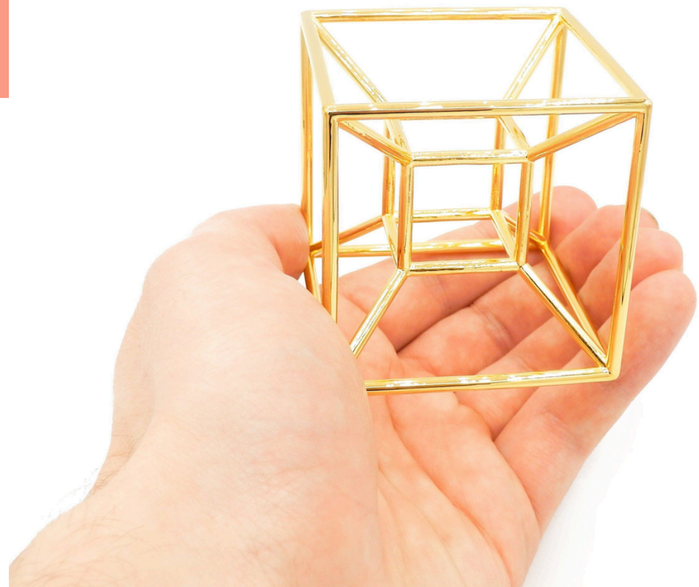
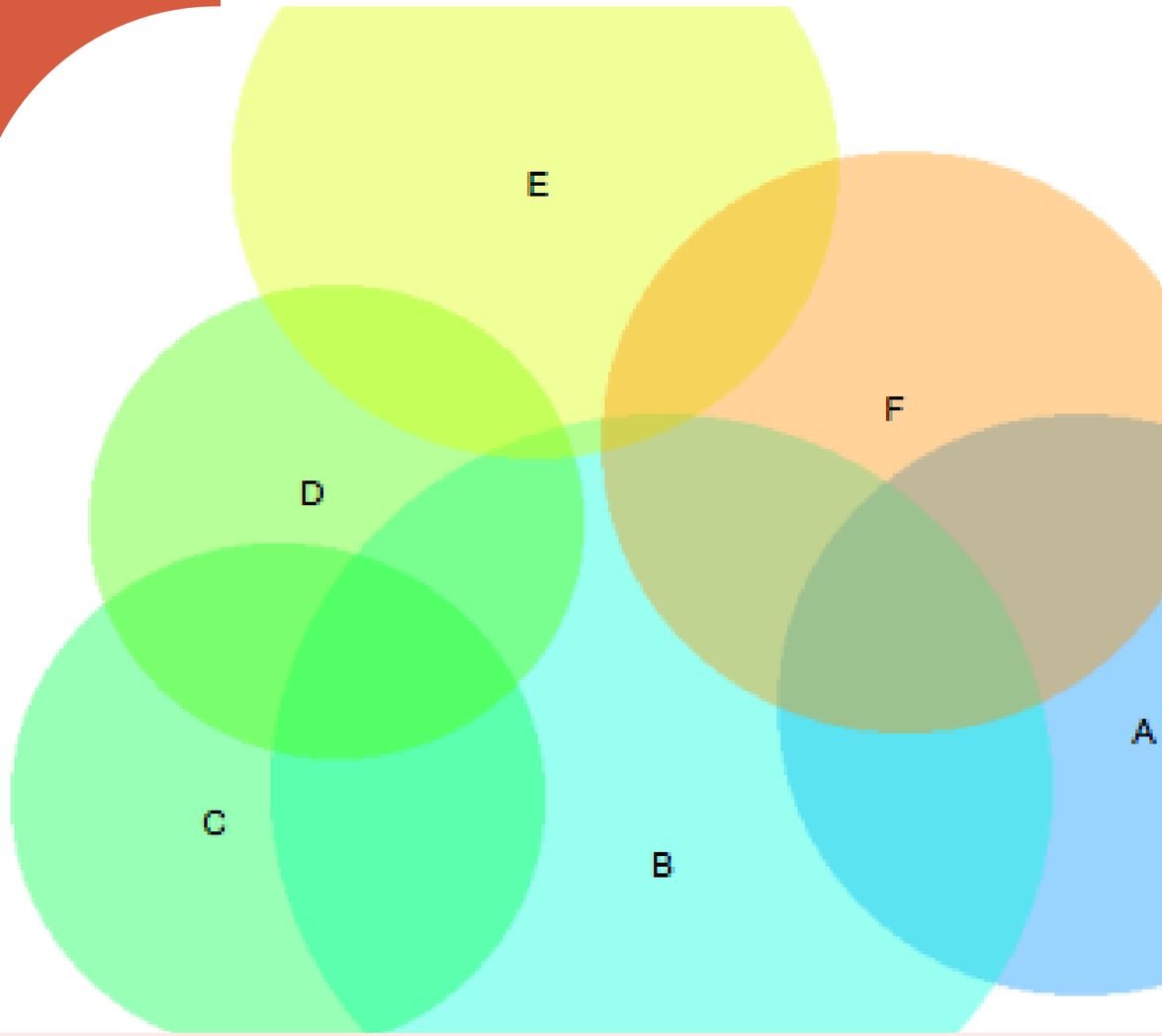
MULTIDIMENSIONAL SCALING

