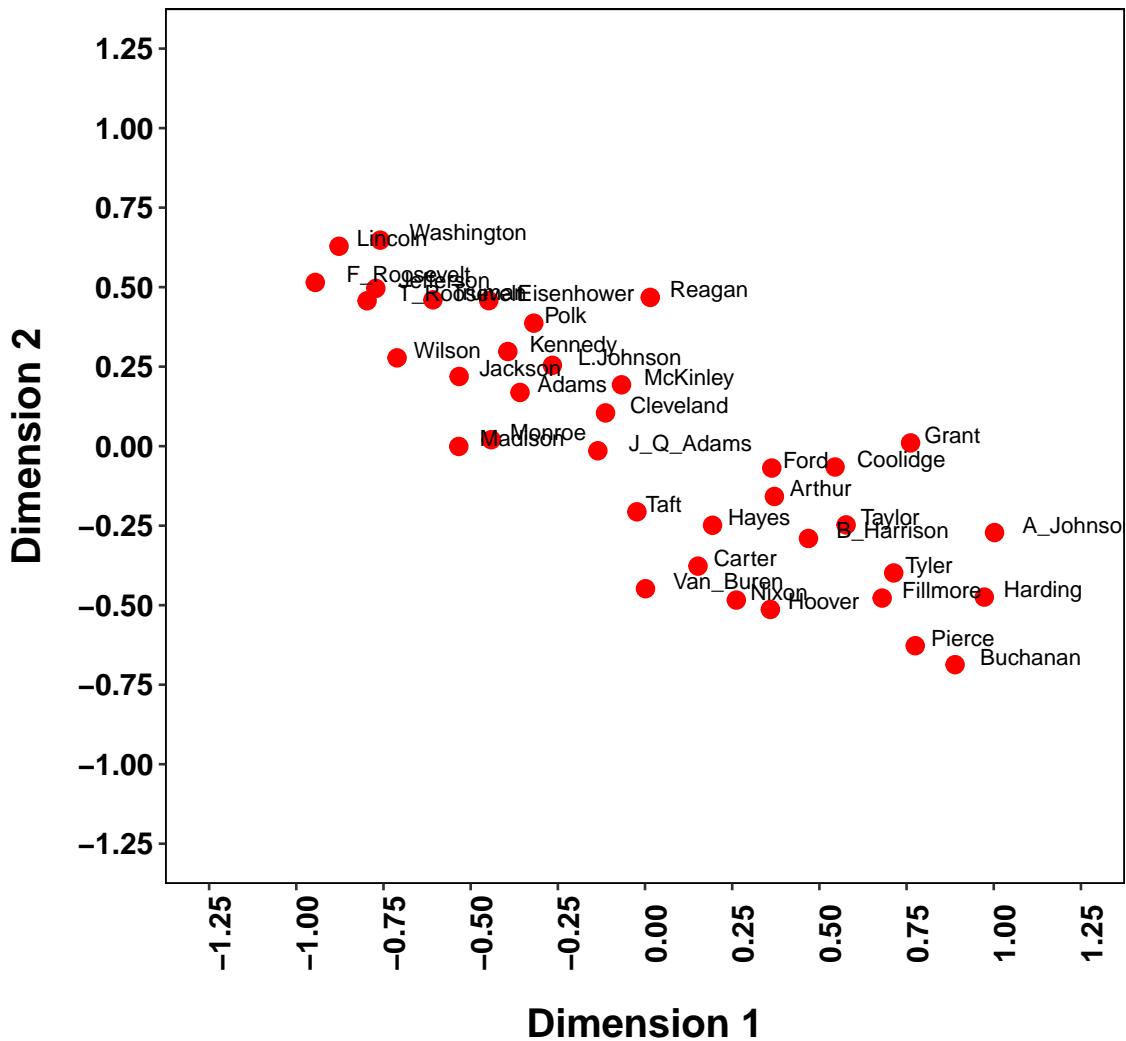
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 7)")

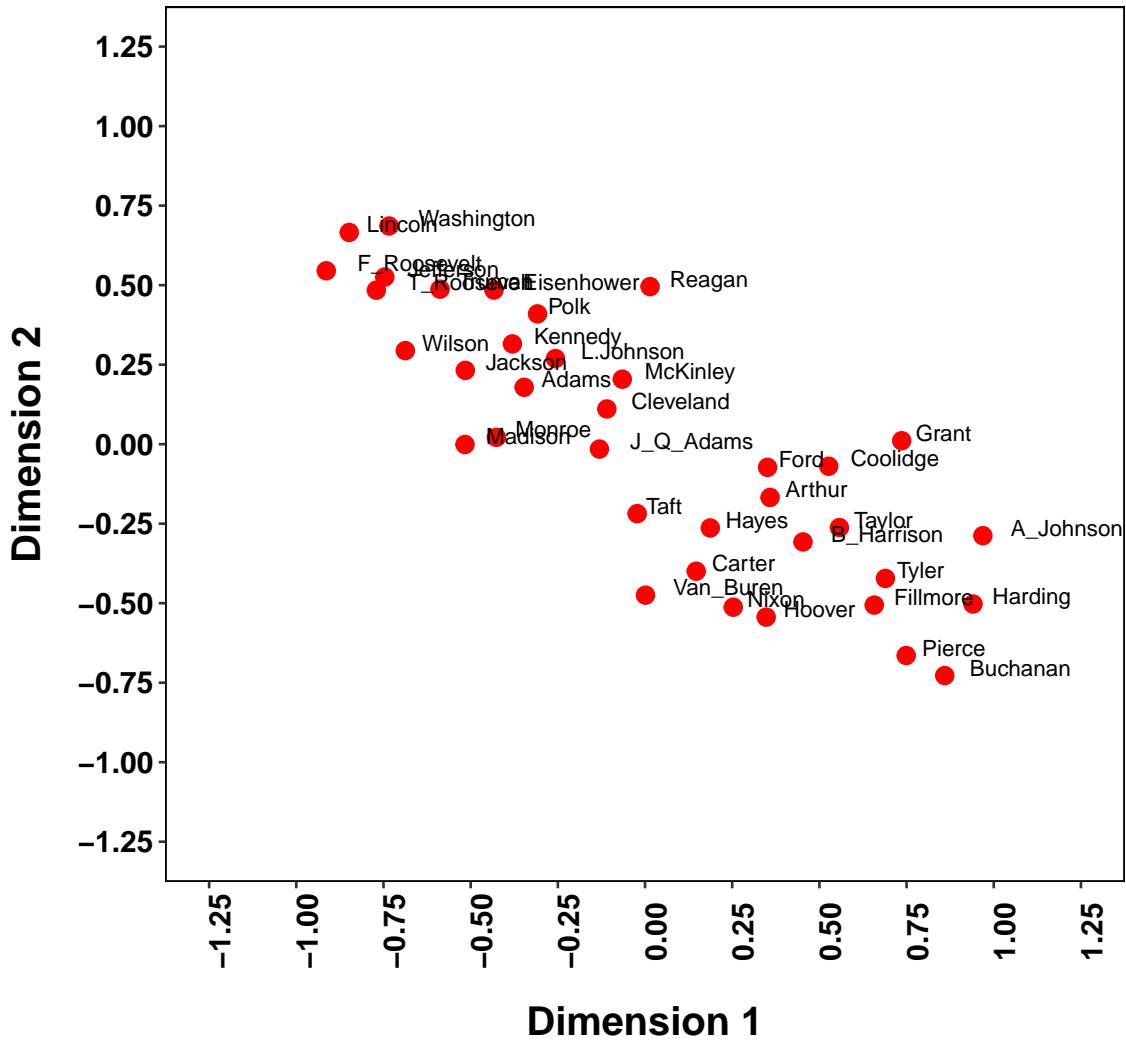
```

Two-Dimensional Space (Source 7)



```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,  
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,  
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,  
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,  
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,  
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,  
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",  
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",  
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,  
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,  
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),  
plot.title = element_text(size = 16, face = "bold", margin = margin(0,  
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",  
linetype = 1, color = "black"), panel.grid.major = element_blank(),  
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),  
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",  
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 8)")
```

Two-Dimensional Space (Source 8)



```
plot_data <- as.data.frame(indscal_fit$conf[[9]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

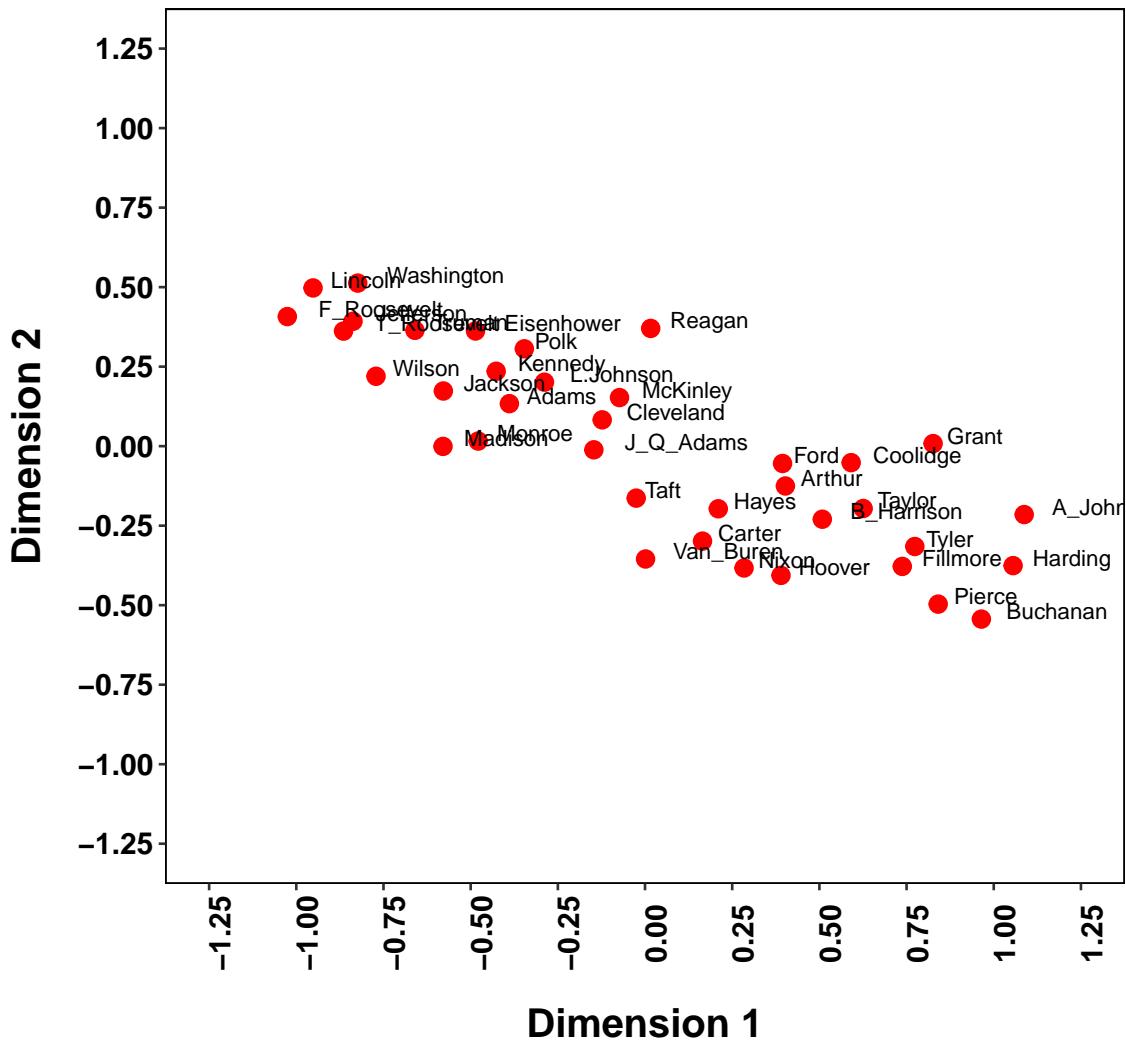
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 9)")

```

Two-Dimensional Space (Source 9)



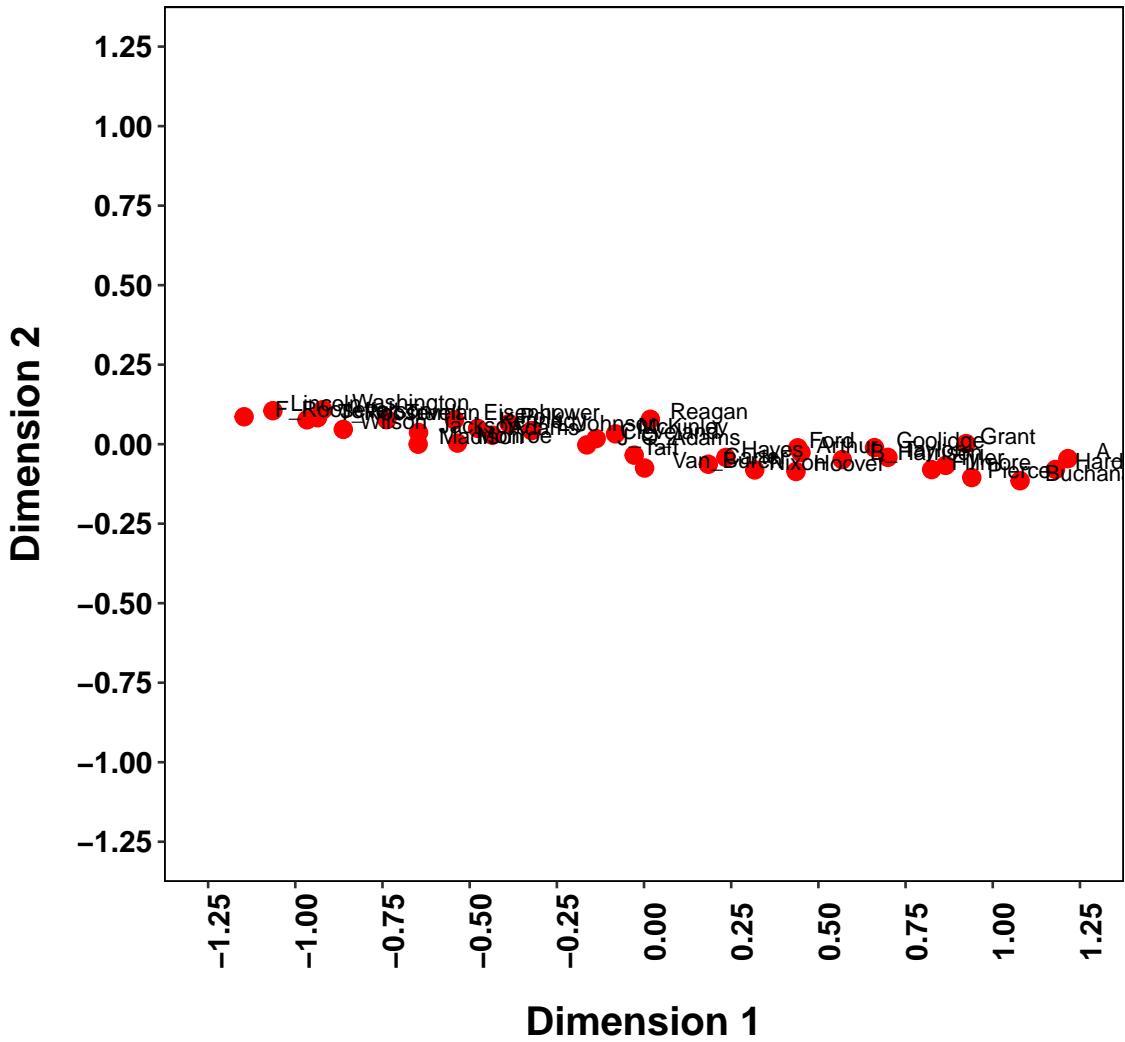
```

plot_data <- as.data.frame(indscal_fit$conf[[10]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

```

```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,  
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,  
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,  
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,  
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,  
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,  
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",  
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",  
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,  
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,  
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),  
plot.title = element_text(size = 16, face = "bold", margin = margin(0,  
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",  
linetype = 1, color = "black"), panel.grid.major = element_blank(),  
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),  
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",  
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 10)")
```

Two-Dimensional Space (Source 10)



```
plot_data <- as.data.frame(indscal_fit$conf[[11]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

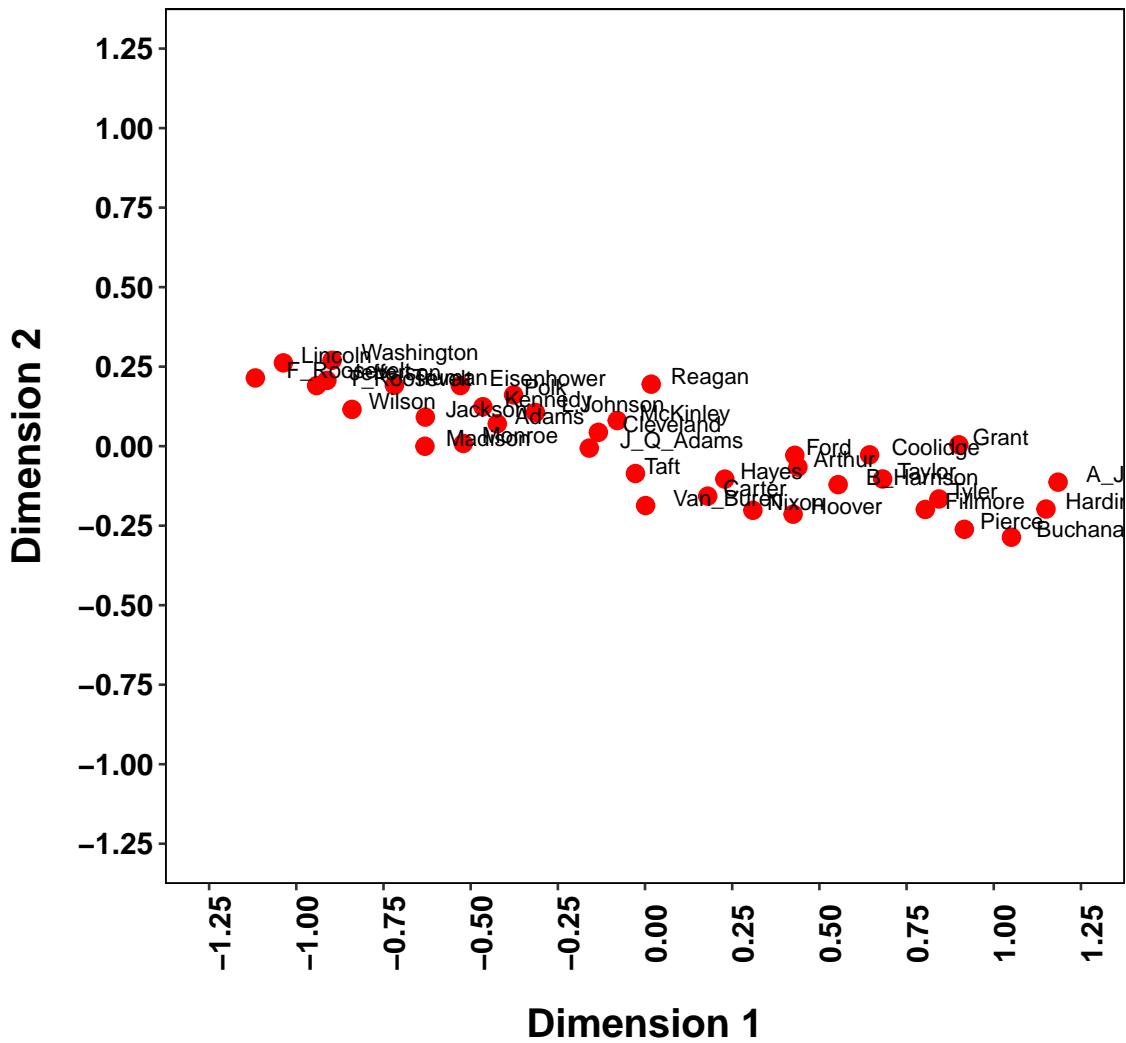
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 11)")

```

Two-Dimensional Space (Source 11)



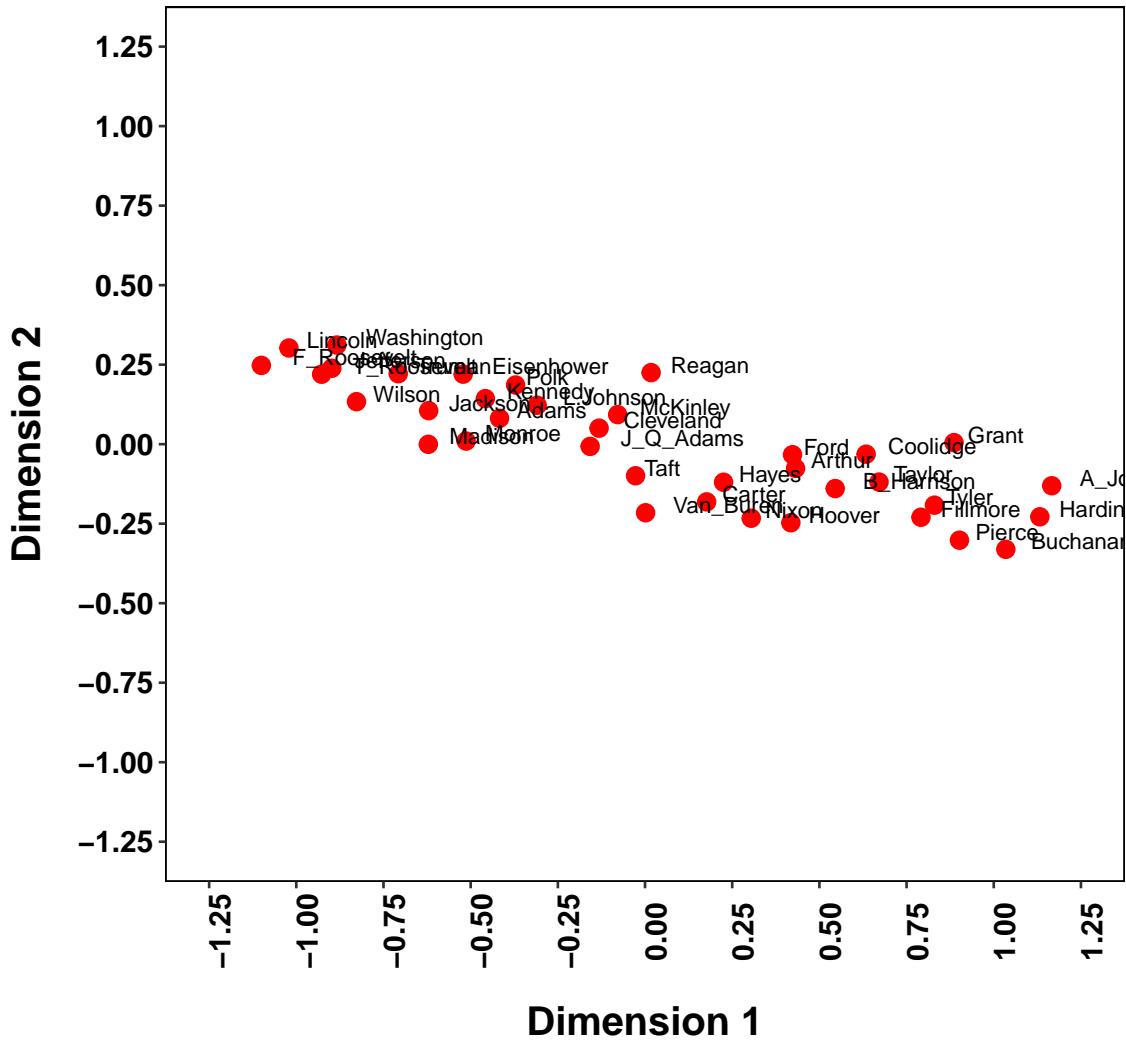
```

plot_data <- as.data.frame(indscal_fit$conf[[12]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

```

```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,  
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,  
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,  
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,  
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,  
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,  
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",  
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",  
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,  
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,  
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),  
plot.title = element_text(size = 16, face = "bold", margin = margin(0,  
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",  
linetype = 1, color = "black"), panel.grid.major = element_blank(),  
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),  
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",  
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 12)")
```

Two-Dimensional Space (Source 12)



```
plot_data <- as.data.frame(indscal_fit$conf[[13]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

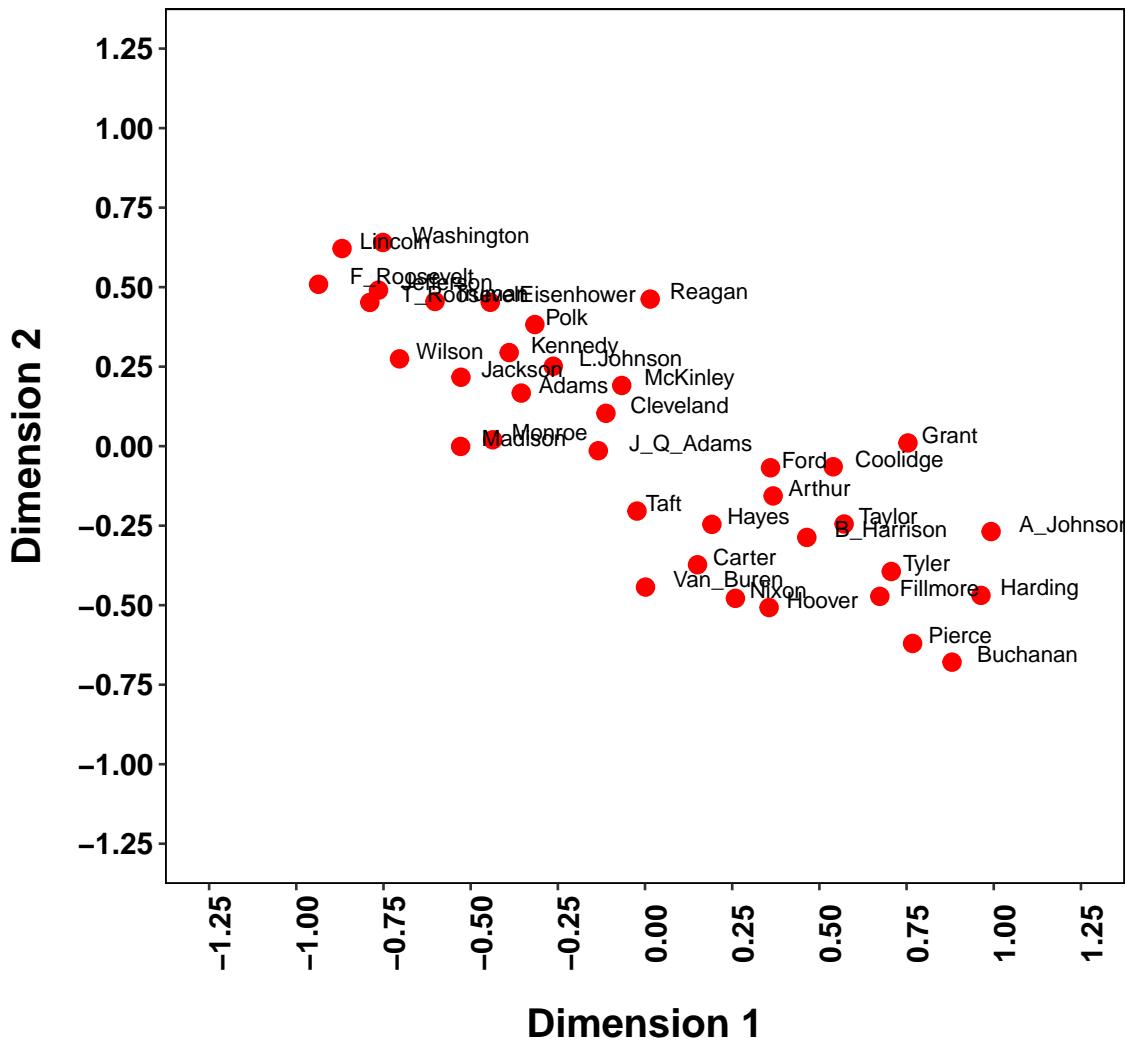
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 13)")

```

Two-Dimensional Space (Source 13)

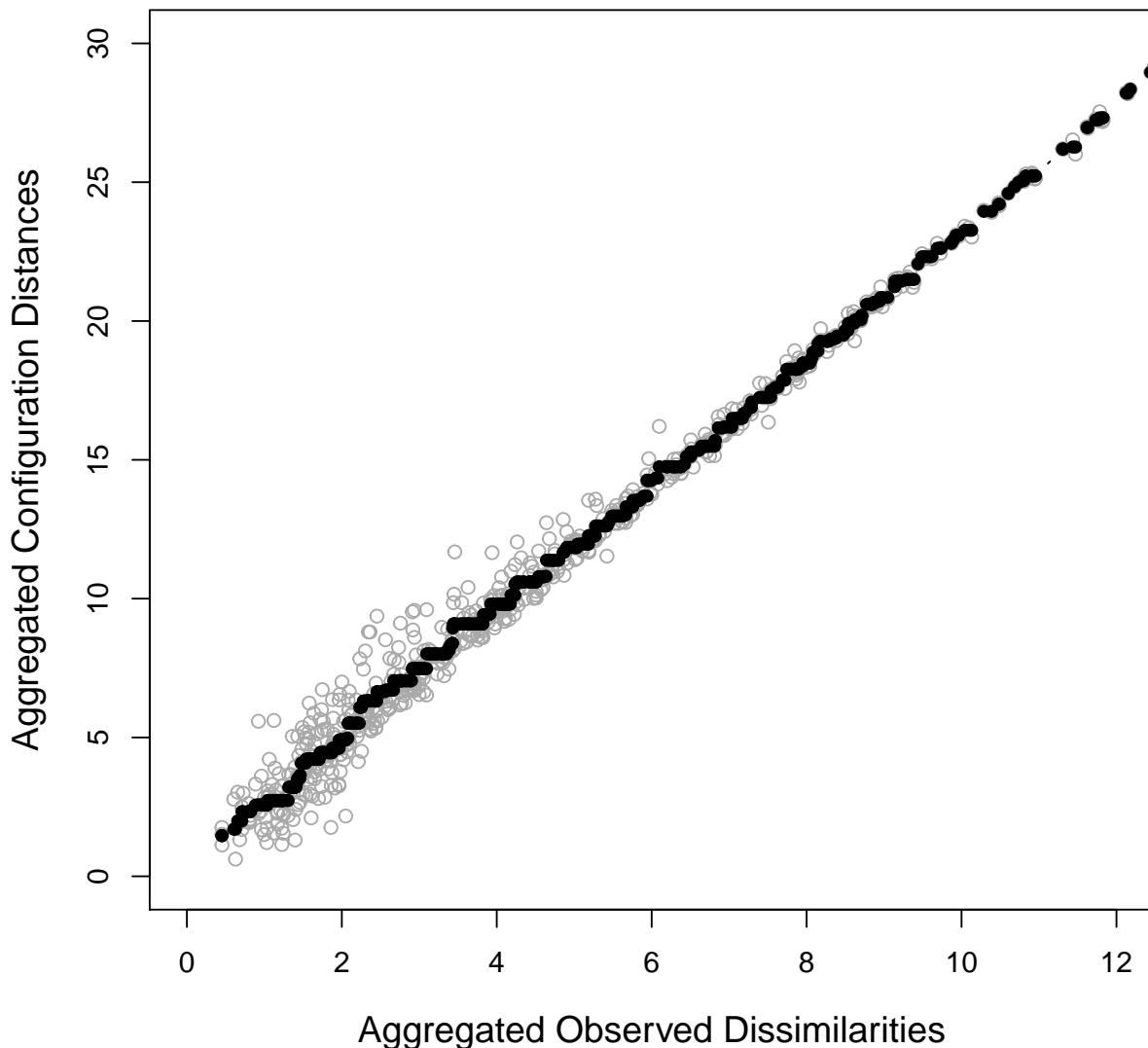


4.2.4 Shepard Plots

Shepard plots show the relationship between aggregated observed dissimilarities and the aggregated configuration distances.

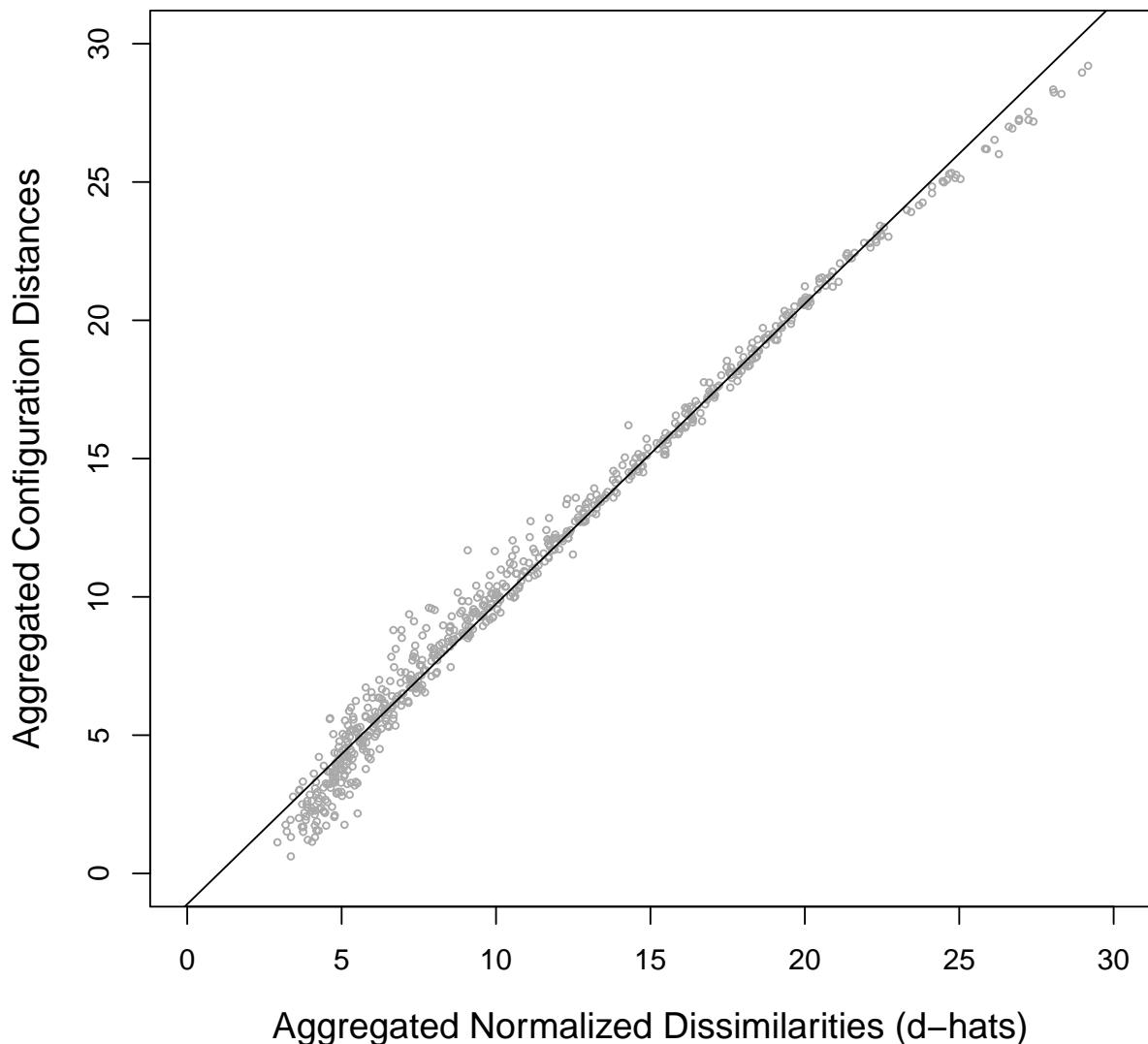
```
plot(indscal_fit, plot.type = "Shepard", xlab = list("Aggregated Observed Dissimilarities",
cex = 1.25), ylab = list("Aggregated Configuration Distances",
cex = 1.25), main = list("Shepard Plot", cex = 1.5), xlim = c(0,
12), ylim = c(0, 30))
```

Shepard Plot



```
# The same information is contained in the residual plot, but a
# best-fit line also included. This is really more appropriate for
# a metric MDS, but does provide useful information for fit.
plot(indscal_fit, plot.type = "resplot", xlab = list("Aggregated Normalized Dissimilarities (d-hats)",
cex = 1.25), ylab = list("Aggregated Configuration Distances",
cex = 1.25), main = list("Residual Plot", cex = 1.5), xlim = c(0,
30), ylim = c(0, 30))
```

Residual Plot



Individual source Shepard plots can also be constructed. These provide a way to visual individual fit. Note that although the configuration plots are forced to be the same for all sources, the fit of that common solution will not be the same for all sources.

```
plot_data <- matrix(cbind(unlist(indscal_fit$delta[[1]]), unlist(indscal_fit$confdist[[1]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")

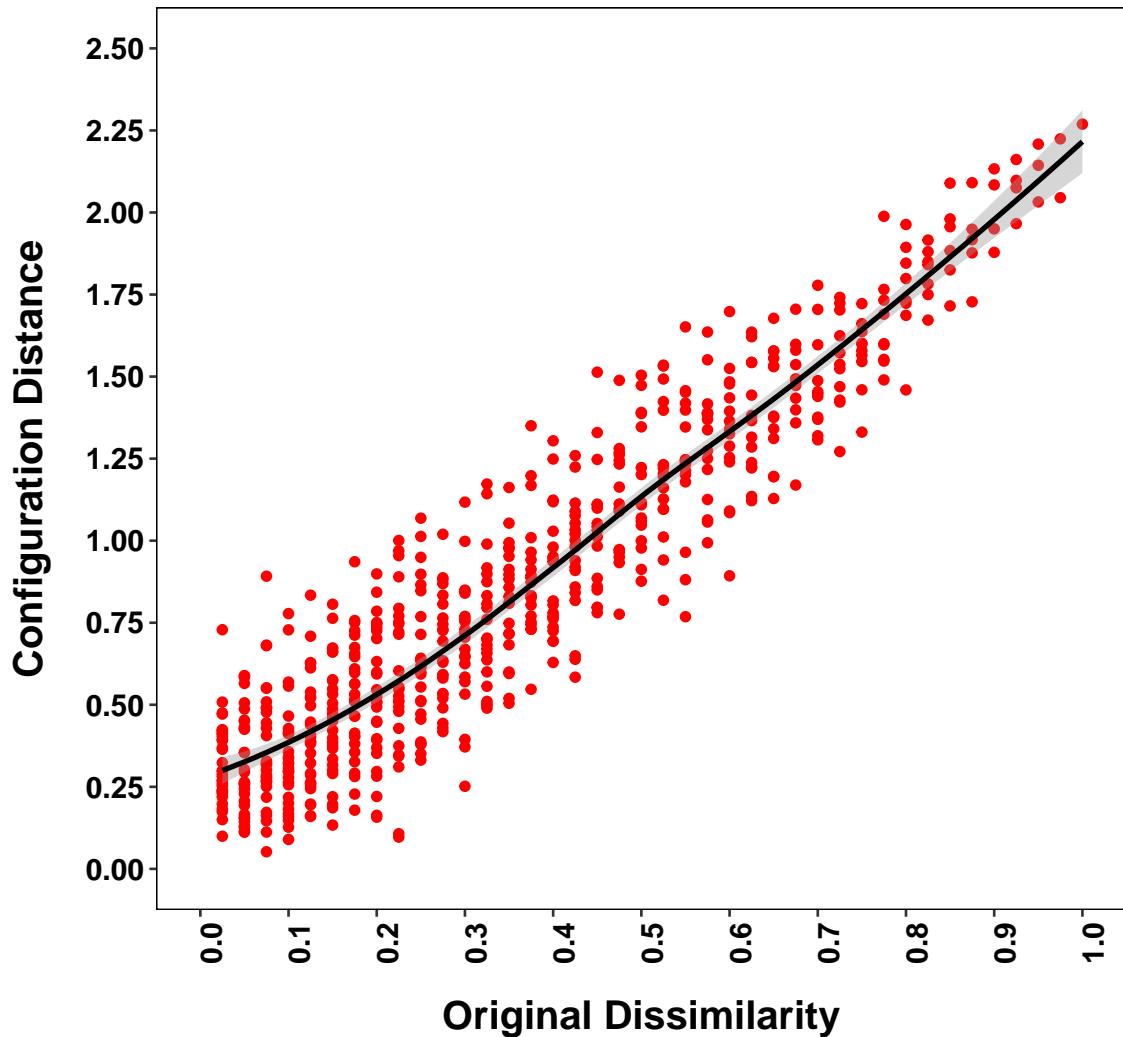
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
```

```

theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 1")

```

Two-Dimensional Space: Source 1



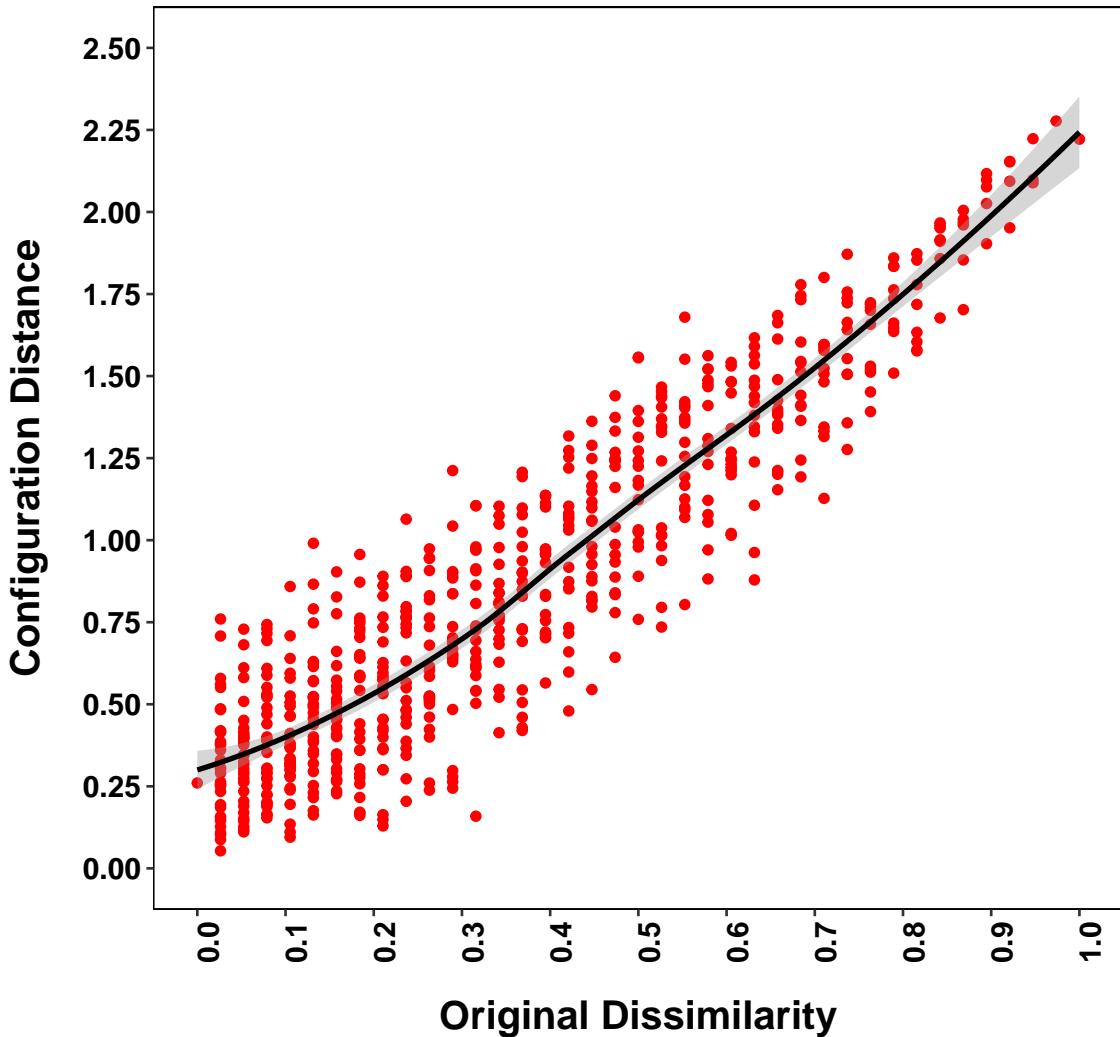
```

plot_data <- matrix(cbind(unlist(indscal_fit$delta[[2]]), unlist(indscal_fit$confdist[[2]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
    face = "bold"), axis.text.y = element_text(colour = "black",
    size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
    size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
    0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
    15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
    plot.title = element_text(size = 16, face = "bold", margin = margin(0,
    0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
    linetype = 1, color = "black"), panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
    plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
    legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 2")

```

Two-Dimensional Space: Source 2



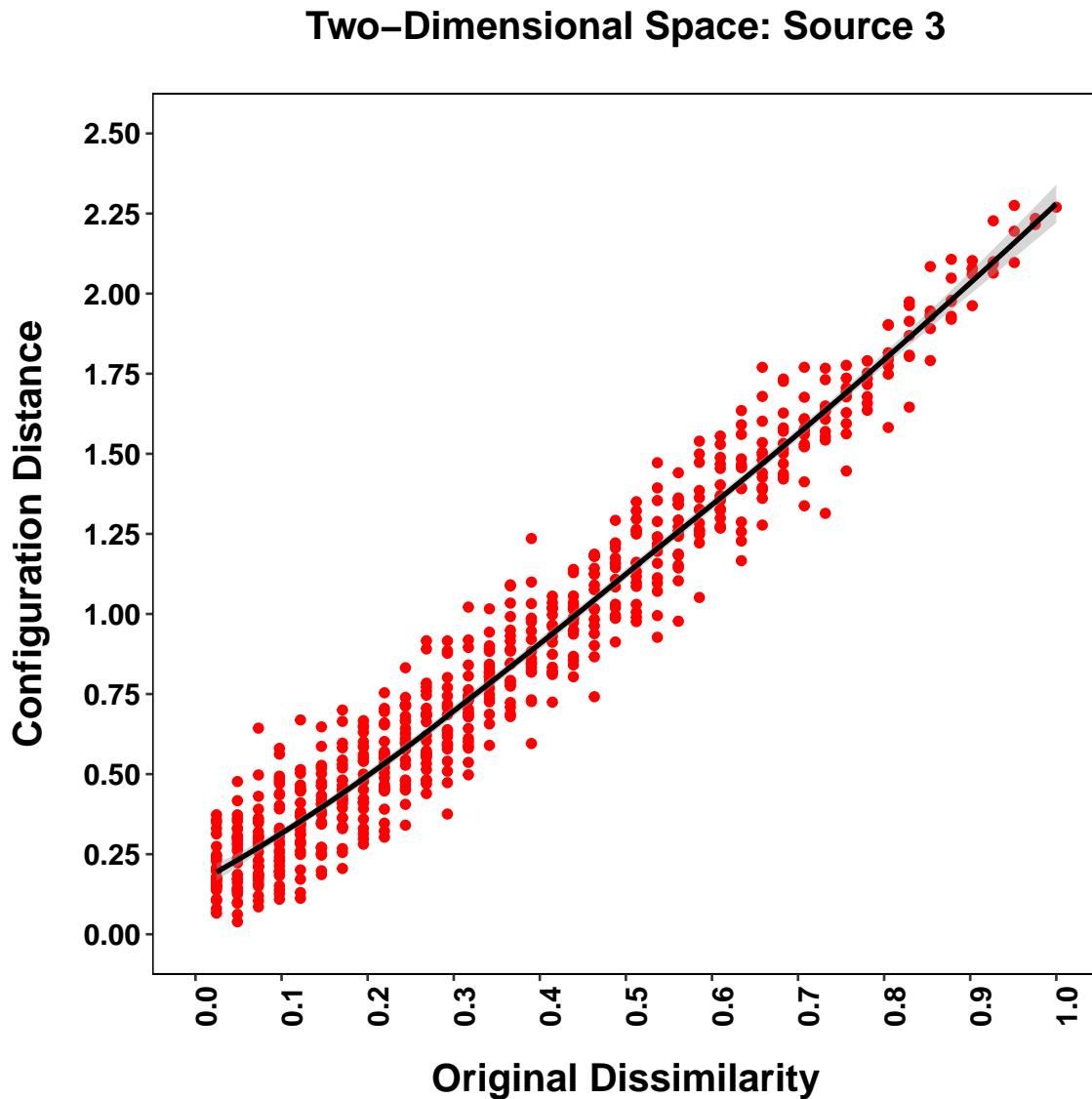
```
plot_data <- matrix(cbind(unlist(indscal_fit$delta[[3]]), unlist(indscal_fit$confdist[[3]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 3")

```



```

plot_data <- matrix(cbind(unlist(indscal_fit$delta[[4]]), unlist(indscal_fit$confdist[[4]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

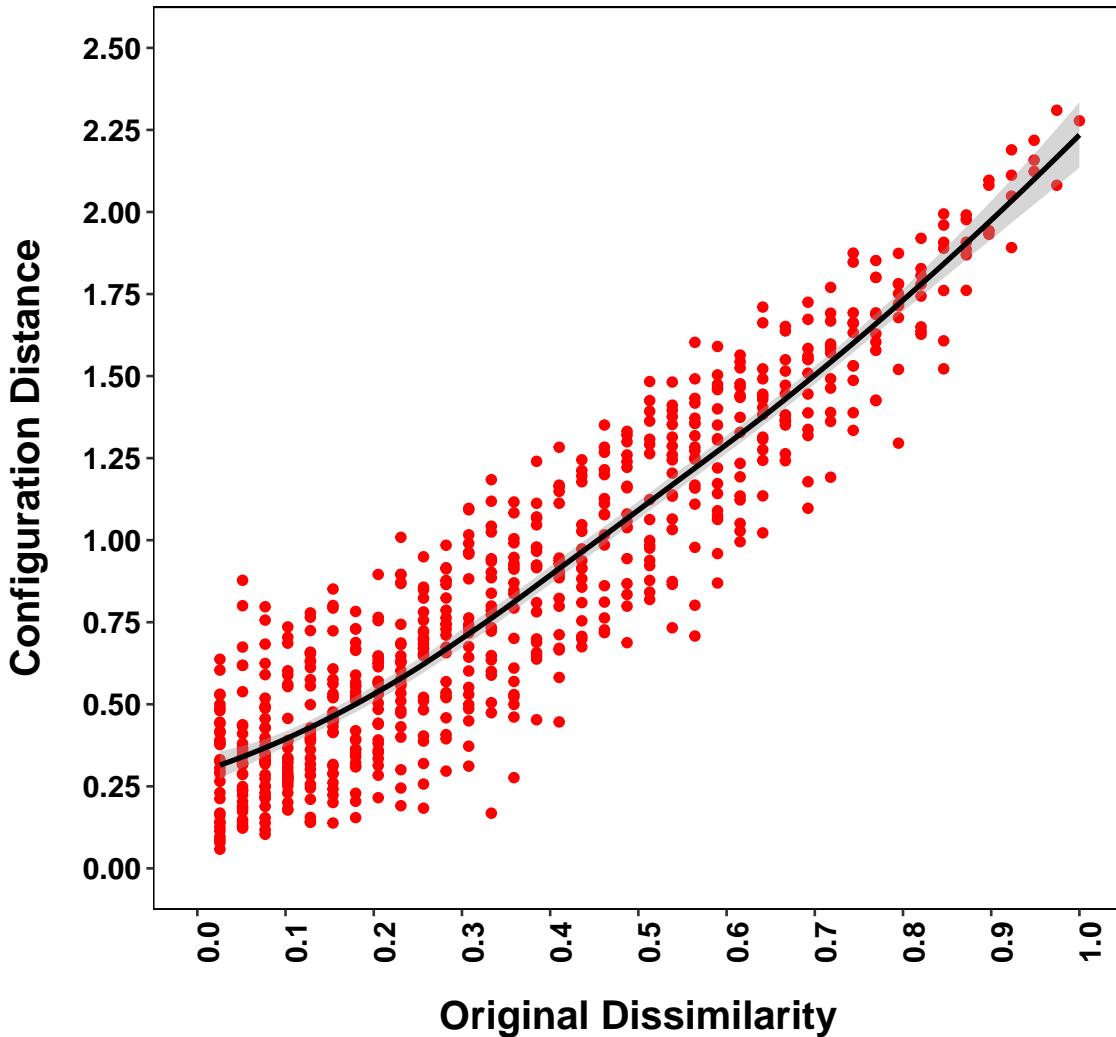
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 4")

```

Two-Dimensional Space: Source 4



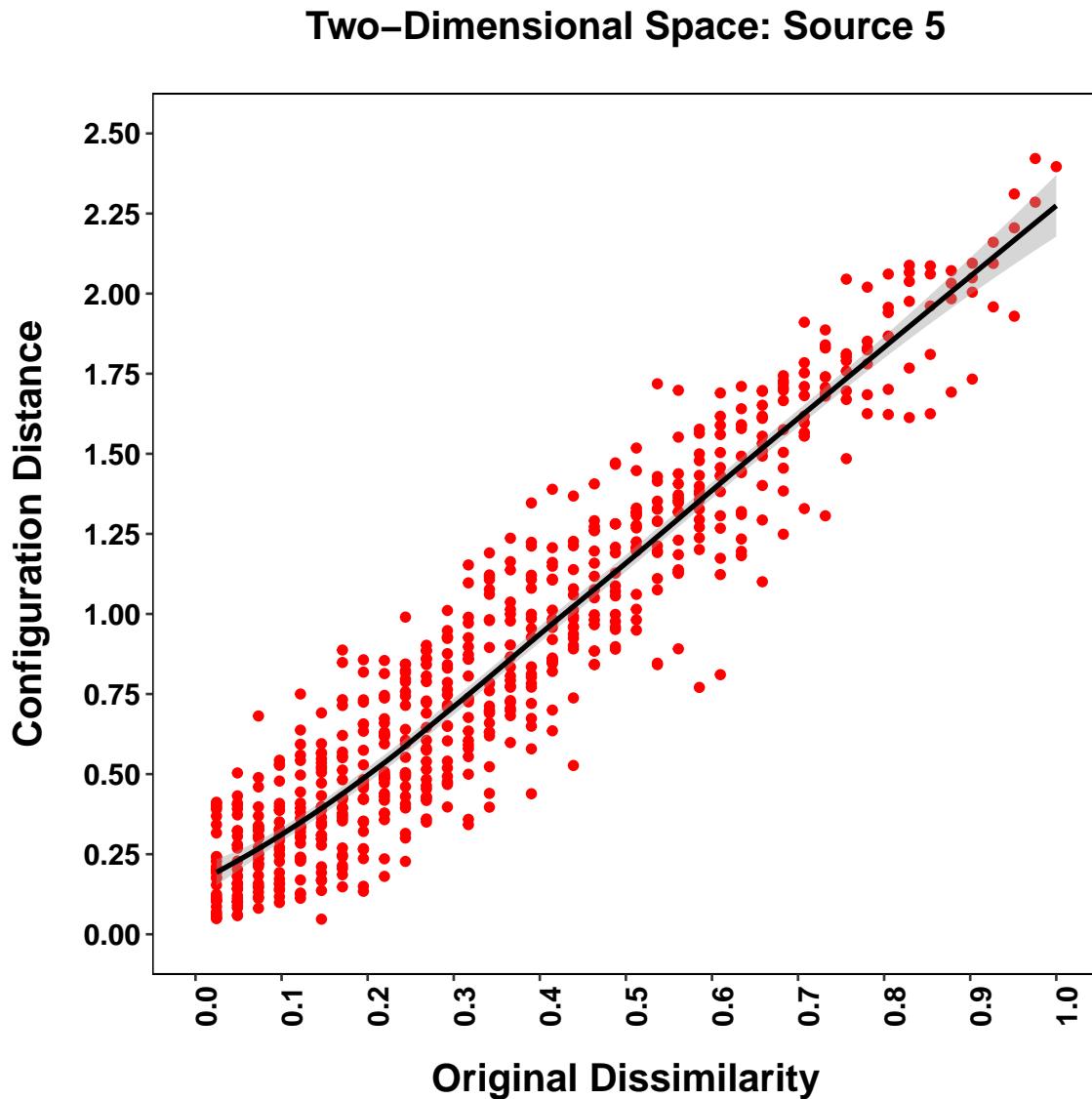
```
plot_data <- matrix(cbind(unlist(indscal_fit$delta[[5]]), unlist(indscal_fit$confdist[[5]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 5")

```



```

plot_data <- matrix(cbind(unlist(indscal_fit$delta[[6]]), unlist(indscal_fit$confdist[[6]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

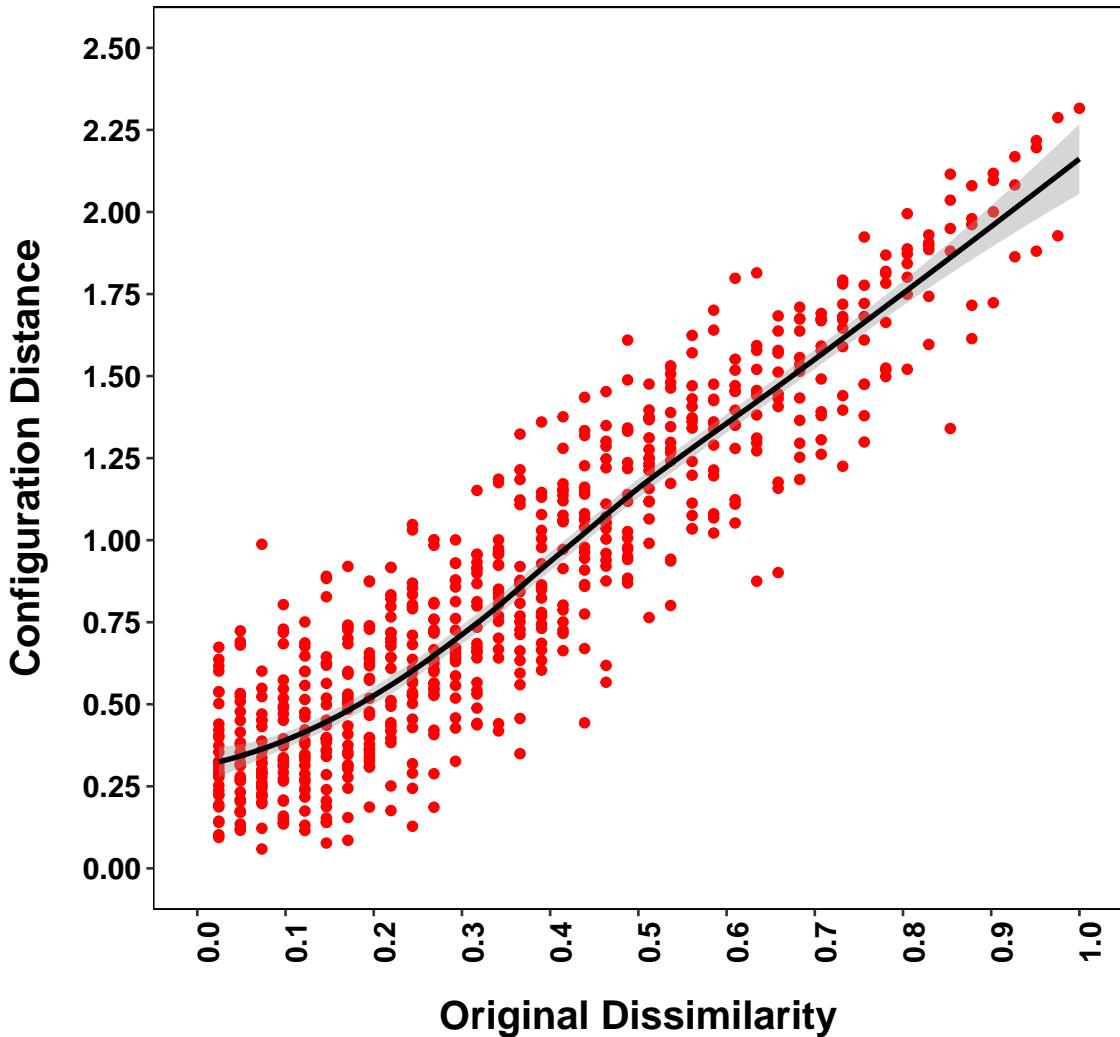
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 6")

```

Two-Dimensional Space: Source 6



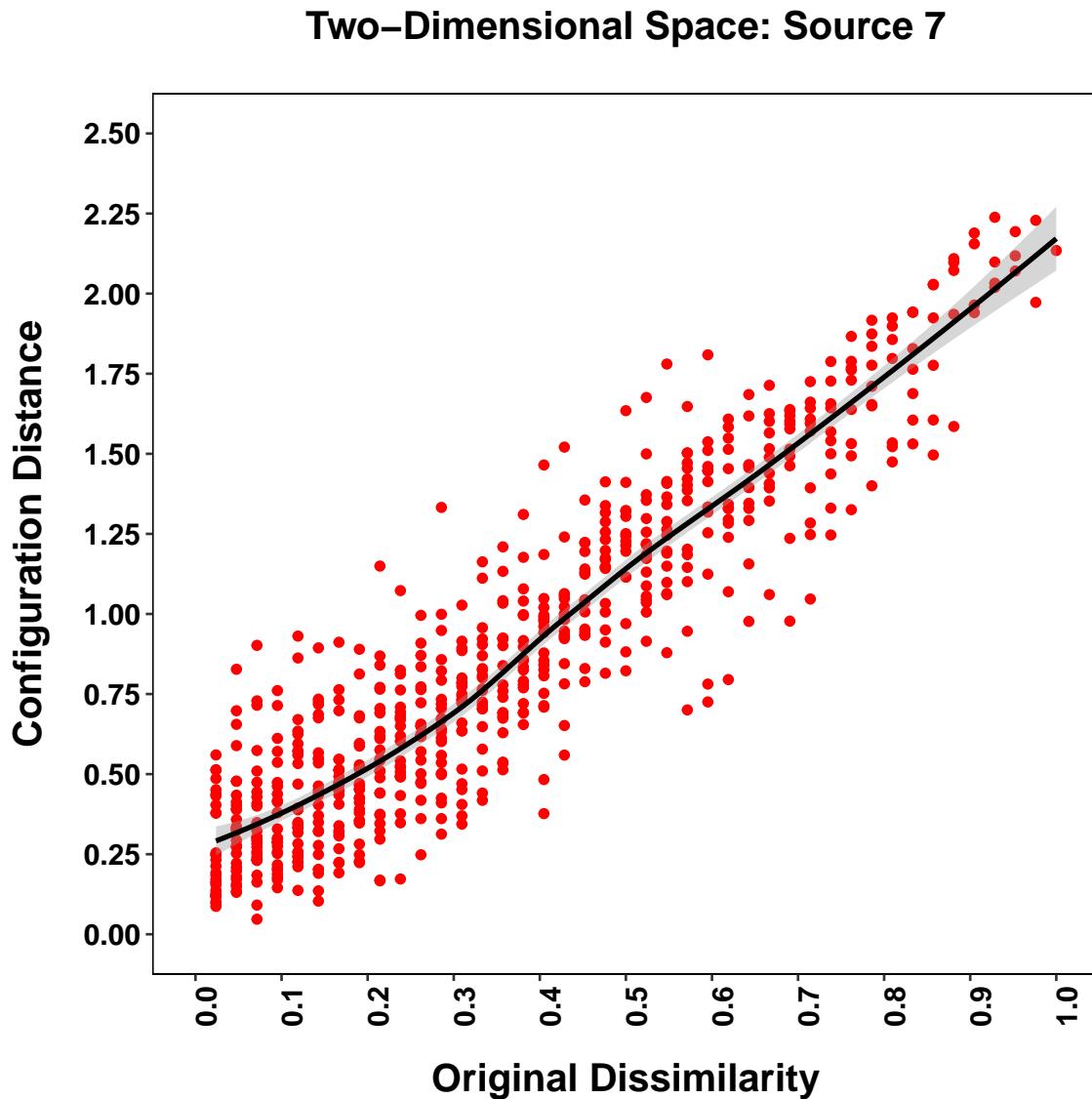
```
plot_data <- matrix(cbind(unlist(indscal_fit$delta[[7]]), unlist(indscal_fit$confdist[[7]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 7")

```



