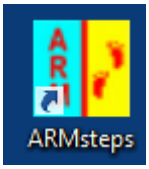
ARMChapter8.pdf: Applying the Rasch Model 4th ed.
Chapter 8: Guilford's Data

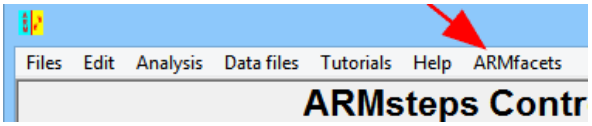
We will analyze the ratings of seven **junior scientists** on five **creativity traits** by three **senior Scientists** (after Guildford, 1954, p.282) using ARMfacets.

		Hard						Creativity Traits						Easy		
		Trait e			Trait c			Trait b			Trait a			Trait d		
Examinee	Judge:	A	C	B	A	C	B	A	C	B	A	C	B	A	C	B
High	2	5	5	2[g]	5	5	5	7	7	7	9	7	8	8	7	7
	5	5	7	3	7	7	3	7	7	4	9	9	2[f]	8	7	2[f]
	7	5	7	4	5	7	5	7	7	3	7	7	3	5	5	5
	1	3	3	3	3	5	4	5	5	5	5	5	6	5	7	6
	3	1	5	6[f]	3	5	3	3	5	5	3	3	4	7[g]	5	6
	4	3	1	5[f]	1	3	4	3	3	6	7	5	5	3	3	5
Low	6	1	3	2	3	3	6[f]	5	3	4	3	3	4	5	5	4

Launch ARMsteps from the short-cut on your desktop or from the Windows "Start" menu.

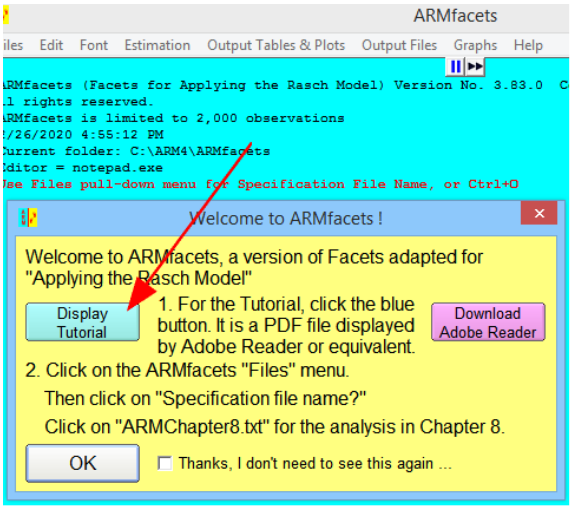


Launch ARMfacets from the ARMsteps menu bar

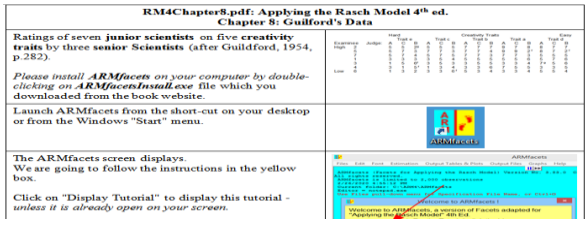


The ARMfacets screen displays.
We are going to follow the instructions in the yellow box.

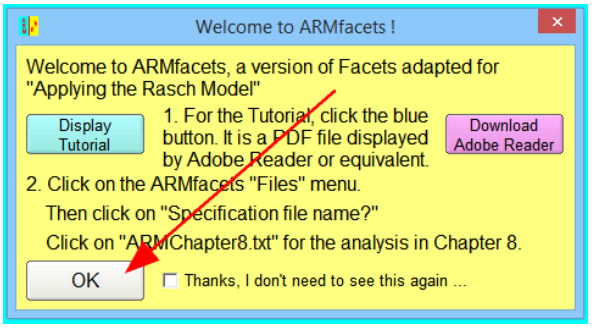
Click on "Display Tutorial" to display this tutorial - *unless it is already open on your screen.*

