

Think Spatial

The UCSB brown-bag forum on spatial thinking

Presents

Helen Couclelis

Department of Geography
University of California, Santa Barbara

Polyplexity: a complexity science for the social and policy sciences

Ellison Hall 5824, 12:00 p.m. Wednesday, 22 October 2008

Abstract: In his famous metaphor of an ant tracing a complicated trajectory on a beach, Herbert Simon points to the possibility of two alternative representations for the same complex phenomenon: the ant's convoluted path may be described as complex behavior against a simple background, or as simple behavior against a complex background (or as a little of both, of course). The metaphor also supports the intuition that complexity is largely in the eye of the beholder – a fruitful philosophical position to take, as it encourages the observer to seek the representation that is the most useful for the purpose at hand. However, the ant-on-the-beach scenario falls short in one important respect: it views phenomena as consisting of a system of interest and an environment, whereas in fact every system description also involves a (usually tacit) underlying spatio-temporal framework.

I will discuss the notion of *polyplexity* as a new way of approaching the study of the most complex of systems, i.e., the systems studied in the social and policy sciences. Polyplexity goes one step further than most conventional approaches to complex systems by taking into account the possibility that the space and time within which a phenomenon unfolds may itself be complex. It suggests that the widely acknowledged greater complexity of the social relative to the natural sciences may be due in part to a more complex underlying spatio-temporal framework. Several examples will be used to illustrate the notion that 'complexifying' space-time in appropriate ways can lead to simpler models, more striking visualizations, and generally, better understanding of the phenomena of interest.

Helen Couclelis, Professor of Geography, joined the faculty at UCSB in 1982. Prior to completing a PhD in urban modeling from Cambridge University, she spent several years as a professional planner and policy advisor in Greece. She has held visiting appointments in the Department of Civil Engineering of the University of Waterloo, the Institute of Urban and Regional Development of the University of California at Berkeley, and the Woodrow Wilson School of Princeton University. Dr. Couclelis was Associate Director of the NCGIA from 1993 to 1996 and served on the executive committee of the Center for Spatially Integrated Social Science. She is a co-editor of the journal *Environment and Planning B: Planning and Design* and holds an Honorary Doctorate from Utrecht University, the Netherlands. Her research areas include urban and regional modeling and planning, spatial cognition, geographic information science, and the geography of the information society.

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Michael Goodchild and Donald Janelle

A spatial literacy initiative for undergraduate education at UCSB

12:00 p.m. Wednesday, 29 October 2008, Ellison Hall 5824

Abstract. This presentation advances the proposition that UCSB is ready to take the lead nationally in developing a trans-disciplinary approach to advancing the art and science of spatial thinking in the undergraduate curriculum. With an emphasis on fundamental spatial concepts, this curriculum would enhance student competency in the practice of spatial reasoning and the application of spatial tools for problem solving in research and in the everyday lives of individuals and societies. The discussion will solicit views from participants about the depth and breadth of such a curriculum and about opportunities for implementation at UCSB.

Michael Goodchild is a professor of geography and director of spatial@ucsb. Since arriving at UCSB in 1988, he has served as Director of the National Center for Geographic Information and Analysis (NCGIA); Associate Director of the Alexandria Digital Library Project; and Director of the Center for Spatially Integrated Social Science. He has published more than 400 scientific papers and a dozen authored and edited books, helping to lay a foundation for geographic information science and spatial analysis, extending the development of geo-libraries, contributing to understanding uncertainty in geographic data, and advancing capabilities in location-allocation modeling. His long list of achievements includes election to membership in the National Academy of Sciences and the American Academy of Arts and Sciences, and recipient of the prestigious international Prix Vautrin Lud.

Donald Janelle, researcher and program director of spatial@ucsb, has for the past five years led an NSF-funded initiative on Spatial Perspectives for Analysis for Curriculum Enhancement (SPACE) as part of the program of the Center for Spatially Integrated Social Science (CSISS). Before joining UCSB, he served as Assistant Vice Provost and Chair of the Department of Geography at the University of Western Ontario. Don's research has focused on space-time patterns of human spatial behavior and on the role of space-adjusting technologies (especially transportation and communications) in urban and regional development.

