Chapter 2.16
Using Organizational Semiotics and Conceptual Graphs in a Two-Step Method for Knowledge Management Process Improvement Measurement

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ABSTRACT

The semantic normal forms of organizational semiotics extract structures from natural language texts that may be stored electronically. In themselves, the SNFs are only canonic descriptions of the patterns of behavior observed in a culture. Conceptual graphs and dataflow graphs, their dynamic variety, provide means to reason over propositions in first order logics. Conceptual graphs, however, do not of themselves capture the ontological entities needed for such reasoning. The culture of an organization contains natural language entities that can be extracted for use in knowledge representation and reasoning. Together in a rigorous, two-step process, ontology charting from organizational semiotics and dataflow graphs from knowledge engineering provide a means to extract entities of interest from a subject domain such as the culture of organizations and then to represent these entities in formal logic reasoning. This paper presents this process, and concludes with an example of how process improvement in an IT organization may be measured in this two-step process.

INTRODUCTION

How may a means be provided to develop an ontology derived from natural language, and then translate that structure into a formal reasoning system? The answer to that question can be applied readily to any subject involving measurement of activities otherwise hard to quantify. The subject domain to be examined here is software process improvement in a large IT department. Like knowledge management, process improvement must possess an appreciation of the organization's culture. The improvement framework applied is the Capability Maturity Model from the Software Engineering Institute. The suggests a two-step procedure of semantic norming and conceptual graph reasoning that take into account both the prevailing software engineering environment and an imposed improvement framework. Both steps require developing semantic nets of two different kinds. The case study to be presented draws data from the CMM and software engineering procedures of an information technology group, ontologically structured from an analysis of natural language artifacts found in organizational culture, translated to semantic normal form, and transformed into the dataflow form of a conceptual graph. Measurements of quality improvement steps take by the IT group over several years are then computed into comparative metrics by the dataflow graph, a conceptual graph variety for dynamic services.

This paper expands a model developed by (Schiffel, 2007) into the semiotic basis for knowledge. In that previous work, the two fields of knowledge management and knowledge engineering were blended. Knowledge management is an applied field derived from organizational studies, a branch of management theory. Knowledge management and process improvement are the opposite sides of the same coin of competitiveness and process efficiency. Knowledge management attempts to increase the rate or quality of knowledge use and knowledge formation. Process improvement removes external impediments to information flow. In practice, successful process improvement among knowledge workers improves efficiency in individual and group problem solving. This yields increased organizational competitiveness (Kreiner, 2002; McElroy, 1999; O'Leary, 1998). Unfortunately, knowledge management has too often become associated with information technology, as a grab bag of management techniques applied to knowledge workers (Malhotra, 2004; Pepper, 2000). Vendors in the enterprise software market re-label supply chain, benchmarking, and database access systems as knowledge management systems in attempts to make "information systems" into "knowledge management" systems and business process reengineering (Bertels & Savage, 1998, p. 7; Wilson, 2002). Here, however, the original definition and purpose of knowledge management is used.

In contrast to knowledge management, knowledge engineering is applied artificial intelligence – especially drawn from the conceptual structures branch – intended to formalized explicit knowledge into well-defined ontologies based in logics (Brachman & Levesque, 2004, pp. 31-32; Fagin, 1999; Sowa, 2000, p. 132; Turban & Aronson, 2001, p. 467ff). Knowledge engineering applies principles of philosophical ontology to intelligent systems to describe a shared, common understanding about the kinds of objects, and the relationships among the objects, in some environment. It is the application of logic and ontology to the task of building models of some subject for transformation into a computable form for some purpose.

Tacit knowledge is knowledge held in the mind (Kreiner, 2002; Polanyi, 1966). Advancements in knowledge representation suggest that tacit knowledge can be represented in technology. For example, software agents have been used to develop learning agents and knowledge repositories to create communities of knowledge. A limitation, however, is that agents do not easily capture or