Social Informatics and Information Society:
The Roles of Sociologists and Computer Scientists

Chyi-In Wu
Institute of Sociology, Academia Sinica.
E-mail: sss1ciw@gate.sinica.edu.tw

Tyng-Ruey Chuang
Institute of Information Science, Academia Sinica.
Email: trc@iis.sinica.edu.tw

Yi-Chien Chen
Institute of Sociology, Academia Sinica.
Email: cic@gate.sinica.edu.tw

Hsin-I Huang
Graduate School of Social Informatics, Yuan Ze University.
Email: shinny@iis,sinica.edu.tw

draft

Paper to be presented at the International Conference on "Challenges to Interdisciplinary Collaborative Research," December 14-16, 2006, at the Institute of Ethnology, Academia Sinica , NangKang, Taipei, Taiwan, 11529.

2006/12/11

Introduction

Kuhn (1972) used to argue that the typical developmental pattern of a mature science is the successive transition from one science paradigm to another through a process of revolution. When a paradigm shift takes place, a scientist's world may be qualitatively and quantitatively transformed by fundamental novelties of existing theory. Also, Kuhn described paradigm changes as the invention of new theories brought by the failure of using existing theory to solve the problems defined by that theory. Nowadays, scientific questions need to be solved by scientists are getting gigantic and complicated. It's hard to only dig on your own scientific paradigm but not try to communication with other disciplines. Based on this presupposition, it seems like the approach of collaborative research is the most important strategy, which could lead to paradigm transition. As we already known, the strength of interdisciplinary scientific collaboration has its potential capacity to bring together diverse professional knowledge to address complex scientific problems and eventually help sciences make progress.

Nonetheless, interdisciplinary collaboration on scientific researches are very difficult to initiate and sustain. Previous studies used to discuss questions about what collaboration is, what will motivate collaboration, who are the collaborators and what are the costs and benefits while collaborating with other scholars in diverse fields (Katz, 1997). Many scholars who have been involved in some kinds of collaborative researches did suggest that collaborative researches could enhance the exchange of diverse information, stimulate new idea from the process of discussion, encourage cross-fertilization across disciplines (Melin, 2000), and to have greater potential for mentoring and training for young scientists (Bozeman and Corley, 2004).

The main object of this paper is trying to review and examine these previous assumptions about the outcomes of collaborative research one at a time based on our previous rehearsals. Actually, it is a case study of the collaboration between a sociologist and an information scientist. Traditionally, sociology is regarded as a more theory-oriented knowledge system and information science is a more application-oriented discipline. In this paper, we intend to share and rethink our two

previous collaborative instances and hope our experiences could provide useful suggestions for further constructing an ideal pattern of collaboration between natural science and social science.

Wu and Chuang, the first two authors of this paper, started their collaborative research in 1997. In the very beginning, the trigger of this collaboration was a question asked by several information scientists, that how come sociologists didn't pay any attention on the newly rising "Internet" phenomena in Taiwan at that historical moment. After that, the Institute of Sociology and the Institute of Information Science in Academia Sinica jointly held the "Information Technology and Social Transformation" Conference in 1997. Wu and Chuang, at that time, were the two young specialists from both disciplines to undertake their first informally collaborative research work, a web-based software system for social network analysis, to solve a research question, which both sides are all interested. In heir first experience, the mindset and motives is to provide an easy use web site where users can perform standard social network analyses on their own empirical data (Chuang, Low and Wu, 1999). In the collaboration, Wu, the sociologist, provided the theory of social network analysis and theoretical thinking of the collective relationship structure in the society. On the other hand, Chuang, the Information Scientist, has the needed programming skills, the ability to realization of the graph theory and the knowledge to architect software upon the web-based system. Besides, in the 2004, Wu and Chuang teamed up again and this time they co-worked on the issues of the e-impact of the information society and the quality of life of citizens in an information society. Unlike last cooperation which was informal, the second one was a government-sponsored research project. Wu was in charge of conducting the survey and analyzing the data while Chuang served as the technical consultant who provided unique points of view to describe the impact of information technology on information society.

