Cases of HWMSE

Xijin Tang

Institute of Systems Science, Academy of Mathematics and Systems Science
Chinese Academy of Sciences, Beijing 100190 P.R. China

Abstract. In 1992, a concept, Hall for Workshop on Meta-synthetic Engineering (HWMSE) was proposed by the Chinese system scientist Qian Xuesen as a platform for practicing the meta-synthesis system approach (MSA). Along the continuous study in MSA & HWMSE, doubts and critical opinions always exist. In this paper, two cases of HWMSE are addressed to expand the understanding of the concept of HWMSE and practice of meta-synthesis system approach.

Keywords: HWMSE, on-line conferencing ba, search engine.

1 Introduction

Along with the system rethinking tide aroused in the end of 1970s, limitations of mathematical modeling to unstructured messy problems had been realized and new approaches were proposed. The meta-synthesis system approach (MSA) is one of those approaches to tackle with the most complex system - open complex giant system (OCGS) problems from the view of systems proposed by a Chinese system scientist Qian Xuesen (Tsien HsueShen) and his colleagues in 1990 [10]. An understanding about MSA is simplified as from confident qualitative hypothesis to rigorous quantitative validation, which reflects a general process of knowing and doing in epistemology. In 1992 Qian proposed a concept - Hall of Workshop for Meta-Synthetic Engineering (HWMSE) as a platform to apply MSA [19]. The concept of HWMSE reflects the emphasis of utilization of the breaking advances in information technologies (IT) to help harness the collective knowledge and creativity of diverse technical group experts by synthesizing data, information, quantitative models, knowledge, experiences into an interdisciplinary problem-solving process for both proposing hypothesis and quantitative validating. At that time, email, newsgroup, or those Web 1.0 technologies just started to spread worldwide.

After those MSA relevant concepts were put forward, studies have been taken to bring the concepts into operational unit for practical problem solving. Some demonstrations were built on military departments for war-gaming, weapon system development, etc. in China in the 1990s. Most of those systems were not open for civil people. On the other hand, IT was heavily discussed in some open reports about those military demonstrations; even saying that adoption of virtual reality was enough for a HWMSE was popular. Those sayings really led to doubtful impressions, especially from those people who were expecting a breakthrough in system studies as system engineering was adopted into China for only 20 years.

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Perplexed opinions toward MSA and HWMSE go with MSA studies in recent 15 years and more concerns in complexity research also draw attentions to the approach itself [2]. In 1999, a major project sponsored by Natural Science Foundation of China (NSFC) for a pilot HWMSE prototype for macroeconomic decision making aroused in-depth research. Explicit explanations of MSA, such as three types of meta-synthesis, using the case of a policy making on macroeconomic problems were given for the 1st time [20]. The three types of meta-synthesis denote qualitative meta-synthesis, qualitative-quantitative meta-synthesis, and meta-synthesis from qualitative understanding to quantitative validation, which actually indicates the working process of MSA to complex problem solving.

By Qian's original idea, HWMSE is composed three systems, human expert system, machine system and knowledge system [19]. Many previous studies, including those demos of HWMSE focused more on software engineering technologies and did not explain how the relevant three systems interact with each other to solve the problems clearly and logically, even those studies about the infrastructure of HWMSE by means of popular software engineering concepts and tools are still popular [1]. However, those studies are not enough to show how to apply collective intelligence to complex problem solving process using MSA. Moreover, too many discussions into details of machine system development distort the understandings of the capabilities of HWMSE.

In this paper, two practical tools/systems, on-line conferencing ba (OLCB) for academic conference organizing, and search engine, are addressed as cases of HWMSE in reality. Those cases are unlike the traditional thinking about HWMSE from the perspective of decision support systems.

2 On-Line Conferencing Ba (OLCB)

The term on-line conferencing ba (OLCB) was firstly coined during the organizing the 7th International Symposium on Knowledge and Systems Sciences (KSS'2006) held in Beijing in September of 2006. OLCB originally emerges from normal conference management system (CMS) to facilitate paper submission, paper review and news release. Studies from both knowledge science and systems science brought new ideas to expand the original functions of the simple CMS.

