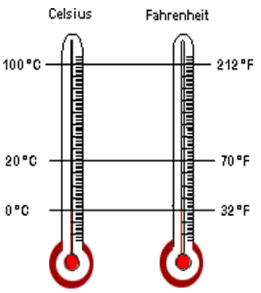
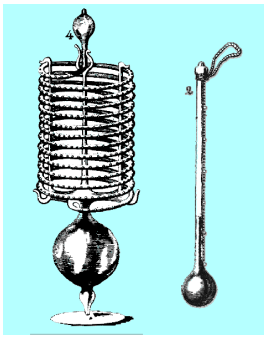
#	Practical Rasch Measurement - Further Topics : www.winsteps.com Mike Linacre, instructor - July 2011
1.	**Tutorial 4. Test Equating** **This week is a quick overview.** • Test equating: separate and concurrent • Prettifying output If you don't know the meaning of a word, then please look at the "Glossary". http://www.winsteps.com/winman/glossary.htm
2.	**A. Equating and Linking Methods**

3.

We are familiar with Celsius and Fahrenheit thermometers. They use different numbering systems, but we can convert from one temperature-measurement scale to the other. The thermometers are "equated".
If we had a third type of thermometer we could equate it to our familiar thermometers by using "linking items", such as melting ice and boiling water. Using these items, we could calibrate the third thermometer to make it comparable to Celsius and Fahrenheit thermometers.



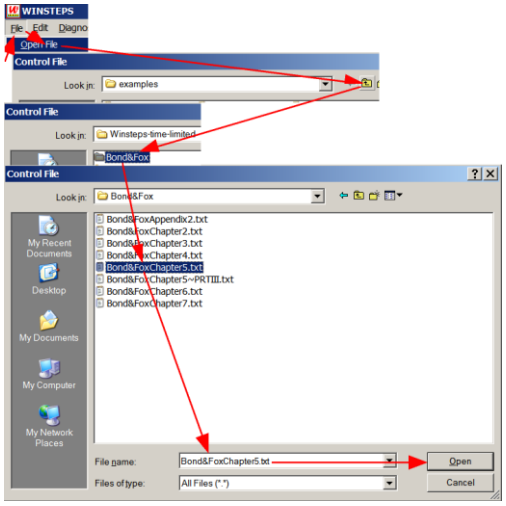
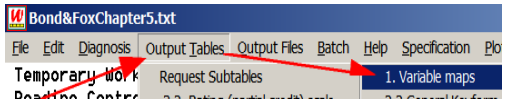
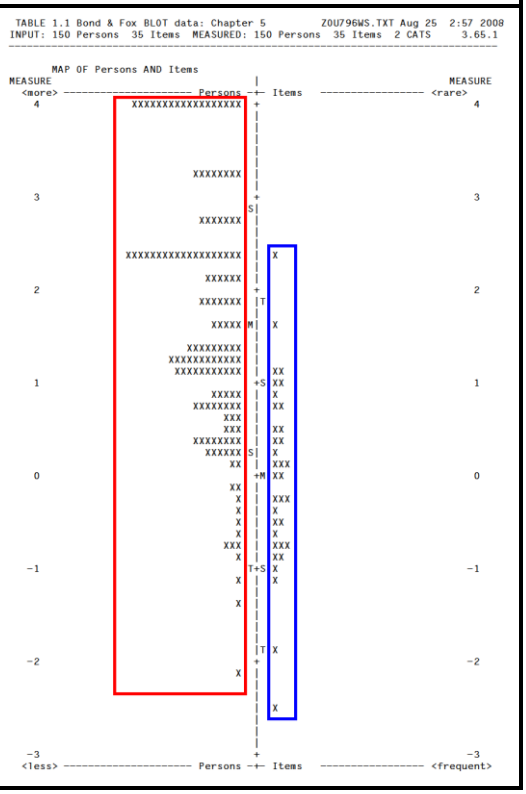
Celsius Fahrenheit Thermometers

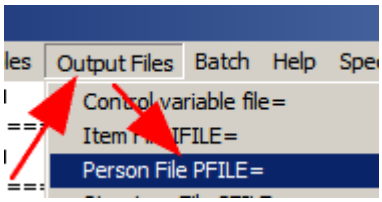
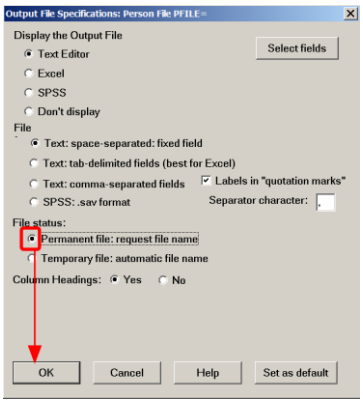
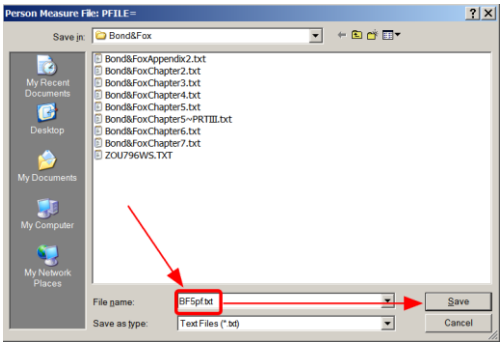
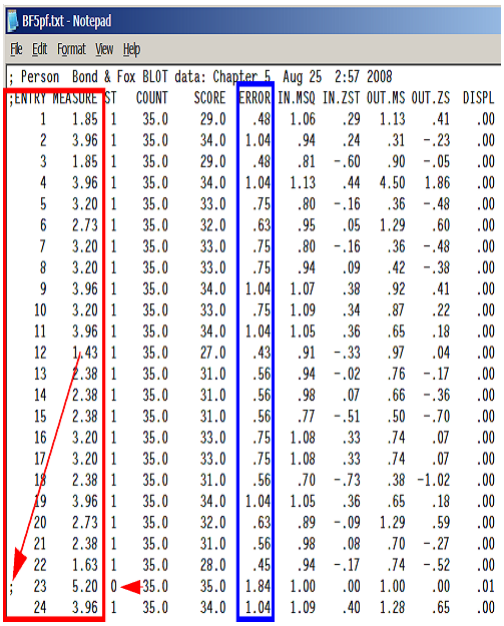

???
Thermometers

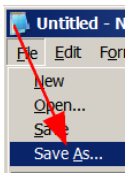
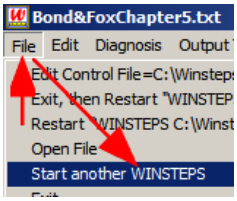
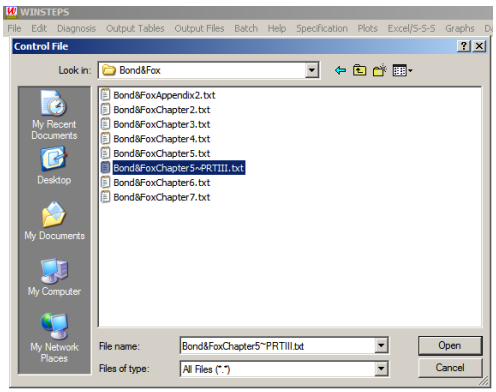
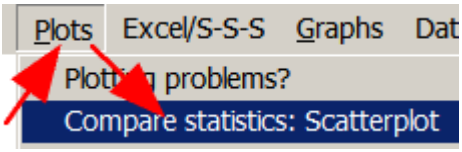
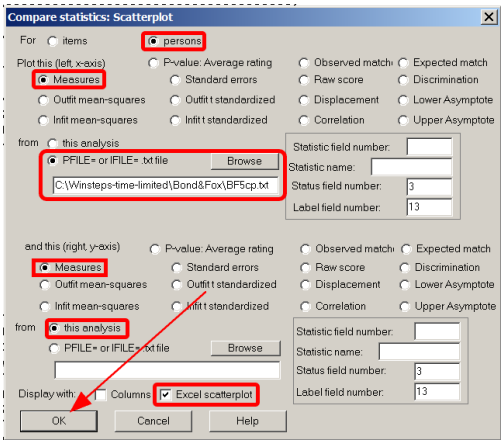
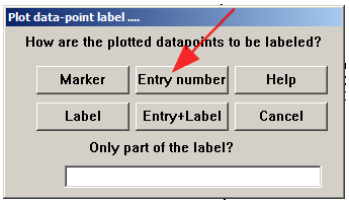
4. *For reference:*

