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And Philosophical Assumptions: A Critique

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Abstract

Hirschheim et al. (1995) argue that information system designers' choice of a particular data modeling approach is inextricably linked to ontological, epistemological, social-contextual, and representational assumptions that they make about the worlds they seek to represent via their models. I argue, instead, that the link between different data modeling approaches and these four sets of assumptions is either weak or non-existent. I agree that there is some type of association between use of a particular data modeling approach and the ontological assumptions that designers make. The nature of the links, however, between different data modeling approaches and different epistemological, social-contextual, and representational assumptions is more problematical.

Introduction

In their insightful, scholarly critique of the philosophical foundations that underlie data modeling, Hirschheim et al. (1995) identify two schools. First, *fact-based* data modelers (e.g., those who use Chen's 1976 entity-relationship approach) focus on facts that reflect "an existing state of affairs" (p. 172). Second, *rule-based* data modelers (e.g., those who use Stamper et al.'s 1991 NORMA approach) focus on "rules which govern the use of signs and symbols in organizational behaviors and thereby attach specific meanings to the organizational vocabulary" (p. 198).

Hirschheim et al. (1995) argue that individuals who employ fact-based data modeling subscribe to the philosophical assumptions underlying Burrell and Morgan's (1979) functionalist paradigm. They uphold the values of realism and positivism rather than subjectivism and interpretivism. Moreover, they focus on and try to account for order in the world rather than conflict. Individuals who employ rule-based data modeling, however, subscribe to Burrell and Morgan's (1979) social-relativist (interpretive) or neohumanist (radical humanist) paradigms. If they subscribe to social-relativism, they uphold the values of subjectivism rather than realism, although like functionalists they assume that order exists in the world. If they subscribe to neohumanism, again they uphold the values of subjectivism, but unlike social relativists they see conflict rather than order in the world.

A central tenet of Hirschheim et al.'s (1995) analysis is that the choice of a data modeling approach is linked inextricably to particular types of (a) ontological, (b) epistemological, (c) social-contextual, and (d) representational assumptions. In this paper, however, I present some counterarguments to their claims. In particular, I argue that the assumptions they ascribe to fact-based data models are *not* inherent in the data models themselves but in how the models are *used* (see, further, Weber 1997).

Ontological Assumptions Underlying Fact-Based Data Modeling

Hirschheim et al. (1995, pp. 157-158) argue that fact-based data modeling is based on the ontological assumption that the world is given and that it exists independently of human social construction. In other words, fact-based models are supposedly based upon a realist philosophy.

This claim is problematical because it ascribes only a particular form of realism to fact-based data modeling. In this regard, Bunge (1993, pp. 230-233) identifies three types of realists: (a) naive realists, who believe it is possible to attain complete and accurate knowledge about the world; (b) critical realists, who believe we know the world only through our perceptions and that these perceptions can be biased by our beliefs, knowledge, interactions with others, and expectations; and (c) scientific realists, who are critical

realists but believe the best way to acquire knowledge about the world is through scientism. Hirschheim et al. (1995) evaluate fact-based data modeling only from the perspective of naive realism.

While some fact-based data modelers might ascribe to naive realism, not all hold this belief. For example, Nijssen and Halpin (1989, p. 12) argue that their fact-based data model (NIAM) reflects a Universe of Discourse as "perceived by a particular user or group of users." They clearly do not subscribe to naive realism. Similarly, Wand and Weber (1995, p. 208) point out that the ontological model they are proposing (allegedly a fact-based model) is intended to represent the world *as perceived by someone or some group*. Like NIAM, Wand and Weber's model is *not* based on naive realism.

From an ontological perspective, I argue that whether we adopt a realist position or an a subjectivist position has little bearing on the data modeling grammars we might choose to design and construct. If we are realists, we believe that the world exists independently of the knowing subject. Whether we can discover this world, however, is another matter. If we are subjectivists, we believe that the knowing subject constructs his or her world. The world does not exist independently of the knowing subject. In both cases, however, we use data models to *represent* the knowing subject's world. We must choose modeling objects and rules that allow us to represent either an objective world or a subjective world. Whether we have an objective world or a subjective world has little bearing on the modeling objects and rules we select to incorporate in our data modeling grammars.

I argue that there *is* a link, however, between the components incorporated in a data modeling grammar and the ontological assumptions made by its designer about how objective or subjective worlds are structured. For example, grammars like NIAM make no distinction between things and elements in property codomains (Weber and Zhang 1996, pp. 153-155). NIAM's design manifests an ontological assumption, therefore, that this distinction is either unimportant or does not exist in the world. Similarly, data modeling grammars often provide constructs to represent only a limited set of ontological constructs (e.g., the entity-relationship grammar cannot represent events). The choice of constructs manifests their designer's ontological assumption about the phenomena in the world that are important to represent from a data modeling perspective (Wand and Weber 1993, pp. 226-228). Users of grammars are always constrained, therefore, in terms of the ways they can represent their worlds by the presence or absence of constructs in the grammars.

Epistemological Assumptions Underlying Fact-Based Data Modeling

Hirschheim et al. (1995, p. 158) argue that the epistemological assumptions underlying functionalist (e.g., fact-based) data modeling imply that "valid data models can be built by applying proper observation and data collection methods to an object system, ..." In contrast, they argue (p. 162) that the epistemological assumptions underlying the social-relativist and neohumanist approaches to data modeling are based on a hermeneutic philosophy that emphasizes the existence of biases and preunderstandings among stakeholders during the data modeling process.

