

## Book Review

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*Elements of Spatial Data Quality.* Stephen C. Gup-till and Joel L. Morrison (eds). Published on behalf of the International Cartographic Association by Elsevier Science, Oxford, U.K., and Tarrytown, New York. 1995. xv-202 pp. Hardcover \$135.

**L**ike generals fighting the previous war, standards committees often have the clearest vision when addressing the most established technology. In this volume, the International Cartographic Association (ICA) Commission on Spatial Data Quality provides a report from the battle front of the international standards efforts.

Some reports come from battlefields that are clearly seen, and others seem shrouded by the mists of battles currently under way. D.R.F. Taylor, President of ICA, provides a brief Foreword that overstates the originality of the volume.

This is the first comprehensive definition of the major elements involved in spatial data quality which is multi-dimensional and uses much more than simply positional accuracy (p. ix).

A closer reading shows that the overall structure of the volume comes directly from the work of the U.S. National Committee for Digital Cartographic Data Standards (NCDCDS) Working Group II, and that nearly each chapter begins by reviewing the Spatial Data Transfer Standard (SDTS) that resulted from that effort. Of course, the research on spatial data quality has progressed substantially over the past 10 years, and the reports of NCDCDS are not particularly easy to obtain any more.

While ICA is formally a coalition of national cartographic organizations, it is strongly influenced by certain personalities. This volume grew out of the persistent efforts of David Bickmore, and it is dedicated to his memory. Throughout the 1980s, Bickmore had been trying to create a global database to serve as the basis for environmental atlases.

At one point, Maxwell Communications nearly became a partner of ICA in this venture. Such an effort required a clear set of quality standards, hence the desire to solidify international agreement. Perhaps the Defense Mapping Agency's Digital Chart of the World deflated any commercial dreams for license revenue to ICA. In any case, the standards effort survived reorganized into the Commission on Spatial Data Quality. The Commission was placed under the direction of

Joel Morrison, then at the U.S. Geological Survey and overseeing the final stages of SDTS.

Chapter one, written by Morrison, begins in the same overarching mood as Taylor's Foreword. There are grand sweeping statements about the history of cartography as related to data quality. Morrison cites the ISO 9000 rule "to deliver no more quality, or less quality, than the customer requires," then tries to connect this direction to the "fitness-for-use" approach taken by NCDCDS. In fact, these approaches are totally inconsistent and a sign that different countries may disagree over the basic philosophy of data dissemination. The International Cartographic Association strives to infuse an illusion of international harmony, though there was no editorial or committee intervention to make the chapters of this book consistent with each other.

The next five chapters cover the five parts of the NCDCDS data quality specification, followed by two proposed additions and two more summary chapters. In Chapter 2, Clarke (Director of Mapping, Department of Land Affairs, South Africa) and Clark (National Geophysical Data Center, USA) wrote on lineage. Since lineage recounts all sources and operations contributing to a GIS product, this topic includes everything. The authors valiantly attempt to cover the territory, but their efforts do not produce much more than a survey of the current jumble. The chapter ends with a review of the draft of the FGDC metadata standards without much analysis of how they differ from SDTS or any other quality specifications.

The third chapter, on positional accuracy, is written by Drummond, now a lecturer at the University of Glasgow. Although Taylor had diminished the importance of the topic, this chapter marshals the mathematics of the mapping sciences to considerable effect. The chapter mobilizes Drummond's international experience at ITC, but it cites mainly the classic works of mapping science, not much of the recent literature. The foray into the calculation of area from raster data should have been left for Chapter IV.

Dealing with attribute accuracy, Chapter IV is written by Goodchild, a permanent fixture on the error landscape. This chapter, like Goodchild's role in the profession, does not confine itself to the topic. It defines spatial representation, resolution, and accuracy, then develops various measures of uncertainty. The rapid tour of different topics is slightly flawed by the imprecise value of density for the Vatican: the value is closer to 5.9 popes per square mile,

not the 3.7 reported. Perhaps the correct figure was left to the reader to figure out as an exercise.

The chapter on completeness adopts a frankly research tone, and mobilizes another kind of authorship. Brassel includes three of his current Ph.D. students in a serious discussion of the part of the NCDCDS standard that fits the model least well. The chapter reports from the front lines of current research, but with practical assistance on reducing incompleteness. Kainz rounds out the original five NCDCDS parts with a formal treatment of topology and its role in data quality investigations. He instills great rigor into the definition of topology, with much less consideration of other aspects of logical consistency.

The next two chapters step off into new territory. Salgé (from Institut géographique nationale, France) states the case for "semantic accuracy," a concept that attempts to separate the perhaps intentional simplification of a data model from errors in carrying it out. The term is defined as "the quality with which geographical objects are described in accordance with the selected model." A critical term in this framework is rendered as "Perceived Reality" following a communications model, but the original French term "terrain nominal" suggests something altogether different (and untranslatable into a non-Cartesian language). This concept is carefully argued, but the relationship to the other chapters will cause significant disruption of the NCDCDS framework.

The Guptill chapter on temporal accuracy contends that time must be treated separately, but aside from a review of research on temporal GIS, it demonstrates that the NCDCDS framework accommodates time rather well.

In chapter nine, Veregin (USA) and Hargitai (Hungary) attempt to fulfill the original charter of the Commission—providing a scheme to evaluate data quality. Their three-dimensional diagram

(space, time, and theme), reminiscent of Berry, Haggett and John K. Wright, finally explains the mystery of the front cover of this book. It is curious that the space and time axes create a color image of the San Francisco Bay area, but it is even more amazing that theme and space create an image of the waters of the same Bay, while time and theme only create a black and white image of the self-same Bay.

Sometimes it is difficult to remember that Hägerstrand's space-time cube does not have a "theme" dimension. These kinds of illustrations mix the metaphor so much that the message, though valid, gets lost. Veregin and Hargitai begin the chapter with another redefinition of data quality, one that would have helped set the volume on a combined track if all the authors had adhered to it. Then they begin the perilous task of multi-criteria evaluation. They only get as far as judging the relative importance of space, time, and theme to a selection of users, based on projects performed by Geometria in Budapest, but without any sense of the techniques used to create the rankings. At the end of the chapter, I remain unconvinced that their matrix goes very far to solve Bickmore's original requirement.

The concluding chapter by Guptill and Morrison leaves me with the impression that the ICA has marshaled the international staff college to profess an international unity that still needs to be developed. Some advances have been recorded on the data quality front, enough to make this volume a worthwhile contribution to knowledge. I do not think it lives up to Taylor's praise. Whether it is fully worth the price of \$135 is an issue of greater importance.

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