# EXPERIENCE, MEMORY, AND REASONING

*Edited by*

Janet L. Kolodner
*Georgia Institute of Technology*

Christopher K. Riesbeck
*Yale University*

LAWRENCE ERLBAUM ASSOCIATES, PUBLISHERS
1986 Hillsdale, New Jersey London

# Contents

**Preface** xi

**Chapter 1 Introduction** 1

Knowledge and AI *1*
Knowledge and Cognitive Psychology *2*
Knowledge versus Memory *3*
Problem Solving in Memory *7*
Basic Questions *7*
Organization of the Book *9*

**PART I: KNOWLEDGE ORGANIZATION AND REPRESENTATION**

**Chapter 2 Knowledge Representation—A Critique and a Proposal** 15
*Robert Wilensky*

Abstract *15*
Introduction *15*
The Problem With Conceptual Dependency *16*
The Problem With Frames *18*
KODIAK *19*

Primitive Epistemological Relations *21*
Examples *25*
Advantages of the Proposal *26*
Problems and Comments *27*

**Chapter 3 Learning and Memory in Machines and Animals: An AI Model that Accounts for Some Neurobiological Data** 29
*Richard H. Granger* and *Dale M. McNulty*

Abstract *29*
Introduction to the Problem *29*
Introduction to the Model: The 12 CEL Operators and Their Functions *32*
A Brief Example of the Operation of the CEL-0 Program *33*
Some Insights Resulting From Experience With CEL-0 *38*
The Neurobiology of Multiple Memory Systems *41*
Conclusions: Artificial and Natural Learning Mechanisms *43*

**Chapter 4 Functional Representation of Devices and Compilation of Diagnostic Problem-Solving Systems** 47
*V. Sembugamoorthy* and *B. Chandrasekaran*

Abstract *47*
Motivation *47*
Components of a Functional Representation *49*
A Representational Scheme for the Functioning of Devices *49*
Compilation of a Diagnostic Problem-Solving System *56*
The Diagnostic Task and the Structure Produced by the Compiler *59*
"What Will Happen If" Problem Solving Using the Functional Representation *63*
Relation to Other Work *65*
Concluding Remarks *68*
Appendix *69*

**Chapter 5 Knowledge-Directed Retrieval of Autobiographical Memories**
*Brian J. Reiser* 75

Abstract 75
Accessing Autobiographical Experiences 75
A Model of Directed Retrieval 76
Arguments for Directed Search Models 80
Psychological Evidence for Directed Search 86
Effective Search Strategies 90

**PART II: MEMORY-BASED HYPOTHESIS FORMATION**

**Chapter 6 Problem Solving and Dynamic Memory**
*Janet L. Kolodner* and *Robert L. Simpson, Jr.* 99

Abstract 99
Experience's Roles in Problem Solving 99
Encoding and Organizing Experience in a Dynamic Memory 102
Experience Contributes to Change in Memory's Structures 104
Experience Contributes Exemplars for Analogy 107
Programs 112
Where Do We Go From Here? 113

**Chapter 7 Learning How to Argue: Using Hypotheticals**
*Edwina L. Rissland* 115

Abstract 115
Introduction 115
Uses of Hypotheticals 116
General Roles Played by Examples 122
Strategies of Using Hypos 123
Summary 125

**Chapter 8 Assignment of Responsibility in Ethical Judgments**
*William M. Bain* **127**

Abstract *127*
Introduction *127*
Background: The Task of the Judge *128*
A Mock Plea Bargaining Session *129*
Conclusions *137*

**Chapter 9 Explanation: A First Pass**
*Roger C. Schank* **139**

Abstract *139*
Introduction *139*
The Role of Reminding *140*
Making Explanations *141*
The Explanation Process *143*
Reminding as Verification *143*
Finding Anomalies *144*
What Must Be Explained *147*
Types of Explanations *158*
Knowing When an Explanation is Right *161*
Conclusions *164*

**Chapter 10 Acquisition of Device Models in Instructionless Learning**
*Jeff Shrager* **167**

Abstract *167*
Instructionless Learning *167*
What is Learned in Instructionless Learning? *169*
Hypotheses and Experimental Failure and Explanation *171*
The Structure of BigTrak Knowledge *173*
Conclusion *175*

## PART III: MEMORY-BASED NATURAL LANGUAGE UNDERSTANDING

**Chapter 11** **Using Memory in Text Understanding** 181
*Michael Lebowitz*

Abstract *181*
Introduction *181*
Basic *RESEARCHER* Understanding Techniques *183*
Using Memory to Resolve Ambiguity *185*
Conclusion *192*

**Chapter 12** **A More General Approach to Word Disambiguation** 195
*Steven L. Lytinen*

Abstract *195*
Introduction *195*
Previous Work in Semantics-Based Word Disambiguation *196*
Problems With Lexically Based Disambiguation Rules *199*
A Different Approach to Word Disambiguation *203*
Conclusion *206*

**Chapter 13** **Direct Memory Access Parsing** 209
*Christopher K. Riesbeck* and *Charles E. Martin*

Abstract *209*
Parsing Into Memory *209*
An Example System *210*
The Direct Memory Access Parser *212*
Recent DMAP Research *221*
Problems *223*
Conclusions *224*

**Chapter 14** **Parsing With Parallelism: A Spreading-Activation Model of Inference Processing During Text Understanding**
*Richard H. Granger, Kurt P. Eiselt,* and *Jennifer K. Holbrook* **227**

Abstract *227*
Introduction *227*
Background *228*
The New Architecture *231*
ATLAST: The Program *235*
Summary and Conclusions *242*
Appendix: Conditional Retention Experiment *244*

**Author Index** **247**
**Subject Index** *251*