Chapter 1.1
Philosophical Foundations of Information Modeling

John M. Artz
The George Washington University, USA

INTRODUCTION

For the past few decades, there have been articles appearing periodically in the information systems research literature criticizing the field for a lack of theory, no core set of concepts, and no accepted paradigm. It is difficult to tell exactly when this critical self-examination began. However, one reasonable starting point would be an article by Peter Keen (1980) at the First International Conference on Information Systems, which begins with the observation, "At present, MIS [management information systems] research is a theme rather than a substantive field" (p. 9). Keen goes on to criticize MIS research for a lack of a cumulative tradition and other factors that are key requirements for a scientific discipline.

A few years later, Culnan (1986) picked up on this idea, cited Keen's remarks, and embarked upon an analysis of the information systems research literature looking for common themes and potentially competing paradigms. Culnan

points out, "As a field matures, new theories are proposed and compete until paradigms emerge" (p. 156)—or, at least, that is the way it is supposed to work. Culnan concludes that the IS research literature consists of "research themes rather than paradigms or even well defined subfields" (p. 167) but excuses the field for its shortcomings with the observation that "MIS is very much a young academic field" (p. 167).

While Culnan took an empirical approach to analyzing the state of the art in IS research, Weber (1987) took a theoretical approach sketching out what we should be looking for. Weber observes, "If a science progresses only when it has a paradigm, it behooves the members of a field to seek paradigms and to articulate paradigms via normal science as their primary research activities" (p. 9). He also remarked, with regard to referent disciplines, that "the IS discipline must develop its own paradigm rather than rely on other disciplines' paradigms if it is to survive in the long run as a distinct discipline" (p. 4).

Orlikowski and Iacono (2001) coalesced the concepts of paradigm, cumulative tradition, and core concepts in the idea of the "IT artifact":

We believe that the lack of theories about IT artifacts, the ways in which they emerge and evolve over time, and how they become independent with socio-economic contexts and practices, are key unresolved issues for our field and ones that will become even more problematic in these dynamic and innovative times. (p. 133)

This certainly sharpens the focus of the investigation, but what is the IT artifact? Weber (1987) comes the closest to answering that question. In his article he cites E. F. Codd's (1970) paper as one of the most cited articles in information systems and one that could be considered a candidate as a paradigm suggesting that the IT artifact is some kind of data model. Later, in an editorial in *MIS Quarterly*, Weber (2003) points out, "After a long period of discernment, we found we could identify only one class of phenomena, for which theories sourced from other disciplines seemed deficient—namely, phenomena associated with building conceptual models and designing databases" (p. viii). So perhaps the IT artifact has something to do with information models or information modeling. This is plausible since data modeling and information modeling are, perhaps, the only intellectual developments that are unique to information systems. Yet the theories in these areas are sketchy at best.

However, theory does not just appear spontaneously: It must be developed. One of the ways in which this can be done is to take general theories from other areas, apply them to phenomena in information systems, and then advance them by making them more specific to IS. The purpose of this article is to do just that. First we begin with a brief description of the process of information modeling followed by a very brief discussion of earlier attempts to address the philosophical foundations. Then we introduce four concepts

from metaphysics that are highly relevant to information modeling. These four concepts are as old as philosophy itself and yet when applied to information modeling, they are as relevant to database design as they were to philosophers over the past few millennia. These four concepts are (a) the concept of identity, (b) the problem of universals, (c) teleology, and (d) the correspondence vs. coherence views of truth. Each concept will be explained in turn, as will its implications for information modeling. Each of these concepts also provides a foundation from which a theory of information modeling and, eventually, a theory of information systems can be built. So, following the introduction of the concepts, we will explain how they were identified.

INFORMATION MODELING

Information modeling is the first step in database design, sometimes referred to as conceptual database design. In this step in the design process, the information modeler examines the domain of interest and determines the classes of entities that will be represented in the database and the relationship between those classes. In a typical university example, one entity class may be Students while another entity class may be Courses. The relationship between Students and Courses is that Students take Courses. As the modeler proceeds, attributes are identified for each entity class. These attributes represent facts of interest that are common to all instances of a class. If a particular student has additional facts, those facts are overlooked in order to have a set of facts common to all students. When the modeler is finished, the conceptual database design is represented in an information model that contains entity-class descriptions, attributes of the entity class, relationships between entity classes, and, possibly, additional information about the nature of those relationships such as cardinality and optionality. In the construction of the information model, a

Related Content

A Systematic Literature Review on the Quality of UML Models
Marcela Genero, Ana M. Fernández-Saez, H. James Nelson, Geert Poelsand Mario Piattini (2013).
Innovations in Database Design, Web Applications, and Information Systems Management (pp. 310-334).
www.irma-international.org/chapter/systematic-literature-review-quality-uml/74398

Creativity of Participants in Crowdsourcing Communities: The Effects of Promotion Focus and Extrinsic Motivation
Lingfei Zou, Shaobo Wei, Weiling Keand Kwok Kee Wei (2020). *Journal of Database Management (pp. 40-66).*
www.irma-international.org/article/creativity-of-participants-in-crowdsourcing-communities/256847

Business-to-Business Integration
Christoph Bussler (2005). *Encyclopedia of Database Technologies and Applications (pp. 54-58).*
www.irma-international.org/chapter/business-business-integration/11122

Knowledge Graph Entity Alignment Using Relation Structural Similarity
Yanhui Peng, Jing Zhang, Cangqi Zhouand Shunmei Meng (2022). *Journal of Database Management (pp. 1-19).*
www.irma-international.org/article/knowledge-graph-entity-alignment-using-relation-structural-similarity/305733

Formal Approaches to Systems Analysis Using UML: An Overview
Jonathan Whittle (2002). *Advanced Topics in Database Research, Volume 1 (pp. 324-341).*
www.irma-international.org/chapter/formal-approaches-systems-analysis-using/4335