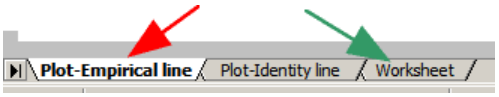
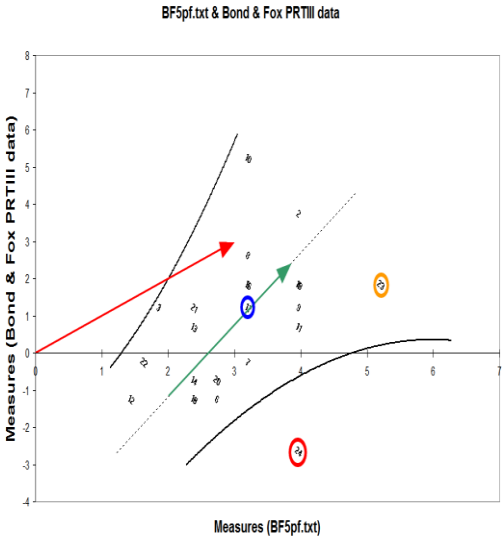
Linking Terminology: Raw Score and Rasch		
Term	**Raw Score CTT meaning**	**Rasch meaning**
Linking	general term for making the results of different tests comparable	enabling the data to be analyzed together in one analysis (if desired) to construct one overall set of measures
Equating	correspondence of raw scores between tests	putting the measures in the same frame of reference
Calibration	putting the scores in the same frame of reference	constructing item measures in the internal frame of reference
Projection	scores on one test weakly predict scores on another test	(a height-weight situation)
Moderation	equivalences based on matching up sample statistics	(Fahrenheit-Celsius equating)
Anchoring (fixing)	-	measures obtained from one analysis (or construct theory) imposed on another to place it in the same frame of reference.
Local origin	zero score or sample mean	reference location from which to measure along the latent variable
from http://www.rasch.org/rmt/rmt204b.htm		

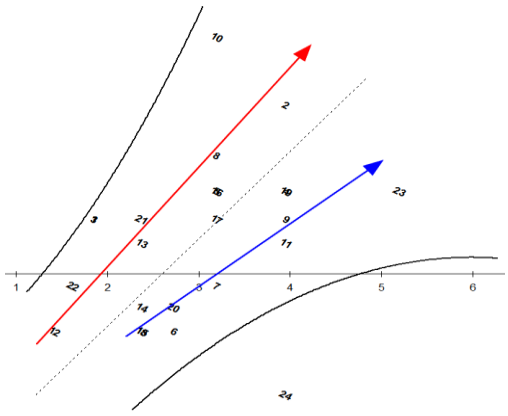
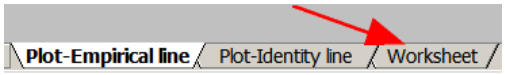
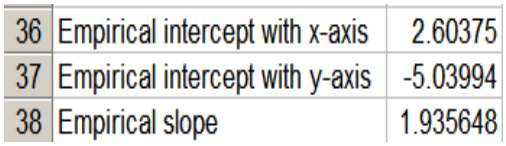
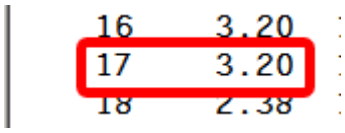
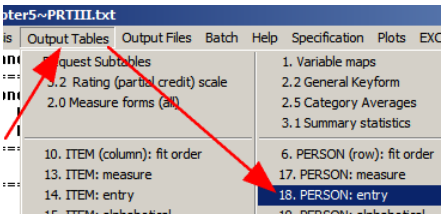
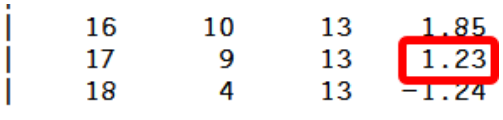
5.	*For reference:* **Equating designs** for two tests: **Baseline equating:** estimates from one analysis are anchor values in another analysis **Parallel equating:** two analyses are performed separately, and then equated by a fit line. **Common-item equating**: some (linking) items in the two tests are the same: *best method.* **Common-person equating**: some (linking) persons who respond to the two tests are the same **Linking tests**: a third test is constructed which contains items from the two tests. This is used as a common-item-equating link between the two tests. **Concurrent (or one-step) equating**: both tests are analyzed together as one dataset. **Virtual equating**: common-item equating based on items with similar (not identical) characteristics **Vertical equating:** the two tests are intended to differ in difficulty, usually by at least a grade-level. **Horizontal equating:** the two tests are intended to have the same difficulty **Polytomous equating:** the two tests share rating scale structures **Separate-estimation equating**: the two tests are analyzed separately, then the estimated measures are used for performing the equating. **Random-equivalence equating**: two tests (or two examinee samples) are declared to produce randomly-equivalent measures because their items (or persons) have been allocated to the tests at random. So that the means and S.D.s of the two sets of item (or person) measures can be equivalenced. **Alternate-forms equating:** two tests are declared to be equivalent, so that their measures are assumed to be in the same frame of reference. **Anchored-form equating:** the tests included pre-calibrated items which force the two tests to report measures in the frame of reference of the item-anchor values. **Common scale:** the measurement scale on which the measures from the two tests are expressed. This is usually the measurement scale of one of the tests. **Equating constant**: when tests are equally discriminating, the amount to add to measures from one test to equate them with measures from the other test. **Scaling constant *or* Equating slope**: when tests have measures with different discriminations (Celsius-Fahrenheit), the amount with which to multiply measures from one test to make them equally discriminating with those of the other test. **Equating error:** loss of precision of the measures from one test when converted to become measures on the other test. **Equipercentile equating**: a non-linear CTT technique based on equivalencing distributions. Not used in Rasch equating. **Item drift**: change in the difficulty of an item from one test (or test administration) to another test (or test administration). For more about equating methods, see Winsteps Help "Equating and Linking Tests" http://www.winsteps.com/winman/equating.htm

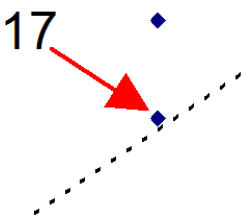
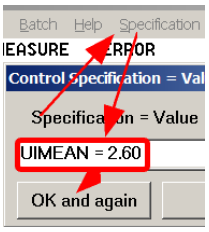
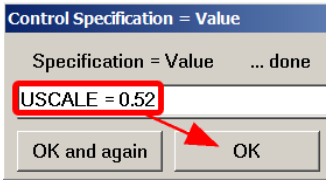
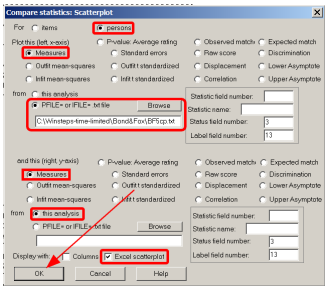
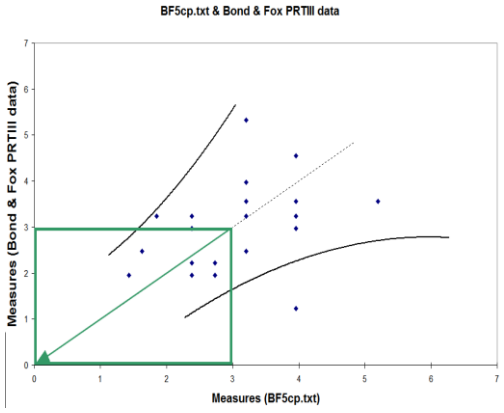
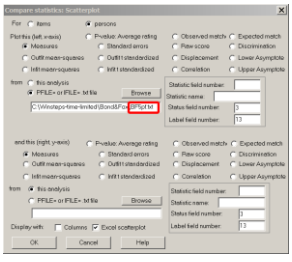
6.	**B. Separate-estimation Common-person Test Equating**	
7.	Let's try equating two of the Bond & Fox datasets, as discussed in B&F Chapter 5. This will use "Common Person" equating, because the instruments were administered to the same people. The basic requirement is that the latent variable be effectively the same, "invariant", across the two instruments to be equated or linked. Then we can make one-to-one conversions between the measures on the two instruments.	
8.	First we need the person ability measures from the "B&F chapter 5" data. Launch Winsteps	
9.	Click on "File" Click on "Open File" Click up one level to the "Winsteps" folder Click on "Bond&Fox" Double-Click on "Bond&FoxChapter5.txt" Report Output? Press Enter Extra Specifications? Press Enter The standard analysis is performed	
10.	Winsteps menu bar Click on "Output Tables" Click on "1. Variable Maps"	
11.	Table 1 displays in a Notepad window Scroll down to Table 1.1 Red box: The summary map shows the ability measures for 150 persons Blue box: and also the difficulties for 35 items. The 150 persons also responded to another test. So these are our "common persons". We need their measures for the equating process. But let's pretend that only the first 24 persons are common persons, we can then check the effectiveness of the equating for the other 126 persons!	

