

THE SPATIAL GRASP MODEL

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THE SPATIAL GRASP MODEL

Applications and Investigations of
Distributed Dynamic Worlds

BY

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INVESTOR IN PEOPLE

*To my family members for their lasting encouragement and support, also
exciting common trips to the unknown and dangerous words.*

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CONTENTS

<i>List of Figures</i>	ix
<i>About the Author</i>	xi
<i>Foreword</i>	xiii
<i>Preface</i>	xv
<i>Acknowledgments</i>	xvii
1. Introduction	1
2. Investigating Terrestrial and Celestial Worlds	17
3. Spatial Grasp Model and Technology Basics	37
4. Spatial Grasp Language Basic Organization	47
5. Mechanisms of SGL Distributed Implementation	59
6. Distributed Worlds Vision and Comprehension in SGL	71
7. Investigating Unknown Worlds in SGL	83
8. SGL Against Other Languages	97
9. Relation of SGL to Higher Psychological and Mental Concepts	111
10. Conclusions	129
<i>Appendix: Spatial Grasp Language Details</i>	135

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LIST OF FIGURES

Chapter 2

Figure 2.1. Challenges of Global Systems. 21

Figure 2.2. New Worlds Discoveries. 23

Chapter 3

Figure 3.1. Traditional System Representations and Solutions in Them;
(a) Hierarchical, (b) Distributed. 38

Figure 3.2. Spatial Grasp Model Main Idea. 39

Figure 3.3. Holistic and Parallel World Conquest-Coverage by Active
Recursive Code. 40

Chapter 4

Figure 4.1. SGL Recursive Syntax. 48

Figure 4.2. Repeated Network Navigation With Self-Spreading-
Parallelizing SGL Scenario. 56

Chapter 5

Figure 5.1. SGL Interpreter Main Components and Their Interactions. 60

Figure 5.2. SGL Distributed Interpretation in Physical and Virtual
Environments. 61

Figure 5.3. Different Spatial Track System Operations. 62

Figure 5.4. Nonsynchronized Advancement in Space. 63

Figure 5.5. Synchronized Advancement in Space. 64

Figure 5.6. Another Variant of Synchronized Advancement. 64

Figure 5.7. Nonsynchronized Repeated Advancement
in Space. 65

Figure 5.8. Synchronized Repeated Advancement in Space. 65

Figure 5.9. Another Variant of Repeated Advancement. 66

Figure 5.10. Parallel Hierarchical Feedback Operation. 67

Figure 5.11. Combining Hierarchical Feedback Operation With
Further Space Navigation. 67

Chapter 6

Figure 6.1. Combining Wave-Like Spreading With Feedback
Grasping in Finding Border of a Region. 72

Figure 6.2.	Combining Tree-like Spreading With Feedback Grasping in Finding the Region's Border.	73
Figure 6.3.	Possible Application to Seeing and Outlining the Hurricane (a) or Galactic (b).	74
Figure 6.4.	Virus-Like Investigation and Finding Border of a Forest Fire.	75
Figure 6.5.	Finding Certain Graph Structures in a Distributed Network: (a) Image to be Found, (b) Matching Template, (c) Parallel Wave-like Network Matching.	76
Chapter 7		
Figure 7.1.	Solving Problems in Large Data Networks Under SGT.	89
Chapter 8		
Figure 8.1.	Finding Shortest Path Tree in a Network.	99
Figure 8.2.	C++ Code for Dijkstra's Shortest Path Algorithm.	100
Figure 8.3.	Articulation Point in a Network.	102
Figure 8.4.	Distributed Campaign Management Scenario.	103
Figure 8.5.	Example of Natural Language Sentence Syntactic Structure.	105
Figure 8.6.	Extended Natural Language Sentence Structure.	106
Chapter 9		
Figure 9.1.	Proximity Examples.	112
Figure 9.2.	The Discovered Groups of Objects.	113
Figure 9.3.	Assessing the Good Gestalt Quality of Groups.	114
Figure 9.4.	Examples of Figure-Ground Perception.	115
Figure 9.5.	An Example for Resolving Figure-Ground Controversy.	116
Figure 9.6.	A Swarm of Chasers Discovering and Fighting Distributed Targets.	117
Figure 9.7.	Supplying the Swarm With Deeply Embedded Global Awareness.	118
Figure 9.8.	Supplying the Swarm With Higher-Level Migrating Global Awareness.	119
Figure 9.9.	Using Separated External Global Awareness.	120

ABOUT THE AUTHOR

Dr Peter Simon Sapaty, Chief Research Scientist, Ukrainian Academy of Sciences, has worked with networked systems for five decades. Outside of Ukraine, he worked in the former Czechoslovakia (now Slovak Republic), Germany, the United Kingdom, Canada, and Japan as a group leader, Alexander von Humboldt researcher, and invited and visiting professor. He invented a distributed control technology that resulted in a European patent. He has published more than 260 papers on distributed systems and has been included in the Marquis Who's Who in the World and Cambridge Outstanding Intellectuals of the twenty-first century.

