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Chapter VI

The Psychology of Information Modeling

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Information modeling is the cornerstone of information systems analysis and design. Information models, the products of information modeling, not only provide the abstractions required to facilitate communication between the analysts and end-users, but they also provide a formal basis for developing tools and techniques used in information systems development. The process of designing, constructing, and adapting information modeling methods for information systems development is known as method engineering. Despite the pivotal role of modeling methods in successful information systems development, most modeling methods are designed based on common sense and intuition of the method designers with little or no theoretical foundation or empirical evidence. Systematic scientific approach is missing! This chapter proposes the use of cognitive psychology as a reference discipline for information modeling and method engineering. Theories in cognitive psychology are reviewed in this chapter and their application to information modeling and method engineering is discussed.

INTRODUCTION

Even though research in systems analysis and design has been going on for over 40 years, successful software development is still an art rather than a science. In the 1980s, Jones (1986) observed that a typical project was one year late and 100% over budget. Yourdon (1989) reported application backlogs of four to seven years or more. The maintenance phase typically consumed up to 70% of all programmer effort, and it was errors, not enhancements, that accounted for 40% of maintenance (Rush, 1985). Page-Jones (1988) wrote: "It looks as if traditionally we spend about half our time making mistakes and the other half of our time fixing them."

We are, however, no better off coming towards the end of this century. The IBMs Consulting Group (Gibbs, 1994) released the results of a survey of 24 leading companies that had developed large distributed systems. The numbers were unsettling: 55% of the projects

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cost more than budgeted, 68% overran their schedules, and 88% had to be substantially redesigned. A recent high-profile failure is the Denver Airport baggage-handling system, responsible for delaying the opening of the airport. The Standish Group research (Chaos, 1995) predicted that a staggering 31.1% of projects would be canceled before they ever get completed and 52.7% of projects would cost 189% of their original estimates.

In the early days of computerized information systems, technological failure was the main cause in the failure of business data processing systems (Avison & Fitzgerald, 1995). Today, the failure of information systems is rarely due to technology that is on the whole reliable and well tested. Failure is more likely to be caused by miscommunication and misspecification of requirements. Similar sentiments were echoed in the Standish Group's report (Chaos, 1995) which listed incomplete requirements and specifications as the second most important factor that caused projects to be challenged and the top factor that caused projects to be impaired and ultimately canceled. A recent survey of hundreds of Digital's staff and an analysis of the corporate planning database revealed that, on average, 40% of the requirements specified in the feasibility and requirements phase of the life cycle were redefined in the later phases. This cost Digital an average of 50% more than budgeted (Hutchings & Knox, 1995).

The process of investigating the problems and requirements of the user community, and building an accurate and correct requirement specification for the desired system is known as information modeling (Siau, 1999; Siau & Rossi, 1998; Siau, Wand, & Benbaset, 1997; Mylopoulos, 1992; Rolland & Cauvet, 1992; Kangassalo, 1990).

INFORMATION MODELING

Information modeling is the process of formally documenting the problem domain for the purpose of understanding and communication among the stakeholders (Siau, 1999; Siau, 1998; Mylopoulos, 1992). Information modeling is central to information systems analysis and design, and takes place in the early phases of the software development life cycle. The product of the information modeling process is one or more information models (e.g., data-flow diagrams, entity-relationship diagrams, use cases, activity diagrams, sequence diagrams). ***Information model*** provides a conceptual basis for communicating and thinking about information systems (Willumsen, 1993), and a formal basis for tools and techniques used in the design and development of information systems (Kung & Solvberg, 1986).

Information models are constructed using ***information modeling method***, which can be defined as an approach to perform modeling, based on a specific way of thinking consisting of directions and rules, and structured in a systematic way (Brinkkemper, 1996). There is no shortage of information modeling methods in the field. In fact, it is a "methodology jungle" out there (Avison & Fitzgerald, 1995). Olle, Sol, and Verrijn-Stuart (1982) and Bubenko (1986) stated that the field was inundated by hundreds of different modeling methods. Recently, Jayaratna (1994) estimated that there were more than a thousand brand name methodologies worldwide. The quest to develop the next modeling method has been wittily termed the YAMA (Yet Another Modeling Approach) syndrome (Oei, van Hemmen, Falkenberg, & Brinkkemper, 1992) and NAMA (Not Another Modeling Approach) hysteria (Siau, Wand, & Benbasat, 1996). Even the new kid on the block, object-oriented approach, has more than a dozen variants. Despite the "impressive" number, miscommunication and misspecification continue (Chaos, 1995).

To reduce the chances of misunderstanding and miscommunication during information modeling, the use of natural and intuitive modeling constructs (e.g., entity, relationship,