Multidimensional Scaling

Multidimensional Scaling (MDS)

- Measures of proximity between pairs of objects.
- *Proximity measure* – index over pairs of objects that quantifies the degree to which the two object are alike.
- *Measure of similarity* – correspond to stimulus pairs that are alike or close in proximity.
- *Measure of dissimilarity* – correspond to stimulus pairs that are least alike or far in proximity.

MDS

- Use:
  - When our information is an assessment of the relative proximity or similarity between pairs of objects in the data set.
- Goal:
  - Use information about relative proximity to create a map of appropriate dimensionality such that the distances in the map closely correspond to the proximities used to create it.
- Consideration:
  - The coordinate locations of the objects are interval scaled variables that can be used in subsequent analysis.

Approaches of MDS

- Proximities between pairs of objects from the same set.
  - Metric MDS
  - Nonmetric MDS
    - Individual differences scaling
- Proximities between objects from disjoint sets
  - Unfolding model

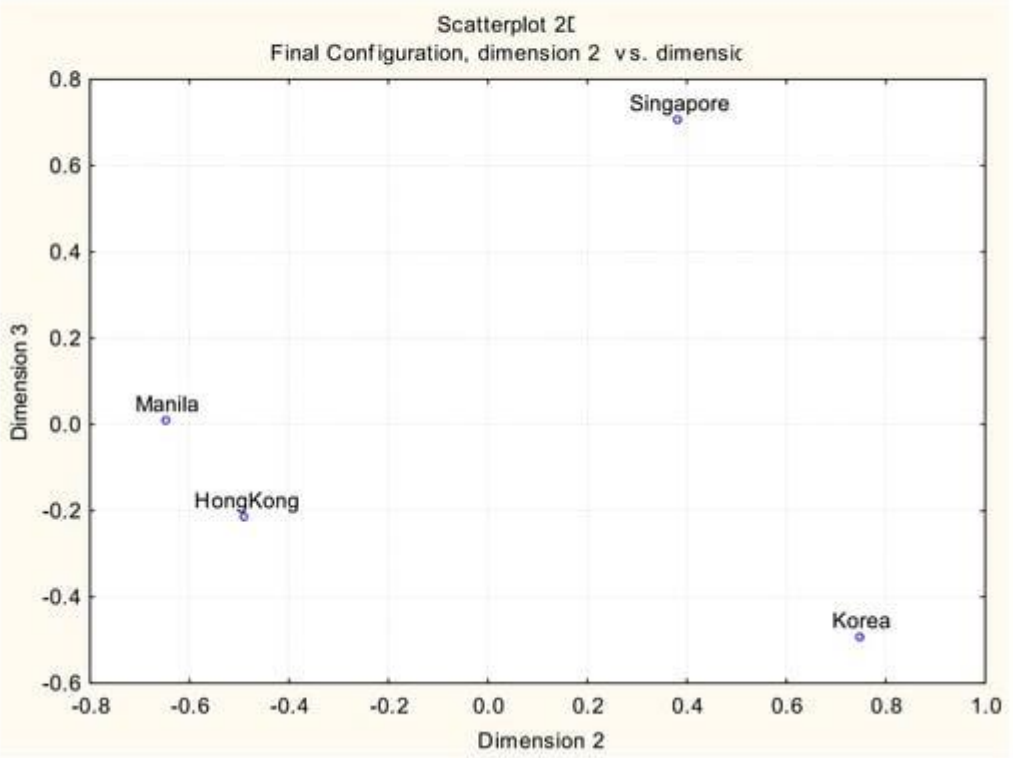
Metric MDS

- Proximity between pairs of objects reflect the actual physical distances.
- Judgment of the respondents' proximity using well calibrated instruments.
- Level of measurement: ratio
- Ex. Actual distances of one city to another.

Example of Proximities

	Manila	Hong Kong	Singapore	Korea
Manila	0			
Hong Kong	1	0		
Singapore	4	5	0	
Korea	4.5	4	8	0

Configuration of distances



Nonmetric MDS

- Perceived similarity of different stimuli judged on a scale that is assumed ordinal in nature.
- Level of measurement: interval, ratio
- Steps:
  - 1. Choose the number of dimensions
  - 2. Plot the configurations
  - 3. Calculate the distances
  - 4. Achieve monotonic correspondence between actual distance and dissimilarities.
  - 5. Reduce stress