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Presents

Karl Grossner

Department of Geography, University of California, Santa Barbara

The First Spatial History of Election 2008: Measuring and Modeling Campaign Discourse

Ellison Hall 5824, 12:00 p.m. Tuesday, 25 November 2008

Abstract. Complex social events like the 2008 US Presidential election cycle are dynamic geographic phenomena: they comprise human activities associated with particular locations on the earth surface, and location over time is integral to their analysis. As such, they represent a relatively unexamined domain for exploring new approaches to geo-historical knowledge representation in geographic information systems (GIS). For the *IssueBrowser* project, analysis has involved measuring the individual textual products of the entire campaign cycle—speeches, debate transcripts, news stories and blogs—for their issue “aboutness,” i.e. their degree of similarity to each of 34 reference documents created from candidates’ issue statements. The resulting document “issue signatures” are then aggregated to summarize differential issue focus by region, candidate, party, and media type. Some interesting aspects of this variation were mapped and graphed, however interpretation of these results is left to political scientists, pundits and the general public, as my principal research focus has been the representation of this two-year long complex social event in an ontology-driven spatiotemporal data model. I will discuss that conceptual framework, methodology and implementation briefly. The challenges in this rather current exemplar are similar in many respects to those of many knowledge domains in historical research, and successful application here is presented as a first step in the development of an ontological framework for geo-historical computing.

Karl Grossner is a fourth-year Ph.D. candidate in Geography at UC Santa Barbara, and a member of the spatial@ucsb research group there. His dissertation topic is "A Semantic Data Model for Representing Human History in Geographic Information Systems," and his research interests include distributed digital earth systems and cognitive science.

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Benjamin E. Reese

Department of Psychology / Neuroscience Research Institute
University of California, Santa Barbara

Spatial Analysis 3D—Software Tools for Point Pattern Analysis in the Nervous System (and beyond)

Ellison Hall 5824, 12:00 p.m. Tuesday, 9 December 2008

Abstract. Visual function is mediated by five major classes of nerve cell within the retina. To ensure a uniformity in their contribution to visual processing across the retinal surface, each type is distributed as a regular array of evenly-spaced nerve cells. Our lab has been interested in the determinants of this patterning of retinal nerve cells during embryogenesis. I will briefly describe our application of a variety of spatial statistics for analyzing retinal nerve cell distributions in two dimensions, and then introduce comparable tools that we have recently produced for conducting such analysis in 3D. This software is freely available at <http://www.nri.ucsb.edu/Labs/breese/SA3D.html>

Benjamin Reese received his BA in Experimental Psychology at UCSB in 1980, and completed his PhD in Experimental Psychology at the University of Oxford in 1984. After five postdoctoral years in the Department of Human Anatomy at Oxford, he returned to UCSB to join the faculty in the Department of Psychology in 1989. His lab is in the Neuroscience Research Institute, where they study various aspects of the organization and development of the retina and visual pathways. He is currently the Editor-in-Chief for the journal, *Visual Neuroscience*.

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Think Spatial

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Martin Raubal

Department of Geography
University of California, Santa Barbara

Cognitive Engineering for GIScience

Ellison Hall 5824, 12:00 p.m. Wednesday, 21 January 2009

Abstract. Geographic information science provides the foundation for the development of geospatial tools and services that support people in their spatio-temporal decision-making. In order to offer useful and useable solutions, principles of human spatial cognition regarding the representation and processing of spatial and temporal aspects of phenomena must be considered in the design of these tools. Such cognitively engineered geospatial services aim for cognitive adequacy and therefore facilitation of user interaction. In this talk I will argue for the necessity of cognitive engineering methods in the field of geographic information science by explicating their theoretical foundation and demonstrating practical geospatial applications. I will further demonstrate a framework for classifying cognitive user parameters, which can be employed for the personalization of geospatial services.