PRESENTED BY
GROUP-8
AMAN SHARMA



What is Multidimensional Scaling ?

MULTIDIMENSIONAL SCALING (MDS) IS A STATISTICAL TECHNIQUE USED TO VISUALIZE THE SIMILARITY OF INDIVIDUAL CASES IN A DATASET. IT TAKES A SET OF DATA IN WHICH THE PAIRWISE SIMILARITIES OR DISSIMILARITIES BETWEEN OBJECTS ARE KNOWN, AND IT REPRESENTS EACH OBJECT AS A POINT IN A LOW-DIMENSIONAL SPACE, TYPICALLY A TWO- OR THREE-DIMENSIONAL SPACE, WHILE PRESERVING THE ORIGINAL PAIRWISE DISTANCES AS MUCH AS POSSIBLE. THIS HELPS IN UNDERSTANDING THE UNDERLYING STRUCTURE OR RELATIONSHIPS WITHIN THE DATA.



Types Of MDS

1) Metric MDS

This method is used when the input data represents metric (distance) information. It aims to find a configuration of points in a low-dimensional space such that the distances between the points approximate the original dissimilarities as closely as possible.

2) Non-metric MDS

This method is suitable when only ordinal (rank) information about the dissimilarities is available. It focuses on preserving the order of dissimilarities rather than their exact values. Non-metric MDS seeks a configuration of points that best reproduces the rank order of the dissimilarities while allowing for some distortion in the distances between points.

METHODS

1)ATTRIBUTES BASED APPROACH

In this approach, the focus is on analyzing the relationships between objects based on their attributes or characteristics. Instead of directly using pairwise similarities or dissimilarities between objects, the analysis is based on the attributes themselves. This approach is often used when the data consist of attribute measurements or feature vectors associated with each object.

2)SIMILARITIES/DISSIMILARITIES BASED APPROACH

This approach, on the other hand, directly considers the pairwise similarities or dissimilarities between objects. The input to MDS is typically a matrix of pairwise distances or similarities, and the goal is to find a low-dimensional representation of the objects that preserves these pairwise relationships as much as possible. This approach is widely used when the focus is on understanding the similarity structure of the data, such as in clustering, classification, or visualization tasks.

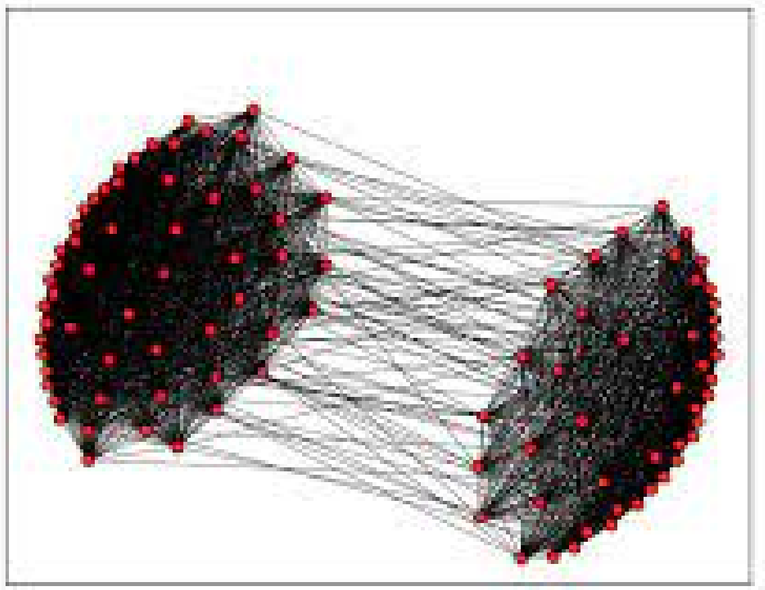
Applications of MDS

MARKETING:

