Technology versus Methodology
Support for Database Design: A Study of Designer Choice Related to Perception and Performance

Thomas E. Marshall
Michael L. Gibson
Auburn University

Information Systems (IS) designers often have to choose between directly applying design methods and/or using technology to support design methods. The purpose of this research is to develop a better understanding of how the choice between design approaches - design methods versus advanced technology - may impact the perceptions and performance of IS designers. The literature suggests that the scope of criteria useful in evaluating design methods and approaches is expanding. Research into methodology and technology support should include aspects addressing how a design approach impacts the designer, facilitates designer-user communications, and supports the implementation process of transforming conceptual models into more computer-oriented forms.

Through a laboratory experiment, this research investigates database design support by comparing a data modeling design approach (Kroenke Semantic Object approach) to a technology-based approach (Analyst designer software). The research findings provide insights into perceived and performance-based support provided by the different design approaches. In general, performance and perceptions with respect to type of support are not entirely consistent. There appears to be an underlying theme addressing the trade-offs between usability and the technical implementation support provided. When possible dysfunctional consequences exist regarding these trade-offs, IS managers should communicate to their designers that implementation integrity should not be sacrificed for increased usability, or vice-versa. Database designers need to be aware of these issues in design methods, especially those related to design performance, and seek means of mitigating any negative impact on the integrity of the databases designed.

Information Systems (IS) designers often have to choose between directly applying design methods and/or using technology to support design methods. The designers’ choice between methods and/or technology may be related to the perception and performance characteristics of the type of support. This research investigates the support provided by database design methods and advanced technology. Support characteristics of interest include the design approach, facilitation of communications between the designer and system user, and effectiveness of generating accurate data model representations. The research investigates design approach performance by allowing database designers to choose a method and/or technology for task completion, and then assessing the quality of their solutions. After completing the IS design, perceptions of design support were collected through a questionnaire.

Theoretical Background for the Study

Analysis and design involves the accurate determination of information requirements relevant to the application, and the transformation of those requirements into a computer-
compatible form. Davis (1982) identified that information requirements specification is often an unstructured task and frequently involves multiple information sources. Furthermore, unstructured applications usually require richer information sources, typically involving personal communications between the analyst and the user community. Davis recognized the difficulties involved in software development and explicitly identified the importance of designer-user communication.

James Martin (1989) considered the interaction between the IS designer and the system user as paramount for system success. Martin stated that in “the design phase, end users are involved in joint application design sessions and often employ the easy-to-use graphic representation of specifications... Clear, easy-to-understand diagrams are essential for end user participation” (p. 22). Martin stressed the need for methods and approaches that facilitate the design process and support effective communications.

Adelson and Soloway (1985) investigated analysis and design, finding that a critical component is the formulation of a mental model of the application and the mental simulation of that model. A clearly-defined mental model is reported to significantly impact the designer’s ability to deal with the application at different levels of abstraction. Baldwin (1993) furthered this discussion by addressing the impact of the designer’s mental model and the necessity of creating IS with multiple views. Criticizing current CASE (computer-assisted software engineering) tools that fail to incorporate multiple views, Baldwin cited multiple-view CASE tools as a means of enhancing IS design success.

Other research in the field suggests that analysis and design methods and technology should be structured to facilitate and expand our thinking and communication. Enhanced thinking and communication between the analyst and end user should produce more creative solutions, foster user involvement, and increase the potential for system success (Zmud, Anthony, and Stair, 1993; Davis, 1982). Winograd and Flores expressed the idea that limitations in IS representations and language constrain our creativity and lessen system success (1987).

The ability of the designer and the end user to effectively communicate may be a function of the analysis and design approach used. Vessey and Conger (1993) recently investigated the existence of interactions between application and methodology knowledge in information requirements specification. They found that research into aspects of application and methodology is warranted. The importance of application-domain representation in analysis and design has also been recognized as critical to system success by Glass and Vessey (1992). Understanding the impact of application and methodology knowledge on system success is critical for IS support of system designers and end users (Fichman and Kemerer, 1993). Design approaches that facilitate representing and understanding of the application user’s view should contribute to system success.

Henderson and Cooprider (1990) begin their development of a functional model of CASE technology for IS planning and design by citing the importance of technology being functionally oriented. Hackathorn and Karimi (1988), Welke and Konsynski (1980), and Henderson and Cooprider (1990) considered the delineation of methodology and technology tools as paramount to measuring the functionality of design-aid technology. In their view, methodology provides the logical disciplines underlying IS design, and technology tools support the usage behaviors during application development. Sprague and McNurlin (1993) report that the organizational benefits and user acceptance of CASE are dependent upon the integration of the technology and methodology. Coleman et al. (1994) suggest that technology tools and methodology improvement will reduce the complexities associated with system development.

The fact that IS professionals have to make clear distinctions between methods and technology in application design has been reported in previous literature (Sumner, 1986). The need for research into the IS designer’s choice process between method and technology has been cited by Channen et al. (1985). Database designers frequently must choose between levels of design method and technology support in their job performance (Sumner, 1986). Payne (1982) identified the importance of choice in his investigation of contingent decision-making behavior. According to Payne, seemingly small deviations in task representation often drastically influenced the decision strategy chosen for task performance. Therefore, database designers’ choice of support is important in the understanding and theoretical development of database design (Channen et al., 1985). This research investigates the choice between the direct use of a design method versus the use of technology with respect to database designer support. Incorporating designer choice into the research model enhances the robustness and naturalism of the study (Kerlinger, 1973; Szajna, 1994).

Research results from other studies suggest that IS designer choice of technology support may not be based on performance benefits of the aid, but more on the reduced effort resulting from using the aid (Todd and Benbasat, 1991). Mahmood and Medewitz (1985) report the importance of design method selection for project success. In a study investigating IS skills needed in the future, Leitheiser (1992) projects that semantic-oriented and object-oriented methodology expertise, along with CASE tools capabilities will become more critical. Leitheiser concludes that these areas of expertise (methodology and technology) will be some of the most important skills possessed by IS personnel in the future. Accordingly, the manner in which designers choose to integrate methodology and technology is a critical issue in IS research that should be further investigated.

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