Cambridge University Press & Assessment 978-1-009-20556-6 — Problem Solving Zygmunt Pizlo Table of Contents <u>More Information</u>

Contents

List List Pre	t of Figures t of Tables face	<i>page</i> ix xiv xv
Ι	 Problem Solving: Definition of the Main Concepts I.I Gestalt Influence I.2 Insight Problems: The Status of the "Aha!" Criterion I.3 Search Problems I.4 The Scientific Status of Goal-Directed Behavior I.5 Forming Mental Representations I.6 Problems to Solve 	I I 3 5 6 11 12
2	 Animal Problem Solving: Innovative Use of Tools 2.1 Early Research with Chimpanzees 2.2 The Role of Brain Size: How Carnivores Solve the Puzzle Box Problem 2.3 Self-Recognition in a Mirror 2.4 Chimpanzees' Visuomotor Coordination Using Camera Images 2.5 Innovative Problem Solving in Crows, Parrots, and Hyenas 2.6 Visual Navigation: Chimps and Monkeys Solve the Traveling Salesman Problem 2.7 Problems to Solve 	I4 14 16 19 22 25 31 33
3	 Modern Research on the Human Ability to Solve Problems that Have Larg Search Spaces 3.1 Permutations and Combinations; Polynomial and Exponential Numbers of Computations 3.2 Nearest Neighbor Algorithm for the TSP 3.3 Something Was In the Air: How the Cognitive Science Community Actually Discovered the TSP 3.4 Problems to Solve 	e 34 34 35 38 56
4	 The Exponential Pyramid Representation that Compensates for Exponentially Large Problem Spaces 4.1 Classification of Computational Complexity: P, NP, NP-Hard, NP-Complete 4.2 The Exponential Pyramid as a Model of the Human Visual System 4.3 Pyramid Model for the TSP 4.4 Solving the 2D and 3D TSP in Real and Virtual Environments: Perception Meets Problem Solving 4.5 Problems to Solve 	57 58 59 65 71 78

Cambridge University Press & Assessment 978-1-009-20556-6 — Problem Solving Zygmunt Pizlo Table of Contents <u>More Information</u>

viii	Contents	
5	 Heuristic Function, Distance, and Direction in Solving Problems 5.1 Heuristic Function and an A* Algorithm 5.2 Human Performance: The Concept of Direction 5.3 Continuous and Discrete Geometry of Direction and Distance 5.4 Pyramid Model for Solving the 15-Puzzle 5.5 Problems to Solve 	80 82 84 87 91 93
6	Insight and Creative Thinking6.1Scientific Discovery6.2A Few More Brain Teasers Called Insight Problems6.3Broader Context for Insight6.4Problems to Solve	94 97 103 106 108
7	 Inference in Perception. Perceptual Representation: A Rejoinder to Insight 7.1 Gestalt Ttradition: Solving Ill-Posed Problems and Their Relationship to Insight 7.2 Figure–Ground Organization and Curve Integration: Examples of Visual Inferences 7.3 Formalism of Forward and Inverse Problems 7.4 More on Implicit and Explicit Constraints in 3D Shape Recovery 7.5 Physics Connection: The Least-Action Principle 7.6 Data Mining and Knowledge Discovery 7.7 Problems to solve 	III 112 114 117 121 123 126 126
8	Cognitive Inferences, Mental Representations8.1Multidimensional Scaling as a Tool for Data Visualization8.2Clustering Methods8.3Using Clusters to Explain Memory Organization8.4TSP with Obstacles8.5Problems to Solve	128 131 134 135 140 145
9	Theory of Mind 9.1 Visual Perspective Taking 9.2 Strategic Reasoning in Matrix Games 9.3 Problems to Solve	146 148 149 153
10	 Solving Problems in Physics and Mathematics 10.1 Physics Education 10.2 Intuitive Physics and Causal Reasoning 10.3 Solving Problems in Mathematics: Polya's Contributions 10.4 Problems to Solve 	155 155 158 165 173
II	Summary and Conclusions11.1Mental Representations11.2Scientific Discovery as Creative (Insightful) Problem Solving11.3Optimization Problems11.4Intuitive Physics11.5The Concept of Direction11.6Problems to Solve	175 176 177 180 180 181 182
References Index		183 190