PRODUCT DEVELOPMENT
MARKET RESEARCH
SEGMENTATION

FINANCE:

PORTFOLIO OPTIMIZATION
CREDIT RISK ASSESSMENT
FINANCIAL ANALYSIS



HUMAN RESOURES :

EMPLOYEE PERCEPTION STUDIES
COMPETENCY MAPPING
ORGANIZATIONAL CLIMATE ASSESSMENT

OPERATION :

SUPPLY CHAIN OPTIMIZATION
DECISION MAKING AND SCENARIO ANALYSIS

Process & Procedure

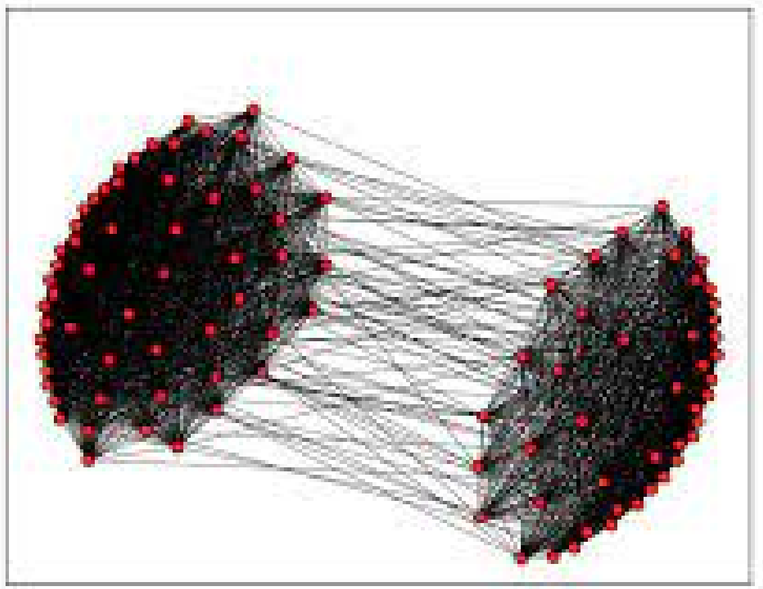
1. DATA COLLECTION
2. DISTANCE MATRIX CALCULATION
3. MDS ALGORITHM
4. DIMENSIONALITY SELECTION & INTERPRETATION

Example

Imagine a survey, where we are asking 50 customers to rate 8 cosmetic products on a scale of 1 (very dissmilar) to 8 (very similar).

Data is converted into a dissimilarity matrix, representing the perceived difference between each brand pair.

An MDS algorithm is applied to the matrix, generating a 2D perceptual map.



questionnaire

1. How similar do you perceive Cinthol and Liril?

0 1 2 3 4 5 6 7 8

2. How similar do you perceive Cinthol and Lifebuoy?

0 1 2 3 4 5 6 7 8

3. How similar do you perceive Cinthol and Dove?

0 1 2 3 4 5 6 7 8

Example using SPSS

MDS DATA (1).sav [DataSet1] - IBM SPSS Statistics Data Editor

File Edit View Data Transform Analyze Graphs Utilities Extensions Window Help

Visible: 9 of 9 Variables

	Brand	Pears	Dove	Nomarks	Nivea_Creme	Himalaya_Herbal	Cinthol	Liril	Lifebuoy	var	var	var	var
1	Pears	.000	6.512	1.223	6.141	5.520	5.310	5.240	4.532				
2	Dove	6.512	.000	6.931	2.123	3.354	4.243	4.433	6.147				
3	Normarks	1.223	6.931	.000	6.627	6.836	5.112	5.236	6.128				
4	Nivea_Creme	6.141	2.123	6.627	.000	1.181	7.432	6.937	6.433				
5	Himalaya_Herbal	5.520	3.354	6.836	1.181	.000	6.645	3.586	6.939				
6	Cinthol	5.310	4.243	5.112	7.432	6.645	.000	1.229	3.391				
7	Liril	5.240	4.433	5.236	6.937	3.586	1.229	.000	1.310				
8	Lifebouy	4.532	6.147	6.128	6.433	6.433	3.391	1.310	.000				
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Data View Variable View