The discussion and rethinking of the collaborative research

In the following paragraphs, we synthesize experiences from both previous

empirical studies to provide a more comprehensive understanding of interdisciplinary scientific research collaboration. Accompany by existed literatures, we are going to discuss the crucial factors for collaborative research in our cases. We identified four factors, i.e., motives, contested group, sharing and transferring of knowledge and skills, and training of young scholars as the most critical factors to promote an ideal collaborative research. Each factor is discussed below:

(1) Why collaborate? The Motives

The most commonly cited reasons for collaboration include access to expertise (Thorsteinsdottir, 2000), access to equipment or resources (Beaver, 2001), to improve access to funds (Beaver, 2001), to gain prestige or visibility (Katz and Martin, 1997), to pool knowledge for tackling complex research problems (Thorsteinsdottir, 2000; Beaver, 2001), to increase productivity (Beaver, 2001) and have fun and pleasure (Katz and Martin, 1997). Nevertheless, other scholars argued that it is only economic benefit playing the role but not social benefit. According to these interesting assumptions, we tried to investigate the reasons for collaboration between sociologist and information scientist. Here are the comments out of the two participants:

Sociology side:

> *Although the sociology and computer science are entirely different academic subjects, we decided to cooperate with each other in running the social network data, since for the sociology, it owns the sociological perspectives to generate the unique researches of social network, but the research method of traditional sociology of social network analysis cannot attain the effect of network visualization. As a result, when the sociological perspective combines with the perspective of computer science, it contributes to the specification and visualization of sociological perspective in the empirical data. It also fulfilled the move of the knowledge required to enhance the understanding of the relationship structures and social meanings.*

Computer science side:

> *For computer scientist, we care about the questions of "What the data is capable of doing," "What could be analyzed from the data," and "How to display the data," especially when the presentation and graph of relationships of social networks matters. These questions are not difficult to clear out, but overcoming the questions will be a meaningful contribution on the computer science.*

In this case, sociology, originally, served as the basic subject runs into the obstacle to go advance of the methodology in network data. At that moment, interdisciplinary collaboration provided a good chance to integrate the technology of computer science to contribute to how to visualize the sociological perspective of social network. The outcome for both sides is that both sides all declare that this integrated and collaborative research work makes them believe that it is possible to collect resources for co-studying and to have the ability to handle any difficult research ideas, which across the interdisciplinary borders.

(2) Contested collaboration

Differences in tools, methods, paradigms and concepts may increase the likelihood of contested collaboration, where collaborators challenge each other in trying to contribute to the collaborated research task. This is also the most interesting part during a collaborative research. Although the disadvantage of group diversity (i.e., it's much harder to organize) (Finholt, Sproull and Kiesler, 2002), the process of trying to explain and debate with others is important for mutual understanding and for further technology advance. Tushman (1977) argued that the role of boundary spanners may help collaborators better understand each other by passing the interpretive information and arbitrating the conflicts among team members (Sonnenwald, 1996). And, Sonnenwald (2000), on the other hand, warned that when challenges are managed in an unproductive manner, it negatively impacts work. It seems like the contested behavior also plays role in collaboration. Was it also significant in our previous experience? Our participant commented:

Sociology side:

In our standpoint, "utility" could be used to estimate one tool of research methods. In other words, the utility of good tool manifests on generating significant or insightful meanings in theory of sociology. According this, the interdisciplinary collaboration between sociology and computer science is an innovation on methodology. The progress of methodology brings the new path to approach the sociological theory and empirical research.

Computer science side:

In our standpoint, we are concerned much about "the efficiency of information programming," "how fast of the computing time,"and "whether or not complete the job with the less equipments,", those are prefer to consider the "technology" and "utility". Furthermore, when resolving the same question, practicing the way of mine will get more utility than others is the best ideal-program. And we take this for our major concerning. Less time and less resource bases on the concern of prime cost, there are greatly different between the thinking of sociologist and computer scientist.

Take the two different experiences as examples; it should be pay more attention by collaborators on the issue of competition in the process of interdisciplinary collaboration. From the examples, we can understand that the most important function of the atmosphere of competition is useful in stimulating both subjects, but not to compete with each other for the leadership or dominance.

