THE SPATIAL GRASP MODEL

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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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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.

Kiev, Ukraine
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Peter Simon Sapaty

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