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Creative Space: Concepts for the "Knowledge Civilization" Era

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In the last decade of the 20th Century and in the beginning years of the 21st, the needs of the new *knowledge economy* motivated an actual revolution in epistemology: many approaches to and theories of *knowledge creation* were proposed, most coming from outside of philosophy. These include: the *Shinayakana Systems Approach* of Sawaragi and Nakamori (1992); *Knowledge Creating Company* with *SECI Spiral* by Nonaka and Takeuchi (1995); and the *Rational Theory of Intuition* of Wierzbicki (1997). From philosophy came the theory *Science and Unconsciousness* with *Process of Regress* by Motycka (1998), characterizing knowledge creation during a scientific revolution of a Kuhnian type; but outside of philosophy we also saw the *I*^{5} *Pentagram System* of Nakamori (2000); the *OPEC Spiral* of Gasson (2004), and several others.

Creative Space, a method of comparing and integrating such theories, based on the construction of a network-like model of creative processes, is proposed in a soon to be published book. The method also helps us to obtain new descriptions of other cases of knowledge creation.

A fundamental observation is the *emergence of qualitatively new properties and concepts* of complicated systems, on higher levels of complexity. This was substantiated rationally by

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Guest Column:
What is the Information Architecture and Knowledge Management (IAKM) Program at Kent State University in a Nutshell?

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JAIST has an exceptional and unique program in Knowledge Sciences. We would like to share with readers of *COE Newsletter* a description of another program that complements the work being done at JAIST. The Master of Science in Information Architecture and Knowledge Management (IAKM) is an interdisciplinary graduate degree program that encompasses three specific emerging disciplines:

- Information Architecture (IA)
- Information Use (IU)
- Knowledge Management (KM)

Our target audiences are those students who wish to acquire practical skills and competencies as information architects, usability engineers, and knowledge managers.

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Creative Space… (con't)

mathematical, *hard systems theory* (bifurcation and catastrophe theory, deterministic chaos theory, dissipative systems and stochastic chaos, and general complexity theory).Experimentally, it was substantiated by *technology* (the construction of complex technological systems, especially computer networks, have shown the practical necessity of using emergence phenomena as a way of coping with complexity). These properties and concepts are *irreducible,* thus in a sense, *transcendental* to those used on lower levels of complexity. This perspective has far reaching ontological consequences, such as the possibility of integrating *monism* and *dualism* into *emergent pluralism.* If new properties must necessarily emerge on higher layers of complexity, there is no sense in disputing whether there is only matter, or only spirit, or both matter and spirit.

Contemporary knowledge in telecommunications and in computational complexity theory also leads us to another conclusion: that *language is only an inadequate code to describe much more complex reality,* simplifying the processing of information about the real world at least 10^4 times. Therefore, it is obviously not possible to achieve absolutely exact, objective truth and knowledge, but *the importance of truth, of objectivity, emerges on a higher level of civilization development* than just the level of interpersonal communication.

The development of language was a great simplification and a great evolutionary shortcut which, however, suppressed the older but cognitively stronger abilities of the human mind. Intuition is such an ability – the ability of *preverbal, holistic, subconscious* (or *unconscious,* or *quasi-conscious*) imagining and processing of sensory signals and memory content, a historical remnant, left over from the *preverbal stage of human evolution.* This definition has a strong explanatory power and allows us to draw practical and theoretical conclusions. One of the latter is that *tacit knowledge* can be explained rationally and usefully subdivided into *intuitive* and *emotive knowledge.*

Individual, group, and *heritage knowledge*, elements of the *social dimension* of knowledge creation processes, can be also classified as *rational, intuitive,* and *emotive* elements of the *epistemological dimension* of knowledge creation processes. This three-by-three matrix constitutes the starting point of *Creative Space,* a network-like model of knowledge creation processes that consists of *nodes* and *transitions* between them and is a generalization of the *SECI Spiral* of Nonaka and Takeuchi. The three nodes of *rational, intuitive,* and *emotive heritage of humanity* are especially important: *rational heritage* corresponds to (most of) the *third world* of Popper; *emotive heritage* contains all human arts, but also the *collective unconscious* of Jung; *intuitive heritage* corresponds to the *a priori synthetic judgments* of Kant.

