DOMAIN ANALYSIS IN INFORMATION SCIENCE: A CHINESE SCHOLAR’S VIEW

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ABSTRACT

The conditions that domain analysis becomes an academic school of Information Science (IS) are mature. Domain analysis can be defined as community epistemology that reflects community is the new focus of IS research and epistemology is the most important foundation of IS. Being community epistemology, domain analysis may also form a new horizon of philosophy. Domain analysis is interpreted from the perspective of community epistemology. Although domain analysis centers on the domain and community, theoretical concerns on the social and individual dimensions of IS are inherent in it by its using sociology as its important approach and socio-cognitive viewpoint. For these reasons domain analysis can integrate social-community-individual levels of IS discipline as a whole. Domain analysis can get strong support from Chinese library and information science scholars’ research. The relation of Tsien Hsue-shen’s thought to domain analysis is mainly discussed. The importance of epistemology and modern architecture of science & technology to information science and professional, social noetic study that Tsien Hsue-shen elucidated echoes domain analysis and provides mighty evidence. Some other Chinese scholars such as Zhang Xuecheng, Liu Guojun and Du Dingyou are also mentioned as far as their arguments embodied the spirit of domain analysis is concerned. The development of information science in China had experienced a stage of attaching attention to subject knowledge especially in professional education and practice field. But the role of subject knowledge has been marginalized since 1990’s. Nowadays the situation is changing and subject knowledge becomes an inseparable part of IS research in China again, which proves the validity of the domain analytic theory. Finally, realistic pragmatism that forms the philosophical foundation of domain analysis is argued and the implications of these theories to IS are presented.

Keywords: Information Science. Chinese Scholar. Community Epistemology.

1 INTRODUCTION

It has been nearly 20 years since Danish well-known information scientists Hjørland and Albrechtsen published the classic paper “Towards a new horizon of information science” in which domain analysis was brought forward and elaborated systematically (Hjørland &Albrechtsen, 1995).
During the last 20 years, the academia all over the world has had heated discussions on domain analysis, even fierce debate sometime. Under the effort of the scholars with Hjørland at their core, the theoretical construction of domain analysis comes to be mature, and its application comes to be wide. As a theory and metatheory, domain analysis gains deserved discipline status in information science. The continuing conversation and debate don’t make domain analysis depressed but make it get more understandings and acceptations, during which it becomes an emerging doctrine in IS.

A school is usually defined as an academic group whose members share the same views and cluster on the basis of tutoring relationship (Baidu Encyclopaedia, Modern Chinese Dictionary). Domain analysis qualified as an important school appears as an alternative paradigm in information science and gradually gets approval. For example, domain analysis has become the chapter of some textbooks (Bawden & Robinson, 2012). There is the entry of domain analysis in the two editions of “Encyclopaedia of Library and Information Science” successively. Besides, ISKO has published the special issue of domain analysis (Hjørland & Hartel, 2003). All of these are the evidence of affirmation of domain analysis by IS circle. As to the research community, Hjørland, the founder and the main contributor of domain analysis, has a group of followers such as Erik-Mai, Nicolaisen, Tennis and so on, who enrich and develop the theory of domain analysis in various aspects. And many other scholars ponder and study the information problems from the perspective of domain analysis consciously or unconsciously.

As China fast steps into the modern information society, the theory of domain analysis has been spread broadly in China and gotten more supports and promotions among many Chinese information scientists (Wang, 2007, 2010, 2011; Lu & Li, 1998; Feng and Leng, 2009; Yang and Zou, 2012). We can see that as a representative theory of Nordic IS research, school of domain analysis is becoming one of the mainstream paradigms leading a great theoretical turn in the discipline.

2 DOMAIN ANALYSIS AS COMMUNITY EPISTEMOLOGY

Domain analysis has a strong flavor of philosophical argument, which is one of its main characteristics. I consider domain analysis as community epistemology, and believe it should become the theoretical basis of information science. The concept of community epistemology isn’t a new one, the source of which could be traced back to the milestone work of domain analysis (Hjørland, 1997). Hjørland (1997:51) puts forward the concept of “epistemic community” and points that we should study users, knowledge organization and scientific communication on the basis of that idea.

Community epistemology is a generalized representation of the basic thoughts of domain analysis. It can be defined as the research on the processes and ways by which a group consisted of social actors acquire, exchange and evaluate knowledge. It pays attention to not only the production and evolution of community’s collective intellectual structure and its internal information ecology in certain social, historical and cultural contexts, but also the rules of knowledge production, organization, assessment, communication, interpretation and utilization of the community in such contexts.

Community epistemology is also social-oriented community epistemology. It doesn’t isolate community from society for research, but really regard community as the output of social division of intellectual labor (Hjørland & Albrechtsen, 1995). It explores the cognitive activities of community by embedding them into the whole flowing and evolving process of social knowledge. It states that
The community and epistemology are the core concepts of community epistemology. As the concept of cost in economics and meaning in semantics, these two concepts also follow the same logic: The concept appears at the beginning is the most complicated. (Wang, 1995). Domain analysis has given a persuasive elucidation to the connotations and implications of the two concepts, derived theory, method and methodology based on these concepts, which compose the important contents of community epistemology.

### 2.1 Community

Domain analysis maintains that the community should be the focus and the best unit of information science research (Hjørland, & Albrechtsen 1995). There are different voices about the definition of the concept of community, but the agreed opinion is that it intimately relates to knowledge domain. Hjørland argues that discourse community is a community in which an ordered and bounded communication process takes place (Hjørland, 2002a). It is also a domain in relation to discipline, politics, religion, hobby or trade (Hjørland, 2010). Bawden (2010) and Mai (2005) also connect community with domain and emphasize that a community is a group of users having common focuses, goals, views, terminologies. In my opinion, discourse community and knowledge domain actually are the two sides of a coin, the former of which is defined from the angle of people as the subject of social activities, the latter of which is defined in terms of social knowledge as object. They reach the same goal by different means and have the same implications.

