

Contents

List of Contributors	page xix
Preface	xxi
Part I. Introduction	1
1. What Is Intelligence and What Are the Big Questions About It?	3
<i>Robert J. Sternberg</i>	
What Is Intelligence?	3
Some Big Questions about Intelligence	4
Is There Such a Thing as Intelligence?	4
Is Intelligence a Single Thing or Many Things?	6
Is Intelligence the Same Thing in All Places and at All Times?	6
Have Levels of Intelligence Changed over Time?	8
Is There a Best Way to Study Intelligence?	8
Is There a Best Test of Intelligence?	9
Is Intelligence Heritable?	10
Can Intelligence Be Increased (or Decreased)?	11
Are There Sex Differences in Intelligence?	12
Are There Racial/Cultural/Ethnic Differences in Intelligence?	13
<i>Focus on Contemporary Research: Okagaki and Sternberg's Work on Parents' and Teachers' Beliefs as They Relate to Children's School Performance</i>	13
Does Intelligence Decrease in Old Age?	14
Does Intelligence Predict Success in Life as Well as in School?	14
Are IQ Tests Inherently Biased?	15
What Is the Relationship of Intelligence to Other Psychological Constructs, Such as Creativity and Personality?	15
Are Machines Becoming More Intelligent than Humans?	16
Conclusion	16
Chapter Summary	16
Key Terms	18
Comprehension and Reflection Questions	18
References	18

2. Approaches to Understanding Human Intelligence	22
<i>Robert J. Sternberg</i>	
Psychometric Approaches	22
Types of Psychometric Tests	22
Using Psychometric Approaches to Understand Intelligence	26
Advantages and Disadvantages of Psychometric Approaches	26
Cognitive Approaches	26
Specific Cognitive Approaches	27
Advantages and Disadvantages of Cognitive Approaches	28
Biological Approaches	29
Models Based on Behavior-genetic and Molecular-Genetic Data	29
Models Based on Data Obtained through Brain Scans	30
Models Based on Data Specific to Patients with Brain Damage	32
Models Based on Data Related to Head or Brain Size	32
Models Based on Electrophysiological Data	32
Advantages and Disadvantages of Biological Approaches	33
Developmental Approaches	33
Piaget's Theory of Development from the Inside, Outward	33
Theories Based on Development from the Outside, Inward	34
Anthropological Approaches	35
Advantages of Anthropological Approaches	35
Disadvantages of Anthropological Approaches	37
Systems Approaches	38
<i>Focus on Contemporary Research: Robert J. Sternberg's Work on Practical Intelligence</i>	39
Conclusion	40
Chapter Summary	41
Key Terms	42
Comprehension and Reflection Questions	42
References	43
3. Early History of Theory and Research on Intelligence	47
<i>Robert J. Sternberg</i>	
Early Contributors to the Testing Movement in Intelligence	47
Francis Galton	47
James McKeen Cattell	49
Alfred Binet	50
Lewis Terman	52
David Wechsler	54

<i>Focus on Contemporary Research: Robert J. Sternberg's Evolution of Ideas about Intelligence</i>	55
Societal Uses of Intelligence Testing	56
The Early Eugenics Movement	56
IQ Testing in the Military	59
Conclusion	59
Chapter Summary	60
Key Terms	61
Comprehension and Reflection Questions	61
References	61
Part II. Approaches to Studying Intelligence	65
4. Psychometric Approaches to Intelligence	67
<i>Alan S. Kaufman, W. Joel Schneider, and James C. Kaufman</i>	
The First Intelligence Tests	67
How Are Intelligence Tests Used Today?	69
Educational Uses of Intelligence Tests	69
<i>Focus on Contemporary Research: Alan S. Kaufman's Work on the Measurement of Cognitive Strengths and Weaknesses</i>	70
Medical (Neuropsychological) Uses of Intelligence Tests	73
Uses of Intelligence Tests within the Legal System	74
Uses of Intelligence Tests in Personnel Selection	74
Psychometric Models of Intelligence	76
Factor Analysis: A Gentle, Non-Technical Introduction	77
The First Factor-Analytic Theory of Intelligence	79
The Glorious Death of Spearman's Two-Factor ("g") Theory	80
Multiple Factor Analysis and Thurstone's Primary Mental Abilities	80
Splitting g in Two: Cattell's Theory of Fluid and Crystallized Intelligence	82
The Theory of Fluid and Crystallized Intelligence Expands	84
Carroll's (1993) Reanalysis Largely Confirms the Horn–Cattell Model	84
The Cattell–Horn–Carroll (CHC) Theory of Cognitive Abilities	85
Fluid Reasoning (Gf)	86
Acquired Knowledge (Gc)	88
Perceptual Processing (Gv, Ga)	89
Attention and Memory (Gl, Gr, Gwm)	90
Processing Speed (Gs)	91
Motor Abilities (Gp, Gps)	91

