

Here I am using the WIRS dataset in the ltm package and I am calculating the 1PL model. There are many methods of assessing unidimensionality. In rasch, we use a very specific procedure. There are two methods of assessing unidimensionality. This procedure reveals the proportion of variance in item responses that can be explained by the Rasch model. Many researchers use a critical value of about 20% of variance explained by Rasch measures as evidence of “close-enough” unidimensionality to support the interpretation of Rasch model results for many practical purposes.

```
>
> ## Raw variance explained by Rasch measures: (VO - VR)/VO
> (VO - VR)/VO
[1] 0.2712589
>
```

It is also somewhat common in Rasch analysis to examine correlations among standardized residuals for evidence of potentially meaningful additional dimensions. PCA of residuals is essentially evaluating the degree to which additional dimensions may have contributed to item responses. If the contrasts come out to be less than 2 then we can say that our model is unidimensional.

```
>
> contrasts
[1] 1.5645327 1.2208999 1.1343585 1.0583101 0.9968146
>
```

The following are some descriptive statistics

```
> summary(df)
      Item 1      Item 2      Item 3      Item 4      Item 5
Min.   :0.0000 Min.   :0.0000 Min.   :0.0000 Min.   :0.0000 Min.   :0.0000
1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.0000 1st Qu.:0.0000
Median :0.0000 Median :1.0000 Median :0.0000 Median :0.0000 Median :0.0000
Mean    :0.3731 Mean    :0.5831 Mean    :0.2826 Mean    :0.2398 Mean    :0.3572
3rd Qu.:1.0000 3rd Qu.:1.0000 3rd Qu.:1.0000 3rd Qu.:0.0000 3rd Qu.:1.0000
Max.    :1.0000 Max.    :1.0000 Max.    :1.0000 Max.    :1.0000 Max.    :1.0000
      Item 6
Min.   :0.0000
1st Qu.:0.0000
Median :0.0000
Mean    :0.1473
3rd Qu.:0.0000
Max.    :1.0000
> view(df)
```

Because this is a Rasch model, Slope has been constrained to 1 and beta are item locations (difficulty). Item 6 is the most difficult. I have also summarized the difficulty.

Item Parameters in IRT parameterization

	item	alpha	beta
1	Item 1	1	0.590
2	Item 2	1	-0.382
3	Item 3	1	1.055
4	Item 4	1	1.303
5	Item 5	1	0.668
6	Item 6	1	1.963