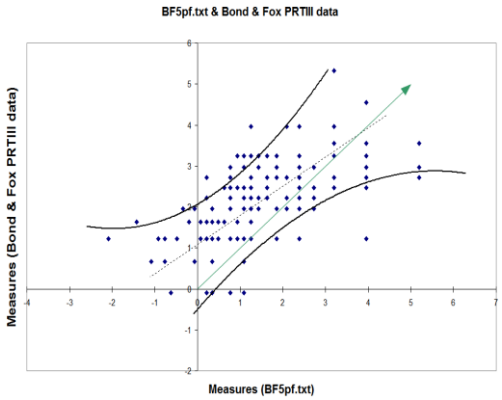
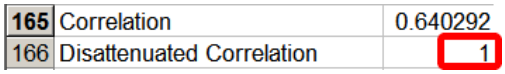
12.	Now let's write out the person measures. Click on Output Files Click on Person File PFILE=	
13.	Output File Specifications Click on Permanent file Click OK	
14.	Enter a memorable file name. Mine is: BF5pf.txt Then Save	
15.	The person file statistics are displayed in a Notepad window. This procedure would be exactly the same if we were doing a Common-item equating. A Rasch model does not know what is a "person" and what is an "item", so treats them essentially the same. We do know which is which, so we use that insight to interpret the numbers. *Red box:* the person entry numbers and their ability measures. These are what we need. The common-person entry numbers must be the same in the analysis of the test to be equated with this one. *Blue box:* the standard errors. These will help us determine how stable the person measures are. *Red arrow:* this indicates an extreme score: ";" (if shown) also status 0 or –1.. The measures corresponding to an extreme score are less secure for equating than the measures for non-extreme scores.	

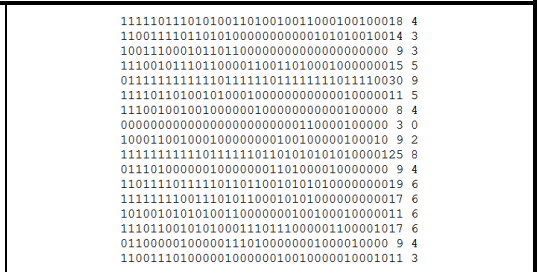
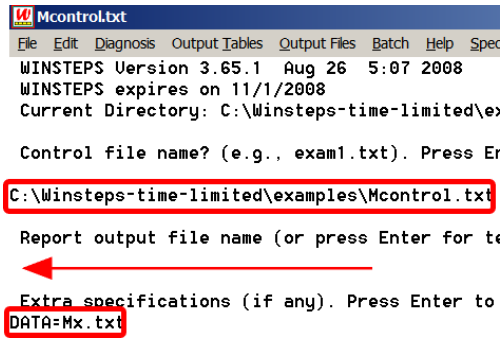
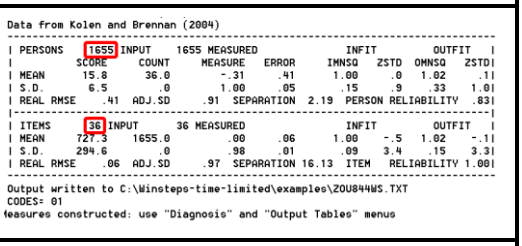
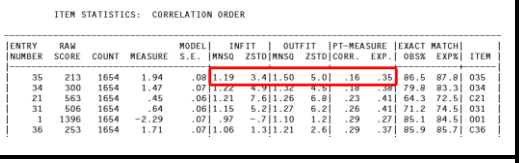
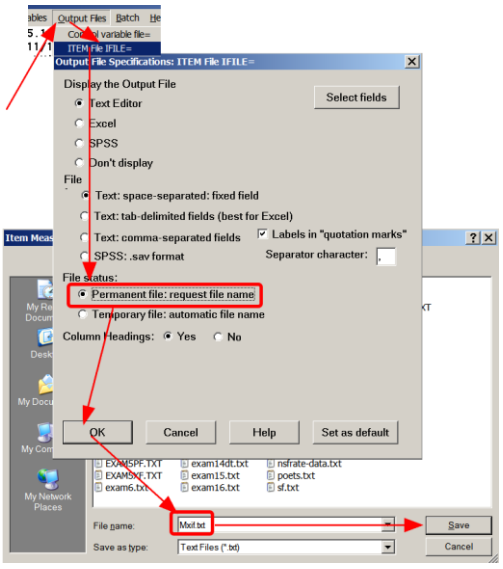
16.	Only persons 1-24 are common. Notepad Window Delete everyone after person 24 in this file. Click on "File" Click on "Save As" the Notepad file Type in: *BF5cp.txt* (cp = common persons)	
17.	Now let's analyze the dataset we want to equate with this one. Winsteps menu bar Click on File Click on Start another Winsteps	
18.	In the new Winsteps window Click on File Click on Open File Click on ....PRTIII.txt Click on Open Report Output? Press Enter Extra Specifications? Press Enter The standard analysis is performed	
19.	Now let's compare the person measures: Winsteps Menu Bar Click on Plots menu Click on Compare Statistics	
20.	In the Compare Statistics control box, Click on for the x-axis: persons Measures PFILE Browse and select BF5cp.txt Click on for the y-axis: Measures this analysis Check-mark: Excel scatterplot Click on OK	
21.	Plot data-point label .... Click on Entry number ... we want to easily identify the outliers	

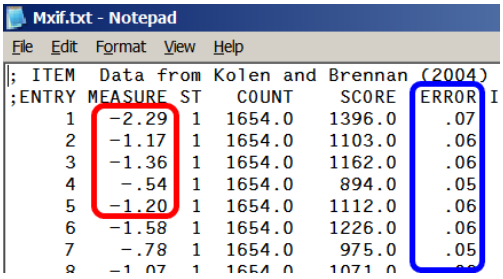
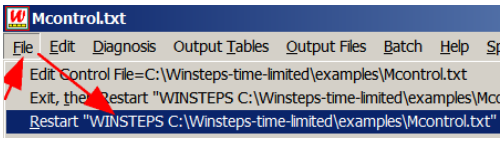
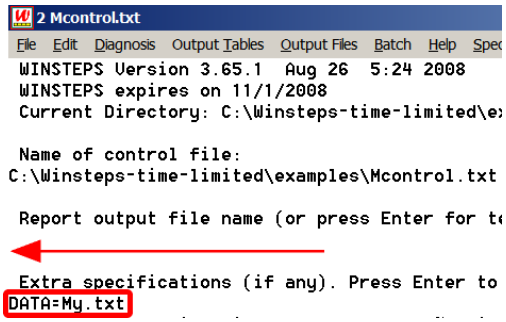
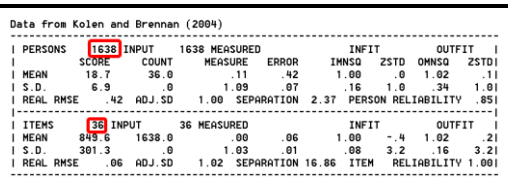
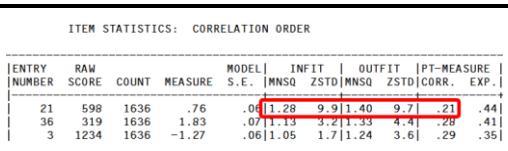
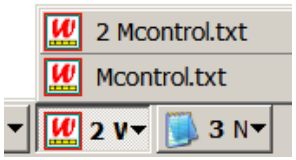
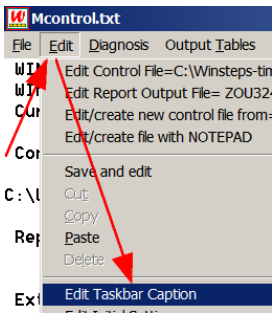
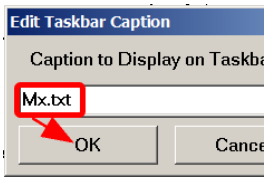
22.	The Excel plot displays. We do want the Empirical trend-line, because we have no reason to suppose that the logit measures defined by the BLOT test (BF5) have the same substantive "length" as the logit measures defined by the PRTIII test. If you don't follow this, read "Length of a Logit" http://www.rasch.org/rmt/rmt32b.htm	
23.	And here's the plot. If you have more than 24 points, then you forgot to Save BF5cp.txt after deleting all the lines after person 24. *Red circle:* We can see that person 24 is an outlier. Not surprising because the curved control lines are set to p<.05, i.e., only 1 point in 20 is expected to lie outside them, but maybe it would be better to omit this person from the equating set as being too variable. For successful common-person equating, we need the person to behave the same way on both instruments. If not, the person becomes a "new and different" person. *Red arrow:* This is the identity line, through the origin, with equal increments on both axes. This would be the trend line if the tests produced the same person measures. *Green arrow:* A best-fit line, a dashed line, is not parallel to the identity line. So the instruments have different discrimination and different average item difficulty, relative to the average person ability. From a measurement perspective, the conversion between the BLOT and the PRTIII is like that between Celsius and Fahrenheit.	 *Blue circle:* Person 17 is on a "best fit" trend line. *Orange circle:* Person 23 had an extreme (perfect) score on the BLOT, so this measure is somewhat arbitrary. This is also an outlying influential point, suggesting that it should be omitted from the equating set.
24.	If the best-fit line (green arrow) is parallel to the identity line (red arrow), then it is usually easiest to analyze all the data together. In each person record, the items on each instrument are placed in adjacent columns, so that they look like one long test. This is called "racking" the data.	

