

Homework 6

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R Markdown

1. data manipulation

```
library(readxl)
library(readr)
library(dplyr)
library(tidyr)
library(smacof)
data <- read_csv("nations_ALLDATA_1920.csv")
demographic <- read_excel("nations_demo_data.xlsx")
sex <- as.character(data[2,2:ncol(demographic)-1])
birth <- as.character(data[1,2:ncol(demographic)-1])
country <- unique(c(as.character(data$nation1),as.character(data$nation2)))
data <- data %>% dplyr::select(2:21)

## create the proximity
dist_list <- list()
for (k in 1:length(sex)){
  proximity <- matrix(NA,nrow = length(country),ncol = length(country))
  rownames(proximity) <- country
  colnames(proximity) <- country
  for (i in rownames(proximity)){
    for (j in colnames(proximity)){
      if (i == j){
        proximity[i,j] = 9
      }else{
        d <- as.numeric(data %>% filter(nation1==i & nation2==j) %>%
dplyr::select(k+2))
        proximity[j,i] = d
      }
    }
  }
  proximity_dist <- as.dist(proximity)
  dist_list[[k]] <- sim2diss(proximity_dist,method = 10,to.dist = TRUE)
}

dist_list

## [[1]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      7
## Cuba       3      7
## Egypt      6      2      5
```

## France	5	7	7	6								
## India	4	7	6	7	9							
## Israel	5	9	8	6	2	6						
## Japan	7	9	8	7	4	4	4					
## China	4	8	3	6	5	3	9	3				
## Russia	5	7	4	6	6	5	7	4	4			
## USA	6	8	6	10	3	4	1	3	7	4		
## Serbia	8	7	7	4	3	7	8	9	8	3	8	

##

[[2]]

##	Brazil	Congo	Cuba	Egypt	France	India	Israel	Japan	China	Russia	USA
## Congo	8										
## Cuba	5	5									
## Egypt	6	6	6								
## France	4	8	8	7							
## India	3	7	6	3	8						
## Israel	9	9	9	7	5	9					
## Japan	9	9	9	9	4	9	2				
## China	3	8	4	5	7	3	8	7			
## Russia	6	9	7	7	7	8	9	9	2		
## USA	6	8	7	7	3	8	7	5	7	6	
## Serbia	9	8	7	8	4	8	7	4	8	5	7

##

[[3]]

##	Brazil	Congo	Cuba	Egypt	France	India	Israel	Japan	China	Russia	USA
## Congo	8										
## Cuba	5	5									
## Egypt	6	6	6								
## France	4	8	8	7							
## India	3	7	6	3	8						
## Israel	9	9	9	7	5	9					
## Japan	9	9	9	9	4	9	2				
## China	3	8	4	5	7	3	8	7			
## Russia	6	9	7	7	7	8	9	9	2		
## USA	6	8	7	7	3	8	7	5	7	6	
## Serbia	9	8	7	8	4	8	7	4	8	5	7

##

[[4]]