Martin Raubal is Associate Professor at the Department of Geography, an affiliated faculty member at the Department of Computer Science, and a faculty member of the Cognitive Science Program at UCSB. Martin received his Ph.D. in Geoinformation from Vienna University of Technology in 2001 with honors. He also holds a M.S. degree in Spatial Information Science and Engineering from the University of Maine and a Dipl.-Ing. in Surveying Engineering from Vienna University of Technology. Martin's research interests lie in the area of cognitive engineering for geospatial services, more specifically he focuses on representing and modeling people's cognition and spatio-temporal behavior, and the integration of such models into geospatial applications for the enhancement of people's decision-making support. His teaching includes courses on GIS, cartographic design, geovisualization, cognitive and temporal aspects of GIS, spatial cognition and wayfinding, and research methods. Martin is currently a board member of the University Consortium for Geographic Information Science (UCGIS) and serves on the editorial boards of *Transactions in GIS*, *Journal of Location Based Services*, and *Geography Compass*. He has authored and co-authored more than 50 books and research papers published in refereed journals and conference proceedings.

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James Frew

Donald Bren School of Environmental Science and Management
University of California, Santa Barbara

Geographic Information Provenance

Location tba, 12:00 p.m. 11 February 2009

Abstract: Scientists are increasingly being called upon to publish data as well as conclusions. Computational science, in particular, often involves the creation of data products as a primary goal, rather than simply a means to an end. To have the same confidence in data that we have in peer-reviewed, appropriately-cited conclusions, we need mechanisms for capturing and conveying the origins and processing history -- the "provenance" -- of digital information. Geographic information presents particular challenges, both in the identification of locations and in the linking of information to locations. I describe recent work on automatic provenance capture and show how it might be applied in a distributed geographic context.

James Frew is an Associate Professor in the Donald Bren School of Environmental Science and Management at the University of California, Santa Barbara (UCSB), and a principal investigator in UCSB's Institute for Computational Earth System Science (ICESS). His research interests lie in the emerging field of environmental informatics, a synthesis of computer, information, and Earth sciences. He is interested in information architectures that improve the discoverability, usability, and reliability of distributed environmental information. Trained as a geographer, he has worked in remote sensing, image processing, software architecture, massive distributed data systems, and digital libraries. His current research is focused on geospatial information provenance, discovery, and curation, using remote sensing data products generated by his Environmental Information Laboratory as operational test beds.

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Rajan Gupta

Nuclear and Particle Physics, Astrophysics and Cosmology Group T-2
Los Alamos National Laboratory

Spatial Cognition of Global Energy Systems

Ellison Hall 5824, 12:00 p.m., 25 February 2009

Abstract. Energy systems are enormous, complex, dynamical and adaptive. Understanding them is crucial as energy is the key to development and is the basis of modern technological societies. At the same time fossil fuels (oil, coal, and gas) provide over 80 percent of the energy in the 20th century and will, most likely, persist well into the 21st century in spite of concern for associated environmental impacts and climate change. How does one help transform existing and planned regional approaches to provide affordable clean energy to 9 (maybe 10) billion people in the coming decades? This talk will describe the OpenModel project that is creating a Global Energy Observatory to build, with public participation, a comprehensive map of the world's energy systems so that we can understand regional variations, choices, and needs, and follow their full cycle: from sources to generation to global movements to use to impacts. The talk will then focus on the interplay between GIS tools and Volunteered Geographical Information, and address the issues of trust and quality in synthesizing heterogeneous data.

Rajan Gupta is a theoretical physicist at Los Alamos National Laboratory and a Laboratory fellow. He came to the USA in 1975 after obtaining his Masters in Physics from Delhi University, India, and earned his Ph.D. in Theoretical Physics from The California Institute of Technology in 1982. The main thrust of his research is to understand the fundamental theories of elementary particle interactions, in particular the interactions of quarks and gluons and the properties hadrons composed of them. In addition, he uses modeling and simulations to study Biological and Statistical Mechanics systems, and to push the envelope of High Performance Computing. He has published over 125 research papers in prestigious refereed journals and is a fellow of the American Physical Society.

During 2007 he served as the chair of the LANL energy council. In this role he helped create a strategic plan for LANL's investment in energy R&D and advocated for energy security to be made a part of the core LANL mission. He is currently building a web based Global Energy Observatory that will provide a comprehensive view of the world's energy systems and their networks and interdependencies. The goal of this project is to help accelerate the transition to cheap and clean energy for the global population.