However, knowledge creation processes are extremely diversified and many more dimensions of *Creative Space* are necessary to describe them in detail. The starting point for such an extension is Nakamori's *I*^{5} *(Pentagram) System*. In total, at least ten dimensions of *Creative Space* can be analyzed. All the analysis of the *nodes* and *transitions* in *Creative Space* results in:

1. Three spirals of organizational knowledge creation, typical for market-oriented organizations: *Oriental SECI Spiral* (Nonaka and Takeuchi), *Occidental OPEC Spiral* (Gasson), and *Brainstorming DCCV Spiral* (Kunifuji)
2. Three spirals of normal academic knowledge creation, typical for normal scientific activities at universities and research institutes: *Hermeneutic AIRE Spiral, Experimental EEIS Spiral, Intersubjective EDIS Spiral,* which can be represented together in the *Triple Helix of Normal Knowledge Creation,* all proposed in our book
3. One spiral of revolutionary scientific creation processes: *ARME Spiral* (Motycka)
4. Two general systemic models of knowledge creation and integration: *Shinayakana Systems Approach* (Sawaragi and Nakamori) and *I*^{5} *(Pentagram) System* (Nakamori).

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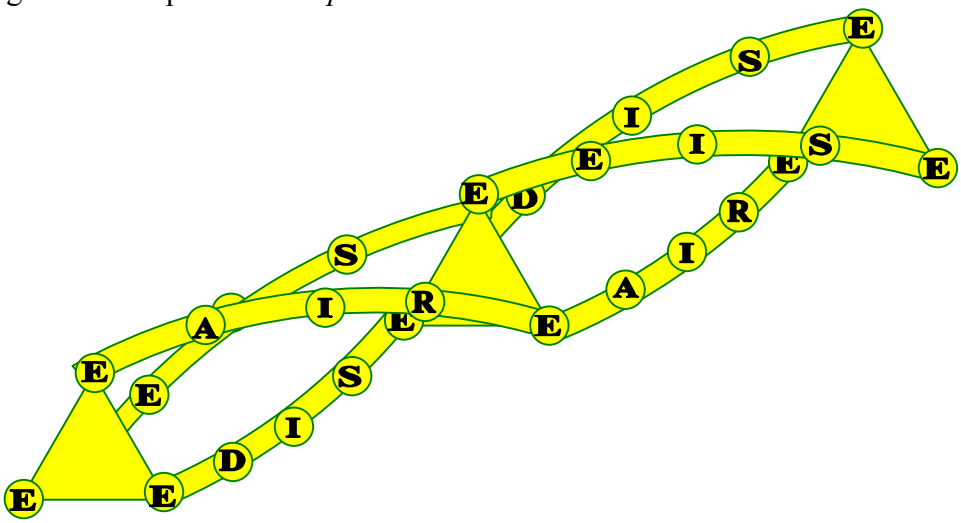
Creative Space… (con't)

To illustrate one of the results, we present on the next page the concept of *The Triple Helix*



***Triple Helix* of normal knowledge creation**

The triangles in *Triple Helix* represent the transition *Enlightenment* (*illumination, aha, eureka* – having a bigger or smaller new idea) which can occur in any of the three spirals, but is common to all of them, thus the idea can be used afterwards in another spiral. Small circles represent diverse transitions: *analysis, immersion, reflection* in the *Hermeneutic EAIR Spiral; experiment, interpretation, selection* in the *Experimental EEIS Spiral; debate, immersion, selection* in the *Intersubjective EDIS Spiral.*

These three spirals of normal knowledge creation in academia and research institutions represent the most basic components of normal knowledge creation:

- the search (in literature and on the web) for results related to a creative idea, the interpretation and analysis of the results of such search, the comparison of the results with the tradition of a given field and a deep intuitive reflection on this comparison that might lead to new ideas in the case of *Hermeneutic EAIR Spiral;*
- the experimental testing of a creative idea, the interpretation of results of the experiment, the intuitive selection of results that might lead to new ideas in the case of the *Experimental EEIS Spiral;*
- the debate of an idea by a group of researchers, the immersion of the results of the debate within the group with a possibility of repeated debate, the intuitive selection of such results of the debate that might lead to new ideas in the case of the *Intersubjective EDIS Spiral.*