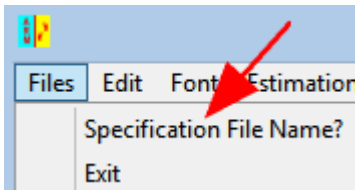
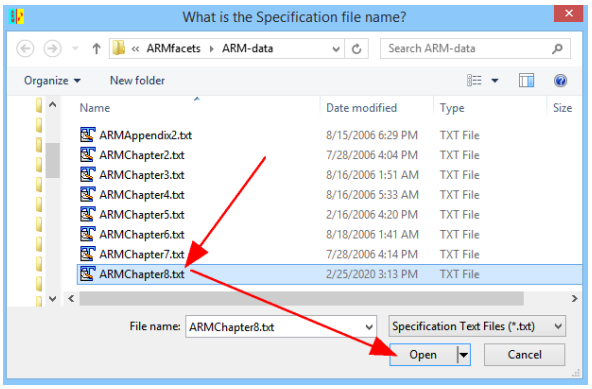
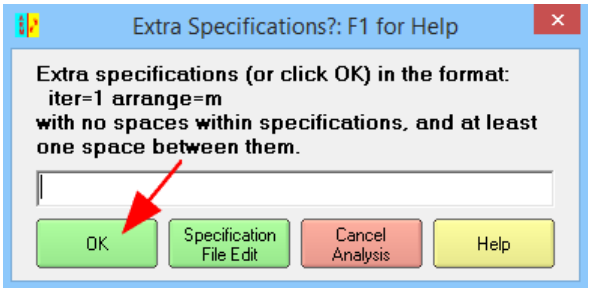
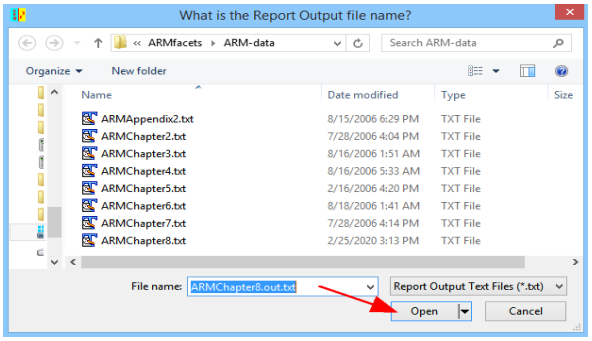
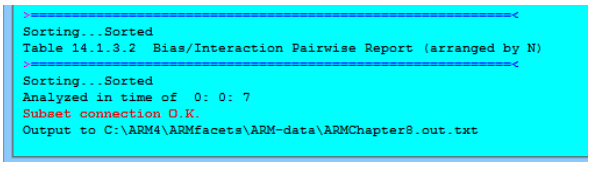
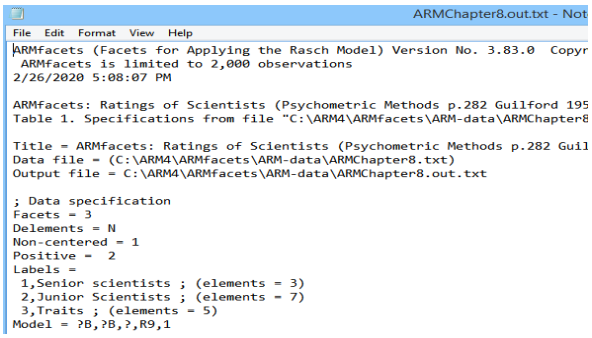


