

Munindar P. Singh

Multiagent Systems

A Theoretical Framework for Intentions,
Know-How, and Communications

Foreword by Michael N. Huhns

Technische Hochschule Darmstadt FACHBEREICH INFORMATIK BIBLIOTHEK Inventar-Nr.: <u>21018</u> Sachgebiete: <u>C.0</u> Standort:
--

Springer-Verlag

Berlin Heidelberg New York
London Paris Tokyo
Hong Kong Barcelona
Budapest

Contents

1	Multiagent Systems	1
1.1	Intentions, Know-How, and Communications	3
1.2	The State of the Art	7
1.3	Major Contributions	13
2	Technical Framework	15
2.1	The Core Formal Framework	17
2.1.1	The Formal Language	17
2.1.2	The Formal Model	19
2.1.3	Semantics	22
2.2	Temporal and Action Operators: Discussion	24
2.3	Coherence Constraints	28
2.4	Results on Time and Actions	38
2.5	Strategies	40
2.6	Belief and Knowledge	44
2.7	More on Actions and Other Events	46
2.7.1	Events in Natural Language	47
2.7.2	Trying to Act	48
2.7.3	Actions and Events in Artificial Intelligence	50
2.8	Rationale for Qualitative Temporal Logic	52
3	Intentions	55
3.1	Dimensions of Variation	55
3.2	Intentions Formalized	63

3.2.1	Formal Language and Semantics	65
3.2.2	Axioms for Intentions	69
3.3	Properties of Intentions	71
3.4	Desires	75
3.5	Other Formal Theories of Intentions	76
3.6	Philosophical Remarks	79
3.7	Conclusions	80
4	Know-How	81
4.1	Intuitive Considerations on Know-How	82
4.1.1	Traditional Theories of Action	83
4.1.2	The Proposed Definition	84
4.2	Reactive Ability	85
4.3	Strategic Ability	90
4.4	Results on Ability	95
4.5	Incorporating Action Selection: Reactive Know-How	99
4.6	Strategic Know-How	103
4.7	Strategic Know-How Defined	107
4.8	Results on Know-How	110
4.9	Conclusions	112
5	Combining Intentions and Know-How	115
5.1	Some Basic Technical Results	115
5.2	Success at Last	117
5.3	Normal Models	120
5.4	Other Theories of Ability and Know-How	121
6	Communications	125
6.1	Protocols Among Agents	125
6.1.1	Speech Act Theory	126
6.1.2	Speech Act Theory in Multiagent Systems	127
6.1.3	The Need for a Semantics	128

6.2	Formal Model and Language	129
6.2.1	Speech Acts as Actions	129
6.2.2	Formal Language	130
6.2.3	Whole-Hearted Satisfaction	131
6.2.4	Interrogatives	136
6.3	Applying the Theory	137
6.3.1	Normative Constraints on Communication	138
6.3.2	The Contract Net	143
6.4	Conclusions	145
7	Conclusions and Future Work	149
A	The Formal Language	153