Alan M MacEachren

Introduction

Alan MacEachren directs the GeoVISTA Center, an interdisciplinary geographical information science center. GeoVISTA conducts and coordinates integrated and innovative research in GIScience, covering a broad range of domains from spatial cognition, through formal geo-information representation, to spatial analysis, cartography and visual analytics.

MacEachren's own research roots are in cartography and spatial cognition. His current research interests cover a wide spectrum of GIScience topics. These include: geovisualization and exploratory spatial data analysis, geovisual analytics, geosemantics, and geocollaboration. Applications domains to which his research connects include public health, crisis management, homeland security, and environmental science.

Interests

Building from a background in cartography and spatial cognition, my work during the 1990s focused on a range of issues associated with geographic representation and geovisualization. Within these domains, a long standing interest was the interaction between formalized visual and digital representations inherent in maps and geographic information systems and human mental representation of space and space-time. In How Maps Work: Representation, Visualization and Design I develop a cognitive-semiotic theoretical perspective from which to address these and related issues. Much of my work in this domain deals with dynamic forms of representation. These include exploratory spatial data analysis tools and map animation for understanding geographic processes. Much of this research has been linked to applications of mapping, geovisualization and ESDA in public health.

Another thread in my research has been integration of geographic visualization with other knowledge construction methods, natural interfaces to GIS, geo-virtual environments, and geocollaboration (design and use of technologies to enable groups to work productively with geospatial information). Much of this research has been grounded in applications within environmental science and crisis management. Some of this research has emphasized designing analytical tools and systems, some has focused on

Alan MacEachren
maceachren@psu.ed
Professor (Tenured an
Research Area: GIS
Course Blog for GEC
Leveraging Geosocial
310 Walker
814-865-7491
Office Hours:
T 2:30p-3:15p W 11:0
Research Interests:
spatial cognition
geographic informatio
visual analytics
geovisualization
cartography
geocollaboration
human-centered syst
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cognitive systems engineering approaches to understanding user needs and work practices and adapting tools to meet those needs, and some has focused on the underlying cognitive and perceptual issues that are critical to building visual displays and interfaces what work.

Over the past several years, a primary focus in my research has been on basic and applied research in visual analytics, defined as the science of analytical reasoning facilitated by interactive visual interfaces. This work draws upon and extends my past work but puts a particular focus on understanding reasoning with complex information and related processes of information foraging and sensemaking with heterogeneous information. The latter topic has brought my interests full circle back to issues of spatial cognition, with a focus on understanding how humans conceptualize space, place, and movement linguistically and on visual-computational interfaces for leveraging spatial information contained in text documents. For a couple of examples of outcomes from research that links some of the work about, see the GeoVISTA Center YouTube site (in particular, the Demonstration of SensePlace and Health GeoJunction): www.youtube.com/user/GeoVISTACenter.

An important research and graduate training initiative, the Big Data Social Science IGERT (for which I am a CoPI), includes a focus on (geo)visual analytics specifically directed to joint advances in social and analytical sciences; for details see: http://bdss.psu.edu/

