

Knowledge engineering and psychology: Towards a closer relationship

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Abstract

Knowledge engineering projects deal with a wide range of domains within organizational and academic contexts. A number of elicitation techniques are used to acquire knowledge from experts. Most of these techniques originated within psychology but have been developed by knowledge engineers to become more structured, efficient and systematic. Until now, nobody has tried to re-apply these modified techniques back into psychology. This paper describes work that addresses this matter. It focuses on the psychological knowledge possessed by all people that enables them to deal with everyday problems and make life decisions. We refer to this as 'personal knowledge'. To take a knowledge engineering approach to personal knowledge, we investigated the use of knowledge elicitation techniques to capture personal knowledge. We describe an empirical study involving ten participants and 80 knowledge acquisition sessions that assessed eight elicitation techniques in this context. The results revealed that each of the techniques showed promise at efficiently capturing and structuring aspects of an individual's personal knowledge. A content analysis of the acquired knowledge led to the construction of a meta-model (a primitive ontology) of personal knowledge and to the design for a new methodology for psychological research. From the perspective of psychology, the paper shows that knowledge engineering methods can be of value to psychologists. From the perspective of knowledge engineering and the wider computer science community, the paper shows that empirical methods used by psychologists can benefit the development and evaluation of ontologies and elicitation techniques.

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1. Introduction

Knowledge engineering is that part of AI concerned with the principles, methods and tools for acquiring knowledge and developing knowledge-based systems (Studer et al., 1998; Schreiber et al., 2000). A primary research area during the 1980s and 1990s addressed the elicitation of knowledge from subject matter experts (Hoffman et al., 1995). Although research in this area has dwindled over the past few years, a number of organizations are benefiting from the practical application of these research findings,

not only for AI but also for the wider field of Knowledge Management (Milton et al., 1999; Hammersley et al., 1999).

A key feature when assessing knowledge elicitation techniques has been the use of empirical studies, particularly controlled experiments (Shadbolt and Burton, 1995). Over recent years, a shift in emphasis in knowledge engineering from acquisition techniques to ontologies and computer languages has taken place. This shift has resulted in a lack of emphasis on experiments and other empirical methods of assessment. One of the aims of the work presented in this paper is to demonstrate that a properly designed empirical study can be of benefit to the development and evaluation of ontologies as well as for elicitation techniques. Another aim, from the perspective of psychology, is to show that techniques used by knowledge

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engineers to acquire and model knowledge can be of benefit for psychological research and perhaps as a therapeutic tool.

1.1. Personal knowledge

Knowledge engineering projects typically involve domains associated with organizational or academic knowledge. In this paper, we explore a different type of knowledge: the psychological knowledge possessed by all people that enables them to deal with everyday problems and make life decisions. This includes the knowledge individuals have of their life history, their behaviours, their moods, their attitudes, their relationships, their abilities, their aspirations, and so on. We refer to such knowledge as ‘personal knowledge’.

The study of personal knowledge is usually the preserve of psychologists, psychotherapists, psychiatrists and counsellors. We aim to show in this paper that a knowledge engineering approach to personal knowledge can provide methods that add to those already used by these professionals. We believe that these methods can help in the development of new psychological theories and be of benefit to ordinary people by increasing their self-understanding. This follows a trend in psychology, and the social sciences, to widen the use of qualitative techniques (Smith et al., 1995).

In exploring these issues, we follow an interdisciplinary approach by treating personal knowledge as if it were a type of expert knowledge. In other words, we take the principles and techniques used by knowledge engineers in domains such as medicine, electronics and geology and apply them to the domain of personal knowledge. Our subject matter experts are ordinary people each of whom possesses the expertise to deal with life situations within complex social environments.

1.2. Knowledge elicitation techniques

It is important to note that many knowledge elicitation techniques originated within psychology. However, work undertaken by the knowledge engineering community over the past 20 years has transformed these techniques so that they have to become more structured, efficient and systematic. One development has been the use of structured methodologies such as CommonKADS (Schreiber et al., 2000) and MOKA (Stokes, 2001). Another has been the use of software support tools such as Protégé (Protégé website) and PCPACK (Epistemics website). Another has been the use of generic knowledgebases such as CYC (CYC Website). In spite of these advances, there has been no attempt to export the adapted techniques back into psychology and assess their merits for psychological purposes. The research presented here aims to rectify this matter.

1.3. Structure

The rest of the paper is organized as follows. Section 2 describes the background and rationale for pursuing a knowledge engineering approach to personal knowledge. Section 3 describes an empirical study that examined the use of knowledge elicitation techniques to acquire personal knowledge. Section 4 presents a meta-model of personal knowledge derived from the empirical results. Section 5 describes a new methodology for psychological research. Section 6 contains a summary and concluding remarks.

2. A knowledge engineering approach to personal knowledge

2.1. Approach

When defining the approach to be used in the study, we first sought to determine the significant differences between the domain of personal knowledge and conventional knowledge engineering domains. We discerned four key differences. First, unlike most knowledge domains, personal knowledge is not based on a core set of theories and practices taught to practitioners at schools and universities. Second, the history of psychology shows that personal knowledge is vastly complex, with numerous perspectives and points of view. Indicative of this is the variety of different psychotherapies and psychological research approaches that are used. Third, the domain of personal knowledge has no obvious experts. Although some may lay claim to be experts, we feel that every person in the world can be considered to be an expert on their own life. Fourth, knowledge engineering domains tend to be problem-focused and often involve structured knowledge, clear-cut goals and decisions. In contrast, an individual’s personal life tends to be less driven by the need to solve clear-cut problems and may involve less structured knowledge, such as knowledge associated with emotions and feelings.

The differences outlined above led us away from a conventional knowledge engineering approach; that is, to acquire and model the knowledge of domain experts to create an intelligent software system. The development of such a system in the context of personal knowledge would be too ambitious and too problematic. Instead, we looked to the use of personal knowledge in psychology. Psychologists capture and analyse personal knowledge for two main reasons: (i) to provide psychotherapeutic help and (ii) to develop theories. Thus, we have two distinct possible aims: to help in the provision of psychotherapeutic help, or to help in the development of new psychological theories. We chose to explore both of these aims, but with an emphasis on the latter.

To address these aims, we asked two questions: (i) How is personal knowledge used to provide psychotherapeutic benefits? (ii) How is personal knowledge treated within psychological research? The following sections briefly address these questions as a background to the study described in Section 3.

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