Teaching Geographic Information Science and Technology in Higher Education

Editors
David Unwin | Kenneth Foote | Nicholas Tate | David DiBiase

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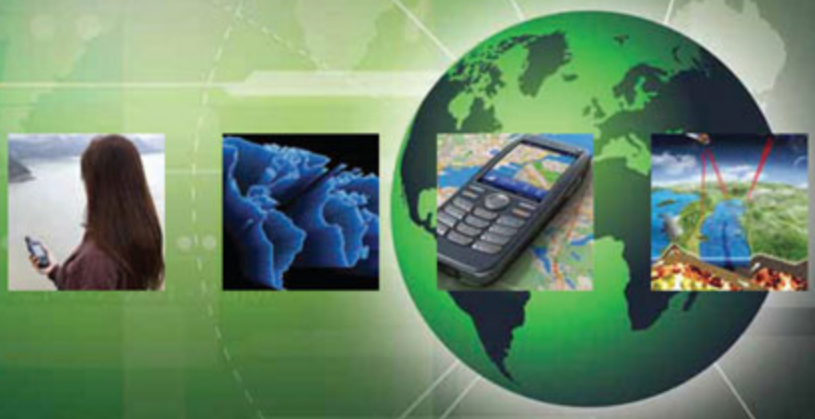

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David J. Unwin

Birkbeck College London, UK

Kenneth E. Foote

University of Colorado, US

Nicholas J. Tate

University of Leicester, UK

David DiBiase

Pennsylvania State University, US

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The Atrium, Southern Gate, Chichester, West Sussex, PO19 8SQ, UK
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About the editors

David J. Unwin

David, formerly professor of geography at Birkbeck College in the University of London is now retired. He was one of the team that established the *Journal of Geography in Higher Education* and in 2006 received recognition from the US *University Consortium for Geographic Information Science* as *Educator of the Year*. In 1999 his work in establishing its continuing professional development scheme led to the award of the UK *Association for Geographic Information's Past President's Prize*. He has experience of teaching GIS&T in universities in the UK, Canada, New Zealand and the USA. With David O'Sullivan he is co-author of *Geographic Information Analysis*, also published by Wiley.

Kenneth E. Foote

Ken is a professor of geography and former department chair at the University of Colorado at Boulder. His interests focus on improving geography in higher education, learning technologies, and GIScience, particularly multimedia cartography. He has served as president of both the *Association of American Geographers* (AAG) (2010–11) and *National Council for Geographic Education* (NCGE) (2006). He edited the *NCGE Pathways* series for geography educators (2000–05) and was the North American editor of the *Journal of Geography in Higher Education* (1999–2003). He received the AAG's Honors in Geographic Education in 2005.

Nicholas J. Tate

Nick is senior lecturer at the Department of Geography, University of Leicester. He was PI and Director of the Spatial Literacy in Teaching (SPLINT) CETL from 2005–10, where he directed the pedagogic activities across the consortium (University of Leicester, University of Nottingham and UCL)

towards the development of geospatial technologies and spatial thinking for a predominantly graduate audience. He is currently GIS section editor for *Geography Compass* and has been on the editorial board of three other journals. He has also served on a variety of committees for the AGI, RGS-IBG and RSPSoc. With Peter Atkinson he is editor of *Advances in Remote Sensing and GIS* and *Modelling Scale in Geographical Information Science*, both published by Wiley.

David DiBiase

David led the *Penn State Online* certificate and Master of GIS degree programs in GIS from their inception in 1998 until 2011. The certificate program earned ESRI's *Special Achievement in GIS* award in 2004, and the masters program earned the *Sloan Consortium's* 2009 award for *Most Outstanding Online Teaching and Learning Program*. David led the editorial teams that completed both the UCGIS *GIS&T Body of Knowledge* and the US Department of Labor's *Geospatial Technology Competency Model*. He participated in the URISA Certification Committee that helped established the GIS Certification Institute, and served as GISCI President from 2010–11. In August 2011, David moves to Esri as Director of Education, Industry Solutions.

