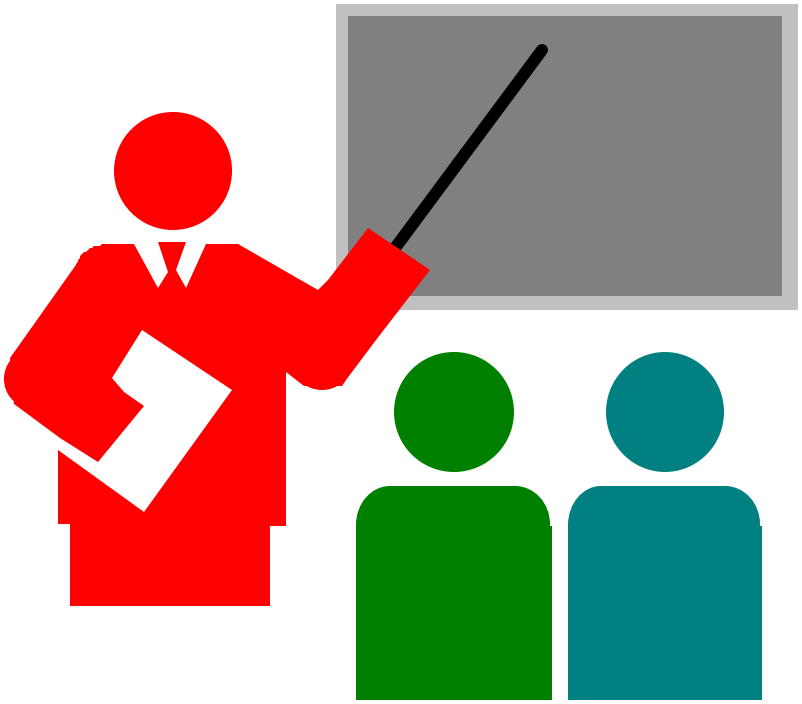
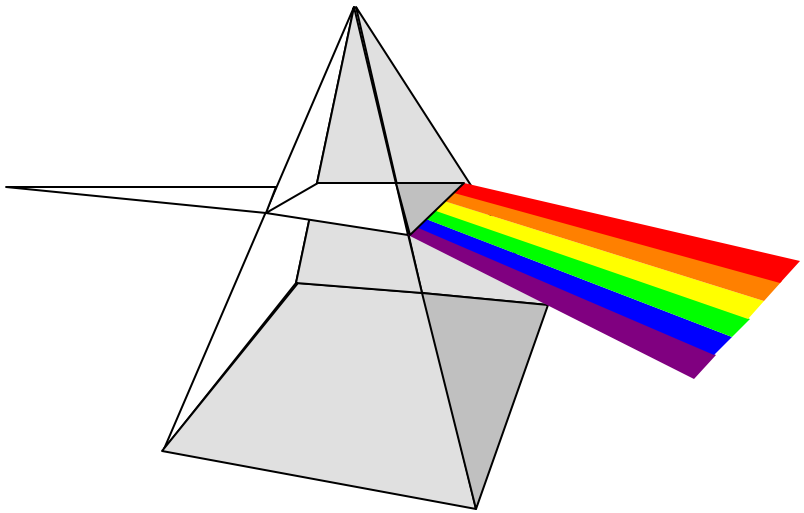
RASCH MODELS



RATING SCALE

University of Alabama

Rating Scale Model



- Provides a “step” interpretation across rating scale points.
- Rating scale points are the same for all items.
- Determine location of item and threshold (location of “step” in each scaled item).

RATING SCALE MODEL

The Rasch logit calibration formula is:

$$\ln [P_{nij} / P_{nij-1}] = e [\beta - (\delta + \tau)] / 1 + e [\beta - (\delta + \tau)]$$

$$\ln [P_{nij} / P_{nij-1}] = B_n - \delta_i + \tau_j$$

Where:

P_{nij} / P_{nij-1} = probability of individual n rating category j relative to category j-1