##	Brazil	Congo	Cuba	Egypt	France	India	Israel	Japan	China	Russia	USA
## Congo	4										
## Cuba	5	7									
## Egypt	4	4	5								
## France	4	8	7	4							
## India	6	5	6	3	8						
## Israel	6	7	7	3	4	6					
## Japan	8	8	8	6	7	4	7				
## China	7	7	4	5	6	4	7	2			
## Russia	8	7	3	5	5	5	5	6	2		
## USA	6	8	6	4	3	6	4	5	7	3	
## Serbia	6	5	4	6	4	4	4	8	4	1	5

```
##
## [[5]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      5
## Cuba       5      6
## Egypt      6      4      4
## France     6      7      9      8
## India      4      6      3      2      6
## Israel     8      7      8      8      3      6
## Japan      7      8      8      7      7      7      6
## China      8      7      7      3      4      3      7      4
## Russia     7      7      6      6      3      5      4      7      2
## USA        7      8      9      8      3      6      4      3      4      4
## Serbia     6      5      4      4      7      5      5      8      8      7      9
```

```
##
## [[6]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      6
## Cuba       3      6
## Egypt      7      1      5
## France     4      1      8      7
## India      6      8      7      8      7
## Israel     6      7      5      5      7      6
## Japan      9      9      4      9      7      7      1
## China      8      9      8      2      7      7      4      4
## Russia     8      8      8      7      7      4      7      7      7
## USA        3      3      8      7      8      4      7      6      3      7
## Serbia     9      7      8      6      4      9      5      6      6      6      7
```

```
##
## [[7]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      7
## Cuba       3      3
## Egypt      3      2      5
## France     7      9      8      7
## India      2      5      6      3      7
## Israel     5      8      7      5      7      7
## Japan      7      9      9      9      4      6      8
## China      4      8      6      7      7      4      6      4
## Russia     3      7      4      6      4      3      7      6      2
## USA        5      9      9      7      2      6      4      3      6      3
## Serbia     5      5      5      4      6      7      6      8      5      3      9
```

```
##
## [[8]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      3
## Cuba       2      6
## Egypt      5      3      5
## France     8      8      8      8
## India      5      4      5      5      8
```

```

## Israel      7      8      8      5      4      8
## Japan       7      8      8      8      5      7      5
## China       3      7      3      7      8      8      8      3
## Russia      9      8      8      9      8      8      7      6      3
## USA         4      8      8      5      3      7      2      5      9      8
## Serbia      6      8      4      4      8      6      8      8      7      3      9
##
## [[9]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      5
## Cuba       3      4
## Egypt      5      3      3
## France     5      8      6      4
## India      4      3      5      2      6
## Israel     4      7      3      2      5      6
## Japan      4      9      5      7      4      6      4
## China      3      6      5      6      5      3      6      3
## Russia     6      7      3      6      3      5      5      4      2
## USA        3      8      5      5      3      6      3      3      3      3
## Serbia     6      6      4      4      4      6      4      7      7      3      5
##
## [[10]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      8
## Cuba       4      8
## Egypt      7      8      8
## France     6      6      8      7
## India      7      8      7      7      8
## Israel     8      8      8      5      6      7
## Japan      8      8      8      7      5      7      6
## China      5      7      6      7      6      7      7      4
## Russia     7      8      5      7      6      6      5      6      3
## USA        5      8      8      7      5      6      5      6      6      7
## Serbia     6      8      6      8      7      7      7      8      7      2      5
##
## [[11]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      4
## Cuba       5      5
## Egypt      6      4      4
## France     6      4      4      7
## India      4      8      5      6      6
## Israel     7      7      7      3      4      6
## Japan      7      7      7      8      4      4      5
## China      3      4      4      5      5      3      5      2
## Russia     5      5      5      4      4      5      5      5      2
## USA        4      8      5      6      2      6      3      2      3      3
## Serbia     7      6      7      5      5      5      5      6      6      5      7
##
## [[12]]

```

```

##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      9
## Cuba       5      9
## Egypt      5      3      7
## France     6      8      7      9
## India      8      7      5      9      9
## Israel     8      9      8      9      5      9
## Japan      2      8      8      9      6      7      8
## China      6      8      9      8      7      7      5      7
## Russia     9      2      7      9      9      5      2      7      4
## USA        4      9      8      9      5      3      8      5      6      6
## Serbia     6      7      6      7      8      7      8      8      8      8      8

```

```

##
## [[13]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      1
## Cuba       8      8
## Egypt      7      9      6
## France     9      4      8      4
## India      9      7      5      3      6
## Israel     9      8      9      2      5      2
## Japan      8      9      8      3      5      6      4
## China      8      8      3      2      5      2      3      1
## Russia     8      9      8      3      8      4      7      2      2
## USA        4      8      1      6      3      7      5      2      5      8
## Serbia     5      7      5      3      5      3      2      3      7      6      5

```

```

##
## [[14]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      4
## Cuba       4      4
## Egypt      4      6      5
## France     7      7      7      7
## India      6      6      5      5      7
## Israel     6      7      5      6      6      7
## Japan      7      7      7      7      3      7      4
## China      5      4      4      3      7      4      5      6
## Russia     3      7      3      3      6      5      6      7      3
## USA        6      7      6      6      4      5      4      3      6      6
## Serbia     4      4      4      4      7      5      6      7      3      4      7

```

```

##
## [[15]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      4
## Cuba       3      4
## Egypt      7      3      4
## France     5      7      5      7
## India      5      8      7      4      7
## Israel     6      7      7      2      5      7
## Japan      8      9      6      8      4      4      5

