

Foundation Matters

C.J. Date

Independent Consultant
PO Box 1000
Healdsburg, CA 95448
U.S.A.

Abstract

This talk is meant as a wake-up call ... The foundation of the database field is, of course, **the relational model**. Sad to say, however, there are some in the database community—certainly in industry, and to some extent in academia also—who do not seem to be as familiar with that model as they ought to be; there are others who seem to think it is not very interesting or relevant to the day-to-day business of earning a living; and there are still others who seem to think all of the foundation-level problems have been solved. Indeed, there seems to be a widespread feeling that “the world has moved on,” so to speak, and the relational model as such is somehow *passé*. In my opinion, nothing could be further from the truth! In this talk, I want to sketch the results of some of my own investigations into database foundations over the past twenty years or so; my aim is to convey some of the excitement and abiding interest that is still to be found in those investigations, with a view—I hope—to inspiring others in the field to become involved in such activities.

First of all, almost all of the ideas I will be covering either are part of, or else build on top of, *The Third Manifesto* [1]. *The Third Manifesto* is a detailed proposal for the future direction of data and DBMSs. Like Codd’s original papers on the relational model, it can be seen as an abstract blueprint for the design of a DBMS and the language interface to such a DBMS. Among many other things:

- It shows that the relational model—and I do mean the relational model, not SQL—is a necessary and sufficient foundation on which to build “object/relational” DBMSs (sometimes called *universal servers*).

Permission to copy without fee all or part of this material is granted provided that the copies are not made or distributed for direct commercial advantage, the VLDB copyright notice and the title of the publication and its date appear, and notice is given that copying is by permission of the Very Large Data Base Endowment. To copy otherwise, or to republish, requires a fee and/or special permission from the Endowment

**Proceedings of the 28th VLDB Conference,
Hong Kong, China, 2002**

- It also points out certain blunders that can unfortunately be observed in some of today’s products (not to mention the SQL:1999 standard).
- And it explores in depth the idea that a relational database, along with the relational operators, is really a *logical system* and shows how that idea leads to a solution to the view updating problem, among other things.

Note: The foregoing interpretation—i.e., of what a database really is—is directly relevant to the process of *logical database design* (and I will mention some recent results in this connection). It is also directly relevant to what the commercial world calls *business rules* [2].

Reference [1] also complements the relational model by introducing a detailed proposal for a theory of types. In particular, that theory includes a novel approach to the vexing issue of type inheritance, an approach in which the answer to the famous (or infamous) question “Is a circle an ellipse?” is—*pace* much of the object literature on the subject—a resounding *yes*. In fact, I will explain why I believe objects and a “good” approach to type inheritance are fundamentally incompatible.

More recently, Hugh Darwen and I, along with Nikos Lorentzos, have been building on Lorentzos’s original work and the ideas presented in reference [1]—including the type inheritance ideas—to investigate the question of support for *temporal data* [3]. Again, it is our belief that the relational model is a necessary and sufficient foundation on which to build such support. It is true that we have defined a large number of new relational operators (with a view to raising the level of abstraction and simplifying implementation), but all of those operators are, in the final analysis, nothing but shorthand. We have also, among other things, defined a new (“sixth”) normal form and proposed a temporal database design methodology.

Acknowledgments: Most of the work I will be reporting on was done in conjunction with my friend and colleague Hugh Darwen of IBM in the UK. Other collaborators include David McGoveran of Alternative Technologies in California and Nikos Lorentzos of the Agricultural University in Athens, Greece.

1. C. J. Date and Hugh Darwen: *Foundation for Future Database Systems: The Third Manifesto*, 2nd edition (Addison-Wesley, 2000).
A detailed study of the impact of type theory on the relational model of data, including a comprehensive model of type inheritance
2. C. J. Date: *WHAT Not HOW: The Business Rules Approach to Application Development* (Addison-Wesley, 2000).
3. C. J. Date, Hugh Darwen, and Nikos A. Lorentzos: *Temporal Data and the Relational Model* (Morgan Kaufmann, to appear 2003).
A detailed investigation into the application of interval and relational theory to the problem of temporal database management.

Biographical Sketch

C.J. Date is an independent author, lecturer, researcher and consultant, specializing in relational database technology. He was one of the first people anywhere to recognize the significance of Codd's pioneering work on the relational model, and has done more than anyone else to make that work accessible to others. Before leaving IBM in 1983, he was involved in technical planning and design for the IBM products SQL/DS and DB2. His book *An Introduction to Database Systems* (7th edition, 2000) is the standard text on the subject; it has sold over 650,000 copies and is used by several hundred colleges and universities worldwide. He is also author or coauthor of some 30 other books on database management, including (with Hugh Darwen) *A Guide to the SQL Standard* (4th edition, 1997) and *Foundation for Future Database Systems: The Third Manifesto* (2nd edition, 2000). He holds an MA Degree in Mathematics from Cambridge University, England (1966) and the honorary degree of Doctor of Technology from De Montfort University, England (1994).