ENLARGING RULES AND GENERALIZATION METHODS IN AN ELECTRONIC ATLAS

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EXTENDED ABSTRACT

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Generalization is one of the most frequently misused cartographic operations in the field of computer graphics, and even in computer-assisted cartography. Very often this complex multi-dimensional process of map simplification is reduced to the automation of one particular aspect, for example line smoothing. Generalization was one of the first problems addressed in computer-assisted cartography and still remains the major domain of research. The fundamental principles, formulated in classical cartography, have to be complied with after they have been modified to meet the specific demands of modern technology.

This paper describes the enlargement and generalization of features implemented in an experimental Graphic Work Station (GWS) developed in the Geographical Services Division of the Surveys and Mapping Branch. The station was established to test selected cartographic and geographic methods that are required for the design and manipulation of electronic thematic maps, and for querying and analyzing attributes that are associated with map elements. If the chosen functions prove to be satisfactory, they will be incorporated into a final electronic atlas system. Such a system will support the Geographical Services Division in the design of conventional thematic maps, and will constitute a new form of cartographic presentation.

The electronic atlas station has a typical hardware configuration for an interactive system used for computer graphics. Its main processor is a microcomputer, the LSI 11/23 with 256 Kb memory, which is additionally supported by a large quantity of high speed disc storage. The essential part of the system is an interactive colour display. The Lexidata System 3400 with a medium resolution display (640 by 512 pixels) was considered sufficient for the experimental application. The processing software is written in Pascal and the mode of operation is raster, except for the editing of input data.

The input material used to create an experimental data base was the 5th edition of The National Atlas of Canada. The 5th edition breaks with the traditional practice of producing bound volumes of maps and will be published as separate map sheets. The information contained in these maps will eventually be available in digital form. The objective of the GWS is to test and evaluate concepts and methods which in the future, could be incorporated into a final electronic atlas; the enlargement and generalization rules are examples of those functions. Establishment of and rigid compliance to such rules is very important, since the use of a "mechanical zoom" function in cartographic transmission is not acceptable, as it may result in considerable distortion in map presentation and may reduce the effectiveness of cartographic communication, or even result in the transmission of incorrect information.

The GWS data base has several types of point, line and area symbols. Some symbols, such as those used for graticule or boundaries, are scale independent. Others symbols, used for rivers, lakes or cities, i.e., those features that have a real areal extent, are scale dependent. For this category, specific rules for enlargement have been established. These rules are based on the theory of visual threshold generalization developed in cartography by L. Ratajski. This theory advocates the necessity of a transformation of the size and the type of symbols (e.g., an areal symbol into a point symbol) according to the rules of effective perception. Since the methods for presentation of given subjects vary according to the purpose of a map, the GWS has implemented several user controlled rules for the choice of symbols, for the substitution of symbols and for enlargement. The user may control under which conditions either the actual areal representation or a substituted point symbol is used. This

substitution may be a function of:

a) the map scale factor - at large scale, the actual object would be shown, while at a small scale, a point symbol, would be shown.
b) the size of the object - if at a given scale, the actual object is smaller than a user-specified physical size, then a point symbol may be substituted.
c) an attribute of the object - a specified attribute of the object, based upon a quantitative or qualitative value, will determine the use of either the actual areal symbol or a substituted point symbol.

This paper analyzes the types of symbols used in the electronic atlas and describes sets of rules which can be selected for each of them.

The electronic media is a very flexible tool for creating user-designed maps. However, the rules for designing such maps, and especially for deriving maps at different scales have to be employed in order that information is transmitted according to the rules of effective perception. Thus, the existing theories of cartographic portrayal have to be examined and modified to utilize the new electronic media.