Andrzej P. Wierzbicki, Yoshiteru Nakamori

Creative Space

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Creative Space

Models of Creative Processes for the Knowledge Civilization Age



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Knowledge is satisfactory in itself (an old Zen philosophy principle)

Preface

The book was written as an activity of the 21st Century Center of Excellence Program Technology Creation Based on Knowledge Science at Japan Advanced Institute of Science and Technology (JAIST) in Nomi, Ishikawa, Japan. It relies also on broad international cooperation, e.g., with the International Institute for Applied Systems Analysis (IIASA) in Laxenburg, Austria, the University of Hull in Hull, Great Britain, the National Institute of Telecommunications and Warsaw University of Technology, as well as the Institute of Philosophy and Sociology in the Polish Academy of Sciences in Warsaw, Poland. The authors also enjoyed cooperation with many Japanese universities and research institutions, e.g., Kyoto University, University of Osaka, Kansai University, Osaka Sangyo University, Hiroshima University, Konan University, University of Tsukuba, and the Japan Institute of Shinayakana Systems Engineering. The main authors and editors of this book are Yoshiteru Nakamori and Andrzej P. Wierzbicki, but there are also several co-authors: Chapter 5 was written with the participation of Akio Kameoka (JAIST), Chapter 6 with the participation of Zhichang Zhu (University of Hull), and Chapter 7 with the participation of Marek Makowski (IIASA).

Although this book is primarily concerned with knowledge creation, thus with philosophical issues on the verge of a new civilization age, the authors are not philosophers, nor do we try to follow the accepted style of philosophical writing. We feel, however, that it is legitimate for us not only to have, but also to express opinions about these issues, for many reasons. Both of us are technological scientists; we jointly represent a considerable experience in diverse disciplines that have contributed substantively to the formation of the new civilization age: telecommunications, control engineering, computer science and computational science, systems science with its diverse varieties, computer networks, computerized decision support and data mining, knowledge engineering, and knowledge and technology management – generally, *computational intelligence*. Moreover, we also have many years of *experience in the practical management*, at diverse levels, of science, technology and knowledge creation; thus we feel that we have also practical expertise to analyze knowledge creation proc-

esses. We feel also that such an analysis is necessary in order to understand knowledge creation in times when knowledge becomes the decisive productive resource and also in order to help in the construction of software or computational intelligence systems supporting creativity.

The book summarizes and attempts to integrate the many novel approaches to knowledge and technology creation that appeared during the last decade of 20^{th} and the first years of 21^{st} Century. A specific feature of most of them is that they try to utilize – or even rationally explain – the irrational or a-rational creative abilities of the human mind, such as tacit knowledge, emotions and instincts, and intuition.

But the essential feature of these new approaches is that they respond to the needs of a new era of knowledge civilization, when the fundamental questions are:

- 1) what mechanisms to use in order to provide for some secure even if small advancements of knowledge and technology, and
- 2) how to support such knowledge and technology creation by computational technology and intelligence.

These questions ask for *micro-theories of knowledge creation* applicable *today and tomorrow*. They are different than those asked by epistemology (with a few exceptions) whose concentration is on questions of *macro-theories of knowledge creation* applicable to *grand historical scale:* how to define rationally what is knowledge and science and how fundamental advancements in science – in particular, basic science such as mathematics or physics – were created historically. This does not mean that this concentration of epistemology is not valuable also for the new questions about *micro-theories*, but it means that we could not find in it ready answers for most of these new questions. Thus, the novel approaches to knowledge and technology creation came mostly from outside philosophy and epistemology.

This is, as we shall discuss in much more detail, a paradigmatic change of the importance of a scientific revolution. Thus, one aim of this book is to analyze, document, and even broaden the scope of this scientific revolution. This revolution actually concerns epistemology, but because it asks different questions than classically addressed by philosophy, we shall call it *a revolution in knowledge creation theories*.

To present this revolution, we will analyze several approaches to knowledge and technology creation, starting with the first signs of the paradigmatic change: the *Shinayakana Systems Approach*, see (Sawaragi and Nakamori 1992), and the organizational knowledge creation theory, in particular *SECI Spiral* – see (Nonaka and Takeuchi 1995). However, the possibility of their integration and generalization is given by *the Rational* Theory of Intuition started in (Wierzbicki 1997). This results in the concept of *Creative Space* presented in this book, a novel tool for integrating such theories. Another concept of the I^5 System, see (Nakamori 2001), can be interpreted as stressing the need for *transitions between nodes of Creative Space in many dimensions*. Also, other novel theories of knowledge creation can be presented jointly with the previously mentioned theories as *processes of transitions between nodes of Creative Space*.

Thus, another aim of this book is to present and broaden the *Rational Theory of Intuition* and show how it leads to the concept of *Creative Space*. A further aim is to present and analyze in detail the concept of *Creative Space* together with its list and meanings of nodes of this space and of the character of transitions linking these nodes. This is supplemented by a summary of essential aspects of the beginning of the knowl-edge civilization era, comments on a change of the meaning of systems science at the beginning of this era, and a review of computational intelligence approaches to decision support and creativity support systems.

The transitions in *Creative Space*, or the entire processes of such transitions, can be supported by *Creative Environments*. The meaning of creative environment can be very general, such as the concept of *Ba*, see e.g. (Von Krogh, Ichijo and Nonaka 2000); but in this book we comment on environments in the information technology or rather computational intelligence sense – specially developed software elements or systems for supporting creativity. The number of possible transitions in *Creative Space* is very large, as is the number of environments that might support these transitions. Thus, we present in this book only a general overview of *Creative Environments*. We originally intended to show how such environments can be constructed, but this we postpone to a sequel of this book that we intend to write. The final value of each theory is in its applications, and the final aim of this intended follow-up book is to show such applications, even if it will be only a rather limited set of applications that will serve to illustrate what might be done in future.

While we intend to write more about *Creative Environments*, we feel that the theory of *Creative Space* and related issues of knowledge civilization age presented in this book are important in themselves. They describe basic models of knowledge and technology creation processes and such theory is necessary on the verge of a new age of knowledge civilization.

Japan June 2005 Andrzej P. Wierzbicki Yoshiteru Nakamori

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