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# Database Issues for Data Visualization

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# Preface

Data Visualization is a captivating field that transcends traditional computing disciplines by creating visual imagery with scientific data. The production of images having artistic and scientific merit is important for explaining phenomena and motivating further research activity. This sensual and sometimes even seductive means of information display leads many to believe that visualization should reside at the center of a data exploration system. To some extent this is true, but visualization requires *data* to be available for display; it is merely a communications technology. The user needs to experience data in order to conduct research. While visualization seems central because it directly affects our perception, it is just one component of data exploration. *Data-centric* visualization is necessary to allow researchers to interact with data, aided by visualization.

Data-centric visualization places data at the cornerstone of software system development. Data undergoes many transformations from a raw state to a displayed state. These transformations, or fundamental data operations, must be presented at the user interface, and include data storage, selection, and access. Grand challenge problems will require these operations to be supported in addition to visualization. To that end we believe that as visualization systems evolve, they will begin to look more like database management systems (DBMS) with advanced visualization capabilities. The large question is: how will these database tools be incorporated into visualization environments (or vice versa)? Visualization places certain constraints on data management. Issues of capabilities, expressiveness, and performance affect how we determine the right mix of services in the appropriate places within the system.

On October 26, 1993, a workshop on Database Issues for Data Visualization was held during the IEEE Visualization '93 conference in San Jose, California. This was the first workshop of its kind, dealing with issues that focused primarily on the integration of database management systems with data visualization systems. Previous workshops held at various locations focused on data models for visualization, or visualization environments; this workshop had a broader scope. Database management applies to a number of data modeling and access activities within a visualization system such as object modeling, user interface construction, dataflow and program module storage and retrieval, the composition and manipulation of graphical representations, and the integration of knowledge bases and rule-based systems. These proceedings offer a snapshot of current research in this synergistic field, and a portrayal of the problems that must be addressed now and in the future towards the integration of database management systems and data visualization systems.

With these proceedings, the reader is presented with a treatment of a wide range of issues, top to bottom, of the research areas and problems facing the integration of database and visualization systems. We hope to stimulate further research activity in this field, and look forward to the realization of truly integrated systems that

accommodate end-user requirements in terms of models, services, displays, and interaction capabilities. We also hope the reader will find the reports and papers as invigorating as the discussion sessions during the workshop.

July 1994, Lowell, Massachusetts

John Peter Lee  
Georges G. Grinstein

# Table of Contents

<b>Workshop Description</b>	<b>IX</b>
<b>Workshop Participants</b>	<b>XIII</b>
<b>Workshop Subgroup Reports</b>	
Developing a Data Model	3
System Integration Issues	16
Interaction, User Interfaces, and Presentation	25
<b>Data Models</b>	
The VIS-AD Data Model: Integrating Metadata and Polymorphic Display with a Scientific Programming Language <i>William L. Hibbard, Charles R. Dyer and Brian E. Paul</i>	37
An Extended Schema Model for Scientific Data <i>David T. Kao, R. Daniel Bergeron and Ted M. Sparr</i>	69
Data Integration for Visualization Systems <i>Karen L. Ryan</i>	83
Inherent Logical Structure of Computational Data: Its Role in Storage and Retrieval Strategies to Support User Queries <i>Sandra Walther</i>	94
<b>Systems Integration Issues</b>	
Database Management for Data Visualization <i>Peter Kochevar</i>	109
Data Exploration Interactions and the ExBase System <i>John Peter Lee</i>	118
Database Requirements for Supporting End-User Visualizations <i>Venu Vasudevan</i>	138
A System Architecture for Data-Oriented Visualization <i>Andreas Wierse, U. Lang and R. Rühle</i>	148

<b>A Hyperspectral Image Data Exploration Workbench for Environmental Science Applications</b>	<b>160</b>
<i>Mark A. Woyna, David G. Zawada, Kathy Lee Simunich and John H. Christiansen</i>	
<b>Interaction, User Interfaces and Presentation Issues</b>	
<b>Design of a 3D User Interface to a Database</b>	<b>173</b>
<i>John Boyle, John E. Fothergill and Peter M.D. Gray</i>	
<b>Visualizing Reference Databases</b>	<b>186</b>
<i>Stephen G. Eick, Eric E. Sumner Jr. and Graham J. Wills</i>	
<b>A 3D Based User Interface for Information Retrieval Systems</b>	<b>194</b>
<i>Matthias Hemmje</i>	
<b>Using Visualization to Support Data Mining of Large Existing Databases</b>	<b>210</b>
<i>Daniel A. Keim and Hans-Peter Kriegel</i>	