B_n = logit "ability" calibrated measure for individual n

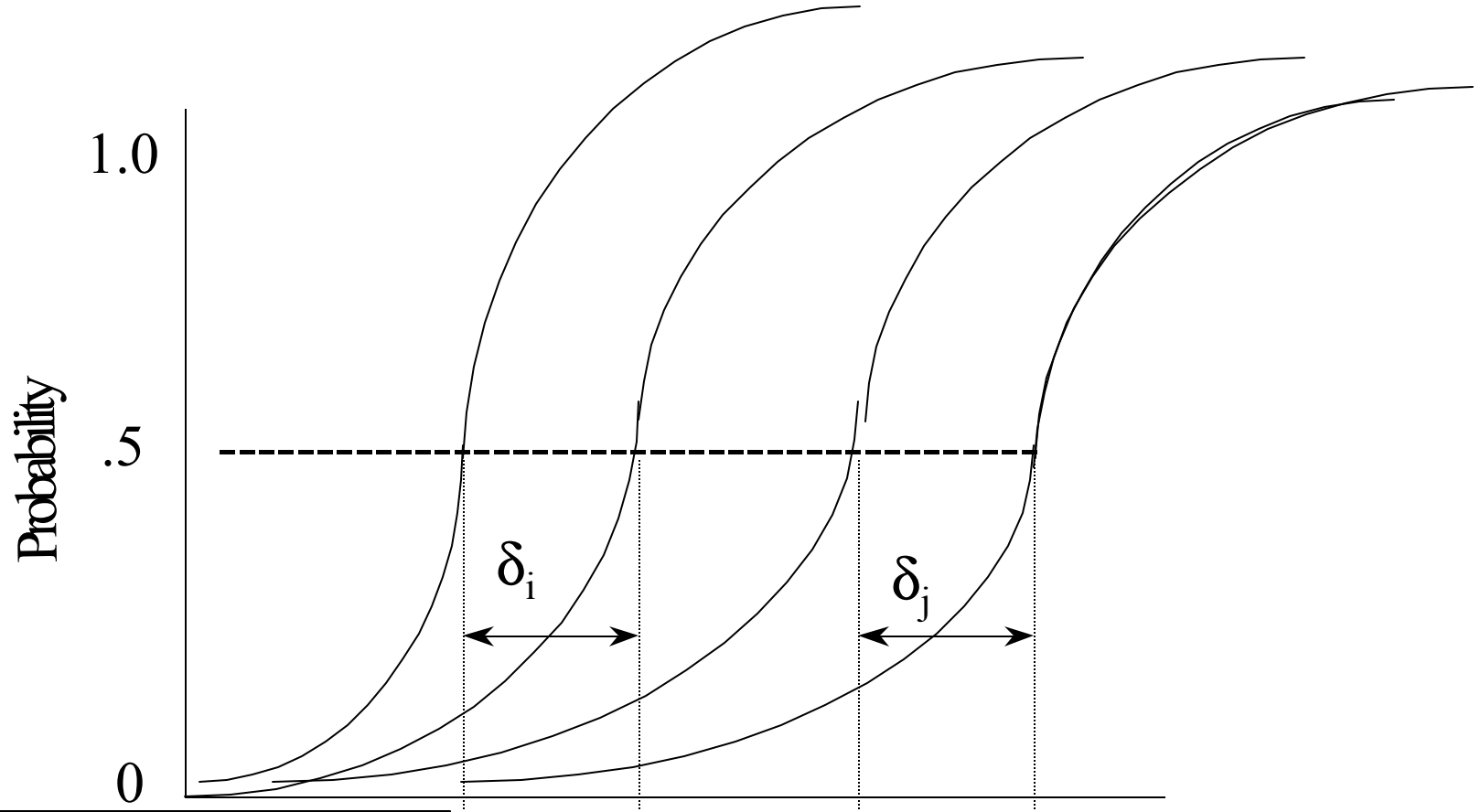
δ_i = logit "item" calibrated measure for statement i

τ_j = scale category j relative to scale category j-1

The Rasch rating scale method helps in determining the number of appropriate scale points to use in an instrument. Same rating points for each statement so shouldn't vary, which means two components: $\delta_i + \tau_j$

Rating Scale Operating Curve

(Items i and j)



δ_i = location of item i on variable
τ = location of jth step on scale

RATING SCALE

MOBILITY INVENTORY

Mobility Scale				Daily Activity Statements
No Concern	Little Concern	Some Concern	Much Concern	How concerned are you About falling when…
1	2	3	4	Getting dressed.
1	2	3	4	Getting undressed.
1	2	3	4	Falling out of bed
1	2	3	4	Slipping on the floor
1	2	3	4	Walking around
1	2	3	4	Stepping out of a bathtub
1	2	3	4	Getting out of a car
1	2	3	4	Using a chair
1	2	3	4	Walking down a ramp

Rating Scale Example

```
&INST
TITLE       = ' MOBILITY INVENTORY '
FORMAT    = '(9A1,2X,A1)'              ;   RAW DATA FILE  FORMAT
NCOLS      = 13
NI             = 9
ITEM1       = 1
XWIDE      = 1
CATEGS     = 4                          ;  MODE L = R is PROGRAM DEFAULT
CODES      = '1234'                      ; 4 RATNG CATEGORIES
INAMES     = 0
NAME1      = 12
MSCDAT  = 'mscale.dat'                  ; DATA READ IN FROM FILE
&END
Getting dressed
Getting undressed
Falling out of bed
Slipping on the floor
Walking around the neighborhood
Stepping out of a bathtub
Getting out of  a car
Using a chair
Walking down a ramp
END NAMES
```