```

```

## China      5      7      4      8      8      3      8      2
## Russia     5      7      4      8      4      6      7      7      4
## USA        3      7      6      8      3      5      5      4      5      5
## Serbia     7      8      6      6      4      6      6      8      5      2      7
##
## [[16]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      6
## Cuba       6      6
## Egypt      7      4      7
## France     7      7      8      9
## India      7      6      5      6      8
## Israel     8      8      8      3      3      7
## Japan      8      9      8      9      6      6      7
## China      5      7      4      6      7      2      8      5
## Russia     7      8      5      9      5      5      7      6      4
## USA        4      7      9      8      3      7      3      5      8      8
## Serbia     7      9      6      9      5      9      7      8      7      2      7
##
## [[17]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      6
## Cuba       3      5
## Egypt      6      7      5
## France     8      7      7      8
## India      6      7      5      7      7
## Israel     8      8      5      6      7      8
## Japan      8      9      7      6      4      4      8
## China      9      8      7      7      6      4      8      3
## Russia     7      9      7      7      4      8      7      5      3
## USA        7      9      9      8      6      8      9      6      2      2
## Serbia     6      6      7      6      6      6      6      7      8      2      10
##
## [[18]]
##      Brazil Congo Cuba Egypt France India Israel Japan China Russia USA
## Congo      2
## Cuba       3      7
## Egypt      5      4      6
## France     5      8      7      3
## India      8      7      7      6      8
## Israel     4      5      5      2      7      4
## Japan      8      7      8      4      6      5      6
## China      8      7      8      3      8      4      6      2
## Russia     7      8      4      7      4      7      3      3      3
## USA        3      6      2      5      3      10      6      7      8      3
## Serbia     3      3      7      5      4      4      3      5      5      5      6

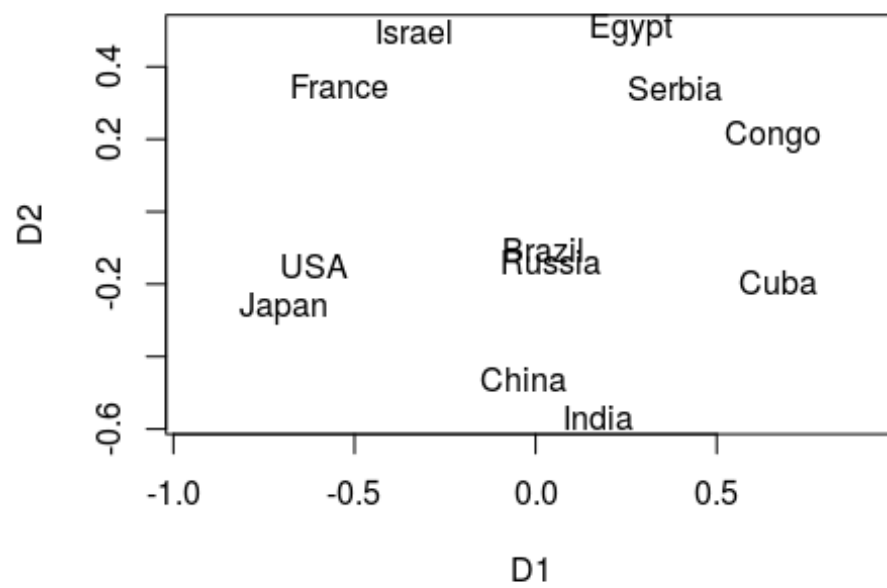
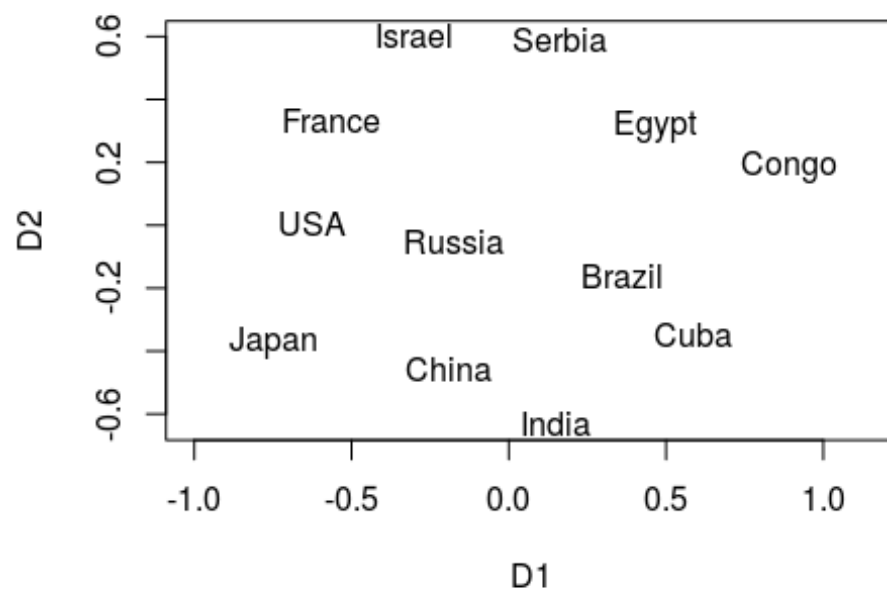
```