I argue that there is nothing inherent in fact-based data modeling that precludes adherence to the epistemological assumptions that Hirschheim et al. (1995) ascribe to the social-relativist and neohumanist approaches to data modeling. As I have contended above, it is now widely accepted that fact-based models are based on someone's or some group's perceptions of the world and that these perceptions will manifest biases. Moreover, it is also widely accepted that fact-based models can be used as a means to facilitate discourse among the stakeholders in a data modeling exercise and to enable a "fusion of different horizons" to occur (e.g., Avison and Wood-Harper 1990, pp. 115-120).

Epistemological assumptions impact *how* individuals reach an understanding of the world. Data models are used to *represent* this understanding. They need *not* impact *how* this understanding is formed, providing users recognize that they are simply *representational* vehicles. I argue that designers and users can develop critical, reflective approach to their epistemological assumptions, independently of the data modeling grammars they use.

Social-Contextual Assumptions Underlying Fact-Based Data Modeling

Under a functionalist (fact-oriented) approach to data modeling, Hirschheim et al. (1995, p. 158) argue that data models are used within a social context that emphasizes stability and order. Data models are devised to support organizational processes that are conceived as maintaining this stability and order. In contrast, data models are used within the social-relativist approach to facilitate stakeholder learning and understanding. As with the functionalist approach, social relativists assume that conflict among stakeholders is not an issue. Within a neohumanist approach, data models are used to facilitate stakeholders achieving their potential and realizing emancipation. The existence of conflict is recognized, and data models serve to contribute to consensual action by enabling shared meanings to be created through discourse.

Again, I argue that there is nothing inherent in the fact-based approach to data modeling that precludes adherence to the social-contextual assumptions that Hirschheim et al. (1995) ascribe to the social-relativist and neohumanist approaches to data modeling. Fact-based data models can be used to facilitate learning and understanding. Similarly, they can be used as a means of promoting an individual's personal growth and emancipation through, say, self-reflection and self-insight.

Unless a data model enables only severely impoverished representations of the world, the social context in which it is used can be framed somewhat (if not completely) independently of its characteristics. Indeed, it would be interesting to pursue both theoretically and empirically whether there is any link between the characteristics of data models and their ability to facilitate the attainment of different goals like learning, understanding, personal growth, and emancipation.

Representational Assumptions Underlying Fact-Based Data Modeling

Under a functionalist (fact-based) approach, Hirschheim et al. (1995, pp. 159-160) argue that the representational quality of data models is assessed in terms of their formal rigor and ease of use. Under a social-relativist approach, Hirschheim et al. (1995, pp. 164-165) argue that the way in which the representational quality of data models is assessed will depend upon the ontological assumptions made. If stakeholders subscribe to realism (which seems anomalous under social relativism!), like the fact-oriented approach, criteria like accuracy, completeness, and consistency will be used. If stakeholders subscribe to subjectivism, however, criteria like sincerity, relevancy, and clarity will be applied. Under a neohumanist approach, Hirschheim et al. (1995, p. 170) argue that the representations provided by data models "would be rich enough to capture intentions and beliefs that help to interpret the information captured in data models." Intentions and beliefs need to be made manifest to allow effective consensual action and discourse to occur.

Once more I argue that there is nothing inherent in the fact-based approach to data modeling that precludes adherence to the representational assumptions that Hirschheim et al. (1995) ascribe to the social-relativist (subjectivist ontology) and neohumanist approaches to data modeling. For example, fact-based data models can be used to represent attributes like sincerity, relevancy, clarity, intentions, and beliefs. These can be conceived as properties of humans (entities) that a fact-based data modeler might seek to represent. Whether fact-based data models can represent these types of phenomena is simply an *ontological* issue. The designer of the data modeling grammar used either has or has not provided constructs in the grammar to represent these phenomena.

Alternatively, stakeholders may use criteria like sincerity, relevancy, clarity, intentions, and beliefs to evaluate the *content* (substance) of a data model. Again, I argue that these criteria can still be applied to evaluate fact-based models. For example, whether a data model is *sincere* depends upon a stakeholder's perception of how well it represents someone else's perceptions of the world. Is it a "true" reflection of their beliefs and values? These sorts of questions can be asked about any data model.

Conclusions

Hirschheim et al. (1995) have made an important contribution to the discipline of data modeling by articulating the different ontological, epistemological, social-contextual, and representational assumptions that can underlie a data modeling exercise. They have enriched our understanding of the theory and application of data modeling. Moreover, they have provided a basis for more enlightened pedagogy and praxis.

Contrary to their arguments, however, I have contended that the assumptions that a data modeler might make in each of these four areas are only weakly coupled to the type of data modeling approach used. In practice, however, Hirschheim et al. (1995) may be right. Empirically we need to investigate whether an association exists between the type of data modeling approach that designers use and the philosophical assumptions they make. They have provided us with a rich basis for theorizing about potential links between philosophical assumptions and data models. Moreover, they have highlighted the need for empirical research to be undertaken to determine whether putative links exist in data modeling practice.

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