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Perceived semantic expressiveness of accounting systems and task accuracy effects

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Abstract

Semantic expressiveness refers to how well a model reflects the underlying reality the model represents. Prior research has claimed the REA (Resources-Events-Agents) accounting model is more semantically expressive than is the traditional DCA (Debit-Credit-Account) accounting model. This research demonstrates experimentally that users perceive REA as more semantically expressive than DCA. This study also demonstrates that, controlling for cognitive fit, accounting knowledge, and field dependence, higher perceived semantic expressiveness is associated with higher task accuracy.

Keywords: Semantic expressiveness; REA accounting model; DCA accounting model; Cognitive fit.

1. Semantic expressiveness

Semantic expressiveness is a term that refers to how well a model reflects the underlying reality the model represents. Computer scientists have long advocated the integration of semantics (real-world meaning) into data models and into technologies centered on those models (e.g., Abrial, 1974; Brodie, 1984; Hammer and McLeod, 1981). In accounting, McCarthy (1982) claimed that semantic expressiveness is an important advantage of the Resource-Event-Agent (REA) accounting model over the traditional Debit-Credit-Account (DCA) accounting model. Dunn and McCarthy (1997) reiterated McCarthy's (1982) position that accounting systems that use real world business phenomena as primitives are more semantically expressive than are accounting systems that use double-entry artifacts as primitives. They identified benefits of a semantically expressive accounting system as including easier integration of accounting phenomena with descriptions of non-accounting phenomena, and a better understanding by users of the system. To our knowledge, no research has attempted to verify McCarthy's claim that the REA model is more semantically expressive than the DCA accounting model, nor have any studies attempted to link semantic expressiveness with task accuracy. Two approaches can be taken to evaluate the semantic expressiveness of alternative accounting models. One approach is to identify as many features of the underlying reality as possible, and then to determine which of those features can be captured by and represented in each of the alternative accounting models. Such an approach (which could be referred to as an ontological approach) assumes that each and every user will agree on the underlying reality and the representational model, and will interpret the model in exactly the same manner. This approach ignores perceptions of users as to how well the model helps them to understand the underlying reality. A second approach is to assume that the degree of semantic expressiveness of a model (or a system based on the model) is indicated by user perceptions as to how well the model represents the underlying reality. This study takes the latter approach, having users of systems based on

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alternative accounting models evaluate how well those systems represented the underlying reality.

This study also examines whether there is any demonstrable benefit associated with semantic expressiveness. Even if there is a difference between systems based on semantic expressiveness, if there is no associated performance difference there is no economic incentive to incur costs to change from a less semantically expressive system to a more semantically expressive system. Consequently, this study investigates whether an accounting system with a higher degree of perceived semantic expressiveness results in greater task accuracy. The remainder of this article is structured as follows: Section 2 provides the hypothesis development; Section 3 describes the method used to test the hypotheses; Section 4 presents the statistical tests and results of those tests; and Section 5 provides concluding discussion.

2. Hypothesis development

For many years the traditional DCA accounting model was the only commonly accepted basis for accounting information systems (AIS) design. The REA accounting model, proposed by McCarthy (1982) has slowly but surely gained acceptance as an alternative basis for AIS design. This acceptance is evidenced by continued research in this area and by its inclusion in AIS textbooks (e.g., Hollander et al., 1996; Romney et al., 1997). Very few studies have attempted to compare this model with alternatives. Most REA research has been normative and focused on extending the model or on applying it to difficult accounting problems (e.g., Andros et al., 1992; Geerts and McCarthy, 1994; Grabski and Marsh, 1994). In reaction to the limited empirical research focused on evaluating the REA model, Dunn and McCarthy (1997)and David et al. (1999) called for more research to develop and test theories about the benefits of REA compared to other accounting models.

Dunn and McCarthy (1997) claim that for an accounting model to be semantically expressive its components must reflect real world phenomena and should not use double-entry artifacts such as debits, credits, and accounts as declarative primitives. That is not to say that a semantically expressive system cannot include debits and credits in any form. To use them as declarative primitives is to make them an integral part of the foundation of the system—declarative primitives, which are the lowest level building blocks upon which everything else is built. Hollander et al. (1996) discuss the fact that an events architecture based on the REA model can include a chart of accounts, debits and credits, and a general ledger. They explain that the fundamental difference between these types of systems and traditional DCA systems is that in the REA systems the debits, credits, and accounts are produced procedurally as user views, whereas they are primitives in traditional DCA systems. The distinction between producing the general ledger procedurally versus maintaining it as a declarative element of an accounting system is less important than is the distinction between including the accounting artifacts as primitives versus including them as report options. The difference is that when debits, credits, and accounts are used as base objects they become the filter which determines what details enter the system and thus limit the semantic expressiveness of the system.

Use of business event details (such as resources, events, and agents) as system primitives is consistent with the recommendation of Hammer and McLeod (1981) to model primitives of a problem domain directly rather than translating them into artificial specification constructs (such as debits and credits) to enhance semantic expressiveness. While traditional DCA systems have some degree of semantic meaning through the chart of accounts coding and hierarchical organization, if a user doesn't have specific training as to the coding and organization of the chart of accounts, that user would probably not be able to understand the system. Anecdotal evidence from our own experience with college students suggests that many students opt for careers in other business fields instead of in accounting because they have difficulty understanding the primitives of debits and credits.

One design objective of the REA model is semantic expressiveness: it models business primitives directly, with terms familiar to users in all departments of a business. Traditional DCA systems translate these business primitives into debits and credits, thus obscuring the meaning to users in non-accounting departments of a business. Traditional DCA systems have also been criticized for not capturing several types of phenomena (e.g., core business activities that do not have an immediate effect on the assets, liabilities, and equity; therefore, they are not accounting transactions) that the REA model specifically models (McCarthy, 1982; Hollander et al., 1996). If these criticisms are valid, they lend support to the notion that REA-based systems include more features of the underlying reality than do DCA-based systems and are thereby more semantically expressive. The literature suggests REA-based systems are, as claimed by McCarthy (1982) and by Dunn and McCarthy (1997), more semantically expressive than are DCA-based systems. If that were the case, then one would expect users to perceive REA-based systems