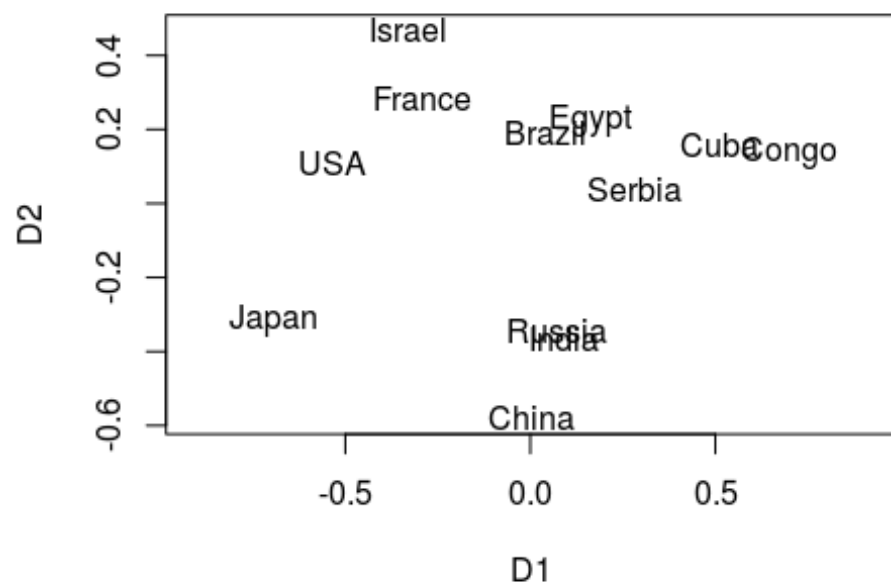
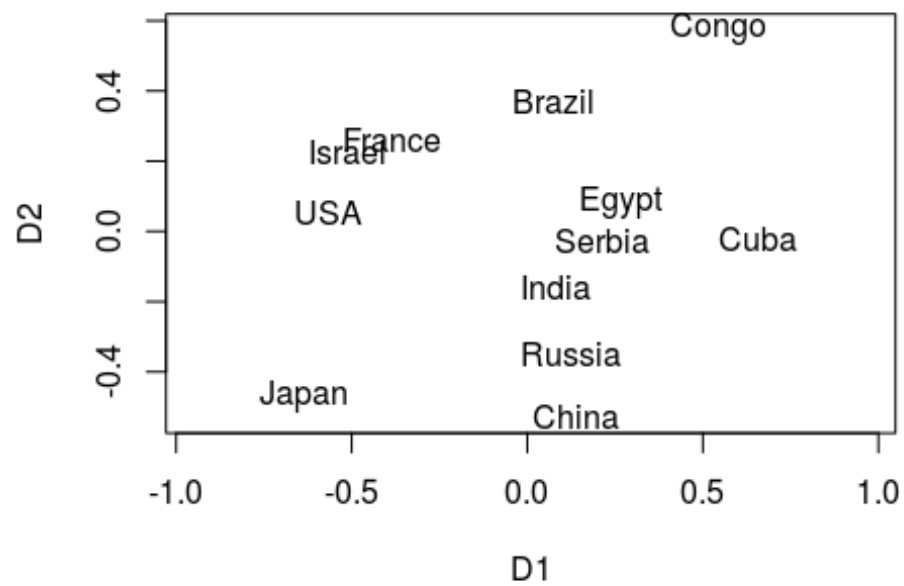
2