The book also discusses a vision of the new era of *knowledge civilization,* known also by many other names – *postindustrial, information, postcapitalist, informational society, knowledge based economy etc.* The vision stresses that this is a long-term historical structure in the Braudelian sense that could last until the year 2100. The vision outlines the chances of solving the current problems of humanity, but also discusses the diverse dangers and threats resulting from the main megatrends of this era.

A new integration of systems science at the beginning of this new civilization era is proposed, called in this book the *informed systems approach;* in particular, it stresses *intercultural, interdisciplinary, open* and *informed* aspects.It is based on a new understanding of *synergy, emergence* and *reductionism;* also, a new perspective of *intercultural* synthesis is proposed.

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Creative Space… (con't)

Existing experience in computerized decision support and the concept of supporting creativity leads us to the conclusion that computerized support for creativity should be more intensively developed. The original concept of *Ba* might be extended, by adding informational, social and psychological aspects into the concept of *Creative Environments.* Existing and needed computerized supports for creativity are reviewed; the need of more developed support for *Web knowledge acquisition, debating, experiment design and virtual laboratories, road-mapping, brainstorming, gaming,* and *distance teaching* is underlined.

Our book, *Creative Space*, is the result of one of the projects (SCP SC-2, *"Theory of Knowledge Expression and Integration")* of JAIST's COE program. We hope to publish it in time for the First World Congress of International Federation of Systems Research in Kobe, November 14-17, 2005.

'*Creative Space*' will be published in Springer Verlag's Computational Intelligence Series in fall, 2005. Contact the authors for more information.

Guest Column… (con't)

The target workplaces for our graduates are organizations in the business, education, government, industry and non-governmental sectors, where efficient and effective access to and use of information and knowledge are the critical success factors. Within a year we will be offering an interdisciplinary doctorate program through the College of Communication and Information (CCI) at Kent State University.

All students are required to take an eight-course, 24-credit core, providing an overview of the information-related professions, information processes and products and information-technology research. The core emphasizes the collaboration of intellectual and computer-based technologies, the importance of the user perspective, professional standards, and the role of research.

Core Subjects

The Information Architecture and Knowledge Management core provides competencies in the following areas:

- Intellectual Technologies, such as Knowledge Organization, Packaging and Repurposing
- Information Technologies, such as Hardware and Software Applications
- Knowledge of Information Needs, Uses and Users
- Knowledge of Information-Intensive Contexts, such as Business and Government
- Knowledge of Information Processes, such as Strategic Planning and Project Management.

Information Architecture

IAKM defines the emerging discipline of Information Architecture as the art and science of organizing information, designing computer interfaces, and human-computer interaction to help information seekers solve their information needs efficiently and effectively. The IA offering encompasses the study of:

- Information Design
- Visual Communication Design for Information Architects
- Project Management and Deliverables
- Online Branding
- Content Management Systems
- Interaction and User Experience Design
- Metadata, Thesauri and Ontologies
- Writing for the Non-Linear Media
- IA Successes and Failures: Best Practices and Lessons Learned.

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Guest Column… (con't)

Information Use

IAKM describes the emerging discipline of Information Use as the art and science of information seeking behavior and of the use and usability of information as it is presented to information seekers, particularly in assessing the actual efficiency or effectiveness of information systems and their interfaces. The IU offering encompasses the study of:

- User and Task Analysis for Information Systems
- Usability Engineering
- Usability Laboratory
- Information Needs, Uses and Users
- Computer-Assisted Collaboration and Virtual Communities
- Information Seeking Behavior
- Human Information Processing
- Methodologies and Software for Usability Engineering and Evaluation
- IU Successes and Failures: Best Practices and Lessons Learned.

