ABSTRACT

User interfaces have always played an important role in the success of Database Management Systems (DBMSs). At the present time, an important issue for database user interfaces is producing interactive visual representations of database information. The most important such information is the database schema; the user base of DBMSs is growing increasingly novice, requiring easier ways to specify schemas; the data in databases are becoming more complex, resulting in more intricate schemas; and database graphical user interfaces need visual schema representations as templates to make other database operations (such as querying or browsing) easier.

In order to satisfy the need for interactive schema visualizations in DBMS interfaces, this thesis describes the approach of Desk-Top Schema Management (DTSM). This approach provides unprecedented flexibility in supporting the following: arbitrary visual styles that may change over time for representing schemas, choice of visual style at any granularity so different parts of a schema may use different visual styles, enhancement of schemas with user-specific information, and many different aesthetic views of each schema.

The foundation of the DTSM approach is a formal framework describing the process of visualizing schemas. Within this framework, the abstract data to be displayed, the visual elements of the display, and the mapping between the abstract data and the visual elements are all described declaratively. Given such declarative descriptions, it is possible to have a generic visualization tool that works with many kinds of data and can display each kind of data in many ways, allowing the visualization of the data to be customized to suit different users and different situations. This framework also includes a novel approach to semi-automated layout as schema elements change in size, which can be used to support intelligent layout of schemas at many levels of abstraction.

This framework has been implemented as the OPOSSUM DTSM tool, part of the interface to a scientific object-oriented DBMS. OPOSSUM is currently in use for schema design, and is the core of prototype query and data visualization tools. This thesis describes OPOSSUM in detail, demonstrating the power and utility of the formal approach to visualization.