```

plot_data <- matrix(cbind(unlist(indscal_fit$delta[[8]]), unlist(indscal_fit$confdist[[8]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

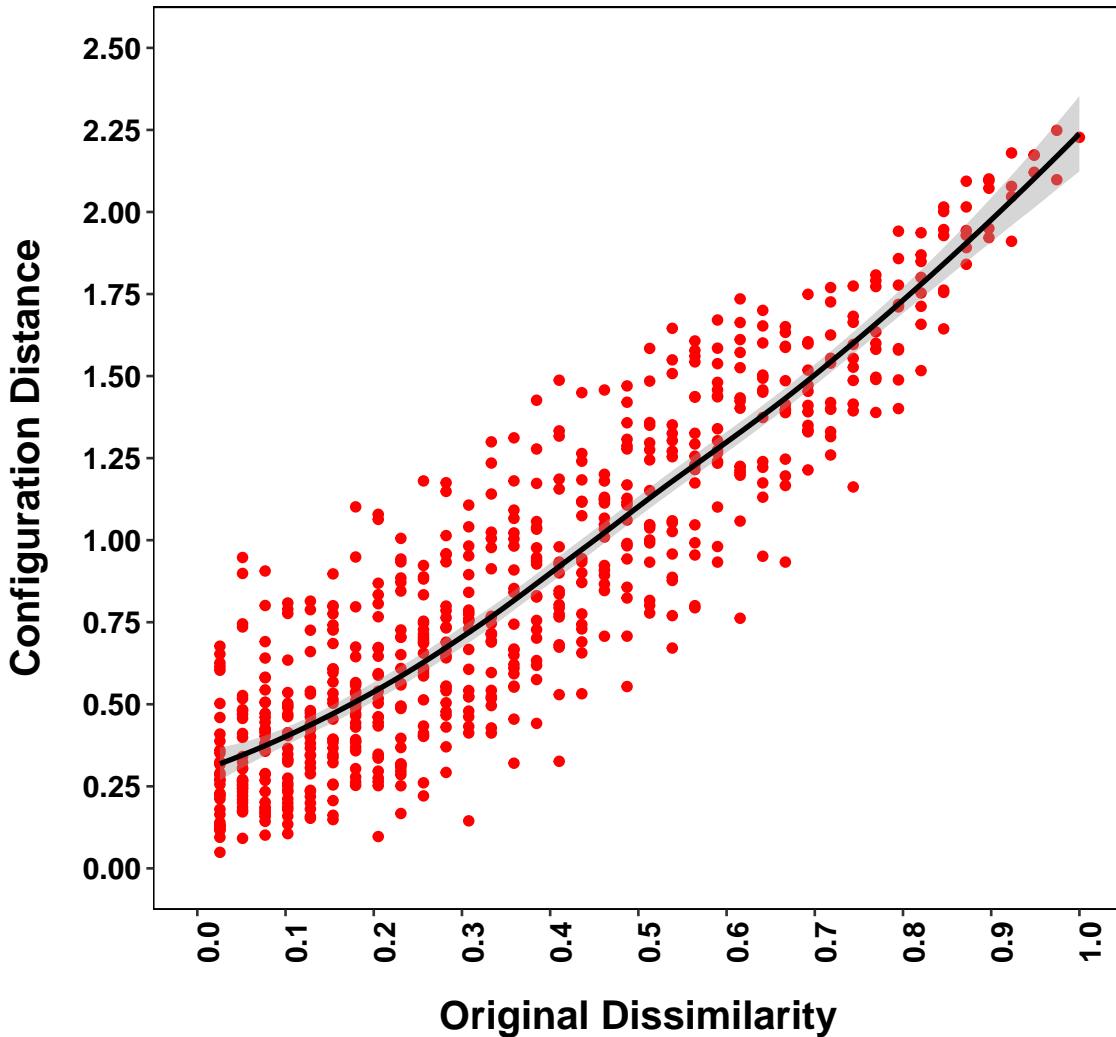
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 8")

```

Two-Dimensional Space: Source 8



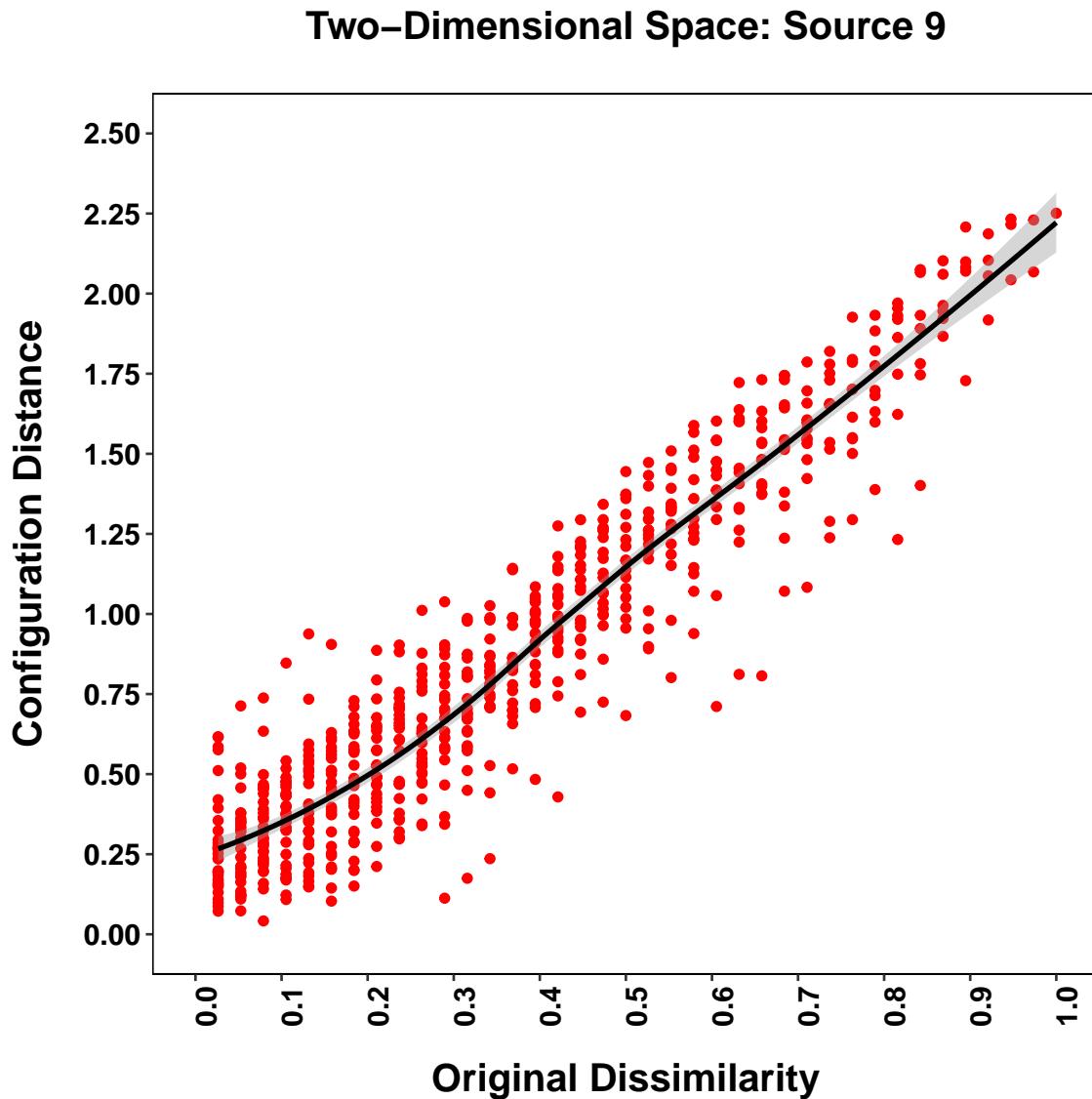
```
plot_data <- matrix(cbind(unlist(indscal_fit$delta[[9]]), unlist(indscal_fit$confdist[[9]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 9")

```



```

plot_data <- matrix(cbind(unlist(indscal_fit$delta[[10]]), unlist(indscal_fit$confdist[[10]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

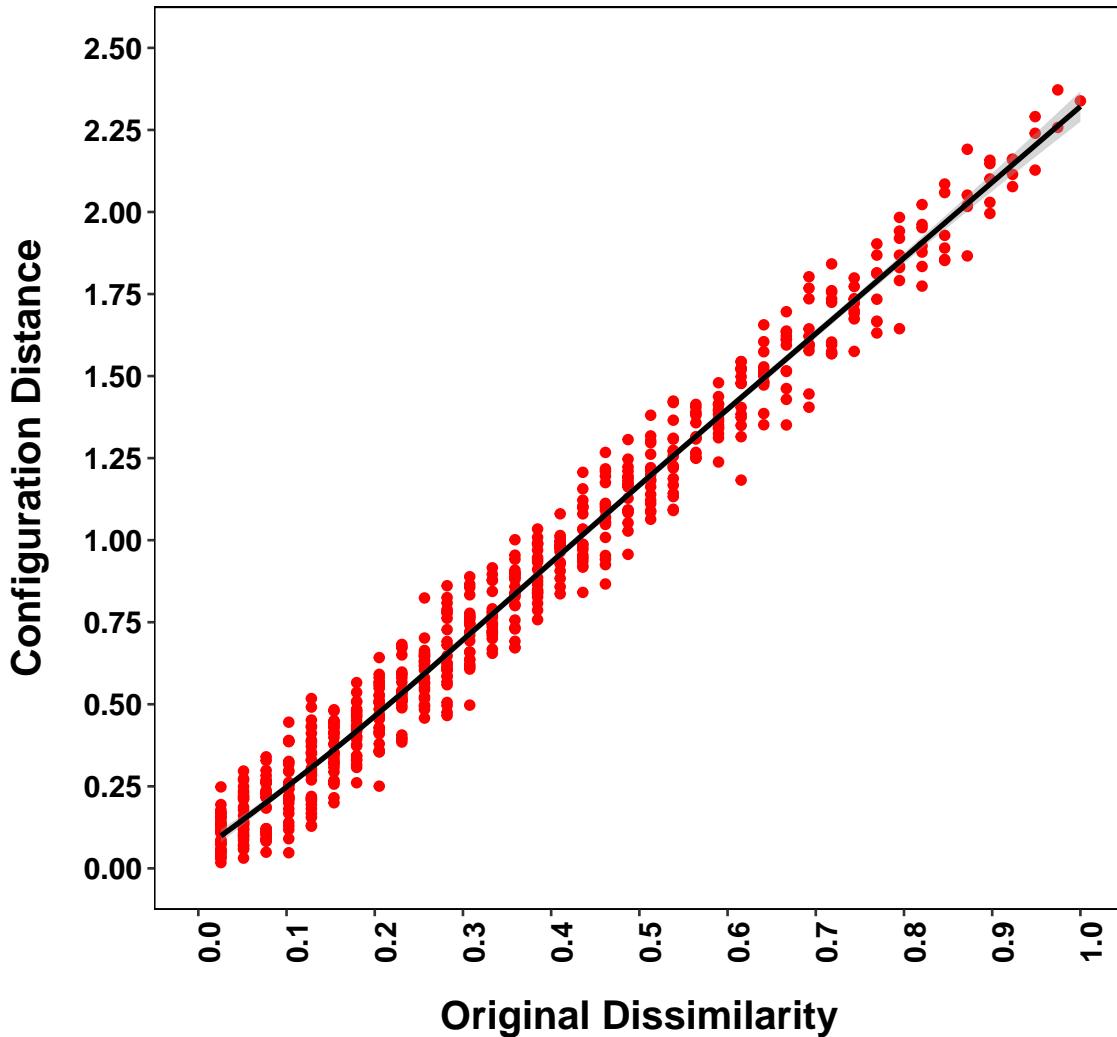
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 10")

```

Two-Dimensional Space: Source 10



```
plot_data <- matrix(cbind(unlist(indscal_fit$delta[[11]]), unlist(indscal_fit$confdist[[11]])),  
  ncol = 2, byrow = FALSE)  
plot_data <- as.data.frame(plot_data)  
names(plot_data) <- c("Dissimilarity", "Distance")
```

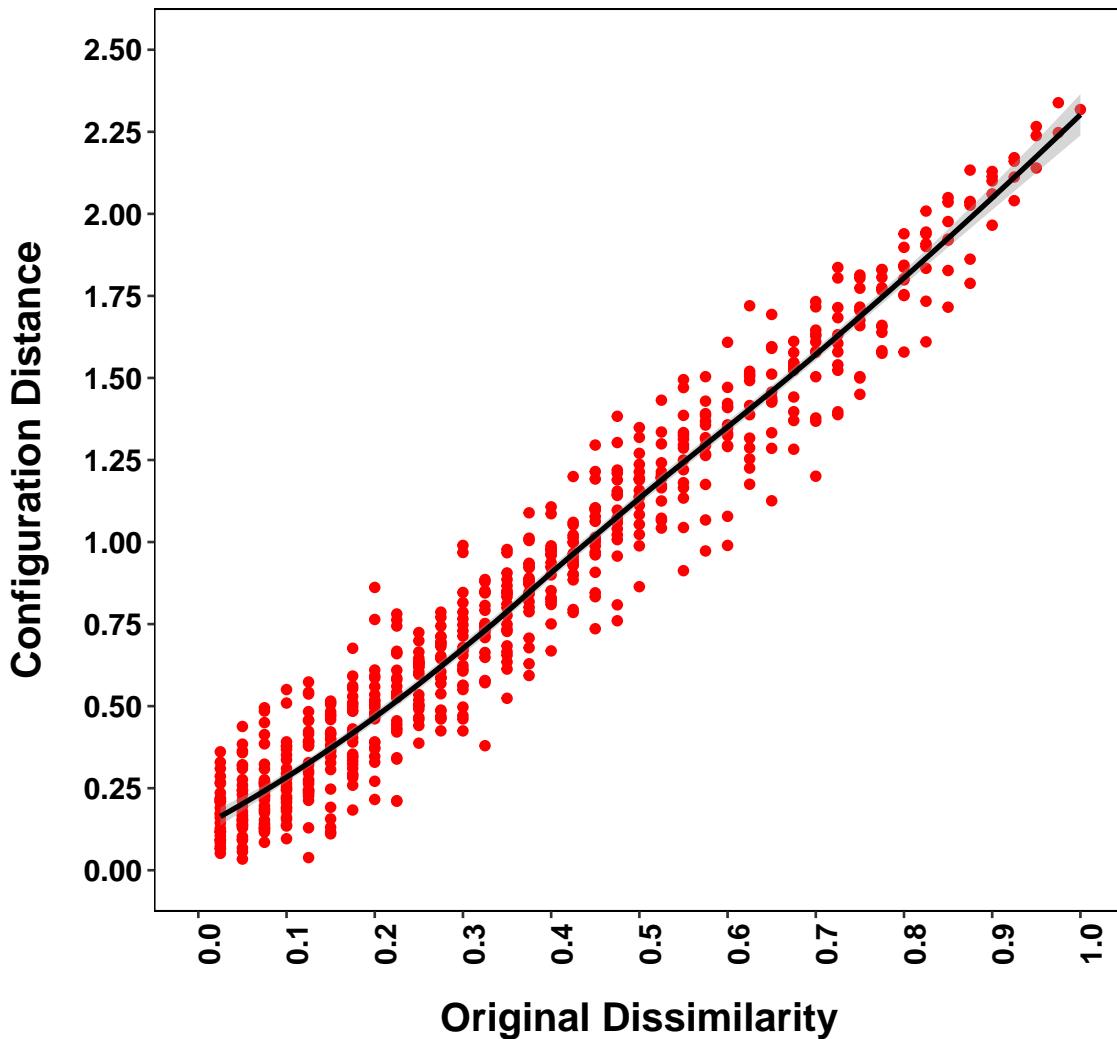
```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,  
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,  
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +  
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,  
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +  
  theme(text = element_text(size = 14, family = "sans", color = "black",  
    face = "bold"), axis.text.y = element_text(colour = "black",  
    size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 11")

```

Two-Dimensional Space: Source 11



```

plot_data <- matrix(cbind(unlist(indscal_fit$delta[[12]]), unlist(indscal_fit$confdist[[12]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

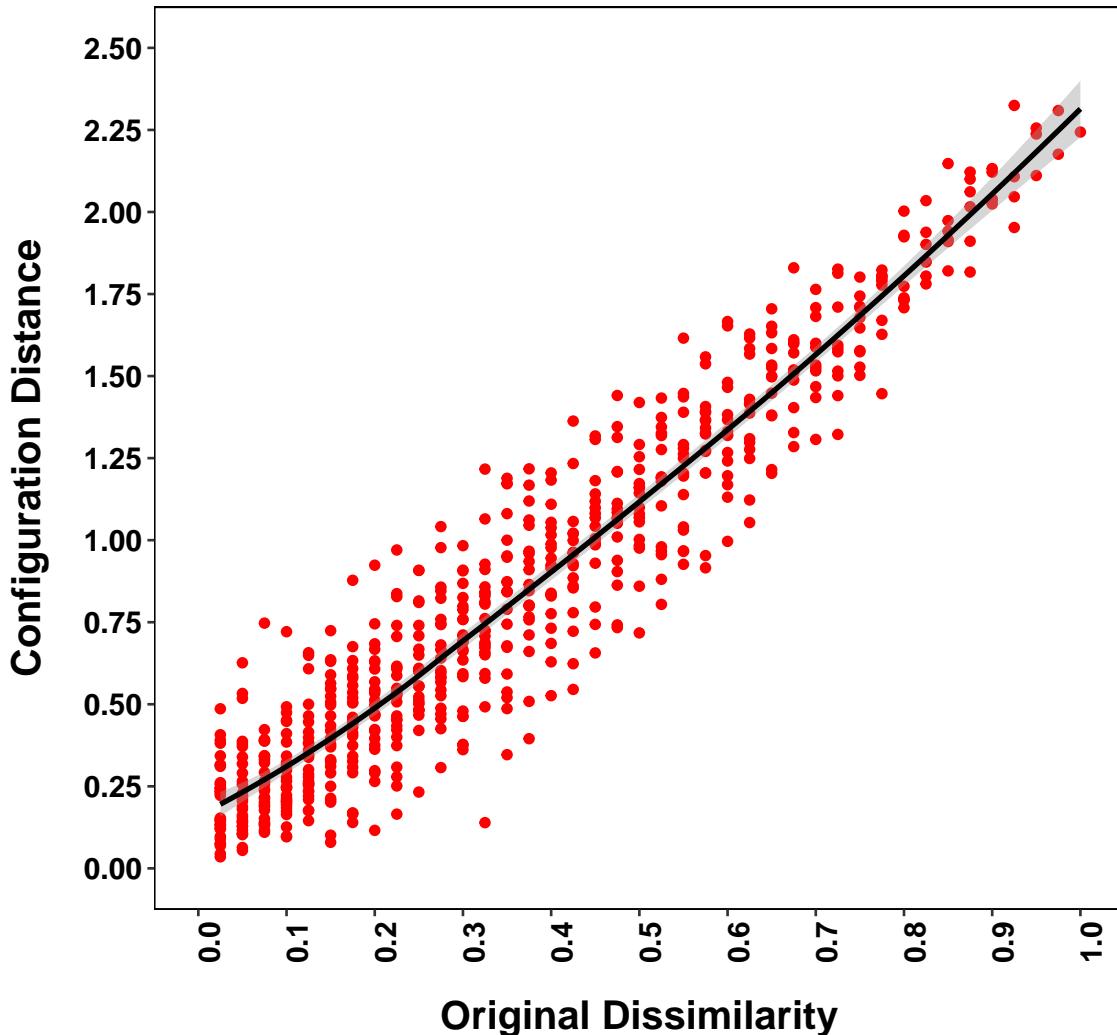
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 12")

```

Two-Dimensional Space: Source 12



```
plot_data <- matrix(cbind(unlist(indscal_fit$delta[[13]]), unlist(indscal_fit$confdist[[13]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

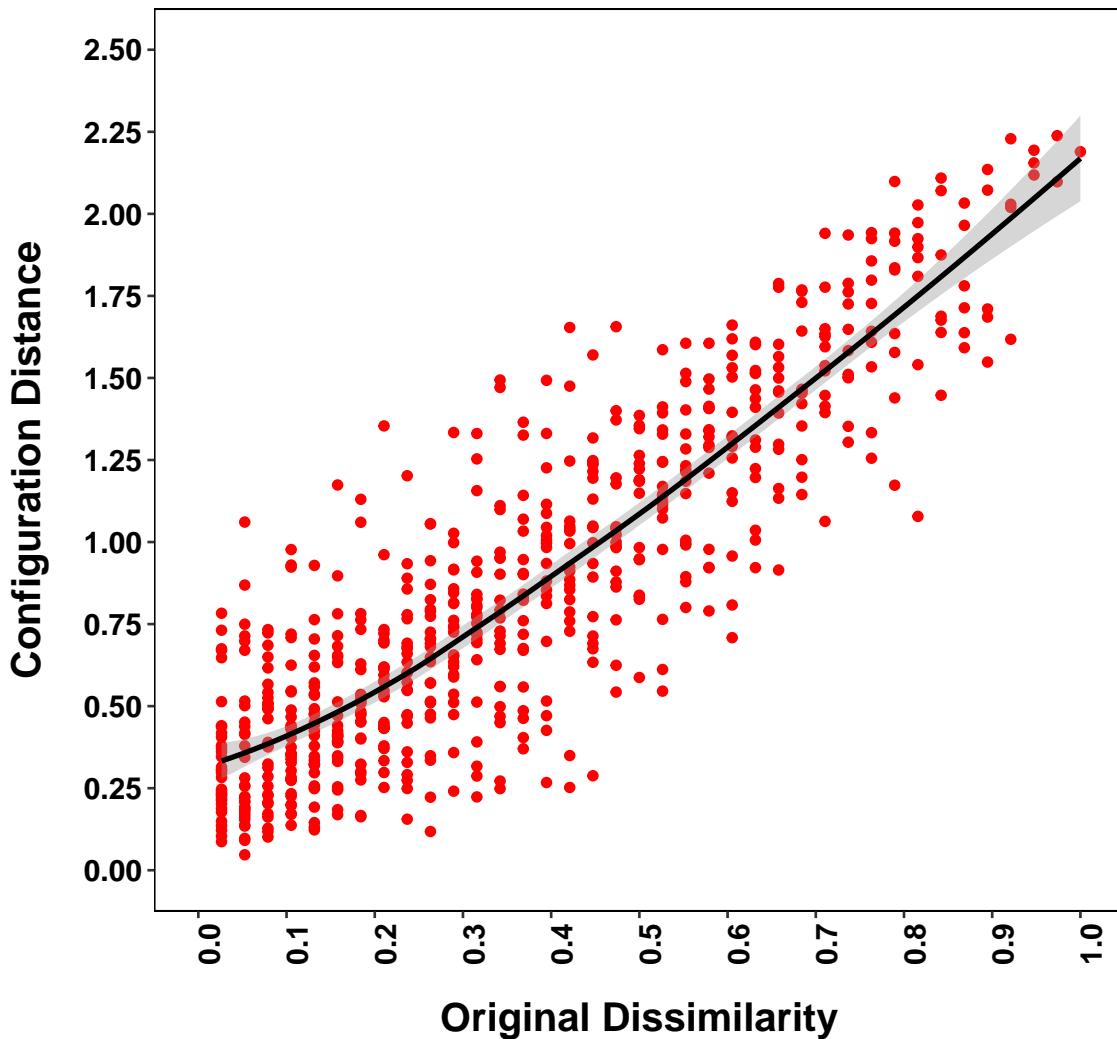
```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 13")

```

Two-Dimensional Space: Source 13



```

plot_data <- matrix(cbind(unlist(indscal_fit$delta[[1]]), unlist(indscal_fit$confdist[[1]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

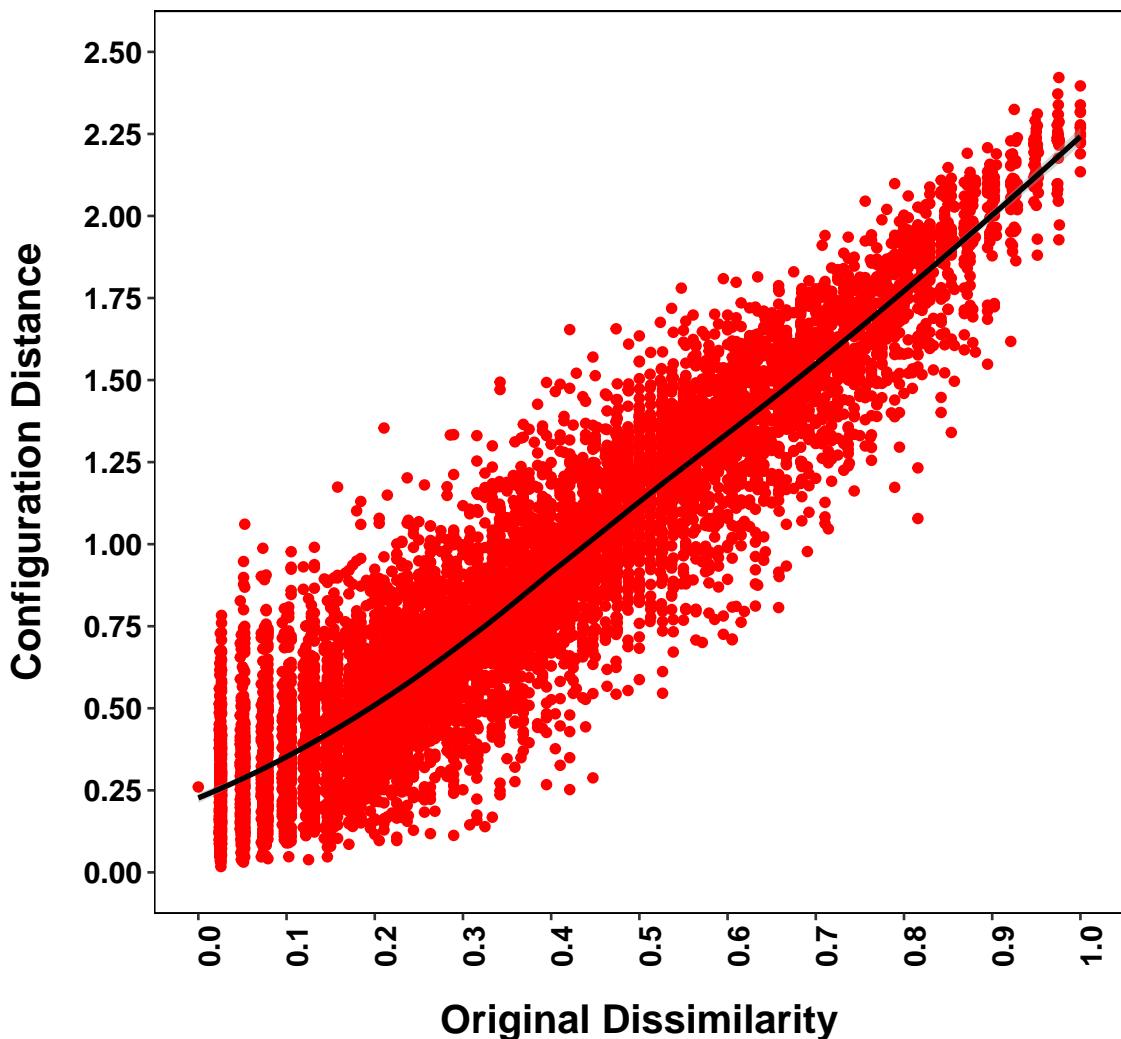
```

names(plot_data) <- c("Dissimilarity", "Distance")
for (j in seq(2, 13)) {
  plot_temp <- (matrix(cbind(unlist(indscal_fit$delta[[j]]), unlist(indscal_fit$confdist[[j]])), ncol = 2, byrow = FALSE))
  plot_temp <- as.data.frame(plot_temp)
  names(plot_temp) <- c("Dissimilarity", "Distance")
  plot_data <- rbind(plot_data, plot_temp)
}
}

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19, color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0, 2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0, 1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black", size = 12, face = "bold"), axis.text.x = element_text(colour = "black", size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(), plot.title = element_text(size = 16, face = "bold", margin = margin(0, 0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white", linetype = 1, color = "black"), panel.grid.major = element_blank(), panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"), plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom", legend.title = element_blank()) + ggtitle("Two-Dimensional Space: All Sources")

```

Two-Dimensional Space: All Sources



4.2.5 Weights

The sources can weight the dimensions differently. The weights represent the extent to which the group configuration needs to be stretched or shrunk in order to achieve a particular source configuration. The weight matrices are diagonal so that any stretching or shrinking is done for each dimension independently. The combined result can be complex, appearing to rotate the group solution (although no rotation is actually being accomplished, just contraction or expansion of the group configuration). The weights can be plotted to determine if some sources cluster together.

```
indscal_fit$cweights  
## [[1]]  
##      D1      D2
```

```

## D1 0.7738 0.000
## D2 0.0000 5.127
##
## [[2]]
##      D1      D2
## D1 0.7503 0.000
## D2 0.0000 5.292
##
## [[3]]
##      D1      D2
## D1 0.9548 0.000
## D2 0.0000 2.972
##
## [[4]]
##      D1      D2
## D1 0.6553 0.000
## D2 0.0000 6.004
##
## [[5]]
##      D1      D2
## D1 0.257 0.000
## D2 0.000 7.604
##
## [[6]]
##      D1      D2
## D1 0.6358 0.000
## D2 0.0000 6.113
##
## [[7]]
##      D1      D2
## D1 0.8483 0.00
## D2 0.0000 4.34
##
## [[8]]
##      D1      D2
## D1 0.82 0.000
## D2 0.00 4.597
##
## [[9]]
##      D1      D2
## D1 0.9203 0.000
## D2 0.0000 3.435
##
## [[10]]
##      D1      D2
## D1 1.029 0.0000
## D2 0.000 0.7265
##
## [[11]]
##      D1      D2
## D1 1.002 0.000
## D2 0.000 1.809
##
## [[12]]

```

```

##      D1      D2
## D1  0.9871  0.000
## D2  0.0000  2.088
##
## [[13]]
##      D1      D2
## D1  0.8399  0.000
## D2  0.0000  4.291

plot_data <- matrix(NA, nrow = 13, ncol = 2)
for (i in 1:13) {
  plot_data[i, 1] <- indscal_fit$cweights[[i]][1, 1]
  plot_data[i, 2] <- indscal_fit$cweights[[i]][2, 2]
}
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1", "D2")
plot_data$Names <- c(paste("Source ", seq(1, 13, 1)))

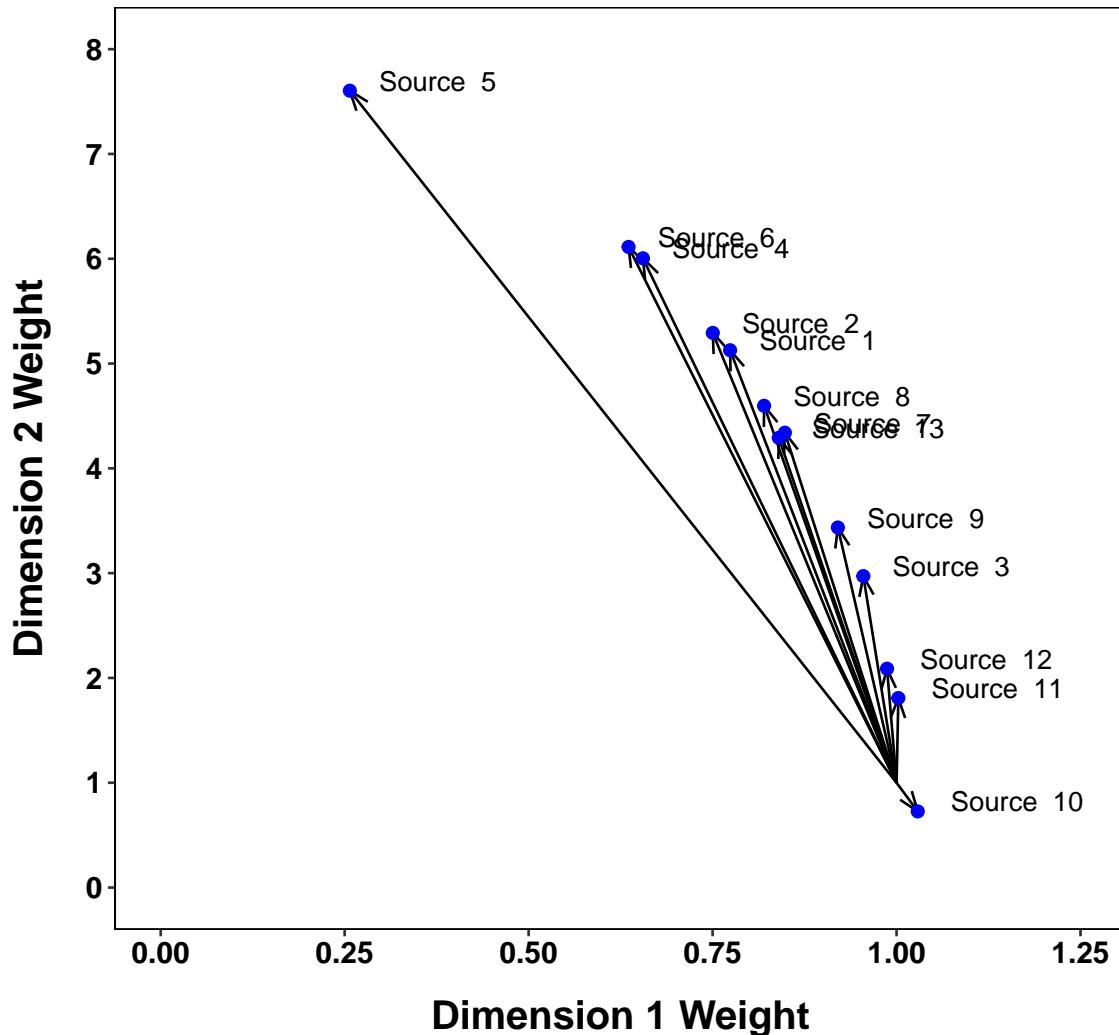
```

```

ggplot() + geom_segment(data = plot_data, mapping = aes(x = 1, y = 1,
  xend = D1, yend = D2), color = "black", size = 0.5, arrow = arrow(length = unit(0.3,
  "cm"), ends = "last", type = "open", angle = 20)) + geom_point(data = plot_data,
  mapping = aes(x = D1, y = D2), color = "blue", size = 2) + geom_text(data = plot_data,
  aes(x = plot_data$D1, y = plot_data$D2, label = plot_data$Names),
  hjust = -0.25, vjust = 0, size = 4, angle = 0) + coord_cartesian(xlim = c(0,
  1.25), ylim = c(0, 8)) + scale_x_continuous(breaks = c(seq(0,
  1.25, 0.25))) + scale_y_continuous(breaks = c(seq(0, 8, 1))) +
  ylab("Dimension 2 Weight") + xlab("Dimension 1 Weight") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Source Weights")

```

Source Weights



A source configuration is an adjustment to the group space, with the adjustment indicated by the source weight matrix. The nature of the adjustment can be shown in plots that represent movement from the group space to the source configuration.

```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[1]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

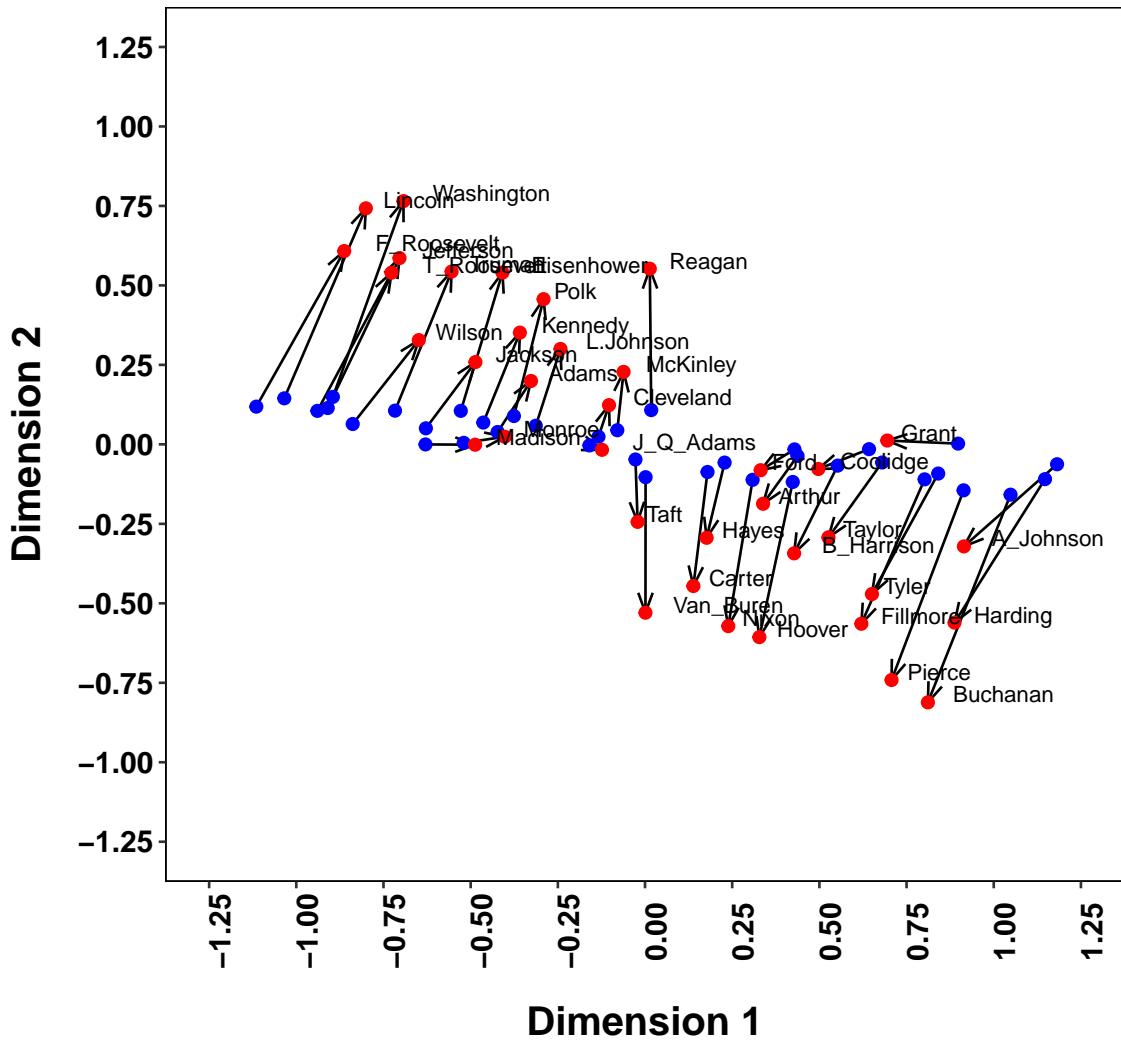
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
```

```

mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 1 Configuration")

```

Group Space to Source 1 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[2]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

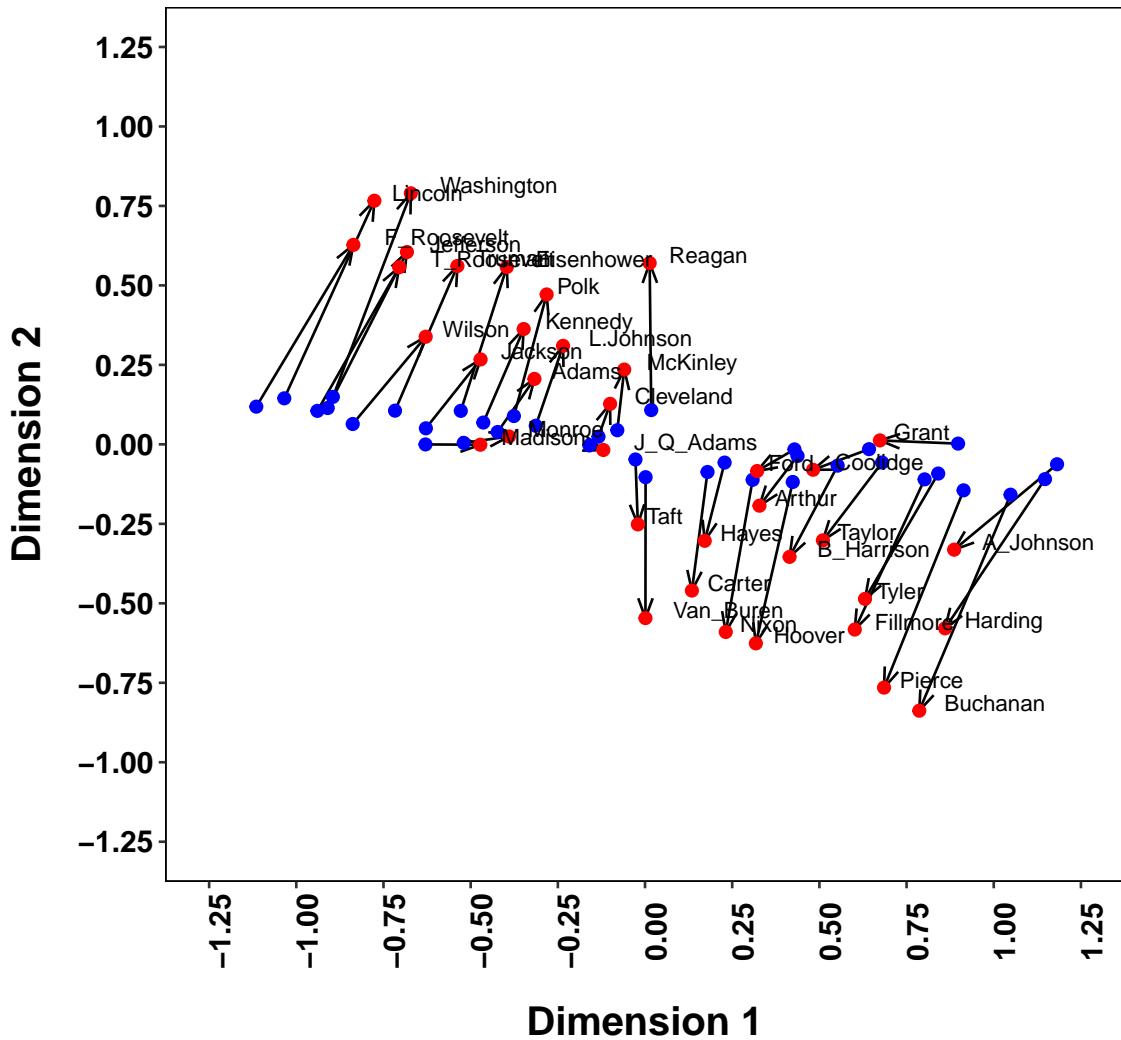
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin =
margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 2 Configuration")

```

Group Space to Source 2 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[3]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

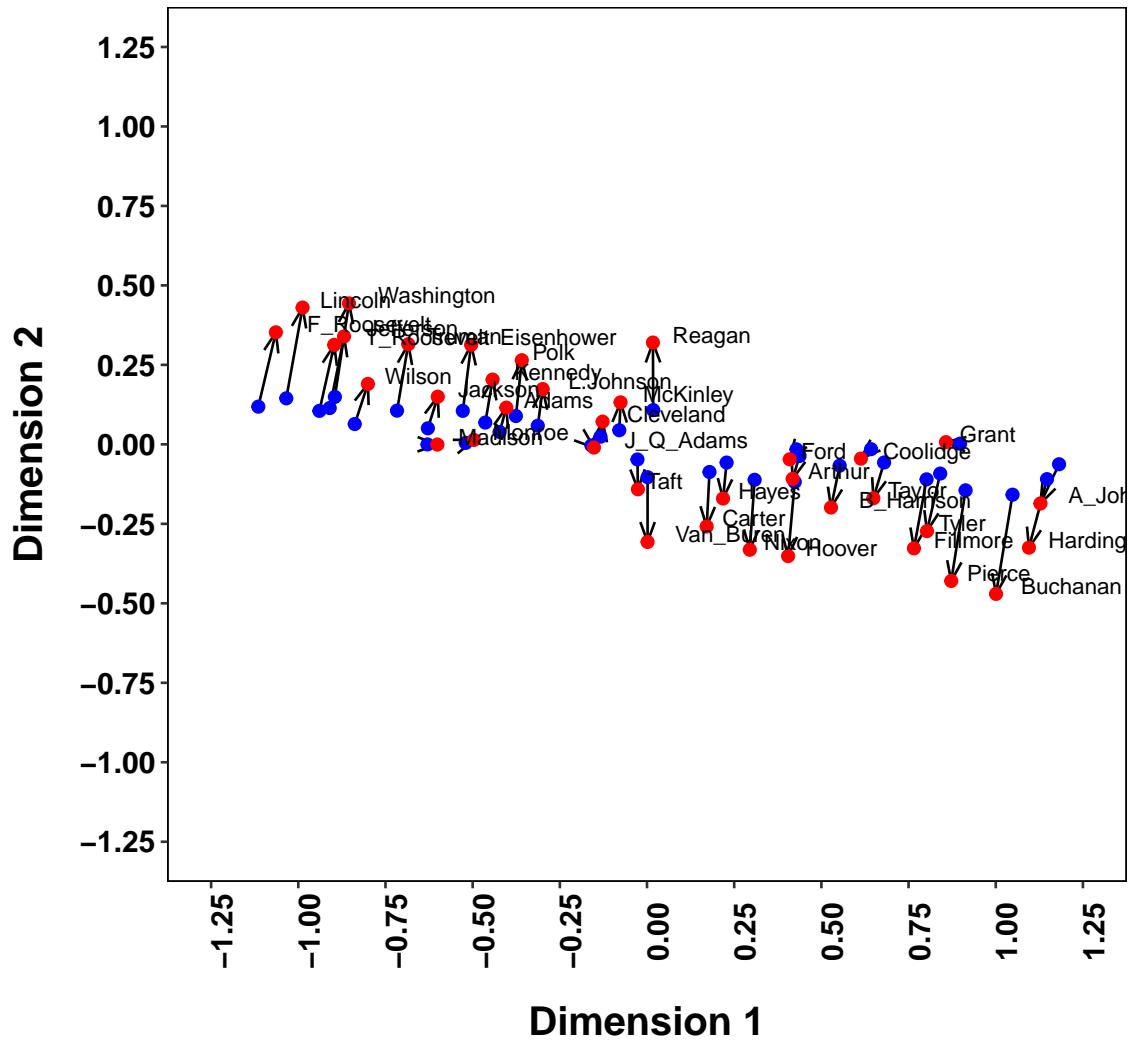
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin =
margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 3 Configuration")

```

Group Space to Source 3 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[4]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

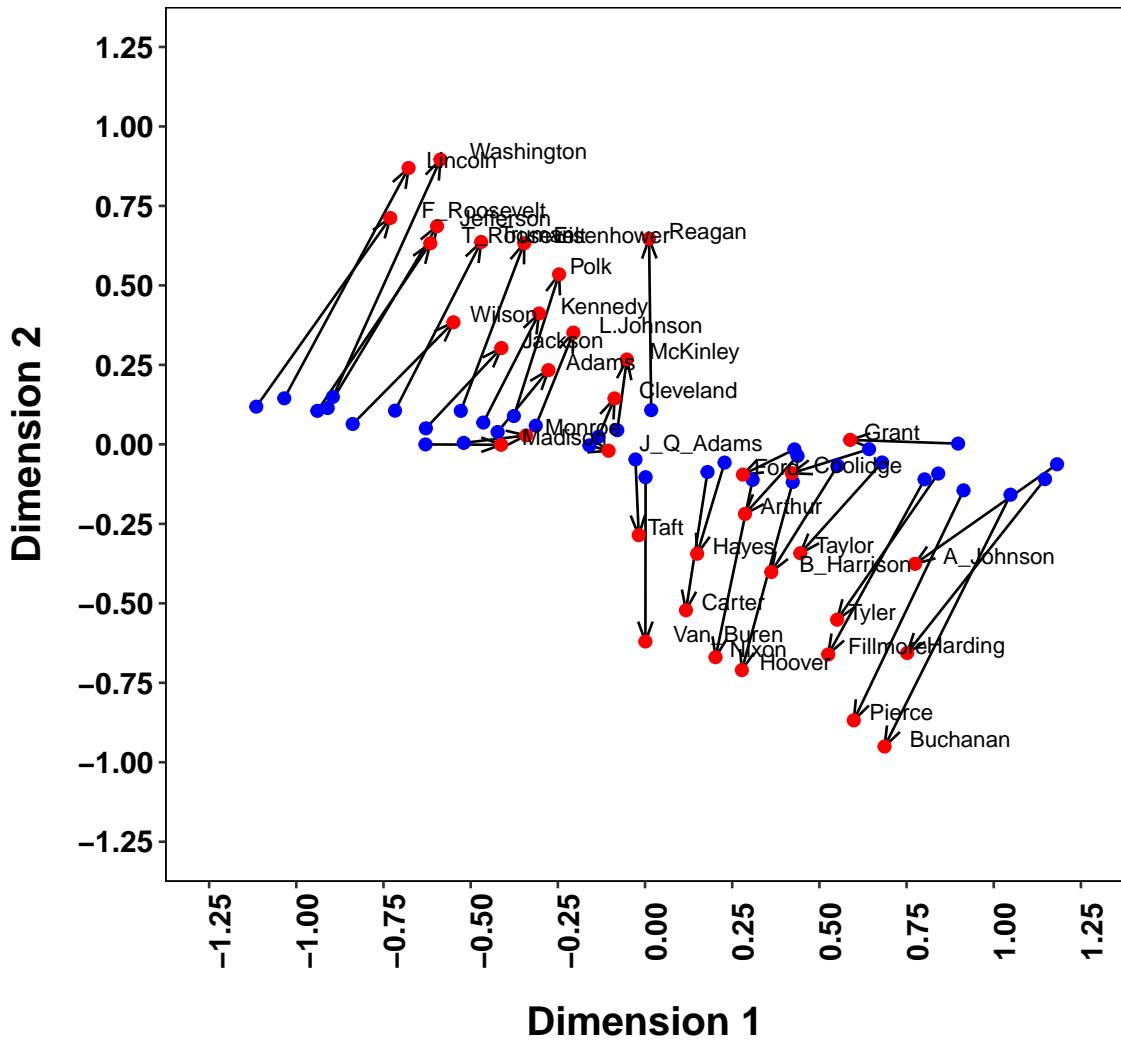
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 4 Configuration")

```

Group Space to Source 4 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[5]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

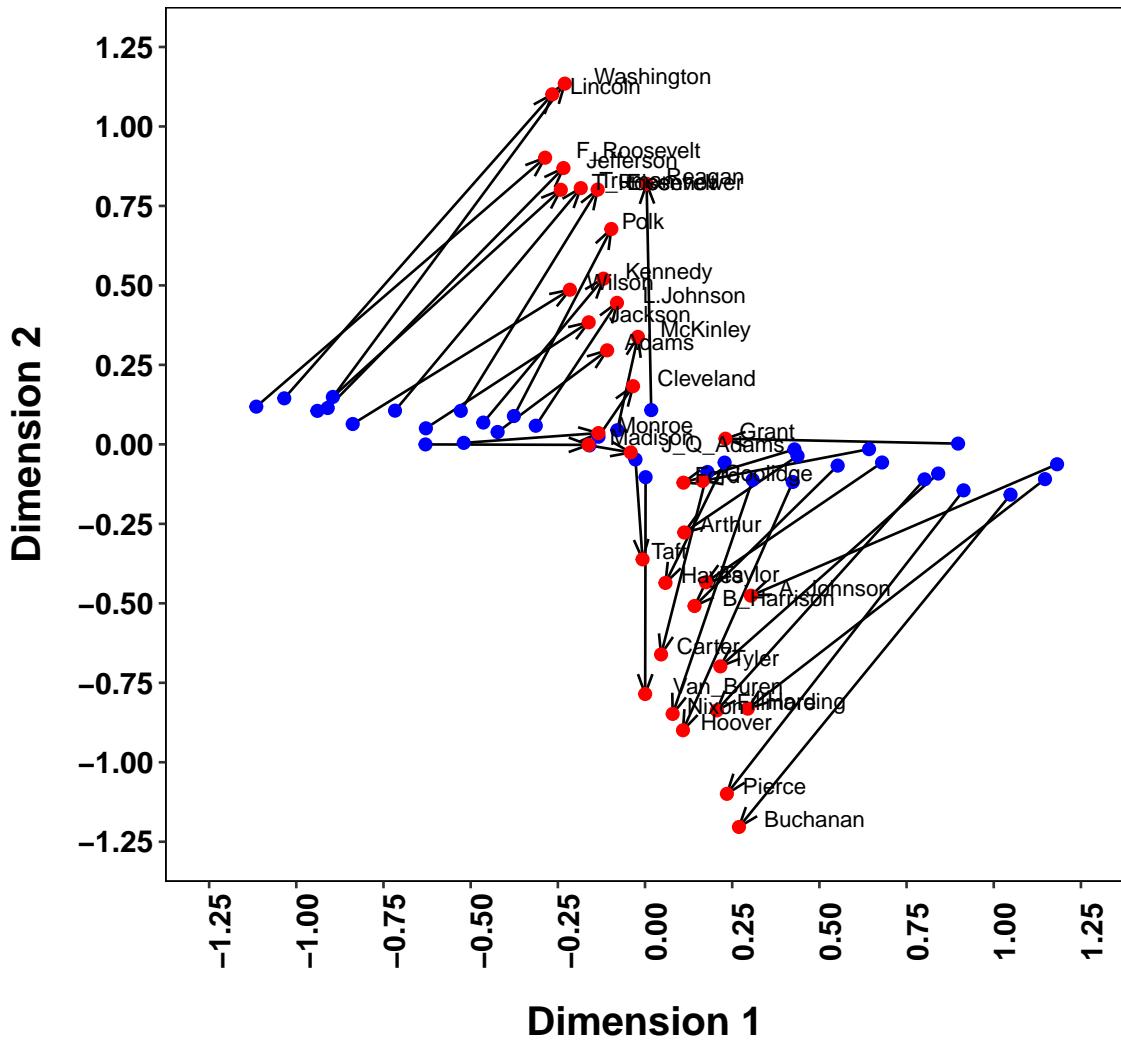
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 5 Configuration")

```

Group Space to Source 5 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[6]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

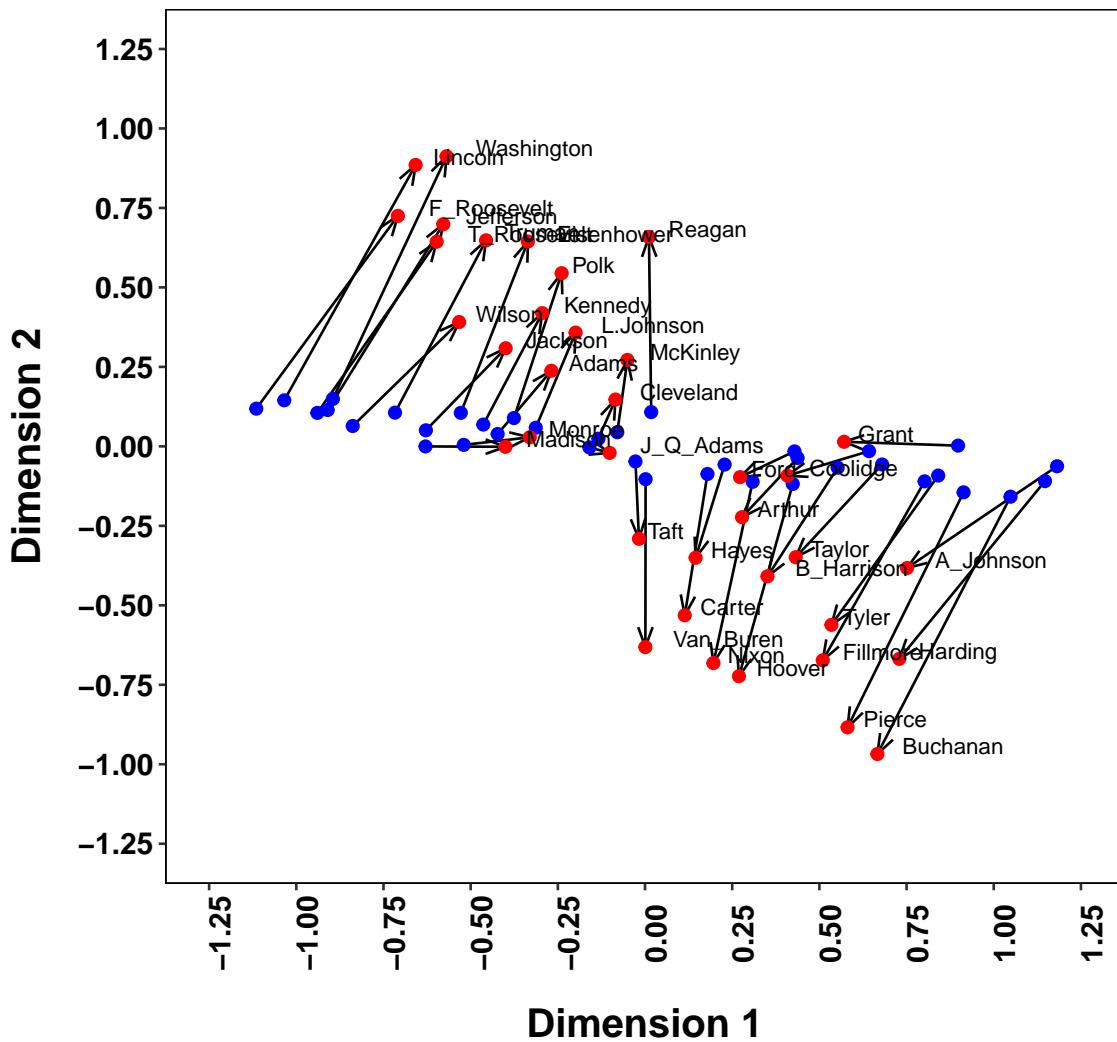
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin =
margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 6 Configuration")

```

Group Space to Source 6 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[7]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

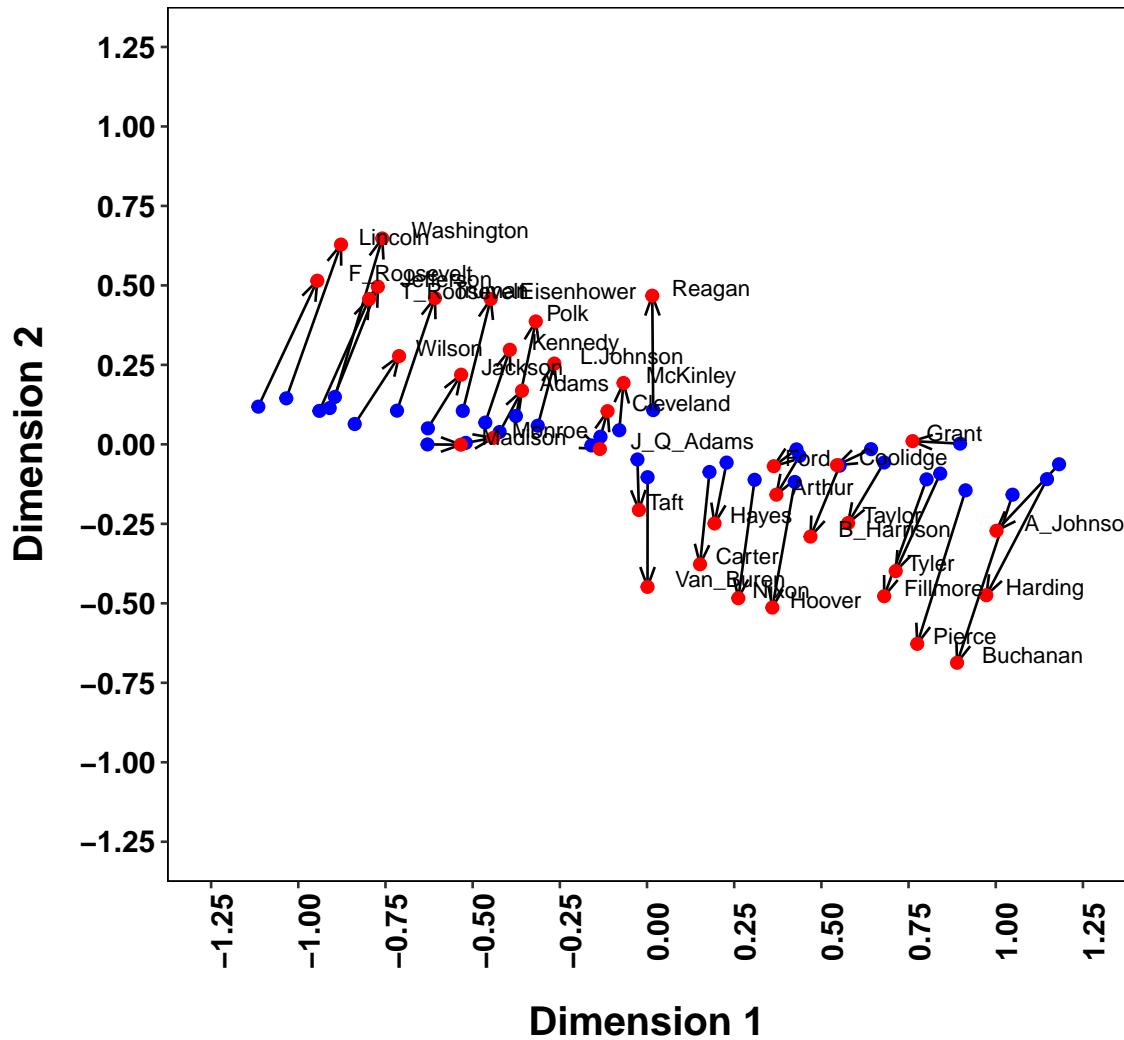
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin =
margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 7 Configuration")

```

Group Space to Source 7 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[8]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

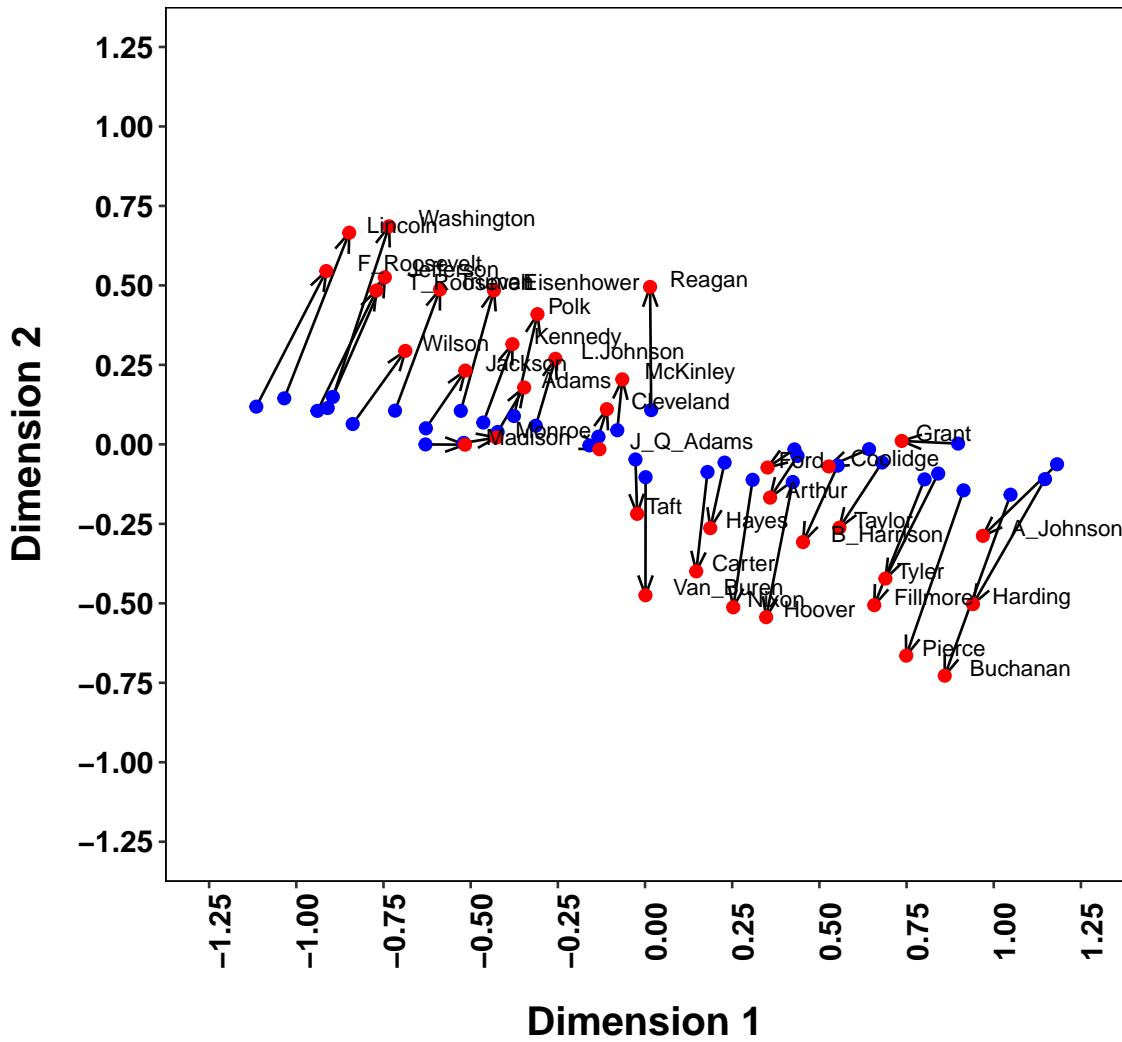
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin =
margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 8 Configuration")

