

Contents

<i>List of Figures</i>	<i>page</i> xiii
<i>List of Tables</i>	xviii
1 What Is Collective Intelligence?	1
1.1 The Need for New Types of Collective Problem Solving	1
1.2 Theoretical Perspectives on CI	6
1.2.1 A General Group Intelligence Factor	7
1.2.2 Self-Organization	9
1.2.3 The Role of Diversity	10
1.3 Top Solvers in Online Innovation Teams	15
1.4 A Cultural-Historical Perspective on CI	16
1.5 The Methodological Steps	18
1.5.1 Step 1: Review Current CI Practices	18
1.5.2 Step 2: Identifying CI as Three Types of Collective Problem Solving	20
1.5.3 Step 3: A Historical Analysis of the Problem-Solving Types	22
1.5.4 Step 4: Design of CI	23
2 Crowdsourcing	27
2.1 What Is Crowdsourcing?	27
2.2 Online Innovation Contests	28
2.2.1 Background	28
2.2.2 The IdeaRally: Rapid Problem Solving in Large Groups	32
2.2.3 The Climate CoLab: Transparent Innovation Contests	36
2.3 Online Citizen Science	38
2.3.1 Zooniverse: Online Citizen Science Platforms	38
2.3.2 FoldIt: Citizen Science Games	42
2.4 Summary	46
2.4.1 Crowdsourcing Skills	47
2.4.2 Design of Crowdsourcing	48

3	Open Online Knowledge Sharing	50
3.1	Background	50
3.2	Open Sharing of Scientific Knowledge	51
3.2.1	Open Access Publishing	51
3.2.2	Open Database Projects	52
3.2.3	Open Textbooks	54
3.2.4	Wikipedia	56
3.2.5	The Polymath Project	58
3.2.6	Galaxy Zoo Quench	61
3.3	Open Sharing of Practical Knowledge	62
3.3.1	Open Sharing of Videos	62
3.3.2	Open Sharing of Geographical Resources	66
3.3.3	Open Sharing of Corporate Knowledge	67
3.3.4	Open Sharing of Political Arguments	68
3.4	Summary	72
4	Human Swarm Problem Solving	75
4.1	Background	75
4.2	Decision Threshold Methods	77
4.2.1	Quorum Decisions as Swarm Problem Solving among Animals	77
4.2.2	Human Quorum Response as Swarm Problem Solving	82
4.2.3	Majority Decisions	85
4.3	Averaging	88
4.3.1	Averaging as Swarm Problem Solving in Animals	88
4.3.2	Human Averaging as Swarm Problem Solving	90
4.4	Large Gatherings	93
4.4.1	Large Gatherings as Swarm Problem Solving among Animals	93
4.4.2	Large Gatherings as Human Swarm Problem Solving	96
4.5	Heterogeneous Social Interaction	104
4.5.1	Heterogeneous Social Interaction in Animal Swarm Problem Solving	104
4.5.2	Human Heterogeneous Social Interaction as Human Swarm Problem Solving	108
4.6	Environmental Sensing	114
4.6.1	Environmental Sensing in Animal Swarm Problem Solving	114
4.6.2	Human Environmental Sensing	118
4.7	What Is Human Swarm Problem Solving?	124
4.7.1	Predefined Problems	125
4.7.2	Prespecified Problem-Solving Procedures	126
4.7.3	Rapid Time-Limited Problem Solving	129
4.7.4	Individual Learning	131
4.7.5	Summary of the Basic Characteristics in Human Swarm Problem Solving	133

5	The Origins of Human Swarm Problem Solving	135
5.1	Background	135
5.2	The Emergence of Group Hunting	136
5.3	The Emergence of Premodern Trade	139
5.4	Human Swarm Problem Solving in Ancient Athens	143
5.4.1	Maximizing Information about the Athenian Territory	143
5.4.2	Heterogeneous Social Interaction through Rotation and Randomization	147
5.4.3	Decision Threshold Methods in the Assembly and the People's Court	153
5.4.4	Large Gatherings in Athens	159
5.5	A Summary of Human Swarm Evolution	163
5.5.1	The Evolution of Synchronized Swarm Problem Solving	165
5.5.2	The Evolution of Pinpointed Swarm Problem Solving	167
6	Human Stigmergic Problem Solving	171
6.1	What Is Stigmergic Problem Solving?	171
6.1.1	Background	171
6.1.2	Quantitative Stigmergy	173
6.1.3	Qualitative Stigmergy	175
6.1.4	Sematectonic Stigmergy	177
6.1.5	Marker-Based Stigmergy	178
6.1.6	Human Stigmergic Problem Solving Is Solution-Centered	178
6.2	Rating Complete Solutions	180
6.2.1	Search Engines and Collaborative Filtering	180
6.2.2	Different Rating Methods	184
6.3	Reestimating Solutions	186
6.4	Completing Solutions	192
6.5	Adapting Complete Solutions	195
6.5.1	Background	195
6.5.2	Open Textbooks	195
6.5.3	Internet Memes	197
6.6	What Is Human Stigmergic Problem Solving?	200
6.6.1	Solution-Centered Collective Problem Solving	200
6.6.2	"Rating Complete Solutions" as Marker-Based, Quantitative Stigmergy	203
6.6.3	"Reestimating Solutions" as Quantitative, Sematectonic Stigmergy	204
6.6.4	"Completing Solutions" as Qualitative, Sematectonic Stigmergy	204
6.6.5	"Adapting Complete Solutions" as Sematectonic, Qualitative Stigmergy	206
6.6.6	Improvement of Solutions as the Basis for Human Stigmergic Problem Solving	207