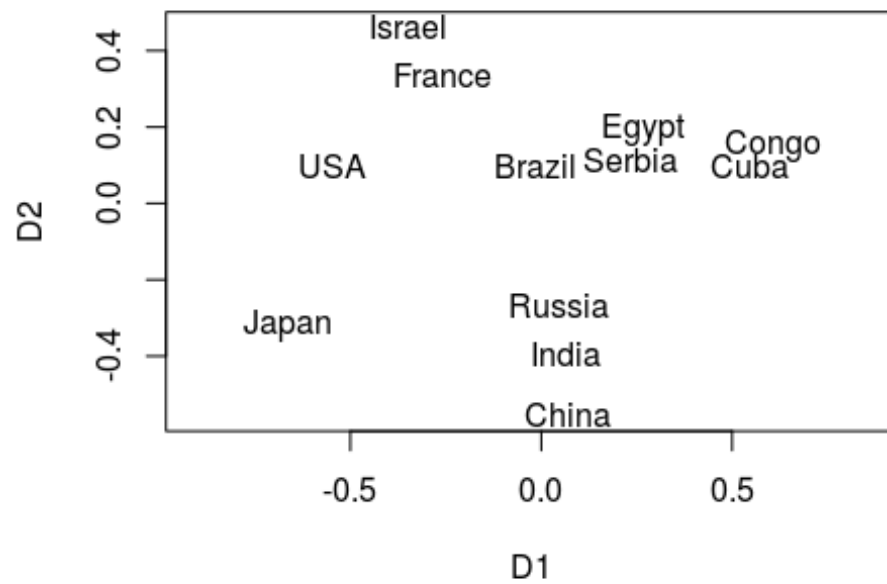
2a: individual difference MDS

There is an error when I try the $r = 1$. I just try r from 2 to 6, instead.

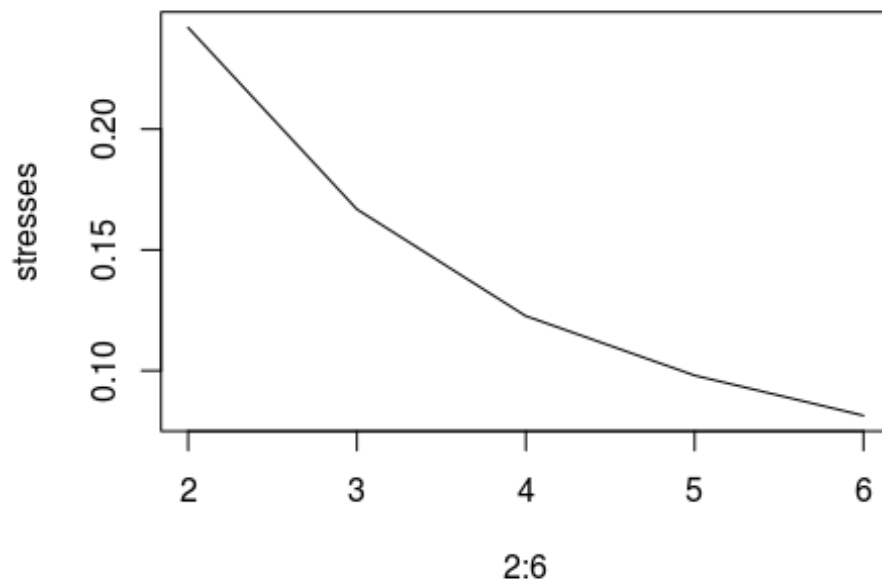
```
stresses <- c()
for (r in 2:6){
  country_ind<- indscal(dist_list,type="ordinal",init="torgerson",ndim = r)
  stresses <- c(stresses,country_ind$stress)
  plot(country_ind$ospace,asp=1,pch=' ')
  text(country_ind$ospace,colnames(proximy))
}
```







```
stresses
## [1] 0.24206113 0.16679605 0.12259322 0.09797922 0.08137385
plot(2:6,stresses,type = 'l')
```