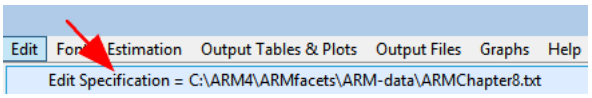
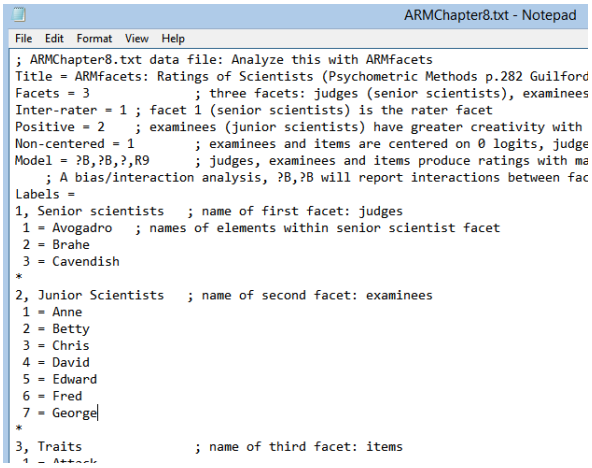
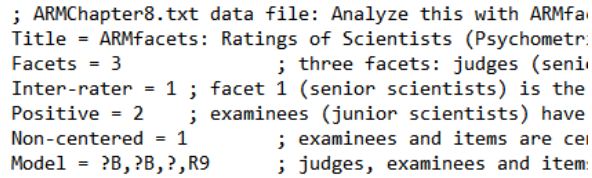
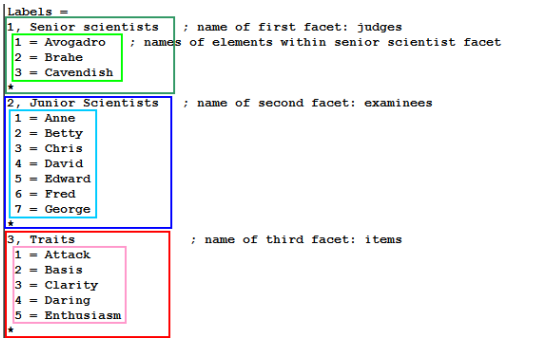
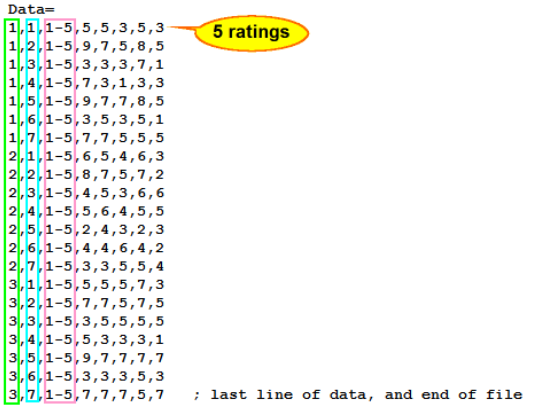
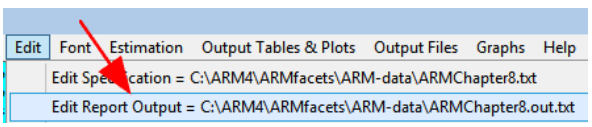
This tutorial, ARMChapter8.pdf, displays. If not, you might need to download and install Adobe Reader.



