

Contents

1	Introduction: Phenomena of Autistic Reasoning	1
1.1	How Computer Scientists Can Help Individuals with Autism	4
1.2	Developing Deductive Reasoning Skills of Machines and Children with Autism	5
1.3	Prior Work in Intelligent Systems for Autistic Education	7
1.4	Teaching Theory of Mind to Autistic Patients	9
1.5	How to Read This Book	12
	References	13
2	Computational Models of Autism	17
2.1	Autistic Deficits	17
2.1.1	Hypotheses for the Origin of Autistic Reasoning	24
2.2	Tests for Differentiating Normal and Autistic Cognition and Reasoning	24
2.3	Neural Network Models	27
2.3.1	The Bridge Between Neural Models and Reasoning	28
2.3.2	Sensory Hyper-sensitivity	30
2.3.3	High or Low Connectivity?	32
2.3.4	Deviation of Neural Network Functioning	33
2.3.5	Neural Network Architecture	36
2.3.6	Neural Simulation of Attention Deficit Disorder	37
2.4	Game-Theoretic Approach	39
2.5	Accounts of Autism	40
2.5.1	Weak Central Coherence Account	41
2.5.2	Executive Function Deficit Account	44
2.5.3	Autistic Memory	47
2.5.4	Account of Complex Information Processing Failure	49
2.5.5	Affective Foundation Account	51
2.5.6	Thinking in Pictures Account of Autism	53
2.5.7	Joint Attention Family of Accounts	56
2.5.8	From Intent to Symbolic Representation	57

2.5.9	Steps in the Normal Development	60
2.5.10	Accounts of Autism and Corporate Environment	62
2.6	Autistic Linguistics.....	63
2.6.1	Cognitive Skills and Processes Involved in Making Sense of Text.....	63
2.6.2	Grammar and Affect.....	67
2.6.3	Understanding Metaphors	68
2.7	Our Account of Autism: Reasoning Engine → Behavior	70
2.8	Discussion and Conclusions	72
	References.....	73
3	Intuitive Theory of Mind	79
3.1	Introducing Theory of Mind	79
3.2	Emphasizing and Systemizing.....	82
3.3	ToM and Other Autistic Accounts.....	85
3.4	ToM and a Module to Implement It	86
3.5	ToM in Humans and Animals	87
3.6	CwA and CC in Abstract Reasoning Tasks	88
3.7	ToM Controversy	89
3.8	Discussion and Conclusions	90
	References.....	91
4	Formalizing Theory of Mind	95
4.1	Computer Science of Theory of Mind.....	96
4.1.1	Defining Main Problem of ToM	96
4.1.2	Belief–Desire–Intention Model	99
4.1.3	Meta-Reasoning	101
4.1.4	Entities of ToM	106
4.1.5	Linguistics of ToM Entities	107
4.1.6	From Deduction to Simulation and Learning	109
4.2	ToM Step-by-Step	113
4.2.1	Mental States and Actions.....	114
4.2.2	Example of a Definition of a Mental Action	117
4.2.3	Derived Metapredicates	119
4.2.4	Handling Multiple Meanings	120
4.2.5	Representing Emotions.....	122
4.3	Scenarios in the Mental World.....	126
4.3.1	Multiagent Conflict.....	128
4.3.2	Dimensions of Intentionality	128
4.3.3	Dissatisfaction and Complaint Scenarios.....	130
4.3.4	Recognizing Plausible Scenarios	135
4.3.5	Communicative Actions and Similarity Between Them.....	136
4.3.6	Defining Scenario as Graphs	145
4.3.7	Machine Learning of Conflict Scenarios	151

4.3.8	Linked Sub-Scenarios	154
4.3.9	Scenario as a Sequence of Local Logics.....	156
4.4	Some Applications of Formalized ToM	158
4.4.1	Learning Conflicts Between Communities of Agents	158
4.4.2	Emotional Profile	159
4.4.3	Analyzing an Email from a Would-Be Terrorist Attacker	162
4.4.4	Reasoning with Emotional Profiles	163
4.4.5	Evaluation of Adequateness of Representation	167
4.4.6	Visual Representation	170
4.5	Discussions and Conclusion	170
	References	173
5	Theory of Mind Engine	177
5.1	The Task of NL_MAMS	177
5.2	Simulating Reasoning About Mental States	179
5.3	Implementation of Simulation	182
5.3.1	Choosing the Best Action Considering Yourself Only	182
5.3.2	Choosing the Best Action Taking into Account Action Selection Analysis of Others.....	184
5.3.3	The Library of Available Behaviors	186
5.4	Evaluation of NL_MAMS	189
5.4.1	Evaluation of Correctness	192
5.4.2	Evaluation of Coverage.....	193
5.4.3	Evaluation of Complexity	195
5.5	Accompanying Reasoning Systems and Application Domains	196
5.6	HCI Issues of Autistic Training.....	197
5.7	Other ToM-Related Systems.....	201
5.7.1	Commonsense Psychology System	207
5.7.2	A Symbolic Production-Based System	209
5.8	Discussion and Conclusions	210
	References	211
6	Reasoning Beyond the Mental World	215
6.1	Mental vs Physical World.....	215
6.1.1	Autistic Generalization	217
6.2	Reasoning, Cognitive Science and Rationality	218
6.3	Autistic Probabilistic and Counterfactual Reasoning.....	221
6.3.1	Example Relief Story and Questions	223
6.3.2	Example Regret Story and Questions.....	223
6.4	Autistic Planning and Adjustment of Action to a New Environment	224
6.4.1	Triangulation Structure	224
6.4.2	Triangulation Cases.....	225

