ABSTRACT

Research on ontology and conceptual data modeling builds on the premise that the world could be represented in terms of concepts (also known as “things”), their properties and their (things’) relationships. A persistent effort in the representation is how to distinguish things from their properties, as well as how to denote relationships that relate two things together. Following the tradition of deriving guidelines from ontology studies, this paper proposes a need to make a clear distinction between relationships among things and relationships among things’ properties. The central thrust of this paper is in proposing an ontologically guided principle: For the same relationship, working with the relationship among things will lead to better user performance than working with the relationship among things’ properties. This principle, called Relationship without Pointers principle, is robustly validated by re-analyzing a set of experiment data on user data modeling performance with three database models. This principle may be applicable to other contexts that study relationships.

Keywords: Data Modeling, Empirical, Ontology, Pointer, Relationship without Pointers

INTRODUCTION

During the system design of an Information System (IS), accurate construction of the diagrammatic representation of the real world (or studied situation/scenario) is important (Bera et al. 2010; Martin 2007; Johnson-Laird 1983). Specifically, an accurately captured representation should connote the essential semantic meanings.
of the focal domain, i.e., the concepts (or “things”), their properties and their inter-
relationships. While the diagrammatic representation, also known as conceptual
data modeling, constitutes a small subset of the entire system analysis, design and
development process, it plays a non-trivial role in determining the success of an
IS development (Moody 2005). The widespread recognition of the importance of
capturing the focal domain’s semantic meanings has led to an enduring research
effort expanded towards proposing, deriving and empirically validating the related
theorems (Recker et al. 2011; Recker and Rosemann 2010; Siau and Rossi 2011).
These theorems span from the general research of Bunge’s ontological theory
(Bunge 1977; Bunge 1979) to specific conceptual data modeling of the Bunge-

While much of these extant theories has significantly propelled the field towards
framing the overarching data modeling guidelines and principles (e.g., Tillquist
et al. 2002), research has shown that there remains many unclear areas (Goldstein
and Storey 1990). A core area of investigation is about things and their prop-
erties. A thing is a general term for any abstract or concrete thing that possesses
properties. For instance, a person, a car, and a country are all things; a person has
properties such as name and height. Recent research along this direction include
Shanks and his colleagues (2008) who examine the relationship between things
and the part-whole relations among them; Bodart and his colleagues (2001) ques-
tion whether including optional properties would make a difference; and Gemino
and Wand (2005) assess the impact of different forms of properties on conceptual
data modeling complexity and clarity.

A research question along this field of exploration, yet not answered, is whether
to model relationship among things or relationship among things’ properties, in
the context of pointer usage. A pointer provides an implied linkage between two
things, or two properties. To illustrate, we refer to two instances of one using
the basic entity diagrammatic and another in relational modeling. In the entity
diagrammatic, a line connecting two entities in a diagram implies a relationship
between the entities. Similarly, in the relational modeling context, the same val-
ues in a primary key-foreign key pair of properties imply a relationship between
the properties and consequently their relations. This inquiry is timely with the
expanded interest in amalgamating object-oriented and component-based thinking
(Frakes and Kang 2005) into conceptual data modeling (Evermann 2005a, 2005b).
While this study focuses on one aspect of conceptual modeling practice, namely
the use of pointers in data modeling, we hope through the testing of the pointer
notion using three data models (to be described shortly) we are able to offer a
convincing, empirically driven argument.

Our research motivation is entrenched in the dilemma entailed in the applica-
tion of pointers. Specifically, the notion of pointers is deeply rooted in the object-
oriented metaphor and relational system development approach. However, pointers,
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