RATING SCALE DATA FILE

MSCALE.DAT

```
121112113   1
111211211   2
111121113   3
111221112   4
112111211   5
111211111   6
121212111   7
112111311   8
```

FORTRAN statement defines how data should be read:

FORMAT = '(9A1,2X,A1)'

Rating Scale Output

PERSON STATISTICS -- MEASURE ORDER

NAME	COUNT	TEST	MEASURE	ERROR	MNSQ INFIT	MNSQ OUTFIT
7	18	9	.89	.45	.7 -.6	.7 -.6
8	17	9	.68	.44	1.3 .8	1.2 .6
5	15	9	.30	.44	1.1 .3	1.1 .4
6	12	9	-.27	.44	.5 -1.3	.5 -1.4
1	4	9	-2.15	.59	.9 .0	.9 .0
2	3	9	-2.53	.65	1.4 .8	1.0 .0
4	3	9	-2.53	.65	.8 -.2	1.0 .0
3	2	9	-3.03	.77	1.3 .6	2.1 1.3

Patients 1 - 4 felt No Concern to Little Concern

Patients 5 - 8 felt Some Concern to Much Concern

Rating Scale Output

PERSON STATISTICS -- MEASURE ORDER

NAME	COUNT	TEST	MEASURE	ERROR	MNSQ INFIT	MNSQ OUTFIT
7	18	9	.89	.45	.7 -.6	.7 -.6
8	17	9	.68	.44	1.3 .8	1.2 .6
5	15	9	.30	.44	1.1 .3	1.1 .4
6	12	9	-.27	.44	.5 -1.3	.5 -1.4
1	4	9	-2.15	.59	.9 .0	.9 .0
2	3	9	-2.53	.65	1.4 .8	1.0 .0
4	3	9	-2.53	.65	.8 -.2	1.0 .0
3	2	9	-3.03	.77	1.3 .6	2.1 1.3