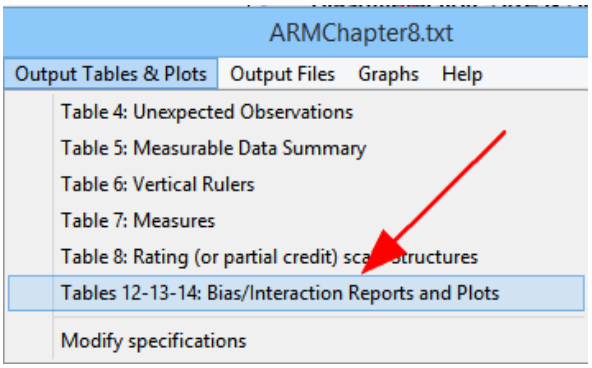
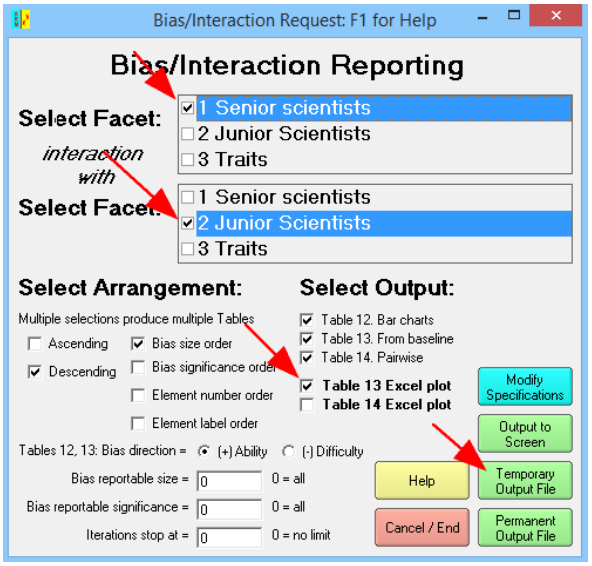
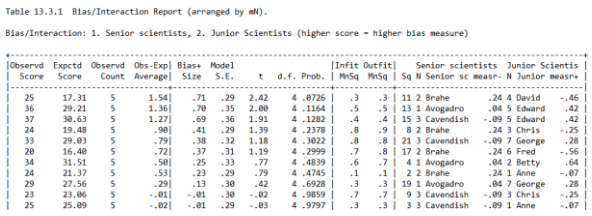
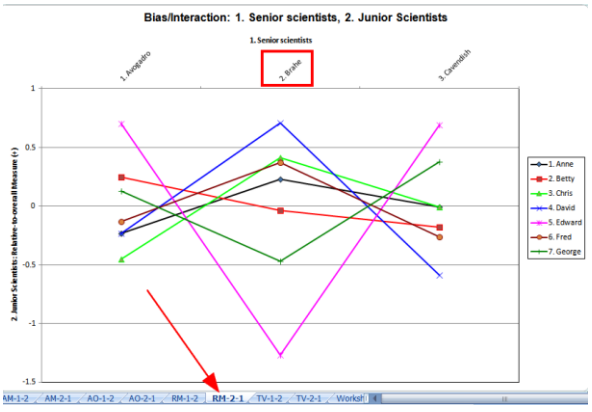
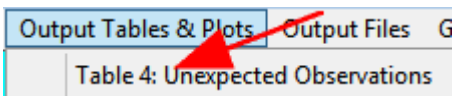
Close the "Welcome" box by clicking "OK".



Click on the ARMfacets "Files" menu. Click on "Specification File Name?"	
Select "ARMChapter8.txt" in your filename list Click on "Open"	
"Extra specifications?" Click "OK".	
What is the Report Output file name? Click "Open" to accept the suggested name of "ARMChapter8.out.txt"	
The ARMfacets analysis is performed.	
The Output file, ARMChapter8.out.txt, is displayed by NotePad.	

Let us first look at the specification and data file for Guilford's dataset. Click on "Edit" menu. Click on "Edit Specification = ...\ARMChapter8.txt"	
The ARMChapter8.txt control instructions and data are displayed on your screen. The data set consists of ratings on 5 items of Creativity awarded by 3 Senior Scientists, the judges, to 7 Junior Scientists. The ratings are on a scale from 1 to 9. We just used the A, B, C … convention to invent names for those persons.	
The top section of ARMChapter8.txt specifies the analysis. Everything after a "**;**" is a comment to help you understand / remind you about the meaning of the command. It is ignored by the software.	
The middle section of ARMChapter8.txt starting "Labels=" identifies the three facets (Senior scientist, Junior Scientist, Trait) and the elements within each facet (e.g, Avogradro, Betty, Clarity).	
The bottom section of ARMChapter8.txt starting "Data=" contains the data. Each line has the element numbers for the 3 facets, and then the observations for those elements. e.g., Line 1 Avagadro rated Anne on five criteria: 5,5,3,5,3 Line 2 Avagadro rated Betty on five criteria: 9,7,5,8,5 … Last Line Cavendish rated Fred on five criteria: 7,7,7,5,7	
Now let's look at the Output file, ARMChapter8.out.txt. This has already been displayed. Click on it on the Task bar or in the ARMfacets Edit Menu	