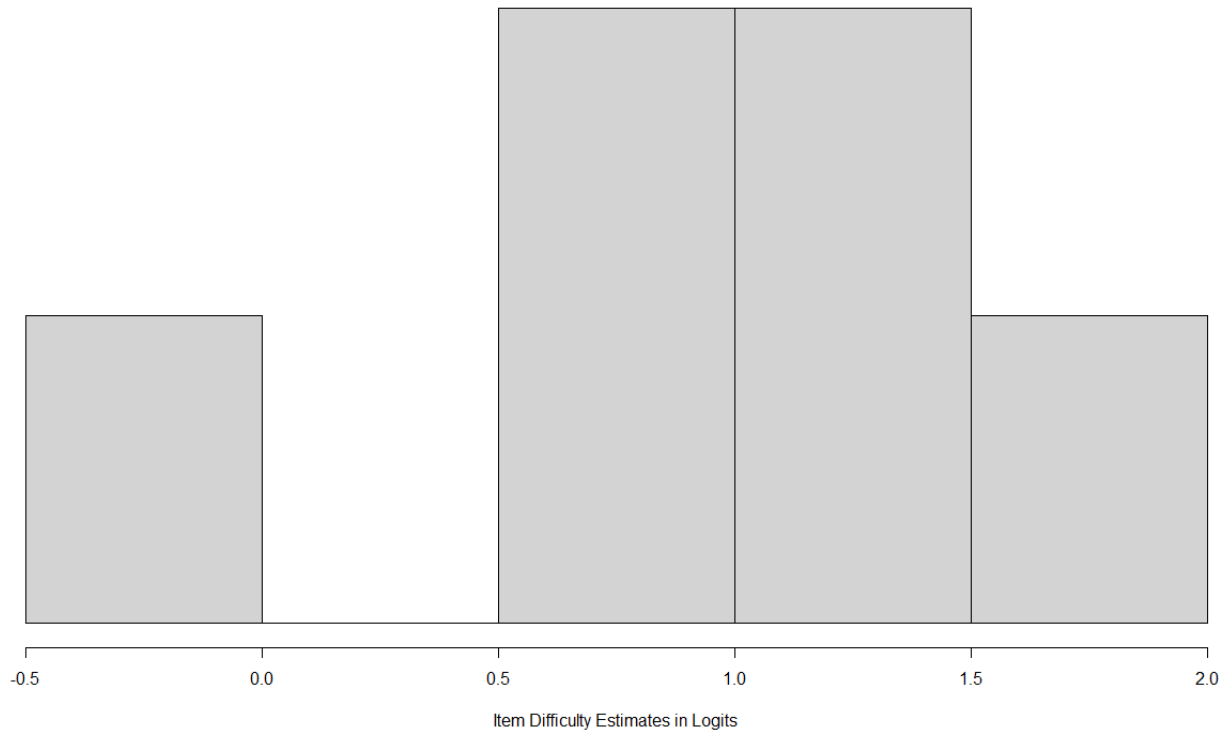
>

Item 6 1.9634182 0.09260779

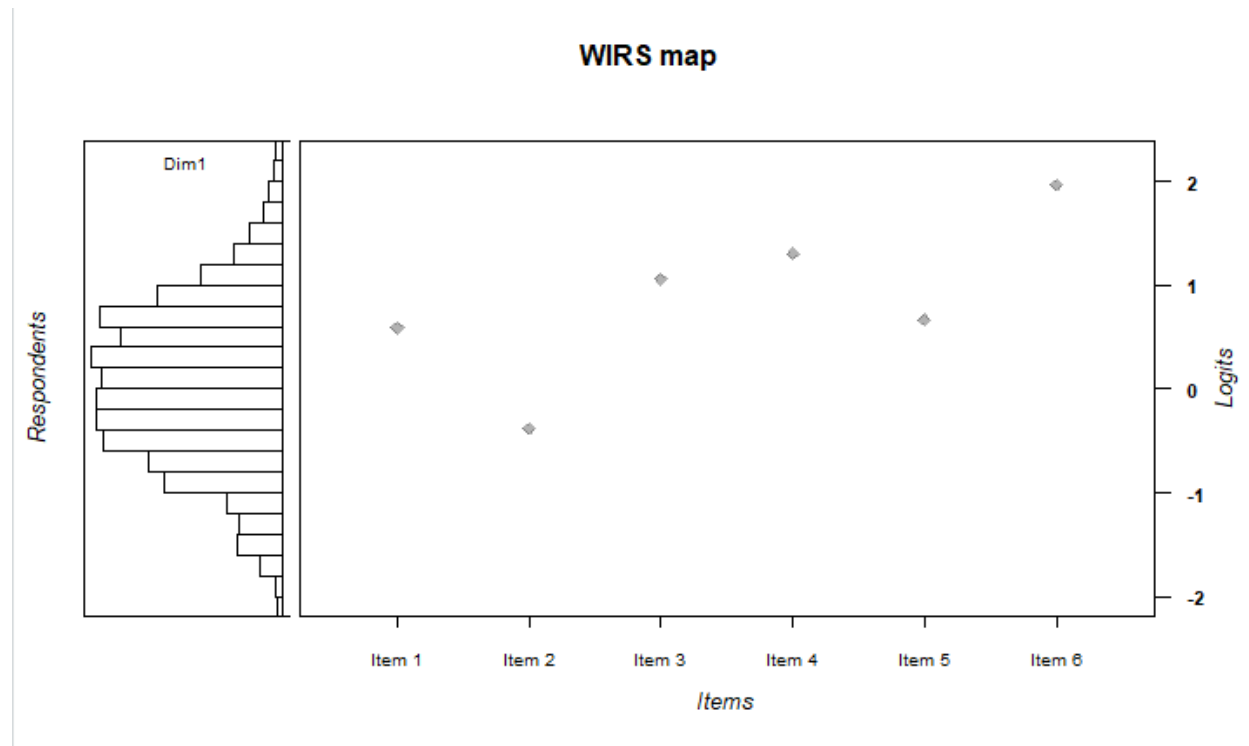
> summary(difficulty)