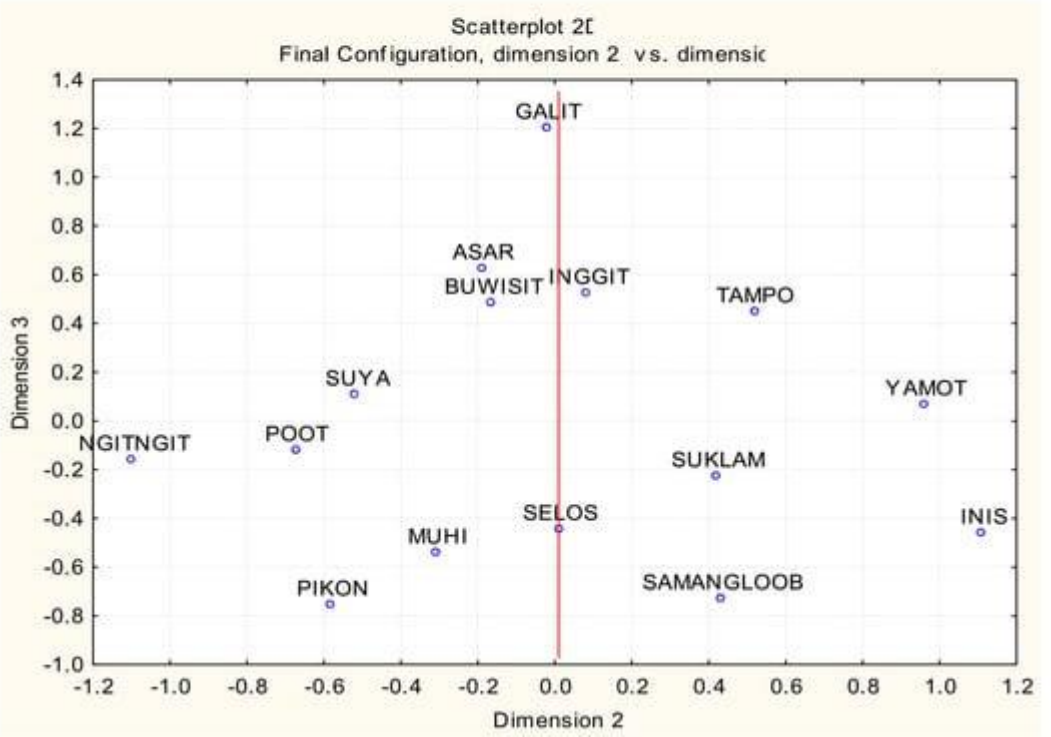
People's Judgment on the similarity of negative emotions

	ASAR	BUWISIT	GALIT	INGGIT	INIS	MUHI	NGITNGIT
ASAR	0						
BUWISIT	3.867	0					
GALIT	5.036	4.872	0				
INGGIT	6.313	6.524	7.005	0			
INIS	3.658	3.646	4.82	6.093	0		
MUHI	5.829	5.926	4.339	6.563	5.537	0	
NGITNGIT	4.867	4.581	4.943	6.513	4.602	5.867	0

15 negative emotions were judged in the study

Step 2

Configuration of the negative emotions



Step 3

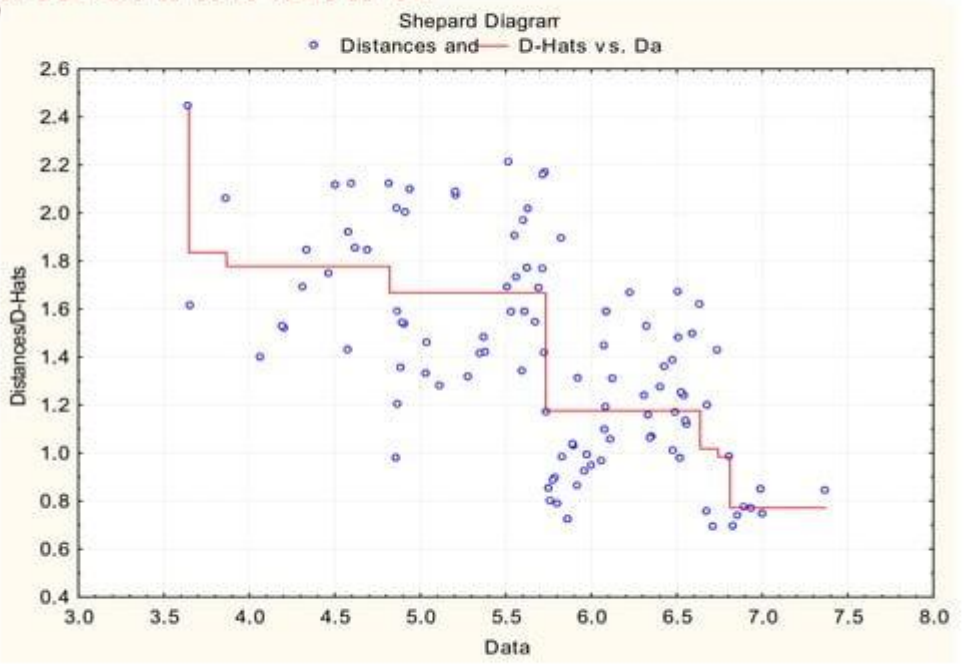
Calculated distances of negative emotions