```

Group Space to Source 8 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[9]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

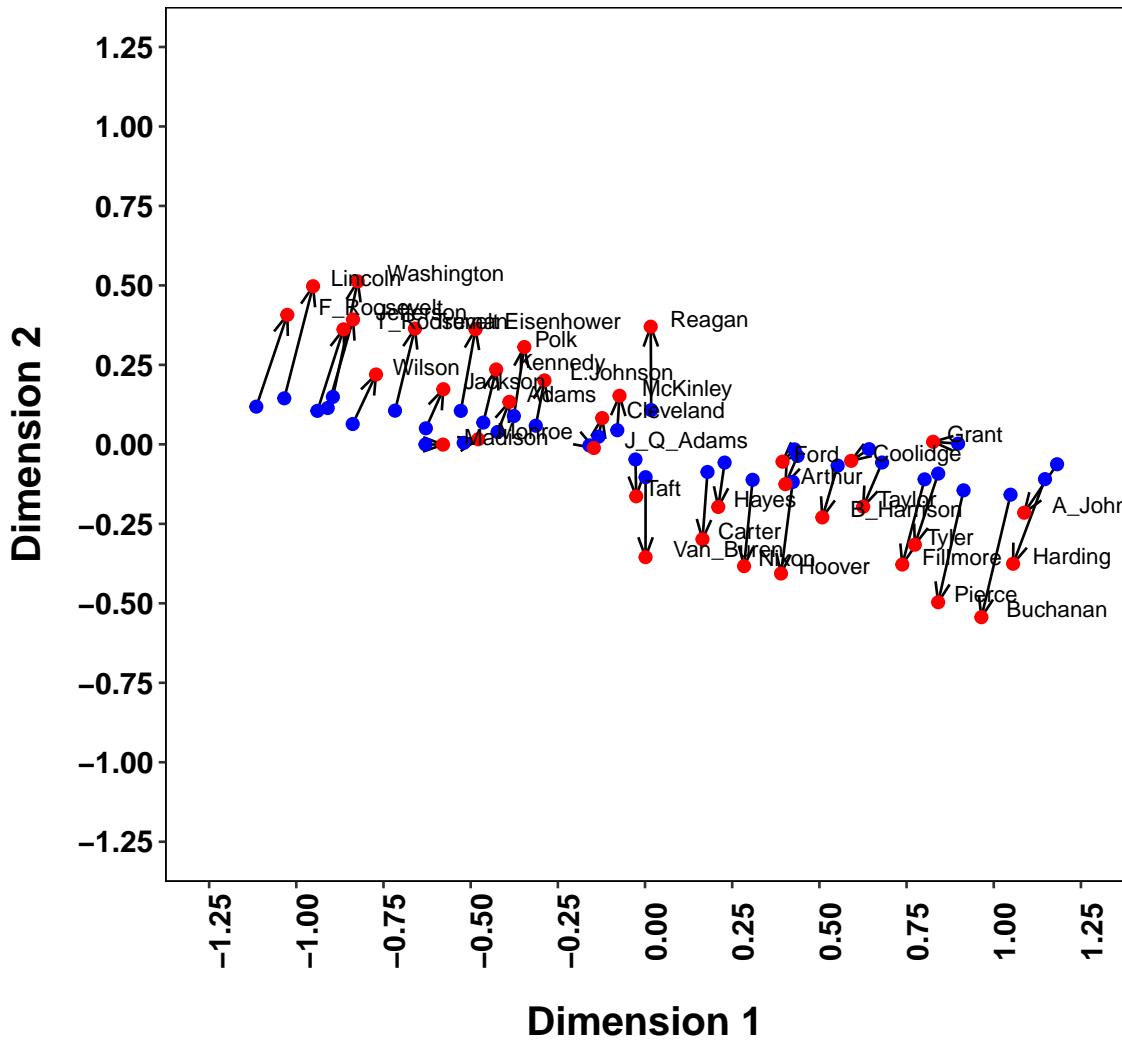
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin =
margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 9 Configuration")

```

Group Space to Source 9 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[10]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

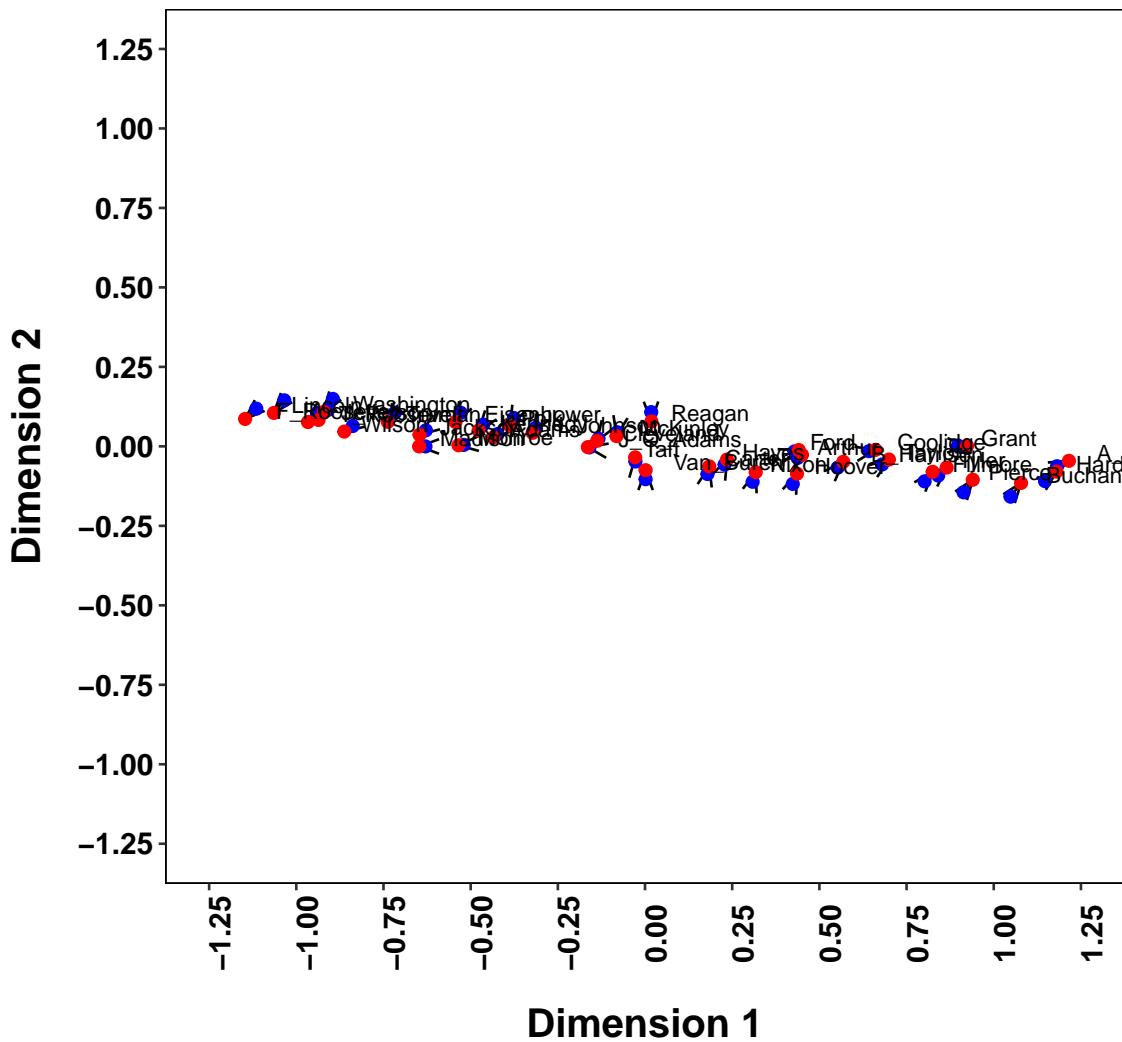
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 10 Configuration")

```

Group Space to Source 10 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[11]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

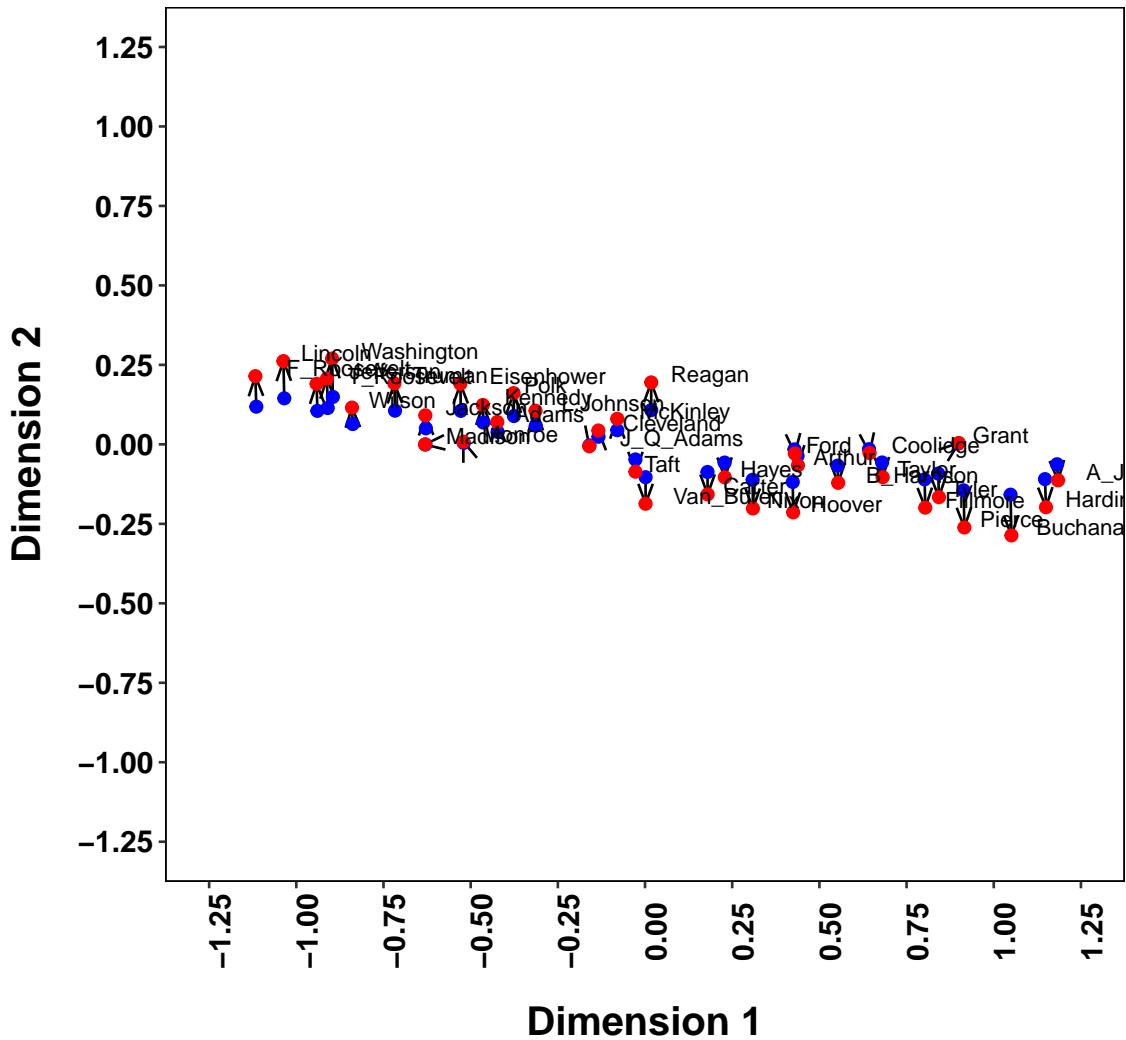
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin =
margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 11 Configuration")

```

Group Space to Source 11 Configuration



```
plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[12]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

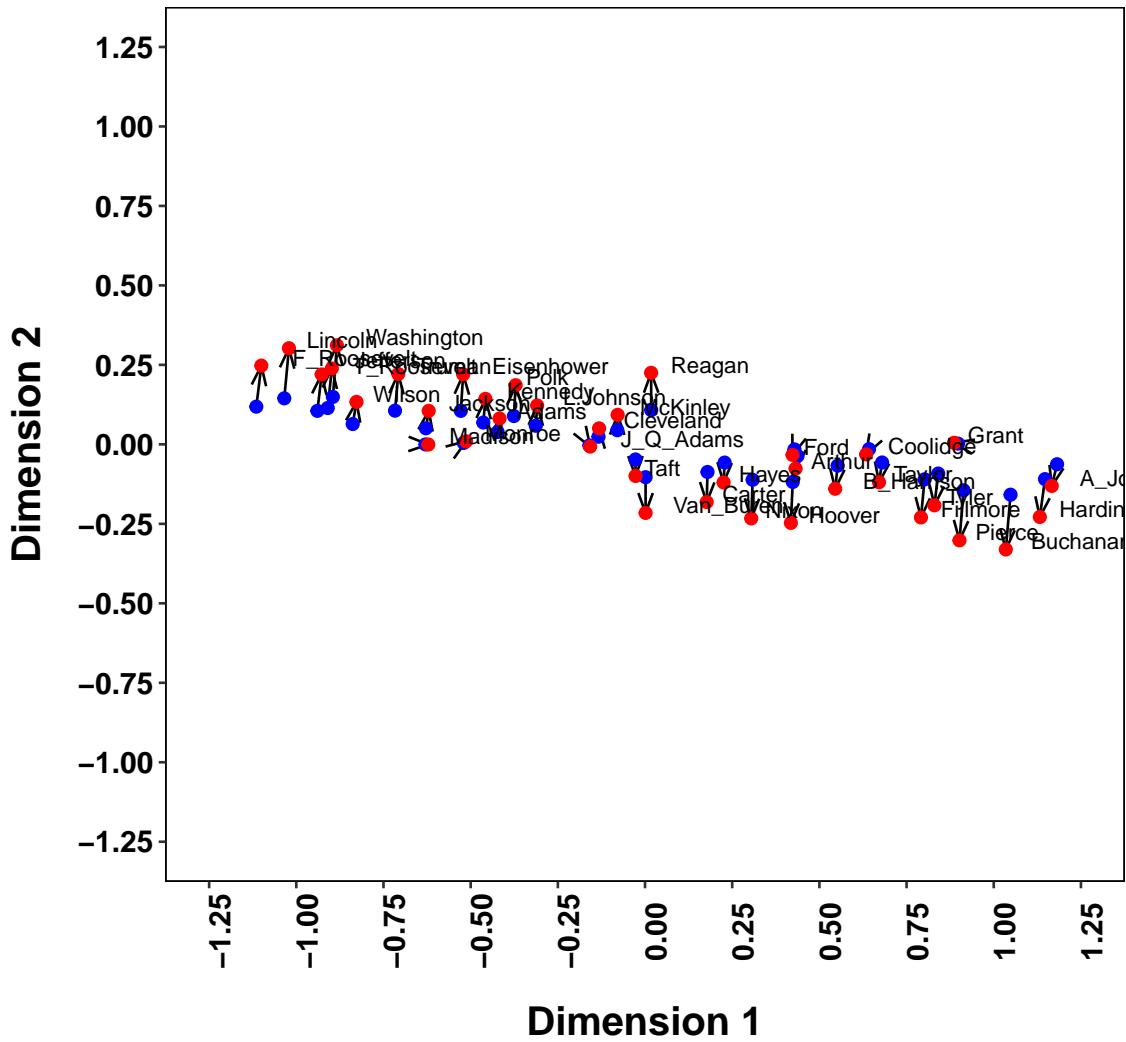
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 12 Configuration")

```

Group Space to Source 12 Configuration



```

plot_data <- cbind(indscal_fit$gspace, indscal_fit$conf[[13]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)

```

```

ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,

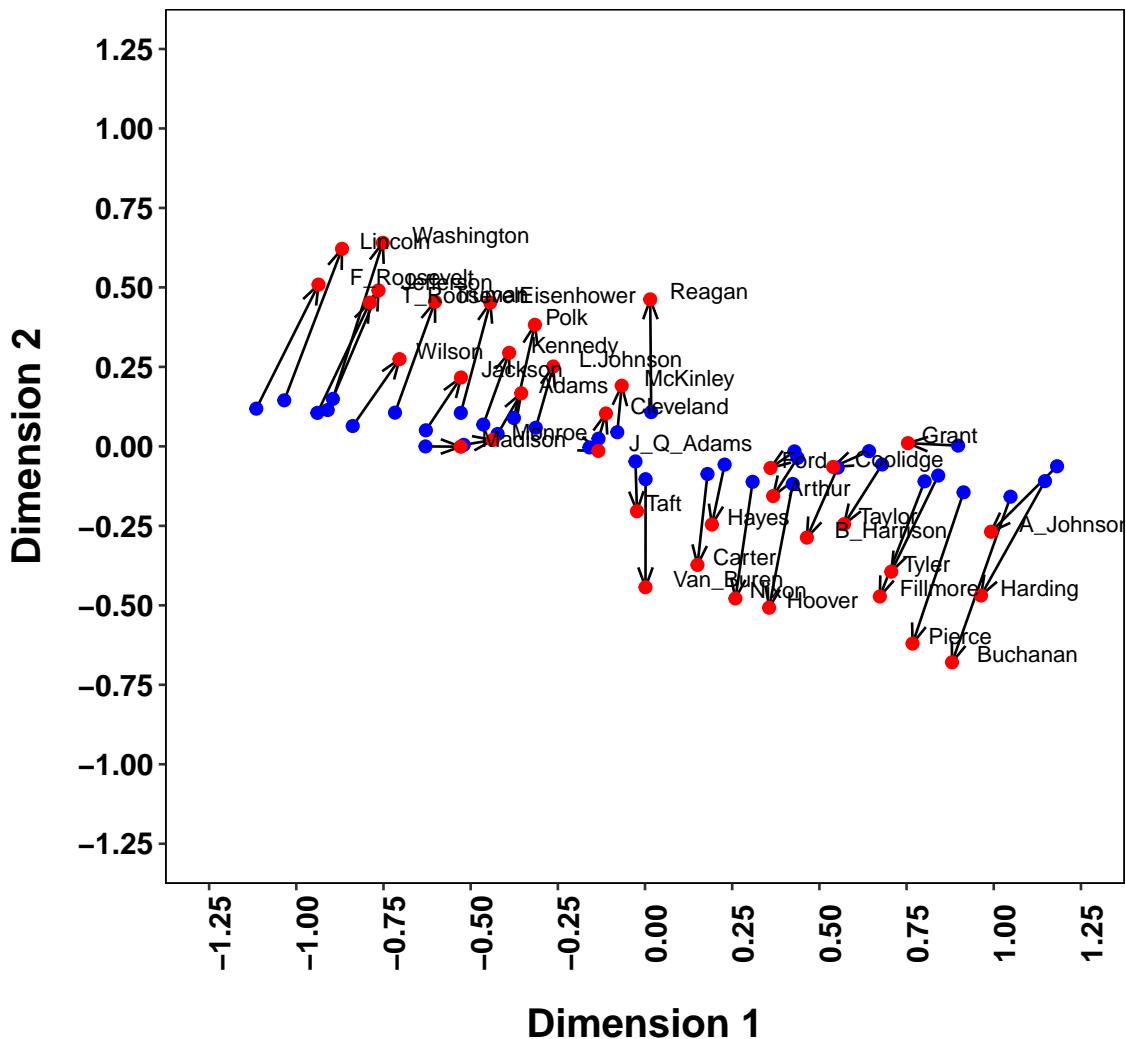
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) + ylab("Dimension 2") +
xlab("Dimension 1") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin =
margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 13 Configuration")

```

Group Space to Source 13 Configuration



4.2.6 Source and Object Information

Additional source information can be used to help identify the meaning behind source differences as indicated by source weights and stress. Likewise, additional object information can help identify the nature of MDS dimensions and relative fit for objects.

```

presz_data <- as.data.frame(cbind(prez_info, siena_info[, 2:21], as.data.frame(indscal_fit$gspace),
                                   as.data.frame(indscal_fit$spp)))
round(cor(prez_data[, 2:26], prez_data[, 25:26], use = "pairwise.complete.obs"),
      2)

##                                     D1      D2
## Height                           -0.22   0.31
## Age                             0.01   0.03

```

```

## BMI          0.03 -0.03
## Background   0.67 -0.52
## Party_leadership 0.83 -0.76
## Communication_ability 0.90 -0.86
## Relations_with_Congress 0.83 -0.78
## Court_appointments 0.88 -0.82
## Handling_of_economy 0.82 -0.86
## Luck          0.72 -0.80
## Ability_to_compromise 0.65 -0.67
## Willing_to_take_risks 0.85 -0.79
## Executive_appointments 0.95 -0.85
## Overall_ability 0.97 -0.85
## Imagination   0.92 -0.81
## Domestic_accomplishments 0.91 -0.81
## Integrity     0.71 -0.67
## Executive_ability 0.97 -0.90
## Foreign_policy_accomplishments 0.82 -0.79
## Leadership_ability 0.90 -0.83
## Intelligence    0.85 -0.68
## Avoid_crucial_mistakes 0.79 -0.82
## Experts_view    0.96 -0.91
## D1             1.00 -0.83
## D2            -0.83  1.00

source_weights <- matrix(NA, nrow = 13, ncol = 2)
for (i in 1:13) {
  source_weights[i, 1] <- indscal_fit$cweights[[i]][1, 1]
  source_weights[i, 2] <- indscal_fit$cweights[[i]][2, 2]
}
source_weights <- as.data.frame(source_weights)
names(source_weights) <- c("D1", "D2")
source_weights$Names <- c(paste("Source ", seq(1, 13, 1)))

source_data <- as.data.frame(cbind(source_info[, 1:6], source_weights,
  as.data.frame(indscal_fit$sps)))
names(source_data) <- c(names(source_data[c(1:9)]), "Stress")

round(cor(source_data[, c(2, 4:8, 10)], use = "pairwise.complete.obs"),
  2)

##           Year Academic News  Dems   D1   D2 Stress
## Year      1.00   -0.44  0.39  0.26 -0.56  0.63  0.38
## Academic -0.44    1.00 -0.62 -0.35  0.58 -0.65 -0.65
## News       0.39   -0.62  1.00 -0.02 -0.76  0.78  0.20
## Dems        0.26   -0.35 -0.02  1.00  0.17  0.02  0.49
## D1         -0.56    0.58 -0.76  0.17  1.00 -0.92 -0.35
## D2          0.63   -0.65  0.78  0.02 -0.92  1.00  0.58
## Stress     0.38   -0.65  0.20  0.49 -0.35  0.58  1.00

```

5 No Constraint

IDIOSCAL can be computed using the "idioscal" argument. The weight matrices are then unconstrained. This means that the source configurations are linear combinations

(not just expansion and contraction) of the group configuration. This is akin to rotation in principal components analysis and factor analysis.

5.1 Basic Model Fit

The basic model is fit by specifying the type of analysis (ordinal here), the constraint (indscal here), and the number of dimensions (2 here). The maximum number of iterations is also specified here to insure that a solution can be found. This solution will allow the 13 sources to weight the dimensions differently, but require that the weight matrices are diagonal.

```
idioscal_fit <- smacofIndDiff(Presidents_Dist, ndim = 2, constraint = "idioscal",
                                itmax = 1000, type = "ordinal")
summary(idioscal_fit)

##
## Group Stimulus Space (Joint Configurations):
##          D1      D2
## 1  -1.0158  0.0657
## 2  -0.3927 -0.0223
## 3  -0.9292 -0.0239
## 4  -0.4328 -0.1388
## 5  -0.3823 -0.0965
## 6  -0.0961 -0.0415
## 7  -0.5684 -0.0468
## 8   0.2692 -0.1872
## 9   0.8288  0.0163
## 10 -0.4962  0.0735
## 11  0.6235  0.0474
## 12  0.8479 -0.0216
## 13  1.0147 -0.0584
## 14  1.1428 -0.0539
## 15 -1.0971  0.0297
## 16  1.0077  0.1269
## 17  0.6218  0.2065
## 18  0.3120 -0.0487
## 19  0.4062  0.0288
## 20 -0.1542  0.0132
## 21  0.5641  0.0024
## 22 -0.1739  0.0616
## 23 -0.9312  0.0119
## 24  0.1017 -0.0858
## 25 -0.7508 -0.0665
## 26  1.0844  0.0565
## 27  0.4781  0.1238
## 28  0.6034 -0.1187
## 29 -1.0852 -0.0311
## 30 -0.7784  0.0308
## 31 -0.6436  0.0694
## 32 -0.5043  0.0188
## 33 -0.3704  0.0333
## 34  0.4955 -0.1326
## 35  0.3381  0.0683
## 36  0.3529 -0.1100
```

```

## 37 -0.2906 0.1996
##
##
## Stress per point:
##   1   2   3   4   5   6   7   8   9   10  11  12  13
## 1.81 2.41 2.30 3.46 3.68 2.57 3.20 2.93 2.05 2.17 2.56 2.28 1.80
## 14   15   16   17   18   19   20   21   22   23   24   25   26
## 1.74 1.83 3.13 3.54 2.64 3.05 2.97 2.50 1.92 1.91 2.04 1.91 1.61
## 27   28   29   30   31   32   33   34   35   36   37
## 2.68 2.71 1.75 1.74 2.05 4.40 2.76 4.96 2.68 5.81 4.46

```

5.2 Additional Information

As with other MDS procedures, additional, largely graphical, information can be consulted to determine the nature of the solution and its adequacy.

5.2.1 Stress Plots

Stress can be viewed in several ways. First, there will be an overall stress value for the solution, as with any MDS. Second, the proportion of that stress value that is due to different objects can be illustrated. Third, the stress due to different sources can be illustrated. The latter two can help identify the reasons for good and poor fit.

```

idioscal_fit$stress
## [1] 0.1604

```

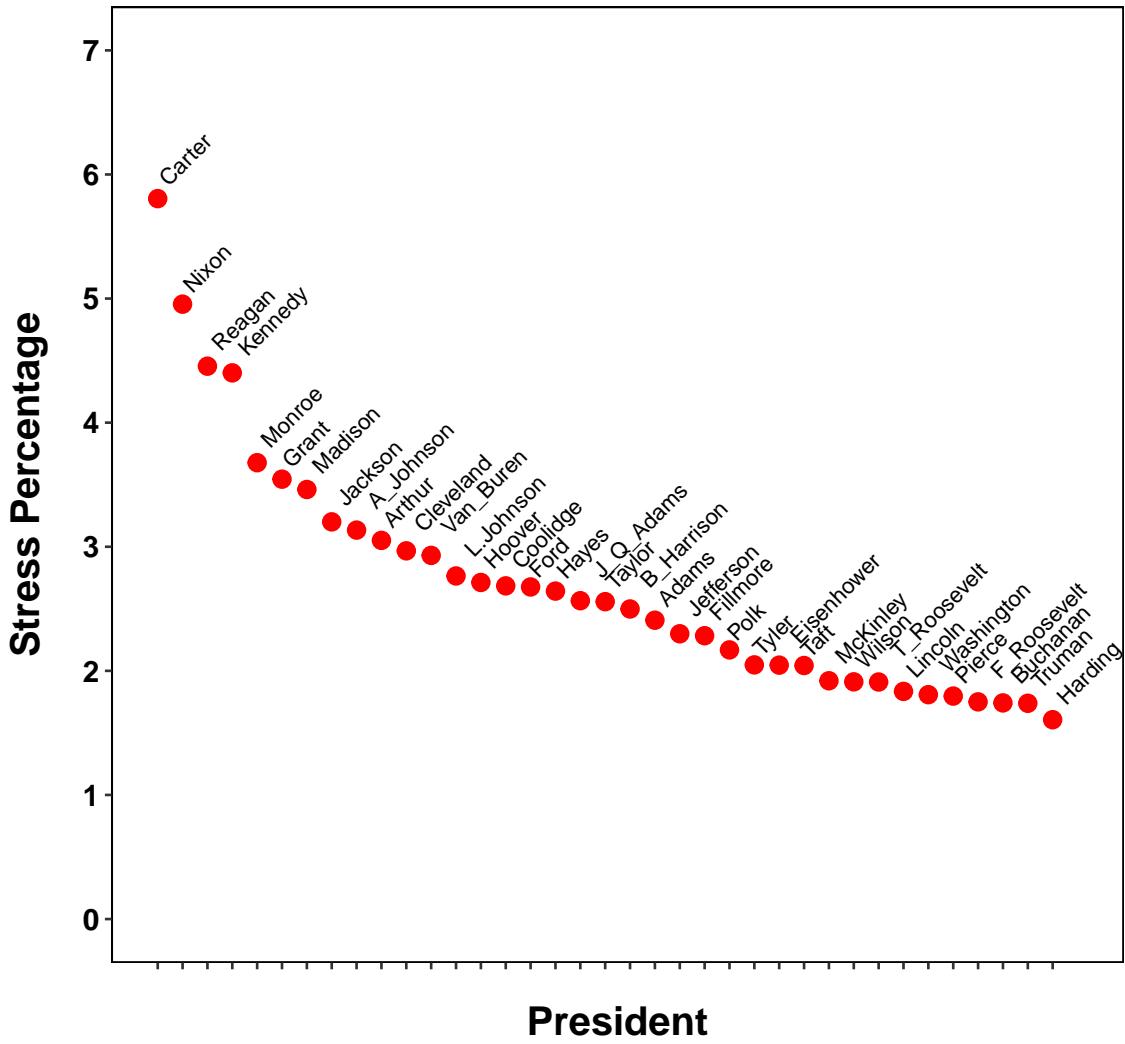
```

plot_data <- as.data.frame(idioscal_fit$spp)
names(plot_data) <- c("SP")
plot_data$Name <- plot_data$Name <- Presidents$Name
plot_data <- plot_data[order(-plot_data[, 1]), ]
plot_data$Index <- seq(1, length(plot_data[, 1]))

ggplot(plot_data, aes(x = Index, y = SP)) + geom_point(shape = 19,
  size = 3, color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  7, 1))) + scale_x_continuous(breaks = c(seq(1, 37, 1))) + geom_text(aes(label = Name),
  hjust = -0.25, vjust = 0, size = 3, angle = 45) + coord_cartesian(xlim = c(1,
  38), ylim = c(0, 7)) + xlab("President") + ylab("Stress Percentage") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_blank(),
  axis.title.x = element_text(margin = margin(15, 0, 0, 0),
  size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(),
  axis.line.y = element_blank(), plot.title = element_text(size = 16,
  face = "bold", margin = margin(0, 0, 20, 0), hjust = 0.5),
  panel.background = element_rect(fill = "white", linetype = 1,
  color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Stress Decomposition for Objects")

```

Stress Decomposition for Objects



```

plot_data <- as.data.frame(idioscal_fit$sp)
names(plot_data) <- c("SS")
plot_data$Name <- c(paste("Source ", seq(1, 13)))
plot_data <- plot_data[order(-plot_data[, 1]), ]
plot_data$Index <- seq(1, length(plot_data[, 1]))

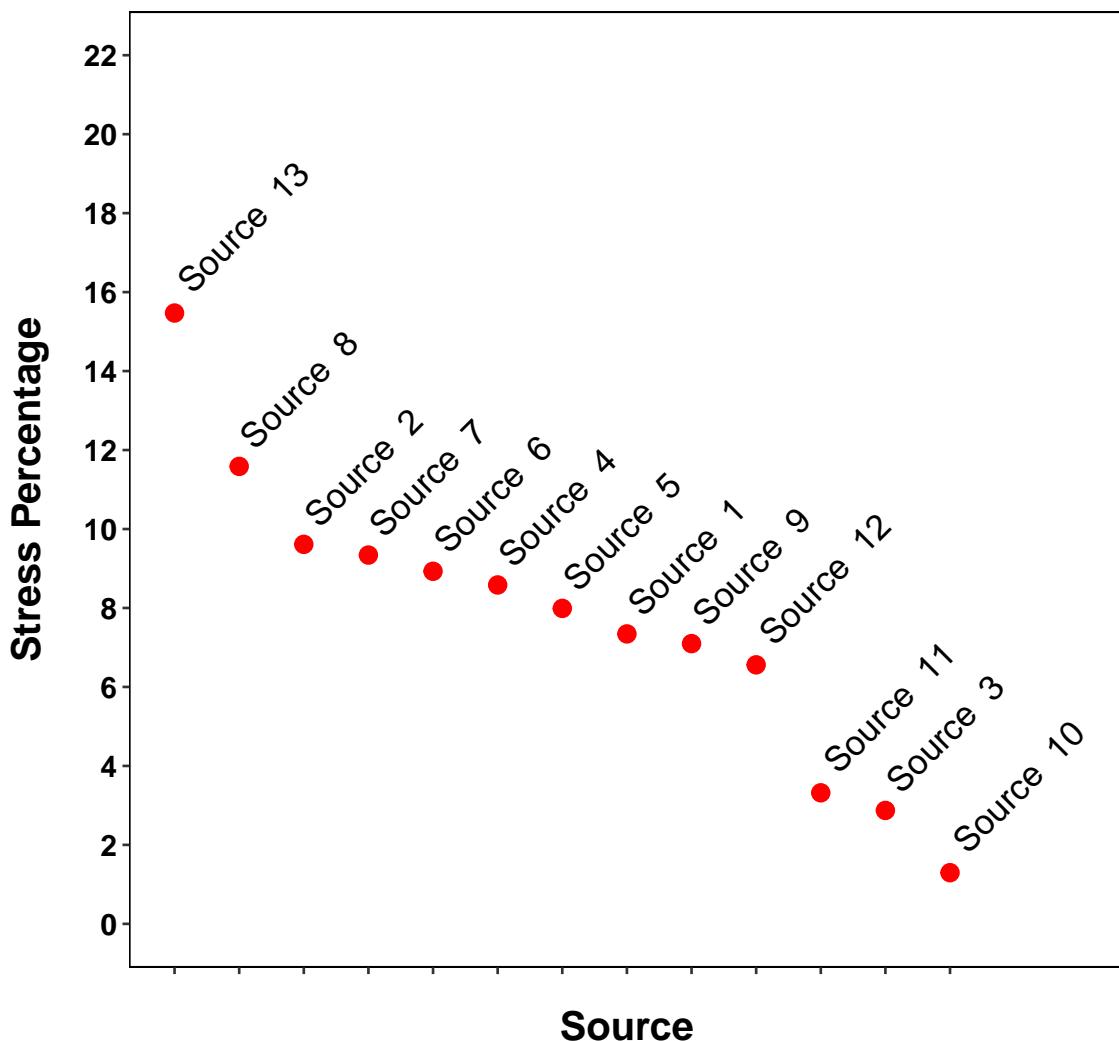
ggplot(plot_data, aes(x = Index, y = SS)) + geom_point(shape = 19,
  size = 3, color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  22, 2))) + scale_x_continuous(breaks = c(seq(1, 13, 1))) + geom_text(aes(label = Name),
  hjust = -0.15, vjust = 0, size = 5, angle = 45) + coord_cartesian(xlim = c(1,
  15), ylim = c(0, 22)) + xlab("Source") + ylab("Stress Percentage") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_blank())
  
```

```

axis.title.x = element_text(margin = margin(15, 0, 0, 0),
    size = 16), axis.title.y = element_text(margin = margin(0,
    15, 0, 0), size = 16), axis.line.x = element_blank(),
axis.line.y = element_blank(), plot.title = element_text(size = 16,
    face = "bold", margin = margin(0, 0, 20, 0), hjust = 0.5),
panel.background = element_rect(fill = "white", linetype = 1,
    color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Stress Decomposition for Sources")

```

Stress Decomposition for Sources



5.2.2 Group Configuration Plot

The group configuration plot shows the aggregate solution or group solution.

```

plot_data <- as.data.frame(idioscal_fit$gspace)
names(plot_data) <- c("D1", "D2")
plot_data$Stress <- idioscal_fit$spp
plot_data>Name <- Presidents>Name

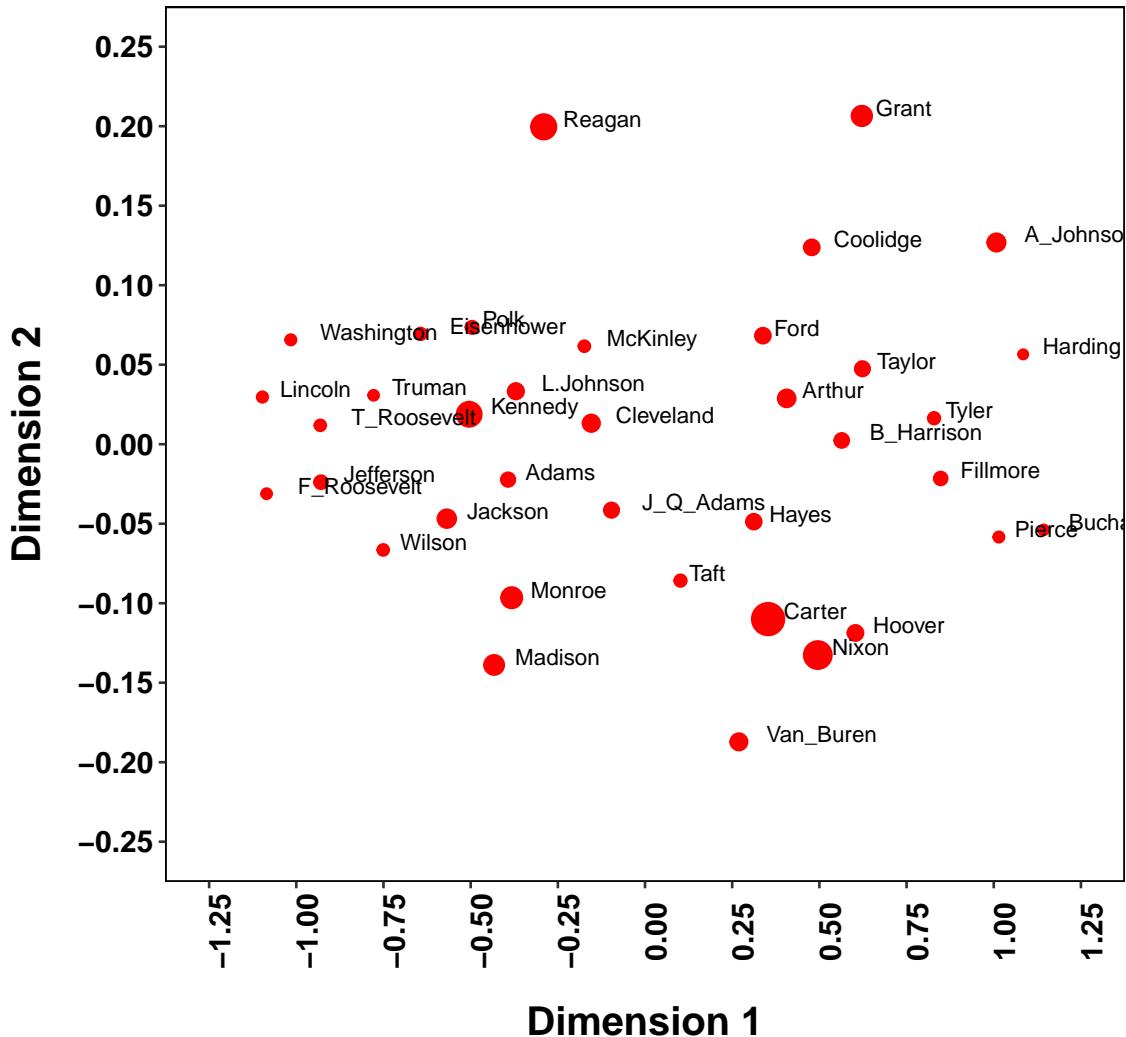
```

```

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = plot_data$Stress,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-0.25,
0.25, 0.05))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.25,
0.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16, face = "bold", margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Size = Object Stress)")

```

Two-Dimensional Space (Size = Object Stress)



5.2.3 Source Configuration Plots

The configuration plots for individual sources can be examined to determine if particular sources have maps that deviate markedly from the group.

```
plot_data <- as.data.frame(idioscal_fit$conf[[1]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$name
```

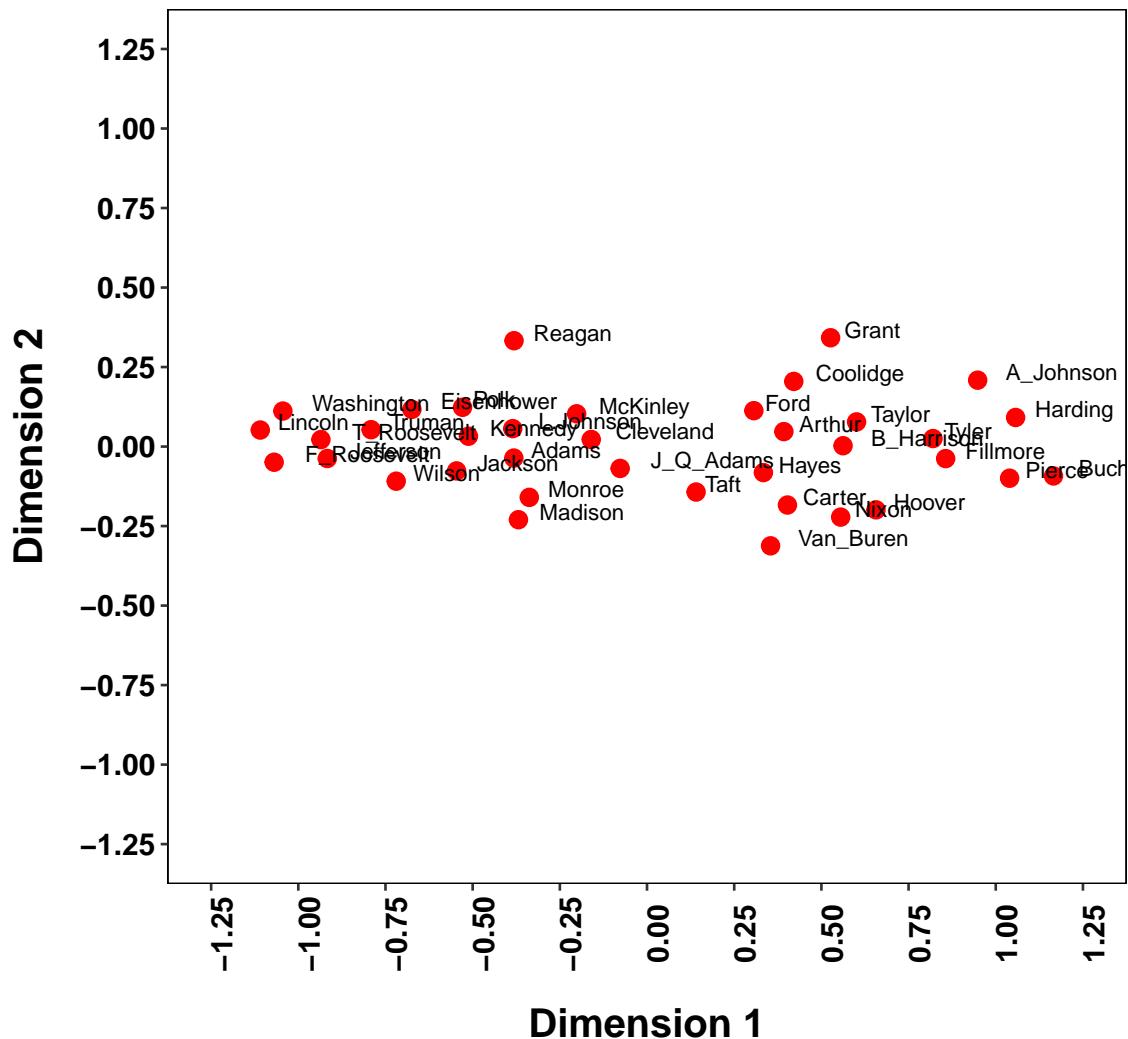
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
```

```

size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 1)")

```

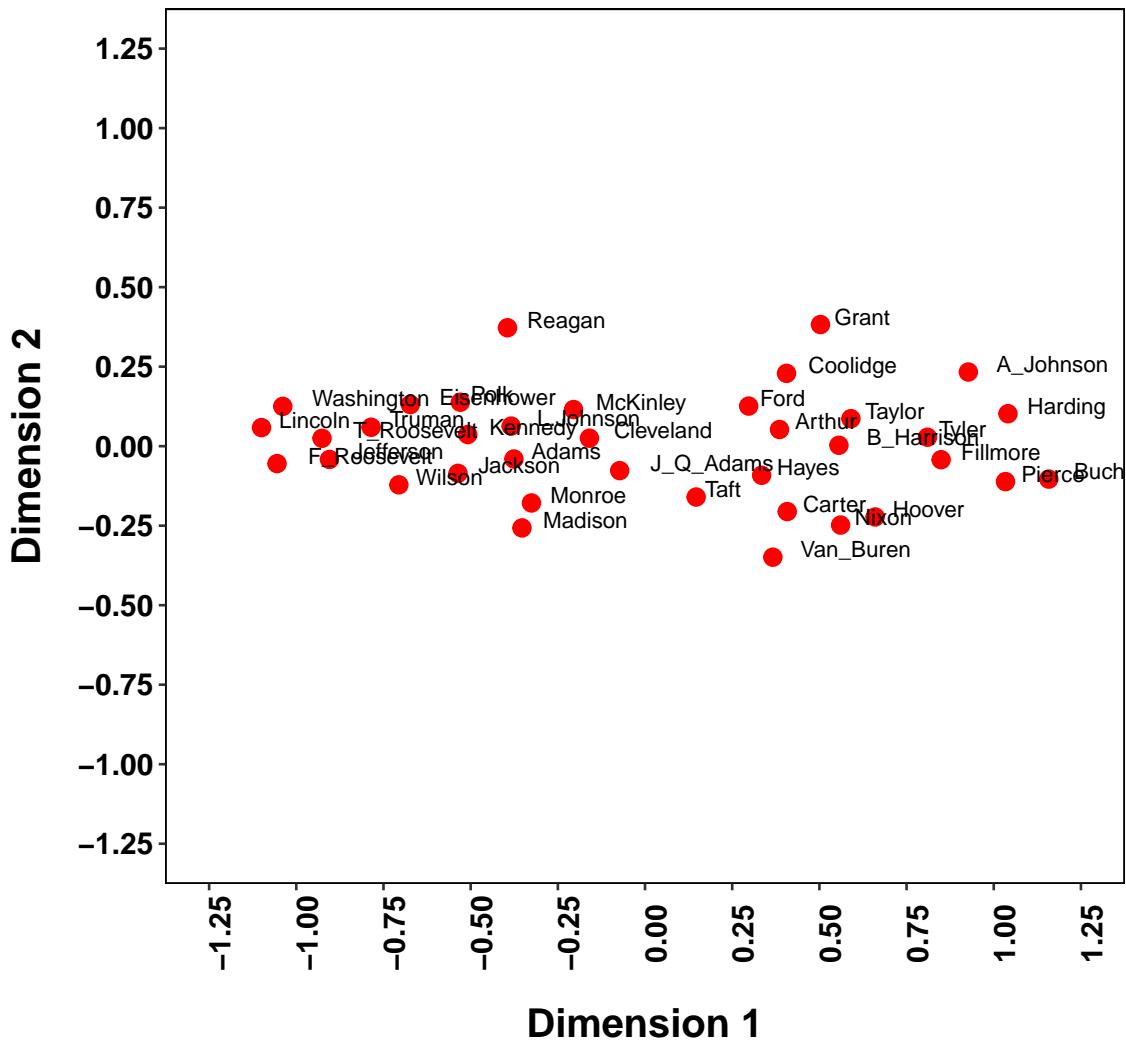
Two-Dimensional Space (Source 1)



```
plot_data <- as.data.frame(idioscal_fit$conf[[2]])  
names(plot_data) <- c("D1", "D2")  
plot_data$Name <- Presidents$Name
```

```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,  
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,  
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,  
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,  
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,  
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,  
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",  
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",  
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,  
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,  
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),  
plot.title = element_text(size = 16, face = "bold", margin = margin(0,  
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",  
linetype = 1, color = "black"), panel.grid.major = element_blank(),  
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),  
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",  
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 2)")
```

Two-Dimensional Space (Source 2)



```
plot_data <- as.data.frame(idioscal_fit$conf[[3]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

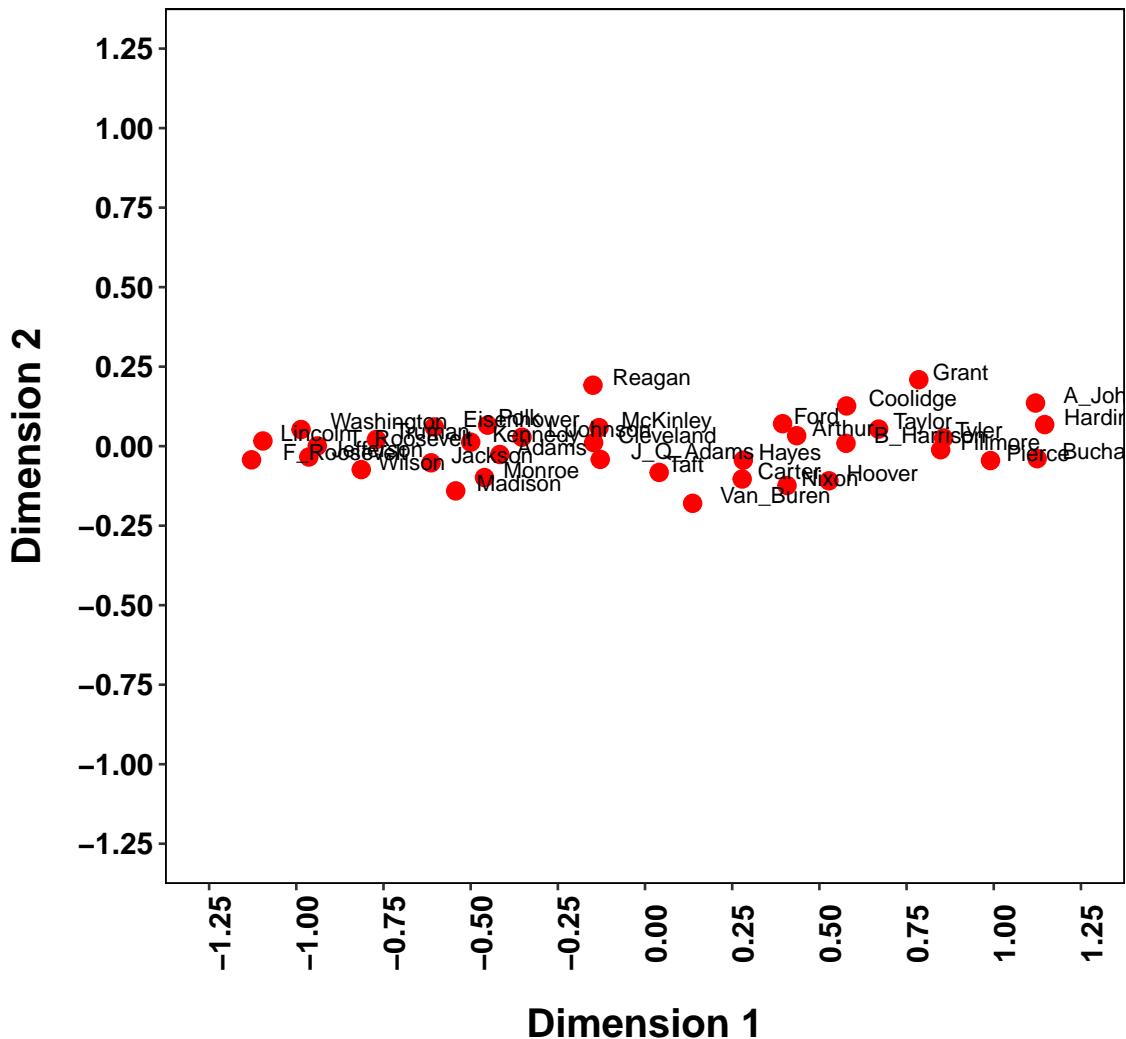
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 3)")

```

Two-Dimensional Space (Source 3)



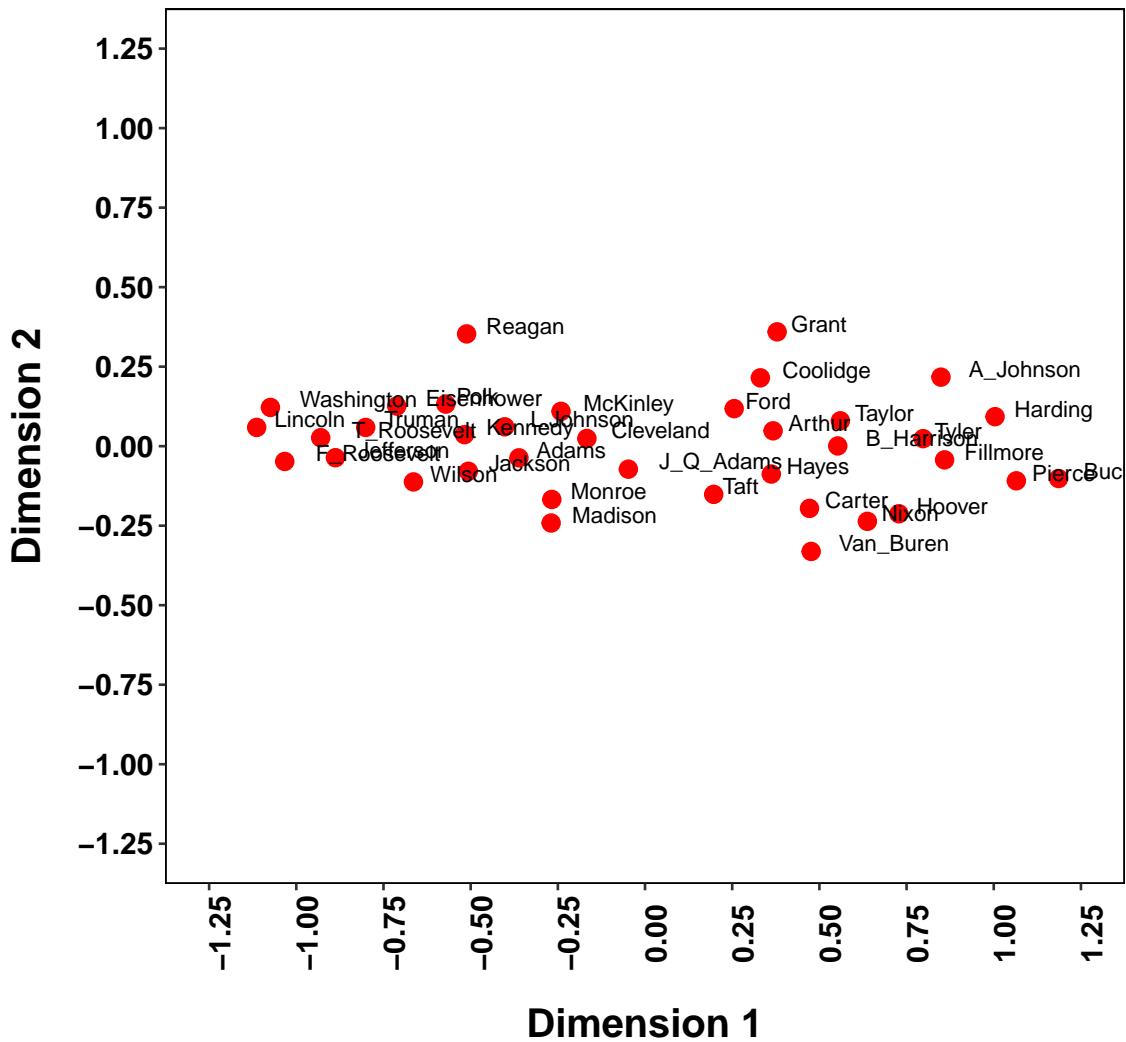
```

plot_data <- as.data.frame(idioscal_fit$conf[[4]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

```

```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,  
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,  
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,  
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,  
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,  
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,  
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",  
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",  
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,  
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,  
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),  
plot.title = element_text(size = 16, face = "bold", margin = margin(0,  
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",  
linetype = 1, color = "black"), panel.grid.major = element_blank(),  
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),  
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",  
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 4)")
```

Two-Dimensional Space (Source 4)



```
plot_data <- as.data.frame(idioscal_fit$conf[[5]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

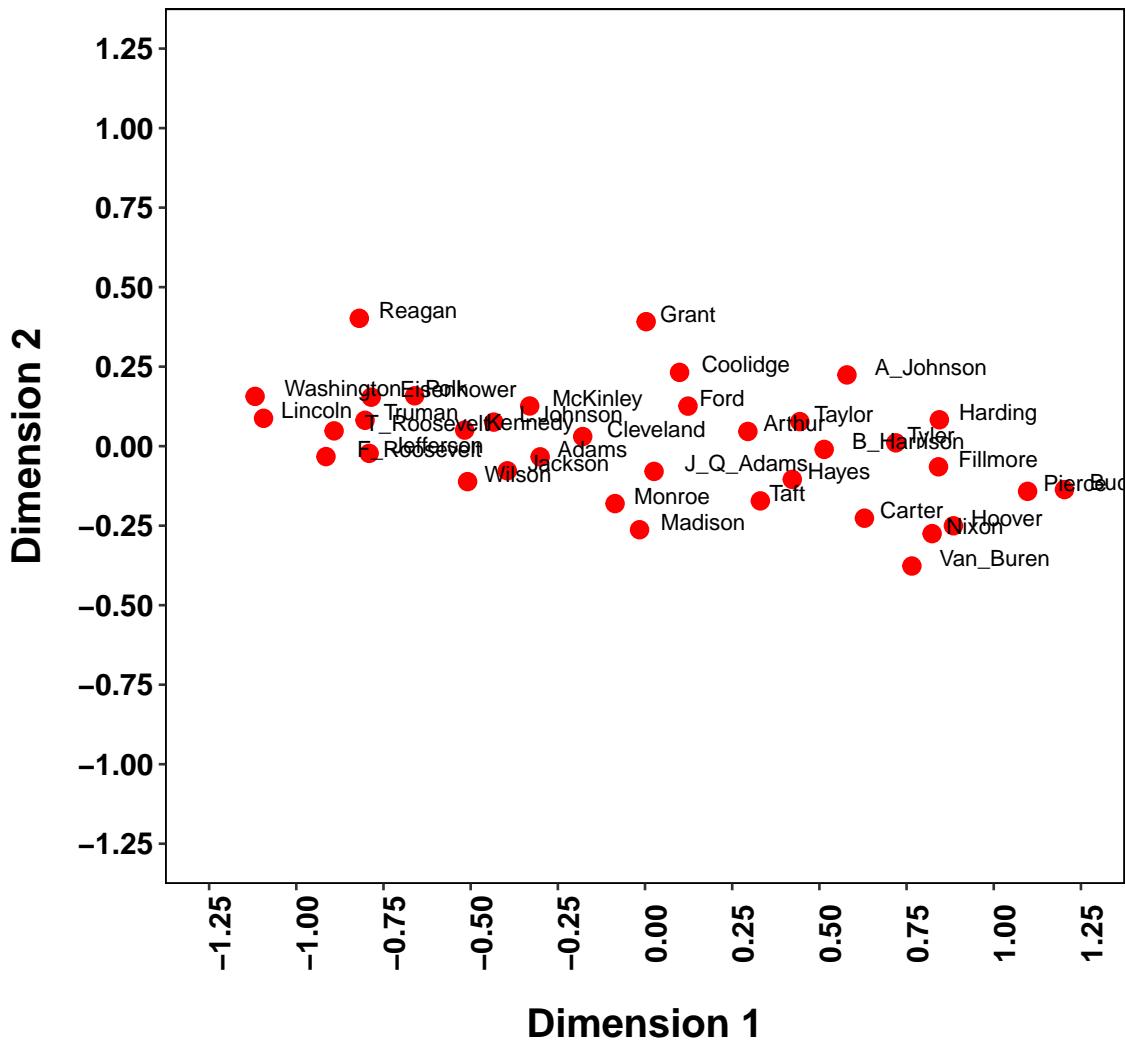
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 5)")

