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About the Author

Robert Vermeulen has been a consultant in the computer industry for over 10 years, specializing in human/computer interfaces, object-oriented programming, relational databases, and project-management techniques. His specialty is in architecting projects for best use of available technology. He has a degree in cognitive science from the University of Rochester.

Robert Vermeulen is President of Objective Analysis, Inc., an Internet consulting firm.

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PREFACE

These days it seems everyone wants to employ object-oriented (OO) technology in his or her computer software applications. But few know the full extent of its advantages, best uses, and limitations. OO is the subject of endless discussions and promotions in myriad forums, on-line bulletin boards, and trade shows. The more it is talked about, however, the greater the anxiety of those who fear they may be left behind. In their haste to catch up, they may initiate OO projects with little merit or return on investment (ROI), simply to have another "me-too" OO application. This need not be the case.

Too soon we forget that until recently relational database management systems (RDBMS) were the latest in technology. They are still on the cutting edge. There is no need to jump on the latest technology bandwagon for its own sake, unless there are real advantages in saved time, resources, or more accurate information. Many groups are still migrating their legacy systems to an RDBMS, whereas others have invested too much in nonrelational technology to warrant an immediate change.

That said, there are many incremental OO projects of small to medium scale that could provide tremendous added value to a relational or other database system. This book discusses the reasons to begin some OO projects now, and suggests where OO may have the greatest payoff when combined with relational technology. Both technologies have their advantages and disadvantages in general, but the combination may provide an overwhelming advantage when used to build applications. This book lays out what it really

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means to do OO design and programming, and how this can best supplement a relational database. And for those willing to take the leap, a pure OO database approach is explored as well.

The Organization of this Book

Objects have many uses and applications, many of which are discussed in this volume. These uses can be roughly described as follows:

- Objects as a better way to model real-world entities and their behaviors (as compared to using relational database tables)
- Objects as a way to encapsulate and distribute information over networks, such as the Internet

Chapter 1, "The Power of Relational Databases," describes the features of relational databases and their uses. This is done in the framework of creating a business model: what is easy and what is difficult to represent using tables.

Chapter 2, "The Expressiveness of Objects," describes the essential features of object technology, and why objects excel in creating certain types of applications.

Chapter 3, "Connecting Objects to Relational Databases," discusses different ways that an application written in an object-oriented language can be linked with a database. This allows the objects to manipulate the data, as well as be stored back into the database.

Chapter 4, "Data Warehousing and OLAP: Extending the Relational Model," describes new features that are being added to current relational databases to enable them to handle new classes of problems, such as data analysis and large data sets.

Chapter 5, "Object/Relational Database Hybrids," describes how some vendors are adding object-oriented features to their relational databases by allowing for user-defined types and object encapsulation.

Chapter 6, "Object-Oriented Databases," discusses database technology that is more seamlessly integrated with an object-ori-

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ented programming language. With object databases, we begin to leave the relational world altogether.

Chapter 7, "Reusable and Distributed Objects," describes how objects can exist on separate computers, and still communicate over a computer network. It also describes how to reuse object applications.

Chapter 8, "Sample Applications Using Objects," describes the kind of applications that benefit from an object-oriented approach.

Chapter 9, "Running an Object-Oriented Project," describes people and team issues associated with designing and implementing an object-oriented project.

Chapter 10 offers concluding remarks, and discusses future directions.

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INTRODUCTION

ACADEMIC: *Objects are the future. They will allow fully validated, reliable software to be built from components. They will allow real-world composite entities, like factories, machines, and assemblies to be better modeled and manipulated. And by using a formal developmental methodology, software development can be made routine.*

SALESMAN: *And don't forget the Internet! Objects can be used to store multimedia assets like video, audio, still images, and rich text documents. User-defined data types, such as maps, documents, and time-series data can be created to extend the fixed and limited types, like STRING, INTEGER, and DATE found in relational databases.*

MANAGER: *I've heard that OO development environments now have team-oriented features to store object definitions, like repositories. And I like the idea that objects can be reused across applications, instead of being reinvented each time.*

ENGINEER: *I think objects can help us bring our data to life, especially for analysis. They will let me build on top of our existing relational database. So how do I link objects to tables?*

In order to understand the advantages and disadvantages of relational and OO technologies, we need to explore the features of

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TABLE I.1 USES OF RELATIONAL AND OBJECT TECHNOLOGY

FUNCTIONS	RELATIONAL DATABASE	OO/RELATIONAL HYBRID DATABASE	OBJECT DATABASE
Modeling complex entities for CAD, finance, simulation, scheduling, and configuration		✔	✔
Implementing document and object repositories		✔	✔+
Handling thousands of transactions per hour	✔+	✔	
Handling transactions of long duration			✔
Maintaining data integrity and security, by separating data from applications	✔		
Storing and retrieving multimedia and other user defined types		✔	✔
Easy integration with existing programming languages, and their types		✔	✔+
Handling data analysis and warehousing tasks	✔-	✔	

each. Only then can we decide which technology to apply to which problems.

Table I.1 illustrates the uses of relational and object technology we will be exploring in upcoming sections, indicating the best uses of each. A ✔- means "acceptable," a ✔ means "good," and a ✔+ means "excellent."

Using this chart, we will see that relational databases excel in applications that require:

- data entry using simple forms,
- information storage, security, and consistency,
- short and quick transactions,

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- tens, hundreds, or even thousands of concurrent users,
- a relatively narrow domain, and simple data, such as numbers, dates, and short text fields,
- simple data reporting and analysis, using descriptive statistics like SUM and TOTAL.

These types of applications are commonly found in many businesses, including

- Banking and finance
- Shipping and receiving
- Manufacturing
- Inventory control and management
- Order entry
- Medical record tracking

Applications in these business areas often revolve around forms-based data entry. Data is entered, and reports are printed on a periodic basis.

More object-oriented features are required in applications that involve the following:

- Complex composite entities, such as assemblies and subassemblies seen in CAD and manufacturing applications
- Hierarchical entities, such as sales territories and subterritories
- Networks of nodes and links used in telecommunications
- Complex data analysis, especially involving time-series and multidimensional data
- Highly knowledge-based applications used for scheduling and configuration
- Representation of any user-defined data types, beyond the simple built-in number, string, and date types
- Storing documents and other multimedia objects

We will explore how object databases and object/relational hybrids can solve some of these problems. If an application does not require these advanced features, however, a relational database would work just fine.

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