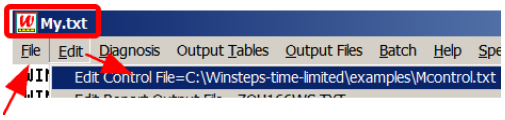
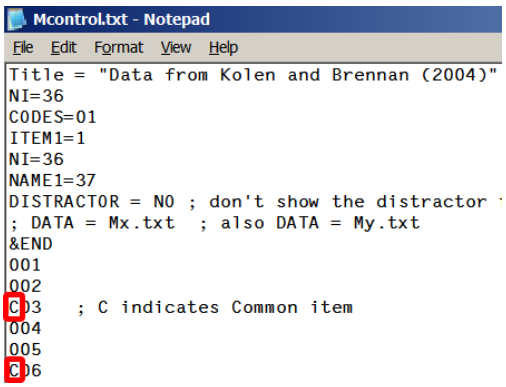
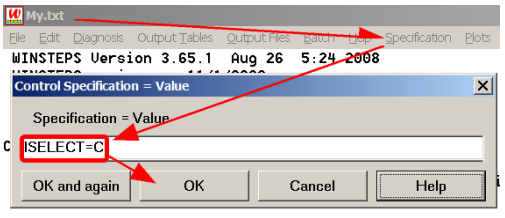
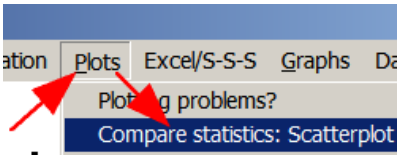
25.	Before we move, look closely at the plot. There seem to be two trends among the persons. One group (perhaps the boys) follows the red arrow. The other group (perhaps the girls) follows the blue arrow. If we follow an automatic linking-person selection rule (such as Frederic Lord's), we will eliminate the minority arrow (fewer persons, probably the red arrow), and will base our equating on the majority arrow (more persons, probably the blue arrow). But "majority" and "minority" may be an accident of the sampling of our common persons, so it would be better to identify which of the two arrows (or what proportion of each) better represents a meaningful commonality between the two tests .	
26.	Back to our trend line. Our job is to find the conversion factors. Fortunately EXCEL has done the hard work for us. It has plotted a best-fit trend line for us. This is shown by the dashed black line on your plot. Click on "Worksheet" below the plot	
27.	Scroll down to the bottom of the Worksheet Do you see the Empirical intercept and slope? They convert PRTIII y-axis measures into the BLOT x-axis measures or the reverse: BLOT (x-axis)*slope + y-axis intercept = Predicted PRTIII PRTIII (y-axis)/slope + x-axis intercept = Predicted BLOT This conversion applies to both the item difficulties and the person measures. We can convert all measures from one analysis onto the measurement scale of the other analysis.	 If we delete any points in the worksheet, then Excel will redraw the plots, and recompute the slopes and intercepts.
28.	It's always wise to check this type of result. Notice that person 17 (blue circle) is almost exactly on the trend line. In BF5pf.txt - the BLOT person 17 measure is 3.20 logits. That should be x-axis position of person 17. Yes.	
29.	For the actual y-axis position: PRTIII analysis (the one we are doing) Click on the Winsteps menu bar Click on Output Tables Click on 18. PERSON: entry	
30.	Scroll down to person 17 The PRTIII person measure is 1.23 logits. This is the y-axis position for person 17 in our plot. Yes! Looks like it	

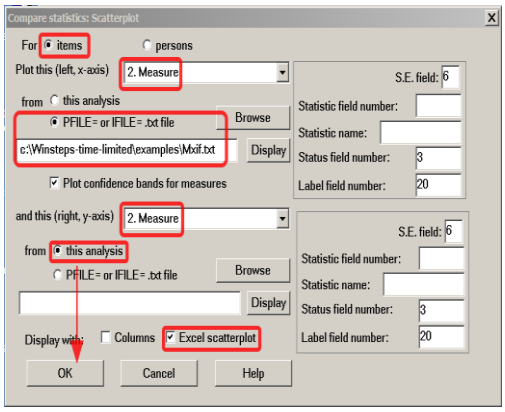
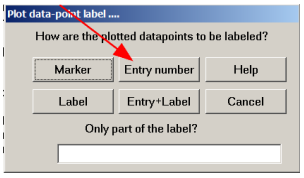
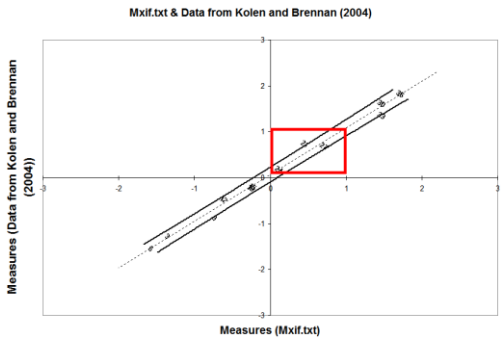
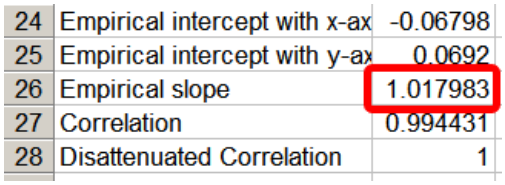
31.	So now let's check the conversion formulae for person 17: BLOT (x-axis)*slope + y-axis intercept = Predicted PRTIII 3.20*1.94 + -5.04 = 1.17 (observed: 1.23) PRTIII (y-axis)/slope + x-axis intercept = Predicted BLOT 1.23/1.94 + 2.60 = 3.23 (observed: 3.20) which are close enough .... see the adjacent Figure.	
32.	But how well does this work? We are doing a PRTIII analysis, let's rescale the PRTIII measures into the predicted BLOT measures: Winsteps analysis menu bar Specification Type in: UIMEAN = 2.60 (the x-axis intercept) Click on "OK and Again"	
33.	Type in USCALE = 0.52 (= 1/SLOPE) Click "OK"	
34.	Winsteps menu bar Click on "Plots" Click on "Scatterplots" Same again ..... Click "OK" Click on "Markers"	
35.	Good! The conversion has worked. The trend line is now the identity line. This plot is in BLOT units.	
36.	But how has this worked for all the other persons? Scatterplot again, but change the file to **BF5pf.txt** which has all the persons .... Click OK Click on "Marker"	