2.1 What Help to Incubate the Emergence of OLCB?

The emergence of OLCB is mainly based on the following findings or achievements.

1) Wide application of various conference management systems *(CMS)*

In order to improve efficiency of academic conference organizing, CMS is widely used to handle different tasks, such as management and monitoring of the program committee, automatic paper submission, paper review assignment, list of the latest events, submission of reviews, sending email to PC members, referees and authors, and even automatic preparation of conference proceedings. As people began to be familiar with EasyChair or Open Conference Systems, more CMS applications had been developed specifically for specific conferences.

2) New Model of Scientific Knowledge Growth by P. Thagard

The Canadian philosopher and psychologist Professor Paul Thagard regards scientific knowledge growth as a complex system and proposes an integrative framework which is composed of three kinds of processes - psychological process of discovery and acceptance, physical process involving instruments and experiments, and social process of collaboration, communication and consensus [18]. In his new model of scientific knowledge change, the social aspects of scientific understanding and the collaborative process of research and consensus building are listed among the essential components that brought out the transformation in scientific knowledge. Thagard's model actually proves the necessity of the academic conferences which are one of principal ways for social interactions in the complex system of scientific change.

3)Nonaka's model for knowledge creation

In 1995, a Japanese Professor Ikujiro Nonaka proposed an organizational knowledge creating theory, essentially denoted as SECI model which refers to 4 kinds of modes, *S*ocialization, *E*xternalisation, *C*ombination and *I*nternalization between tacit and explicit knowledge conversion at a never-ending spiral along a social process [5]. In order to enable the conversion at the spiral process, Nonaka emphasized a ba, as a Japanese word, which is defined as a platform where knowledge is created, shared, and exploited. Ba can be physical, virtual, mental or any combination of them. The knowledge-creating process is also the process of creating ba [6]. Four types of ba are denoted to each mode in SECI model respectively, originating ba for socialization especially at face-to-face situation, dialogue ba for externalization mostly happened peer-to-peer, systematizing ba for combination during collaboration and exercising ba for internalization during practice. Then how to develop a right ba for exploiting and creating knowledge effectively and efficiently is a major concern. Considering the functions of HWMSE, we discuss the HWMSE is a kind of ba for knowledge creation [12].

According to the role of ba expected by Nonaka for knowledge creating, the academic conference can obviously function somewhat kind of dialogue ba for idea exchange. Moreover, conference may work to each ba at SECI spiral process. Simply the conference is a ba for knowledge sharing, where the organizers engage in facilitating the emergence of a nice ba. Some augmented information support may provide help.

4) Augmented information support for interactions along the conference

CMS only provides basic functions to automatic processing of conference affairs, such as paper submission, paper review assignment, etc. Further analysis may be conducted to expose some hidden patterns among those interactions based on those transactional data.

As a matter of fact conference mining studies had already existed. In comparison to those scientometrics studies, some technologies for quick start are proposed to show different perspectives based on speeches or the accepted submissions toward the topics of the conference [13, 15, 17]. The iView technology tries to show the emergent vision by constructing iView network which is then analyzed by social network analysis methods. Such kind of analysis is regarded to conduct qualitative meta-synthesis for hypothesis or scenario for further studies. Ref.[15] shows how iView technology exposes the topics or meanings of a new discipline, knowledge science.

Ref. [16] shows applying iView analysis results to paper review assignment for considering the psychological factors in paper review process.

Generally publications, conference rooms and auxiliary equipments are basic physical elements for holding a conference. Versatile organizing ways are soft elements for better communication among participants. OLCB is such an inter-disciplinary concept to reflect those enabling activities and related integrative supporting tools for various dynamic academic and social exchanges.

2.2 Is OLCB a HWMSE?

The concept of OLCB is firstly addressed formally based on the practical results acquired from KSS'2006 organizing [17]. The computerized components of OLCB include a normal conference management module and BBS area with those conference mining results. Is OLCB an HWMSE?

