Contents

List of Figures vii
Preface to the 1992 Edition ix
Preface xiii

1. The General Setting 1
   1. Introduction 1
   2. Preliminary survey 3
   3. A simple artificial adaptive system 6
   4. A complex natural adaptive system 9
   5. Some general observations 16

2. A Formal Framework 20
   1. Discussion 20
   2. Presentation 28
   3. Comparison with the Dubins-Savage formalization of the gambler’s problem 30

3. Illustrations 32
   1. Genetics 32
   2. Economics 36
   3. Game-playing 40
   4. Searches, pattern recognition, and statistical inference 44
   5. Control and function optimization 54
   6. Central nervous systems 58

4. Schemata 66

5. The Optimal Allocation of Trials 75
   1. The 2-armed bandit 76
   2. Realization of minimal losses 83
   3. Many options 85
   4. Application to schemata 87
Contents

6. Reproductive Plans and Genetic Operators
   1. Generalized reproductive plans 90
   2. Generalized genetic operators—crossing-over 97
   3. Generalized genetic operators—inversion 106
   4. Generalized genetic operators—mutation 109
   5. Further increases in power 111
   6. Interpretations 118

7. The Robustness of Genetic Plans
   1. Adaptive plans of type $R_1(P_C, P_I, P_M, \langle c_i \rangle)$ 121
   2. The robustness of plans $R_1(P_C, P_I, P_M, \langle c_i \rangle)$ 124
   3. Robustness vis-à-vis a simple artificial adaptive system 132
   4. Robustness vis-à-vis a complex natural adaptive system 136
   5. General consequences 139

8. Adaptation of Codings and Representations
   1. Fixed representation 141
   2. The “broadcast language” 143
   3. Usage 148
   4. Concerning applications and the use of genetic plans to modify representations 153

9. An Overview
   1. Insights 159
   2. Computer studies 161
   3. Advanced questions 164

10. Interim and Prospectus
    1. In the interim 171
    2. The optimal allocation of trials revisited 181
    3. Recent work 184
    4. Possibilities 195

Glossary of Important Symbols 199
Bibliography 203
Index 207