	xsi	se.xsi
Min.	:-0.3822	Min. :0.06821
1st Qu.:	0.6093	1st Qu.:0.06958
Median :	0.8614	Median :0.07208
Mean :	0.8661	Mean :0.07538
3rd Qu.:	1.2409	3rd Qu.:0.07692
Max. :	1.9634	Max. :0.09261

>



The following is a wright map. We might need some items for people with low abilities. Although we should confirm the fit of the model before interpreting this.



The following are the fit statistics. In general, the MSE versions of Outfit and Infit are expected to be close to 1.00 and the standardized versions of Outfit and Infit are expected to be around 0.00 when data fit the Rasch model expectations..

```
> summary(item.fit)
parameter      Outfit      Outfit_t      Outfit_p      Outfit_pholm
Length:6      Min.   :0.8777   Min.   : -3.917834   Min.   :1.000e-08   Min.   :4.000e-08
Class :character 1st Qu.:0.8955   1st Qu.: -2.954540   1st Qu.:2.580e-05   1st Qu.:1.067e-04
Mode  :character Median :0.9279   Median : -1.601140   Median :6.496e-04   Median :1.994e-03
              Mean  :0.9823   Mean  : 0.004964   Mean  :5.173e-02   Mean  :5.801e-02
              3rd Qu.:1.0713   3rd Qu.: 3.162747   3rd Qu.:2.654e-02   3rd Qu.:5.338e-02
              Max.   :1.1563   Max.   : 5.804860   Max.   :2.741e-01   Max.   :2.741e-01

      Infit      Infit_t      Infit_p      Infit_pholm
Min.   :0.9238   Min.   : -2.9177   Min.   :0.0000013   Min.   :0.000008
1st Qu.:0.9394   1st Qu.: -1.6657   1st Qu.:0.0015140   1st Qu.:0.006688
Median :0.9634   Median : -0.7185   Median :0.0264168   Median :0.081014
Mean   :0.9989   Mean   : 0.3086   Mean   :0.1665874   Mean   :0.323814
3rd Qu.:1.0525   3rd Qu.: 2.3357   3rd Qu.:0.3454452   3rd Qu.:0.703217
Max.   :1.1290   Max.   : 4.8340   Max.   :0.5016885   Max.   :0.888316
>
```

