Roles of Knowledge Engineers and Their Relationship to Systems Analysts

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ES development projects involve domain experts, appropriate languages, and/or ES shells, in addition to knowledge engineers (KEs), defined as being responsible for structuring and/or constructing ES (McGraw and Harbison-Briggs, 1989). They are also responsible for a multitude of ES development issues, including the activity of knowledge acquisition. (Knowledge acquisition is a term that encompasses numerous meanings today, in addition to its traditional interpretation which is to obtain knowledge from one or more domain experts for use in developing an expert system. Some of these perspectives are addressed in the next section). Knowledge acquisition is crucial for successful ES development efforts. Factors contributing to problems associated with this activity were alluded to by Yoon, Guimaraes, and O’Neal (1995). They include the number of participants typically involved in the knowledge acquisition process; the difficulties related to having the expert actually express what he/she knows; conceptualizing and structuring knowledge; often managing the process of dealing with two or more experts; and numerous behavioral and interpersonal issues inherent in experts as well as the KE. This makes it difficult to clearly identify or define the KE’s role in ES development. For the most part, the academic and practitioner literature has taken a normative perspective regarding the role of KEs. Perhaps much of the uncertainty surrounding KEs can be attributed to the fact that the KE is a new professional within the computer industry (Couger and McIntyre, 1988). Much like emerging hardware and software technologies, organizations may consider KEs integral to ES development projects, but given the recent emergence of this professional and the scarcity of information regarding the position, organizations may simply be uncertain as to the specific role KEs should play. Organizations that develop ES would benefit from having a better understanding of the KE’s role in ES development. Such information would enable organizations to identify, recruit or train appropriate personnel for this job. The effective development of this essential resource will be influenced by the ability to specify the requirements for this job based on the role the KE is expected to play in the ES development. The ES literature does not offer any guidelines for identifying or
Review of the Literature

Knowledge Acquisition

In the mid-1980s, various efforts pertaining to inductive learning were proposed. Inductive learning is a branch of machine learning that deals with obtaining knowledge of concepts from examples. It is “a similarity-based learning method ... [which] is the process of inferring the general description of a class from the description of individual objects of the class by examining the similarities and differences among a large number of examples” (Kiang, Chi, and Tam, 1993). Basically, the learning system deals with a large number of instances that are both positive and negative relevant to the concept. These instances are compared so that a generalized concept description, which is capable of describing all positive examples and excluding all of the negative ones, is developed. This type of system has been used to acquire knowledge for systems that perform classification tasks.

Explanation-based learning (EBL) (DeJong and Mooney, 1986) and similarity-based learning (SBL) (Quinlan, 1986) are strategies to mechanize the process of learning from the machine learning perspective. In contrast to SBL, which is an inductive approach that was described above, EBL is based on a deductive learning mechanism that includes a necessary and complete existing domain theory consisting of production rules to explain and generalize a single training example. In addition, research by Kiang et al. (1993) is based on distributed artificial intelligence that presents a distributed knowledge acquisition system. Since it employs a distributed architecture, more learning agents can be included within the system; in turn, it is suggested that this distributed approach should improve the efficiency of information processing.

Inductive learning approaches have been criticized for a number of reasons, including the difficulty of incorporating existing domain knowledge into the learning process, the large number of examples required, and the possible bias in the resulting rules that may occur due to a lack of representative training examples (Kiang et al., 1993). However, research using this approach continues with some promising results. Recently, Tessmer, Shaw, and Gentry (1993) developed a layered approach to inductive learning that improves the stability and accuracy of this approach to knowledge acquisition. They demonstrated the effectiveness of their method by applying it to risk structures of different economic environments in international financial analysis.

The more traditional approach to knowledge acquisition for expert systems involves having one or more domain experts meet with a KE who extracts domain knowledge from the expert(s). Most knowledge-based systems that are discussed in the literature are based on this approach (Kiang et al., 1993). This approach to knowledge acquisition was integral to the present research and formed the basis of it for a number of reasons. First, it is a very common approach. Second, it is