Community epistemology states that because every discourse community undertake different social role and task determined by the social division of labor, they develop their own paradigms, rules, conventions, norms and routines that may be explicit, formalized or tacit, uncodified. Different discourse communities have diverse social interests, collective cognitive structures and discourse system respectively. This fact determines that communities will give different interpretations when facing the same information and adopting the same information system. So the information will have different meanings and information system will produce different functions for each community. Other disciplines are also concerned with this issue. For example in organization science, Orlikowski and Gash (1994) bring up technological frames based on the social cognitive perspective. Technological frames are the presuppositions, understandings and expectations that a social group at large own about the certain technology and its application. The differences of technological frameworks owned by distinct groups such as managers, technicians and users will greatly influence the development, use and change of technology.

Regarding information science, focusing on the discourse community and its knowledge nature means that the research and practice of knowledge organization, information retrieval, and information system design must cater to the needs of certain user group, and satisfy the group’s goals and interests and try to facilitate knowledge progress and growth of the community as best it can. Documents should be regarded as things constructed to satisfy functional needs of the standard practice in the community; due to different features, different community may construct different document genres.

The subject access points of documents do not have the same informational values to all communities, but have different values along with the differences of conventions and norms between
communities (Hjørland & Kyllesbech Nielsen 2001, Hjørland, 2006a). Hjørland (1998) also explains the conventions of knowledge domain and community determine the strategies of heuristic rules in information retrieval and proposes that such conventions should be an important part of database semantics research.

Among the information scientists whose research involves community, Brian Vickery is a scholar we need to mention. He highlights that the theoretical problems in IS need to be discussed from the perspective of community. Community is discussed for several times in his later years. For example, in the part 2 of his serial papers of information science, Vickery believes that the nature of a user group is the key factor to determine the subject of a document: “What is undoubtedly true is that different communities of users have different foci of interest. Consequently, if a retrieval system is being constructed for a specialist community, subject analysis may be focused on their needs”.

In the user community and domain section of part 3, he thinks that in order to give a better service to the users community, information professionals should master the knowledge about domain and community, including: the range, the mode, the subject domain of users activities in community, the structural degree of a domain, the specific value of a certain type of document to a certain group of users and the relationships between the user communities (Vickery 2006a, 2006b). Apparently, Vickery’s arguments conform to domain analysis, though on which he has some dissenting opinions in some situations.

A research tendency has arisen to focus on community in information science as well as in many other disciplines. In the case of evolutionary economics, there are some unsolved important problems, such as how to deduce the macroscopic research from microscopic research and what is the basic microscopic mechanism of macroscopic research. Huang (2010: 237-239) brings in “genre” that tags social heterogeneity. Every “genre” gathers the individuals sharing the common nature; the production, maintenance and usage frequency of “genre” can well explain the dynamic mechanisms connecting macro-process with micro-process in economic evolution. He further uses rules (system, strategies, and conventions) to describe meso-genre and uses the differences of rules to reveal the difference of genres. He holds the view that macroscopic order is a complex structure composed of lots of different rules.

We can find that the concept of genre is very similar to community and either concept manifests a social structure at the meso-level. The rule, which defines the concept of genre, actually is the paradigm, custom, convention and the goal of community that are elaborated by domain analysis. Evolutionary economics shows the tendency to turn the focus to the community to accomplish the breakthrough of theory construction. For that matter, evolutionary economies can learn from the theory and method of domain analysis to facilitate the communication of different disciplines and get benefit from each other.

2.2 EPISTEMOLOGY

Epistemology is a subject that researches what is knowledge and how to get knowledge. The epistemological content of community epistemology has double-tier structure. Its fundamental structure comes from traditional epistemology, the most typical of which are empiricism / positivism, historicism, hermeneutics and pragmatism (Hjørland, 2002). These categories of basic epistemology apply to all discourse communities and exist in all of them.
Community epistemology is closely related with the traditional epistemology. However, the positions of each epistemology are not equal in different communities. For example, empiricism is dominant in some sciences, while pragmatism represents the metatheoretical mainstream in other sciences. The competition between the basic epistemologies is the source of power to promote the growth of community and the progress of knowledge domain.

Each community constructs the upper structure of epistemology catering to its own goal, interest, and the need of social division of intellectual labor, which is done on the basis of fundamental epistemology committed by the community. The upper structure of epistemology is a collective cognitive structure manifested as disciplinary paradigm, convention and rule.

As information science is an applied epistemology (Hjørland, 1998), it must attach great importance to the double-tier structure of community epistemology. It is the double-tier epistemology that determines the communities’ discourse system, communication system, information needs, information seeking behavior and information use. Furthermore, the basic epistemologies whose categories are empiricism /positivism/, historicism, hermeneutics and pragmatism play a major and critical role in the construction of theoretical framework and the fundamental research in IS (Hjørland, 2002a, b). Wei (1979) points out that if one discipline does not have a root of epistemology, it cannot be seen as a formal and independent one. The reason that LIS professionals regard their work as a professional technique or craft but not academic knowledge is that LIS education lacks the content of epistemologies. Just as Hjørland claims:

“Epistemological theories have a fundamental impact on theories about users, their cognition and information seeking behavior, on subject analysis, and on classification. They have also fundamental impact on information retrieval, the understanding of information, on the view of documents and their role in communication, on information selection, on theories about the functions of information systems and on the role of information professionals.” (Hjørland, 1998).

It should arouse all information scientists’ ponderation and reflection on their own researches.

Although the upper structures of epistemology are different in each community, but the basic epistemologies are same. In my opinion, because basic epistemology as metatheory is the important part of interdisciplinary trends and related to Zeitgeist (Hjørland, 1998), so it is qualified to become the candidate of “interdisciplinary paradigm” that scholars are earnestly pursuing (Wang, Luo & Ye, 2004). In the field of knowledge management, epistemology has been getting more attention. Boisot and MacMillan (2008) suggest that epistemologies should be the foundation of knowledge management, otherwise it is very difficult for KM to become a real discipline.

2.3 TO BE A MEMBER OF THE FAMILY OF SOCIAL EPISTEMOLOGY

It’s a brief introduction to community epistemology above. Taking domain analysis as its core idea, community epistemology is the philosophical statement of domain analytical metatheory and paradigm. It is fair to claim that domain analysis is well under way to lay the foundation for the prosperity of the Nordic school in the international information science circle.