Estimates are calculated Eucledian distances

	ASAR	BUWISIT	GALIT	INGGIT	INIS	MUHI	NGITNGIT
ASAR	0.00						
BUWISIT	1.57	0.00					
GALIT	2.42	1.16	0.00				
INGGIT	1.66	0.89	0.82	0.00			
INIS	2.88	2.64	1.94	1.75	0.00		
MUHI	0.80	1.09	1.67	0.87	2.18	0.00	
NGITNGIT	1.09	2.15	2.52	1.72	2.18	1.05	0.00

Step 4

Achieving monotonic correspondence



Stress Estimates

- STRESS
- Goodness of fit of the configuration
- The larger the difference between the actual distance (d)and the transformed distance ($\hat{d}$) in the monotone curve, the greater the stress, the poorer the fit.
- Raw stress = 13.94786;
- Alienation = .2470421
- D-hat: ($\hat{d}$) Raw stress = 8.131408;
- Stress = .1901042

Step 5

Distances in final configuration To reduce stress (adjustments)

	ASAR	BUWISIT	GALIT	INGGIT	INIS	MUHI	NGITNGIT
ASAR	0.00						
BUWISIT	2.05	0.00					
GALIT	1.27	1.19	0.00				
INGGIT	1.18	0.94	0.69	0.00			
INIS	1.75	2.26	2.12	1.59	0.00		
MUHI	1.92	1.16	1.81	1.19	1.79	0.00	
NGITNGIT	1.77	1.36	1.75	1.37	2.39	0.90	0.00

Step 4

Adjusted STRESS

- D-star: Raw stress = 14.50918;
- Alienation = .2518842
- D-hat: Raw stress = 7.887925;
- Stress = .1872363

How many dimensions?

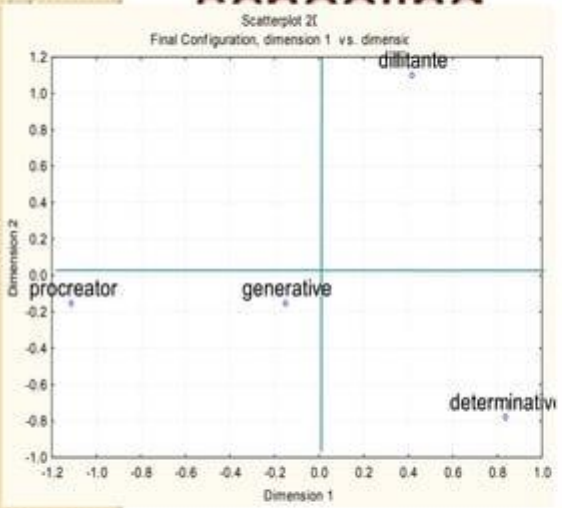
Final Configuration (Data-mds 3D) D-star: Raw stress = 14.50918; Alienation = .2518842 D-hat: Raw stress = 7.887925; Stress = .1872363

	DIM. 1	DIM. 2	DIM. 3
ASAR	-0.79737	-0.572371	0.558761
BUWISIT	1.07104	0.291474	0.551326
GALIT	0.02729	0.287986	1.147567
INGGIT	0.10695	0.257840	0.407289
INIS	-1.03424	0.429567	-0.681523
MUHI	0.51738	0.108730	-0.620473
NGITNGIT	0.85552	-0.529090	-0.596416
PIKON	0.06820	-0.838535	-0.504953
POOT	-0.00772	-0.984225	0.321472
SAMANGLOOB	0.43138	0.888015	-0.557057
SELOS	-0.11607	-0.125611	-0.463976
SUKLAM	-0.85576	-0.229485	-0.266352
SUYA	0.47404	-0.388411	0.278249
TAMPO	-0.58434	0.243385	0.381489
YAMOT	-0.15632	1.160731	0.044598