What Do Psychometric Models Miss?	91
Conclusion	92
Chapter Summary	93
Key Terms	94
Comprehension and Reflection Questions	94
References	95
5. Cognitive Approaches to Intelligence	104
<i>Victor J. Ellingsen and Randall W. Engle</i>	
Precursors to the Cognitive Approach to Intelligence	104
Two Branches of Psychology: Experimental and Differential	106
Psychometric <i>g</i> versus Psychological <i>g</i>	106
Understanding the Cognitive Approach	107
Defining Intelligence for Research	108
Methods in the Cognitive Approach to Intelligence	109
Cognitive Correlates Methods	109
Componential Analysis Method	111
Speed of Mental Processing	112
Measuring Speed: Inspection Time and Reaction Time	113
The Speed-Intelligence Relationship	114
Challenges for Intelligence-as-Speed Theories	115
Working Memory and Executive Attention	117
Measuring Working Memory Capacity (WMC)	117
Working toward Reliable Estimates of WMC	120
Theories of Working Memory (WM)	122
The Relationship between WMC and <i>Gf</i>	124
<i>Focus on Contemporary Research: Randall W. Engle's Work on Working Memory Capacity and Reading Comprehension</i>	127
Conclusion	130
Chapter Summary	131
Key Terms	132
Comprehension and Reflection Questions	132
References	132
6. Biological Approaches to Intelligence	139
<i>Richard J. Haier</i>	
Pre-Imaging Studies	140
Brain Waves and Efficient Information Processing	141
Lesion Studies	142

The First Phase of Neuroimaging Studies (1988–2007)	144
Positron Emission Tomography (PET)	144
Using PET to Investigate Sex Differences in Cognitive Ability	146
Magnetic Resonance Imaging	148
MRI Studies Examining Gray Matter Concentrations and Intelligence	148
Efficiency Follow-up Studies (MRI)	150
The P-FIT Model of Intelligence	151
Phase 2 of Imaging Studies: Post-2007 to the Present	153
Intelligence Components and Brain Chemistry:	
Functional Studies	153
Anatomical Correlates: Structural Studies of Brain Areas	155
Network and Efficiency Connectivity Studies	157
Developmental Studies	159
Genetic/Imaging Studies	160
What's Next?	161
Conclusion	162
<i>Focus on Contemporary Research: Richard J. Haier's Path to Neuroimaging Research</i>	163
Chapter Summary	164
Key Terms	165
Comprehension and Reflection Questions	165
References	165
7. Cultural Approaches to Intelligence	174
<i>Robert J. Sternberg</i>	
What Is Culture and What Is Intelligence?	175
Implicit Theories of Intelligence	176
<i>Focus on Contemporary Research: Robert Sternberg's Work on Whether Practical Skills Can Predict Health</i>	177
The Importance of Intelligence to Western Culture	181
Expert versus Lay Theories of Intelligence	181
Models of the Relationship of Culture to Intelligence	182
Studies of Intelligence in its Cultural Contexts	182
The Dangers of Single-Culture Research	182
Recognizing the Importance of Cultural Context for Research	183
Culture-Fair and Culture-Relevant Testing	190
Conclusion	191
Chapter Summary	191

Key Terms	192
Comprehension and Reflection Questions	192
References	192
8. Systems Approaches to Intelligence	202
<i>Robert J. Sternberg</i>	
The Theory of Multiple Intelligences	202
Multiple Intelligences	202
Criteria for Constructing the Theory of Multiple Intelligences	204
Evidence for the Theory	206
The Theory of Successful Intelligence	207
The Nature of Intelligence	207
Processes Underlying Intelligence	208
The Assessment of Successful Intelligence	211
Analytical Intelligence	211
Creative Intelligence	213
Practical Intelligence	215
Putting Together All Three Aspects of Intelligence	217
<i>Focus on Contemporary Research: Robert J. Sternberg's Work on Alternatives to Current Graduate School-Admissions Tests</i>	218
Conclusion	219
Chapter Summary	220
Key Terms	221
Comprehension and Reflection Questions	221
References	221
Part III. Theories on the Development of Intelligence	225
9. Genetics/Genomics and Intelligence	227
<i>Mei Tan and Elena L. Grigorenko</i>	
The Definition of Intelligence and How We Investigate It	228
Methods of the Field: A Capsule Overview	230
Quantitative-Genetic Methods	230
Molecular-Genetic Methods	231
<i>Focus on Contemporary Research: Sergey Kornilov, Mei Tan, and Elena L. Grigorenko: The First GWAS on Aspects of Intelligence in an African Population</i>	233
Genetics/Genomics and Intelligence: The Frontiers of Knowledge	234
Debates over the Origins of Intelligence	234
Intelligence-related Processes	239
Educational Attainment, Life Success, and Lifespan	242