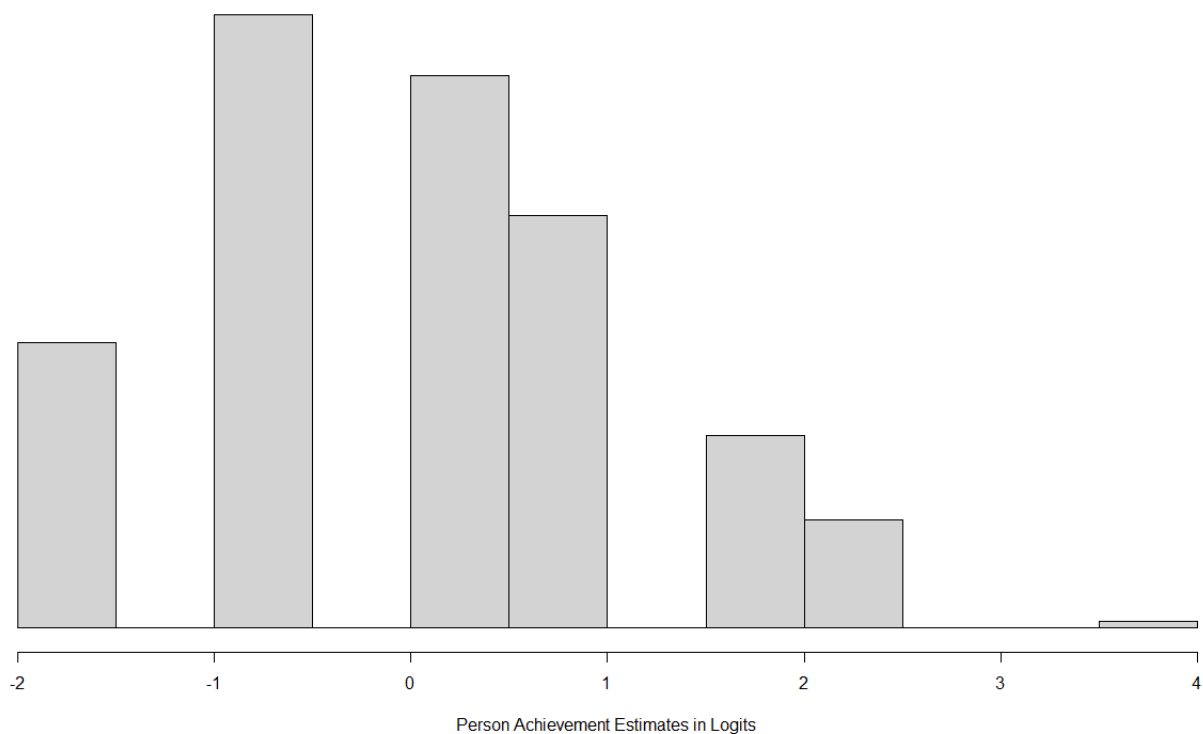
The following are the ability estimates along with reliability estimates.

WLE reliability is the person separation statistic. This value is interpreted similarly to Cronbach's alpha when there is good fit between the data and the Rasch model .

	pid	N.items	PersonScores	PersonMax	theta	error	WLE.rel
1	1	6	0	6	-1.991469	1.662788	0.1142828
2	2	6	0	6	-1.991469	1.662788	0.1142828
3	3	6	0	6	-1.991469	1.662788	0.1142828
4	4	6	0	6	-1.991469	1.662788	0.1142828
5	5	6	0	6	-1.991469	1.662788	0.1142828
6	6	6	0	6	-1.991469	1.662788	0.1142828
7	7	6	0	6	-1.991469	1.662788	0.1142828

```
> view(achievement)
>
> summary(achievement)
      pid      N.items      PersonScores      PersonMax      theta      error
Min.   : 1      Min.   :6      Min.   :0.000      Min.   :6      Min.   : -1.9915      Min.   :0.8638
1st Qu.:252      1st Qu.:6      1st Qu.:1.000      1st Qu.:6      1st Qu.: -0.6127      1st Qu.:0.8981
Median :503      Median :6      Median :2.000      Median :6      Median : 0.1990      Median :0.9022
Mean   :503      Mean   :6      Mean   :1.983      Mean   :6      Mean   : 0.0469      Mean   :1.0456
3rd Qu.:754      3rd Qu.:6      3rd Qu.:3.000      3rd Qu.:6      3rd Qu.: 0.8757      3rd Qu.:1.0508
Max.   :1005      Max.   :6      Max.   :6.000      Max.   :6      Max.   : 3.6917      Max.   :1.6628

      WLE.rel
Min.   :0.1143
1st Qu.:0.1143
Median :0.1143
Mean   :0.1143
3rd Qu.:0.1143
Max.   :0.1143
>
> I
```