```

Two-Dimensional Space (Source 5)



```

plot_data <- as.data.frame(idioscal_fit$conf[[6]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

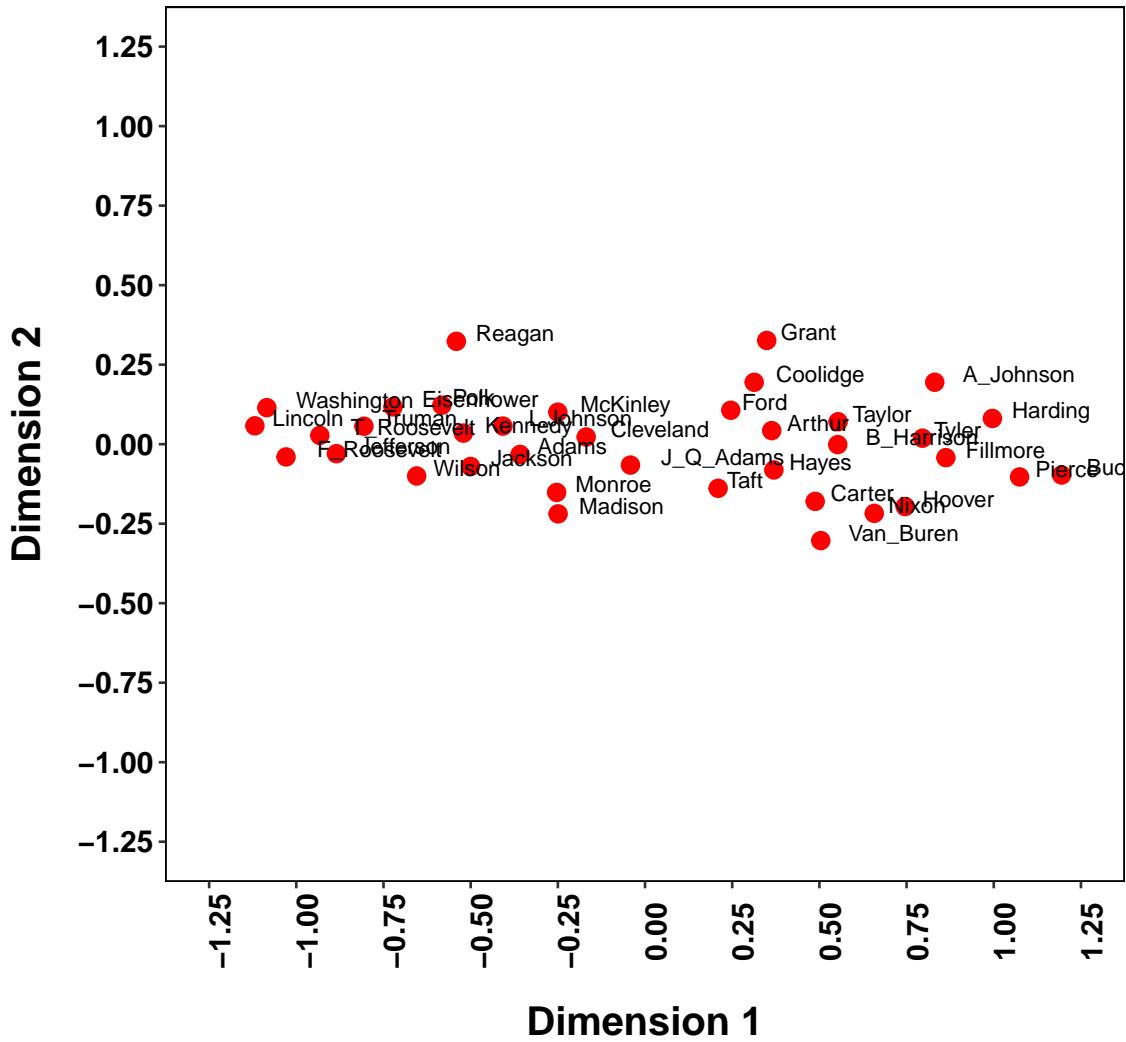
```

```

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 6)")

```

Two-Dimensional Space (Source 6)



```
plot_data <- as.data.frame(idioscal_fit$conf[[7]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

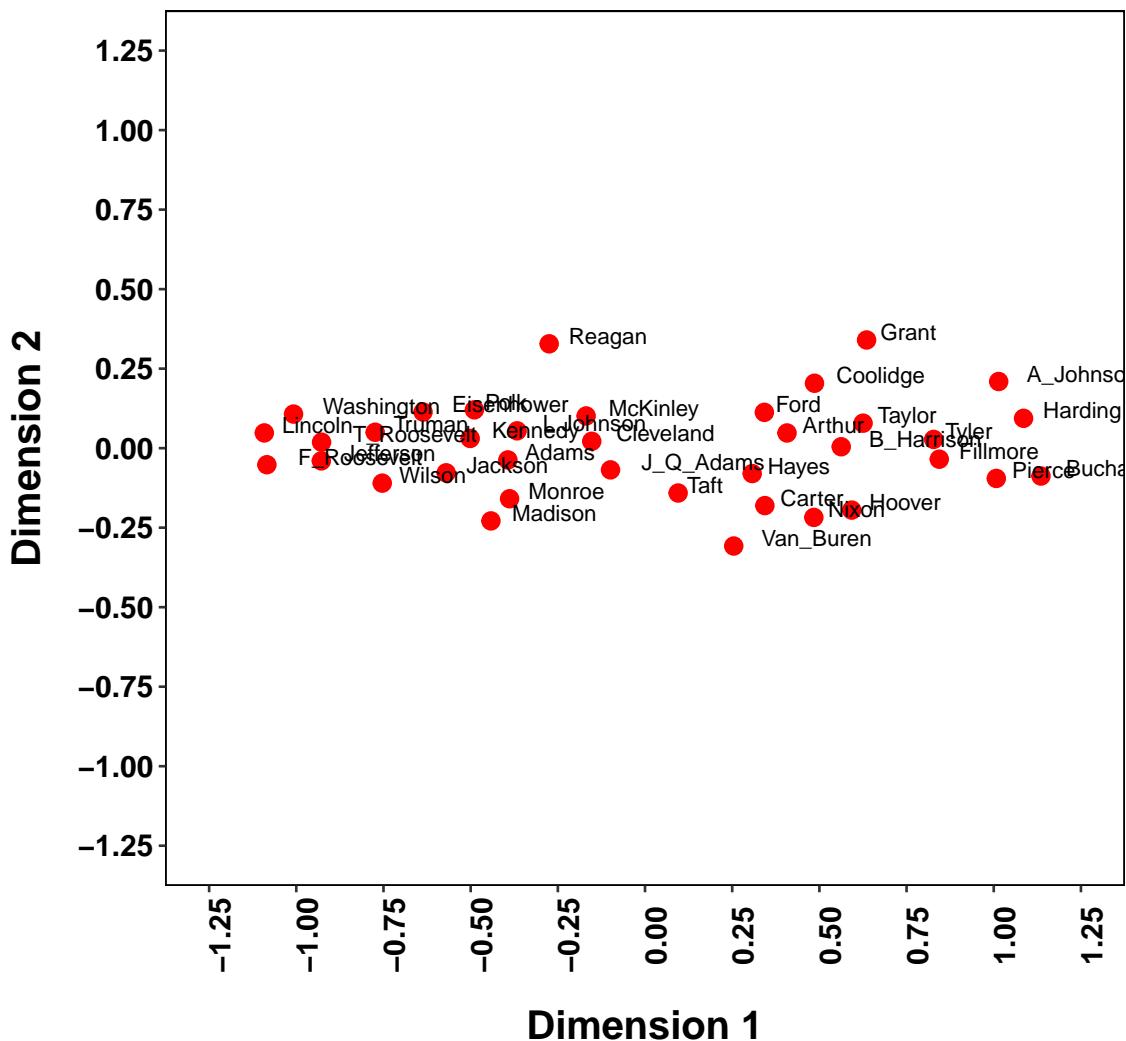
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 7)")

```

Two-Dimensional Space (Source 7)



```

plot_data <- as.data.frame(idioscal_fit$conf[[8]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

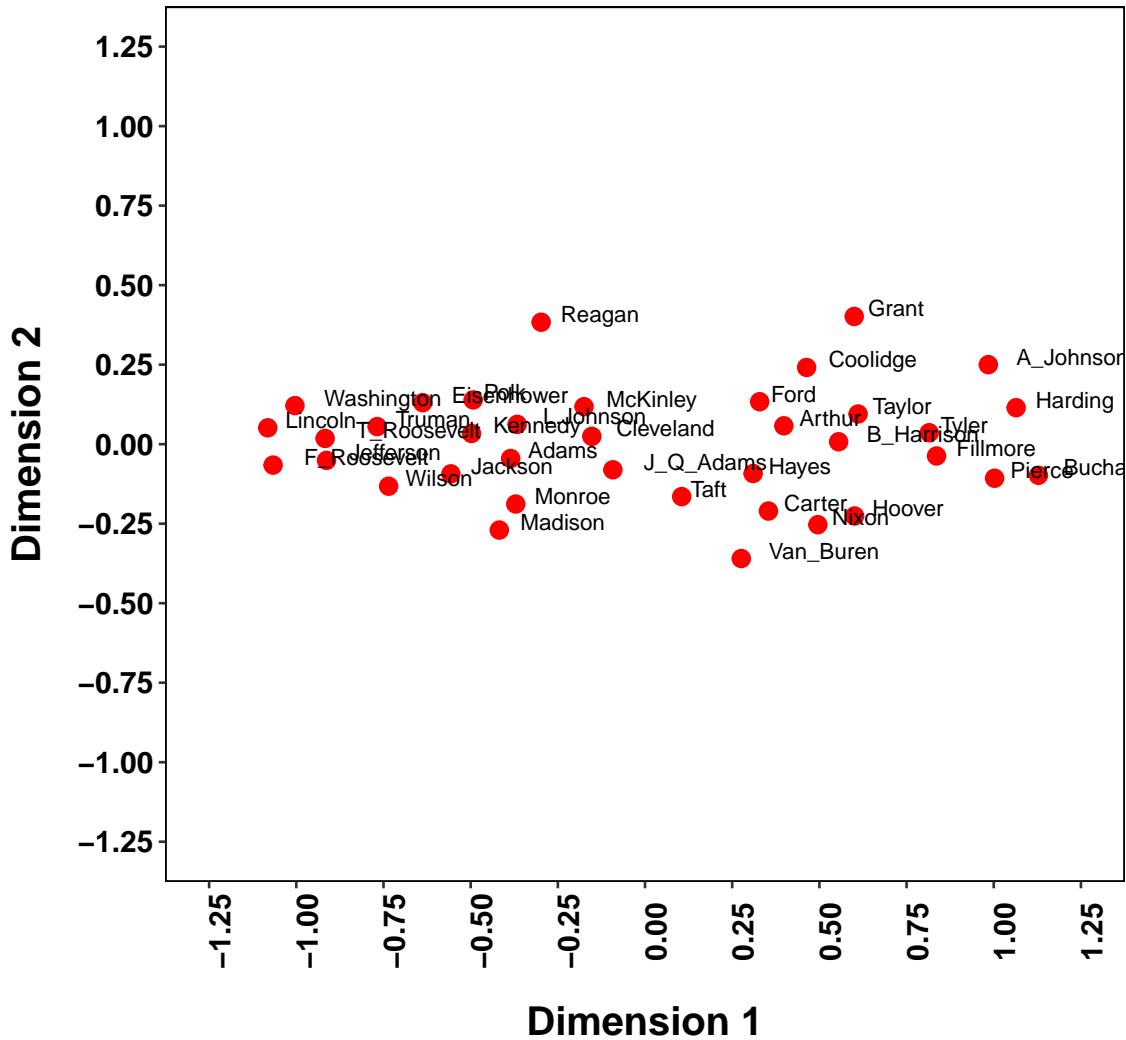
```

```

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 8)")

```

Two-Dimensional Space (Source 8)



```
plot_data <- as.data.frame(idioscal_fit$conf[[9]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

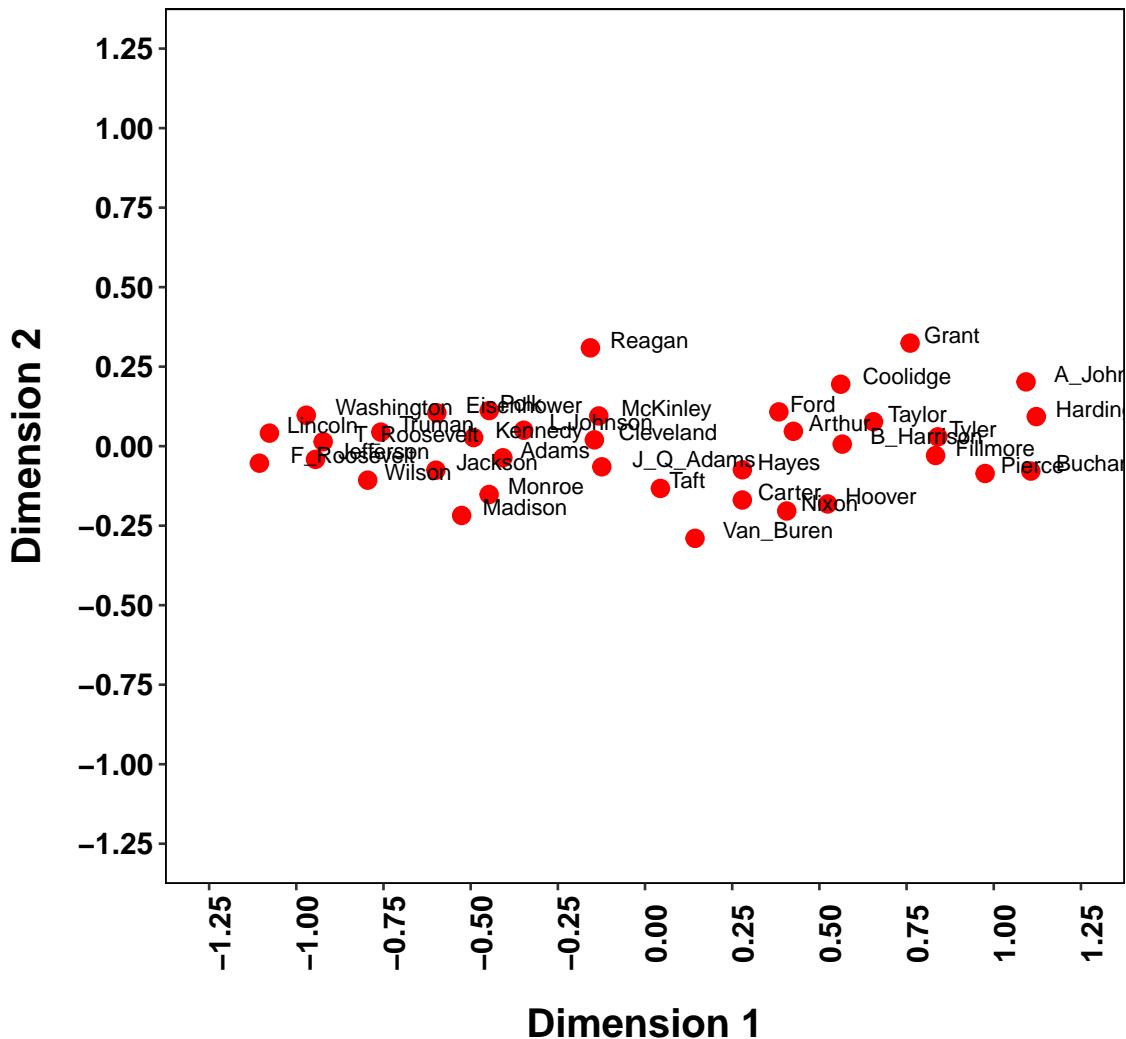
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 9)")

```

Two-Dimensional Space (Source 9)



```

plot_data <- as.data.frame(idioscal_fit$conf[[10]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

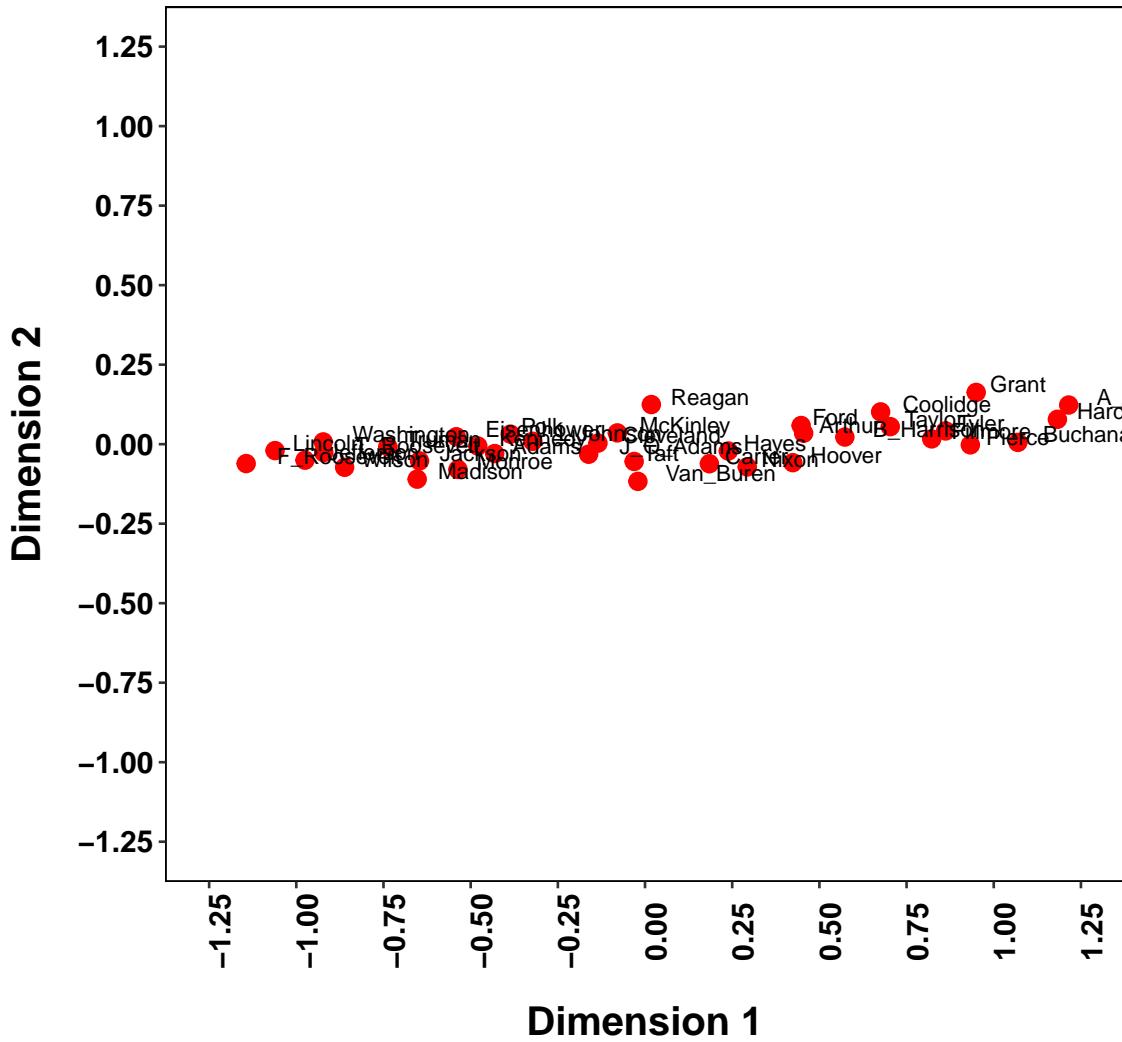
```

```

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 10)")

```

Two-Dimensional Space (Source 10)



```
plot_data <- as.data.frame(idioscal_fit$conf[[11]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

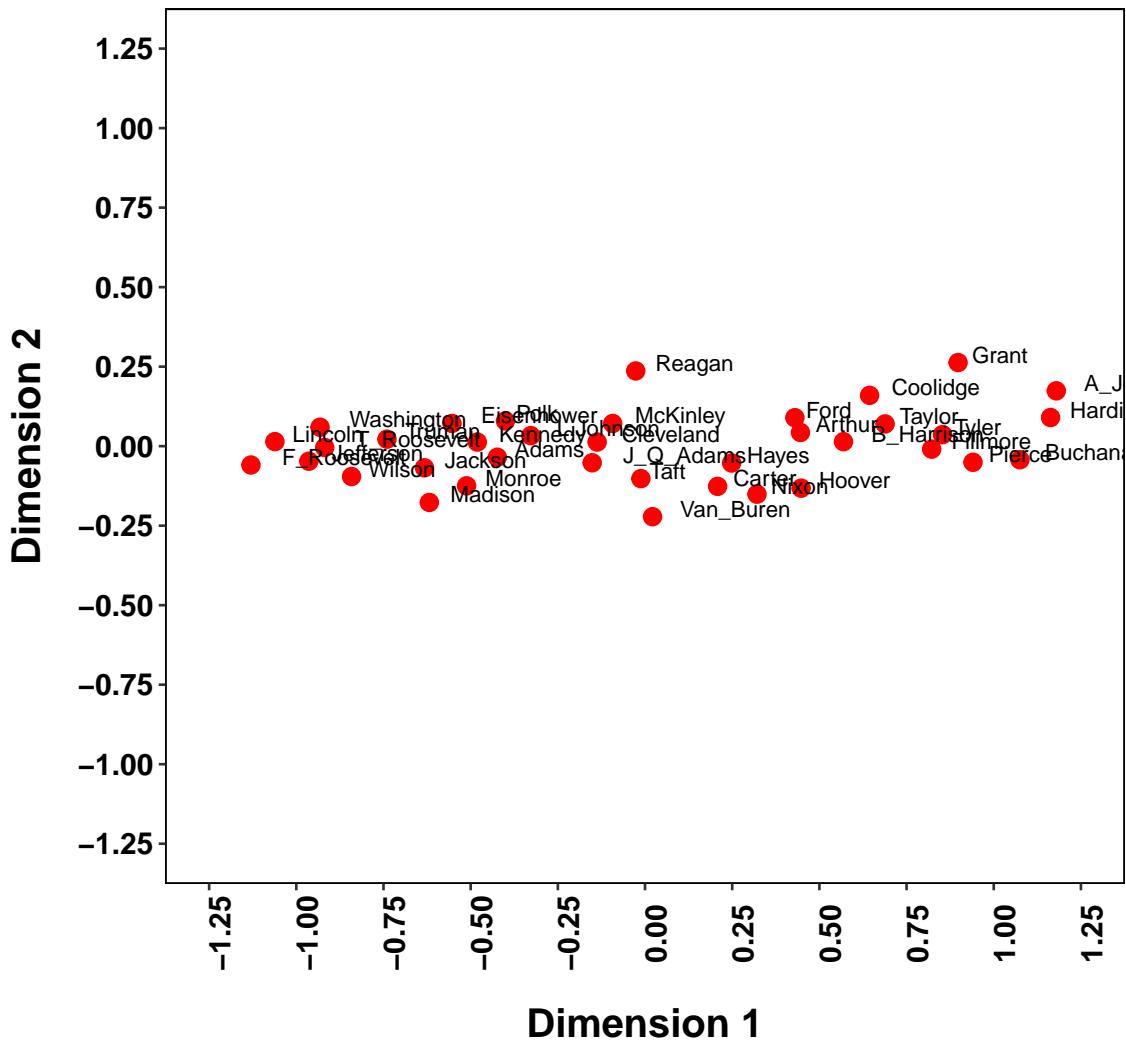
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 11)")

```

Two-Dimensional Space (Source 11)



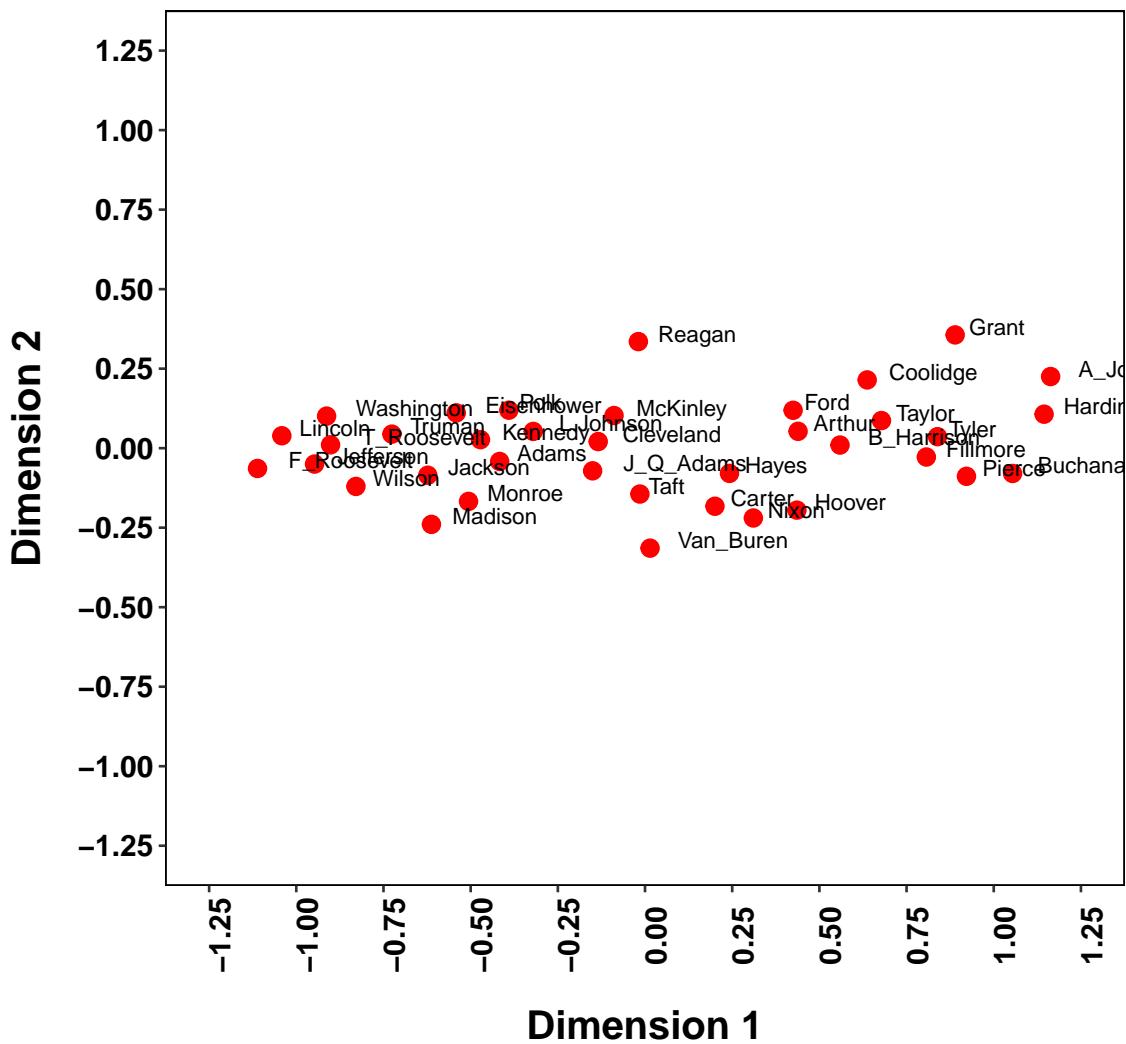
```

plot_data <- as.data.frame(idioscal_fit$conf[[12]])
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

```

```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,  
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,  
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,  
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,  
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,  
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,  
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",  
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",  
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,  
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,  
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),  
plot.title = element_text(size = 16, face = "bold", margin = margin(0,  
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",  
linetype = 1, color = "black"), panel.grid.major = element_blank(),  
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),  
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",  
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 12)")
```

Two-Dimensional Space (Source 12)



```
plot_data <- as.data.frame(idioscal_fit$conf[[13]])
names(plot_data) <- c("D1", "D2")
plot_data$name <- Presidents$name
```

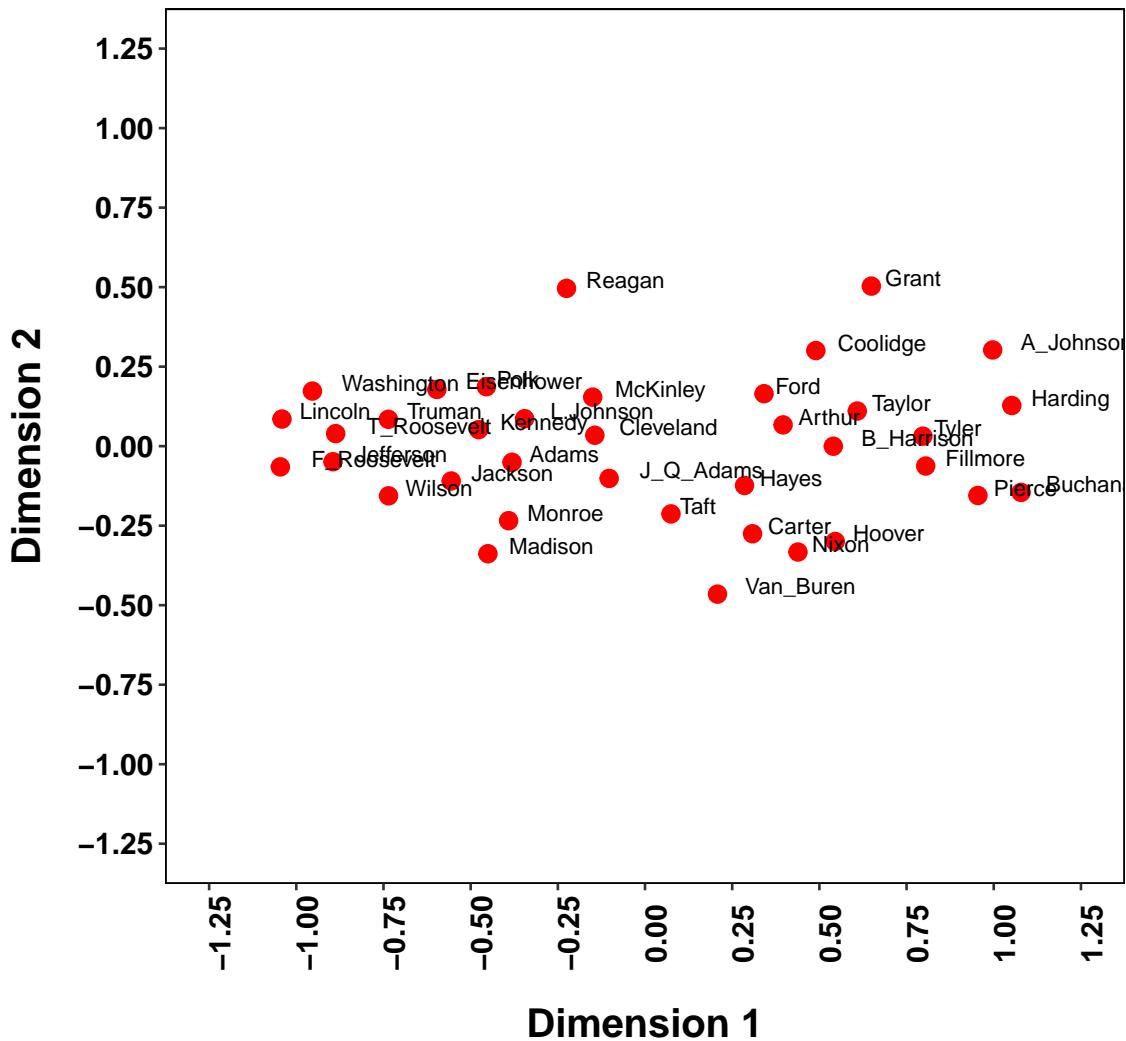
```
ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space (Source 13)")

```

Two-Dimensional Space (Source 13)



5.2.4 Shepard Plots

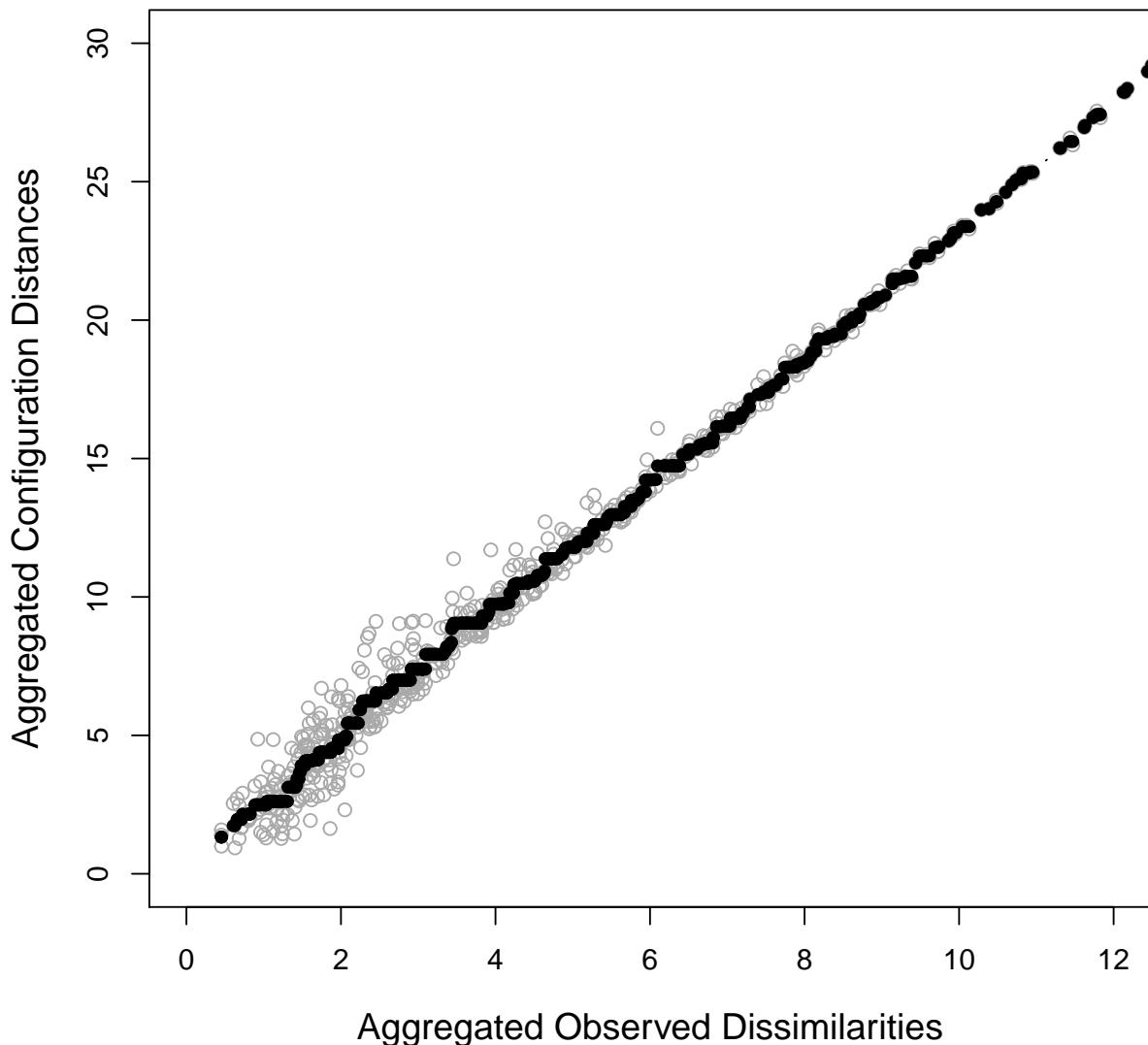
Shepard plots show the relationship between aggregated observed dissimilarities and the aggregated configuration distances.

```

plot(idioscal_fit, plot.type = "Shepard", xlab = list("Aggregated Observed Dissimilarities",
cex = 1.25), ylab = list("Aggregated Configuration Distances",
cex = 1.25), main = list("Shepard Plot", cex = 1.5), xlim = c(0,
12), ylim = c(0, 30))

```

Shepard Plot

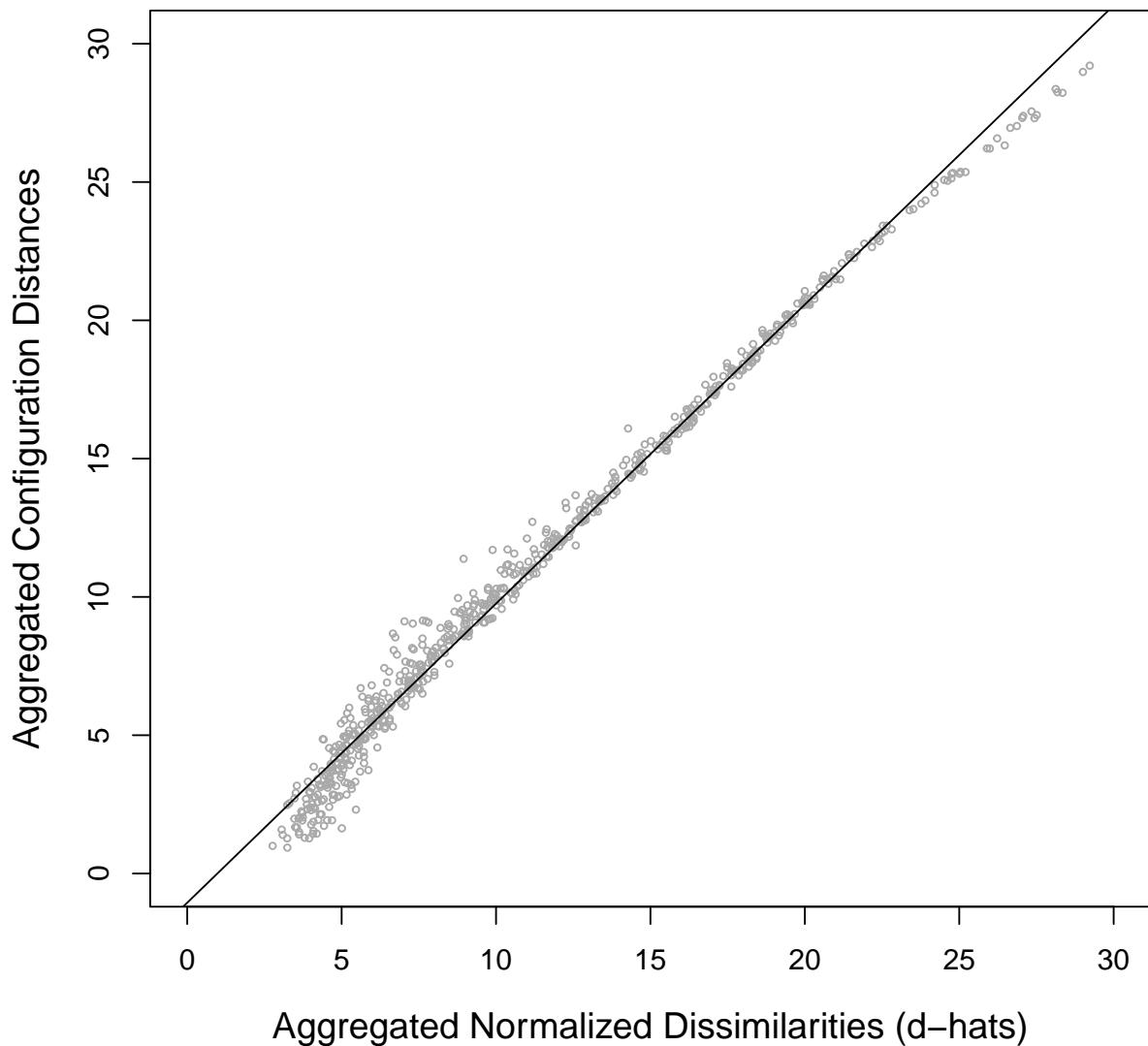


```

# The same information is contained in the residual plot, but a
# best-fit line also included. This is really more appropriate for
# a metric MDS, but does provide useful information for fit.
plot(idioscal_fit, plot.type = "resplot", xlab = list("Aggregated Normalized Dissimilarities (d-hats)",
cex = 1.25), ylab = list("Aggregated Configuration Distances",
cex = 1.25), main = list("Residual Plot", cex = 1.5), xlim = c(0,
30), ylim = c(0, 30))

```

Residual Plot



Individual source Shepard plots can also be constructed. These provide a way to visual individual fit. Note that although the configuration plots are forced to be the same for all sources, the fit of that common solution will not be the same for all sources.

```
plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[1]]), unlist(idioscal_fit$confdist[[1]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")

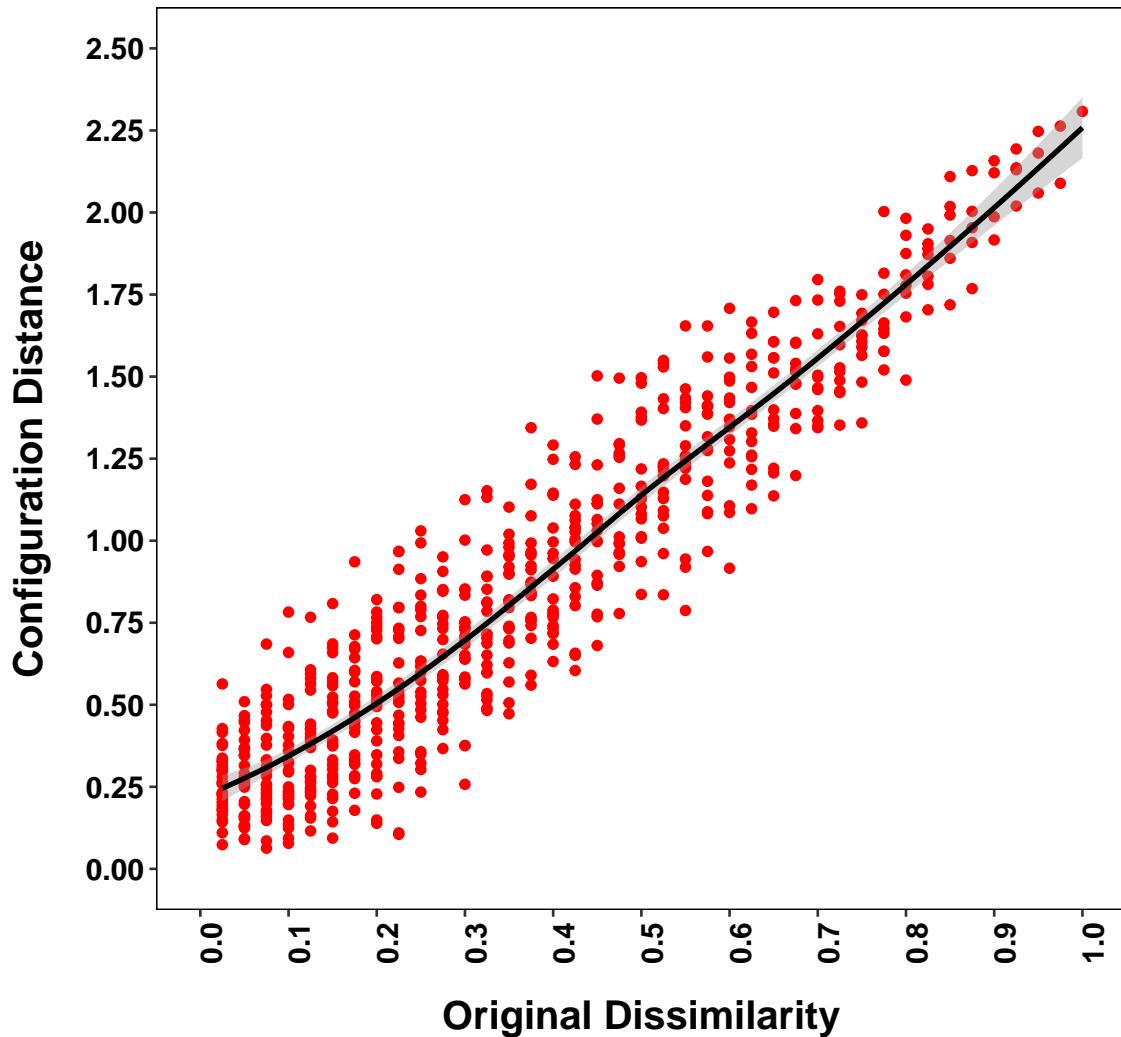
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
```

```

theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 1")

```

Two-Dimensional Space: Source 1



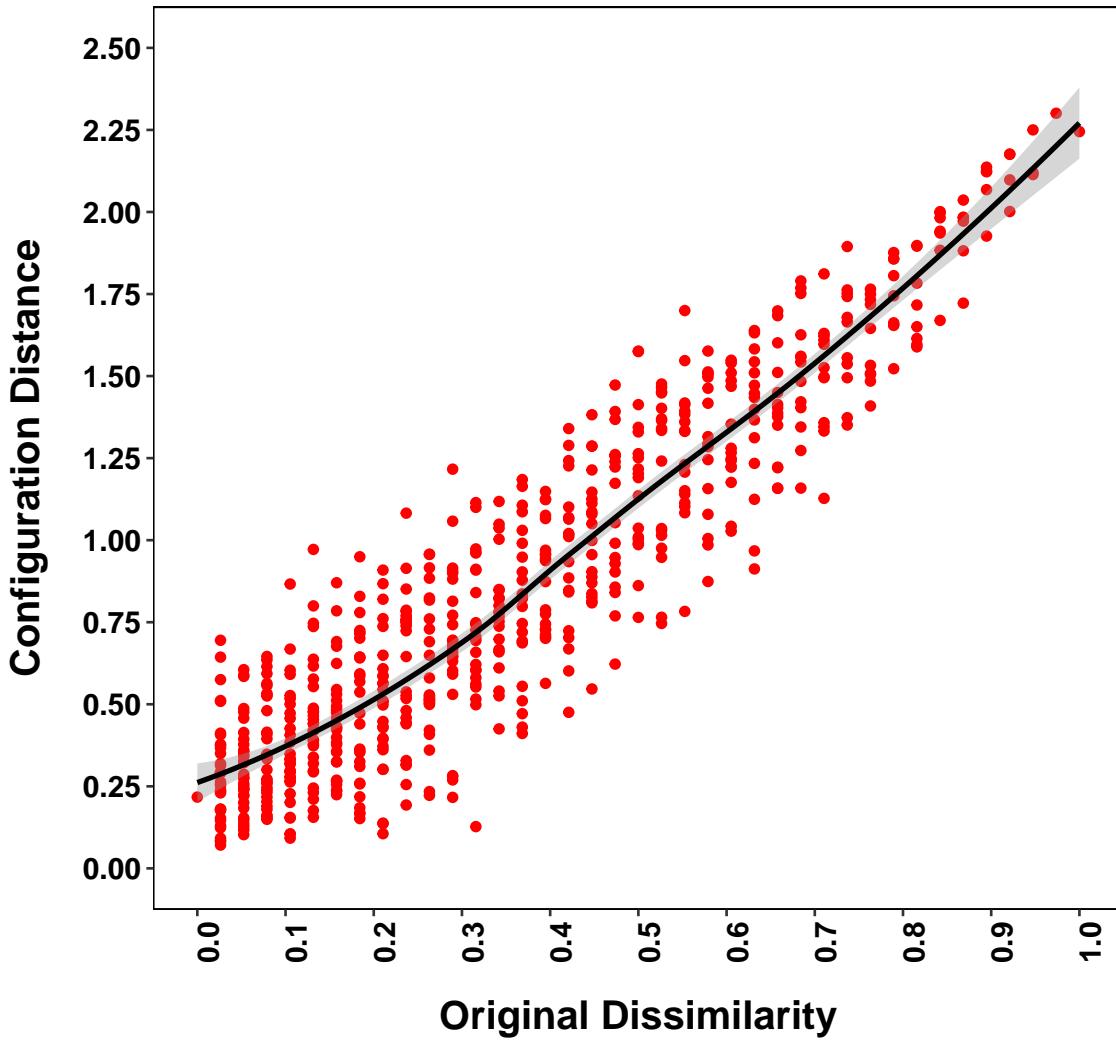
```

plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[2]]), unlist(idioscal_fit$confdist[[2]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
    face = "bold"), axis.text.y = element_text(colour = "black",
    size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
    size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
    0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
    15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
    plot.title = element_text(size = 16, face = "bold", margin = margin(0,
    0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
    linetype = 1, color = "black"), panel.grid.major = element_blank(),
    panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
    plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
    legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 2")

```

Two-Dimensional Space: Source 2



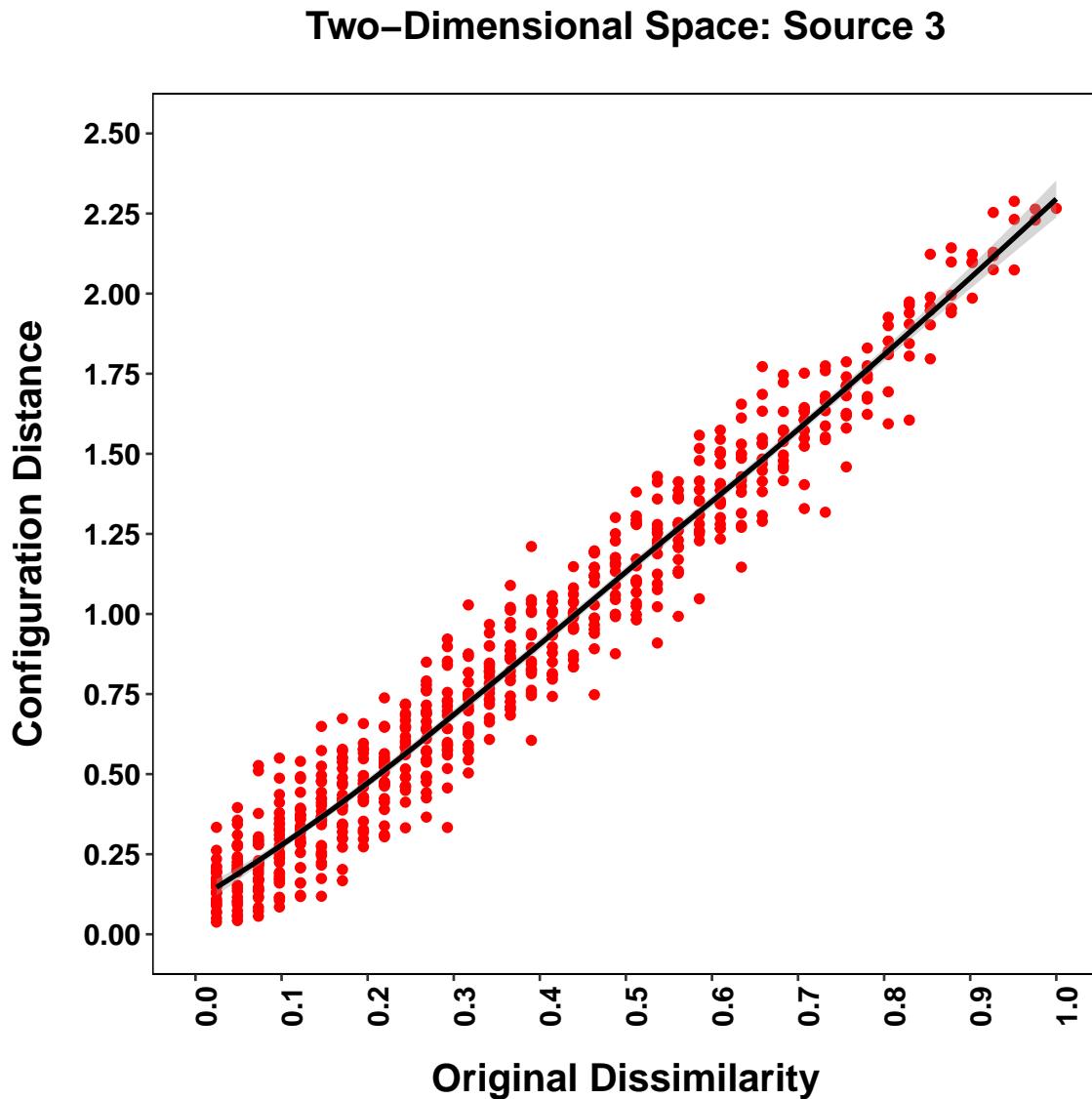
```
plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[3]]), unlist(idioscal_fit$confdist[[3]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 3")

```



```

plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[4]]), unlist(idioscal_fit$confdist[[4]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

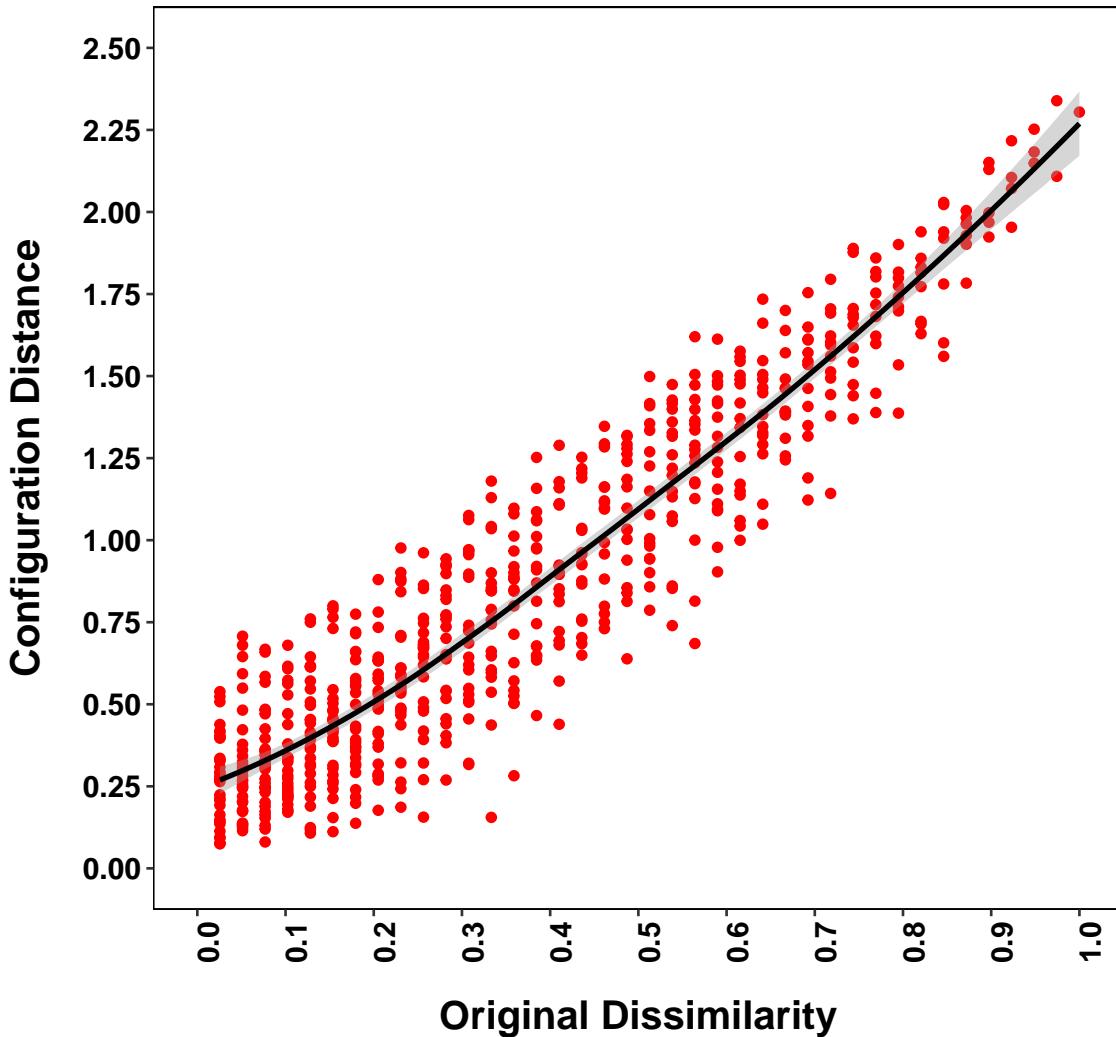
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 4")

```

Two-Dimensional Space: Source 4



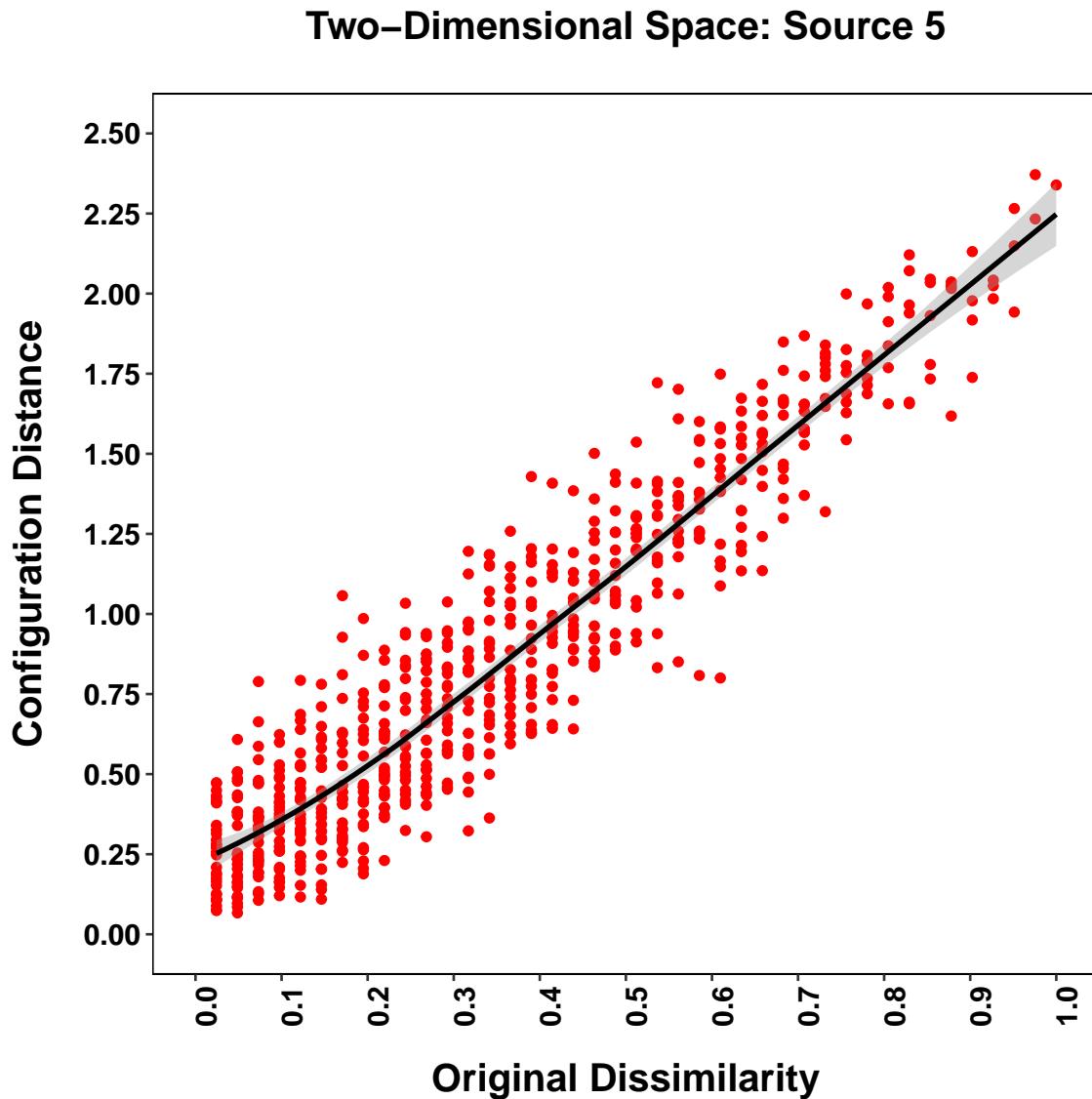
```
plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[5]]), unlist(idioscal_fit$confdist[[5]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 5")

```



```

plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[6]]), unlist(idioscal_fit$confdist[[6]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

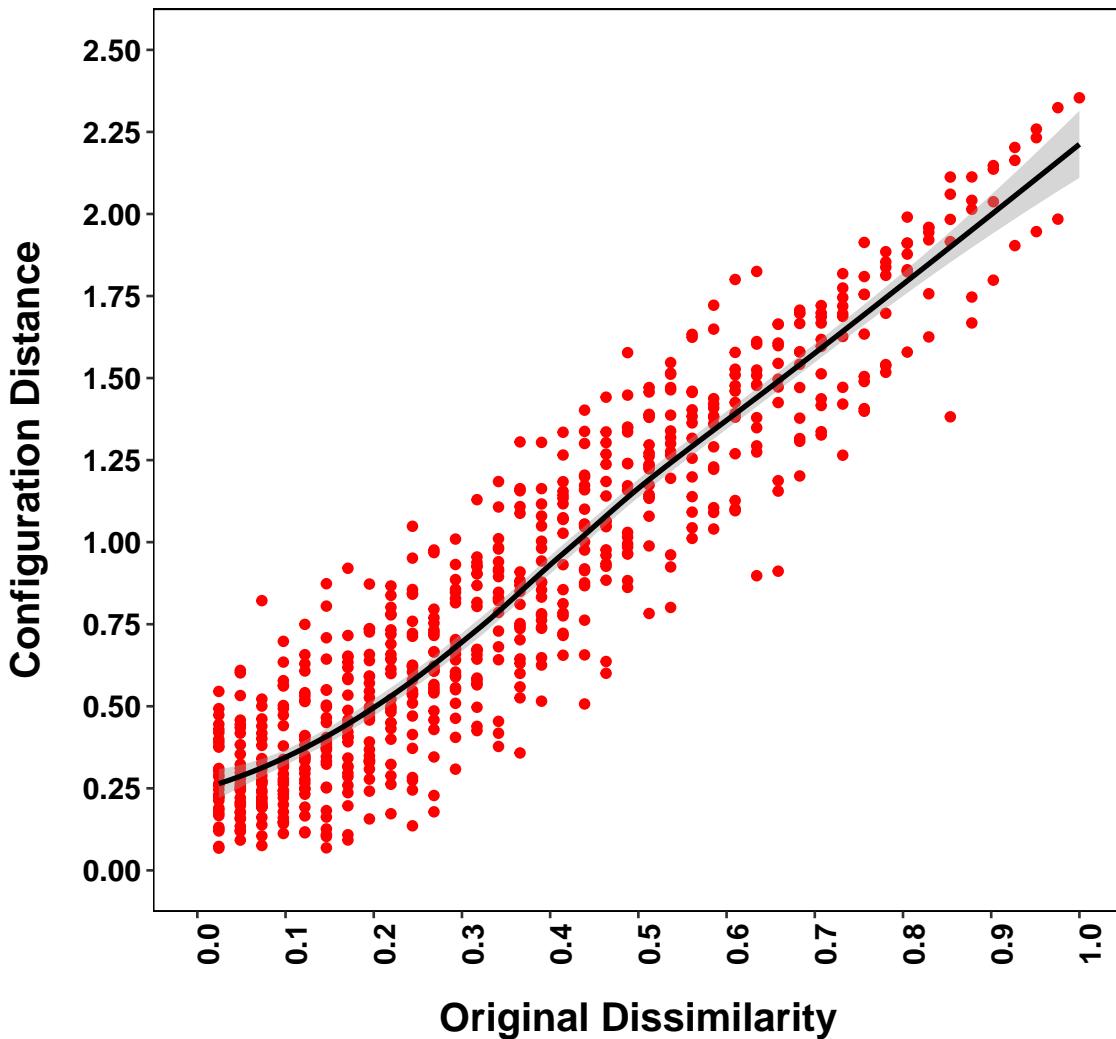
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 6")

