Profile Analysis Equations

Psy 524
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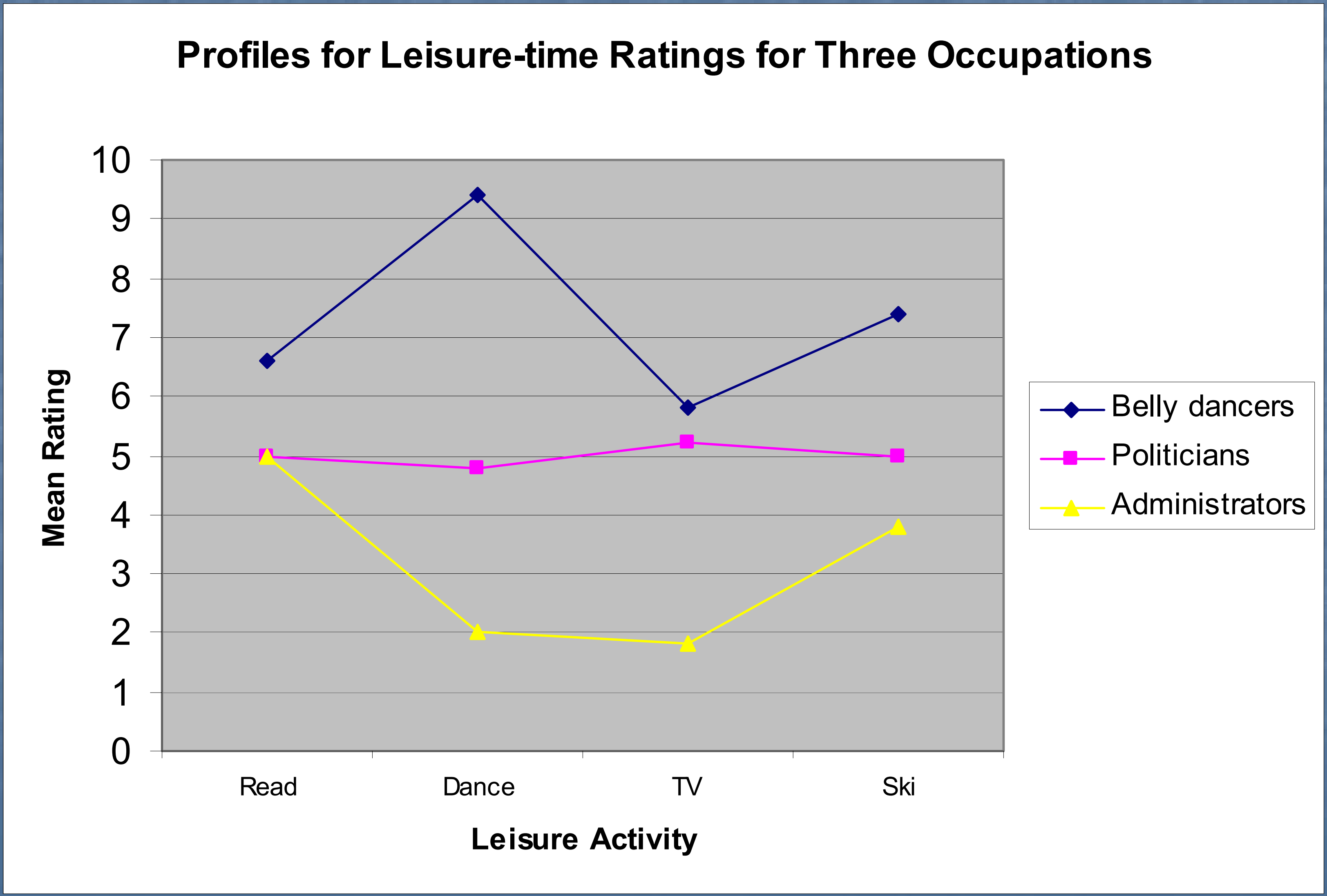
Example Data

Group		Read	Dance	TV	Ski	Average across activities
		7	10	6	5	7
		8	9	5	7	7.25
Belly dancers		5	10	5	8	7
		6	10	6	8	7.5
		7	8	7	9	7.75
	Mean BD	6.6	9.4	5.8	7.4	7.3
		4	4	4	4	4
		6	4	5	3	4.5
Politicians		5	5	5	6	5.25
		6	6	6	7	6.25
		4	5	6	5	5
	Mean P	5	4.8	5.2	5	5
		3	1	1	2	1.75
		5	3	1	5	3.5
Administrators		4	2	2	5	3.25
		7	1	2	4	3.5
		6	3	3	3	3.75
	Mean A	5	2	1.8	3.8	3.15
Grand Mean		5.53	5.4	4.27	5.4	5.15

Profile of Example data



Steps to Profile Analysis

- Profile analysis is similar to MANOVA with one exception and some rearranging of the data

Steps to Profile Analysis

- Equal Levels is a univariate test; each persons score is the average across all of the DVs and the group average is found by averaging the groups mean score on each DV

Steps to Profile Analysis

$$\sum_i \sum_j (Y_{ij} - GM)^2 = np \sum_j \left(\bar{Y}_j - GM_{(y)}\right)^2 + p \sum_i \sum_j (Y_{ij} - \bar{Y}_j)^2$$

$$SS_{Total} = SS_{bg} + SS_{wg}$$

- N is the number of subjects in each group (equal n case)
- P is the number of DVs

Steps to Profile Analysis

$$SS_{bg} = (5)(4)[(7.3 - 5.15)^2 + (5 - 5.15)^2 + (3.15 - 5.15)^2]$$

$$SS_{wg} = (4)[(7 - 7.3)^2 + (7.25 - 7.3)^2 + \cdots + (3.75 - 3.15)^2]$$

Steps to Profile Analysis

- A normal univariate ANOVA ;summary table is created

Sourceof Variance	SS	DF	MS	F	Sig.
Between Groups	172.9	2	86.45	44.145	.000
Within Groups	23.5	12	1.958		

Steps to Profile Analysis

- Preparing the data for the Multivariate tests
  - Creating segments – DVs can be combined in any number of ways but one of the easiest is taking the difference between parallel sections of the DVs. It has been shown that what linear combination you use is irrelevant.