The first part of the Output file is Table 1. This reports the specifications that controlled the analysis.	ARMfacets: Ratings of Scientists (Psychometric Methods p.282 G Table 1. Specifications from file "C:\ARM4\ARMfacets\ARM-data\ Title = ARMfacets: Ratings of Scientists (Psychometric Methods Data file = (C:\ARM4\ARMfacets\ARM-data\ARMChapter8.txt) Output file = C:\ARM4\ARMfacets\ARM-data\ARMChapter8.out.txt
For the data used to construct ARM, Fig. 8.1, scroll down to ARMfacets Table 7.2.1. This shows the Junior Scientists in measure order (descending). Betty is rated as most creative (highest measure, 0.64 logits). Fred is rated as least creative (lowest measure, -0.56 logits).	Table 7.2.1 Junior Scientists Measurement Report (arranged by mN). | Total Score | Total Count | Obsvd Average | Fair(M) Average | + Measure | Model S.E. | Infit MnSq | Infit ZStd | Outfit MnSq | Outfit ZStd | Estim. Discrm | Correlation PtMea | Correlation PtExp | N Junior Scientists | | 94 | 15 | 6.27 | 6.30 | .64 | .18 | .61 | -1.1 | .60 | -1.2 | 1.30 | .85 | .47 | 2 Betty | | 87 | 15 | 5.80 | 5.82 | .42 | .17 | 1.94 | 2.2 | 1.94 | 2.2 | .34 | .51 | .48 | 5 Edward | | 82 | 15 | 5.47 | 5.47 | .28 | .17 | .85 | -.3 | .84 | -.4 | 1.37 | .30 | .48 | 7 George | | 70 | 15 | 4.67 | 4.64 | -.07 | .17 | .24 | -3.2 | .23 | -3.2 | 1.48 | .81 | .47 | 1 Anne | | 64 | 15 | 4.27 | 4.23 | -.25 | .17 | 1.13 | .4 | 1.22 | .7 | .84 | .16 | .46 | 3 Chris | | 57 | 15 | 3.80 | 3.76 | -.46 | .18 | 1.31 | .9 | 1.37 | 1.0 | .87 | .20 | .44 | 4 David | | 54 | 15 | 3.60 | 3.57 | -.56 | .18 | .70 | -.8 | .77 | -.5 | .93 | .40 | .43 | 6 Fred |
In ARMfacets Table 7.3.1 are the items. Daring and Attack are the easiest items to satisfy (lowest measure). Enthusiasm the most difficulty (highest measure, 0.50 logits). (These item labels are not the original ones - they are now lost.)	Table 7.3.1 Traits Measurement Report (arranged by mN). | Total Score | Total Count | Obsvd Average | Fair(M) Average | - Measure | Model S.E. | Infit MnSq | Infit ZStd | Outfit MnSq | Outfit ZStd | Estim. Discrm | Correlation PtMea | Correlation PtExp | N Traits | | 79 | 21 | 3.76 | 3.69 | .50 | .15 | 1.22 | .7 | 1.29 | .9 | .85 | .49 | .56 | 5 Enthusiasm | | 92 | 21 | 4.38 | 4.33 | .20 | .15 | .75 | -.8 | .81 | -.5 | 1.24 | .56 | .58 | 3 Clarity | | 108 | 21 | 5.14 | 5.15 | -.14 | .15 | .59 | -1.5 | .59 | -1.5 | 1.40 | .67 | .58 | 2 Basis | | 114 | 21 | 5.43 | 5.45 | -.27 | .15 | 1.41 | 1.3 | 1.42 | 1.3 | .67 | .62 | .58 | 1 Attack | | 115 | 21 | 5.48 | 5.50 | -.29 | .15 | .89 | -.3 | .87 | -.3 | .92 | .51 | .58 | 4 Daring |