Domain analysis, appearing in the name of the social-oriented community epistemology, is closely connected with the family of social epistemology. The notion of social epistemology is put forward and developed by Jesse Shera (Shera, 1970). Now social epistemology has become a
philosophical theory system. Especially domain analysis as community epistemology is similar to Kuhn’s evolutionary social epistemology (Wray, 2011) to a large degree. Both of them stress the key role that community can play in the knowledge progress and the research locus of scientific change should be the community rather the individual. That is to say, community or specialization ought to be the necessary layer that ties the social and the epistemic, which are the basic components of social epistemology together (Langhe, 2012). The epistemic contribution of social and historical factors to scientific investigation and the view of regarding theory change as the determinant variable to value data (fact) are also approved by Hjørland and Kuhn.

In addition, domain analysis can remedy the drawbacks of some branch of social epistemologies, for example, analytic social epistemology (ASE). One of the main reasons that ASE does not make great progress is “the tendency to operate with a minimal understanding of actual knowledge practice, including their histories and aspirations” (Fuller, 2012). Introducing domain analysis to ASE can solve the problem just fine because being community epistemology, DA attaches great importance to the knowledge activities and the practice of community and holds that abstract and generalized research cannot encompass all plentiful scientific practice (Hjørland, 2005). And in this sense, DA sides with Fuller’s social epistemology. The social epistemology of cognitive economy advocated by Fuller (2012), which calls the participation of LIS scholars, may also benefit a lot from DA research.

3 DOMAIN ANALYSIS: THE BRIDGE TO THE UNIFIED INFORMATION SCIENCE

The digital environment brings great change to information science. Although IS has had some accomplishments in some fields already, it still faces the problem of “dissociation of discipline and dissociate discipline”. On one side, some scholars proposed IS doesn’t have a definite disciplinary identity. It’s difficult for not a few scholars to distinguish it from computer science and communication studies. In China, many undergraduates and postgraduates majoring in LIS say ironically that their major is “second computer science”, because they have too many courses of IT in curriculum and IT applications occupy the main positions in research direction lists of most LIS schools. On the other side, the theoretical structure of discipline is loose. It lacks logical and organic relations between theories so that it’s of great difficulties to build the unified theoretical system of IS.

Domain analysis is very helpful to solve these difficulties. Domain analysis aims to optimize the process of accessing information, knowledge and documents, and meanwhile concentrates on the information quality and social dimension of information management to help users to make sensible choices on knowledge access. This distinguishes information science from computer science; domain analysis identifies the concepts of information science coherently and logically and makes all sub-disciplines of IS a unit (Hjørland, 2004a). Furthermore, domain analysis crosses three dimensions of IS: society, community and individual. It uses the same methodology to study three dimensions and build up the foundations of each dimension on the basis of the same and unified metatheory. We can claim that domain analysis qualifies for integrating all branch theories in three dimensions to build a integrated information science. Dimension of community was elucidated in the former section of this paper. I will have a discussion on the social dimension and individual dimension next.
3.1 SOCIAL DIMENSION

The embodiment of social dimension is that domain analysis uses the theories and methods of sociology including sociology of knowledge and science studies, and studies the information phenomenon from the standpoint of social context. The social dimension is the key dimension of domain analysis. And domain analysis is also called sociological-epistemological paradigm (Hjørland, 1998; Hjørland & Hartel, 2003). Although in the early stage, some leading scholars (Wilson, 1981) appealed to pay more attention to the values that sociology and sociology of science may have to information science, the proposal has not gained many echoes until domain analysis emerged. It is domain analysis that substantively quotes the theories and methods of sociology, and fully utilizes them in the LIS research.\(^2\) Domain analysis is one of the few IS theories having apprehended the thoughts and methodologies of sociology and consciously exploring the information world in the way of sociological thinking. It should be mentioned that analysis of the community dimension in domain analysis is also based on the thoughts of sociology.

The social division of intellective labor is an important part of social dimension. The social division of intellective labor includes the social organization system of universities and research institutes, the structure of disciplines and occupations, the social organization mode of information channels, the system of document publication, the social roles and functions of different information actors, and so on. The social organization of knowledge (general knowledge organization), including social division of intellectual labor and sociology of knowledge, determines the principles of knowledge organization in information science (narrow knowledge organization)(Hjørland, 2008b).

The disciplines, specialties and their structures, relations in general knowledge organization research catch more attention from LIS. Disciplines, specialties and their dynamic changes (such as intradiscipline, interdiscipline) are the results of the social division of intellectual labor. They have a fundamental impact on the classification and knowledge organization in LIS, which has been elaborated by domain analysis (Hjørland, 2008b, Hjørland & Hartel 2003). Tennis (2002) designs the tool “Subject Ontogeny”. He analyzes and represents the evolution of the contents and structure of subject in order to refine the classification. His research is a good example about strengthening the effect and function of disciplines in the knowledge organization from the evolutionary view. Vickery (2007) believes that in order to understand and organize recorded knowledge, information professional “needs, first, to build up an understanding of the structure of knowledge, how it has divided and subdivided into ever more specific fields, and how these fields are forever interacting with each other to form a complex network.”

The sociology of knowledge and the sociology of science are another focuses of the social dimension. Domain analysis states that the theories and metatheories mastered by people, theories about how knowledge is produced in disciplinary structure in what information channels together guide information behavior directly, such as information seeking or browsing. Information professionals need to grasp the distribution of the metatheories in the information ecology in order that they can enable users bring the best strategy of information behavior into effect (Hjørland, 2011).

\(^2\) Nobel Economics Prize Winner Ronald H. Coase’s classic paper “The Nature of the Firm”(1937) in which the concept of transactional cost is put forward is quoted hundreds of times, but Coase complains that most of citing papers do not utilize his idea and actually few people knows his true idea. The hundreds of situations that sociology is introduced into information science is like that.
3.2 INDIVIDUAL DIMENSION: SOCIO-COGNITIVE VIEW

Domain analysis appears as a strong challenger of the traditional cognitive view. Since domain analysis was brought forward, the traditional cognitive view has not been the only focus of cognition research in IS.

Domain analysis criticizes for the individualistic methodology and the rationalism-based mental modeling of traditional cognitive view.