List of contributors

Matthew Bampton
Department of Geography-Anthropology
University of Southern Maine
37 College Avenue
Gorham ME 04038 USA

Robert S. Bednarz
Department of Geography
Texas A&M University
College Station TX 77843-3147 USA

Sarah W. Bednarz
Department of Geography
Texas A&M University
College Station TX 77843-3147 USA

Susanne Bleisch
FHNW University of Applied Sciences
Northwestern Switzerland
Institute of Geomatics Engineering
4132 Muttenz SWITZERLAND

David J. Bodenhamer
The Polis Center
1200 Waterway Boulevard
Suite 100
Indianapolis IN 46202-2157 USA

Andy Burton
Computing and Technology Team
Nottingham Trent University
Room 302 Computing and Informatics Building

Clifton Campus Nottingham NG11 8NS UK

William Cartwright
School of Mathematical and Geospatial Sciences
RMIT University
GPO Box 2476
Melbourne 3001 AUSTRALIA

Paula Curvelo
Institute for Statistics and Information Management
New University of Lisbon
Campus de Campolide
1070-312 Lisbon PORTUGAL

David DiBiase
John A. Dutton e-Education Institute
418 Earth-Engineering Sciences Building
Penn State University
University Park PA 16802 USA

Kenneth E. Foote
Department of Geography
Campus Box 260
University of Colorado at Boulder
Boulder CO 80309 USA

Nick Frunzi
Esri
380 New York Street
Redlands, CA 92373 USA

Michael F. Goodchild
Center for Spatial Studies and Department of Geography
University of California

Santa Barbara, CA 93106-4060 USA

Christopher Goranson
GIS Center
Department of Health and Mental Hygiene
City of New York
125 Worth Street New York NY 10013 USA

Ian N. Gregory
Department of History
Lancaster University
Lancaster LA1 4YG UK

Thomas Grossmann
ETH Zurich
Institute of Terrestrial Ecosystems
8092 Zurich SWITZERLAND

Francis Harvey
Department of Geography
University of Minnesota
267 19th Ave S
Minneapolis MN 55455 USA

Claire Jarvis
Department of Geography
University of Leicester
Leicester LE1 7RH UK

Injeong Jo
Department of Geography
Texas A&M University
College Station TX 77843-3147 USA

Ann Johnson
National Geospatial Technology Center
Del Mar College
Corpus Christi, TX 78404 USA

Karen K. Kemp
Spatial Sciences Institute
University of Southern California
3616 Trousdale Parkway
Los Angeles CA, 90089-0374 USA

Andrew Klein
Department of Geography
Texas A&M University
College Station TX 77843-3147 USA

Patrick Lüscher
Department of Geography
University of Zurich
WinterthurerstraBe 190
8057 Zurich SWITZERLAND

Susanna A. McMaster
Department of Geography
University of Minnesota
267 19th Ave S
Minneapolis MN 55455 USA

Robert B. McMaster
Department of Geography
University of Minnesota
267 19th Ave S
Minneapolis MN 55455 USA

Nick J. Mount
School of Geography
University of Nottingham
University Park
Nottingham NG7 2RD UK

David M. Mountain
School of Informatics
City University London
Northampton Square
London, EC1V 0HB UK

Monika Niederhuber
ETH Zurich
Institute of Terrestrial Ecosystems
8092 Zurich SWITZERLAND

Marco Painho
Institute for Statistics and Information Management
New University of Lisbon
Campus de Campolide
1070-312 Lisbon PORTUGAL

Michael Phoenix
Esri
380 New York Street
Redlands, CA 92373 USA

Steven D. Prager
Department of Geography
University of Wyoming
1000 E. University Ave
Laramie WY 82071 USA

Gary Priestnall
School of Geography
University of Nottingham
University Park
Nottingham NG7 2RD UK

Richard B. Schultz
Department of Geography and Geosciences
Elmhurst College
190 Prospect Avenue
Elmhurst IL 60126-3296 USA

Diana S. Sinton
University of Redlands
1200 E. Colton Avenue
Redlands California 92374 USA

Martin J. Smith
Department of Civil Engineering
University of Nottingham
The Nottingham Geospatial Building
Triumph Road
Nottingham NG7 2TU UK

Lynn Songer
Department of Social Science
Lane Community College
Eugene Oregon 97405 USA

Josef Strobl
University of Salzburg
Center for Geoinformatics (Z_GIS)
Hellbrunnerstraße 30
A-5020 Salzburg AUSTRIA

Nicholas J. Tate
Department of Geography
University of Leicester
Leicester LE1 7RH UK

David J. Unwin
School of Geography
Birkbeck College, University of London
Malet Street
London WC1E 7HX UK

Robert Weibel
Department of Geography
University of Zurich
WinterthurerstraBe 190
8057 Zurich SWITZERLAND

Eric West
Department of Geography
Southern Connecticut State University
118 Morrill Hall
501 Crescent Street
New Haven CT 06515-1355 USA

Dawn Wright
Department of Geosciences
Oregon State University
Corvallis OR 97331-5506 USA

Foreword

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 (GIScience).

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 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