Back up to ARMfacets Table 7.1.1, are the Senior Scientists, the judges. Brahe is most severe (highest measure, 0.24 logits)..	Table 7.1.1 Senior scientists Measurement Report (arranged by mN). | Total Score | Total Count | Obsvd Average | Fair(M) Average | - Measure | Model S.E. | Infit MnSq | Infit ZStd | Outfit MnSq | Outfit ZStd | Estim. Discrm | Correlation PtMea | Correlation PtExp | Exact Agree. Obs % | Exact Agree. Exp % | N Senior scientists | | 156 | 35 | 4.46 | 4.39 | .24 | .12 | 1.42 | 1.7 | 1.47 | 1.8 | .02 | .17 | .62 | 21.4 | 25.2 | 2 Brahe | | 171 | 35 | 4.89 | 4.86 | .04 | .11 | .84 | -.6 | .87 | -.5 | 1.40 | .85 | .63 | 35.7 | 25.8 | 1 Avogadro | | 181 | 35 | 5.17 | 5.17 | -.09 | .11 | .66 | -1.6 | .65 | -1.6 | 1.63 | .76 | .63 | 37.1 | 25.3 | 3 Cavendish |
ARM Fig. 8.2 shows these results summarized as measurement rulers. Scroll back up to ARMfacets Table 6.0 Along the top row of the Table are the facet names. The "-" or "+" next to the name provides the orientation. "+" means that biggest average ratings are at the top. So that "+Junior Scientists" means that Betty has the highest average ratings. "-" means that the smallest average ratings are at the top, so "-Traits" means that Enthusiasm received the lowest average ratings, and so is the most difficult item. On the right-hand side is the rating scale. "---" indicates a half-score point. The difference between the leniencies of the Senior Scientists is less than a score-point. The Junior Scientists differ by almost 3 score-points.	Table 6.0 All Facet Vertical "Rulers". Vertical = (1A,2A,3A) Yardstick (columns lines low high extreme)= 0,10,-1,1,End |Measr|-Senior scientists|+Junior Scientists|-Traits |Scale| + 1 + + + + (9) + | | | | | 7 | | | | | | --- | | | | Betty | | | | | | Edward | Enthusiasm | 6 | | | | George | | | | | Brahe | | Clarity | --- | | | | | | | * 0 * Avogadro * * * 5 * | | Cavendish | Anne | Basis | | | | | Chris | | --- | | | | | Attack Daring | | | | | | | 4 | | | | David | | | | | | Fred | | --- | | | | | | | | | | | | 3 | + -1 + + + + (1) + |Measr|-Senior scientists|+Junior Scientists|-Traits |Scale|
Chapter 8 Going Further: ARM Fig. 8.4 shows the results of two separate analyses cross-plotted. But we can see a similar result from this analysis.	