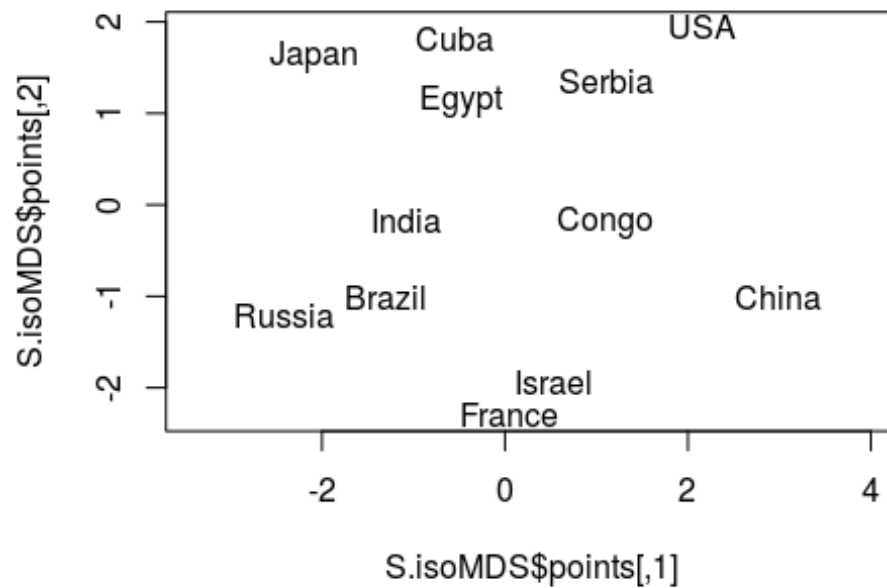
There are no big differences between the results from different dimension after $r = 3$. The overall configuration of the countries are similar. I personally feel the 4 dimension result is the best one: Russia and Japan are closer probably because of the deographic factors. USA and China are closer probably because of their social-economics status.

2b average difference MDS

```
nations <- read_csv("nations_ALldata_1920_lowerhalf.csv")
row.names(nations) <- nations %>% pull(X1)
nations <- nations %>% dplyr::select(c(-1))
nations <- nations %>% replace(is.na(.),0)
S <- as.matrix(nations + t(nations))
diag(S) <- 9
S <- as.dist(S)
S.isoMDS <- MASS::isoMDS(S,k=3)

## initial value 22.759334
## iter 5 value 17.702845
## iter 10 value 17.099188
## final value 16.995915
## converged

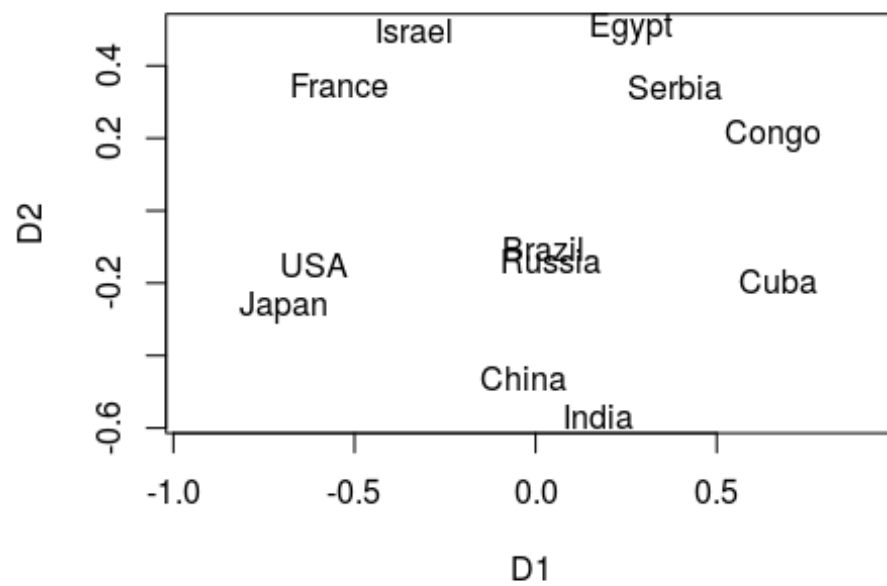
plot(S.isoMDS$points,asp = 1,pch=" ")
text(S.isoMDS$points,row.names(nations))
```



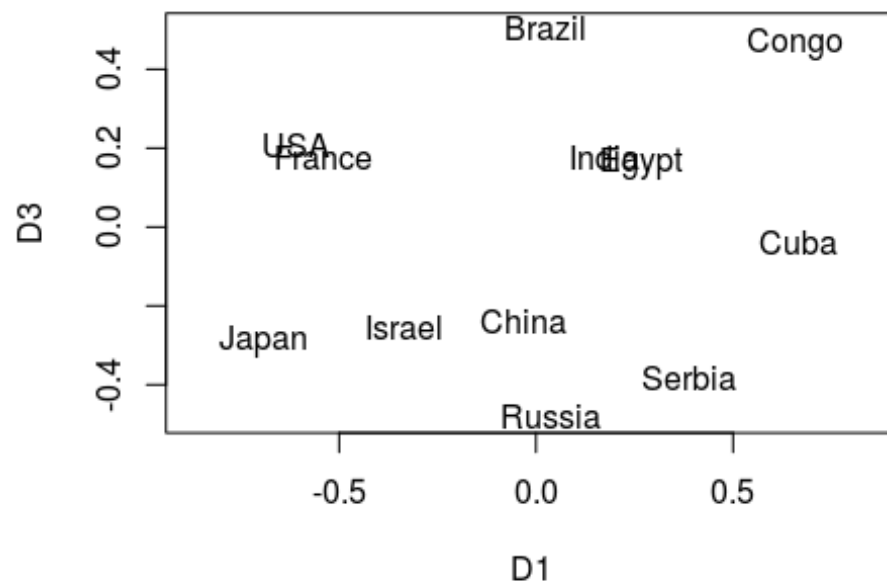
There are big difference in the result. In this configuration, China and USA are far away in the dimension 2. Same as Russia and Japan.

