
Contents

Acknowledgement	ix
Authors	xiii
Glossary of Notation and Acronyms	xv
1 Measurement in the Social, Behavioral, and Health Sciences	1
Introduction	1
Methodological Procedures and Psychometric Measurement	
Models	2
Relation of Measurement Model to Attribute Scale	3
Developing Attribute Theory Is Important	4
Measurement Instruments	5
Measurement Models	6
Scales of Measurement	9
Causes of Messy Data	11
A Scale for Transitive Reasoning	13
Cycle of Instrument Construction	16
This Monograph	23
2 Classical Test Theory and Factor Analysis	29
Historical Introduction	29
The Classical Test Model	32
Measurement Level and Norm Scores	32
Model Assumptions	35
Repeatability of Test Scores: Reliability	39
Methods for Estimating Reliability	43
Methods Commonly Used in Test-Construction Practice	43
Parallel-Test Method	43
Retest Method	44
Split-Half Method	45
Internal Consistency Method	45
Reliability Methods Based on One Test Administration	47
Method λ_1	48
Method λ_3	50
Method λ_2	53
Method λ_4	58
Method λ_5	60
Method λ_6	62
Greatest Lower Bound	63
Special Topics Concerning Methods λ_1 through λ_6 and the GLB	66
Mutual Relationships of Lower Bounds and Reliability	66

Discrepancy of Methods λ_1 through λ_6 and the GLB	66
Overestimation of Reliability in Real Data	67
Confidence Intervals	71
Reliability versus Measurement Precision	73
Traditional Methods	74
Alternative Methods and Special Topics	80
Constructing Scales in the Classical Test Theory Context	83
Corrected Item-Total Correlations and Oblique Multiple Group Method	84
Principal Component Analysis	85
Factor Analysis	88
Factor-Analysis Approach to Reliability	91
One-Factor Model	92
Multi-Factor Model	94
Real-Data Example: The Type D Scale14 (DS14)	96
Discussion	101
3 Nonparametric Item Response Theory and Mokken Scale	
Analysis	105
Introduction	105
Model of Monotone Homogeneity	109
Prerequisites	109
Definitions and Notation	109
Assumptions	110
Strictly and Essentially Unidimensional IRT	115
An Ordinal Scale for Person Measurement	118
Goodness-of-Fit Methods	124
Unidimensionality: Scalability and Item Selection	125
Local Independence	139
Monotonicity	144
Data Example: The Type D Scale14 (DS14) Revisited Using Nonparametric IRT	152
Model of Double Monotonicity	156
Goodness-of-Fit Methods	158
Method Manifest Invariant Item Ordering	160
Other Methods for Investigating Manifest Invariant Item Ordering	163
Reliability	166
Data Example: The Type D Scale14 (DS14) Continued	168
Discussion	170
4 Parametric Item Response Theory and Structural Extensions	173
Introduction	173
A Taxonomy for IRT Models	177
Some Basic IRT Models for Dichotomous Items	178

Guttman Model	178
Normal-Ogive Models.....	180
One-Parameter Logistic Model or Rasch Model	185
The Model, Separability of Parameters.....	185
Sufficiency and Estimation	189
Information Functions and Measurement Precision	194
Goodness-of-Fit Methods.....	196
The Rasch Paradox	205
Epilogue.....	208
Two and Three-Parameter Logistic Models	209
Some Basic IRT Models for Polytomous Items	216
Adjacent Category Models.....	216
Cumulative Probability Models.....	223
Continuation Ratio Models.....	227
Filling in the Taxonomy	229
IRT Models for Special Purposes.....	238
Linear Logistic Test Model	238
Generalized Rasch Model with Manifest Predictors.....	239
Multidimensional IRT Models	241
Data Example: Transitive Reasoning	244
Discussion	249
5 Latent Class Models and Cognitive Diagnostic Models	251
Introduction.....	251
Latent Class Model	254
An Example: Proportional Reasoning	254
Introduction	256
The Unrestricted Model	258
Restricted Models	261
Estimation	264
Goodness-of-Fit Methods.....	266
Ordered LCM and Testing Monotonicity in Nonparametric IRT....	273
Data Example: Proportional Reasoning by Means of the Balance Scale.....	274
Discussion	280
Cognitive Diagnostic Model.....	281
An Example: Identifying Patients' Disorder Profiles Using the MCMI-III	281
Introduction	282
Models	285
Estimation	304
Goodness-of-Fit Methods.....	305
Relationship to Nonparametric IRT	310
Data Example: Identifying Patients' Disorder Profiles Using the MCMI-III.....	311

Discussion	318
General Discussion	319
6 Pairwise Comparison, Proximity, Response Time, and Network Models.....	321
Introduction	321
Pairwise Comparison Models.....	322
Thurstone Model.....	323
Bradley-Terry-Luce Model.....	328
Discussion	331
Proximity Models	331
Deterministic Model.....	333
Probabilistic Models	336
Discussion	344
Response Time Models	346
Lognormal Model	350
Diffusion Model	352
Discussion	356
Network Psychometrics	356
Network Approach for Gaussian Data	361
Prerequisites for Gaussian Data Networks	361
Networks for Gaussian Data	363
Network Approach for Binary Data.....	364
Discussion	367
References	369
Index.....	399