It demonstrates that the traditional cognitive view regards the isolated individual cognition and inner psychological structure, which are separated from the sociocultural and historical context, as the studying object and has the tendency of psychologizing epistemological issues. The orientation of traditional view makes the cognitive research in IS fruitless (Hjørland, 1997, 2002a). This criticism gets many scholars’ agreements. Cronin (2008) proposes that “the cognitive viewpoint’s emphasis on the individual’s knowledge state can cause us to lose sight of the epistemological significance of social relations and social structures … cognition is not an exclusively individual phenomenon nor is it readily amenable to scrutiny either inside or outside the lab; rather it is multi-componential and interactive in character”.

Wang (1995) argues that the social division of labor has a great impact on the utilities of knowledge possessed by individual, thus the individual knowledge structure mainly depends on his position in the social division of labor. The convincing criticism put forward by domain analysis urges advocates of traditional cognitive view to revise or give up their academic positions.

Domain analysis, as being the alternative paradigm of traditional cognitive view, also places emphasis upon the process of individual cognition, but its viewpoint is social-cognitive view. The theoretical basis of socio-cognitive view is the school of Vygotsky, Leontiev and Luria in psychology, including social-historical-cultural developmental theory and activity theory. The American Dewey’s pragmatism is also the source of socio-cognitive view (Hjørland, 2004, 2007a).

On account of these two kinds of theories, Hjørland (1991, 2004) maintains that cognition is firstly determined by the social practical activities and the contextual factors of socioculture and history. According to socio-cognitive view, human grasps the intermediate carrier of socioculture—the symbol system of language to transform the dynamics of cognitive functions from the early biological drive to the sociocultural and historical drive. The meanings constructed by sociocultural and historical contexts are the mediators constructed of cognitive process, and information professionals should investigate that mediating process of cognition thoroughly. He suggests that information science should adopt the outside-in research roadmap, applying the sociocultural context-based and community oriented methodology to analyze the formation and development of individual cognition. The individual cognitive structure, and the uncertainty and benefits in individual information activities can be really elaborated not through the physiological and psychological analysis on brain’s functions, but through understanding of the social role, educational level, the degree of association with knowledge domain as far as the individual is concerned. The basic logic is to epistemologize psychological issues. Epistemology is the best and most generalized mental models (Hjørland, 2002a). Socio-cognitive view can be explained well by the citation below:

Domain analysis consequently does not conceive users in general but sees them as belonging to different cultures, to different social structures, and to different domains of knowledge. Information producers, intermediaries and users are more or less connected in communities that share common
languages, genres, and other typified communication practices. There are different semantic distances between the agents. (Hjørland, 2004c).

Domain analysis holds that social-cognitive view is also the metatheory of information behavior research. Hjørland (2011) insists that human browsing behavior changes along with culture and context either physically or cognitively and is shaped by culture.

He quoted Vygotsky’s theory of higher mental functions to support his view. I totally agree with Hjørland. What I want to complement is: in his late time, Vygotsky,3 “Psychology’s Mozart”, changes his view that human’s lower mental functions are driven by biological nature, and believes these functions are also mediated by human’s symbols. The nature of human organism is determined by social reality to a large extent. The deep origin of human’s all psychological functions isn’t from the inside but the outside; they are not innate but can be only preserved in the cultural—historical form (Davydov, 2003).

According to this view, the whole essence of human information behavior and cognition is of society-culture-history, and furthermore the formation and development of such behavior and cognition are also dominated by the sociocultural and historical contexts to the last degree.

We could see from the discussion that domain analysis crosses three dimensions: society-community-individual. It can provide the unified theoretical framework and the ample substantive theoretical contents for information science. On the basis of domain analytic view, IS researchers need master the knowledge as follows: epistemological knowledge, context-based sociological knowledge, subject knowledge and knowledge about the metatheoretical ecology in information resources, and discourses distribution in domain. These kinds of knowledge involve all three dimensions of IS and are also contained in the social-oriented community epistemology research.

4 CHINESE LIS SCHOLARS’ RELATED RESEARCH

4.1 TSIEH HSUE-SHEN’ S IDEA ON INFORMATION SCIENCE

Academician Tsien Hsue-shen (1911-2008) is leading founder of Chinese industry of “two bombs, one satellite”, outstanding settler of Chinese scientific and technical information enterprise, especially in national defense field (Huo 2009, Wang 2013). It’s interesting that many ideas of IS put forward by Tsien are the mighty supports to domain analysis, although he was too old to get a chance to know about domain analysis more.

4.1.1 TSIEH HSUE-SHEN’S EMPHASIS ON EPISTEMOLOGY: ECHOING THE EPISTEMOLOGICAL METHOD OF DOMAIN ANALYSIS

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3 In recent years, an enthusiasm for learning Vygotsky is in all China. His masterpieces are translated and published systematically in China. The monographs and thesis about his theories in Chinese are published increasingly. In 1998, there found an academic research organization—Chinese Association of Vygotsky Research. From then on, there are annual sessions every year that promotes his thought in China. Wang (2009) is an excellent monograph on Vygotsky’s school of psychology.
Tsien has a distinct idea about the affiliation of information science: it belongs to noetic science. As the first person established Chinese noetic science, he considers it as an independent department in modern architecture of science & technology, just like natural science and social science. Tsien suggests that noetic science is very different from cognitive science (Wang, 2007). Tsien neither agrees brain science is the appropriate start point of noetic science, nor takes cranial nerves science as the basis of noetic research. On the contrary, he stresses that the laws of this new science should be explored by starting from the macroscopic view (Zhao, 2011). Tsien (1986) refines the disciplinary status of information science and defines it as an applied science of the noetic science, paralleling with scientific methodology.

In the modern architecture of S&T, Tsien (1986) singles epistemology out for being the fundamental subject of noetic science. Because information science is an applied science of noetic science, it should be based on epistemology. To use epistemology as the theoretical guideline of IS research is of great importance for making rapid disciplinary progress. That Tsien considers epistemology as the philosophical foundation of information science is consistent with that domain analysis puts emphasis on epistemology. No doubt, Tsien agrees on Hjørland’s domain analysis. Domain analytic paradigm holds that epistemology is the most fundamental method of domain analysis. If this method is lacking, all others will become too superficial. Any theoretical problems in information science will be finally deduced to the basic research about its epistemological hypothesis (Hjørland, 2002).