37.	No, this doesn't look good - even though we have done our best to equate the two sets of person measures. *Green arrow:* we expected the dashed trend line to be along the identity line. But the identity line is within the confidence intervals, so we can't reject the hypothesis that we have the correct equating line. The first 24 persons were not a good equating sample from the persons. They are too central. There are many techniques for selecting the best equating sample, and choosing the best line. We do the best that we can do, but it is not perfect.	
38.	Look at the bottom of the Excel Worksheet: We see that the correlation between the PRTIII and BLOT measures is 0.64, which means that only 40% of their variances are shared. But this correlation is "attenuated" by measurement error.	
39.	"Attenuation" of correlations is counter-intuitive. Imagine we have two measures that are perfectly correlated = 1.0. But we cannot measure them perfectly. We measure them with measurement error. So the correlation is "attenuated" (=reduced) by measurement error. Correlation = 0.9. **Every correlation we observe is attenuated by measurement error, because we can never measure perfectly.** Then we discover how to remove ("**disattenuate**") the measurement error. After the measurement error is removed, the correlation becomes 1.0. The "disattenuated" correlation is always higher (more extreme) than the observed correlation.	
40.	Look at the bottom of the Excel Worksheet: We see that the correlation between the PRTIII and BLOT measures is 0.64. If we remove the measurement error, then the Disattenuated Correlation is 1.0. The "true" relationship between the two sets of measures could be perfect!	 Disattenuated correlation: http://www.rasch.org/rmt/rmt101g.htm
41.	*Conversion tables - Table 20 - USCALE UMEAN* Here is a general instruction for "common item" (same items on two tests) or "common person" (same persons respond to two tests). We need to put both sets of measurements onto the same "ruler" (frame-of-reference). We usually choose one test as the "baseline", and then adjust the measures on the other test to match it. UIMEAN= and USCALE= are a convenient way of making the measures match each other. 1. Choose one instrument as the baseline. 2. Its Table 20 (or SCFILE=) is the score-to-measure conversion. 3. For the other instrument, set USCALE=(equating slope) UMEAN=(equating constant). 4. Analyze the data. 5. Check that the numerical difficulties of the common items are almost the same in both analyses. 6. Table 20 (or SCFILE=) for this analysis is the equated score-to-measure conversion.	
42.	Please close all windows	

43.	**C. Equating with Common Items**	
44.	*"Test Equating, Scaling, and Linking: Methods and Practices" by Michael J. Kolen, Robert L. Brennan, (Springer, 2004)* uses two illustrative datasets. They are dichotomous (0-1) responses to 36 items by 1600+ persons. The two datasets have 12 common items. Let's equate these two datasets, called Mx.txt and My.txt	
45.	Launch Winsteps	
46.	We will analyze file, Mx.txt, using control file Mcontrol.txt Mcontrol.txt has no data, so we will need to specify the data file. Open File: **Mcontrol.txt** Extra Specifications: **Data=Mx.txt**	
47.	Estimation completes. Mx.txt has 1655 persons and 36 items	
48.	As usual, confirm that everything is OK in Mx.txt Diagnosis menu. A. Item Polarity *Yes, the worst item looks acceptable ....*	
49.	Save the item difficulties .... Click on "Output Files" menu Click on "Item File: IFILE=" Click on "Permanent file' Click "OK" Save as Mxif.txt These are the difficulties for the 36 items in Mx.txt	

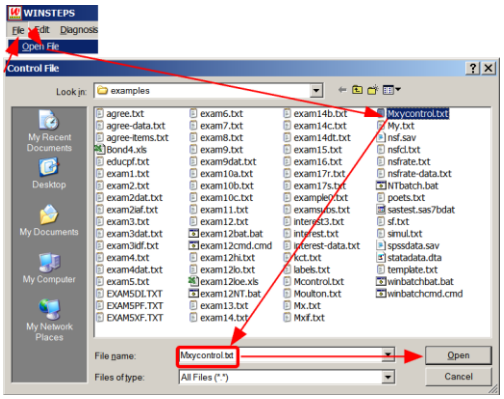
50.	The item file displays in a Notepad window. *Red box:* here are the logit item calibrations *Blue box:* these are the standard errors (precision) of the measures. They are small because we have 1654 observations of each item.	
51.	Now for file My.txt Winsteps menu bar "Restart Winsteps ... Mcontrol.txt"	
52.	We are using the same control file, but specifying a different data file. Extra specifications? DATA=My.txt Then run the analysis.	
53.	In My.txt there are 1638 person records, and 36 items.	
54.	Confirm that everything is OK in My.txt Diagnosis menu. A. Item Polarity	
55.	We have two Winsteps analyses on the Windows task bar. It is easy to get them confused. Let's give them more distinctive names. Click on the first one, Mcontrol.txt - the analysis of Mx.txt	
56.	Winsteps menu bar Click on Edit Click on Edit Taskbar Caption	
57.	In the "Edit Taskbar Caption" dialog box: Type the name of the data file: **Mx.txt** Click on Ok	

58.	Now on the Windows taskbar we have Mx.txt	
59.	Click on other Winsteps analysis Edit menu Edit Taskbar Caption My.txt OK Then on the Windows taskbar	
60.	Click on My.txt Winsteps menu bar Edit menu Edit control file: Mcontrol.txt	
61.	Mcontrol.txt displays in a Notepad window. The items are numbered 1 to 36. They are different items in the two data files, except for the 12 common items. Conveniently they are in the same columns in both data files. I have put a "C" as the first letter of the item labels for the common items.	
62.	12 is a generous number of common items. The minimum number is around 5, uniformly distributed across the expected range of person ability. Any less, and we may not have enough items if some seriously misfit in our analyses or their item difficulties change (drift). In Rasch methodology, it is the number of items, rather than the proportion (percentage) of items which is crucial.	
63.	*Let's equate them using separate estimation!* For My.txt analysis, Winsteps menu bar Click on Specification We want to look at the Common Items, which have a "C" in the first character of the item label: ISELECT=C	
64.	The Winsteps analysis window confirms we have selected the 12 common items	ISELECT=C ITEMS SELECTED: 12
65.	Now to scatterplot .... My.txt analysis: Winsteps menu bar Click on Plots Click on Scatterplots	

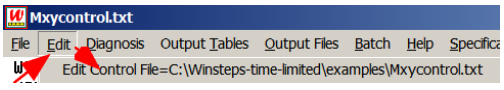
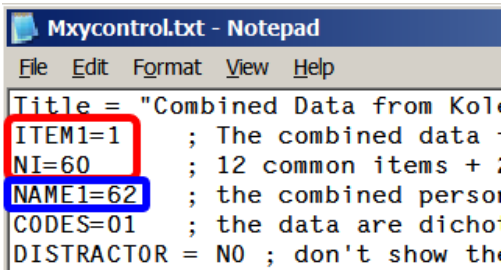
66.	In the "Compare Statistics" Dialog box: Click on "Items" *We want the item difficulties from Mxif.txt on the x-axis* "Measures" Browse to Mxif.txt *and My.txt on the y-axis* "Measures" "This analysis" "Excel scatterplot" Click on OK	
67.	"Data point" dialog box: Click on Entry Number	
68.	What an amazingly well-behaved plot! None of the difficulties are conspicuously outside the very tight confidence intervals. *Red box:* This is one logit wide and one logit high. The empirical line is the diagonal of the red box, so it appears to be parallel to the identity line.	
69.	Confirm the slope of the empirical line in the worksheet: 1.02, as near to 1.0 as real data ever get. At this point, we can apply the conversion formulae we used above. But this time it will be easier to do a concurrent analysis	
70.	Please close all windows	

