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The Evolution of Cartographic Education in the United States

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Abstract:

As with most technology-intensive disciplines, cartographic education in the United States has witnessed a remarkable transformation over the past century. Much of the curriculum in academic cartography during the 1930s to 1970s focused on basic mapping techniques, map projections, and map construction using pen and ink or photographic/darkroom methods (scribing, peelcoat, and photoreproduction). Transformations during the 1970s and 1980s saw the use of computer-based methods increasingly dominating cartographic education, starting with the first mapping programs such as SYMAP and Odyssey. Concurrently, educators included more advanced statistical methods, and the results of psychophysical and cognitive cartographic studies were integrated into the modern cartographic curriculum. Throughout this transformation to computer cartography, many of the fundamental cartographic principles— map projections, generalization, symbolization, and map design—were maintained and enhanced. Moving into the 1990s, personal computers increasingly became popular, which ushered in desktop mapping with associated applications such as Illustrator and Freehand. At the same time, the World Wide Web was looked upon as a novel way to disseminate and interact with cartographic products. The modern cartography curriculum of the 2000s, while still including these fundamental principles, has shifted to include animated and four-dimensional cartography, geovisualization, maps and society, web mapping, and very recently, the application of artificial intelligence into cartographic methodology.

The paper is designed to: (1) review some of the major trends in cartographic education, focusing on the period from 1950 to the present, and (2) provide a revised curriculum for the modern cartography course using topics from the recently published textbook, *Thematic Cartography and Geovisualization*.

Although the earliest courses in cartography (dating back to the 1920s) can be sourced to Columbia University (with Armin Lobeck), the University of Chicago (with J. Paul Goode), and a few other universities, it was in the early 1950s that the first American comprehensive “model’ cartographic curriculum was proposed by George Jenks (1953), who had spent one academic year visiting various agencies to learn about their methods and needs. The culmination of his project was the development of a model curricula, published in the *Annals of the AAG* in 1953, as "An Improved Curriculum for Cartographic Training at the College and University Level.” The model included a five-course sequence that included topics such as training in projections, grids, scale, lettering, and symbolization; the use, availability, and evaluation of maps; compiling and construction of small-scale and large-scale maps; and training in the preparation of simple manuscript maps.

Of course, Jenks’ model curricula was the ideal model at the time, and few geography departments could offer this type of a robust sequence. Subsequent to Jenks’ proposed model, other efforts have examined and proposed the content of cartography courses. One such effort was by Freyman and Sines (1990), who used an extensive survey of instructors to identify the key components of a basic cartography course. Their study identified the most commonly taught topics and included data types and manipulation, symbolization, map design, map projections, lettering, scale, grids, and generalization. Surprisingly, the basic thematic mapping types, such as choropleth mapping, isarithmic mapping, and dot mapping were not always included in their recommended syllabus. Research in the 1980s,1990s, and early 2000s by Nyerges and Chrisman (1989), McMaster and Thrower (1991), Fryman and Sines (1998) and Tyner (2005) have taken a critical examination of cartographic education during a time of continued rapid technological change and subsequent impacts on the cartographic process.

As we would expect, the modern course in cartography has significantly advanced since the Jenks’ model curricula

of the 1950s. As computer technology has continued to offer expansive opportunities for developing mapping applications, novel symbolization methods, web-based interactivity and visualization, and intelligent agents, an ongoing comprehensive look at a cartographic curriculum is still needed. Building on this brief history, the second component of the paper provides a detailed view of a modern thematic cartography class using the framework established in the 4th edition of the recently-published textbook *Thematic Cartography and Geovisualization*. Its framework is divided into three major sections: Part I, Principles of Cartography; Part II, Mapping Techniques; and Part III, Geovisualization.

Part I covers the traditional, yet highly relevant, topics including the history of the field, graphical and statistical foundations, symbolization, generalization, coordinate systems and map projections, color, typography, and map design. An important component to Part II includes material on the fundamental thematic mapping techniques, which in many ways, is the core of a class on thematic cartography. In this part, students are presented with the principles of choropleth mapping, dasymetric mapping, isarithmic mapping, proportional symbol mapping, cartograms, flow mapping, and the mapping of multivariable spatial data. This part focuses on the variety of mapping techniques according to the map purpose and required data. For instance, the section on isarithmic mapping reviews isometric vs. isoplethic mapping, spatial interpolation methods, and visualization methods in identifying for what purposes the isarithmic method would be best suited and the requisite data. Part III delves into the more advanced topic of geovisualization. Some of the geovisualization topics include visualizing terrain, map animation, data exploration, geovisual analytics, visualizing uncertainty, and virtual environments. These are topics, which rely heavily on the work of cartography's cognate disciplines—computer science, mathematics, and specific domain research such as public health—and represent much of the cutting-edge research currently underway in the discipline.

The material in Part III is often relegated to separate upper-division courses, following the mastery of basic cartography concepts in Parts I and II. We argue that its inclusion within the same textbook not only introduces students to a broader array of mapping techniques but also helps them better understand how the basic concepts are still valuable to the array of geovisualization topics. To help support our argument of a modern cartography curriculum that is adapting to technological changes, this paper also reviews and compares the content of several modern and commonly used cartography textbooks, including Slocum et. al.'s *Thematic Cartography and Geovisualization*, Dent's *Thematic Cartography*, and Kraak and Ormeling's *Cartography: Visualization of Geospatial Data.*

In summary, the teaching of basic thematic cartography, as with the field of cartography itself, has evolved remarkably over the past nearly one hundred years since J. Paul Goode's teaching of thematic cartography at the University of Chicago in 1925 (McMaster and Thrower, 1991). Whereas early cartography classes included topics such as map projections, design and photo-mechanical map reproduction, modern cartography classes now delve into sophisticated communication theory, advanced statistical methods, and geovisual analytics using the power of modern technology. Perhaps most importantly, the field of geographic information science/systems is increasingly realizing that a solid foundational knowledge of cartography and geovisualization is critical for students today.

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