Hjørland has set up a website discussing epistemology, which is named Epistemological Lifeboat. The comparison of the role of epistemology in IS to lifeboat stresses that the future of information science crucially depends on epistemology.

### 4.1.2 SOCIAL NOETIC SCIENCE: RESEARCH EXEMPLAR EMBODIING THE IDEA OF DOMAIN ANALYSIS

Tsien attaches much importance to social thinking and group thinking. He brings forward the concept of social noetic science by which it is meant a discipline studying both the principles that human as a group thinks and the interrelations, interactions between different group thinkings. He and his workmates integrate the social noetic science into meta-synthesis to found the decision supporting system, Hall for Workshop of Metasynthetic Engineering (HWME).

“The nature of human’s thinking is social” is the essential idea of social noetic science. There are two kinds of Chinese scholars’ discussions on the nature of social thinking. One stresses on the social feature of thinking, stating that since human is synthesis of social relations and thinking is social actor’s thinking, so human thinking is shaped by forefathers, other people, social environment and historical traditions (Dai, 2007: 15). The other one studies social thinking from the perspective of group thinking. People sharing the same natural and social characteristics cluster a group in the process of thinking. As the thinking subject, this group shows its thinking ability as a whole to form the specific systematic function and produce general thinking ability that any single person isn’t able to get. It’s an expansion of individual cognitive ability. It’s not a simple multiplicity of individual thinking but a social thinking that forms on the basis of the interrelations, interactions among a group of people according to a given rule. The modern research on human intelligent behavior finds that most intelligent activities are involved in social group. The most important and most part of intelligence are manifested in social activities. Social intelligence is the product of social thinking and

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4 Meta-synthesis is the put forward by late Tsien to resolve Open Complex Giant System (OCGS). Meta-synthesis has an intimate relation to social noetic science. Meta-synthesis has become one of the important theoretical foundations of information science in China.
can be seen as group intelligence emerging from group thinking (Dai, 2007: 163-165; Dai, etc. 2013: 35-36).

Both kinds of discussions about social thinking reflect the essential idea of domain analysis. The first actually is a republication of socio-cognitive view. The opinion that individual cognition is formed by the sociocultural and historical context, which the socio-cognitive view argues, is manifested well in the first kind of discussion (Hjørland, 2004).

The second supports domain analysis as community epistemology. Tsien’s view that the think subject is group consists with the domain analytic view that community is the basic research unit (Hjørland & Albrechtsen, 1995). Since group thinking means the ways by which community as a whole produces, acquires, uses and assesses knowledge, so it belongs to the research field of community epistemology. Besides, social thinking based on the meta-synthetic methodology puts stress on the emergence of social intelligence and group intelligence and integrates science of complexity into its research. This is worthy of reference for domain analysis.

4.1.3 THE NECESSARY EXPERTISE OF IS RESEARCHERS: MODERN ARCHITECTURE OF SCIENCE AND TECHNOLOGY & SCIENCE STUDIES.

Domain analysis calls for the study on sociology of knowledge and regards it as an influential discipline in relation to information science. This is echoed in Tsien’s research. By using the modern architecture of science and technology as reference framework, Tsien discusses the disciplinary relations and background knowledge of information science. He claims that IS scholars and practicers, should understand not only the development of modern architecture of S&T, the disciplinary relations changes and declines of old disciplines in that architecture, but also knowledge about social phenomenon of S&T research activities to avoid our narrowness. So in order to do the information research and analysis well, in Tsien’s opinion, we must have some special kinds of knowledge: one is architecture of science; the other is science of science (Shi, 2009). Architecture of science is the S&T knowledge, while science of science is a kind of social science and refers to the sociological knowledge about scientific research activities. To learn and master these two kinds of knowledge, then internalize them into the disciplinary framework is a necessary way to improve the theoretical level of information science.

Tsien’s idea is consistent with the domain analytic paradigm. Domain analysis focuses on the roles of subject knowledge, science studies and sociology of scientific knowledge in IS; it insists that information science is meta-science, that is, the science of science. Because of that, science should become the research object of IS and exploring the system structure and social features of science should become the goal of IS. The research output is knowledge of science architecture and sociological knowledge of science, which actually are the aforementioned necessary knowledge of IS research formulated by Tsien. I think if Tsien was alive, and had chance to know the domain analytic thought, he would be applaud it and become a firm advocate and propagator of domain analysis.

4.2 THE RELATED RESEARCHES OF OTHER FAMOUS CHINESE SCHOLARS

In addition to Tsien Hsue-shen, there are many LIS Chinese scholars whose researches are related to domain analysis. Especially some well-known library scientists in earlier times could be seen as
the contributors to the domain analysis. Limited to space, this paper focuses on Zhang Xuecheng, Liu Guojun and Du Dingyou.

4.2.1 CHINESE CLASSICAL BIBLIOGRAPHY WITH ZHANG XUECHENG AS THE REPRESENTATIVE

Domain analysis shows that knowledge organization in LIS should be embedded into the scientific inquiry and research activities of special knowledge domain, making some contribution to the knowledge progress and development of the domain. The information professionals should become special participants and researchers in knowledge domain, rather than mechanical, routine service workers (Hjørland, 2007c, 2008c).

The main way to become participants and researchers is to fully identify and present theoretical perspectives, paradigms and epistemological bases in knowledge domain to users, and show the distribution of metatheories in the information ecology to the conscious and literate users and enable them to browse, examine and choose among various knowledge claims critically (Hjørland, 2004b, 2008a, 2011). I believe this may be the greatest contribution that LIS can make to realization and protection of civil rights in the democratic society. It makes the freedom of choice possible on a deep level and also achieves democracy and equality on the problem of the information. Social democracy can be reached through the democracy of information and the freedom of the human development through the freedom of information only if the information work suggested by domain analysis is done.

The thought of Chinese classical bibliography fits domain analysis. Chinese bibliography research also stresses that the work of bibliographic organization should be integral to academic research and contributes to it in the knowledge domain, which is considered as the primary objective of bibliography. The typical representative is the research of scholar Zhang Xuecheng in the Qing Dynasty.