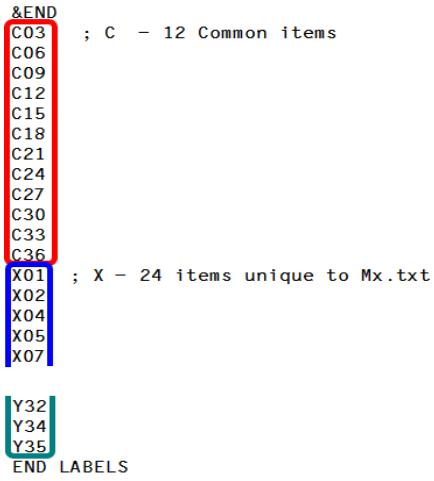
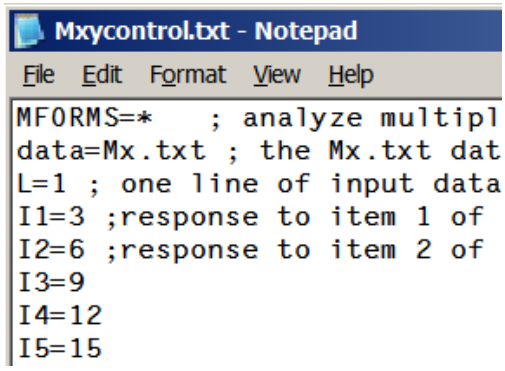
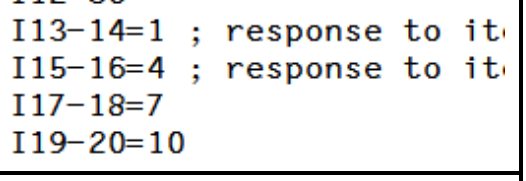
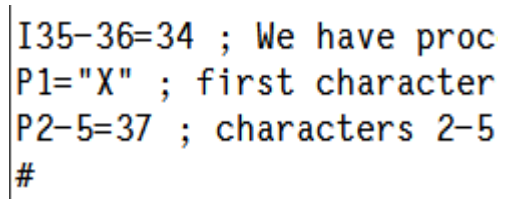
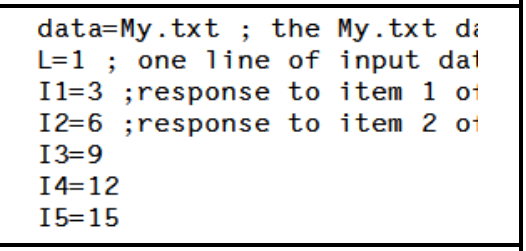
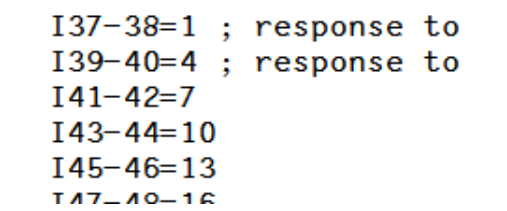
71.	**D. Common-item Concurrent Equating**	

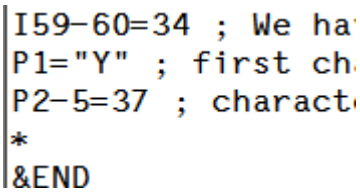
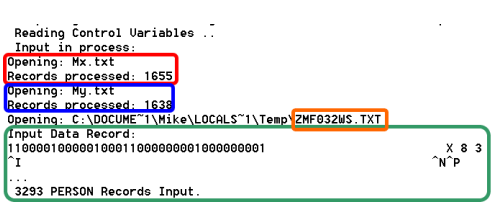
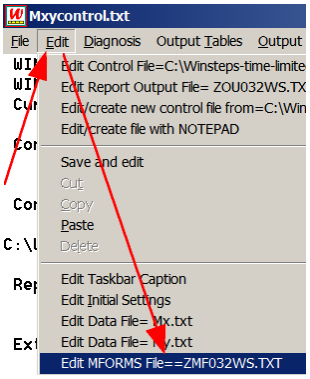
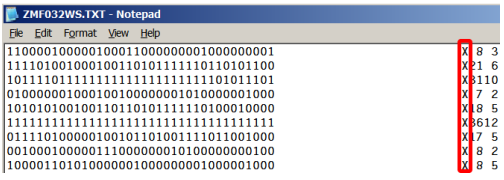
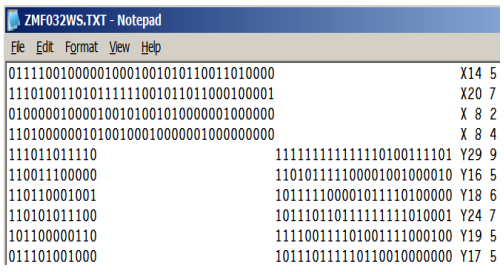
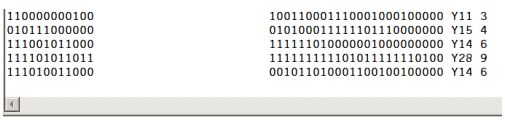
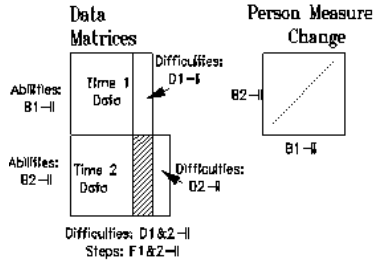
72.	We have two tests, Mx.txt and My.txt.
	They have 12 items in common, and 24 unique items each.
	We want to analyze them together: 12+24+24 = 60 items.
	Mx.txt has 1655 persons. My.txt has 1638 persons.
	Combined they have 3293 person
	The Winsteps control variable, MFORMS=, provides a convenient way to combine these data so that all the measures are reported in the same frame-of-reference.
	It is in Winsteps Help and at
	http://www.winsteps.com/winman/mforms.htm
		MFORMS= reformat input data and multiple data forms
		Up Previous Next
		MFORMS= supports the reformatting of input data records, and also equating multiple input files in different formats, such as alternate forms of the same test. Data after END NAMES or END LABELS is processed first, as is data specified by DATA= in the core control file.
		Data reformatted by MFORMS= can be accessed, viewed, edited and "saved as" permanently using the "Edit" pull-down menu. It has a file name of the form: ZMF.....txt
		Here is the layout:
		`mforms=*`
		`data=forma.txt ; the name of an input data file`
		`L=2 ; there are 2 lines in input data file for each data record`
		`I1 = 20 ; response to item 1 of the test is in column 20 of the input data file`
		`I3-5 = 21 ; items 3, 4, 5 are in columns 21, 22, 23 of the input data file`
		`I16-20=11 ; items 16, 17,18, 19, 20 are in columns 11, 12, 13, 14, 15`
		`P1=9 ; the first character of person label is in column 9 of the input data file`

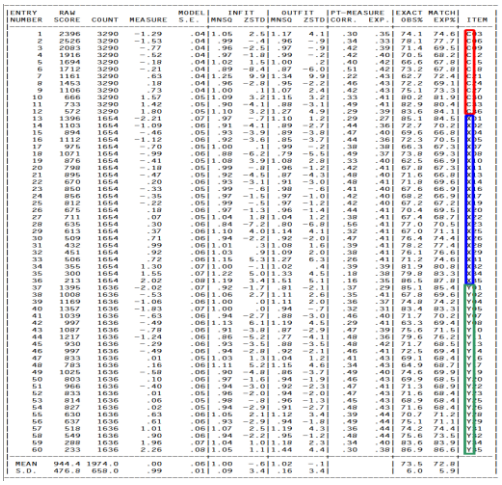
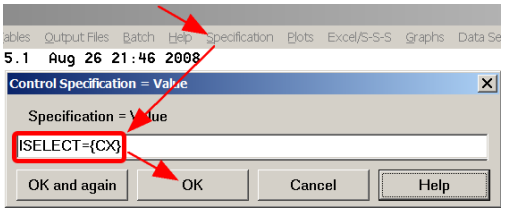
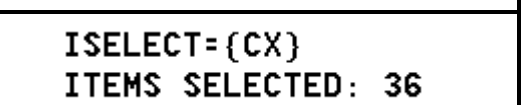
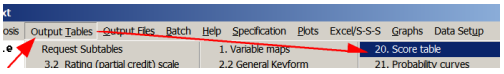
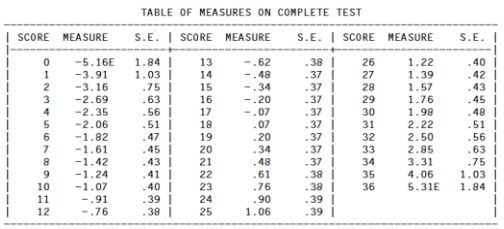
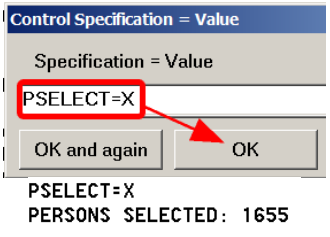
73.	Please launch Winsteps	
74.	Winsteps menu bar Click on Open file Double-click on "Mxycontrol.txt" in the examples folder Report ...? Press Enter Extra specifications? Press Enter Run the analysis	