Let us depict the three systems, human expert system, machine system and knowledge system of HWMSE in OLCB. Obviously the *machine system* refers to the computer system for conference management, conference mining functions and BBS, etc. The *human expert system* mainly includes two groups of people. One group denotes the conference organizers, who take charge of conference affairs and enable the convening the conference. The program committee is the most important in this group. PC members or the extension of PC for paper review contributes their knowledge and judgments for paper acceptance, one of complex problem solving tasks for the conference. Another group denotes the authors, who contribute both their own research results and their opinions toward others results by questions, comments or some other activities. The technical staffs who construct the OLCB for service are not actually members of human experts system. The *knowledge system* denotes the knowledge owned by both human experts system and machine system. Narrowly speaking, at least three categories of technologies or methods are included. One is domain knowledge, which can be reflected by the submissions and the referees. Besides the knowledge possessed by both authors and PC members, some may be reflected by the concrete technologies or demonstrations which then belong to machine system. Those can be referred as the domain technologies or methods. The 2nd category of knowledge refers to the augmented information technologies for in-depth findings, such as conference mining technologies, which may refer to a variety of methods and algorithms. The 3rd category of knowledge refers to the conferencing system, mainly the technology which facilitates humans to exchange ideas via a variety of ways. A variety of virtual conference or ubiquitous computing technologies belong to this category, so do Web 2.0 technologies.

As a HWMSE, what kind of problems solved at OLCB from the view of MSA? It should be indicated that an OLCB not only concentrates to one kind of problems, such as academic problems. In fact, people can use a search engine to get *url*s to what they want to know. Browsing *wikipedia* may bring them more details. Authors may get fresh ideas or direct solutions via OLCB to their own problems in work. The scientific knowledge discovery is an unstructured problem. How to get some constructs of the concerned disciplines? Quick replies to the following questions are always expected. What are the major research topics? Who are the principal investigators? Which conferences are flagships? Where and when to hold the influential conferences? etc.

Conference mining technologies at OLCB may provide some answers. That is the results of qualitative meta-synthesis from the perspective of MSA [13, 15]. A small OLCB for one conference is then expected to be expanded to all scientific communities. Thus a workshop on meta-synthetic discovery engineering for the focused disciplines is naturally emerged. If still limited to social process, we just say it is a meta-synthetic discovery workshop.

As scientific knowledge growth is a complex system, applying MSA to this system is very natural. Construction of HWMSE for three processes of knowledge growth is also required. An extended OLCB or a meta-synthetic discovery workshop may help to enable three processes [14]. The enhanced machine system provides meta-synthetic support for social consensus process and fosters the emergence of a meta-synthetic *ba* for active and trustworthy interactions, especially more widely gets empathic feedbacks and critical comments, which are helpful for knowledge transfer and creation. The scope of a topic can be quickly acquired. Misconducts such as plagiarism may easily either happen or be found, and then interventions may also be easily taken at both technological and social sides. Web 2.0's impact on scholarly communication has already been concerned [3].

2.3 The Illustration of Conference Mining Technologies

For better understanding, a simple example of the application of iView analysis to the 7th International Workshop on Meta-synthesis and Complex System (MCS'2007, Beijing) is shown to illustrate the augmented information support. Figure 1 shows the keyword network of iView networks of MCS'2007.