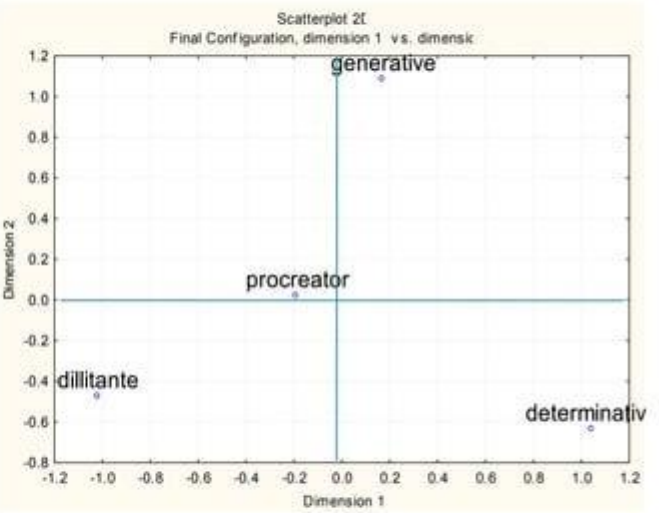
Individual differences scaling model

- The number (m) subjects each judge similarities or dissimilarities of all pairs of n objects leading to m matrices.
- m x n x n