Patients 1 - 4 felt No Concern to Little Concern

Patients 5 - 8 felt Some Concern to Much Concern

Rating Scale Output

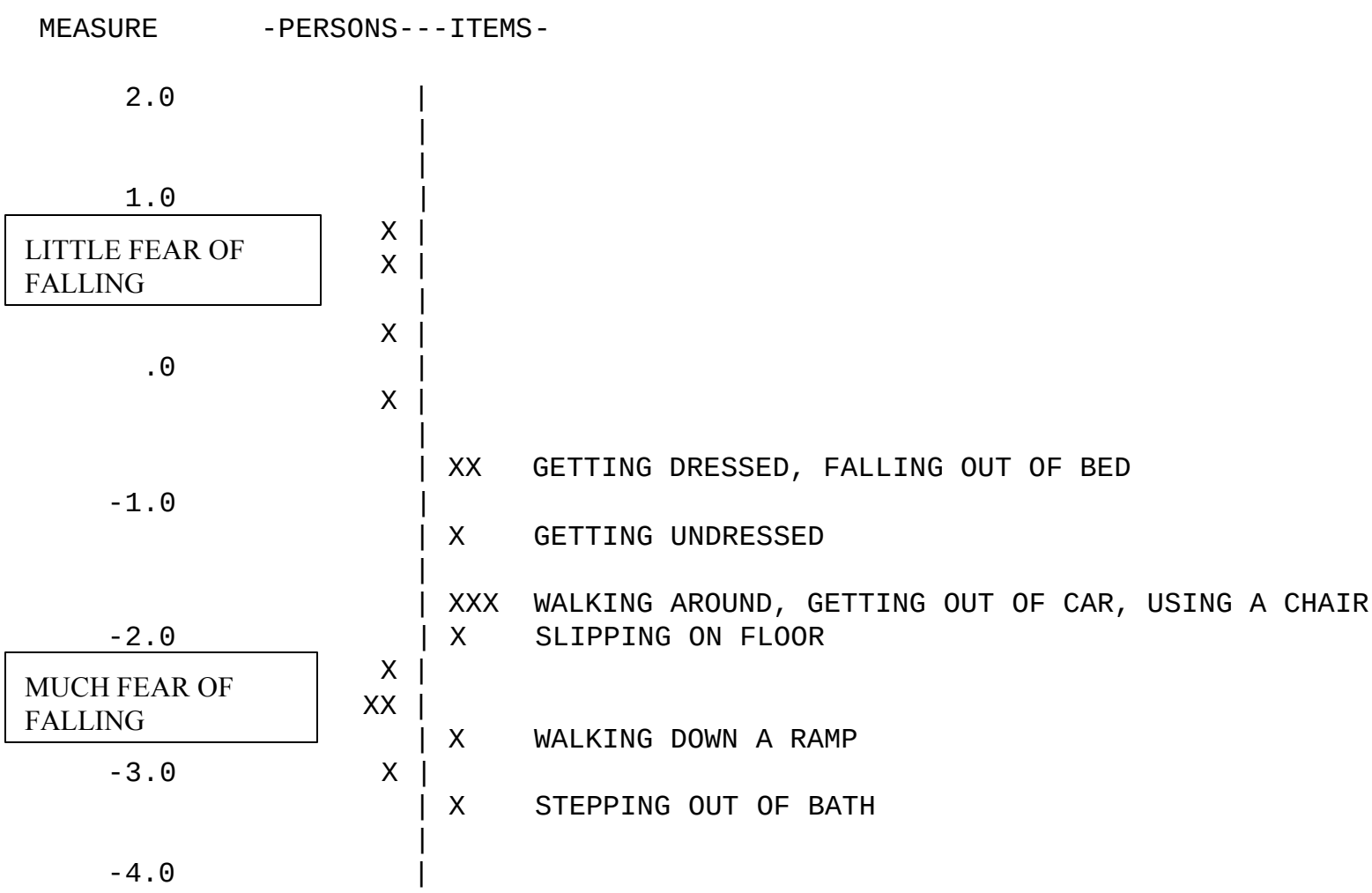
ITEMS STATISTICS -- MEASURE ORDER

NAME	COUNT	CALIBRTN	ERROR	MNSQ INFIT	MNSQ OUTFIT
1 Getting dressed	5	.99	.60	.2 -2.0	.2 -1.4
3 Falling out of bed	5	.99	.60	1.3 .7	2.2 1.4
2 Getting undressed	6	.65	.57	1.3 .6	1.5 .9
5 Walking around	8	.03	.54	.5 -1.0	.6 -.7
7 Getting out of car	8	.03	.54	.8 -.3	1.0 .2
8 Using a chair	8	.03	.54	1.4 .9	1.0 .3
4 Slipping on floor	9	-.26	.53	1.0 .0	.9 .0
9 Walking down ramp	12	-1.09	.52	1.7 1.3	1.6 1.2
6 Stepping out bath	13	-1.36	.53	.4 -1.3	.5 -1.2

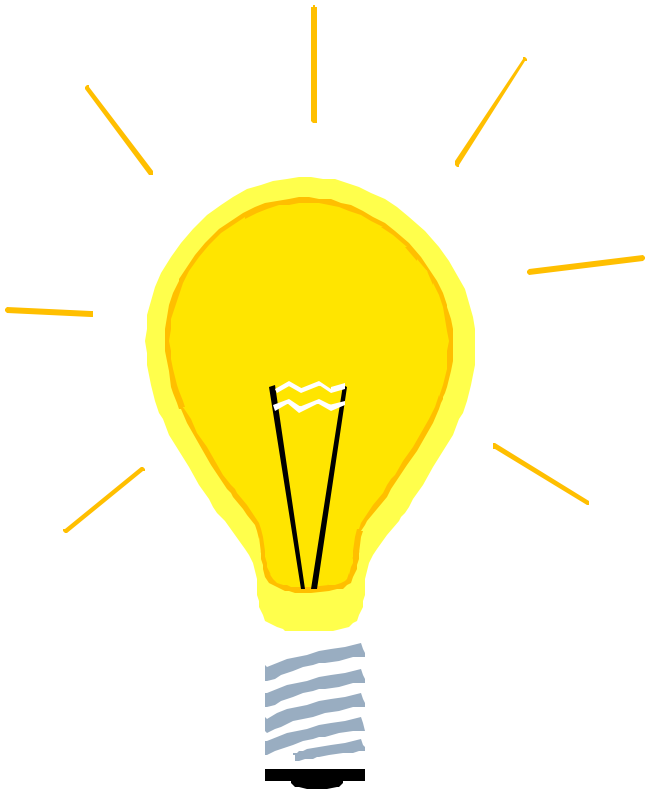
Items 1, 2 and 3 were of low concern for falling.
Items 5, 7 and 8 were of middle concern for falling.
Items 4, 6, and 9 were of high concern for falling.

University of Alabama

Rating Scale Output



Binary, Partial, or Rating Model?



- Items with a numerical rating scale can still be compared to partial credit (reduced rating points) and binary (1,0) models.
- Reliability(coefficient of separation) and Validity (fit statistics) can be used to determine best scaling.