Zhang fully develops the idea that Chinese classical bibliography regarded bibliographic organizations as organizations of academic thoughts. He points out that the main functions of bibliography are to identify and clarify the different academic schools and theories, elucidate and represent the origin, development, evolution and scholastic inheritance of the academic schools to guide scholars to access literature and conduct research; classification, indexing and interpretation of documents must be connected with academic history and academic development (Lu, 2008). Zhang’s regarding bibliographic organization as important methods of scholarly pursuits improves the status of bibliography and promotes the social recognition to it. His thought has become the core idea of the Chinese classical bibliography (Lu, 2008). In this sense, the Chinese classical bibliographer’s mind and the domain analytic scholars’ minds in modern information science meet.

But unfortunately, modern Chinese library science does not inherit the fine tradition of Chinese classical bibliography that locates the goal of bibliographic organization as distinguishing and organizing different schools of academic thoughts, and actively participating in academic research activities. Modern Chinese library science research mainly is introduction and replication of library science in the western countries, which particularly emphasizes on IT application to library. This way of conducting research greatly weakens the position of the fine tradition of classic bibliography. At present, we can make good use of the rise timing of domain analysis in China and vigorously recover the tradition of Chinese classical bibliography, to make this tradition that is full of strong intellectual factors rejuvenated in Chinese LIS research. In this way, the Chinese traditional paradigm and the Nordic domain analytic paradigm will shine each other.
4.2.1 LIU GUOJUN AND DU DINGYOU: THEIR THOUGHTS IN RELATION TO DOMAIN ANALYSIS

Chinese library scientists’ focus on the relationship between scientific classification and bibliographic classification to a certain degree coincides with the arguments of domain analysis implicitly.

Domain Analysis holds that scientific classification and bibliographic classification are closely related and the former should be the base of the latter. To avoid being reduced to naive knowledge organization tools, bibliographic classification design should follow the principles of scientific classification and attach importance to theories in subject domains. Sadly, this view, supported by forerunners like Sayers, Cutter and Richardson, is being neglected by many LIS researchers in the digital age (Hjørland, 2002b; Hjørland & Nicolaisen, 2004). Meanwhile, the design of both scientific classification and bibliographic classification are determined by certain purposes and social interests. They result from active constructing process by different scientific theories. Pragmatism is the best metatheory to study the construction and evolution of classifications and it’s also the best way to compare different classifications (Hjørland, 2011c). To put in another way, domain analysis answers the two fundamental questions regarding classification contentedly: “1), How independent should bibliographical classifications be in relation to scientific classification; and 2), what epistemological methods or combination of methods, should be used?” (Hjørland, 1998). In fact, these views of domain analysis are supported by Chinese modern library scientists with Liu Guojun and Du Dingyou as representatives.

Liu (1899-1980) was the dean of the Department of Information Management in Peking University. Hailed as the grand master of Chinese library science, he was the first to introduce MARC and online cataloguing to China, and also one of the first Chinese scholars that introduced and studied DDC in China.

As for the relationship between scientific classification and bibliographic classification, Liu (1962) believes the former should be the most basic method. The nature of the scientific content of a book and its position in the architecture of science are the most important factors to consider when being classified. LIS researchers cannot arbitrarily group and divide the categories in bibliographic classification. The arrangement of categories should be scientific to avoid messing up the relationship between different subjects and confusing the division of science. Category organization in LIS must obey the principles of disciplinary organization and follow its status quo. Only in this way can bibliographic classification be of assistance to scientific research (Liu, 1962).

Liu (1953, 1981) also points out that knowledge classification is some different from bibliographic classification; The design work of the later is not just copying the former. The reason is: for ancient books or books that contain old and stuck questions and knowledge, there should be corresponding categories in bibliographic classification to put them in so that user can access these books easily. This requires that we should design bibliographic classification on a holistic knowledge evolving point of view. In retrospective information retrieval, domain analysis states that all different kinds of semantic relations (old and new) in each period caused by the changes of theoretical views should be shown in semantic tools and presented to the users (Hjørland 2006). It’s not difficult to see that Liu’s views are the same to Hjørland’s argument and also based on historism.

To sum up, apart from being directly influenced by academic development, growth of S&T knowledge and scientific classification, bibliographic classification are fundamentally constrained by
the social nature and determined by the evolving nature of themselves (Liu, 1978). Therefore, one can see that Liu was indeed a supporter of domain analysis.

Another Chinese library scientist enjoying the same popularity with Liu, Du Dingyou (1898-1967) argues that because the books contain lore, mastering the classification of lore is the requisite for the work of classifying books. Bibliographic classification should be based on scientific classification and obey the rules of scientific classification to reflect the evolving process of objective reality and advances of science. But these two kinds of classification aren’t all the same. Good bibliographic classification is one side, scientific, the other side, pragmatic to serve readers better (Du, 1962, 1957a, 1957b). As to the principles of classifying and indexing, Du (1957a) thinks that to develop the utilities of a book as possible as an indexer can is the most important one. Under such a view, the problem indexers should consider at first is that what kind of the user group will read the book. If only indexer targets users group, she/he can know the potential utilities of the book for that special group and then determine which category the book belongs to. This is consistent with domain analytic views of subject analysis.

As for library science, Du (1926) states it is science of science, whose top goal is to make library become confluence of scholarship and improve academic level of each discipline. He proposes that library science should help each kind of science make progress and contribute substantively to academic research and knowledge growth of all sciences. That ought to be what all librarians and library scientists are praying for day and night. In other word, Du illustrates the goal of library and information science well in remote east from the angle of domain analysis.

4.3 Research Tradition of Subject Knowledge and Its Renaissance in Information Science in Chinas

The developmental history of Chinese scientific and technical information enterprise is a history that concentrates on subject knowledge. Before 1990s, scientific and technical information science is the synonym of information science and the work of the S&T information is the synonym of information work in China. It is generally regarded that mastering respective subject knowledge in different industries is prerequisite to all types of S&T information service, such as metallurgy information service, mechanics industrial information service, traffic industrial information service, nuclear technological information service, and so on. Therefore, Chinese S&T information service centers recruited many researchers and graduates having diplomas of nature science, technology or engineering and let them be trained in LIS to be special librarians. Most of the excellent scholars and executives of IS at that time were the masters in science. For example, Yuan Hanqing, the first director of Institute of S&T Information of China, was a famous chemist and science academician.