Father's Involvement in their grade school and college child's schooling

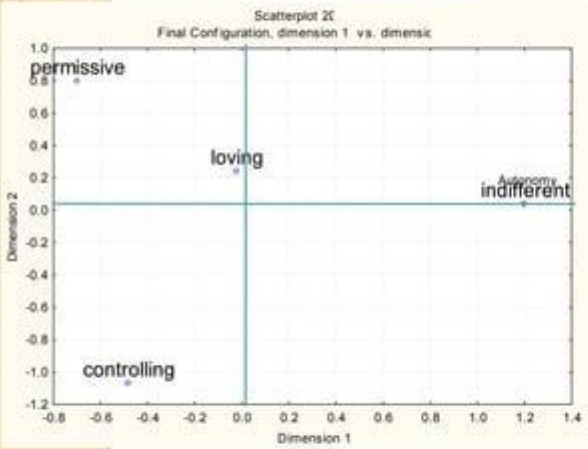


Father's involvement for the grade school child
STRESS=.000

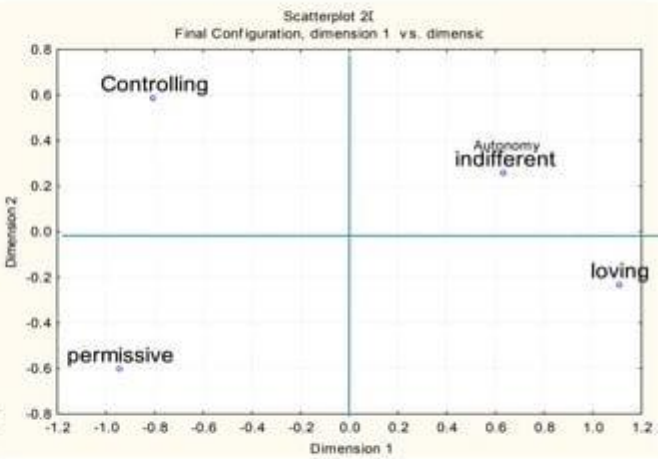


Father's involvement for the college child
STRESS=.000

Mother's Involvement in their grade school and college child's schooling



Mother's involvement for the grade school child
STRESS=.000



Mother's involvement for the college child
STRESS=.000

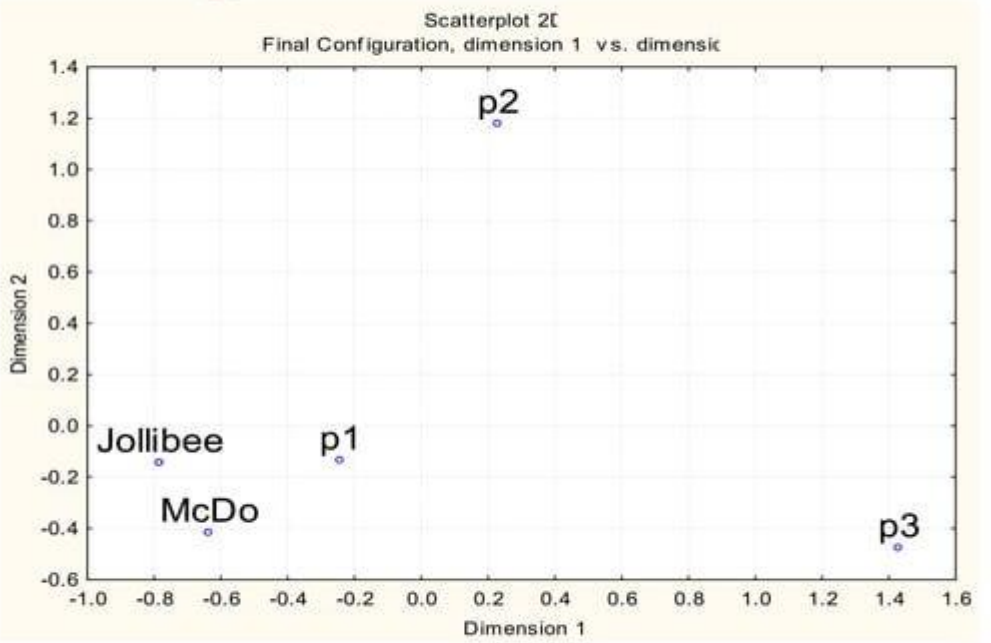
Unfolding Model

- To map the person with the object rated.
- Determine the distance of the person with the object rated.
- The closer the object rated with the person's preference the more simmilar.

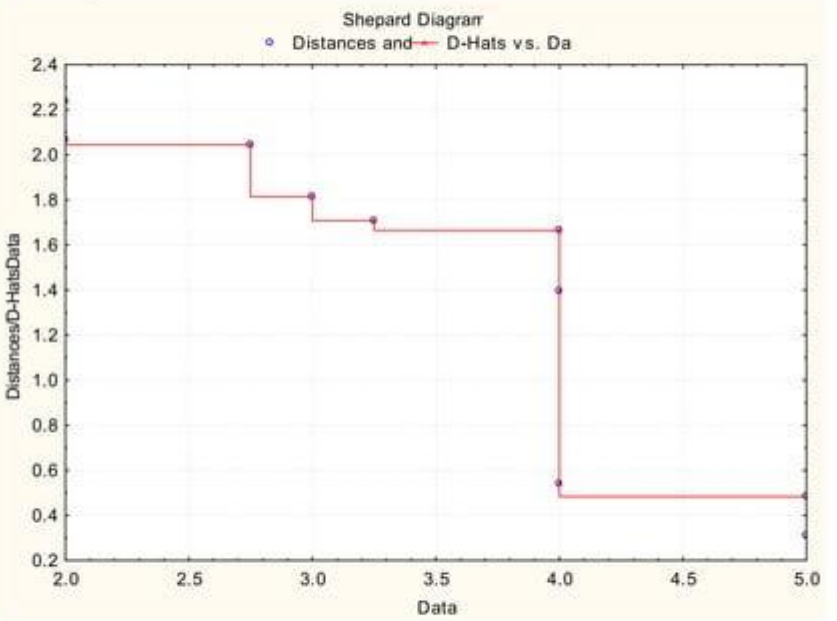
Distance estimates

	McDo	Jollibee	p1	p2	p3
McDo	0	2	5	3	2
Jollibee	5	0	4	4	2
p1	5	4	0	1	2.5
p2	3	4	1	0	1.5
p3	2	2	2.5	1.5	0
Means	0	0	0	0	0
Std. Dev.	0	0	0	0	0
No. of Cases	3				
Matrix	2				

Configuration



Shephard Plot



D-star: Raw stress = 0.000000; Alienation = 0.000000
D-hat: Raw stress = 0.000000; Stress = 0.000000

Proximity measures

- Category rating technique-the subject is presented a stimulus pair.
- The respondents task is to indicate how similar or dissimilar they think the two stimuli are by checking the appropriate category along along the rating scale.

Example

Judge how similar or dissimilar are the following universities:

	Highly similar							Highly dissimilar
DLSU: ADMU	1	2	3	4	5	6	7	8
DLSU: UP	1	2	3	4	5	6	7	8
DLSU: UST	1	2	3	4	5	6	7	8
ADMU: UP	1	2	3	4	5	6	7	8
ADMU: UST	1	2	3	4	5	6	7	8
UP: UST	1	2	3	4	5	6	7	8