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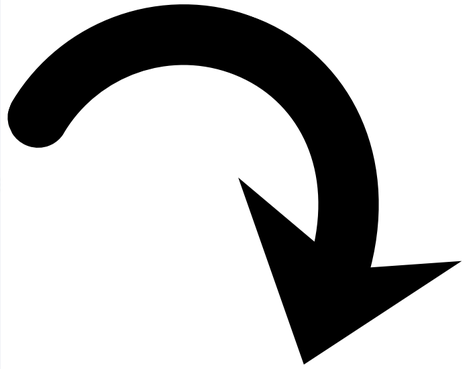

MDS DATA (1).sav [DataSet1] - IBM SPSS Statistics Data Editor

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	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure	Role
1	Brand	String	21	0		None	None	12	Left	Nominal	Input
2	Pears	Numeric	8	3		{1.000, stro...	None	8	Right	Scale	Input
3	Dove	Numeric	8	3		{1.000, stro...	None	8	Right	Scale	Input
4	Nomarks	Numeric	8	3		{1.000, stro...	None	8	Right	Scale	Input
5	Nivea_Creme	Numeric	8	3		{1.000, stro...	None	12	Right	Scale	Input
6	Himalaya_H...	Numeric	8	3		{1.000, stro...	None	15	Right	Scale	Input
7	Cinthol	Numeric	8	3		{1.000, stro...	None	8	Right	Scale	Input
8	Liril	Numeric	8	3		{1.000, stro...	None	8	Right	Scale	Input
9	Lifebuoy	Numeric	8	3		{1.000, stro...	None	8	Right	Scale	Input
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MDS DATA (1).sav [DataSet1] - IBM SPSS Statistics Data Editor

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Visible: 9 of 9 Variables

	Brand	Pea	_Creme	Himalaya_Herbal	Cinthol	Liril	Lifebuoy	var	var	var	var
1	Pears		6.141	5.520	5.310	5.240	4.532				
2	Dove	6	2.123	3.354	4.243	4.433	6.147				
3	Normarks	1	6.627	6.836	5.112	5.236	6.128				
4	Nivea_Creme	6	.000	1.181	7.432	6.937	6.433				
5	Himalaya_Herbal	5	1.181	.000	6.645	3.586	6.939				
6	Cinthol	5	7.432	6.645	.000	1.229	3.391				
7	Liril	5	6.937	3.586	1.229	.000	1.310				
8	Lifebouy	4	6.433	6.433	3.391	1.310	.000				
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Reports
Descriptive Statistics
Bayesian Statistics
Tables
Compare Means
General Linear Model
Generalized Linear Models
Mixed Models
Correlate
Regression
Loglinear
Neural Networks
Classify
Dimension Reduction
Scale
Nonparametric Tests
Forecasting
Survival
Multiple Response
Missing Value Analysis...
Multiple Imputation
Complex Samples
Simulation...
Quality Control
ROC Curve...
Spatial and Temporal Modeling...
Direct Marketing

Reliability Analysis...
Multidimensional Unfolding (PREFSCAL)...
Multidimensional Scaling (PROXSCAL)...
Multidimensional Scaling (ALSCAL)...

Data View Variable View

Multidimensional Scaling (ALSCAL)...

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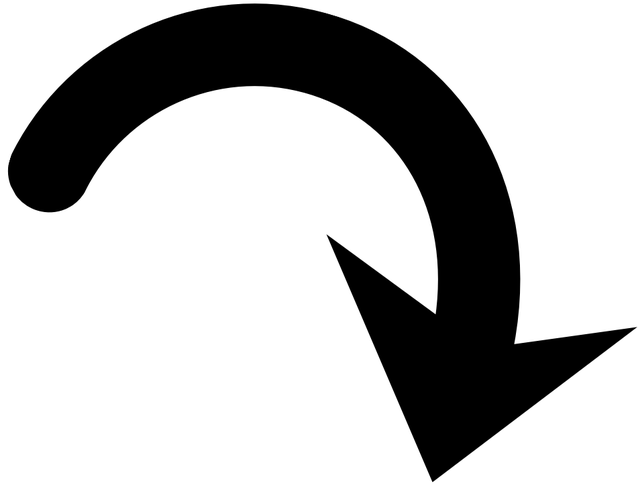