3 INDSCAL Interpretation

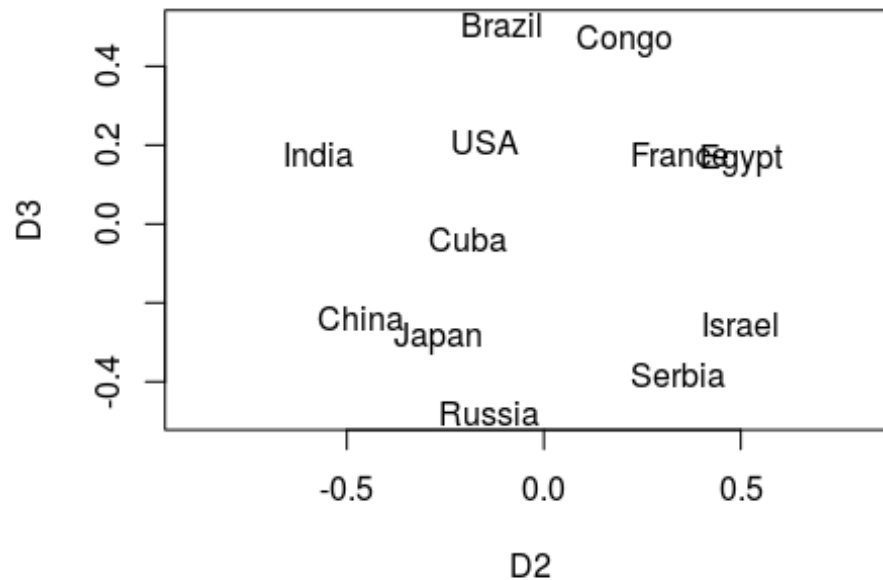
```
country_ind<- indscal(dist_list,type="ordinal",init="torgerson",ndim = 3)
plot(country_ind$gspace[,c(1,2)],asp=1,pch=' ')
text(country_ind$gspace[,c(1,2)],colnames(proximy))
```



```
plot(country_ind$gspace[,c(1,3)],asp=1,pch=' ')
text(country_ind$gspace[,c(1,3)],colnames(proximity))
```



```
plot(country_ind$gspace[,c(2,3)],asp=1,pch=' ')
text(country_ind$gspace[,c(2,3)],colnames(proximy))
```



For the first dimension: Congo and Cuba are low while Israel, Janpan, USA, and France are low. Maybe this is related to the technology and education difference.

For the second dimension: Janpan, China are low, while Rgypt, Congo, and France are low. May be related to the cultural and demographic difference.

For the third dimension: Congo, Egypt and India are high, while Russia, China, and Japan are low. May be related to the economics difference.