Steps to Profile Analysis

- Segmented data

Group		Read - Dance	Dance - TV	TV - Ski
		-3	4	1
		-1	4	-2
		-5	5	-3
		-4	4	-2
Belly dancers		-1	1	-2
	Mean BD	-2.8	3.6	-1.6
		0	0	0
		2	-1	2
		0	0	-1
		0	0	-1
Politicians		-1	-1	1
	Mean P	0.2	-0.4	0.2
		2	0	-1
		2	2	-4
		2	0	-3
		6	-1	-2
Administrators		3	0	0
	Mean A	3	0.2	-2
Grand Mean		0.13	1.13	-1.13

Steps to Profile Analysis

- Parallelism
  - Really asks the question is there a difference between groups on difference scores made by subtracting parallel scores on the DVs

Steps to Profile Analysis

- Parallelism
  - In the example "Is the difference between reading and dancing the same for dancers, politicians and administrators?" and simultaneously asks "Is the difference in ratings of dancing and skiing the same for each group", etc.

Steps to Profile Analysis

- Parallelism
  - In the example, a one way MANOVA would be used to tests the parallelism hypothesis. Each segment represents a slope between two original DVs, if a multivariate effect is found than there is a difference in slope between at least two of the groups.

Steps to Profile Analysis

- Flatness
  - This is a test that the average slope (segment) is different than zero for at least one pair of DVs
  - Performs the multivariate equivalent to a one sample t-test called a one sample Tau squared (Hotelling's T2).

Steps to Profile Analysis

- Flatness
  - Basically the average of each segment across groups is used to compute this and each score has zero subtracted from is, is squared and divided by the pooled error SSCP matrix (Swg).

Matrix Equations

- Parallelism
  - For the first belly dancer:

$$(Y_{111} - M_1) = \begin{bmatrix} -3 \\ 4 \\ 1 \end{bmatrix} - \begin{bmatrix} -2.8 \\ 3.6 \\ -1.6 \end{bmatrix} = \begin{bmatrix} -0.2 \\ 0.4 \\ 2.6 \end{bmatrix}$$

$$(Y_{111} - M_1)(Y_{111} - M_1)' = \begin{bmatrix} -0.2 \\ 0.4 \\ 2.6 \end{bmatrix} \begin{bmatrix} -0.2 & 0.4 & 2.6 \end{bmatrix}$$

Matrix Equations

- This is done for every case and added together to create the Swg matrix

$$S_{wg} = \begin{bmatrix} 29.6 & -13.2 & 6.4 \\ -13.2 & 15.2 & -6.8 \\ 6.4 & -6.8 & 26 \end{bmatrix}$$

Matrix Equations

- Now for the between groups S matrix you need to get the difference between each group mean and the grand mean for each segment, for the first group:

Matrix Equations

$$(M_1 - GM) = \begin{bmatrix} -2.8 \\ 3.6 \\ -1.6 \end{bmatrix} - \begin{bmatrix} 0.13 \\ 1.13 \\ -1.13 \end{bmatrix} = \begin{bmatrix} -2.93 \\ 2.47 \\ -.47 \end{bmatrix}$$

$$(M_1 - GM)(M_1 - GM)' = \begin{bmatrix} -2.93 \\ 2.47 \\ -.47 \end{bmatrix} \begin{bmatrix} -2.93 & 2.47 & -.47 \end{bmatrix}$$

Matrix Equations

- This is done for each group and added together, then each entry in the matrix is multiplied by the number of people in each group. This results in the Sbg matrix:

$$S_{bg} = \begin{bmatrix} 84.133 & -50.067 & -5.133 \\ -50.067 & 46.533 & -11.933 \\ -5.133 & -11.933 & 13.733 \end{bmatrix}$$

Matrix Equations

- Lambda is calculated the same way, etc.

Matrix Equations

- Flatness - is tested by subtracted a hypothesized grand mean (0) from the actual grand mean

$$(GM - 0) = \begin{bmatrix} 0.13 \\ 1.13 \\ -1.13 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix} = \begin{bmatrix} 0.13 \\ 1.13 \\ -1.13 \end{bmatrix}$$

Matrix Equations

$$Hotelling's\ \mathrm{T}^2 = N(GM)' S_{wg}^{-1}(GM)$$

$$\mathrm{T}^2 = (15)[.13 \quad 1.13 \quad -1.13] \begin{bmatrix} .05517 & .04738 & -.00119 \\ .04738 & .11520 & .01847 \\ -.00119 & .01847 & .04358 \end{bmatrix} \begin{bmatrix} .13 \\ 1.13 \\ -1.13 \end{bmatrix}$$

$$= 2.5825$$

Matrix Equations

$$F = \frac{N - k - p + 2}{p - 1}(\mathrm{T}^2)$$

$$F = \frac{15 - 3 - 4 + 2}{4 - 1}(2.5825) = 8.608$$

$$\Lambda = \frac{1}{1 + \mathrm{T}^2} = \frac{1}{1 + 2.5825} = .27913$$