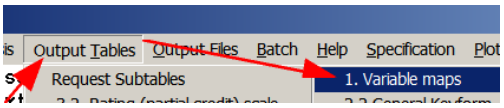
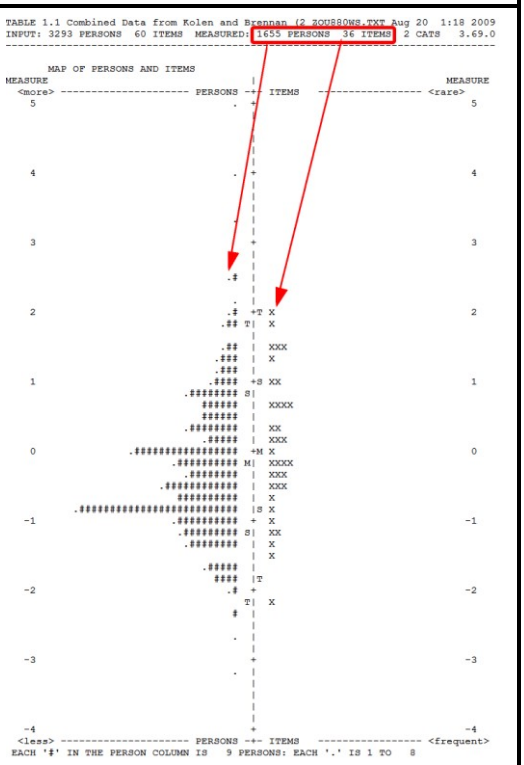
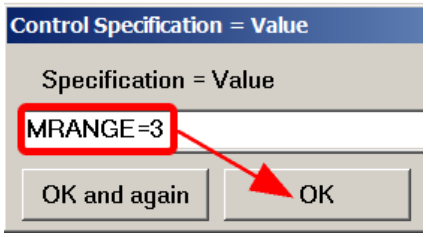
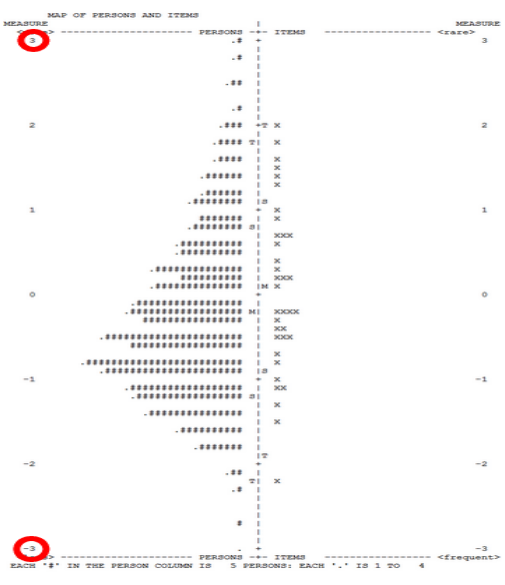
75.	The Analysis completes ...
	
	3293 persons = 1655 + 1638. *Correct!*
	60 items = 12 + 24 + 24. *Correct!*
	
	We have concurrently (one-step) equated the two tests. But how did we do it? And how can we use it?
		`| PERSONS 3293 INPUT 3293 MEASURED`
		`| SCORE COUNT MEASURE ERR`
		`| MEAN 17.2 36.0 -.08`
		`| S.D. 6.8 .0 1.05`
		`| REAL RMSE .42 ADJ.SD .97 SEPARAT`
		`| ITEMS 60 INPUT 60 MEASURED`
		`| MEAN 946.2 1975.8 .00`
		`| S.D. 477.2 658.6 .99`
		`| REAL RMSE .06 ADJ.SD .99 SEPARAT`

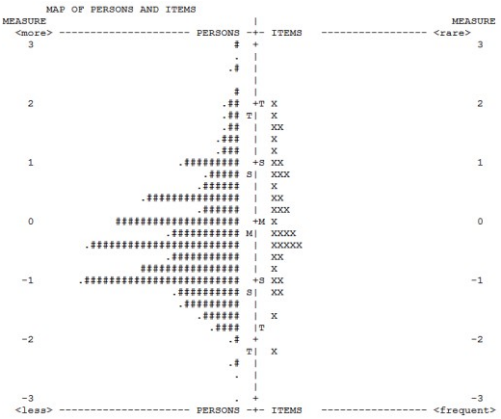
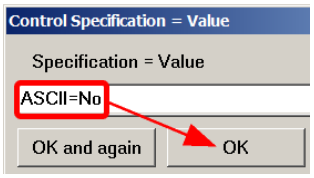
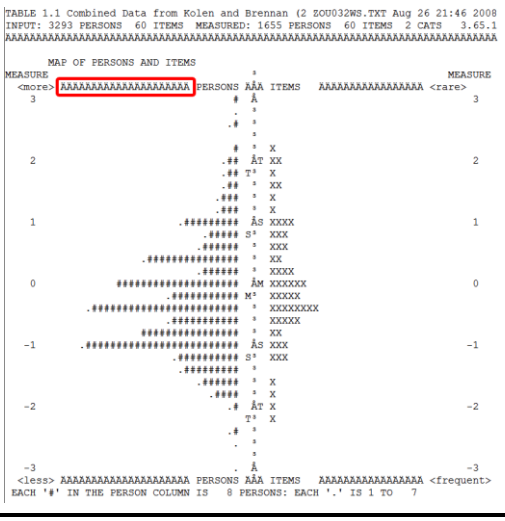
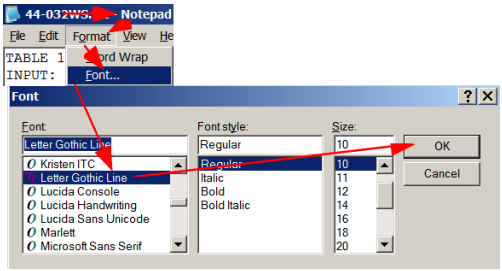
76.	Winsteps menu bar Click on Edit Click on Edit Control File	
77.	Mxycontrol.txt displays in a Notepad window We define the combined Mx.txt+My.txt data file: ITEM1=1 - the combined item responses start in column 1 NI=60 - there are 60 different items NAME1=62 - the person identification starts in column 62 *Leave a blank column between the item responses and the person label so that it easy to see that the layout is correct.*	