Knowledge Management

IAKM identifies Knowledge Management to be an interdisciplinary management framework for integrating and processing organizational, group, and individual knowledge. The effective adoption and execution of KM may dramatically contribute to the success of an organization's goals, learning, structural, and cultural transformation, and knowledge integration and processing. The KM offering encompasses the study of:

- Business Intelligence / Competitive Intelligence Analysis
- Business Transformation (Process Engineering and Workflow Management)
- Data and Information Mining and Knowledge Discovery
- Foundational Principles of Knowledge Management
- Leadership Competencies in KM
- Knowledge Management and Learning Organizations
- Organizational Knowledge Management
- Organizational Memory Management
- Strategic Knowledge Management (Communities-of-Practice and Communities-of-Interest)
- KM Successes and Failures: Best Practices and Lessons Learned.

Faculty

At Kent State University the faculty of IAKM is committed to equipping career seekers and mid-career professionals with a structured suite of courses leading to a specialization in one of these three emerging disciplines. The courses offered in IAKM, along with other courses within the Kent State University, will establish a strong foundation for information and knowledge professionals preparing for careers in the emergent knowledge economy.

Our goal is to build alliances and partnerships with other faculties in institutions such as JAIST. We hope we can find ways to share our knowledge and research as well as build upon the strengths of our students. Please contact the author for further information.

The Role of Intuition in the Creation of Mathematical Knowledge

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Many different theories of scientific change can be found in the philosophy of science (Popper, Kuhn, Lakatos, Toulmin, Fayerabend, Laudan, Holton, Hanson ...). But there are also difficulties in describing the change of *mathematical knowledge* with theories that were created based on examples from *physical science*, and it is difficult to include the concepts of *scientific revolution, paradigms, scientific research programs,* etc., into the description of *mathematical knowledge*.

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The Role of Intuition… (con't)

On the other hand, we also have many theories concerning intuition in Western philosophy. Intuition, and especially mathematical intuition as a core factor in almost every such theory, is recognized as a principal source of rational knowledge (Plato, Aristotle, Descartes, Kant, Husserl, Frege, Brouwer, etc.). The literature on the role of intuition in the creation of mathematical knowledge is extensive. But it clearly shows that formulating a theory of scientific change in terms of a theoretical explanation of patterns of scientific development will not do. One must test such a theory using historical case studies. This is a predominant attitude, shared by many schools in the philosophy of science.

My own method to describe mathematical intuition uses two approaches. First of all, it is possible to describe with pure mathematical consideration of formal languages those "places" within mathematical systems where certain essential factors in mathematical reasoning, which can not be formalized, emerge. In these places something – including an intuitive certainty– is given to the working mathematician directly as ready-to-use and already-present, without any previous construction or act of consciousness. Some new mathematical theories are created as an attempt to control such places. This phenomenon (what is intuitively evident or given) we can call the *hermeneutic horizon for contemporary mathematics.*

The second approach is a reconstruction of the *hermeneutic horizon in different historical epochs.* An effective method for such a reconstruction is to compare the content of the horizon in different epochs. As it turns out, reconstructing the horizon for ancient mathematics helps to describe the horizon for modern mathematics, because of the striking differences in what was evident to mathematicians in antiquity and what is evident today. This enables the working mathematician to broaden the field of possible mathematical problems and to create new theories.

During my short research stay at JAIST, I will prepare a paper for a scientific journal and present a seminar on this subject.

Introducing the On-going Research by Research Assistants at the COE Center

1. Masao Usuki (PhD candidate at the School of Knowledge Science; E-mail: usuki@jaist.ac.jp)

Title: Diagram Based Communication Supporting Systems

Keywords: Communication support system, Ba, Visualization, Graph drawing, Diagram.

Abstract: Multi-participant communication is recognized to be an effective means of making tacit knowledge explicit, an important step in the knowledge structuring process. Our research is concerned with systems that support the notion of "Ba" for communication for academic researchers. Specifically, we develop, implement and evaluate systems, which make automatically the diagram that consists of the research data (graphs) and which provide a "Ba" for communication in a distributed environment, rather than face-to-face settings.

