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## EXPLORING THE IDENTIFICATION OF EXPERTISE: AN EXPERIMENT IN A COMPUTER SOFTWARE CORPORATION

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### ABSTRACT

People recognize and express their expertise in several ways. In one way, workers can build personal profile to list their expertise. They recall their working experience and write some keyword terms in their personal profiles. In the other way, workers can build expertise in extracting from any documents they provided that includes studying documents, working documents or published papers. We want to know how the workers in the computer software corporation recognize and identify their expertise and explore the heuristics in identification of the expertise. We made an experiment comprised the above methods and invited 25 persons in a computer software corporation to participate and explore how they identify their expertise. During the experiment process, we found that (1) for most people, it's hard to tell what expertise they completely have without any hint; (2) except these two ways, researchers or practitioners must innovate other methods to identify or elicit human's expertise; (3) expertise in particular domain is rather than single term, but also multiple complex and related term sets; (4) expertise would be different with different audiences.

### INTRODUCTION

It's a big problem to identify people's expertise. As Powell et al. [18] said, "access to an expert is difficult, perhaps because the expertise is not well 'labeled' and therefore it is difficult to identify its holder." It's hard for people to recognize and identify what expertise they completely have. But under the radical changing circumstance, people often face many complicated problems and need help from others with their suitable expertise. As to that, it's useful for us to

know how people recognize and identify their expertise and improve our understanding of human's expertise.

### Expertise and Tacit Knowledge

In the definition of McDonald and Ackerman [6], Expertise identification is the problem of knowing what information or special skills other individuals have. And Stenmark [10] suggested that expertise is highly related to human's emotion, experience, value, belief or moral that are in the tacit dimension and hardly to tell. As Polayni [12] mentioned, "We can know more than we can tell and we can know nothing without relying upon those things which we may not be able to tell". Although people can't easily identify human's expertise, in the previous research, many researchers use different ways to elicit human's expertise or tacit knowledge. Goldberg etc., [3] monitored who read or responded to a particular bulletin board message to recommend experts. Resnick etc., [14] used time spent reading a message as an expertise hint. Hill etc., [5] relied on frequency-of-mention in a stream of discussion as a type of voting mechanism for web page. McDonald and Ackerman [7] used more complicated methods that including explicit ratings, user behavior, implicit activity and hearsay to create and maintain every worker's profile.

### Social Collaboration

As Drucker [2] suggested, every employee in information-oriented organization must request others' information to complete his own job. In other words, people face difficult problems that they cannot solve alone every day. For these situations, the right people are those who can answer a specific question by their expertise or move the

problem toward resolution. Besides to solving problem, Nonaka and Takeuchi [9] mentioned to set out, elaborate and implement innovations, tacit knowledge such as skill and intuition must be shared. Although social collaboration is important, it's hard to find the right people. As McDonald and Ackerman's field study [6] in Medical Software Corporation that they found for many people, "experience" is the primary guide in identifying others with specific expertise. For this sake, we should design IT solutions to help us to locate and communicate with knowledgeable people.

### Official Documents and Professional Expertise

Just like Stenmark [10] suggested that expertise is a quality highly dependent on one's daily performs, and only be observed and recognized through its resulting documents, papers or reports. He also had made a very interesting study. He implemented a prototype application that enabled users with similar job profiles to learn of each other's existence. The outcome was so sad because one person tried this feature and claimed to have been connected to people with whom he had nothing in common. As we know, much of knowledge workers' daily office activity is thus governed by professional expertise that dictate which official documents they write especially. For this sake, maybe we could elicit their expertise from official documents.

### RESEARCH METHODS

The experiment was conducted at a computer software company in Taiwan, and the subjects were 25 workers and the positions are ranging from programmer to group manager. We subscribe to a grounded theory-inspired approach, meaning that instead of starting by forming a hypothesis that may later be tested, the field is approached an exploratory way, letting the empirical findings form the hypothesis on which the analysis is built. This is an iterative process during which the empirical findings are reinterpreted until a theory that considers all observed cases has been formed. So we emphasized the heuristics during this research rather than the accuracy of the results. This research not only intend to ground theory but also the practice of the system development.

Computer software industry is a knowledge intensive industry and workers often face complicated problem. For this sake, this research took place at a computer software corporation named AAA during the summer of 2001. We spent two months implementing a keyword mining prototype application and constructing a pilot about knowledge management system at AAA company. The associative and relative words were be mined by the association rule model of data mining. In other words, the Chinese sentence would be considered a transaction. According to two-gram algorithms, the sentence would be split into two words. Every two-gram is considered an item in a transaction. In association rule, Support and Confidence values are given to solve to associative item in a transaction. Similarly, the associative or relative words could be mined by support and confidence value. In this experiment, we used 10 and 0.01 as the support and confidence value.

AAA is about 100 employees and the service is to implement e-Commerce IT solution in various industries. At the time, AAA has run more than thirty projects and has published thousands of official documents, such as patent applications, published technical papers, published essay papers, requirement analysis report, application specification reports, test plan report, test case report and user training documents etc. Approximately 30 workers were invited, of which 25 agreed to participate in the study, which ran from May to June 2001. They are group managers, project managers, system analysts and programmers as shown in Table 1.

Table 1. Summary of the participants

Position	Number of the participants
Group Manager	2
Project Manager	5
System Analyst	7
Programmer	11

In order to explore workers' expertise, the authors designed an experiment that had three stages (1) all participants provided one official document written by their own. The official documents they provided including patent applications, application planning reports, published technical reports, requirement specification reports, design specification reports and test planning reports as shown in

Table 2; (2) to write down some related expertise terms as the keyword terms of their own expert profile; (3) the authors use keyword mining prototype application to extract keywords from official document the participants provided; (4) all users were invited to a half-hour meeting using semi-structured interview[8] with nondirective approach[11] to obtain the facts and opinions of their real professional expertise in the particular domain.

