Chapter X
Database Engineering Supporting the Data Evolution

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INTRODUCTION

Researchers in several areas (sociology, philosophy and psychology), among them Herbert Spencer and Abraham Maslow, attribute human actions resulting in continual environmental changes to the search for the satisfaction of individual and collective needs. In other fields of science, this behavior represents a challenge in ethical researches on concepts, methodologies and technologies aimed at optimizing and qualifying the actions involved in these continual changes to obtain better results.

Specifically in computer science, software engineering is a critical sub-area for these researches and their application (Lehman & Stenning, 1997), since it involves the construction of models and orientation for their use in the development of resources, such as software, to support the user's needs. Databases should be included in this context as a component for data storage (Table 1).

Considering the premise of continuous changes (table 2) and the human needs involved (Khan & Khang, 2004), the consequences for software and for the required database are obvious. In the field of computational science, these changes in

Table 1. Laws of evolution (Lehman & Stenning, 1997)

Continuing Change
Increasing Complexity
Self Regulation
Conservation of Organization Stability
Conservation of Familiarity
Continuing Growth
Declining Quality
Feedback System

the modern world are reflected in evolutionary features for software and databases, based on Database concepts, structures and processes that allow for rapid, albeit not traumatic, shifts to new industrial, commercial or scientific systems (Mcfadden et al., 1999) in new contexts (*temporal scenarios*) (Camolesi, 2004).

BACKGROUND

Database models must comprise representation elements that are adaptable to the user's varying and dynamic needs, and contain the taxonomy needed for their manipulation. Thus, traditional (generic) database models such as the Entity-Relationship (ERM) and Relational (RM) models (Siau, 2004) have been expanded with appropriate "profile" for specific applications and requirements. Considering their purpose of supporting

changes, "Profile Models" can be easily referenced in scientific researches as:

- **Version model**: Considering versions as database objects derived (originating from, but containing alterations) from others, models of this "profile" must be applied to a database characterized by the explicit and voluntary storage of the historical information about object changes (Conradi & Westfechtel, 1998). The features frequently specified in versions models are:

- **Derivation structure:** Establishes the data structure for organizing versions, e.g., stack, tree or not cyclic digraph, linked by special relationships representing linear or nonlinear derivation actions;

- **Versionable element:** Establishes which *variant* elements (database objects) can have versions created and represented in the database;

- **Property of versioning:** This is a feature that serves to define a versionable element. This property must be dynamically established for each element during either its creation or its definition;

- **Version status:** Status set (state or situation) for the versions;

- **Manipulation of versions:** The creation, update and deletion of versions can be accomplished implicitly either by the database system or by the user through specific command language;

Table 2. Type of changes

Evolution: actions for an (*variant*) element's technological progress, improvement, modernization or correction.	**Revolution**: alteration actions of an element can influence the element's purpose in the context.
Involution: simplification actions of an element, regression in its conception or content.	

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