MDS DATA (1).sav [DataSet1] - IBM SPSS Statistics Data Editor

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17 : Himalaya_Herbal

Visible: 9 of 9 Variables

	Brand	Pears	Dove	Nomarks	Nivea_Creme	Himalaya_Herbal	Cinthol	Liril	Lifebuoy	var	var	var	var
1	Pears	.000	6.512	1.223	6.141	5.520	5.310	5.240	4.532				
2	Dove	6.512	.000	6.931	2.123	3.354	4.243	4.433	6.147				
3	Normarks	1.223	6.931					6	6.128				
4	Nivea_Creme	6.141	2.123	6				7	6.433				
5	Himalaya_Herbal	5.520	3.354	6				6	6.939				
6	Cinthol	5.310	4.243	5				9	3.391				
7	Liril	5.240	4.433	5				0	1.310				
8	Lifebouy	4.532	6.147	6				0	.000				
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Multidimensional Scaling

Multidimensional Scaling: Model

Level of Measurement
- Ordinal:
- Untie tied observations
- Interval
- Ratio

Conditionality
- Matrix
- Row
- Unconditional

Dimensions
Minimum: 2 Maximum: 2

Scaling Model
- Euclidean distance
- Individual differences Euclidean distance:
- Allow negative subject weights

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17 : Himalaya_Herbal

Visible: 9 of 9 Variables

	Brand	Pears	Dove	Nomarks	Nivea_Creme	Himalaya_Herbal	Cinthol	Liril	Lifebuoy	var	var	var	var
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6	Cinthol	5.310	4.243	5				9	3.391				
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Multidimensional Scaling

Brand

Distances

Data a

Shape

Create

Measu

Model...

Options...

OK Paste Reset Cancel Help

Multidimensional Scaling: Options

Display

- [x] Group plots
- [ ] Individual subject plots
- [ ] Data matrix
- [ ] Model and options summary

Criteria

S-stress convergence: 0.001

Minimum s-stress value: 0.005

Maximum iterations: 30

Treat distances less than: 0 as missing

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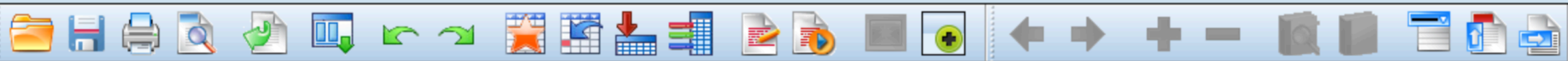

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    - Scatterplot of Line

Alscal

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Iteration history for the 2 dimensional solution (in squared distances)

Young's S-stress formula 1 is used.

Iteration	S-stress	Improvement
1	.20083	
2	.18520	.01563
3	.18504	.00016

Iterations stopped because
S-stress improvement is less than .001000

Stress and squared correlation (RSQ) in distances

RSQ values are the proportion of variance of the scaled data (disparities)
in the partition (row, matrix, or entire data) which
is accounted for by their corresponding distances.
Stress values are Kruskal's stress formula 1.

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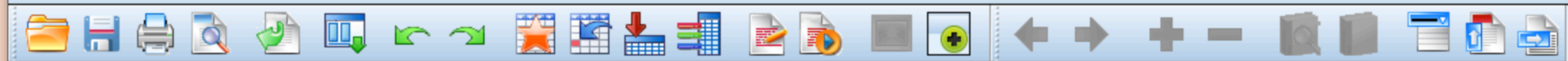

For matrix

Stress = .17369 RSQ = .84365

Configuration derived in 2 dimensions

Stimulus Coordinates

Stimulus Number	Stimulus Name	Dimension 1	Dimension 2
1	Pears	.7530	1.2276
2	Dove	-1.2010	-.6055
3	Nomarks	.9532	1.3944
4	Nivea_Cr	-1.6208	.4953
5	Himalaya	-1.3711	.1156
6	Cinthol	.9582	-.9220
7	Liril	.5324	-.8582
8	Lifebuoy	.9962	-.8472