(3) Sharing and transferring knowledge and skills

The very nature of interdisciplinary collaboration expects that participants teach and learn from each other so that they have a common ground from which they can substantially work together. This exchange of diverse knowledge can facilitate the progression of scientific knowledge (Klein, 1994). Interdisciplinary collaboration often involves resolving problems in new areas which may be especially exciting and stimulating, leading to discoveries and the questioning of previous assumptions during the experimentation process (Salter and Hearn, 1996; Thorsteindottir, 2000). Katz and Martin (1997) suggested that collaboration may bring a clash of view which may generate new insights that each scholars, working on their own, would take a much long time to comprehend and tackle. To sum up, previous studies most likely believe that collaboration is greater than the sum of its parts. Back to our own experience, we tried to ask some questions about the issue of exchanging knowledge and cross-fertilizing with each other. Our participants explained:

Computer science side:

It should be said that the collaboration did not push us to realize the subjects from each other. In the single project, we do what we can do and

each of us obtains what he need in the process of the collaboration. In other words, neither did we enhance the understanding of another subject, nor to have enough knowledge to do the researches of another subject. "Every man has his merit and every man acquires his demand" just like our experience. Instead of learning from the other subject, Wu and Chuang affect nothing to the original subject. From the perspective of a problem, computer science fulfilled the goal of the network visualization, and at the same time attained the realistic data to practice the way to know how. Moreover, we can compare with many kinds of data set to test the generality of the way

Sociology side:

Realizing perspective and technology of another subject may bring the new opportunity to initiate new knowledge, find a new path on the methodology and overcome the obstacle to the traditional subject. Besides this, to be the collaborators of interdisciplinary collaboration, we should do advance to think about "whether or not the process of collaboration increases the comprehension of each other", and "is it necessary for components of the collaboration?" From the perspective of a problem, sociology attain the new advance of knowledge required to enhance the capturing the mechanism of the interpersonal relationship structures and the phenomenon of contemporary society. Resolving some questions of basic subject, just like sociology, mean that the subject find the new way to go forward.

When the progress of knowledge runs into some problems, finding the new way is the lively motive power of the subject. And the interdisciplinary collaboration provided opportunity for collaborators to overcome the problem, as well as finding the new way to approach the unknown world. Therefore, "the merit of research question" is the beginning to open the possibility of interdisciplinary collaboration.

(4) Mentoring young scholars

In terms of the factor of student resources, in the past, they are mostly regarded as only human resources (e.g., Beaver, 2001). Students facilitate collaboration by conducting background research, running experiments and acting as communication bridges between collaborators. They were viewed as facilitators in every stage of the collaboration process, although their contributions were rarely discussed on the table of the interdisciplinary research. Gradually, some studies begin to observe if students can obtain benefits from the interdisciplinary experience.

Bozeman e al. (2004) is the one who proposed that scientific collaboration often plays a critical role in developing S&T human capital, especially in those cases where the collaboration takes on mentoring characteristics, that is, when a more experienced scientist collaborating with a junior scientist, a post-doctoral researcher, or a graduate student. He defined scientific and technical human capital (S&T human capital) is the sum of scientific, technical and social knowledge, skill and resources embodied in a particular individual. S&T capital is the unique set of resources the individual brings to his or her own work and to collaborative efforts. Students as human resources may be the lubricant in the collaboration process (Corley et al., 2006). Therefore, in this paper we further want to discuss the situation of mentoring students during collaboration. What should students learn from the interdisciplinary research? Is it possible to train students being an interdisciplinary scholar in the process of interaction and knowledge exchange? Our participants commented below:

Wu:

The members of research team are major core to operate the process of the collaboration interdisciplinary. There are several graduate students and postgraduate students teaming up to be my research team and involving in the process of interdisciplinary collaboration. The collaboration constructs the resources and the students who are interested in the research between sociology and computer science. The collaboration forms the condition to enhance chances to talk to others who major in another subject. Besides, it benefits the joining students or junior scholars from increasing contacts with the collaborators, like the professors, and building up the circumstances to improve the realizing what the computer science is and how the problem of sociology to be resolved. Gradually, there are more and more contacts with participators from two subjects, the joining students and junior scholars grow farther matured to handle the difference between both subjects, as well as, they can learn more about the computer science and comprehend the sociology deeply.