```

Two-Dimensional Space: Source 6



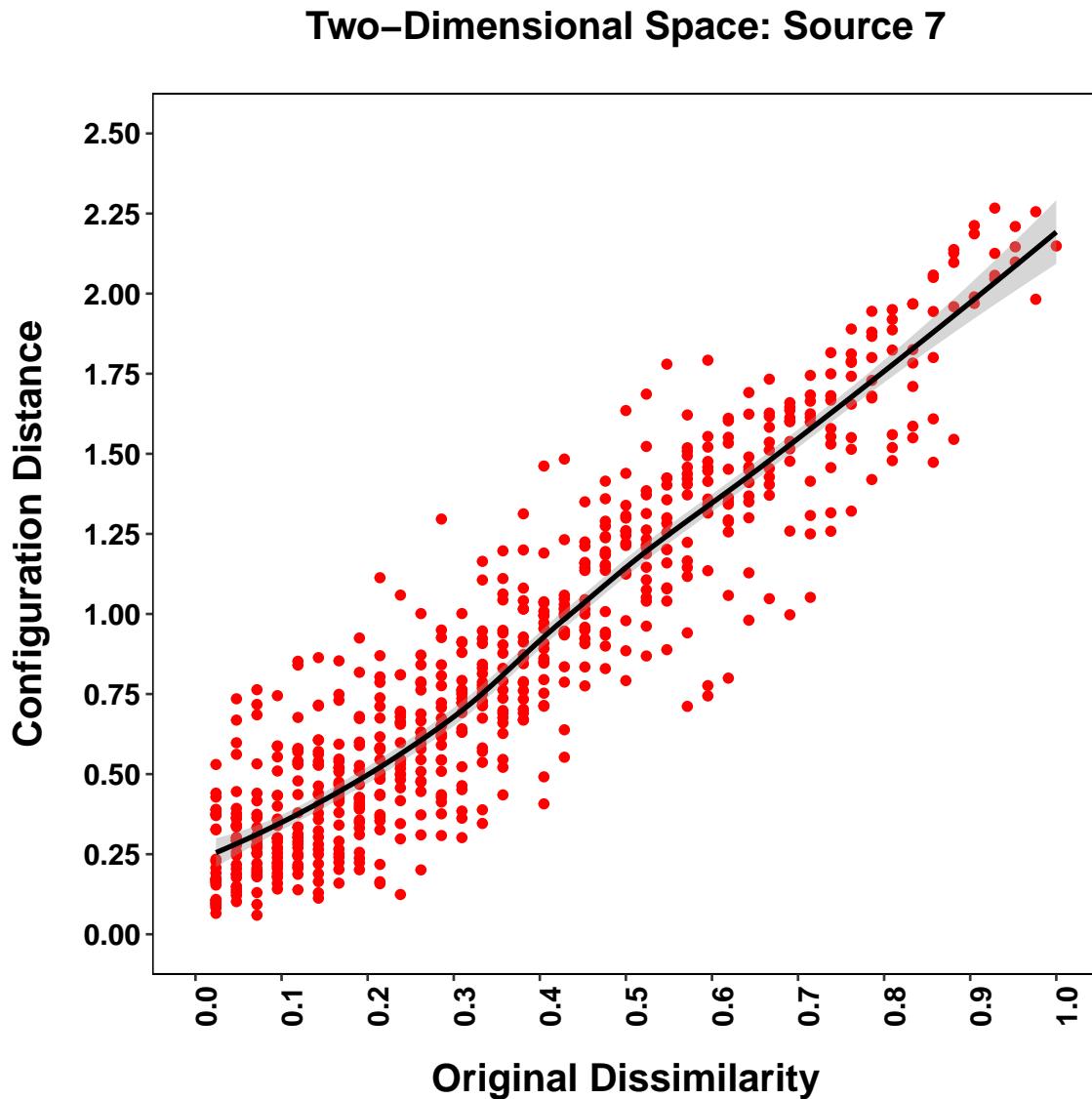
```
plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[7]]), unlist(idioscal_fit$confdist[[7]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 7")

```



```

plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[8]]), unlist(idioscal_fit$confdist[[8]]))),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

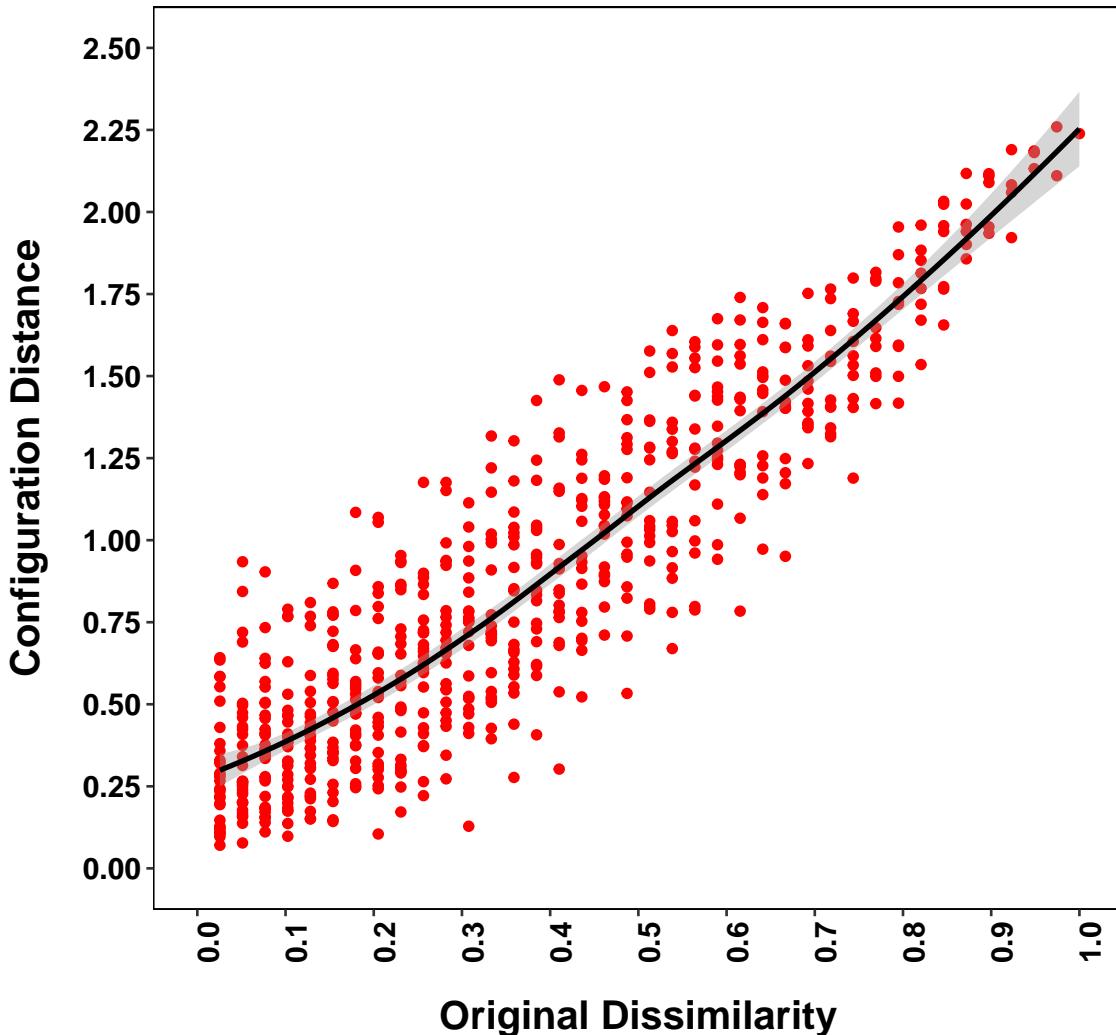
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 8")

```

Two-Dimensional Space: Source 8



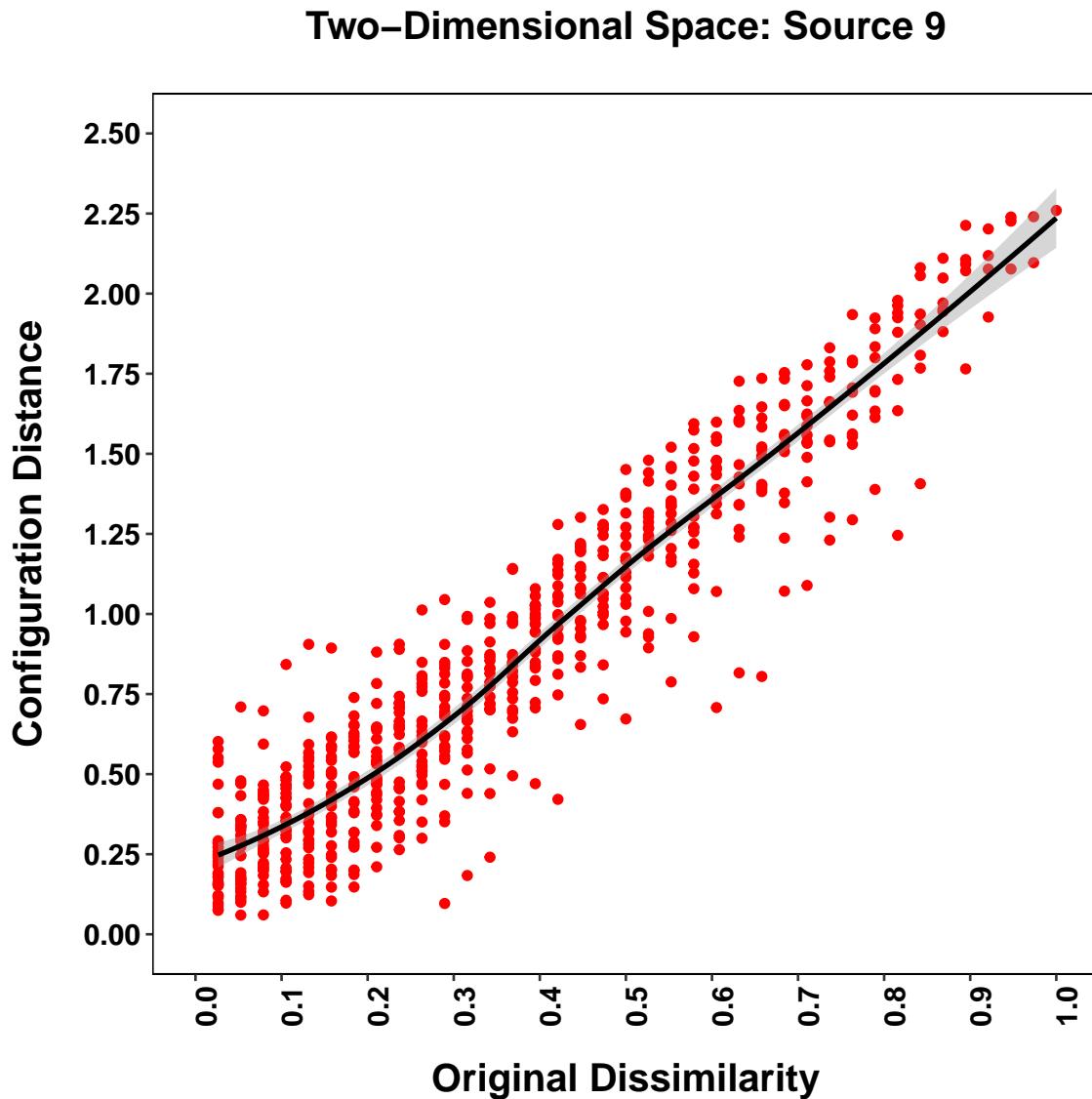
```
plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[9]]), unlist(idioscal_fit$confdist[[9]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 9")

```



```

plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[10]]), unlist(idioscal_fit$confdist[[10]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

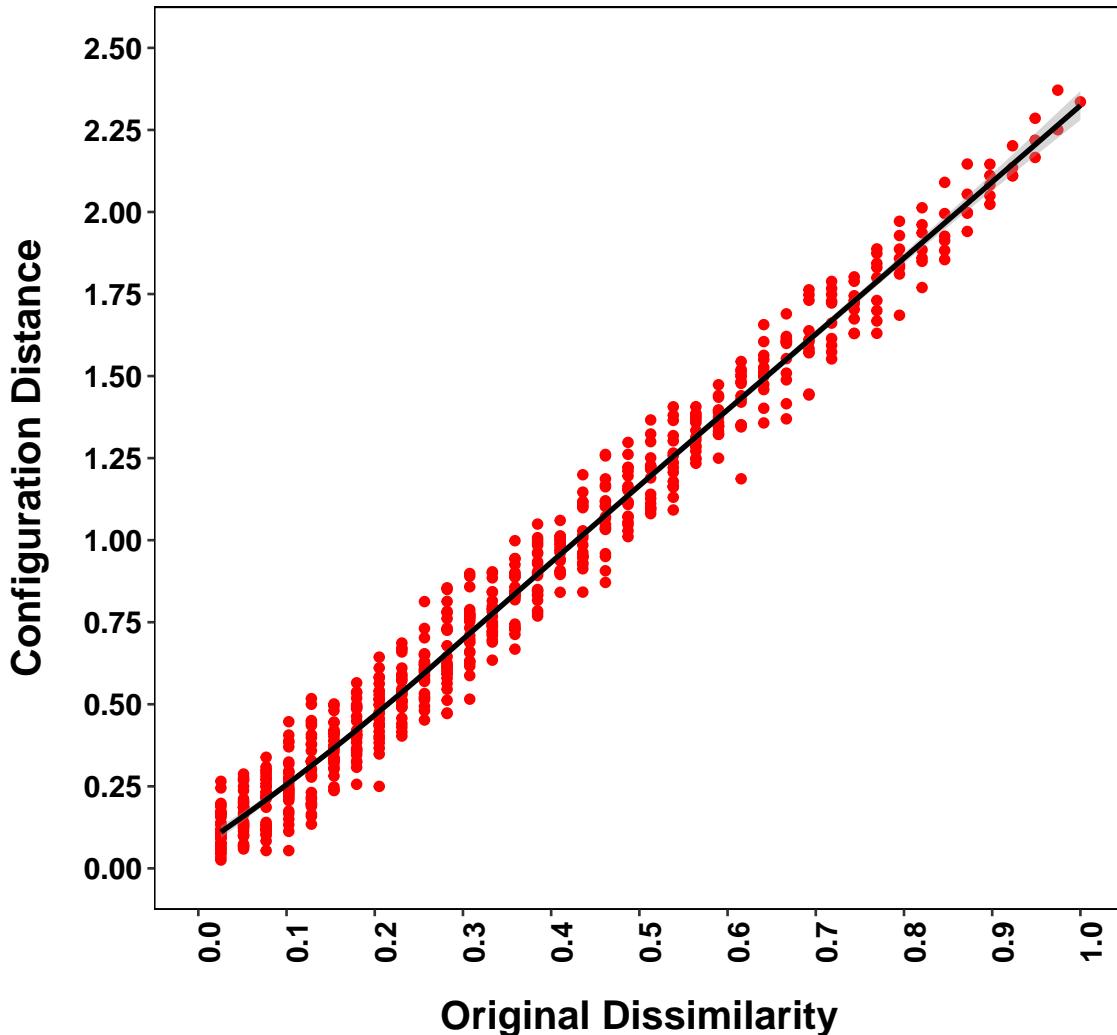
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 10")

```

Two-Dimensional Space: Source 10



```
plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[11]]), unlist(idioscal_fit$confdist[[11]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

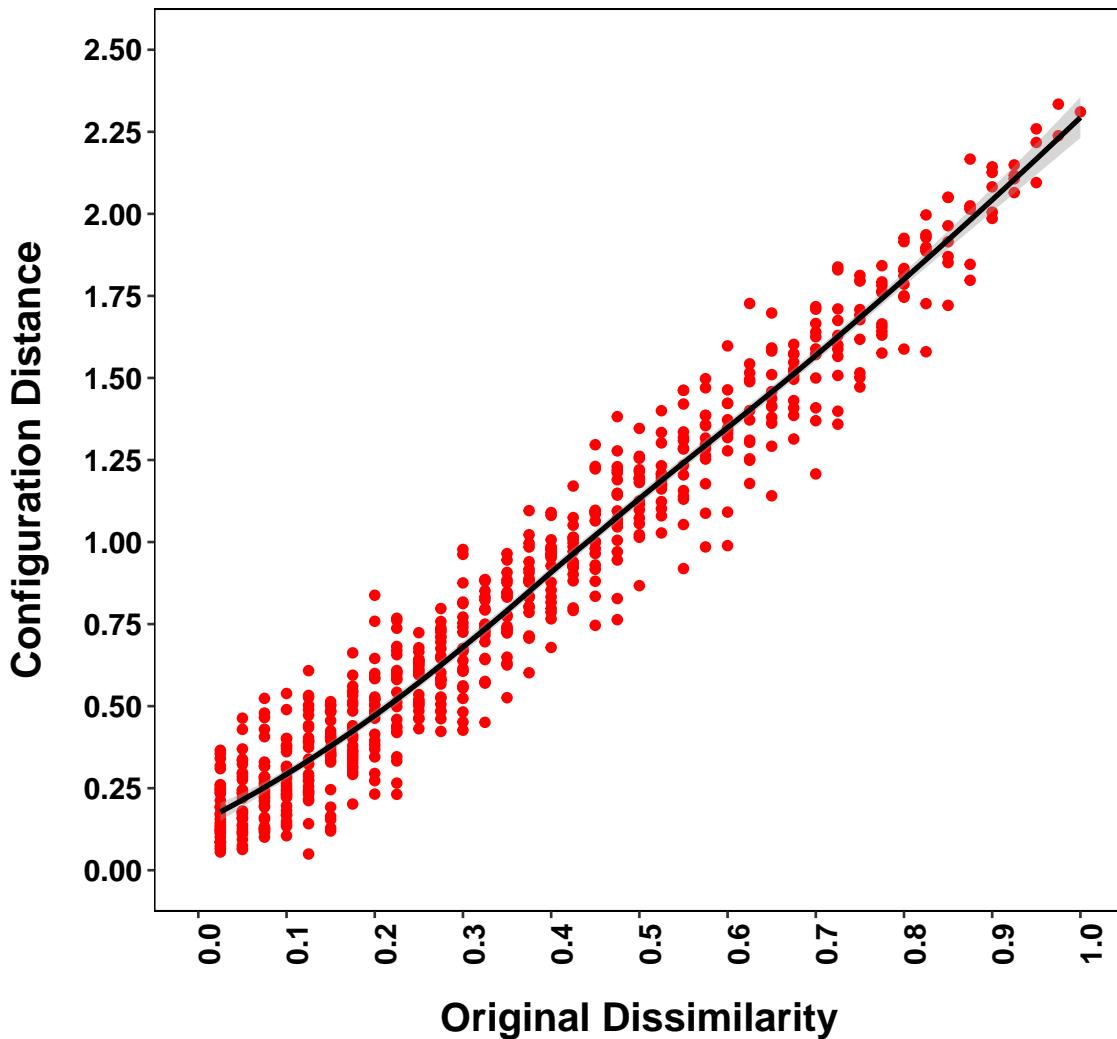
```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 11")

```

Two-Dimensional Space: Source 11



```

plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[12]]), unlist(idioscal_fit$confdist[[12]]))),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

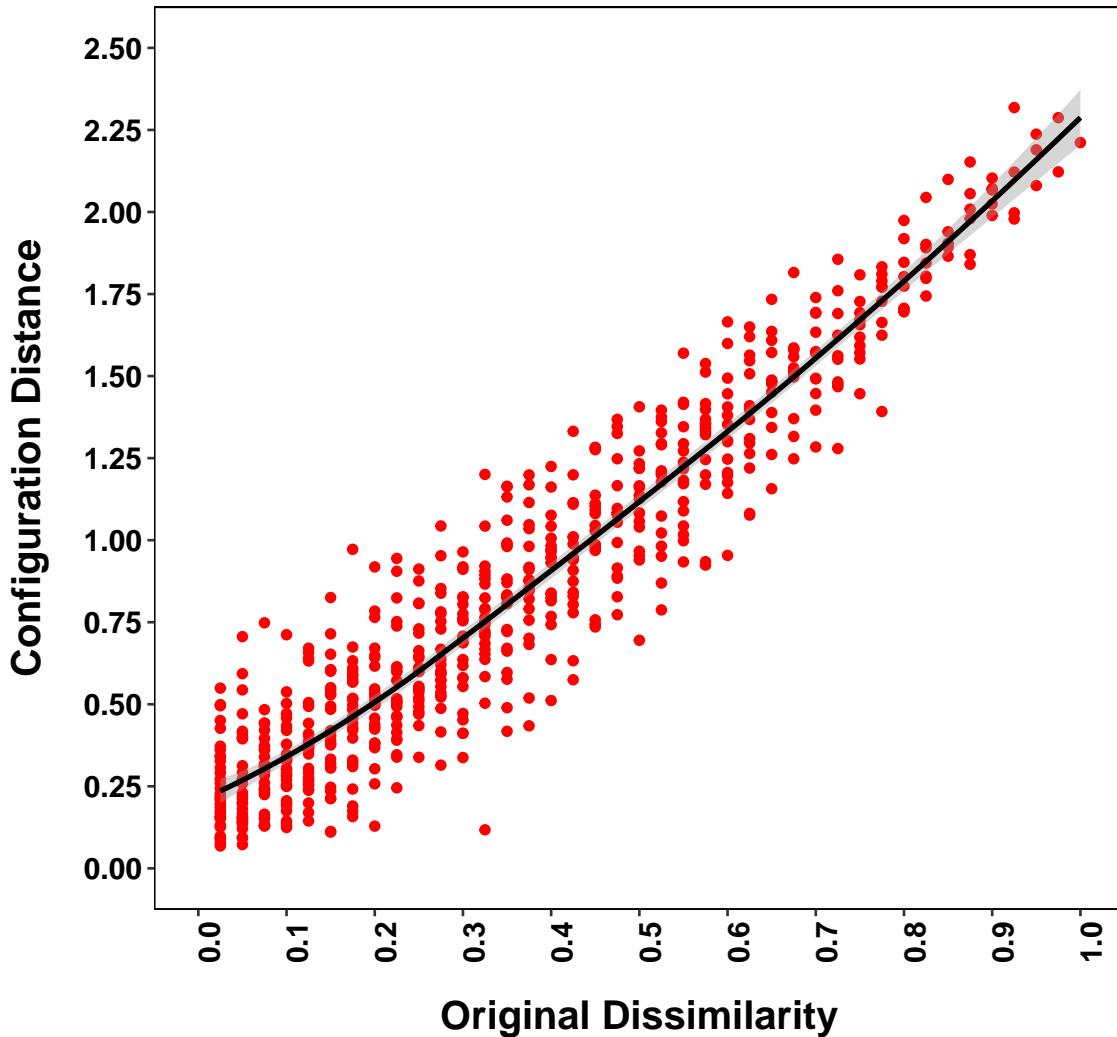
```

names(plot_data) <- c("Dissimilarity", "Distance")

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
theme(text = element_text(size = 14, family = "sans", color = "black",
face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 12")

```

Two-Dimensional Space: Source 12



```
plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[13]]), unlist(idioscal_fit$confdist[[13]])),
  ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("Dissimilarity", "Distance")
```

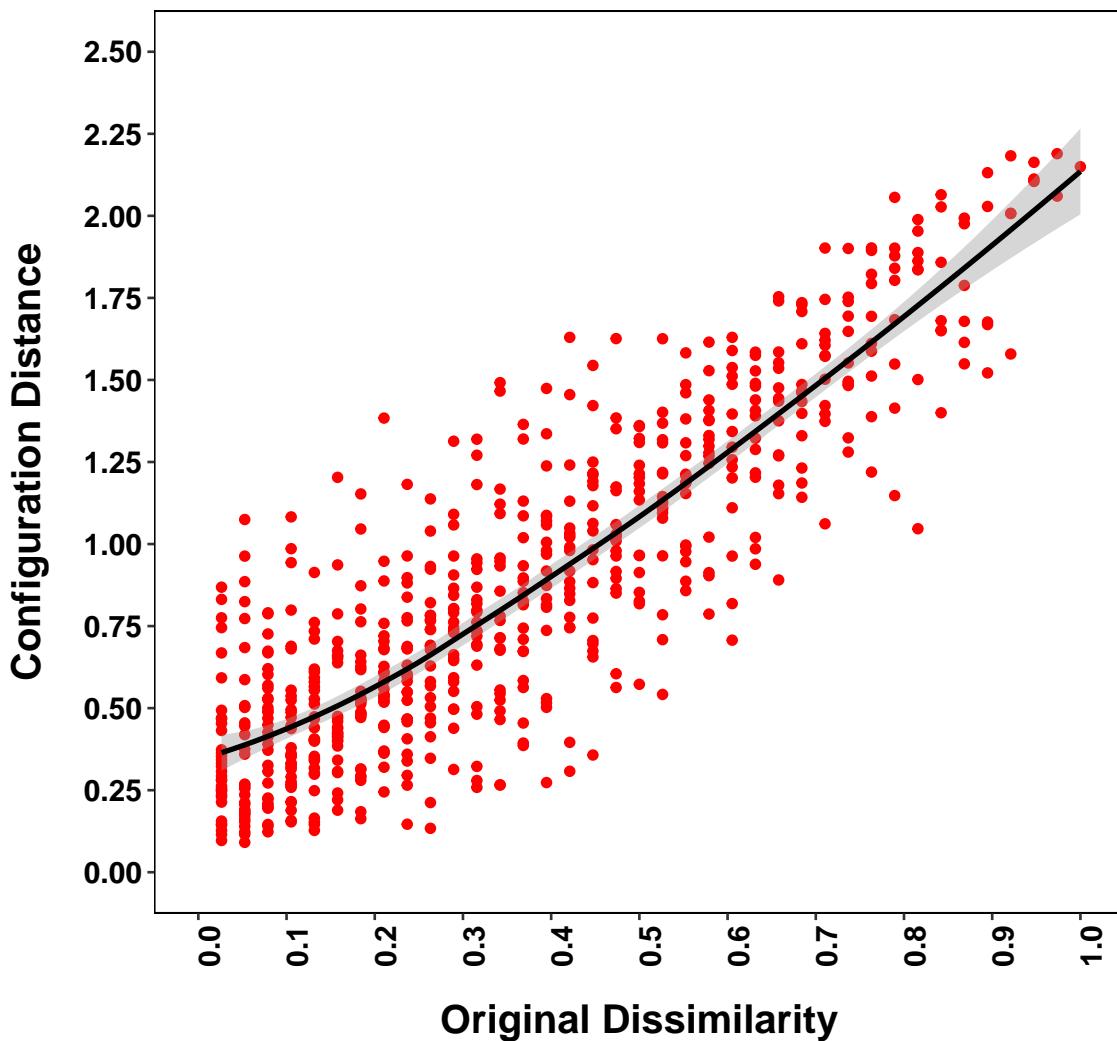
```
ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
```

```

size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Two-Dimensional Space: Source 13")

```

Two-Dimensional Space: Source 13



```

plot_data <- matrix(cbind(unlist(idioscal_fit$delta[[1]]), unlist(idioscal_fit$confdist[[1]])),
ncol = 2, byrow = FALSE)
plot_data <- as.data.frame(plot_data)

```

```

names(plot_data) <- c("Dissimilarity", "Distance")
for (j in seq(2, 13)) {
  plot_temp <- (matrix(cbind(unlist(idioscal_fit$delta[[j]]), unlist(idioscal_fit$confdist[[j]])),
    ncol = 2, byrow = FALSE))
  plot_temp <- as.data.frame(plot_temp)
  names(plot_temp) <- c("Dissimilarity", "Distance")
  plot_data <- rbind(plot_data, plot_temp)
}

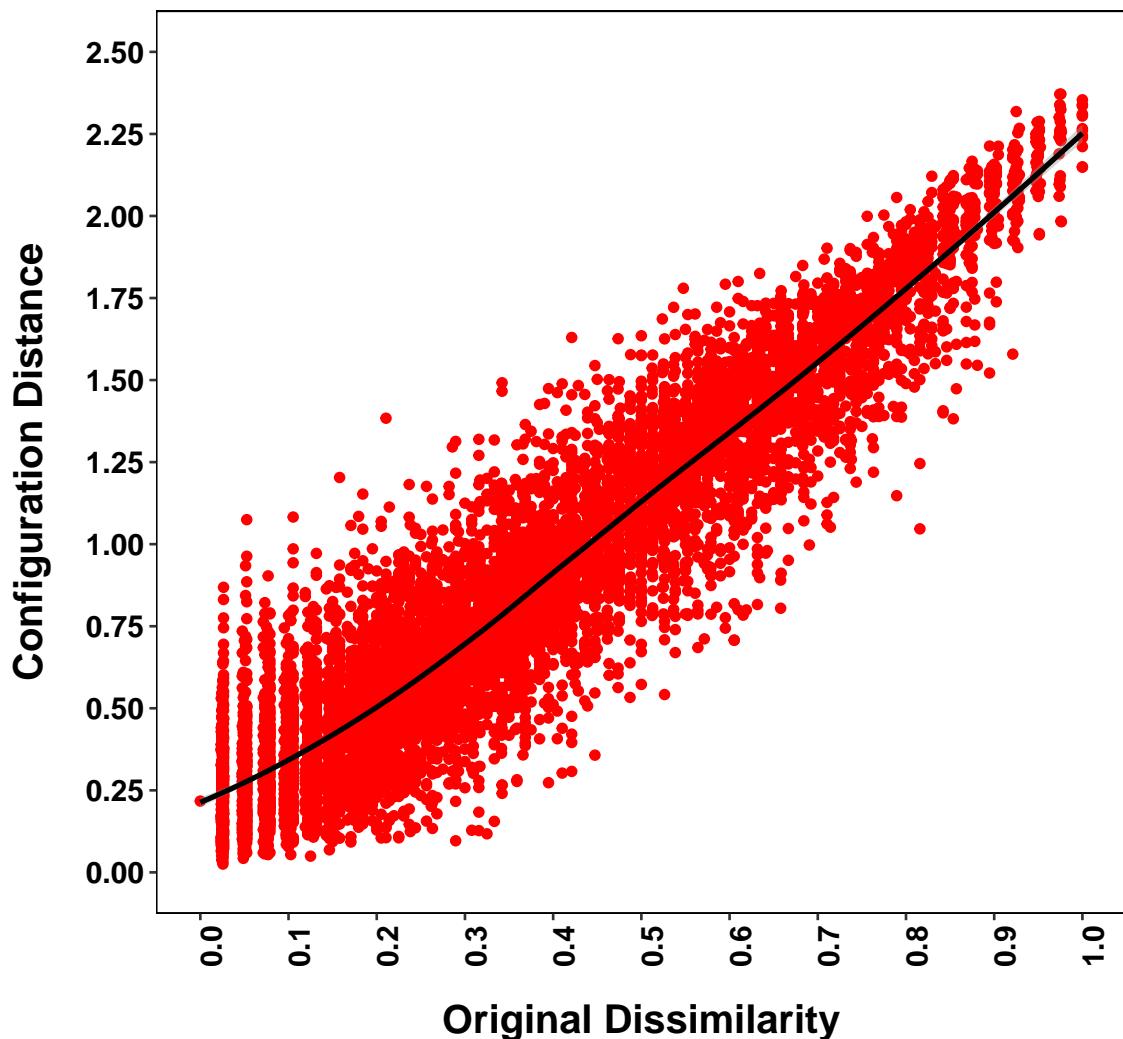
```

```

ggplot(plot_data, aes(x = Dissimilarity, y = Distance)) + geom_point(shape = 19,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  geom_smooth(method = loess, se = TRUE, color = "black") + coord_cartesian(xlim = c(0,
  1), ylim = c(0, 2.5)) + xlab("Original Dissimilarity") + ylab("Configuration Distance") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
    face = "bold"), axis.text.y = element_text(colour = "black",
    size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
    size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
    0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
    15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
    0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
    linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space: All Sources")

```

Two-Dimensional Space: All Sources



5.2.5 Weights

The sources can weight the dimensions differently. Those can be plotted to determine if some sources cluster together. The nature of the weights is now more complex because the off-diagonals are not constrained to 0. This means that a source configuration is a linear combination of the group configuration dimensions. The weight matrices thus are similar to the transformation matrices in principal components analysis and factor analysis that produce rotation. That provides some additional insight into interpretation here. If the columns of the weight matrix are normalized, then the weight matrix elements can be viewed as direction cosines (which can be converted to degrees) that indicate the relative position of the source dimensions relative to the group dimensions.

```
idiostat_fit$cweights
```

```

## [[1]]
##      D1      D2
## D1  0.9985 -0.00236
## D2 -0.4570  1.66403
##
## [[2]]
##      D1      D2
## D1  0.9878 -0.002864
## D2 -0.5382  1.860772
##
## [[3]]
##      D1      D2
## D1  1.0186 0.01157
## D2  0.7351 0.97700
##
## [[4]]
##      D1      D2
## D1  0.9844 -0.006133
## D2 -1.1299  1.759364
##
## [[5]]
##      D1      D2
## D1  0.9223 -0.0264
## D2 -2.7621  1.9753
##
## [[6]]
##      D1      D2
## D1  0.9852 -0.009105
## D2 -1.2762  1.606770
##
## [[7]]
##      D1      D2
## D1  0.99709 0.0008277
## D2  0.07467 1.6449956
##
## [[8]]
##      D1      D2
## D1  0.98445 0.005295
## D2 -0.05905 1.928795
##
## [[9]]
##      D1      D2
## D1  0.9998 0.004735
## D2  0.6712 1.555201
##
## [[10]]
##      D1      D2
## D1  1.009 0.03681
## D2  1.560 0.67751
##
## [[11]]
##      D1      D2
## D1  1.003 0.01982

```

```

## D2 1.327 1.21343
##
## [[12]]
##      D1      D2
## D1 0.9855 0.01023
## D2 1.3396 1.69383
##
## [[13]]
##      D1      D2
## D1 0.9561 -0.01082
## D2 0.2646  2.47000

plot_data <- matrix(NA, nrow = 13, ncol = 2)
for (i in 1:13) {
  plot_data[i, 1] <- idioscal_fit$cweights[[i]][1, 1]
  plot_data[i, 2] <- idioscal_fit$cweights[[i]][2, 2]
}
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1", "D2")
plot_data$Names <- c(paste("Source ", seq(1, 13, 1)))

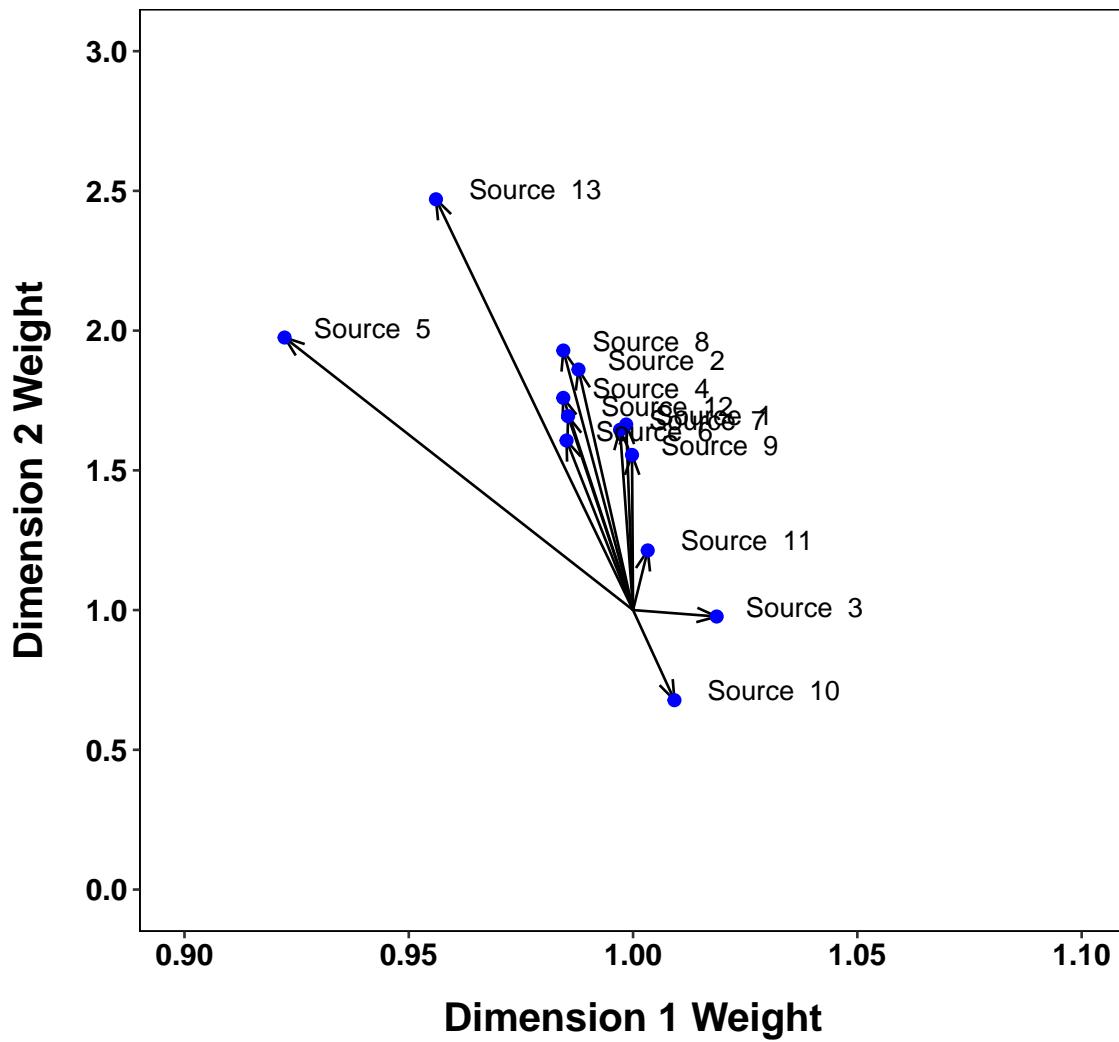
```

```

ggplot() + geom_segment(data = plot_data, mapping = aes(x = 1, y = 1,
xend = D1, yend = D2), color = "black", size = 0.5, arrow = arrow(length = unit(0.3,
"cm"), ends = "last", type = "open", angle = 20)) + geom_point(data = plot_data,
mapping = aes(x = D1, y = D2), color = "blue", size = 2) + geom_text(data = plot_data,
aes(x = plot_data$D1, y = plot_data$D2, label = plot_data$Names),
hjust = -0.25, vjust = 0, size = 4, angle = 0) + coord_cartesian(xlim = c(0.9,
1.1), ylim = c(0, 3)) + scale_x_continuous(breaks = c(seq(0.9,
1.1, 0.05))) + scale_y_continuous(breaks = c(seq(0, 3, 0.5))) +
ylab("Dimension 2 Weight") + xlab("Dimension 1 Weight") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Source Weights")

```

Source Weights



A source configuration is an adjustment to the group space, with the adjustment indicated by the source weight matrix. The nature of the adjustment can be shown in plots that represent movement from the group space to the source configuration.

```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[1]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

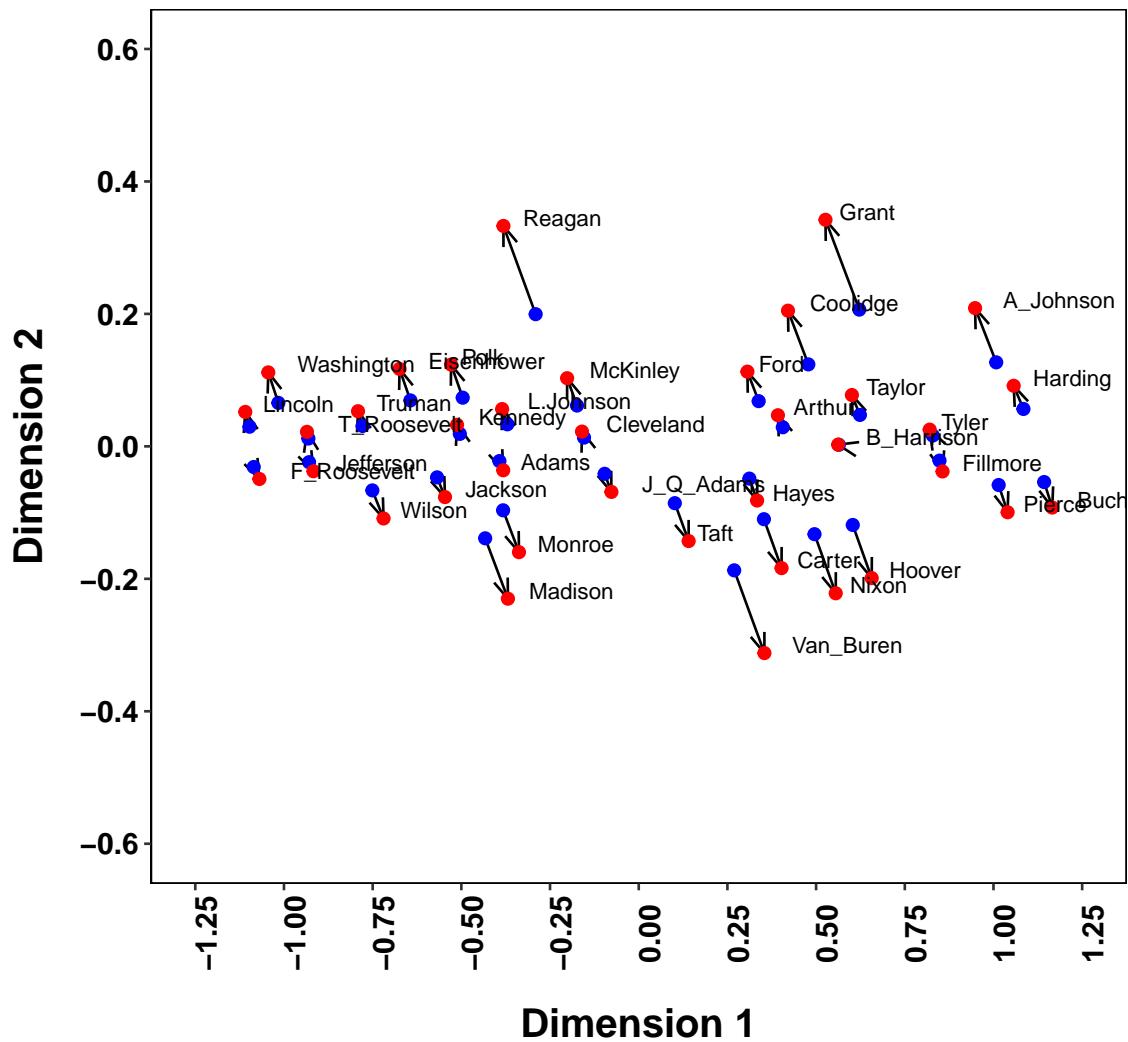
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
```

```

mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 1 Configuration")

```

Group Space to Source 1 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[2]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

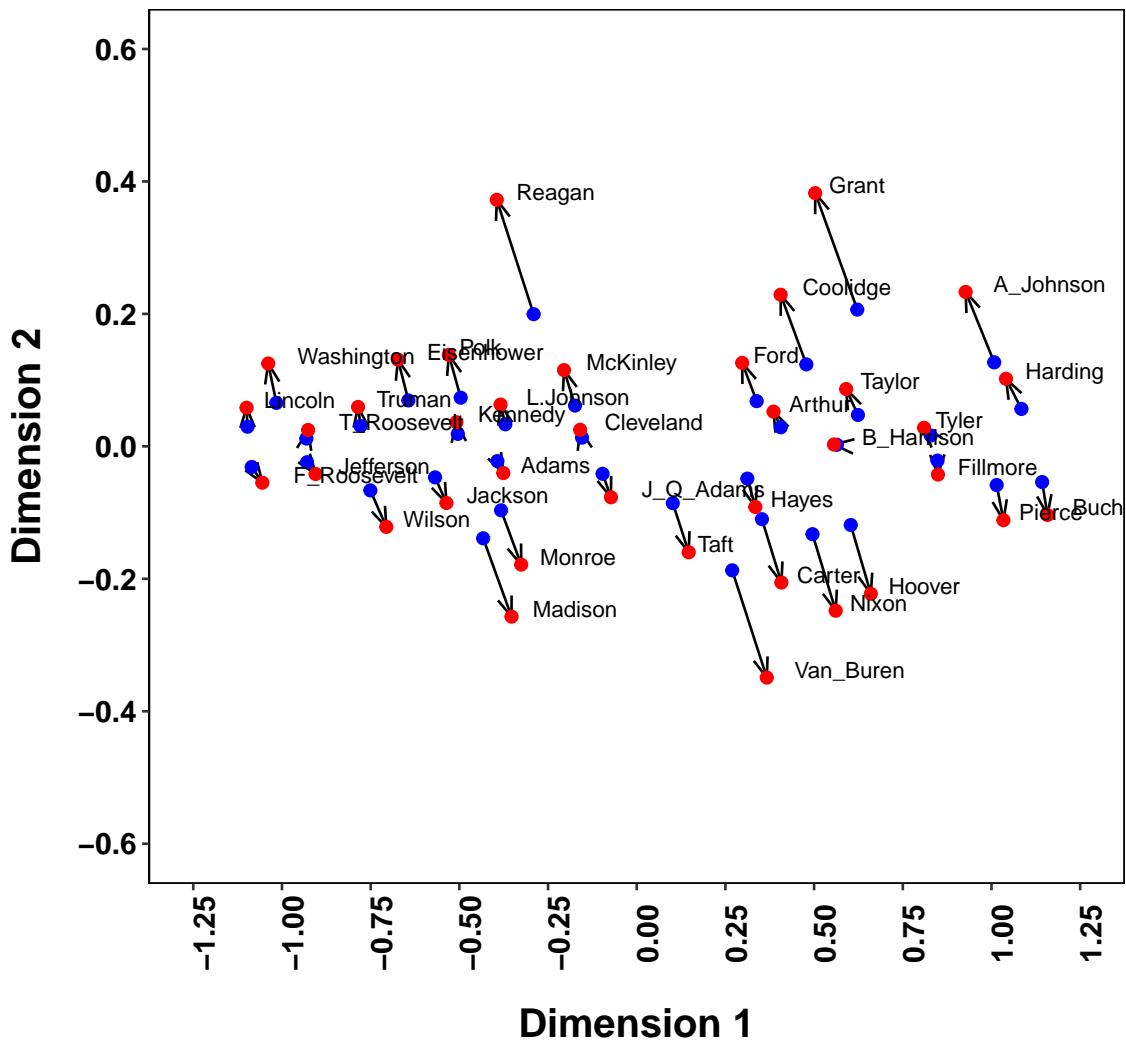
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 2 Configuration")

```

Group Space to Source 2 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[3]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

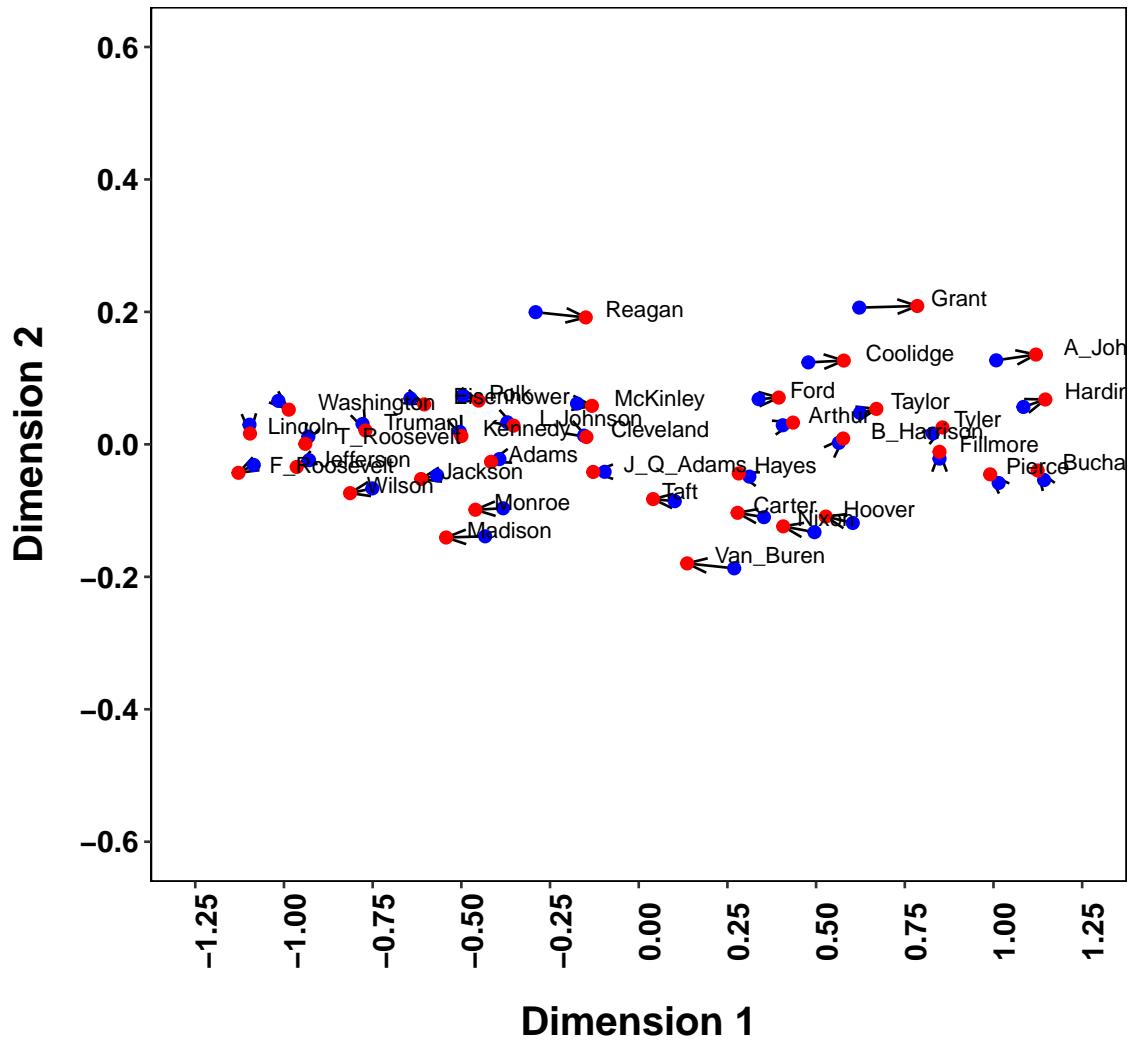
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 3 Configuration")

```

Group Space to Source 3 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[4]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

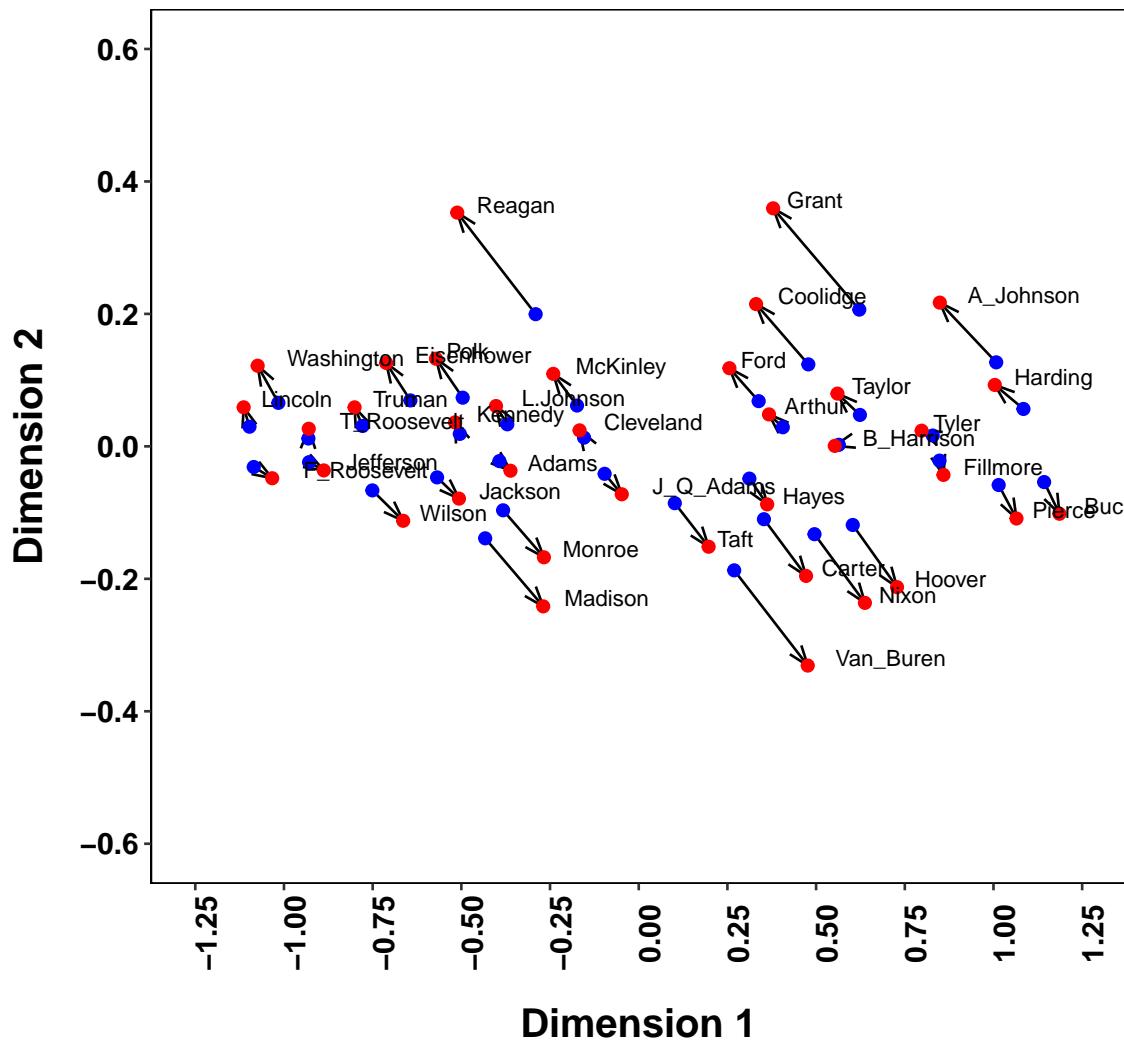
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 4 Configuration")

```

Group Space to Source 4 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[5]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

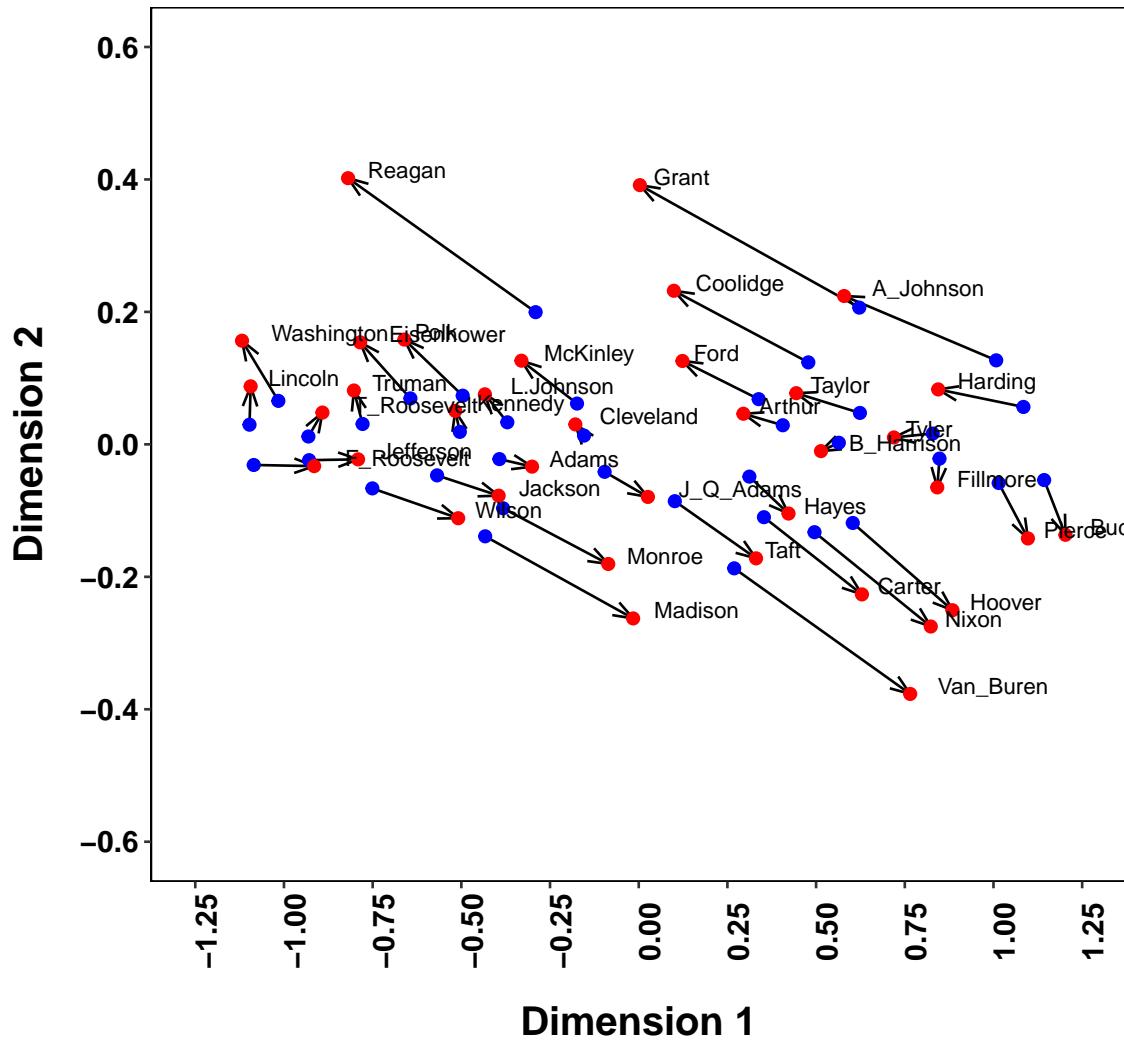
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 5 Configuration")

```

Group Space to Source 5 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[6]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

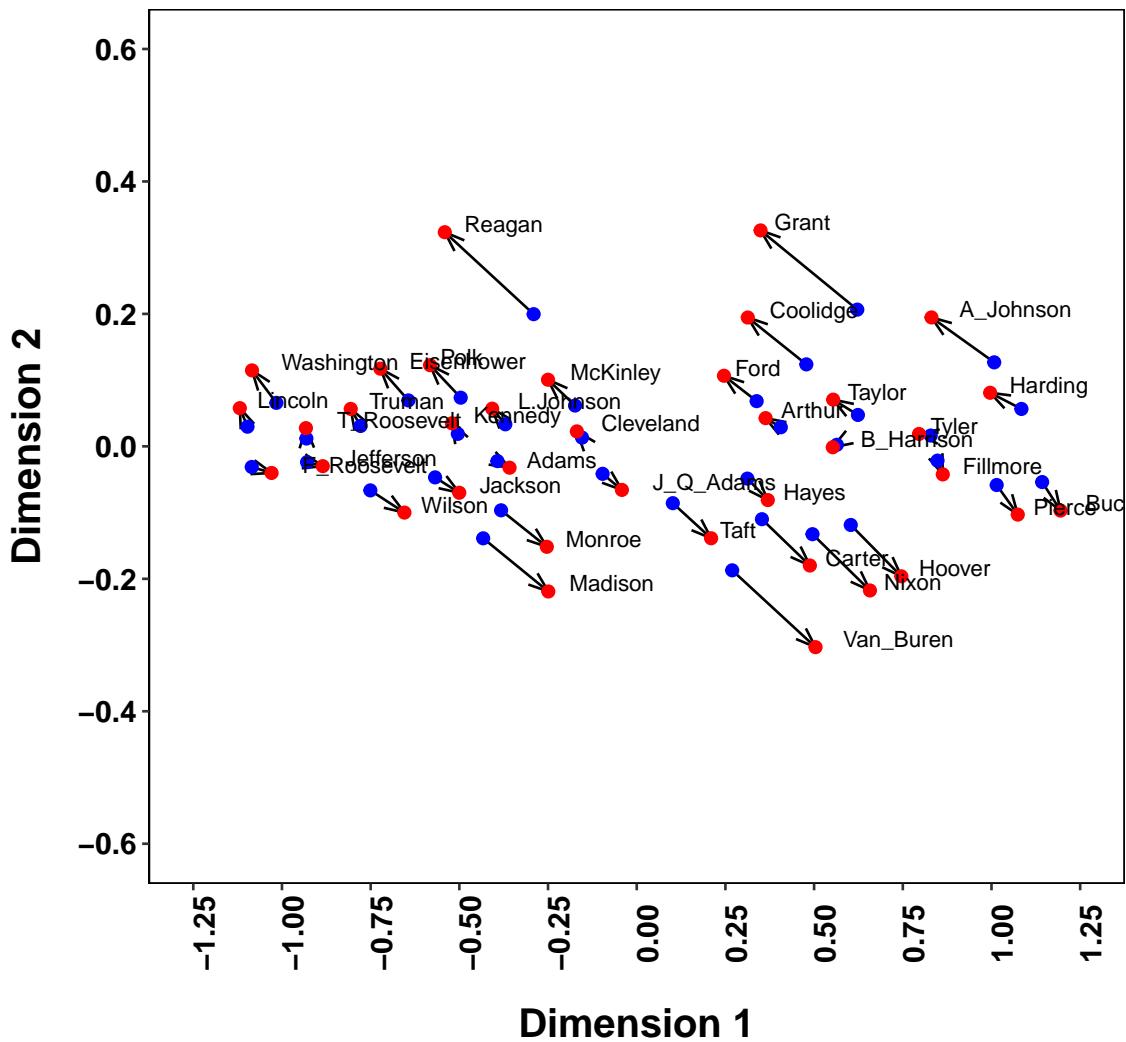
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 6 Configuration")

```

Group Space to Source 6 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[7]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

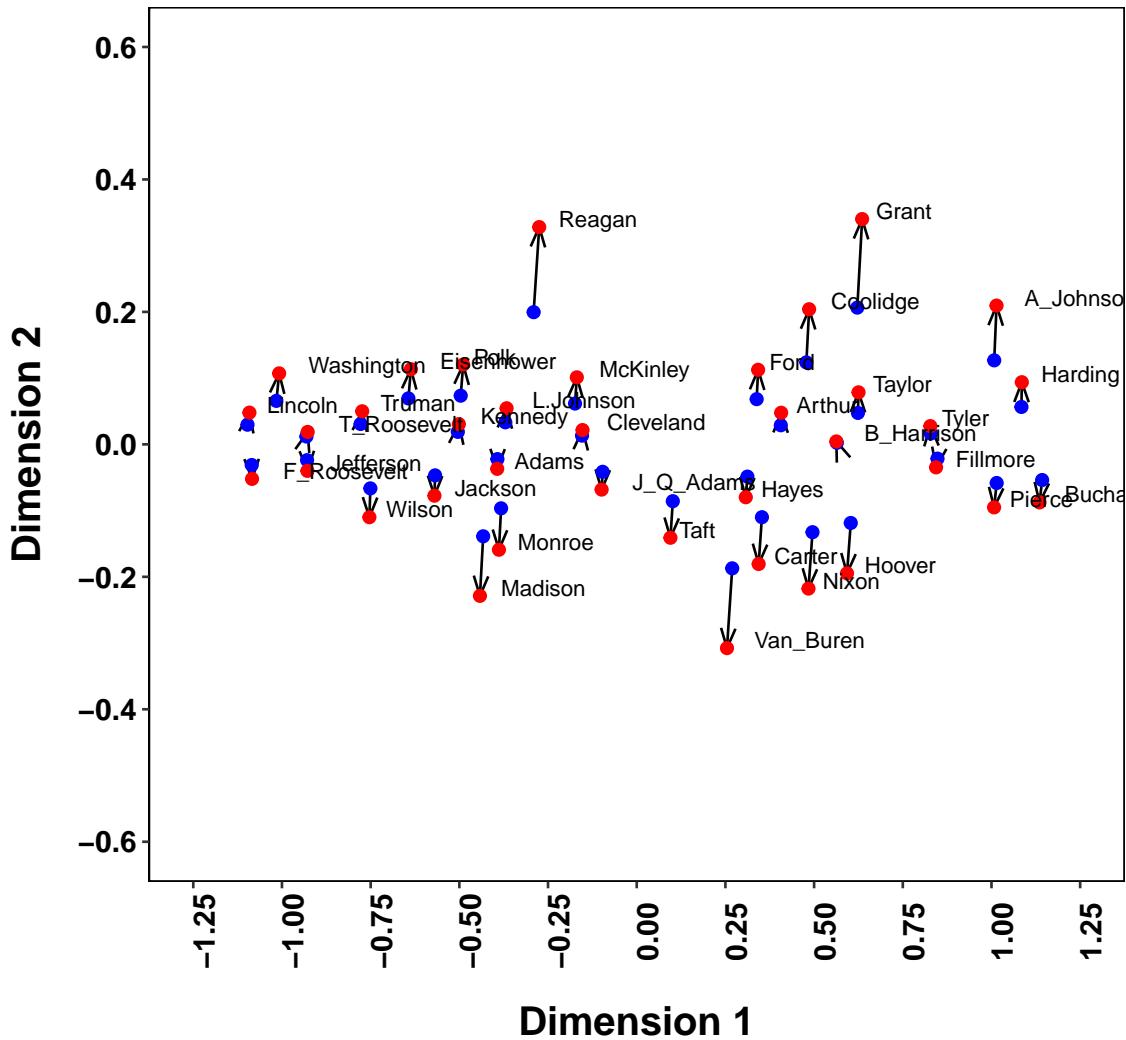
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 7 Configuration")