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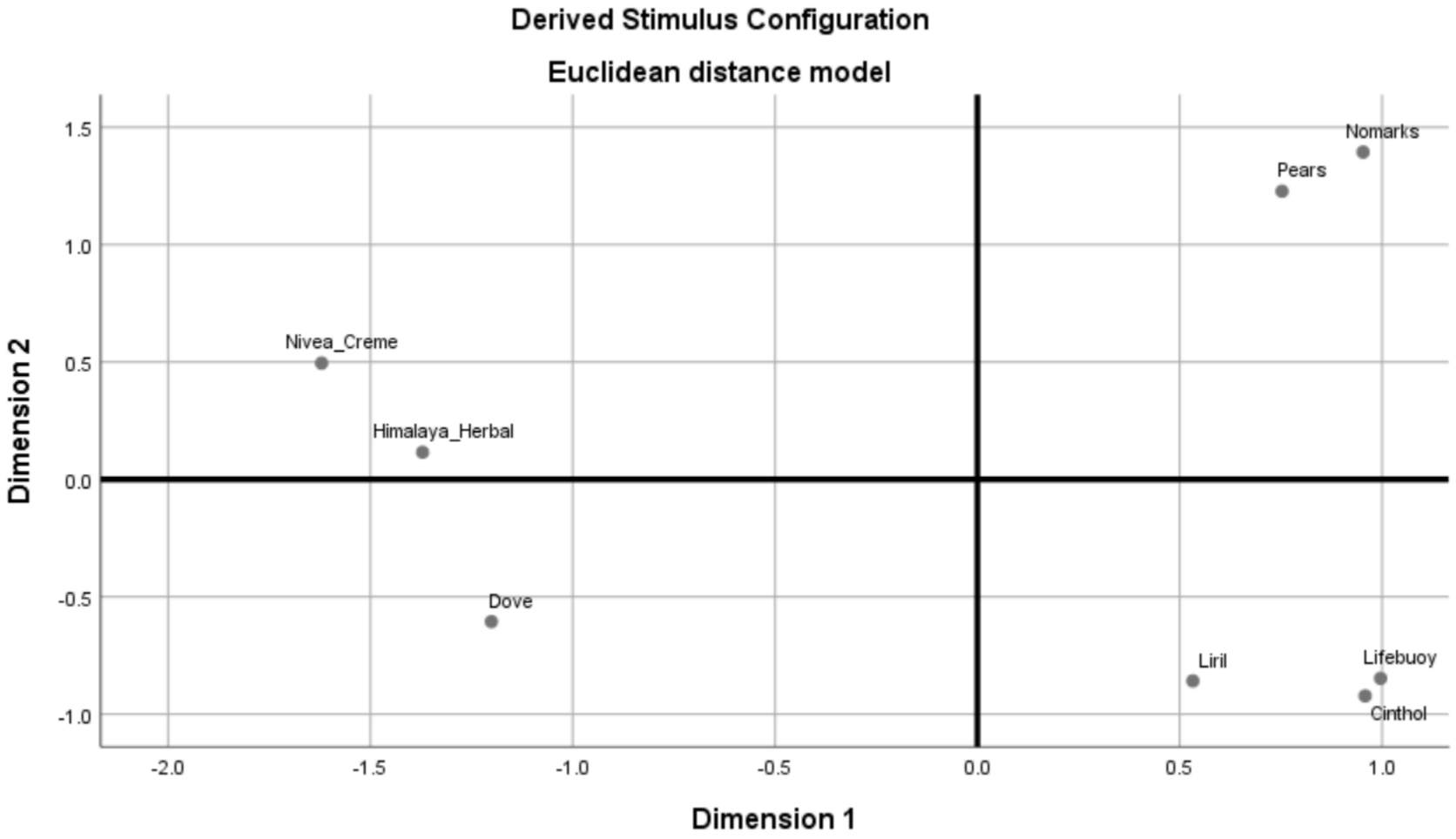

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Interpretation

- lifeboy and cinthol are most similar in the overall Analysis.
- Dove is the most least similar in the overall Analysis, as it lies alone in an dimention.
- Lifeboy cinthol and liril come under same dimention as they are more similar compared to other products.
- Pears and nomarks lie in the same dimention.
- Stress value is 0.17 which indicated the analysis to better fit.

Conclusion

•MDS gives to identify the similarity which leads to get new opportunity to develop new product also to take corrective action on present product.

•Base on dimension action can be taken to change opinion of people so that product acceptance will improve , which leads to get market benefit.

THANK YOU!!