

Contents

Part I: Future of Artificial Intelligence

1	On the Way to Intelligence Singularity	3
	Ivan M. Havel	
1.1	What Is Singularity	3
1.2	Artificial Intelligence Ready to Start	5
1.3	The Dual Nature of the Future Tense	7
1.4	Intelligence—What Does It Actually Mean?	8
1.5	Can Intelligence Be Measured?	12
1.6	Intelligence in Motion	14
1.7	How the Explosion Is Born	16
1.8	Speed of Time	20
1.9	If a Machine Were <i>Able</i> to Design a Better Machine, Would It Do It?	21
1.10	What Then?	23
	References	26
2	Slippage in Cognition, Perception, and Action: From Aesthetics to Artificial Intelligence	27
	William W. York and Hamid R. Ekbia	
2.1	Introduction	27
2.2	Aesthetics: From Philosophy to AI	28
2.2.1	Computational Aesthetics and the Formalist Dream	29
2.2.2	A Relational Perspective on Aesthetics	30
2.3	Computer Models of Analogy-Making	31
2.3.1	Copycat and Metacat	32
2.3.2	Conceptual Slippage and the Aesthetics of Analogy-Making	35
2.4	Perceptual Slippage	37
2.4.1	Visual Analogies	37
2.4.2	Perceptual Slippage and Blending	39
2.4.3	Visual Analogy is “Seeing-As”	41

2.5	Action Slips	41
2.5.1	Affordances and Slippage	42
2.5.2	From Slips and Slippage to Aesthetics and Affect	43
2.6	Conclusion	44
	References	45
3	Rationality {in for through} AI	49
	Tarek R. Besold	
3.1	Introduction	49
3.2	Rationality	50
3.3	A Survey: Rationality in AI	52
3.3.1	Rationality & (Natural) Intelligence	52
3.3.2	Why Should AI Care About Rationality?	53
3.3.3	Earlier Work & Status Quo	54
3.4	The Goal: Rationality for AI	55
3.5	An Outlook: Rationality Through AI	58
3.6	Conclusion	59
	References	60
4	Usage of “Formal Rules” in Human Intelligence Investigations	63
	Tzu-Keng Fu	
4.1	Introduction	63
4.2	From Freud to Bi-logic Framework	64
4.2.1	Two Principles in the Bi-logic Framework	64
4.2.2	The “Logic” of Unconscious Processes	65
4.3	The Physical Features of Unconscious Processes	66
4.3.1	The Conceptions of Space-Time Taken in Matte Blanco’s Theory of Mind	66
4.3.2	The Dimensional Transformation between the Conscious Processes and Unconscious Processes	67
4.3.3	The Infiniteness of Emotion in Psychotic	68
4.3.4	The Characteristics of Space-Time in the Unconscious Processes	68
4.4	The Logical Features of Unconscious Processes	69
4.4.1	The Absence of Classical Negation	69
4.4.2	The Paraconsistency	70
4.5	Discussion and Outlook	71
	References	72
5	New Emergence as Supervenience Relieved of Problems	75
	Eliška Květová	
5.1	Introduction	75
5.2	Development of the Relationship of Emergence and Supervenience	77
5.3	Development of the Relationship between the Concepts	78
5.4	Emergence in Artificial Intelligence	79

5.5	The Nature of the Relationship between Supervenience and Emergence	80
5.6	New Emergence as Continuation of Supervenience	82
5.7	Conclusions	83
	References	84
6	Beyond Knowledge Systems	85
	Jozef Kelemen	
6.1	Introduction	85
6.2	From Data to Knowledge—Role of the Context	86
6.3	The Structure of Knowledge	87
6.4	What Is Coming Now?	88
6.5	The Role of the Embodiment	90
6.6	Through Robotic Bodies towards the Computational Wisdom?	92
	References	94
 Part II: Nature-Inspired Models		
7	Selfish Genes and Evolutionary Computation	97
	Jan Zelinka	
7.1	Introduction	97
7.2	Evolution and Selfish Genes	98
	7.2.1 A Gene Definition	98
	7.2.2 Scattered Genes	99
	7.2.3 Sources of Evolutions	100
	7.2.4 Evolutionarily Stable Strategy and Evolutionarily Stable Population	101
	7.2.5 Selfishness and a Selfish Gene Manifestations	102
7.3	Evolutionary Computation	103
7.4	Selfish Genes and Evolutionary Computation	103
	7.4.1 State of the Art	104
	7.4.2 Selfish Gene Manifestations in Examples and Experiments	104
	7.4.3 Advantages of Selfish Gene in Evolutionary Computation	106
	7.4.4 Metaevolutions	108
7.5	Selfish Genes and Artificial Intelligence	108
7.6	Conclusion	110
	References	110
8	Nonlinear Trends in Modern Artificial Intelligence: A New Perspective	113
	Elena N. Benderskaya	
8.1	Introduction	113
8.2	Modern Artificial Intelligence	114