Alan MacEachren's Google Scholar page

Course Blog for GEOG 597: Visual Analytics: Leveraging Geosocial Data

Recent Grants Received

- GeoCollaborative Crisis Management (GCCM): Building better systems through advanced technology and deep understanding of technology-enabled group work, National Science Foundation — Digital Government, Alan M. MacEachren (PI), Rajeev Sharma (Co-PI), Guoray Cai (Co-PI), Michael McNeese (Co-PI), Sven Fuhrmann (Co-PI). July. 1, 2003- June 30, 2006; supplement April 2005-June 2009.
- Geographic Contextualization for Accounts of Movement (GeoCAM): Representing, extracting, mapping, and interpreting movement references in text. Alan M. MacEachren (PI), Alexander Klippel (CoPI), Presenjit Mitra (CoPI) — National Geospatial Intelligence Agency; Sept. 2007 — Aug. 2011
- Evaluation of Candidate Vaccine Technologies Using Computational Models, Donald Burke U of Pittsburgh (PI), Neil Ferguson (CoPI), Bryan Grenfell (CoPI) {one of 7 other penn State investigators} — Gates Foundation; Spring 2008-Spring 2012.
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Symbology Standardization Support, Alan M. MacEachren (PI), Anthony Robinson (CoPI), Dept. of Homeland Security, Feb. 2009 — July 2011.
- Visualization and Analytics for Command, Control, and INteroperability Environments — DHS Center of Excellence for Command, Control and Interoperability, David Ebert, Purdue (PI), Alan MacEachren (CoPI) {one of several CoPIs} — Dept. of Homeland Security; Summer, 2009-Summer, 2013.
- New Methods for Representing and Interacting with Qualitative Geographic Information, US Army Corps of Engineers, March, 2011— Oct. 2012.
- IGERT - Big Data Social Science: An Integrative Research Program in Social Data Analytics, National Science Foundation, July 2012— June, 2017.

Research Interests
- spatial cognition
- geographic information science
- visual analytics
- geovisualization
- cartography
- geocollaboration
- human-centered systems

Previous Appointments
- Fall 2007, Visiting Professor, Department of Computer Science, Stanford University
- 1985-1992, Associate Professor of Geography and Director, Deasy GeoGraphics Laboratory, Penn State
- 1983-1985, Associate Professor of Geography, University of Colorado-Boulder
- 1980-1983, Director of the Department of Geography Spatial Analysis Laboratory, Virginia Polytechnic Institute and State University
- 1979-1983, Assistant Professor of Geography and Director of the Department of Geography Cartography Laboratory, Virginia Polytechnic Institute and State University
- 1974-1978, Teaching Assistant (Meteorology), University of Kansas

Education
- Ph.D., 1979, Geography, University of Kansas
- M.A., 1976, Geography, University of Kansas
- B.A., 1974, Geography, Ohio University

Advisees
- Eun-Kyeong Kim, Ph.D. (current, co-adviser with Klippel)
- Raechel Bianchetti, Ph.D. (current)
- Morteza Karimzadeh, Ph.D. (current)
- Wei Luo, Ph.D. (current)
- Ryan Mullins, M.S. (current)
- Alexander Savelyev, Ph.D. (current)
- Joshua Stevens, Ph. D. (current)
- Michael Stryker, Ph.D. (current)
- Robert Roth, PhD (2011): Interacting with Maps: The Science and Practice of Cartographic Interaction
- Jin Chen, Ph.D. (2009): Exploratory Learning from Space-Attribute Aggregated Data -- A Geovisual Analytics Approach
- Brian Tomaszewski, Ph.D. (2009): A Geovisual Analytics Approach for Producing Geo-Historical Context
- Anthony Robinson, Ph.D. (2008): Design for Synthesis in Geovisualization
- Isaac Brewer, Ph.D. (2005): Undertaking Work with Geospatial Information in Emergency Management: A Cognitive Systems Engineering Approach in GIScience
- Amy Griffin, Ph.D. (2004): Understanding How Scientists Use Data-Display Devices for Interactive Visual Computing with Geographical Models
- Frank Hardisty, Ph.D. (2003): Strategies for Designing Coordinated Geographic Visualization Software for Enumerated Data: A Component-Based Approach
- Mark Harrower, Ph.D. (2002): Visual Benchmarks: Representing Geograhpic Change with Map Animation
- Robert Edsall, Ph.D. (2001): Interacting with Space and Time: Designing Dynamic Geographic Visualization Environments