The following are person fit statistics. In general, the MSE versions of Outfit and Infit are expected to be close to 1.00 and the standardized versions of Outfit and Infit are expected to be around 0.00 when data fit the Rasch model expectations.

```
>
> summary(person.fit)
  outfitPerson  outfitPerson_t  infitPerson  infitPerson_t
Min.   :0.07492  Min.   : -1.3593  Min.   :0.1044  Min.   : -1.5063
1st Qu.:0.37492  1st Qu.: -0.7745  1st Qu.:0.5057  1st Qu.: -0.8458
Median :0.78642  Median : -0.3345  Median :0.8765  Median : -0.4125
Mean   :0.76034  Mean   : -0.1463  Mean   :0.7890  Mean   : -0.2200
3rd Qu.:1.09484  3rd Qu.:  0.3543  3rd Qu.:1.0739  3rd Qu.:  0.3232
Max.   :2.22870  Max.   :  2.2141  Max.   :1.6625  Max.   :  2.2285
>
>
```

```
>
> person.fit <- personfit(student.locations)
> summary(person.fit$p.infitMSQ)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.6312 0.6772  0.9272  0.9538 1.1228  1.6619
> |
```

```
> summary(person.fit$p.outfitMSQ)
  Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
0.4066 0.6098  0.8964  0.9304 1.1441  3.6013
```

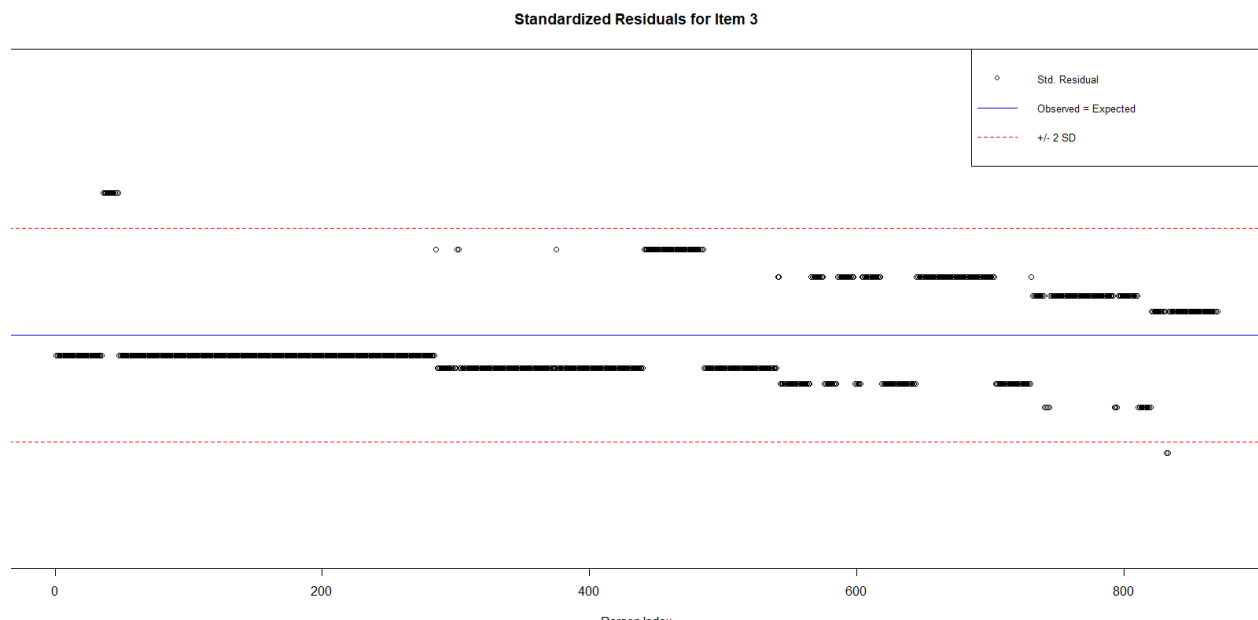
- Expected value is about 1.00 when data fit the model
- Less than 1.00: Responses are too predictable; they resemble a Guttman-like (deterministic) pattern (“muted”)
- Greater than 1.00: Responses are too haphazard (“noisy”); there is too much variation to suggest that the estimate is a good representation of the response pattern
- Some variation is expected, but noisy responses are usually considered more cause for concern than muted responses