2. Shoko Okutsu (PhD candidate at the School of Knowledge Science; E-mail: s-okutsu@jaist.ac.jp)

Title: Bridging the Gap between MOT Education and Company Practice by means of Tacit Knowledge

Keywords: Management of Technology (MOT), Tacit Knowledge

Abstract: MOT education is mainly intended for experienced engineers and managers in technology intensive companies, and it aims at

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Introducing the On-going Research… (con't)

transferring knowledge and skills acquired during study into company practice. But it is not easy to verify the effectiveness of MOT education since practice contains much tacitness, which is difficult to measure. This research analyzes the tacit knowledge of MOT education and practices both quantitatively and qualitatively. This complementary approach attempts to bridge the gap between MOT education and practice, and could improve the design of the educational programs.

3. Takashi Yoshinaga (PhD candidate at the School of Knowledge Science; E-mail: tyoshina@jaist.ac.jp)

Title: Study on R&D Concept Making Activities Using Six-Lenses Model

Keywords: Knowledge reframing, Six-lenses model, Concept making

Abstract: The purpose of this study is to find effective innovational process of R&D concept. This study focuses on knowledge reframing process using Six-lenses interaction activities.

Six-lenses model developed by Kichiro Hayashi is creative reframing guide using six perspectives: Subject & Object, Future & Past, and Analog & Digital.

4. Tian Jing (PhD candidate at the School of Knowledge Science; E-mail: jtian@jaist.ac.jp)

Title: Knowledge Management and Creativity Support in Academic Laboratories

Keywords: knowledge management, scientific knowledge creation, creativity support, laboratory knowledge management

Abstract: This research concentrates on understanding the situation and problems of knowledge creators in scientific laboratories. For that purpose, I survey the management and the process of scientific knowledge creation in a research institute by using comparison, classification, cross tabulation, and other analysis methods. This survey discovers some serious obstacles and hidden problems, such as the unevenness of technical support among different departments (schools), ignorance of cooperation as one source of knowledge, different requirements of foreign and Japanese researchers, and so on. Based on the primary data finding and using practical knowledge creation models, such as Nonaka's SECI model and Nakamori's *i*-system model, I present a framework to develop Laboratory Knowledge Management System (LKMS) for more effective knowledge management and better creativity support.

5. Yan Jie (PhD candidate at the School of Knowledge Science; E-mail: yan-jie@jaist.ac.jp)

Title: A Study on Roadmapping System as a Decision Making Process for Supporting Scientific Research

Keywords: Management of Technology (MOT), Knowledge Management, Technology Roadmapping, Integrated Decision Making.

Abstract: With the development of the internet, researchers can easily obtain a great quantity of data and information on topic of interests. However, sorting out to find a gap to research remains nontrivial. My research attempts to construct a decision-making model to support researcher in university context define a gap for future research. For this purpose, I employ technology roadmapping method.

Upcoming Events Co-Organized by the COE Center

1. 2005.09.29 ~ 31; KSS2005: International Symposia on Knowledge and Systems Sciences. To be held jointly with the 19th International Workshop on Complex Systems Modeling in IIASA (International Institute for Applied Systems Analysis). This symposia aims at discussing around the disciplines of Knowledge science and Systems science, on novel ideas of using them as a methodology or as a tool; and the possibility of how the two fields can benefit each other. Venue: Laxenburg, Austria. For more information, see http://www.iiasa.ac.at/~marek/wrksp/csm05/
2. 2005.11.14 ~ 17; The First World Congress of International Federation of Systems Research, on 'New Roles of Systems Sciences for a Knowledge-based Society'. The congress seeks to promote the establishment of a scientific discipline which promotes the creation, management, integration, and application of knowledge-based, technology-supported society as an option for dealing with the current problems of mankind. Venue: Kobe, Japan. Deadline of abstract submission: July 15, 2005. For more information see http://ifsr2005.jtbcom.co.jp

COE Center News

- *Dr. Boumsoung Kim and Dr. Totok Hari Wibowo* joined the COE Center as postdoctoral researchers as of April 1, 2005.
- *Dr. Zbigniew Król* from the Institute of Philosophy and Sociology of the Polish Academy of Sciences was a visiting researcher at the COE Center from May 9 to June 9, 2005.

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