Contents

Chapter 1 A Framework for Modelling Behaviour 1

1.1 Preliminary Remarks 1
1.1.1 On Language Behaviour 1
1.1.2 On the Study of Complex Behaviour 3
1.2 The Nature of Scientific Activity 7
1.2.1 What Scientific Theories Are About 7
1.2.2 Role of Agents in Performing Experiments 11
1.3 Explanations in the Physical and the Behavioural Sciences 14
1.3.1 Explanations in the Physical Sciences 14
1.3.2 Explanations in the Behavioural Sciences 15
1.4 The Need for a New Experimental Framework 17
1.4.1 Simulation as a Methodology for Behaviour Modelling 17
1.4.2 Psychologists' Study of Behaviour 19
1.4.3 Controlling and Shaping Behaviour 21
1.4.4 Computer Simulation Studies 24
1.4.5 Concluding Remarks 25

Chapter 2 The Mediating Role of Language Behaviour 27

2.1 Human and Animal Communication Systems 27
2.1.1 Human Communication System 27
2.1.2 Animal Communication Systems 30
2.1.3 Language Behaviour: Biological Basis 31
2.1.4 Language Behaviour: Characterizing Features 32
2.2 Organism as a Behavioural System 34
2.2.1 Child as a Behavioural System 34
2.2.2 Organism as an Agent 35
2.2.3 Organism as a Behavioural System 38
2.2.4 Additional Comments 40

2.3 Language Behaviour as a Second-Signalling System 42
2.3.1 Preliminary Remarks 42
2.3.2 Situational Aspects of the World 44
2.3.3 Describing, Manipulating, and Exploring 47
2.3.4 Language Behaviour as a Second-Signalling System 49
2.3.5 Language Behaviour and Artificial Worlds 53

Chapter 3 Teaching Language Behaviour to Chimpanzees 56

3.1 Principal Objectives of the Review 56
3.2 The Washoe Project 57
3.2.1 Project Set-Up 57
3.2.2 Training Methods and Results 59
3.2.3 Comments on Washoe's Performance 61
3.3 The Sarah Project 64
3.3.1 Project Background 64
3.3.2 The Nature of the Language and the World 65
3.3.3 Training and Testing 66
3.3.4 Some General Comments 67
3.4 The Lana Project 70
3.4.1 The World and the Nature of the Interaction 70
3.4.2 The Yerkish Language 71
3.4.3 Training Methodology and Performance 72
3.4.4 Object Naming and Colour Naming Experiments 73
3.4.5 Conversational Language Behaviour 75
3.4.6 Some General Comments on the Lana Project 76
3.5 General Comments on the Chimpanzee Language Learning Experiments 77
3.5.1 Limitations of the Experiments 77
3.5.2 The Case of Helen Keller 79
3.5.3 Language Behaviour and Affect 81

Chapter 4 Language Behaviour Schemata and Tokens in English 83

4.1 Language and Behavioural Pragmatics 83
4.1.1 Scope of the Analysis 83
4.1.2 Language Schemata and Proforms 85
4.1.3 Pragmatics of Language Behaviour 87
4.2 Schemata for Descriptions 91
4.2.1 Naive Phenomenology 91

4.2.2 Specification of Time Relationships 93
4.2.3 Question Tokens (q-Tokens) 97
4.2.4 Specification of Actions 98
4.2.5 Specifications of Attributes and Their Values 101
4.2.6 Other Relationship Specifiers 102
4.2.7 Specification of Locations and Displacements 104
4.2.8 Agent/Object Specification 106
4.2.9 Propositional Speech 108
4.3 Schemata for Commands 110
4.4 Schemata for Controls 111
4.5 Concluding Comments 112

Chapter 5 Implications of the Model for Child Language Acquisition ... 114

5.1 Scope of the Chapter 115
5.1.1 Aim of the Chapter 115
5.1.2 Outline of the Chapter 117
5.2 The Language Acquisition Phenomena 118
5.2.1 Aspects of Child Language Acquisition 118
5.2.2 Behavioural Implications of the Aspects 118
5.3 Developmental Stages in Language Acquisition 122
5.3.1 Statement of the Problem 122
5.3.2 The Very Early Stages of Language Acquisition 124
5.3.3 Complexity in Child Language Behaviour 127
5.3.4 Analysis of Helen's Speech 130
5.4 The Language Acquisition Process 131
5.4.1 Statement of the Problem and Solution 131
5.4.2 Imitation and Rehearsal 133
5.4.3 Analogizing 136
5.4.4 Some Additional Comments 139
5.5 Linguistics and Language Behaviour 141
5.5.1 Language and Language Behaviour 141
5.5.2 Linguistic Grammars and Behavioural Pragmatics 143
5.5.3 Oral Speech and Written Language 145

Chapter 6 Computer Simulation of Language Behaviour 150

6.1 Relevance of Computer Simulation to Theory Construction 150
6.2 Interpretation Assignment in Grammar-Based Models 153

6.2.1 Interpreting Statements in Computer Languages 153
6.2.2 Grammar-Based Language Understanding Systems 154
6.3 PLAS, a Paradigmatic Language Acquisition System 156
6.3.1 The Behavioural Environment of PLAS 156
6.3.2 The Teaching Mode of Interaction 158
6.3.3 How PLAS Learns to Assign Interpretations 159
6.3.4 Similarities to Concept Formation in Children 162
6.3.5 Open Problems Yet to be Tackled 164
6.4 Modelling Conversational Language Behaviour 166
6.4.1 Pragmatics of Naive Conversational Interaction 166
6.4.2 Knowledge and Control in Conversation 168
6.4.3 Modelling the Role of Affect in Language Behaviour 170
6.5 Concluding Remarks 172
6.5.1 Summary of the Main Ideas 172
6.5.2 Relevance of the Model to Neurophysiology 173

Appendix A Listing of Schemata in Helen's Speech 176
Appendix B Listing of Tokens in Helen's Speech 186
Appendix C PLAS: An Illustration of Its Performance 197

References 203

Author Index 209

Subject Index 213