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James Marston

Department of Geography
University of California, Santa Barbara

Enhancement of spatial cognition and wayfinding for vision-impaired travelers using remote infrared audible signage

Ellison 5824, 12:00 p.m. 4 March 2009

Abstract: Visual perception is the major sense used to navigate throughout the environment and restricted or total loss of vision greatly impacts the ability to travel successfully. A “real world” experiment with blind travelers using location-based infrared auditory signage will be discussed. This work goes well beyond the common measurement of time or success of tasks when evaluating efficacy of assistive technologies, and looks at spatial and subjective measurements, including the ability to make shortcuts, understanding of spatial relationships, perceived changes to travel frequency, and access to activities and other “quality of life” issue relating to interaction with the urban environment.

James Marston is an Assistant Researcher in the Department of Geography at UCSB. He earned his Ph. D. in 2002 in Geography with an Emphasis in Cognitive Science from UCSB and spent the next 5+ years as a post doc conducting research on UCSB’s Personal Guidance System (PGS). Currently, he is the Principal Investigator at UCSB on a collaborative research project “The Wayfinding Project: Fundamental Issues in Wayfinding Technology” funded by the National Institute on Disability and Rehabilitation Research. His main research responsibilities include a comprehensive survey of need, travel planning behavior and use, and measures of travel performance. His overall interests include environmental perception, spatial behavior, wayfinding and the spatial problems encountered by those with disabilities, especially visual impairments.

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Lisa Jevbratt

Department of Art, University of California, Santa Barbara

Mapmaking as Art

Ellison Hall 6824, 12:00 p.m. Wednesday, 15 April 2009

Abstract. Lisa Jevbratt has been mapping various aspects of the Web and the Internet from an artistic perspective for more than a decade. She will present some of her projects and in addition she will discuss her experience teaching art making with online mapping tools such as Google Earth and Google Maps.

Lisa Jevbratt is a Swedish-born new media artist, currently an associate professor in the Art Department and the Media Art Technology program at University of California, Santa Barbara. Her work, ranging from Internet visualization software to biofeedback and interspecies collaboration, is concerned with collectives and systems, the languages and conditions that generate them, and the exchanges within them. Her projects explore alternative, distributed and unintentional collaborations and the expressions of the collectives they create. Her work has been exhibited extensively in venues such as The Walker Art Center (Minneapolis), Banff Centre for the Arts (Canada), The New Museum (New York), The Swedish National Public Art Council (Stockholm, Sweden), and the Biennial at the Whitney Museum of American Art (New York); and it is discussed in numerous books, for example in *Internet Art* by Rachel Greene, *Digital Art* by Christiane Paul (Thames and Hudson) and *The Atlas of Cyberspace* by Martin Dodge and Rob Kitchin (Addison and Wesley). Jevbratt also publishes texts on topics related to her projects and research, for example in the anthology *Network Art—Practices and Positions*, ed. Tom Corby (Routledge). See <http://jevbratt.com>.

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Kevin D. Lafferty

US Geological Survey

Marine Science Institute, University of California, Santa Barbara

Spatial and Temporal trends in global malaria: How do climate change and economics interact?

Ellison Hall 6824, 12:00 p.m. Wednesday, 22 April 2009

Abstract. Malaria is the most important infectious disease facing humans. Although it is largely a concern in tropical developing countries, a century ago its distribution extended well into upper latitudes presently occupied by developing countries. Because temperature and precipitation affect mosquito vectors and the plasmodium disease agent, transmission depends on climate. Projected climate changes may therefore alter where malaria will be a problem in the future. The discussion will briefly describe the ways that geographers have used spatial data to project future climate envelopes for infectious disease. It will then consider the relative importance of covariates that help explain a portion of the variation in transmission. By analogy, a paper by Kuhn (PNAS 2002) shows that wetland destruction and cattle farming do a better job explaining historical temporal variability in malaria in Britain than does climate variability. The main purpose of the discussion will be to pose the question of how to partition the effects of climate and economics on the spatial and temporal variation in malaria at the global scale. Knowing the relative roles of these factors would greatly help explain current patterns of transmission as well as identify future challenges and opportunities for diseases control.

