Foreword

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Information about the Earth's surface, about the nature of places and the routes that connect them, is vital to almost all aspects of life today. For centuries such information has been captured and disseminated in the form of maps, but in recent decades a suite of new tools and technologies has become available that has vastly increased the range of what can be captured and how it is applied. Today we make constant use of the Global Positioning System, online mapping services such as Google Earth, imagery captured by Earth-orbiting satellites, and the analytic capabilities of geographic information systems. Moreover the need to solve problems that arise in developing and using these geographic information technologies, and the need to discover general principles that can be used to improve them, are of sufficient significance and difficulty as to constitute a research field of their own, a field known as geographic information science.

One of the most pressing of the problems of geographic information science and technology (GIS&T) concerns representation: how to design an effective and efficient way of capturing the infinite complexity of the geographic world in the absurdly limited space and two-character alphabet of a digital computer. We have learned over the past four decades that such designs involve a host of choices: what to capture and what to leave out, which of innumerable coding schemes to use to convert geographic reality into a binary sequence, and how to make the result understandable by any application system. GIS&T is not a simple matter of a few rules, but a complex world of nuanced alternatives that requires an understanding not only of the technology but also of the geographic world that the technology is attempting to represent. The fundamental principles of GIScience include some that reflect the nature of computational systems, and some that concern the ways in which the geographic world itself is organized.

Just as there are numerous choices in GIS&T, so also are there numerous choices in how GIS&T is taught. How should we balance training in the technical details of today's technology with education in the principles that will still be true when today's technology is a memory? Who are we teaching: the researchers of tomorrow or the next generation of practitioners? How should we balance open-source and commercial software products, and how should students be exposed to them? What is the appropriate mix of lecture, practical exercises, and individual or group projects?

When I started a course in GIS&T over thirty-five years ago I had little doubt of who my audience was: university students majoring in geography who would go on to careers in the fields traditionally staffed by professional geographers, as teachers, environmental consultants, or location analysts. Even then, knowledge of the rapidly expanding field of GIS&T would give them a valuable edge in competing for such jobs. Courses like this proliferated, and GIS&T slowly evolved into a recognized professional qualification. Yet today the situation we face could not be more different. In addition to an ever-increasing demand for professionals, universal access to at least a minimal set of geographic information services has raised a different set of questions: in addition to asking what the

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professional needs to know, we also need to be asking what *every* well-educated citizen needs to know. While online mapping tools may appear to make working with digital geographic information easy and straightforward, in reality it is all too easy to make mistakes and false inferences, to endanger personal privacy, and to engage with many other ethical issues. We teach mathematics and language skills to everyone -- should we not also be teaching some subset of GIS&T to everyone?

This question is becoming more and more important as the phenomenon of *neogeography* takes hold and makes everyone both a consumer and a producer of geographic information. The costs of entry into map-making have declined effectively to zero, and services such as Google's MapMaker now allow anyone not only to make their own maps, but also to contribute geographic information to central repositories where it can be accessed by anyone. Unlike the maps of the past, these new maps are personal, up to date, cheap to produce, and readily distributed. Moreover the people making them, and needing a basic understanding of parts of GIS&T, are in many cases long past their period of formal education.

This book provides a very welcome review of the issues surrounding the teaching of GIS&T in higher education. Some of them are longstanding, while others have arisen only recently, and all are being impacted by the rapid evolution of the technologies, the abundance of new research results, and the changing social role of GIS&T. The community of practice that has assembled the book includes many of the world's leading thinkers about GIS&T pedagogy, and its leading innovators. Together its chapters present an intriguing range of options and choices, and much food for thought.

Higher education finds itself today in a state of transition. The traditional notion of public higher education is under threat in numerous parts of the world because of budget pressures; today's students have grown up with advanced technologies and have adopted very different approaches to learning; online and student-centered learning are on the rise; and undergraduates are expected to acquire substantial levels of personal debt. GIS&T, with its strong employment prospects, high-tech appeal, and engagement with many of the major issues facing society, may be better able than many fields to withstand contemporary pressures and better able to adapt to the evolving academic environment.

I have always derived a great deal of satisfaction from the privilege of being able to teach GIS&T to generations of students. If this book achieves nothing else, I hope it helps others to think creatively about their own teaching, and adds an increment to their own satisfaction.