Are there Practical Implications for Genetic Research on Intelligence?	242
Sociogenomics: The Study of How Social Life Evolved	243
Development of an Oligogenic System to Substantiate Intelligence	243
Genetic Alteration of Intelligence	244
Conclusion	246
Chapter Summary	246
Key Terms	247
Comprehension and Reflection Questions	247
References	248
10. Environment and Intelligence	253
<i>James R. Flynn and Robert J. Sternberg</i>	
IQ and Intelligence	253
Relative Roles of Genes and the Environment in the History of Our Minds	255
How People Reasoned in the Past	255
New Habits of Mind in Practice	257
Some Contradictory Trends	258
The Decline of IQ Gains in Developed Countries	259
Significant IQ Gains in Developing Countries	260
The Case for the Environment as the Source of Intelligence	260
<i>Focus on Contemporary Research: James R. Flynn's Work Applying What We Know about Environment and Intelligence to Real-World Problems</i>	261
Relative Roles of Genes and the Environment in the History of the Individual	261
Ages 2–3 and the Fairness Factor	262
Age 10 and the Rising Correlation	262
Age 20 and the Correlation Made Near Perfect	264
Human Autonomy	264
Specific Environmental Factors Affecting Human Development	265
Prenatal Factors	265
Postnatal Factors – Growing Children and Adults	268
Socioeconomic Status	271
Schooling	272
Conclusion	272
Chapter Summary	273
Key Terms	274
Comprehension and Reflection Questions	274
References	274

11. Lifespan Development of Intelligence	279
<i>Christopher Hertzog</i>	
Metatheoretical Views of Intelligence and Intellectual Development	279
Theories of Intellectual Development	280
Relevant Methodological Principles	284
Methodological Challenges in Development Research	285
Intellectual Development Across the Lifespan	287
Cross-sectional Studies of Fluid and Crystallized Intelligence	287
Cognitive Mechanics and Cognitive Pragmatics	289
Limitations of the Gf-Gc Model	290
Longitudinal Evidence about Patterns of Age Changes	291
Evidence from the SLS Study	292
Methodological Concerns with SLS Data	292
Individual Differences in the Development of Intellectual Abilities	295
Explanations for Individual Differences in Ability Change	297
Challenges to Detecting Causes for Rates of Change	301
Plasticity of Human Abilities across the Lifespan	302
Training Programs Targeting Cognition	302
Predicting Older Adults' Everyday Cognitive Function from Intellectual Abilities	303
<i>Focus on Contemporary Research: Hertzog et al.'s Research on Intellectual Ability and Other Factors as Predictors of Everyday Cognition</i>	303
Maintaining Intellectual Function in Old Age	304
Conclusion	304
Chapter Summary	305
Key Terms	305
Comprehension and Reflection Questions	306
References	306
Part IV. Applications of Intelligence Research	315
12. Extremes of Intelligence	317
<i>Julian G. Elliott and Wilma C. Resing</i>	
Intelligence Assessed at the Higher Extreme of the IQ Distribution	318
Is Giftedness Synonymous with High Intelligence?	318
Theories Related to High Intelligence and Giftedness	320
Application of Multiple Intelligences and Successful Intelligence	
Theories to the Education of Gifted Students	321
The Continuing Debate over the Identification and Causes of Giftedness	323
Are Current Measures of High Intelligence/Giftedness Able to Accurately Identify Potential High Achievers Irrespective of Social or Cultural Background?	324

Dynamic Assessment: An Alternative to Standardized Testing	325
Are Highly Intelligent People Likely to be High Achievers?	327
The Relationship between Giftedness and Psychological Health	327
Intelligence Assessed at the Lower Extreme of the IQ Distribution	328
Classification Systems and Assessment Tools	329
Etiology of Intellectual Disabilities	332
Intellectual Disability and Related Health Conditions	332
Learning Disability	333
Can Intelligence Be Increased in Those at the Extremes?	335
Interventions for Gifted Children	335
Interventions for Children with Learning Disabilities	335
Focus on Executive Functions	336
<i>Focus on Contemporary Research: Julian G. Elliott and Wilma C. Resing's Work on Determining Who Should Receive Specialized Reading Instruction</i>	337
Conclusion	339
Chapter Summary	339
Key Terms	340
Comprehension and Reflection Questions	340
References	341
13. Group Differences in Intelligence	349
<i>Diane F. Halpern and Tomoe Kanaya</i>	
Two Fundamental Questions about Group Differences in Intelligence	349
What Does It Mean to Say that There Are (on Average) Group Differences in Intelligence?	349
Why Are Group Differences in Intelligence Among the Most Contentious Topics in Psychology?	350
Causes and Correlations of Group Differences	350
Biological Explanations	350
Environmental/Sociocultural Explanations	351
Biopsychosocial Explanations	353
Explanations that Attack the Assumption of Group Differences	354
Which Is the Smarter Sex: Female or Male?	356
<i>Focus on Contemporary Research: Diane F. Halpern's and Tomoe Kanaya's Work on Cognitive Sex Differences</i>	357
What Are the Cognitive Tasks that Usually Show Sex Differences?	358
Tails and Tales of Distributions	360
The Why of Sex Differences in Cognition	361
Biological Explanations	361
Environmental Explanations	363