6.4.3	Discovering Commonalities Between the Triangulation Cases	230
6.4.4	Building a Bridge Between Triangulation and Default Reasoning	231
6.4.5	Handling a Single Default Rule by Autistic Reasoning ..	233
6.4.6	Handling Conflicting Default Rules	237
6.5	Discussion and Conclusions	241
	References	243
7	Autistic Learning and Cognition	245
7.1	Autistic Cognition	245
7.2	Active Learning in Computer Science	248
7.2.1	Performance of an Active Learning Systems	250
7.2.2	Monitoring, Assessing and Terminating the Learning Process	250
7.3	Active Learning and Autistic Development	251
7.3.1	Hyper-sensitivity	251
7.3.2	Autistic Adaptation	253
7.3.3	Active Inductive Learning of CwA and CC	253
7.3.4	Learning Repetitive Patterns	255
7.3.5	Stereotypy	257
7.3.6	Ignoring Important Features	263
7.3.7	From Hyper-sensitivity to Stereotypy of an Engineering System	265
7.4	Hybrid Active Learning System <i>Jasmine</i>	266
7.4.1	A Reasoning Schema	269
7.4.2	Computing Similarity Between Objects	274
7.4.3	Normal and Autistic Development Pathways for <i>Jasmine</i>	277
7.5	Exploring Forming and Updating Hypotheses in Human Learning	281
7.6	Deductive Reasoning About Actions	284
7.6.1	The Architecture of a Hybrid System	288
7.6.2	Merging Deductive and Inductive Reasoning About Action	289
7.7	Discussion and Conclusions	291
	References	292
8	Rehabilitating Autistic Reasoning	295
8.1	Training Environment	295
8.1.1	Short-Term and Long-Term Training Settings	297
8.2	Exercising Scenarios	299
8.2.1	Mental State of Another Person	299
8.2.2	A Wrong Mental State	301
8.2.3	Mental State Transmission	301
8.2.4	Temporal Relationships Over the Mental States. To Forget and to Recall	302

8.2.5	Pretending	302
8.2.6	Exercising Results	303
8.3	Construction of Mental Formulas	303
8.4	The Literature Search System	304
8.4.1	Architecture and Implementation	307
8.4.2	HCI Aspects and Query Examples	310
8.5	The Action Adjustor Training System	312
8.6	Emotional Remediation	313
8.6.1	Emotions in Conversational Agents	316
8.6.2	Tuning Emotional Response	321
8.6.3	Autism and CwA Expression of Feelings	323
8.6.4	Teaching Gestures	324
8.6.5	Modifying Emotions in an Image	327
8.7	Teaching Hide-and-Seek Game	328
8.7.1	Orienteering Exercise	330
8.8	Language Improvement	331
8.8.1	Reading Comprehension	332
8.9	Evaluation of Training	333
8.9.1	Short-Term Evaluation	333
8.9.2	Long-Term Evaluation	335
8.9.3	Evaluation of Intervention of Adjustment of Actions	336
8.10	Discussion and Conclusions	339
	References	343
9	From Reasoning to Behavior in the Real World	345
9.1	Origination of Autism	345
9.2	Diagnosing Autism	347
9.3	Autistic Spectrum	349
9.4	Applied Behavior Analysis and Rehabilitation of Reasoning	350
9.5	Dealing with Challenging Behavior	351
9.6	Rehabilitation Case Studies	353
9.7	Relying on Hyper-Systematizing Skills	359
9.8	Estimating Real-World Performance	359
9.9	Assisting in Autistic Cognition	360
9.10	Autistic Team Formation	362
9.10.1	How Trust Develops in a Baby	362
9.10.2	Assessing Mental Reasoning Capability to Form Teams	363
9.10.3	Autistic Cooperation in the Real World	366
9.11	Preparing Autistic Children for School	369
9.12	Preparing Autistic Adults for Work	370
9.13	Cross-Cultural Differences and Autism	374
9.14	Discussion and Conclusions	375
	References	377
10	Conclusions	379

Computational Autism

Galitsky, B.A.

2016, XI, 380 p. 149 illus., 78 illus. in color., Hardcover

ISBN: 978-3-319-39971-3