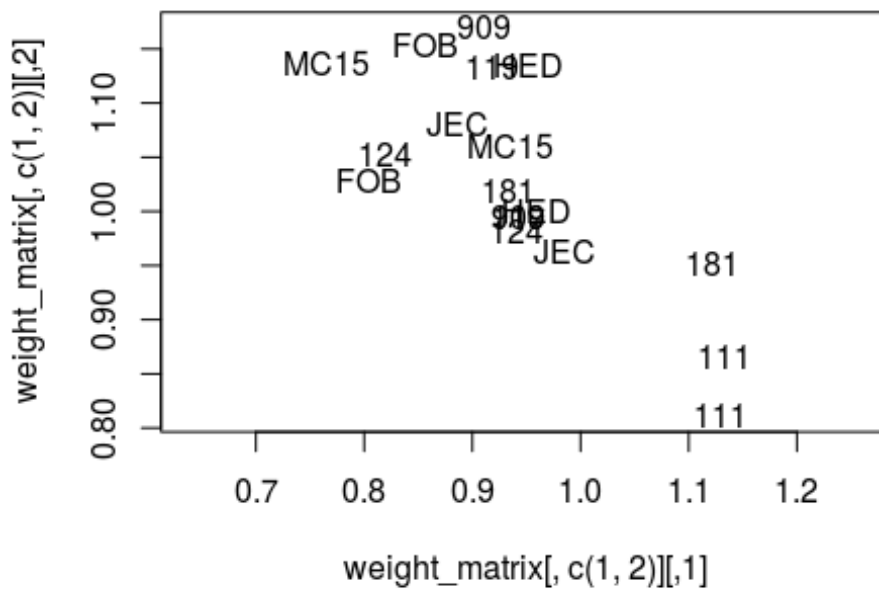
4

```
#country_ind<- indscal(dist_List,type="ordinal",init="torgerson",ndim = 4)
weight_matrix <- matrix(NA,nrow=length(sex),ncol = 3)
for (i in 1:length(sex)){
  weight_matrix[i,] <- diag(country_ind$cweights[[i]])
}
weight_matrix
```

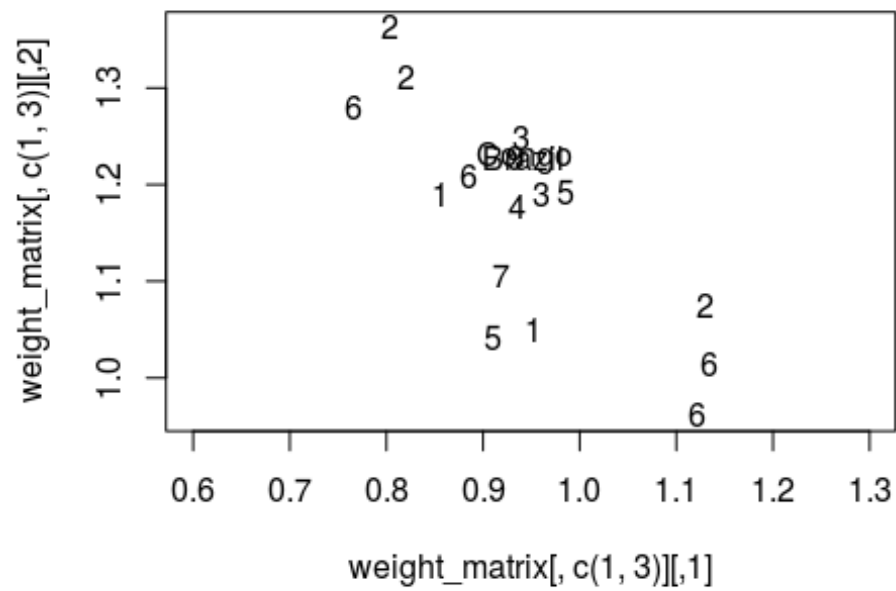
	[,1]	[,2]	[,3]
## [1,]	0.9525080	1.1341427	1.0502796
## [2,]	0.9417935	0.9946555	1.2270807
## [3,]	0.9417935	0.9946555	1.2270807
## [4,]	0.9401665	0.9806793	1.2479379
## [5,]	1.1297687	0.8108202	1.0737825
## [6,]	0.8040193	1.0276428	1.3624709

```
## [7,] 1.1211207 0.9522580 0.9609639
## [8,] 0.9861716 0.9636382 1.1927617
## [9,] 0.9354330 1.0608883 1.1779747
## [10,] 0.9596332 1.0003871 1.1896828
## [11,] 0.9188522 1.1330881 1.1063076
## [12,] 0.9113015 1.1694523 1.0417977
## [13,] 0.8193659 1.0526524 1.3118363
## [14,] 1.1332880 0.8648257 1.0133890
## [15,] 0.8563618 1.1530766 1.1890325
## [16,] 0.9329159 1.0192787 1.2277427
## [17,] 0.8859778 1.0799848 1.2083233
## [18,] 0.7654909 1.1370943 1.2804174

plot(weight_matrix[,c(1,2)],asp=1,pch=' ')
text(weight_matrix[,c(1,2)],colnames(data)[4:12])
```



```
plot(weight_matrix[,c(1,3)],asp=1,pch=' ')
text(weight_matrix[,c(1,3)], birth)
```



```
plot(weight_matrix[,c(2,3)],asp=1,pch=' ')
text(weight_matrix[,c(2,3)], birth)
```