- Kevin Ross, M.S. (2010): SQSynC: Spatial Queries in Synchronous Collaboration
- Craig McCabe, M.S. (2009): Effects of Data Complexity and Map Abstraction on the Perception of Patterns in Infectious Disease Animations
- Thomas Auer, M.S. (2009): Explicity Representing Geographic Change Map Animations with Bivariate Symbolization
- Anthony Robinson, M.S. (2005): Assessing Geovisualization in Epidemiology: A Design Framework for an Exploratory Toolkit
- Biliang Zhou, M.S. (2004): Constructing Bivariate Color Schemes in Ciecam02 Color Space for Geovisualization Applications
- Amy Griffin, M.S. (2000): Feeling It Out: The Use of Haptic VIsualization for Exploratory Geographical Analysis
- Trudy Suchan, Ph.D. (1998) Categories in Geographic Representation
- Daniel Haug, M.S. (1998)
- Nicholas Huffman, M.S. (1996)
- Beverly Evan, M.S. (1995)
- Beverly Evan, M.S. (1995)
- John Krygier, Ph.D. (1995) Visualization, Geography, and Landscape: Visual Methods and the Study of Landscape Dereliction as a Process
- David Howard, M.S. (1994)
- Martin von Wyss (1994)
- Fritz Kessler, M.S. (1991)
- Tami Mistrick, M.S. (1990)
- Ann Deakin, M.S. (1989)
- William McKay, M.S. (1987)
- From Virginia Tech:
  Gregory Johnson, M.S. (1983)
  Donald Kiel, M.S. (1983)
  Ellen White, M.S. (1983)

Courses Taught

- GEOG 461W
- GEOG 160
- GEOG 597A Visual Analytics: Leveraging Geosocial Data

Publications

- Alan M. MacEachren, How Maps Work, Representation, Visualization and Design, New York: Guilford Press, 1995 & 2004 (paperback)
- Jason Dykes, Alan M. MacEachren, Menno-Jan Kraak, co-editors. Exploring Geovisualization, London: Elsevier Science, 2005
- Andrienko G, Andrienko N, Jankowski P, Keim D, Kraak MJ, MacEachren A, and Wrobel S 2007 Geovisual analytics for spatial decision support: Setting the research agenda. International Journal of Geographical Information Science 21 839 - 857
- Bhowmick T, Griffin AL, MacEachren AM, Kluhsman BC, and Lengerich EJ 2008 Informing geospatial toolset design: Understanding the process of cancer data exploration and analysis. Health and Place 14 576-607
- Bhowmick T, Robinson AC, Adrienne Gruver, MacEachren AM, and Lengerich E 2008 Distributed Usability Evaluation of the Pennsylvania Cancer Atlas. International Journal of Health Geographics 7
- Chen C, Zhu W, Tomaszewski B, and MacEachren A 2007 Tracing Conceptual and Geospatial Diffusion of Knowledge. HCI International 2007, Lecture Notes in Computer Science (LNCS 4564), Beijing, P.R. China 265– 274
- Chen J, MacEachren A, and Lengerich E 2008 Visual Analytics of Spatial Scan Statistic Results. Workshop on Geospatial Visual Analytics at GIScience '08, Park City, Utah
- Chen J, and MacEachren AM 2008 Resolution Control for Balancing Overview + Detail in Spatial Multivariate Analysis. Cartographic Journal 45 261-273
- Chen J, MacEachren AM, and Guo D 2008 Supporting the Process of Exploring and Interpreting Space-Time, Multivariate Patterns: The Visual Inquiry Toolkit. Cartography and Geographic Information Science 35 33-50
- Chen J, MacEachren AM, and Peuquet D 2009 Constructing overview + detail dendrogram-matrix views. IEEE Transactions on Visualization and Computer Graphics 15 889-896
- Chen J, Roth RE, Naito AT, Lengerich EJ, and MacEachren AM 2008 Geovisual analytics to enhance

spatial scan statistic interpretation: an analysis of U.S. cervical cancer mortality. International Journal of Health Geographics 7