Chinese IS education also concentrates on subject knowledge. However, until the end of the 1990s when the IS major was reformed by the Chinese Education Ministry, the status of content had been equal to that of form in IS curriculum, and even more important than the later one. When I was an undergraduate student majoring in S&T information science in Tianjin Normal University in the middle of 1990s, the serial courses-introduction to modern science& technology were set from the first semester and lasted for four semesters. In each semester, a professor employed from other polytechnic university taught us a course about science or technology, such as introduction to chemical engineering, the foundation of life science, metal craft technology and electric engineering. During the courses we students were organized to visit factories and related high-tech companies and practice there, aiming to lay the foundation of the subject knowledge for students who would
undertake the job of S&T information service after graduation. The facts turned out that subject knowledge-oriented pedagogy of IS is very effective.

In 1998, the Chinese Education Ministry cancelled the major of S&T information science and integrated it with business information management and MIS to create a new major—“information management and information system”. Since then, the courses related to the subject knowledge gradually disappeared in undergraduate curriculum. With widespread use of the Internet and enhancing role of IT in IS discipline, Chinese IS education including master degree and Ph. D degree education attaches too much importance to the courses related to computer science. Technology-oriented studies have a high ratio in IS dissertations. The balance between content and form in information organization and retrieval research are regrettably lost. The form is more preferred. In China the hot topics of general information science and form-oriented research fade the subject knowledge in LIS.

It is gratified that in recent years some scholars have pointed out that ignoring subject knowledge does do harm to LIS. Thus, they call for the renaissance of the subject knowledge in LIS education and research. After checking recruiting information in Chinese libraries and information centers, I find that the masters and doctors majoring in science and technology are highly demanded. Since I taught in university, I have always encouraged LIS students to minor and try to get the second bachelor degrees. The students are required by me to explore and reflect on the minors with the identities of the LIS profession. Most students follow my suggestions and choose the minors, such as math, education, chemistry, economics linguistics and accounting, etc. Any amounts of students say that they benefit a lot from this and their confidences of undertaking the job of information service in the future become stronger. I think this is the reason why domain analysis is so attractive.

The scholars of the domain analytic school have paid attention on subject knowledge for a long time. As early as 1988, Hjørland, the founder of domain analysis, takes information retrieval in psychology as an example to discuss the decisive role of subject knowledge in effective information retrieval and service (Hjørland, 1988). Since domain analysis was brought forward formally in 1995, subject knowledge has always been its core issue. The scholars of domain analysis maintain that in every subject domain there exist unique terminologies, the ways of their use and discourse conventions, knowledge about which is an expertise that information profession should master when performing information service.

Only by mastering subject knowledge can information professional better do the job of understanding users’s information needs and information ecology in certain domain, interpreting the meaning of information and valuing it, establishing informational authority to users (Bawden &Robinson, 2012). Here, subject knowledge includes not only terminologies and conventions of discourse system, but also different theories, schools, scientific principles and classifications in certain domains. Domain analysis states that subject knowledge rather than users’s knowledge should become the basis of knowledge organization, information need and relevance research etc. in LIS (Hjørland, 2008b, 2010). Under such a view, scientific theories, paradigms and epistemologies are the most fruitful contents that form semantic contexts of knowledge claims and document subjects and the most important variables to study co-evolution and interaction of information systems and users (Hjørland, 2010). Armed with subject knowledge, information specialists can easily utilize their general LIS knowledge in a top-down way to undertake the information work in a subject domain (Hjørland, 2004d).
Hjørland (1998) points out that philosophy could be used for analyzing the metatheory and theory of information science and fundamental epistemologies should form the basis of metatheories in IS. Domain analysis is also based upon the philosophical theory elaborated clearly by Hjørland: pragmatic realism. Just because the philosophical foundation of domain analysis is solid and clear, the theory construction of domain analysis can have a fast development. Hjørland is the first scholar in IS to adopt the triadic mode of theoretical construction, that is, the construction mode of “philosophical metatheory-theory-application”. His research exhibits the constructive role of philosophy for IS theory.

Pragmatic realism is a philosophical theory synthesizing pragmatism and realism organically. On one side, pragmatic realism insists that there exists a reality independent of human consciousness. On the other side, it holds that to support human goals, values and actions is the fundamental criterion of evaluating scientific concepts and theories, which are scrupulously constructed to manifest the nature of reality (Hjørland, 2003, 2004c). Thomas Kuhn is seen as the scholar holding this standpoint. I agree in Hjørland's idea that the pragmatic realism is logically self-consistent and coherent. I think that as an philosophical theory, pragmatic realism is the most promising metatheory in information science so far. It can also fundamentally ensure that information science research avoids fruitlessness and goes along the right way. I will respectively discuss the main components of pragmatic realism—the principles of realism and pragmatism as following.

It seems that although realism is weak in the western countries, it is very popular in China. It also represents the mainstream of philosophy in China. Since “all good science should have a realist foundation” (Hjørland, 2007b), the appropriate philosophical basis of information science should be realism rather than anti-realism, which unfortunately still attracts many LIS scholars stealthily and forms the metatheory of their research. Dousa (2010) argues among all the pragmatists, Dewey’s including objective realism of knowledge and conception of community philosophic thinking is the nearest to pragmatic realism. Pragmatic realism also absorbs James’ thought of course. However if considering the issue that whether different schools of pragmatism accept realism, we can find that since James the tendency has arisen to turn the standpoint from realism to anti-realism in pragmatism and culminated at Rorty’s research, whereas the founder of pragmatism, Pierce’s philosophical thought and Putnam’s scientific realism are the exemplars insisting on realism. Dewey’s contextual realism whose research object is reality in certain context can be seen as realism to certain degree (Tu, 2006:51-52). So in my opinion, the pragmatic realism of domain analysis is consistent with Pierce’s thought, Putnam’s scientific realism, and overlaps with Dewey’s thought mostly. Pierce, Dewey and early Putnam are the same pragmatic realists as Kuhn. In addition, it is interesting that although anti-realism prevails in pragmatism research, but except for Rorty, the title of “anti-realist” isn’t applauded among most pragmatists (Tu, 2006:103). It’s necessary to explore more about the representatives’ thoughts relative to pragmatic realism in each school of pragmatism.