Table 2. Summary of the official documents

Type	Number
Patent Application	3
Application Planning Report	2
Published Technical Report	4
Requirement Specification Report	5
Design Specification Report	5
Test Planning Report	2
Training Document	4

In the final stage, the following questions were asked,

1. Why did you write this official document?
2. Which terms that the keyword mining prototype application generated would you reject? Why do you reject these terms in your domain expertise?
3. Which terms that the keyword mining prototype application generated would you accept? Why do you accept these terms in your domain expertise?
4. In each term you accept, please tell me what it is?

## RESULTS AND CONCLUSIONS

To sum up, participants averagely wrote about 4.5 expertise terms in stage 1. After they checked the keyword list that the keyword mining prototype application generated, all participants selected more than 6 expertise terms in particular domain.

Overall, the user reactions were positive. The respondents said that they believed in this prototype application and considered it as “a computerized assistant in identifying personnel expertise” that helped them remember something. It is a good idea to elicit personnel expertise from official documents.

In this research, we found several interesting things listed in the following and shows possibility of doing further research.

### Limits of the Human's Mind

The act of recognizing and identifying expertise utilizes tacit knowledge, whereas the task of selecting keyword terms requires a translation to explicit knowledge. But in the most time, people can only remember or tell limited experience. For example, we've tried to ask a group manager about her expertise of system planning in the agriculture domain. In the beginning, she felt very hard to tell and answered only 3 expertise terms. After she checked the results of which the keyword mining prototype application generated, she successfully selected 17 keyword terms as her expertise in system planning of the agriculture industry. Almost all participants found some expertise terms that they forgot or ignored after they checked the keywords list that the keyword mining prototype application generated. In the further interviewing stage, we found that participants sometimes consider their expertise in some ways, but they ignore their expertise in the other ways. In this research, for example, one programmer considered his expertise that are all about “security”, such as encryption, decryption, key generator, but he ignored some expertise about “device”, such as IC card that he had been implemented during the patent applying period.

### Limits of the Mining Prototype Application

The problem of the keyword mining prototype application is when someone's expertise term was not repeated in any particular official document, these expertise terms would be lost in the keywords list. Refer to the hierarchy of understanding which Nunamaker etc. [17] proposed, data is the understanding of symbols; information is the understanding of relationships among data; knowledge is the understanding of patterns, processes, and context; wisdom and judgment is the understanding of the principles, causes, and consequences that give rise to intellectual and ethical positions. In this research, we discovered some expertise must represent using phrase in the wisdom and judgment layer of the hierarchy of understanding that would hard to elicit from official documents, such as “how to select suitable programming solutions” or “how to build a flexible web application architecture”.

Although the mining prototype application can easily extract

keyword terms from the official documents, we didn't exactly know individual different if two or more documents had similar keyword terms. As Neisser etc. [16] mentioned individuals differ from one another in their ability to understand complex ideas, to adapt effectively to the environment, to learn from experience, to engage in various forms of reasoning, to overcome obstacles by taking thought. But the authors found the different keyword terms among those similar documents revealed the difference of the related expertise domain. For example, in this research, we found "SOAP", "WSDL", "UDDI", "Web Service" as a keyword set from one published technical document and "ebXML", "Business Process", "UDDI" as a keyword set from another published technical document, they are partial overlapping [13]. Then, we thought the previous worker's domain was the web service and the other's domain was about the ebXML and business process integration using web service.

### **The Nature of the Expertise**

We also discovered the expertise was hard to define. People often tell others their expertise using a meaningless single term or some vague expressions to express their expertise. If someone wants to identify their expertise correctly, they can use multiple sets of the critical keyword terms. For example, the expertise of "web service" could be in ".Net programming" area, in "Java programming", or in "Application Architecture Design" area. So, If you want to describe such expertise more precisely, you must identify your expertise in both "web service" and ".Net programming". Unfortunately, the world is more complicated than previous case that as Polayni [12] mentioned, "We can know more than we can tell". So, it's a big issue that how to identify one's expertise correctly. The lesson we learned is to identify the real expertise is not easy. But we can elicit the worker's expertise from the related working experience in the particular domain and compare with the other workers.

### **The Influence of the Audience**

As Powell et al. [18] mentioned the process of expert consultation can be viewed as a two-person interaction; the

expert is a repository of knowledge and skill related to a particular domain and the consultant lacks this expertise, but knows the expert to possess it. In our research, some participants argued their expertise would be different with different audience. A programmer said, "If someone who is not an IT professional ask what expertise I have, he only can get a general answer like programming or the e-Commerce software application. But if one is an IT profession, he will get more detail answers like J2EE or ASP+." Otherwise, one system analyst said, "If my colleague ask my expertise, I may tell him about page flow, BO flow or Page construction flow that are well known in my company. But if other people ask the same question, I will never say that, because these terms are so unacquainted to them." When people interact, they communicate jointly held understanding of reality: there is sufficient correspondence between the understanding of the individuals concerned to allow interactions between them to be meaningful.

### **FUTURE WORK**

It is important to well describe and share every workers' working experience that will result in improved social collaboration among knowledge workers. Because the working experience is too ambiguous to communicate among workers, we need the common thesaurus and shared ontologies to communicate our understanding of each particular working experience among workers and computer software.

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