- Du P, Lemkin A, Kluhsman B, MacEachren A, Meyers C, Zurlo J, and Lengerich E 2010 The roles of social domains, screening, and HPV infection in spatial clusters of US cervical cancer mortality: Not all the clusters are the same. Cancer Causes and Control DOI 10.1007/s10552-10010-19596-10554
- Hopfer S, and MacEachren AM 2007 Leveraging the potential of geospatial annotations for collaboration: a communication theory perspective. International Journal of Geographical Information Science 21 921 - 934
- Klippel A, MacEachren AM, Mitra P, Turton I, Zhang X, and Jaiswal A 2008 Geographic analysis of linguistically encoded movement patterns: A contextualized perspective. In: Cova TJ, Miller HJ, Beard K, Frank AU and Goodchild MF eds Extended Abstracts, 5th International Conference, GIScience 2008, Park City, Utah 113-117
- Koua EL, MacEachren A, Turton I, Pezanowski S, Tomaszewski B, and Frazier T 2009 Conceptualizing a User-Support Task Structure for Geocollaborative Disaster Management Environments. In: Walle BVd, Hiltz R and Turoff M eds Information Systems for Emergency Management M.E. Sharpe, Armonk NY 254-278
- MacEachren AM, Crawford S, Mamata Akella, and Lengerich G 2008 Design and Implementation of a Model, Web-based, GIS-Enabled Cancer Atlas. The Cartographic Journal 45 246-260
- MacEachren AM, Stryker MS, Turton IJ, and Pezanowski S 2010 HEALTH GeoJunction: Visual-computationally Enabled Browsing of Health Publications and Their Contents. International Journal of Health Geographics 9
- Pike W, MacEachren AM, and Yarnal B 2009 Infrastructure for collaboration. In: Yarnal B, Polsky C and O'Brien J eds Sustainable Communities on a Sustainable Planet: The Human-Environment Regional Observatory Project Cambridge University Press, Cambridge 34-58
- Roth RE, MacEachren AM, and McCabe C 2009 A workflow learning model to improve geovisual analytics utility. Proceedings of the International Cartographic Conference, Santiago, Chile
- Tomaszewski B, and MacEachren AM in press Geo-Historical Context Support for Information Foraging and Sensemaking: Conceptual Model, Implementation, and Assessment. IEEE Conference on Visual Analytics Science and Technology (IEEE VAST), Salt Lake City, Utah, USA
- Tomaszewski BM, Pan C-C, Mitra P, and MacEachren AM 2007 Facilitating Situation Assessment through GIR with Multi-scale Open Source Web Documents. 4th Workshop on Geographic Information Retrieval, held at CIKM 2007, Lisbon 95-96
- Turton I, and MacEachren AM 2008 Visualizing Unstructured Text Documents using Trees and Maps. Workshop on Geospatial Visual Analytics at GIScience '08, Park City, Utah
- Weaver C, Fyfe D, Robinson A, Holdsworth D, Peuquet D, and MacEachren AM 2007 Visual Analysis of Historic Hotel Visitation Patterns. Information Visualization 6 89-103
- Yu C, MacEachren AM, Yarnal B, and Peuquet DJ 2009 Integrating scientific modeling with a GeoAgent-based representation of human-environment interactions for supporting dynamic hazard management: a drought example in Pennsylvania, USA. Environmental Modelling & Software 27 1501-1512
- Zhang X, Mitra P, Jaiswal A, Xu S, MacEachren AM, and Klippel A 2009 Extracting route directions from webpages. Twelfth International Workshop on the Web and Databases (WebDB 2009) Providence, Rhode, Island, USA
- Zhang X, Mitra P, Klippel A, and MacEachren A in press Automatic Extraction of Destinations, Origins and Route Parts in Human Generated Driving Directions. GIScience 2010, Zurich, Switzerland
- Chen, J., MacEachren, A.M. and Peuquet, D. 2009. Constructing overview + detail dendrogram-matrix views, IEEE Transactions on Visualization and Computer Graphics, 15(6): 889-896.