Click on "Output Tables & Plots" Click on "Table 13-14: Bias/Interaction Report	
"Bias/Interaction Request" Check "1 Senior scientists" Check "2 Junior scientists" Check "Produce Excel plot" Click on "Temporary Output File"	
The Temporary Output File displays. This reports the numbers, but not in an immediately obvious way.	
Shortly an Excel plot also displays. Click on RM-2-1 below the plot This shows the same contrast as ARM Fig. 8.4 Brahe's perception of the Junior Scientists is *almost the opposite* of the other scientists. Edward is rated highest by Avogadro and Cavendish, but lowest by Brahe. Something is wrong!	
What about the unexpectedness of the ratings? Click on ARMfacets "Output Tables & Plots" Click on "Table 4: Unexpected Observations"	

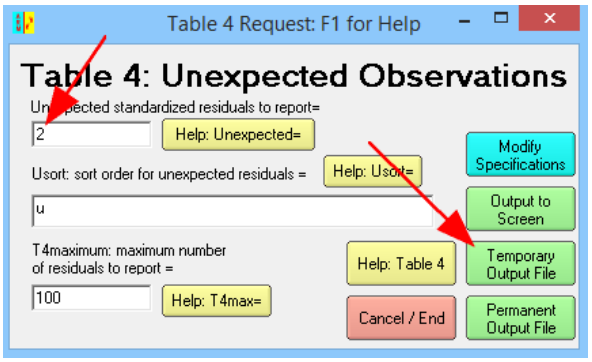
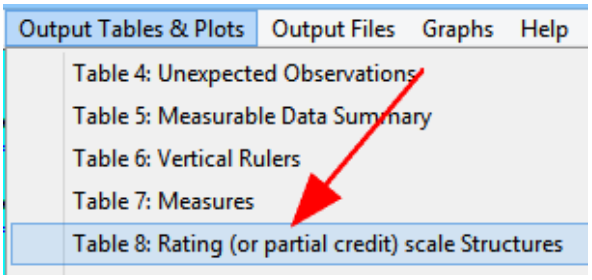
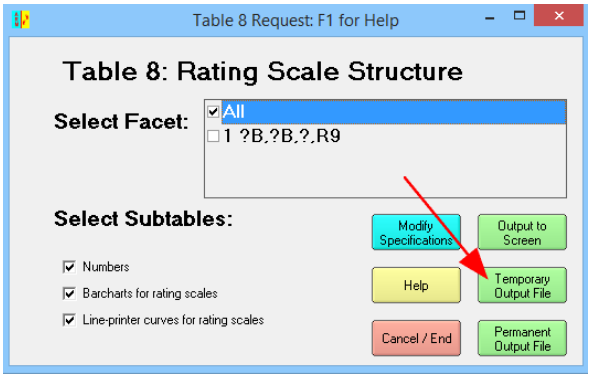
"Table 4 Request" "Unexpected standardized residuals to report=" Type in "2" Click on "Temporary Output File"	
Tables 4 displays, reporting *significantly misfitting* observations. Notice that Brahe features in all of them!	Table 4.1 Unexpected Responses (4 residuals sorted by u). | Cat Score Exp. Resd StRes| N Senior sc N Junior N Traits | | 2 2 6.0 -4.0 -2.7 | 2 Brahe 5 Edward 1 Attack | | 2 2 6.1 -4.1 -2.7 | 2 Brahe 5 Edward 4 Daring | | 6 6 2.9 3.1 2.4 | 2 Brahe 3 Chris 5 Enthusiasm | | 6 6 2.9 3.1 2.4 | 2 Brahe 6 Fred 3 Clarity | | Cat Score Exp. Resd StRes| N Senior sc N Junior N Traits |
This concludes this example in ARM. But there is one more aspect we could look at: the use of the rating scale. Rating Scale use is discussed in ARM Chapter 11. Back to the ARMfacets analysis	
Click on "Output Tables & Plots" Click on "Table 8: Rating (or partial credit) scale Structures"	
Leave "All" checked Click on "Temporary Output File"	

Table 8 displays. Look down the 9 categories. Three categories (Cats 3, 5 & 7) have noticeably higher frequencies than the other 6 categories. The judges were asked to discriminate 9 levels of Creativity. These data appear to be telling us that, in practice, the judges discriminated only 3 levels clearly. Find out more about constructing meaningful rating scales in ARM Chapter 11.	Table 8.1 Category Statistic Model = ?B,?B,?,R9 DATA Category Counts Score Total Used % 1 4 4 4% 2 4 4 4% 3 25 25 24% 4 8 8 8% 5 31 31 30% 6 6 6 6% 7 21 21 20% 8 3 3 3% 9 3 3 3%
Close all open windows	☒