Kevin Lafferty is a GS-15 Ecologist with the US Geological Survey Western Ecological Research Center, an adjunct faculty with the UCSB Ecology, Evolution and Marine Biology Dept., and a Principal Investigator at the Marine Science Institute. His research spans conservation biology and disease ecology, with particular emphasis on marine systems. The topic of this discussion stems from an upcoming Forum in *Ecology* he produced on the ecology of climate change and infectious disease. He has previously considered global-scale effects of human infectious diseases with the common and personality changing *Toxoplasma gondii*. He uses ecological network theory to consider the role of infectious diseases and novel means of disease control (such as human schistosomiasis). He is on the editorial board of *Ecology* and is this year's recipient of the Ward Medal from the American Society of Parasitologists. He has published over 100 journal articles and book chapters.

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Lisa Weckbacher and Yukari Okamoto

Child and Adolescent Development, California State University Northridge / Gevirtz Graduate School of Education, UCSB

The role of visualization in geometric problem solving

Ellison 6824, 12:00 p.m. 20 May 2009

Abstract: Geometry is intuitively associated with spatial ability. Consequently, ongoing efforts to explain why US students are less likely to do well in geometry compared to other areas of mathematics draw attention to how spatial ability differentially influences problem solving performance. Research on spatial cognition suggests that differences in how individuals construct and use visual images determine the likelihood for successful solution attempts. That is, some individuals are prone to visualizing holistic images (e.g., pictures of objects) that depict overall shape and size. In contrast, other individuals tend to construct images part by part to arrange and analyze the components in relation to what a problem requires. In this presentation, we will discuss a recent study that examined geometric problem solving by high school students with different spatial orientations. In short, students with strong spatial visualization skills, compared to those identified as average or low, earned higher grades in geometry and scored significantly higher on a geometry test developed for the purpose of this study. We will also discuss the implications of this work for improving student geometric problem solving. Our approach incorporates teaching strategies that encourage students to focus on relevant spatial information in geometric problems.

Lisa Weckbacher is a faculty member of the Child and Adolescent Development Department at CSUN. She earned her Ph.D. in education with an emphasis in child and adolescent development from UCSB in 2007. Dr. Weckbacher also holds three master's degrees that branch into different areas of psychology and education. Her research interests largely pertain to the role of spatial ability in problem solving situations (particularly geometry), and how strength in spatial ability relates to differences in mathematics achievement. A recent focus involves educating elementary school teachers on helping their students develop an awareness and use of spatial ability as a problem-solving tool across a variety of classroom contexts.

Yukari Okamoto is a faculty member of the Department of Education at the Gevirtz Graduate School of Education at UCSB. She earned her Ph.D. in psychological studies in education from Stanford University in 1992. Dr. Okamoto is a developmental psychologist who is interested in cross-cultural differences in children's thinking, in particular, in the domains of mathematical, scientific and spatial thinking. From a neo-Piagetian perspective, she studies children's conceptual development, provides instructional programs, and examines the question of culture and the developing mind. She was also a member of the TIMSS Video Study of math and science teaching practices in Australia, Czech Republic, Germany and Japan.

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Presents

Nora S. Newcombe

Department of Psychology, Spatial Intelligence and Learning Center
Temple University

Educating Spatial Intelligence

Ellison Hall 5824, 3:00 p.m. Wednesday, 17 June 2009

Abstract. This talk will review the evidence that: (1) spatial intelligence and learning are important (2) spatial intelligence and learning can be improved, and improvements are durable and show transfer; (3) there are sex-linked and SES-linked differences in spatial intelligence, so that addressing these differences is important for social equity; (4) spatial intelligence and learning are critically under-studied; and (5) specific educational techniques to foster spatial intelligence are within our grasp.

Nora S. Newcombe is Professor and James H. Glackin Fellow at Temple University. Her Ph.D. is from Harvard University. Her research focuses on spatial development and the development of episodic memory. Dr. Newcombe is the author of numerous chapters, articles, and books, including *Making Space* (with Janellen Huttenlocher). Her work has been recognized by awards including the George A. Miller Award and the G. Stanley Hall Award. She has served as Editor of the *Journal of Experimental Psychology: General* and Associate Editor of *Psychological Bulletin*. She is currently PI of the NSF-funded Spatial Intelligence and Learning Center (<http://spatiallearning.org/>).

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