



Tracing the Evolution of Digital Cartography in Cartography Textbooks

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Computer-based systems are established as a quintessential tool in cartography. While their applications have been thoroughly explored, digital cartography as a discipline can be enriched by more historical research. To achieve this, cartography textbooks are identified as a lens through which the evolution of digital cartography can be observed. Here, two cartography textbooks published in recent decades and composed of multiple editions are selected for the analysis. These are *Thematic Cartography and (Geo)Visualization* by Slocum et al. and *Cartography: Visualization of (Geo)Spatial Data* by Kraak & Ormeling.

CONTENT ANALYSIS

Content analysis is a research technique that compresses many words of text into fewer categories based on explicit rules of coding [1]. Since this research concerns the changes found along the editions of a textbook, the traditional content analysis method is adjusted and applied as below.

- Table of contents and prefaces are analysed to grasp the structural changes.
- Corresponding chapters from different editions are compared with each other and relevant changes are documented.
- Documented changes are categorised to observe trends and patterns.
- Occurrences of web resources included in textbooks are counted and analysed.
- Authors are interviewed to understand the reasoning behind the changes.

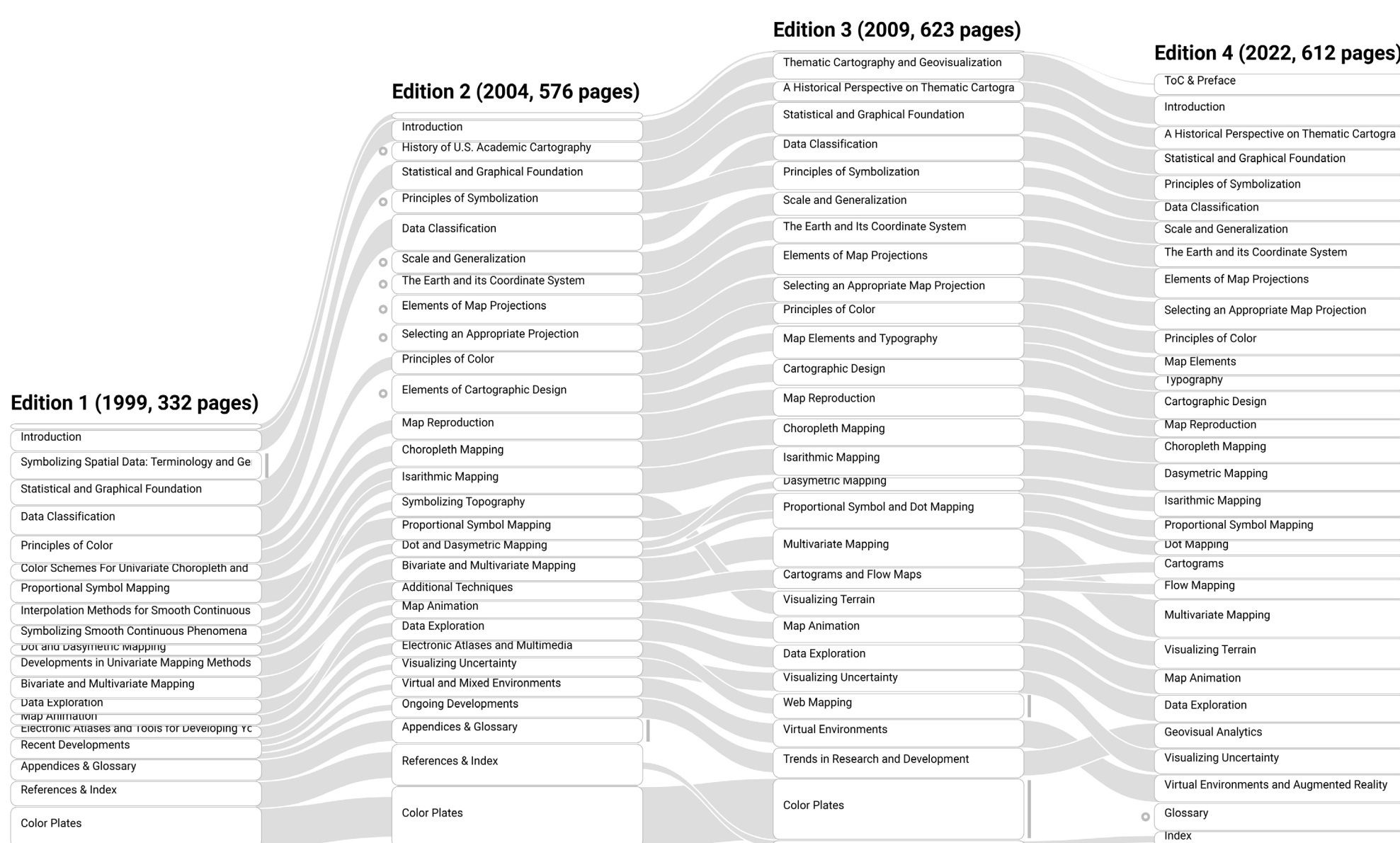


Fig. 1. Flow diagram showing connections of chapters to subsequent editions and respective chapter's volume from Slocum et al.'s 'Thematic Cartography and (Geo)Visualization'.

TEXT MINING

Text mining seeks to extract useful information from textual data using a suite of analysis tools [2]. Because of its ability to quantitatively summarise the usage of words, it is chosen as a method to complement the result from the content analysis which is largely qualitative. Here, two text mining methods are applied; First, word frequencies are calculated to understand how the overall character of a textbook has changed along with editions. Second, bigram analysis is performed to look at the neighbours of the commonly used digital keywords and to explore how relationships among them have changed.

RESULTS

Findings from the content analysis suggest that the evolution of digital cartography can be observed in various realms, from printing and map design to virtual environments and digital policies. While the selected textbooks had different scopes, commonly identified is the emergence and proliferation of computer-based GIS and the web, which have led to a substantial shift in cartography in terms of how geodata and maps are produced and disseminated. Their influence is also accountable for the recent development of neighbouring fields including visual analytics, volunteered geographical information (VGI), location-based services (LBS), et cetera.

The increased relevance of digital technologies was also confirmed by the analysis of web resources included in textbooks and the results from text mining. In both textbooks, the number of hyperlinks has constantly increased, which indicates that more map examples and geodatabases are being published online and the authors of the textbooks have re-responded to this phenomenon. The results from text mining supported this as well; Word frequencies found that terms related to web mapping (e.g., user, web, interactive) are significantly used more often along with editions. Furthermore, the bigram analysis found that the evolution of the textual content in a textbook can be better understood by considering the context of words.



Fig. 2. Network graph of bigrams from Kraak & Ormeling's 'Cartography: Visualization of (Geo)Spatial Data'. An arrow indicates the pair of words and the line opacity shows their occurrence.

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KEYWORDS

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