

Contents

List of Figures	x
Preface	xv
Acknowledgments	xvii
Introduction: What is Cognitive Science?	1
1.1 Broad Construal	2
1.2 Narrow Construal	4
1.3 Cognition: Broad and Narrow	4
1.4 Computation: Broad and Narrow	5
1.5 The Working Conception of Cognitive Science	6
<i>Appendix 1978 Sloan Report</i>	7
<i>Study Questions</i>	8
<i>Suggested Reading</i>	9
Part I Historical Background	
Introduction	15
1 Associationism	16
1.1 Introduction: What is Associationism?	16
1.2 Generic Empiricist Associationism	16
1.3 Varieties of Associationism	18
1.4 Locke and James	19
1.5 The End of Classical Associationism	33
<i>Study Questions</i>	34
<i>Suggested Reading</i>	35
2 Behaviorism and Cognitivism	37
2.1 Introduction	37
2.2 The Rise of Behaviorism and Stimulus-Response Psychology	37

2.3	Challenges to Behaviorism and Stimulus-Response Psychology	43
2.4	Cognitivism: Information Processing Psychology	45
	<i>Study Questions</i>	52
	<i>Suggested Reading</i>	53
3	Biological Background	55
3.1	Introduction	55
3.2	Brain Ventricles vs. Brain Substance	55
3.3	Cortical Localization vs. Holism	60
3.4	Nerve Net Theory vs. the Neuron Doctrine	66
3.5	The First Half of the Twentieth Century	71
	<i>Study Questions</i>	76
	<i>Suggested Reading</i>	77
4	Neuro-Logical Background	79
4.1	Introduction	79
4.2	Neural Networks and the Logic of Propositions	80
4.3	Perceptrons	85
4.4	Linear Separability and XOR: McCulloch and Pitts Nets and Perceptrons	90
4.5	Simple Detector Semantics	95
	<i>Study Questions</i>	100
	<i>Suggested Reading</i>	102
Part II	The Digital Computational Theory of Mind	
	Introduction	105
5	A Sample Artificial Intelligence Model: SHRDLU	107
5.1	Introduction	107
5.2	SHRDLU Dialogue	108
5.3	The Program	116
5.4	Limitations	119
5.5	Historical Role of SHRDLU	121
	<i>Study Questions</i>	122
	<i>Suggested Reading</i>	122
6	Architecture(s)	124
6.1	Introduction: Some Preliminary Concepts	124
6.2	Turing Machines	126

6.3	von Neumann Machines	132
6.4	Production Systems	139
6.5	Intermezzo: Pandemonium	144
6.6	Taxonomizing Architectures (I)	147
	<i>Study Questions</i>	149
	<i>Suggested Reading</i>	151
7	Representation(s)	153
7.1	Introduction	153
7.2	The Variety of Representations: Some Standard High-level Formats	155
7.3	The Nature of Digital Computational Representation	171
	<i>Study Questions</i>	174
	<i>Suggested Reading</i>	175
8	The Digital Computational Theory of Mind	178
8.1	Introduction	178
8.2	From the Representational Theory of Mind to the Computational Theory of Mind	179
8.3	The Digital Computational Theory of Mind and the Language of Thought	190
8.4	DCTM and the Mind-Body Problem	193
8.5	DCTM and Representational Content	202
8.6	DCTM and Consciousness (I)	208
8.7	Modular (Cognitive) Architectures	213
	<i>Appendix Modularity: Gall vs. Fodor</i>	218
	<i>Study Questions</i>	219
	<i>Suggested Reading</i>	222
9	Criticisms of the Digital Computational Theory of Mind	225
9.1	Introduction: The Turing Test (Again)	225
9.2	Against Strong AI: Searle and the Chinese Room	227
9.3	The Digital Computational Mind in the Chinese Room	231
9.4	The DCTM and Consciousness (II)	236
9.5	The DCTM and Mental Content	244
9.6	Against Cognitivism	250
9.7	DCTM Hardware and the Brain	259
9.8	The Domain and Scope of the DCTM	263
	<i>Study Questions</i>	266
	<i>Suggested Reading</i>	270

Part III	The Connectionist Computational Theory of Mind	273
Introduction		275
10	Sample Connectionist Networks	276
10.1	Introduction	276
10.2	Jets and Sharks	276
10.3	NETtalk	280
	<i>Study Questions</i>	287
	<i>Further Reading</i>	288
11	Connectionism: Basic Notions and Variations	289
11.1	Introduction	289
11.2	Basic Notions and Terminology	289
11.3	Learning and Training	304
11.4	Representation(s)	317
11.5	Generic Connectionism	325
	<i>Study Questions</i>	327
	<i>Suggested Reading</i>	328
12	The Connectionist Computational Theory of Mind	330
12.1	Introduction	330
12.2	The Connectionist Computational Theory of Mind	330
12.3	Motivations for the CCTM	332
12.4	A Bit of History: Connectionism and Associationism	335
12.5	Interpreting Connectionism: PTC	337
12.6	Taxonomizing Architectures (II)	351
	<i>Appendix Connectionism and Turing's Unorganized Machines</i>	353
	<i>Study Questions</i>	356
	<i>Suggested Reading</i>	358
13	Criticisms of the Connectionist Computational Theory of Mind	359
13.1	Introduction	359
13.2	Differences: The CCTM and the Brain	359
13.3	CCTM: The Lures of Connectionism	362
13.4	CCTM and the Chinese Gym	367

13.5	CCTM and Propositional Attitudes	371
13.6	CCTM Detector Semantics	383
13.7	CCTM: Problems and Prospects	389
	<i>Study Questions</i>	390
	<i>Suggested Reading</i>	392
 Coda: Computation for Cognitive Science, or What IS a Computer, Anyway?		394
C.1	Introduction	394
C.2	Functional View of Computers	395
C.3	Levels of Description View of Computers	398
C.4	Combined Functional-Descriptive View of Computers	403
C.5	Levels of Computation: Stabler	404
C.6	Digital and Connectionist Computers	407
C.7	Is Everything a Computer?	410
	<i>Study Questions</i>	411
	<i>Suggested Reading</i>	412
 Bibliography		 413
Index		434