

Contents

Volume 1: Cognitive Process Analyses of Aptitude

Foreword xi

Acknowledgments xiv

- 1. Adaptive Instruction: Trends and Issues** 1
Pat-Anthony Federico
Summary of Preceding Pertinent Symposia 1
Alternative Approaches to Adaptive Instruction 8
The Theme of this Meeting 22
- 2. Aptitude Processes** 27
Richard E. Snow
Models of Aptitude 31
Toward a Theory of Aptitude 58
Toward Adaptive Instruction 60
- 3. Information-Processing Abilities** 65
Andrew M. Rose
Introduction 65
Operations 70
Task Descriptions 71
Overview of Results 80

4. The Foundations of Verbal Comprehension 87

Earl Hunt

Theoretical Considerations 88

Structural Processes 90

Attention Allocation 96

Sentence Comprehension 97

Concluding Comments 101

5. Component Skills in Reading: Measurement of Individual Differences Through Chronometric Analysis 105

John R. Frederiksen

Validation in a Component Skills Analysis 106

Component Skill Measures 107

Evaluation of the Component Skills Model 119

Summary and Conclusions 125

Extensions of Component Skills Analysis to Reading of Text 126

Conclusions 136

6. Discussion: Aptitude Processes, Theory, and the Real World 139

John B. Carroll

Aptitudes and Aptitude Processes 140

Are Processes the Only Kinds of Considerations? 142

Acquired Knowledge and the Structure of Abilities 145

Summary 147

7. Spatial Information Processing: Strategies for Research 149

Lynn A. Cooper

Analysis of Processes Underlying Performance on a Single Spatial Task 150

Individual-Difference Analysis of Spatial Information Processing 155

Analysis of the Task-Dependent Nature of Spatial Information Processing 169

Concluding Remarks 174

8. Components of Inductive Reasoning 177

James W. Pellegrino and Robert Glaser

The Analysis of Aptitude: Overview 177

Analyses of Inductive Reasoning 181

Summary and Conclusions 212

9. Deductive Reasoning 219

Robert J. Sternberg, Martin J. Guyote, and Margaret E. Turner

Categorical Syllogisms 219

Conditional Syllogisms 230

Linear Syllogisms 234

Conclusions and Current Directions 243

10. A Cognitive-Style Approach to Metaphoric Thinking	247
<i>Nathan Kogan</i>	
Introduction	247
Task Description	252
Descriptive Statistics for the Metaphoric Triads Task	256
External Correlates of MTT Performance	261
Training Metaphoric Thinking	265
Educational Implications and Future Directions	269
Summary	276
Appendix: Sample Metaphoric Triads Task (MTT) Items	277
11. Discussion: Maps, Models, Methods, and Metaphors	283
<i>Richard E. Snow</i>	
12. Independent Process Analyses of Aptitude-Treatment Interactions	293
<i>Robert C. Calfee and Larry V. Hedges</i>	
Learning Models	293
Independent Processes	295
An Independent Process Perspective on Aptitudes and Treatments	304
Conclusion	311
13. Cognitive Learning Strategies and Dualities in Information Processing	315
<i>Joseph W. Rigney</i>	
Introduction	315
Some Conceptual Geography	316
Duality in the Human Information-Processing System	322
Implications for Cognitive Learning Strategies	336
Summary	340
Author Index	344
Subject Index	350

Volume 2: Cognitive Process Analyses of Learning and Problem Solving

Foreword xi

Acknowledgments xiv

14. Some Examples of Cognitive Task Analysis with Instructional Implications	1
<i>James G. Greeno</i>	
Problem Solving in Geometry	2
Computation and Understanding in Arithmetic	7
Conclusions	18

- 15. An Elaborative Conception of Learner Differences 23**
William D. Rohwer, Jr.
Performance Differences on Learning and Memory Tasks 24
An Elaborative Conception of Learner Differences 25
Recent Research on Elaboration and Learner Differences 30
Instruction and Differences in Elaborative Proficiency 43
- 16. Event-Related Potentials: Approaches to Cognitive Psychology 47**
Emanuel Donchin and Jack B. Isreal
Introduction 47
Event-Related Brain Potentials 48
The P300 Component and Human Information Processing 52
Task Relevance and the P300 55
Subjective Probability and P300 59
Relationships Between P300 Latency and Reaction Time 72
Concluding Remarks 78
- 17. Discussion: Process Analyses of Learning and Problem Solving 83**
Henry M. Halff
Donchin and Isreal's Electropsychophysiology 83
Rohwer's Elaboration Theory 87
Greeno's Cognitive Task Analysis 90
- 18. Planning Nets: A Representation for Formalizing Analogies and Semantic Models of Procedural Skills 95**
Kurt VanLehn and John Seely Brown
Introduction 95
A General Theory of Analogy 98
Finding the Right Representation for Procedural Analogies 102
Analogies and Teleologic Semantics in Educational Research 121
Conclusions 131
Appendix: An Explanation of the Teleologic Semantics of Subtraction 132
- 19. A Theory-Based Approach to the Study of Individual Differences in Mental Imagery 139**
Stephen M. Kosslyn and Pierre Jolicoeur
Individual-Differences Research 140
A Model of Imagery 144
The Model 149
Imagery and Question Answering 153
Individual Differences in Imagery Use 162
Conclusions 172

- 20. Multiple Conceptual Models of a Complex System** 177
Albert L. Stevens and Allan Collins
Introduction 177
Models 182
Conclusion 196
- 21. Complex Learning Processes** 199
John R. Anderson, Paul J. Kline, and Charles M. Beasley, Jr.
Abstract 199
Introduction 199
The ACT Production System 201
Production Designation 208
Generalization 211
Discrimination 217
Production Strength 222
The Origin of Designating Productions 229
Future Directions: Inspection of Productions 232
- 22. Discussion: Teaching, Learning, and the Representation of Knowledge** 237
Donald A. Norman
Learning and Understanding Through the Use of Conceptual Models 238
Complex Learning: The Chapter by
Anderson, Kline, and Beasley 240
Mental Images: The Chapter by Kosslyn and Jolicoeur 242
Overview 244
- 23. Models of Concept Formation** 245
Richard B. Millward
Prototype Models 246
The Exemplar Model 249
Frequency Models 254
The Rule Model 257
A Computational Theory 259
- 24. Learning Theory, Instructional Theory, and Adaptation** 277
Thomas J. Shuell
The Relationship Between Learning and Instruction 278
The Role of Individual Differences 289
Adaptive Instruction 294
Implications for Future Research 298

**25. Discussion: Coordinating Research Topics
With Instructional Requirements 303**

William E. Montague

**26. General Discussion: Relationships Between Aptitude, Learning, and
Instruction 309**

Robert Glaser

Approaches to Process Theories of Aptitude 310

Learning and Instruction 315

Adaptive Instruction 322

Author Index 327

Subject Index 333