- MacEachren, A.M., Stryker, M.S., Turton, I.J. and Pezanowski, S. 2010: HEALTH GeoJunction: Visual-computationally Enabled Browsing of Health Publications and Their Contents. International Journal of Health Geographics, http://www.ij-healthgeographics.com/content/9/1/23
- Du, P., Lemkin, A., Kluhsman, B., MacEachren, A., Meyers, C., Zurlo, J. and Lengerich, E. 2010: The roles of social domains, screening, and HPV infection in spatial clusters of US cervical cancer mortality: Not all the clusters are the same. Cancer Causes and Control 21, 1669-1683.
- Auer, T., MacEachren, A.M., McCabe, C. and Pezanowski, S. 2011: HerbariaViz: A web-based client-server interface for mapping and exploring flora observation data. Ecological Informatics 6(2): 93-110 doi:10.1016/j.ecoinf.2010.09.001.
- Tomaszewski, B., Blanford, J., Ross, K., Pezanowski, S. and MacEachren, A. 2011: Supporting geographically-aware web document foraging and sensemaking. Computers, Environment and Urban Systems 35, 192-207.
- Robinson, A.C., Roth, R.E. and MacEachren, A.M. 2011: Designing web-delivered learning materials for geographic visualization in public health. Health Informatics Journal 17(3): 191-208.
- Andrienko, G., Andrienko, N., Keim, D., MacEachren, A.M. and Wrobel, S. 2011: Challenging Problems of Geospatial Visual Analytics (editorial introduction). Journal of Visual Languages & Computing 22: 251-256.
- Robinson, A.C., Roth, R.E. and MacEachren, A.M. 2011: Understanding User Needs for Map Symbol Standards in Emergency Management. Journal of Homeland Security and Emergency Management 8, Article 33.
- Roth, R.E., Finch, B.G., Blanford, J.I., Klippel, A., Robinson, A.C. and MacEachren, A.M. 2011: The card sorting method for map symbol design Cartography & GISI, 38(2): 89-99.
- Jaiswal, A., X. Zhang, P. Mitra, S. Pezanowski, I. Turton, S. Xu, A. Klippel, and A. M. MacEachren. 2011. GeoCAM: A Geovisual Analytics Workspace to Contextualize and Interpret Statements about Movement. Journal of Spatial Information Science 3:65-101.
- Robinson, A.C., Roth, R.E., Blanford, J., Pezanowski, S. and Maceachren, A.M. 2011: A Collaborative Process for Developing Map Symbol Standards. Procdeia Social and Behavioral Sciences (STGIS 2011: Spatial Thinking and Geographic Information Sciences) 21, 93-102.
- Blanford, J.I., Kumar, S., Luo, W. and MacEachren, A.M. 2012: It′s a long, long walk: accessibility to health facilities in Niger. International Journal of Health Geographics.
- Tomaszewski, B. and MacEachren, A.M. 2012: Geovisual Analytics to Support Crisis Management: Information Foraging for Geo-Historical Context. Information Visualization {invited extension of paper originally published in Proceedings of IEEE VAST 2010}, 11(4): 339-359.

- MacEachren, A.M., Roth, R.E., O′ Brien, J., Li, B., Swingley, D. and Gahegan, M. 2012: Visual Semiotics & Uncertainty Visualization: An Empirical Study. IEEE Transactions on Visualization & Computer Graphics 18, 2496-2505.

Awards

External:

- Honorary Fellow, International Cartographic Association, 2005 (6th Fellow from U.S. since 1974).
- Exceptional Scholarly Contributions to the Practice of Cartography, Canadian Cartographic Association, 2004.
- Ohio University, College of Arts & Sciences "Distinguished Alumnus" 2012
- Elected as a Fellow of the American Association for Advancement of Science (AAAS) 2013

Penn State:

- 2010 Faculty Scholar Medal in Social and Behavioral Sciences, The Pennsylvania State University
- 2009-2014 E. Willard and Ruby S. Miller Faculty Fellowship
- 2004-2007 E. Willard and Ruby S. Miller Professor of Geography, College of Earth and Mineral Science, Penn State.

Other Links

- Google Scholar page

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Contact us **at:**
302 Walker Building
University Park, PA
16802
814-865-3433
geography@psu.edu