```

Group Space to Source 7 Configuration



```

plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[8]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)

```

```

ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,

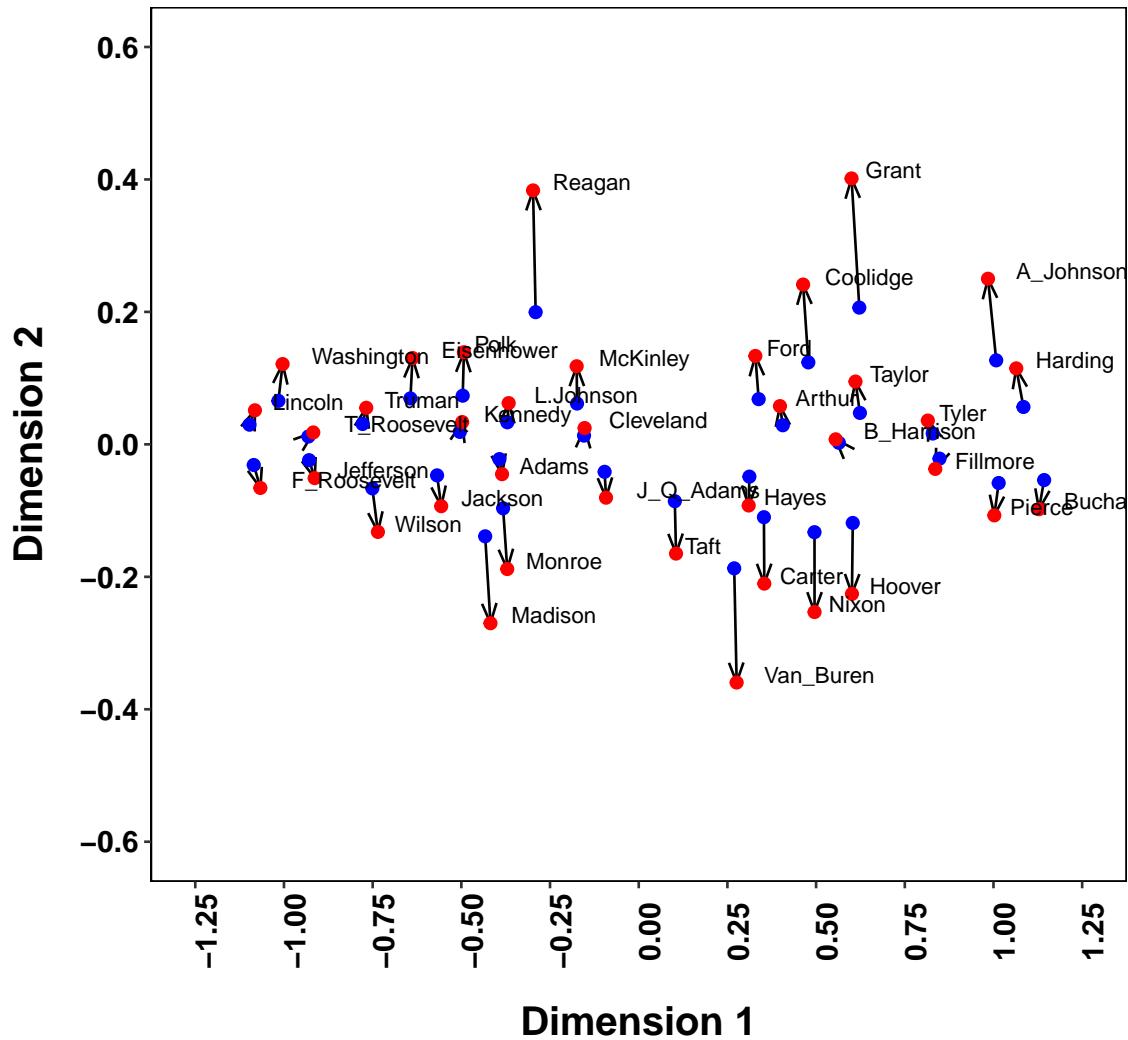
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 8 Configuration")

```

Group Space to Source 8 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[9]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

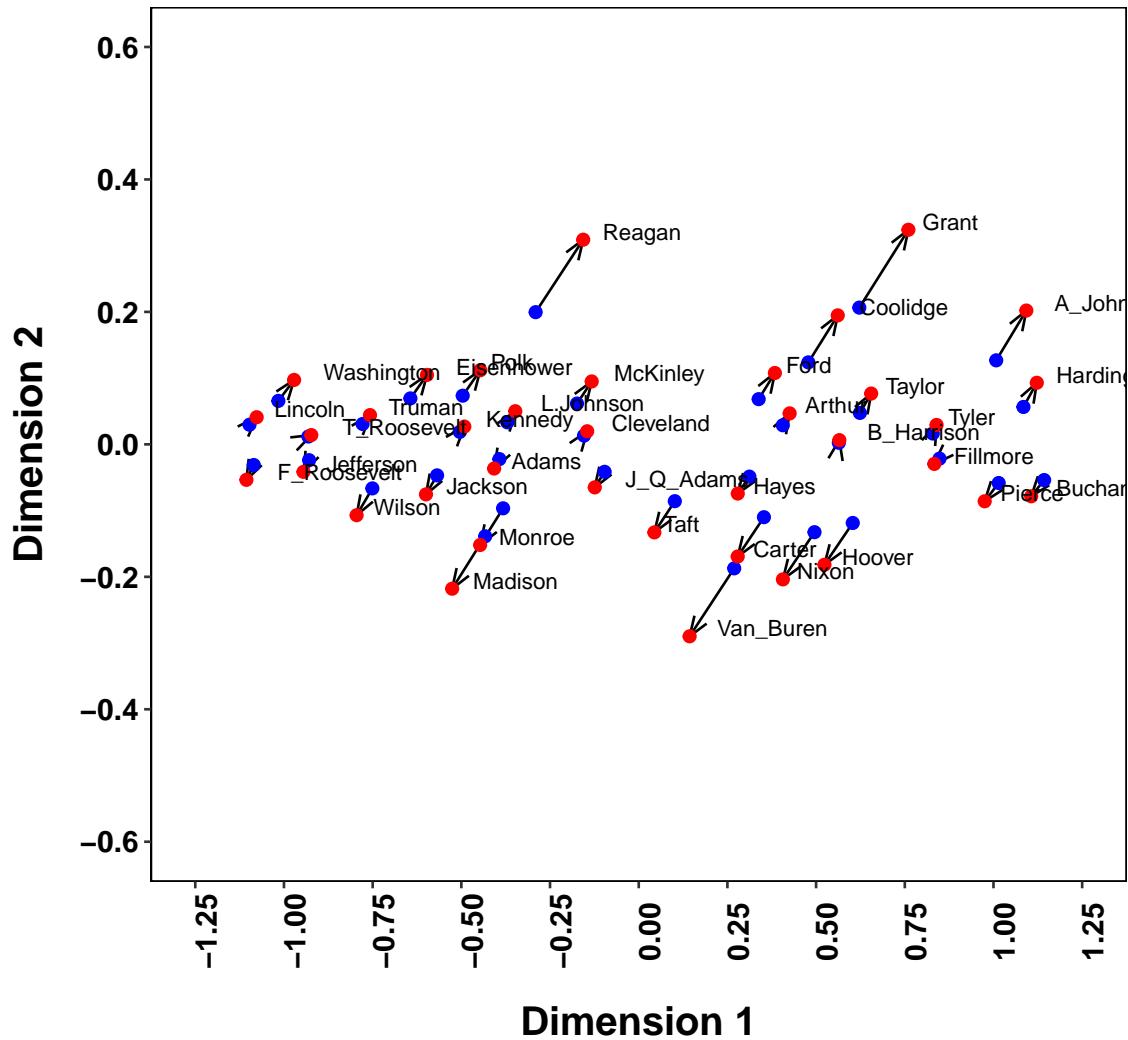
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 9 Configuration")

```

Group Space to Source 9 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[10]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

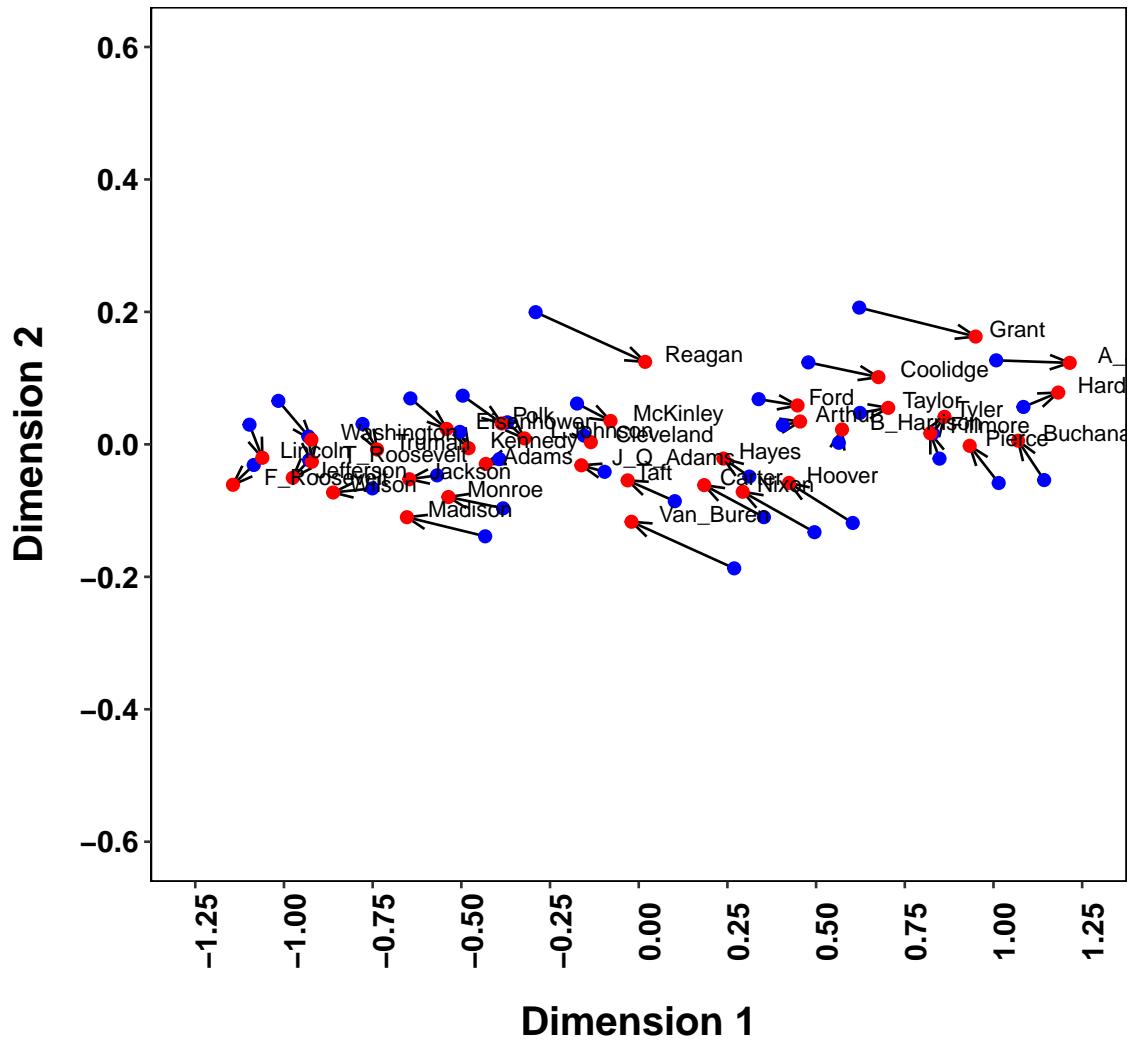
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 10 Configuration")

```

Group Space to Source 10 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[11]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

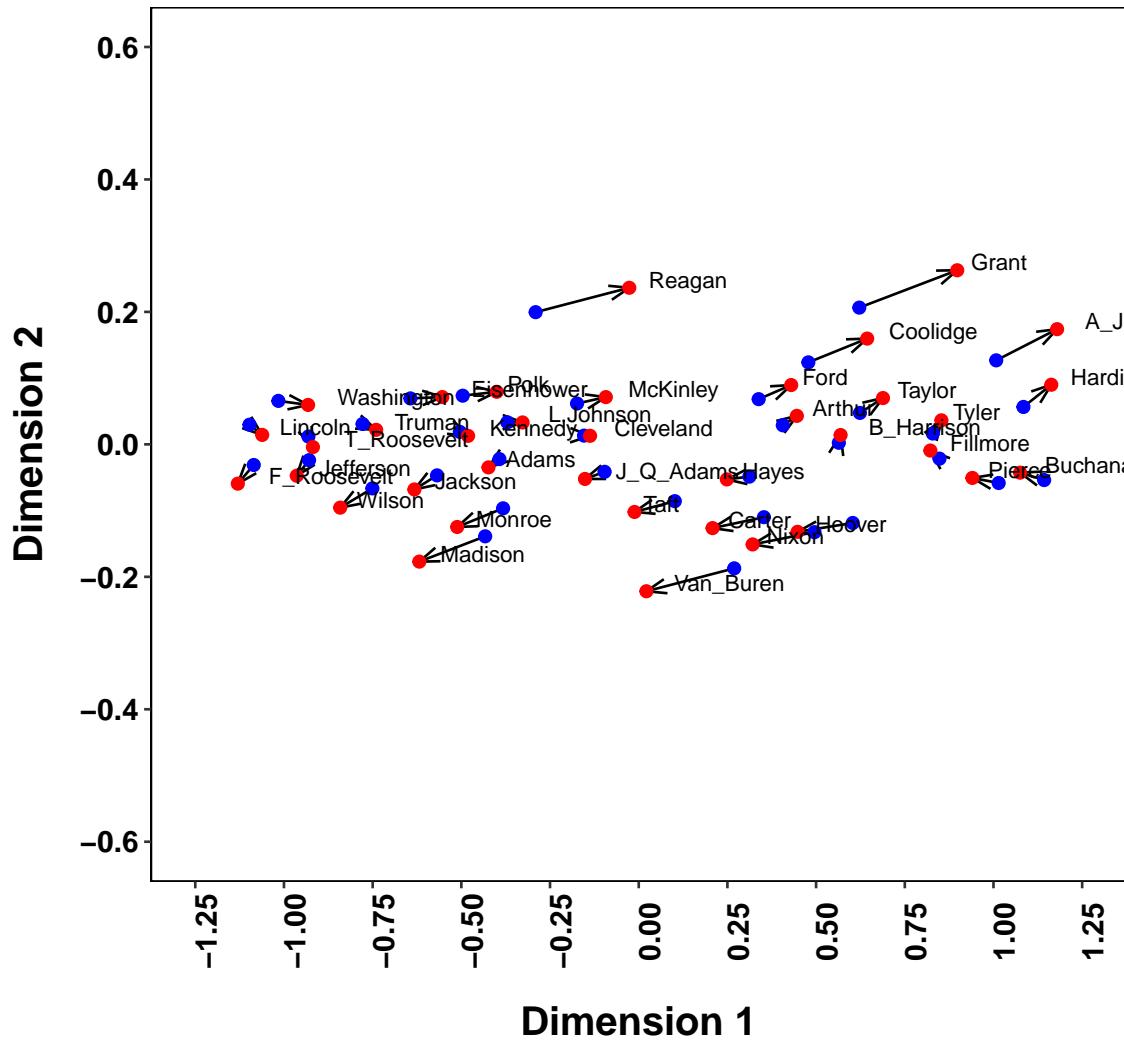
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 11 Configuration")

```

Group Space to Source 11 Configuration



```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[12]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

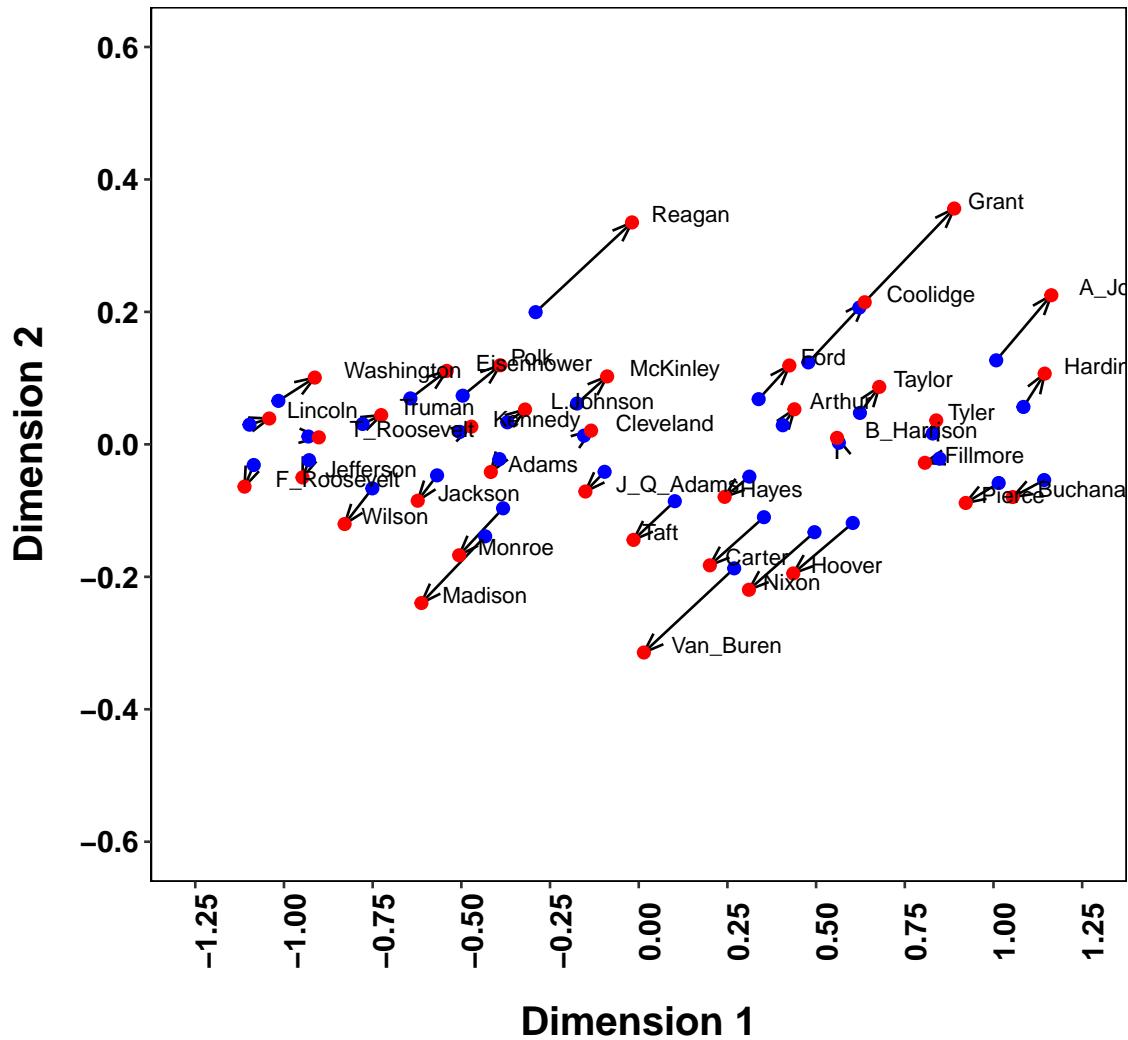
```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```

    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 12 Configuration")

```

Group Space to Source 12 Configuration

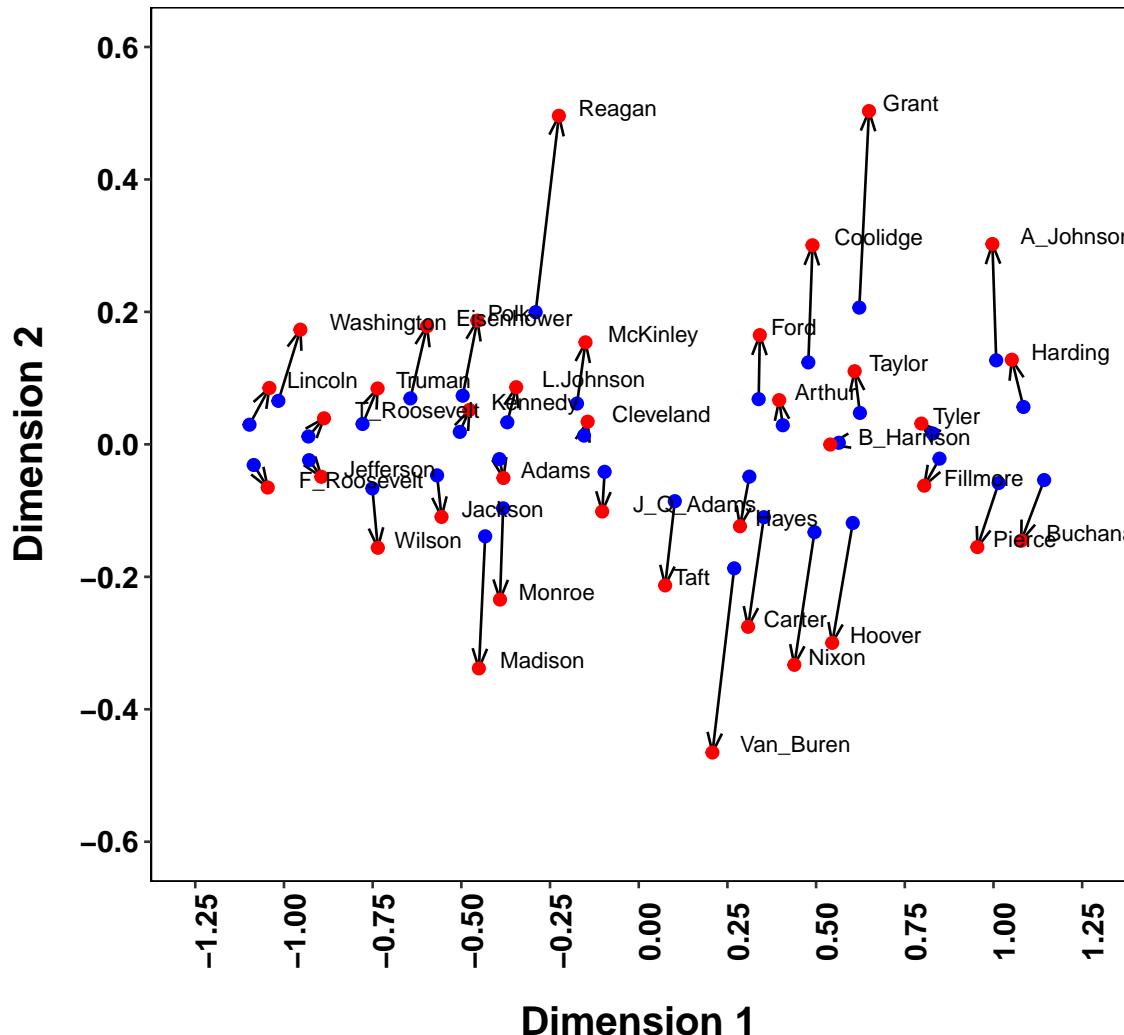


```
plot_data <- cbind(idioscal_fit$gspace, idioscal_fit$conf[[13]])
plot_data <- as.data.frame(plot_data)
names(plot_data) <- c("D1_G", "D2_G", "D1_I", "D2_I")
plot_data$Names <- row.names(Presidents)
```

```
ggplot() + geom_segment(data = plot_data, mapping = aes(x = D1_G,
y = D2_G, xend = D1_I, yend = D2_I), color = "black", size = 0.5,
arrow = arrow(length = unit(0.3, "cm"), ends = "last", type = "open",
angle = 20)) + geom_point(data = plot_data, mapping = aes(x = D1_G,
y = D2_G), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D1_I, y = D2_I), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D1_I, y = plot_data$D2_I,
label = plot_data$Names), hjust = -0.25, vjust = 0, size = 3,
```

```
    angle = 0) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-0.6,
0.6)) + scale_x_continuous(breaks = c(seq(-1.25, 1.25, 0.25))) +
scale_y_continuous(breaks = round(c(seq(-0.6, 0.6, 0.2)), 2)) +
ylab("Dimension 2") + xlab("Dimension 1") + theme(text = element_text(size = 14,
family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Group Space to Source 13 Configuration")
```

Group Space to Source 13 Configuration



```
# Weight matrix off-diagonals.
source_weights <- matrix(NA, nrow = 13, ncol = 4)
colnames(source_weights) <- c("D_11", "D_22", "D_12", "D_21")
for (i in seq(1, 13, 1)) {
  source_weights[i, 1] <- idioscal_fit$cweights[[i]][1, 1]
  source_weights[i, 2] <- idioscal_fit$cweights[[i]][2, 2]
  source_weights[i, 3] <- idioscal_fit$cweights[[i]][1, 2]
  source_weights[i, 4] <- idioscal_fit$cweights[[i]][2, 1]
}
```

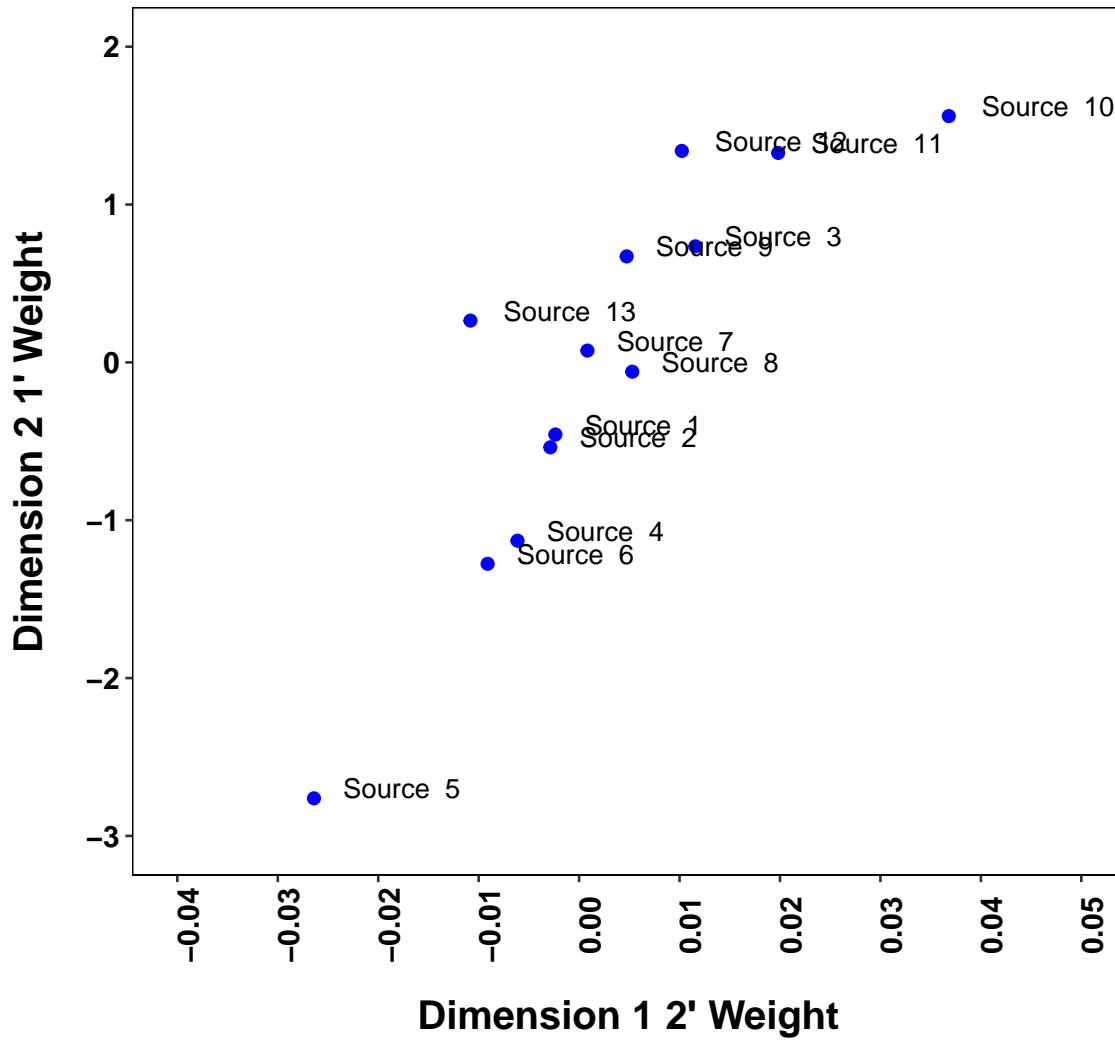
```
plot_data <- as.data.frame(source_weights)
plot_data$Names <- c(paste("Source ", seq(1, 13)))
```

```

ggplot() + geom_point(data = plot_data, mapping = aes(x = D_12, y = D_21),
  color = "blue", size = 2) + geom_text(data = plot_data, aes(x = plot_data$D_12,
  y = plot_data$D_21, label = plot_data$Names), hjust = -0.25, vjust = 0,
  size = 4, angle = 0) + coord_cartesian(xlim = c(-0.04, 0.05),
  ylim = c(-3, 2)) + scale_x_continuous(breaks = c(seq(-0.04, 0.05,
  0.01))) + scale_y_continuous(breaks = c(seq(-3, 2, 1))) + ylab("Dimension 2 1' Weight") +
  xlab("Dimension 1 2' Weight") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Source Weights")

```

Source Weights



```

plot_data <- as.data.frame(source_weights)
plot_data$Names <- c(seq(1, 13))

ggplot() + geom_segment(data = plot_data, mapping = aes(x = 0, y = 0,
xend = D_12, yend = D_21), color = "black", size = 0.75, arrow = arrow(length = unit(0.3,
"cm"), ends = "last", type = "open", angle = 20)) + geom_point(data = plot_data,
mapping = aes(x = 0, y = 0), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = D_12, y = D_21), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$D_12, y = plot_data$D_21,
label = plot_data$Names), hjust = -1, vjust = 0, size = 5,
angle = 0) + coord_cartesian(xlim = c(-0.04, 0.05), ylim = c(-3,
2)) + scale_x_continuous(breaks = c(seq(-0.04, 0.05, 0.01))) +
scale_y_continuous(breaks = c(seq(-3, 2, 1))) + ylab("Dimension 2 1' Weight") +
xlab("Dimension 1 2' Weight") + theme(text = element_text(size = 14,

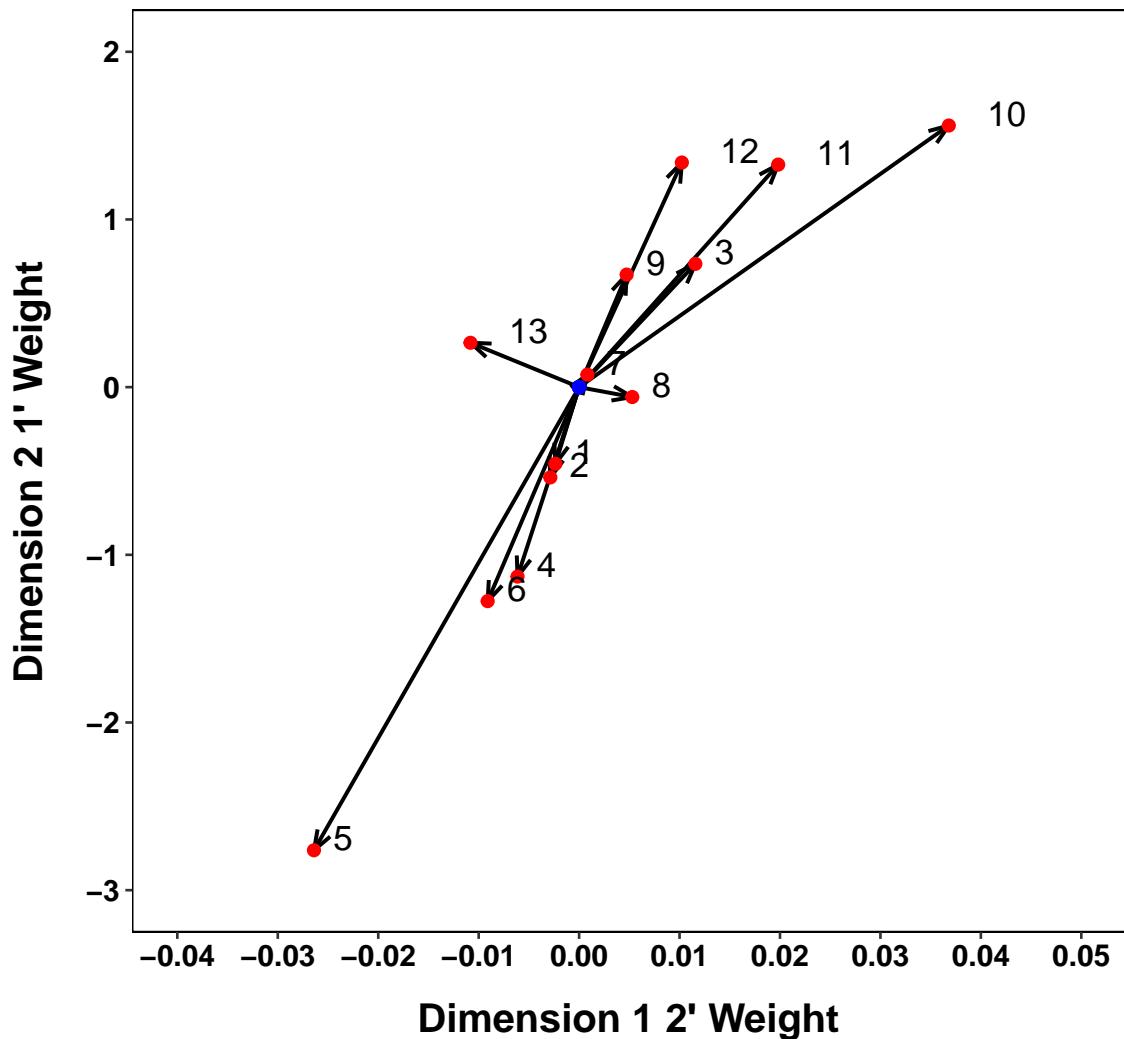
```

```

family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Source Weights")

```

Source Weights



```

# Conversion of off-diagonals to degrees of rotation.
source_angles <- matrix(NA, nrow = 13, ncol = 5)

squared_elements <- matrix(NA, ncol = 2, nrow = 2)
for (i in 1:13) {
  # Square the elements in the weight matrices.
  squared_elements <- (idiostat_fit$cweights[[i]])^2
  # Calculate the adjustment as the square root of the sum of the
  # squared column elements.
  C_adj <- sqrt(colSums(squared_elements))
  # Calculate the angles, with conversion from radians.
  source_angles[i, 1] <- acos(idioscal_fit$cweights[[i]][1, 1]/C_adj[1]) *
    180/pi
  source_angles[i, 2] <- acos(idioscal_fit$cweights[[i]][2, 1]/C_adj[1]) *
    180/pi
  source_angles[i, 3] <- acos(idioscal_fit$cweights[[i]][1, 2]/C_adj[2]) *
    180/pi
  source_angles[i, 4] <- acos(idioscal_fit$cweights[[i]][2, 2]/C_adj[2]) *
    180/pi
  source_angles[i, 5] <- (90 - source_angles[i, 1] + source_angles[i,
    4])
}
source_angles <- as.data.frame(source_angles)
names(source_angles) <- c("A_D1", "A_LOD", "A_UOD", "A_D2", "Angle")

```

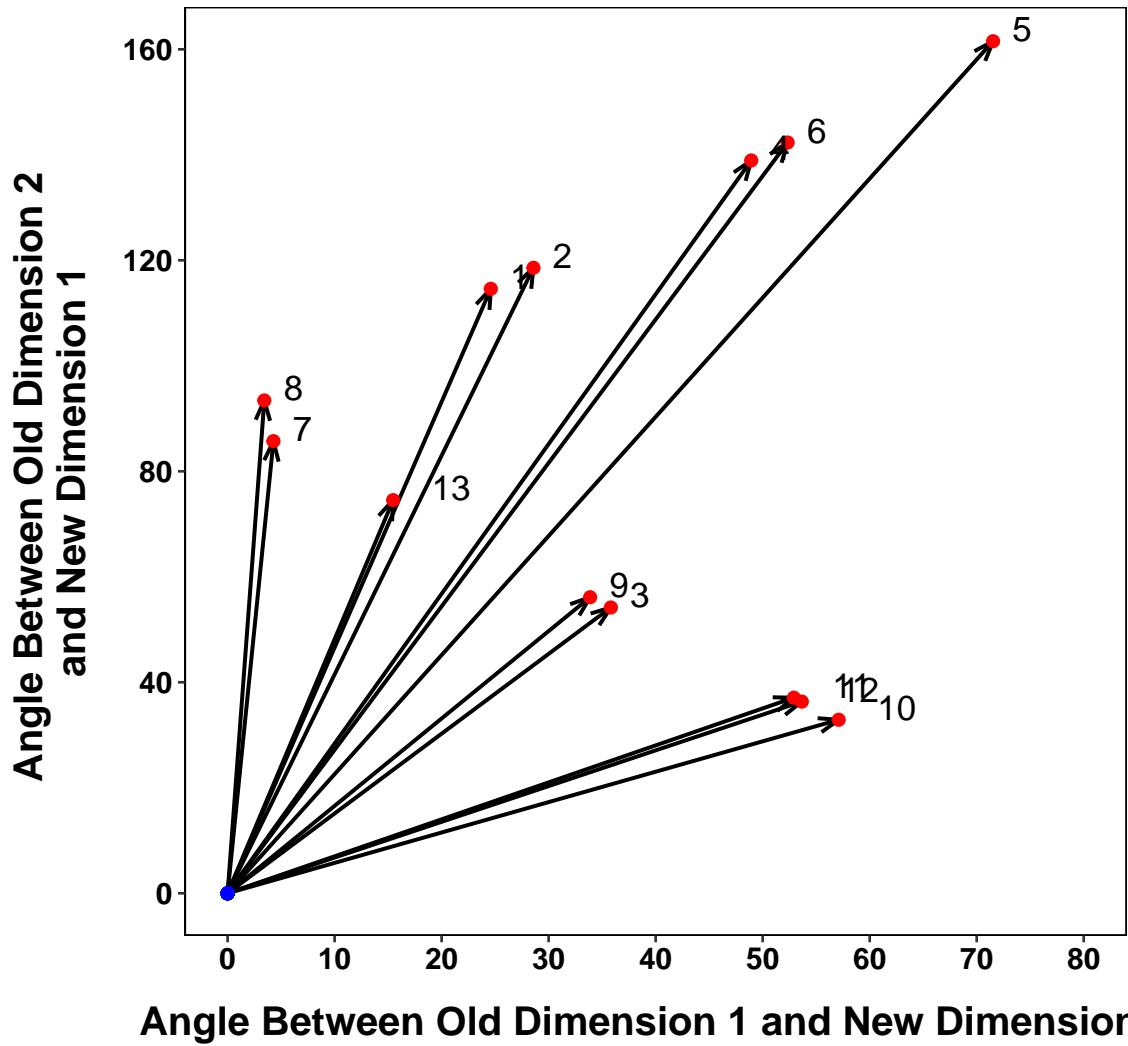
```

plot_data <- as.data.frame(source_angles)
plot_data$Names <- c(seq(1, 13))

ggplot() + geom_segment(data = plot_data, mapping = aes(x = 0, y = 0,
  xend = A_D1, yend = A_LOD), color = "black", size = 0.75, arrow = arrow(length = unit(0.3,
  "cm"), ends = "last", type = "open", angle = 20)) + geom_point(data = plot_data,
  mapping = aes(x = 0, y = 0), color = "blue", size = 2) + geom_point(data = plot_data,
  mapping = aes(x = A_D1, y = A_LOD), color = "red", size = 2) +
  geom_text(data = plot_data, aes(x = plot_data$A_D1, y = plot_data$A_LOD,
    label = plot_data$Names), hjust = -1, vjust = 0, size = 5,
    angle = 0) + coord_cartesian(xlim = c(0, 80), ylim = c(0,
    160)) + scale_x_continuous(breaks = c(seq(0, 80, 10))) + scale_y_continuous(breaks = c(seq(0,
    160, 40))) + ylab("Angle Between Old Dimension 2 \nand New Dimension 1") +
  xlab("Angle Between Old Dimension 1 and New Dimension 1") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Location of New Dimension 1")

```

Location of New Dimension 1



```

plot_data <- as.data.frame(source_angles)
plot_data$Names <- c(seq(1, 13))

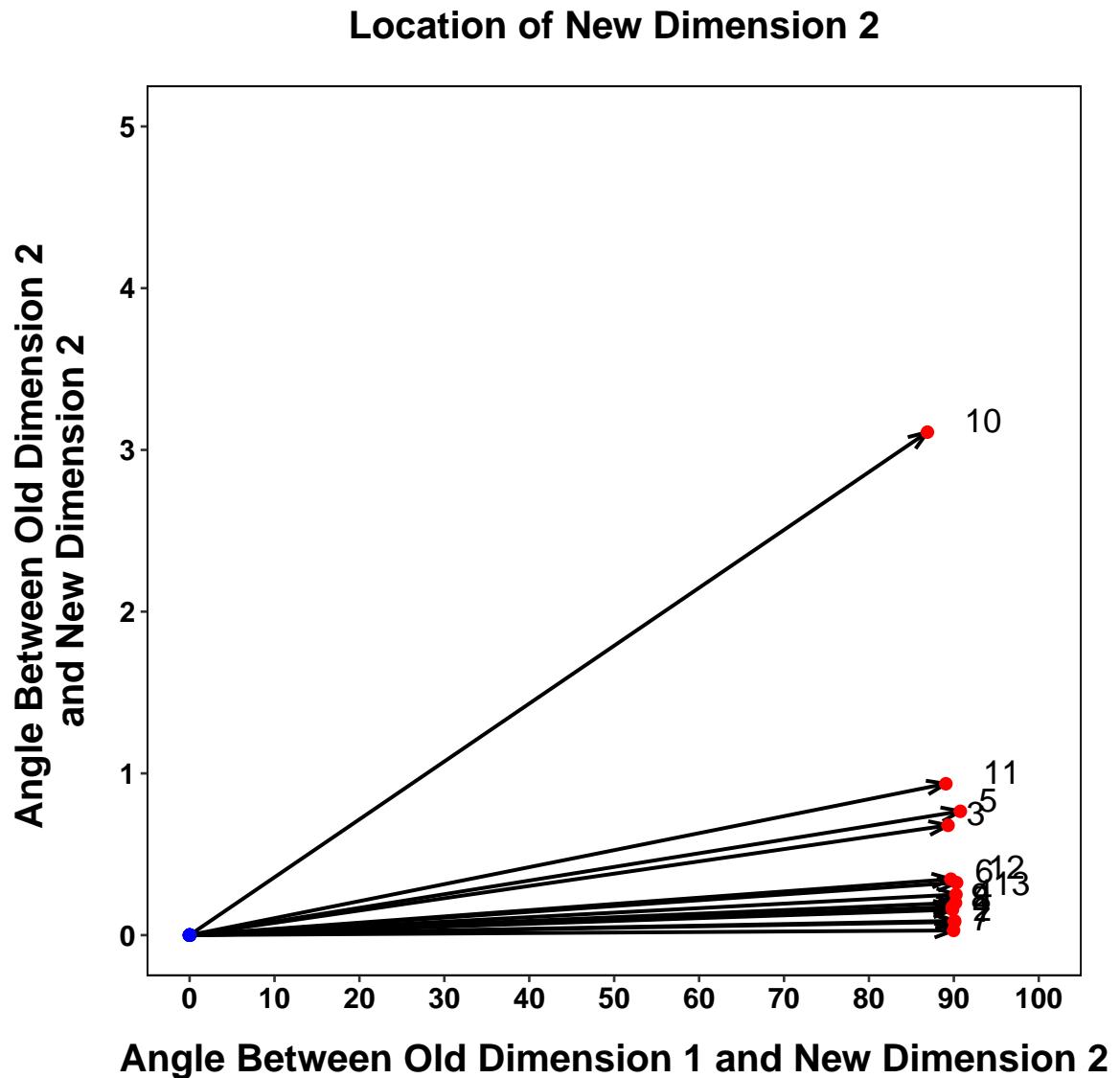
ggplot() + geom_segment(data = plot_data, mapping = aes(x = 0, y = 0,
xend = A_UOD, yend = A_D2), color = "black", size = 0.75, arrow = arrow(length = unit(0.3,
"cm"), ends = "last", type = "open", angle = 20)) + geom_point(data = plot_data,
mapping = aes(x = 0, y = 0), color = "blue", size = 2) + geom_point(data = plot_data,
mapping = aes(x = A_UOD, y = A_D2), color = "red", size = 2) +
geom_text(data = plot_data, aes(x = plot_data$A_UOD, y = plot_data$A_D2,
label = plot_data$Names), hjust = -1, vjust = 0, size = 5,
angle = 0) + coord_cartesian(xlim = c(0, 100), ylim = c(0,
5)) + scale_x_continuous(breaks = c(seq(0, 100, 10))) + scale_y_continuous(breaks = c(seq(0,
5, 1))) + ylab("Angle Between Old Dimension 2 \nand New Dimension 2") +
xlab("Angle Between Old Dimension 1 and New Dimension 2") + theme(text = element_text(size = 14,

```

```

family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Location of New Dimension 2")

```



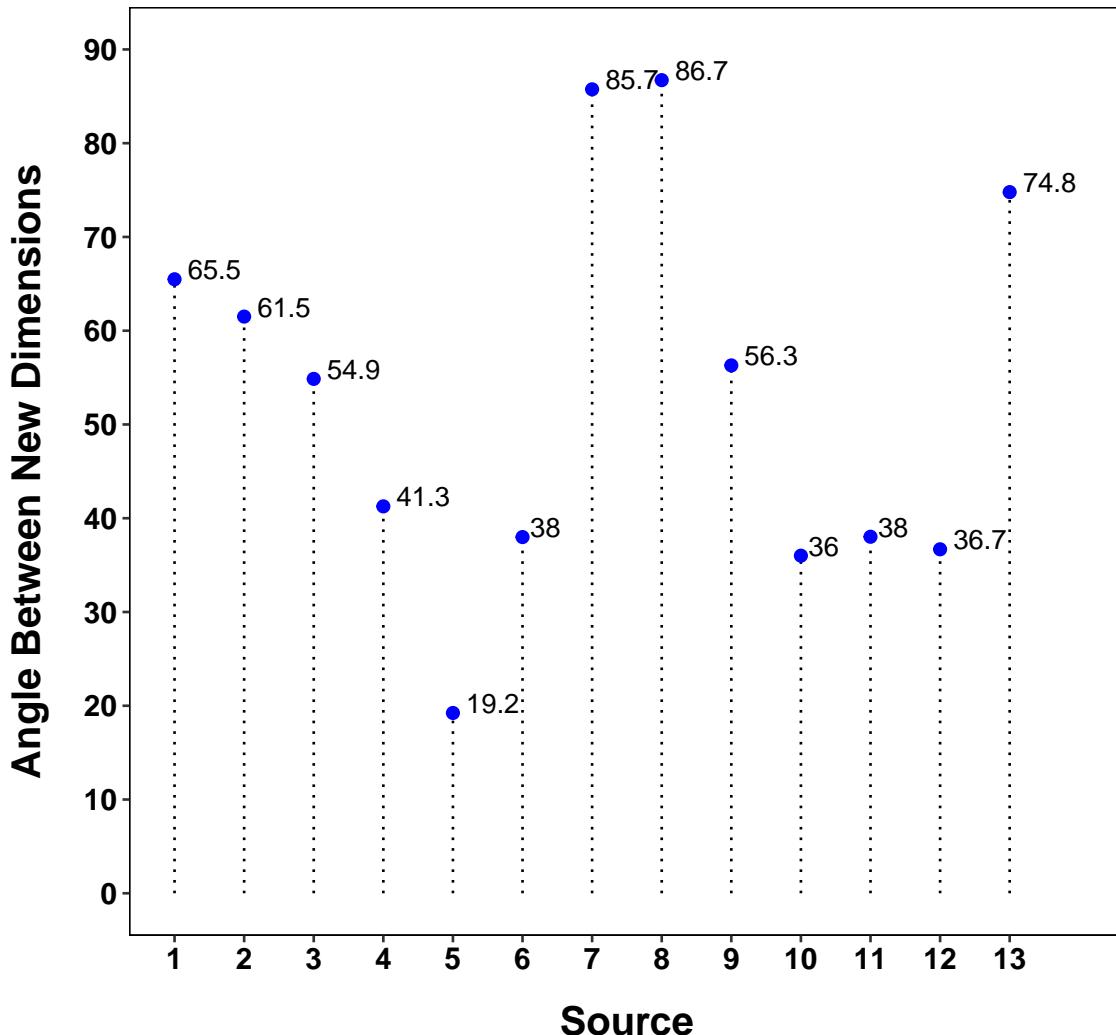
```

plot_data <- as.data.frame(source_angles)

ggplot() + geom_segment(data = plot_data, mapping = aes(x = seq(1,
  13, 1), y = 0, xend = seq(1, 13, 1), yend = Angle), color = "black",
  size = 0.5, linetype = "dotted") + geom_point(data = plot_data,
  mapping = aes(x = seq(1, 13, 1), y = Angle), color = "blue", size = 2) +
  geom_text(data = plot_data, aes(x = seq(1, 13, 1), y = plot_data$Angle,
  label = round(plot_data$Angle, 1)), hjust = -0.25, vjust = 0,
  size = 4, angle = 0) + coord_cartesian(xlim = c(1, 14), ylim = c(0,
  90)) + scale_x_continuous(breaks = c(seq(1, 13, 1))) + scale_y_continuous(breaks = c(seq(0,
  90, 10))) + ylab("Angle Between New Dimensions") + xlab("Source") +
  theme(text = element_text(size = 14, family = "sans", color = "black",
  face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Angle Between New Dimensions by Source")

```

Angle Between New Dimensions by Source



5.2.6 Source and Object Information

Additional source information can be used to help identify the meaning behind source differences as indicated by source weights and stress. Likewise, additional object information can help identify the nature of MDS dimensions and relative fit for objects.

```
presz_data <- as.data.frame(cbind(prez_info, siena_info[, 2:21], as.data.frame(idioscal_fit$gspace),
                                    as.data.frame(idioscal_fit$spp)))
round(cor(prez_data[, 2:26], prez_data[, 25:26], use = "pairwise.complete.obs"),
      2)

##                                     D1      D2
## Height                          -0.26   0.16
## Age                            -0.01   0.04
```

```

## BMI 0.03 0.01
## Background 0.65 0.19
## Party_leadership 0.84 0.03
## Communication_ability 0.92 -0.02
## Relations_with_Congress 0.84 -0.02
## Court_appointments 0.89 0.00
## Handling_of_economy 0.87 -0.17
## Luck 0.78 -0.23
## Ability_to_compromise 0.68 -0.11
## Willing_to_take_risks 0.86 0.02
## Executive_appointments 0.95 0.07
## Overall_ability 0.96 0.11
## Imagination 0.92 0.10
## Domestic_accomplishments 0.91 0.08
## Integrity 0.72 -0.02
## Executive_ability 0.98 0.02
## Foreign_policy_accomplishments 0.84 -0.04
## Leadership_ability 0.91 0.02
## Intelligence 0.83 0.21
## Avoid_crucial_mistakes 0.83 -0.14
## Experts_view 0.98 -0.02
## D1 1.00 0.00
## D2 0.00 1.00

# source_weights <- matrix(NA,nrow=13,ncol=2) for (i in 1:13) {
# source_weights[i,1] <- idioscal_fit$cweights[[i]][1,1]
# source_weights[i,2] <- idioscal_fit$cweights[[i]][2,2] }
# source_weights <- as.data.frame(source_weights)
# names(source_weights) <- c('D1','D2') source_weights$Names <-
# c(paste('Source ',seq(1,13,1)))

source_data <- as.data.frame(cbind(source_info[, 1:6], source_weights,
  as.data.frame(idioscal_fit$sps), source_angles[5]))
names(source_data) <- c(names(source_data[c(1:10)]), "Stress", "Angle")

round(cor(source_data[, c(2, 4:12)]), 2)

##          Year Academic News Dems D_11 D_22 D_12 D_21
## Year      1.00   -0.44  0.39  0.26 -0.33  0.32 -0.50 -0.63
## Academic -0.44    1.00  -0.62 -0.35  0.62 -0.73  0.65  0.60
## News       0.39   -0.62   1.00 -0.02 -0.38  0.28 -0.62 -0.81
## Dems        0.26   -0.35  -0.02   1.00  0.01  0.41 -0.09  0.11
## D_11      -0.33    0.62  -0.38  0.01   1.00 -0.73  0.78  0.71
## D_22       0.32   -0.73   0.28  0.41 -0.73   1.00 -0.80 -0.52
## D_12      -0.50    0.65  -0.62 -0.09  0.78 -0.80   1.00  0.87
## D_21      -0.63    0.60  -0.81  0.11  0.71 -0.52  0.87   1.00
## Stress     0.37   -0.64   0.17  0.47 -0.57  0.94 -0.69 -0.43
## Angle      0.19    0.03  -0.33  0.47  0.24  0.34 -0.01  0.19
##          Stress Angle
## Year      0.37  0.19
## Academic -0.64  0.03
## News      0.17 -0.33
## Dems       0.47  0.47
## D_11     -0.57  0.24

```

```

## D_22      0.94  0.34
## D_12     -0.69 -0.01
## D_21     -0.43  0.19
## Stress    1.00  0.54
## Angle     0.54  1.00

```

6 Correlations Among Object Configuration Values

Listed below for informational purposes are the correlations among configuration values for the indscal and idioscal solutions, both source and group space.

```

for (i in seq(1, 13)) {
  print(paste("Source ", i))
  print(cor(indscal_fit$conf[[i]]))
}

## [1] "Source  1"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source  2"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source  3"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source  4"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source  5"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source  6"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source  7"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source  8"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source  9"
##          D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000

```

```

## [1] "Source 10"
##      D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source 11"
##      D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source 12"
##      D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000
## [1] "Source 13"
##      D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000

cor(indscal_fit$gspace)

##      D1      D2
## D1  1.0000 -0.8346
## D2 -0.8346  1.0000

for (i in seq(1, 13)) {
  print(paste("Source ", i))
  print(cor(idioscal_fit$conf[[i]]))
}

## [1] "Source 1"
##      D1      D2
## D1  1.00000 -0.06978
## D2 -0.06978  1.00000
## [1] "Source 2"
##      D1      D2
## D1  1.00000 -0.08191
## D2 -0.08191  1.00000
## [1] "Source 3"
##      D1      D2
## D1  1.0000  0.1837
## D2  0.1837  1.0000
## [1] "Source 4"
##      D1      D2
## D1  1.0000 -0.1733
## D2 -0.1733  1.0000
## [1] "Source 5"
##      D1      D2
## D1  1.0000 -0.4551
## D2 -0.4551  1.0000
## [1] "Source 6"
##      D1      D2
## D1  1.0000 -0.2081
## D2 -0.2081  1.0000
## [1] "Source 7"
##      D1      D2
## D1  1.00000  0.01391

```

```

## D2 0.01391 1.00000
## [1] "Source 8"
##          D1      D2
## D1 1.00000 0.01375
## D2 0.01375 1.00000
## [1] "Source 9"
##          D1      D2
## D1 1.0000 0.1103
## D2 0.1103 1.0000
## [1] "Source 10"
##          D1      D2
## D1 1.0000 0.5606
## D2 0.5606 1.0000
## [1] "Source 11"
##          D1      D2
## D1 1.0000 0.2912
## D2 0.2912 1.0000
## [1] "Source 12"
##          D1      D2
## D1 1.0000 0.2194
## D2 0.2194 1.0000
## [1] "Source 13"
##          D1      D2
## D1 1.000000 0.002344
## D2 0.002344 1.000000

cor(idioscal_fit$gspace)

##          D1      D2
## D1 1.0000000 0.0003246
## D2 0.0003246 1.0000000

```

7 Why Are Those Weights So Wacky?

The source weights in the INDSCAL and IDIOSCAL solutions were, in some cases, quite extreme, appearing to move the source configuration substantially relative to the group configuration. Moreover, the sign and magnitude does not seem consistent with intuition that they ought to average to an identity matrix (to essentially recover the group space). Here we explore this a bit further. The particularly large weights occur for the second dimension, which is substantially smaller than the first dimension. This means that a correspondingly large weight is necessary to effect even a small configuration shift. In that regard, the large weights are not unusual. Also, the group space is not necessarily a simple average of the source configurations.