Race and Ethnic Group Differences in Intelligence	364
The Black–White Test Score Gap: Then and Now	365
Is Race Biological or Environmental?	366
Other Racial and Ethnic Groups	367
Our Differences May Not Be Meaningful: Overlapping Populations	368
Using What We Know about Stereotype Threat to Reduce Group Differences	370
Conclusion	371
Chapter Summary	372
Key Terms	373
Comprehension and Reflection Questions	373
References	373
14. The Predictive Value of General Intelligence	381
<i>Paul R. Sackett, Oren R. Shewach, and Jeffrey A. Dahlke</i>	
A Model of General Cognitive Ability (GCA)	381
Interpreting the Relationship between GCA and Outcomes	383
Accounting for the Complexity of Human Behavior	385
What Makes this Research Credible?	385
Using GCA to Predict Educational Outcomes	388
GCA Predicts Academic Grades across Stages of School and across Wide Time Intervals	388
GCA Predicts Graduation and Dropout at Many Stages of Schooling	389
<i>Focus on Contemporary Research: Paul R. Sackett's Work on College Admissions Tests and a Variety of Outcomes</i>	390
GCA Predicts Educational Attainment	391
GCA Predicts Creativity	391
GCA Predicts Educational Outcomes even after Accounting for Non-Cognitive Variables	392
Applications of GCA in the Workplace	393
GCA Is the Best Predictor of Task Performance for Jobs Where People Learn the Specific Job Skills after Hire	393
GCA Is a Stronger Predictor of Task Performance than of Other Facets of Job Performance	394
The GCA–Performance Relationship Holds for Virtually All Jobs	394
The GCA–Performance Relationship Gets Stronger as Job Complexity Increases	394
There Is Not a Threshold Above Which Higher Levels of GCA Do Not Matter	395
The GCA–Performance Relationship Holds over Time	396
GCA Predicts Both Rate and Amount of Learning	396
GCA Predicts Salary within a Given Job and Predicts Salary Trajectories of Individuals	396
GCA Predicts Occupational Attainment	397

GCA as a Predictor of Deviance/Wrongdoing	397
GCA Predicts Delinquency, But Only for Certain Forms of Delinquency	398
GCA Predicts Criminal Conviction	398
GCA Is Predictive of Counterproductive Behavior at Work	399
Health and Safety	400
GCA Predicts Mortality	400
GCA Predicts Aspects of Physical Health	401
GCA Predicts Aspects of Mental Health	402
GCA Predicts Accidents And Safety Behaviors	404
Conclusion	405
Chapter Summary	406
Key Terms	406
Comprehension and Reflection Questions	407
References	407
15. The Relationship of Intelligence to Other Psychological Traits	415
<i>Colin G. DeYoung</i>	
Personality Traits and the Five-Factor Model	416
Openness/Intellect	417
Intellect	419
<i>Focus on Contemporary Research: Colin G. DeYoung's Work on Personality Neuroscience</i>	420
Openness to Experience	421
Creativity	422
Wisdom	425
Neuroticism	426
Relationship of Neuroticism to Intelligence	426
Psychopathology	427
Agreeableness	428
Compassion and Politeness	428
Emotional Intelligence	429
Aggression	430
Conscientiousness	430
Theory of Compensation	431
Future Discounting	431
Extraversion	432
Conclusion	432
Chapter Summary	434
Key Terms	434
Comprehension and Reflection Questions	434
References	435

16. Intelligence, Education, and Society	443
<i>Richard E. Mayer</i>	
Learning Strategies	443
Generative Learning Processes	444
Generative Learning Strategies	445
Cognitive Processing Skills	448
Computer Games	449
<i>Focus on Contemporary Research: Richard E. Mayer's Work on Computer Games for Learning</i>	451
Brain-Training Games	452
Transferable Knowledge	454
Instructional Methods for Producing Transferable Knowledge	457
Principles for Designing Multimedia Lessons	461
Conclusion	462
Chapter Summary	462
Key Terms	463
Comprehension and Reflection Questions	463
References	463
Glossary	467
Index	481