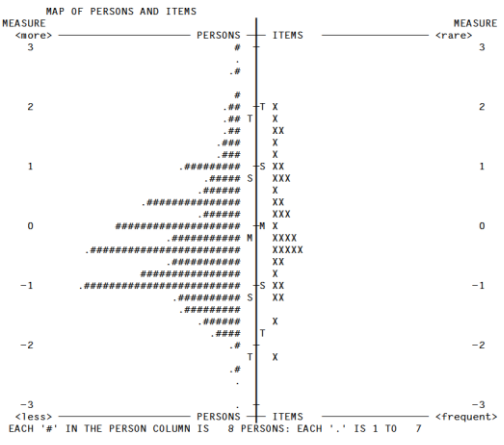
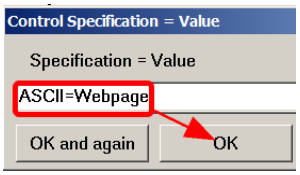
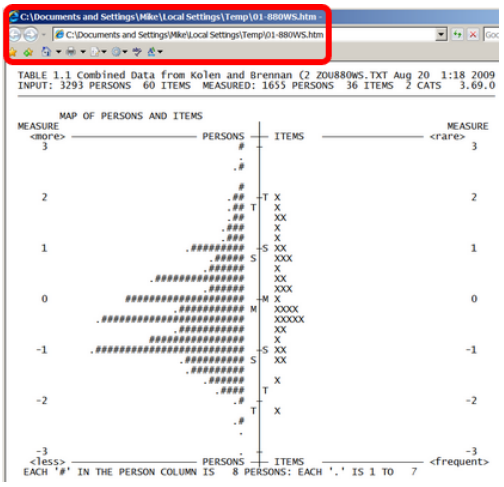
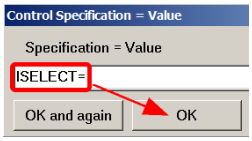
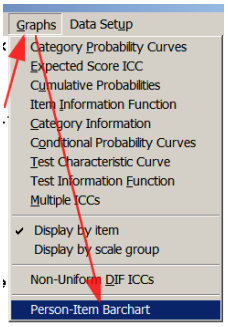
78.	Scroll down to the item labels &END - end of the control variables *Red box:* the 12 common items. I have kept the same item labels as in Mx.txt and My.txt *Blue box:* the 24 items unique to Mx.txt. I have changed the Mx.txt item labels to start "X" *Green box:* the 24 items unique to My.txt. I have changed the My.txt item labels to start "Y" END LABELS (Notice that there are no data below)	
79.	Scroll back up to MFORMS= Now we have some clerical work - but much less than trying to rearrange the data using "rectangular copying" (such as Alt+Mouse in Word) or many other methods of rearranging the data. MFORMS= input data files with different layouts. data=Mx.txt - input the Mx.txt data file. L=1 - each person record is one line in Mx.txt I1=3 - the first item in the combined data file is the first common item, C03, this is in column 3 of Mx.txt I2=6 - the second item, C06, is in column 6 of Mx.txt	
80.	I12=36 - the twelfth item is the last common item C36 I13-14=1 - now we have the items unique to Mx.txt. Columns 13-14 of the combined data have items X01 and X02 (originally 001 and 002) of Mx.txt which are in columns 1 and 2 of Mx.txt.	
81.	I35-36=34 - columns 35 and 36 of the combined file hold the last two unique items of Mx.txt, X34 and X35. P1="X" - this puts character X as the first character of the person label P2-5=37 - X is followed by the 4 characters of person label from column 37 onwards of Mx.txt. # - end of instructions for Mx.txt	
82.	Same again, but for My.txt	
83.	I37-38=1 - Items unique to My.txt follow to the right of the unique items for Mx.txt	

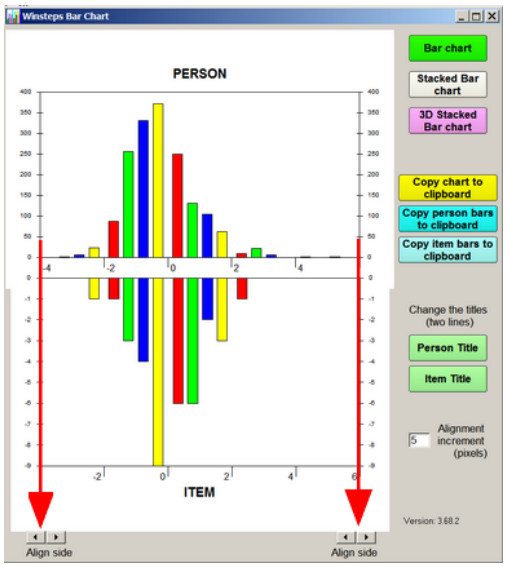
84.	I59-60=34 - these are the last two unique items of My.txt P1="Y" - first character of combined person label is Y for My.txt P2-5=37 - the person label information from My.txt * - end of MFORMs= &END - end of control variables	
85.	Now, what did this do? Winsteps Analysis window, near the top *Red box:* Mx.txt is processed *Blue box:* My.txt is processed *Orange box:* They are reformatted into a temporary file *Green box:* The temporary file is processed as the data file.	
86.	The temporary file is available: Winsteps menu bar Click on Edit Click on Edit MFORMS File= Temporary files are automatically deleted when Winsteps closes.	
87.	The reformatted temporary file displays in a Notepad window. The first records are from Mx.txt. The X (P1="X") is the first character of the person label	
88.	Scroll down the file ... We can see the transition from Mx.txt to My.txt. The 12 common items. Then the unique Mx.txt items. Then the unique My.txt items. Notice that a wonderful feature of Rasch methodology is that the missing data doesn't matter! The measures are estimated from the observations. Fewer observations means less precision. There is no need to impute missing data nor to delete cases, items or whatever.	
89.	And then My.txt finishes at the bottom. If you want to keep this file, then "Save As" a permanent file. Its control file would be Mxycontrol.txt, omitting the MFORMS= instructions	
90.	Equating of polytomous items is somewhat more complex. Which rating-scale structure is the decisive one? We usually need to anchor this SAFILE= early in the equating study. Test A or Test B or a joint analysis of Test A and Test B? See the suggestions at http://www.rasch.org/rmt/rmt101f.htm	

91.	**E. Reporting the Concurrent-Equating Measures**	
92.	We have one analysis with all the items and persons in the same frame-of-reference. Winsteps menu bar Click on Output Tables Click on 14. Items in Entry Order There are all the items Red box: 12 Common items Blue box: 24 items unique to Mx.txt Green box: 24 items unique to My.txt This combined listing would be useful if we wanted to make an item-bank of 60 items.	
93.	But suppose we need a score-to-measure Table for future administrations of the Mx.txt test. Windows menu bar Click on Specification Type in: ISELECT={CX} *(Select item labels starting C or X)* Click on OK	
94.	In the Windows analysis window, we see that 36 items have been selected. *Correct!*	
95.	Winsteps menu bar Click on Output Tables Click on 20. Score table	
96.	And, in a Notepad window, we have the measures corresponding to scores from 0 to 36 on the Mx.txt test.	
97.	To report the persons in Mx.txt test: Windows menu bar Click on Specification Type in: PSELECT=X Click on OK Persons selected = 1655. *Correct again!*	

98.	**F. Improving the Appearance of the Tables**	
99.	So now we can see the "map" for Mx.txt Winsteps menu bar Click on Output Tables Click on 1. Variable maps	
100.	The Table 1. Variable Map displays in a Notepad window. On the left are the 1655 persons. On the right are the 36 items. Let's "prettify" (beautify) the map ... The range shown is +5 to -4. We only need +3 to -3 *You could also change to a more user-friendly scaling with UIMEAN= and USCALE=*	
101.	Winsteps menu bar Click on Specification Type in: MRANGE=3 Click on OK MRANGE= specifies the half-range to display around the local origin.	
102.	Winsteps menu bar Click on Output Tables Click on 1. Variable maps This Table-Map is too long. Let's squash it.	

103.	Winsteps menu bar Click on Specification Type in: MAXPAGE=50 Click on OK This specifies the maximum number of lines on a Table page	
104.	Winsteps menu bar Click on Output Tables Click on 1. Variable maps That looks better. But let's make it look more "publication quality" We have three options: ASCII = Yes - this is what we are seeing here → ASCII = No - display using line-drawing characters ASCII = Webpage - display using HTML codes	
105.	Winsteps menu bar Click on Specification Type in: ASCII=No Click on OK This specifies the line drawing characters	
106.	Winsteps menu bar Click on Output Tables Click on 1. Variable maps Notepad window ... Oops! Has something gone wrong? ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ That is correct, but we need to change font	
107.	Notepad menu bar Click on Format Click on Font Font: Scroll to Letter Gothic Line *This font is usually installed with Winsteps* Click on Letter Gothic Line Click OK	

108.	Winsteps menu bar Click on Output Tables Click on 1. Variable maps Elegant! The lines look much neater. You can copy-and-paste this into a Word document, but you will need to set the font to Letter Gothic Line in Word. ***Sorry. This does not work in some versions of Windows*** To make the Notepad font change permanent: see Winsteps Help - "Notepad" So let's try the third display option	
109.	Winsteps menu bar Click on Specification Type in: ASCII=Webpage Click on OK This specifies HTML output	
110.	Cool! *Red box:* the variable map displays in your Internet Browser software. You can copy-and-paste this direct to Word without losing the font or the formatting	
111.	Reinstate all the items: Windows menu bar Click on Specification Type in: ISELECT= Click on OK	 ISELECT= ITEMS SELECTED: 60
112.	And a different way to see the same distribution: Graphs menu Click on: Person-item Barchart	

113.	You see a graphical distribution chart .... If the sides at the top and bottom do not align correctly, please adjust them with the arrows at the bottom of the window. This plot is an experimental prototype - a better-looking plot is coming!	
114.	*Oh no! Our time is up, and there is so much more ....* Please close all windows	
115.	Thank you for joining in this exciting exploration. We have all learned so much	