7.1 What is the Average of the Separate Source Weight Matrices?

Here we average the source weight matrices for the INDSCAL and IDIOSCAL solutions. They clearly do not produce identity matrices.

```

# INDSCAL
indscal_fit$cweights

## [[1]]

```

```

##      D1      D2
## D1 0.7738 0.000
## D2 0.0000 5.127
##
## [[2]]
##      D1      D2
## D1 0.7503 0.000
## D2 0.0000 5.292
##
## [[3]]
##      D1      D2
## D1 0.9548 0.000
## D2 0.0000 2.972
##
## [[4]]
##      D1      D2
## D1 0.6553 0.000
## D2 0.0000 6.004
##
## [[5]]
##      D1      D2
## D1 0.257 0.000
## D2 0.000 7.604
##
## [[6]]
##      D1      D2
## D1 0.6358 0.000
## D2 0.0000 6.113
##
## [[7]]
##      D1      D2
## D1 0.8483 0.00
## D2 0.0000 4.34
##
## [[8]]
##      D1      D2
## D1 0.82 0.000
## D2 0.00 4.597
##
## [[9]]
##      D1      D2
## D1 0.9203 0.000
## D2 0.0000 3.435
##
## [[10]]
##      D1      D2
## D1 1.029 0.0000
## D2 0.000 0.7265
##
## [[11]]
##      D1      D2
## D1 1.002 0.000
## D2 0.000 1.809
##

```

```

## [[12]]
##      D1      D2
## D1  0.9871  0.000
## D2  0.0000  2.088
##
## [[13]]
##      D1      D2
## D1  0.8399  0.000
## D2  0.0000  4.291

weights_sum <- matrix(0, nrow = 2, ncol = 2)
for (i in 1:13) {
  weights_sum <- weights_sum + indscal_fit$cweights[[i]]
}
weights_sum <- weights_sum/13
weights_sum

##      D1      D2
## D1  0.8057  0.000
## D2  0.0000  4.184

# IDIOSCAL
idioscal_fit$cweights

## [[1]]
##      D1      D2
## D1  0.9985 -0.00236
## D2 -0.4570  1.66403
##
## [[2]]
##      D1      D2
## D1  0.9878 -0.002864
## D2 -0.5382  1.860772
##
## [[3]]
##      D1      D2
## D1  1.0186  0.01157
## D2  0.7351  0.97700
##
## [[4]]
##      D1      D2
## D1  0.9844 -0.006133
## D2 -1.1299  1.759364
##
## [[5]]
##      D1      D2
## D1  0.9223 -0.0264
## D2 -2.7621  1.9753
##
## [[6]]
##      D1      D2
## D1  0.9852 -0.009105
## D2 -1.2762  1.606770
##
## [[7]]

```

```

##          D1          D2
## D1  0.99709  0.0008277
## D2  0.07467  1.6449956
##
## [[8]]
##          D1          D2
## D1  0.98445  0.005295
## D2 -0.05905  1.928795
##
## [[9]]
##          D1          D2
## D1  0.9998  0.004735
## D2  0.6712  1.555201
##
## [[10]]
##          D1          D2
## D1  1.009  0.03681
## D2  1.560  0.67751
##
## [[11]]
##          D1          D2
## D1  1.003  0.01982
## D2  1.327  1.21343
##
## [[12]]
##          D1          D2
## D1  0.9855  0.01023
## D2  1.3396  1.69383
##
## [[13]]
##          D1          D2
## D1  0.9561 -0.01082
## D2  0.2646  2.47000

weights_sum <- matrix(0, nrow = 2, ncol = 2)
for (i in 1:13) {
  weights_sum <- weights_sum + idioscal_fit$cweights[[i]]
}
weights_sum <- weights_sum/13
weights_sum

##          D1          D2
## D1  0.98710  0.002432
## D2 -0.01922  1.617461

```

7.2 What is the Average of the Separate Configuration Matrices?

Here we average the source configuration matrices for the INDSCAL and IDIOSCAL solutions to determine how closely they match the group space. The average does not match closely the group space for INDSCAL but does a much better job for IDIOSCAL.

```

# INDSCAL
indscal_fit$conf

## [[1]]
##          D1         D2
## 1 -0.692702  0.765118
## 2 -0.327040  0.199436
## 3 -0.704139  0.586055
## 4 -0.487159 -0.001144
## 5 -0.402297  0.023910
## 6 -0.123367 -0.017188
## 7 -0.486317  0.258829
## 8  0.001271 -0.529548
## 9  0.650642 -0.470901
## 10 -0.290965  0.456816
## 11  0.526077 -0.292478
## 12  0.620391 -0.564284
## 13  0.706942 -0.741275
## 14  0.811126 -0.811601
## 15 -0.800514  0.742421
## 16  0.914368 -0.320940
## 17  0.694711  0.012014
## 18  0.176639 -0.293876
## 19  0.338504 -0.186911
## 20 -0.103263  0.123441
## 21  0.427549 -0.342874
## 22 -0.061503  0.227952
## 23 -0.727036  0.539945
## 24 -0.021213 -0.243893
## 25 -0.648653  0.327943
## 26  0.887598 -0.560595
## 27  0.497112 -0.077430
## 28  0.327878 -0.606401
## 29 -0.862574  0.608023
## 30 -0.554795  0.543526
## 31 -0.408799  0.540359
## 32 -0.358883  0.351475
## 33 -0.242423  0.300168
## 34  0.238827 -0.571700
## 35  0.331642 -0.081268
## 36  0.138637 -0.445608
## 37  0.013727  0.552484
##
## [[2]]
##          D1         D2
## 1 -0.671592  0.78979
## 2 -0.317073  0.20587
## 3 -0.682681  0.60495
## 4 -0.472313 -0.00118
## 5 -0.390038  0.02468
## 6 -0.119607 -0.01774
## 7 -0.471497  0.26717
## 8  0.001232 -0.54662
## 9  0.630814 -0.48608

```

```

## 10 -0.282098  0.47154
## 11  0.510045 -0.30191
## 12  0.601485 -0.58248
## 13  0.685399 -0.76517
## 14  0.786408 -0.83777
## 15 -0.776119  0.76636
## 16  0.886504 -0.33129
## 17  0.673540  0.01240
## 18  0.171256 -0.30335
## 19  0.328188 -0.19294
## 20 -0.100116  0.12742
## 21  0.414520 -0.35393
## 22 -0.059628  0.23530
## 23 -0.704881  0.55735
## 24 -0.020566 -0.25176
## 25 -0.628886  0.33852
## 26  0.860550 -0.57867
## 27  0.481963 -0.07993
## 28  0.317886 -0.62595
## 29 -0.836288  0.62763
## 30 -0.537888  0.56105
## 31 -0.396341  0.55778
## 32 -0.347946  0.36281
## 33 -0.235035  0.30985
## 34  0.231549 -0.59013
## 35  0.321535 -0.08389
## 36  0.134413 -0.45997
## 37  0.013309  0.57030
##
## [[3]]
##          D1          D2
## 1 -0.854717  0.4434618
## 2 -0.403531  0.1155931
## 3 -0.868829  0.3396768
## 4 -0.601100 -0.0006628
## 5 -0.496390  0.0138581
## 6 -0.152221 -0.0099622
## 7 -0.600061  0.1500170
## 8  0.001568 -0.3069253
## 9  0.802819 -0.2729337
## 10 -0.359019  0.2647700
## 11  0.649120 -0.1695198
## 12  0.765493 -0.3270584
## 13  0.872288 -0.4296425
## 14  1.000839 -0.4704033
## 15 -0.987745  0.4303066
## 16  1.128228 -0.1860168
## 17  0.857196  0.0069633
## 18  0.217952 -0.1703304
## 19  0.417676 -0.1083335
## 20 -0.127415  0.0715464
## 21  0.527548 -0.1987292
## 22 -0.075887  0.1321209
## 23 -0.897082  0.3129515

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## 24 -0.026174 -0.1413602
## 25 -0.800366  0.1900755
## 26  1.095197 -0.3249203
## 27  0.613381 -0.0448785
## 28  0.404565 -0.3514693
## 29 -1.064320  0.3524093
## 30 -0.684556  0.3150269
## 31 -0.504412  0.3131915
## 32 -0.442821  0.2037147
## 33 -0.299123  0.1739768
## 34  0.294686 -0.3313565
## 35  0.409209 -0.0471030
## 36  0.171063 -0.2582737
## 37  0.016937  0.3202193
##
## [[4]]
##          D1          D2
## 1 -0.586605  0.896030
## 2 -0.276949  0.233560
## 3 -0.596290  0.686329
## 4 -0.412544 -0.001339
## 5 -0.340680  0.028001
## 6 -0.104472 -0.020129
## 7 -0.411831  0.303115
## 8  0.001076 -0.620153
## 9  0.550987 -0.551472
## 10 -0.246400  0.534977
## 11  0.445501 -0.342521
## 12  0.525370 -0.660833
## 13  0.598664 -0.868108
## 14  0.686891 -0.950466
## 15 -0.677905  0.869450
## 16  0.774320 -0.375853
## 17  0.588307  0.014070
## 18  0.149584 -0.344159
## 19  0.286657 -0.218892
## 20 -0.087447  0.144562
## 21  0.362064 -0.401539
## 22 -0.052083  0.266955
## 23 -0.615681  0.632330
## 24 -0.017964 -0.285623
## 25 -0.549303  0.384054
## 26  0.751651 -0.656513
## 27  0.420973 -0.090679
## 28  0.277659 -0.710156
## 29 -0.730459  0.712056
## 30 -0.469821  0.636523
## 31 -0.346186  0.632815
## 32 -0.303915  0.411613
## 33 -0.205292  0.351526
## 34  0.202248 -0.669518
## 35  0.280846 -0.095173
## 36  0.117403 -0.521851
## 37  0.011624  0.647014

```

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##  

## [[5]]  

##          D1          D2  

## 1 -0.230051  1.134704  

## 2 -0.108612  0.295773  

## 3 -0.233849  0.869145  

## 4 -0.161789 -0.001696  

## 5 -0.133605  0.035459  

## 6 -0.040971 -0.025491  

## 7 -0.161509  0.383855  

## 8  0.000422 -0.785342  

## 9  0.216082 -0.698367  

## 10 -0.096631  0.677478  

## 11  0.174713 -0.433757  

## 12  0.206036 -0.836858  

## 13  0.234780 -1.099344  

## 14  0.269380 -1.203640  

## 15 -0.265856  1.101043  

## 16  0.303667 -0.475969  

## 17  0.230718  0.017817  

## 18  0.058663 -0.435831  

## 19  0.112419 -0.277197  

## 20 -0.034294  0.183069  

## 21  0.141992 -0.508497  

## 22 -0.020425  0.338063  

## 23 -0.241453  0.800762  

## 24 -0.007045 -0.361704  

## 25 -0.215422  0.486354  

## 26  0.294777 -0.831387  

## 27  0.165094 -0.114832  

## 28  0.108890 -0.899319  

## 29 -0.286466  0.901724  

## 30 -0.184251  0.806072  

## 31 -0.135765  0.801376  

## 32 -0.119187  0.521253  

## 33 -0.080510  0.445162  

## 34  0.079316 -0.847855  

## 35  0.110140 -0.120524  

## 36  0.046042 -0.660855  

## 37  0.004559  0.819358  

##  

## [[6]]  

##          D1          D2  

## 1 -0.569139  0.912248  

## 2 -0.268703  0.237787  

## 3 -0.578535  0.698751  

## 4 -0.400260 -0.001364  

## 5 -0.330536  0.028508  

## 6 -0.101361 -0.020493  

## 7 -0.399568  0.308601  

## 8  0.001044 -0.631378  

## 9  0.534581 -0.561453  

## 10 -0.239063  0.544660  

## 11  0.432236 -0.348720

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## 12  0.509726 -0.672794
## 13  0.580838 -0.883820
## 14  0.666438 -0.967669
## 15 -0.657719  0.885186
## 16  0.751264 -0.382656
## 17  0.570789  0.014324
## 18  0.145130 -0.350388
## 19  0.278122 -0.222853
## 20 -0.084843  0.147179
## 21  0.351284 -0.408807
## 22 -0.050532  0.271787
## 23 -0.597348  0.643774
## 24 -0.017429 -0.290793
## 25 -0.532947  0.391005
## 26  0.729269 -0.668395
## 27  0.408438 -0.092320
## 28  0.269392 -0.723010
## 29 -0.708709  0.724943
## 30 -0.455831  0.648044
## 31 -0.335878  0.644268
## 32 -0.294866  0.419063
## 33 -0.199180  0.357889
## 34  0.196226 -0.681635
## 35  0.272484 -0.096896
## 36  0.113907 -0.531296
## 37  0.011278  0.658725
##
## [[7]]
##          D1          D2
## 1 -0.759320  0.6477077
## 2 -0.358492  0.1688320
## 3 -0.771857  0.4961223
## 4 -0.534010 -0.0009681
## 5 -0.440987  0.0202407
## 6 -0.135231 -0.0145505
## 7 -0.533087  0.2191105
## 8  0.001393 -0.4482863
## 9  0.713215 -0.3986392
## 10 -0.318948  0.3867155
## 11  0.576670 -0.2475959
## 12  0.680055 -0.4776922
## 13  0.774930 -0.6275236
## 14  0.889134 -0.6870576
## 15 -0.877501  0.6284935
## 16  1.002304 -0.2716908
## 17  0.761523  0.0101703
## 18  0.193626 -0.2487797
## 19  0.371058 -0.1582288
## 20 -0.113194  0.1044987
## 21  0.468667 -0.2902583
## 22 -0.067417  0.1929720
## 23 -0.796957  0.4570880
## 24 -0.023253 -0.2064666
## 25 -0.711035  0.2776188

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## 26  0.972960 -0.4745693
## 27  0.544921 -0.0655483
## 28  0.359411 -0.5133461
## 29 -0.945529  0.5147190
## 30 -0.608151  0.4601193
## 31 -0.448113  0.4574386
## 32 -0.393397  0.2975399
## 33 -0.265737  0.2541055
## 34  0.261796 -0.4839699
## 35  0.363536 -0.0687973
## 36  0.151970 -0.3772272
## 37  0.015047  0.4677032
##
## [[8]]
##          D1          D2
## 1 -0.733990  0.685986
## 2 -0.346532  0.178810
## 3 -0.746108  0.525442
## 4 -0.516196 -0.001025
## 5 -0.426276  0.021437
## 6 -0.130720 -0.015410
## 7 -0.515303  0.232060
## 8  0.001346 -0.474779
## 9  0.689422 -0.422198
## 10 -0.308308  0.409570
## 11  0.557433 -0.262228
## 12  0.657368 -0.505923
## 13  0.749078 -0.664609
## 14  0.859472 -0.727662
## 15 -0.848228  0.665637
## 16  0.968868 -0.287747
## 17  0.736118  0.010771
## 18  0.187167 -0.263482
## 19  0.358680 -0.167580
## 20 -0.109418  0.110674
## 21  0.453033 -0.307412
## 22 -0.065168  0.204376
## 23 -0.770371  0.484101
## 24 -0.022477 -0.218668
## 25 -0.687315  0.294026
## 26  0.940503 -0.502616
## 27  0.526742 -0.069422
## 28  0.347421 -0.543684
## 29 -0.913986  0.545138
## 30 -0.587863  0.487312
## 31 -0.433165  0.484473
## 32 -0.380274  0.315124
## 33 -0.256872  0.269123
## 34  0.253062 -0.512572
## 35  0.351409 -0.072863
## 36  0.146901 -0.399521
## 37  0.014545  0.495344
##
## [[9]]

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```

##          D1          D2
## 1 -0.823760  0.5126550
## 2 -0.388915  0.1336291
## 3 -0.837360  0.3926765
## 4 -0.579329 -0.0007663
## 5 -0.478411  0.0160203
## 6 -0.146708 -0.0115166
## 7 -0.578327  0.1734241
## 8  0.001511 -0.3548148
## 9  0.773742 -0.3155195
## 10 -0.346015  0.3060819
## 11  0.625609 -0.1959700
## 12  0.737767 -0.3780892
## 13  0.840694 -0.4966795
## 14  0.964590 -0.5438002
## 15 -0.951970  0.4974472
## 16  1.087365 -0.2150409
## 17  0.826149  0.0080497
## 18  0.210058 -0.1969070
## 19  0.402548 -0.1252368
## 20 -0.122800  0.0827098
## 21  0.508441 -0.2297369
## 22 -0.073139  0.1527356
## 23 -0.864590  0.3617812
## 24 -0.025226 -0.1634166
## 25 -0.771377  0.2197329
## 26  1.055530 -0.3756175
## 27  0.591165 -0.0518809
## 28  0.389912 -0.4063090
## 29 -1.025771  0.4073957
## 30 -0.659761  0.3641805
## 31 -0.486142  0.3620587
## 32 -0.426783  0.2355003
## 33 -0.288288  0.2011223
## 34  0.284013 -0.3830580
## 35  0.394387 -0.0544525
## 36  0.164867 -0.2985720
## 37  0.016324  0.3701830
##
## [[10]]
##          D1          D2
## 1 -0.920944  0.1084221
## 2 -0.434798  0.0282614
## 3 -0.936150  0.0830477
## 4 -0.647676 -0.0001621
## 5 -0.534853  0.0033882
## 6 -0.164016 -0.0024357
## 7 -0.646556  0.0366777
## 8  0.001689 -0.0750403
## 9  0.865025 -0.0667296
## 10 -0.386837  0.0647337
## 11  0.699417 -0.0414460
## 12  0.824807 -0.0799626
## 13  0.939877 -0.1050434

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## 14  1.078389 -0.1150090
## 15 -1.064281  0.1052058
## 16  1.215649 -0.0454793
## 17  0.923616  0.0017024
## 18  0.234840 -0.0416441
## 19  0.450039 -0.0264865
## 20 -0.137288  0.0174924
## 21  0.568425 -0.0485874
## 22 -0.081767  0.0323023
## 23 -0.966592  0.0765136
## 24 -0.028202 -0.0345612
## 25 -0.862382  0.0464716
## 26  1.180058 -0.0794399
## 27  0.660909 -0.0109724
## 28  0.435913 -0.0859308
## 29 -1.146788  0.0861607
## 30 -0.737598  0.0770210
## 31 -0.543496  0.0765723
## 32 -0.477133  0.0498063
## 33 -0.322300  0.0425356
## 34  0.317520 -0.0810135
## 35  0.440916 -0.0115162
## 36  0.184318 -0.0631454
## 37  0.018250  0.0782905
##
## [[11]]
##          D1          D2
## 1 -0.897330  0.2698894
## 2 -0.423649  0.0703496
## 3 -0.912145  0.2067262
## 4 -0.631069 -0.0004034
## 5 -0.521138  0.0084340
## 6 -0.159810 -0.0060629
## 7 -0.629977  0.0912998
## 8  0.001646 -0.1867938
## 9  0.842845 -0.1661066
## 10 -0.376918  0.1611382
## 11  0.681483 -0.1031692
## 12  0.803658 -0.1990467
## 13  0.915777 -0.2614791
## 14  1.050737 -0.2862859
## 15 -1.036991  0.2618832
## 16  1.184477 -0.1132092
## 17  0.899933  0.0042378
## 18  0.228819 -0.1036625
## 19  0.438500 -0.0659314
## 20 -0.133767  0.0435429
## 21  0.553850 -0.1209460
## 22 -0.079671  0.0804083
## 23 -0.941807  0.1904613
## 24 -0.027479 -0.0860313
## 25 -0.840269  0.1156793
## 26  1.149800 -0.1977455
## 27  0.643962 -0.0273129

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## 28  0.424735 -0.2139031
## 29 -1.117383  0.2144752
## 30 -0.718685  0.1917244
## 31 -0.529560  0.1906074
## 32 -0.464899  0.1239801
## 33 -0.314036  0.1058817
## 34  0.309378 -0.2016625
## 35  0.429610 -0.0286668
## 36  0.179592 -0.1571845
## 37  0.017782  0.1948844
##
## [[12]]
##          D1          D2
## 1 -0.883571  0.3116631
## 2 -0.417153  0.0812383
## 3 -0.898159  0.2387234
## 4 -0.621393 -0.0004658
## 5 -0.513148  0.0097394
## 6 -0.157360 -0.0070014
## 7 -0.620318  0.1054313
## 8  0.001621 -0.2157058
## 9  0.829922 -0.1918166
## 10 -0.371139  0.1860792
## 11  0.671034 -0.1191378
## 12  0.791335 -0.2298552
## 13  0.901735 -0.3019509
## 14  1.034626 -0.3305974
## 15 -1.021091  0.3024176
## 16  1.166316 -0.1307318
## 17  0.886134  0.0048937
## 18  0.225310 -0.1197075
## 19  0.431776 -0.0761363
## 20 -0.131716  0.0502825
## 21  0.545358 -0.1396661
## 22 -0.078449  0.0928540
## 23 -0.927366  0.2199410
## 24 -0.027058 -0.0993473
## 25 -0.827385  0.1335842
## 26  1.132170 -0.2283526
## 27  0.634088 -0.0315404
## 28  0.418223 -0.2470112
## 29 -1.100250  0.2476718
## 30 -0.707665  0.2213996
## 31 -0.521440  0.2201097
## 32 -0.457771  0.1431698
## 33 -0.309221  0.1222702
## 34  0.304635 -0.2328759
## 35  0.423023 -0.0331038
## 36  0.176838 -0.1815136
## 37  0.017509  0.2250488
##
## [[13]]
##          D1          D2
## 1 -0.751855  0.6403508

```

```

## 2 -0.354967 0.1669144
## 3 -0.764268 0.4904871
## 4 -0.528760 -0.0009571
## 5 -0.436651 0.0200108
## 6 -0.133902 -0.0143852
## 7 -0.527845 0.2166218
## 8 0.001379 -0.4431945
## 9 0.706203 -0.3941113
## 10 -0.315812 0.3823230
## 11 0.571001 -0.2447836
## 12 0.673369 -0.4722664
## 13 0.767311 -0.6203960
## 14 0.880392 -0.6792538
## 15 -0.868874 0.6213549
## 16 0.992450 -0.2686048
## 17 0.754035 0.0100548
## 18 0.191723 -0.2459539
## 19 0.367410 -0.1564316
## 20 -0.112081 0.1033118
## 21 0.464060 -0.2869614
## 22 -0.066755 0.1907801
## 23 -0.789121 0.4518963
## 24 -0.023024 -0.2041215
## 25 -0.704045 0.2744655
## 26 0.963394 -0.4691790
## 27 0.539563 -0.0648037
## 28 0.355877 -0.5075153
## 29 -0.936233 0.5088727
## 30 -0.602172 0.4548931
## 31 -0.443708 0.4522429
## 32 -0.389529 0.2941604
## 33 -0.263124 0.2512193
## 34 0.259222 -0.4784728
## 35 0.359962 -0.0680159
## 36 0.150476 -0.3729425
## 37 0.014899 0.4623908

weights_sum <- matrix(0, nrow = 37, ncol = 2)
for (i in 1:13) {
  weights_sum <- weights_sum + indscal_fit$conf[[i]]
}
weights_sum <- weights_sum/13
weights_sum

##          D1          D2
## 1 -0.721198 0.6244633
## 2 -0.340493 0.1627731
## 3 -0.733105 0.4783178
## 4 -0.507200 -0.0009334
## 5 -0.418847 0.0195143
## 6 -0.128442 -0.0140283
## 7 -0.506323 0.2112472
## 8 0.001323 -0.4321986
## 9 0.677408 -0.3843331

```

```

## 10 -0.302935  0.3728373
## 11  0.547718 -0.2387103
## 12  0.645912 -0.4605492
## 13  0.736024 -0.6050035
## 14  0.844494 -0.6624011
## 15 -0.833446  0.6059387
## 16  0.951983 -0.2619406
## 17  0.723290  0.0098054
## 18  0.183905 -0.2398517
## 19  0.352429 -0.1525505
## 20 -0.107511  0.1007485
## 21  0.445138 -0.2798417
## 22 -0.064033  0.1860467
## 23 -0.756945  0.4406844
## 24 -0.022086 -0.1990571
## 25 -0.675337  0.2676558
## 26  0.924112 -0.4575384
## 27  0.517563 -0.0631959
## 28  0.341366 -0.4949236
## 29 -0.898058  0.4962472
## 30 -0.577618  0.4436069
## 31 -0.425616  0.4410225
## 32 -0.373646  0.2868621
## 33 -0.252395  0.2449864
## 34  0.248652 -0.4666016
## 35  0.345285 -0.0663284
## 36  0.144341 -0.3636896
## 37  0.014292  0.4509186

```

```
indscal_fit$gspace
```

```

##          D1          D2
## 1 -0.895148  0.1492325
## 2 -0.422619  0.0388991
## 3 -0.909927  0.1143071
## 4 -0.629534 -0.0002231
## 5 -0.519871  0.0046635
## 6 -0.159421 -0.0033524
## 7 -0.628445  0.0504833
## 8  0.001642 -0.1032856
## 9  0.840795 -0.0918469
## 10 -0.376001  0.0890996
## 11  0.679825 -0.0570463
## 12  0.801703 -0.1100608
## 13  0.913549 -0.1445821
## 14  1.048182 -0.1582988
## 15 -1.034469  0.1448056
## 16  1.181597 -0.0625978
## 17  0.897744  0.0023433
## 18  0.228262 -0.0573191
## 19  0.437433 -0.0364561
## 20 -0.133442  0.0240766
## 21  0.552503 -0.0668758
## 22 -0.079477  0.0444609

```

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## 23 -0.939517  0.1053135
## 24 -0.027412 -0.0475701
## 25 -0.838226  0.0639637
## 26  1.147003 -0.1093413
## 27  0.642396 -0.0151024
## 28  0.423702 -0.1182755
## 29 -1.114665  0.1185918
## 30 -0.716937  0.1060120
## 31 -0.528272  0.1053943
## 32 -0.463768  0.0685535
## 33 -0.313272  0.0585462
## 34  0.308626 -0.1115072
## 35  0.428566 -0.0158510
## 36  0.179155 -0.0869135
## 37  0.017739  0.1077593

indscal_fit$gspace - weights_sum

##          D1          D2
## 1 -0.1739495 -0.4752308
## 2 -0.0821253 -0.1238740
## 3 -0.1768215 -0.3640108
## 4 -0.1223341  0.0007103
## 5 -0.1010238 -0.0148508
## 6 -0.0309795  0.0106759
## 7 -0.1221225 -0.1607640
## 8  0.0003191  0.3289130
## 9  0.1633874  0.2924863
## 10 -0.0730664 -0.2837377
## 11  0.1321070  0.1816640
## 12  0.1557909  0.3504884
## 13  0.1775254  0.4604215
## 14  0.2036878  0.5041023
## 15 -0.2010230 -0.4611331
## 16  0.2296137  0.1993427
## 17  0.1744540 -0.0074621
## 18  0.0443570  0.1825326
## 19  0.0850042  0.1160944
## 20 -0.0259311 -0.0766719
## 21  0.1073650  0.2129659
## 22 -0.0154444 -0.1415858
## 23 -0.1825715 -0.3353709
## 24 -0.0053269  0.1514870
## 25 -0.1628881 -0.2036922
## 26  0.2228913  0.3481971
## 27  0.1248336  0.0480935
## 28  0.0823359  0.3766481
## 29 -0.2166072 -0.3776554
## 30 -0.1393187 -0.3375950
## 31 -0.1026564 -0.3356281
## 32 -0.0901217 -0.2183086
## 33 -0.0608765 -0.1864402
## 34  0.0599737  0.3550944
## 35  0.0832810  0.0504774

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## 36  0.0348143  0.2767760
## 37  0.0034470 -0.3431593

# IDIOSCAL
idioscal_fit$conf

## [[1]]
##          D1          D2
## 1 -1.0442  0.111644
## 2 -0.3819 -0.036134
## 3 -0.9169 -0.037543
## 4 -0.3687 -0.229996
## 5 -0.3376 -0.159755
## 6 -0.0770 -0.068778
## 7 -0.5461 -0.076585
## 8  0.3543 -0.312109
## 9  0.8201  0.025243
## 10 -0.5290  0.123459
## 11  0.6009  0.077478
## 12  0.8564 -0.037866
## 13  1.0398 -0.099509
## 14  1.1657 -0.092359
## 15 -1.1090  0.051977
## 16  0.9482  0.208727
## 17  0.5265  0.342079
## 18  0.3338 -0.081789
## 19  0.3924  0.047002
## 20 -0.1600  0.022318
## 21  0.5622  0.002618
## 22 -0.2018  0.102944
## 23 -0.9351  0.021940
## 24  0.1408 -0.142981
## 25 -0.7193 -0.108870
## 26  1.0570  0.091447
## 27  0.4208  0.204851
## 28  0.6567 -0.198956
## 29 -1.0693 -0.049258
## 30 -0.7912  0.053037
## 31 -0.6743  0.116949
## 32 -0.5121  0.032520
## 33 -0.3850  0.056310
## 34  0.5554 -0.221835
## 35  0.3064  0.112795
## 36  0.4026 -0.183824
## 37 -0.3814  0.332808
##
## [[2]]
##          D1          D2
## 1 -1.03873  0.125073
## 2 -0.37594 -0.040318
## 3 -0.90505 -0.041773
## 4 -0.35281 -0.257092
## 5 -0.32567 -0.178558
## 6 -0.07262 -0.076888

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## 7 -0.53625 -0.085512
## 8  0.36663 -0.349071
## 9  0.80995  0.028041
## 10 -0.52967  0.138168
## 11  0.59041  0.086498
## 12  0.84916 -0.042533
## 13  1.03376 -0.111503
## 14  1.15791 -0.103537
## 15 -1.09977  0.058369
## 16  0.92718  0.233179
## 17  0.50311  0.382385
## 18  0.33440 -0.091530
## 19  0.38572  0.052468
## 20 -0.15939  0.024992
## 21  0.55598  0.002801
## 22 -0.20498  0.115155
## 23 -0.92621  0.024744
## 24  0.14664 -0.159909
## 25 -0.70587 -0.121573
## 26  1.04085  0.102015
## 27  0.40571  0.228964
## 28  0.65994 -0.222616
## 29 -1.05522 -0.054838
## 30 -0.78546  0.059483
## 31 -0.67308  0.130922
## 32 -0.50829  0.036479
## 33 -0.38381  0.063051
## 34  0.56085 -0.248175
## 35  0.29724  0.126055
## 36  0.40782 -0.205638
## 37 -0.39446  0.372223
##
## [[3]]
##          D1          D2
## 1 -0.98643  0.0523848
## 2 -0.41639 -0.0263050
## 3 -0.96408 -0.0340855
## 4 -0.54291 -0.1406467
## 5 -0.46038 -0.0987519
## 6 -0.12838 -0.0416273
## 7 -0.61338 -0.0523317
## 8  0.13659 -0.1797600
## 9  0.85630  0.0255631
## 10 -0.45138  0.0660564
## 11  0.67003  0.0535708
## 12  0.84784 -0.0112431
## 13  0.99070 -0.0452740
## 14  1.12450 -0.0394156
## 15 -1.09578  0.0162975
## 16  1.11976  0.1356104
## 17  0.78514  0.2089040
## 18  0.28199 -0.0439775
## 19  0.43493  0.0328607
## 20 -0.14734  0.0111058

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## 21  0.57638  0.0088487
## 22 -0.13188  0.0581873
## 23 -0.93979  0.0008136
## 24  0.04055 -0.0826302
## 25 -0.81366 -0.0736514
## 26  1.14619  0.0677464
## 27  0.57805  0.1264713
## 28  0.52738 -0.1089930
## 29 -1.12830 -0.0429853
## 30 -0.77026  0.0210513
## 31 -0.60458  0.0603234
## 32 -0.49985  0.0125579
## 33 -0.35280  0.0282608
## 34  0.40727 -0.1238239
## 35  0.39458  0.0706070
## 36  0.27866 -0.1033549
## 37 -0.14927  0.1916355
##
## [[4]]
##          D1          D2
## 1  -1.07414  0.1217355
## 2  -0.36143 -0.0367757
## 3  -0.88777 -0.0363135
## 4  -0.26920 -0.2415987
## 5  -0.26725 -0.1675178
## 6  -0.04775 -0.0723691
## 7  -0.50661 -0.0789053
## 8   0.47648 -0.3309698
## 9   0.79747  0.0236744
## 10 -0.57147  0.1323378
## 11  0.56023  0.0796484
## 12  0.85904 -0.0431193
## 13  1.06485 -0.1089018
## 14  1.18592 -0.1018083
## 15 -1.11362  0.0589459
## 16  0.84870  0.2170196
## 17  0.37884  0.3594167
## 18  0.36217 -0.0876101
## 19  0.36729  0.0482176
## 20 -0.16667  0.0241579
## 21  0.55267  0.0007163
## 22 -0.24085  0.1094749
## 23 -0.93008  0.0265847
## 24  0.19705 -0.1515427
## 25 -0.66399 -0.1123760
## 26  1.00375  0.0927416
## 27  0.33085  0.2148483
## 28  0.72813 -0.2125503
## 29 -1.03312 -0.0481324
## 30 -0.80103  0.0589068
## 31 -0.71194  0.1259908
## 32 -0.51772  0.0362182
## 33 -0.40227  0.0608835
## 34  0.63764 -0.2363471

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## 35  0.25570  0.1180271
## 36  0.47169 -0.1956404
## 37 -0.51157  0.3529326
##
## [[5]]
##          D1         D2
## 1  -1.118185  0.15650
## 2  -0.300678 -0.03363
## 3  -0.791065 -0.02264
## 4  -0.015707 -0.26281
## 5  -0.085913 -0.18062
## 6   0.025904 -0.07938
## 7  -0.394863 -0.07750
## 8   0.765269 -0.37684
## 9   0.719297  0.01041
## 10 -0.660594  0.15826
## 11  0.444049  0.07726
## 12  0.841541 -0.06496
## 13  1.097066 -0.14207
## 14  1.202861 -0.13660
## 15 -1.093894  0.08759
## 16  0.579027  0.22399
## 17  0.003233  0.39140
## 18  0.422284 -0.10445
## 19  0.295014  0.04621
## 20 -0.178629  0.03013
## 21  0.513743 -0.01020
## 22 -0.330620  0.12631
## 23 -0.891588  0.04802
## 24  0.330741 -0.17213
## 25 -0.508816 -0.11152
## 26  0.844162  0.08297
## 27  0.099099  0.23189
## 28  0.884398 -0.25041
## 29 -0.914866 -0.03287
## 30 -0.802886  0.08132
## 31 -0.785180  0.15401
## 32 -0.517118  0.05050
## 33 -0.433632  0.07558
## 34  0.823299 -0.27502
## 35  0.123279  0.12592
## 36  0.629253 -0.22654
## 37 -0.819286  0.40192
##
## [[6]]
##          D1         D2
## 1  -1.084448  0.114736
## 2  -0.35845 -0.032210
## 3  -0.88495 -0.029908
## 4  -0.24919 -0.219128
## 5  -0.25340 -0.151649
## 6  -0.04175 -0.065756
## 7  -0.50017 -0.070070
## 8   0.50406 -0.303207

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## 9   0.79568  0.018717
## 10  -0.58259  0.122598
## 11   0.55374  0.070555
## 12   0.86281 -0.042350
## 13   1.07413 -0.103012
## 14   1.19463 -0.096983
## 15  -1.11876  0.057678
## 16   0.83087  0.194666
## 17   0.34908  0.326065
## 18   0.36952 -0.081105
## 19   0.36337  0.042612
## 20  -0.16872  0.022603
## 21   0.55273 -0.001323
## 22  -0.25000  0.100589
## 23  -0.93249  0.027542
## 24   0.20968 -0.138755
## 25  -0.65480 -0.099999
## 26   0.99627  0.080898
## 27   0.31308  0.194538
## 28   0.74594 -0.196230
## 29  -1.02935 -0.040155
## 30  -0.80609  0.056525
## 31  -0.72256  0.117318
## 32  -0.52084  0.034844
## 33  -0.40741  0.056901
## 34   0.65741 -0.217584
## 35   0.24596  0.106606
## 36   0.48804 -0.179909
## 37  -0.54099  0.323340
##
## [[7]]
##          D1         D2
## 1  -1.00790  0.107157
## 2  -0.39322 -0.036962
## 3  -0.92829 -0.040050
## 4  -0.44190 -0.228733
## 5  -0.38838 -0.159137
## 6  -0.09892 -0.068295
## 7  -0.57021 -0.077506
## 8   0.25441 -0.307689
## 9   0.82764  0.027574
## 10  -0.48922  0.120479
## 11   0.62527  0.078562
## 12   0.84380 -0.034753
## 13   1.00739 -0.095164
## 14   1.13547 -0.087691
## 15  -1.09174  0.047915
## 16   1.01426  0.209525
## 17   0.63539  0.340133
## 18   0.30744 -0.079868
## 19   0.40715  0.047748
## 20  -0.15273  0.021576
## 21   0.56266  0.004371
## 22  -0.16883  0.101217

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## 23 -0.92756  0.018746
## 24  0.09501 -0.141024
## 25 -0.75358 -0.109998
## 26  1.08551  0.093829
## 27  0.48600  0.204019
## 28  0.59278 -0.194774
## 29 -1.08435 -0.052124
## 30 -0.77381  0.049970
## 31 -0.63653  0.113578
## 32 -0.50142  0.030555
## 33 -0.36683  0.054495
## 34  0.48417 -0.217732
## 35  0.34221  0.112573
## 36  0.34369 -0.180607
## 37 -0.27483  0.328083
##
## [[8]]
##          D1          D2
## 1 -1.00384  0.121251
## 2 -0.38528 -0.045037
## 3 -0.91335 -0.050978
## 4 -0.41786 -0.270067
## 5 -0.37064 -0.188245
## 6 -0.09216 -0.080493
## 7 -0.55676 -0.093335
## 8  0.27604 -0.359608
## 9  0.81498  0.035916
## 10 -0.49278  0.139119
## 11  0.61104  0.094813
## 12  0.83597 -0.037082
## 13  1.00236 -0.107194
## 14  1.12822 -0.097878
## 15 -1.08184  0.051436
## 16  0.98456  0.250030
## 17  0.59992  0.401502
## 18  0.31001 -0.092298
## 19  0.39816  0.057743
## 20 -0.15255  0.024632
## 21  0.55521  0.007565
## 22 -0.17487  0.117927
## 23 -0.91738  0.017954
## 24  0.10519 -0.164914
## 25 -0.73519 -0.132221
## 26  1.06425  0.114706
## 27  0.46340  0.241285
## 28  0.60102 -0.225767
## 29 -1.06647 -0.065810
## 30 -0.76808  0.055225
## 31 -0.63767  0.130389
## 32 -0.49756  0.033645
## 33 -0.36660  0.062295
## 34  0.49564 -0.253153
## 35  0.32881  0.133457
## 36  0.35393 -0.210239

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## 37 -0.29785  0.383428
##
## [[9]]
##          D1          D2
## 1 -0.97145  0.097292
## 2 -0.40756 -0.036497
## 3 -0.94502 -0.041537
## 4 -0.52587 -0.217958
## 5 -0.44700 -0.151961
## 6 -0.12391 -0.064947
## 7 -0.59966 -0.075521
## 8  0.14347 -0.289829
## 9  0.83961  0.029345
## 10 -0.44671  0.111942
## 11  0.65523  0.076739
## 12  0.83321 -0.029504
## 13  0.97528 -0.085959
## 14  1.10638 -0.078387
## 15 -1.07697  0.040962
## 16  1.09264  0.202071
## 17  0.76021  0.324024
## 18  0.27922 -0.074275
## 19  0.42543  0.046748
## 20 -0.14527  0.019789
## 21  0.56558  0.006363
## 22 -0.13254  0.095004
## 23 -0.92297  0.014042
## 24  0.04411 -0.132924
## 25 -0.79525 -0.106961
## 26  1.12211  0.092994
## 27  0.56112  0.194773
## 28  0.52357 -0.181757
## 29 -1.10583 -0.053569
## 30 -0.75753  0.044166
## 31 -0.59686  0.104834
## 32 -0.49153  0.026893
## 33 -0.34794  0.050056
## 34  0.40639 -0.203888
## 35  0.38383  0.107765
## 36  0.27903 -0.169353
## 37 -0.15654  0.309026
##
## [[10]]
##          D1          D2
## 1 -0.92269  0.007092
## 2 -0.43107 -0.029544
## 3 -0.97504 -0.050381
## 4 -0.65339 -0.109989
## 5 -0.53645 -0.079483
## 6 -0.16169 -0.031633
## 7 -0.64668 -0.052648
## 8 -0.02040 -0.116909
## 9  0.86198  0.041582
## 10 -0.38607  0.031527

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## 11  0.70331  0.055096
## 12  0.82207  0.016607
## 13  0.93300 -0.002191
## 14  1.06928  0.005559
## 15 -1.06096 -0.020276
## 16  1.21496  0.123044
## 17  0.94964  0.162763
## 18  0.23886 -0.021517
## 19  0.45489  0.034478
## 20 -0.13500  0.003264
## 21  0.57303  0.022373
## 22 -0.07940  0.035344
## 23 -0.92123 -0.026236
## 24 -0.03119 -0.054373
## 25 -0.86146 -0.072683
## 26  1.18260  0.078192
## 27  0.67569  0.101465
## 28  0.42375 -0.058216
## 29 -1.14378 -0.061042
## 30 -0.73754 -0.007804
## 31 -0.54128  0.023309
## 32 -0.47956 -0.005806
## 33 -0.32183  0.008937
## 34  0.29318 -0.071605
## 35  0.44772  0.058694
## 36  0.18460 -0.061515
## 37  0.01815  0.124528
##
## [[11]]
##          D1      D2
## 1 -0.93195  0.059530
## 2 -0.42354 -0.034809
## 3 -0.96394 -0.047395
## 4 -0.61846 -0.177040
## 5 -0.51167 -0.124731
## 6 -0.15145 -0.052224
## 7 -0.63237 -0.068091
## 8  0.02163 -0.221795
## 9  0.85324  0.036263
## 10 -0.40024  0.079340
## 11  0.68854  0.069931
## 12  0.82205 -0.009346
## 13  0.94055 -0.050704
## 14  1.07504 -0.042730
## 15 -1.06134  0.014266
## 16  1.17939  0.173916
## 17  0.89782  0.262844
## 18  0.24836 -0.052921
## 19  0.44576  0.043025
## 20 -0.13716  0.012954
## 21  0.56912  0.014062
## 22 -0.09273  0.071321
## 23 -0.91845 -0.004061
## 24 -0.01180 -0.102072

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## 25 -0.84149 -0.095564
## 26  1.16297  0.090047
## 27  0.64399  0.159681
## 28  0.44782 -0.132083
## 29 -1.13006 -0.059298
## 30 -0.74008  0.021907
## 31 -0.55362  0.071416
## 32 -0.48095  0.012851
## 33 -0.32739  0.033083
## 34  0.32114 -0.151090
## 35  0.42980  0.089535
## 36  0.20813 -0.126444
## 37 -0.02664  0.236428
##
## [[12]]
##          D1          D2
## 1 -0.91309  0.100813
## 2 -0.41685 -0.041742
## 3 -0.94773 -0.049953
## 4 -0.61249 -0.239582
## 5 -0.50608 -0.167445
## 6 -0.15026 -0.071224
## 7 -0.62286 -0.085136
## 8  0.01452 -0.314298
## 9  0.83872  0.036165
## 10 -0.39052  0.119403
## 11  0.67806  0.086741
## 12  0.80672 -0.027834
## 13  0.92181 -0.088474
## 14  1.05407 -0.079578
## 15 -1.04149  0.039049
## 16  1.16306  0.225194
## 17  0.88934  0.356060
## 18  0.24221 -0.079313
## 19  0.43890  0.052975
## 20 -0.13425  0.020771
## 21  0.55913  0.009791
## 22 -0.08887  0.102591
## 23 -0.90177  0.010571
## 24 -0.01468 -0.144257
## 25 -0.82898 -0.120303
## 26  1.14441  0.106783
## 27  0.63704  0.214559
## 28  0.43563 -0.194898
## 29 -1.11117 -0.063848
## 30 -0.72587  0.044154
## 31 -0.54132  0.110914
## 32 -0.47176  0.026733
## 33 -0.32039  0.052640
## 34  0.31069 -0.219548
## 35  0.42464  0.119085
## 36  0.20050 -0.182659
## 37 -0.01900  0.335097
##

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## [[13]]
##          D1          D2
## 1 -0.95375  0.1731477
## 2 -0.38134 -0.0507632
## 3 -0.89470 -0.0489305
## 4 -0.45050 -0.3382286
## 5 -0.39103 -0.2343369
## 6 -0.10285 -0.1013879
## 7 -0.55578 -0.1095220
## 8  0.20782 -0.4652470
## 9  0.79674  0.0314077
## 10 -0.45491  0.1868857
## 11  0.60869  0.1104435
## 12  0.80492 -0.0624069
## 13  0.95467 -0.1551279
## 14  1.07834 -0.1454520
## 15 -1.04109  0.0851761
## 16  0.99701  0.3024530
## 17  0.64909  0.5032178
## 18  0.28539 -0.1236855
## 19  0.39596  0.0667969
## 20 -0.14390  0.0342559
## 21  0.53996 -0.0002393
## 22 -0.14999  0.1540771
## 23 -0.88710  0.0393775
## 24  0.07454 -0.2129774
## 25 -0.73539 -0.1561094
## 26  1.05174  0.1278080
## 27  0.48989  0.3005733
## 28  0.54547 -0.2997338
## 29 -1.04574 -0.0651790
## 30 -0.73603  0.0844177
## 31 -0.59694  0.1783005
## 32 -0.47715  0.0519601
## 33 -0.34530  0.0862925
## 34  0.43866 -0.3329045
## 35  0.34130  0.1649537
## 36  0.30832 -0.2754410
## 37 -0.22500  0.4961281

weights_sum <- matrix(0, nrow = 37, ncol = 2)
for (i in 1:13) {
  weights_sum <- weights_sum + idioscal_fit$conf[[i]]
}
weights_sum <- weights_sum/13
weights_sum

##          D1          D2
## 1 -1.00391  0.103719
## 2 -0.38721 -0.036979
## 3 -0.91676 -0.040884
## 4 -0.42454 -0.225605
## 5 -0.37549 -0.157092
## 6 -0.09406 -0.067308

```

```

## 7 -0.56013 -0.077128
## 8 0.26929 -0.302103
## 9 0.81782  0.028454
## 10 -0.49116 0.117660
## 11 0.61458  0.078256
## 12 0.83735 -0.032799
## 13 1.00272 -0.091929
## 14 1.12910 -0.084374
## 15 -1.08356 0.045337
## 16 0.99228  0.207648
## 17 0.60979  0.335446
## 18 0.30889 -0.078026
## 19 0.40038  0.047606
## 20 -0.15243 0.020965
## 21 0.55680  0.005211
## 22 -0.17288 0.099241
## 23 -0.91937 0.016926
## 24 0.10205 -0.138499
## 25 -0.73983 -0.109371
## 26 1.06937  0.094013
## 27 0.46960  0.201378
## 28 0.59789 -0.190537
## 29 -1.07058 -0.053008
## 30 -0.76892  0.047874
## 31 -0.63660  0.110635
## 32 -0.49814  0.029227
## 33 -0.36625  0.052984
## 34 0.49167 -0.213285
## 35 0.33242  0.111236
## 36 0.35049 -0.177013
## 37 -0.29066 0.322121

```

`idiосcal_fit$gspace`

```

##          D1          D2
## 1 -1.0158  0.065652
## 2 -0.3927 -0.022272
## 3 -0.9292 -0.023879
## 4 -0.4328 -0.138830
## 5 -0.3823 -0.096548
## 6 -0.0961 -0.041469
## 7 -0.5684 -0.046830
## 8  0.2692 -0.187181
## 9  0.8288  0.016345
## 10 -0.4962  0.073490
## 11  0.6235  0.047445
## 12  0.8479 -0.021553
## 13  1.0147 -0.058361
## 14  1.1428 -0.053883
## 15 -1.0971  0.029680
## 16  1.0077  0.126864
## 17  0.6218  0.206455
## 18  0.3120 -0.048709
## 19  0.4062  0.028822

```

```

## 20 -0.1542  0.013194
## 21  0.5641  0.002374
## 22 -0.1739  0.061618
## 23 -0.9312  0.011865
## 24  0.1017 -0.085780
## 25 -0.7508 -0.066490
## 26  1.0844  0.056493
## 27  0.4781  0.123784
## 28  0.6034 -0.118707
## 29 -1.0852 -0.031141
## 30 -0.7784  0.030769
## 31 -0.6436  0.069368
## 32 -0.5043  0.018828
## 33 -0.3704  0.033314
## 34  0.4955 -0.132609
## 35  0.3381  0.068264
## 36  0.3529 -0.109969
## 37 -0.2906  0.199589

idioscal_fit$gspace - weights_sum

##          D1      D2
## 1 -0.0118452 -0.038067
## 2 -0.0054952  0.014707
## 3 -0.0124489  0.017004
## 4 -0.0082524  0.086775
## 5 -0.0067882  0.060544
## 6 -0.0020370  0.025839
## 7 -0.0082339  0.030298
## 8 -0.0001239  0.114922
## 9  0.0110090 -0.012108
## 10 -0.0049899 -0.044170
## 11  0.0089576 -0.030812
## 12  0.0105264  0.011246
## 13  0.0119716  0.033568
## 14  0.0137108  0.030491
## 15 -0.0135867 -0.015658
## 16  0.0154411 -0.080784
## 17  0.0119907 -0.128990
## 18  0.0030896  0.029317
## 19  0.0057950 -0.018784
## 20 -0.0017357 -0.007772
## 21  0.0073248 -0.002838
## 22 -0.0010603 -0.037624
## 23 -0.0117872 -0.005061
## 24 -0.0003361  0.052719
## 25 -0.0109656  0.042881
## 26  0.0150788 -0.037520
## 27  0.0085485 -0.077595
## 28  0.0055047  0.071830
## 29 -0.0146011  0.021867
## 30 -0.0094524 -0.017105
## 31 -0.0069713 -0.041267
## 32 -0.0061453 -0.010399

```

```

## 33 -0.0041391 -0.019669
## 34  0.0038455  0.080676
## 35  0.0056744 -0.042972
## 36  0.0024407  0.067043
## 37  0.0000861 -0.122532

```

7.3 What is the MDS Solution for the Average of the Separate Distance Matrices?

Here we do a simple MDS but on the average distance matrix from the 13 sources. This will provide some insight into what the group space in weighted MDS represents.

```

# INDSCAL

# The distance matrices for each source are created and averaged.
dist_sum <- matrix(0, nrow = 37, ncol = 37)
for (i in 1:13) {
  dist_sum <- dist_sum + as.matrix(Presidents_Dist[[i]])
}
dist_mean <- dist_sum/13
dist_mean <- as.dist(dist_mean)

```

7.3.1 Stress Plot

```

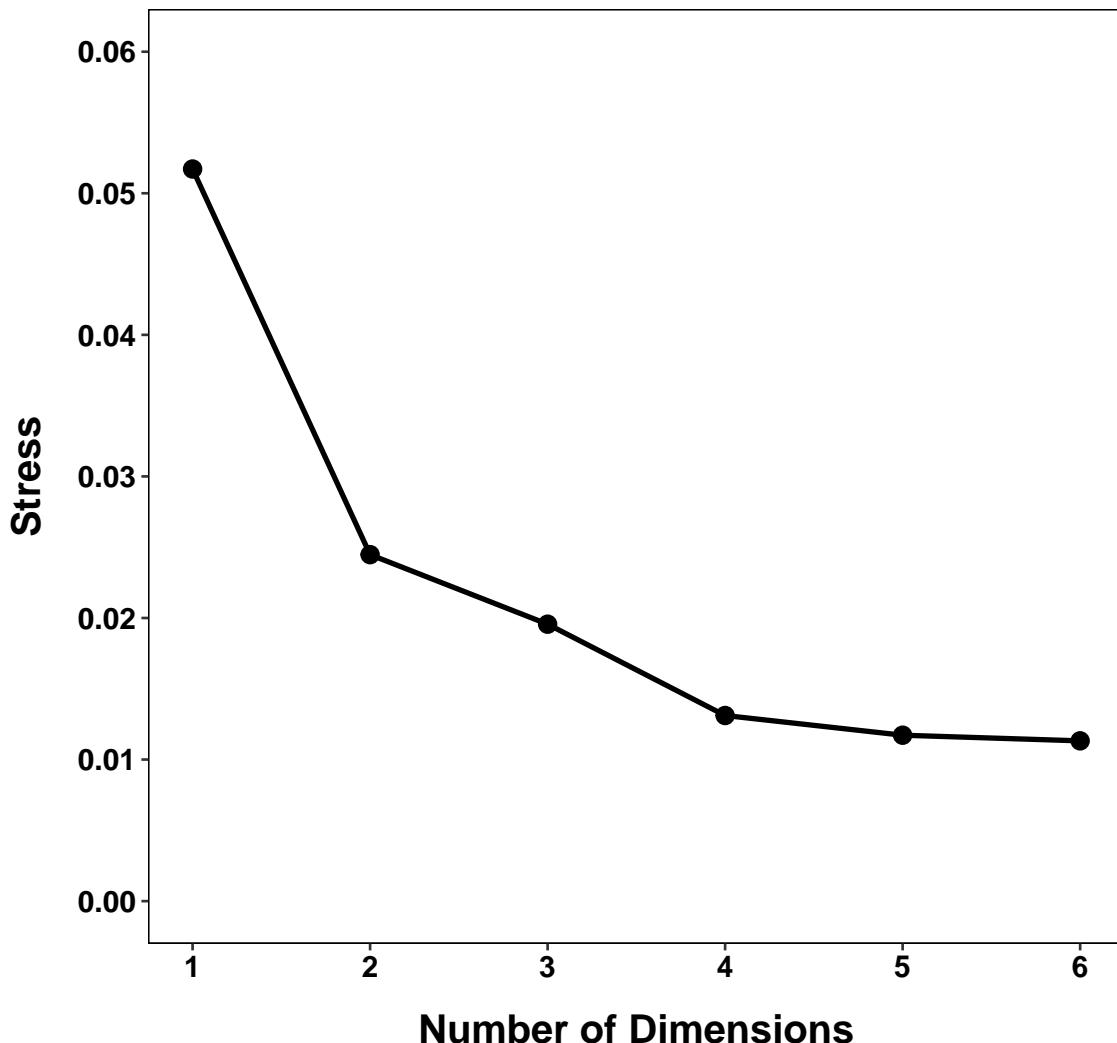
mds_stress <- matrix(NA, nrow = 6, ncol = 2)
for (i in 1:6) {
  mds_1 <- smacofSym(dist_mean, ndim = i, verbose = FALSE, type = "ordinal")
  mds_stress[i, 1] <- i
  mds_stress[i, 2] <- mds_1$stress
}

plot_data <- as.data.frame(mds_stress)
names(plot_data) <- c("D", "Stress")

ggplot(plot_data, aes(x = D, y = Stress)) + geom_point(shape = 19,
  size = 3, color = "black", na.rm = TRUE) + geom_line(size = 1) +
  scale_y_continuous(breaks = c(seq(0, 0.06, 0.01))) + scale_x_continuous(breaks = c(seq(1,
  6, 1))) + coord_cartesian(xlim = c(1, 6), ylim = c(0, 0.06)) +
  xlab("Number of Dimensions") + ylab("Stress") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Stress Plot for Mean President Distances")

```

Stress Plot for Mean President Distances



7.3.2 Shepard Plots

Shepard plots for up to 4 dimensions.

```
mds_2 <- smacofSym(dist_mean, ndim = 1, verbose = FALSE, type = "ordinal")
dist_mean_1_fits <- Shepard(dist_mean, mds_2$conf)
mds_2 <- smacofSym(dist_mean, ndim = 2, verbose = FALSE, type = "ordinal")
dist_mean_2_fits <- Shepard(dist_mean, mds_2$conf)
mds_2 <- smacofSym(dist_mean, ndim = 3, verbose = FALSE, type = "ordinal")
dist_mean_3_fits <- Shepard(dist_mean, mds_2$conf)
mds_2 <- smacofSym(dist_mean, ndim = 4, verbose = FALSE, type = "ordinal")
dist_mean_4_fits <- Shepard(dist_mean, mds_2$conf)
```

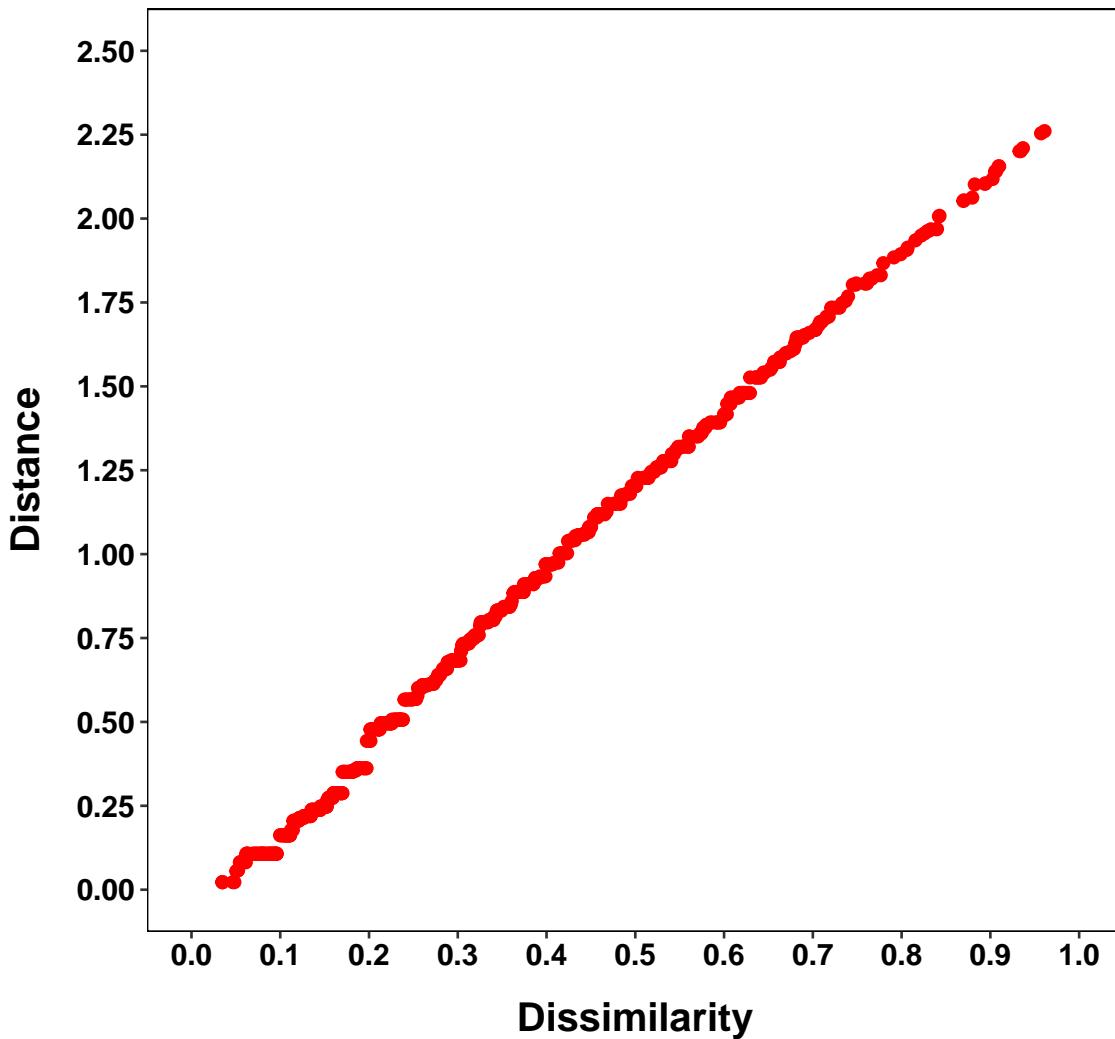
```

plot_data <- as.data.frame(dist_mean_1_fits)

ggplot(plot_data, aes(x = x, y = yf)) + geom_point(shape = 19, size = 2,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  coord_cartesian(xlim = c(0, 1), ylim = c(0, 2.5)) + xlab("Dissimilarity") +
  ylab("Distance") + theme(text = element_text(size = 14, family = "sans",
  color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin =
  margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Shepard Plot: One-Dimensional Space")

```

Shepard Plot: One-Dimensional Space



```
plot_data <- as.data.frame(dist_mean_2_fits)

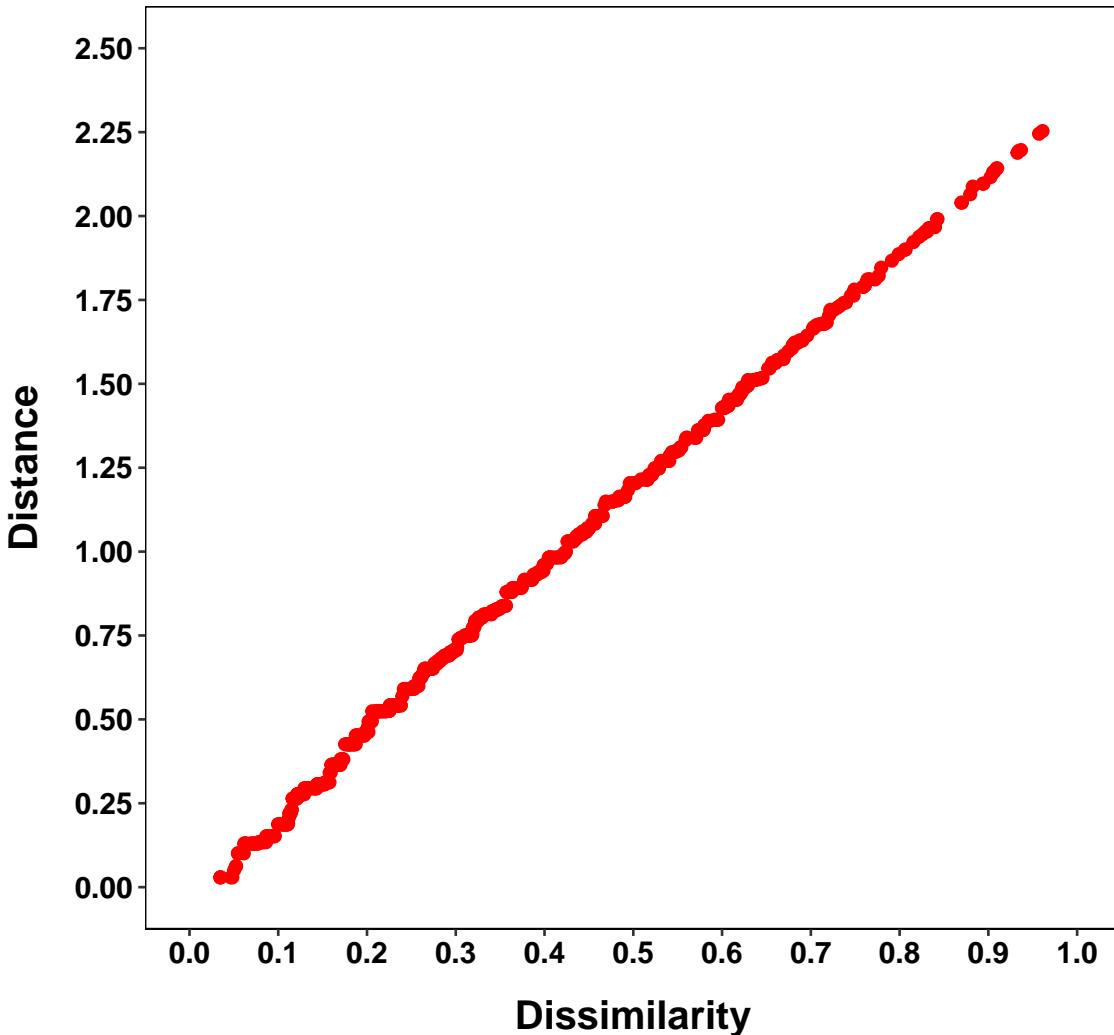
ggplot(plot_data, aes(x = x, y = yf)) + geom_point(shape = 19, size = 2,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  coord_cartesian(xlim = c(0, 1), ylim = c(0, 2.5)) + xlab("Dissimilarity") +
  ylab("Distance") + theme(text = element_text(size = 14, family = "sans",
  color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin =
  margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
```

```

linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Shepard Plot: Two-Dimensional Space")