In a word, it is important to remind that the collaboration supply an integrated circumstance for the joining students and junior scholars to learn the attitude and vision of the interdisciplinary. As participators, it means that they have chances to use the resources between both subjects, in the meanwhile, having the duty to continue the reward of the collaboration

experiences.

Chuang:

According to the character of the computer science, it tries to find the way to resolve the question, moreover, increasing more kinds of data sets to fit the way in the collaboration. In the process of the collaboration, the common participators of our subject get some stimulation to rethink the relationship between social informatics and information society. For our science paradigm, we are concentrated on the job in progress of our subject, neither to think what we could do to other subjects nor to think what the relationship between our major in and the society.

The interdisciplinary collaboration gives us not only some inspirations to rethink the concern and the purpose of our subject, but extend the possibilities of technological application in the computer science. The common participators, such the joining students and junior scholars, can own a widely open mind and view to conceive more innovation in our own subject, even to the technological application in the society.

Open mind and wide view are good to all the participators, the experience of interdisciplinary collaboration give the chance to access to the knowledge required of each subject, and rear on the interdisciplinary scholars in the future. Interdisciplinary collaboration as a condition, combining sociological perspective with the technology of computer science produced new knowledge of each subject, cultivated the junior students and scholars to own the potential for ability of interdisciplinary integration. And then the experience will be continued and the knowledge will be accumulated because of those who ever participate in the process of the interdisciplinary collaboration.

Conclusion

The natural science has been communicated with the humane and social science for a long time, and the dialogue is a meaningful communication to these two paradigms, especially on the interchange of the view between them. Based on the above, we should try to make the effort and the communication specific in advance. Therefore, the interdisciplinary collaboration becomes so important to the progress of the scientific knowledge.

The interdisciplinary collaboration of sociology and computer science gives us a new example to surmount the limitation of traditional subjects, in the meanwhile, to specify how the sociological perspective is to be visualized by the technology of

computer science. This gives us a rather thriving experience in the interdisciplinary collaboration. It also generates the possibility of creating new knowledge. Using the technology of computer science for another purpose brings new design of the method for the sociologist to catch the phenomenon, such as the relationship in the social network. With the change of society, the sociologist ought to think new method and designs to approach the contemporary society. And then, the interdisciplinary collaboration makes the possibility to create new knowledge to be realized.

Besides, the purpose of the projects will affect the reward of collaboration. Comparing with the two experiences in basic subject and policy application, there are some differences happened in the sense of question and the purpose. About the sense of question, basic subject focuses on the problem of traditional subject, try to find new approach of method to go forward of the research, but the policy application is devoted to resolve the emergency specific social problem. And the purpose, basic subject makes efforts in the innovation of knowledge and the evolution of methods, but the policy application try to change the conditions in present through the policy practice.

It deserved to be mentioned that we can expect the next generation of junior students and scholars to benefit from the interdisciplinary collaboration, and the process offers the participators to enter the circumstance of interdisciplinary collaboration where was full of chances, resources and stimulation, as well as their minds and abilities will grow with the collaboration and interaction of two subjects. According to this, we may look forward to the more advance on knowledge of sociology and computer science in the future, no matter in the project of basic subject or policy application.

In briefly, our original purpose to get into the interdisciplinary collaboration is to explore the unknown world, find the real explanation to the phenomenon and look forward to the answer of the question. Under this circumstance, our experiences of collaboration can be regarded as an accomplishment in this concern. In addition, we can imagine that our successive scholars will work together to pursue further interdisciplinary collaboration and knowledge accumulation.