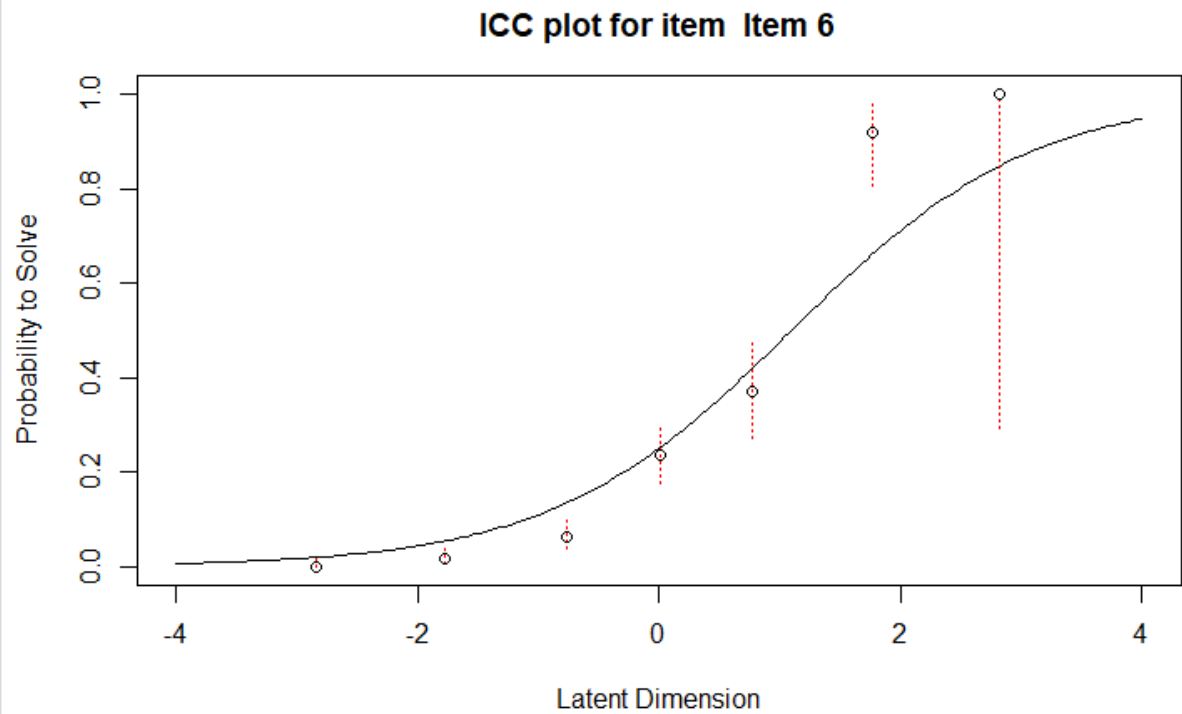
Researchers usually begin individual Rasch fit analyses by examining fit statistics for items, rather than persons.

Itemfit statistics:

	Chisq	df	p-value	outfit MSQ	Infit MSQ	outfit t	Infit t	Discrim
Item 1	1243.272	869	0	1.429	1.317	9.360	9.287	-0.284
Item 2	1123.961	869	0	1.292	1.196	5.345	6.311	-0.188
Item 3	616.772	869	1	0.709	0.780	-6.403	-6.512	0.531
Item 4	705.955	869	1	0.811	0.871	-3.405	-3.313	0.330
Item 5	622.054	869	1	0.715	0.766	-7.607	-7.999	0.554
Item 6	544.934	869	1	0.626	0.744	-4.865	-5.147	0.448

We can also draw plots for individual items





Following is the reliability:-

```
> summary(sepker(student, locations))
```

```
separation reliability: 0.0637
```

```
Observed variance: 1.0576 (Squared Standard Deviation)
```

```
Mean Square Measurement Error: 0.9902 (Model Error Variance)
```

```
> |
```