```

Shepard Plot: Two-Dimensional Space



```

plot_data <- as.data.frame(dist_mean_3_fits)

ggplot(plot_data, aes(x = x, y = yf)) + geom_point(shape = 19, size = 2,
color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
coord_cartesian(xlim = c(0, 1), ylim = c(0, 2.5)) + xlab("Dissimilarity") +
ylab("Distance") + theme(text = element_text(size = 14, family = "sans",
color = "black", face = "bold"), axis.text.y = element_text(colour = "black",

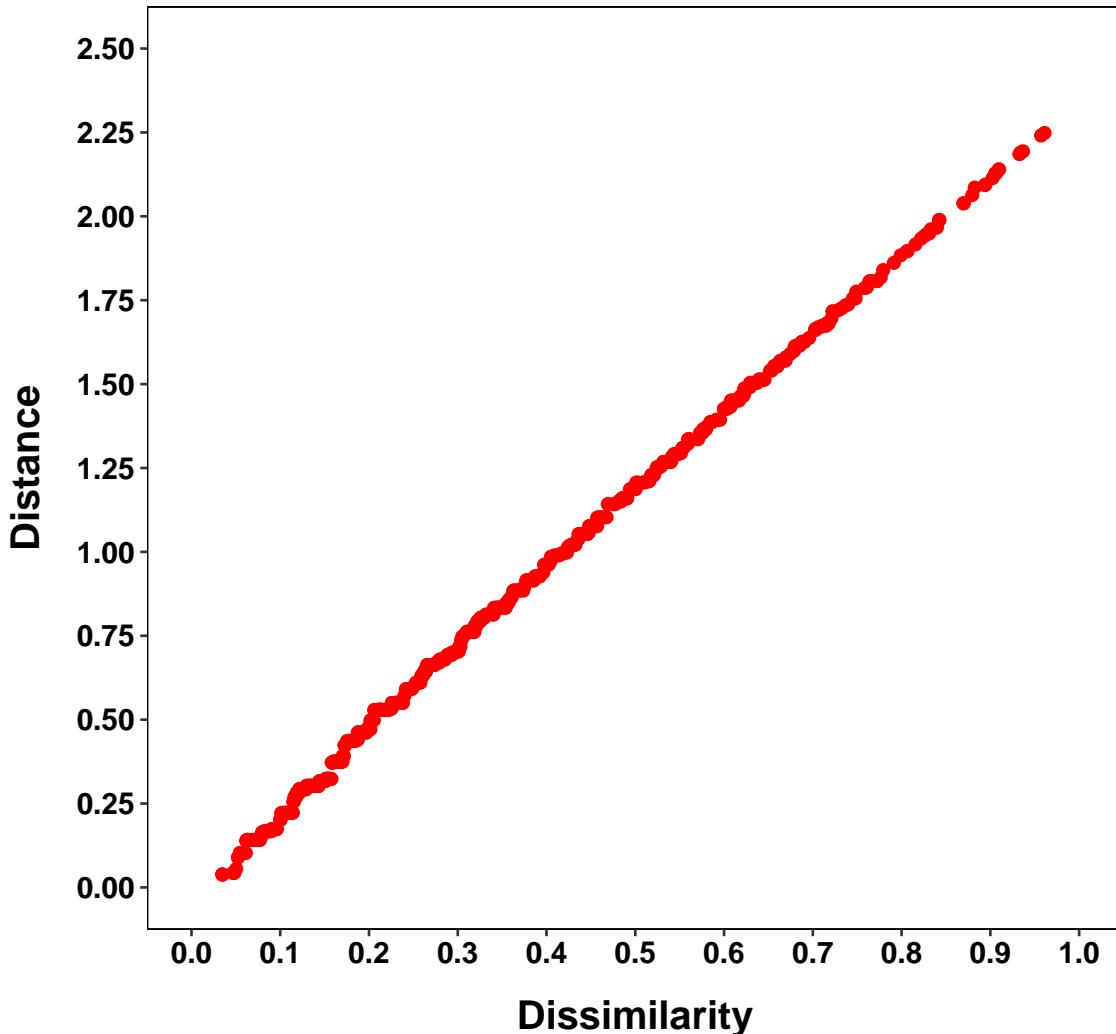
```

```

size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin = margin(15,
0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Shepard Plot: Three-Dimensional Space")

```

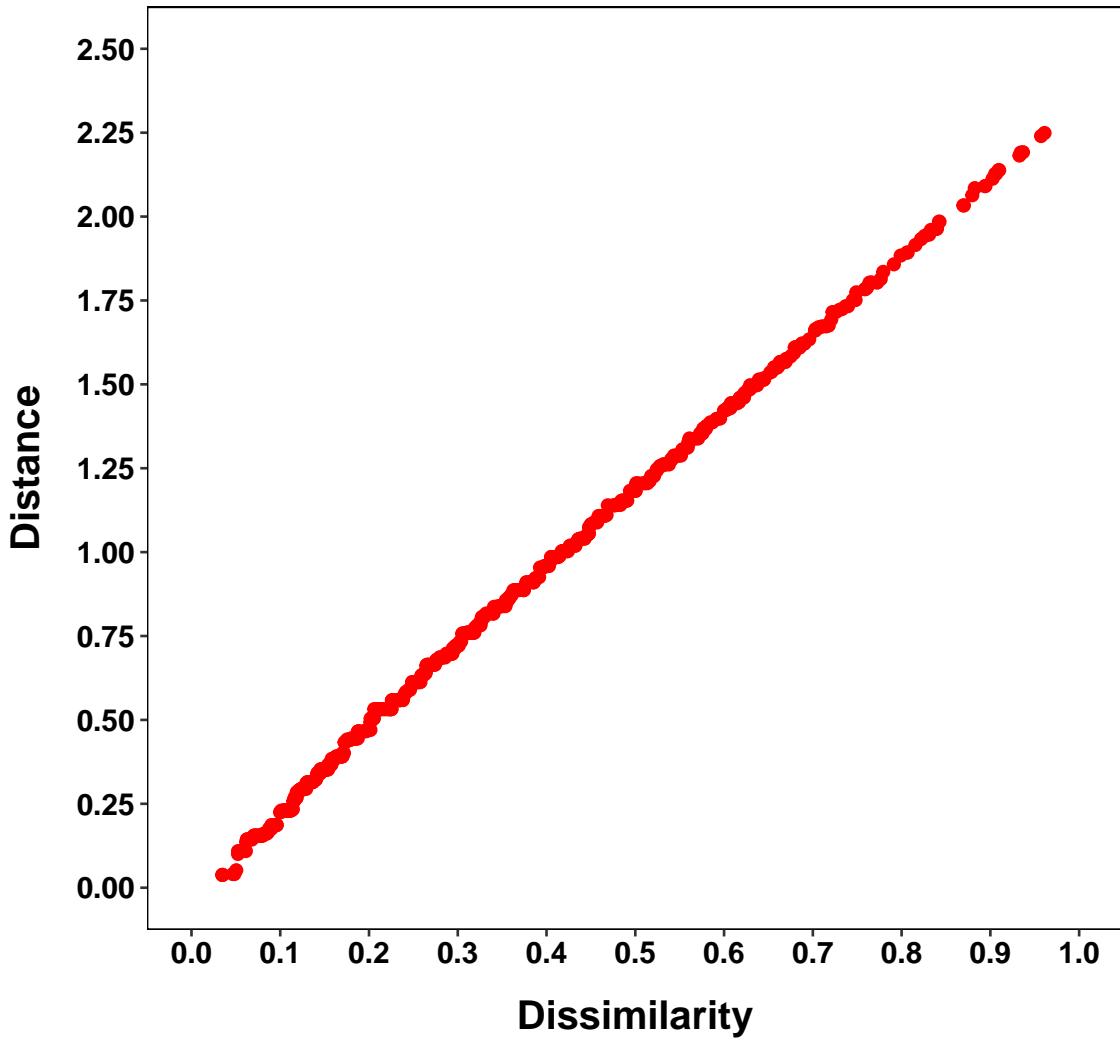
Shepard Plot: Three-Dimensional Space



```
plot_data <- as.data.frame(dist_mean_4_fits)
```

```
ggplot(plot_data, aes(x = x, y = yf)) + geom_point(shape = 19, size = 2,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  coord_cartesian(xlim = c(0, 1), ylim = c(0, 2.5)) + xlab("Dissimilarity") +
  ylab("Distance") + theme(text = element_text(size = 14, family = "sans",
  color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 0), axis.title.x = element_text(margin =
  margin(15, 0, 0, 0), size = 16), axis.title.y = element_text(margin =
  margin(0, 15, 0, 0), size = 16), axis.line.x = element_blank(),
  axis.line.y = element_blank(), plot.title = element_text(size = 16, face =
  "bold", margin = margin(0, 0, 20, 0), hjust = 0.5), panel.background =
  element_rect(fill = "white", linetype = 1, color = "black"),
  panel.grid.major = element_blank(), panel.grid.minor = element_blank(),
  plot.background = element_rect(fill = "white"), plot.margin =
  unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Shepard Plot: Four-Dimensional Space")
```

Shepard Plot: Four-Dimensional Space



```
plot_data <- as.data.frame(dist_mean_1_fits)
plot_data <- rbind(plot_data, dist_mean_2_fits)
plot_data <- rbind(plot_data, dist_mean_3_fits)
plot_data <- rbind(plot_data, dist_mean_4_fits)
plot_data$D <- c(rep(1, 666), rep(2, 666), rep(3, 666), rep(4, 666))

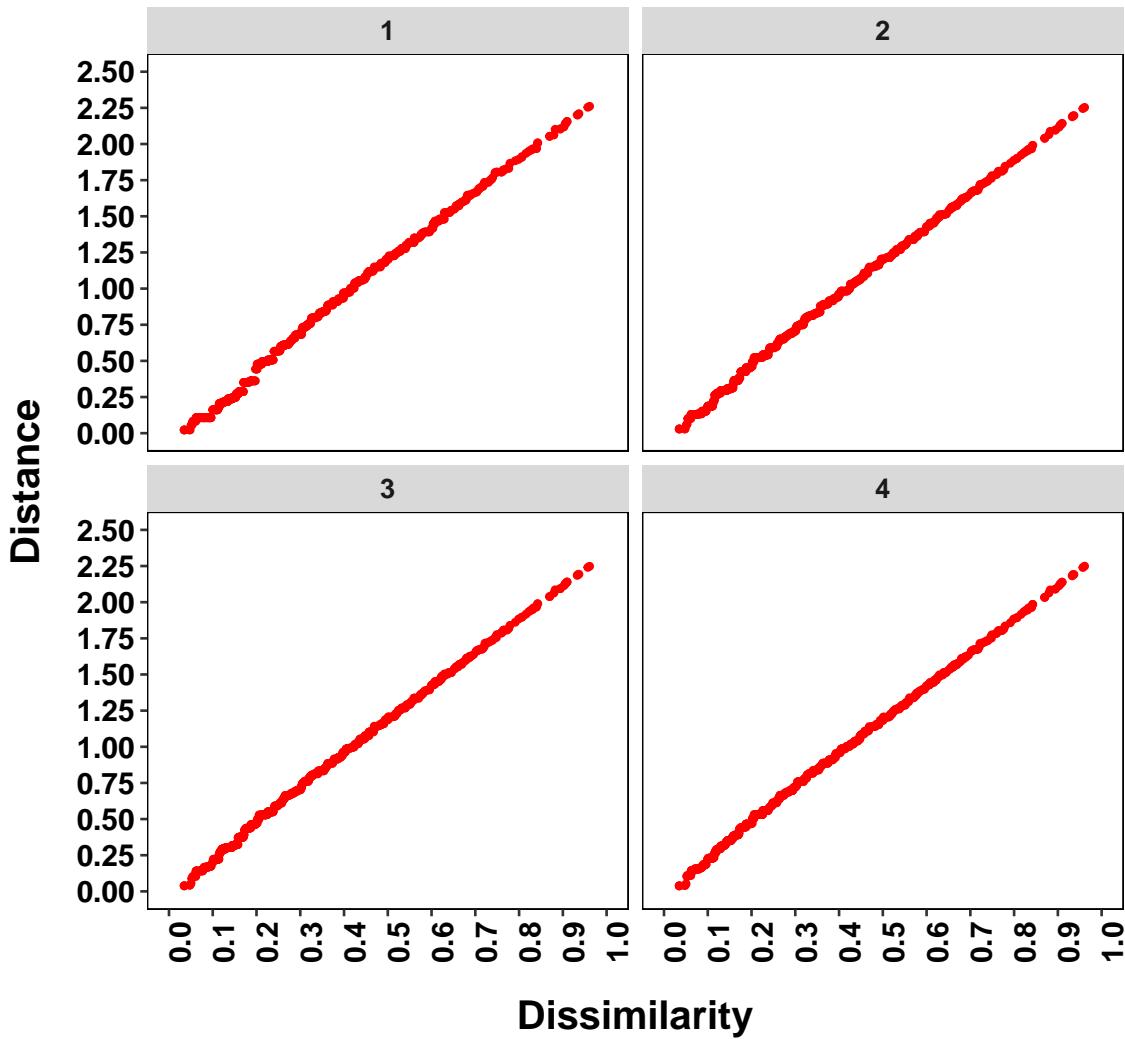
p <- ggplot(plot_data, aes(x = x, y = yf)) + geom_point(shape = 19,
  size = 1, color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(0,
  2.5, 0.25))) + scale_x_continuous(breaks = c(seq(0, 1, 0.1))) +
  coord_cartesian(xlim = c(0, 1), ylim = c(0, 2.5)) + xlab("Dissimilarity") +
  ylab("Distance") + theme(text = element_text(size = 14, family = "sans",
  color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
```

```

0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
plot.title = element_text(size = 16, face = "bold", margin = margin(0,
0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
linetype = 1, color = "black"), panel.grid.major = element_blank(),
panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
legend.title = element_blank()) + ggtitle("Shepard Plots as a Function of Dimensions")
p + facet_wrap(~D, nrow = 2)

```

Shepard Plots as a Function of Dimensions



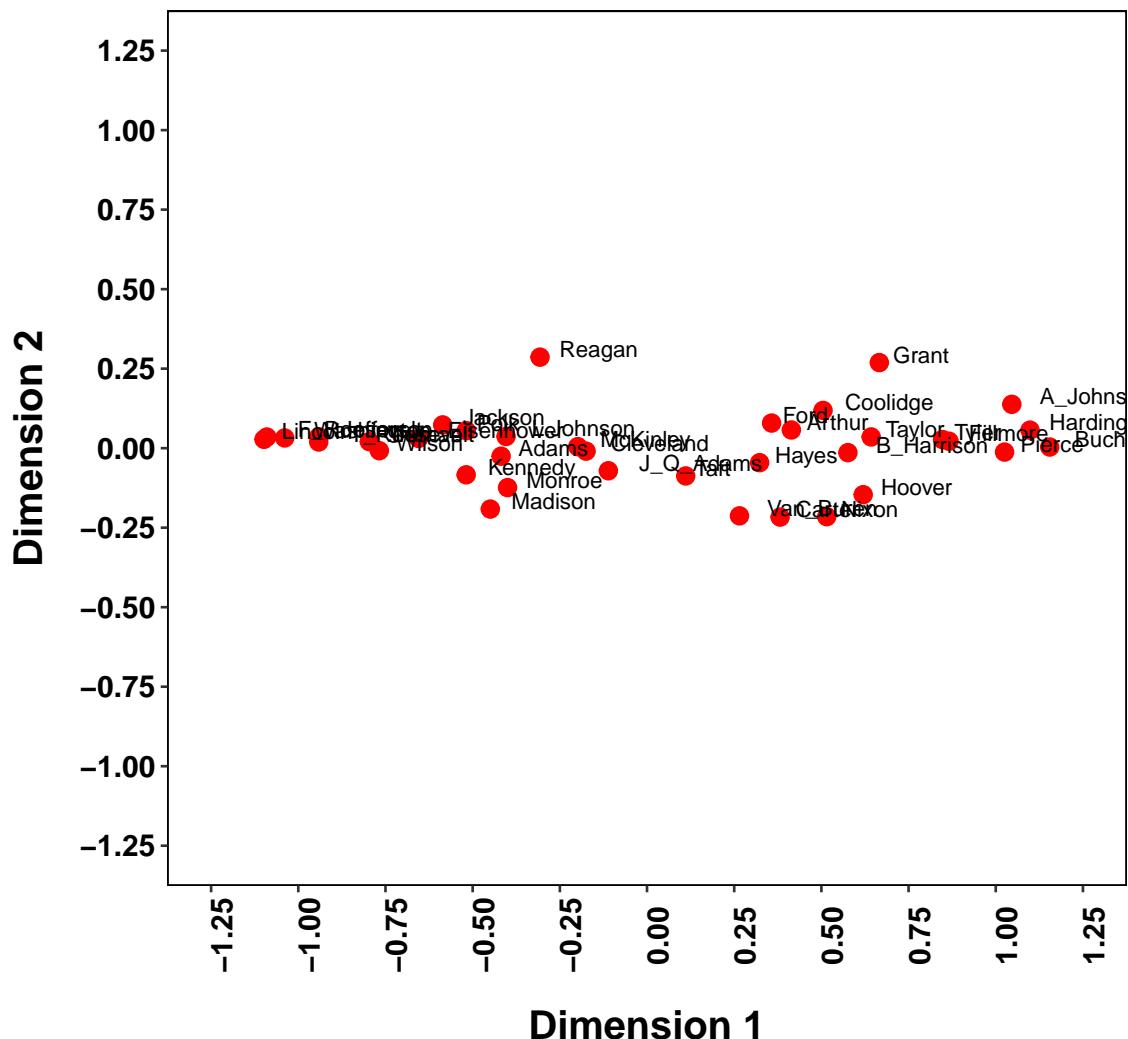
7.3.3 Scatterplots

```
mds_2 <- smacofSym(dist_mean, ndim = 2, verbose = FALSE, type = "ordinal")
```

```
plot_data <- as.data.frame(mds_2$conf)
names(plot_data) <- c("D1", "D2")
plot_data$Name <- Presidents$Name

ggplot(plot_data, aes(x = D1, y = D2)) + geom_point(shape = 19, size = 3,
  color = "red", na.rm = TRUE) + scale_y_continuous(breaks = c(seq(-1.25,
  1.25, 0.25))) + scale_x_continuous(breaks = c(seq(-1.25, 1.25,
  0.25))) + geom_text(aes(label = Name), hjust = -0.25, vjust = 0,
  size = 3) + coord_cartesian(xlim = c(-1.25, 1.25), ylim = c(-1.25,
  1.25)) + xlab("Dimension 1") + ylab("Dimension 2") + theme(text = element_text(size = 14,
  family = "sans", color = "black", face = "bold"), axis.text.y = element_text(colour = "black",
  size = 12, face = "bold"), axis.text.x = element_text(colour = "black",
  size = 12, face = "bold", angle = 90), axis.title.x = element_text(margin = margin(15,
  0, 0, 0), size = 16), axis.title.y = element_text(margin = margin(0,
  15, 0, 0), size = 16), axis.line.x = element_blank(), axis.line.y = element_blank(),
  plot.title = element_text(size = 16, face = "bold", margin = margin(0,
  0, 20, 0), hjust = 0.5), panel.background = element_rect(fill = "white",
  linetype = 1, color = "black"), panel.grid.major = element_blank(),
  panel.grid.minor = element_blank(), plot.background = element_rect(fill = "white"),
  plot.margin = unit(c(1, 1, 1, 1), "cm"), legend.position = "bottom",
  legend.title = element_blank()) + ggtitle("Two-Dimensional Space")
```

Two-Dimensional Space



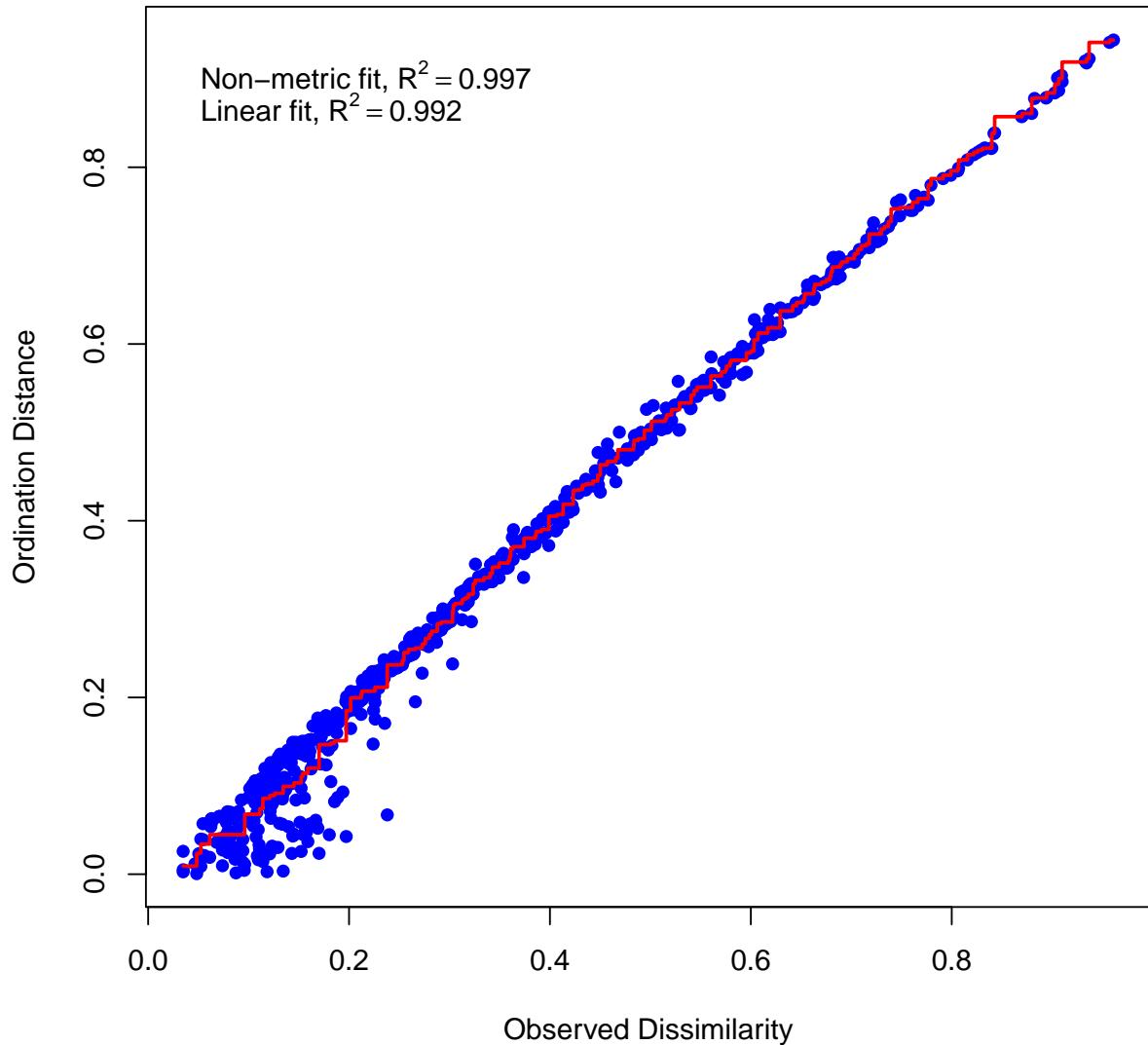
7.3.4 Additional Functions and Output

The `isoMDS()` function in the `MASS` package along with the `stressplot()` function in the `vegan` package can produce nice looking Shepard plots. These include linear and nonmetric fit indices. The former is the usual linear squared multiple correlation. The latter is 1 minus the stress squared.

```
mds_4 <- isoMDS(dist_mean, k = 1)

## initial value 5.711558
## final value 5.171820
## converged

stressplot(mds_4, dist_mean, pch = 16)
```

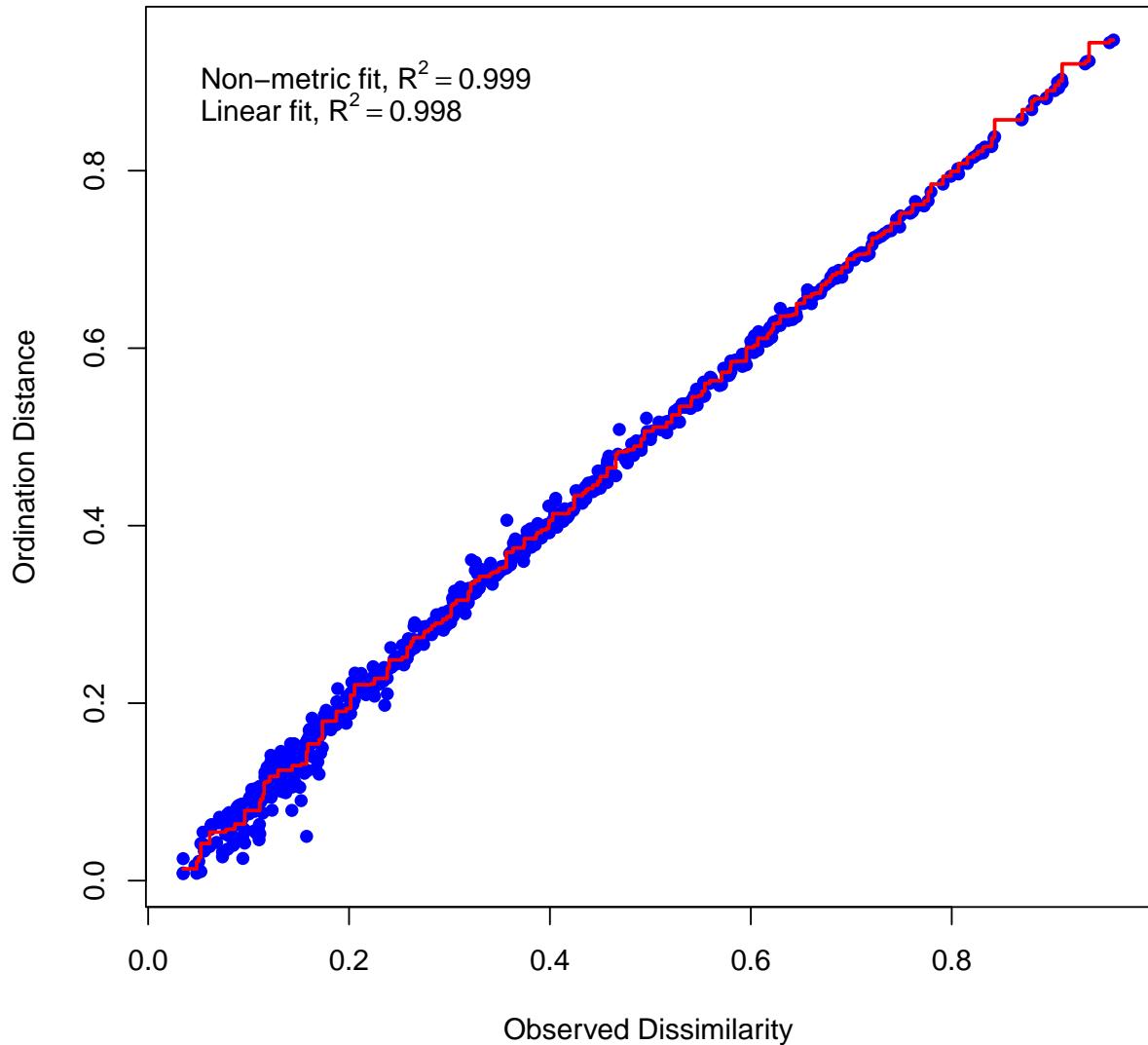


```

mds_4 <- isoMDS(dist_mean, k = 2)

## initial value 3.571727
## iter 5 value 2.497162
## iter 10 value 2.441123
## iter 10 value 2.438988
## iter 10 value 2.438108
## final value 2.438108
## converged

stressplot(mds_4, dist_mean, pch = 16)
  
```

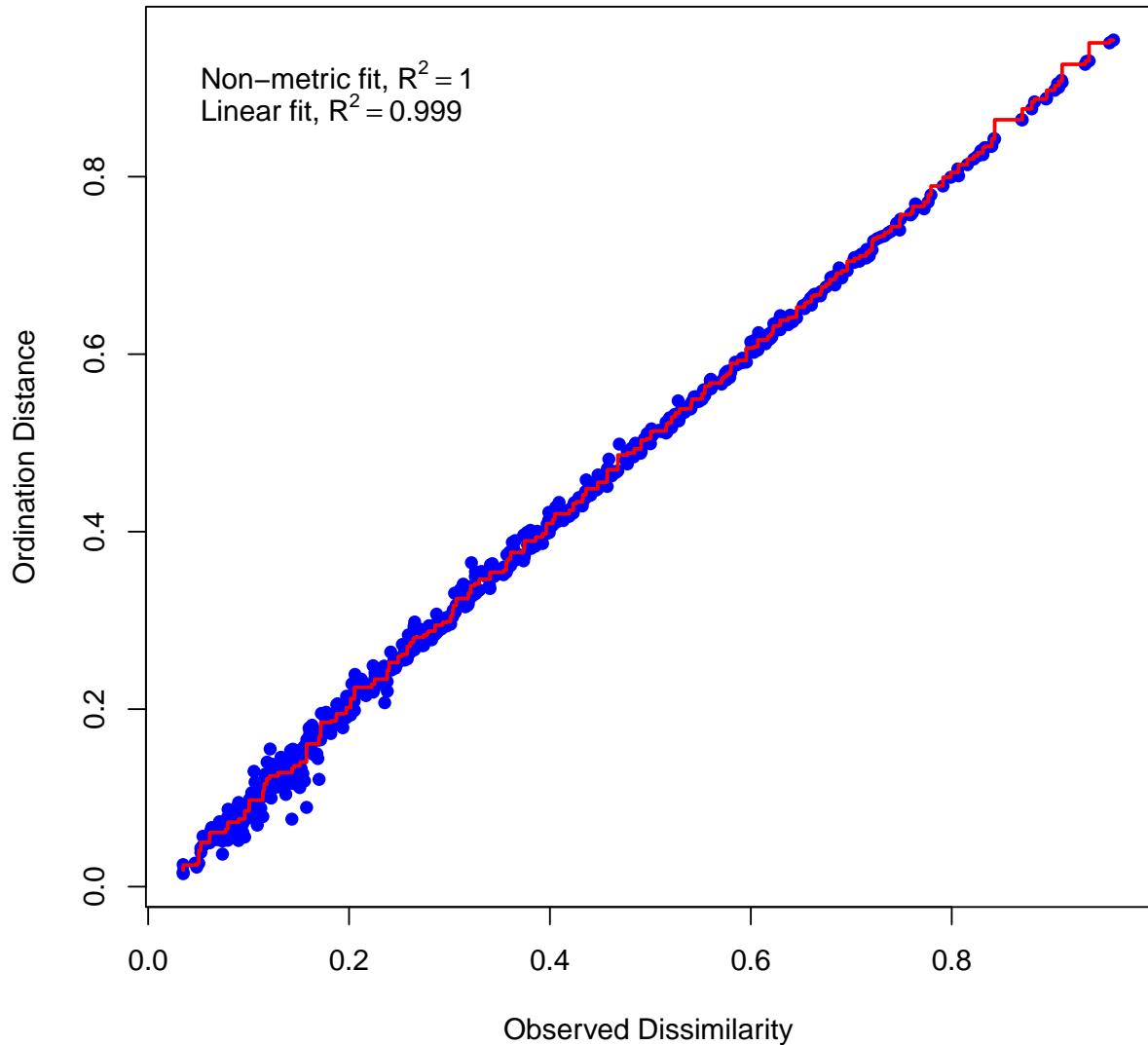


```

mds_4 <- isoMDS(dist_mean, k = 3)

## initial value 3.168015
## iter 5 value 2.217699
## iter 10 value 2.027786
## iter 15 value 1.973645
## iter 20 value 1.956212
## iter 25 value 1.917978
## final value 1.911416
## converged

stressplot(mds_4, dist_mean, pch = 16)
  
```



```
mds_4 <- isoMDS(dist_mean, k = 4)

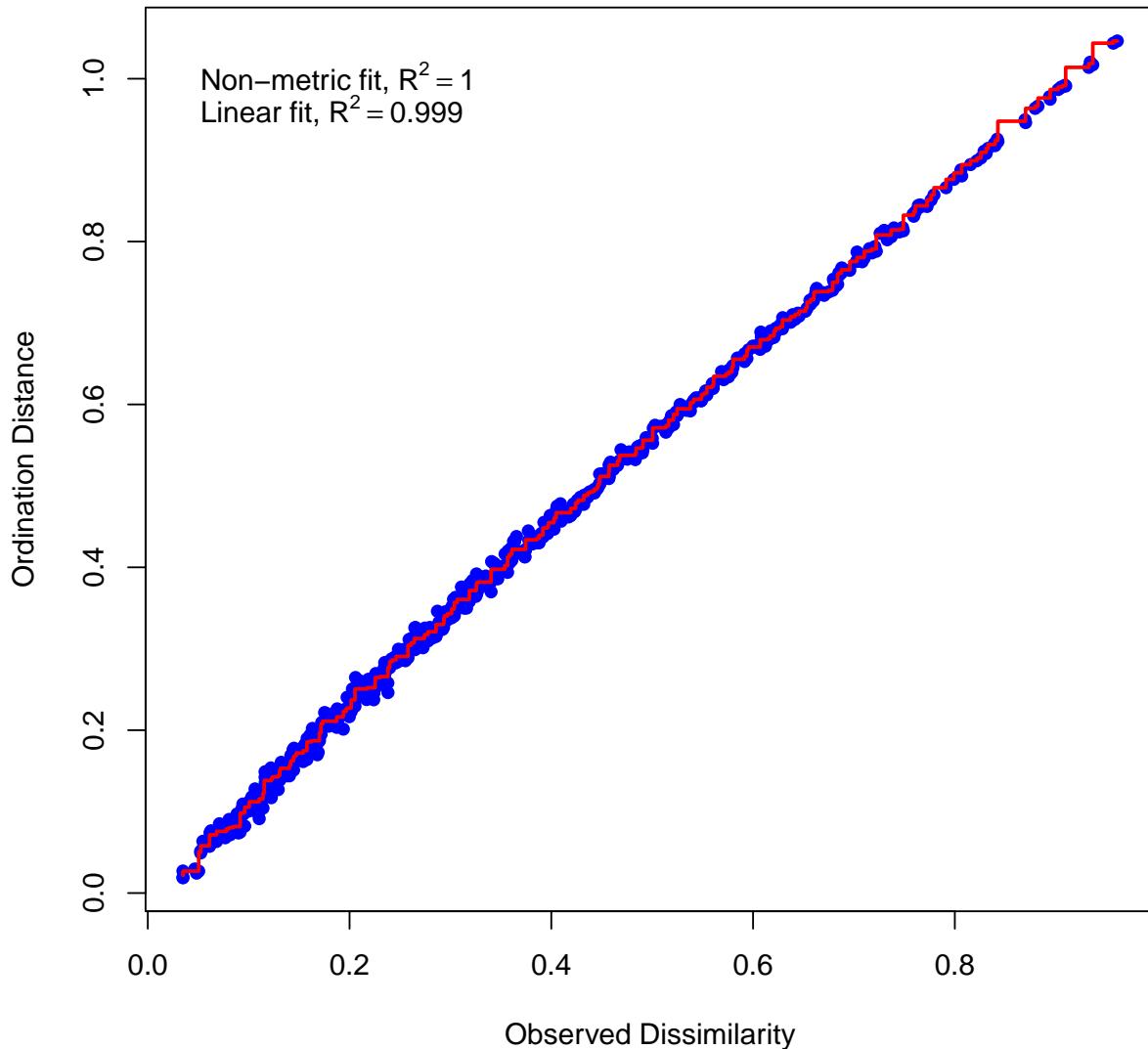
## initial value 2.286049
## iter 5 value 1.603686
## iter 10 value 1.400003
## iter 15 value 1.340015
## iter 20 value 1.313398
## iter 25 value 1.296809
## iter 30 value 1.279264
## iter 35 value 1.261654
## iter 40 value 1.240134
## iter 40 value 1.239786
## iter 45 value 1.199089
## iter 50 value 1.186972
```

```

## final value 1.186972
## stopped after 50 iterations

stressplot(mds_4, dist_mean, pch = 16)

```



The metaMDS() function in the vegan package can provide some other useful features. In particular it runs the analysis from multiple start points to find the best solution and insure that a local minimum has not been found.

```

mds_4 <- metaMDS(dist_mean, k = 1, distance = "euclidean", autotransform = FALSE)

## Run 0 stress 0.05171
## Run 1 stress 0.0516
## ... New best solution
## ... Procrustes: rmse 0.0008918 max resid 0.003544

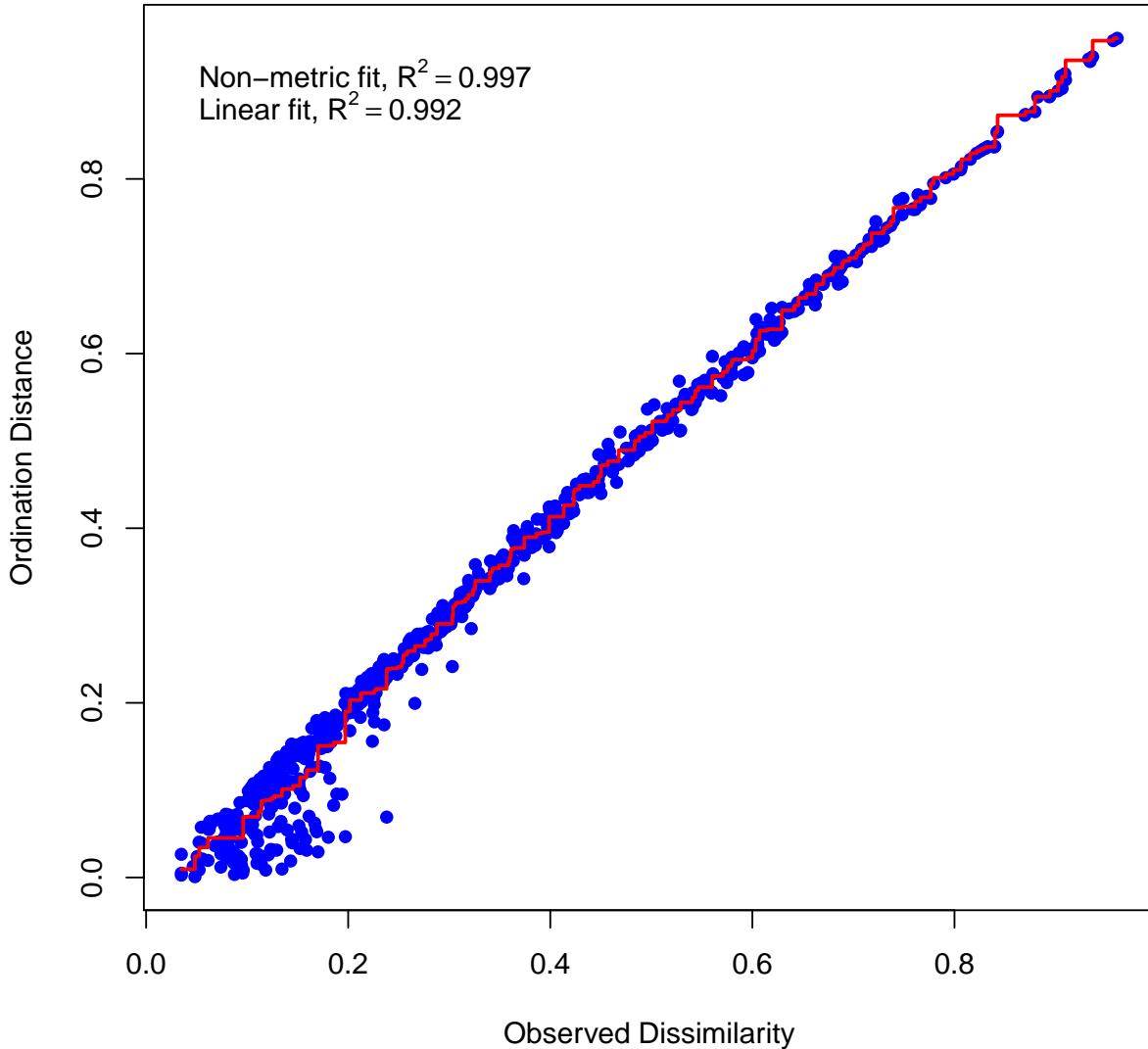
```

```

## ... Similar to previous best
## Run 2 stress 0.5468
## Run 3 stress 0.5532
## Run 4 stress 0.05162
## ... Procrustes: rmse 0.001095 max resid 0.00351
## ... Similar to previous best
## Run 5 stress 0.5468
## Run 6 stress 0.5402
## Run 7 stress 0.5326
## Run 8 stress 0.5503
## Run 9 stress 0.5614
## Run 10 stress 0.2925
## Run 11 stress 0.5597
## Run 12 stress 0.05152
## ... New best solution
## ... Procrustes: rmse 0.0007455 max resid 0.003219
## ... Similar to previous best
## Run 13 stress 0.5244
## Run 14 stress 0.5556
## Run 15 stress 0.0516
## ... Procrustes: rmse 0.00074 max resid 0.003218
## ... Similar to previous best
## Run 16 stress 0.5444
## Run 17 stress 0.5466
## Run 18 stress 0.5223
## Run 19 stress 0.05164
## ... Procrustes: rmse 0.0008745 max resid 0.003467
## ... Similar to previous best
## Run 20 stress 0.5505
## *** Solution reached

stressplot(mds_4, pch = 16)

```



```

mds_4 <- metaMDS(dist_mean, k = 2, distance = "euclidean", autotransform = FALSE)

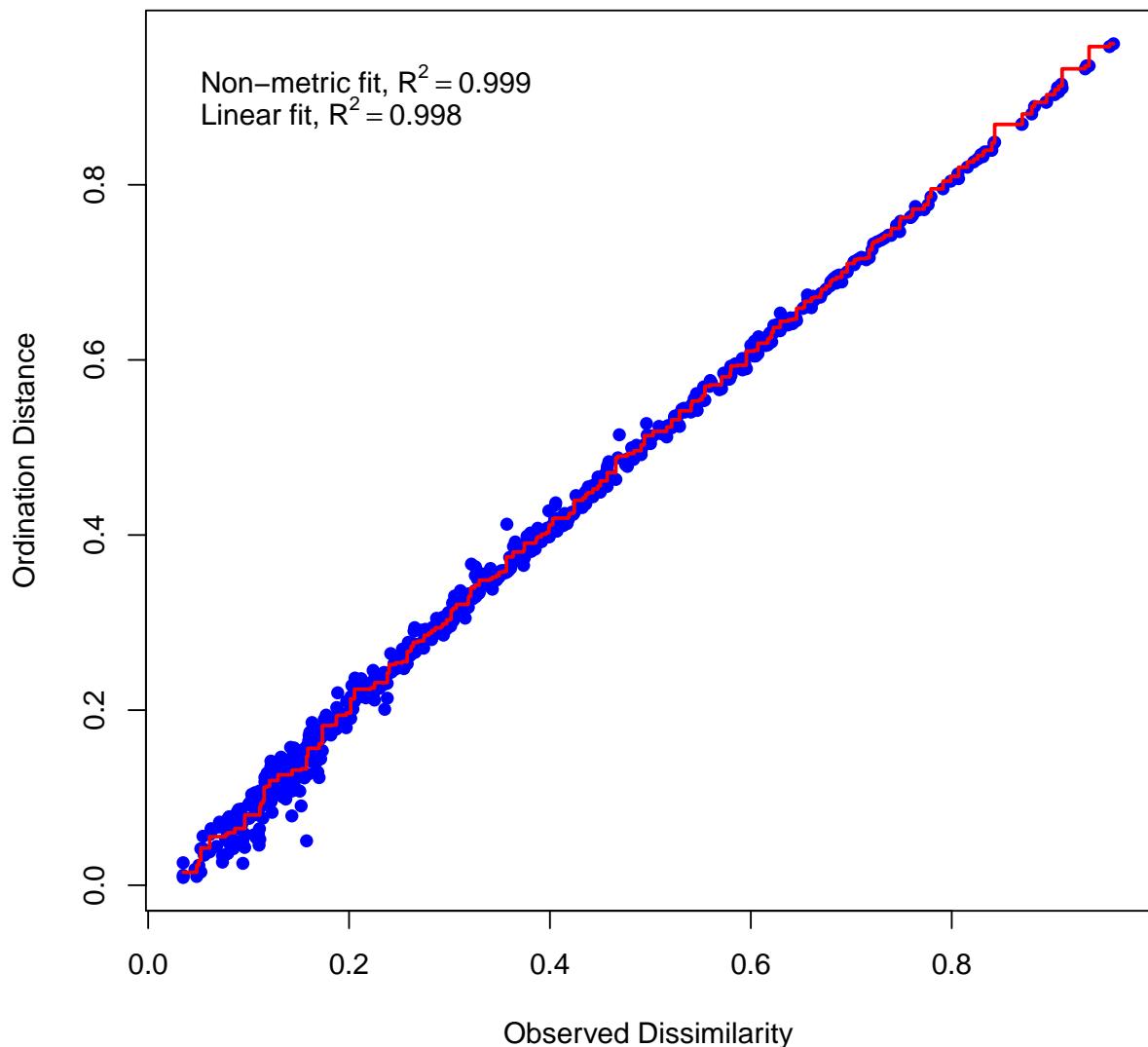
## Run 0 stress 0.02431
## Run 1 stress 0.0284
## Run 2 stress 0.02754
## Run 3 stress 0.02737
## Run 4 stress 0.03591
## Run 5 stress 0.02911
## Run 6 stress 0.03106
## Run 7 stress 0.02856
## Run 8 stress 0.02797
## Run 9 stress 0.03386
## Run 10 stress 0.02762
## Run 11 stress 0.02829
    
```

```

## Run 12 stress 0.02934
## Run 13 stress 0.3959
## Run 14 stress 0.02958
## Run 15 stress 0.02778
## Run 16 stress 0.02834
## Run 17 stress 0.03258
## Run 18 stress 0.03196
## Run 19 stress 0.03365
## Run 20 stress 0.03206
## *** No convergence -- monoMDS stopping criteria:
##      20: stress ratio > sratmax

stressplot(mds_4, pch = 16)

```



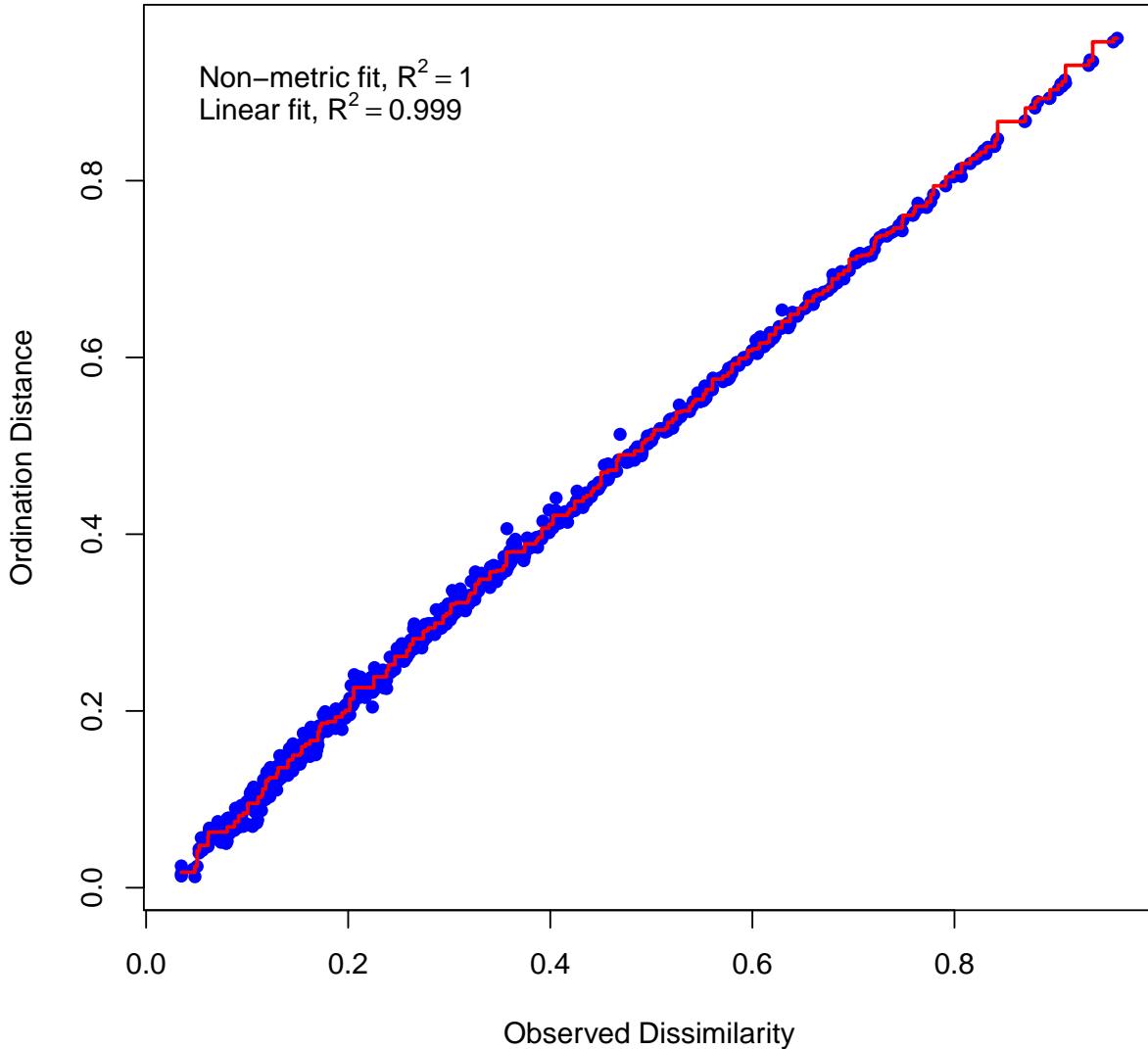
```

mds_4 <- metaMDS(dist_mean, k = 3, distance = "euclidean", autotransform = FALSE)

## Run 0 stress 0.01839
## Run 1 stress 0.01539
## ... New best solution
## ... Procrustes: rmse 0.02769 max resid 0.07231
## Run 2 stress 0.01569
## ... Procrustes: rmse 0.00756 max resid 0.01948
## Run 3 stress 0.01581
## ... Procrustes: rmse 0.009544 max resid 0.04658
## Run 4 stress 0.01501
## ... New best solution
## ... Procrustes: rmse 0.01883 max resid 0.06217
## Run 5 stress 0.01521
## ... Procrustes: rmse 0.02743 max resid 0.09157
## Run 6 stress 0.01515
## ... Procrustes: rmse 0.02652 max resid 0.08382
## Run 7 stress 0.01599
## Run 8 stress 0.01517
## ... Procrustes: rmse 0.006505 max resid 0.01637
## Run 9 stress 0.01721
## Run 10 stress 0.01527
## ... Procrustes: rmse 0.01923 max resid 0.06412
## Run 11 stress 0.01515
## ... Procrustes: rmse 0.02601 max resid 0.07976
## Run 12 stress 0.01535
## ... Procrustes: rmse 0.01103 max resid 0.02928
## Run 13 stress 0.01505
## ... Procrustes: rmse 0.003356 max resid 0.008731
## ... Similar to previous best
## Run 14 stress 0.01602
## Run 15 stress 0.01606
## Run 16 stress 0.01599
## Run 17 stress 0.01604
## Run 18 stress 0.015
## ... New best solution
## ... Procrustes: rmse 0.004703 max resid 0.01329
## Run 19 stress 0.01527
## ... Procrustes: rmse 0.01127 max resid 0.03086
## Run 20 stress 0.01537
## ... Procrustes: rmse 0.01932 max resid 0.05906
## *** No convergence -- monoMDS stopping criteria:
##      16: no. of iterations >= maxit
##      4: stress ratio > sratmax

stressplot(mds_4, pch = 16)

```



```

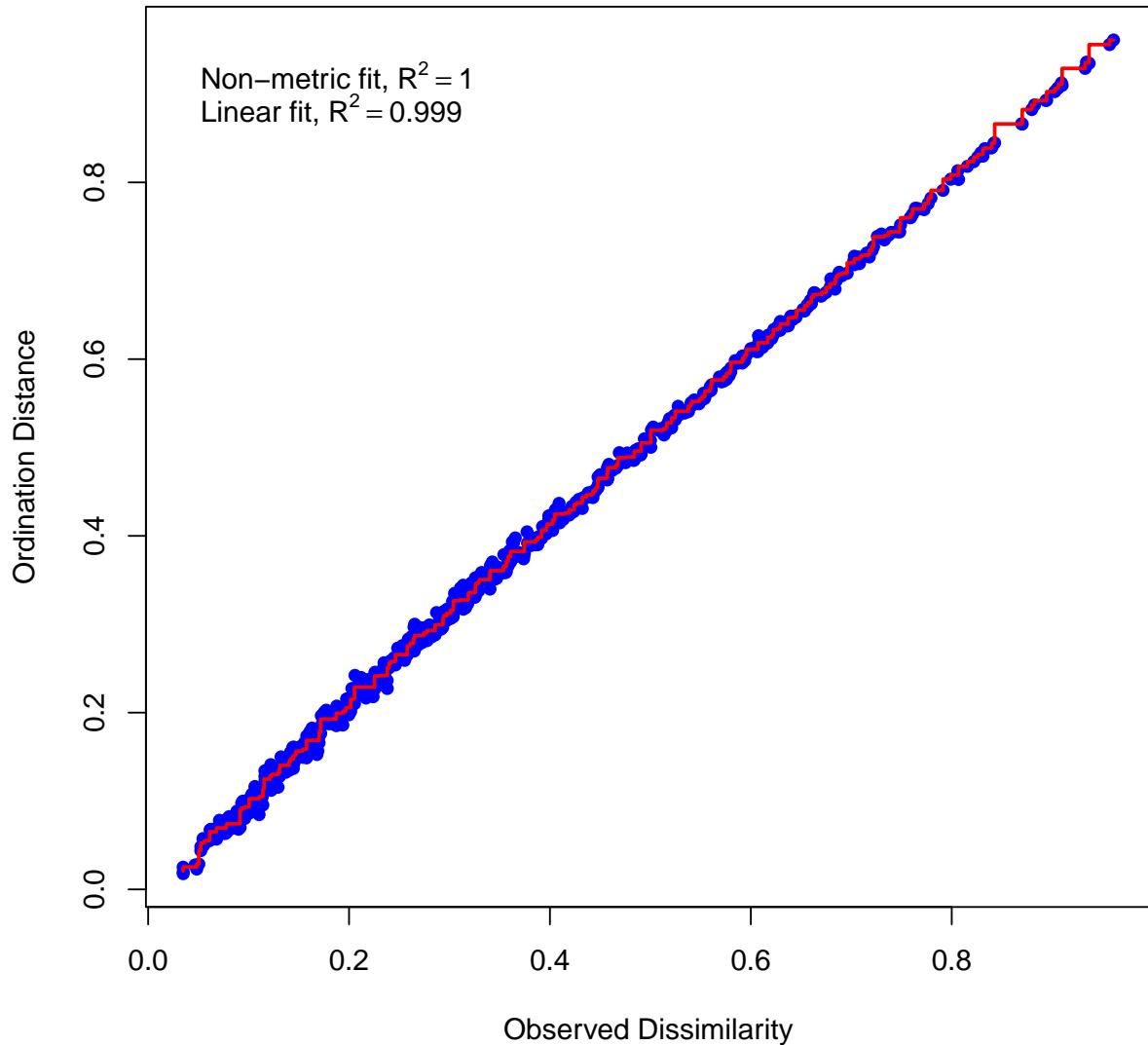
mds_4 <- metaMDS(dist_mean, k = 4, distance = "euclidean", autotransform = FALSE)

## Run 0 stress 0.01172
## Run 1 stress 0.01221
## ... Procrustes: rmse 0.0226  max resid 0.06181
## Run 2 stress 0.01205
## ... Procrustes: rmse 0.01069  max resid 0.03741
## Run 3 stress 0.01262
## Run 4 stress 0.0126
## Run 5 stress 0.01283
## Run 6 stress 0.0122
## ... Procrustes: rmse 0.01325  max resid 0.04071
## Run 7 stress 0.01558
## Run 8 stress 0.01244

```

```
## Run 9 stress 0.01198
## ... Procrustes: rmse 0.01897 max resid 0.04726
## Run 10 stress 0.0123
## Run 11 stress 0.01252
## Run 12 stress 0.01239
## Run 13 stress 0.01235
## Run 14 stress 0.01248
## Run 15 stress 0.01182
## ... Procrustes: rmse 0.02111 max resid 0.05562
## Run 16 stress 0.01204
## ... Procrustes: rmse 0.01022 max resid 0.0375
## Run 17 stress 0.01268
## Run 18 stress 0.01222
## Run 19 stress 0.01282
## Run 20 stress 0.012
## ... Procrustes: rmse 0.02173 max resid 0.06488
## *** No convergence -- monoMDS stopping criteria:
##      20: no. of iterations >= maxit

stressplot(mds_4, pch = 16)
```



7.3.5 Configuration Correlations

The configuration from the simple MDS of the average distance matrix resembles reasonably closely the group space from the identity solution and very closely the IDIOSCAL solution. It does not resemble very closely the INDSCAL solution.

```
mds_2$conf
##          D1         D2
## 1 -1.0390  0.032159
## 2 -0.4184 -0.025273
## 3 -0.9415  0.035479
## 4 -0.4494 -0.191469
## 5 -0.3999 -0.123954
```

```

## 6 -0.1108 -0.070992
## 7 -0.5860  0.073187
## 8  0.2652 -0.212751
## 9  0.8475  0.026966
## 10 -0.5184  0.055129
## 11  0.6428  0.035289
## 12  0.8660  0.021816
## 13  1.0253 -0.012276
## 14  1.1548  0.003511
## 15 -1.0982  0.027873
## 16  1.0461  0.137858
## 17  0.6662  0.269045
## 18  0.3229 -0.045619
## 19  0.4139  0.057218
## 20 -0.1747 -0.009347
## 21  0.5761 -0.014056
## 22 -0.1986  0.004885
## 23 -0.9414  0.019446
## 24  0.1110 -0.087399
## 25 -0.7676 -0.007998
## 26  1.0982  0.056634
## 27  0.5048  0.118732
## 28  0.6199 -0.146248
## 29 -1.0902  0.035051
## 30 -0.7964  0.020484
## 31 -0.6551  0.030607
## 32 -0.5186 -0.083793
## 33 -0.4042  0.036758
## 34  0.5154 -0.215433
## 35  0.3572  0.078969
## 36  0.3817 -0.216684
## 37 -0.3068  0.286196

identity_fit$gspace - mds_2$conf

##          D1          D2
## 1  0.045236  0.1299683
## 2  0.023940 -0.0241332
## 3  0.055825  0.1884752
## 4  0.048360 -0.1443324
## 5  0.044184 -0.1122830
## 6  0.012806 -0.1070062
## 7  0.027905  0.0215679
## 8 -0.041668 -0.1269449
## 9 -0.038363  0.0456733
## 10 0.046629  0.1915340
## 11 -0.034738  0.0949452
## 12 -0.044186 -0.1302432
## 13 -0.051688 -0.1910011
## 14 -0.037301 -0.0838707
## 15 0.038382 -0.1850829
## 16 -0.067916  0.1428982
## 17 -0.057684  0.1197552
## 18 -0.018091 -0.0089897

```

```

## 19 -0.020679 0.0596554
## 20 0.025954 0.0874961
## 21 -0.030208 -0.0355410
## 22 0.034795 0.1885140
## 23 0.043491 -0.1777452
## 24 -0.008081 -0.0232809
## 25 0.046474 -0.1771630
## 26 -0.039080 0.0423132
## 27 -0.048078 0.1600162
## 28 -0.036295 -0.0974717
## 29 0.029391 -0.0266515
## 30 0.033016 -0.0001433
## 31 0.038102 0.1879358
## 32 0.026195 -0.1279970
## 33 0.042379 0.0566582
## 34 -0.042646 -0.1182528
## 35 -0.041486 0.1596271
## 36 -0.044288 -0.0922993
## 37 0.039415 0.1133998

indscal_fit$gspace - mds_2$conf

##          D1      D2
## 1 0.143842 0.11707
## 2 -0.004201 0.06417
## 3 0.031548 0.07883
## 4 -0.180144 0.19125
## 5 -0.119979 0.12862
## 6 -0.048666 0.06764
## 7 -0.042490 -0.02270
## 8 -0.263546 0.10947
## 9 -0.006730 -0.11881
## 10 0.142394 0.03397
## 11 0.037021 -0.09234
## 12 -0.064344 -0.13188
## 13 -0.111791 -0.13231
## 14 -0.106654 -0.16181
## 15 0.063778 0.11693
## 16 0.135535 -0.20046
## 17 0.231555 -0.26670
## 18 -0.094684 -0.01170
## 19 0.023524 -0.09367
## 20 0.041302 0.03342
## 21 -0.023627 -0.05282
## 22 0.119166 0.03958
## 23 0.001873 0.08587
## 24 -0.138385 0.03983
## 25 -0.070588 0.07196
## 26 0.048805 -0.16597
## 27 0.137640 -0.13383
## 28 -0.196228 0.02797
## 29 -0.024474 0.08354
## 30 0.079424 0.08553
## 31 0.126809 0.07479

```

```

## 32  0.054842  0.15235
## 33  0.090919  0.02179
## 34 -0.206774  0.10393
## 35  0.071362 -0.09482
## 36 -0.202562  0.12977
## 37  0.324528 -0.17844

idioscal_fit$gspace - mds_2$conf

##          D1          D2
## 1  0.023233  0.0334935
## 2  0.025716  0.0030010
## 3  0.012270 -0.0593579
## 4  0.016602  0.0526392
## 5  0.017609  0.0274060
## 6  0.014654  0.0295238
## 7  0.017591 -0.1200173
## 8  0.003983  0.0255708
## 9 -0.018693 -0.0106206
## 10 0.022242  0.0183604
## 11 -0.019270  0.0121552
## 12 -0.018170 -0.0433691
## 13 -0.010648 -0.0460857
## 14 -0.012025 -0.0573944
## 15  0.001099  0.0018064
## 16 -0.038343 -0.0109945
## 17 -0.044406 -0.0625897
## 18 -0.010964 -0.0030900
## 19 -0.007732 -0.0283961
## 20  0.020581  0.0225403
## 21 -0.012007  0.0164292
## 22  0.024704  0.0567331
## 23  0.010237 -0.0075814
## 24 -0.009263  0.0016188
## 25  0.016846 -0.0584924
## 26 -0.013753 -0.0001403
## 27 -0.026612  0.0050518
## 28 -0.016537  0.0275406
## 29  0.005010 -0.0661912
## 30  0.017994  0.0102850
## 31  0.011506  0.0387610
## 32  0.014322  0.1026213
## 33  0.033802 -0.0034434
## 34 -0.019886  0.0828239
## 35 -0.019111 -0.0107055
## 36 -0.028791  0.1067146
## 37  0.016212 -0.0866065

all_conf <- cbind(mds_2$conf, identity_fit$gspace, indscal_fit$gspace,
                  idioscal_fit$gspace)
all_conf <- as.data.frame(all_conf)
names(all_conf) <- c("mean_D1", "mean_D2", "identity_D1", "identity_D2",
                     "indscal_D1", "indscal_D2", "idioscal_D1", "idioscal_D2")
cor(all_conf)

```

```

##          mean_D1  mean_D2 identity_D1 identity_D2
## mean_D1      1.000000 0.007051    0.999710  0.0022618
## mean_D2      0.007051 1.000000    0.008087  0.8808713
## identity_D1  0.999710 0.008087    1.000000  0.0041154
## identity_D2  0.002262 0.880871    0.004115  1.0000000
## indscal_D1   0.982569 0.173991    0.982808  0.1694830
## indscal_D2   -0.921806 0.343680   -0.921547  0.3454006
## idioscal_D1  0.999828 0.004020    0.999880  0.0004719
## idioscal_D2  0.003629 0.906067    0.004311  0.8839401
##          indscal_D1 indscal_D2 idioscal_D1 idioscal_D2
## mean_D1      0.9826     -0.9218    0.9998277  0.0036294
## mean_D2      0.1740     0.3437    0.0040200  0.9060672
## identity_D1  0.9828     -0.9215    0.9998802  0.0043113
## identity_D2  0.1695     0.3454    0.0004719  0.8839401
## indscal_D1   1.0000     -0.8346    0.9821690  0.1876296
## indscal_D2   -0.8346     1.0000   -0.9231959  0.3819218
## idioscal_D1  0.9822     -0.9232    1.0000000  0.0003246
## idioscal_D2  0.1876     0.3819    0.0003246  1.0000000

```