8.2.1	Limitations of Basic AI Approaches	114
8.2.2	Evolution of Formal Methods: Dealing with Uncertainty	115
8.3	Neuroscience: Brain as Chaotic Computer	117
8.4	Novel Bio-inspired Methods and Dynamic Neural Networks	118
8.5	Chaotic Bio-inspired Systems	120
8.6	Chaotic Computing	121
8.7	Conclusions	122
	References	122
9	Membrane Computing in Robotics	125
	Ana Brândușa Pavel, Cristian Ioan Vasile, and Ioan Dumitrache	
9.1	Membrane Computing—An Overview	125
9.2	Membrane Controllers for Mobile Robots	128
9.3	An Overview of the Results	129
9.4	Conclusions and Future Developments	133
	References	134
10	Implementing Enzymatic Numerical P Systems for AI Applications by Means of Graphic Processing Units	137
	Manuel García–Quismondo, Luis F. Macías–Ramos, and Mario J. Pérez–Jiménez	
10.1	Introduction	137
10.2	Preliminaries	138
	10.2.1 P Systems	138
	10.2.2 Numerical P Systems	140
10.3	Enzymatic Numerical P Systems	142
	10.3.1 Description of Enzymatic Numerical P Systems	142
	10.3.2 ENPSs and Artificial Intelligence	143
	10.3.3 Simulation of ENPSs	143
10.4	The Compute Unified Device Architecture (CUDA) Standard for GPU Computing	144
	10.4.1 Outline of the CUDA Programming Model	144
	10.4.2 The <i>CUDA–C</i> Programming Language	144
10.5	A GPU–Based Simulator for Enzymatic Numerical P Systems	146
	10.5.1 Data Representation	146
	10.5.2 Repartition Coefficients Normalization	147
	10.5.3 Program Checking	147
	10.5.4 Calculation of Production Functions	148
	10.5.5 Variable Clearing	151
	10.5.6 Repartition Protocol Application	152
	10.5.7 Execution of a Simulation Step	153
	10.5.8 Remarks on the Simulator	154

10.6	Simulator Performance	154
10.6.1	Simulator Workflow	154
10.6.2	Performance Comparison	154
10.7	Conclusions	156
	References	157
11	How to Design an Autonomous Creature Based on Original Artificial Life Approaches	161
	Pavel Nahodil and Jaroslav Vítků	
11.1	Introduction — History of Artificial Life Research	161
11.2	State-of-the-Art — Comparison to Similar Architectures	163
11.2.1	Integrating Neural Networks and Knowledge-Based Systems for Intelligent Robotic Control	163
11.2.2	Reinforcement-Learning Teleo-Operators	164
11.3	Architecture with Elements of Hierarchy, Abstraction, Reinforcements and Motivations	165
11.3.1	Main Ideas of the HARM Approach	166
11.3.2	Sample Experiment: The Treasure Problem	168
11.4	Proposed Autonomous Creature	169
11.4.1	Brief Description of Designed Architecture	169
11.4.2	Augmenting Original Hierarchical Learning System ...	170
11.4.3	Intentional State Space	171
11.4.4	Deliberative Action Selection — Planning	171
11.4.5	Artificial Neural Network — Learning the Reflexive Behavior	172
11.5	Selected Experiments	173
11.5.1	Two Attractors in Complex Environment — Hierarchy Creation	174
11.5.2	Part 1 — Creation of Hierarchy Based on Intentions ...	175
11.5.3	Part 2 — Planning over the Hierarchy of Decision Spaces	176
11.6	Conclusion	178
	References	179
Part III: When Artificial Becomes Natural		
12	A View on Co-existence of Various Entities in Intelligent Environments	183
	Peter Mikulecky and Petr Tucnik	
12.1	Introduction	183
12.2	Related Works	185
12.3	Co-existential View	188
12.4	Perceiving Users and Environment	189

12.5	Significance of Roles	192
12.6	Conclusions	194
	References	194
13	Multi-agent Systems in Industry: Current Trends & Future Challenges	197
	Paulo Leitao	
13.1	Introduction	197
13.2	Artificial Intelligence and Multi-agent Systems	198
13.3	Applications of MAS in Industry	198
13.4	Current Trends and Future Challenges	200
13.5	Conclusions	200
	References	201
14	Voice Conservation: Towards Creating a Speech-Aid System for Total Laryngectomees	203
	Zdeněk Hanzlíček, Jan Romportl, and Jindřich Matoušek	
14.1	Introduction	203
14.2	Practical Aspects	205
14.3	Voice Conservation	207
14.4	Proposed System Layout	208
14.5	Speech Synthesis	209
14.6	Preliminary Experiments	210
14.7	Conclusion	211
	References	212
15	Extended Mind: Is There Anything at All to Be Externalised?	213
	Eva Zackova and Jan Romportl	
15.1	Introduction	213
15.2	Extended Mind Conception	214
15.3	Express Yourself—Exted Yourself: Language as a Mind-Transformer	214
15.4	Criteria of External Cognitive Process	217
15.5	Hard-Wired System Criterion	218
15.6	Speech Prosthetics as a Real-Life Application of Extended Mind	218
15.7	Internal and External	219
	References	220
16	Embodied Agent or Master of Puppets: Human in Relation with his Avatar	223
	Mateusz Woźniak	
16.1	Introduction	223
16.2	Treating Artificial as Real	224
16.3	Avatar—Virtual Body	225
16.4	Body Representations	226

16.5	Research	228
16.5.1	Purpose and Methods	228
16.5.2	Results	230
16.6	Discussion and Conclusions	233
	References	234
Index	237