Multi-Dimensional Models ?



- Interest is in detecting presence of multidimensionality in data.
- Uni-dimensionality is necessary to have Rasch model measurement properties.

Multi-Dimensional Items

Logit Score	Persons	Items	
3	XXX	5	 When item distributions are bi-modal
2	XX	3,4	then two dimensions or
1	XX	8	variables are present.
0	XXX		 Item separation statistics indicate if items
-1	XX	1,2	spread out along a linear
-2	XX	6	continuum defining distinct levels of
-3	XXX	7	difficulty.

Multi-Dimensional Persons

Logit Score	Persons	Items	
3	XXX	5	 When person distributions are bi-modal
2	XX	4	then two different types of
1	X	8	people are being measured.
0		3,2	 Person separation statistics indicate if
-1	X	1	persons spread out along a
-2	XX	6	linear continuum defining distinct levels of ability.
-3	XXX	7	

Rasch Fit Statistics

Mean Square Fit

• Item MnSq > 1.4 or Z > 2.0 indicates that item is not related to the rest of the items comprising the scale

(HINT: several non-fitting items may comprise another scale)

• Person MnSq > 1.4 or Z > 2.0 indicates that person is not related to rest of sample.

(HINT: several non-fitting persons may comprise different group)

Smith, R.M. (1996). A Comparison of Methods for Determining Dimensionality in Rasch Measurement. Structural Equation Modeling, 3(1), 25-40.

Rasch Fit Statistics Update

Mean Square Fit

A Single MnSq value > 1.4 or Z > 2.0 doesn't give exact .05 Type I Error Rates. Correction for Sample Size Required.

 $MS(WT) = 1 + 2 / (SAMPLE SIZE)^{1/2}$

MS(UT) = 1 + 6 / (SAMPLE SIZE) $^{1/2}$

Smith, R.M., Schumacker, R.E., & Bush, M.J. (1998). Using Item Mean Squares to Evaluate Fit to the Rasch Model. Journal of Outcome Measurement, 2(1), 66-78.

Rasch Fit Statistics Update

Sample Size	MS Weighted Total	MS Unweighted Total
150	1.16	1.48
500	1.09	1.27
1000	1.06	1.19

The t-statistic is less affected by different sample sizes and test lengths than the MnSq fit statistic. Recommend using IPARM t-statistics, rather than BIGSTEPS MnSq-fit statistics because it corrects for Type I error.

Smith, R.M. (1991). IPARM: Item and Person Analysis with the Rasch Model. Chicago: MESA Press