7	The Origins of Human Stigmergic Problem Solving	208
7.1	Background	208
7.2	The Invention of Writing	209
7.3	The Invention of the Printing Press	214
	7.3.1 Mass Copying of Printed Information	215
	7.3.2 Flexible Modification of Printed Information	225
7.4	A Summary of Human Stigmergic Evolution	232
	7.4.1 The Invention of Writing	232
	7.4.2 The Invention of the Printing Press	234
	7.4.3 The Invention of the Internet	235
8	Collaborative Problem Solving	238
8.1	Background	238
8.2	Working Well with Others	239
	8.2.1 Being in a Symmetrical Group Relationship	240
	8.2.2 Interest in Meeting People Who Are Different	241
8.3	Cognitive Diversity	242
8.4	Equal Participation	247
8.5	Joint Coordination	250
	8.5.1 Establishing a Shared Understanding of the Problem	251
	8.5.2 Planning the Process	251
	8.5.3 Staying Focused on Shared Goals	251
	8.5.4 Ensuring the Conversational Flow	252
9	The Origins of Collaborative Problem Solving	254
9.1	Background	254
9.2	Antecedents to Mutual Collaboration	254
	9.2.1 Mutual Collaboration Originates from Gestural Communication	255
	9.2.2 Three Communicative Motives	258
	9.2.3 The Joy of Collaboration	260
9.3	Antecedents to Collaborative Culture	262
	9.3.1 The Emergence of a Community of Learners	262
	9.3.2 Equal Participation	266
9.4	A Summary of the Evolution of Collaborative Problem Solving	271
10	Intelligent Engagement	276
10.1	Background	276
10.2	Mass Deliberation	278
	10.2.1 Citizens' Council in Ostbelgien	279
	10.2.2 Better Reykjavík	282
10.3	Mass Voting	285
10.4	Transparent Collective Work	290
	10.4.1 Crowd Peer Review	292
	10.4.2 The Icelandic Experiment	295
	10.4.3 Crowdsourcing Bills of Law	296

10.5	Social Media Activism	298
10.6	Dysfunctional Engagement	303
10.7	Summary	309
11	Intelligent Contributions	313
11.1	Background	313
11.2	Many Different Perspectives on the Same Work	314
11.3	The Golden Middle Way Is the Best Solution	317
11.3.1	Meeting at the Quantitative Middle Point	318
11.3.2	Finding a Balanced Representation of All Sides	319
11.3.3	Identifying Commonalities	320
11.4	Searching for the Unexpected Solution	325
11.5	Modularizing the Tasks	329
11.5.1	A Modularization Strategy	329
11.5.2	Modularization in Strongly Interconnected Content Structures	332
11.5.3	Modularization in Loosely Connected Content Structures	333
11.6	Summary	335
12	Intelligent Evaluations	340
12.1	Background	340
12.2	The Reputation Society	341
12.2.1	The Emergence of the Reputation Society	341
12.2.2	Online Reputations Moving into New Domains	344
12.2.3	Reputation Score Systems in Social Media	346
12.3	Evaluating the Collective Work	349
12.3.1	Shared Coordination	349
12.3.2	The Need for Coordinators	353
12.4	Institutionalizing Critical Discourse	355
12.4.1	The Nomothetai	355
12.4.2	The Citizen's Assembly in Ireland	356
12.4.3	Knowledge Commons	361
12.5	Summary	363
13	COVID-19 as a Wicked Problem	366
13.1	Background	366
13.2	The Test and Trace Strategy	368
13.3	Effective Communication about the Pandemic	370
13.4	Rule Compliance	373
13.5	COVID-19 in a CI Perspective	375
13.5.1	Transparent Information	376
13.5.2	Citizen Responsibility	377
13.5.3	Collective Learning	378

14	Motivation to Contribute	381
14.1	Background	381
14.2	Being Immersed	382
14.2.1	Being Immersed in Simple Tasks	382
14.2.2	Being Immersed in Complex Tasks	383
14.3	Being Recognized	384
14.4	Being Part of a Community	386
14.5	Learning as Motivation	389
14.5.1	Individual Learning as Motivation	389
14.5.2	Collective Learning as Motivation	390
14.5.3	Transformative Learning as Motivation	391
14.6	Economic Motivation	392
14.7	Making Societal Contributions	393
14.8	Summary	396
15	The Intelligent Society	399
15.1	Background	399
15.2	Instrumentarian Intelligence	401
15.3	Civic Intelligence	408
	<i>References</i>	419
	<i>Index</i>	442