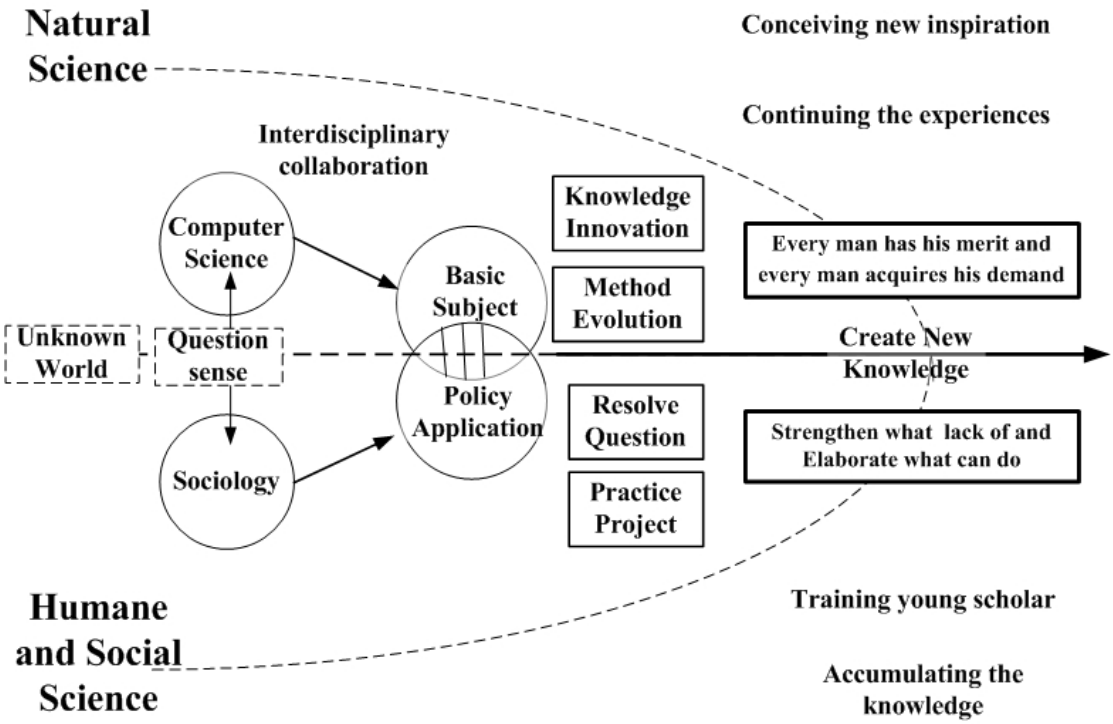

Figure 1. A collaboration model of sociology and computer science

Reference

[1]. Beaver, D. (2001). "Reflections on scientific collaboration and its study," *Scientometrics*, 52: 365-377.

[2]. Bozeman, B. and Corley, E. (2004). "Scientists' collaboration strategies: implications for scientific and technical human capital," *Research Policy*, 33:599-616.

[3]. Chuang, T. R., Low, B. C. and Wu, C. I. (1999). "The two webs; towards a web-based systems for social network analysis," *proceeding of the 3rd workshop on information technologies and social transformations*, vol(1): 75-85.

[4]. Corley, E., Boardam, P. and Bozeman, B. (2006). "Design and the management of multi-institutional research collaborations: Theoretical implications from two case studies," *Research Policy*, 35:975-993.

[5]. Finholt, T. Sproull, L. and Kiesler, S. (2002). "Outsiders on the inside: sharing know-how across space and time," in *Distributed Work* (pp. 356-378), Cambridge: MIT Press.

[6]. Katz, J. and Martin, B. (1997). "What is research collaboration?," *Research policy*, 26:1-18.

[7]. Kuhn, T. S. (1962). *The structure of scientific revolutions*, University of Chicago Press.

[8]. Maglaughlin, K. and Sonnenwald, D. (2005). "Factors that impact interdisciplinary natural science research collaboration in academia," to appear in the International society for scientometrics and Informatrics (ISSI) 2005 conference.

[9]. Melin, G. (2000). "Pragmatism and self-organization: research collaboration on the individual level," *Research policy*, 29: 31-40.

[10]. Salter, L. and Hearn, A. (1996). *Outside the lines*, Montreal: McGill-Queen's University Press.

[11]. Sonnebwald, D. H. (1996). "Communication roles that support collaboration during the design process," *Design Studies*, 17:277-301.

[12]. Sonnenwald, D. H. and Pierce, L. (2000). "Information behavior in dynamic group work contexts: interwoven situation awareness, dense social networks and contested collaboration in common and control," *Information processing and management*, 36(3): 461-479.

[13]. Thorsteinsdottir, O. (2000). "External research collaboration in two small science systems," *Scientometrics*, 49:145-160.

[14]. Tushman, M. (1977). "Special boundary spanning roles in the innovation process," *ASQ*, 24:82-98.