A Conceptual Framework for Generalization of Maps

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For many years, the problem of generalization of maps has been studied and several approaches have been suggested for its solution. A book on this topic was published as recently as 1991, but no highly automated solution is known today.

The problem of map generalization can be stated as the problem of deriving, at a smaller scale, a map from existing larger scale maps. It is a very important problem, because finding a consistent, highly automated, solution will be the clue to eliminating the need for a database per map series. For example, the United States Geological Survey has a database for its 1:24,000 DLG-3 Standard series and another one for its 1:100,000 series. These multiple databases greatly increase the costs of maintenance and updating the spatial representation of a country.

In this paper, map generalization is studied from the basic, most fundamental component of a map, the skeleton. The skeleton of the map is what is left after most of the map components are removed from the map representation. These include: contour interval specification, credit and notes, direction arrow, legend, map projection, quality of data sources, positional reference frame, scale representation, surfaces of reference and title block. What is left are the representational signs. After removing Bertin's "visual variables" (size, value, pattern, color, orientation and shape), we are left with the skeleton of the map. The skeleton of the map is formed by the primitives of the cartographic language (the alphabet signs) and some of the cartographic operations (concatenation, coordinate transformation and addition). This concept was introduced by the author as part of the development of a cartographic language for intensive automation of map production. The problem of map generalization is discussed and studied in relation to the generalization problem in natural languages. Then using the concept of the cartographic language, the map skeletal information and the parallel between natural and cartographic languages, a conceptual framework for map generalization is developed. The application of this framework in the development of highly automated solutions is also discussed.