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FOREWORD

This is a sequel to the previous seven books on high-level management of large distributed systems. Born half a century ago, well before the internet, and called WAVE in its infancy, the developed model and technology was tested on numerous applications in different countries. The book is oriented on their extended applications including new worlds of terrestrial and celestial nature, global systems, and NASA strategic research areas and technologies. It presents main ideas of the Spatial Grasp (SG) paradigm and details of its key Spatial Grasp Language (SGL), including its philosophy, methodology, syntax, semantics, and interpretation in distributed systems. The scenario-pattern in SGL spatially propagates, replicates, modifies, covers, and matches distributed worlds in parallel wavelike mode, allowing us to evaluate large distributed phenomena by their physical or virtual coverage. The solutions in SGL contain investigation of the regions of interest like hurricanes and forest fires, with similar techniques applicable for celestial cases, and show how to find images in arbitrary distributed networks using spatial graph-pattern matching technique. It provides investigation of group behavior of ocean animals, discovery of unknown terrain features, and path-findings in large transport networks. Comparison of SGL with other programming, specialized, and natural languages shows simplicity and compactness of obtained solutions, due to SGL operating directly on distributed networked bodies in a holistic, parallel, and pattern matching mode. Relation of SGL to some higher mental concepts has been investigated by showing how to simulate gestalt psychology principles and maintain global awareness and consciousness of distributed systems by SGL recursive virus-like spatial coverage. The results confirm potential applicability of the developed paradigm, language, and technology for solving much broader classes of problems related to large unknown worlds. The approach can also be used for high-level formulation of key problems and their solutions instead of natural languages, due to clarity and compactness of the resulting descriptions.

Peter Simon Sapaty

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PREFACE

The world around us as individuals, collectives, countries, and continents, around the Earth, the Sun, other planets, stars, and galaxies is enormously large, diverse, and fully distributed. It is impossible to see and comprehend it from any separate point or points (whether physical, virtual, or combined) and at any levels, And for achieving this we should develop radically new space-related philosophies, paradigms, models, technologies, and languages, on which the current book is oriented, while continuing our previous work on spatial intelligence and technologies described in previous publications, seven books from Wiley, Springer, Emerald, and Taylor & Francis including.

The current book actually inherits practical works on creation of citywide computer networks in Kiev, Ukraine, from the end of 1960s, well before the internet, which were integrating different institutes of the National Academy of Sciences and other organizations. They resulted in a new management concept and distributed control methodology and technology which were further developed in different countries including Ukraine, former Czechoslovakia, Germany, the United Kingdom, United States, Canada, and Japan. The investigated applications covered intelligent network management, industry, social systems, collective robotics, military command and control, crisis management, national and international security, defense, distributed simulation, physical–virtual symbiosis, space-based systems, and even biology, psychology, and art.

The current book presents main ideas of the developed SG paradigm and details of its key SGL, including their philosophy, methodology, syntax, semantics, and interpretation in distributed systems. The scenario-pattern in SGL spatially propagates, replicates, modifies, covers, and matches distributed worlds in parallel wavelike mode, allowing us to evaluate large distributed phenomena by their physical or virtual coverage. The presented solutions in SGL contain investigation of the regions of interest like hurricanes and forest fires, with similar techniques applicable for celestial cases, and show how to find images in arbitrary distributed networks using spatial graph-pattern matching technique. They also include investigation of group behavior of

ocean animals, discovery of unknown terrain features, and path-findings in large transport networks.

Comparison of SGL with other programming, specialized, and natural languages showed simplicity and compactness of obtained solutions, due to SGL operating directly on distributed networked bodies in a holistic, parallel, and pattern matching mode. Relation of SG paradigm to some higher mental concepts has been investigated by showing how to simulate gestalt psychology principles and maintain global awareness and consciousness of distributed systems. The results confirmed potential applicability of the developed model, language, and technology for solving much broader classes of problems related to large unknown worlds. The approach can also be used for high-level formulation of key problems and their solutions instead of natural languages, due to clarity and compactness of the resulting descriptions.

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