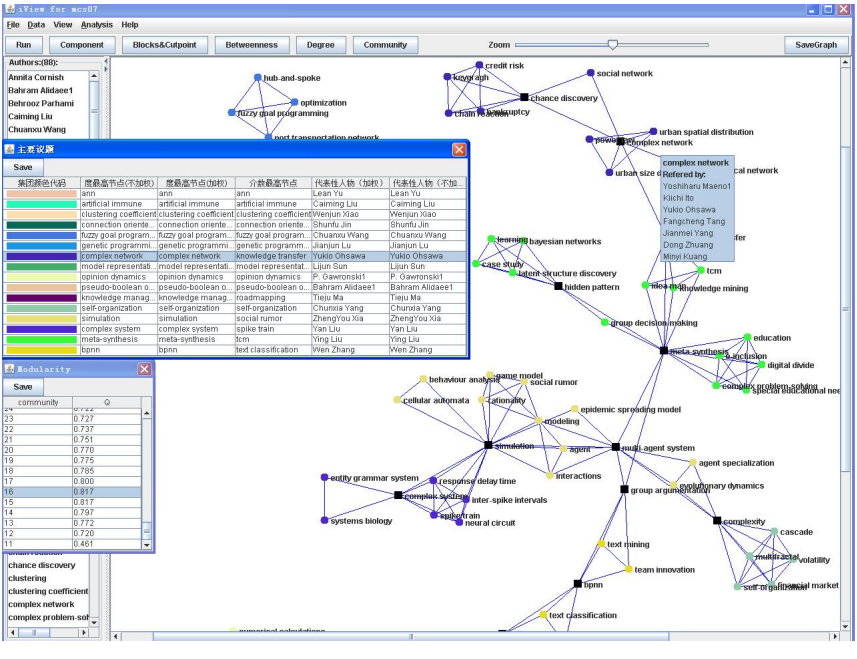

Fig. 1. iView's idea map of MCS'2007 (keyword network; black square node: cutpoint)

In the iView's idea map of MCS'2007, we find 13 cutpoints, *meta-synthesis, group argumentation, multi-agent system, hidden pattern, BPNN, knowledge management, simulation, complexity, complex system, SVM, knowledge transfer, complex network* and *chance discovery*, which may be constructs in meta-synthesis studies. 16 clusters (nodes with different colors) are detected. Centrality analysis may dig out more information. Only by simple analysis, such as cutpoint analysis, a new comer or bystander can quickly know the main topics in meta-synthesis research, the collective scenario contributed by those authors. All those results were released at the OLCB of MCS'2007 before the convening date for awareness of participants and interesting people. The iView network of one conference only reflects participants' understandings at that year. For more comprehensive scenario of meta-synthesis study, it is better to retrospect past workshops to trace the change of the relevant research foci.

The visualized result may provide some hints for new association. Such analytical ways may be integrated into the meta-synthetic discovery workshop for augmented search. Furthermore, it is also expected to explore interactive ways to experience those computational results directly using the authors' methods and datasets, and then serve another kind of consensus process to validate those achievements, as one way to achieve meta-synthesis from qualitative hypothesis to quantitative validation.

3 Search Engine

Internet is such a giant knowledge system, whose knowledge comes from contributions of millions of users enabled by the emerging Web technologies. The search engine itself is a HWMSE.

A search engine is actually a collective intelligence product emerged along the time. Currently heavy investment had been put toward the infrastructure to facilitate versatile and specialized search. Microsoft has already launched out into building an infrastructure to provide large-scale data processing and data management capabilities. WebStudio, an infrastructure is being constructed to facilitate the development and experimentation with new data mining algorithms for improving Web search [4]. The infrastructure can be regarded as the basic elements of machine system of HWMSE. On the other side, social networking sites, wikis, blogs and other bionic software [8] are to enable collective intelligence from on-line wisdom. Those infrastructure and advanced technologies, especially Web 2.0 technologies enhance the machine system of the search engine.

One category of human expert comes from the people who submit the various inquires to the search engine, even the obvious experts denotes to those people who provide answers or those original contributors to the answers. By advanced information technologies in machine system, such as discussed in Ref. [7, 9] about next-generation search tools, the answer to the inquiry will be greatly strengthened by fusion of a vast of diverse knowledge stored in the Internet.

Besides the tremendously explosion of information at the Internet, those algorithms and technologies adopted to acquire or push relevant links with different ranks to the users also belong to the knowledge system. Wiki is a good example of knowledge system or even another good example of HWMSE.

4 Conclusions

In March of 2008, Professor Ben Schneiderman pointed out that traditional scientific methods need to be expanded to deal with complex issues that arise as social systems meet technological innovation and proposed Science 2.0 to call for new ways of studying those integrated interdisciplinary problems at the heart of sociotechnical systems [11]. His viewpoints toward the disadvantages of reductionism are in accord with the system rethinking tide since 1970s. Meta-synthesis is one of those system approaches to deal with complex system problems, and HWMSE is the test bed of MSA practice. The impetus gained from both the innovative IT development and urgent requirements from the emergent complex issues in reality drive the research and demonstrations of HWMSE. Unlike those DSS-like demos, both the on-line conferencing ba and even the popular search engine are typical HWMSE to support complex problem solving. New door just opens toward research on MSA and HWMSE which are not abstract concepts at all.

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