Digital Map Quality: The Last Frontier of Cartographic Research

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Quality, quality control and quality assurance for the production of digital maps are some of the least understood technical subjects in cartography. A reason for this is the fact that cartographers do not fully understand these topics in analog map production. For example, after looking at existing United States National Map Accuracy Standards (developed more than 30 years ago), it is obvious that even positional accuracy cannot be evaluated for all kinds of terrain features. Only the position of well-defined points can be evaluated, and this is very costly. Positional accuracy is just one of the multiple aspects that affect the quality of spatially referenced data.

Understanding quality is becoming more and more important. The extended use of Geographic Information Systems (GIS) in the decision-making process has transformed spatially referenced data into a valuable high-demand resource. If the quality of spatially referenced data is poor, it will affect the represented terrain and the result of the analysis performed by GIS. Ultimately, they will affect the decisions made by governments, corporations and private individuals. Because maps are the most efficient means of encoding and carrying spatially referenced data, is imperative to improve our understanding of their quality, control and assurance. The purpose of this paper is to present a framework for the understanding of these topics.

This paper starts by introducing the concepts of information and quality in general, followed by a discussion of the definitions of quality, quality control and quality assurance specifically in analog and digital mapping. Then, three major components of digital map quality are identified and discussed: internal quality, quality with respect to the data source and quality with respect to the terrain. Internal quality is sub-divided into geometric, topological and attribute consistency. Then, each sub-topic is discussed. The two other major topics: quality with respect to the data source, and to the terrain, are subdivided into three topics each: completeness, positional, and attribute quality. Each one of them is discussed. Finally, a research agenda in each subject, for the specific case of the 1:24,000 maps of the United States Geological Survey, is presented.