The requisite for prosperity of LIS is the acknowledgement of social reality. For information science, this reality is a social reality in more situations. First, it contains social events, activities and objects which constitute the substantive knowledge at the ontological level. This kind of social reality forms the basis of KO and IR work. Hjørland (2002a) used the example of retrieving documents about the train accident to illustrate the importance of social reality. Secondly, social reality refers to the social production, organization and communication of knowledge in subject domains and discourse communities, within the process and structure of which the meanings of terminologies and documents are developed and embedded (Hjørland & Pedersen, 2005). Therefore when LIS
professionals begin to work, what they face is this “given” social reality. For them, paradigms, theories and views competing with each other are the real knowledge structure of domain that already exists objectively. Knowledge organization system design, knowledge organization activities (classifying, indexing etc.) and IR in LIS should be based on this solid, social reality rather than users’s psychology that is proven to be an illusionary reality eventually. Thirdly, ignoring these layers of social reality will lead LIS to fall into idealism or anti-realism.

As for research on users’ needs and their interaction with information, objective possibilities based on the first and second kind of social reality and information ecology can best explain users’ information needs and seeking behavior and are the ideal utilizing source for user service. Knowledge of such objective possibilities is the essential content that should be taught in user instruction (Hjørland, 2004c). This means an outside-in logic is necessary in users studies. Any theoretical construct of user studies should be filtered by the standard of realism before they are incorporated into IR theory. In addition to subject knowledge, IR theory must attach great importance to the degree of realism in users profile, semantic distances between users and information resources coupled by the same conceptions and theories (Hjørland, 2004d).

Pragmatism is the core thought of domain analysis. Pragmatism is one of the four main epistemologies which constitute the metatheories of information science (Hjørland, 1998). The three others are positivism/empirism, rationalism and historism. Domain analysis mostly criticizes positivism/empirism that is the dominating metatheory in IS. Research on domain analysis has systematically and convincingly elucidated the drawbacks and disadvantages of positivism/empirism as the philosophical foundation of IS, including: anti-realism; regarding knowledge as separate facts or thoughts; viewing knowledge organization as “a bare transcript or duplicate of some finished and done-for arrangement pre-existing in nature”; no exploration in causes and basic mechanisms of non-relevance; “one size fits all” idea established deeply in information representation and users modeling in system-oriented and user-oriented traditions without considering domain-specific issues, etc. (Hjørland, 2000, 2005, 2008b). These statements make more LIS scholars aware of the fallacy of positivism. Consensus of seeking alternatives to positivism is forming.

Domain analysis demonstrates that historism and pragmatism are the most suitable ones. Especially pragmatism is the best epistemology or metatheory for information science (Hjørland, 2011a). Contrary to positivism/empirism, pragmatism stresses that human goals, interests and activities play critical roles in theory construction and acceptance; and they form the baselines against which what is truth is judged. In the broader sense, both facilitating scientific progress and having utilities for human, which are two sides of one coin, are the nature of pragmatism (Hjørland, 2003b, 2011c). I think model-dependent realism put forward by physicist Stephen Hawking in his recent book “Grand Design” elucidates the broader form of pragmatism and Hjørland’s point of view precisely: (Hawking-Mlodinow, 2010).

“The goldfish view is not the same as our own, but goldfish could still formulate scientific laws governing the motion of objects they observe outside their bowl. ... If there are two models that both agree with observation, like the goldfish’s picture and ours, then one can use whichever model is more convenient in the situation under consideration.”

Pragmatic views in information science include: living and acting are the origins of knowledge; viewing knowledge as knowledge claims serving human goals and values; in general, “knowledge organization should be functional and thus reflecting given goals, purposes and values” (Hjørland, 2006c); any classification is theory-laden and biased (Mai, 2003); and corresponding to special goal, purpose and user community, this bias is positive and we should make it explicit; indexing is an activity representing information potentials and satisfying human goals and values which is
neutral in no way (Hjørland, 2011d); semantic relations are theory-embedded and “determined by their function as tools for human goals” (Hjørland, 2003b); mainstream research in IR is problematic because it overlooks how algorithms discriminate against some views and interests in favor of others (Hjørland, 2008b).

6 CONCLUDING REMARKS

I teach the course of information storage and retrieval to undergraduate students majoring in business administration each semester. Several years ago when I was teaching the chapter of online document retrieval in the class one day, one of the students rose his hand and asked me: “Professor, the intellectual level about these methods of information organization and retrieval is too average. Why not organize and access documents or information according to the theoretical views?” Of course he, whose major is not LIS, did not hear of domain analysis before. I suddenly realize that what domain analysis research concerns is the informational nature of human beings in society. Domain analysis can address the intrinsic needs of human beings. Domain analysis provides optimal strategies for effective human information processing. Only through information work based on domain analysis can human information needs in society be best satisfied.

Over the past twenty years, domain analysis has established its academic status in the international LIS circle. Being an important metatheory, paradigm and methodology, domain analysis become the theoretical foundation of LIS research. The developmental history of the domain analytic school represents the rise of Nordic school in LIS. In this paper, I discuss domain analysis from several aspects. First, domain analysis is thought of as community epistemology. I give an account of the concept and implications of community epistemology. The double-tier structures of community epistemology are identified. Second, I argue that domain analysis can provide a theoretical framework for the construction about unified information science. Dimensions that a unified information science has are reviewed from the perspective of domain analysis. Third, some representatives of Chinese LIS scholars, whose thoughts are related to domain analysis, are elucidated. It is demonstrated that these scholars’ thoughts give mighty supports to domain analysis. Finally, I investigate the philosophical foundation of domain analysis, that is, pragmatic realism in detail. For the next twenty years it is my strong belief that domain analysis will still be the most promising and the most fruitful research direction in LIS field. The great disciplinary changes that domain analysis will bring about may be beyond our expectations.

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